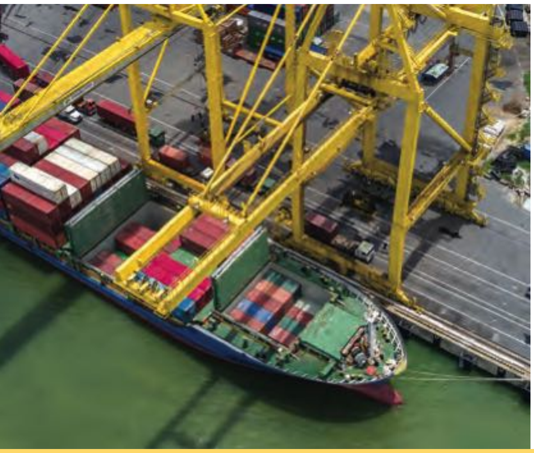

THE GREATER MEKONG SUBREGION 2030 AND BEYOND

INTEGRATION, UPGRADING, CITIES, AND CONNECTIVITY

MARCH 2021

ASIAN DEVELOPMENT BANK

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6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 8632 4444; Fax +63 2 8636 2444
www.adb.org

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Notes:
In this publication, "$" refers to United States dollars.
ADB recognizes "China" as the People's Republic of China; "Guangxi" as the Guangxi Zhuang Autonomous Region; "Hong Kong" as Hong Kong, China; "Laos" as the Lao People's Democratic Republic; "Vietnam" as Viet Nam; and "Yunnan" as Yunnan Province.
All photos are by ADB.

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Notes

In this publication, the members of the Greater Mekong Subregion are: Cambodia, the Lao People's Democratic Republic, Myanmar, the People's Republic of China (specifically Yunnan Province and Guangxi Zhuang Autonomous Region), Thailand, and Viet Nam.

Whenever possible, data for Yunnan Province and Guangxi Zhuang Autonomous Region are used, otherwise, data are for the whole of the People's Republic of China.

The boundaries, colors, denominations, and any other relevant information shown on the maps in this publication do not imply, on the part of the Asian Development Bank, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries, colors, denominations, or information.

The data used in this publication cover until 2019, i.e., prior to the onset of the coronavirus disease (COVID-19) pandemic. Therefore, the analysis does not focus on the impact of the pandemic. Despite this, all the proposed ideas and recommendations will be quite appropriate in the post-pandemic context, as the Greater Mekong Subregion countries implement measures for economic recovery, while managing the continuing short-term health, social, and economic vulnerabilities.

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Highway 12 from Phitsanulok to Lom Sak, Thailand (105 km). As a main intersection of the East-West Economic Corridor and the North-South Economic Corridor, the new four-lane highway is a regional gateway creating wider opportunities for cross-border trade, tourism, and investment in Thailand, the Lao People's Democratic Republic, Myanmar, and Viet Nam. The Highway 12 expansion from two lanes to four was supported by Asian Development Bank (photo by Ariel Javellana/ADB).

Foreword

The Greater Mekong Subregion (GMS) Economic Cooperation Program, inaugurated in 1992, ushered in a new era of development policy coordination among its members.[1] It has coincided with a period of strong and robust growth, which has led to higher per capita incomes and overall progress across all member countries of the subregion.

The Asian Development Bank (ADB) has served as the program's secretariat over the last three decades. It has worked with member countries in defining a practical, goal-oriented work program for the GMS, focused on enhancing physical connectivity through infrastructure and facilitating cross-border trade; as well as on issues of shared regional concerns, such as the environment and health.

Despite the significant success, the GMS faces critical challenges as it moves forward in a changing world. This study is an effort to articulate and define clearly some of the most important challenges, and to confront them squarely with a cutting-edge agenda for development. The gains to date can be consolidated by moving forward with increased focus, insight, and vigor.

A key challenge is the significant economic differences that now exist between the countries of the GMS. As this study highlights, efforts must be made to ensure that Cambodia, the Lao People's Democratic Republic, Myanmar, and Viet Nam converge with the People's Republic of China and Thailand, and that the subregion as a whole continues to catch up with more developed countries. This convergence must be achieved in the face of emerging political, technological, and health challenges. As of the date of this writing, the world continues to grapple with the human and economic damage wrought by the coronavirus disease (COVID-19) pandemic, as well as with a gradual breakdown in the global consensus on trade liberalization.

Technological change, for so long a source of opportunity for emerging markets, may also pose a threat to industrialization strategies in the GMS. Countries must now contend with risks arising from the so-called fourth industrial revolution (4IR), which refers to the increased fusion of traditional technologies with emerging tools, such as artificial intelligence, cloud computing, robotics, 3D printing, and the internet of things. 4IR has the potential to render traditional industrialization strategies obsolete, and may have significant implications for employment. This report therefore specifically assesses the impact of 4IR on the GMS.

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1 Composed of Cambodia, the People's Republic of China (Guangxi Zhuang Autonomous Region and Yunnan Province), the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam.

Looking forward to the coming decades, the report focuses on three interconnected areas where the GMS can focus its efforts:

- integration into the global economy and upgrading of production capabilities,
- the role of cities as engines of growth, and
- the importance of transport infrastructure for enhanced trade integration and inter-urban connectivity.

The report rises to the challenge of "raising the game" among development practitioners in each of these areas, by leveraging the latest insights in development thinking, moving beyond traditional exclusively top–down economic analysis; and by utilizing traditional and new sources of data in support of its analysis.

I sincerely hope that the recommendations in this report are read and discussed widely. If implemented, the ideas contained herein will help improve livelihoods for people across this region.

Ahmed M. Saeed
Vice-President for East Asia, Southeast Asia, and the Pacific

Acknowledgments

This project was conceived during a series of conversations in early 2019. It took us about 18 months to conceptualize its main ideas and develop them. It resulted out of the need to provide the Greater Mekong Subregion (GMS) program with a solid understanding of the challenges its members will face during the coming decade and beyond to move forward and achieve their development objectives. We hope that the ideas we developed in this document are useful to all members.

The analysis and recommendations should be accessible to a wide audience as well as to scholars interested in the details. We have avoided technical arguments in the body of the document. These are explained in the appendixes at the end of each chapter. Also, we have made efforts to write relatively short chapters and as self-contained as possible.

We are deeply grateful to the members of our team for their commitment to deliver thoughtful analyses and sound recommendations for the members of the GMS program to think about, and to possibly incorporate into their development plans. Several meetings with GMS representatives in 2019 corroborated that the ideas we were proposing were novel and useful at many different levels. Very unfortunately, the coronavirus disease (COVID-19) pandemic that has affected the world since early 2020 did not allow us to visit the countries (as we had planned) to brief GMS officials and exchange views.

Alfredo Perdiguero, Director of the Regional Cooperation and Operations Division of the Southeast Asia Department, Asian Development Bank, was instrumental in ensuring the takeoff of the project. Conversations with him helped us understand the GMS needs and also focused the analysis. We are also grateful to the GMS team, led by Asadullah Sumbal, and Maria Josephine Duque-Comia for facilitating our work.

Finally, our gratitude to Vanessa Sumo-van Zandweghe, Judy Yñiguez, Jonathan Yamongan, and Ricardo Chan, for patiently editing and laying out the manuscript, and ensuring its readability and professional look.

Jesus Felipe
Asian Development Bank

Neil Foster-McGregor
United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT)

Contributors

Liming Chen is a Young Professional in the Economic Research and Regional Cooperation Department (ERCD) of the Asian Development Bank (ADB). His research interests include urban economics, transport infrastructure, and international trade. He obtained his PhD in Economics from the University of California, Santa Barbara and his Bachelor's degree in Economics from Fudan University, the People's Republic of China .

Jesus Felipe (Team Leader) is Advisor in ADB's ERCD. He joined ADB in 1996. He is a member of the editorial board and the Managing Editor of the Asian Development Review, and a member of the editorial board of Metroeconomica. He has published extensively on Asia's development, productivity, growth, employment, and technological progress in World Development, Journal of Comparative Economics, and Cambridge Journal of Economics; and he has written and coedited books on aggregate production functions, structural change in Asia, industrial policy, and labor markets. Jesus Felipe has held academic positions with the Hong Kong University of Science and Technology and the Georgia Institute of Technology. He holds a PhD from the University of Pennsylvania.

Neil Foster-McGregor (Team Leader) is Deputy Director and Professorial Research Fellow in Innovation and Globalization at the United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology (United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology [UNU-MERIT]). He has published extensively on issues related to economic growth and development, international trade and globalization, and innovation and technology transfer. He has conducted consultancy work for numerous organizations including ADB, various United Nations agencies, and the European Commission (for various directorate generals). Prior to moving to UNU-MERIT, he was a Senior Economist at the Vienna Institute for International Economic Studies, and prior to that he was Assistant Professor at the University of Vienna. He obtained his PhD from the University of Nottingham.

Eugenia Go is an Economics Officer in the Office of the Chief Economist in ADB's ERCD. Her research interests are in agriculture, trade, and transport economics. She holds a PhD in Economics from the University of Sussex, United Kingdom.

Rana Hasan is Director of the Economic Analysis and Operational Support Division in ADB's ERCD. His research areas and interests include industrial development, labor economics, poverty and inequality, and urban economics. He has also served as Principal Economist in ADB's India Resident Mission and Fellow at the East-West Center (United States). He has published in various journals including the Journal of Development Economics, Review of Economics and Statistics, and World Development. He has also coedited two volumes on trade- and labor-related issues. He holds a PhD in Economics from the University of Maryland and a Master's degree in Economics from the Delhi School of Economics, University of Delhi.

Matthias Helble is a Senior Economist in ADB's ERCD. Previously, he was a Senior Research Fellow in the Asian Development Bank Institute in Tokyo. His research interests include international trade, health, and housing. His research has been published in scholarly journals as well as in flagship reports of international organizations. His publication record also includes several books. He holds graduate degrees in economics from the University of Tübingen, the University of Wisconsin-Madison, and a PhD from the Graduate Institute of International and Development Studies in Geneva.

Yi Jiang is a Principal Economist in the Economic Analysis and Operational Support Division of ADB's ERCD. His research interests include public economics, urban and transport economics, and development economics. His work has been published in various journals including Economic Development and Cultural Change, Environmental and Resource Economics, and Energy Economics. He has also worked with ADB's East Asia Department on lending and policy advisory projects. Yi Jiang holds a PhD in Economics from the University of Maryland, College Park, a Master's degree in Statistics from the University of Missouri-Columbia, and a Bachelor's degree in Finance and Economics from Zhejiang University, People's Republic of China.

Mary Ann Magadia is Associate Operations Analyst in the Office of the Chief Economist in ADB's ERCD. Previously, she was Senior Investments Specialist at the Board of Investments, Department of Trade and Industry, Philippines. She holds a Master's degree in International Development Studies from the National Graduate Institute for Policy Studies in Tokyo, Japan.

Alfredo Perdiguero is the Director of the Regional Cooperation and Operations Coordination Division in ADB's Southeast Asia Department. He leads the secretariat of the Greater Mekong Subregion Program. Alfredo Perdiguero also acts as the administrator of the ASEAN Infrastructure Fund. Prior to joining ADB, Alfredo Perdiguero was an Economist in the European Union Delegation in South Africa. He also worked as a trade specialist in the Embassy of Spain in Egypt and in microfinance in Latin America. He holds a Master's degree in Economics from the Universidad Autónoma de Madrid, Spain.

Keola Souknilanh is an Associate Senior Research Fellow at the Institute of Developing Economies, Japan External Trade Organization. He received a Bachelor's degree in Computer Sciences from Toyohashi Institute of Technology (Japan) and a Master's degree in Economics from Nagoya University. He has held adjunct lecturer positions at Tokyo University of Foreign Studies, Chiba University, at Keio University, and currently at Sophia University, Japan.

Bart Verspagen is Professor of the Macroeconomics of Innovation and New Technologies at the Maastricht Economic and Research Institute on Innovation and Technology (MERIT) at Maastricht University in the Netherlands. He has published extensively on the economics of technological change, evolutionary economics, development, growth, trade, and productivity. His work includes conducting research for (international) policy organizations such as the European Commission, the United Nations, and various (Dutch) ministries. He holds a PhD from Maastricht University and has held academic positions at Eindhoven University of Technology and Oslo University. He holds an honorary doctorate from Oslo University.

Abbreviations

3D	three dimensional
4IR	fourth industrial revolution
ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
BEC	Broad Economic Categories (United Nations)
BRT	bus rapid transit
CAD-CAM	computer-aided design and computer-aided manufacturing
CIP	competitive industrial performance
COVID-19	coronavirus disease
DVX	domestic value added
EU	European Union
FDI	foreign direct investment
FVA	foreign value added
GADM	global administrative boundaries
GDP	gross domestic product
GMS	Greater Mekong Subregion
GMS-5	Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam
GRUMP	Global Rural Urban Mapping Project
GVC	global value chain
HS	Harmonized System
ICT	information and communication technology
km	kilometer
km^2	square kilometer
km/h	kilometer per hour
Lao PDR	the Lao People's Democratic Republic
LOWESS	locally weighted scatterplot smoothing
LPI	Logistics Performance Index

MRIO	multi-region input–output
MTR	multilateral trade resistances
NTL	nighttime lights
OECD	Organisation for Economic Co-operation and Development
OSM	OpenStreetMap
OSRM	Open Source Routing Machine
PC	product complexity
PIR	price-to-income ratio
PPP	purchasing power parity
PRC	People's Republic of China
PTA	preferential trade agreement
PUG	potential upgrading gain
R&D	research and development
RCA	revealed comparative advantage
ROK	Republic of Korea
SEZ	special economic zone
SMEs	small and medium-sized enterprises
TEU	twenty-foot equivalent unit
UN	United Nations
UR	upgrading relatedness
US	United States
WIOD	World Input–Output Database
WUP	World Urbanization Prospects (United Nations)

Container vans waiting to be shipped at Danang Port. The port is the third largest port system in Viet Nam and lies at the eastern end of the GMS East–West Economic Corridor (EWEC), which connects Viet Nam with the Lao People's Democratic Republic, Thailand, and Myanmar (photo by Ariel Javellana/ADB).

Executive Summary

The future of the members of the Greater Mekong Subregion (GMS) depends, to a significant extent, upon their policy makers' views about what they have to do in the coming decades.

This study provides an analysis and recommendations for the GMS to move forward and realize its development ambitions by taking advantage of the opportunities that regional cooperation offers to its members. *Where* the GMS members desire to go is clear: attain higher per capita income and living standards for all its members in a context of cross-country income convergence. The study focuses mainly on proposals on how to achieve this.

Given the lack of clear cross-country convergence documented in the introductory chapter, growth is at the core of the analysis and proposals. A successful convergence strategy will require that the countries with the lowest per capita income (Cambodia, the Lao People's Democratic Republic [Lao PDR], Myanmar, and Viet Nam) grow substantially faster than the People's Republic of China (PRC) and Thailand in the coming decades. As a consequence, the program has to make efforts in the future to focus on the members with the lowest per capita income.

To address this issue, the argument underlying the study is that a successful development strategy for the GMS in the coming decades will require economic policies that focus on the following three interrelated areas:

(i) Part 1: Integration into the Global Economy and Upgrading (Chapters 1–15)
(ii) Part 2: The Role of Cities as Engines of Growth (Chapters 16–19)
(iii) Part 3: The Need to Improve the Quality of Road Infrastructure and Connectivity to Enhance Trade Integration and Connect Competitive Cities (Chapters 20–22)

Below is a summary of the major arguments and findings of the study.

PART 1 (Chapters 1–15): Integration Into the Global Economy and Upgrading

In thinking about the development opportunities that regional integration in the GMS can promote, the role of integration into the global economy stands out as particularly important. A successful development strategy will involve access to rich-world markets and advanced technologies and the exploitation of economies of scale and scope.

A Stocktaking of the Extent of Integration of the Greater Mekong Subregion into the Global Economy

Chapters 1–4 provide an introductory discussion of the state of the subregion's integration by asking three main questions:

(i) What is the current level of integration of GMS economies in the global economy?
(ii) What is the current export structure and specialization of GMS economies?
(iii) To what extent are the export structures and specialization of the GMS members similar?

Providing answers to these questions requires an understanding and further analysis of the potential for GMS members to diversify their export structures, both geographically and in terms of a wider basket of products. It also requires an understanding of the extent to which members' specialization patterns are dependent on the specialization patterns of their neighbors.

The analysis suggests that the exports of Cambodia, the Lao PDR, and Myanmar are limited in geographic scope and that none of them trade heavily with rich-world markets. Overall, and with exceptions in some product categories, these economies rely on intra-GMS trade to a relatively large extent.

The exports of the PRC, Thailand, and Viet Nam have a much broader geographic scope and have penetrated rich-world markets to a significant degree. They are, therefore, not in competition with the three smaller GMS members in many markets, though they are in competition with one another. Within the GMS, however, the larger economies do compete with the three smaller economies in GMS markets.

In terms of products and sectors, the analysis again finds this dichotomy between the PRC, Thailand, and Viet Nam on the one hand, and Cambodia, the Lao PDR, and Myanmar on the other. The PRC, Thailand, and Viet Nam have export structures that are very different from those of the other three members. The export structures of Cambodia, the Lao PDR, and Myanmar are also very different among themselves, particularly when the analysis is carried out using very detailed product-level trade statistics.

The PRC, Thailand, and Viet Nam have been able to export a wide variety of products, notably in sectors such as electronic goods, while the exports of Cambodia, the Lao PDR, and Myanmar are highly concentrated in consumer textiles, agriculture, and mining.

Results further suggest that, in general, the exports of the GMS members do not compete. Despite this, there is evidence to suggest that there is a great deal of competition between the six members in certain low-complex sectors such as textiles, particularly in intra-GMS trade.

The PRC, Thailand, and Viet Nam have relatively unique export structures—meaning that few other countries have a similar export structure—while Cambodia, the Lao PDR, and Myanmar have relatively low levels of uniqueness.

These initial results suggest that there are two distinct groups of countries within the GMS in terms of the level of global integration and diversification: Cambodia, the Lao PDR, and Myanmar are more reliant on intra-GMS (and regional) trade and on a relatively narrow set of products; while the PRC, Thailand, and Viet Nam are more integrated into the global economy and have a more diversified export structure.

Chapter 5 deals with a question that arises from the results above, namely whether the distinction between regional and global orientation has implications for development prospects, for instance, by affecting the extent of growth spillovers that come from interactions with other countries. Analyzing such spillovers suggests that the GMS members benefit from spillovers from both their neighbors (geographic contiguity) and export partners more generally, with spillovers from export partners larger than those from their neighbors. Results thus suggest that both regional cooperation and engagement in the broader global economy can be important—and complementary—sources of per capita growth spillovers.

The analysis further suggests that those GMS members that rely heavily on spillovers from their neighbors tend to have a nondiversified export structure and export heavily to their neighbors. Conversely, those GMS members that benefit relatively strongly from spillovers from other export partners tend to have more diversified export structures—both geographically and in terms of the number of products exported with comparative advantage—and tend to produce and export more sophisticated goods. Such results have important implications, particularly that engaging in the broader global economy can be an important source of development. This raises the question of how to engage in the global economy and of the role of regional integration in facilitating global engagement.

Another important issue, addressed in **Chapter 6**, is whether GMS members are meeting expectations with regard to trading in the global economy given their current levels of development, size, and distance from the rest of the world; or whether they have an unexploited trade potential. The results of the gravity model of trade—which relates trade between countries to the distance between countries and economic sizes, among other factors—indicate that there are many opportunities for the GMS members to expand trade with third countries, though the geographical dimension of these opportunities differs across members. For the PRC, Thailand, and Viet Nam, there are opportunities to increase exports to developed countries along with other Asian countries; while opportunities exist in more distant and low- or middle-income countries for Cambodia, the Lao PDR, and Myanmar. In addition to this geographic dimension, the PRC, Thailand, and Viet Nam have a relatively large number of trade partners for which high export potential exists in many sectors; while Cambodia, the Lao PDR, and Myanmar have fewer options. In general, the results further suggest that export potential tends to be greatest in those sectors where the GMS members are relatively intensive exporters (the exception being the PRC).

Integration into the Global Economy: Structural Change and Upgrading

Chapters 7–9 address the fundamental question of how the GMS members should think about the next decades. The analysis revolves around the idea of upgrading the economy, that is, the imperative to transform production and export baskets and shift the composition of these baskets so as to increase the share of more *complex* products. These are products that embody more knowledge and command higher wages. Thus, this will be the only way to ensure a steady increase in wages. The study proposes a sound methodology to evaluate products and sectors of higher complexity that each GMS member could feasibly add to its export basket.

Chapter 7 discusses the options available for GMS members to upgrade their production. The analysis is based on the premise that development is about "discovering" new products that contain more knowledge (i.e., more complex) and that the new products that a country can successfully produce are likely to depend on what the country currently produces and exports successfully. Such an approach implies that each country will have its own upgrading path to realize its future diversification. The GMS members are rather diverse in terms of their current export specialization structures, which leads to different upgrading paths. The analysis thus identifies a set of products that individual GMS members are likely to be able to specialize in relatively easily and/or will provide relatively large gains in terms of the quality and complexity of production. A major finding of the analysis is that the GMS members need to upgrade the quality of their production. While the PRC as a whole, as well as Guangxi Zhuang Autonomous Region (Guangxi) and Yunnan Province (Yunnan), Thailand, and Viet Nam have been able to diversify their economies, there remain many opportunities for upgrading. For the other GMS members, not only are there upgrading possibilities but also scope for increasing the diversification of their production.

It would be too much to discuss these individual results in this summary, but it is worth emphasizing that these upgrading paths represent one possible road map for further industrialization, or economic development more broadly, including a general rise in income and the creation of new employment. It should also be emphasized that following such a path and successfully upgrading in the short run will lead to new upgrading opportunities, often in highly complex products. The analysis also provides one potential path for long-run upgrading, though the actual long-run opportunities will depend upon which products members successfully upgrade into in the short run.

In the context of upgrading, it is relevant to consider both the agriculture and services sectors, sectors that account for a relatively large share of employment and/or value added for all GMS members. These are discussed in **Chapters 8–9**. The case of agriculture is particularly interesting since it accounts for a relatively high share of employment in the GMS members, but it is generally a low-complexity sector. Despite this, the analysis suggests that there are upgrading possibilities within the agriculture sector to develop certain relatively complex subsectors, such as dairy and honey and coffee, tea, and cocoa. Upgrading possibilities in these subsectors tend to be common across the GMS.

Services account for between 25% and 45% of employment in the GMS economies and tend to become even more important for countries in terms of value added, employment, and exports as they develop. As with other major sectors of the economy, however, services are not homogenous, with some services subsectors involving highly complex activities and other less-complex activities. The analysis indicates that most GMS members are heavily specialized in travel and tourism exports, which, while an important source of exports and employment, tend to not be associated with a high-income status. Such results suggest that, over time, the GMS members will need to build other service subsectors, most notably financial services and other business services, and decrease their reliance on travel and tourism.

Integration into the Global Economy: Global Value Chains and Preferential Trade Agreements

Chapters 10–13 address the other fundamental question that underlies this study, namely the tools the GMS members could use to grow and upgrade.

The role of global value chains (GVCs) is addressed in **Chapters 10–12**. GVCs have become the dominant paradigm for countries to engage in the global economy, specifically as a mechanism for upgrading. GVCs break up the production process so that different steps can be carried out in different economies. Production is sliced into different production segments, with these segments relocated across national borders to places where they can be performed most efficiently. Regional integration can be an important facilitator of global integration into GVCs by creating possibilities for the development of complementary activities in different countries within a region, with firms in one country providing primary commodities or intermediate inputs for assembly activities, or final goods production, undertaken by other members in the region. The key issue is whether firms in the GMS move up the value chain, reflected in shifting activities or tasks, such as moving from product assembly to research and design. This process results in higher wages.

The development of regional value chains is considered to be a crucial factor in realizing the benefits from participating in GVCs, with regional trade agreements a potentially important driver of such complementary activities. Results in **Chapter 10** suggest that the GMS members are engaged in GVCs largely as assemblers, i.e., by importing specific intermediates intensively, processing, assembling final products, and exporting processed consumption goods, although the PRC and Thailand have been able to compete in exporting specific intermediate products within GVCs.

An interesting pattern emerges when considering sourcing and export patterns. While regional value chains are important in the sense that other GMS members are often important sources of specific intermediates (i.e., GMS members account for relatively high shares of specific intermediate imports), the regional (GMS) market is not an important destination for processed consumption goods produced by GMS members within GVCs. Such results suggest that regional value chains and regional integration can be an important stepping stone for entering into and upgrading within GVCs and for serving world markets, by providing GMS members with the intermediate goods needed to produce processed consumption goods that serve global markets

Moving from an aggregate analysis using gross trade figures to an analysis of sectoral participation in GVCs (**Chapter 11**) using value-added data reveals important heterogeneities across GMS economies. While the GMS members tend to be engaged in sectors that are most commonly associated with GVCs (e.g., electrical and machinery, textiles, and transport equipment), there are differences in both the intensity of GVC engagement and the positioning within GVCs. Myanmar, for example, has only been able to enter into upstream GVCs as a supplier of raw materials and simple intermediates (and not as a generator of research and development) in most value chains; while Thailand, Viet Nam, and to a lesser extent the PRC have moved into more downstream GVC participation (as final assemblers) in certain sectors.

Positioning within GVCs has further implications, with evidence suggesting that upstream GVC participation tends to be associated with relatively low wages. This is discussed in **Chapter 12**. Efforts to develop and raise average wages through GVCs, therefore, often requires a movement toward more downstream participation in the value chain. There are important exceptions to this pattern, however. An important sector for most GMS members within GVCs is textiles, with most GMS members engaging in relatively downstream production. However, this is also a sector where downstream production is associated with relatively low wages, meaning that efforts to move into a more upstream position (e.g., away from assembly and toward design and intermediate production) would be expected to lead to higher wages.

The analysis of the role of GVCs as a means to integrate into the global economy leads to thinking about different policies to attain this integration in a general sense. In particular, the study considers a highly relevant mechanism to facilitate integration into the global economy and into GVCs, namely preferential trade agreements (PTAs). This is discussed in **Chapter 13**.

Data on PTAs for 2015 show that GMS members have signed a relatively small number of PTAs (between 15 and 19). Most of these agreements are with each other or with other countries in the region (i.e., through the Association of Southeast Asian Nations), meaning that they have few agreements with countries outside the region and with developed countries in particular. Despite this, the evidence suggests strongly that those PTAs that do exist have a strong positive impact on exports, a result that is true for both total exports and exports across a variety of sectors. PTAs have played a significant role in driving GMS exports of intermediate goods, and they can be seen, therefore, as an important facilitator of GVC participation. Further, it is not simply the presence of a PTA that is important for expanding export flows. What matters, rather, is the breadth of such agreements. Consistent with other empirical evidence, the results here suggest that there may be an optimal breadth of PTAs, with certain behind-the-border measures limiting the benefits from PTAs in terms of, for example, export flows.

The Fourth Industrial Revolution: Implications for the Greater Mekong Subregion

Understanding the possible impacts and effects of the so-called fourth industrial revolution (4IR) is of paramount importance for the GMS. These are discussed in **Chapters 14 and 15**. The term 4IR is used to capture ongoing technological progress associated with the fusion of the digital, biological, and physical worlds alongside the increased use of new technologies such as artificial intelligence, cloud computing, robotics, three dimensional (3D) printing, and the internet of things, among others. Two issues are of immediate concern: first, the extent to which GMS members are engaged in the production and use of these technologies, thus providing initial insights into the region's readiness for the 4IR; and second, the extent to which these new technologies provide a risk to development opportunities, in particular those related to employment generation.

Using trade data to capture the production and use of a specific set of 4IR technologies (**Chapter 14**), the analysis finds that the production (i.e., export) of 4IR technologies is highly concentrated in the developed world and a small number of large developing countries, including the PRC; while the use (i.e., import) of 4IR technologies is less concentrated, with many developing countries using 4IR technologies. There is also a strong positive association between the production and use of 4IR technologies and manufacturing performance, a result suggestive of the importance of these technologies in developing a complex manufacturing sector. However, the direction of causality may work in the opposite direction, i.e., that a competitive manufacturing sector is what creates demand for new technologies. In the context of the GMS, the PRC dominates in terms of the absolute value of both exports and imports of 4IR technologies, with other GMS members appearing more engaged when considering the intensity of production and use of these technologies. Despite this, there are few examples of specialization in specific 4IR technologies, either in terms of production (export) or use (import). The PRC is specialized in the export of 3D printing technologies and Thailand in the export of computer-aided design and computer-aided manufacturing (CAD-CAM) technologies. No other GMS member is specialized in exporting any other 4IR technology.

In the case of imports, the PRC has maintained specialization in the different 4IR products (i.e., 3D printing, CAD-CAM, and robots), with Thailand developing or maintaining specialization in CAD-CAM and robots. Viet Nam and Myanmar have also developed specialization in specific products, with Myanmar acquiring specialization in the use of 3D printing, and Viet Nam in the use of CAD-CAM technologies. Based on an analysis of exports and imports in aggregated 4IR products, the study suggests a typology according to the GMS economies' involvement with 4IR technologies: (i) the PRC and Thailand are emerging producers and leading users of 4IR technologies; (ii) Viet Nam and Cambodia are followers in production, but leading or emerging users; and (iii) the Lao PDR and Myanmar are followers in both production and use.

These results thus suggest that, without relevant investment in new technologies, there is a risk that the GMS members—particularly the Lao PDR and Myanmar—will be excluded from the 4IR.

Results from the recent empirical literature, summarized and discussed in **Chapter 15**, indicate that the GMS members are at a significant risk of job loss from automation, with estimates suggesting that between 40% and 80% of jobs are at risk of automation, depending on the country and the study. Such estimates are likely to be misleading, however, with a number of factors suggesting that these estimates may exaggerate the risk of automation. These include the fact that the approach adopted in the literature concentrates on the technological feasibility of automating occupations (as opposed to specific tasks) and ignores economic aspects such as the relative costs of automation versus labor, which may favor labor in GMS members for quite some time. The approach further ignores the possibility that other conditions and capabilities, e.g., those related to infrastructure, institutions, human capital, and so on, may affect the feasibility of automating jobs. Moreover, during the course of development, there will likely be a large amount of job churning, with jobs lost in agriculture and generated in manufacturing and especially services. These job losses in agriculture will be partly due to the use of older forms of technological progress—associated with mechanization, for example (use of tractors)—rather than due to implementing technologies associated with the 4IR. In short, while some estimates suggest that 4IR technologies may have large impacts on employment in the GMS economies, it is likely that these estimates are exaggerated, and they do not provide a strong justification for failing to take advantage of these new technologies as a development tool. What may possibly be true is that the introduction of 4IR technologies exacerbates job polarization, with some workers getting high-paying jobs associated with these technologies (in both manufacturing and services), while other workers are stuck in low-paying jobs within agriculture, manufacturing, construction, or low-productivity services.

PART 2 (Chapters 16–19): The Role of Cities as Engines of Growth

Chapters 16–19 also add to the discussion on to how to move forward in the coming decades by highlighting the importance of cities as engines of growth.

Chapter 16 documents the significant increase in urbanization that the GMS has experienced over the last several decades. The share of the subregion's population living in urban areas is estimated to be around 40%, and projections suggest that this will increase to around 60% by 2050. According to the World Urbanization Prospects data, the process of urbanization has been fastest in the Lao PDR, where urban population grew by an average of 4.8% per year between 1970 and 2017. Urbanization has also been rapid in Guangxi and Yunnan in the PRC. The slowest growth has been in Myanmar, at 2.1% per year over the same period.

Simultaneously, a growing share of the urban population is residing in large cities with a population of 1 million or more. The growth is most remarkable for Myanmar and Viet Nam, where the share of urban dwellers in large cities increased by about 10% between 2000 and 2015. Moreover, satellite-based nighttime lights data show that GMS cities, like many others in developing Asia, have expanded beyond their administrative boundaries. This is most pronounced for Phnom Penh, Bangkok, and Ha Noi. As these cities continue to expand, many closely located cities are forming "city clusters."

As a result of advances in the field of economic geography, we understand today the important role of cities as places where workers and firms interact. Cities are believed to generate increases in productivity known as "agglomeration economies" (which result from size and/or density). **Chapter 17** shows that firms in bigger GMS cities tend to be more productive and pay workers more, and they are more likely to engage in innovative activities. This, however, does not imply that smaller cities do not have an important role to play. In fact, robust economic growth requires vibrancy in all types of cities: small, medium, and large.

Given the important role that cities have played in the growth of today's developed countries as well as newly industrialized economies, the unfolding urbanization in the GMS bodes well for its prospects. However, recent experience from the developing world suggests that urbanization does not automatically imply greater economic dynamism. Cities may be getting larger and denser, but various factors seem to be constraining them from achieving their full potential. As discussed in **Chapter 18**, factors such as traffic congestion, weak urban planning, and a lack of affordable housing all take away from the productivity advantages of cities.

For cities to play their role as engines of growth, they need to be managed well so that intracity travel is fast, reliable, and cheap; land-use plans anticipate areas of urban expansion and do not introduce undue rigidity into the location decisions of firms and households; and real estate is affordable. In addition, cities must pay attention to institutions that build human capital and provide a conducive business environment, not just for incumbents, but also for new entrepreneurs and new economic activities.

Further, as emphasized in **Chapter 19**, cities are not "individual islands," rather, they are interconnected with one another through the flows of goods, services, and people and constitute a *system*. These interconnections often cross borders, as in the case of the GMS. Making the most of the benefits that urbanization can bring requires that cities are managed well, not only from the perspective of individual cities but also from the perspective of the system of cities spanning both individual economies and the GMS as a whole. This requires that policy makers pay attention to the factors that underpin how efficiently the system of cities works, namely, the state of intercity transport infrastructure and institutions that can coordinate decisions and plans across cities.

PART 3 (Chapters 20–22): The Need to Improve the Quality of Road Infrastructure and Connectivity to Enhance Trade Integration and Connect Competitive Cities

The three chapters in Part 3 also add to the discussion of how to upgrade the GMS economies. **Chapters 20–21** provide an innovative analysis on the quality of the road network in the GMS and the identification of networks that would generate higher growth. These chapters show how data on actual travel distance and time between several thousand districts in the GMS could be generated relatively quickly and used to analyze the quality of roads by using online routing systems and without resorting to expensive field surveys. **Chapter 22** argues that improvements in trade facilitation will enhance connectivity. This discussion matters because, in order to develop competitive cities, and in particular to form systems of cities, the GMS needs high-quality infrastructure that connects its cities.

Chapter 20 compares *required travel distance to straight-line distance* among districts to assess the level and quality of road infrastructure. The analysis estimated travel speed and time to evaluate the quality of existing roads. The chapter finds that the lack of close-to-straight-line road connectivity arises partly as a result of geographic conditions, such as a mountainous landscape and the shape of a territory, as well as lack of infrastructure funds and technological capabilities. The quality of roads in the GMS is still low in general when compared to that of selected industrialized countries. Richer members such as Guangxi (PRC) and Thailand build better roads than the other members of the GMS.

Chapter 21 evaluates road connectivity in over 2,000 districts in the GMS and their major markets, such as capital cities and cities with major international ports, using online routing systems. On average, only districts in Thailand and Guangxi, and to a lesser extent in Yunnan, have proper road connectivity to their own capitals. Many districts in the GMS are better connected by road to the capital cities of other members than to their own. Likewise, many districts in the western and northwestern areas of the GMS have poor road connectivity to major international ports.

The chapter introduced the concept of *market potential* of a city or a region. This is the size of a city or a region's own market, plus that of all other markets, corrected by the distances between them. Results show that the market areas of each capital city are significantly different from what national boundaries indicate. For many districts in the GMS (e.g., in the Lao PDR), cities across the border (e.g., Bangkok) have the largest market potential. Several options to increase the districts' market potential were examined. The analysis indicates that the best way to increase the market potential of a city or region is to improve its connectivity to major cities (e.g., Bangkok and Ha Noi) with a large number of cities around them. For instance, simulations of the time it would take to travel from a city located between Bangkok and Chiang Mai to these two larger cities reveal that reducing the travel time to Bangkok by 1 hour would increase the city's market potential between 24% and 154% above the increase in market potential derived from the same reduction in travel time to Chiang Mai. This is because reducing the access time to Bangkok also reduces the time to access many other cities around Bangkok. Likewise, for a city between Ha Noi and Da Nang in Viet Nam, reducing travel time to Ha Noi by 1 hour would increase market potential between 19% and 90% above the same improvement in travel time to Da Nang.

Improving connectivity also depends on the performance of GMS members on various measures of trade facilitation. This is discussed in **Chapter 22**. For the purpose of the analysis, trade facilitation can be summarized in an index which includes (i) efficiency of customs and border clearance (i.e., speed, simplicity, and predictability of formalities) by border control agencies; (ii) quality of trade and transport-related infrastructure (e.g., ports, railroads, roads, and information technology); (iii) ease of arranging competitively priced shipments; (iv) competence and quality of logistics services (e.g., transport operators and customs brokers); (v) ability to track and trace consignments; and (vi) timeliness of shipments in reaching a destination within the scheduled or expected delivery time.

There is significant heterogeneity across the GMS members with respect to trade facilitation. The PRC, Thailand, and Viet Nam perform relatively well in the index of trade facilitation, particularly in terms of timeliness and international shipping, and for the PRC in terms of infrastructure; while the other three GMS members rank relatively low in the trade facilitation index (though, again, performing relatively well in terms of timeliness). The empirical analysis indicates that an improvement in trade facilitation has a strong positive impact for exporters. These effects are found to be important across a broad range of sectors and product types (e.g., consumption, intermediate, and capital goods), highlighting the importance of investments in trade facilitation to encourage exports within the GMS.

PART 4 (Chapter 23): Recommendations

Chapter 23 brings together a series of recommendations based on the analysis in the previous chapters. As noted above, the ultimate goal and rationale of a regional cooperation program such as the GMS is to contribute to its members' development. The underlying argument is that regional cooperation can be an important tool to facilitate this process. Naturally, it is expected that all countries and regions grow faster with than without regional cooperation and, moreover, that those countries and regions that start at the bottom with lower per capita incomes grow faster so that the group experiences convergence in per capita income.

The analysis in **Part 1: Integration into the Global Economy and Upgrading**, leads to a number of recommendations in the following areas:

(i) Develop trade policies and infrastructure investments to enhance trade integration.
(ii) Encourage integration into GVCs and upgrading production within GVCs.
(iii) Develop an environment conducive to maximizing the benefits from the 4IR.
(iv) Develop a strategy for upgrading the production structure.
(v) Consider the employment implications of the upgrading paths.
(vi) Encourage the diversification of GMS economies.

The analysis in **Part 2: The Role of Cities as Engines of Growth**, leads to the following recommendations:

(i) Evaluate whether cities are able to reap agglomeration economies (e.g., higher productivity and higher wages resulting from the concentration of firms and workers in a given location) commensurate with their size, or whether factors such as traffic congestion, weak urban planning, and unaffordable housing are undermining the benefits of agglomeration.

(ii) To manage cities adequately, pay attention to basic issues such as transport and other urban infrastructure, urban planning and land-use regulations, and affordable housing. This also requires developing the institutions that contribute to enhancing human capital and create a conducive business environment, as well as implementing policies to encourage new economic activities and young firms to operate.

(iii) Cities are connected to one another and to the rural hinterland, through flows of goods, services, and people. This requires developing an efficient intercity transport infrastructure together with setting up institutions to coordinate decisions and plans across cities and their administrative units.

Finally, the analysis in **Part 3: The Need to Improve the Quality of Road Infrastructure and Connectivity to Enhance Trade Integration and Connect Competitive Cities**, leads to a series of general recommendations for the GMS as a whole and for each member. Recommendations for the GMS as a whole include:

(i) Make use of volunteer-based and bottom–up online routing systems to evaluate and monitor up-to-date road connectivity more efficiently.

(ii) Improve connectivity to Bangkok, Ho Chi Minh City, and Ha Noi as the most efficient option to increase market potential for most districts in the GMS (except those in Guangxi and Yunnan, which have large cities close by).

(iii) Develop a metropolitan area similar to Bangkok, Ho Chi Minh City, or Ha Noi somewhere in the western part of the GMS, and another one in central Viet Nam, which would help the upper part of the GMS and the East–West Economic Corridor.

(iv) Reduce border crossing time, which accounts for much of the total transport time between origin and final destination. This is the cheapest and most efficient way for border-area districts to benefit from larger and closer markets in neighboring members.

(v) Connect seaports with cross-border railway networks, two of the cheapest modes of long-haul transport. These would enable more firms located in the GMS to participate or penetrate further into GVCs.

(vi) Improve different aspects of trade facilitation, especially in Cambodia, the Lao PDR, and Myanmar.

A major intersection. This is where the Bangkok Mass Transit System (BTS) or the Skytrain, an elevated rapid transit system and the Metropolitan Rapid Transit (MRT), a mass rapid transit system serving the Bangkok Metropolitan Region in Thailand are interconnected. (photo by Patarapol Tularak/ADB).

Convergence: *Where To?* The Rationale of the Greater Mekong Subregion Economic Cooperation Program

The Greater Mekong Subregion (GMS) Economic Cooperation Program was established in 1992. Its members are Cambodia, the Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, Viet Nam, and the People's Republic of China (PRC), specifically the Guangxi Zhuang Autonomous Region and Yunnan Province. The GMS program was created under the argument that regional cooperation could be a powerful development escalator that can facilitate its members' development.

One key objective of its members has been to increase their income per capita and overall living standards. This has been achieved by all of them largely as a result of high growth rates. Another important objective of the GMS is to ensure that its members experience convergence at different levels; that is, that the poorest districts or regions in per capita income (or appropriate indicator) at the start of a given period grow faster than the richer ones, so that by the end of the period in question the income disparity within the country has declined. When considering countries, the convergence objective implies that the poorest countries grow faster than the richer ones. This objective is key within the context of a cooperation program among several countries.

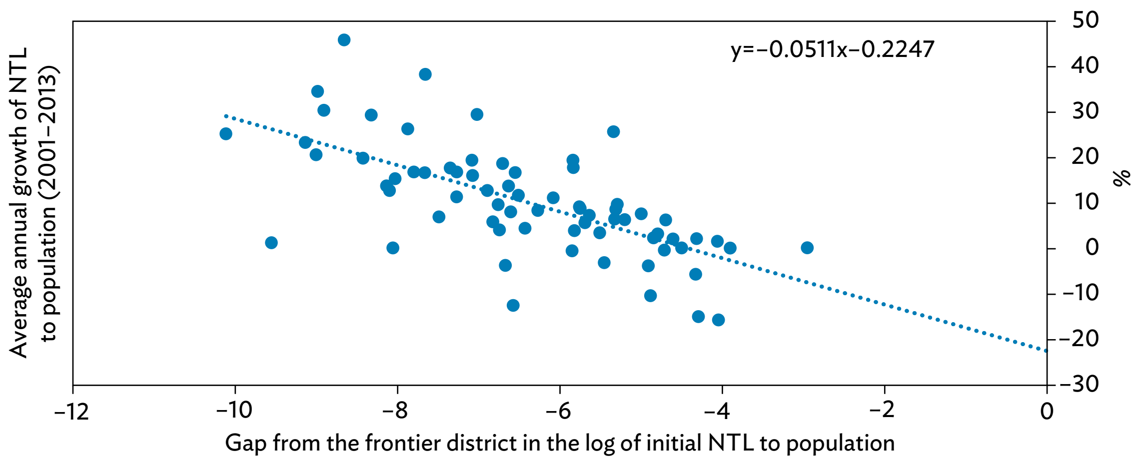
The analysis below offers a discussion of the extent to which the different convergence objectives have been attained. We analyze convergence across districts within each GMS country, convergence across the six GMS countries, and convergence of the GMS countries to the world's frontier. The empirical evidence shows that, while within-country convergence has been attained by all of six country members, this has been much less so at the country level, both within the GMS (with respect to Thailand) and when comparing the GMS to the world's frontier (the United States [US]). The corollary of these findings is that growth is key for the GMS. They provide a strong rationale for the GMS program to develop a solid growth agenda with specific reference to the convergence objective. While growth is certainly not everything, and not the only objective of the GMS, it is a necessary condition for the members of the subregion to advance. This idea is the basis of this study.

Within-Country Convergence in the Greater Mekong Subregion

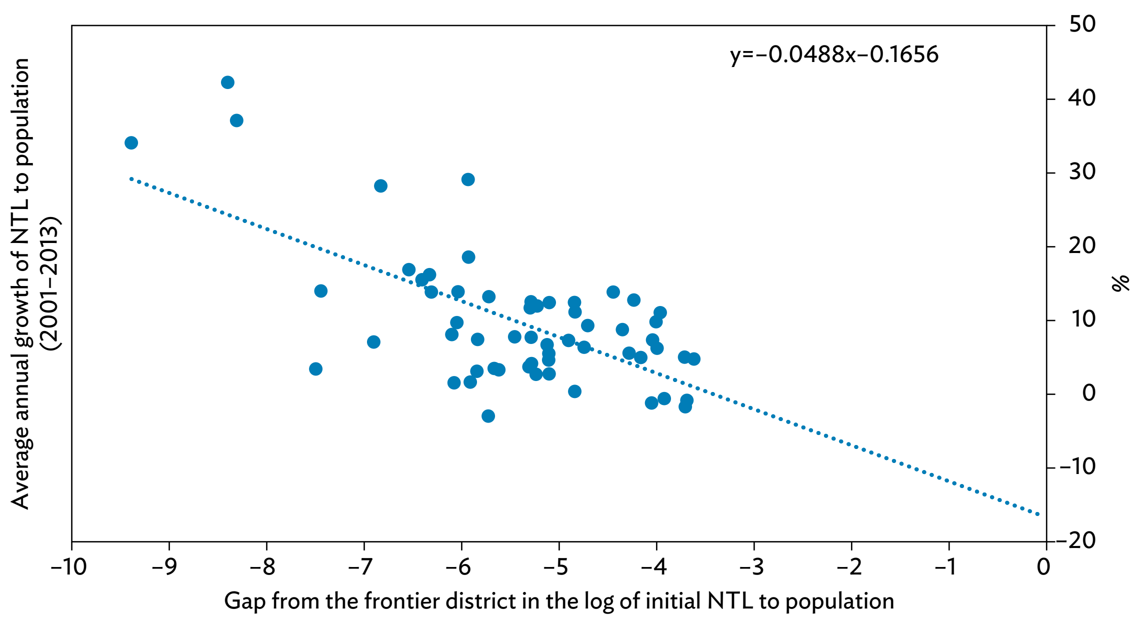
Using district-level data for each GMS country, the evidence indicates that there has been absolute convergence within each of them; that is, that poorer districts in all six countries grew faster than richer districts. Figure 0.1 (panels (a)–(f)) plots the annual average growth rate of nighttime light per person over the period 2001–2013, used as an indicator of economic activity at the district level, against the gap in initial level (i.e., 2001) of nighttime light per person, for each of the GMS countries.[1]

Figure 0.1: Convergence to the Frontier District in Nighttime Lights per Person

(a) Across Districts in Cambodia



(b) Across Districts in the Lao People's Democratic Republic



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[1] The initial gap is calculated as the log of nighttime light per person in a district minus the log of nighttime light per person in the district with the highest level of nighttime light per person (the frontier district), in each GMS member in 2001. As such, larger negative numbers indicate a larger gap with the leading district.

Figure 0.1 *continued*

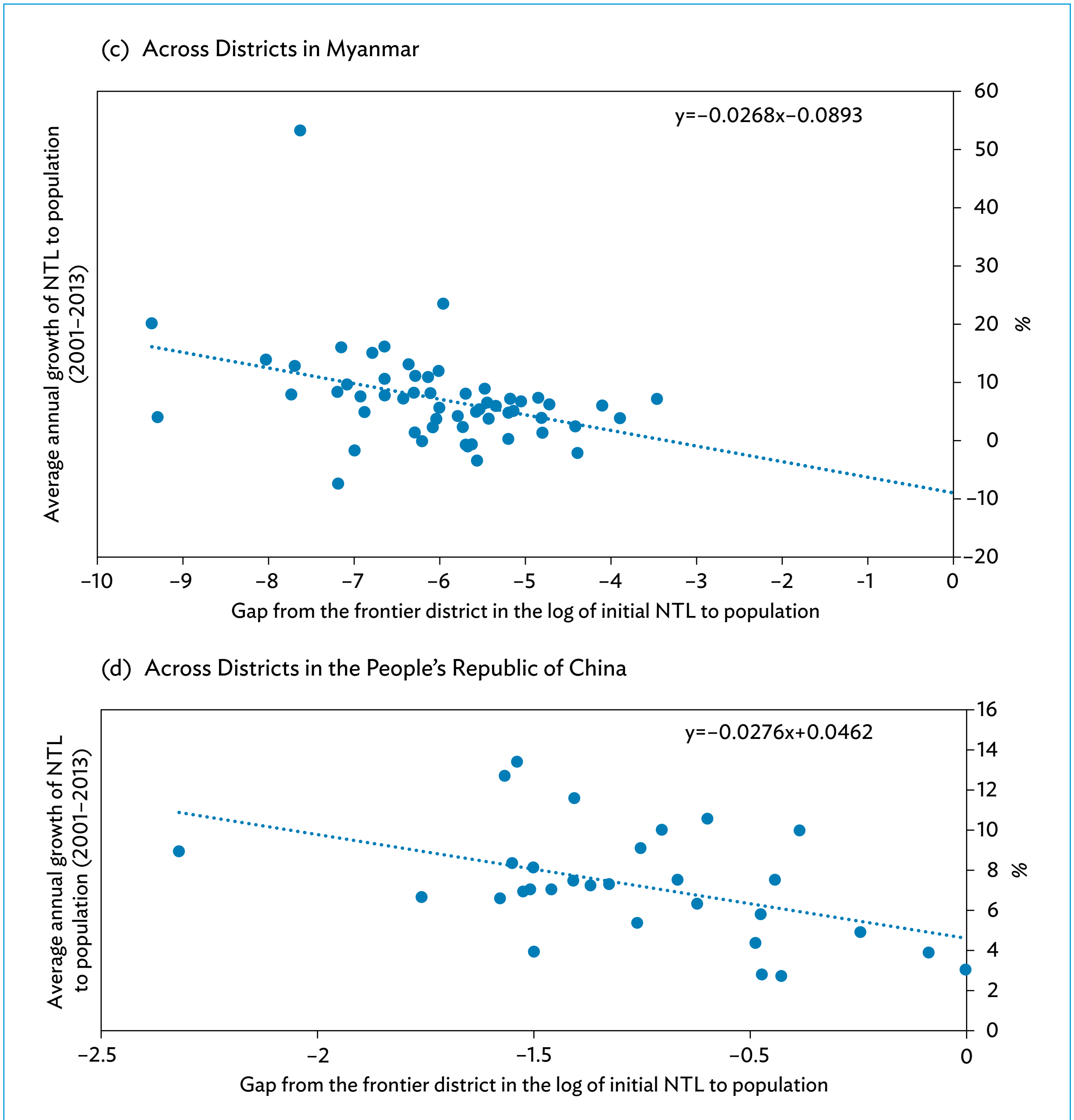

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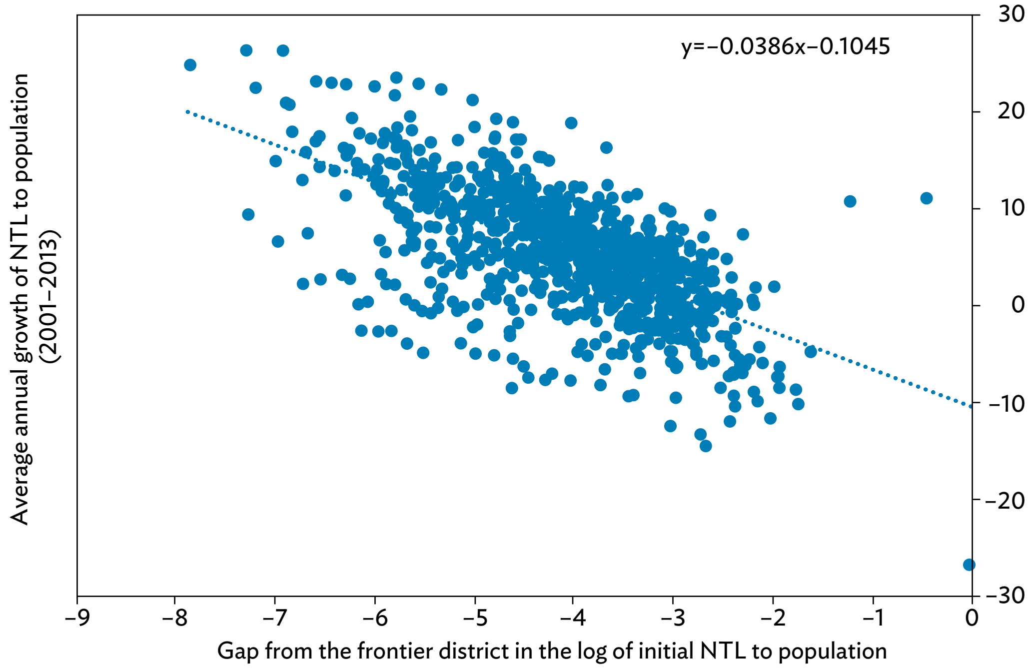
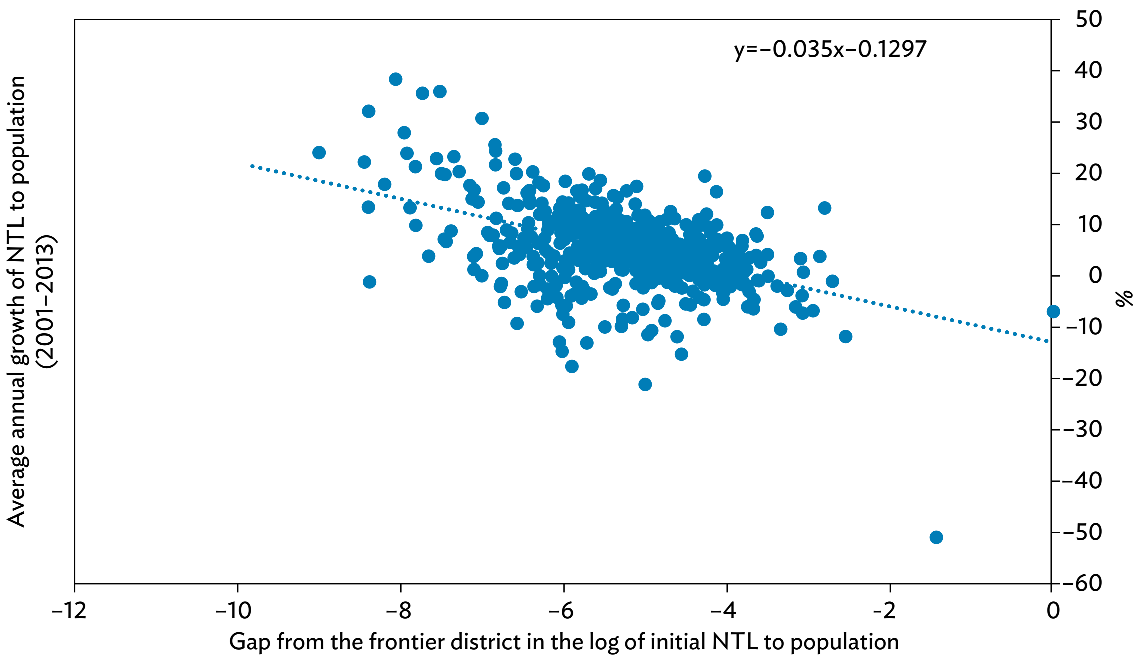
Figure 0.1 *continued*

(e) Across Districts in Thailand



(f) Across Districts in Viet Nam



NTL = nighttime light.

Note: Number of districts (represented by the circles in each plot) in each member: Cambodia: 69; the Lao People's Democratic Republic: 58; Myanmar: 57; the People's Republic of China: 30; Thailand: 905; and Viet Nam: 654.

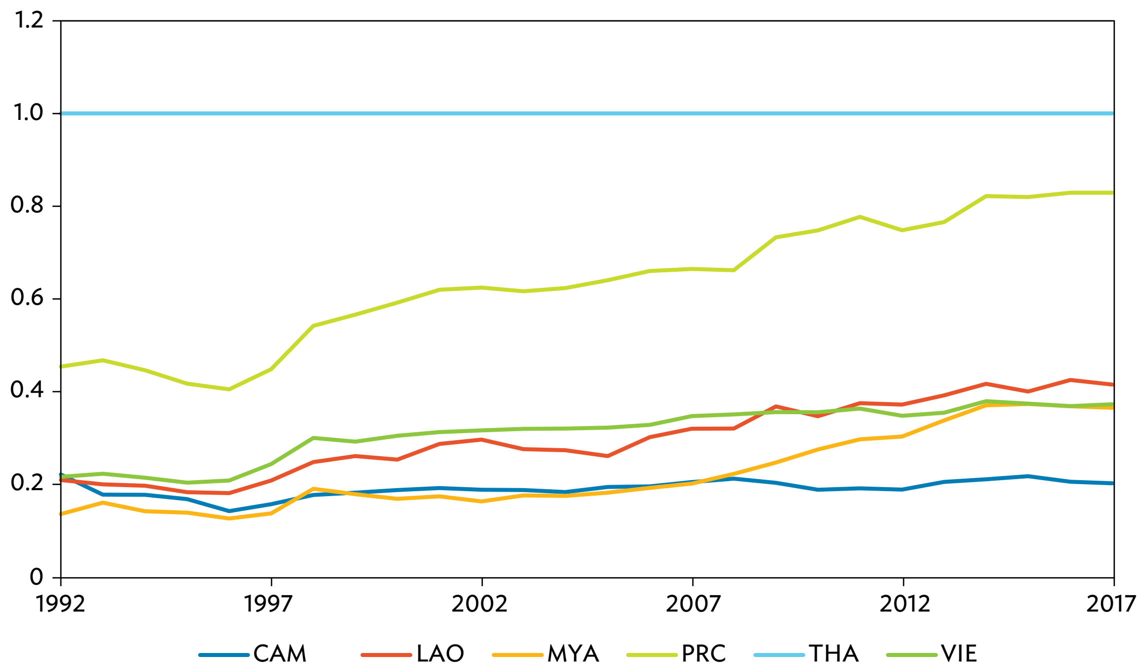
Source: Authors' calculations based on nighttime light data from the National Oceanic and Atmospheric Administration (NOAA) (https://ngdc.noaa.gov/eog/download.html), Global Administrative Areas (GADM) (https://gadm.org/), and LandScan from Oakridge Institute (https://landscan.ornl.gov/).

The evidence indicates with clarity that, in all GMS countries, those districts that recorded lower nighttime light per person relative to the frontier district in 2001 registered higher growth rates of nighttime light per person during 2001–2013. This is indicated by the negative slopes of the fitted lines in the different panels of Figure 0.1. The estimated rates of convergence to the frontier district are 11.7% (per year) in Cambodia, 11.2% in the Lao PDR, 6.2% in Myanmar, 6.3% in the PRC, 8.9% in Thailand, and 8.1% in Viet Nam.[2]

Cross-Country Convergence within the Greater Mekong Subregion

Yet, despite the obvious progress reflected in the within-country convergence documented above, Cambodia, the Lao PDR, and Myanmar (and, to a certain extent, Viet Nam) are significantly behind the PRC and Thailand in income per capita. Figure 0.2 graphs the ratio of income per capita of each

Figure 0.2: Gross Domestic Product per Capita Relative to that of Thailand



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Note: Series are in constant purchasing power parity dollars.

Source: Penn World Tables version 9.1 (Feenstra, Inklaar, and Timmer 2015).

[2] The rate of convergence is calculated from the slope of each regression. The coefficient of −0.051 for Cambodia, for example, implies a rate of absolute convergence of 5.11%, which further implies that a district that initially had a tenth of the level of nighttime light of the lead district boosted its growth in nighttime light per person by 12.7% per year (i.e., $0.0511 \times \ln(10)$).

country with respect to Thailand's, at each point in time, between 1992 and 2017. While income per capita across the region at the country level has not diverged, it has not shown clear signs of convergence. Thailand was, by far, the richest member in 1992, and it is still the richest today by a similar margin with respect to all other GMS members except for the PRC.

At the inception of the GMS program in 1992, per capita income differences among its members were large.[3] Though income per capita increased in all countries, the data suggest that there are two groups within the GMS. The first group, Thailand and Cambodia, experienced relatively small increases in per capita income, specifically an increase of around 2.5 times between 1992 and 2017. The second group, the other four members, experienced larger increases in per capita income, by a factor of between 4.5 (Viet Nam) and 7.0 (Myanmar).

The relatively low rate of increase in per capita income in Thailand—the richest GMS country in 1992—compared to that of most other GMS members suggests that there has been some convergence in income per capita since the inception of the GMS program.[4] The exception to this pattern of convergence is Cambodia, where there has been no convergence to Thailand's per capita income. In fact, the ratio of its income per capita with respect to that of Thailand declined from 21% to 20% during the period under consideration.

Overall, therefore, the data reported in Figure 0.2 suggest there has been only a slow degree of convergence across the GMS members since the inception of the program, with the exception of the PRC, whose income per capita has clearly approached that of Thailand. Ultimately, this has been due to the fact that, although the members with the lowest gross domestic product (GDP) per capita in 1992 grew faster in the last 25 years, this higher growth has not compensated the base effect, i.e., Thailand's already significantly higher income per capita in 1992.

This persistent gap in incomes means that the program needs to ensure that the GMS members lagging behind will grow significantly faster than the more advanced members in the coming decades, so that convergence in income per capita becomes a reality within the GMS. This is the intrinsic and ultimate purpose of a regional cooperation agreement, i.e., not only that its members grow, but also that they grow in such a way that income per capita converges with those of the other members.

Convergence to the International Frontier

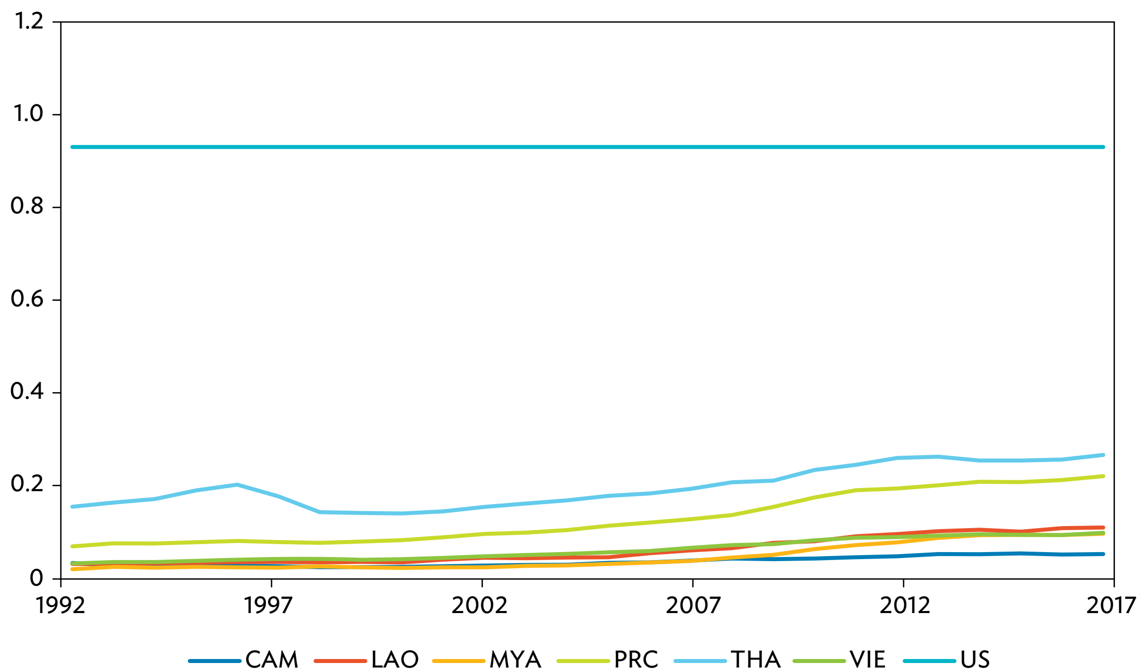
In addition to cross-country convergence in per capita GDP within the GMS, a further requirement for successful regional cooperation is that the GMS members converge to the global economic frontier. Combined, the two dimensions of convergence will involve rising income levels for the region as a whole and equitable development within the GMS. Consistent with the evidence of slow intra-GMS

[3] Myanmar had the lowest per capita gross domestic product (GDP) at 822 constant purchasing power parity (PPP) dollars, and per capita income was between 54% (1,271 PPP $) and 64% (1,344 PPP $) higher in Cambodia, the Lao PDR, and Viet Nam. The PRC's income per capita was nearly 3.5 times (2,772 PPP $) that of Myanmar, while Thailand's was 7.5 times (6,123 PPP $) Myanmar's income.

[4] Income per capita in the PRC was 45% of Thailand's in 1992, rising to 83% by 2017. The corresponding numbers for Myanmar are 13% and 37%, 21% and 41% for the Lao PDR, and 21% and 37% for Viet Nam.

convergence, convergence to the global frontier since the beginning of the GMS regional cooperation program has been, at best, weak. This can be seen by considering whether the GMS members' per capita incomes have converged to that of the US for the period covered. This is shown in Figure 0.3. In 1992, the GMS members' ratio of income per capita with respect to the US ranged from a low of 2.2% (Myanmar) to a high of 16.7% (Thailand).[5] These numbers rose over time, such that, by 2017, Thailand and the PRC had per capita incomes that were 28.8% and 23.8% of US per capita income, respectively. The ratios for the Lao PDR, Myanmar, and Viet Nam increased from around 2%–3% in 1992 to 10%–12% in 2017. Cambodia showed the weakest convergence, with per capita income increasing from 3.7% to 5.8% of that of the US between 1992 and 2017. Therefore, despite some heterogeneity in outcomes across the GMS members, the pattern observed above is one of relatively slow convergence to the global frontier.

Figure 0.3: Gross Domestic Product per Capita Relative to That of the United States



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, US = United States, VIE = Viet Nam.

Source: Authors.

To give some indication of the implications of a lack of convergence within the GMS and to the world's frontier, Table 0.1 reports estimated dates of when GMS members can catch up with Thailand (closest to world frontier) and the US (the world's frontier). The first exercise provides the year the GMS members will attain the income levels that Thailand and the US had in 2017. The second exercise

5 Ratios for the other members are 3.4% for the Lao PDR, 3.6% for Viet Nam, 3.7% for Cambodia, and 7.6% for the PRC.

provides the year the GMS members will catch up with Thailand and the US, assuming per capita incomes of these two countries continue growing.

The approach is a very simple exercise, yet it highlights why growth matters. The results serve as reference. The exercise assumes that the GMS members grow in the future at a rate equal to the highest annual average growth rate achieved in a consecutive 5-year period during 1990–2017. These per capita growth rates range from 8.4% for Viet Nam (over the period 2003–2007) to 14.4% for Myanmar (2007–2011), with growth rates of 8.9% (2007–2011) for the PRC, 9.0% (2004–2008) for Cambodia, 11.2% (2006–2010) for the Lao PDR, and 9.1% (1992–1996) for Thailand. Under this very optimistic assumption, the estimated catch-up date represents possibly the best that the GMS members can hope to do to catch up with Thailand and the US.

Using these hypothetical growth rates for all subsequent years, the first two columns of Table 0.1 report the year the GMS members would attain the income levels that Thailand and the US had in 2017. The results show the PRC rapidly catching up to Thailand in 2020 and to the US in 2034. Other members are also estimated to catch up with Thailand relatively quickly—in 2025 for Myanmar, 2026 for the Lao PDR, 2030 for Viet Nam, and 2036 for Cambodia. Catching up to the US will obviously take longer. Thailand achieves this in 2032, followed by both Myanmar and the PRC in 2034, the Lao PDR in 2038, Viet Nam in 2045, and Cambodia in 2051.

Table 0.1: Estimated Catch-Up Dates with Thailand and the United States under Optimistic Growth Assumptions

	(1) With Thailand's GDP Per Capita in 2017	(2) With the US GDP Per Capita in 2017	(3) With Thailand	(4) With the US
Cambodia	2036	2051	2053	2058
Lao PDR	2026	2038	2031	2041
Myanmar	2025	2034	2028	2036
PRC	2020	2034	2022	2038
Thailand		2032		2035
Viet Nam	2030	2045	2042	2051

GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China, US = United States.
Source: Authors' calculations based on Penn World Tables version 9.1.

The second exercise estimates the number of years that GMS members need to catch up to Thailand and the US, assuming that per capita income levels of these two countries grow after 2017 at the rates observed over the period 1992–2017, which are 4.2% for Thailand (used for the calculations in column [3]) and 1.5% for the US (used in column [4]). The growth assumptions for the other GMS members remain as above. For catching up to the US in column (4), the assumption for Thailand is its fastest-growth rate of 9.1% per annum. Results are shown in columns (3) and (4) in Table 0.1. It is obvious that, because both Thailand's and the US income per capita are allowed to grow, it will take significantly longer for the GMS members to catch up with both countries compared with the first exercise.

The PRC catches up relatively quickly to Thailand in 2022 and to the US in 2038, even when allowing for growth in the frontier. The next earliest date of intra-GMS catch-up after the PRC is 2028 for Myanmar, followed by the Lao PDR in 2031, Viet Nam in 2042, and Cambodia in 2053. Catch-up estimates with respect to the US when allowing for growth in the frontier show a similar pattern, with the PRC and Myanmar catching up relatively quickly in 2038 and 2036, respectively, and other countries somewhat later, with Cambodia coming last in 2058.

The estimated years in Table 0.1 are based on extrapolations and optimistic assumptions. They provide a sense of the fastest catch-up dates. They also highlight the hard fact that the GMS members need to focus their economic policies and interventions on growth, keeping in mind that the income gap both within the group and with respect to the world's frontier needs to be closed in the coming decades. This will ultimately be the greatest achievement of the subregion.

Summing up, the above two cross-country convergence analyses imply that, going forward, the GMS program has to make efforts to not only ensure that income per capita of all its members increases, but also that convergence (in income per capita) both within the subregion and to the world frontier become a reality. Regional cooperation and investments in infrastructure do matter, but are not sufficient *alone*. They need to be inserted into a comprehensive growth and development strategy. This is what this document proposes.

The O-Ring Analogy and the Greater Mekong Subregion

This Introduction closes with a reference to the seminal work of Michael Kremer, 2019 Nobel Memorial Prize in Economic Science. Kremer's (1993) article is an excellent anchor to understand the challenges that the developing nations of the GMS face to advance and realize their objectives.

Development, in the sense of achieving the living standards of today's advanced economies, is proving to be a difficult endeavor for many countries. It is important to understand why wage and productivity differentials between the industrialized nations and developing countries are so large. Economist Michael Kremer (1993) put forward a very interesting theory—the O-Ring theory of economic development—to answer this and other related questions in a novel fashion. An o-ring is a donut-shaped rubber seal. The malfunctioning of one such seal caused the explosion of the Challenger space shuttle in 1986. The shuttle had cost billions of dollars, required the cooperation of several hundreds of teams, and combined a considerable number of components. All this joint effort was lost because one seal failed to function properly. Kremer applied the o-ring metaphor to explain why there exist such large differences in income between developed and developing countries. The implications of his theory are very important since they seem to contradict a great deal of conventional wisdom, especially regarding the implications of the theory of comparative advantage.

In his article, Kremer explained that production is often the result of a series of tasks as, for example, found on an assembly line. These tasks can be performed at different levels of "skills," where the latter refers not to a particular level of education but to the probability of completing a task successfully, a function of a myriad of things that have to be in place and work properly. A key tenet of Kremer's argument is that, for a final product or service to be successfully made or delivered, every single task must be completed correctly. This implies that the value of each worker's efforts depends on the quality of all other workers' efforts. For example, in Kremer's model, a car that leaves the assembly line is a car if and only if the brakes, transmission, and other parts work properly.

The model has very important applications for both economic development and labor markets. One of the most important implications of Kremer's theory is that it explains why workers of similar skills have strong incentives to match together, i.e., highly skilled workers will attempt to work with other highly skilled workers and, likewise, low-skilled workers will work with other low-skilled workers. The consequence is that highly skilled workers complement one another, giving rise to increasing returns to skills, resulting in higher productivity. Unskilled workers, on the other hand, lower one another's productivity even more.[6]

It also explains why highly skilled workers, such as a surgeon from a developing country would want to migrate to the advanced countries, giving rise to brain drain. They will be much more productive after they have migrated, even though their individual skills remain the same. Migration allows them to match up with the skilled labor force in the developed country. Conventional economic theory would suggest that, as surgeons are a scarce factor of production in the developing nation compared to the advanced nations, their marginal products and pay would be commensurately higher than their counterparts in the advanced nations. In fact, their wage rates are much lower.

Financial capital will also flow toward the richest countries since increasing returns imply that the rate of return is higher where it is already abundant. The model is also consistent with the evidence that rich countries specialize in the production of complicated products, firms are larger in industrial countries, and firm size and wages are positively correlated.

Differences in product quality are associated with differences in workers' skills where, recall, skill refers to the probability of completing a task successfully, a function of things such as the quality of infrastructure, trade facilitation measures, the quality of foreign direct investment, or well-functioning cities. This explains why Italian bicycle manufacturers can compete with their counterparts in the PRC, despite the difference in labor costs. The matching story also offers an explanation of income differences among countries. A small difference in workers' skills leads to a proportionally larger difference in wages and output, so wages and productivity differentials between countries with different skill levels are enormous.

Arguably, o-ring effects also exist across firms. Suppose one firm builds roads and another automobiles. The additional value to drivers of an improvement in the quality of cars most likely will

[6] The problem of investing in education in a developing country can be phrased in terms of "How much will my earnings increase after I become a doctor?" According to this theory, the increase will depend on how successful a doctor is at matching up with other doctors as well as with other skilled professionals such as pharmacists and nurses. The probability of a successful match is a function of how much education everyone else is getting. All this will work well if a lot of people are highly educated, in which case the probability of matching up with other highly skilled people is high. In other words, from a personal point of view, investing in school is worthwhile in a developed country; and the incentives to do so are not present in developing countries where there are not so many skilled workers. Naturally, from the developing country's point of view, this individual decision turns out to have devastating effects: no single individual will find it valuable attending school. The situation is even worse if skills are complementary to the general state of knowledge in that nation. Even if knowledge leaks, the value of being educated is much less if there is not much knowledge to leak. The result is that, even if the workers do go to school in a low-knowledge society, the nation will stay impoverished.

be smaller if the roads happen to be of a poor quality, and vice versa. When tasks are performed sequentially (as in global value chains, discussed in the study), highly skilled workers will undertake research and development at the earliest stages as well as perform other complex tasks at the latest stages of production. This explains why poor countries have higher shares of primary output in GDP, and workers will be paid more in industries with high-value inputs. Also, under sequential production, countries with highly skilled workers specialize in products that require expensive intermediate goods, and countries with low-skilled workers specialize in primary production. In other words, there is nothing natural about the international pattern of specialization: comparative advantage in primary goods, manufactures, and services is itself endogenously determined, that is, comparative advantage in agriculture and manufactures is itself manufactured.

Finally, and fundamental also for the members of the GMS and discussed in the study, the O-Ring theory has implications for trade theory and the pattern of specialization. Under the circumstances described above (i.e., production is the result of a series of sequential tasks), the rich and skilled nations will produce "advanced" and "high-value" goods (or the most complex stages in a global value chain), while the poor nations will produce raw materials (primary production in general) and "low-value" goods. This is consistent with the claim that export structures tend to be path-dependent and difficult to change, which has important implications for growth and development (Hobday 1995).[7] Trade patterns are much less responsive to changing factor prices than is commonly assumed. They are the outcome of a long, cumulative process of learning, agglomeration and increasing returns, institution-building, and business culture. This means that the world's pattern of specialization and trade is, fundamentally, arbitrary: what each country produces is the result of history and accidents, and it is not dictated by comparative advantage given by tastes, resources, and technology. Moving from a low-technology (labor-intensive) structure to a high-technology (capital- and knowledge-intensive) one is a difficult and far-from-straightforward process. It is one that has involved policy interventions, not only in Singapore, the Republic of Korea, and Japan but also in most Western economies. The result is that most products that enter international trade are created in imperfectly competitive industries. This is an important lesson for the GMS members.

The Greater Mekong Subregion 2030 and Beyond: Integration, Upgrading, Cities, and Connectivity

This study is an exercise in understanding the development prospects of the GMS. It proposes a comprehensive and coherent growth and development strategy for the next decades. As stated above, growth is not everything, but it is a necessary condition for the members of the GMS to advance, especially Cambodia, the Lao PDR, Myanmar, and Viet Nam. They have done well in recent times, but they are still significantly behind. This is documented throughout the study. The O-Ring theory analogy is especially relevant for them and the discussion and proposals are meant to steer debate about how to expedite development.

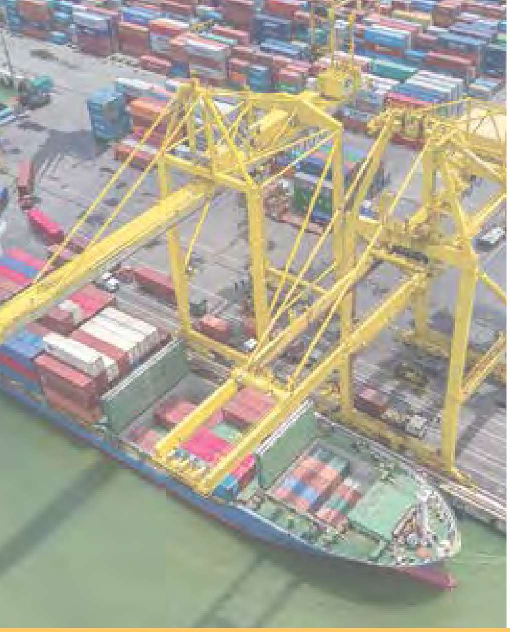
[7] Hobday (1995) provides an in-depth account of how Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China upgraded their production structures. It was the result of learning in a path-dependent context. There was no such thing as leapfrogging.

The material is arranged into the 22 chapters that follow this Introduction plus a final chapter on recommendations, i.e., a total of 23. Arguments and proposals are arranged into three groups:

(i) Part 1: further integration into the global economy, which stresses the need to penetrate rich-world markets, together with the imperative to upgrade production and export structures (chapters 1–15);
(ii) Part 2: urbanization and the need to develop competitive cities, as these act as engines of growth (chapters 16–19); and
(iii) Part 3: the need to improve the quality of road infrastructure to link cities and enhance trade integration; and trade facilitation measures (chapters 20–22).

The choice of the topics and themes covered was the result of months of brainstorming about the state of development of the GMS members, as well as the team's state-of-the-art knowledge of development issues. The material covered is very broad and deals directly and indirectly with topics that are fundamental for the development of the GMS in the coming decades.[8]

[8] The study does not cover topics such as education, the financial system, governance, institutions, or competition policy, for example. While these are certainly important, a decision had to be made. The three areas covered in this study provide sufficient material for the GMS to think about its future.



PART 1

INTEGRATION INTO THE GLOBAL ECONOMY AND UPGRADING

1.1
A STOCKTAKING OF THE EXTENT OF INTEGRATION OF THE GREATER MEKONG SUBREGION INTO THE GLOBAL ECONOMY

Aerial view of Danang Port. The port is the third largest port system in Viet Nam and lies at the eastern end of the GMS East–West Economic Corridor (EWEC), which connects Viet Nam with the Lao People's Democratic Republic, Thailand, and Myanmar (photo by Ariel Javellana/ADB).

Chapter 1

Integration of the Greater Mekong Subregion into the Global Economy

1.1 Introduction

This chapter addresses three questions: (i) To what extent are the Greater Mekong Subregion (GMS) members engaged in international trade? (ii) Are GMS economies able to penetrate rich-world markets in Europe and North America? (iii) How important is intra-GMS trade and trade within the broader Asian region for GMS members? These questions are relevant as the study considers the appropriate strategies for the GMS economies to integrate into the global economy.

The trade literature considers the idea that trade integration—in particular free trade agreements—is likely to be more welfare improving if countries are natural trading partners, meaning that they display, for example, a high initial volume of trade, geographic proximity, and trade complementarity, i.e., whether the export capacity of an exporting country can fulfill the import demand of the importing country (Wonnacott and Lutz 1989). This suggests a number of important factors to consider when thinking about trade prospects of the GMS economies. The discussion in this chapter and subsequent chapters highlights the need to integrate locally (i.e., within the region), to develop existing trade relationships, and to upgrade and diversify in order to meet the needs of rich-world markets that dominate trade flows through their role as consumers within global value chains. The analysis in this chapter will provide initial insights into some of these issues and will be used as the foundation for subsequent analysis in other chapters on the trade potential of GMS members.

1.2 The Greater Mekong Subregion Trade

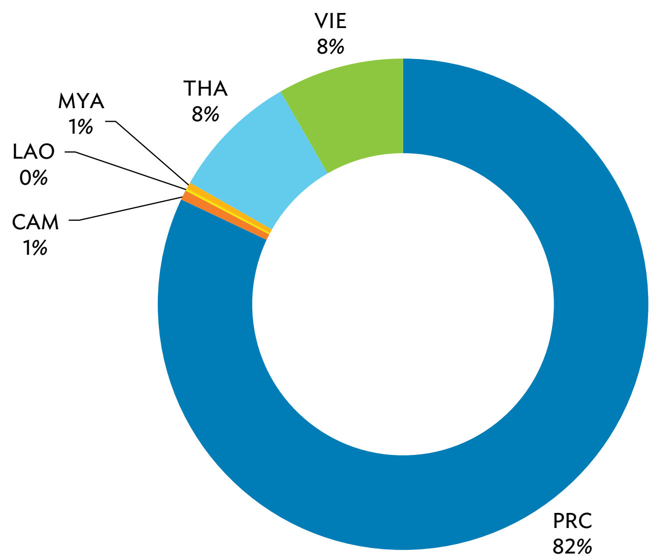
The total value of exports for the period 2016–2018 of the six GMS members (including the entire PRC, given the lack of disaggregated data for Guangxi Zhuang Autonomous Region (Guangxi) and Yunnan Province (Yunnan) was $8.9 trillion (summed over the period).[9] The value of imports for the GMS members in the same period was $6.4 trillion.[10] These numbers account for 18% and 13% of world

[9] Data on 2016 exports are available for Guangxi Zhuang Autonomous Region and Yunnan Province. Figure A1.1 in the Appendix reports the shares of GMS exports for the year 2016 for the five GMS members plus the two regions. The two Chinese regions account for around 18% of GMS exports. When the rest of the PRC is excluded, the shares of Thailand (40%) and Viet Nam (36%) dominate GMS exports. Cambodia (3%), the Lao PDR (1%), and Myanmar (2%) continue to account for a relatively small share of GMS xports.

[10] Note that these numbers are based on a dataset of around 155 countries, and thus exclude trade with a number of smaller countries (e.g., small island economies).

exports and imports, respectively.[11] It is unsurprising that the PRC accounts for the vast majority of this trade by the GMS members. This can be seen in Figures 1.1 and 1.2, which report shares of individual GMS members in total exports and imports for 2016–2018 (summed over the period), respectively. The figures reveal the dominance of the PRC within the region, accounting for 82% of total exports and 79% of total imports of the entire GMS. Much of the remaining trade is accounted for by Thailand (8% of exports and 10% of imports) and Viet Nam (8% of exports and 9% of imports), implying that Cambodia, the Lao PDR, and Myanmar combined account for just over 2% of both GMS exports and

Figure 1.1: Share of Greater Mekong Subregion Exports, 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

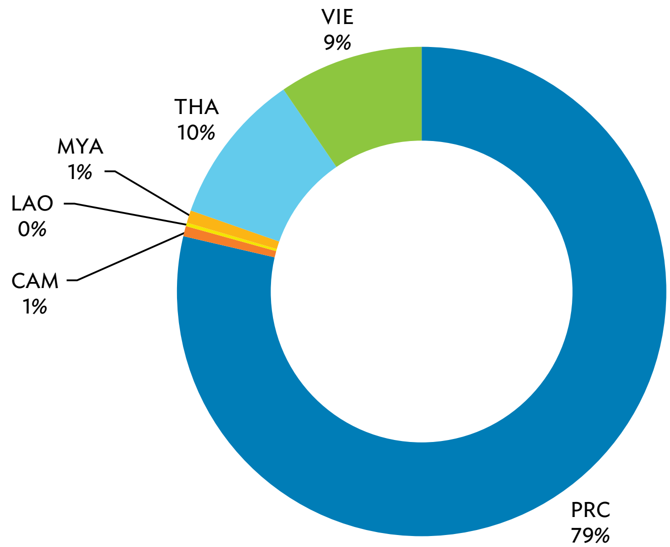
imports.

In terms of integration into world markets, these numbers imply that, while the PRC accounts for 14.7% and 10.2% of world exports and imports, respectively, the other five countries combined account for less than 4% of world exports and imports. In Thailand, these shares are 1.5% and 1.3% for exports and imports, respectively, while for Viet Nam the shares are around 1.5% and 1.2%, respectively. In the other three countries, the shares of exports or imports account for less than one tenth of 1%.

Figure 1.3 shows the share of exports of each GMS member to different regions of the world, including the GMS (exports are summed over the period 2016–2018). The figure reveals a great deal of heterogeneity in export structure by region across the GMS economies. Nearly a third (29%) of the PRC's exports go to East Asia and the Pacific, while almost half (49%) go to either Europe and Central

[11] The respective shares for the period 1996–2001 are 7.2% of world exports and 3.3% of world imports.

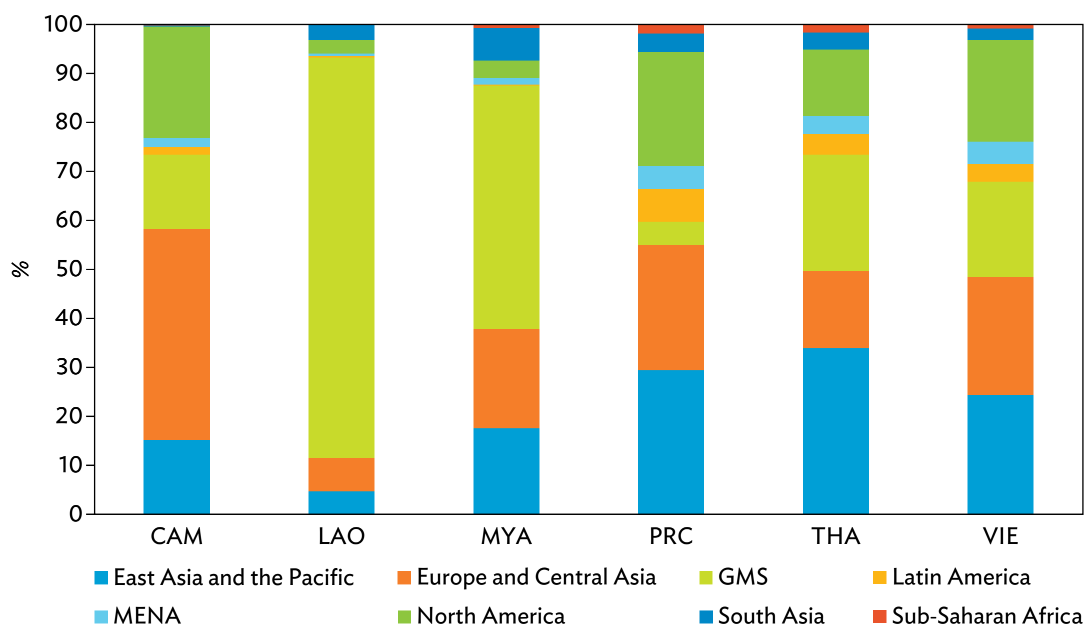
Figure 1.2: Share of Greater Mekong Subregion Imports, 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

Figure 1.3: Exports by Region of Destination, 2016–2018



CAM = Cambodia, GMS = Greater Mekong Subregion, LAO = Lao People's Democratic Republic, MENA = Middle East and North Africa, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

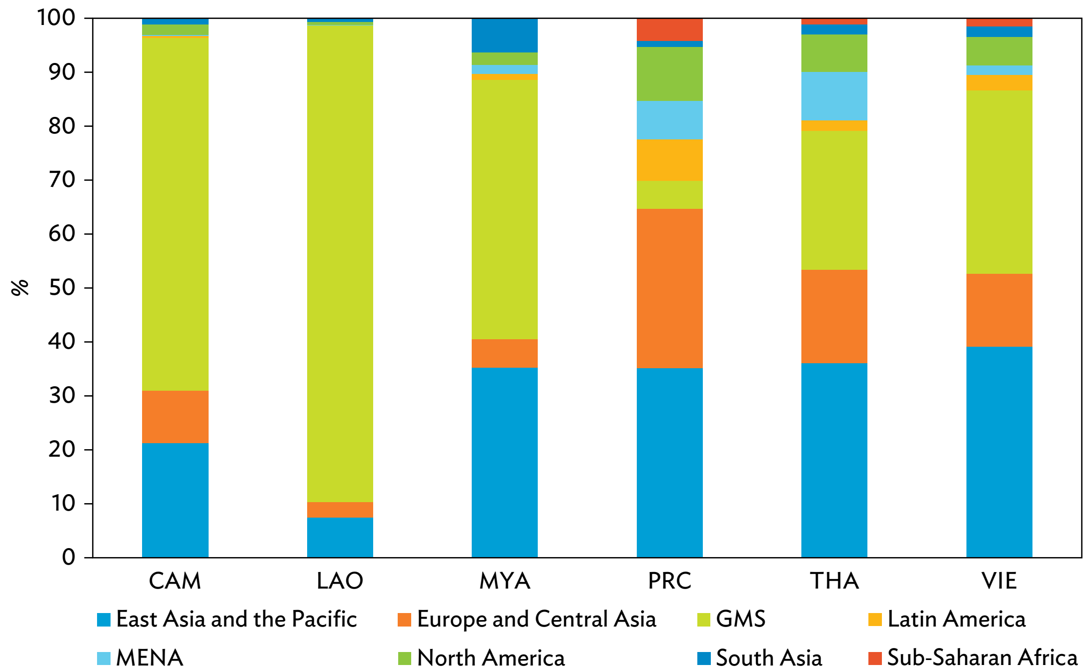
Asia or North America. The remaining regions account for a small share of the PRC's exports, with other GMS members accounting for just 4.8% and South Asia just 3.8%.[12] Similar to the PRC, East Asia and the Pacific also accounts for a significant share of Thailand's (34%) and Viet Nam's (24%) exports. Likewise, a significant share of these two countries' exports are sent to Europe and Central Asia and North America, which account for a combined share of 29% of Thailand's exports and 45% of Viet Nam's. The GMS members are a more important market for these two countries' exports than for the PRC, with shares of 24% and 20% for Thailand and Viet Nam, respectively. The Lao PDR and Myanmar are remarkable in that they rely heavily on other GMS members for their exports. The share of exports going to other GMS members is 50% for Myanmar and 82% for the Lao PDR. Europe and Central Asia (20%) and East Asia and the Pacific (18%) account for much of Myanmar's remaining export share. Cambodia's export structure is perhaps the most surprising, with 66% of its exports going to either Europe and Central Asia or North America. East Asia and the Pacific (15%) and other GMS members (15%) account for practically all of Cambodia's remaining export share.

Figure 1.4 shows that the pattern of imports is quite different from that of exports, with a larger role for GMS members in most cases. Imports of the Lao PDR and Myanmar are again dominated by trade with other GMS members. In the Lao PDR, 88% of its imports come from other GMS economies. In Myanmar, the share from other GMS members is 48%, with a significant share also coming from East Asia and the Pacific (35%). Cambodia resembles more closely the patterns observed in the Lao PDR and Myanmar, with imports predominantly sourced from other GMS members (65%) and East Asia and the Pacific (21%). Thailand and Viet Nam have large import shares from East Asia and the Pacific (36% and 39%, respectively) and other GMS economies (26% and 34%, respectively). In these two countries, Europe and Central Asia are also relevant sources of imports (17% and 14% for Thailand and Viet Nam, respectively). While East Asia and the Pacific account for the majority of the PRC's imports (35%), imports from Europe and Central Asia (30%) and North America (10%) are also significant. More generally, the PRC's import structure seems more diversified than that of the other GMS members, with six of the eight regions contributing a share of 5% or more to the PRC's total imports. Interestingly, the GMS (5%) and South Asia (1%) do not account for a significant share of the PRC's imports.

To summarize, the results presented above suggest a great deal of heterogeneity in the importance of the GMS for trade in GMS economies. While the Lao PDR and Myanmar rely heavily on the GMS for both exports and imports, and Cambodia relies mostly on the GMS for imports (but not exports), the remaining three countries show somewhat different patterns. The PRC seems largely detached from the GMS, though the data is for the entire country and not just for the Chinese regions of Guangxi and Yunnan. For Thailand and Viet Nam, the GMS members are important destinations for exports (between 20% and 24% of exports go to GMS members) and sources of imports (between 26% and 34% of imports are from GMS members), but they are far less reliant on GMS members than Cambodia and, in particular, the Lao PDR and Myanmar.

[12] Note that the GMS members are not included in either East Asia and the Pacific or South Asia.

Figure 1.4: Imports by Region of Origin, 2016–2018

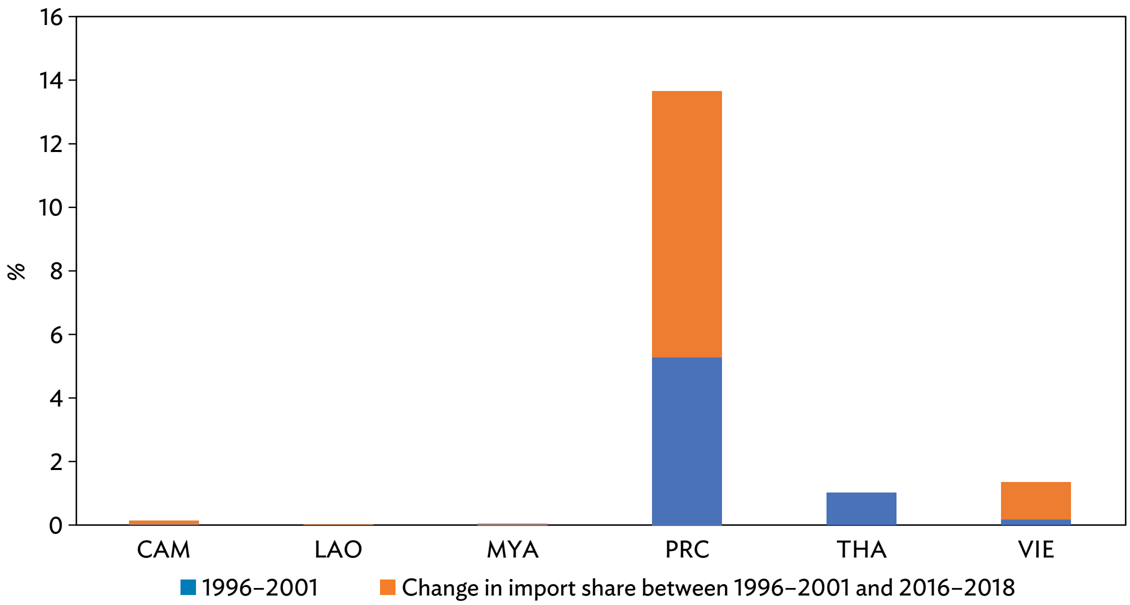


CAM = Cambodia, GMS = Greater Mekong Subregion, LAO = Lao People's Democratic Republic, MENA = Middle East and North Africa, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

These results thus suggest that, while some GMS members are heavily reliant on other members of the subregional group for trade, others have been able to expand trade with the rest of the world. Investigating this pattern further, Figure 1.5 addresses the question of whether GMS members have been able to penetrate rich-country markets. The figure reports the share of developed-country imports (defined as the United States, Japan, and the 27 European Union countries in 2018, excluding Croatia) that come from each individual GMS member. The figure reveals that, while imports from the PRC represent a significant share of the imports of the developed world, the share of imports from other GMS economies is very small (and never above 1% of the total). Looking at changes over time, the figure shows that between 1996–2001 and 2016–2018 the PRC was able to increase its share of developed countries' total imports from around 5% to just over 13%. Changes for the other GMS members were very small, except for Viet Nam, whose share of developed countries' imports increased from less than half a percent to around 1.3%.

Figure 1.5: Share in Developed-Country Imports



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Note: In the case of Thailand, the change in import share between 1996–2001 and 2016–2018 is marginally negative.

Source: United Nations Comtrade.

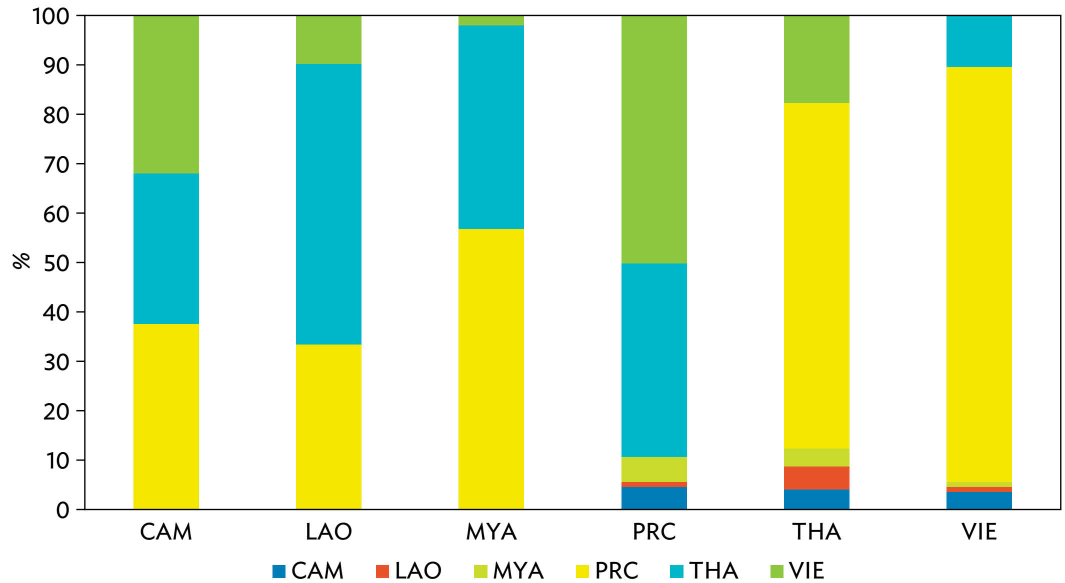
1.3 Intra-Greater Mekong Subregion Trade

The previous section suggests that, while imports from and exports to other GMS members are an important component of trade for some GMS economies, intra-GMS trade for others is relatively unimportant. This section examines intra-GMS trade in greater detail.

Figure 1.6 reports the shares of intra-GMS exports of each GMS member for the period 2016–2018. Given their relatively small size—and therefore volume of trade—it is unsurprising that Cambodia, the Lao PDR, and Myanmar are not important destinations for GMS members' exports. Their export shares in any GMS economy are generally less than 5%. Using the same argument, it is also not surprising that the PRC is a major export destination for most GMS economies. The PRC's export shares in Thailand, Viet Nam, and Myanmar are 70%, 84%, and 57%, respectively. These numbers are somewhat smaller for Cambodia (38%) and the Lao PDR (33%) but remain significant. In the Lao PDR, Thailand is a much more important export destination (57%), while for Cambodia, Thailand (30%) and Viet Nam (32%) make up the majority of intra-GMS exports.

The composition of intra-GMS imports is, in some ways, similar to that of exports (Figure 1.7). Cambodia, the Lao PDR, and Myanmar continue to play a small role, again reflecting their relatively small size. Interestingly, these countries tend to import relatively little from one another—import shares from each account for less than 1% of intra-GMS imports. However, imports from these

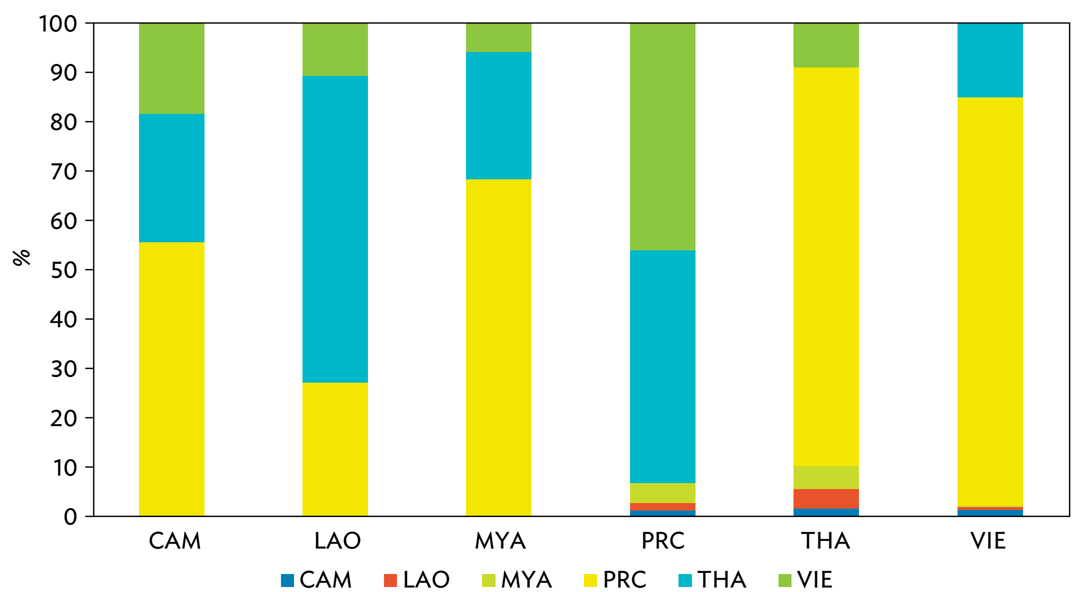
Figure 1.6: Intra-Greater Mekong Subregion Exports by Destination, 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

Figure 1.7: Intra-Greater Mekong Subregion Imports by Origin, 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

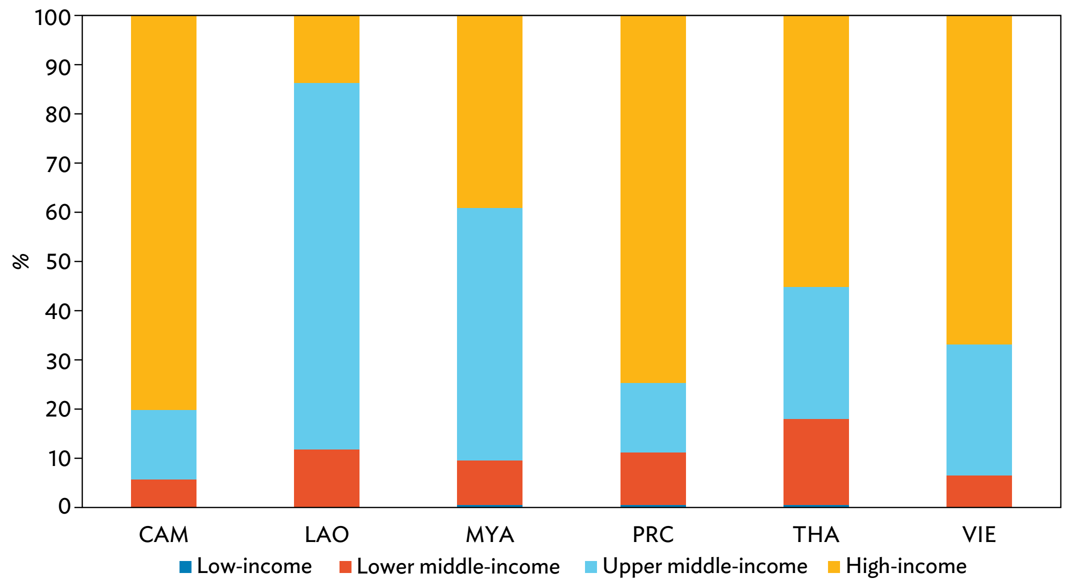
three countries account for larger shares of the three bigger countries' intra-GMS imports: around 10% of the PRC's and Thailand's intra-GMS imports originate from Cambodia, the Lao PDR, and Myanmar. In Viet Nam, the share of imports from the three smaller countries is about 2%. The PRC is a relatively important source of imports, particularly for Thailand and Viet Nam, but also for the other three countries. In the Lao PDR, however, the share of Thailand's imports is largest; and Viet Nam is important for Cambodia.

1.4 Trade Partners of the Greater Mekong Subregion by Development Level

The results presented in the two previous sections focused on the regional source and destination of imports and exports. This section examines trade structure in another way—by looking at GMS exports and imports by its trade partners' income level, which can play an important role in determining the effects of trade on development possibilities. In the case of exports, being able to export to developed countries provides access to a richer market and may have implications for the type (i.e., complexity) of products that are demanded. On the import side, importing from richer and more developed economies may provide access to more advanced technologies, which can encourage technology diffusion and aid technological upgrading. To consider this dimension, Figures 1.8 and 1.9 report GMS members' shares of exports and imports, respectively, that are destined to and sourced from countries at different income levels (low-, lower middle-income, upper middle-income, and high-income according to the World Bank's classification in 2016).

Figure 1.8 (exports) and Figure 1.9 (imports) display similarities. Unsurprisingly, low-income countries make up a small share of both GMS exports and imports (less than 1%) for all GMS members. Lower middle-income countries also tend to make up a relatively small share of GMS exports and imports, between 5% and 18%. The relatively small shares of exports and imports to and from low-income and lower middle-income countries likely reflect the relative lack of demand and lack of diversification of their production baskets. Upper middle-income and high-income countries, therefore, account for the vast majority of exports and imports of GMS economies. However, there are significant differences across GMS members in terms of the importance of these two sets of countries. For both exports and imports, high-income countries dominate in the case of the PRC, accounting for 75% of its exports and 71% its imports. High-income countries are also dominant sources of imports and destinations for exports of Thailand and Viet Nam, where they account for between 54% and 67% of either exports or imports. In the three remaining countries, upper middle-income countries tend to be the more dominant trade partners. In the case of imports, upper middle-income countries account for 52% and 80% of imports of Myanmar and the Lao PDR, respectively. For exports, the study finds that upper middle-income countries account for 74% and 52% of exports of the Lao PDR and Myanmar, respectively. The major exception to these patterns is Cambodia where 80% of its exports goes to high-income countries.

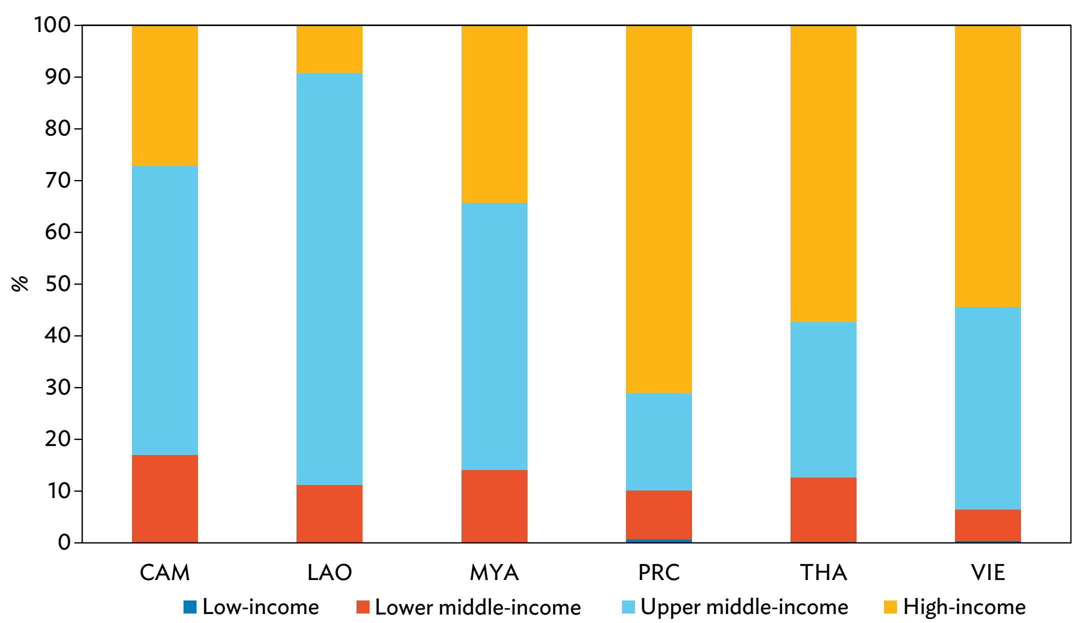
Figure 1.8: Exports by Income Level of Destination Country, 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

Figure 1.9: Imports by Income Level of Origin Country, 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

1.5 Conclusions

This chapter provided a stocktaking of the current structure of exports and imports of the GMS members. In particular, it described the trade structure along three dimensions: (i) the regional structure of imports and exports, (ii) intra-GMS structure of imports and exports, and (iii) structure of imports and exports by income level. The results provide important insights that will feed into the study's analysis of trade potential.

The main conclusions of the chapter are as follows:

First, Cambodia, the Lao PDR, and Myanmar are only marginally engaged in international trade. These countries account for a small share of both global and intra-GMS trade. Moreover, the geographic diversification of these countries' trade is limited, with intra-GMS trade often accounting for a major share of their imports and exports. There is thus a great deal of scope for expanding trade and regional diversification.

Second, while the PRC, Thailand, and Viet Nam have been able to penetrate Europe and Central Asia and North America (rich-world markets in general), these regions account for a relatively small share of both imports and exports of the Lao PDR and Myanmar, and a small share of Cambodia's imports.

Third, with the exception of the PRC, the GMS economies account for a very small fraction of imports of the most-developed countries, with little change in this share over time for most GMS members. Therefore, there is scope for expanding trade with these regions, possibly in the context of global value chains.

Fourth, the South Asian region plays a minor role in trade for GMS members. Given the stated aim of the GMS to integrate more broadly with the South Asian region, there are opportunities for developing trade with this region.

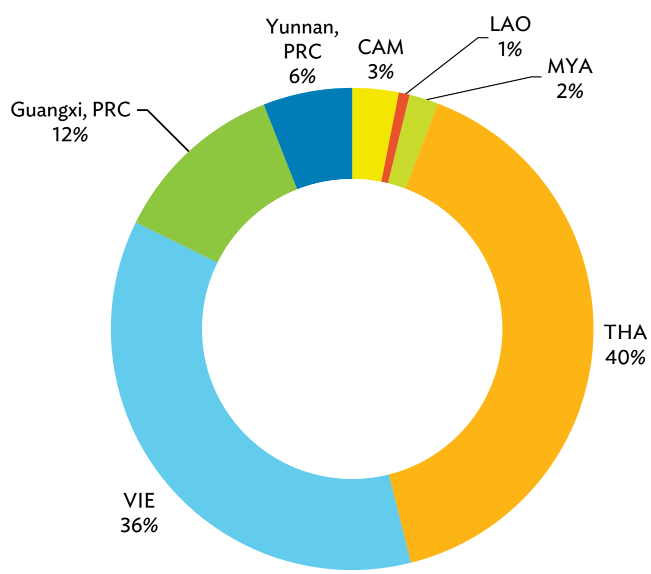
Appendix

Data Sources

The data used for this analysis come from United Nations (UN) Comtrade, which reports data on bilateral exports and imports at the six-digit Harmonized System product level for a large number of reporter (and partner) countries. The data are reported in thousands of US dollars. For this study, the analysis concentrates on data for the period 2016–2018 using the 2012 version of the Harmonized System, though for purposes of comparison the analysis also reports additional data for the period 1996–2001 using the 1996 version of the Harmonized System.

The analysis concentrates on a sample of around 155 countries, thus ignoring small countries and other categories reported in the UN Comtrade database. Following convention, the study uses the mirror flow to measure exports, i.e., exports of a particular reporter country are calculated as the imports of the partner country. The study follows a similar approach when constructing imports, using the exports of the partner to construct imports of the reporter country.

Figure A1.1: Share of Greater Mekong Subregion Exports in 2016
(including Guangxi Zhuang Autonomous Region and Yunnan Province)



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors.

Chapter 2

The Export Structure of the Greater Mekong Subregion

2.1 Introduction

This chapter addresses three questions: (i) What is the export structure of the Greater Mekong Subregion (GMS) members? (ii) How does it differ between them? (iii) How does it compare to that of other countries outside the GMS?

The importance of a nation's production and export structures for its economic development has long been emphasized and established. In more recent literature, two strands stand out. The first relates to the seminal work of Imbs and Wacziarg (2004), who showed that the relationship between diversification and income follows an inverted U shape, suggesting that low-income countries tend to be highly specialized, but become more diversified as they move to higher income levels. Imbs and Wacziarg further suggest that, at high levels of income, countries tend to re-specialize, though subsequent studies suggest that the evidence in favor of this re-specialization is weak.

Second, the work of Hausmann and Hidalgo (2001), among others, suggests that export diversification, or the number of products exported with comparative advantage, strongly predicts future growth. Moreover, they showed that the types of products that are exported matter, with a higher share of sophisticated products having a greater impact on growth.[13] The sophistication of a country can be captured by the uniqueness of its export basket. Both diversification and uniqueness are discussed further in Chapter 3. These two dimensions combine to define the complexity of a product and the complexity of country's export basket. Countries with a diversified and unique export basket are considered to be more complex. The concept of product complexity is used extensively in Chapter 7. Given this empirical evidence suggesting the importance of diversification patterns for development, this chapter provides an introduction to the current export structure of the GMS.

2.2 The Export Structures of the Greater Mekong Subregion Members

The analysis of the export structure of the GMS economies begins by considering the average value of exports for the period 2016–2018 for the subregion as a whole and for its individual members.

[13] See also Hausmann, Hwang, and Rodrik (2007).

This information is reported at the level of 44 sectors, which comprise different production sectors that are further classified from a value-chain perspective (capital goods, consumption goods, and intermediate goods). The study distinguishes by value-chain stage because this distinction is often related to the sophistication of the products. For example, goods used for investment often require more sophisticated production capabilities than intermediate goods. The 44 sectors are reported in Table 2.1.

Table 2.1: List of Sectors

Sector No.	Sector	Description	Label
1	Agriculture (intermediate)	Crop and animal production, hunting and related service activities (intermediate goods)	Agriculture, INT
2	Agriculture (consumer)	Crop and animal production, hunting and related service activities (consumption goods)	Agriculture, CONS
3	Forestry	Forestry and logging	Forestry
4	Fishing	Fishing and aquaculture	Fishery
5	Mining	Mining and quarrying	Mining
6	Food (intermediate)	Manufacture of food products, beverages, and tobacco products (intermediate goods)	Food, INT
7	Food (consumer)	Manufacture of food products, beverages, and tobacco products (consumption goods)	Food, CONS
8	Textiles (intermediate)	Manufacture of textiles, wearing apparel, and leather products (intermediate goods)	Textiles, INT
9	Textiles (consumer)	Manufacture of textiles, wearing apparel, and leather products (consumption goods)	Textiles, CONS
10	Wood and products (intermediate)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (intermediate products)	Wood & prod., INT
11	Wood and products (consumer)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (consumption goods)	Wood & prod., CONS
12	Paper and products (intermediate)	Manufacture of paper and paper products (intermediate goods)	Paper & prod., INT
13	Paper and products (consumer)	Manufacture of paper and paper products (consumption goods)	Paper & prod., CONS
14	Refining	Manufacture of coke and refined petroleum products	Refining
15	Chemicals (intermediate)	Manufacture of chemicals and chemical products (intermediate goods)	Chemicals, INT
16	Chemicals (consumer)	Manufacture of chemicals and chemical products (consumption goods)	Chemicals, CONS

(continued on next page)

Table 2.1 *continued*

Sector No.	Sector	Description	Label
17	Pharmaceuticals (intermediate)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (intermediate goods)	Pharma, INT
18	Pharmaceuticals (consumer)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (consumption goods)	Pharma, CONS
19	Rubber and plastic (intermediate)	Manufacture of rubber and plastic products (intermediate goods)	Rubber & plastic, INT
20	Rubber and plastic (consumer)	Manufacture of rubber and plastic products (consumption goods)	Rubber & plastic, CONS
21	Stone, glass (intermediate)	Manufacture of other non-metallic mineral products (intermediate goods)	Stone, glass, INT
22	Stone, glass (consumer)	Manufacture of other non-metallic mineral products (consumption goods)	Stone, glass, CONS
23	Basic metals	Manufacture of basic metals	Basic metals
24	Fabricated metal (intermediate)	Manufacture of fabricated metal products, except machinery and equipment (intermediate goods)	Fabr. metal, INT
25	Fabricated metal (consumer)	Manufacture of fabricated metal products, except machinery and equipment (consumption goods)	Fabr. metal, CONS
26	Fabricated metal (capital)	Manufacture of fabricated metal products, except machinery and equipment (capital goods)	Fabr. metal, CAP
27	Electronics (intermediate)	Manufacture of computer, electronic, and optical products (intermediate goods)	Electronics, INT
28	Electronics (consumer)	Manufacture of computer, electronic, and optical products (consumption goods)	Electronics, CONS
29	Electronics (capital)	Manufacture of computer, electronic, and optical products (capital goods)	Electronics, CAP
30	Electricals (intermediate)	Manufacture of electrical equipment (intermediate goods)	Electricals, INT
31	Electricals (consumer)	Manufacture of electrical equipment (consumption goods)	Electricals, CONS
32	Electricals (capital)	Manufacture of electrical equipment (capital goods)	Electricals, CAP
33	Machinery (intermediate)	Manufacture of machinery and equipment n.e.c. (intermediate goods)	Machinery, INT
34	Machinery (consumer)	Manufacture of machinery and equipment n.e.c. (consumption goods)	Machinery, CONS
35	Machinery (capital)	Manufacture of machinery and equipment n.e.c. (capital goods)	Machinery, CAP
36	Automotive (intermediate)	Manufacture of motor vehicles, trailers, and semi-trailers (intermediate goods)	Automotive, INT
37	Automotive (consumer and capital)	Manufacture of motor vehicles, trailers, and semi-trailers (consumption/capital goods)	Automotive, CONS/CAP

(continued on next page)

Table 2.1 *continued*

Sector No.	Sector	Description	Label
38	Other transport equipment (intermediate)	Manufacture of other transport equipment (intermediate goods)	Other transp. eq., INT
39	Other transport equipment (capital)	Manufacture of other transport equipment (capital goods)	Other transp. eq., CAP
40	Other manufacturing (intermediate)	Manufacture of furniture; other manufacturing (intermediate goods)	Other man., INT
41	Other manufacturing (consumer)	Manufacture of furniture; other manufacturing (consumption goods)	Other man., CONS
42	Other manufacturing (capital)	Manufacture of furniture; other manufacturing (capital goods)	Other man., CAP
43	Other (intermediate)	Other goods (intermediate goods)	Other, INT
44	Other (consumer)	Other goods (consumption goods)	Other, CONS

CAP = capital goods, CONS = consumer goods, INT = intermediate goods, n.e.c. = not elsewhere classified.

Notes: Not all sectors have products in all value-chain stages. Some products cannot be distinguished into consumer or investment products (e.g., automobiles). Raw materials (e.g., in mining or agriculture) are treated as intermediate products.

Source: Authors, based on World Input–Output Database sectors and the United Nations' Broad Economic Categories.

Figure 2.1 reports the export structure of the GMS, constructed by taking the sum of exports of the five countries and two regions of the PRC,[14] specifically Guangxi and Yunnan.[15] The figure shows export shares of the 44 sectors in Table 2.1 for the period 2016–2018. Three sectors dominate the exports of GMS members, namely capital electronics, consumer textiles, and intermediate electronics. These three sectors account for around 45% of the group's total exports over the period 2016–2018. Other sectors also make significant contributions to GMS exports, with 22 sectors each accounting for at least 1% of total exports. The inverse Herfindahl index is 12.2, suggesting a fairly diversified export basket.[16]

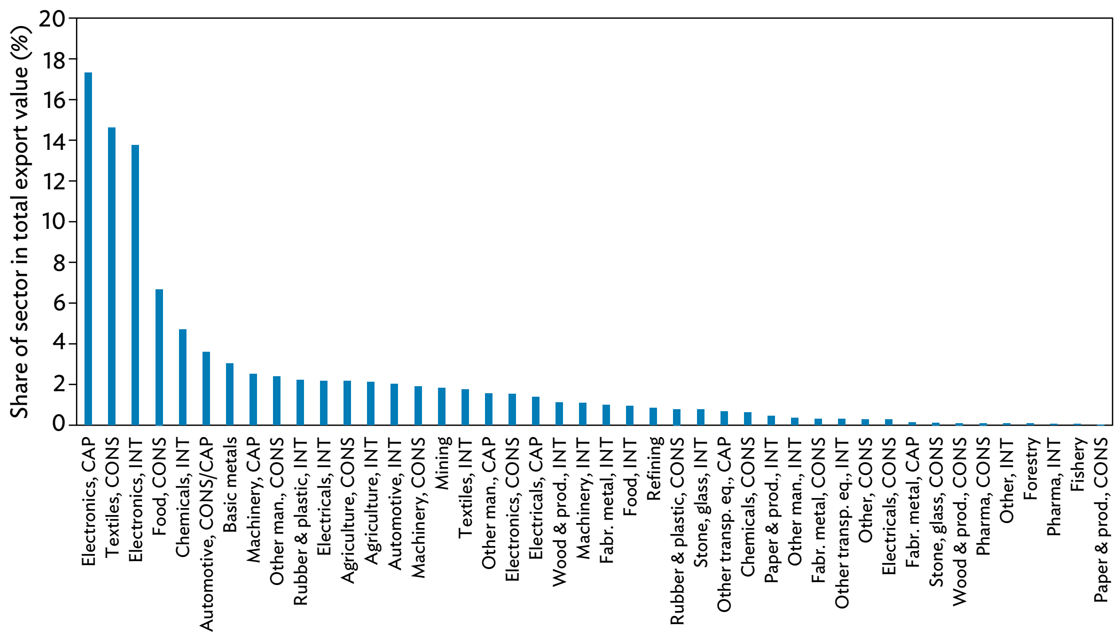
The export structures for each country, which are reported in Figures 2.2a–2.2h, show significant differences across GMS members.

[14] Note that the analysis concentrates on goods trade only, thus ignoring services trade. There remain significant challenges in the appropriate measurement and collection of data on different modes of services trade, with existing data generally aggregated at a higher level than trade data and often missing for many countries (Measuring Trade in Services https://www.wto.org/english/res_e/statis_e/services_training_module_e.pdf). According to the Atlas of Economic Complexity (http://atlas.cid.harvard.edu/), however, the share of services in exports differed greatly across the GMS members. In 2017, services accounted for 7.56% and 4.82% of exports in the PRC and Viet Nam, respectively, but for much larger shares in Cambodia (21.8%), the Lao PDR (24.36%), Myanmar (22.53%), and Thailand (24.19%). In the latter four countries, services exports were dominated by tourism and travel.

[15] Recent export data (2017–2018) for Guangxi and Yunnan are not available. Hence, the analysis extrapolates the data for these two regions from 2015 and 2016 data.

[16] The Herfindahl index is an indicator of market concentration, calculated as the sum of squared export shares of each of the 44 sectors. The inverse Herfindahl index is then calculated as one divided by the Herfindahl index. It has a straightforward interpretation. If exports were equally distributed over the sectors, then 1/H would equal the number of sectors (i.e., 1/H=44 in this study). Conversely, if the value of the inverse Herfindahl is 1, it would indicate complete concentration in one sector or, to put it differently, it would indicate an equal distribution if there were only one sector. A value of 12.2, therefore, can be considered relatively diversified and would imply an equal distribution if there were 12.2 sectors in the analysis.

Figure 2.1: Export Structure of the Greater Mekong Subregion, 2016–2018 Average



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Cambodia has the most concentrated export structure (Figure 2.2a), with an inverse Herfindahl index of only 1.7. Just over 75% of total Cambodian exports are consumer textiles. All other sectors are below 5% of total export value, with basic metals ranking second.

The PRC, on the other hand, has a fairly diversified export structure, with an inverse Herfindahl index of 10.4. Its exports are dominated by capital goods electronics, consumer textiles, and intermediate electronics (Figure 2.2b). Guangxi and Yunnan are even more diversified than the PRC as a whole. Both have higher inverse Herfindahl indices: Guangxi's index is 14.7 and Yunnan's is 11.0. However, the sectoral shares of export values (Figures 2.2c and 2.2d) show some overlap with the PRC. In Guangxi, two of the three largest sectors are also among the top three sectors for the PRC (capital goods electronics and consumer textiles). In Yunnan, this overlap occurs only in consumer textiles, which along with consumer agriculture and intermediate chemicals are among the top three sectors in the province. The shares of consumer agriculture and intermediate chemicals are much smaller in Guangxi and in the PRC as a whole.

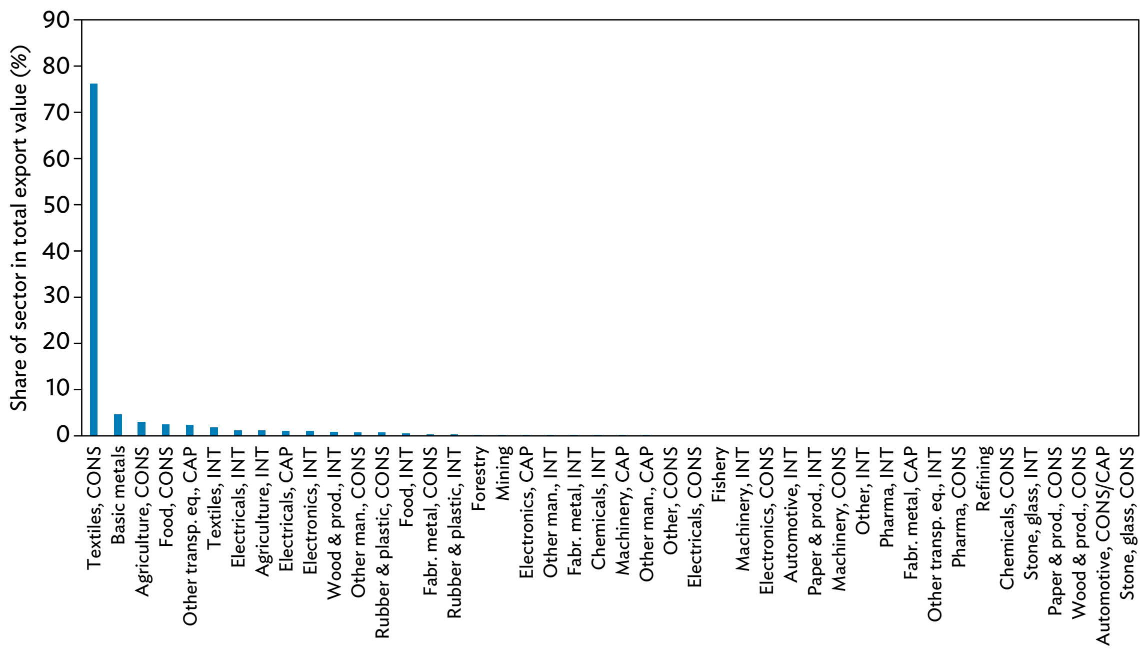
The Lao PDR's top three export sectors (Figure 2.2e) are other goods (consumer), mining, and basic metals. Sectors that play a dominant role in other GMS economies, such as the different electronics and textiles sectors, remain important in the Lao PDR but generally account for lower export shares. The inverse Herfindahl index for the Lao PDR is 8.1, making its export basket less concentrated than those of Cambodia and Myanmar.

As in the Lao PDR, mining is also a large sector in Myanmar (Figure 2.2f). Consumer textiles is the other large sector in Myanmar, while consumer agriculture is the third largest sector, but at some distance from the other two sectors. The different electronics sectors account for a small share of Myanmar's exports. Myanmar's export structure is fairly concentrated. Its inverse Herfindahl index is 4.3, only slightly higher than Cambodia's.

Thailand's export structure (Figure 2.2g) is rather diversified with an inverse Herfindahl index of 14.6, the highest in the GMS (least concentrated). Electronics, both intermediate and capital goods, and consumer foods are the three largest export sectors. Other fairly advanced sectors, such as intermediate and consumer automotive, intermediate chemicals, and capital goods machinery, are also large export sectors in Thailand. The textiles sector is not very large in Thailand.

Finally, Viet Nam's export structure (Figure 2.2h), which has an inverse Herfindahl index of 7.4, is moderately diversified. The top three sectors in Viet Nam are the same as in the entire GMS, namely intermediate and capital goods electronics and consumer textiles. The shares of Viet Nam's other export sectors are all less than 5%, with consumer foods the largest of this group of sectors outside the top three.

Figure 2.2a: Export Structure of Cambodia, 2016–2018 Average

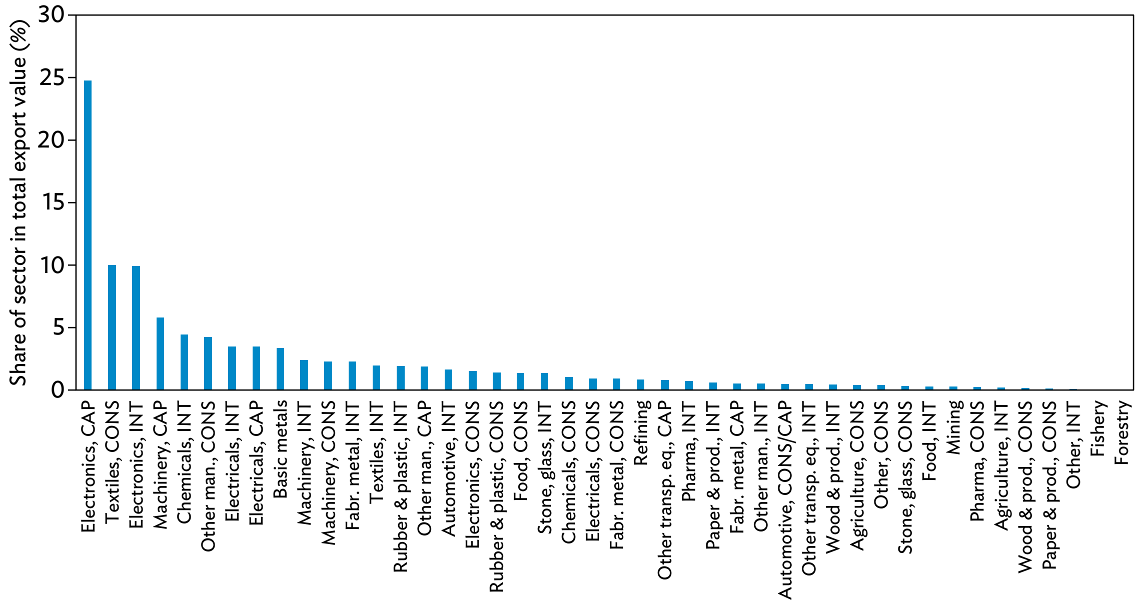


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Figure 2.2b: Export Structure of the People's Republic of China, 2016–2018 Average

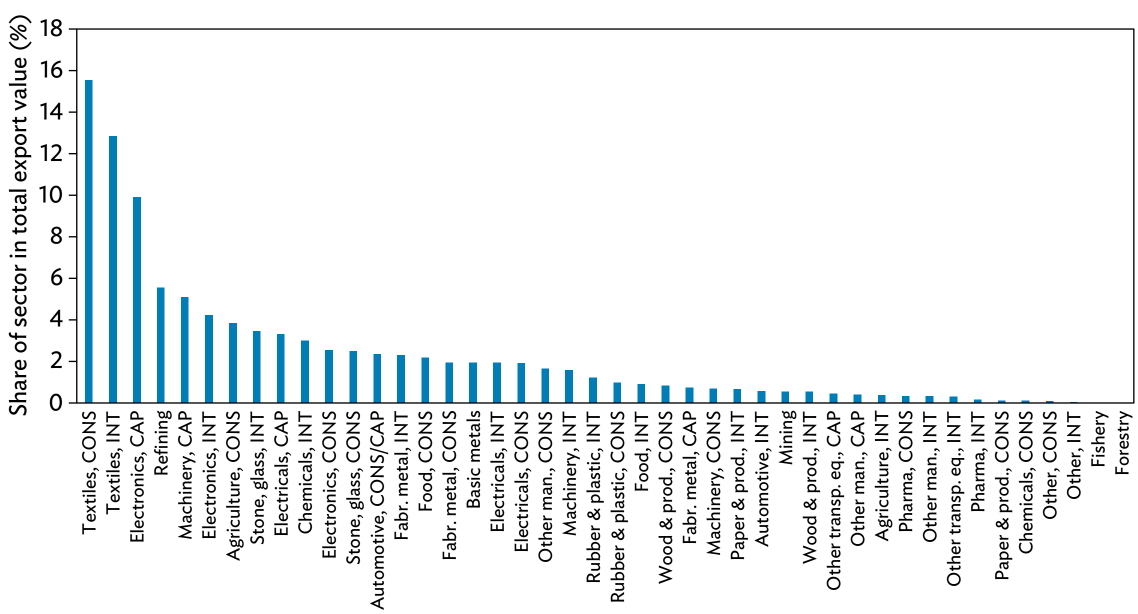


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Figure 2.2c: Export Structure of Guangxi Zhuang Autonomous Region, PRC, 2016–2018 Average

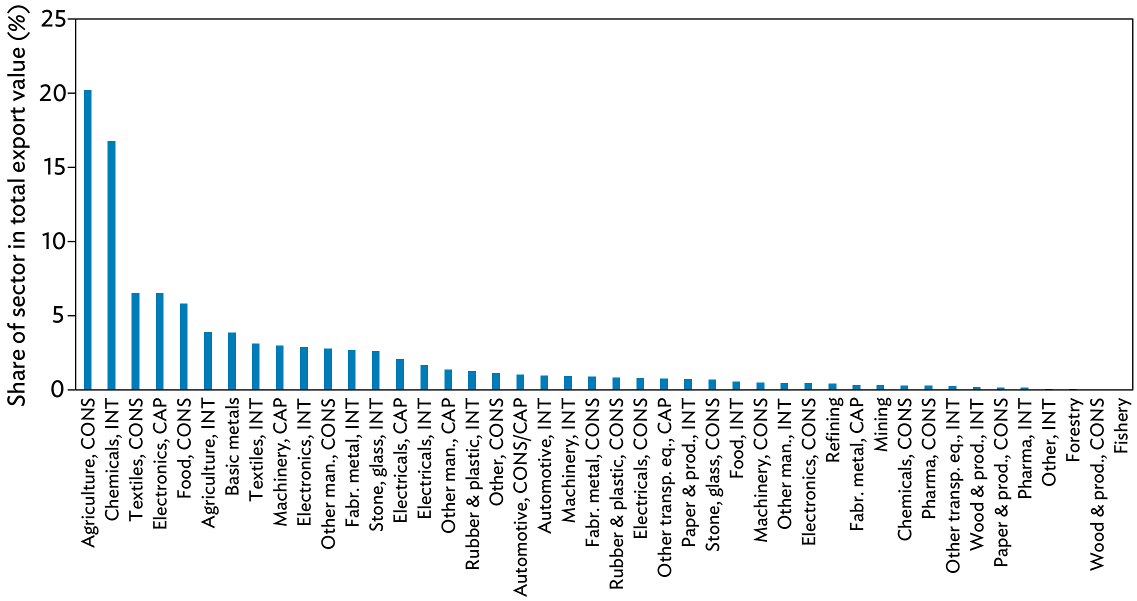


CAP = capital goods, CONS = consumer goods, INT = intermediate goods, PRC = People's Republic of China.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Figure 2.2d: Export Structure of Yunnan Province, PRC, 2016–2018 Average

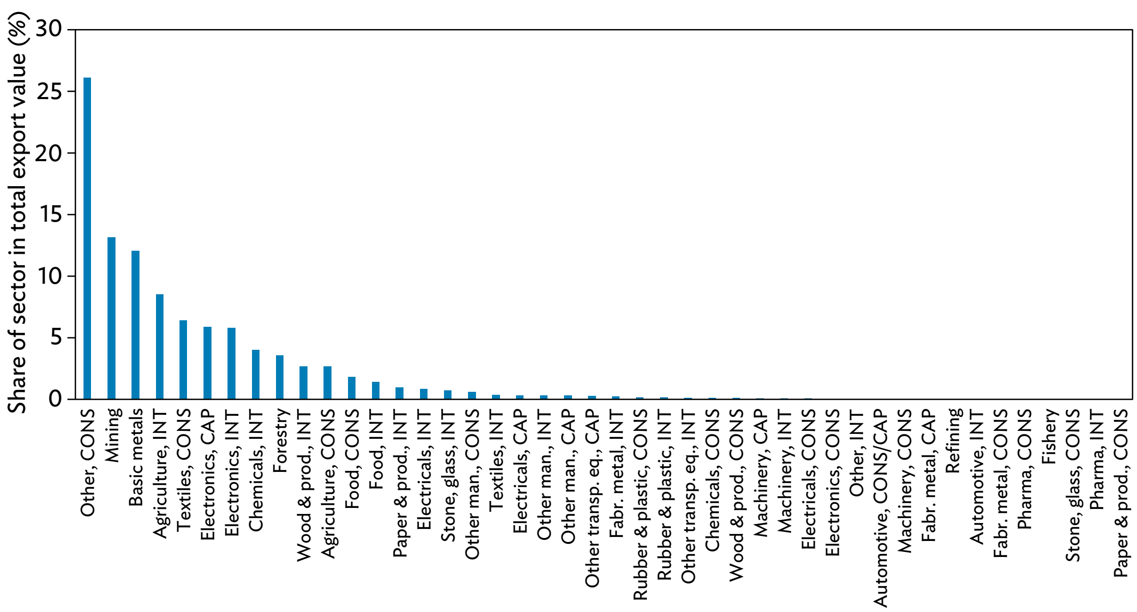


CAP = capital goods, CONS = consumer goods, INT = intermediate goods, PRC = People's Republic of China.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Figure 2.2e: Export Structure of the Lao People's Democratic Republic, 2016–2018 Average

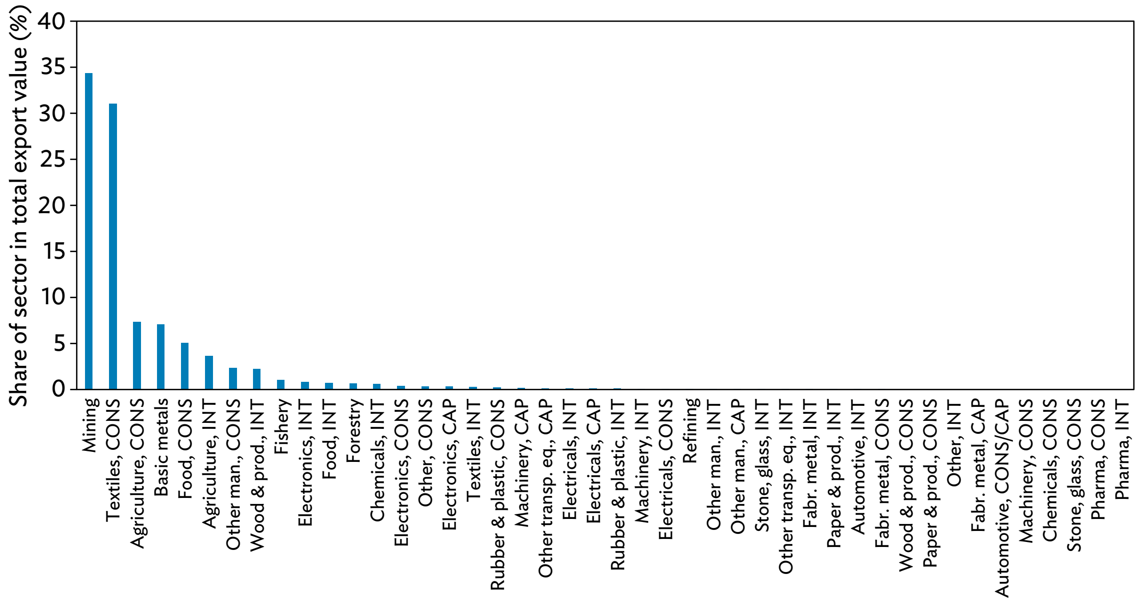


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Figure 2.2f: Export Structure of Myanmar, 2016–2018 Average

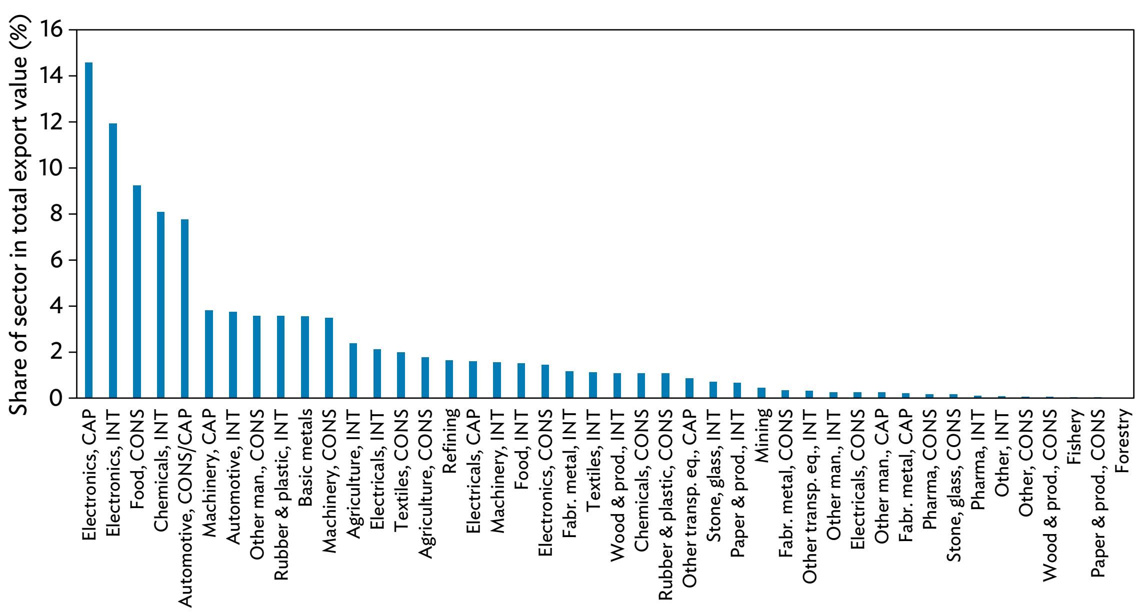


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Figure 2.2g: Export Structure of Thailand, 2016–2018 Average

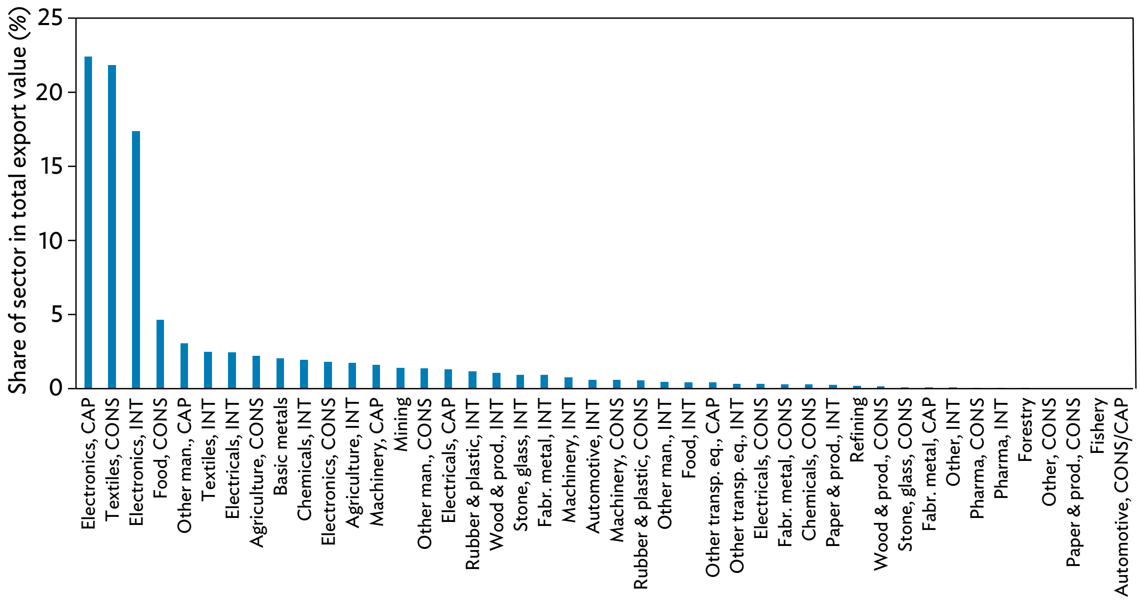


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Figure 2.2h: Export Structure of Viet Nam, 2016–2018 Average



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

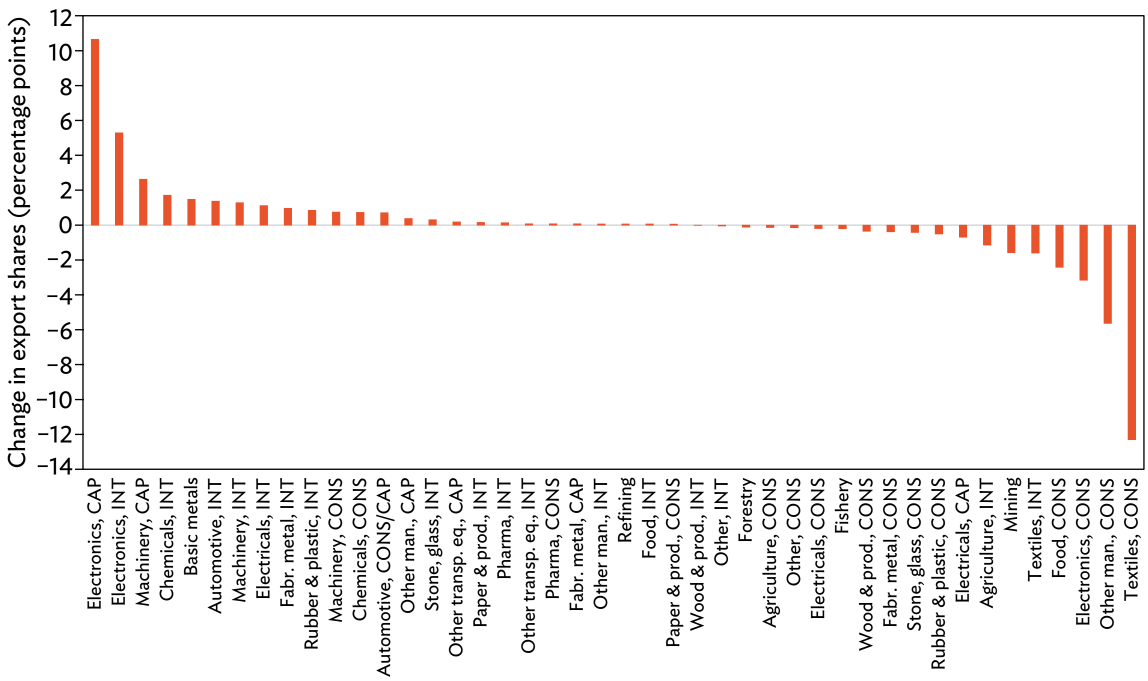
Source: United Nations Comtrade.

To summarize, the export structure of the GMS is dominated by a small number of sectors. These include sectors that demand a certain level of capabilities or requirements to produce or export them. Electronics, both intermediate and capital goods, are two such important sectors which require a high level of production capabilities. On the other hand, consumer textiles is also a large GMS sector (at least in some members) that requires significantly lower production capabilities than electronics. The export shares of consumer agriculture, mining, and automotive sectors are significant for some GMS members.

To evaluate changes in the structure of exports over time, the study provides a comparison between the periods 1996–2001 and 2016–2018 (aggregated across all years in each period). Figure 2.3 reports the changes in sectoral shares for the six countries of the GMS (data are not available for Guangxi and Yunnan in 1996–2001). The figure reveals that the shares of three sectors increased by more than 2 percentage points. These are capital goods electronics, intermediate goods electronics, and capital goods machinery. Together, these three sectors saw an increase of 18.6 percentage points. The sectors that saw declines of over 2 percentage points include consumer textiles, other manufactured consumer goods (such as toys and musical instruments), consumer electronics goods, and consumer foods. Together, these sectors accounted for a 23.5 percentage-point decrease.

Because these figures are heavily influenced by the PRC, Figure 2.4 documents the same indicator but excluding the PRC (Cambodia, the Lao PDR, Myanmar, Thailand, and Viet Nam [GMS-5]). The three sectors that registered the largest increases in shares are capital goods electronics, intermediate goods electronics, and capital and consumer automotive products. The sector with the largest

Figure 2.3: Increases and Declines in Export Shares between 1996–2001 and 2016–2018 in the Six Greater Mekong Subregion Countries



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

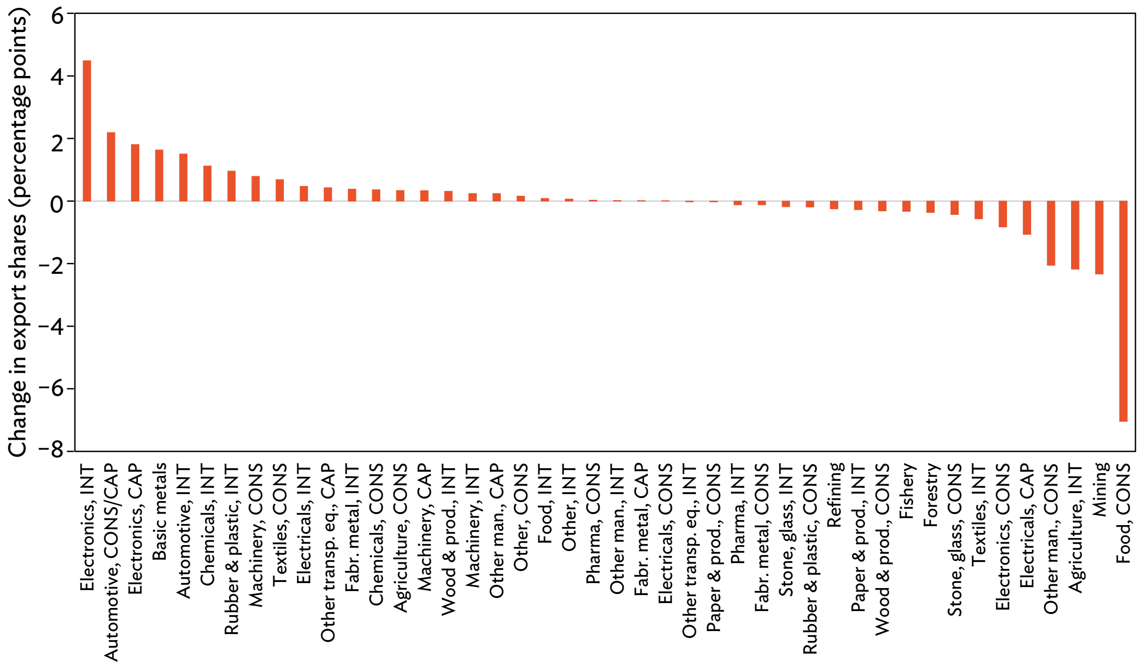
decrease in the GMS-5 is consumer food products, followed at some distance by mining, intermediate agriculture, and other consumer manufacturing.

The findings suggest that the differences in terms of the structural changes in export values of the GMS members are substantial. Figure A2.1 in Appendix 2.2 documents these sectoral changes for each of the six individual GMS members. From these additional figures, it appears that the Lao PDR has the highest degree of structural change.[17] The consumer textiles sector falls sharply in the Lao PDR, while other products (consumer), mining, and basic metals rise. Myanmar also sees a rise in mining and basic metals, at the expense of forestry and consumer food and agriculture.

The significant rise of electronics (intermediate and capital goods) is observed across all GMS members, especially in Viet Nam and the PRC. On the other hand, the consumer textiles sector is a somewhat paradoxical case. The share of this sector in total exports has fallen in all six GMS economies, although to different degrees. The fact that the consumer textiles sector grows slightly in Figure 2.4 is likely the result of intercountry dynamics: exports of countries where this sector is large grew more rapidly than the exports of countries where the share of the sector is low.

[17] The study measures this by taking the sum of the absolute values of the changes in shares of the 44 sectors. The results vary between 147 percentage points for the Lao PDR and 36 percentage points for Cambodia.

Figure 2.4: Increases and Declines in Export Shares between 1996–2001 and 2016–2018 in Five Greater Mekong Subregion Countries (excluding the People's Republic of China)



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

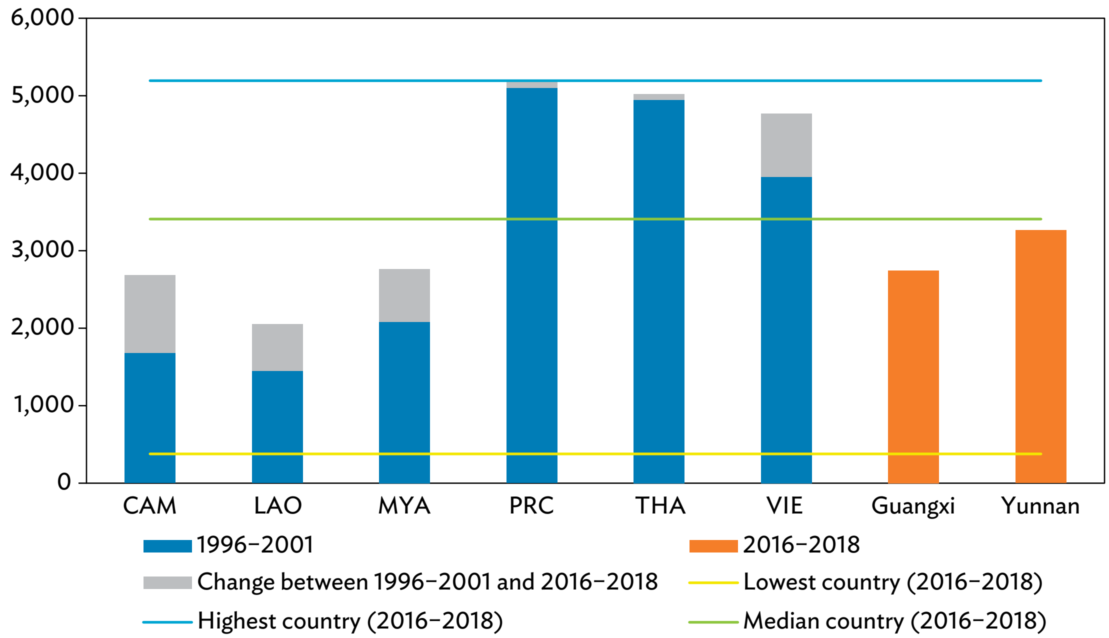
Source: United Nations Comtrade.

To extend the analysis to the product level, the study looks at the number of products that the GMS members export. The United Nations Comtrade database includes around 5,200 products (depending on the year and version of the Harmonized System). Figure 2.5 reports how many of these products are exported by each of the GMS members on average for the period 1996–2001 and the change in the average number of products exported between 1996–2001 and 2016–2018.[18] For comparison, the figure also reports the average number of products exported by the country with the largest number of exported products in 2016–2018 (Germany), the country with the smallest number of exported products (Guinea-Bissau), and the country at the median (Ecuador).

The figure reveals that the PRC had positive exports in the vast majority of products in 2016–2018 (5,182) as well as during 1996–2001 (5,103). Relatively high numbers are also reported for Thailand (5,022) and Viet Nam (4,771). In Viet Nam, the increase in the number of products exported between 1996–2001 and 2012–2016 was relatively large, over 800 products. Cambodia, the Lao PDR, and Myanmar, on the other hand, exported fewer products in 1996–2001 at 1,683, 1,450, and 2,086 products, respectively. Between 1996–2001 and 2016–2018, the number of products exported by these countries saw a relatively large increase, ranging from a low of 600 for the Lao PDR to a high

[18] The study aggregates export values across all years in each period, and then counts how many products show an export value greater than zero.

Figure 2.5: Number of Products Exported



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Note: Values for Guangxi and Yunnan are the total number of products for 2016–2018 (no data available for 1996–2001).

Source: United Nations Comtrade.

of 1,004 in Cambodia. Despite these rapid increases, the number of products exported by these countries remains below that of the median country, though significantly above the worst-performing countries. The results suggest that there is a dichotomy within the GMS: the PRC, Thailand, and Viet Nam have a highly diversified export basket, while Cambodia, the Lao PDR, and Myanmar have a much less-diversified export basket.

2.3 Conclusions

This chapter suggests that the export structure of the GMS is very heterogeneous. The PRC, Thailand, and Viet Nam have very different export structures from those of Cambodia, the Lao PDR, and Myanmar. The former three have been able to export in a wide variety of products, with large shares of their exports accounted for by products that are traditionally associated with high-technology sectors. Cambodia, the Lao PDR, and Myanmar, on the other hand, export far fewer products—although at a level that is commensurate with their development level—with their export structure dominated by products associated with low-technology sectors.

Appendix 2.1

Data

The data used for this analysis come from United Nations Comtrade, which reports data on bilateral exports and imports at the six-digit Harmonized System product level for a large number of reporting (and partner) countries. The data are reported in thousands of US dollars. For this study, the analysis focuses on data for the period 2016–2018 using the 2012 version of the Harmonized System. The analysis follows common practice and relies on import data; that is, using imports of the partner to capture exports of the reporter country.

Appendix 2.2

Figure A2.1: Increases and Declines in Export Shares between 1996–2001 and 2016–2018

(a) Cambodia

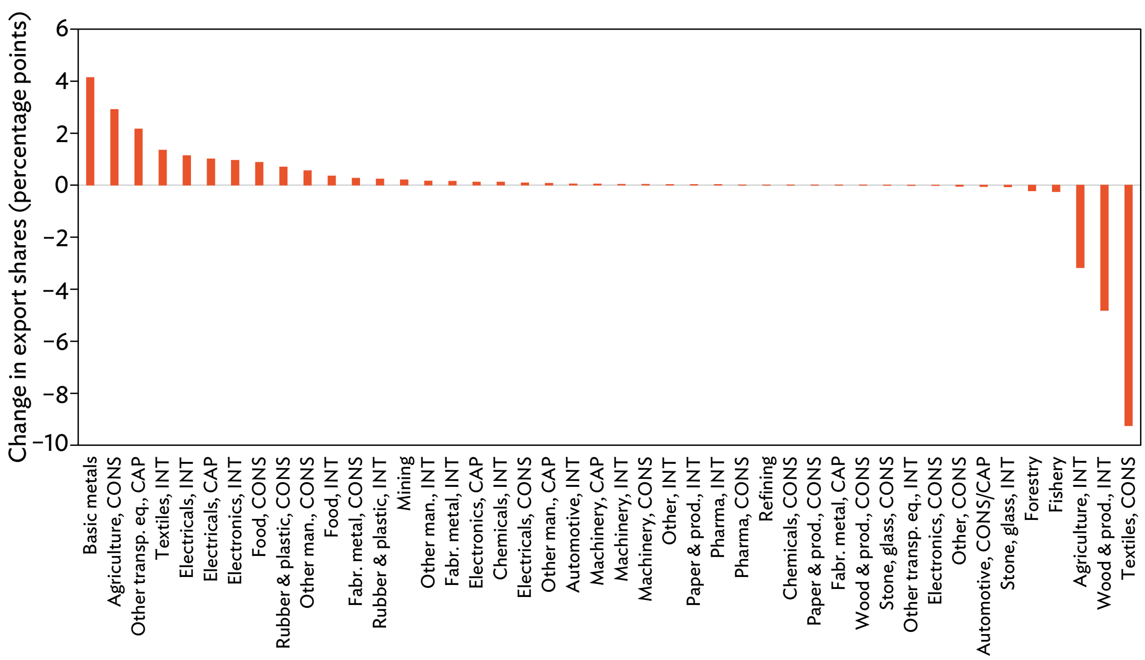


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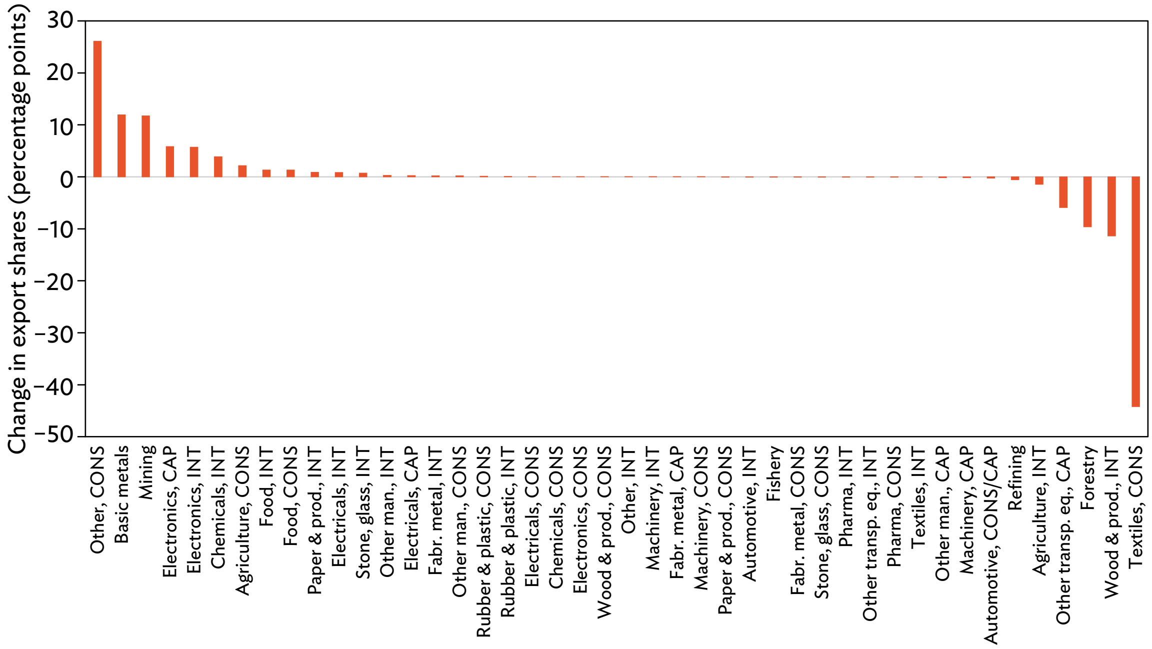
Figure A2.1 *continued*

(b) Lao People's Democratic Republic



(c) Myanmar

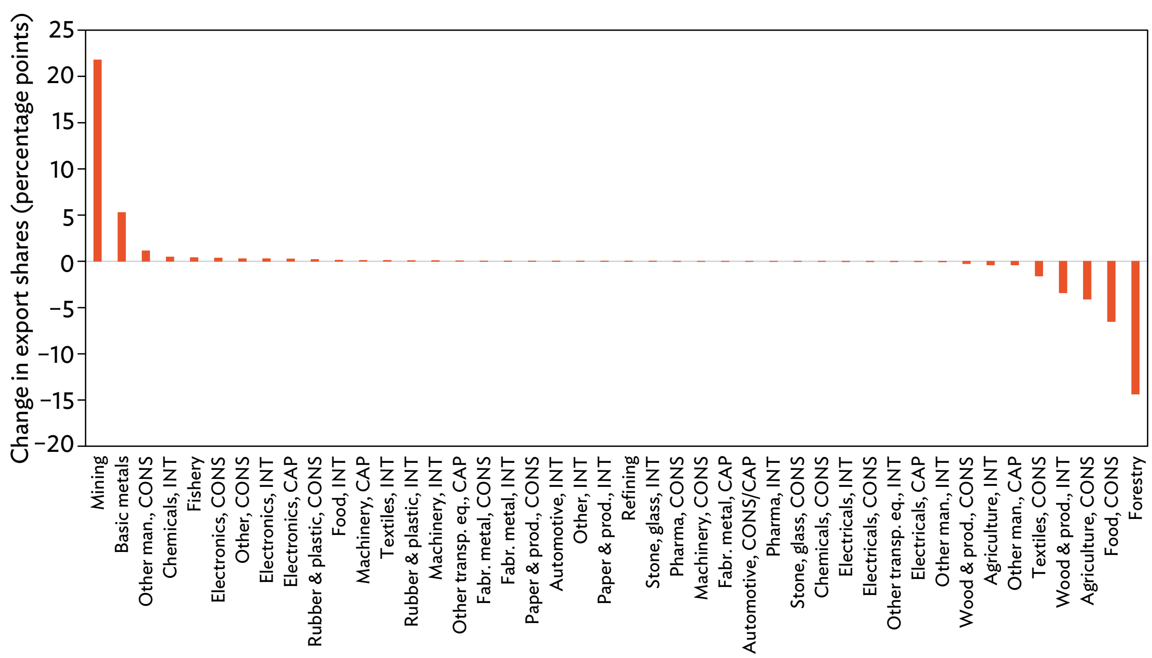


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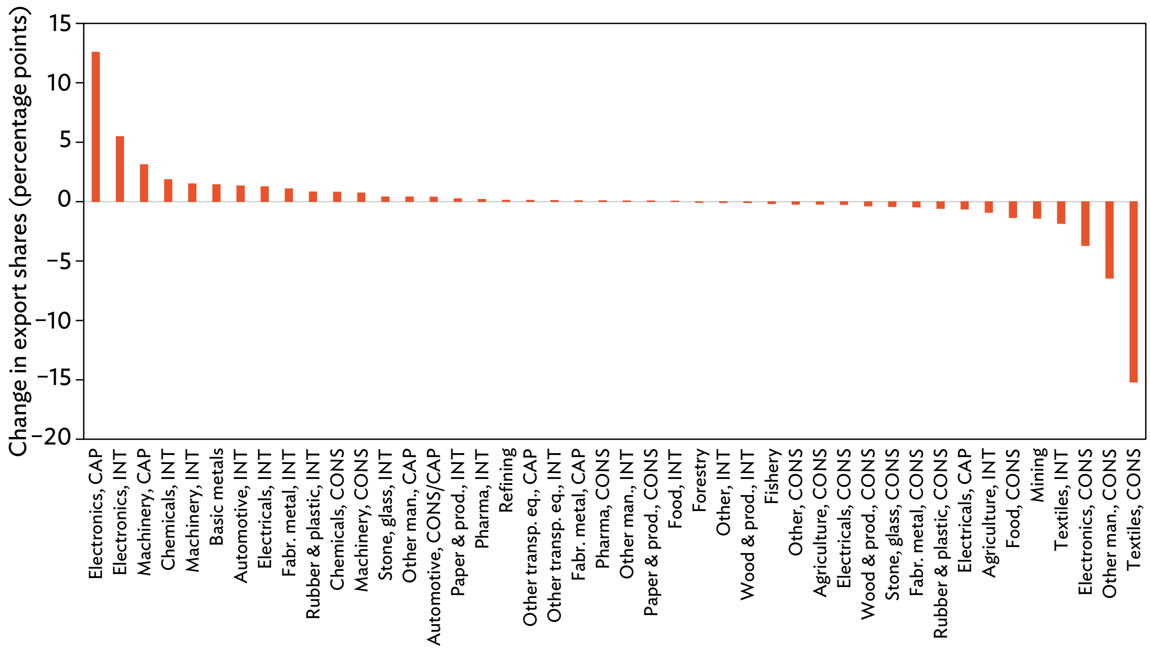
Figure A2.1 *continued*

(d) People's Republic of China



(e) Thailand

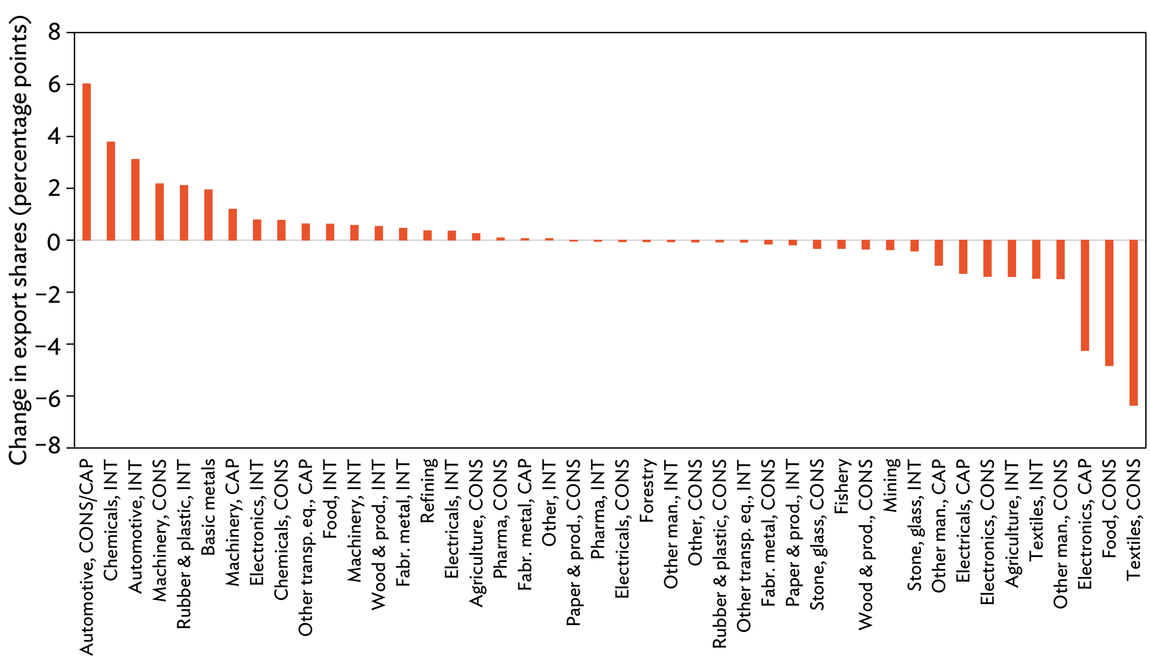


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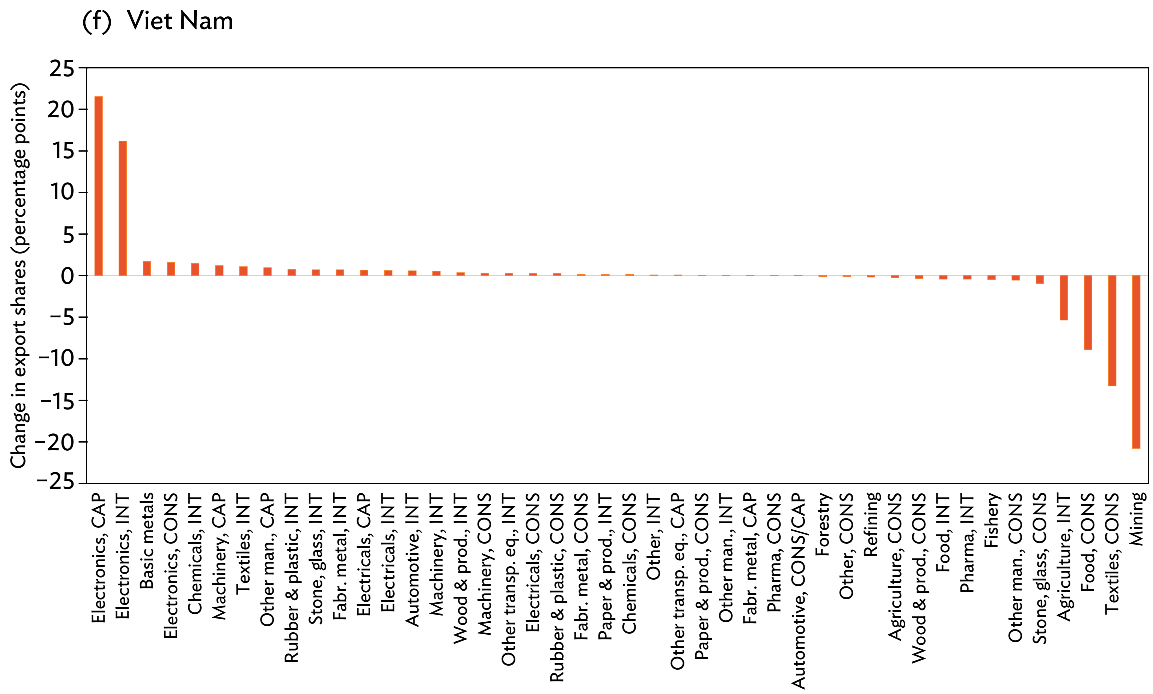
Figure A2.1 *continued*



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table 2.1 for definitions of sectors.

Source: United Nations Comtrade.

Chapter 3

Specialization Patterns of the Greater Mekong Subregion

3.1 Introduction

This chapter addresses four questions: (i) What are the specialization patterns of the Greater Mekong Subregion (GMS) members? (ii) How do these patterns differ across members? (iii) How do they compare to those of other countries? (iv) Do the GMS members produce complex goods, or do they rely on traditional, noncomplex goods? The introduction to Chapter 2 defined *complexity* as a feature of a product and of a country that results from using information about both how diversified is the country's export basket and how unique each exported product is. To answer the questions above, this chapter makes use of detailed trade data for the most recent period (2016–2018) to identify the sets of products in which the GMS members can compete successfully. In particular, the chapter uses the concept of *revealed comparative advantage* to identify these products and establish the degree of diversification of the economy. It then further examines how *unique* the resulting export baskets are.

As discussed in Chapter 2, the modern development literature emphasizes the importance of diversifying production and export structures for economic development (see, for example, Imbs and Wacziarg 2004). Likewise, the new structural economics literature (Lin 2012) also emphasizes this point. This literature argues that factor endowments determine a country's comparative advantage and, in turn, a country's industrial structure and level of economic development. Upgrading, therefore, involves changing the factor endowment structure to become more capital and technology intensive and developing the nation's industries according to newly acquired comparative advantages. Relatedly, Hausmann and Hidalgo (2011), among others, suggest that export diversification can predict future growth and that the types of products that are exported matter, with more complex products having a greater impact on growth.[19]

3.2 Specialization Patterns and Diversification of the Exports Baskets of the Greater Mekong Subregion

This section shows which products GMS members have been able to develop with comparative advantage. A country's specialization in a particular product is captured by the concept of revealed comparative advantage (RCA) (see Appendix for details). RCA is an index that compares the proportion of a country's exports of a particular product to the proportion of world exports in that

[19] See also Hausmann, Hwang, and Rodrik (2007).

particular product. If this ratio is larger than 1, then a country exports the product with comparative advantage. Based on this criterion, it is possible to construct an indicator capturing the number of products in which a country specializes.

Figure 3.1 reports for each GMS member (including the PRC as a whole as well as separately for Guangxi Zhuang Autonomous Region and Yunnan Province) the total number of products exported with RCA in 1996–2001 (average); the change in the number of products exported with RCA between 1996–2001 and 2016–2018; and three horizontal lines representing the highest (2,440, PRC), lowest (16, Iraq), and median (384, Ireland) number of products exported with RCA among the 155 countries in the database.

The figure indicates that the PRC exports the largest number of products with RCA in the world (2,440), and that this number increased significantly between 1996–2001 and 2016–2018 (833).[20] Thailand (1,013) and Viet Nam (881) also export a relatively large number of products with comparative advantage. The change in the number of products exported between the two periods is also significant in Viet Nam (297 products). These two countries export many more products with RCA than the median country (384).

The number of products exported with comparative advantage by Cambodia, the Lao PDR, and Myanmar is much smaller, ranging from 240 for the Lao PDR to 445 for Myanmar, with Cambodia reporting 385. The figures for Myanmar and Cambodia are close to that of the median country in 2016–2018. Interestingly, while the number of products exported by these three countries increased between 1996–2001 and 2016–2018 (see Figure 2.5 in Chapter 2), they have not been able to acquire RCA in many of them. The actual increases in the number of products exported with RCA ranges from just 49 for the Lao PDR to 171 for Cambodia, with an increase of 166 in Myanmar.

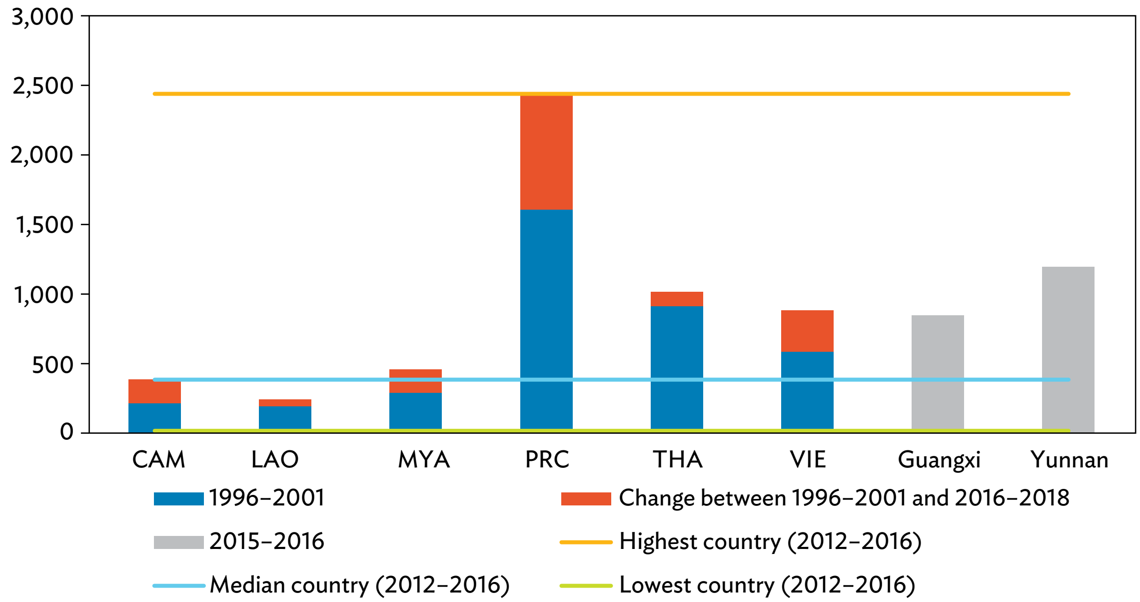
Figure 3.1 also reports the number of products that Guangxi and Yunnan export with comparative advantage, using data for the period 2015–2016 (the latest data on hand for these two regions). Unsurprisingly, these two regions export far fewer products with comparative advantage than the PRC as a whole, but they perform well in comparison with other GMS members, with Guangxi exporting 845 products and Yunnan exporting 1,194 products with RCA.

The number of products exported with comparative advantage in Figure 3.1 can be broken down by sector. This is shown in Table 3.1, which reports the number of products exported with RCA by each GMS member for the 44 sectors in the study (sector names are listed in Table A3.1 in the Appendix). This table also shows the total number of products in each sector and the share of the total number of products that is exported with comparative advantage by each GMS member. An initial observation is that a few sectors dominate specialization patterns in the GMS, particularly food (consumer goods) and textiles (intermediate and consumer goods) sectors.

There are, however, differences across GMS members. To see this, the analysis calculates a five-sector concentration ratio, which is the share of the five sectors with the highest number of products exported with comparative advantage out of all products exported with comparative advantage. This share is 78% for Cambodia, which indicates that just five sectors account for more

[20] Export data for these different periods are first aggregated across years before calculating RCA.

Figure 3.1: Number of Products Exported with Revealed Comparative Advantage



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

than three-quarters of Cambodia's exports with comparative advantage. Similarly, with a five-sector concentration ratio of 70%, Myanmar also has a highly concentrated sectoral specialization pattern. The concentration ratios are smaller for other GMS members: 53% in the PRC and the Lao PDR, 58% in Thailand, and even lower in Viet Nam (46%), Guangxi (46%), and Yunnan (44%). These results thus suggest that, while most GMS members have been able to develop comparative advantages in a relatively broad number of sectors, Cambodia and Myanmar are largely reliant on the textiles sector and, to a lesser extent on the food sector, for their comparative advantages.

While the analysis above is informative, the outcomes are to an extent driven by the differences in the number of products across the different sectors: it is somewhat unsurprising, for example, that food (consumer goods) and textiles (intermediate and consumer goods) sectors account for a large share of products exported with comparative advantage since these are also sectors with relatively large numbers of products (see the final column of Table 3.1). It is instructive, therefore, to also consider the share of products within each sector that a country exports with comparative advantage. Looking at this share, the study finds support for the view that GMS members have been successful in developing a comparative advantage in food and textiles sectors. The PRC has developed a comparative advantage in 91% of 352 textile consumer goods, while Cambodia (70%), Myanmar (55%), and Viet Nam (65%) also have comparative advantage in many of these products. The PRC also has comparative advantage in 77% of textile intermediate goods, while both Thailand and Viet Nam achieve comparative advantage in around a quarter of these products. These shares are lower for consumer foods, with Thailand and Viet Nam obtaining comparative advantage in just over 20% of products in this sector.

Table 3.1: Number and Share of Products Exported with Comparative Advantage by Sector, 2016–2018 Average

Sector	Number of Products Exported with Comparative Advantage							
	PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan
Agriculture (intermediate)	16	11	22	24	22	13	7	16
Agriculture (consumer)	20	8	17	32	20	31	26	61
Forestry	5	4	6	6	4	6	2	3
Fishing	7	7	0	22	6	6	3	1
Mining	19	2	15	17	10	10	4	12
Food (intermediate)	12	8	8	12	23	17	9	7
Food (consumer)	83	9	16	46	90	83	29	32
Textiles (intermediate)	362	24	9	17	129	127	92	86
Textiles (consumer)	320	245	58	195	35	229	84	71
Wood (intermediate)	16	3	12	12	12	18	6	7
Wood (consumer)	16	2	4	4	4	14	13	2
Paper (intermediate)	19	0	5	3	21	7	9	16
Paper (consumer)	8	1	0	2	1	1	2	4
Refining	3	0	0	0	3	1	3	2
Chemicals (intermediate)	296	4	13	5	144	32	54	119
Chemicals (consumer)	15	0	2	0	15	3	3	3
Pharma (intermediate)	45	1	0	0	6	2	3	4
Pharma (consumer)	5	0	0	0	0	0	0	1
Rubber (intermediate)	41	2	4	0	45	13	29	20
Rubber (consumer)	17	5	0	2	10	6	12	4
Stone (intermediate)	81	2	4	4	44	23	36	46
Stone (consumer)	14	0	0	0	6	5	10	7
Basic metals	128	6	9	18	55	45	30	56
Fabricated metal (intermediate)	73	4	2	1	17	12	35	38
Fabricated metal (consumer)	39	4	0	1	7	10	28	15
Fabricated metal (capital)	42	0	0	0	6	6	28	13
Electronics (intermediate)	66	3	6	8	55	19	15	8
Electronics (consumer)	31	1	0	2	10	7	9	6
Electronics (capital)	91	0	6	2	30	28	22	16
Electricals (intermediate)	42	2	2	1	19	7	14	15
Electricals (consumer)	17	1	0	1	6	3	7	5
Electricals (capital)	32	2	2	1	9	7	12	14
Machinery (intermediate)	41	0	1	2	15	6	12	14
Machinery (consumer)	36	0	0	0	19	5	3	4
Machinery (capital)	194	2	2	1	46	10	125	69
Automotive (intermediate)	6	0	0	0	12	3	1	1
Automotive (consumer/capital)	4	0	0	0	5	0	6	6
Other transport equipment (intermediate)	10	0	1	0	1	3	6	3
Other transport equipment (capital)	22	1	0	0	7	9	2	7

Products Exported with Comparative Advantage as a Share of Total Number of Products								Total Number of Products in Sector
PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan	
0.111	0.076	0.153	0.167	0.153	0.090	0.049	0.111	144
0.129	0.052	0.110	0.206	0.129	0.200	0.168	0.394	155
0.263	0.211	0.316	0.316	0.211	0.316	0.105	0.158	19
0.108	0.108	0.000	0.338	0.092	0.092	0.046	0.015	65
0.200	0.021	0.158	0.179	0.105	0.105	0.042	0.126	95
0.082	0.054	0.054	0.082	0.156	0.116	0.061	0.048	147
0.201	0.022	0.039	0.112	0.218	0.201	0.070	0.078	412
0.765	0.051	0.019	0.036	0.273	0.268	0.195	0.182	473
0.909	0.696	0.165	0.554	0.099	0.651	0.239	0.202	352
0.242	0.045	0.182	0.182	0.182	0.273	0.091	0.106	66
1.000	0.125	0.250	0.250	0.250	0.875	0.813	0.125	16
0.176	0.000	0.046	0.028	0.194	0.065	0.083	0.148	108
0.727	0.091	0.000	0.182	0.091	0.091	0.182	0.364	11
0.150	0.000	0.000	0.000	0.150	0.050	0.150	0.100	20
0.401	0.005	0.018	0.007	0.195	0.043	0.073	0.161	738
0.319	0.000	0.043	0.000	0.319	0.064	0.064	0.064	47
0.536	0.012	0.000	0.000	0.071	0.024	0.036	0.048	84
0.294	0.000	0.000	0.000	0.000	0.000	0.000	0.059	17
0.366	0.018	0.036	0.000	0.402	0.116	0.259	0.179	112
0.680	0.200	0.000	0.080	0.400	0.240	0.480	0.160	25
0.559	0.014	0.028	0.028	0.303	0.159	0.248	0.317	145
0.778	0.000	0.000	0.000	0.333	0.278	0.556	0.389	18
0.329	0.015	0.023	0.046	0.141	0.116	0.077	0.144	389
0.664	0.036	0.018	0.009	0.155	0.109	0.318	0.345	110
0.929	0.095	0.000	0.024	0.167	0.238	0.667	0.357	42
0.724	0.000	0.000	0.000	0.103	0.103	0.483	0.224	58
0.635	0.029	0.058	0.077	0.529	0.183	0.144	0.077	104
0.633	0.020	0.000	0.041	0.204	0.143	0.184	0.122	49
0.569	0.000	0.038	0.013	0.188	0.175	0.138	0.100	160
0.667	0.032	0.032	0.016	0.302	0.111	0.222	0.238	63
0.810	0.048	0.000	0.048	0.286	0.143	0.333	0.238	21
0.696	0.043	0.043	0.022	0.196	0.152	0.261	0.304	46
0.383	0.000	0.009	0.019	0.140	0.056	0.112	0.131	107
0.720	0.000	0.000	0.000	0.380	0.100	0.060	0.080	50
0.526	0.005	0.005	0.003	0.125	0.027	0.339	0.187	369
0.240	0.000	0.000	0.000	0.480	0.120	0.040	0.040	25
0.143	0.000	0.000	0.000	0.179	0.000	0.214	0.214	28
0.357	0.000	0.036	0.000	0.036	0.107	0.214	0.107	28
0.423	0.019	0.000	0.000	0.135	0.173	0.038	0.135	52

continued on next page

Table 3.1 *continued*

Sector	Number of Products Exported with Comparative Advantage							
	PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan
Other manufacturing (intermediate)	27	4	3	1	5	10	13	9
Other manufacturing (consumer)	81	12	5	10	31	25	31	27
Other manufacturing (capital)	22	0	3	1	1	15	4	2
Other (intermediate)	7	1	1	1	6	3	1	2
Other (consumer)	9	3	2	1	1	1	1	3
Total	2,440	384	240	455	1,013	881	841	857

CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Notes: Data for Guangxi and Yunnan are for 2016. Intermediate, consumer, and capital refer to intermediate, consumer, and capital goods, respectively. A full description of the sectors is provided in Table A3.1 of the Appendix.

Source: United Nations Comtrade.

While it is unsurprising that the PRC has developed a comparative advantage in a large number of products across a number of sectors—more than half of the products in 21 of the 44 sectors—other GMS members also appear relatively successful in a broader range of sectors when looking at a sector's share of products that are exported with comparative advantage. This is limited to sectors such as forestry in the Lao PDR and to forestry, fishing, wood (consumer and intermediate products), and paper (consumer goods) in Myanmar, which are either primary or low-tech manufacturing sectors. Thailand and Viet Nam have acquired comparative advantage in a relatively large share of products in a broader range of sectors, including chemicals (consumer goods), rubber (intermediate goods), electronics (intermediate and consumer goods), and electrical machinery (consumer goods). In addition, Thailand has comparative advantage in the automotive sector (intermediate goods), while Viet Nam has an advantage in forestry, wood (intermediate and consumer goods), fabricated metal (consumer goods), and other manufacturing (intermediate and consumer goods). Guangxi and Yunnan have also developed a comparative advantage in a significant share of products across a range of sectors, notably fabricated metals (intermediate, consumer, and capital goods) and electrical machinery (intermediate, consumer, and capital goods). Such results are consistent with the view that Cambodia, the Lao PDR, and Myanmar are heavily specialized in primary and low-technology sectors, while the PRC (and its two regions), Thailand, and Viet Nam have been able to develop a comparative advantage in a broader range of sectors and in high-technology sectors.

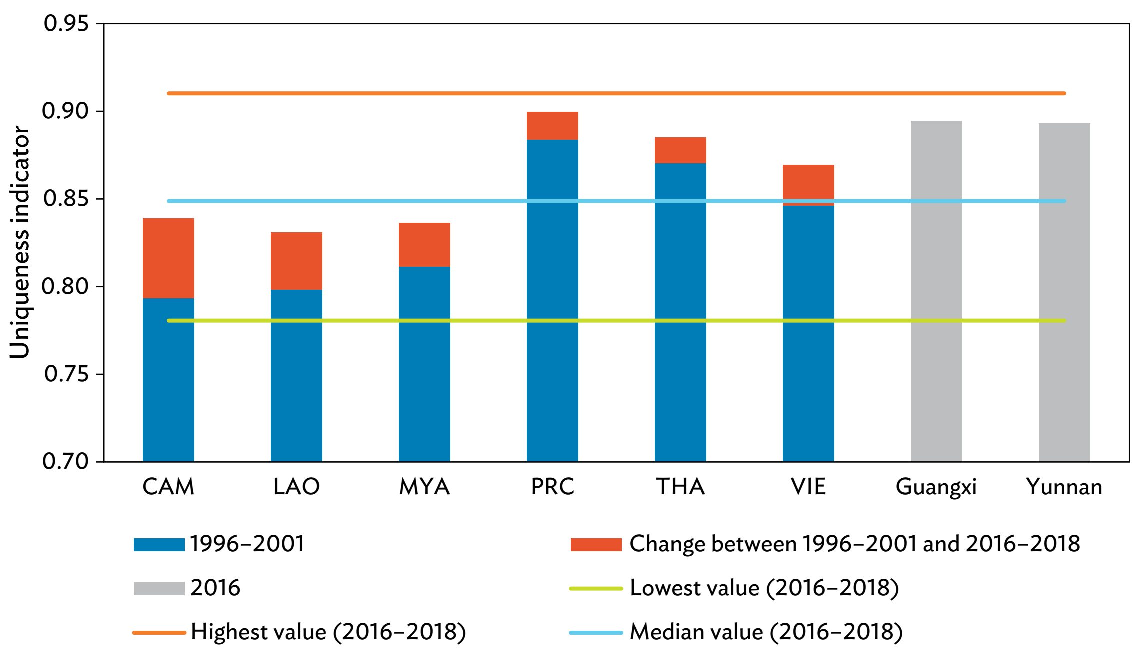
3.3 Uniqueness of the Exports Baskets of the Greater Mekong Subregion

The results discussed above suggest that, while the export baskets of the PRC (including its two regions), Thailand, and Viet Nam are highly diversified, those of Cambodia, the Lao PDR, and Myanmar are much less so. In this section, the analysis moves beyond the question of specialization and considers whether the export baskets of the GMS members are relatively unique, i.e., whether they export products exported by just a few countries (unique products) or by a large number of countries (ubiquitous products).

	Products Exported with Comparative Advantage as a Share of Total Number of Products								Total Number of Products in Sector
	PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan	
	0.818	0.121	0.091	0.030	0.152	0.303	0.394	0.273	33
	0.779	0.115	0.048	0.096	0.298	0.240	0.298	0.260	104
	0.815	0.000	0.111	0.037	0.037	0.556	0.148	0.074	27
	0.241	0.034	0.034	0.034	0.207	0.103	0.034	0.069	29
	0.265	0.088	0.059	0.029	0.029	0.029	0.029	0.088	34

Figure 3.2 reports the average uniqueness of the export baskets of each GMS member (see the Appendix for details on how to construct the uniqueness indicator). In particular, the figure shows the average levels of uniqueness for the period 1996–2001 and the change in the average level of uniqueness between 1996–2001 and 2016–2018. The numbers reflect the extent to which other countries in the database are able to specialize (i.e., an RCA of greater than one) in the same set of products as the country or region under consideration. Higher numbers indicate a more unique export basket (i.e., few countries have the same specialization pattern). Also reported in this figure is the average uniqueness of

Figure 3.2: Uniqueness of the Greater Mekong Subregion Members' Export Baskets



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

the country with the highest level of uniqueness in 2016–2018 (Japan), the median country (Tunisia), and the country with the lowest average level of uniqueness in this period (Iraq).

Consistent with other patterns reported above, the uniqueness of the export baskets of the PRC, Thailand, and Viet Nam is relatively high. On the other hand, the uniqueness of the export baskets of Cambodia, the Lao PDR, and Myanmar is much lower. In 1996–2001, Cambodia's export basket was the least unique out of 152 countries, while the Lao PDR was ranked 147th and Myanmar 145th. Conversely, the PRC was ranked relatively high (26th), as was Thailand (41st), while Viet Nam was ranked somewhat lower (85th).

Over time, however, Cambodia, the Lao PDR, and Myanmar have been able to increase the uniqueness of their export baskets relatively rapidly, such that by 2016–2018 their ranking moved up quite significantly. The Lao PDR moved up to 118th (out of 154), Cambodia to 96th, and Myanmar to 101st. From a situation where the uniqueness of their export baskets was at or near the bottom, they have been able to improve and move toward the median country. In absolute terms, the increases in uniqueness of the PRC, Thailand, and Viet Nam were smaller than those of the other three countries—perhaps reflecting the fact that their uniqueness levels were already relatively high. Nevertheless, they also saw significant improvements in ranking, with the PRC rising to 5th and Thailand and Viet Nam to 14th and 38th, respectively. Data on Guangxi and Yunnan for the most recent period suggest that their export baskets are also relatively unique, though not as much as the PRC as a whole.

Combining the comparative advantage and uniqueness results, the study concludes that the export baskets of the PRC, Thailand, and Viet Nam are highly diversified and unique, not very far from those of many high-income countries. The export baskets of Cambodia, the Lao PDR, and Myanmar, however, are much less diversified and unique, which is typical of low-income or lower middle-income countries. Overall, despite recent improvements, Cambodia, the Lao PDR, and Myanmar remain relatively noncomplex economies.

3.4 Does the Specialization Pattern of the Greater Mekong Subregion Differ from That of the World?

Previous sections have shown that the PRC, Thailand, and Viet Nam have been able to develop diversified and unique export baskets; while Cambodia, the Lao PDR, and Myanmar have not been able to do so to the same extent. In this section, the study analyzes whether these findings also hold when considering intraregional trade. In other words, rather than considering exports to the world, the analysis considers the structure and specialization of exports within the GMS. In particular, the study asks whether the GMS members are more successful at developing a comparative advantage and in diversifying within the GMS than at the global level. If the answer is yes, then this may suggest the possibility of using the GMS as a springboard toward increased diversification of the region's exports to the world.

Table 3.2 reports intra-GMS export shares by sector for 2016–2018 (total per country adds up to 100), as well as the ratio of a sector's intra-GMS export share to its share of exports to the rest of the world (ratio equals to one indicates that the two shares are equal). This ratio captures to what extent a particular sector is more or less important in a member's export basket when considering intra-GMS trade than when considering world trade.[21]

Results for the PRC suggest that its intra-GMS export structure is similar to the structure of its exports to the rest of the world. There are some exceptions, however, with exports of intermediate textiles, basic metals, refining, intermediate food, and consumer agricultural products accounting for a larger share of intra-GMS exports; while shares of world exports of textiles (consumer goods), wood (consumer goods), and other manufacturing (capital and consumer goods) are larger than intra-GMS shares.

In Cambodia, the intra-GMS export shares of primary sectors, such as agriculture, forestry, fishing, mining, and low-tech manufacturing sectors, such as food and textiles (intermediate goods), are larger than the shares in world exports. Textiles (consumer goods) account for a much smaller share of intra-GMS exports than world shares of exports for all GMS members, suggesting that they are able to compete in the global economy in these sectors (perhaps within global value chains), but that they do not serve the local market. There are few sectors in the Lao PDR and Myanmar that account for significant shares of intra-GMS exports (with primary sectors being among the exceptions).

In general, the shares of intra-GMS exports of textiles (consumer goods), pharmaceuticals, wood consumer products, paper consumer products, stone (consumer goods), and other manufactured goods (consumer goods) are small. In Thailand, the intra-GMS export shares of agriculture, mining, low-tech manufacturing (e.g., textiles intermediates and wood intermediates), as well as those of high-tech sectors such as chemicals (intermediates) and pharmaceuticals, are significantly higher than shares for the rest of the world. By contrast, the intra-GMS export shares of high-tech sectors such as automotive, electronics, and electrical machinery are smaller than world export shares.

In Viet Nam, intra-GMS export shares of many primary sectors, along with other low-tech intermediate sectors such as food, textiles, wood, paper, and electronics, are higher than the world export share. On the other hand, the intra-GMS shares of nearly all consumer goods sectors, including pharmaceuticals, fabricated metal, electricals, machinery, and automotive, are generally lower than the world export share.

To summarize, intra-GMS export shares are higher than the corresponding shares in exports to the world in many sectors, with primary sectors in particular showing higher intra-GMS shares.

Finally, Table 3.3 reports the number of products that each GMS member exports with comparative advantage in intra-GMS exports. The table also reports the ratio of the number of products exported with comparative advantage in intra-GMS exports to the number of products exported with comparative advantage to the world. The table reveals that, in many cases, this ratio is greater than one, reflecting a greater degree of diversification in intra-GMS trade than in world trade. Such an outcome may provide opportunities to develop global competitiveness based on the development of local competitiveness. The exceptions to this general pattern are Myanmar and, to a lesser extent, the Lao PDR, where the number of products exported with comparative advantage

[21] Because data on bilateral exports for Guangxi and Yunnan are not available, these regions are not included in this section.

Table 3.2: Export Structure of the Greater Mekong Subregion Members in Intraregional Trade, 2016–2018 Average

Sector	Export Shares of Intra-GMS Exports by Sector					
	PRC	CAM	LAO	MYA	THA	VIE
Agriculture (intermediate)	0.255	6.260	9.762	5.555	4.568	0.875
Agriculture (consumer)	0.788	25.820	3.250	1.676	5.290	2.369
Forestry	0.007	1.216	4.010	1.129	0.003	0.112
Fishing	0.025	0.422	0.000	1.903	0.020	0.025
Mining	0.219	0.661	14.573	68.289	0.863	3.866
Food (intermediate)	0.683	1.725	1.162	1.287	1.073	0.885
Food (consumer)	1.094	5.307	1.856	1.043	6.270	4.485
Textiles (intermediate)	11.269	8.283	0.267	0.089	2.103	7.098
Textiles (consumer)	1.990	16.171	0.162	1.273	0.668	6.511
Wood (intermediate)	0.499	5.370	3.221	0.818	2.984	2.108
Wood (consumer)	0.029	0.009	0.058	0.008	0.007	0.022
Paper (intermediate)	1.039	0.144	1.143	0.015	1.155	0.425
Paper (consumer)	0.036	0.000	0.000	0.000	0.013	0.023
Refining	0.517	0.000	0.000	0.001	0.376	0.008
Chemicals (intermediate)	7.561	0.531	3.273	1.160	16.604	4.551
Chemicals (consumer)	1.358	0.002	0.000	0.005	0.880	0.242
Pharma (intermediate)	0.757	0.003	0.000	0.000	0.160	0.019
Pharma (consumer)	0.139	0.009	0.000	0.001	0.289	0.052
Rubber (intermediate)	2.623	0.072	0.077	0.009	2.174	0.574
Rubber (consumer)	1.288	0.235	0.166	0.073	0.540	0.173
Stone (intermediate)	1.615	0.084	0.883	0.023	1.263	0.753
Stone (consumer)	0.161	0.001	0.000	0.001	0.106	0.040
Basic metals	10.197	10.736	11.181	11.752	2.411	1.512
Fabricated metal (intermediate)	4.027	0.303	0.066	0.021	0.690	0.562
Fabricated metal (consumer)	0.845	1.422	0.001	0.004	0.116	0.131
Fabricated metal (capital)	0.441	0.104	0.028	0.021	0.173	0.129
Electronics (intermediate)	13.413	4.106	6.757	0.880	16.894	40.990
Electronics (consumer)	0.748	0.115	0.013	0.165	1.054	4.699
Electronics (capital)	11.414	0.259	4.008	0.187	12.308	7.238
Electricals (intermediate)	4.780	4.890	0.731	0.104	2.184	2.762
Electricals (consumer)	0.489	0.378	0.053	0.094	0.160	0.213
Electricals (capital)	3.476	3.119	0.309	0.134	1.294	1.427
Machinery (intermediate)	2.015	0.138	0.038	0.012	1.507	0.789
Machinery (consumer)	1.178	0.133	0.039	0.001	2.256	0.339
Machinery (capital)	8.285	0.212	0.065	0.225	2.762	1.642
Automotive (intermediate)	1.445	0.170	0.001	0.001	1.855	0.775
Automotive (consumer/capital)	0.572	0.003	0.013	0.011	2.969	0.005
Other transport equipment (intermediate)	0.338	0.036	0.118	0.000	0.097	0.312

	Ratio of Intra-GMS Share to World Share of Exports					
	PRC	CAM	LAO	MYA	THA	VIE
	1.202	4.624	1.040	1.512	1.906	0.506
	2.031	6.524	1.129	0.225	2.872	1.062
	0.463	5.152	1.155	1.732	0.210	3.157
	0.508	6.605	0.000	1.870	0.426	1.162
	0.847	3.174	1.124	1.992	1.825	2.699
	2.279	3.374	0.785	1.748	0.689	1.937
	0.798	2.267	0.987	0.204	0.669	0.968
	5.187	4.671	0.746	0.328	1.705	2.680
	0.200	0.216	0.026	0.041	0.338	0.299
	1.135	5.642	1.134	0.362	2.732	1.974
	0.176	0.937	0.678	0.225	0.108	0.146
	1.761	2.515	1.213	0.353	1.572	1.564
	0.329	0.010	0.308	0.005	0.434	0.882
	2.538	0.000	0.000	1.600	2.268	0.281
	1.682	3.281	0.773	1.912	1.991	2.307
	1.289	0.136	0.002	0.853	0.784	0.830
	1.089	0.129	0.000	0.014	1.445	0.461
	0.614	0.682	0.003	0.720	1.521	1.096
	1.372	0.291	0.600	0.087	0.599	0.482
	0.928	0.324	1.207	0.312	0.495	0.312
	1.189	5.017	1.222	0.505	1.602	0.790
	0.518	0.383	0.264	0.294	0.624	0.395
	2.943	2.334	0.950	1.614	0.652	0.727
	1.754	1.766	0.279	0.491	0.575	0.588
	0.938	5.223	0.891	0.105	0.337	0.435
	0.840	5.225	1.196	1.305	0.776	1.236
	1.331	4.078	1.196	1.052	1.407	2.370
	0.490	2.102	0.306	0.446	0.727	2.576
	0.461	1.322	0.697	0.575	0.849	0.325
	1.358	4.209	0.886	0.811	0.989	1.123
	0.529	4.168	0.984	1.031	0.616	0.628
	0.999	3.052	0.967	1.056	0.796	1.103
	0.842	2.220	0.632	0.125	0.943	1.034
	0.516	3.788	1.145	0.160	0.631	0.565
	1.431	1.401	0.849	1.231	0.706	1.013
	0.898	3.047	0.404	0.028	0.498	1.269
	1.162	1.068	0.497	0.970	0.381	0.377
	0.742	2.206	1.042	0.000	0.298	0.856

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Table 3.2 *continued*

Sector	Export Shares of Intra-GMS Exports by Sector					
	PRC	CAM	LAO	MYA	THA	VIE
Other transport equipment (capital)	0.563	0.076	0.028	0.000	1.040	0.268
Other manufacturing (intermediate)	0.610	0.177	0.379	0.008	0.134	0.118
Other manufacturing (consumer)	0.650	0.589	0.235	1.297	2.206	0.261
Other manufacturing (capital)	0.361	0.014	0.369	0.045	0.103	0.442
Other (intermediate)	0.016	0.174	0.031	0.033	0.289	0.120
Other (consumer)	0.190	0.520	31.670	0.643	0.090	0.051

CAM = Cambodia, LAO = Lao People's Democratic Republic, GMS = Greater Mekong Subregion, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Notes: Intermediate, consumer, and capital refer to intermediate, consumer, and capital goods, respectively. A full description of the sectors is provided in Table A3.1 of the Appendix.
Export shares per country add up to 100.

Source: United Nations Comtrade.

Table 3.3: Number of Products Exported with Comparative Advantage to Greater Mekong Subregion Members by Sector, 2016–2018 Average

Sector	Number of Products Exported with Comparative Advantage to other GMS Members					
	PRC	CAM	LAO	MYA	THA	VIE
Agriculture (intermediate)	21	15	21	23	41	19
Agriculture (consumer)	56	11	19	32	33	25
Forestry	5	6	7	6	4	4
Fishing	5	12	0	21	6	5
Mining	32	4	13	17	12	15
Food (intermediate)	32	8	9	10	36	26
Food (consumer)	111	16	16	27	119	76
Textiles (intermediate)	414	26	6	6	121	133
Textiles (consumer)	266	204	10	115	94	198
Wood (intermediate)	33	8	13	8	16	24
Wood (consumer)	16	4	5	4	4	12
Paper (intermediate)	60	2	3	1	42	21
Paper (consumer)	11	0	0	0	6	4
Refining	5	0	0	0	6	2
Chemicals (intermediate)	383	8	8	4	174	48
Chemicals (consumer)	25	0	0	0	20	8
Pharma (intermediate)	49	0	0	0	10	1
Pharma (consumer)	1	0	0	0	2	0
Rubber (intermediate)	85	2	3	0	53	18
Rubber (consumer)	22	4	1	0	11	6

Ratio of Intra-GMS Share to World Share of Exports					
PRC	CAM	LAO	MYA	THA	VIE
0.718	0.033	1.092	0.003	1.142	0.643
1.208	1.044	1.187	0.123	0.507	0.246
0.154	0.797	0.374	0.554	0.622	0.191
0.193	0.104	1.170	0.846	0.400	0.145
0.230	5.854	0.978	1.482	3.414	1.423
0.504	4.919	1.222	1.971	1.298	1.473

Total Number of Products in Sector	Ratio of Number of Intra-GMS Products Exported with Comparative Advantage to Number of Products Exported with Comparative Advantage to the World					
	PRC	CAM	LAO	MYA	THA	VIE
144	1.313	1.364	0.955	0.958	1.864	1.462
155	2.800	1.375	1.118	1.000	1.650	0.806
19	1.000	1.500	1.167	1.000	1.000	0.667
65	0.714	1.714		0.955	1.000	0.833
95	1.684	2.000	0.867	1.000	1.200	1.500
147	2.667	1.000	1.125	0.833	1.565	1.529
412	1.337	1.778	1.000	0.587	1.322	0.916
473	1.144	1.083	0.667	0.353	0.938	1.047
352	0.831	0.833	0.172	0.590	2.686	0.865
66	2.063	2.667	1.083	0.667	1.333	1.333
16	1.000	2.000	1.250	1.000	1.000	0.857
108	3.158		0.600	0.333	2.000	3.000
11	1.375	0.000		0.000	6.000	4.000
20	1.667				2.000	2.000
738	1.294	2.000	0.615	0.800	1.208	1.500
47	1.667		0.000		1.333	2.667
84	1.089	0.000			1.667	0.500
17	0.200					
112	2.073	1.000	0.750		1.178	1.385
25	1.294	0.800		0.000	1.100	1.000

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Table 3.3 *continued*

Sector	Number of Products Exported with Comparative Advantage to other GMS Members					
	PRC	CAM	LAO	MYA	THA	VIE
Stone (intermediate)	114	4	4	3	58	23
Stone (consumer)	14	0	0	0	9	5
Basic metals	220	16	12	16	68	65
Fabricated metal (intermediate)	90	2	1	0	30	22
Fabricated metal (consumer)	39	5	0	1	11	10
Fabricated metal (capital)	50	1	2	0	10	4
Electronics (intermediate)	47	3	5	3	32	18
Electronics (consumer)	31	1	1	3	7	9
Electronics (capital)	87	3	9	3	31	27
Electricals (intermediate)	48	5	2	0	15	16
Electricals (consumer)	17	1	1	1	5	4
Electricals (capital)	42	6	3	1	10	7
Machinery (intermediate)	65	2	0	0	24	7
Machinery (consumer)	38	1	2	0	21	10
Machinery (capital)	290	6	3	2	60	11
Automotive (intermediate)	12	0	0	0	6	0
Automotive (consumer/capital)	13	0	1	1	11	1
Other transport equipment (intermediate)	16	1	2	0	3	4
Other transport equipment (capital)	28	1	1	0	13	3
Other manufacturing (intermediate)	28	4	3	2	6	6
Other manufacturing (consumer)	75	9	4	11	34	24
Other manufacturing (capital)	20	0	7	1	8	13
Other (intermediate)	12	2	0	1	16	5
Other (consumer)	16	6	2	2	5	5
Total	3,044	409	199	325	1,303	944

CAM = Cambodia, LAO = Lao People's Democratic Republic, GMS = Greater Mekong Subregion, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Notes: Intermediate, consumer, and capital refer to intermediate, consumer, and capital goods, respectively. A full description of the sectors is provided in Table A3.1 of the Appendix.

Source: United Nations Comtrade.

	Total Number of Products in Sector	Ratio of Number of Intra-GMS Products Exported with Comparative Advantage to Number of Products Exported with Comparative Advantage to the World					
		PRC	CAM	LAO	MYA	THA	VIE
	145	1.407	2.000	1.000	0.750	1.318	1.000
	18	1.000				1.500	1.000
	389	1.719	2.667	1.333	0.889	1.236	1.444
	110	1.233	0.500	0.500	0.000	1.765	1.833
	42	1.000	1.250		1.000	1.571	1.000
	58	1.190				1.667	0.667
	104	0.712	1.000	0.833	0.375	0.582	0.947
	49	1.000	1.000		1.500	0.700	1.286
	160	0.956		1.500	1.500	1.033	0.964
	63	1.143	2.500	1.000	0.000	0.789	2.286
	21	1.000	1.000		1.000	0.833	1.333
	46	1.313	3.000	1.500	1.000	1.111	1.000
	107	1.585		0.000	0.000	1.600	1.167
	50	1.056				1.105	2.000
	369	1.495	3.000	1.500	2.000	1.304	1.100
	25	2.000				0.500	0.000
	28	3.250				2.200	
	28	1.600		2.000		3.000	1.333
	52	1.273	1.000			1.857	0.333
	33	1.037	1.000	1.000	2.000	1.200	0.600
	104	0.926	0.750	0.800	1.100	1.097	0.960
	27	0.909		2.333	1.000	8.000	0.867
	29	1.714	2.000	0.000	1.000	2.667	1.667
	34	1.778	2.000	1.000	2.000	5.000	5.000

in intra-GMS exports is lower than that for global exports (i.e., a ratio less than one) in a majority of sectors. There are also some differences across sectors. For example, in textiles and intermediate electronics, the ratio for several GMS members is less than one.

3.5 Conclusions

In summary, this chapter suggests that the specialization patterns of the GMS members are divergent. The PRC, Thailand, and Viet Nam have a more diversified export structure, with significant exports and a high number of products exported with comparative advantage in relatively complex sectors, most notably machinery and electrical equipment. Cambodia, the Lao PDR, and Myanmar export fewer products with comparative advantage, and these are in relatively low-complex sectors.

The evidence suggests that there is a great deal of competition within the GMS in certain low-complex sectors, such as textiles, and in certain primary sectors. These results provide insights into the potential pathways for diversification and industrialization that the members may be able to follow in the context of regional cooperation and regional competition.

Appendix

Data

The data used for this analysis come from United Nations Comtrade, which reports data on bilateral exports and imports at the six-digit Harmonized System product level for a large number of reporter (and partner) countries. The data are reported in thousands of US dollars. The analysis for this report uses data for the period 2016–2018, using the 2012 version of the Harmonized System, with data collected for a common sample of 155 countries.

Table A3.1: List of Sectors

Sector no.	Sector	Description
1	Agriculture (intermediate)	Crop and animal production, hunting and related service activities (intermediate goods)
2	Agriculture (consumer)	Crop and animal production, hunting and related service activities (consumption goods)
3	Forestry	Forestry and logging
4	Fishing	Fishing and aquaculture
5	Mining	Mining and quarrying
6	Food (intermediate)	Manufacture of food products, beverages, and tobacco products (intermediate goods)
7	Food (consumer)	Manufacture of food products, beverages, and tobacco products (consumption goods)
8	Textiles (intermediate)	Manufacture of textiles, wearing apparel, and leather products (intermediate goods)
9	Textiles (consumer)	Manufacture of textiles, wearing apparel, and leather products (consumption goods)
10	Wood and products (intermediate)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (intermediate products)
11	Wood and products (consumer)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (consumption goods)
12	Paper and products (intermediate)	Manufacture of paper and paper products (intermediate goods)
13	Paper and products (consumer)	Manufacture of paper and paper products (consumption goods)
14	Refining	Manufacture of coke and refined petroleum products
15	Chemicals (intermediate)	Manufacture of chemicals and chemical products (intermediate goods)
16	Chemicals (consumer)	Manufacture of chemicals and chemical products (consumption goods)
17	Pharmaceuticals (intermediate)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (intermediate goods)
18	Pharmaceuticals (consumer)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (consumption goods)
19	Rubber and plastic (intermediate)	Manufacture of rubber and plastic products (intermediate goods)
20	Rubber and plastic (consumer)	Manufacture of rubber and plastic products (consumption goods)

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Table A3.1 *continued*

Sector no.	Sector	Description
21	Stone, glass (intermediate)	Manufacture of other non-metallic mineral products (intermediate goods)
22	Stone, glass (consumer)	Manufacture of other non-metallic mineral products (consumption goods)
23	Basic metals	Manufacture of basic metals
24	Fabricated metal (intermediate)	Manufacture of fabricated metal products, except machinery and equipment (intermediate goods)
25	Fabricated metal (consumer)	Manufacture of fabricated metal products, except machinery and equipment (consumption goods)
26	Fabricated metal (capital)	Manufacture of fabricated metal products, except machinery and equipment (capital goods)
27	Electronics (intermediate)	Manufacture of computer, electronic, and optical products (intermediate goods)
28	Electronics (consumer)	Manufacture of computer, electronic, and optical products (consumption goods)
29	Electronics (capital)	Manufacture of computer, electronic, and optical products (capital goods)
30	Electricals (intermediate)	Manufacture of electrical equipment (intermediate goods)
31	Electricals (consumer)	Manufacture of electrical equipment (consumption goods)
32	Electricals (capital)	Manufacture of electrical equipment (capital goods)
33	Machinery (intermediate)	Manufacture of machinery and equipment n.e.c. (intermediate goods)
34	Machinery (consumer)	Manufacture of machinery and equipment n.e.c. (consumption goods)
35	Machinery (capital)	Manufacture of machinery and equipment n.e.c. (capital goods)
36	Automotive (intermediate)	Manufacture of motor vehicles, trailers, and semi-trailers (intermediate goods)
37	Automotive (consumer and capital)	Manufacture of motor vehicles, trailers, and semi-trailers (consumption/capital goods)
38	Other transport equipment (intermediate)	Manufacture of other transport equipment (intermediate goods)
39	Other transport equipment (capital)	Manufacture of other transport equipment (capital goods)
40	Other manufacturing (intermediate)	Manufacture of furniture; other manufacturing (intermediate goods)
41	Other manufacturing (consumer)	Manufacture of furniture; other manufacturing (consumption goods)
42	Other manufacturing (capital)	Manufacture of furniture; other manufacturing (capital goods)
43	Other (intermediate)	Other goods (intermediate goods)
44	Other (consumer)	Other goods (consumption goods)

n.e.c. = not elsewhere classified.

Notes: Not all sectors have products in all value-chain stages. Some products cannot be distinguished into consumer or investment products (e.g., automobiles). Raw materials (e.g., in mining or agriculture) are treated as intermediate products.

Source: Authors, based on World Input–Output Database sectors and the United Nations' Broad Economic Categories.

Methods and Variables

Measuring Specialization: Revealed Comparative Advantage

To measure specialization, the study uses the commonly adopted approach of Balassa (1965) and constructs the indicator of revealed comparative advantage:

$$RCA_{ci} = \frac{EXP_{ci} / \sum_i EXP_{ci}}{\sum_c EXP_{ci} / \sum_i \sum_c EXP_{ci}}$$

where RCA refers to revealed comparative advantage, EXP refers to the value of exports, subscripts c and i denote countries and products, respectively. The indicator captures the ratio of the share of exports of a particular product i in country c exports to the share of that product in world exports. If the share of that product in country c is higher than the share of the product in world exports (i.e., if $RCA > 1$) then that country has a revealed comparative advantage in that product. When constructing this index, it is normal to use exports to the world, though it is possible to consider exports to particular sets of countries only, as this study does when considering exports to the GMS members.

Uniqueness

The indicator of uniqueness captures the number of other countries that can export (with comparative advantage) the same set of products that are exported with comparative advantage by a particular country. If a product is exported with comparative advantage by many countries, then it is considered to be standard; but if it is exported by few, then it can be considered unique, requiring more capabilities to be produced.

To measure the uniqueness of the export basket the study adopts the approach of Hidalgo and Hausmann (2009) in computing an indicator of *standardness*, which is calculated as the average ubiquity of the commodities exported with comparative advantage by a country:

$$Standardness_c = \frac{1}{diversification_c} \sum_i ubiquity_{ic}$$

where diversification is the total number of commodities in which country c has a comparative advantage (i.e., an RCA greater than 1) and the ubiquity of commodity i is the number of countries exporting commodity i with comparative advantage. A lower value indicates that the country's export basket is more unique. The index is adjusted slightly to construct an indicator of uniqueness:

$$Uniqueness_c = 1 - \frac{Standardness_c}{155}$$

with 155 being the maximum number of countries (excluding the country of interest) in the sample. This indicator thus lies between 0 and 1, with higher values indicating that fewer countries are able to produce a country's export basket with RCA.

Chapter 4

Similarities in Specialization Patterns across the Greater Mekong Subregion

4.1 Introduction

This chapter addresses two questions: (i) How similar are the specialization patterns of the Greater Mekong Subregion (GMS) members? (ii) Do specialization patterns of the GMS members co-evolve? To answer these questions, the analysis uses detailed trade data for the most recent period (2016–2018). It considers the regional dimension of production capabilities and asks to what extent the GMS members' specialization patterns are correlated with the specialization patterns of their neighbors. Given that knowledge tends to diffuse more easily across relatively short distances, one would expect that countries that are geographically close may share similar production and export capabilities and that, as a result, they may end up producing similar goods. Therefore, being surrounded by neighbors that invest in improving their capabilities presents opportunities for upgrading and diversification. Likewise, being surrounded by neighbors that lack capabilities and that do not invest in improving them will limit opportunities for upgrading and diversification. Such arguments support the need for coordinated regional policies to develop capabilities and comparative advantage.

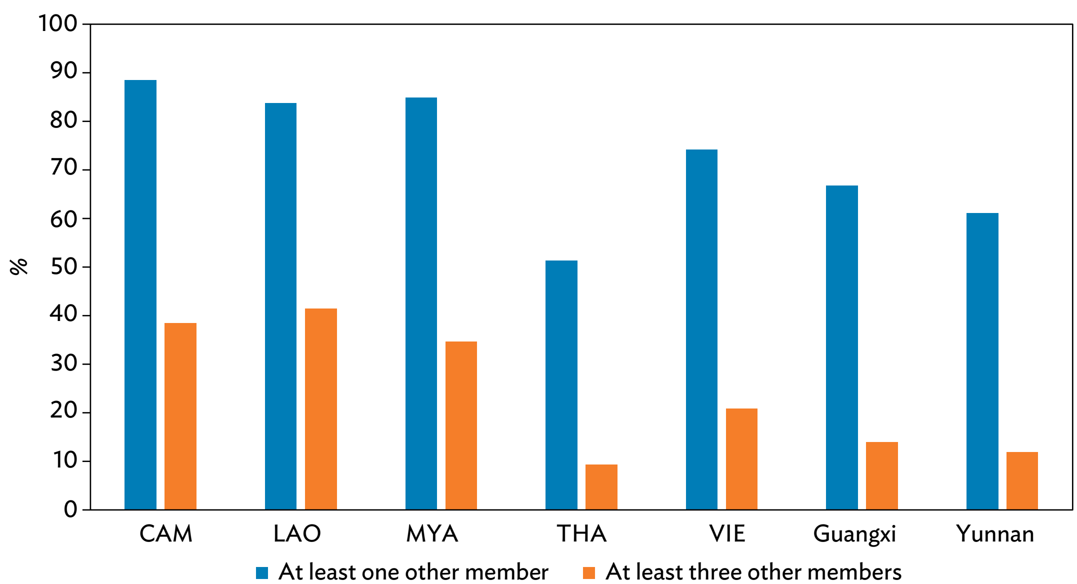
As noted above, knowledge tends to diffuse more easily across relatively short distances, which may imply that technology levels and capabilities are shared by the GMS members. This, in turn, may suggest that the GMS members end up specializing in similar products. Such an outcome can be beneficial, by allowing for the possibility of knowledge and technology spillovers, which further allows for upgrading and diversification by one GMS member to be shared with other GMS members. Conversely, such an outcome could also be associated with increased competition in similar products from fellow GMS members, which can have negative implications for upgrading and diversification, particularly for those members that are smaller and poorer (i.e., that have smaller domestic markets) and those that are less technologically advanced (i.e., that have a lower absorptive capacity). To examine the extent to which specialization patterns co-evolve among the GMS members, this study adopts an indicator developed by Bahar, Hausmann, and Hidalgo (2014) that measures the similarity of members' export patterns.

4.2 Similarity in Specialization Patterns of the Greater Mekong Subregion Members

The evidence presented in previous chapters suggests that export specialization patterns across the GMS differ. At the same time, new research suggests that a country's specialization pattern is influenced by those of its neighbors (Bahar, Hausmann, and Hidalgo 2014). There are a number of reasons why such links exist, most notably similarities in factor endowments and development levels as well as the importance of technological diffusion, which is geographically concentrated (Keller 2002). In this section, the study explores the links between the specialization patterns of each GMS member and others within the subregion. The purpose of the analysis is to ask whether specialization patterns within the GMS have co-evolved and whether there are differences across countries.

Figure 4.1 reports the share of products exported with comparative advantage by a GMS member and at least one other member (blue bars) and by a GMS member and at least three other members (orange bars). The blue bars indicate whether there is evidence of similarity in specialization structures, while the orange bars present a much stronger criterion, one that requires similarity across a broader group of GMS members. This analysis uses data for five GMS countries (for the period 2016–2018) and for Guangxi Zhuang Autonomous Region and Yunnan Province (for the year 2016).[22]

Figure 4.1: Share of Products Co-Exported with Another Greater Mekong Subregion Member



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, THA = Thailand, VIE = Viet Nam.
Note: Data for the five Greater Mekong Subregion countries are for 2016–2018 and data for Guangxi and Yunnan are for 2016.
Source: United Nations Comtrade.

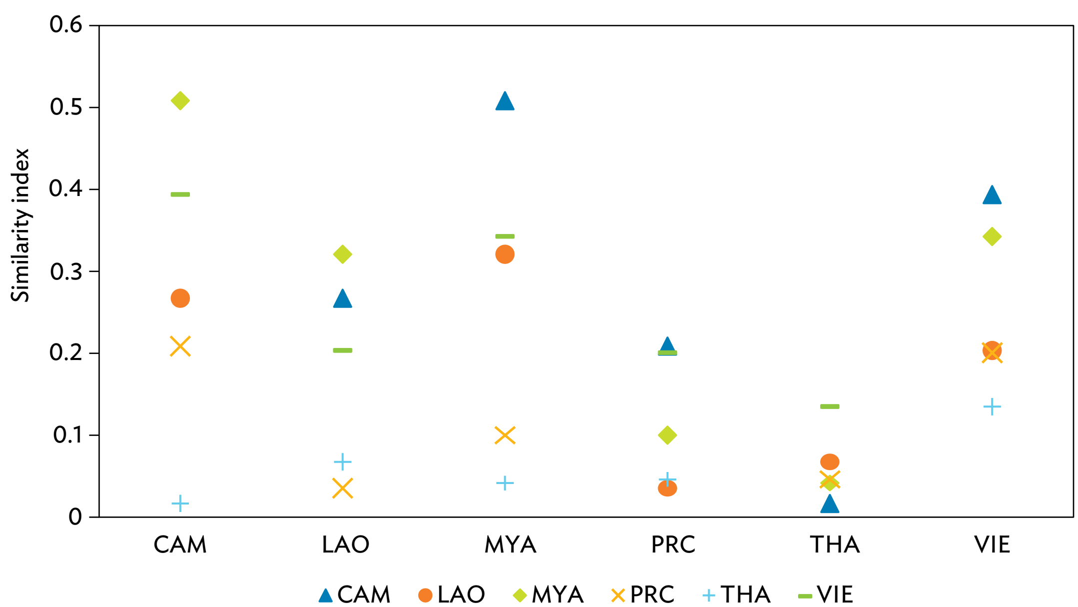
[22] Results without Guangxi and Yunnan and using the PRC as a whole show that the share of products that the PRC co-exports with GMS members is low, suggesting that the two Chinese regions are more similar to the other GMS members than the other members are to the PRC as a whole.

The shares of products co-exported with at least one other GMS member are above 70% for all members, except for Thailand, where the value is around 50%. Numbers for Guangxi and Yunnan are also high, above 60%. The pattern looks quite different when considering the share of products co-exported with at least three GMS members. As expected, these shares are substantially lower, especially for Thailand, Guangxi, and Yunnan.

Consistent with much of the evidence discussed earlier, the findings here reinforce the view of a divergent pattern. Cambodia, the Lao PDR, and Myanmar have export specialization patterns that are more similar to those of other GMS members; while Thailand, Viet Nam, and the two Chinese regions are more detached from the other members in the region.

Figure 4.2 shows the values of an index that measures the similarity in export structures between each GMS member and that of other members.[23] This index captures the degree of correlation between specialization patterns in member pairs. Details of its construction are provided in the Appendix. Consistent with the results in Figure 4.1, the results in Figure 4.2 show that the similarity indices of the PRC and Thailand are low, i.e., their export baskets are not "similar" to those of other

Figure 4.2: Export Similarity Index for the Members of the Greater Mekong Subregion, 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

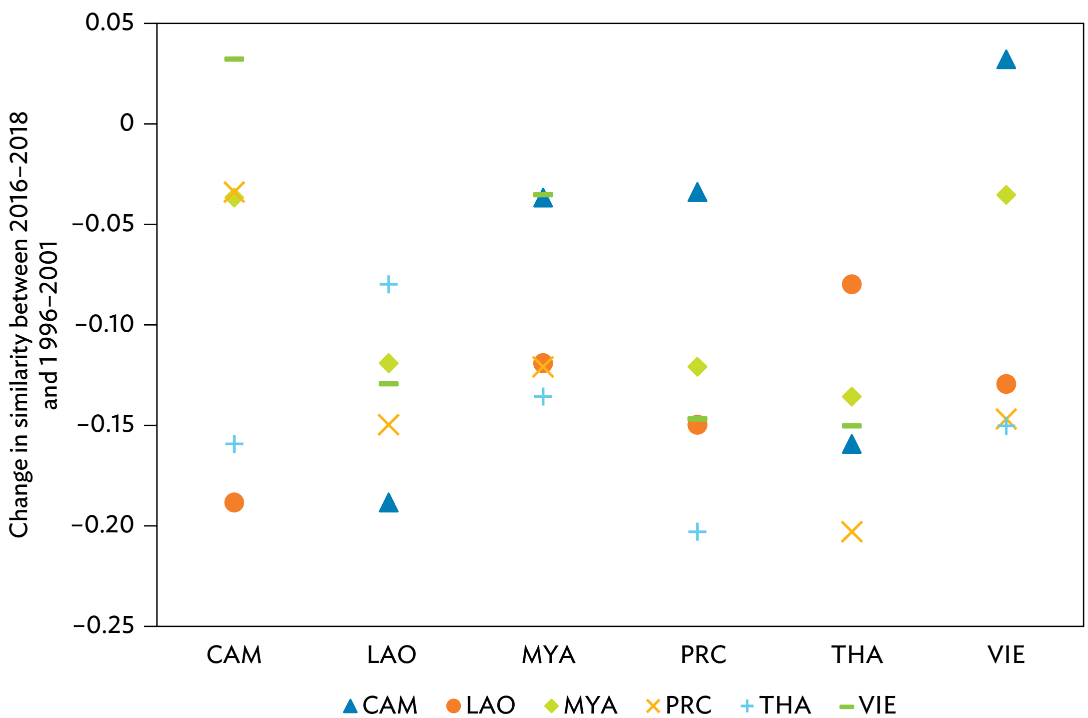
Source: United Nations Comtrade.

[23] The study uses data for the PRC as a whole in this analysis because export data at the regional level are not available for the earlier period (1996–2001).

members. Viet Nam's values are a little higher, especially with Cambodia. The values of the index for Cambodia, the Lao PDR, and Myanmar are also higher (e.g., see the Cambodia–Myanmar pair), reflecting similar export baskets (low-complexity products).[24]

Figure 4.3 shows the change in the similarity index between 1996–2001 and 2016–2018. Results show that, over time, all member-pair indices have declined (negative values), except for the Cambodia–Viet Nam pair. On average, the declines are largest in Thailand, the PRC, and the Lao PDR (with declines of between 0.13 and 0.15). Overall, therefore, the developments over the past 20 years suggest that the subregion's export structures have become more dissimilar.

Figure 4.3: Changes in the Similarity Index between 1996–2001 and 2016–2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

Finally, in this section, we use network analysis to consider similarity patterns for the 155 countries in the database.[25] Figure 4.4 shows the 155-country network of similarity in export specialization patterns. In this figure, similar countries appear close to each other, with clusters of countries distinguished by the different colors.

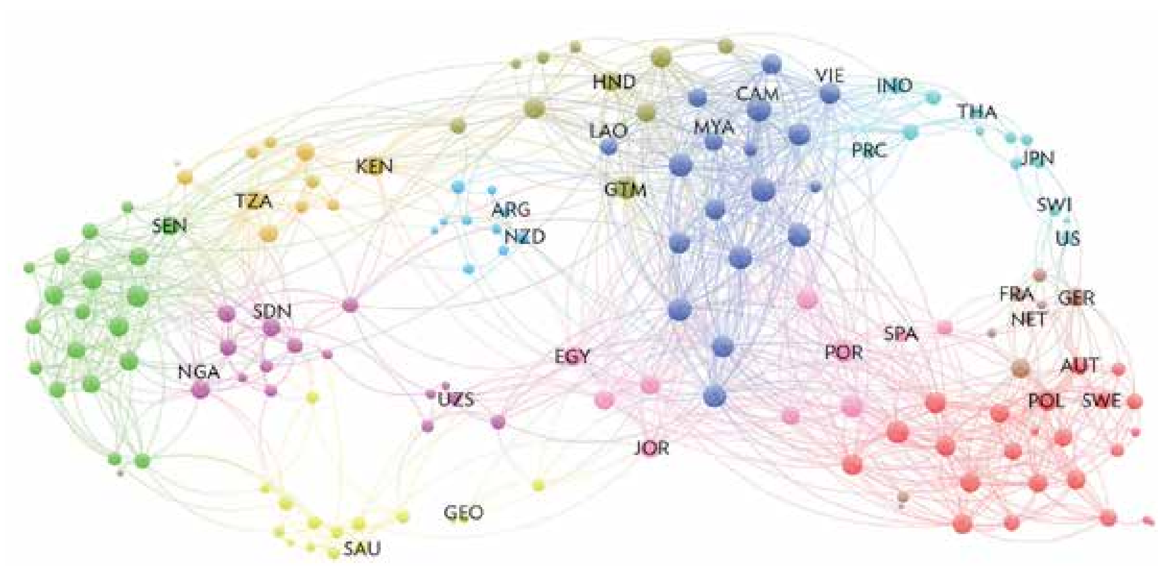
24 To give some context to these numbers, the average similarity levels of GMS members to all countries in the world range between −0.026 in the PRC and 0.075 in Myanmar. Even when similarity levels are found to be low between GMS members, therefore, they are generally higher than similarity levels with respect to non-GMS members.

25 See Appendix for details on the data and methodology.

The figure suggests that the GMS members are split between two clusters. Cambodia, the Lao PDR, Myanmar, and Viet Nam are in the darker blue cluster, slightly to the right of the center of the graph, alongside countries that tend to specialize in 2-digit sectors, which include vegetables, minerals, leather, textiles, and footwear. There are 14 other (non-GMS) countries in this group, including six other Asian countries.

The PRC and Thailand are part of another smaller group of 13 countries. This is the lighter blue cluster on the far right of the figure. These countries have a much more diversified export structure and specialize in chemicals, plastics, textiles, metals, and machinery. The US, Switzerland, and Japan are also part of this group. The other groups on the right-hand side of the figure are also highly diversified, especially the light green cluster (with the Netherlands, Germany, and France) and the large red cluster (with many Eastern European countries, alongside Sweden and Austria).

Figure 4.4: Network Analysis of Similarity in Export Specialization Patterns, 2012–2014 Average



ARG = Argentina, AUT = Austria, BEN = Benin, CAM = Cambodia, EGY = Egypt, FRA = France, GEO = Georgia, GER = Germany, GTM = Guatemala, HND = Honduras, INO = Indonesia, JOR = Jordan, JPN = Japan, KEN = Kenya, LAO = Lao People's Democratic Republic, MYA = Myanmar, NET = Netherlands, NGA = Nigeria, NZL = New Zealand, POL = Poland, POR = Portugal, PRC = People's Republic of China, SAU = Saudi Arabia, SDN = Sudan, SEN = Senegal, SPA = Spain, SWE = Sweden, SWI = Switzerland, THA = Thailand, TZA = Tanzania, USA = United States, UZB = Uzbekistan, VIE = Viet Nam.

Note: Countries with similar export specialization structures are clustered together and distinguished from other clusters by color.

Source: Based on data for 155 countries from United Nations Comtrade.

4.3 Similarity in Specialization Patterns at the Sectoral Level

After considering similarities in export structure for the aggregate economy, it is instructive to consider similarities at the sectoral level. Table 4.1 shows the number of products exported with comparative advantage in each sector (precise sector names are listed in the Appendix, Table A4.1) that are also exported with comparative advantage by at least one other GMS member.[26] The table further reports the share of products exported with comparative advantage in each sector that are exported with comparative advantage by at least one other GMS member. The table thus provides information on the similarity of specialization patterns across GMS members at the sectoral level.

The results reported in Table 4.1 suggest that there is a great deal of similarity in specialization patterns in certain sectors. This is particularly the case for textiles (consumer goods) in many GMS economies: more than half of the products that the PRC, Cambodia, Myanmar, and Viet Nam export with specialization in textiles (consumer goods) are also exported with specialization by at least one other GMS member. Other sectors that show evidence of similarity in export specialization include forestry, wood consumer goods (particularly for the PRC, Viet Nam, and Guangxi), rubber and plastic consumer goods (the PRC, Thailand, Viet Nam, and Guangxi), stone and glass consumer goods (the PRC, Thailand, Viet Nam, Guangxi, and Yunnan), and other manufactured consumer goods (the PRC, Thailand, Viet Nam, and Guangxi). In other sectors, however, particularly high-tech sectors such as the electrical and machinery sectors, similarity levels are generally low.

[26] Note that, for all countries and regions, the requirement that one other country or region must export the product with comparative advantage is based on a comparison between the five GMS countries plus the two Chinese regions. This approach avoids the problem that would occur if the study used the PRC as a comparator: since the PRC has comparative advantage in many products, a comparison with the PRC would no doubt inflate the share of products that are co-exported by at least one other GMS member.

Table 4.1: Intra-Greater Mekong Subregion Co-Exports with Comparative Advantage, 2016–2018

Sector	Co-exports with Comparative Advantage: Number of Products[a]							
	PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan
Agriculture (intermediate)	7	8	17	20	15	11	6	9
Agriculture (consumer)	16	5	16	17	18	25	26	37
Forestry	3	3	5	6	3	3	2	2
Fishing	3	5	0	6	5	2	2	0
Mining	4	0	7	9	7	5	2	3
Food (intermediate)	4	8	6	9	12	9	5	4
Food (consumer)	34	9	11	35	61	55	27	22
Textiles (intermediate)	106	16	6	16	72	79	62	57
Textiles (consumer)	239	227	58	192	29	213	76	61
Wood (intermediate)	8	3	7	8	3	12	6	5
Wood (consumer)	15	2	4	4	4	13	12	2
Paper (intermediate)	4	0	1	1	8	3	6	9
Paper (consumer)	3	1	0	2	1	0	2	1
Refining	0	0	0	0	0	0	0	0
Chemicals (intermediate)	43	2	6	3	33	20	35	47
Chemicals (consumer)	1	0	1	0	0	2	2	2
Pharma (intermediate)	1	0	0	0	2	1	2	1
Pharma (consumer)	0	0	0	0	0	0	0	0
Rubber (intermediate)	15	2	4	2	19	9	17	14
Rubber (consumer)	11	4	0	2	8	6	11	4
Stone (intermediate)	29	0	2	4	22	16	21	28
Stone (consumer)	8	0	0	0	6	4	7	7
Basic metals	17	5	6	5	23	20	12	26
Fabricated metal (intermediate)	32	2	2	1	13	11	25	20
Fabricated metal (consumer)	21	2	0	1	6	7	20	14
Fabricated metal (capital)	13	0	1	0	2	4	13	10
Electronics (intermediate)	29	2	5	6	33	18	14	5
Electronics (consumer)	12	1	1	2	7	4	9	5
Electronics (capital)	28	2	5	1	14	19	15	12
Electricals (intermediate)	10	2	2	3	7	5	8	9
Electricals (consumer)	6	1	0	0	3	1	3	5
Electricals (capital)	15	4	3	1	8	6	10	9
Machinery (intermediate)	7	1	0	1	6	4	4	4
Machinery (consumer)	7	0	0	0	6	5	3	2
Machinery (capital)	43	1	2	0	17	11	52	45
Automotive (intermediate)	1	0	0	0	2	2	0	0
Automotive (consumer/ capital)	1	0	1	0	1	0	4	5

Co-exports with Comparative Advantage: Shares[b]							
PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan
0.049	0.056	0.118	0.139	0.104	0.076	0.042	0.063
0.103	0.032	0.103	0.110	0.116	0.161	0.168	0.239
0.158	0.158	0.263	0.316	0.158	0.158	0.105	0.105
0.046	0.077	0.000	0.092	0.077	0.031	0.031	0.000
0.042	0.000	0.074	0.095	0.074	0.053	0.021	0.032
0.027	0.054	0.041	0.061	0.082	0.061	0.034	0.027
0.083	0.022	0.027	0.085	0.148	0.133	0.066	0.053
0.224	0.034	0.013	0.034	0.152	0.167	0.131	0.121
0.679	0.645	0.165	0.545	0.082	0.605	0.216	0.173
0.121	0.045	0.106	0.121	0.045	0.182	0.091	0.076
0.938	0.125	0.250	0.250	0.250	0.813	0.750	0.125
0.037	0.000	0.009	0.009	0.074	0.028	0.056	0.083
0.273	0.091	0.000	0.182	0.091	0.000	0.182	0.091
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.058	0.003	0.008	0.004	0.045	0.027	0.047	0.064
0.021	0.000	0.021	0.000	0.000	0.043	0.043	0.043
0.012	0.000	0.000	0.000	0.024	0.012	0.024	0.012
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.134	0.018	0.036	0.018	0.170	0.080	0.152	0.125
0.440	0.160	0.000	0.080	0.320	0.240	0.440	0.160
0.200	0.000	0.014	0.028	0.152	0.110	0.145	0.193
0.444	0.000	0.000	0.000	0.333	0.222	0.389	0.389
0.044	0.013	0.015	0.013	0.059	0.051	0.031	0.067
0.291	0.018	0.018	0.009	0.118	0.100	0.227	0.182
0.500	0.048	0.000	0.024	0.143	0.167	0.476	0.333
0.224	0.000	0.017	0.000	0.034	0.069	0.224	0.172
0.279	0.019	0.048	0.058	0.317	0.173	0.135	0.048
0.245	0.020	0.020	0.041	0.143	0.082	0.184	0.102
0.175	0.013	0.031	0.006	0.088	0.119	0.094	0.075
0.159	0.032	0.032	0.048	0.111	0.079	0.127	0.143
0.286	0.048	0.000	0.000	0.143	0.048	0.143	0.238
0.326	0.087	0.065	0.022	0.174	0.130	0.217	0.196
0.065	0.009	0.000	0.009	0.056	0.037	0.037	0.037
0.140	0.000	0.000	0.000	0.120	0.100	0.060	0.040
0.117	0.003	0.005	0.000	0.046	0.030	0.141	0.122
0.040	0.000	0.000	0.000	0.080	0.080	0.000	0.000
0.036	0.000	0.036	0.000	0.036	0.000	0.143	0.179

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Table 4.1 *continued*

Sector	Co-exports with Comparative Advantage: Number of Products[a]							
	PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan
Other transport equipment (intermediate)	1	0	0	0	1	1	1	1
Other transport equipment (capital)	5	1	0	0	3	3	2	4
Other manufacturing (intermediate)	12	3	3	2	2	7	9	8
Other manufacturing (consumer)	37	14	5	9	22	22	24	21
Other manufacturing (capital)	8	1	2	1	1	8	3	2
Other (intermediate)	1	0	0	0	0	1	1	0
Other (consumer)	0	1	1	1	0	0	0	2
Total	860	338	190	370	505	647	561	524

CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Notes: Data for the Greater Mekong Subregion (GMS) members are for 2018, and data for the two Chinese regions of Guangxi and Yunnan are for 2016. Intermediate, consumer, and capital refer to intermediate, consumer, and capital goods, respectively. A full description of the sectors is provided in Table A4.1 of the Appendix.

[a] Number of products exported with comparative advantage by the GMS member in the column and also exported with comparative advantage by at least one other GMS member.

[b] Ratio of the number of products exported with comparative advantage by the GMS member in the column to the number of products also exported with comparative advantage by the other GMS members.

Source: United Nations Comtrade.

4.4 Conclusions

The results from this chapter suggest that the export structures of the GMS members are somewhat similar. This is particularly the case for Myanmar, the Lao PDR, and Cambodia. There is also some evidence that the specialization patterns of the GMS members have become more divergent over time. Finally, at the sectoral level, similarity levels tend to be relatively high in primary and low-tech manufacturing sectors, but low in high-tech manufacturing sectors.

Co-exports with Comparative Advantage: Shares[b]							
PRC	CAM	LAO	MYA	THA	VIE	(PRC) Guangxi	(PRC) Yunnan
0.036	0.000	0.000	0.000	0.036	0.036	0.036	0.036
0.096	0.019	0.000	0.000	0.058	0.058	0.038	0.077
0.364	0.091	0.091	0.061	0.061	0.212	0.273	0.242
0.356	0.135	0.048	0.087	0.212	0.212	0.231	0.202
0.296	0.037	0.074	0.037	0.037	0.296	0.111	0.074
0.034	0.000	0.000	0.000	0.000	0.034	0.034	0.000
0.000	0.029	0.029	0.029	0.000	0.000	0.000	0.059
0.350	0.885	0.837	0.849	0.514	0.741	0.667	0.611

Appendix

Data

The data used for this analysis come from United Nations Comtrade, which reports data on bilateral exports and imports at the six-digit Harmonized System product level for a large number of reporter (and partner) countries. The data are reported in thousands of US dollars. The analysis for this report uses data for the period 2016–2018, using the 2012 version of the Harmonized System, with data collected for a common sample of 155 countries.

Methods and Variables

Measuring Specialization—Revealed Comparative Advantage

To measure specialization, the study uses the commonly adopted approach of Balassa (1965) to construct the indicator of revealed comparative advantage:

$$RCA_{ci} = \frac{EXP_{ci} / \sum_i EXP_{ci}}{\sum_c EXP_{ci} / \sum_i \sum_c EXP_{ci}}$$

where RCA refers to revealed comparative advantage, EXP refers to the value of exports, and subscripts c and i denote countries and products, respectively. The indicator captures the ratio of the share of exports of a particular product i in country c exports to the share of that product in world exports. If the share of that product in country c is higher than the share of the product in world exports (i.e., if $RCA > 1$), then that country has a revealed comparative advantage in that product. When constructing this index, it is normal to use exports to the world, though it is possible to consider exports to particular sets of countries only, as this study does when considering exports to the GMS members.

Similarity Index

The similarity index used in this analysis is the index proposed by Bahar, Hausmann, and Hidalgo (2014). They construct a measure of similarity in export structures ($S_{cc'}$) for a pair of countries c and c' as the Pearson correlation between the logarithm of the revealed comparative advantage (RCA) vectors of the two countries:

$$S_{cc'} = \frac{\sum_i (r_{ci} - \bar{r}_c) \sum_i (r_{c'p} - \bar{r}_{c'})}{\sqrt{\sum_i (r_{ci} - \bar{r}_c)^2 \sum_i (r_{c'p} - \bar{r}_{c'})^2}}$$

where $r_{ci} = \log(RCA_{ci} + \varepsilon)$ and $\bar{r}_c$ is the average of r_{ci} over all products in country c. Bahar, Hausmann, and Hidalgo use a log form to prevent the correlation from being driven by the few products that countries export with very high RCA and a small value ($\varepsilon = 0.1$) to ensure that all values or RCA are nonzero. The resulting similarity index is larger than zero for pairs of countries that tend to export a similar set of goods, and negative for pairs of countries exporting different sets of goods.

Network Analysis

The data on export specialization profiles can also be summarized using network analysis. This yields a classification of countries into groups, based on their specialization profiles. These groups provide a frame of reference for further analysis in subsequent chapters, for example, when looking at developments in terms of economic growth.

The classification analysis starts from a metric that aims to capture similarities and differences in the export specialization structures of 155 countries in 5,197 products according to the Harmonized System 2012 product classification. The first step was to calculate the RCA (a measure introduced above) for 5,197 products of each of the 155 countries for the period 2012–2014 (averaged over the 3 years). The RCA values were then transformed to be symmetric between –1 and 1, with positive (negative) values pointing to (non-) specialization. The study then calculated the correlation coefficients of the 5,197 symmetric RCA values between all possible pairs of countries, yielding 11,935 correlation coefficients.

These correlation coefficients can be considered weights in a network of the 155 countries. Thus, two countries that have similar export specialization structures (i.e., a high correlation coefficient) will be strongly linked in this network. Although the network could in principle contain negative links (indicating dissimilarity), the study set all negative correlation coefficients to zero. This eliminated 2,641 of the 11,935 links in the network. Of the remaining links, a large number were rather weak. A large number of these weak links were then removed in order to bring out the salient features of the network structure in a better way. Thus, all links with correlation coefficients smaller than 0.215 were cut, which left 1,239 links, i.e., about 10.4% of the original number of links. With this threshold, the network remains fully connected, i.e., there exists a path in the network from every country to all other countries.

The final step was to apply the so-called VOS algorithm to cluster countries in the network. This algorithm grouped together countries with strong links to one other, i.e., with similar export specialization structures. The number of clusters can be influenced by choosing a resolution parameter, which was set to 1.75, yielding 11 clusters of countries. Although this is somewhat arbitrary, these 11 clusters seem to be rather homogenous groups. The VOS algorithm also allowed for a graph of the network of 155 countries, with similar countries appearing close to one other in the picture.

Table A4.1: List of Sectors

Sector No.	Sector	Description
1	Agriculture (intermediate)	Crop and animal production, hunting and related service activities (intermediate goods)
2	Agriculture (consumer)	Crop and animal production, hunting and related service activities (consumption goods)
3	Forestry	Forestry and logging
4	Fishing	Fishing and aquaculture
5	Mining	Mining and quarrying
6	Food (intermediate)	Manufacture of food products, beverages, and tobacco products (intermediate goods)
7	Food (consumer)	Manufacture of food products, beverages, and tobacco products (consumption goods)
8	Textiles (intermediate)	Manufacture of textiles, wearing apparel, and leather products (intermediate goods)
9	Textiles (consumer)	Manufacture of textiles, wearing apparel, and leather products (consumption goods)
10	Wood and products (intermediate)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (intermediate products)
11	Wood and products (consumer)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (consumption goods)
12	Paper and products (intermediate)	Manufacture of paper and paper products (intermediate goods)
13	Paper and products (consumer)	Manufacture of paper and paper products (consumption goods)
14	Refining	Manufacture of coke and refined petroleum products
15	Chemicals (intermediate)	Manufacture of chemicals and chemical products (intermediate goods)
16	Chemicals (consumer)	Manufacture of chemicals and chemical products (consumption goods)
17	Pharmaceuticals (intermediate)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (intermediate goods)
18	Pharmaceuticals (consumer)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (consumption goods)
19	Rubber and plastic (intermediate)	Manufacture of rubber and plastic products (intermediate goods)
20	Rubber and plastic (consumer)	Manufacture of rubber and plastic products (consumption goods)
21	Stone, glass (intermediate)	Manufacture of other non-metallic mineral products (intermediate goods)
22	Stone, glass (consumer)	Manufacture of other non-metallic mineral products (consumption goods)
23	Basic metals	Manufacture of basic metals
24	Fabricated metal (intermediate)	Manufacture of fabricated metal products, except machinery and equipment (intermediate goods)
25	Fabricated metal (consumer)	Manufacture of fabricated metal products, except machinery and equipment (consumption goods)

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Table A4.1 *continued*

Sector No.	Sector	Description
26	Fabricated metal (capital)	Manufacture of fabricated metal products, except machinery and equipment (capital goods)
27	Electronics (intermediate)	Manufacture of computer, electronic, and optical products (intermediate goods)
28	Electronics (consumer)	Manufacture of computer, electronic, and optical products (consumption goods)
29	Electronics (capital)	Manufacture of computer, electronic, and optical products (capital goods)
30	Electricals (intermediate)	Manufacture of electrical equipment (intermediate goods)
31	Electricals (consumer)	Manufacture of electrical equipment (consumption goods)
32	Electricals (capital)	Manufacture of electrical equipment (capital goods)
33	Machinery (intermediate)	Manufacture of machinery and equipment n.e.c. (intermediate goods)
34	Machinery (consumer)	Manufacture of machinery and equipment n.e.c. (consumption goods)
35	Machinery (capital)	Manufacture of machinery and equipment n.e.c. (capital goods)
36	Automotive (intermediate)	Manufacture of motor vehicles, trailers, and semi-trailers (intermediate goods)
37	Automotive (consumer/capital)	Manufacture of motor vehicles, trailers, and semi-trailers (consumption/capital goods)
38	Other transport equipment (intermediate)	Manufacture of other transport equipment (intermediate goods)
39	Other transport equipment (capital)	Manufacture of other transport equipment (capital goods)
40	Other manufacturing (intermediate)	Manufacture of furniture; other manufacturing (intermediate goods)
41	Other manufacturing (consumer)	Manufacture of furniture; other manufacturing (consumption goods)
42	Other manufacturing (capital)	Manufacture of furniture; other manufacturing (capital goods)
43	Other (intermediate)	Other goods (intermediate goods)
44	Other (consumer)	Other goods (consumption goods)

n.e.c. = not elsewhere classified.

Notes: Not all sectors have products in all value-chain stages. Some products cannot be distinguished into consumer or investment products (e.g., automobiles). Raw materials (e.g., in mining or agriculture) are treated as intermediate products.

Source: Authors, based on World Input–Output Database sectors and the United Nations' Broad Economic Categories.

Chapter 5

Measuring Growth Spillovers in the Greater Mekong Subregion: Benefits from Neighboring Countries

5.1 Introduction

Successful examples of economic development have often been linked to effective integration into the global economy, with growth spillovers considered an important part of the process. A branch of the literature examines the extent of spillovers from one country to another. This literature is broadly based on the idea that growth in per capita GDP in a particular country is determined by domestic factors, global developments, and developments in countries with which the country has some kind of link, usually trade-related links. Much of this literature confirms that per capita growth rates co-move across countries in the long term, particularly in countries that have extensive interactions through international trade (Frankel and Rose 1998; Doyle and Faust 2005; Sly and Weber 2013; Dabla-Norris, Espinoza, and Jahan 2015).

The evidence also suggests that per capita growth spillovers may also occur in the short run (Yang and Samake 2011; Barrot, Calderón, and Servén 2018; Almansour et al. 2015). Such results are usually explained by the idea that increased trade integration makes economies more sensitive to foreign shocks by intensifying the channels through which the shocks can propagate across countries, increasing the co-movement between domestic and foreign variables.

Beyond trade, it has also been suggested that capabilities may spill over to other regions, with the spread of capabilities, technology, and knowledge heavily constrained by geographical distance (Boschma, Martin, and Minondo 2017; Jaffe, Trajtenberg, and Henderson 1993). Such arguments suggest that there may well be important network linkages between neighboring countries that may generate per capita growth spillovers.

This chapter examines these arguments and estimates the size of spillovers within the Greater Mekong Subregion (GMS). In particular, the analysis will consider the extent to which per capita growth in neighboring (i.e., bordering) countries, and per capita growth in export destinations more generally, impact a GMS member's per capita growth rate.

While evidence of per capita growth spillovers exists, there may be reasons why the nature of GMS trade relationships and the structure of its members' economies result in spillovers impacting this group differently. Structural barriers to per capita growth spillovers in the GMS may be related to its members' integration into the regional and global economy, their position in global value chains, their existing capabilities and overlap between these capabilities, and the extent of regional cooperation and integration in the GMS.

5.2 Growth Spillovers in the Greater Mekong Subregion

To provide an initial insight into the relationship between a GMS member's per capita growth rate and that of its neighbors and export partners, Figure 5.1 shows, for each GMS member, its annual growth rate of per capita GDP alongside neighbor-weighted and export-weighted per capita GDP growth rates in 1951–2016. The figures reveal the relatively high per capita growth attained by the GMS during 2000-2008. While the correlation between per capita GDP growth and the weighted per capita growth rates should be treated with caution since both domestic and weighted per capita growth rates are both likely to reflect, to some extent, developments in world per capita growth—something that is controlled for in the analysis that follows—the plots provide some initial insight into the expected relationships. They suggest that, for a number of countries, including the PRC, Cambodia, Thailand, and Viet Nam, the actual per capita growth rates tend to be closely linked to their neighbors' per capita growth rates. For most of them, actual per capita growth rate and the export-weighted per capita growth rate are correlated, albeit much less so. The major exception to these general patterns is the case of the Lao PDR, whose per capita growth rate has been relatively volatile in the recent period.

Visual impressions are largely confirmed by the correlations between actual per capita GDP growth rates and weighted per capita growth rates. Table 5.1 shows that correlations between a GMS member's GDP per capita growth rate and that of its neighbors are all positive, and that the correlation is particularly large in the case of Myanmar. The correlations between per capita GDP growth rate and export-weighted per capita growth rate vary. They are negative in a number of cases (Cambodia, the Lao PDR, and Viet Nam), but positive and relatively large in the case of Myanmar and, in particular, Thailand.

Table 5.1: Correlation between Actual and Weighted Per Capita Gross Domestic Product Growth Rates

	Neighbor-Weighted Growth	Export-Weighted Growth
Cambodia	0.291	−0.242
Lao PDR	0.306	−0.072
Myanmar	0.564	0.288
PRC	0.343	0.022
Thailand	0.241	0.412
Viet Nam	0.382	−0.042

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: Authors.

Figure 5.1: Actual and Weighted Per Capita Gross Domestic Product Growth Rates

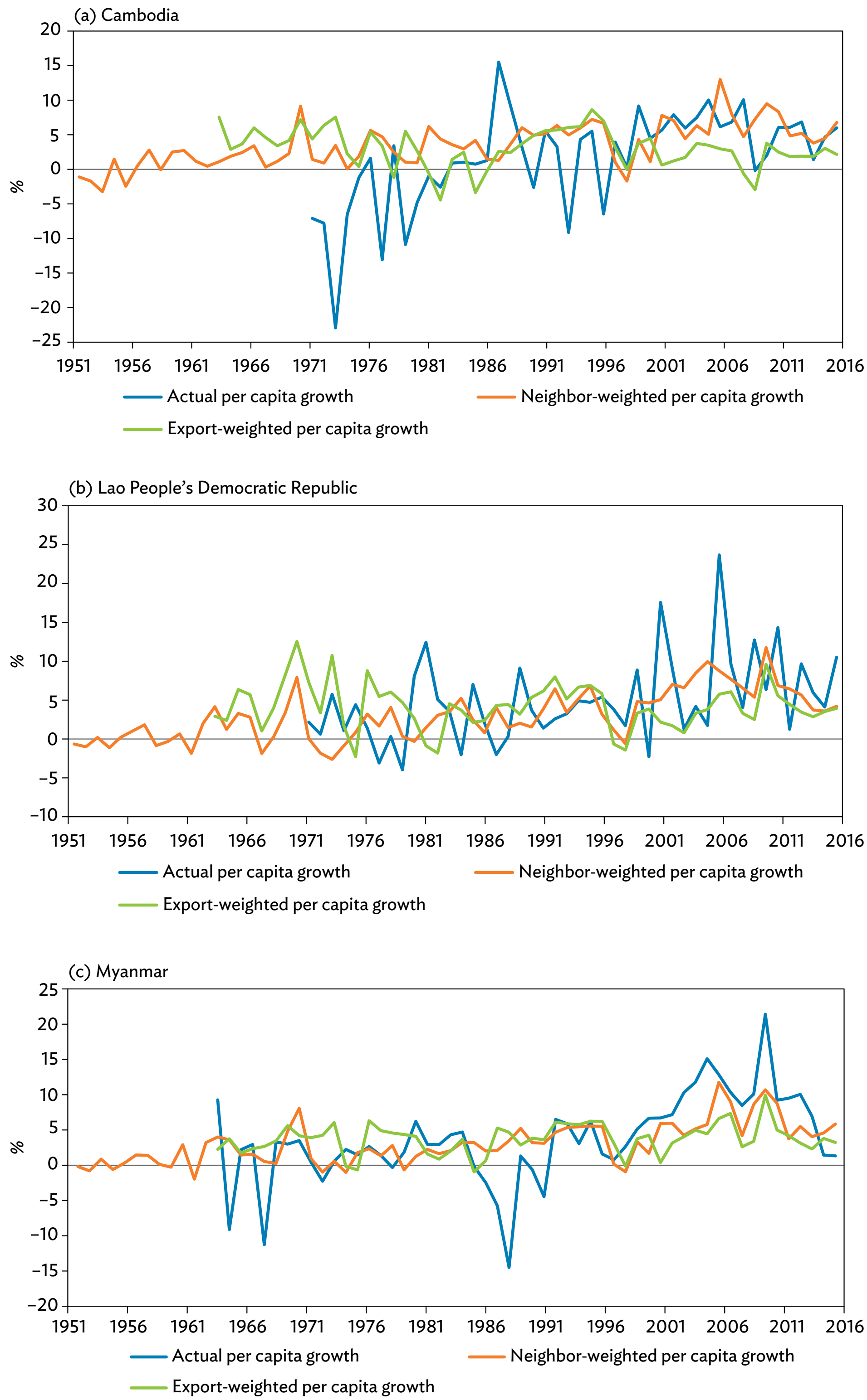
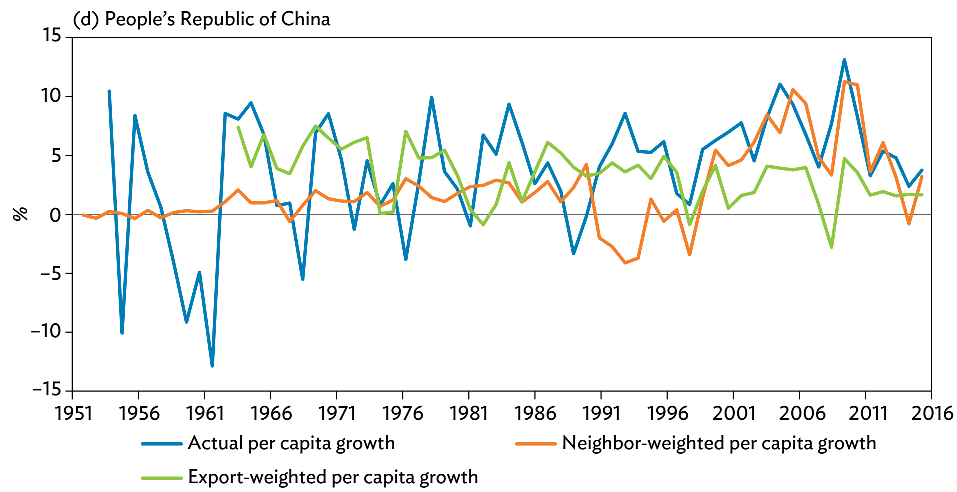
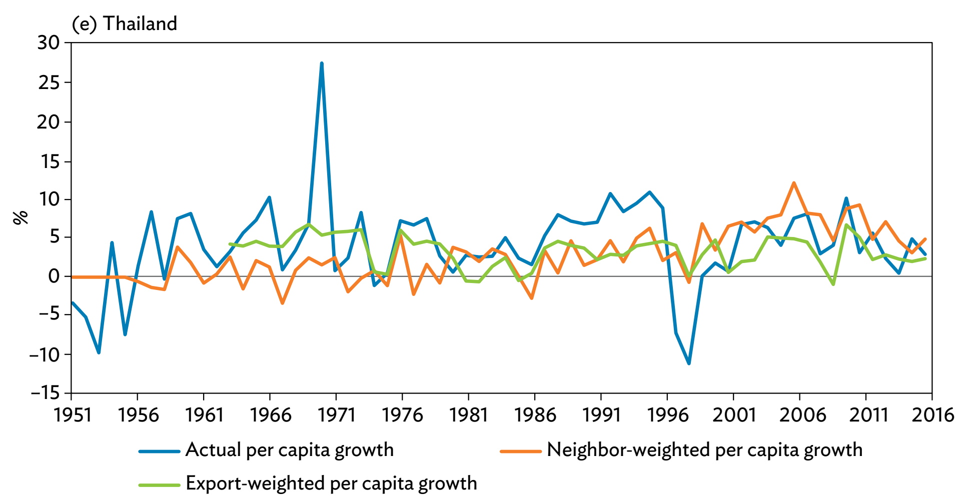
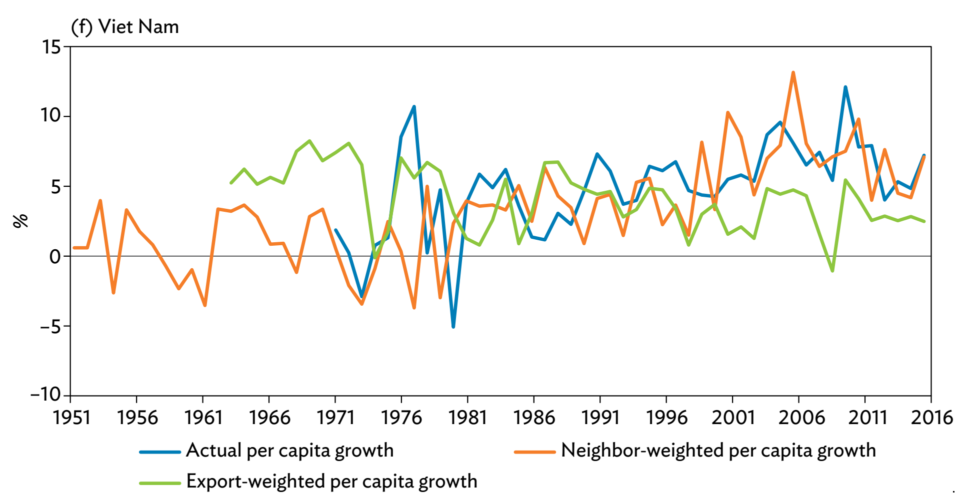


Table 5.1 *continued*







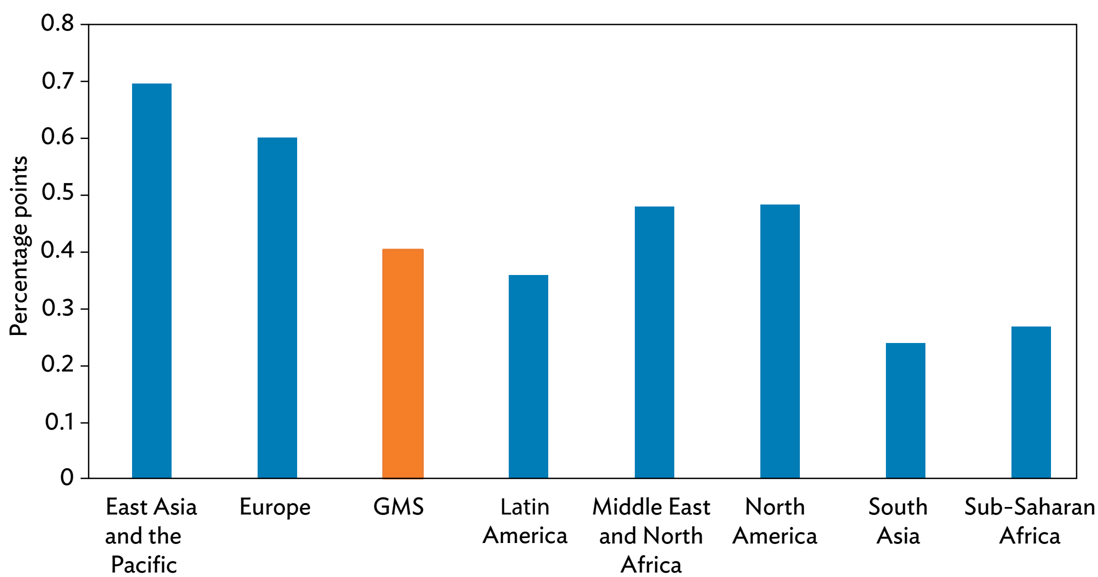
Source: Authors.

5.3 Estimating Neighbor-Weighted Spillovers

The formal analysis of the importance of per capita growth spillovers begins by considering spillovers due to per capita growth in neighboring countries, with neighbor defined as any country that shares a land border with the country of interest.[27] This involves using regression analysis (see the Appendix for details) to estimate the impact of an increase in the per capita growth rate of a country's neighbors on its own per capita growth rate.

Figure 5.2 reports the estimated impact of an increase in neighboring countries' per capita growth rate by 1 percentage point for different regions of the world. The estimated effects are found to be relatively large for East Asia and the Pacific and for Europe, where a 1 percentage point increase in the per capita growth rate of a country's neighbors is associated with an increase in that country's own per capita growth rate of 0.7 and 0.6 percentage points, respectively. The estimated effects in the Middle East and North Africa and North America are also relatively large, around 0.48 percentage points, but smaller for South Asia and Sub-Saharan Africa at 0.24 and 0.27 percentage points, respectively. These

Figure 5.2: Impact of a 1 Percentage Point Increase in Neighbors' Per Capita Growth Rates on a Country's Own Per Capita Growth Rate, by Region



GMS = Greater Mekong Subregion.

Notes: The figure reports the estimated average impact of a 1 percentage point increase in the per capita growth rate of a country's neighbors in different regions of the world. Estimates are based on a per capita growth regression for up to 177 countries over the period 1951–2016.

Source: Authors' estimates.

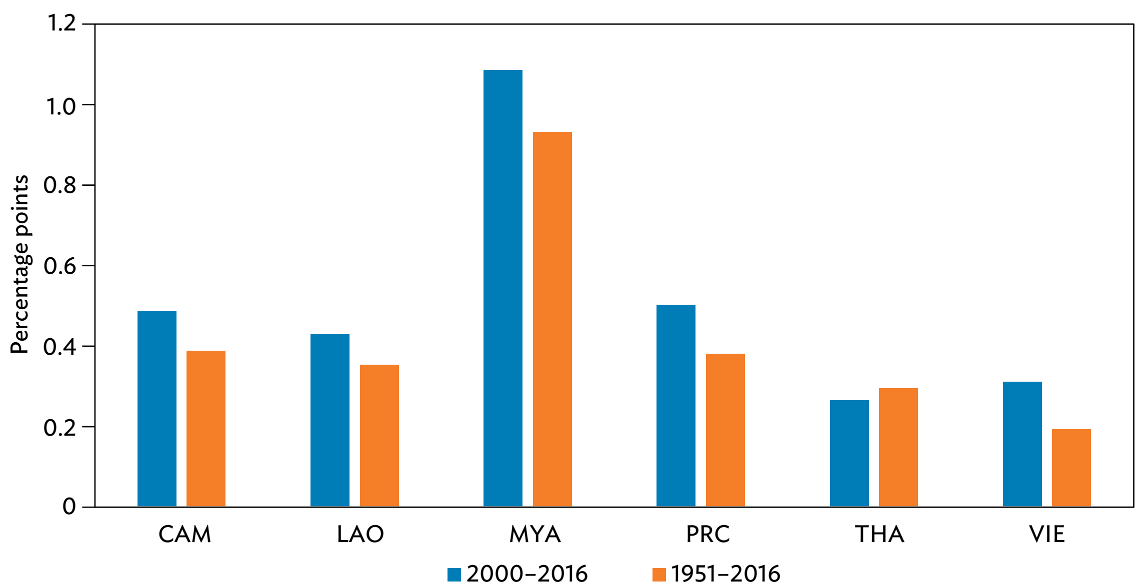
[27] As a robustness check, the study also uses a distance-weighted measure (see Appendix), with the results tending to indicate the importance of proximity in delivering per capita growth spillovers.

results are somewhat in line with expectations, with relatively large spillover effects in the regions that are more integrated and relatively small effects in those regions that are perhaps more fragmented.

Results for the GMS are somewhere in the middle of the distribution—an increase in the per capita growth rate of neighbors by 1 percentage point is associated with an increase in per capita GDP growth of 0.4 percentage points. These results lead to at least three initial observations. First, across the globe, having fast-growing neighbors is an important factor driving individual countries' per capita growth rates. Second, results are suggestive of the importance of regional integration and cooperation in order to benefit from per capita growth spillovers from one's neighbors. Third, GMS spillovers are smaller than those of the more integrated regions of the world—e.g., Europe and East Asia and the Pacific. This suggests that there are still opportunities to further increase per capita growth spillovers from neighbors in the GMS, with increased regional cooperation being a potentially important channel for achieving these spillovers.

Moving beyond average spillover effects for the GMS as a whole, Figure 5.3 reports information on country-specific estimates of spillovers from neighbors. The figure reports two sets of estimates: (i) the orange bars report estimates for the entire period (1951–2016) and (ii) the blue bars report estimates for 2000–2016.

Figure 5.3: Impact of a 1 Percentage Point Increase in Neighbors' Per Capita Growth Rate on Per Capita Growth Rates of the Greater Mekong Subregion Members



CAM = Cambodia, GMS = Greater Mekong Subregion, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Notes: The figure reports the estimated average impact of a 1 percentage point increase in the per capita growth rate of neighboring countries on the per capita growth rates of individual GMS members. Estimates are based on a per capita growth regression for up to 177 countries over the period 1951–2016.

Source: Authors' estimates.

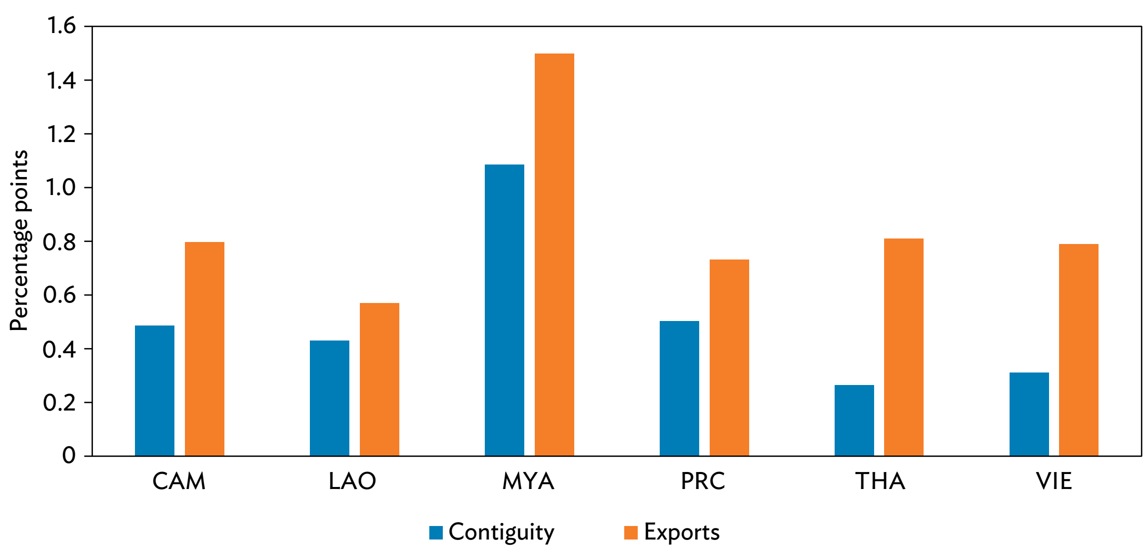
The most interesting result is that the estimates for 2000–2016 are higher than those for the full period, except for Thailand. This suggests that the extent of spillovers from neighbors has increased recently. Estimated spillovers for Myanmar are found to be particularly large: a 1 percentage point increase in neighbors' per capita growth increases its own per capita growth by more than 1 percentage point (1.09) in the most recent period. Results for other GMS members, while still significant, are more muted. Estimates of spillovers tend to be relatively small for Viet Nam and Thailand (0.31 and 0.27 percentage points, respectively, in the most recent period) and somewhat higher for the Lao PDR, Cambodia, and the PRC (0.43, 0.49, and 0.50 percentage points, respectively, in the most recent period).

5.4 Estimating Export-Weighted Spillovers

This section considers the importance of export-weighted per capita growth spillovers and compares the results to those of neighbor-weighted per capita growth. The approach involves constructing a spillover variable using the weighted per capita growth rates of all export destinations, using the export shares of the export destination as weights (see Appendix for more details).

Figure 5.4 reports the estimated effects of export- and neighbor-weighted per capita growth spillovers for the GMS, focusing on the results for the most recent period 2000–2016 (as in Figure 5.3).

Figure 5.4: Impact of a 1 Percentage Point Increase in Neighbors' and Export Partners' Per Capita Growth Rates on Per Capita Growth Rates of the Greater Mekong Subregion Members



CAM = Cambodia, GMS = Greater Mekong Subregion, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Notes: The figure reports the estimated average impact of a 1 percentage point increase in the per capita growth rate of neighboring countries or export partners on the per capita growth rates of individual GMS members. Estimates are based on a per capita growth regression for up to 177 countries within the period 2000–2016.

Source: Authors' estimates.

The first thing to note is that the export-weighted spillovers are always larger than the neighbor-weighted spillovers (labeled contiguity in the figure). This may reflect the idea that spillovers depend upon the entire set of interactions with partners—i.e., through trade for example—with neighborhood effects only capturing a subset, albeit an important subset, of the interactions with other countries. To the extent that this explanation applies, it would suggest that the export-weighted measure provides a more comprehensive indicator of per capita growth spillovers. It would also suggest that, in most cases, interactions with neighbors provide the most important source of spillovers, possibly because of the relative importance of linkages (e.g., export shares) with nearby countries. A further implication of this initial observation is that, while regional cooperation can be an important means of generating per capita growth through spillovers, it is also the case that integration into the broader global economy can further enhance per capita growth spillovers.

A second observation, consistent with the results for neighbor-weighted spillovers, is the relatively large export-weighted spillover effect in the case of Myanmar, while the estimates for the other countries are much smaller. The export-weighted spillover effects for Cambodia, Thailand, and Viet Nam are also relatively large—and considerably larger than the neighbor-weighted spillover effect—while the Lao PDR and the PRC have the smallest effects. This latter result is also reflected in the ratio of export- to neighbor-weighted per capita growth spillovers.

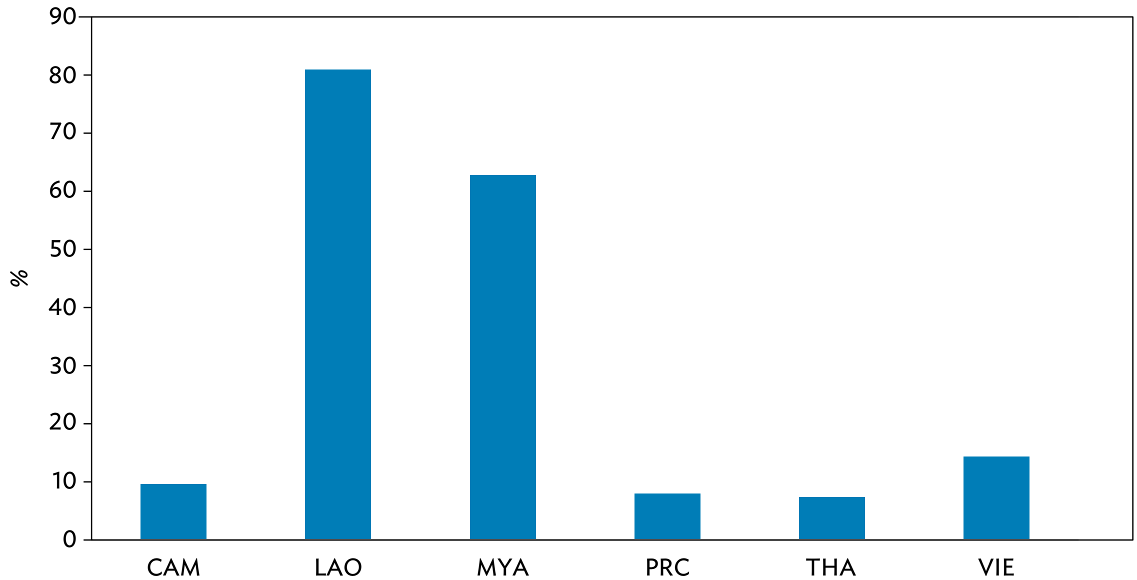
5.5 Explaining the Heterogeneity of Spillovers across the Greater Mekong Subregion

The results in the previous sections indicate that both neighbor- and export-weighted spillovers are important for the GMS, although the extent of spillovers and the relative importance of the two types of spillovers varies across countries. A particular split is between the Lao PDR and Myanmar, which benefit relatively strongly from spillovers from neighbors, and Thailand and Viet Nam, which benefit relatively greatly from export spillovers. While it is difficult to provide a full and complete explanation for these differences, some of the analysis previously presented provides some explanation.

One potential explanation for these differences relates to the geographic structure of exports. As reported in Figure 1.3 in Chapter 1 (regional structure of GMS exports), other GMS members as well as other countries in East Asia and the Pacific and South Asia are important destinations for Myanmar's and the Lao PDR's exports; while the export structure of the other GMS members tends to be much more diversified. This is further reinforced by Figure 5.5, which shows that the Lao PDR and Myanmar rely heavily on their neighbors for their exports, while the other four GMS members rely much less (i.e., a relatively low share of their exports goes to their GMS neighbors). Combined, this evidence may help explain why spillovers from neighbors are relatively more important and closer to the estimates of export spillovers in the Lao PDR and Myanmar.

An alternative explanation relates to the levels of diversification and sophistication of exports, with Thailand and Viet Nam benefiting to a much larger extent from export spillovers than from neighborhood spillovers (Thailand and Viet Nam have more diversified export baskets and export more unique products).

Figure 5.5: Share of Exports to Neighboring Countries, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors.

The results presented in Chapter 3 provide some evidence in favor of such a conclusion. Figure 3.1 in Chapter 3 indicates that, in addition to the PRC, both Thailand and Viet Nam export a relatively large number of products with comparative advantage. Figure 3.2 in Chapter 3 further indicates that, in addition to the PRC, both Thailand and Viet Nam have relatively unique export baskets. Conversely, Cambodia, the Lao PDR, and Myanmar export a relatively low number of products with comparative advantage, and their export baskets have a low level of uniqueness. Indeed, the results presented in Chapter 3 provide some evidence to suggest that Thailand and Viet Nam are more diversified and able to produce and export relatively sophisticated products, which may be a further explanation for the relatively strong impact of export spillovers in these two countries. If correct, such results further suggest that countries need to diversify and upgrade their production and export capabilities in order to maximize the benefits from export spillovers.

5.6 Conclusions

This chapter has estimated the per capita growth spillovers from neighbors (geographic contiguity) and export partners among the GMS members. The results suggest that both types of spillovers are important in the GMS, with spillovers from exports larger than those from neighbors. The results lead to the conclusion that both regional cooperation and engagement in the broader global economy can be important—and complementary—sources of per capita growth spillovers, allowing countries to maximize the benefits of their interactions with neighbors as well as with more distant export partners. The results further suggest that those GMS members that rely heavily on spillovers from their neighbors tend to have a less-diversified export structure than those with large export spillovers. Conversely, those GMS members that benefit relatively strongly from export spillovers tend to be more diversified—both geographically and in terms of the number of products exported with comparative advantage—and tend to produce and export more sophisticated goods. These results provide preliminary evidence of the importance of upgrading in terms of production in order to engage in and benefit from interaction with the global economy.

Appendix

Estimating Per Capita Growth Spillovers

Methodology

To estimate the extent of per capita growth spillovers, the study estimates a panel fixed-effects per capita growth regression, the basic specification of which is given by

$$\Delta \ln y_{it} = \alpha_i + \sum_{l=1}^{L} \delta_l \Delta \ln y_{i,t-l} + \tau \Delta \ln y_{it}^{W} + \boldsymbol{\beta}\mathbf{X}_{it} + \sigma S_{it} + \varepsilon_{it}$$

where y_{it} is the per capita GDP in country i in time t, $\mathbf{X}$ is a matrix of control variables, y_{it}^{W} is the world per capita growth rate, and $S_{it} = \sum_{j=1}^{J} W_{ij} \Delta \ln y_{jt}$ is the weighted per capita GDP growth rate of partner countries with weighting matrix W (i.e., geographic contiguity, export shares). In addition to the per capita growth spillover variable, the model includes the following variables: annual global per capita growth rate to ensure that the analysis is not confounding global trends with spillover effects; two lags of the country per capita growth rate to control for persistence effects; and other common control variables (the ratio of investment to GDP [INV], an indicator of human capital [HK], and population growth [POPGR]). Country fixed effects, α_i, are included to control for time-invariant country-specific heterogeneity, and standard errors are clustered at the country level to control for possible unobserved correlation within countries.

The study uses three different indicators of "linkages" for the weighting matrix, namely geographic contiguity, distance, and export shares, though the discussion in the main text concentrates on the results for contiguity and export shares. In the case of contiguity, each cell of the weighting matrix is constructed as the value of a dummy variable (equal to one if country i and j share a common border) divided by the row sum of the matrix, i.e.,

$$w_{ij} = \frac{C_{ij}}{\sum_{k=1}^{K} C_{ik}}$$

where w is a cell of the weighting matrix and C is the contiguity dummy variable.

In the case of bilateral distance, the analysis begins by calculating 1 minus the standardized distance as

$$d_{ij} = 1 - \frac{\left(D_{ij} - D^{min}\right)}{\left(D^{max} - D^{min}\right)}$$

with D being the distance between capital cities (in kilometers). As with the contiguity matrix, the distance weighting matrix is constructed as the value of standardized bilateral distance divided by the row sum of the matrix.

Finally, in the case of export weighting, the lagged value of exports from i to j is used as weights, again dividing by the row sum of the export matrix, i.e.,

$$w_{ijt} = \frac{X_{ij,t-1}}{\sum_{k=1}^{K} X_{ik,t-1}}$$

Data

Data on GDP per capita along with data on human capital, investment to GDP ratio, and population are from the Penn World Tables. These data are available for the period 1951–2016. Data on contiguity and distance are from CEPII's gravity dataset. Trade data are collected from two sources. For the period 1962–1998, the study uses data from Feenstra, Inklaar, and Timmer (2015), while data from 1998 onward are from United Nations Comtrade. The resulting dataset, depending on the specific weighting matrix used, covers the period 1951–2016 for up to 177 countries.

Regression Results

The full regression results are reported in Tables A5.1–A5.3.

Table A5.1 shows the results using the three different weighting matrices, estimating the coefficient on a single per capita growth spillover variable (i.e., the average effect across all countries) and separate spillover coefficients for different regions (introduced by interacting the per capita growth spillover variable with region dummies). The results in columns (1)–(3) confirm that per capita growth in a country is positively related to the per capita growth rate of nearby countries (i.e., based on contiguity and distance) and to the per capita growth rate of export partners. This also tends to be the case when considering the different regional groupings. In the case of contiguity, the analysis finds that spillovers are relatively large in the case of Europe and Central Asia (ECA) and East Asia and the Pacific (EAP), but lower in the case of South Asia (SAS) and Sub-Saharan Africa (SSA). The value for the GMS lies in the middle of this distribution. This pattern also seems to appear in the case of distance and exports, albeit with some exceptions (e.g., relatively high coefficients for Middle East and North Africa and Latin America). In these latter two cases (i.e., distance and exports), the coefficients for the GMS tend to be relatively small and, in the case of exports, the coefficient is small and not significant. These initial results suggest, on a general level, that a country's per capita growth rate is not independent of its neighbors or its trade partners. More specifically for the GMS, these results tend to suggest that neighbors are a more important source of per capita growth spillover than export partners. One possible implication of this result is that regional cooperation is important for this region, with the performance of neighboring economies being an important determinant of a country's per capita growth rate in this region.

Table A5.2 reports individual coefficients for the GMS members (by introducing an interaction between the spillover variable and GMS member dummies), further distinguishing between the most recent period (since 2000) and the earlier period (pre-2000) to examine whether there has been a change in the extent of spillovers over time. The results in the first three columns indicate that spillovers to the individual GMS members tend to be positive and significant. In the case of contiguity, the estimated coefficients range between 0.194 (Viet Nam) and 0.932 (Myanmar), and in the case of distance between 0.416 (Thailand) and 1.11 (Myanmar). Results using exports as weights are somewhat different, with negative coefficients found in the case of Cambodia and the Lao PDR. The coefficients for exports are largest for Thailand (0.834). In the final three columns—splitting the period into an earlier and a more recent period—there are important differences in estimated spillovers between the earlier and the more recent period. While coefficients are often small, negative, and sometimes insignificant in the earlier period, there are more consistent results with positive and significant coefficients in the more recent period across the different specifications. Across the different weighting matrices, the spillover effect tends to be largest for Myanmar in this more recent period.

Finally, Table A5.3 reports results when just using the subsample of GMS members. The results are somewhat weaker than those for the full sample, but in general are consistent with those from the full sample. Estimates of the per capita growth spillover effects tend to be smaller when including only GMS members, with the coefficients being significant in the case of the contiguity weighting matrix only. Consistent with earlier results, coefficients on the country-specific spillover coefficients (columns [4]–[6]) tend to be positive and are often significant, with the exception of the export weighting matrix, in which case the coefficient is negative and significant in a couple of cases. As with the earlier results, these negative coefficients tend to reflect negative effects in the earlier period. When distinguishing between the earlier and more recent period, the study finds coefficients that are positive and significant in the more recent period, with the coefficients for Myanmar again tending to be largest.

Table A5.1: Estimation of Spillover Effects—Panel Fixed-Effects Regression Results I

Variables	(1) Contiguity	(2) Distance	(3) Exports	(4) Contiguity	(5) Distance	(6) Exports
$\Delta \ln y_{t-1}$	0.128***	0.130***	0.156***	0.125***	0.128***	0.154***
	(0.0208)	(0.0198)	(0.0208)	(0.0206)	(0.0205)	(0.0208)
$\Delta \ln y_{t-2}$	0.0481**	0.0498**	0.0614**	0.0451**	0.0472**	0.0597**
	(0.0223)	(0.0228)	(0.0240)	(0.0221)	(0.0232)	(0.0242)
HK	0.000533	−0.00984**	0.00907**	0.000798	−0.0108***	0.00921**
	(0.00398)	(0.00388)	(0.00399)	(0.00406)	(0.00407)	(0.00394)
INV	0.0218	0.0207	0.0302	0.0227	0.0246	0.0287
	(0.0162)	(0.0165)	(0.0192)	(0.0165)	(0.0175)	(0.0191)
$POPGR$	0.00108	0.00678	0.0396	−0.0182	−0.0492	0.0343
	(0.305)	(0.278)	(0.269)	(0.317)	(0.301)	(0.268)
$\Delta \ln y_{it}^{W}$	0.0595***	0.0170*	0.0572***	0.0569***	0.0169*	0.0569***
	(0.00986)	(0.00971)	(0.0112)	(0.00961)	(0.00976)	(0.0111)
S	0.415***	0.935***	0.564***			
	(0.0540)	(0.101)	(0.0680)			
$S \times EAP$				0.696***	0.934***	0.659***
				(0.177)	(0.298)	(0.125)
$S \times ECA$				0.601***	0.785***	0.834***
				(0.0737)	(0.111)	(0.0732)
$S \times GMS$				0.403***	0.563***	0.100
				(0.0929)	(0.110)	(0.196)
$S \times LAM$				0.358***	0.898***	0.522***
				(0.0712)	(0.192)	(0.112)
$S \times MENA$				0.479***	1.650***	0.954***
				(0.128)	(0.369)	(0.287)
$S \times NAM$				0.482**	0.467***	0.720***
				(0.208)	(0.169)	(0.231)
$S \times SAS$				0.238**	0.397***	0.0763
				(0.0948)	(0.0762)	(0.0814)
$S \times SSA$				0.267***	0.964***	0.254*
				(0.0711)	(0.213)	(0.139)
Constant	0.0105***	0.00135	0.00490***	0.00256	0.0184	−0.0240*
	(0.00102)	(0.00174)	(0.00170)	(0.0144)	(0.0140)	(0.0141)
Observations	9,147	9,147	8,482	7,706	7,706	7,056
R-squared	0.100	0.088	0.060	0.117	0.107	0.080
Number of countries	177	177	177	143	143	143

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. $\Delta \ln y_{t-1}$ and $\Delta \ln y_{t-2}$ are first and second lags of country per capita growth rates. HK, INV, and POPGR are measures of human capital, investment rates, and population growth, respectively (all from Penn World Tables). $\Delta \ln y_{it}^{W}$ is the world per capita growth rate. S is the spillover variable (as described in the text above). EAP, ECA, GMS, LAM, MENA, NAM, SAS, and SSA are region dummies for East Asia and the Pacific, Europe and Central Asia, Greater Mekong Subregion, Latin America, Middle East and North Africa, North America, South Asia, and Sub-Saharan Africa, respectively.

Source: Authors' estimates.

Table A5.2: Estimation of Spillover Effects—Panel Fixed-Effects Regression Results II

Variables	(1) Contiguity	(2) Distance	(3) Exports	(4) Contiguity	(5) Distance	(6) Exports
$\Delta \ln y_{t-1}$	0.124***	0.128***	0.153***	0.122***	0.126***	0.144***
	(0.0206)	(0.0205)	(0.0208)	(0.0205)	(0.0206)	(0.0204)
$\Delta \ln y_{t-2}$	0.0449**	0.0471**	0.0596**	0.0425*	0.0460**	0.0530**
	(0.0222)	(0.0232)	(0.0242)	(0.0223)	(0.0232)	(0.0242)
HK	0.000866	−0.0108***	0.00928**	−0.00384	−0.00984**	−0.00589
	(0.00405)	(0.00407)	(0.00395)	(0.00417)	(0.00474)	(0.00452)
INV	0.0227	0.0246	0.0283	0.0190	0.0214	0.0178
	(0.0166)	(0.0175)	(0.0190)	(0.0160)	(0.0169)	(0.0172)
$POPGR$	−0.0166	−0.0493	0.0368	0.00856	−0.0281	−0.00465
	(0.318)	(0.301)	(0.269)	(0.323)	(0.308)	(0.283)
$\Delta \ln y_{it}^{W}$	0.0567***	0.0168*	0.0566***	0.0562***	0.0162	0.0544***
	(0.00962)	(0.00977)	(0.0111)	(0.00947)	(0.0103)	(0.0108)
$S \times PRC$	0.381***	0.602***	0.109*			
	(0.0403)	(0.0466)	(0.0563)			
$S \times CAM$	0.388***	0.430***	−0.534***			
	(0.0601)	(0.0345)	(0.0170)			
$S \times LAO$	0.354***	0.351***	−0.140***			
	(0.0269)	(0.0279)	(0.0111)			
$S \times MYA$	0.932***	1.110***	0.694***			
	(0.0447)	(0.0438)	(0.0273)			
$S \times THA$	0.296***	0.416***	0.834***			
	(0.0450)	(0.0337)	(0.0365)			
$S \times VIE$	0.194***	0.469***	0.115***			
	(0.0308)	(0.0405)	(0.0267)			
$S \times EAP$	0.696***	0.934***	0.659***			
	(0.177)	(0.298)	(0.125)			
$S \times ECA$	0.602***	0.785***	0.835***			
	(0.0738)	(0.111)	(0.0733)			
$S \times LAM$	0.358***	0.898***	0.522***			
	(0.0712)	(0.192)	(0.112)			
$S \times MENA$	0.479***	1.650***	0.955***			
	(0.128)	(0.369)	(0.287)			
$S \times NAM$	0.483**	0.467***	0.720***			
	(0.208)	(0.169)	(0.230)			
$S \times SAS$	0.238**	0.397***	0.0771			
	(0.0949)	(0.0762)	(0.0815)			

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Table A5.2 *continued*

Variables	(1) Contiguity	(2) Distance	(3) Exports	(4) Contiguity	(5) Distance	(6) Exports
$S \times SSA$	0.267***	0.965***	0.254*			
	(0.0711)	(0.213)	(0.139)			
$S \times PRC$ (≥ 2000)				0.503***	0.765***	0.731***
				(0.0506)	(0.0648)	(0.0569)
$S \times CAM$ (≥ 2000)				0.486***	0.789***	0.796***
				(0.0595)	(0.0402)	(0.0694)
$S \times LAO$ (≥ 2000)				0.430***	0.541***	0.570***
				(0.0292)	(0.0316)	(0.0364)
$S \times MYA$ (≥ 2000)				1.086***	1.445***	1.499***
				(0.0526)	(0.0588)	(0.0648)
$S \times THA$ (≥ 2000)				0.265***	0.409***	0.809***
				(0.0543)	(0.0471)	(0.0435)
$S \times VIE$ (≥ 2000)				0.311***	0.589***	0.789***
				(0.0403)	(0.0491)	(0.0605)
$S \times PRC$ (< 2000)				−0.100**	−0.0149	−0.0596
				(0.0403)	(0.0526)	(0.0617)
$S \times CAM$ (< 2000)				−0.247***	−0.981***	−0.674***
				(0.0660)	(0.0950)	(0.0172)
$S \times LAO$ (< 2000)				−0.195***	−0.398***	−0.303***
				(0.0306)	(0.0411)	(0.0156)
$S \times MYA$ (< 2000)				0.158***	−0.109***	0.0229
				(0.0325)	(0.0389)	(0.0288)
$S \times THA$ (< 2000)				0.628***	0.437***	0.799***
				(0.0403)	(0.0504)	(0.0524)
$S \times VIE$ (< 2000)				−0.0407***	0.00812	−0.0473
				(0.00715)	(0.0285)	(0.0372)
$S \times EAP$ (≥ 2000)				0.862***	0.852***	0.682***
				(0.250)	(0.285)	(0.197)
$S \times ECE$ (≥ 2000)				0.672***	0.793***	1.116***
				(0.0976)	(0.130)	(0.113)
$S \times LAM$ (≥ 2000)				0.659***	0.942***	0.972***
				(0.113)	(0.207)	(0.149)
$S \times MENA$ (≥ 2000)				0.478***	1.586***	1.382***
				(0.125)	(0.361)	(0.330)
$S \times NAM$ (≥ 2000)				0.460**	0.355**	0.604**
				(0.216)	(0.147)	(0.292)

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Table A5.2 *continued*

Variables	(1) Contiguity	(2) Distance	(3) Exports	(4) Contiguity	(5) Distance	(6) Exports
$S \times SAS$ (≥ 2000)				0.451***	0.570***	0.481***
				(0.0898)	(0.0814)	(0.0877)
$S \times SSA$ (≥ 2000)				0.417***	0.901***	0.717***
				(0.121)	(0.207)	(0.229)
$S \times EAP$ (< 2000)				0.628***	1.249***	0.611***
				(0.157)	(0.402)	(0.140)
$S \times ECA$ (< 2000)				0.543***	0.744***	0.549***
				(0.0691)	(0.0931)	(0.0994)
$S \times LAM$ (< 2000)				0.257***	0.771***	0.325***
				(0.0597)	(0.184)	(0.122)
$S \times MENA$ (< 2000)				0.483***	1.839***	0.722***
				(0.162)	(0.444)	(0.259)
$S \times NAM$ (< 2000)				0.476**	0.821***	0.691***
				(0.206)	(0.247)	(0.195)
$S \times SAS$ (< 2000)				−0.0394	−0.197	−0.240**
				(0.0552)	(0.166)	(0.111)
$S \times SSA$ (< 2000)				0.202***	1.142***	0.0559
				(0.0702)	(0.262)	(0.131)
Constant	0.00236	0.0184	−0.0243*	0.0121	0.0168	0.0115
	(0.0144)	(0.0141)	(0.0141)	(0.0143)	(0.0156)	(0.0156)
Observations	7,706	7,706	7,056	7,706	7,706	7,056
R-squared	0.117	0.108	0.081	0.122	0.111	0.093
Number of countries	143	143	143	143	143	143

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. $\Delta \ln y_{t-1}$ and $\Delta \ln y_{t-2}$ are first and second lags of country per capita growth rates. HK, INV, and POPGR are measures of human capital, investment rates, and population growth, respectively (all from Penn World Tables). $\Delta \ln y_{it}^{W}$ is the world per capita growth rate. S is the spillover variable (as described in the text above). EAP, ECA, LAM, MENA, NAM, SAS, and SSA are region dummies for East Asia and the Pacific, Europe and Central Asia, Latin America, Middle East and North Africa, North America, South Asia, and Sub-Saharan Africa, respectively. PRC, CAM, LAO, MYA, THA, and VIE refer to the People's Republic of China, Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam, respectively. ≥ 2000 and < 2000 indicate that the coefficients refer to the periods after 2000 and before 2000, respectively.

Source: Authors' estimates.

Table A5.3: Estimation of Spillover Effects—Panel Fixed-Effects Regression Results III

Variables	(1) Contiguity	(2) Distance	(3) Exports	(4) Contiguity	(5) Distance	(6) Exports	(7) Contiguity	(8) Distance	(9) Exports
$\Delta \ln y_{t-1}$	0.180**	0.181**	0.225**	0.156**	0.164**	0.201*	0.116	0.113*	0.113
	(0.0642)	(0.0622)	(0.0770)	(0.0529)	(0.0547)	(0.0799)	(0.0587)	(0.0509)	(0.0831)
$\Delta \ln y_{t-2}$	0.0857**	0.0824**	0.0622	0.0726**	0.0714**	0.0590	0.0374*	0.0423*	-0.0120
	(0.0323)	(0.0295)	(0.0528)	(0.0259)	(0.0273)	(0.0523)	(0.0155)	(0.0171)	(0.0442)
HK	0.0179	0.0257	0.0191	0.0183	0.0284	0.0263	0.0250	0.0271	0.0266**
	(0.0171)	(0.0139)	(0.0108)	(0.0191)	(0.0143)	(0.0131)	(0.0202)	(0.0191)	(0.00924)
INV	0.0913	0.0897	0.114*	0.110	0.0933	0.104*	0.0490	0.0746	0.0612
	(0.0708)	(0.0709)	(0.0518)	(0.0843)	(0.0760)	(0.0477)	(0.0931)	(0.0923)	(0.0433)
$POPGR$	0.782*	0.838**	0.515	0.946**	0.892**	0.615	1.198***	0.901**	0.887**
	(0.317)	(0.314)	(0.444)	(0.239)	(0.300)	(0.400)	(0.278)	(0.275)	(0.241)
$\Delta \ln y_{it}^{W}$	0.106	0.0890	0.110	0.0955	0.0880	0.100	0.105	0.104	0.0968
	(0.0638)	(0.0791)	(0.0670)	(0.0684)	(0.0811)	(0.0646)	(0.0659)	(0.0796)	(0.0639)
S	0.232*	0.280	0.0532						
	(0.0984)	(0.160)	(0.212)						
$S \times PRC$				0.114	0.143	0.255			
				(0.113)	(0.176)	(0.181)			
$S \times CAM$				0.129*	0.255	-0.579***			
				(0.0600)	(0.128)	(0.0613)			
$S \times LAO$				0.206***	0.178	-0.198**			
				(0.0508)	(0.0913)	(0.0570)			
$S \times MYA$				0.788***	0.857***	0.599***			
				(0.0963)	(0.146)	(0.0544)			
$S \times THA$				0.272	0.122	0.647**			
				(0.138)	(0.0647)	(0.170)			
$S \times VIE$				0.0350	0.165	0.184*			
				(0.0803)	(0.169)	(0.0799)			
$S \times PRC\ (\geq 2000)$							0.327*	0.288	0.444*
							(0.141)	(0.217)	(0.173)
$S \times CAM\ (\geq 2000)$							0.294***	0.592***	0.591**
							(0.0630)	(0.137)	(0.164)
$S \times LAO\ (\geq 2000)$							0.348***	0.362**	0.450***
							(0.0478)	(0.0905)	(0.0842)
$S \times MYA\ (\geq 2000)$							1.068***	1.280***	1.509***
							(0.137)	(0.164)	(0.137)
$S \times THA\ (\geq 2000)$							0.212	0.108	0.558***
							(0.165)	(0.0769)	(0.114)

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Table A5.3 *continued*

Variables	(1) Contiguity	(2) Distance	(3) Exports	(4) Contiguity	(5) Distance	(6) Exports	(7) Contiguity	(8) Distance	(9) Exports
$S \times VIE$ (≥ 2000)							0.205*	0.269	0.534**
							(0.0947)	(0.206)	(0.153)
$S \times PRC$ (< 2000)							−0.137	−0.0319	0.0560
							(0.0752)	(0.217)	(0.116)
$S \times CAM$ (< 2000)							−0.429***	−0.786***	−0.721***
							(0.0760)	(0.192)	(0.0454)
$S \times LAO$ (< 2000)							−0.328***	−0.391**	−0.363***
							(0.0382)	(0.138)	(0.0576)
$S \times MYA$ (< 2000)							0.0934	−0.281	−0.00369
							(0.135)	(0.230)	(0.0839)
$S \times THA$ (< 2000)							0.595***	0.255	0.817***
							(0.0746)	(0.404)	(0.181)
$S \times VIE$ (< 2000)							−0.0192	0.0450	0.0827
							(0.0239)	(0.139)	(0.0571)
Constant	−0.0416*	−0.0525**	−0.0372*	−0.0479*	−0.0577**	−0.0531	−0.0486*	−0.0488*	−0.0455*
	(0.0200)	(0.0168)	(0.0171)	(0.0196)	(0.0169)	(0.0273)	(0.0210)	(0.0208)	(0.0195)
Observations	310	310	292	310	310	292	310	310	292
R-squared	0.235	0.234	0.214	0.253	0.246	0.252	0.298	0.290	0.328
Number of countries	6	6	6	6	6	6	6	6	6

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. $\Delta \ln y_{t-1}$ and $\Delta \ln y_{t-2}$ are first and second lags of country per capita growth rates. HK, INV, and POPGR are measures of human capital, investment rates, and population growth, respectively (all from Penn World Tables). $\Delta \ln y_{it}^{W}$ is the world per capita growth rate and S is the spillover variable (as described in the text above). PRC, CAM, LAO, MYA, THA, and VIE refer to the People's Republic of China, Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam, respectively. ≥ 2000 and < 2000 indicate that the coefficients refer to the periods after 2000 and before 2000, respectively.

Source: Authors' estimates.

Chapter 6

Realizing the Export Potential of the Greater Mekong Subregion

6.1 Introduction

This chapter discusses whether the Greater Mekong Subregion (GMS) members have reached their *potential* in terms of both intraregional and global exports. A country's export potential in this context is captured by the difference between a country's actual exports and the level of exports predicted from an (theoretically derived) empirical model, with those countries with actual exports far below their predicted levels considered to be falling short of their potential. The predictions from the theoretically grounded empirical model are used as a benchmark with which to judge whether countries are meeting their export potential.

Bilateral trade flows usually depend on trade costs, both policy-induced (e.g., tariffs) and natural (e.g., geographic distance), and the size of the market where trade takes place. Under these assumptions, it is possible to estimate the potential export flows between countries using the familiar *gravity model of trade*, with these estimates reflecting the export potential between two countries. The gravity model has become the standard workhorse empirical model for predicting trade flows. It relates bilateral trade flows to variables capturing the size of the trade partners and the distance between them, among other things. Differences between actual export flows and those estimated from the gravity model can then be used to determine whether countries are meeting or exceeding their potential. Of interest in this study is whether the GMS members are meeting their export potential with one other and also whether they are meeting their potential with other regions of the world (e.g., richer regions). A finding that countries are not reaching their export potential has important policy implications, and it may be an important explanation for differences in the complexity of production.

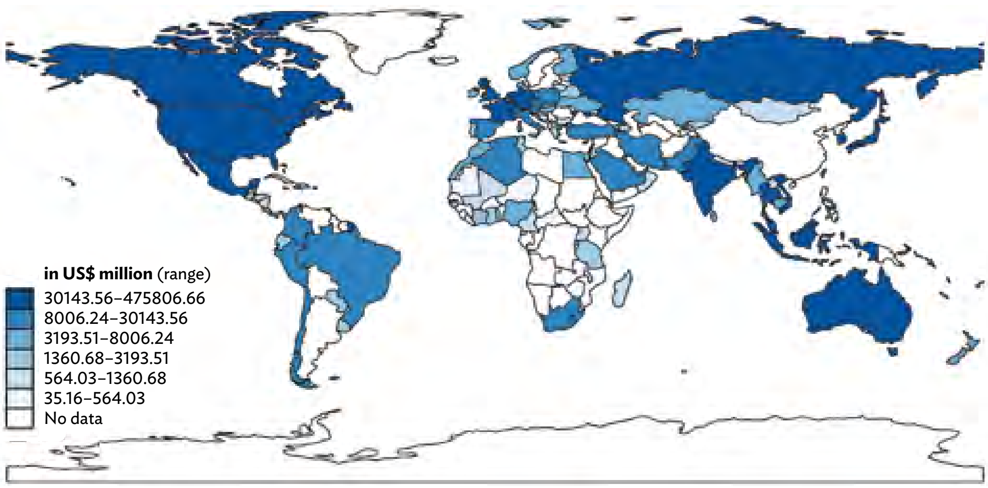
While the gravity model is commonly used to model exports at the aggregate level, the study further adapts the approach to allow for the estimation of export potential at the sector level. Moreover, in addition to identifying whether these countries reach their export potential in certain sectors, the analysis will also consider the set of countries with which the GMS has attained its potential and those countries where possibilities to further exploit opportunities are available. In other words, the approach can provide information on both the sector and geographic export potential of the GMS, leading to policy-relevant implications for both regional and global export integration.

6.2 Description of Export Patterns

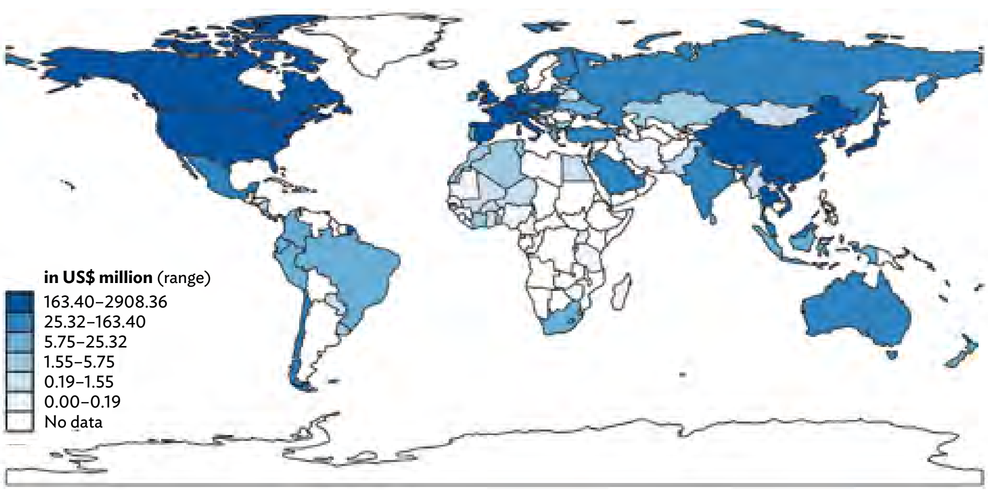
The analysis begins in Figures 6.1(a)–6.1(f) by using a heat map to report the values of each GMS member's exports to the rest of the world in 2016.[28] While it is difficult to compare across maps because of the difference in scales, Figures 6.1(a)–6.1(f) reveal important differences. Compared to other GMS members, the PRC, Thailand, and Viet Nam have relatively high export values in a wide range of countries, including many in the West (i.e., North America and Europe). These three countries also trade more extensively with other regions such as Africa and Latin America. The figures further

Figure 6.1: Total Exports in 2016 by Partner

(a) People's Republic of China



(b) Cambodia



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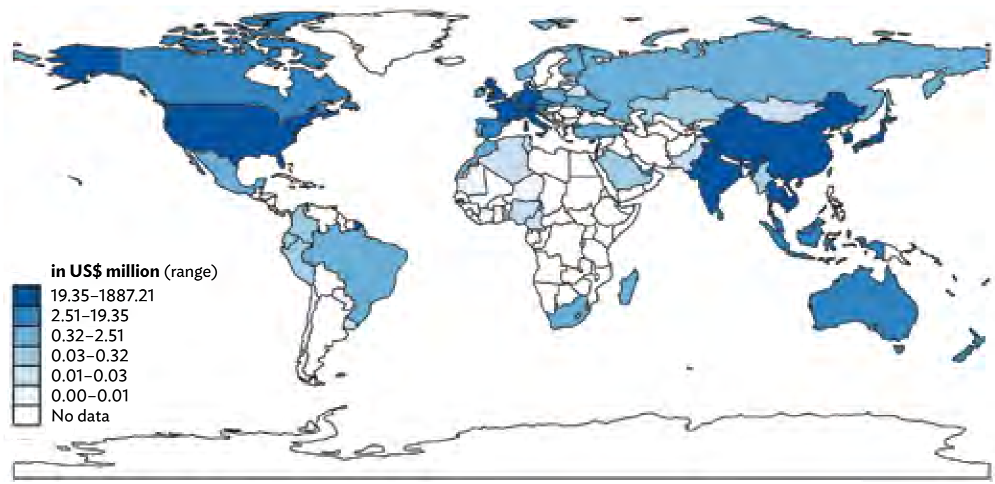
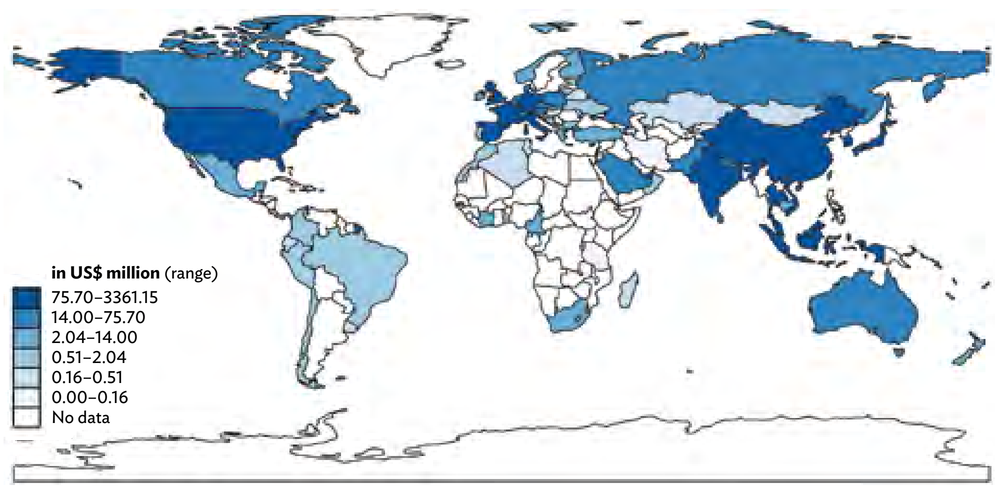
[28] Note that the countries in white on the maps either have zero export flows or are missing data.

Figure 6.1 *continued*

(c) Lao People's Democratic Republic



(d) Myanmar



(e) Thailand

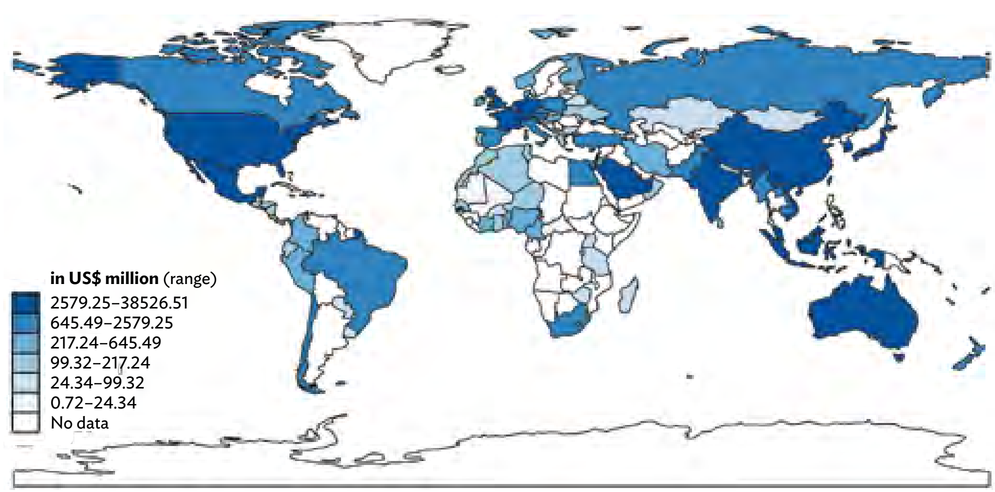


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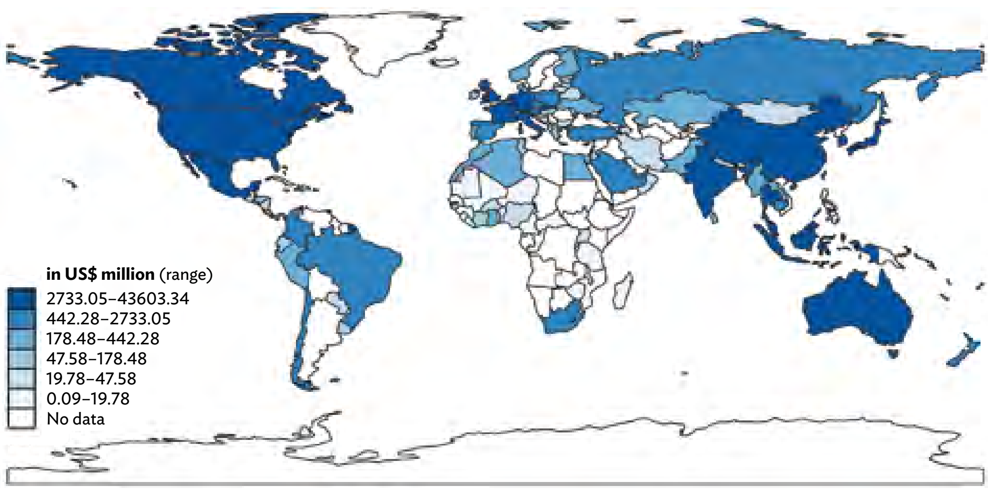
Figure 6.1 *continued*

(f) Viet Nam



Source: United Nations Comtrade.

reveal the importance of exports to countries within the broader Asian region. In addition to giving an initial insight into which countries GMS members export to intensively, and therefore insights into the types of countries where there might be an export potential to be realized, the figures also confirm the basic hypothesis of the gravity model, namely that countries export to large developed countries and countries that are geographically close by.

6.3 Aggregate Export Potential of the Greater Mekong Subregion Members

This section reports the export potential of each of the GMS members with respect to the remaining countries in the 155-country sample. Further details of the methodology are provided in the Appendix. The approach is to estimate a gravity model to predict bilateral exports, based on some observable factors, and then use the difference between actual exports and predicted exports to give an indicator of export potential. This section will concentrate on total exports, identifying the set of countries with which each GMS member has the strongest trade potential based on the gravity results for 2016.

Figures 6.2(a)–6.2(f) show heat maps of each GMS member's *relative residuals*—a measure of export potential—with respect to 155 partner countries.[29] Darker blue areas in the maps indicate the highest levels of export potential. The results suggest that the GMS members have between 29 (for the

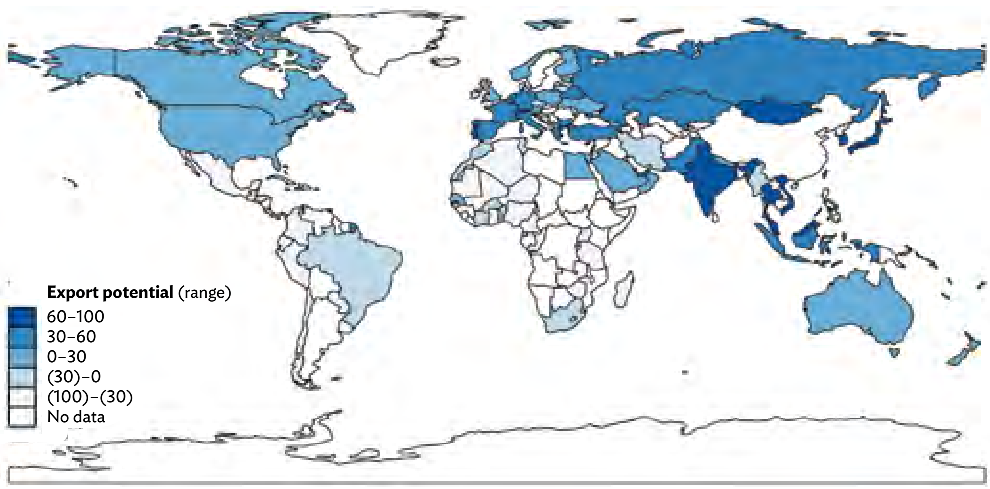
[29] To distinguish between trade partners with low- versus high-trade potential, the analysis uses the concept of *relative residual*. The relative residual for an exporting country i and importing country j is calculated as $rr_{ij} = \frac{(\hat{X}_{ij} - X_{ij})}{(X_{ij} + \hat{X}_{ij})} \times 100$, where $\hat{X}_{ij}$ is the predicted level of exports between i and j, and X_{ij} is the actual level of exports between i and j. A relative residual of zero implies that an exporter is meeting its trade potential. Following convention, a value of rr in excess of 30 indicates that a country has high levels of untapped export potential, while a value of rr less than −30 indicates that a country already has strong exports (i.e., exceeding its export potential).

PRC and the Lao PDR) and 38 (Cambodia) partners with high export potential. However, these partner countries vary across the GMS. For the PRC, the partner economies with the highest relative residuals include rich Asian countries such as Japan; the Republic of Korea (ROK); Taipei,China; and Singapore, along with rich European countries. This is also true to some extent for Thailand and Viet Nam, with the PRC also an important potential partner for these two countries. In Cambodia and the Lao PDR, export potential is high with some African countries, with other Asian countries also a source of export potential, particularly in the case of Cambodia. This is also true but to a lesser extent for Myanmar.

Are GMS members meeting their export potential with one another? The evidence, summarized in Table 6.1, is mixed. Cambodia is a relative outlier in that it has unexploited export potential with

Figure 6.2: Relative Residuals (Export Potential) in 2016

(a) People's Republic of China



(b) Cambodia

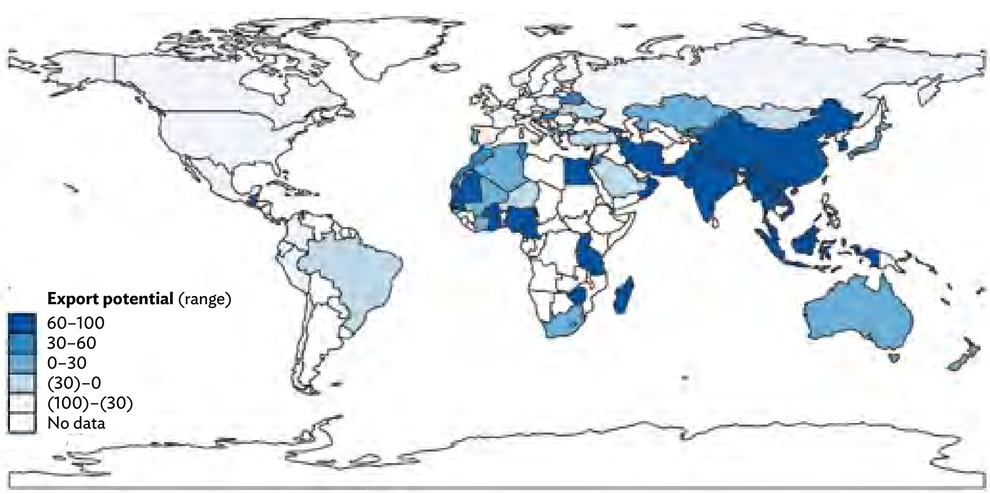


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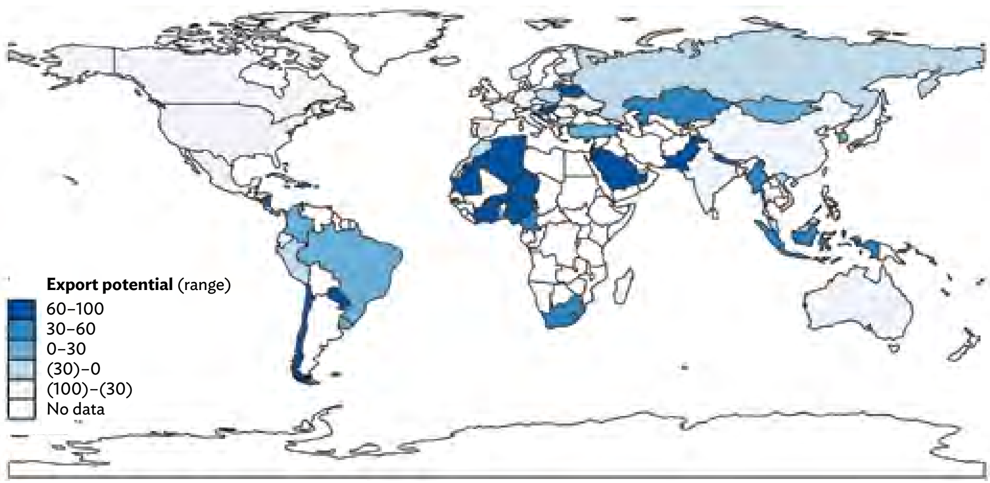
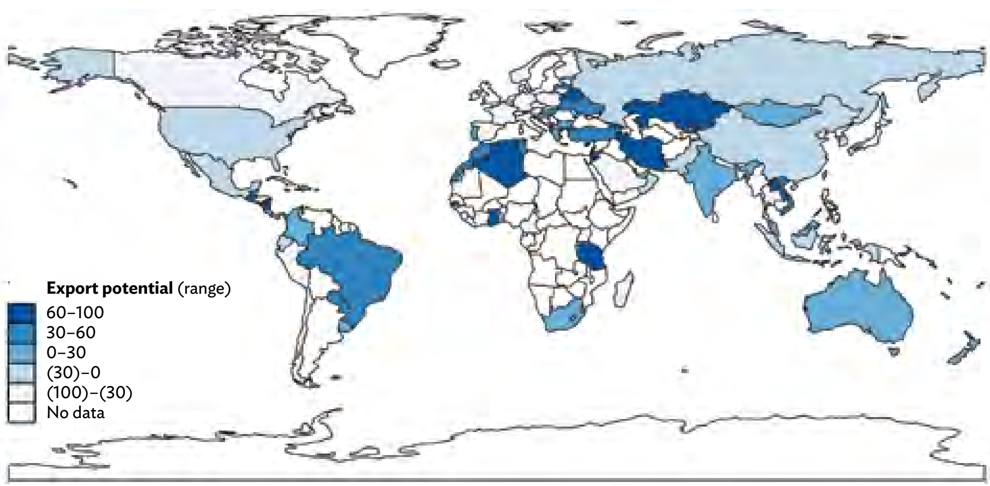
Figure 6.2 *continued*

(c) Lao People's Democratic Republic



(d) Myanmar



(e) Thailand

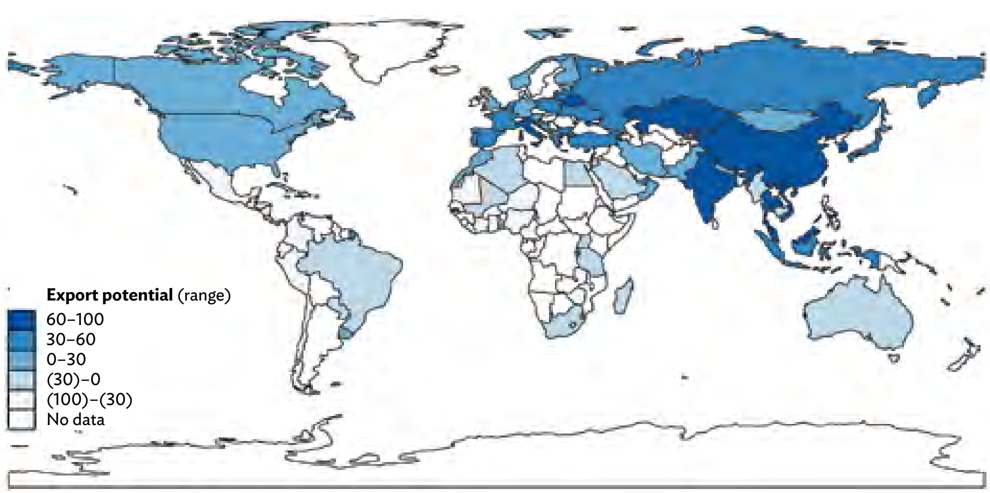


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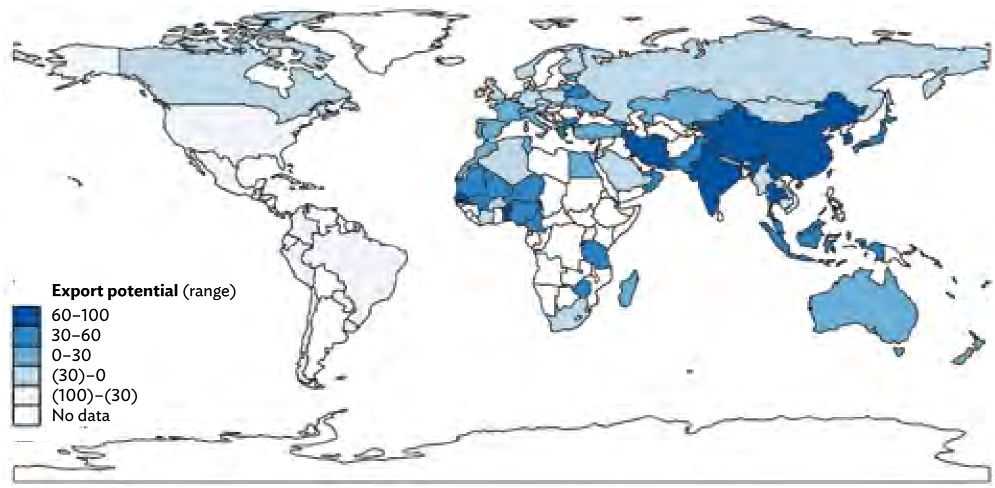
Figure 6.2 *continued*

(f) Viet Nam



Note: Values in parentheses denote negative export potential, indicating that actual trade is greater than predicted trade. In this case, there is no export potential to be realized in the sense defined in this chapter.

Source: Gravity results based on United Nations Comtrade data.

all other GMS members. The PRC is meeting its export potential with Cambodia, the Lao PDR, and Myanmar, but it has relatively large relative residuals—and thus unexploited export potential—with Thailand and Viet Nam. The Lao PDR has unexploited export potential with Myanmar and has met its export potential with all other GMS members. Myanmar has unexploited export potential with the Lao PDR and Viet Nam, but not with other GMS members. Thailand and Viet Nam have unexploited export potential with each other and with the PRC but have met their export potential with other GMS members.

Table 6.1: Unexploited Export Potential within the Greater Mekong Subregion

	Exporters					
	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Viet Nam
Cambodia						
Lao PDR	High		High			
Myanmar	High	High				
PRC	High				High	High
Thailand	High			High		High
Viet Nam	High		High	High	High	

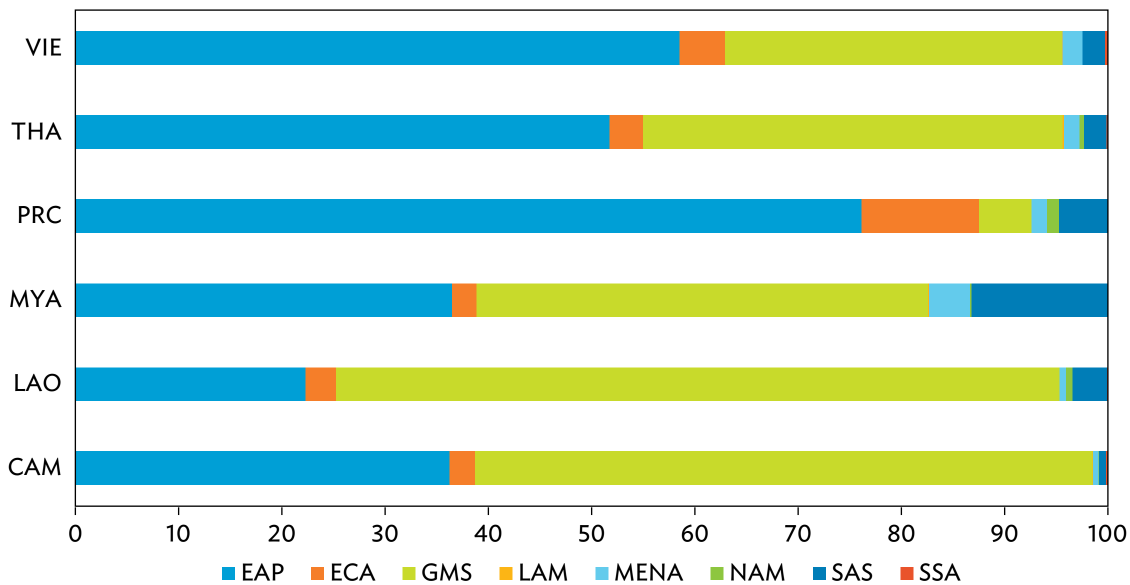
Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Note: A blank white cell indicates that the country is meeting its export potential with its trade partner, while "High" indicates a relative residual above 30 (suggesting high export potential).

Source: Authors.

Figure 6.3 reports a decomposition of the value of export potential by region.[30] The figure reveals that East Asia and the Pacific accounts for the largest share of the export potential of most GMS members—over 50% in the PRC, Thailand, and Viet Nam. Except for the PRC, other GMS members are also an important source of export potential, accounting for 60% and 70% of the export potential of Cambodia and the Lao PDR, respectively, and between 32% and 44% for Myanmar, Thailand, and Viet Nam. Other regions that are relatively important for some GMS members include Europe and Central Asia (for the PRC) and South Asia (particularly for Myanmar).

Figure 6.3: Export Potential by Region



CAM = Cambodia, EAP = East Asia and the Pacific, ECA= Europe and Central Asia, GMS = Greater Mekong Subregion, LAM = Latin America, LAO = Lao People's Democratic Republic, MENA = Middle East and North Africa, MYA = Myanmar, NAM = North America, PRC = People's Republic of China, SAS = South Asia, SSA = Sub-Saharan Africa, THA = Thailand, VIE = Viet Nam.

Source: Authors' estimates.

6.4 Trade Potential by Sector

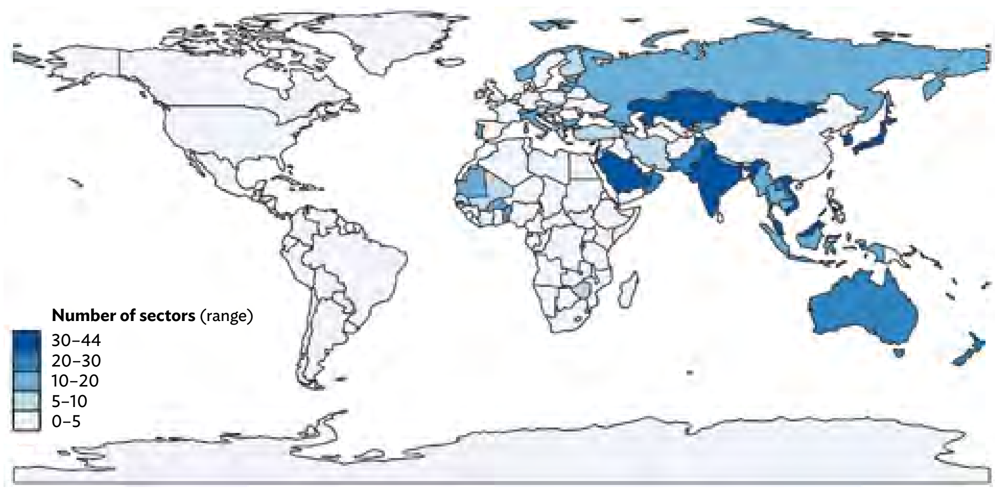
This section moves beyond aggregate exports to consider the export potential of the 44 sectors in this study (see Appendix for list of sectors). Following the previous analysis, the study estimates the gravity model for each of these 44 sectors and constructs relative residuals.

30 Each country's export potential in Figure 6.3 is derived from individual regressions for each sector. Then, each sectoral regression yields an export potential for each sector and for each country. Figure 6.3 is based on an aggregation of sectoral export potentials.

The maps in Figures 6.4(a)–6.4(f) report the number of sectors with high export potential in each partner country, with darker colors indicating more sectors with high potential. The PRC has high export potential across a broad range of sectors (30 or more) with a number of partners, including Mongolia, Kazakhstan, India, Saudi Arabia, Malaysia, Japan, the ROK, and Viet Nam. On the other hand, Cambodia, the Lao PDR, and Myanmar do not have high export potential in as many sectors in any country, but they do have high export potential in a significant number of sectors (10–20) with several partners. These include other GMS members as well as India, the ROK, and Singapore in Asia and, particularly in Cambodia's case, countries in Europe and Mexico. Thailand and Viet Nam also have high export potential across a large number of sectors (10–30) in many countries, including other GMS members and countries in West Africa, Latin America, and Eastern Europe.

Figure 6.4: Number of Sectors with High Export Potential

(a) People's Republic of China



(b) Cambodia

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Figure 6.4 *continued*

(c) Lao People's Democratic Republic

(d) Myanmar

(e) Thailand

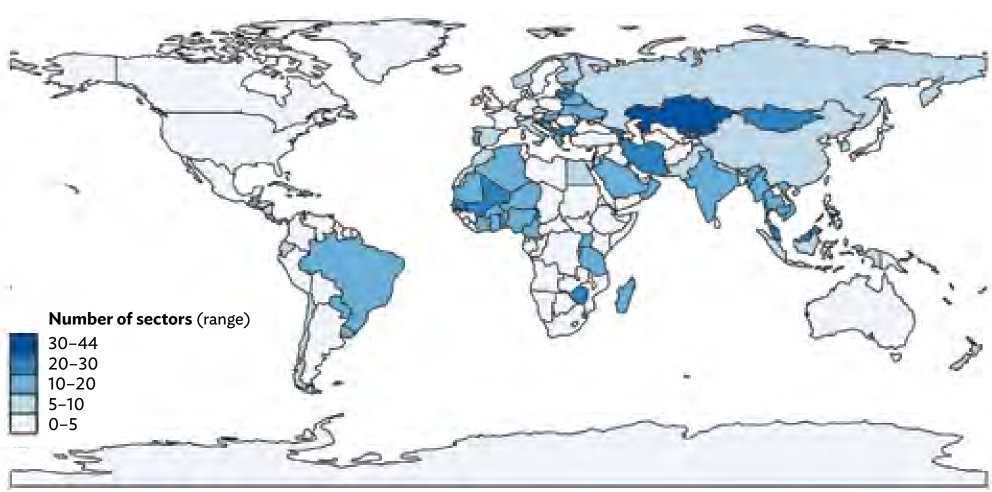

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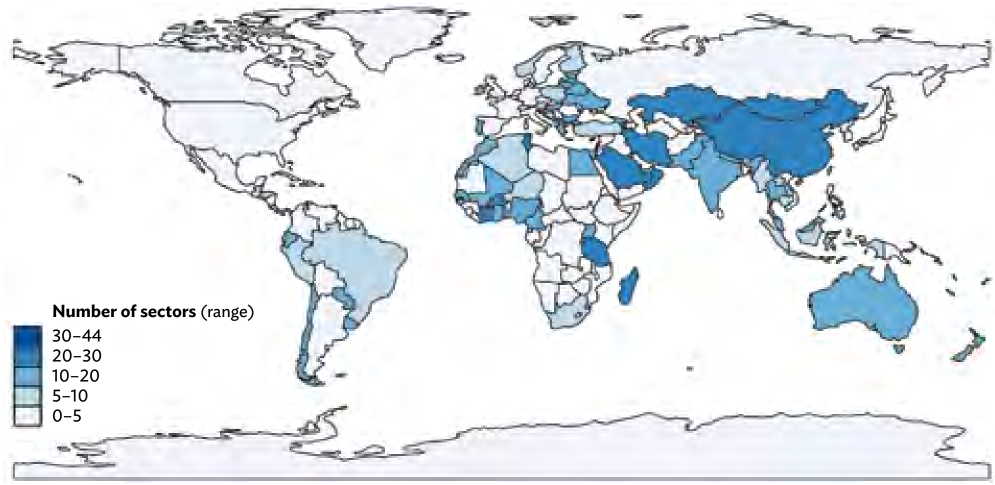
Figure 6.4 *continued*

(f) Viet Nam



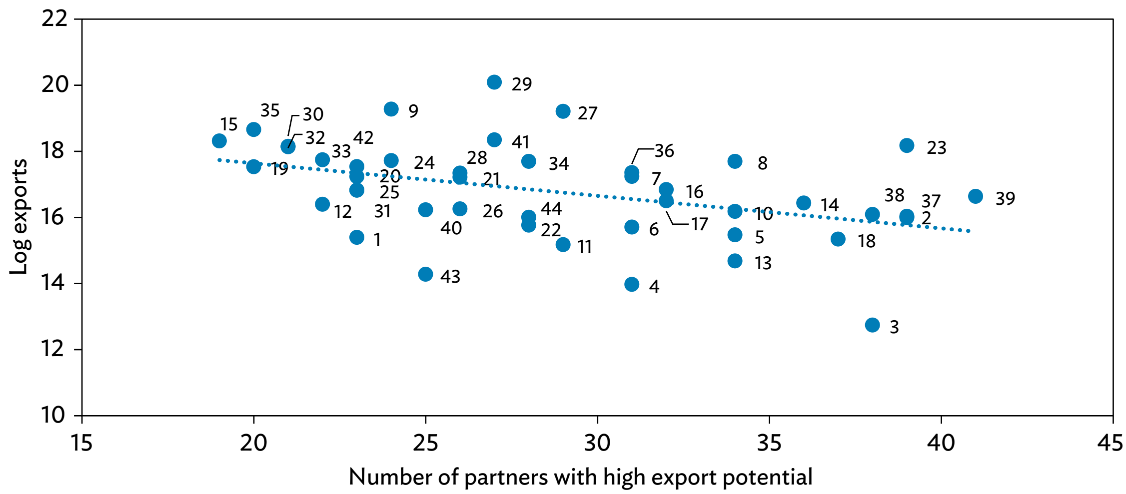
Source: Authors' calculations based on United Nations Comtrade data.

Overall, these results suggest that export potential is larger for the PRC, Thailand, and Viet Nam than for Cambodia, the Lao PDR, and Myanmar. For the PRC, this is reflected in high export potential with many countries in a broad range of sectors, while Thailand and Viet Nam have high export potential in fewer sectors but a broader range of countries. Furthermore, the PRC, Thailand, and Viet Nam have more trade partners with high export potential than the other three countries. There are a few exceptions, however, where Cambodia, the Lao PDR, and Myanmar also report a relatively high number of partners with high export potential. These sectors include textiles (consumer goods) and electronics (consumer goods).

Figures 6.5(a)–6.5(f) report the relationship between the log of exports by sector (sector names and numbers are listed in the Appendix) in 2016 and the number of countries (by sector) with high export potential. The figures reveal that, in most cases, this relationship is positive, suggesting that opportunities to develop exports with a range of countries are greater in those sectors where the level of exports is currently higher. The exception to this finding is the PRC, where the reverse relationship is found. In this case, the greatest opportunities for developing its export potential are in those sectors where exports are currently lowest. This may be a reflection of the fact that the PRC is largely exploiting trade opportunities in those sectors where its exports are highest.

Figure 6.5: Relationship between Current Exports and Number of Countries with High Export Potential

(a) People's Republic of China



(b) Cambodia

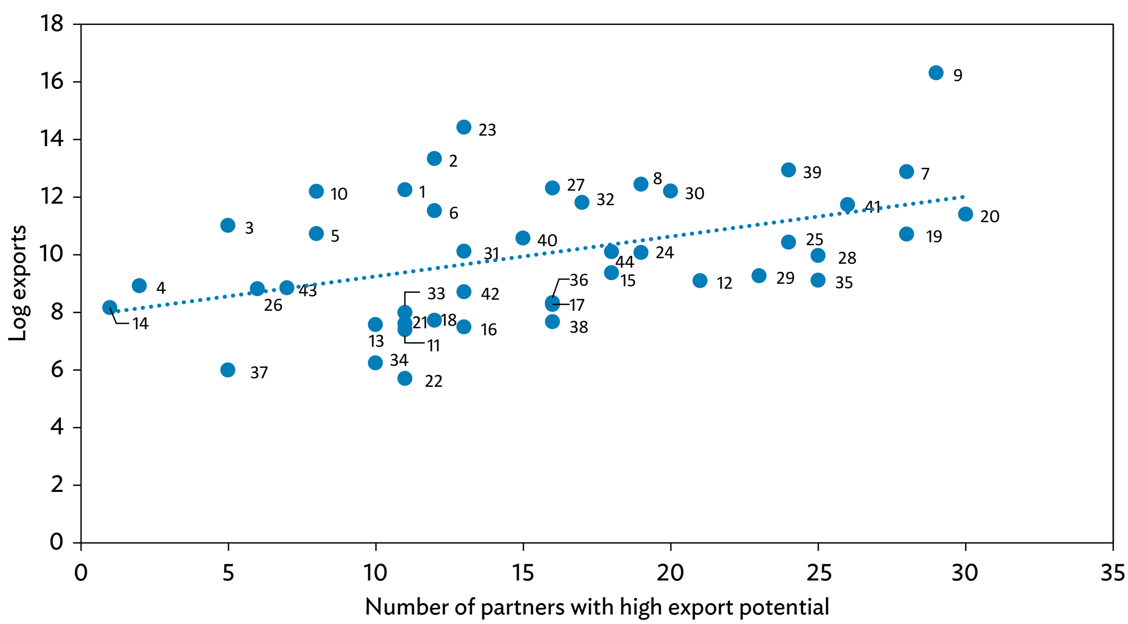


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Figure 6.5 *continued*

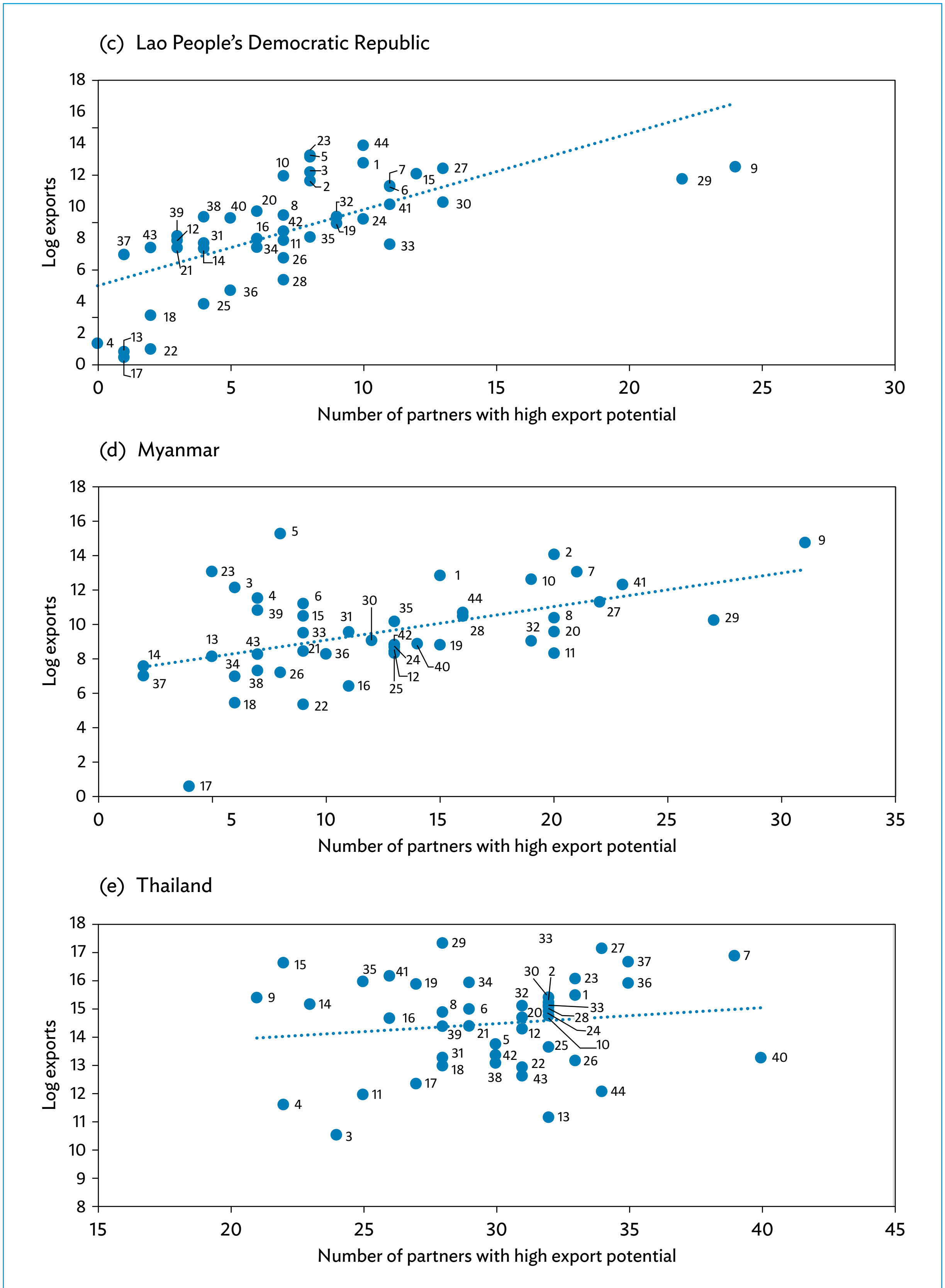

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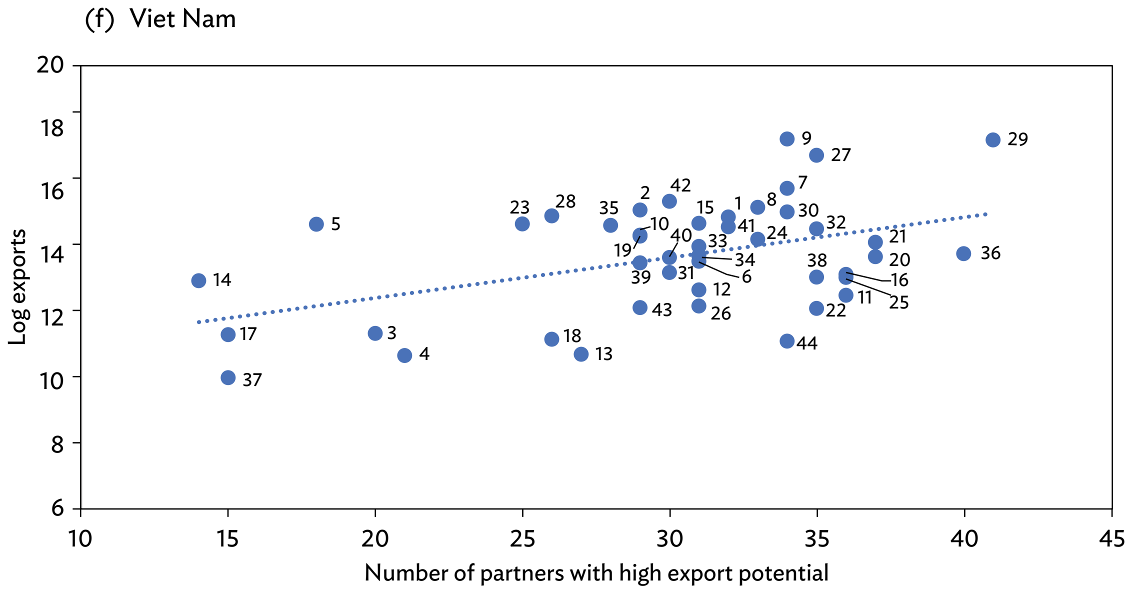
Figure 6.5 *continued*



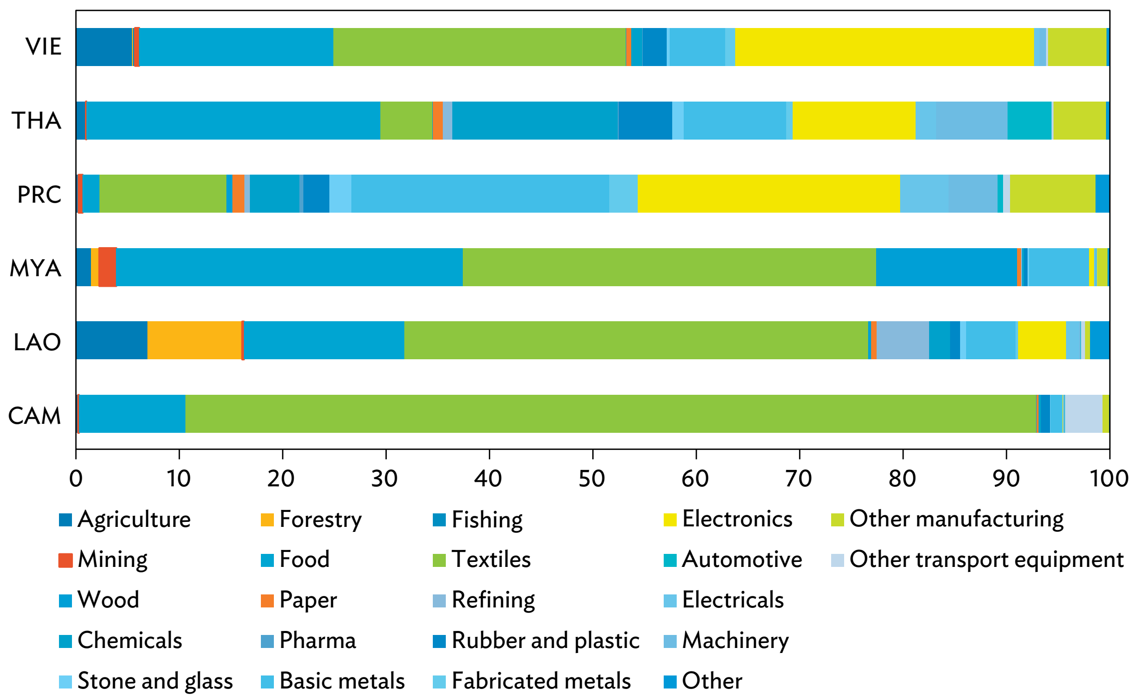
Note: Each dot represents one of 44 sectors in the study. Sector names and numbers are listed in the Appendix.
Source: Authors' calculations based on United Nations Comtrade data.

Figure 6.6 reports a breakdown of export potential by broad sectors. The figures reported are based on the sector gravity results and involves predicting bilateral exports for each sector.[31] The figure reveals some interesting differences across GMS members.[32] In Cambodia, the Lao PDR, and Myanmar (and to a lesser extent Viet Nam), there is a great deal of export potential in textiles. This sector accounts for around 80% of Cambodia's export potential and nearly 50% for the Lao PDR. The food sector also makes up a relatively large share of the export potential of these two countries and Thailand. Conversely, in the PRC and Viet Nam (and Thailand to a lesser extent), relatively large shares of export potential are found in electronics. The PRC has a large share in basic metals. More generally, export potential seems more diversified in the PRC, Thailand, and Viet Nam. Other sectors that are relevant in some GMS members include wood (Myanmar), chemicals (Thailand), and forestry (Lao PDR).

[31] This is done by constructing sectoral export potential as the difference between predicted and actual bilateral sectoral exports. These estimates of bilateral export potential at the sectoral level are then aggregated over partner countries to come up with an estimate of total sectoral export potential, which in turn is aggregated to provide an estimate of total export potential across all sectors. These estimates of the total export potential of sectors are then used to construct the sectoral share in total export potential, which is calculated as the sum of export potential across the different sectors.

[32] Note that the level of aggregated predicted exports from the sectoral regressions, in general, will not add up to the predicted exports from the gravity regression on total exports. More generally, given model uncertainty, data measurement issues, and so on, the gravity model provides only a rough estimate of export potential. As such, the analysis does not concentrate on actual levels of predicted export potential, but instead on more general indicators (e.g., relative residuals greater than 30 indicating "high" export potential, the sectoral decomposition of export potential, and the regional decomposition of export potential).

Figure 6.6: Export Potential by Sector



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on United Nations Comtrade data.

6.5 Conclusions

This chapter has discussed the extent to which the GMS members are meeting their export potential, both with one another and with countries outside of the region. It has examined where opportunities exist for developing this export potential, both at the sector and country levels. The results reveal that there are many opportunities for the GMS to increase exports. Many of these opportunities exist with non-GMS members, though the geographic dimension of these opportunities differs across members. The PRC, Thailand, and Viet Nam have many export opportunities in developed countries and in other Asian countries; while Cambodia, the Lao PDR, and Myanmar have opportunities in more distant and lower-income countries. At the sector level, the study again finds a distinction between the PRC, Thailand, and Viet Nam on the one hand, and Cambodia, the Lao PDR, and Myanmar on the other. The former group has high export potential in many sectors across a broad range of countries, while the latter group generally has fewer sectors for which high export potential exists and fewer countries in which this potential exists. Interestingly, opportunities in terms of the number of partners with significant export potential tend to be larger in those sectors in which countries are already relatively intensive exporters. The exception is the PRC, where the relationship is the reverse, suggesting that it has exploited most of its opportunities in those sectors where it is a relatively intensive exporter.

Appendix

Methodology

The study estimates the trade potential of the GMS members with respect to intraregional and global trade using the gravity model of trade. The simple gravity equation is as follows:

$$logX_{ij} = \beta_0 + \beta_1 logGDP_i + \beta_2 logGDP_j + \beta_3 logDistance_{ij} + \beta_{ij} X'_{ij} + \varepsilon_{ij} \quad (1)$$

where X'_{ij} is the vector of control variables added to the gravity equation. The study employs control variables that are commonly used when estimating gravity models, such as contiguity, common language, common colonizers, preferential trade agreements, whether countries are landlocked, and indicators of trade facilitation (i.e., the logistics performance index and its constituent parts from the World Bank).

The model is estimated for total exports and sectoral exports (i.e., the 44 sectors in Table A6.2) for the full sample of countries (i.e., 155 exporters and importers). It is also estimated separately for the GMS as exporters. The analysis focuses on data for the year 2016 only.

As the simple gravity equation is inherently problematic, as shown by Anderson and van Wincoop (2003), the study uses their structural gravity model for further analysis. Equations (3) and (4) are the main contributions of this model, which accounts for multilateral trade resistances (MTR).

$$logX_{ij}^k = logY_i^k + logE_j^k + logY^k + (1 - \sigma_k)\left[log\tau_{ij}^k + log\Pi_i^k + logP_j^k\right] \quad (2)$$

$$\Pi_i^k = \sum_{j=1}^{C} \{\frac{\tau_{ij}^k}{P_j^k}\}^{1-\sigma^k} \frac{E_j^k}{Y^k} \quad (3)$$

$$P_j^k = \sum_{i=1}^{C} \{\frac{\tau_{ij}^k}{\Pi_i^k}\}^{1-\sigma^k} \frac{Y_i^k}{Y^k} \quad (4)$$

$$log\tau_{ij}^k = \beta_1 logDistance_{ij} + \beta_2 Contig_{ij} + \beta_3 ComLang_{ij} + \beta_4 Colony_{ij} + \beta_5 ComCol_{ij} \quad (5)$$

The study operationalizes the MTR terms using exporter and importer fixed effects or the Baier and Bergstrand (2009b) methodology that uses theoretically motivated MTR terms that are simple to implement. The analysis uses both approaches. Further, the possibility of zero export flows is accounted for. Since the standard gravity model is estimated in log form it is not possible to include observations with zero exports in the analysis. To get around this problem, the study adopts the pseudo Poisson Maximum Likelihood (PPML) estimator, which estimates the model in levels rather than logs. The model further allows one to control for heteroscedasticity that is inherent in gravity models.

There is a number of additional options in estimating the gravity model at the sector level. One possibility is to estimate the model separately for each sector. Another is to pool all of the data at the sector level and estimate a model with three sets of fixed effects—importer, exporter, and sector fixed effects. The study estimates the gravity model both ways. The different gravity models estimated are reported in Table A6.1.

The results reported in the main text are based on a gravity model estimated on the full sample of exporters and importers for the year 2016 that includes both importer and exporter fixed effects to control for MTR (column 3 in Table A6.1). The inclusion of these exporter- and importer-specific fixed effects implies that exporter- and importer-specific variables (such as GDP and the logistics index) cannot be included in the model. Instead of importer- and exporter-specific logistics indices, the study includes the average of these two in the analysis.

Table A6.1: Selection of Gravity Results for Total Exports

	1	2	3	4	5	6
	All Exporters	All Exporters	All Exporters	GMS Exporters Only	GMS Exporters Only	GMS Exporters Only
	Baier and Bergstrand (2009b)	PPML	Importer and Exporter Fixed Effects	Baier and Bergstrand (2009b)	PPML	Importer and Exporter Fixed Effects
Ldist	−1.220***	−0.517***	−1.210***	−0.563***	−0.276***	−0.253
	(0.0430)	(0.0629)	(0.0384)	(0.160)	(0.0965)	(0.647)
lgdp_exp	1.059***	0.782***		0.344***	0.354***	
	(0.0158)	(0.0410)		(0.0693)	(0.0778)	
lgdp_imp	0.980***	0.722***		0.880***	0.837***	
	(0.0157)	(0.0394)		(0.0491)	(0.0644)	
Comlang	0.750***	0.177	0.806***	0.467	1.208***	−1.206**
	(0.0848)	(0.184)	(0.0710)	(0.498)	(0.322)	(0.486)
Contig	0.577***	0.454**	0.662***	1.614***	0.840***	1.931***
	(0.167)	(0.197)	(0.158)	(0.508)	(0.243)	(0.631)
Comcol	0.780***	0.162	0.805***	0.132	−0.223	−0.570*
	(0.118)	(0.416)	(0.0966)	(0.296)	(0.944)	(0.308)
Colony	0.677***	0.122	0.614***	0.176	0.317	0.357
	(0.149)	(0.170)	(0.140)	(0.632)	(0.326)	(0.623)
landlocked_imp	−12.42***	2.620		57.65***	35.22***	
	(1.652)	(2.611)		(6.534)	(11.92)	
landlocked_exp	3.320*	4.534		0.907	17.55***	
	(1.913)	(3.444)		(5.469)	(6.365)	
landlocked			−0.306			−4.157***
			(0.265)			(1.237)

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Figure A6.1 *continued*

	1 All Exporters	2 All Exporters	3 All Exporters	4 GMS Exporters Only	5 GMS Exporters Only	6 GMS Exporters Only
	Baier and Bergstrand (2009b)	PPML	Importer and Exporter Fixed Effects	Baier and Bergstrand (2009b)	PPML	Importer and Exporter Fixed Effects
pta depth	0.775***	0.368***	0.635***	0.207	0.274	0.476
	(0.0583)	(0.126)	(0.0691)	(0.326)	(0.257)	(0.703)
logistics_imp	0.521***	0.547***		1.187***	0.677***	
	(0.0523)	(0.0943)		(0.172)	(0.151)	
logistics_exp	1.024***	0.132		5.433***	3.092***	
	(0.0481)	(0.102)		(0.349)	(0.447)	
logistics_avg			4.008***			2.656*
			(0.276)			(1.469)
Constant	−49.49***	−29.69***	1.852**	−39.26***	−28.64***	6.663
	(0.480)	(1.516)	(0.924)	(1.359)	(2.358)	(4.275)
Observations	13,549	17,216	14,130	610	774	616
R-squared	0.695	0.579	0.781	0.856	0.891	0.907

GDP = gross domestic product, GMS = Greater Mekong Subregion, PPML = Poisson Maximum Likelihood.

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Ldist refers to the log of distance; lgdp_exp and lgdp_imp to the logged GDP of exporter and importer, respectively; comlang, contig, comcol, and colony indicate whether importer and exporter share a common language, common border, a common colonizer, or were in a colonial relationship, respectively; landlocked_exp and landlocked_imp indicate whether the exporter or importer are landlocked, respectively, with landlocked the sum of these two variables; pta_depth is an indicator of the presence and depth of a preferential trade agreement between importer and exporter; and logistics_imp and logistics_exp are indicators of logistics infrastructure for the importer and exporter, respectively (logistics_avg is the average of the two).

Source: Authors' estimates.

Data

All the variables and their descriptions are listed in Table A6.2.

Table A6.2: List of Sectors

Sector No.	Sector	Description
1	Agriculture (intermediate)	Crop and animal production, hunting and related service activities (intermediate goods)
2	Agriculture (consumer)	Crop and animal production, hunting and related service activities (consumption goods)
3	Forestry	Forestry and logging
4	Fishing	Fishing and aquaculture
5	Mining	Mining and quarrying
6	Food (intermediate)	Manufacture of food products, beverages, and tobacco products (intermediate goods)
7	Food (consumer)	Manufacture of food products, beverages, and tobacco products (consumption goods)
8	Textiles (intermediate)	Manufacture of textiles, wearing apparel, and leather products (intermediate goods)
9	Textiles (consumer)	Manufacture of textiles, wearing apparel, and leather products (consumption goods)
10	Wood and products (intermediate)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (intermediate products)
11	Wood and products (consumer)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (consumption goods)
12	Paper and products (intermediate)	Manufacture of paper and paper products (intermediate goods)
13	Paper and products (consumer)	Manufacture of paper and paper products (consumption goods)
14	Refining	Manufacture of coke and refined petroleum products
15	Chemicals (intermediate)	Manufacture of chemicals and chemical products (intermediate goods)
16	Chemicals (consumer)	Manufacture of chemicals and chemical products (consumption goods)
17	Pharmaceuticals (intermediate)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (intermediate goods)
18	Pharmaceuticals (consumer)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (consumption goods)
19	Rubber and plastic (intermediate)	Manufacture of rubber and plastic products (intermediate goods)
20	Rubber and plastic (consumer)	Manufacture of rubber and plastic products (consumption goods)
21	Stone, glass (intermediate)	Manufacture of other non-metallic mineral products (intermediate goods)
22	Stone, glass (consumer)	Manufacture of other non-metallic mineral products (consumption goods)
23	Basic metals	Manufacture of basic metals
24	Fabricated metal (intermediate)	Manufacture of fabricated metal products, except machinery and equipment (intermediate goods)
25	Fabricated metal (consumer)	Manufacture of fabricated metal products, except machinery and equipment (consumption goods)

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Figure A6.2 *continued*

Sector No.	Sector	Description
26	Fabricated metal (capital)	Manufacture of fabricated metal products, except machinery and equipment (capital goods)
27	Electronics (intermediate)	Manufacture of computer, electronic, and optical products (intermediate goods)
28	Electronics (consumer)	Manufacture of computer, electronic, and optical products (consumption goods)
29	Electronics (capital)	Manufacture of computer, electronic, and optical products (capital goods)
30	Electricals (intermediate)	Manufacture of electrical equipment (intermediate goods)
31	Electricals (consumer)	Manufacture of electrical equipment (consumption goods)
32	Electricals (capital)	Manufacture of electrical equipment (capital goods)
33	Machinery (intermediate)	Manufacture of machinery and equipment n.e.c. (intermediate goods)
34	Machinery (consumer)	Manufacture of machinery and equipment n.e.c. (consumption goods)
35	Machinery (capital)	Manufacture of machinery and equipment n.e.c. (capital goods)
36	Automotive (intermediate)	Manufacture of motor vehicles, trailers, and semi-trailers (intermediate goods)
37	Automotive (consumer/capital)	Manufacture of motor vehicles, trailers, and semi-trailers (consumption/capital goods)
38	Other transport equipment (intermediate)	Manufacture of other transport equipment (intermediate goods)
39	Other transport equipment (capital)	Manufacture of other transport equipment (capital goods)
40	Other manufacturing (intermediate)	Manufacture of furniture; other manufacturing (intermediate goods)
41	Other manufacturing (consumer)	Manufacture of furniture; other manufacturing (consumption goods)
42	Other manufacturing (capital)	Manufacture of furniture; other manufacturing (capital goods)
43	Other (intermediate)	Other goods (intermediate goods)
44	Other (consumer)	Other goods (consumption goods)

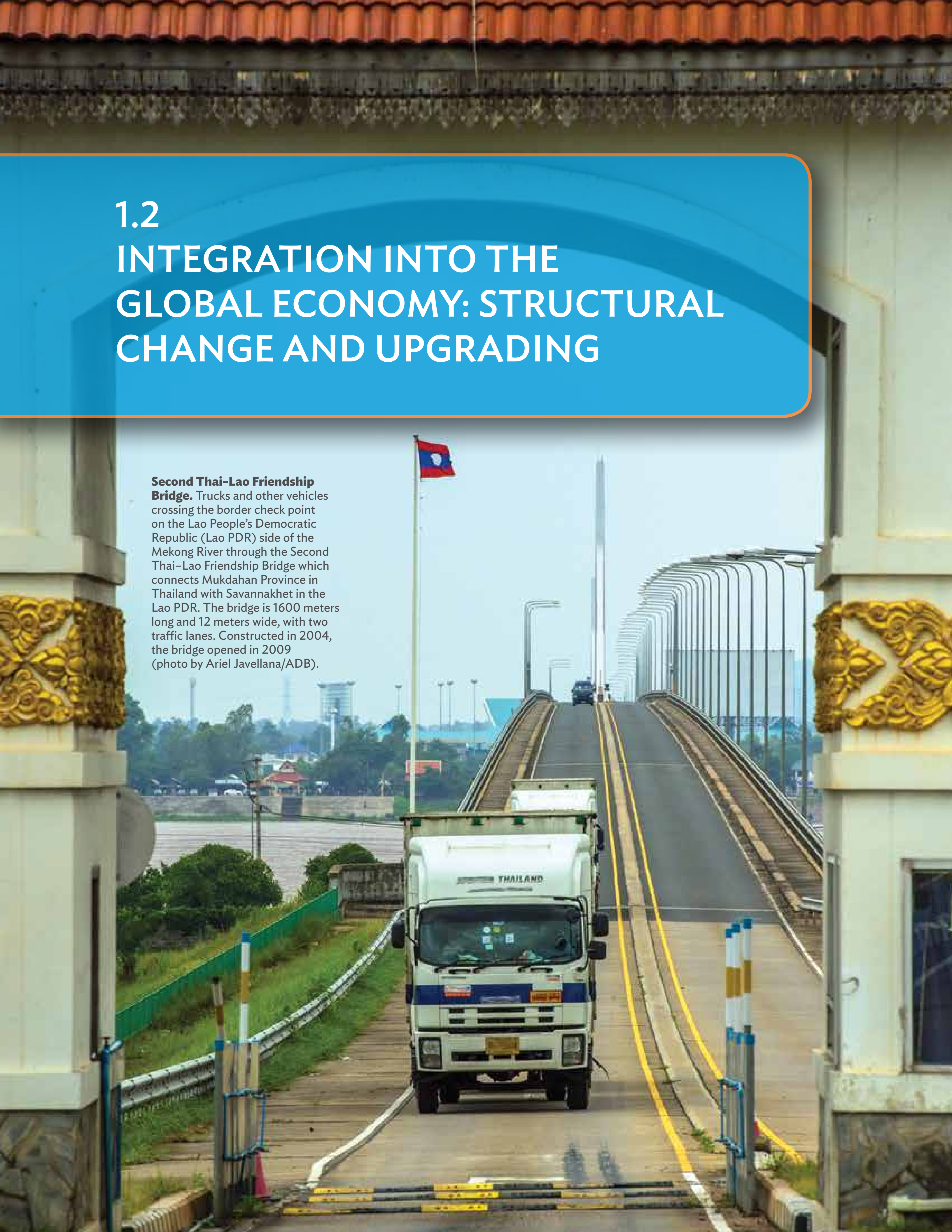
n.e.c. = not elsewhere classified.

Notes: Not all sectors have products in all value-chain stages. Some products cannot be distinguished into consumer or investment products (e.g., automobiles). Raw materials (e.g., in mining or agriculture) are treated as intermediate products.

Source: Authors, based on World Input–Output Database sectors and the United Nations' Broad Economic Categories.

Photo by Ariel Javellana/ADB.

1.2
INTEGRATION INTO THE GLOBAL ECONOMY: STRUCTURAL CHANGE AND UPGRADING



Second Thai–Lao Friendship Bridge. Trucks and other vehicles crossing the border check point on the Lao People's Democratic Republic (Lao PDR) side of the Mekong River through the Second Thai–Lao Friendship Bridge which connects Mukdahan Province in Thailand with Savannakhet in the Lao PDR. The bridge is 1600 meters long and 12 meters wide, with two traffic lanes. Constructed in 2004, the bridge opened in 2009 (photo by Ariel Javellana/ADB).

Chapter 7

Upgrading Paths in the Greater Mekong Subregion: Where To?

7.1 Introduction

Economic development is, first and foremost, a process of transformation of the economy, especially the structure of employment, with workers leaving agriculture and moving into industry and services, both sectors with higher productivity and wages than agriculture. Transformation takes place by developing new production capabilities, which allow producers to sell new products in foreign markets. As mentioned in Chapter 2, when the range of production capabilities in a country expands over time, the portfolio of products that the country exports will also expand. This is called *diversification*. At the same time, it is expected that the new products will embody more knowledge and become more *unique* or *sophisticated*. This process of developing new production capabilities aimed at producing and exporting more sophisticated products is referred to as *upgrading*. Countries at a more advanced stage of development tend to be more diversified and export more sophisticated products.

Upgrading is a gradual process that requires many different tasks that have to be completed successfully, as explained by Kremer's (1993) O-Ring theory (see Introduction Chapter). As production capabilities accumulate, the development of new capabilities opens up new options for upgrading. In practice, the experience of many countries has been one of moving in small steps in the upgrading process. Moreover, there is *path dependence* (countries jump to products that require capabilities similar to those embodied in the products being produced) in the transition to new products, i.e., countries do not *leapfrog* (big jumps to much more sophisticated products). The accumulation of many such small steps eventually leads to large jumps in terms of development. It took quite some time for advanced Western countries to accomplish this. Some Asian countries have achieved this faster, and hence have reached high income per capita in record time. Other countries are undergoing this process much more slowly (Felipe, Kumar, and Galope 2017).

The analysis in this chapter aims to identify the most promising *upgrading paths* for the Greater Mekong Subregion (GMS) members, both for the short run and the long run. Chapter 8 provides a similar analysis for agriculture, given the importance of this sector in the GMS. The study defines a country's upgrading path as a basket of products currently not exported with comparative advantage, but with production capabilities that are close (related) to its existing capabilities (as evidenced by current exports). In other words, the upgrading paths identify the accumulation of small steps that is typical of historical development paths. The upgrading path will allow a country to improve its export portfolio (i.e., become more diversified and sophisticated) and, in turn, improve its level of economic development. Because the GMS members differ in the production capabilities they have mastered, upgrading opportunities will be different among them, although there are also similarities.

It is important to stress the usefulness and limitations of this analysis. The information here is meant to guide policy makers. It is based on a robust methodology that relies on two concepts: (i) the ease of acquiring comparative advantage in a product; and (ii) the product's sophistication, which the study refers to as *complexity*. This leads to the identification of products that will enhance the country's capabilities portfolio and allow further upgrading (i.e., gain comparative advantage in products that embody more knowledge). The analysis should not be taken in the normative sense, that is, as the products the study necessarily recommends for government support. Rather, they can be considered to represent the types of products which GMS members could successfully export, and hence be upgrading opportunities.

The study's findings indicate that the GMS members can be divided into two main groups in terms of the characterization of their upgrading paths. On the one hand, Cambodia, the Lao PDR, and Myanmar export with comparative advantage mostly products that embody little knowledge and that are not complex (discussed in the next section). Therefore, accessible upgrading opportunities for these countries are mostly in other low- or medium-complexity products. On the other hand, Thailand, Viet Nam, and especially the PRC already export complex products with comparative advantage, and therefore these countries have access to upgrading opportunities in higher complexity products.

7.2 Complexity and Its Relevance

The analysis starts by constructing an index called *product complexity* (PC) to measure the relative value of products in the diversification and upgrading process. PC is a measure (index) that takes into account the degree of *diversification* of an economy (i.e., the number of products exported with comparative advantage) and the *uniqueness* of the export basket (i.e., the number of countries that export a given product with comparative advantage). These two variables were introduced and discussed in Chapter 3 of the document. PC is constructed using country information on diversification together with information on the uniqueness of a product.[33]

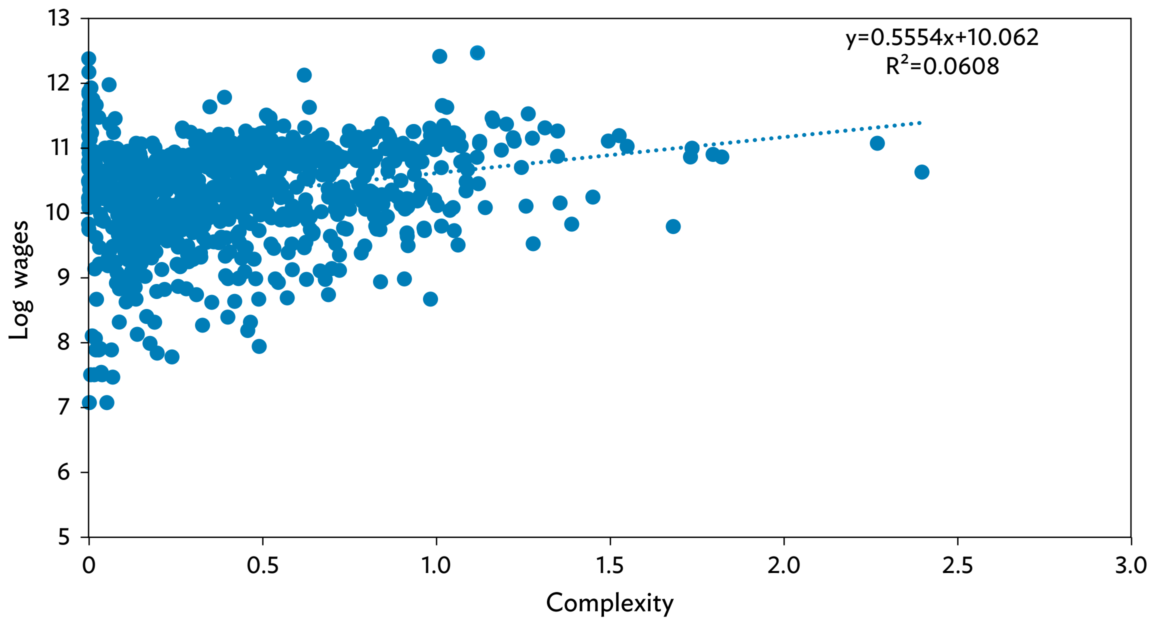
Products highly ranked in the complexity scale (high PC values) are the products that developing countries can aspire to export. Exporting these products will require countries to develop the necessary production capabilities because products with high PC require advanced capabilities. This is what the study calls *upgrading*.

It is important to understand the relevance of PC for policy making. Its relevance derives from the fact that there is a clear (statistically significant) positive relationship between PC and wage rates, that is, more complex products are associated with higher wages. This means that upgrading the economic structure should be at the core of the economic policy of a nation.

[33] This study's specific measure of complexity is the one proposed by Tacchella et al. (2013). The authors call this measure "product quality."

This relationship is documented in Figure 7.1, which reports for the year 2014 a scatterplot of PC and average wages, with both variables aggregated to 21 sectors for 43 countries.[34] The figure further reports a line of best fit. The slope of this line is positive, indicating that more complex sectors earn higher wages.[35] This is why upgrading to more complex sectors is of paramount importance.

Figure 7.1: Relationship between Wages and Average Complexity of World Input–Output Database Sectors



Source: Authors' calculations based on data from United Nations Comtrade, the World Input–Output Database, and the World Development Indicators.

[34] The analysis uses a correspondence between the World Input–Output Database (WIOD) sectors and detailed trade data (i.e., assigning each traded product to one of the WIOD sectors). The average complexity of each WIOD sector is then constructed as the weighted average of the complexity levels of each product in a particular WIOD sector, where the weights used are the export shares.
The analysis also uses wage data from the WIOD, which reports information on labor compensation (in millions of national currency) and the number of persons engaged (in thousands). The analysis uses this data along with data on the consumer price index (CPI) and the international purchasing power parity (PPP) conversion rate from the World Bank's World Development Indicators to construct a comparable measure of wages across countries and time. The following steps are used to create a comparable measure of wages: (i) construct average wages as the ratio of labor compensation in national currency to the total number of employees, (ii) deflate wages in national currencies using the consumer price index from the World Development Indicators to get real wages in national currency at 2010 prices, and (iii) use the PPP conversion rate for 2010 to convert wages in 2010 national currency to 2010 international PPP dollars.

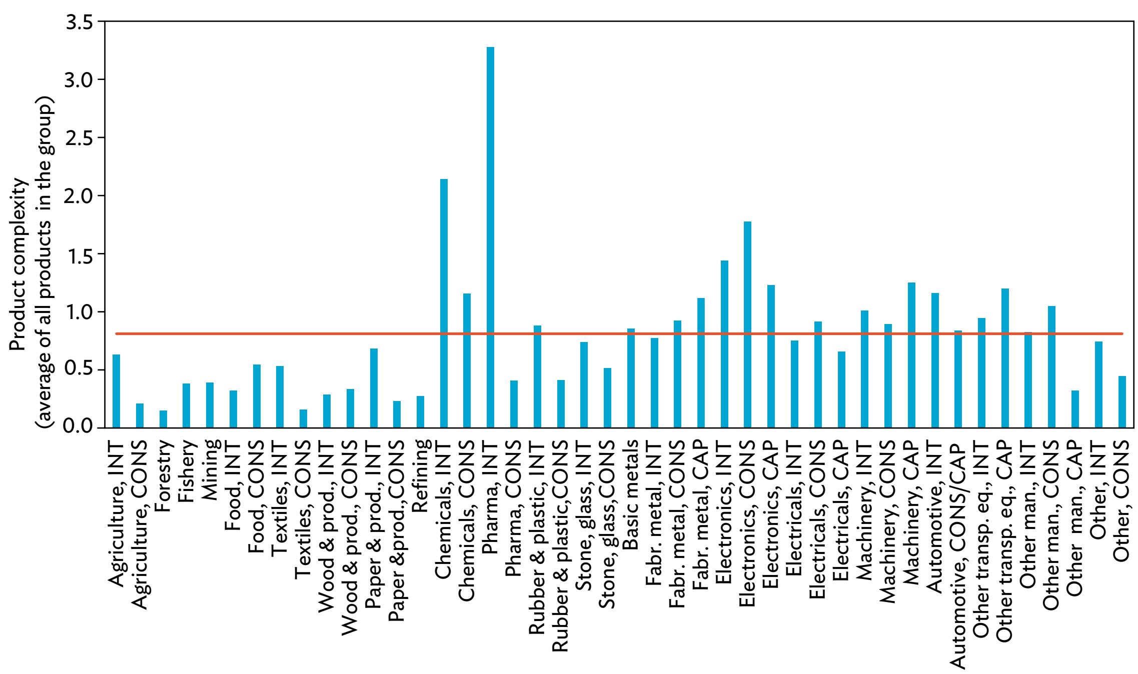
[35] To have an idea of how much wages rise as complexity increases, note that the coefficient (slope) of the regression in Figure 7.1 is 0.5554. This means that the impact of a one standard deviation (equivalent to 0.35) change is exp(0.55*0.35) = 21% higher wages. This could also be stated in terms of a move from the 10th percentile (with PC of 0.055) to the 50th percentile (with PC of 0.37) of the distribution of complexity, i.e., exp[0.55*(0.37–0.055)] = 19% higher wages; or from the 25th percentile (with PC of 0.16) to the 50th percentile, i.e., exp[0.55*(0.37–0.16)] = 12% higher wages.

The analysis also considers the share of products in a sector that a country already exports with comparative advantage. Information on this indicator is useful and relevant since a country can only further upgrade in sectors where there are still products not exported with comparative advantage (potential products).

This study assesses the upgrading potential in 5,197 products aggregated into 44 sectors, which are a combination of broad production sectors that are further classified from a value chain perspective into capital goods, consumption goods, and intermediate goods. Distinguishing by value-chain stage is useful because this difference is often related to the complexity of the products (PC), with activities in the middle of the value chain often considered to involve less complex activities, for example. Splitting by value-chain stage also provides a link to the global value chain analysis in other chapters. The 44 sectors are reported in Table A7.1 of Appendix 7.1.

Figure 7.2 documents the average PC score of these 44 sectors. The red line indicates the average of all 5,197 products. Above-average PC values are in 18 of the 44 sectors. The sector with the highest PC score is intermediate pharmaceutical products. Intermediate chemicals and consumer electronics products are also sectors with high PC. The lowest PC values are found in consumer textiles products, a sector that is important in the GMS, and also in forestry and consumer agriculture products.

Figure 7.2: Average Product Complexity Score by Sector, 2012–2018



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Notes: The red line indicates the average of all products. See Table A7.1 for definitions of sectors.

Source: Authors' estimates.

7.3 Export Structure and Product Complexity in the Greater Mekong Subregion

Because the current structure of exports is a main determinant of an economy's upgrading path, this section will look at what the GMS members export and the PC score of each export sector. The analysis includes data for Guangxi Zhuang Autonomous Region and Yunnan Province (results for the entire PRC are in Figure A7.1 in Appendix 7.3) as well as the other five members of the GMS. Figures 7.3(a)–7.3(g) present the share of the sector in total exports (right axis) and the deviation of average PC in the sector from the global average PC of that sector (left axis). This latter variable is called competitiveness, with a number above zero indicating that countries are able to export above-average complexity goods in that sector. The figures show that:

(i) Cambodia's (Figure 7.3(a)) exports depend strongly on exports of consumer textiles, which account for over 75% of the country's total exports. Despite this high share, the PC of this sector is somewhat below the global average, indicating that Cambodia is only able to compete in relatively low-complexity goods in consumer textiles. There are, however, three sectors with exports that have PCs well above the global average: intermediate textiles products, consumer rubber and plastic products, and consumer/capital automotive. Still, 37 out of the 44 sectors have PCs that are below the global average.

(ii) Guangxi (Figure7.3(b)) has a diversified export profile. Textiles products (both intermediate and consumer), refining, capital electronics products, and capital machinery products are the largest sectors. This region also has a higher-than-average PC in 19 of the 44 sectors, including basic metals and the different fabricated metals and electrical goods sectors.

(iii) Yunnan (Figure 7.3(c)) is a little less diversified than Guangxi but is still among the most diversified within the GMS. Consumer agriculture goods, consumer food products, consumer textiles products, intermediate chemical products, and capital electronics products are the sectors with the largest export shares. PC is particularly high in intermediate rubber and plastic products in this province. In total, there are 17 sectors in which PC is higher than the global average.

(iv) The Lao PDR (Figure 7.3(d)) has a mildly diversified economy, less diversified than Guangxi and Yunnan. Its largest export sector is other consumer products, a small sector globally. In the Lao PDR, this is mainly electricity. Other important export sectors are mining and intermediate chemicals. The sectors' PC scores are generally below the global average. Only four sectors have PC scores higher than the global average, with fabricated metal capital goods and other transport capital equipment having the highest PC.

(v) There is little diversification in Myanmar's (Figure 7.3(e)) exports, with two sectors, consumer textiles products and mining, accounting for about 75% of total exports. Basic metals and agriculture (intermediate and consumer products) are also important export sectors. PC scores are generally low with just four sectors having PC scores higher than the global average, with intermediate products in other transport equipment reporting the highest PC in Myanmar.

(vii) Thailand (Figure 7.3(f)) has a very diversified export structure. Electronic capital goods, electronic intermediate goods, intermediate chemicals, consumer food products, and consumer/capital automotive are the largest export sectors. However, most sectors in Thailand are below the global average in terms of PC. Consumer agriculture products and other transport capital equipment, which have relatively high PC levels, are the two main exceptions.

(vii) Viet Nam's (Figure 7.3(g)) export structure is fairly diversified, with consumer textiles products, intermediate electronics products, and capital electronics products the three largest sectors (together, these account for about 60% of total export value). PC scores in Viet Nam are below the global average for most sectors, with the level of PC in consumer machinery products and consumer fabricated metal products the two main exceptions.

Figure 7.3: Export Shares and Complexity Relative to the Global Average

(a) Cambodia

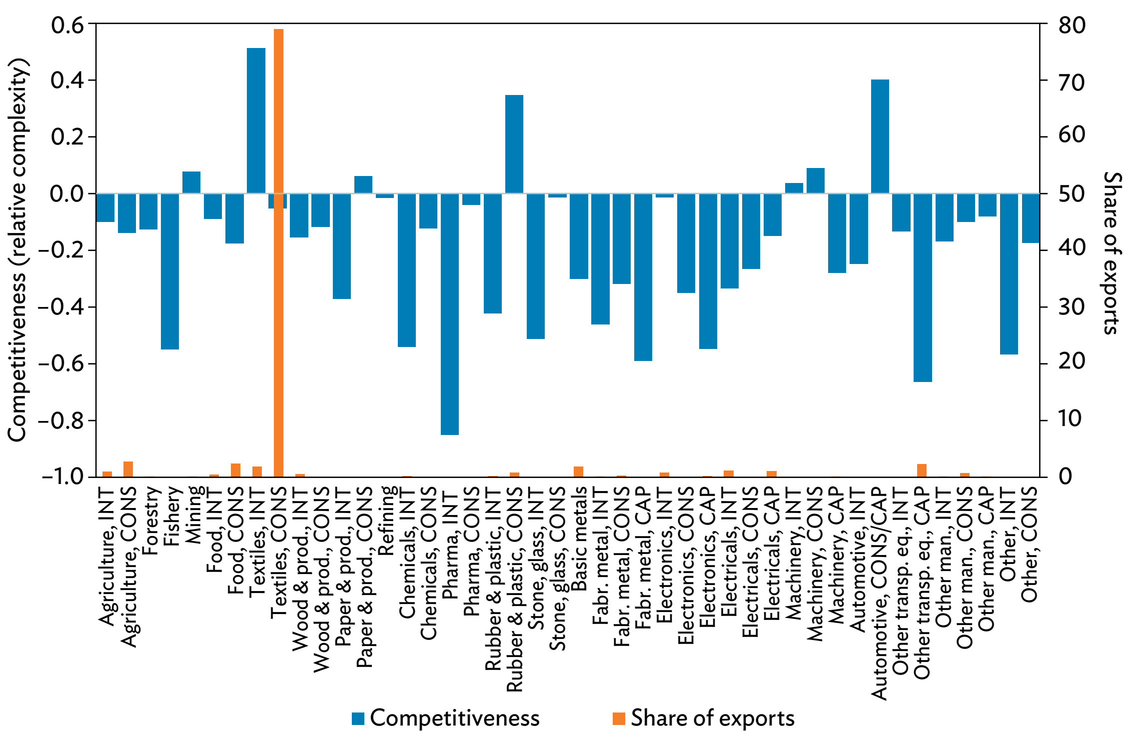


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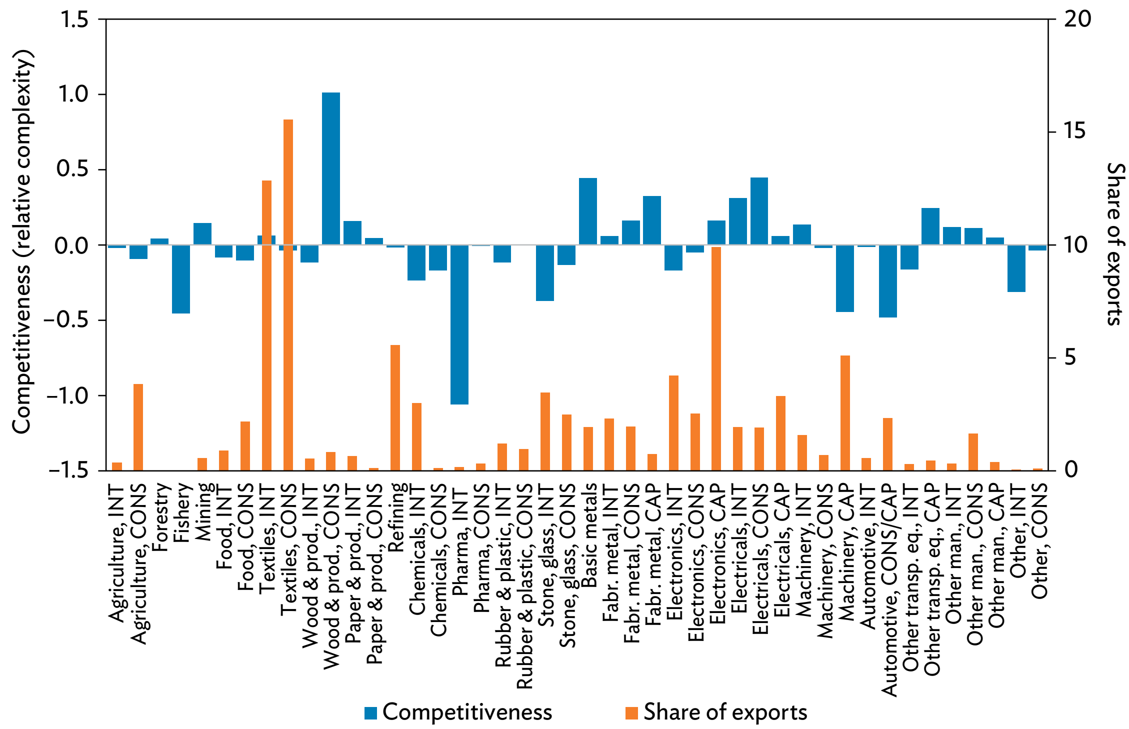
Figure 7.3 *continued*

(b) Guangxi Zhuang Autonomous Region



(c) Yunnan Province

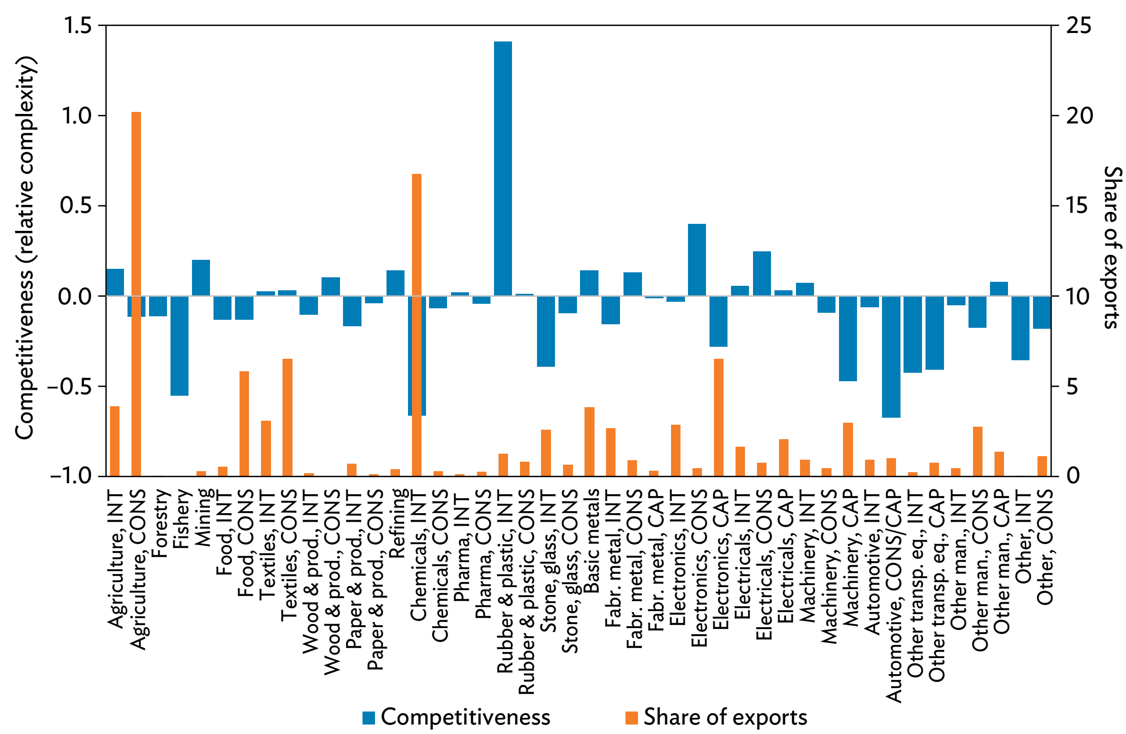


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Figure 7.3 *continued*

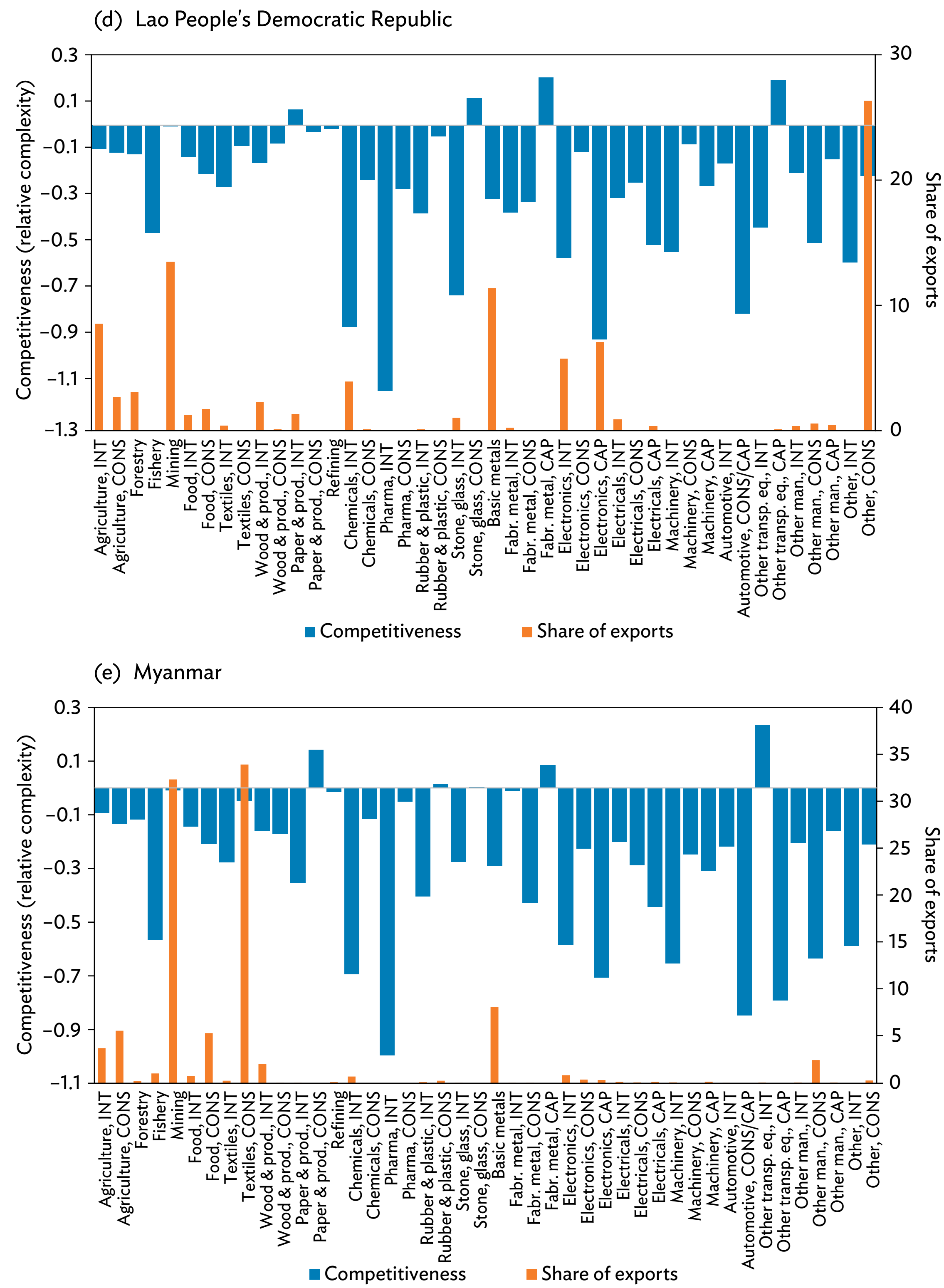

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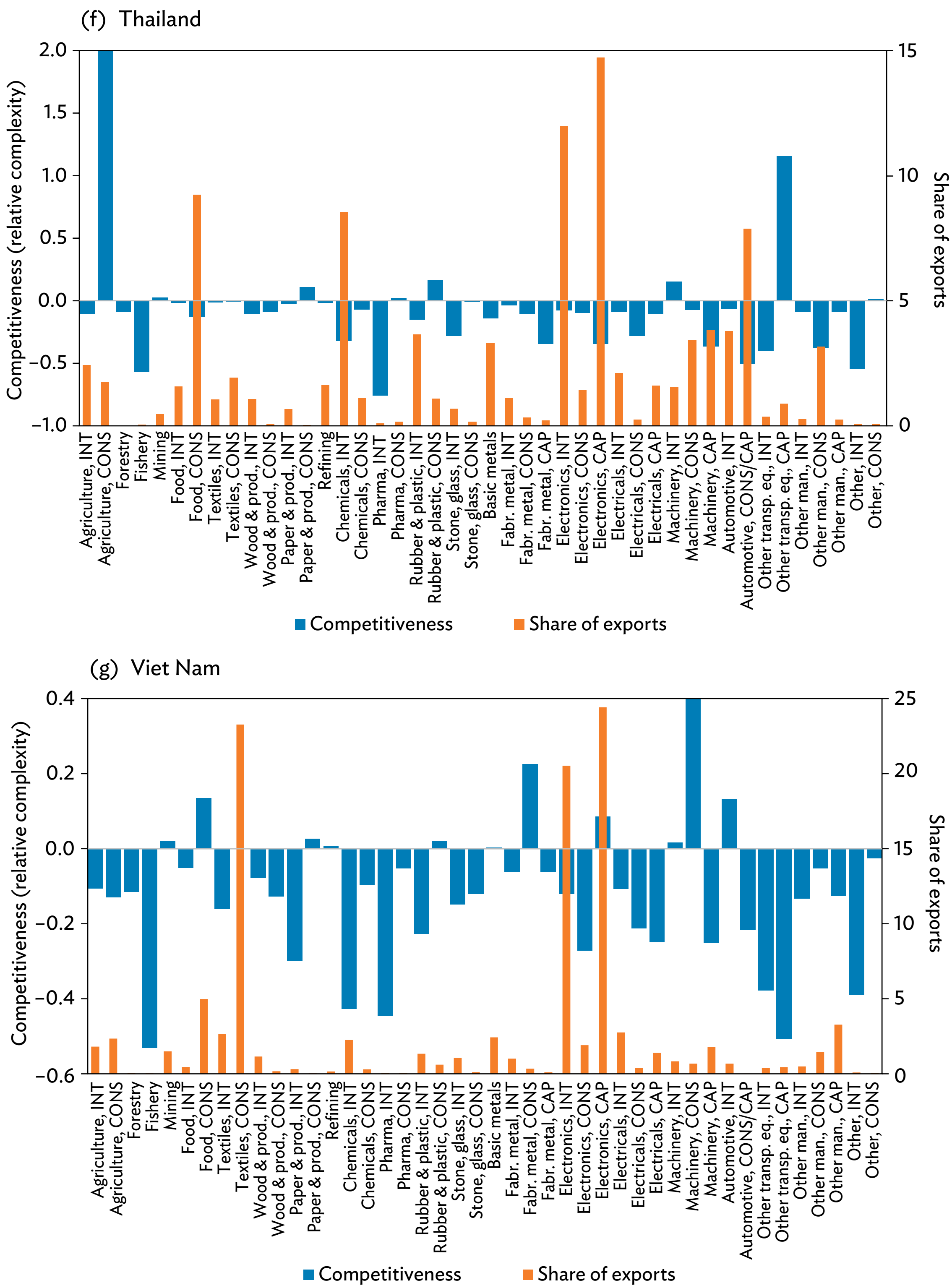
Figure 7.3 *continued*



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.
Note: See Table A7.1 for definitions of sectors.
Source: Authors' calculations based on United Nations Comtrade data.

7.4 Upgrading Paths in the Greater Mekong Subregion —Conceptual Framework

The analysis that follows presents a useful approach in identifying sectors that are likely good targets for improving an economy's overall capabilities and complexity, which ultimately leads to an upgrading of the economy. The approach is clearly not the only one, however. There are many dimensions that could be considered when looking to identify such (sub)sectors. Details are in Appendix 7.2

To make both the analysis and also recommendations manageable, the analysis considers two particular dimensions that appear highly relevant in existing work.[36] First, in every sector, the analysis divides all products into two groups: the group of products currently exported with comparative advantage by the GMS member under consideration and the group of products not exported with comparative advantage. This latter group comprises the set of potential products. Comparing the PC of the potential products with that of the products in which the country has a comparative advantage provides an indicator of *potential upgrading gain* (PUG). A large difference between the PC of the potential products and that of the products currently exported with comparative advantage implies a large potential upgrading gain, with the products without comparative advantage having a high PC relative to the products currently exported with comparative advantage.

A second indicator called *upgrading relatedness* (UR) measures how potential products (products in which a GMS member has not yet acquired comparative advantage) are related to the products that a member currently produces with comparative advantage. A high level of UR implies that the set of potential products is relatively accessible. While UR is a product-specific indicator, in the analysis that follows this variable is aggregated to the sector level. The UR measure (aggregated or not) also differs across countries (even for the same product), since each country has its own current specialization profile.

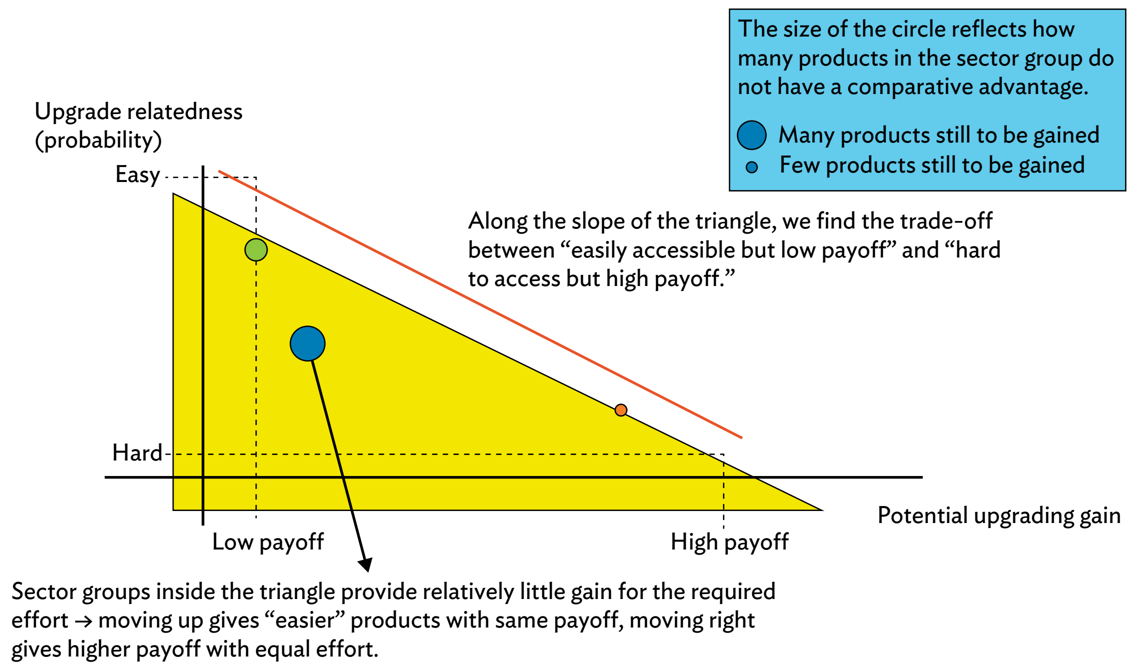
Implicit in this thinking—and confirmed by the empirical analysis—is a trade-off between the two dimensions used in this analysis. The ease of acquiring comparative advantage in a particular sector is likely dependent on a member's current capabilities but also on the complexity of the sector and its products, with more complex sectors and products likely more difficult to achieve comparative advantage.

Consequently, the result is an upgrading triangle, with sectors that are easy to acquire a comparative advantage (UR) having lower complexity (PUG), and sectors with a higher complexity being more difficult to obtain a comparative advantage. According to this methodology, the "best" options for GMS members are to target those sectors that appear along the edge of the triangle, i.e., those with the highest ease of obtaining comparative advantage, the highest sophistication gains, or some combination of the two.

[36] This is not to say that other indicators are not potentially useful or that these additional indicators or other—perhaps political—considerations should not be used when making choices on policies regarding sectoral targeting. Nevertheless, the approach used in this study provides a useful and meaningful tool focused on the potential complexity gains from targeting certain (sub)sectors that can feed into the decision-making process.

The triangle in Figure 7.4 is representative of what the actual empirical analysis will show in the next section. *Potential upgrading gain* (PUG) is on the horizontal axis and *upgrading relatedness* (UR) on the vertical axis. The circles in the graph are examples of the sectors into which all products are aggregated (see list of products in Table A7.1 in Appendix 7.1).

Figure 7.4: Upgrading Triangle



Source: Authors.

As mentioned above, the outer part of the graph shows that there is a generalized trade-off between PUG and UR. Sectors with high UR (easy to move into) generally have low PUG (low-complexity gain), e.g., the green circle; while sectors with high PUG (high-complexity gain) have low UR (hard to get into), e.g., the orange circle. Thus, it appears that large gains (PUG) are relatively hard to achieve (low UR), while the opportunities that are easiest to achieve (high UR) tend to have relatively low gains (PUG). This is indicated by the downward-sloping line of the graph.[37]

Note that sectors that are not on or close to the trade-off line (i.e., those well inside the triangle) represent opportunities that are somehow inefficient, e.g., the blue circle. For example, when moving to the right from a point inside the triangle, we find opportunities with potentially more gains (PUG on the horizontal axis) that are not more difficult to access (UR on the vertical axis remains constant). Similarly, more accessible options can be found without sacrificing potential gains by moving upwards from a point inside the triangle.

[37] The outer line is indicative only. It is not the result of any statistical estimation.

The trade-off in the triangle offers a discussion of where to go in the coming decades. One end of the trade-off, high UR and low PUG, represents the relatively easy options for industrial policy, but it also presents low potential gains. The other end, high PUG and low UR, shows the sectors with potentially higher gains, but these also require stronger (policy) efforts. The reality for most developing countries, including the members of the GMS, is that they need to decide the direction where they want to move to see wages and income per capita increase in the coming decades. This will happen only if significant shares of workers shift to the production of more complex products (and services) because complex sectors pay higher wages. It is difficult to leave this process or decision to the market because the market does not guarantee that niches will open up in the areas that will ensure progress. At the same time, this study is not suggesting that countries should prioritize the products (sectors) suggested in the analysis by providing them with subsidies and penalizing other products (sectors). What the study argues is that the sectors suggested here should be considered by policy makers in discussions about the future of their economies.

Therefore, this analysis can be useful in two ways. First, the methodology described helps to understand how wages can increase (i.e., a country's wages are determined by the sophistication of the products it produces or exports). Hence, a GMS member's economic policy and national plans should incorporate this idea (i.e., the development of new production possibilities) and make it the center of a development strategy. Second, from a practical point of view, the analysis on how an improvement or upgrading takes place can be useful in discussions between the public and private sectors. Ultimately, firms make the products that the analysis refers to. Are firms aware of the possibilities these products offer? Do they have plans to acquire the necessary capabilities to produce them? Can they do it? Are there any public inputs required? These are the kinds of questions that could be considered relevant and important in these public–private dialogues, which may increase the awareness of private sector firms and provide valuable insights into bottlenecks and appropriate policy interventions for governments.

7.5 Upgrading Paths in the Greater Mekong Subregion —Overview

The detailed analysis of upgrading paths in the GMS presented below highlights a number of general findings and associated policy conclusions. One important finding is that the dichotomy between GMS members that was highlighted earlier has implications for upgrading paths. One group of members is not yet very diversified in terms of exports, and the short-run upgrading opportunities for this group are mainly located in low-tech or resource-based industries (such as textiles, paper, and wood). In these industries, this group of GMS members can find that are not yet exported with comparative advantage, but which are relatively easily accessible in terms of production capabilities that need to be developed. The sophistication level (PC) of these products is relatively low, but they do provide a stepping stone to more sophisticated products in the longer run (long-run upgrading paths).

The less-diversified GMS members can also reach for somewhat more sophisticated products in different industries, but this may require more elaborate plans to enhance production capabilities in domestic firms, e.g., through training programs, export promotion, and investment policies. Industries in which such opportunities present themselves are fabricated metals, machinery, and electricals.

If successful upgrading takes place in these economies in the short to medium run, new upgrading opportunities will emerge in the longer run. These new opportunities will contain more advanced and sophisticated product options, which are made possible by short-run upgrading and the policies that facilitate such upgrading. The GMS members that are not yet so diversified can see such long-run upgrading opportunities emerge in sectors such as chemicals, machinery, and rubber and plastic. The sectors that offer short-run upgrading options, however, will also not be depleted in the longer run. It is likely that these will continue to play a role in the industrialization of these members for a while to come.

The GMS members that are already more diversified have a broader range of upgrading opportunities in the short run, with opportunities existing in medium-tech industries, such as automotive (mostly in terms of parts) and machinery. The long-run upgrading paths of these countries and regions may even venture into high-tech production, for example, pharmaceuticals or specialized machinery. As is true with the less-diversified economies, policy and public–private dialogue will continue to play an important role in the success of the members' diversification and upgrading efforts.

7.6 Upgrading Paths in the Greater Mekong Subregion—Short-Run Results

This section applies the methodology introduced in previous sections to construct the upgrading triangle for the GMS members and for Guangxi Zhuang Autonomous Region and Yunnan Province (the upgrading triangle for the entire PRC is shown in Figure A7.2 in Appendix 7.3). The current section focuses on the short-run upgrading paths, with the following section reporting the long-run results. These long-run results are constructed under the assumption that GMS members do indeed acquire comparative advantage (in the short run) in some new products. Table 7.1 provides a summary.

The short-run results are shown in Figures 7.5(a)–7.5(g). The size of the circles represents the share of products in the sector without comparative advantage. In other words, smaller circles represent sectors in which an economy already has comparative advantage for a relatively large number of products, and hence further upgrading opportunities are limited. The graphs show only the sectors with positive PUG and positive UR, such that not all 44 sectors appear in each of the figures.

Figure 7.5(a) shows Cambodia's upgrading triangle. The circles for Cambodia are approximately of equal size. This is a reflection of a highly concentrated export structure: Cambodia has most of its comparative advantage in consumer textiles products, leaving many opportunities to achieve comparative advantage within a broad range of sectors. To illustrate a set of sectors worth considering as sectors to focus on, three sectors are colored green and three orange. The green sectors are relatively easy to access (high UR) but offer relatively low potential gains (low PUG). The green sectors are intermediate textiles products, consumer wood and wooden products, and consumer stone and glass products. The orange sectors are further down the red trade-off slope: these sectors have higher potential gains but lower upgrade relatedness. The orange sectors are capital and intermediate fabricated metal products and consumer machinery products.

The upgrading triangle for Guangxi is presented in Figure 7.5(b). While there are a few relatively small circles, the majority of the circles are large, which means that Guangxi can acquire a comparative advantage in many products. Consumer paper and paper products, intermediate automotive products, and intermediate rubber and plastic products are the green sectors for Guangxi. The orange sectors are consumer chemicals, intermediate stone and glass products, and consumer/capital automotive products.

Figure 7.5(c) shows Yunnan's upgrading triangle. Yunnan has many more small circles than Guangxi. Similar to Guangxi, however, intermediate automotive is also a green sector in Yunnan, while consumer chemicals and consumer/capital automotive are also orange sectors. The other green sectors in Yunnan are intermediate machinery products and intermediate fabricated metal products, while the other orange sector is intermediate chemicals.

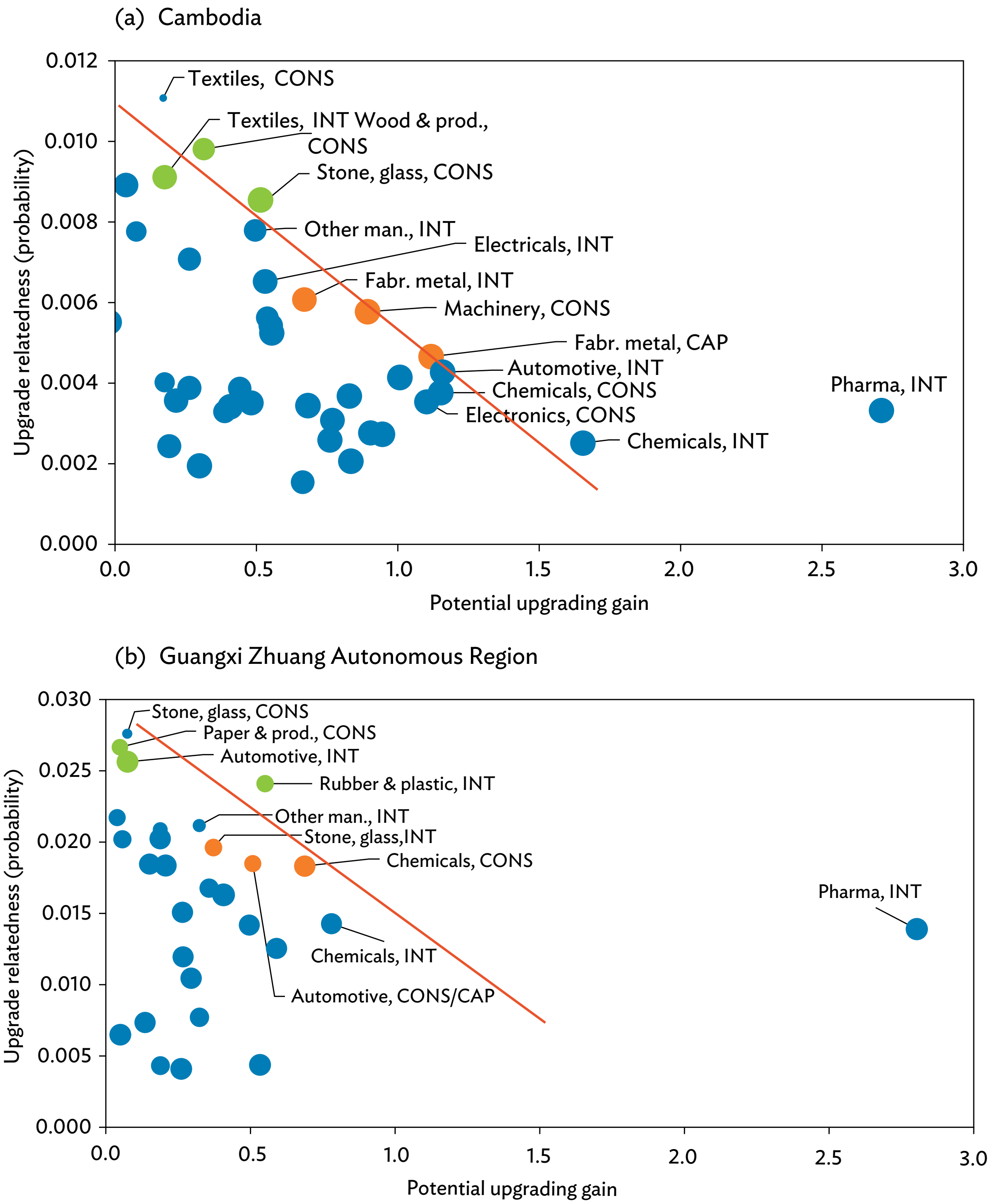
Figure 7.5(d) shows the upgrading triangle for the Lao PDR. In this graph, consumer textiles products stand out with a high UR value, which makes this also a green sector. The other green sectors are capital other manufacturing products and consumer paper and products. The orange sectors are consumer fabricated metal, consumer electrical products, and intermediate other manufactures. The Lao PDR has no sectors with very small circles, indicating that there are comparative advantages to be gained almost everywhere.

The upgrading triangle for Myanmar is displayed in Figure 7.5(e). Consumer textiles products have high UR, but Myanmar already has comparative advantage in most products in this sector. Accordingly, the green sectors are consumer wood and wooden products, intermediate textiles products, and capital other manufacturing products. The orange sectors are consumer fabricated metal products, consumer machinery products, and consumer electrical products.

Thailand's upgrading triangle is shown in Figure 7.5(f). The green circles are relatively small, which is consistent with the country's relatively high level of diversification (the green sectors have relatively few new products in which to gain comparative advantage, but these few products are relatively easy to reach). The green sectors are intermediate rubber and plastic products, intermediate automotive products, and intermediate electrical products. The orange circles are somewhat larger. These orange sectors are capital fabricated metal products, consumer electrical products, and consumer chemical products.

Finally, the upgrading triangle for Viet Nam is in Figure 7.5(g). Here the green sectors are intermediate textiles products, consumer paper and products, and intermediate other manufacturing products. The orange sectors are consumer chemical products, intermediate chemical products, and consumer/capital automotive products.

Figure 7.5: Short-Run Upgrading Triangles



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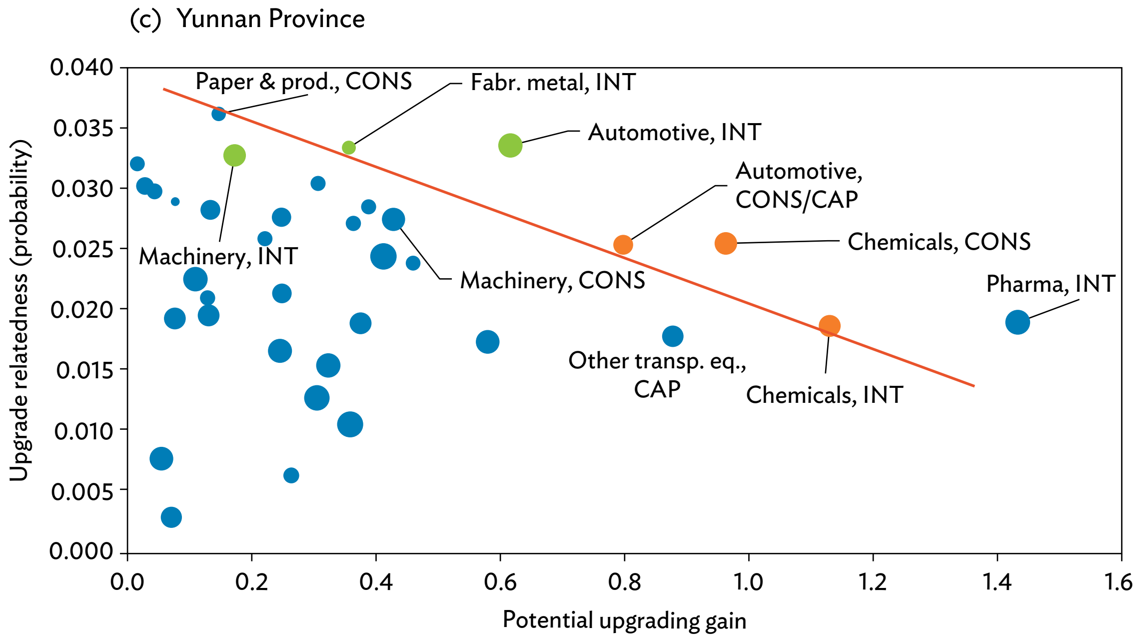

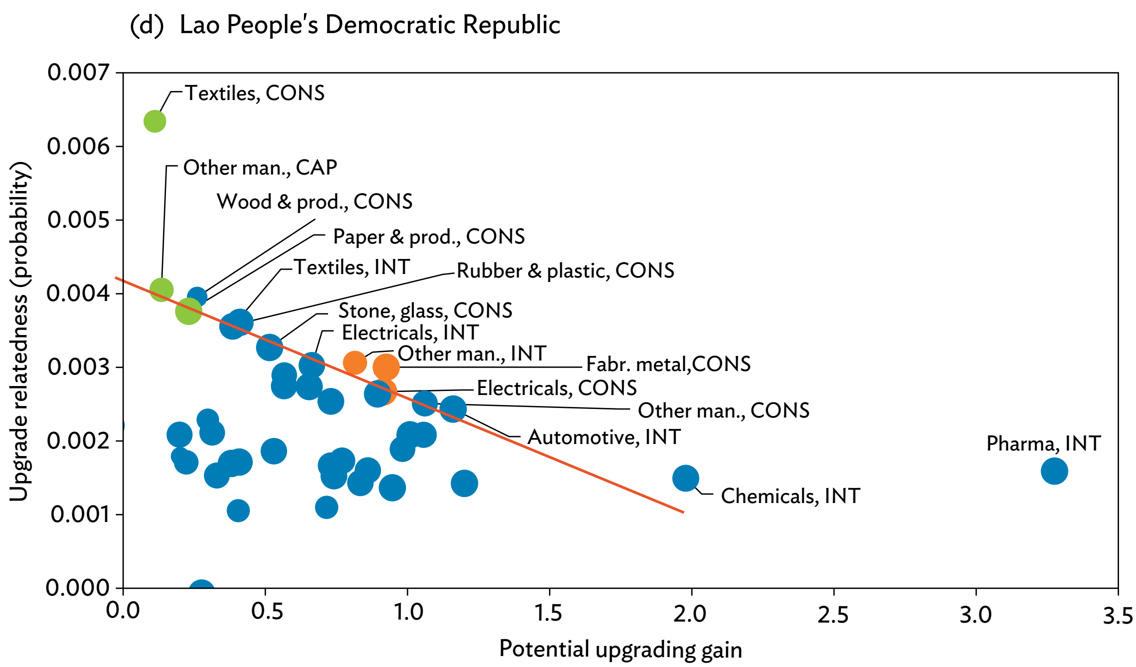

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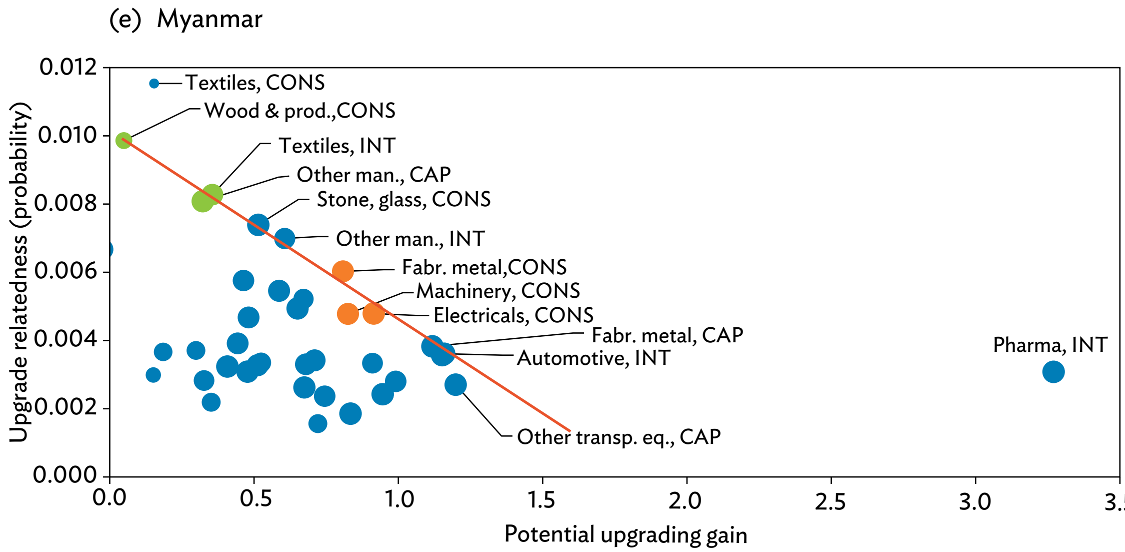

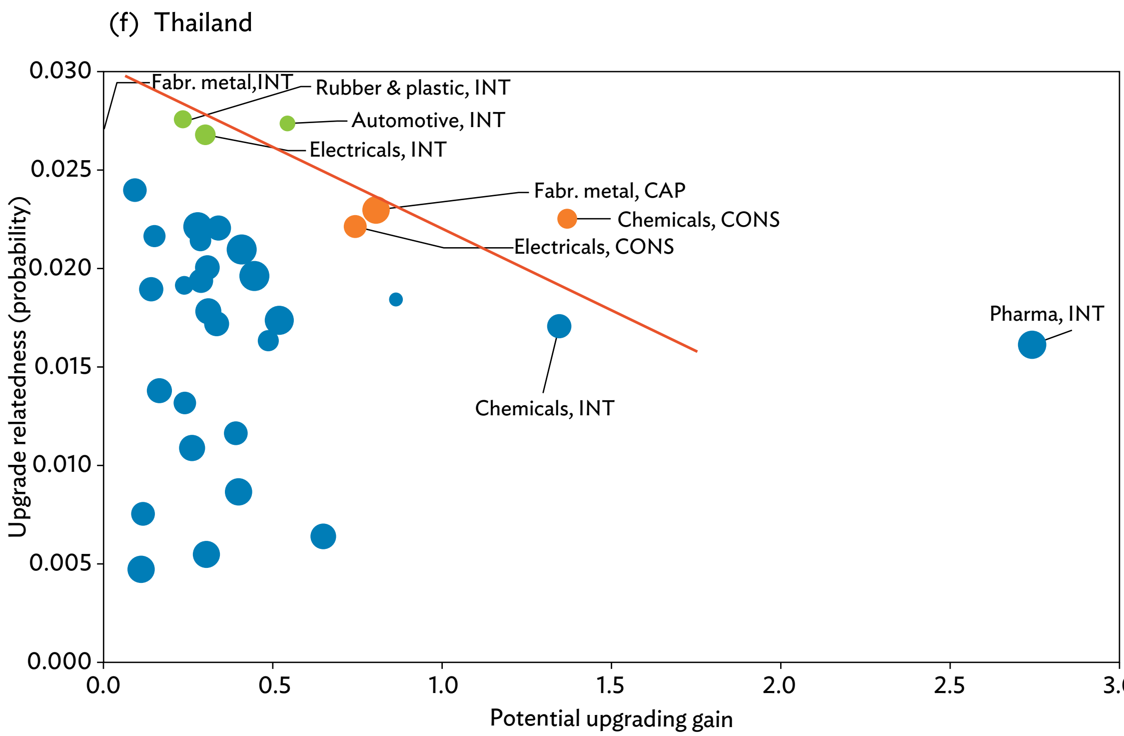

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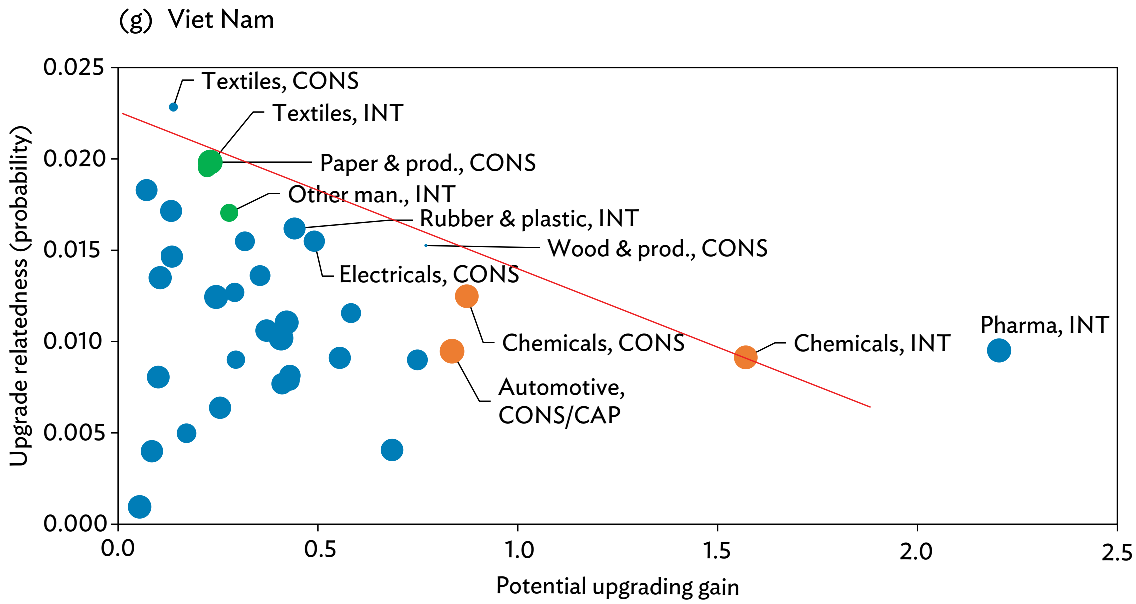


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Notes: The size of the circles represents the share of products in the sector without comparative advantage (bigger circles indicate more upgrading opportunities). Green (orange) circles are sectors that are more accessible but offer lower (higher) potential gains. See Table A7.1 for definitions of sectors.

Source: Authors.

The left-hand side of Table 7.1 (Short Run) provides a summary, including examples of products within each sector and for each GMS member, Guangxi Zhuang Autonomous Region and Yunnan Province, that provide either high upgrading opportunities (green cell) or large potential complexity gains (orange cell). The upgrading triangles show that the idea of shared production capabilities between products and sectors provides a useful policy perspective on upgrading. Because production capabilities are shared among products, some upgrading opportunities are more easily accessible than others, i.e., the products that a member does not yet export with comparative advantage but for which it has relevant production capabilities. This suggests that a specific industrial policy aimed at particular products is likely a better way of thinking about industrial policy than a generic policy framework that is not aimed at specific sectors or products.

To avoid confusion in the argument and proposal, it is important to stress the point made earlier, namely that this exercise is not to suggest that countries should prioritize the products (sectors) suggested in the analysis by providing them with subsidies and penalizing other products (sectors). What the study argues is that the products (sectors) suggested here should be considered by policy makers in discussions about the future of their economies. This thinking ought to be in terms of specific products, rather than in terms of a generic policy. Certainly, the subject of industrial policy is a controversial one, much more so when the idea of picking winners surfaces. The proposal in this study is grounded in the view that the market alone will not provide the necessary incentives for firms to invest in those advantageous economic activities that will serve as a springboard and shorten the time to becoming a

Table 7.1: Summary of Greater Mekong Subregion Upgrading Opportunities

	Short Run		Long Run	
	Sectors	**Product Examples**	**Sectors**	**Product Examples**
Cambodia	• Textiles (INT) • Wood and products (CONS) • Stone and glass (CONS)	• Cotton yarn, woven synthetic fabric • Tableware, rattan plaiting	• Rubber and plastic (INT) • Electricals (INT) • Fabricated metal (INT)	• Tubes and pipes, plastic lamps • Lamp parts, battery parts • Mountings for furniture, screws and washers, skid chain
	• Fabricated metal (INT) • Machinery (CONS) • Fabricated metal (CAP)	• Table- and kitchenware, statuettes • Rivets, washers, sanitary ware • Dishwashers, storage heaters • Specialized hand tools, boilers, hedge shears	• Fabricated metal (CAP) • Machinery (CAP) • Chemicals (CONS)	• Specialized hand tools, super-heated boilers • Tube mills, induction furnaces • Polishes and creams for coachwork, modelling paste
Lao People's Democratic Republic	• Textiles (CONS) • Other man. (CAP) • Paper and products (CONS)	• Woolen women's suits, synthetic track suits • Office furniture, kitchen furniture • Cigarette paper, toilet paper	• Stone, glass (CONS) • Fabricated metal (INT) • Rubber and plastic (INT)	• Glass table- and kitchenware • Furniture mountings, tabular rivets • Rubber tubes, conveyor belts
	• Other man. (INT) • Fabricated metal (CONS) • Electricals (CONS)	• Magnetic parts, lamp parts, battery parts • Table- and kitchenware, razors and blades • Defrosting equipment, nickel-cadmium batteries	• Other man. (INT) • Fabricated metal (CAP) • Electricals (INT)	• Buttons, pens • Specialized hand tools, boilers • Lamps and parts, voltage limiters
Myanmar	• Wood and products (CONS) • Other man. (CAP) • Textiles (INT)	• Table- and kitchenware • Office furniture, upholstered seats • Synthetic woven fabrics, cotton yarns	• Fabricated metal (INT) • Rubber and plastic (INT) • Machinery (CONS)	• Nails, screws, bolts, sanitary ware • Rubber tubes and pipes • (Dish)washing machines, air pumps
	• Machinery (CONS) • Fabricated metal (CONS) • Electricals (CONS)	• Air pumps, parts for washing machines • Table- and kitchenware • Clocks, watches, calculators	• Electricals (INT) • Fabricated metal (CAP) • Chemicals (CONS)	• Battery parts, lamp parts • Specialized hand tools, boilers, tanks • Aftershave preparations, manicure preparations

continued on next page

Table 7.1 *continued*

	Short Run		Long Run	
	Sectors	**Product Examples**	**Sectors**	**Product Examples**
Thailand	• Rubber and plastic (INT) • Automotive (INT) • Electricals (INT)	• Raw rubber, rubberized textile fabrics • Gear boxes and parts, chassis with engines • Sound signaling equipment, signaling parts	• Machinery (INT) • Machinery (CAP) • Fabricated metal (CAP)	• Flywheels, electrical handling equipment • Industrial robots, injection-molding machines • Screwdrivers, pipe cutters
	• Electricals (CONS) • Chemicals (CONS) • Fabricated metal (CAP)	• Defrosters, batteries, tungsten halogen lamps • Eye makeup, hair lacquers, coach work polishes • Specialized hand tools, spanners	• Pharmaceuticals (INT) • Chemicals (INT) • Chemicals (CONS)	• Choline, ergotamine, salicylic acid • Adipic acid, terpene alcohols • Artist's paints, modelling glue
Viet Nam	• Textiles (INT) • Other man. (INT) • Paper and products (CONS)	• Flax and artificial woven fabrics, yarn • Pens, buttons • Envelopes, paper apparel	• Fabricated metal (INT) • Machinery (INT) • Fabricated metal (CAP)	• Skid chain, screws and bolts • Chain sprockets, jacquards • Super-heated boilers, pliers, chainsaws
	• Chemicals (CONS) • Automotive (CAP/CONS) • Chemicals (INT)	• Aftershaves, special paints, makeup preparations • Small motor cars • Ketones and quinone, hydrocarbons	• Chemicals (CONS) • Electricals (CONS) • Rubber and plastic (INT)	• Polishes and creams for coachwork, eye makeup • Nickel-cadmium batteries, halogen lamps • Raw rubber, tubes, pipes
(PRC) Guangxi Zhuang Autonomous Region	• Paper and products (CONS) • Automotive (INT) • Rubber and plastic (INT)	• Envelopes, tissues • Suspension systems, engine parts • Amino resin materials	• Other (CONS) • Pharma (CONS) • Machinery (INT)	• Electricity • Antisera, vaccines • Chains
	• Stone, glass (INT) • Automotive (CONS/CAP) • Chemicals (CONS)	• Worked mica • Golf carts, fire engines • Make up, special pastes	• Chemicals (INT) • Automotive (CONS/CAP) • Chemicals (CONS)	• Tarred macadam • Golf carts, containers • Perfumes, makeup
(PRC) Yunnan Province	• Fabricated metal (INT) • Automotive (INT) • Machinery (INT)	• Cotters, rivets, nuts • Suspension systems, engines • Textile machinery parts, transmission shafts parts	• Machinery (INT) • Machinery (CONS) • Machinery (CAP)	• Parts for machine tools, needle roller bearings • Self-tapping screws • Engines, bodies
	• Chemicals (INT) • Automotive (CONS/CAP) • Chemicals (CONS)	• Oxygen-function amino-compounds, binders for foundry molding • Road tractors • Makeup, artists' paints	• Automotive (CONS/CAP) • Chemicals (CONS) • Chemicals (INT)	• Caravans, golf carts • Recording media, film • Dichlorofluoroethane, tilidine (INN) and its salts

CAP = capital goods, CONS = consumer goods, INT = intermediate goods, PRC = People's Republic of China.

Notes: Consistent with the upgrading paths discussed earlier, sectors and products in green indicate more accessible upgrading opportunities, while sectors and products in orange indicate larger potential complexity gains. See Table A7.1 for definitions of sectors.

Source: Authors.

high-income country and catching up with the frontier.[38] There are information and coordination failures that slow down diversification and upgrading toward complex activities, characterized by having a high income elasticity of demand; they compete on quality not price, allow improvements in a quality ladder, and absorb investment; and they are produced by workers who experience human capital accumulation. Hence, some type of public intervention will be needed to relax the market failures that prevent their development. As noted in the introductory chapter, all successful cases of upgrading around the world have involved government intervention. Today, the key to upgrading lies in the strategic collaboration between public and private sectors in identifying the specific coordination and information failures that slow down diversification and upgrading of production and export structures.

The analysis has suggested potential products that can be considered in policy discussions for each GMS member. In terms of sectors, some of these are common to several members. However, the study also finds sectors and products that are specific to a single member. Even for shared policy options, there is a variety of products that the study's relatively aggregated graphs do not cover.[39]

7.7 Upgrading Paths in the Greater Mekong Subregion —Long-Run Results

As already explained, the upgrading triangles are based on the specific export diversification structure of each economy. If a GMS member manages to upgrade, i.e., to gain comparative advantage in additional products as a result of efforts by firms to upgrade, then the shape of the triangle will change. Therefore, the triangles presented thus far can be considered short-run upgrading opportunities. This further implies that the long-run upgrading opportunities on offer will depend upon how successful a country is in achieving the short-run gains on offer.

To get a sense of the potential change in the upgrading triangles in the long run, the analysis will now turn to the results of a simulation analysis. In this simulation, the export diversification structure of each GMS member was "upgraded" by assuming that each member gained a comparative advantage in the top 20% of products with the highest UR (i.e., products in which a member did not have a current comparative advantage, but which provided the easiest opportunities for upgrading based upon existing capabilities). The analysis also assumed that the GMS members did not lose comparative advantage in any product currently exported with comparative advantage. Combining information on the products currently exported with comparative advantage and the products in which countries were assumed to gain comparative advantage in the short run, the entire analysis was repeated to produce a new set of upgrading triangles (while keeping the export diversification structure in all other economies fixed) that reflect long-run possibilities for upgrading.

[38] There is a large literature on the shortcomings of markets that refers to the existence of externalities, time horizons, systemic effects, fundamental innovations, static versus dynamic efficiency, and increasing returns. All these justify some kind of public intervention to guide the economy toward the production of the complex activities mentioned in the text.

[39] This variety (detailed product level) may present additional policy guidance and is available from the authors.

The resulting long-run upgrading triangles are shown in Figures 7.6(a)–7.6(g) (the upgrading triangle for the entire PRC is shown in Figure A7.3 in Appendix 7.3). It must be stressed that these long-run triangles are strongly influenced by the assumptions made (i.e., upgrading in 20% of the products of all sectors), and therefore they are indicative of the long-run potential of a country or region, rather than a prediction of what will actually happen in the long run. Whether these potential long-run upgrading paths will be realized or not depends, among other things, on policy. The final two columns of Table 7.1 summarizes these results:

(i) Compared to the short-run triangle (Figure 7.5(a)), Cambodia's long-run upgrading triangle (Figure 7.6(a)) shows that sectors have moved up on the slope of the UR–PUG trade-off schedule. For example, intermediate electrical products and intermediate fabricated metal products are now part of the green set. However, because of the intricate way in which product capabilities are (apparently) related, new sectors also rise, moving toward the edge of the triangle. This is the case, for example, for capital fabricated metal products.

(ii) Guangxi's long-run upgrading triangle (Figure 7.6(b)) shows that many of the high UR sectors are small circles, i.e., in the long-run simulation, this region has already acquired comparative advantage in a majority of the products in these sectors. Two relatively large green sectors are other consumer products and consumer pharmaceutical products. The three orange sectors, consumer and intermediate chemicals and consumer/capital automotive products, are the only sectors on the slope with fairly large circles.

(iii) The upgrading triangle for Yunnan (Figure 7.6(c)) likewise shows many small circles, especially near the upper part of the slope. The three machinery sectors (intermediate, capital, and consumer) make up the green sectors. Intermediate and consumer chemicals and consumer/capital automotive are the orange sectors.

(iv) There are relatively many new sectors rising to the slope of the Lao PDR's long-run upgrading triangle (Figure 7.6(d)), such as intermediate rubber and plastic products and intermediate fabricated metal products. The consumer textiles sector no longer appears on the slope, but intermediate textiles is still close to the line, indicating the changing role of textiles in the long-run in the GMS.

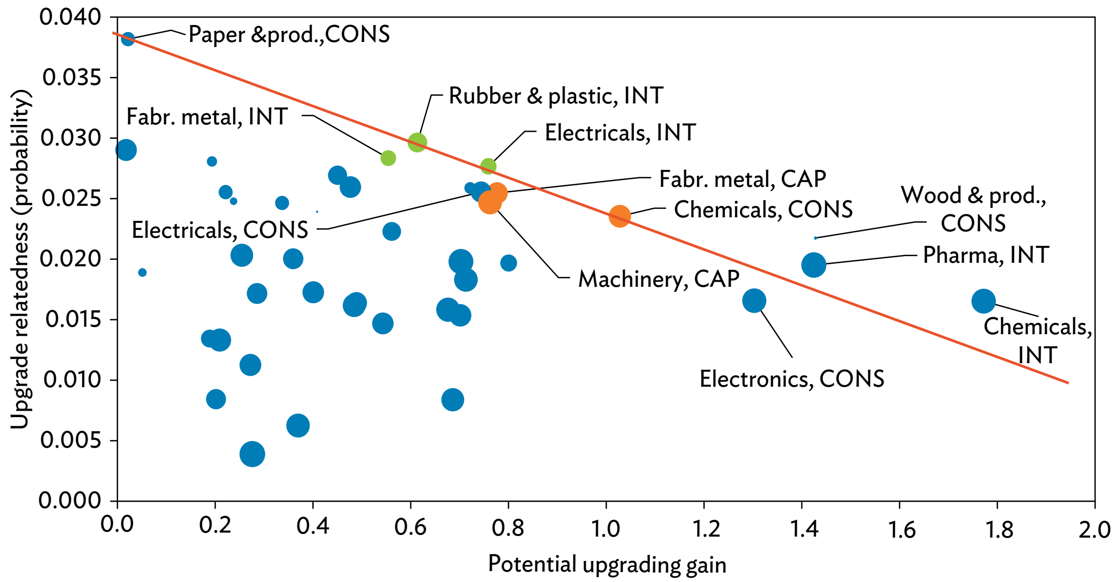
(v) The long-run upgrading triangle for Myanmar (Figure 7.6(e)) shows consumer machinery products moving up along the slope, while consumer chemicals is a sector that rises from the inside to the edge of the triangle.

(vi) Thailand's long-run upgrading triangle (Figure 7.6(f)) shows intermediate and capital machinery products rising from the inside to the edge of the triangle, in the green group. Intermediate pharmaceuticals is no longer the sector with the largest PUG value.

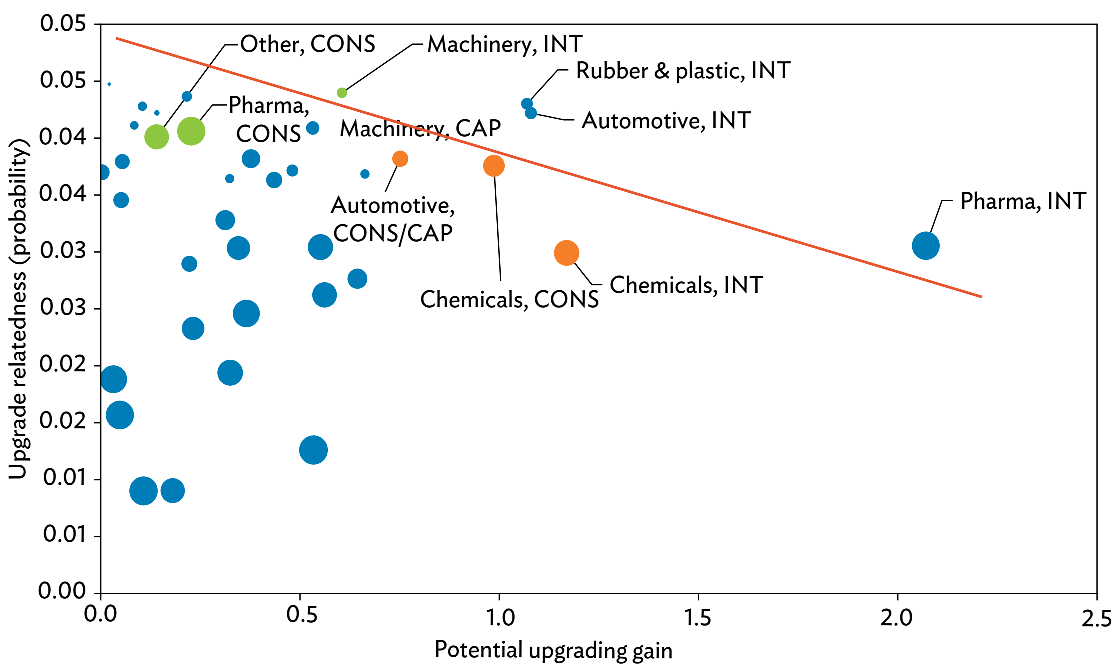
(vii) Finally, in Viet Nam (Figure 7.6(g)), intermediate electricals, intermediate fabricated metal products, and intermediate machinery products move toward the frontier of its long-run upgrading triangle.

Figure 7.6: Long-Run Upgrading Triangles

(a) Cambodia



(b) Guangxi Zhuang Autonomous Region



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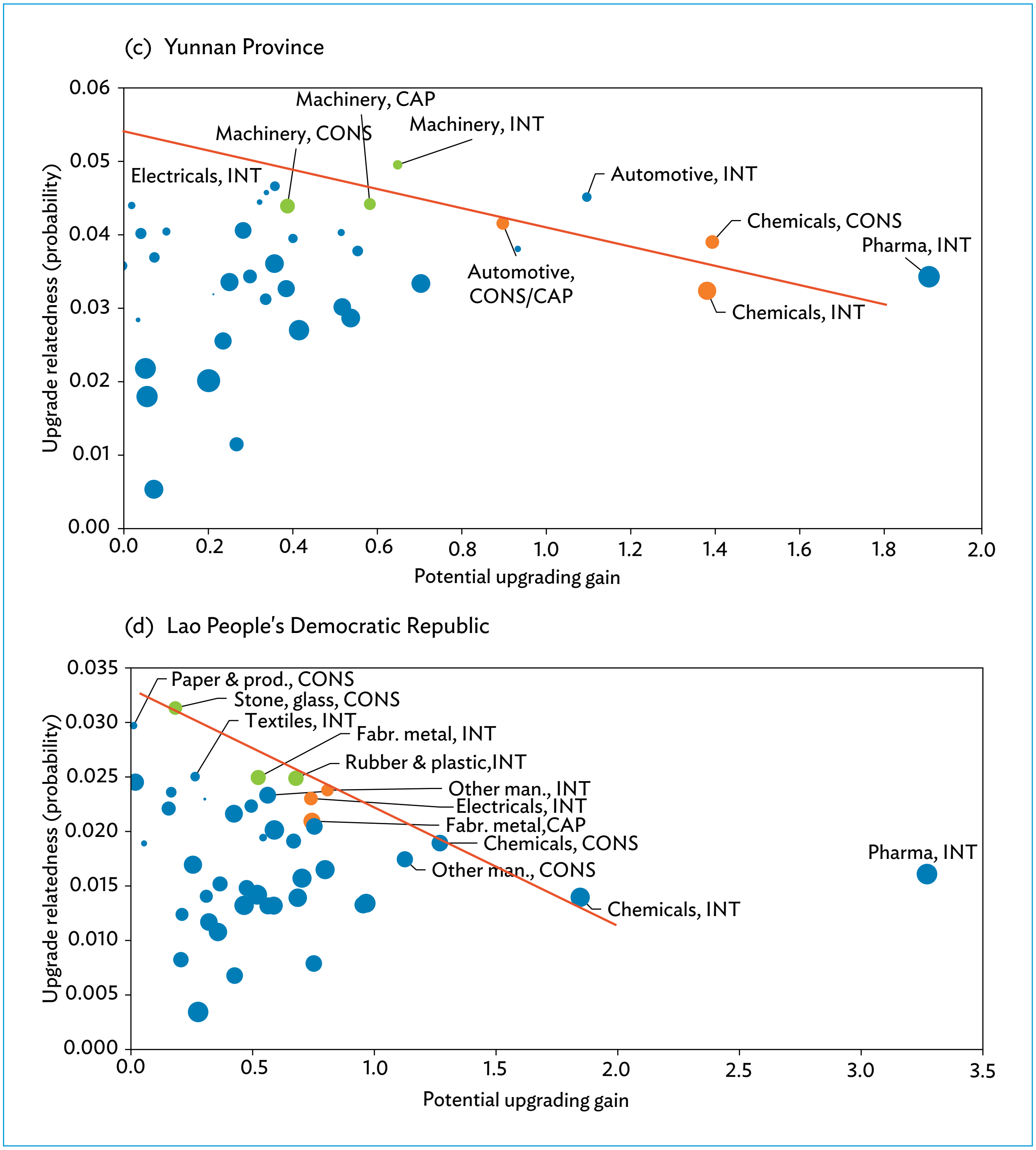

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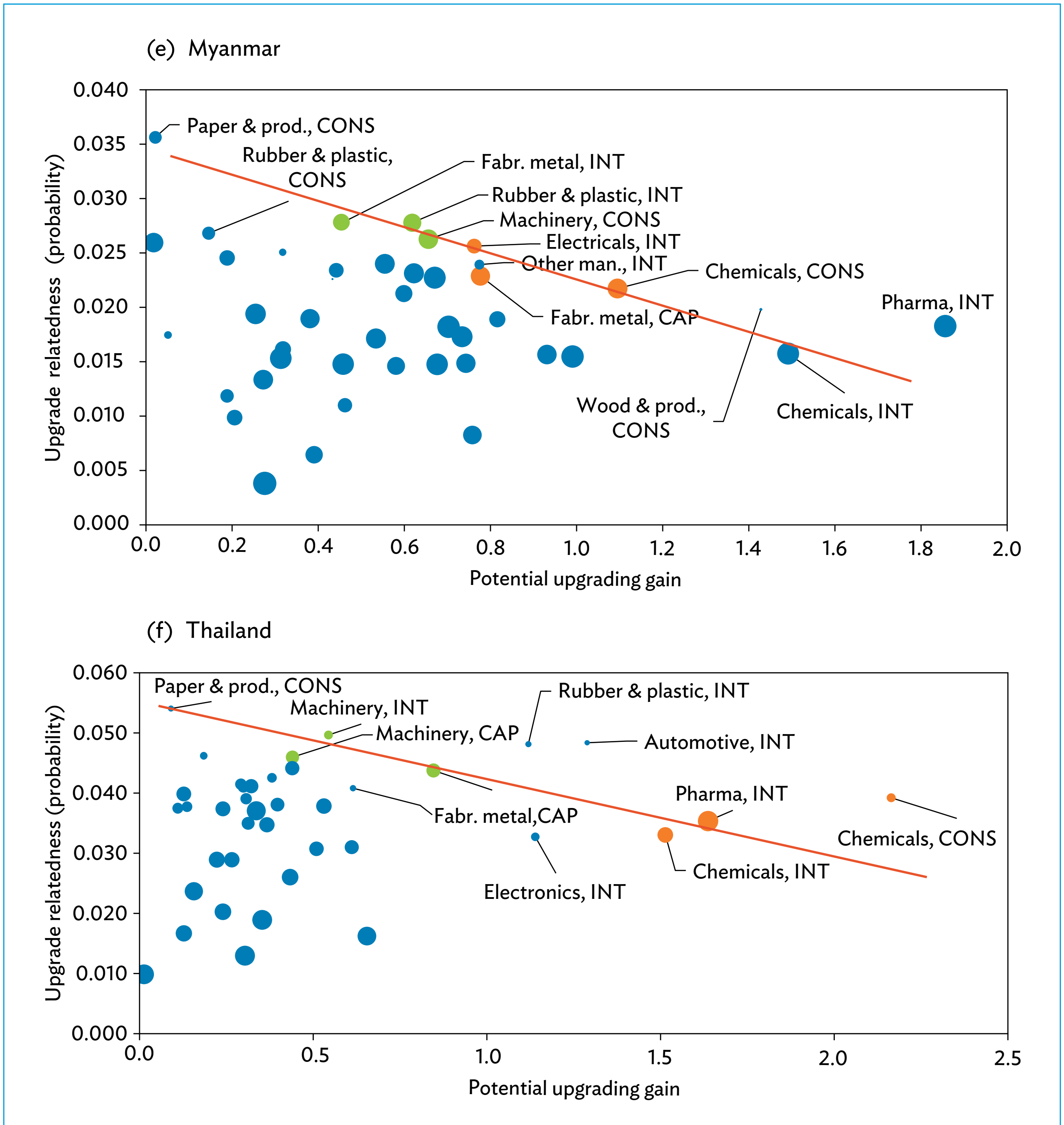

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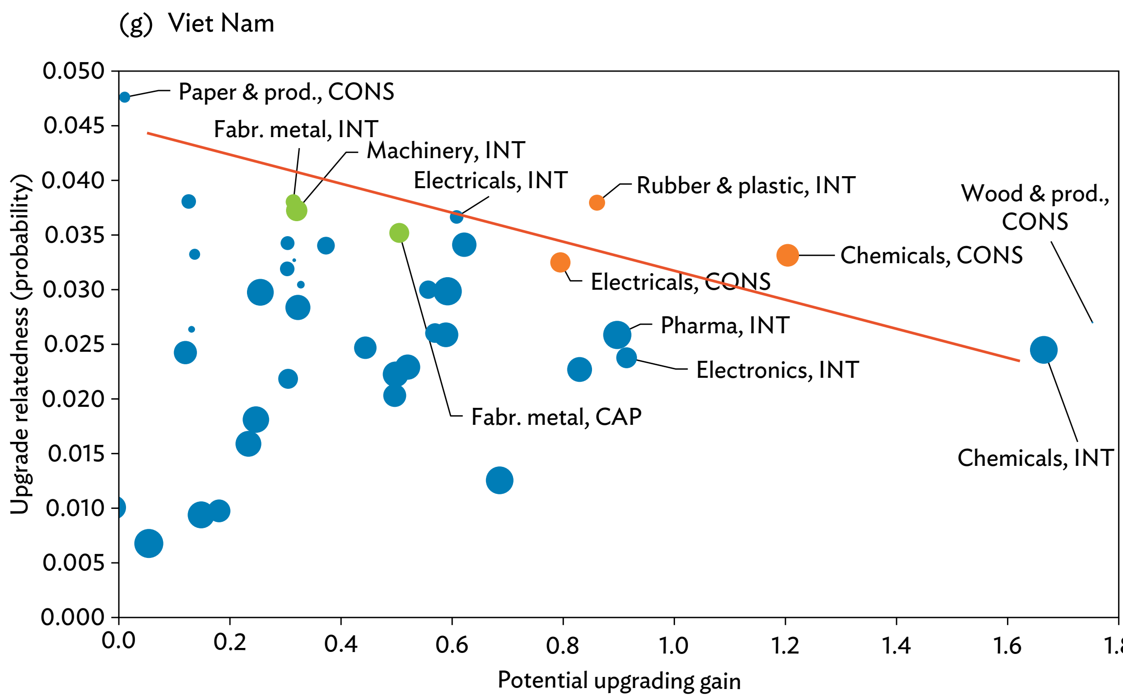

CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Notes: The size of the circles represents the share of products in the sector without comparative advantage (bigger circles indicate more upgrading opportunities). Green (orange) circles are sectors that are more (less) accessible but offer lower (higher) potential gains. See Table A7.1 for definitions of sectors.

Source: Authors.

While it is important to keep in mind that the results reported in these figures rely on some strong assumptions, the analysis is suggestive of the importance of upgrading in products that are relatively close to the GMS members' current capabilities (i.e., the short-run upgrading opportunities) in order to ultimately move into high-tech sectors and highly complex products in the long run. This is most obvious for the GMS members where capabilities are already relatively high, but it is also true for Cambodia, the Lao PDR, and Myanmar, which have fewer capabilities. In these three countries, opportunities may develop, for example, in electronics, chemicals, and fabricated metals if they are able to take the short-run upgrading opportunities on offer. The right-hand side of Table 7.1 (Long Run) includes some of the specific products for which long-run upgrading opportunities may arise.

7.8 Conclusions

Development is about "discovering" new products that bring new and more value added to the economy. The new products that can be added to a country's comparative-advantage set in the (near) future depend on what the economy currently exports successfully. GMS members are rather diverse in terms of their current export specialization structures. Thus, each member has its own upgrading path for realizing future diversification. This chapter has presented potential upgrading paths for the GMS that are based on current specialization patterns as well as the idea of related variety.

What these upgrading paths represent are possible road maps of further industrialization, or economic development more broadly, including an overall increase in income and the creation of new employment. These road maps are specific to each GMS member, and they call for both private investment in new production capabilities and (public) policy to facilitate these plans. Industrial policy to make these upgrading paths possible will have to be specific to the industry that is targeted, because specific capabilities need to be created. The policy will also have to be comprehensive in addressing all production factors that are involved in the process. Hence, human capital (training of workers), entrepreneurship, export promotion, and investment in knowledge and tangible capital will have to be elements of the policy and the upgrading paths.

If the GMS members manage to realize (a part of) these upgrading paths, new upgrading opportunities will open up, with these opportunities often in highly complex products. Upgrading and development is a cumulative process, an idea that this study implemented by way of simulating long-run upgrading paths. These upgrading paths, both long run and short run, provide policy guidance for specific industrial policy that is specific to each GMS member.

Appendix 7.1

Data

The data used for this analysis come from United Nations Comtrade, which reports data on bilateral exports and imports at the six-digit Harmonized System product level for a large number of reporter (and partner) countries. The data are reported in thousands of US dollars. In the analysis for this report, the study uses data for the period 2016–2018, using the 2012 version of the Harmonized System, with data collected for a common sample of 155 countries.

Table: A7.1: List of Sectors

Sector No.	Sector	Description	Label
1	Agriculture (intermediate)	Crop and animal production, hunting and related service activities (intermediate goods)	Agriculture, INT
2	Agriculture (consumer)	Crop and animal production, hunting and related service activities (consumption goods)	Agriculture, CONS
3	Forestry	Forestry and logging	Forestry
4	Fishing	Fishing and aquaculture	Fishery
5	Mining	Mining and quarrying	Mining
6	Food (intermediate)	Manufacture of food products, beverages, and tobacco products (intermediate goods)	Food, INT
7	Food (consumer)	Manufacture of food products, beverages, and tobacco products (consumption goods)	Food, CONS
8	Textiles (intermediate)	Manufacture of textiles, wearing apparel, and leather products (intermediate goods)	Textiles, INT
9	Textiles (consumer)	Manufacture of textiles, wearing apparel, and leather products (consumption goods)	Textiles, CONS
10	Wood and prod. (intermediate)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (intermediate products)	Wood and prod., INT
11	Wood and prod. (consumer)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (consumption goods)	Wood and prod., CONS
12	Paper and prod. (intermediate)	Manufacture of paper and paper products (intermediate goods)	Paper and prod., INT
13	Paper and prod. (consumer)	Manufacture of paper and paper products (consumption goods)	Paper and prod., CONS
14	Refining	Manufacture of coke and refined petroleum products	Refining
15	Chemicals (intermediate)	Manufacture of chemicals and chemical products (intermediate goods)	Chemicals, INT
16	Chemicals (consumer)	Manufacture of chemicals and chemical products (consumption goods)	Chemicals, CONS

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Table A7.1 *continued*

Sector No.	Sector	Description	Label
17	Pharma (intermediate)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (intermediate goods)	Pharma, INT
18	Pharma (consumer)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (consumption goods)	Pharma, CONS
19	Rubber and plastic (intermediate)	Manufacture of rubber and plastic products (intermediate goods)	Rubber and plastic, INT
20	Rubber and plastic (consumer)	Manufacture of rubber and plastic products (consumption goods)	Rubber and plastic, CONS
21	Stone, glass (intermediate)	Manufacture of other non-metallic mineral products (intermediate goods)	Stone, glass, INT
22	Stone, glass (consumer)	Manufacture of other non-metallic mineral products (consumption goods)	Stone, glass, CONS
23	Basic metals	Manufacture of basic metals	Basic metals
24	Fabricated metal (intermediate)	Manufacture of fabricated metal products, except machinery and equipment (intermediate goods)	Fabr. metal, INT
25	Fabricated metal (consumer)	Manufacture of fabricated metal products, except machinery and equipment (consumption goods)	Fabr. metal, CONS
26	Fabricated metal (capital)	Manufacture of fabricated metal products, except machinery and equipment (capital goods)	Fabr. metal, CAP
27	Electronics (intermediate)	Manufacture of computer, electronic, and optical products (intermediate goods)	Electronics, INT
28	Electronics (consumer)	Manufacture of computer, electronic, and optical products (consumption goods)	Electronics, CONS
29	Electronics (capital)	Manufacture of computer, electronic, and optical products (capital goods)	Electronics, CAP
30	Electricals (intermediate)	Manufacture of electrical equipment (intermediate goods)	Electricals, INT
31	Electricals (consumer)	Manufacture of electrical equipment (consumption goods)	Electricals, CONS
32	Electricals (capital)	Manufacture of electrical equipment (capital goods)	Electricals, CAP
33	Machinery (intermediate)	Manufacture of machinery and equipment n.e.c. (intermediate goods)	Machinery, INT
34	Machinery (consumer)	Manufacture of machinery and equipment n.e.c. (consumption goods)	Machinery, CONS
35	Machinery (capital)	Manufacture of machinery and equipment n.e.c. (capital goods)	Machinery, CAP
36	Automotive (intermediate)	Manufacture of motor vehicles, trailers, and semi-trailers (intermediate goods)	Automotive, INT
37	Automotive (consumer/capital)	Manufacture of motor vehicles, trailers, and semi-trailers (consumption/capital goods)	Automotive, CONS/CAP
38	Other transport equipment (intermediate)	Manufacture of other transport equipment (intermediate goods)	Other transp. eq., INT

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Table A7.1 *continued*

Sector No.	Sector	Description	Label
39	Other transport equipment (capital)	Manufacture of other transport equipment (capital goods)	Other transp. eq., CAP
40	Other manufacturing (intermediate)	Manufacture of furniture; other manufacturing (intermediate goods)	Other man., INT
41	Other manufacturing (consumer)	Manufacture of furniture; other manufacturing (consumption goods)	Other man., CONS
42	Other manufacturing (capital)	Manufacture of furniture; other manufacturing (capital goods)	Other man., CAP
43	Other (intermediate)	Other goods (intermediate goods)	Other, INT
44	Other (consumer)	Other goods (consumption goods)	Other, CONS

CAP = capital goods, CONS = consumer goods, INT = intermediate goods, n.e.c. = not elsewhere classified.

Notes: Not all sectors have products in all value-chain stages. Some products cannot be distinguished into consumer or investment products (e.g., automobiles). Raw materials (e.g., in mining or agriculture) are treated as intermediate products.

Source: Authors, based on World Input–Output Database sectors and the United Nations' Broad Economic Categories.

Appendix 7.2

Upgrading Triangle Methodology

The upgrading triangles are based on a probability-based relatedness measure for a country's opportunities for diversification. Diversification is understood as an increase in the range of products that a country exports with comparative advantage. Similar to the related variety literature, the basic idea of the analysis is that a country's current specialization structure (partly) determines which products are likely targets for developing new comparative advantages (diversification).

X is defined as the familiar binary matrix of comparative advantage, i.e., this matrix has dimensions $m \times n$, where m is the number of products and n is the number of countries. Typically, $m \gg n$. The elements of X, denoted as x_{ij}, are binary, according to the rule

$$x_{ij} = 1 \text{ if } \frac{E_{ij}/E_j}{E_i/E} \geq 1 \text{ and } x_{ij} = 0 \text{ otherwise},$$

where E_{ij} denotes exports of product i by country j, and the absence of a subscript indicates summation over the relevant dimension. Each country is assumed to export at least one product, and each product is exported by at least one country.

Next, a matrix of conditional probabilities C is defined as follows:

$$C = S^{-1}XX^T,$$

where the superscript T indicates a transposed matrix, and S is the matrix with the row-sum of X on the main diagonal and zeros elsewhere (note that the diagonal of S thus contains what Hidalgo and Hausmann (2009) call ubiquity of products). The element c_{kl} of C denotes the probability that a country has a comparative advantage in product l, conditional on the country having comparative advantage in product k.

These conditional probabilities are a central idea of the analysis. They capture the idea that having a comparative advantage in one product (k) provides information about the probability that a country has a comparative advantage in another product (l). This is represented by multiplying the actual matrix of comparative advantages by C (and scaling by m):

$$G = (X^T C)/m.$$

G is an $n \times m$ matrix in which element g_{ji} indicates the probability of country j having a comparative advantage in product i, based on the information (contained in X) about the full range of products in which j has a comparative advantage.

Another idea is that the information that a country does not have a comparative advantage in a particular product may also be useful information for establishing a probability that a country has comparative advantage in another product. Hence, the analysis also defines the matrix $Z = O - X^T$, in which O is an $n \times m$ matrix with only ones, and the superscript T indicates transposition. The elements of the matrix Z are defined as follows:

$$z_{ji} = 1 \text{ if } x_{ij} = 0 \text{ and } z_{ji} = 0 \text{ if } x_{ij} = 1.$$

Define also a corresponding matrix of conditional probabilities D:

$$D = U^{-1} X Z^T$$

where U is the matrix with the row-sum of Z on the main diagonal and zeros elsewhere. Elements d_{kl} of matrix D denote the probability that a country has comparative advantage in product l, conditional on the information that it does not have comparative advantage in product k. This leads to the following:

$$H = (Z^T D)/m$$

Matrix H is similar to the previously defined matrix G. The elements h_{ji} indicate the probability of country j having a comparative advantage in product i, based on the information (contained in Z) about the range of products in which j does not have a comparative advantage.

As a final step, the two probabilities are added up:

$$E = G + H = (X^T C - Z^T D)/m = (X^T C - (O - X)^T D)/m = (O^T D - X^T K)/m,$$

where $K \equiv C - D$ is a matrix that contains marginal conditional probabilities.

The matrix E is a probabilistic estimation of X. It has two constituent elements. The first of these, $E_1 \equiv O^T D/m$ is a matrix in which all rows are equal to each other, i.e., where there is no country variation. In each of the country row of this matrix, the column i element measures the autonomous probability of being specialized in product i, which the analysis defines as the probability for a hypothetical country without any comparative advantages (a country that does not trade and begins exporting just product j). This part of matrix E is characterized as the part that corresponds to unrelated variety. The part $E_2 \equiv X^T K/m$ is the part of probabilistic RCA (X) that results from the specialization profile of the country, i.e., the part that relates to related variety.

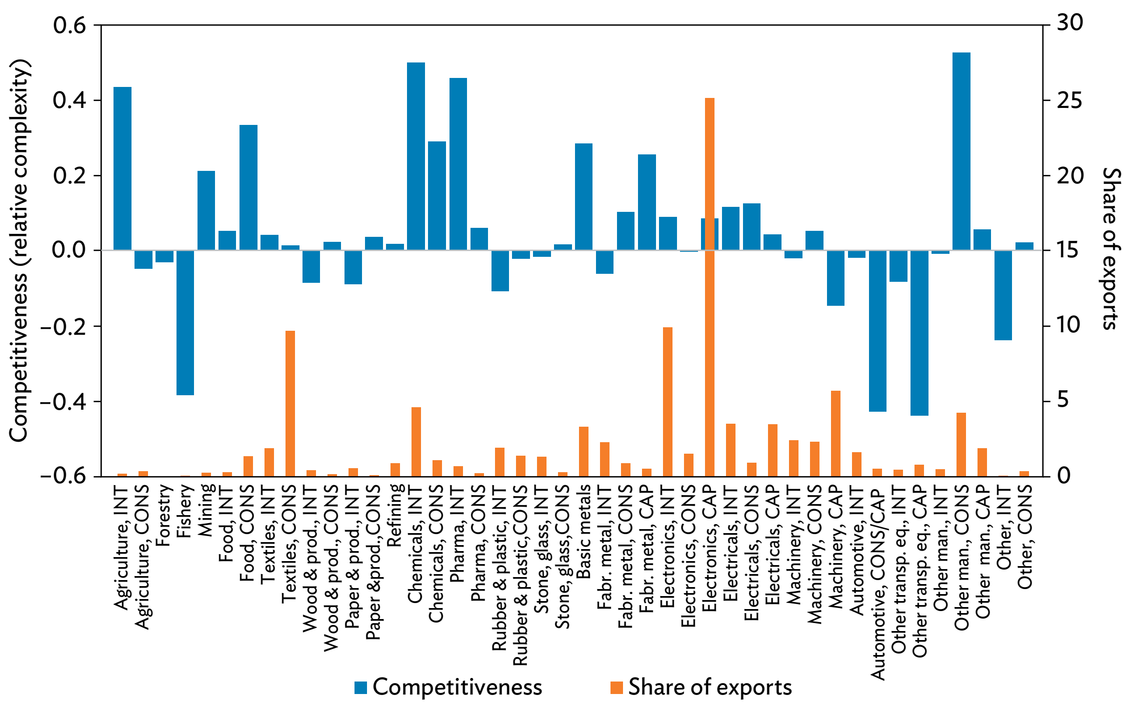
In the upgrading triangles used in the main text, the analysis uses the measure E_2. Each of the products in the analysis is attributed to a product group, and the average value of E_{2pi} for country j is taken over all products p in the sector group in which the country does not yet have a comparative advantage. The higher this measure is, the higher the probability that the country can develop a comparative advantage in these selected products.

Appendix 7.3

People's Republic of China Upgrading Paths

This Appendix shows the export shares and product complexity indices, as well as the upgrading triangles, for the PRC as a whole.

Figure A7.1: People's Republic of China—Export Shares and Complexity Relative to Global Average

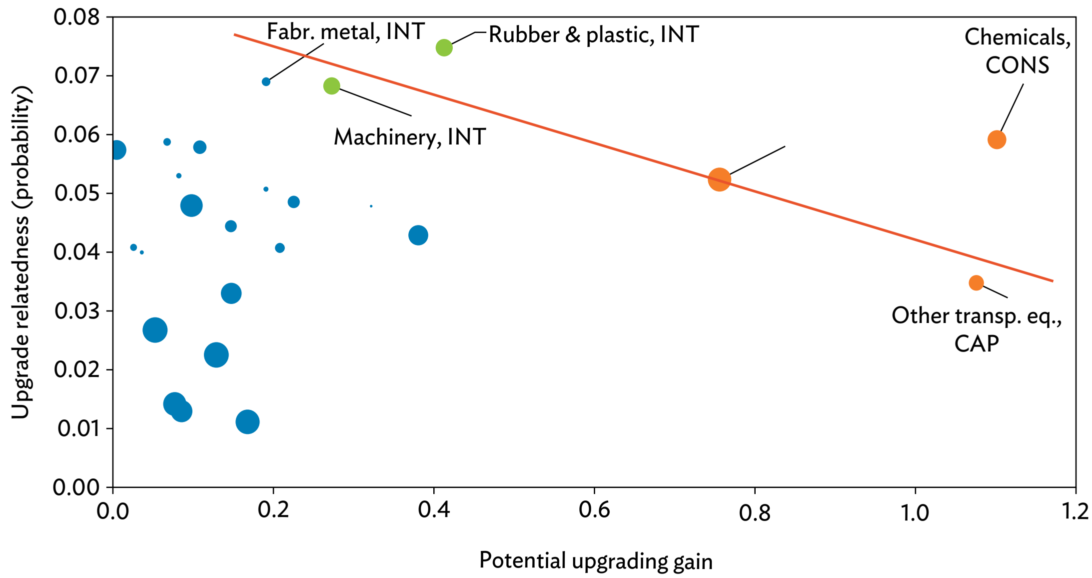


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: See Table A7.1 for definitions of sectors.

Source: Authors.

Figure A7.2: People's Republic of China—Short-Run Upgrading Triangle

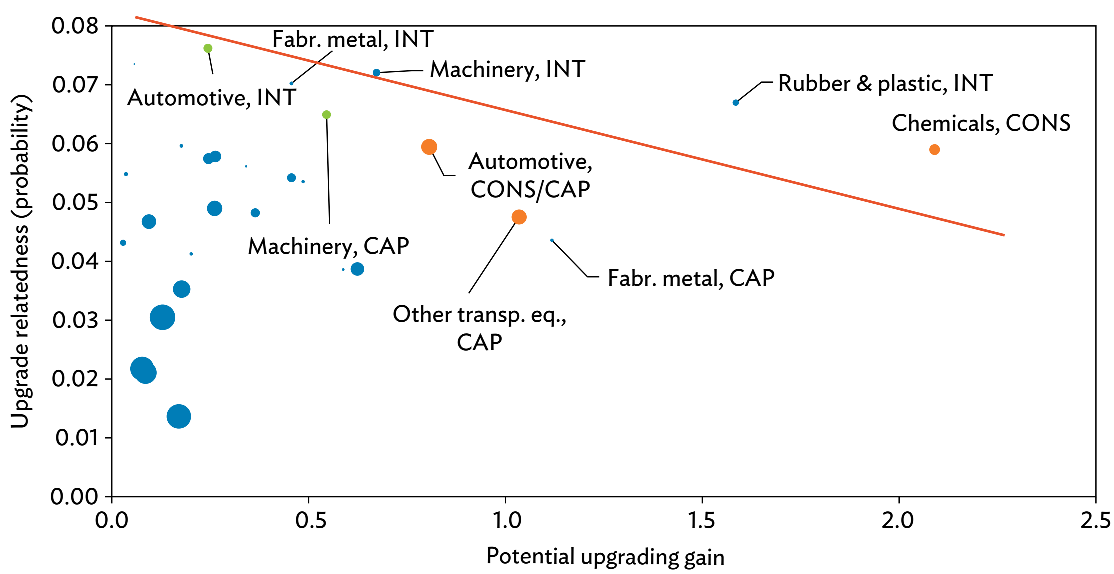


CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Notes: The size of the circles represents the share of products in the sector without comparative advantage (bigger circles indicate more upgrading opportunities). Green (orange) circles are sectors that are more (less) accessible but offer lower (higher) potential gains. See Table A7.1 for definitions of sectors.

Source: Authors.

Figure A7.3: People's Republic of China—Long-Run Upgrading Triangle



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Notes: The size of the circles represents the share of products in the sector without comparative advantage (bigger circles indicate more upgrading opportunities). Green (orange) circles are sectors that are more (less) accessible but offer lower (higher) potential gains. See Table A7.1 for definitions of sectors.

Source: Authors

Chapter 8

Upgrading Paths in Agriculture

8.1 Introduction

A key stylized fact of development is that the importance of agriculture diminishes during the course of economic development, with shares in both total employment and GDP tending to decline. Empirically, it has been documented that the share of agriculture in employment declines significantly more slowly than its share in GDP, hence agriculture remains an important source of employment in many developing countries. While it is an important source of employment, agriculture as a whole contains many products with a relatively low complexity level, offering relatively few opportunities for significant upgrading. Consequently, it provides little in the way of capability development to allow countries to move into more complex activities in other sectors.

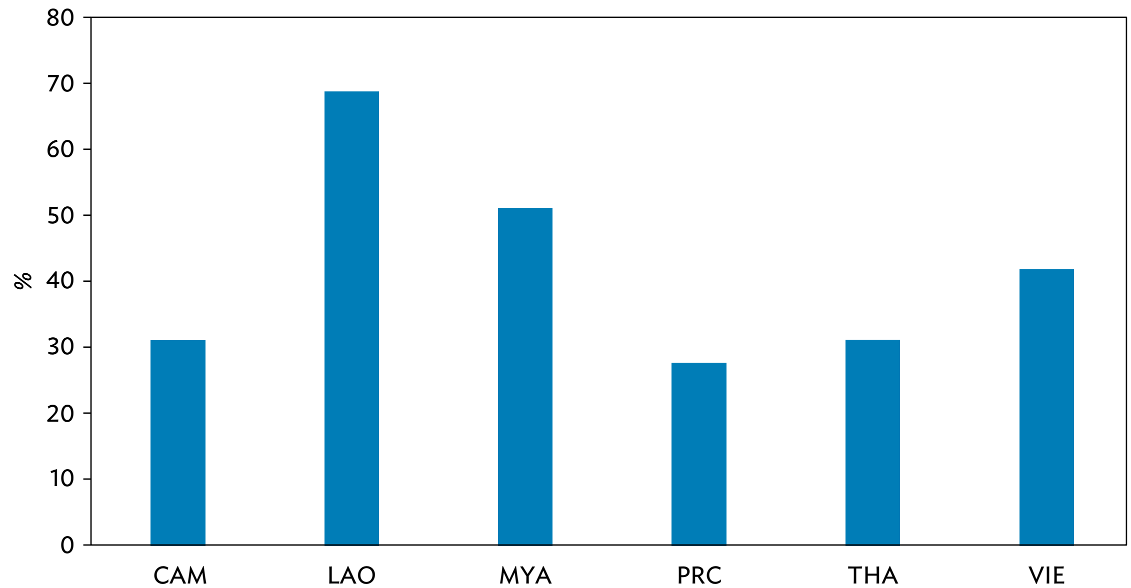
The observations above suggest that, with employment in agriculture remaining an important component of labor demand in developing countries, efforts should be made to modernize the sector (e.g., by using new technologies) and upgrade agricultural production to the extent possible by shifting toward more complex segments of agricultural production (see Chapters 14 and 15). Such a movement will increase the overall complexity levels of a country, and, by developing its capabilities, it may also open up possibilities to diversify into more complex activities in other sectors of the economy.

This chapter extends the analysis in Chapter 7 by focusing on the agriculture sector in the context of the Greater Mekong Subregion (GMS). It will discuss the relative importance of agriculture in these economies and then consider the possibilities for upgrading opportunities within the sector.

8.2 The Importance of Agriculture in Employment and GDP

Figure 8.1 shows the share of total employment accounted for by agriculture in the GMS. The figure suggests that, even in those economies that are more developed and have a relatively high share of manufacturing and services, agricultural employment still accounts for a large share of total employment. In the PRC, Thailand, and Cambodia, agriculture employment accounts for around 30% of employment, with this share rising to more than 40% in Viet Nam, more than 50% in Myanmar, and as high as 69% in the Lao PDR. This figure, therefore, highlights the important role of agriculture as a source of employment in the GMS.

Figure 8.1: Share of Employment in Agriculture, 2016

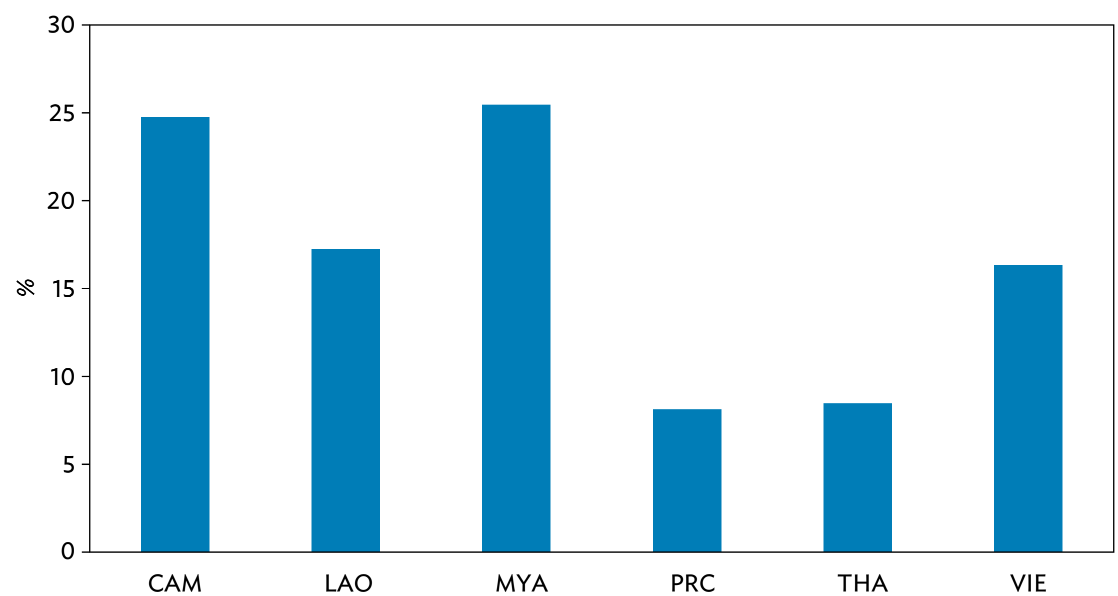


CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Note: Agriculture also covers hunting, forestry, and fishing.

Source: World Development Indicators.

Figure 8.2: Share of Value Added in Agriculture, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Note: Agriculture also covers hunting, forestry, and fishing.

Source: World Development Indicators.

While an important source of employment, Figure 8.2 reveals that agriculture is a much less important source of value added, particularly in the more advanced economies in the GMS. In the case of the PRC and Thailand, the share of agriculture in value added is around 8%, rising to 16% in Viet Nam. In the less-developed GMS members, these shares are somewhat higher. In the case of the Lao PDR, the share is marginally larger than in Viet Nam at 17%, while in Cambodia and Myanmar the shares rise to around 25%.

8.3 Upgrading Opportunities in Agriculture

Given the importance of agriculture as a source of value added and especially of employment in the GMS, this section considers the upgrading possibilities that exist within this sector. While these upgrading possibilities will lie inside the upgrading triangle defined in Chapter 7 (see Figure 7.4), the idea is to identify subsectors of agriculture that are relatively complex and which, if developed, will increase the overall complexity of the GMS economies and potentially help them move into new complex activities in other sectors of the economy. This section follows the approach developed in Chapter 7, but rather than considering all sectors and all exported goods, the analysis will focus on agricultural products only, dividing these into the 13 subsectors reported in Table 8.1.[40]

Table 8.1: List of 13 Subsectors in Agriculture, Fisheries, and Forestry

ID No.	Description	Harmonized System 2-Digit Classes
1	Live animals	01
2	Fisheries	Parts of 03 and 71
3	Dairy, honey	Parts of 04
4	Other animal products	Parts of 05, 41, and 43
5	Plants, flowers	06
6	Vegetables	Parts of 07
7	Fruits	Parts of 08
8	Coffee, tea, cocoa	Parts of 09 and 18
9	Cereals	Parts of 10
10	Oil seeds, etc.	Parts of 12
11	Wood & cork	Parts of 44 and 45
12	Wool, cotton, silk	Parts of 50, 51, 52, and 53
13	Other, including tobacco, rubber	Parts of 13, 14, 15, 24, and 40

Note: The numbers in the right-hand column refer to the two-digit class or chapter of the 2012 revision of the Harmonized System.

Source: Authors.

The analysis begins by constructing short-run upgrading paths. As noted in Chapter 7, it is important to stress the usefulness and limitations of the analysis provided by the upgrading triangles.

[40] For this purpose, agricultural exports are defined as exports in Harmonized System 2-digit classes 01 and parts of 03. Only non-processed products have been included.

The information here is to be taken as a guide for policy makers to develop specific policies in agriculture and related sectors. The sectors and products that the study points to are not the only options for such policy, but they stand out in terms of the dimensions that the upgrading triangles specify, i.e., upgrading relatedness (UR) and potential upgrading gain (PUG).

Figures 8.3(a)–8.3(g) report the short-run upgrading triangles in agriculture for all GMS members, including Guangxi Zhuang Autonomous Region and Yunnan Province (Figure A8.1 in the Appendix shows the short-run upgrading triangle for the entire PRC). As with the results reported in Chapter 7 on upgrading paths, the figures highlight a set of upgrading possibilities that are relatively easy to achieve but that lead to relatively small improvements in competitiveness or complexity (green circles); or that lead to relatively large improvements in competitiveness or complexity but that are relatively difficult to achieve (orange circles). Also consistent with Chapter 7, the size of the circles represents the number of opportunities for specialization that are available in each agriculture subsector (i.e., larger circles imply more opportunities).

Figure 8.3: Short-Run Upgrading Triangles in Agriculture

(a) Cambodia

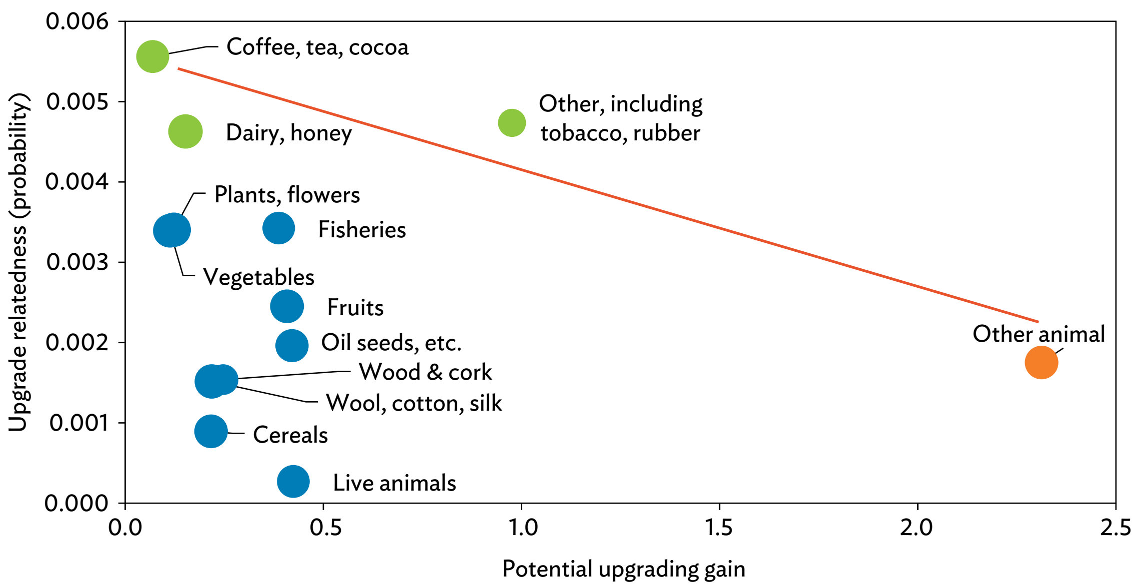


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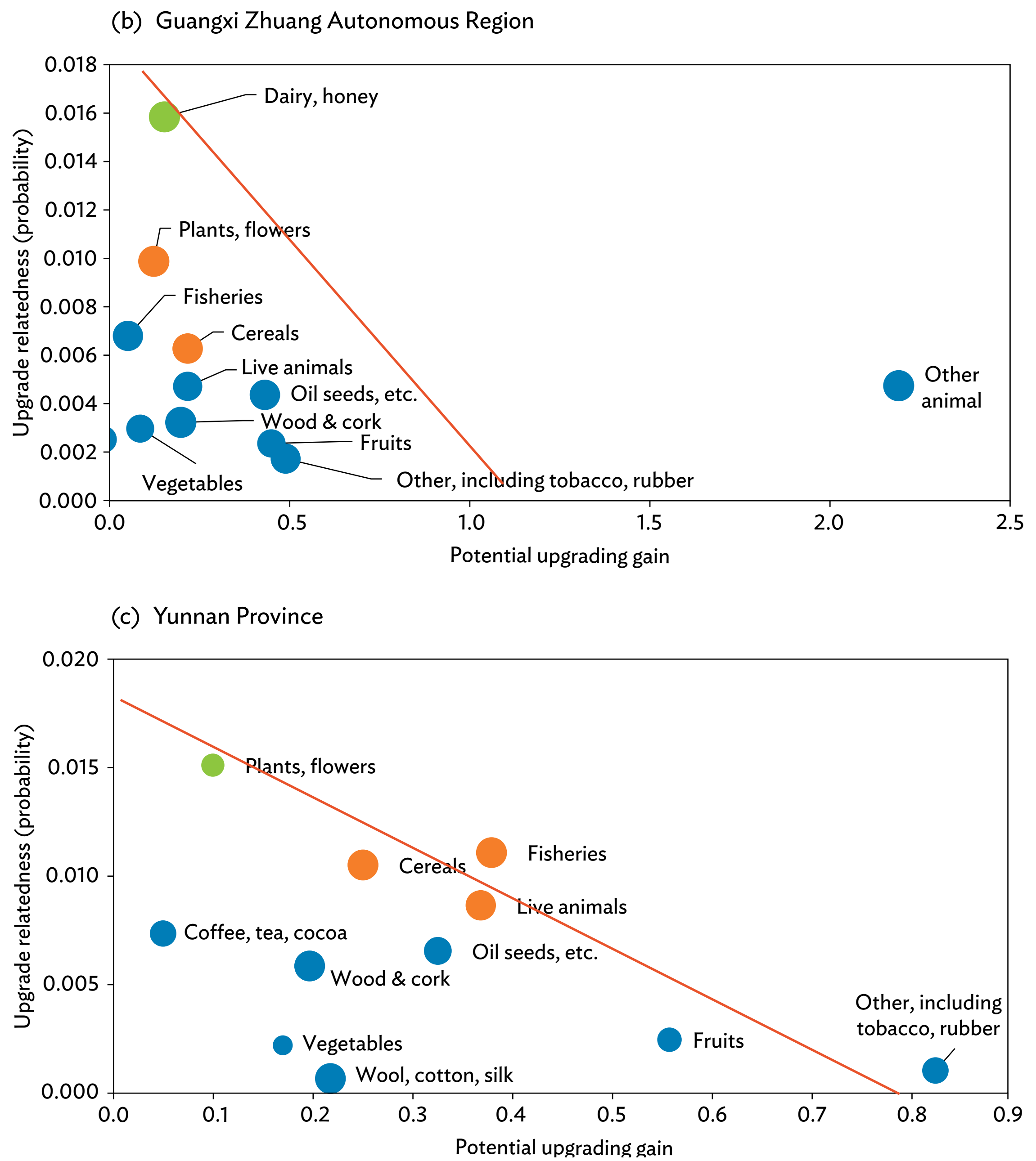
Figure 8.3 *continued*



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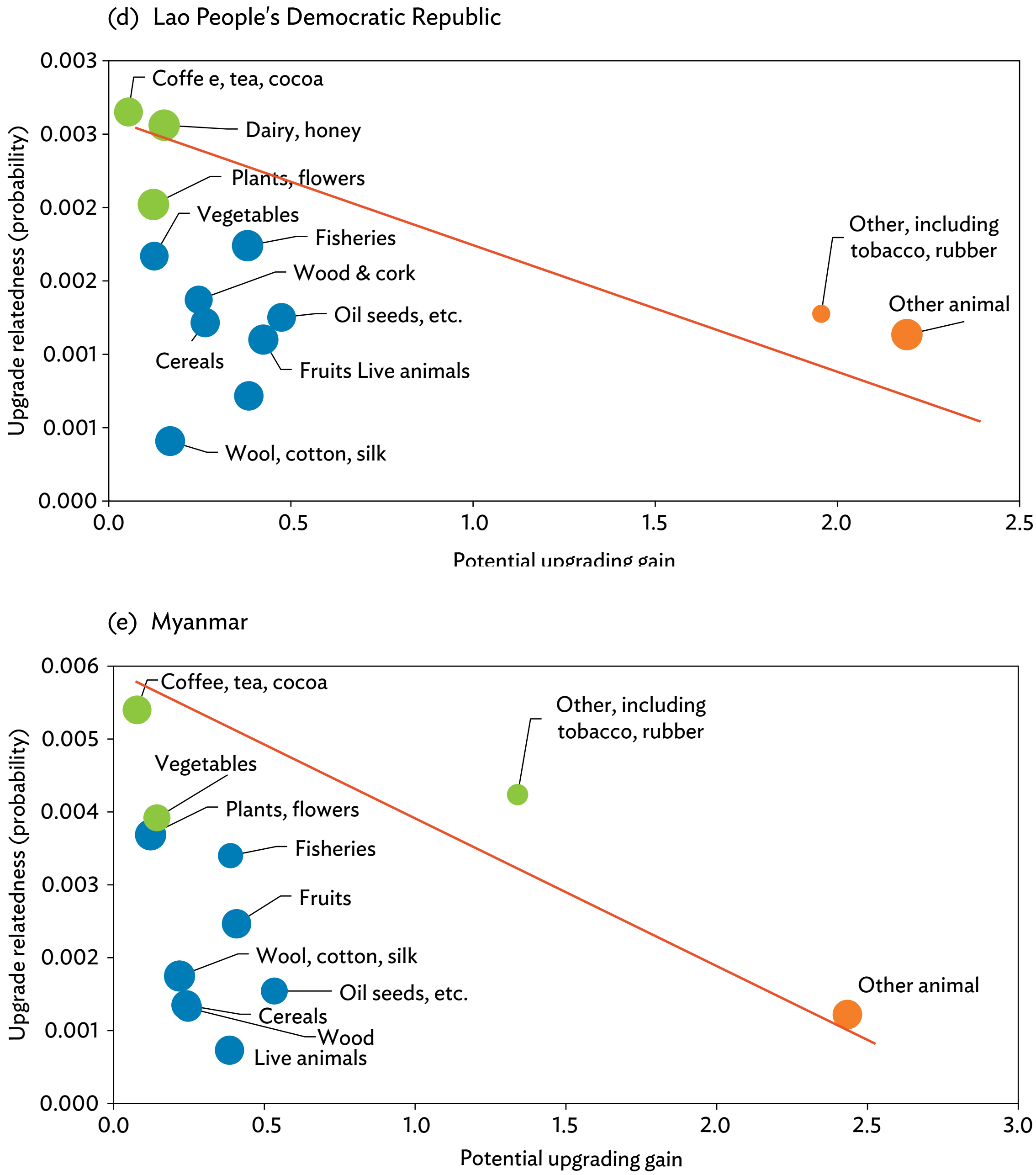

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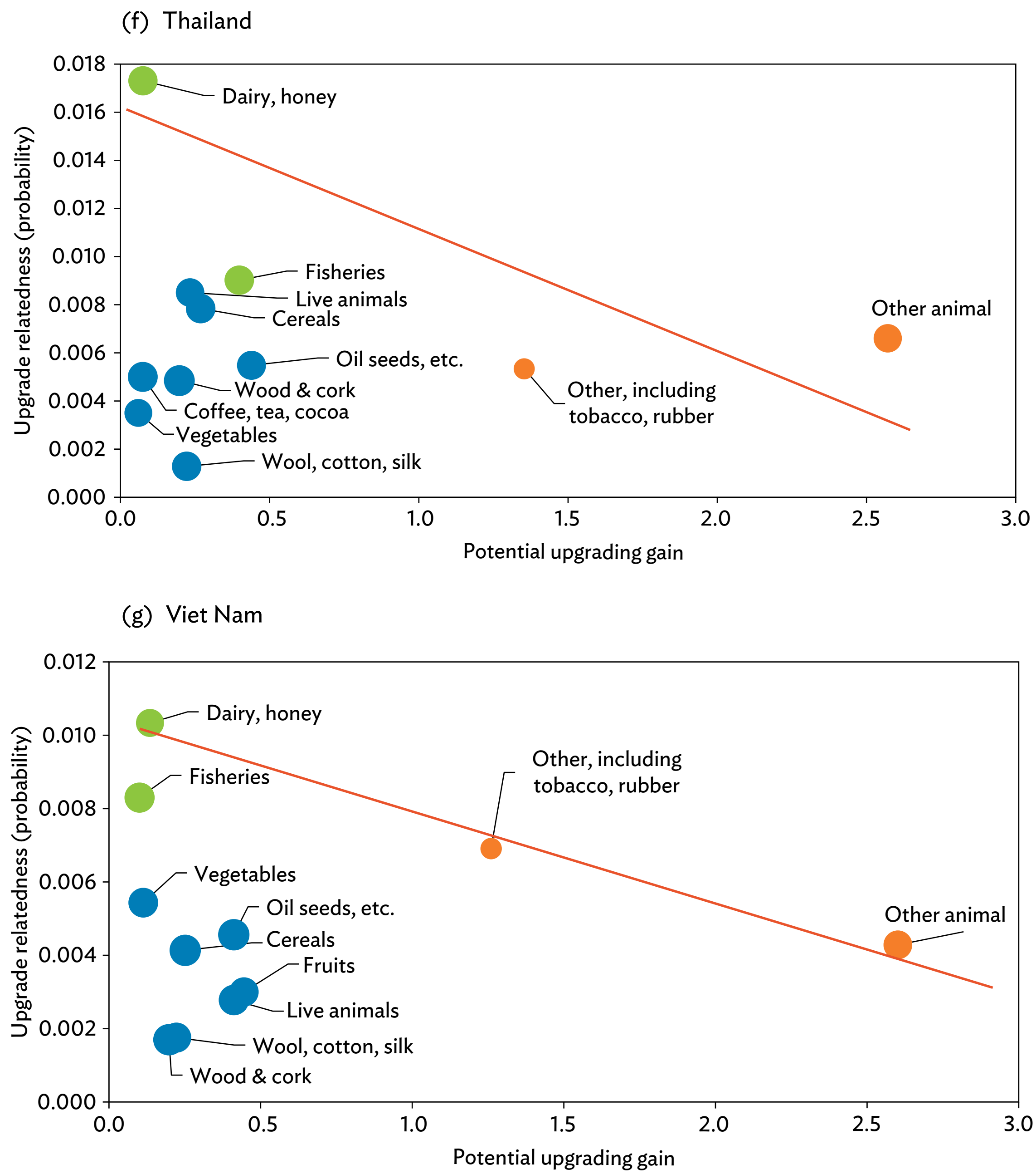
Figure 8.3 *continued*



Notes: The size of the circles represents the number of opportunities for specialization (bigger circles indicate more opportunities). Green (orange) circles are subsectors that are more (less) accessible but offer lower (higher) potential gains.

Source: Authors.

A number of similarities in the results across the GMS members allow for a discussion of these results simultaneously for all members. The first thing to note is that all GMS members have significant short-run upgrading opportunities, particularly opportunities with relatively high upgrade probability. Sectors that appear to have high upgrade-probability opportunities across a number of GMS members include dairy and honey; coffee, tea, and cocoa; other products, including tobacco and rubber; plants and flowers; and vegetables. The fisheries sector also offers high upgrade-probability options for some GMS members.

The subsectors that offer the largest competitiveness or complexity gains but with relatively low probability include other animal products; other products, including tobacco and rubber; and, in the case of the PRC, oil seeds. The left-hand side of Table 8.2 (Short Run) provides examples of products that can be targeted in these sectors that have either high upgrading opportunities (green cell) or large competitiveness or complexity gains (orange cell), in the short-run.

Table 8.2: Summary of Greater Mekong Subregion Upgrading Opportunities in Agriculture

	Short Run		Long Run	
	Subsectors	**Product Examples**	**Subsectors**	**Product Examples**
Cambodia	• Coffee, tea, cocoa • Dairy, honey • Other, including tobacco, rubber	• Spices such as nutmeg, cloves • Fresh birds' eggs • Bamboo	• Dairy, honey	• Milk and cream
	• Other animal products	• Fur skins	• Other, including tobacco, rubber • Other animal	• Opium • Pigs' bristles
Lao People's Democratic Republic	• Coffee, tea, cocoa • Dairy, honey • Plants, flower	• Anise, fennel • Natural honey • Orchids, chrysanthemums, lilies	• Dairy, honey	• Fresh birds' eggs
	• Other, including tobacco, rubber • Other animal products	• Natural rubber • Ambergris, castoreum, civet, and musk	• Other, including tobacco, rubber • Other animal	• Natural rubber • Fur skins
Myanmar	• Coffee, tea, cocoa • Other, including tobacco, rubber • Vegetables	• Ginger, saffron, turmeric • Tobacco • Leeks, pumpkins	• Plants, flowers • Vegetables	• Flower bulbs • Chicory
	• Other animal products	• Fur skins	• Other, including tobacco, rubber • Other animal	• Natural rubber • Skins of birds
Thailand	• Dairy, honey • Fisheries	• Milk and cream, natural honey • Molluscs, fresh fish	• Dairy, honey	• Fresh birds' eggs
	• Other animal products • Other, including tobacco, rubber	• Bovine semen • Tobacco, rattans	• Other animal	• Skins of birds

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Table 8.2 *continued*

	Short Run		Long Run	
	Subsectors	**Product Examples**	**Subsectors**	**Product Examples**
Viet Nam	• Dairy, honey • Fisheries	• Milk and cream • Live fish (trout, eel)	• Dairy, honey	• Milk and cream
	• Other animal products • Other, including tobacco, rubber	• Pigs' bristles • Bamboo, tobacco	• Other animal • Other, including tobacco, rubber	• Bones and horn cores • Tobacco
(PRC) Guangxi Zhuang Autonomous Region	• Dairy, honey	• Milk and cream, natural honey	• Dairy, honey • Plants, flowers	• Natural honey • Flower bulbs
	• Plants, flowers • Cereals	• Bulbs, flowers (roses) • Rye and rye seed	• Other animal	• Skins of birds
(PRC) Yunnan Province	• Plants, flowers	• Orchids	• Plants, flowers • Cereals	• Orchids • Barley
	• Fisheries • Live animals • Cereals	• Live fish, crabs • Horses • Oats	• Fruits	• Durians

PRC = People's Republic of China.

Note: Subsectors and products in green indicate high upgrading probability, while subsectors and products in orange indicate large competitiveness gains.

Source: Authors.

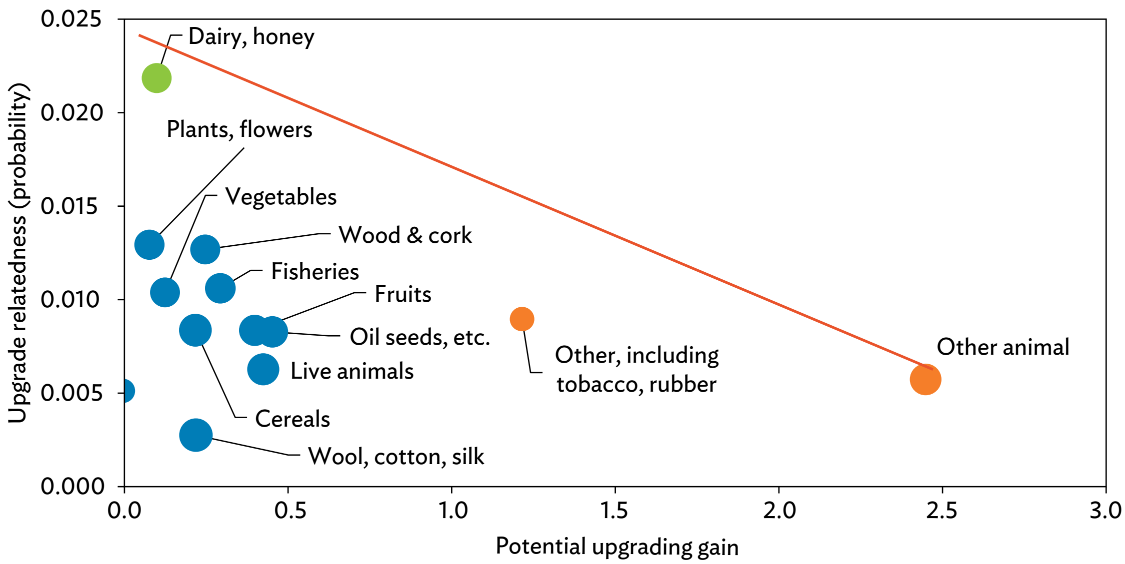
8.4 Long-Run Upgrading Paths in Agriculture

This section presents the long-run upgrading paths for the agriculture sector. These paths are defined and constructed in a similar way to those in Chapter 7. As with the short-run paths, this section discusses the results for the long-run upgrading paths for all members simultaneously. The paths are shown in Figures 8.4(a)–8.4(g), and Figure A8.2 in the Appendix shows the result for the entire PRC. Examples of specific sectors are shown in the right-hand side of Table 8.2 (Long Run).

The first thing to note is that, when compared to the short-run upgrading paths, there is less variety in the sectors with relatively high upgrade probability. The subsectors that appear to have high upgrade-probability opportunities across a number of GMS members are mostly dairy and honey and sometimes plants and vegetables. The subsectors that offer the largest competitiveness or complexity gains but with relatively low probability also show somewhat less variety than those in the short-run. There are also many subsectors in the long-run upgrading path that are similar to the short-run path. These sectors include other animals and other products, including tobacco and rubber.

Figure 8.4: Long-Run Upgrading Triangles in Agriculture

(a) Cambodia



(b) Guangxi Zhuang Autonomous Region

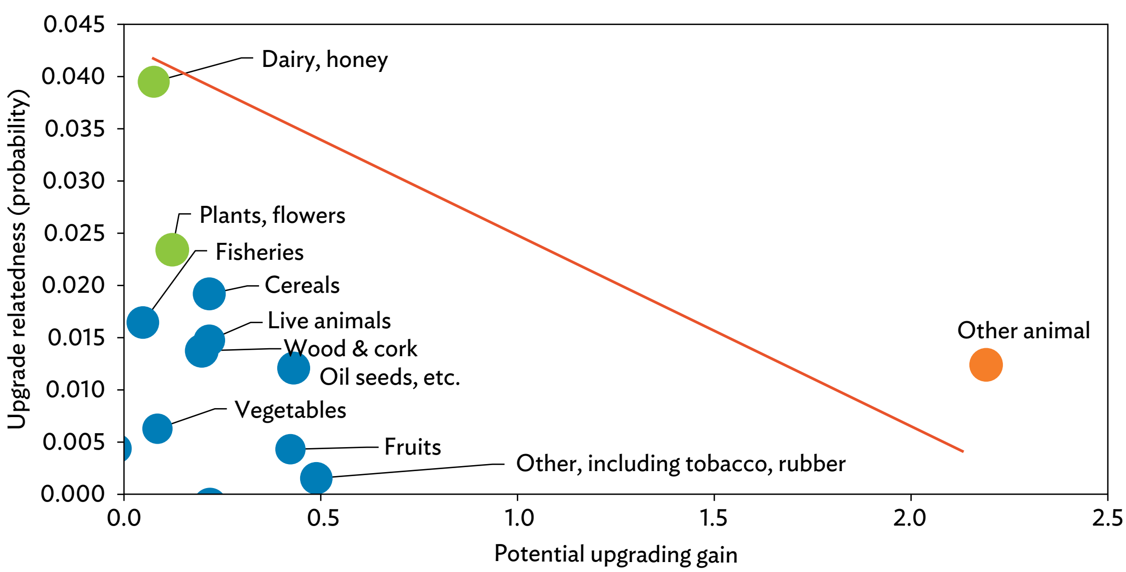


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Figure 8.4 *continued*

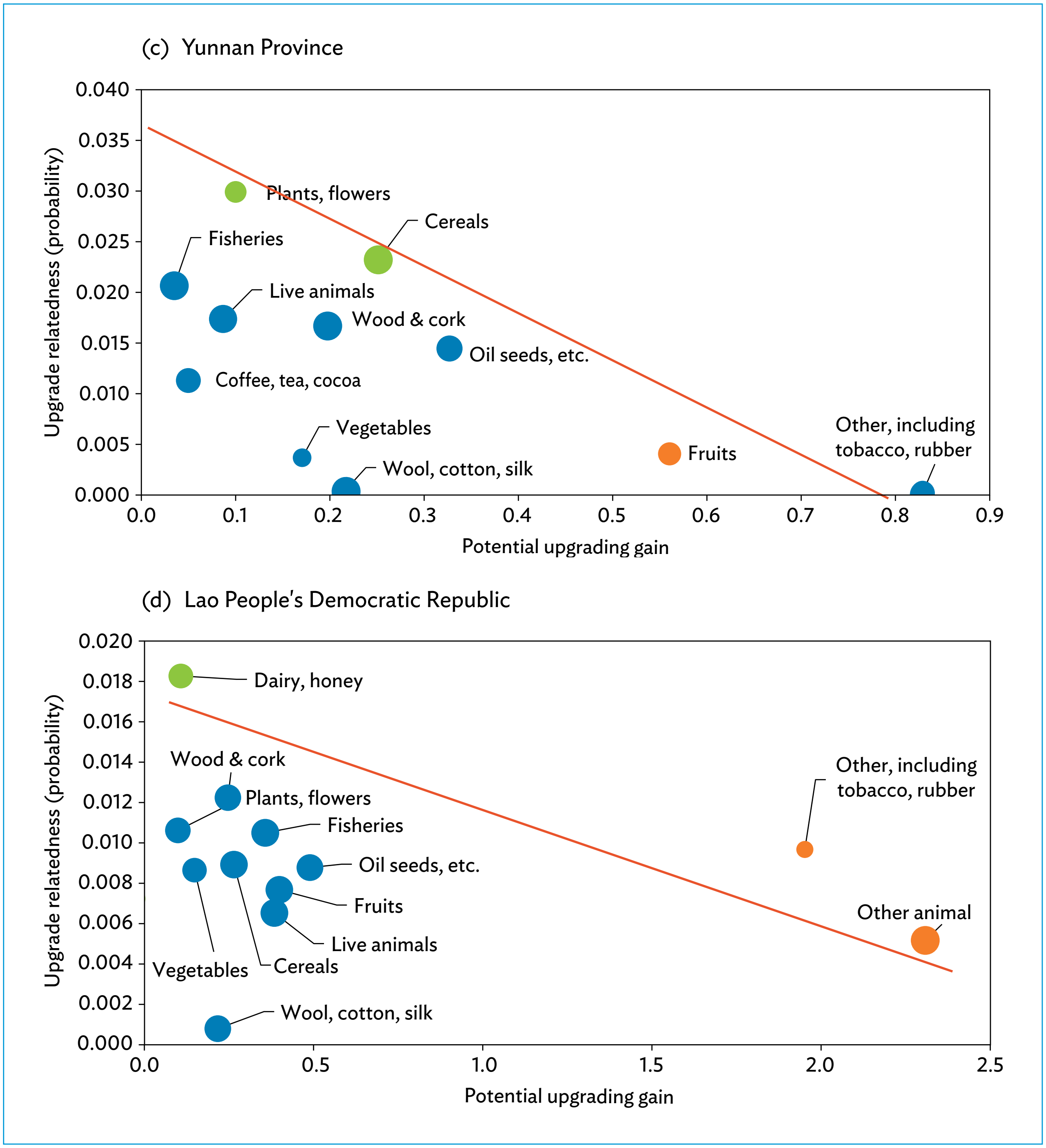

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Figure 8.4 *continued*

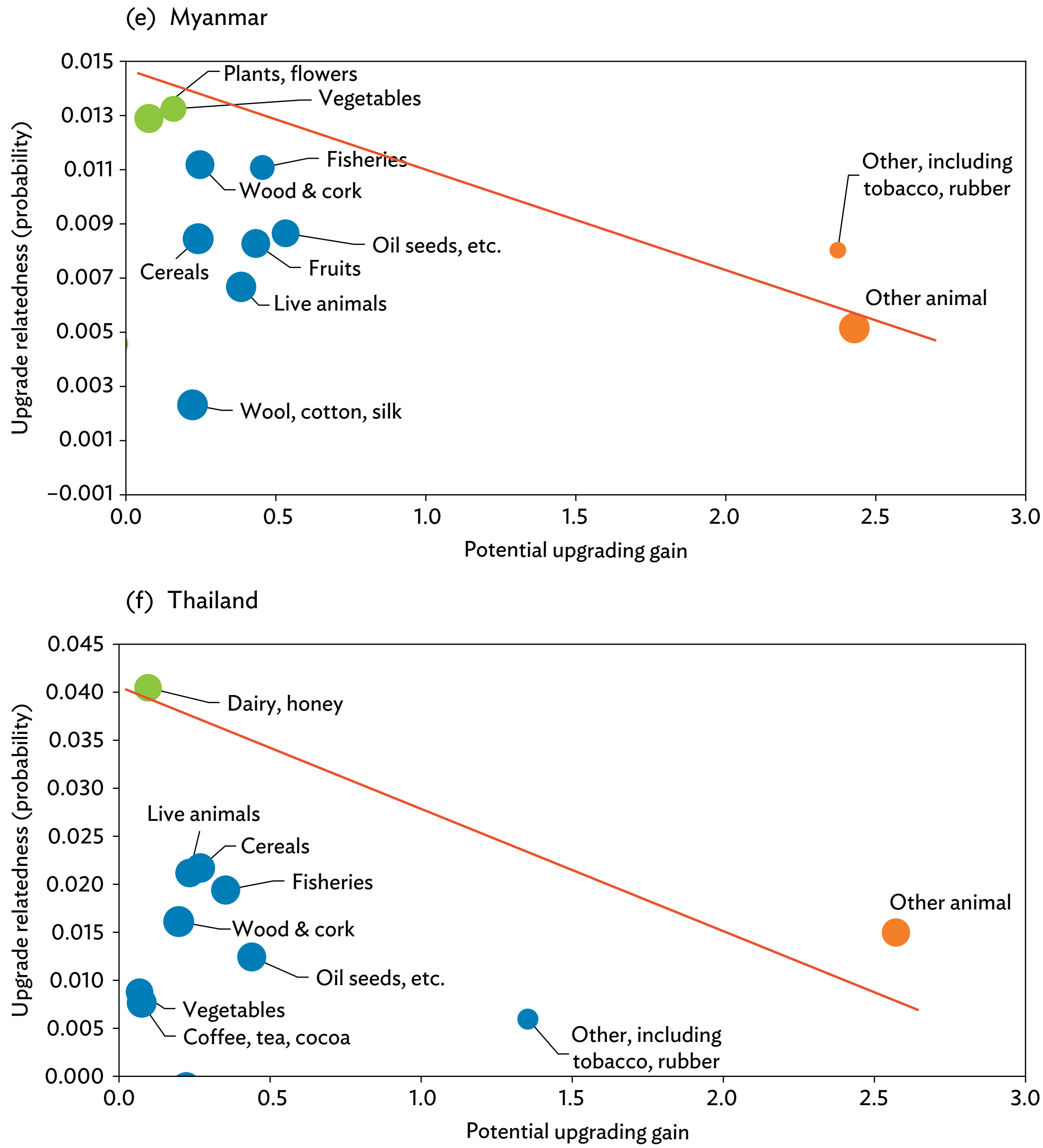

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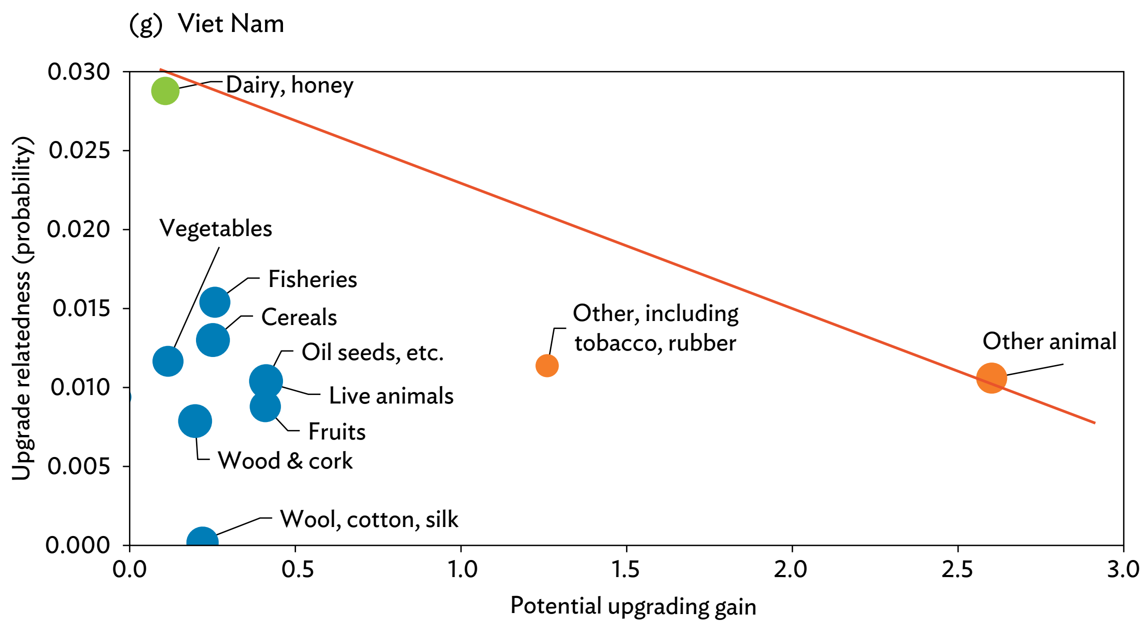
Figure 8.4 *continued*



Notes: The size of the circles represents the number of opportunities for specialization (bigger circles indicate more opportunities). Green (orange) circles are subsectors that are more (less) accessible but offer lower (higher) potential gains.

Source: Authors.

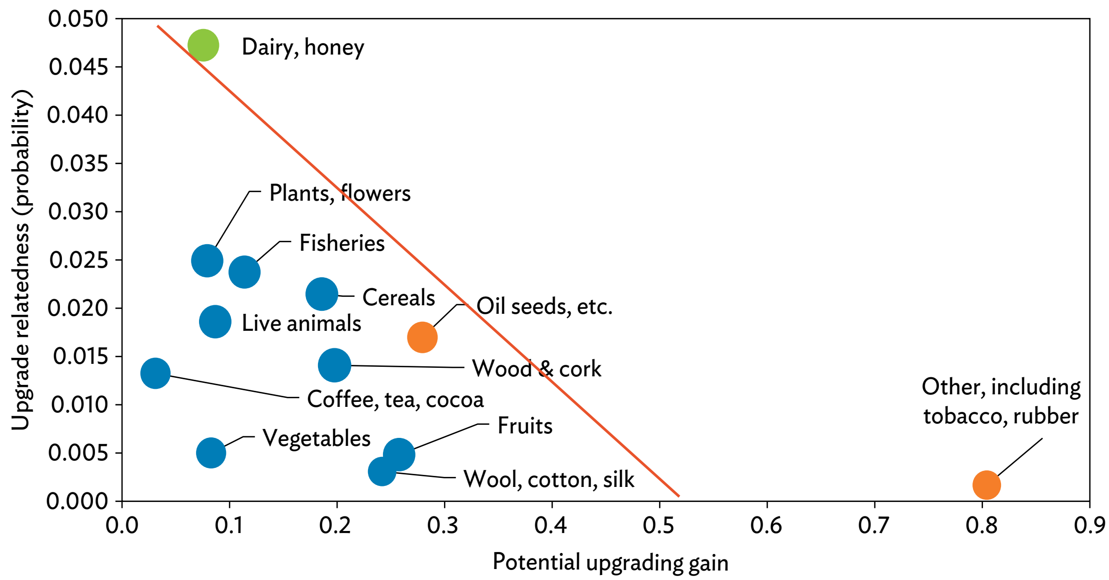
8.5 Conclusions

The importance of agriculture in total employment and GDP tends to diminish with economic development. Moreover, agriculture tends to be a relatively low-complexity activity, with relatively few upgrading opportunities. For developing countries, however, agriculture is often the most important source of employment. Ensuring the development of the agriculture sector is an important development priority, insofar as it can generate employment opportunities while also moving toward more complex agricultural production. Chapter 15 will discuss the opportunities and challenges that the technologies associated with the fourth industrial revolution (digitalization) offer to the agriculture sector.

This chapter has emphasized the importance of the agriculture sector for the GMS, particularly with regard to employment. It has used the concept of upgrading paths developed in Chapter 7 to discuss upgrading possibilities for the GMS members in agriculture. The results suggest that there are indeed possibilities to develop certain relatively complex subsectors of agriculture, with these subsectors tending to be common across the GMS (e.g., dairy and honey; coffee, tea, and cocoa). This suggests, on the one hand, the possibility for competition between GMS members in the development of these sectors. On the other hand, this also presents possibilities for coordination and cooperation to maximize the regional benefits from agricultural development.

Appendix

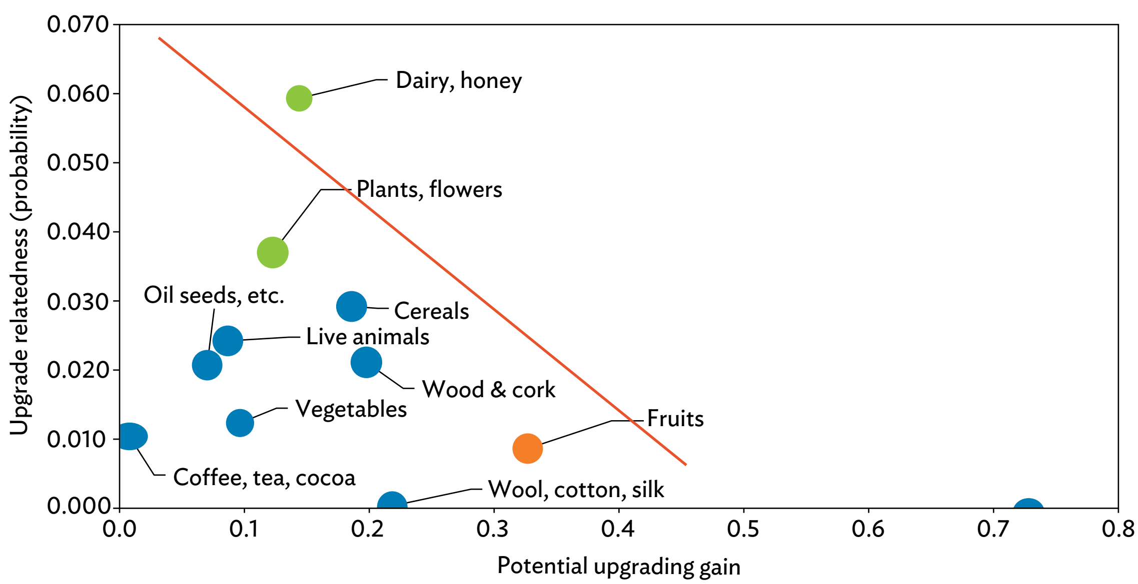
Figure A8.1: People's Republic of China—Short-Run Upgrading Triangle in Agriculture



Notes: The size of the circles represents the number of opportunities for specialization (bigger circles indicate more opportunities). Green (orange) circles are subsectors that are more (less) accessible but offer lower (higher) potential gains.

Source: Authors.

Figure A8.2: People's Republic of China—Long-Run Upgrading Triangle in Agriculture



Notes: The size of the circles represents the number of opportunities for specialization (bigger circles indicate more opportunities). Green (orange) circles are subsectors that are more (less) accessible but offer lower (higher) potential gains.

Source: Authors.

Chapter 9

Upgrading Paths in Services

9.1 Introduction

As noted in the introduction to Chapter 8, the economic structure of a country changes during the course of development. At early levels of development, the shares of agriculture in both total employment and total value added (GDP) are high. Then, as income per capita increases, the shares of both manufacturing and services tend to rise. At some point, the shares of the manufacturing sector in both total employment and total GDP stabilize before falling (i.e., they follow an inverted U shape with respect to income per capita), with the share of services continuing to rise with income per capita. In recent times, there have been concerns that the process of "servicification" has begun earlier in the development process, with the associated observation that the turning point in manufacturing is also occurring earlier in the development process and often at lower shares of manufacturing value added and especially employment (Felipe, Mehta, and Rhee 2019). Such observations emphasize the importance of understanding the role of services in the development process of countries.

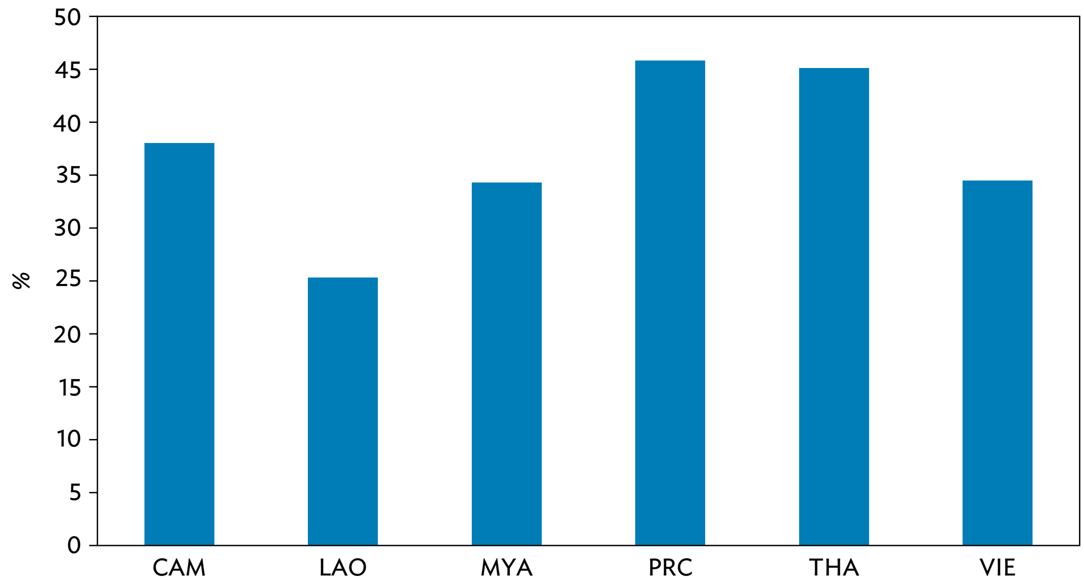
This chapter first considers the importance of services for the Greater Mekong Subregion (GMS) members. While the lack of detailed trade data for services prevents an analysis similar to that in Chapters 7 and 8, the current chapter investigates the particular specialization patterns of the GMS members in services and discusses whether such specialization patterns are associated with development.

9.2 The Structures of Employment and Exports in Services in the Greater Mekong Subregion

The analysis begins by describing the structure of employment in services and the structure of services exports. Figure 9.1 reports the share of employment in services to total employment for the GMS members in 2018. The shares are relatively large, except for the Lao PDR, which has the lowest share at 25%. Shares in other GMS members are significantly higher at around 35% in Cambodia, Myanmar, and Viet Nam, and as high as 45% in the PRC and Thailand. Such results are generally consistent with expectations, with richer countries having higher shares of employment in services.

Breaking down services employment into nine subsectors (Figure 9.2) shows a certain degree of similarity across the GMS members, with wholesale and retail trade accounting for the biggest share of services employment, between 32% and 45%. Other services subsectors that are relatively important include transport, storage, and communication (notably Cambodia and Myanmar), accommodation

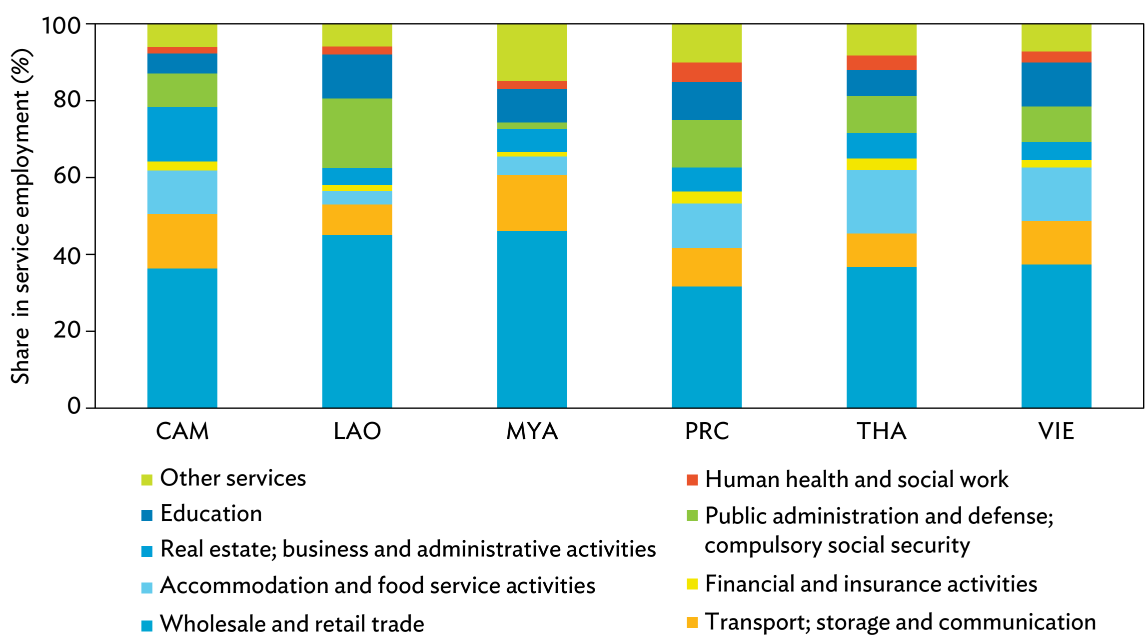
Figure 9.1: Employment Share in Services, 2018



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: International Labour Organization.

Figure 9.2: Structure of Employment in Services, 2018



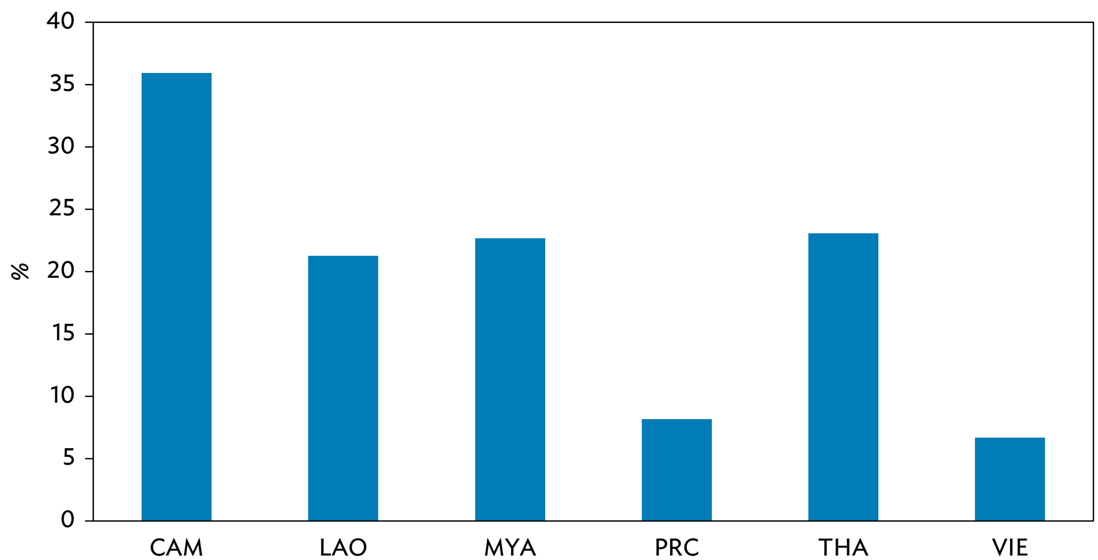
CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: International Labour Organization.

and food service activities (particularly in Thailand and Viet Nam), and public administration and defense (especially in the Lao PDR).

Turning to exports, Figure 9.3 shows a great deal of heterogeneity in the share of services exports to total exports (sum of goods and services exports). This share is relatively low in the PRC and Viet Nam at less than 10%, while it is above 20% in the other four GMS economies, with Cambodia's share the highest at about 35%.

Figure 9.3: Share of Services in Total Exports, 2016



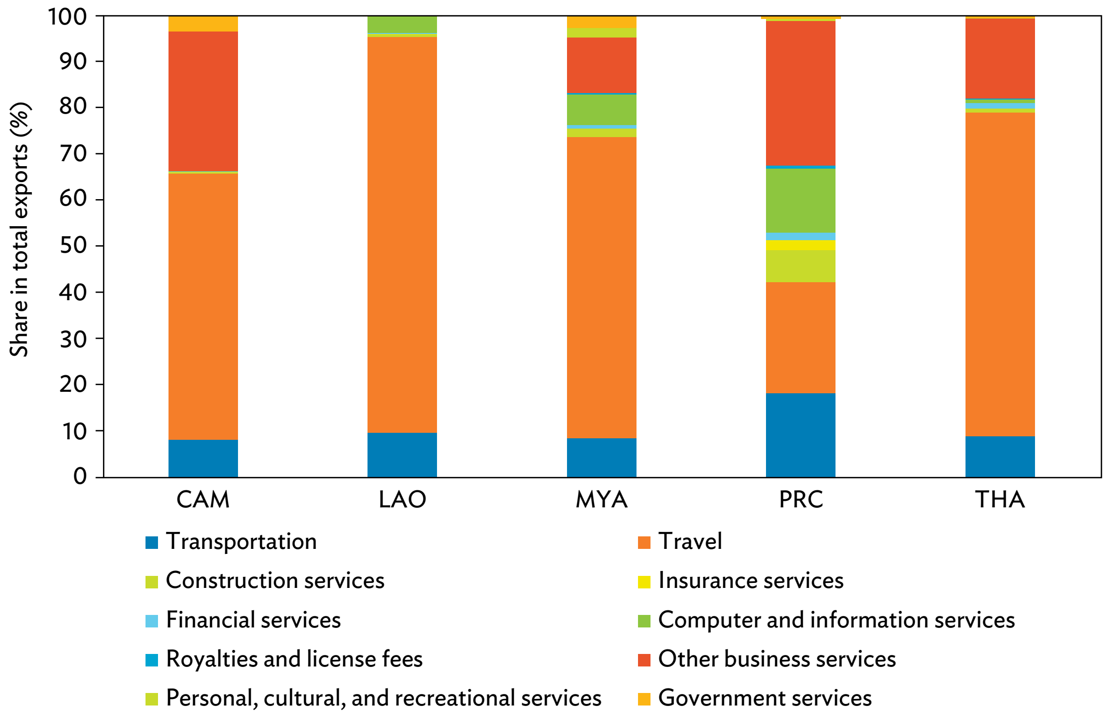
CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: United Nations Comtrade.

Services exports can also be broken down by subsector, and each subsector's share in total services exports is shown in Figure 9.4 for five of the six GMS members.[41] The data reveal that, for most of them, travel (including tourism) dominates the exports of services, reaching as high as 85% of total services exports in the Lao PDR and between 55% and 70% in Cambodia, Myanmar, and Thailand. The exception to this general pattern is the PRC, which has a relatively low share of travel in services exports (24%) and relatively larger shares in transportation, computer and information services, and other business services.

[41] Disaggregated data are not available for Viet Nam.

Figure 9.4: Structure of Exports of Services, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

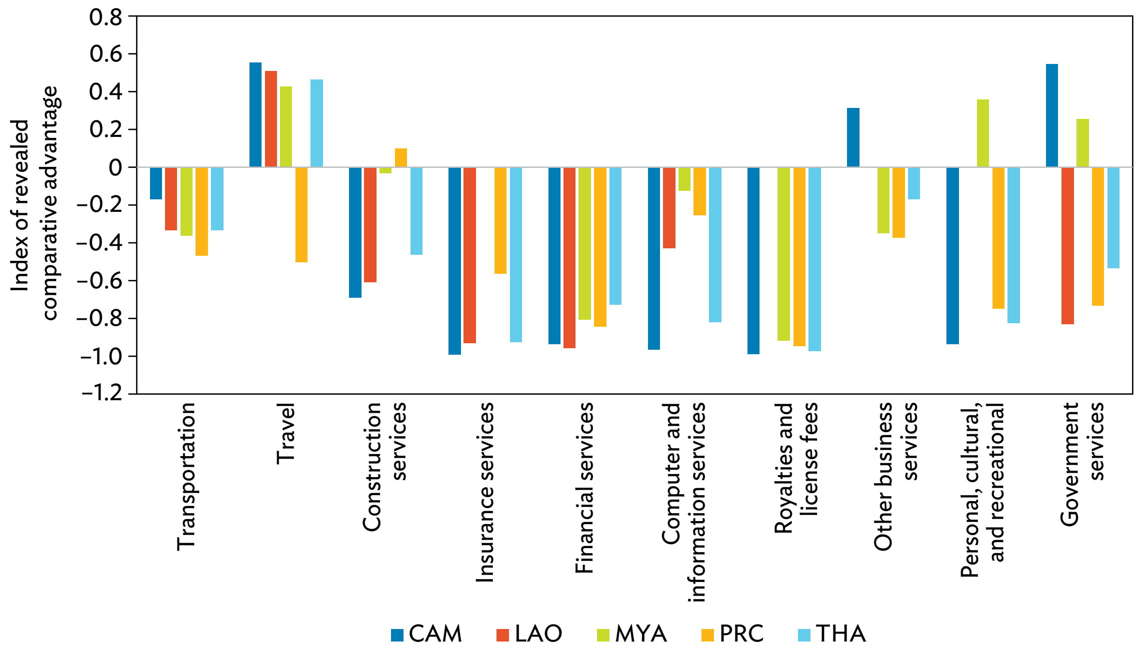
Source: United Nations Comtrade.

9.3 Specialization Patterns in Services

Building on the structure of services exports discussed above, this section examines the services that the GMS members export with revealed comparative advantage (RCA).[42] Figure 9.5 shows the index of RCA in 2016 for 10 services subsectors. The figure reveals that GMS members have comparative advantage in only a few of the services subsectors. The obvious exception is travel and tourism, which all GMS members, except for the PRC, export with comparative advantage. Despite having relatively high shares of services exports in transportation, computer and information services, and other business services, the PRC does not have comparative advantage in any of these subsectors.

[42] Revealed comparative advantage (RCA) is constructed using data on both goods and services exports, combining information on product level exports for goods and subsector level exports for services. The RCA is then normalized, such that values less than zero imply a lack of specialization and values greater than one imply specialization.

Figure 9.5: Revealed Comparative Advantage in Services Subsectors, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand.

Note: There are no disaggregated data for Viet Nam.

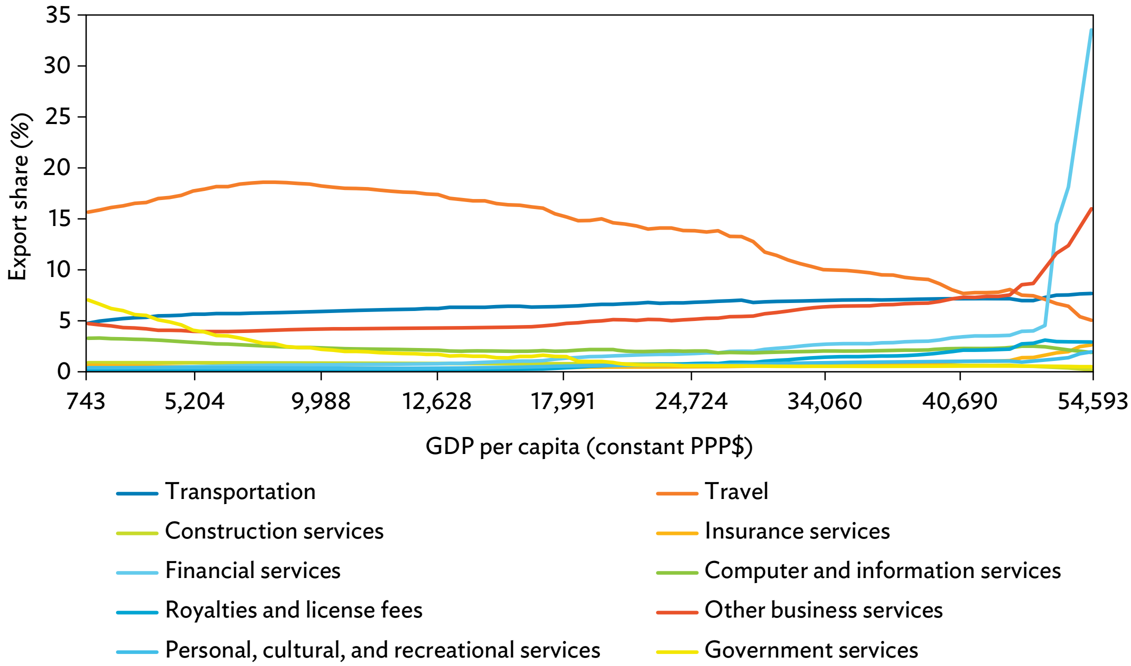
Source: United Nations Comtrade.

9.4 Export Structure in Services and Economic Development

The data presented above suggest that most GMS members have a strong specialization in travel and tourism exports. Other than this subsector, their export shares of other services subsectors are low; and, with a few exceptions, they do not have comparative advantage in any other services subsector. In this section, the analysis considers whether specialization in travel and tourism is associated with high levels of income per capita and whether countries have been able to become rich because of (or in spite of) a high export share in travel and tourism.

Figure 9.6 reports results from a smoothing procedure that describes the typical export structure of services for countries at different levels of GDP per capita (using data for 2016). The figure shows that the travel and tourism subsector makes up a relatively large share of exports (around 15% of total exports) at lower levels of income per capita, rising to a high of around 19% at an income level of around \$8,000. Beyond this level, however, the share of travel and tourism in exports drops significantly, with a share of around 5% of total exports at the highest income levels. Other services sectors tend to play a relatively small role in exports (usually less than 5%) even as income levels rise, with the major exceptions being financial services and other business services, which become very

Figure 9.6: Typical Relationship between Per Capita Income and Export Shares in Services Subsectors, 2016



GDP = gross domestic product, PPP = purchasing power parity.

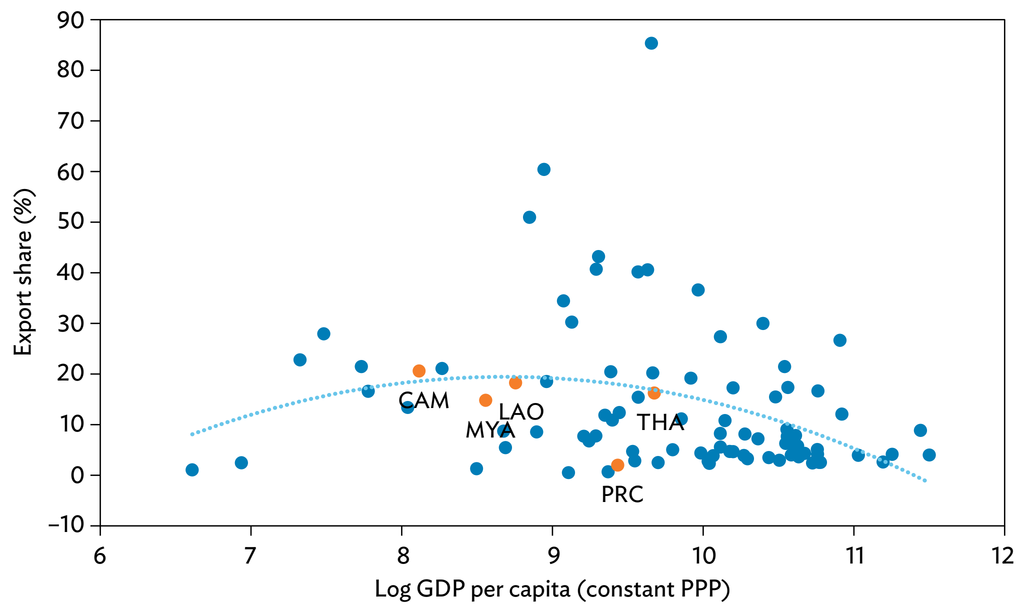
Source: Authors' estimates based on data from United Nations Comtrade and Penn World Tables.

large at the highest levels of GDP per capita. Financial services account for over 30% of exports in the richest countries, while the share of other business services rises to above 15% of exports.

The pattern found above, i.e., a rising share of travel and tourism in total exports at low per capita GDP levels followed by a declining share at high income levels, is confirmed by the results in Figure 9.7. This figure plots the share of travel and tourism in exports against the log of per capita GDP for a large set of developed and developing countries in 2016. GMS members tend to be close to the regression line, which implies that the shares of travel and tourism are about what they should be given per capita incomes. The exception is the PRC, which has a relatively low export share of travel and tourism for its income level.

The results in this section suggest that, as per capita GDP increases, countries rely relatively less on travel and tourism in their export basket. Other products and sectors become relatively more important. These include many goods, but also some services subsectors such as financial services and other business services.

Figure 9.7: Relationship between Export Share in Travel and Tourism and Per Capita Gross Domestic Product, 2016



CAM = Cambodia, GDP = gross domestic product, LAO = Lao People's Democratic Republic, MYA = Myanmar, PPP = purchasing power parity, PRC = People's Republic of China, THA = Thailand.

Sources: United Nations Comtrade and Penn World Tables.

9.5 Conclusions

Services tend to become more important—in terms of value added, employment, and exports—as countries develop, with recent evidence suggesting that the rise of the services sector occurs at earlier levels of development. As with other major sectors of the economy, however, services are not homogenous, with some services subsectors involving highly complex activities and others less complex activities.

The brief analysis in this chapter has considered the importance of services for the GMS members, noting that services account for a significant share of both employment and exports. The analysis indicates that most GMS members are heavily specialized in travel and tourism exports. While an important source of exports and employment, a high share of travel and tourism in exports is not associated with high income, suggesting that, over time, the GMS members will need to move away from a reliance on travel and tourism and shift toward other services subsectors, most notably financial services and other business services.

Photo by Lu Guang/ADB.

Food production. The clean automatic production line for seafood condiment (photo by Lu Guang/ADB).

1.3 INTEGRATION INTO THE GLOBAL ECONOMY: GLOBAL VALUE CHAINS AND PREFERENTIAL TRADE AGREEMENTS

Chapter 10

Positioning within Global Value Chains: Part I

10.1 Introduction

For developing economies, the emergence of global value chains (GVCs) offers a new—and potentially faster and easier—path to industrialization (Baldwin 2012). Indeed, in an era in which possibilities for industrial policy have been heavily curtailed (Felipe 2021), GVCs may present one of the few opportunities for industrialization. GVCs break up the production process so that different steps can be carried out in different countries. Production is sliced into different production segments or tasks, with these segments relocated across national borders to the places where they can be performed most efficiently. While this is not new, these activities have increased significantly in the last 20–25 years, driven by lower trade costs—both natural and policy-related—and developments in information and communication technologies.

Participation in GVCs is considered by some to be an important component of a development strategy for developing economies. While the PRC is regarded as a major beneficiary and example of successful development through GVCs, there are other examples of successful entry and participation in GVCs (e.g., Bangladesh in textiles, Thailand in automobiles, and Mexico in various sectors). The question policy makers ask in many developing countries is how to move up to the more knowledge-intensive stages within a GVC after entering, most often at the assembly stage where wages are low. There is hardly any example where this has happened to a significant extent (i.e., progressing from low to high income due to GVCs). Thus, one cannot confidently say that GVCs are truly a development escalator in the sense that many developing countries have entered GVCs and progressed across many sectors.

Despite the above, many consider GVCs to have the advantage over the more traditional approach to industrialization. Economies do not need to build the entire course of production capacity of a sector, but can instead concentrate on a specific production process or task based on their comparative advantage. GVCs can allow them to integrate into the global economy more rapidly than was possible in the previous industrialization period (Kowalski et al. 2015). In the context of regional integration, GVCs also create possibilities for the development of complementary activities in different countries within a region, with firms in one country providing primary commodities or intermediate inputs for assembly or final goods production for other countries in the region. Indeed, the development of regional value chains is considered a crucial factor in obtaining benefits from GVCs (Kowalski et al. 2015), with regional trade agreements a potentially important driver of such complementary activities.

At the same time, the focus on a narrow range of activities may also be considered a disadvantage if GVCs prevent countries from developing the full set of capabilities needed across all stages of a value chain (this is in fact the experience of today's advanced economies), which could lead to technological lock-in and few opportunities for learning and upgrading.

Moreover, the benefits from GVC participation are not automatic, and many economies have not benefitted from GVC participation to the same extent as others. The success or otherwise of economies in GVCs is likely to depend on many factors. An important factor affecting the successful integration and progress of economies in GVCs relates to positioning—whether an economy operates at the low or high end of the value chain, as noted in the introductory chapter (the O-Ring theory analogy). A typical value chain would involve activities such as research and development and design at the top of the chain (upstream), and post-production services such as marketing toward the end of the chain (downstream). More generally, downstream GVC activities include distribution activities as well as marketing and after-sales services, among other things.[43] In between are the extraction of primary inputs, the production of various intermediate goods, and final assembly. In the case of apparel, for example, the design stage would be considered the starting point of the value chain. Once designs are made, the manufacturing stage begins, which initially involves the production of raw materials (e.g., natural fibers, synthetic yarns, and trims such as buttons and zippers) as well as the machines needed to produce the final apparel. The component and subassembly manufacturing stage follows, which involves activities such as weaving, knitting, cutting, yarn spinning, and so on. The final assembly of products is the next stage in the process, with sewing and pressing considered important activities. Once the clothing item is complete, it will need to be distributed before the final stages of marketing and sales take place.

It is often observed that, within GVCs, developed economies tend to specialize in high-wage activities at the beginning of the value chain, such as research and development and design, and at the end of the value chain, such as after-sales services and marketing. Conversely, developing economies are often specialized in low-wage activities in the middle of the value chain, such as assembly. This pattern of specialization can have important implications for the distribution of gains from GVC participation. Case study evidence suggests that an economy's positioning within the chain has huge implications for the share of value added (the sum of wages and profits) that it can capture from GVC participation. The prime example of this is the iPhone. The PRC, where the final product is assembled, captures a tiny fraction (<2%) of the value added of the iPhone, while Apple in California captures the vast majority of it (Kraemer, Linden, and Dedrick 2011). This type of pattern is depicted through the concept of the smile curve (a U-shaped curve), which was suggested by Stan Shih, the founder of Acer, in the early 1990s. This curve reflects the idea that the two ends of the value chain, i.e., the beginning and the end of the chain, provide greater value added (certainly higher wage rates) than the middle of the value chain. This can also be seen in the apparel example above, where high-wage activities are in the design and the marketing and sales stages, which tend to be dominated by large retailers in the developed world. Economies that contribute at the middle of the value chain are therefore likely to benefit less than economies that contribute at either end of the chain. While middle-of-the-chain

[43] Distribution activities are not captured in the analysis because the sector is represented as a so-called margin industry in input–output tables. In the analysis, therefore, downstream activity is generally associated with final assembly activities.

production activities may indeed be an entry point for economies into GVCs, successful development will rely on being able to move up in either direction, by diversifying the set of production activities that the economy undertakes. The ability to upgrade will depend on local capabilities and learning and the extent of technology transfer from developed economies (something that very few developing countries can enforce upon multinationals).

Aside from the share of value added that an economy can capture within a value chain, another factor that will affect the success of a development strategy based on GVC participation is the scale of production. Economies may be able to create significant value added and employment through GVC participation if they can produce at scale, even if that economy's share of value added within a value chain is relatively small. It can be argued that this was the PRC's experience in the electronics sector (OECD 2015). During 2000–2009, the data suggested that the PRC captured an increasingly smaller share of the value added in electronics production, but that the overall value of Chinese production increased dramatically, offsetting the smaller value-added share.

The discussion above has concentrated on the positioning and scale of production within a particular value chain. However, there are numerous value chains in which economies can hope to participate. Upgrading, therefore, does not necessarily involve a movement within a value chain to high-wage activities, i.e., a movement up the smile curve. It may also involve a shift to a different value chain of higher complexity that allows for greater spillovers and technology diffusion or involves more opportunities for upgrading.

This chapter examines the extent of Greater Mekong Subregion (GMS) members' integration into GVCs using highly disaggregated trade data. The analysis shows that GMS members are mostly engaged as assemblers in GVCs, segments of the value chain that typically produce jobs with lower wages. However, there are examples—the PRC and Thailand—of integration into high-wage activities, specifically the export of customized intermediate goods. Despite integration in the middle of the value chain, the results further show that regional value chains are present in the GMS, which is considered to be an important means of benefiting from GVCs and which may provide opportunities for upgrading and integration into GVCs. This is especially true since regional interactions tend to be on the input side, with final goods exported to non-GMS world markets.

10.2 Using Trade Data to Capture Global Value Chain Participation

Several approaches have been suggested in the literature to capture the intensity of GVC involvement. One line of research is the use of input–output tables, which track flows of intermediate goods between sectors both within and across countries (see for example Timmer et al. 2014).[44] A drawback of the input–output approach is the relatively aggregated nature of the data. For this reason, the analysis will

[44] The data used for this analysis come from United Nations Comtrade, which reports data on bilateral exports and imports at the six-digit Harmonized System product level for many reporter (and partner) countries. The data are reported in thousands of US dollars. For this report, the analysis uses data for 2016 based on the 2012 version of the Harmonized System. The analysis relies on data for 155 countries.

move away from input–output tables and focus instead on using the information contained in trade data to capture the extent of GMS members' involvement and their positioning within GVCs.[45] This approach also has drawbacks. For example, it is not possible to relate trade flows to GVC participation with a strong degree of certainty, and it is not possible to analyze sectoral value chains (without certain assumptions). Moreover, the detailed trade data used in the analysis only have information on goods trade but not services, meaning that certain parts of the value chain are missing. Despite these shortcomings, the trade data are a rich source of information that can provide insights into the GMS members' participation in GVCs.

The approach that the study adopts assumes that a GVC essentially involves the sourcing of inputs (i.e., intermediate imports) to produce or assemble final capital and consumption goods (or further intermediate goods) for export. As such, the analysis can provide insights into a country's positioning within GVCs by considering the structure of imports (in particular, the extent to which it imports intermediate goods) and exports (in particular, the extent to which it exports final goods versus intermediate goods, for example).

To provide an overview of the composition of the import and export baskets of GMS members, the analysis groups products (both on the import and export sides) that are included in the United Nations Comtrade database. The analysis employs the fifth and latest revision of the United Nations' Broad Economic Categories (BEC) classification (UN DESA 2019) to identify six main groups. These are defined according to three key criteria: the products' end-use, that is, whether they are capital, intermediate, or final goods; their degree of processing; and their degree of customization or "specificity." Therefore, in addition to capital goods, the study identifies the following five groups:

(i) Primary intermediates are goods which typically originate in the primary sectors of the economy, such as the extractive industries, and that are used as an intermediate input by other industries. An example is iron ores.

(ii) Generic intermediates are intermediate products characterized by a high degree of standardization. They tend to be consumed across a wide range of industries. Examples include woven fabrics and plastic tubes.

(iii) Specific intermediates, by contrast, are more differentiated products intended for use in specific industries or the manufacture of specific final goods, such as radar parts or lithium batteries. Relative to their generic counterparts, specific intermediates are more closely associated with trading relationships involving higher degrees of customization and inter-firm coordination, such as trade in GVCs.[46] Intermediates characterized by a higher degree of specificity also reflect greater complexity, suggesting that countries that manufacture them have more developed industrial capabilities (UN DESA 2019).

(iv) Primary consumption goods are final products that either originate in one of the primary sectors of the economy—such as fresh fruit—or manufacturing products that are characterized by a low degree of processing and whose value derives almost entirely from

[45] Chapter 11 uses available data from input–output tables to discuss GVC participation as a complement to this chapter.

[46] The BEC rev. 5 classification builds on previous attempts at distinguishing between standardized and customized products in the international trade literature (see, for instance, Rauch 1999; Sturgeon and Memedovic 2010; Athukorala 2010). "Specific" intermediates correspond to Rauch's (1999) category of differentiated products without published prices.

the primary sectors of the economy rather than from the manufacturing process. Examples include cotton yarn, food sauces, or spirits.

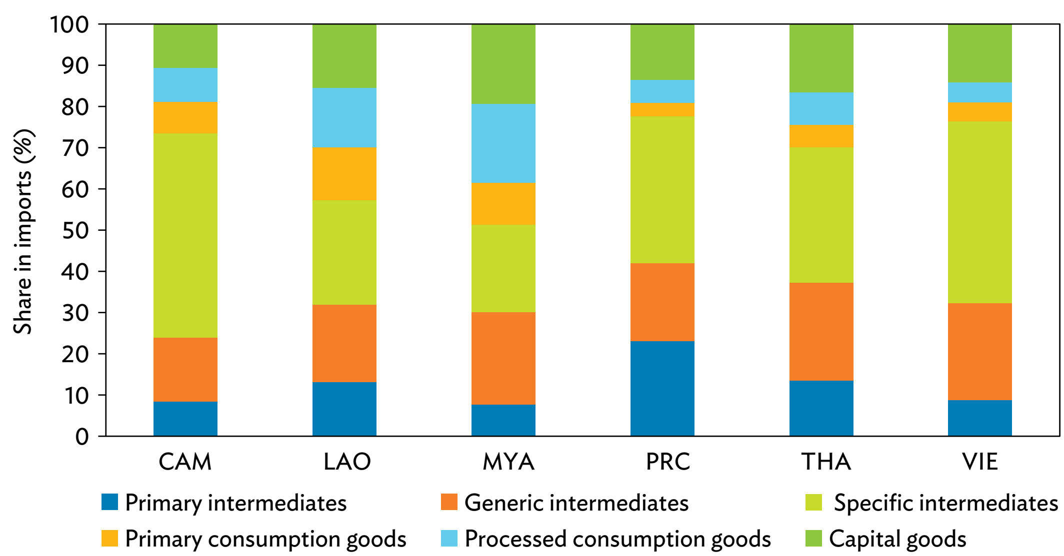
(v) Processed consumption goods are final products characterized by a higher degree of processing and potentially more amenable for production through global value chains. Examples range from apparel to refrigerators.

10.3 The Structure of Trade as an Indicator of Global Value Chain Participation

Figures 10.1 and 10.2 show the structure of imports and exports, respectively, in 2016 according to the six categories above. The import shares in Figure 10.1 show that all intermediates combined make up a relatively large share of total imports of all GMS members, ranging from 51% in Myanmar to 78% in the PRC. This is not unexpected, since most trade is in intermediate goods. The figure further reveals that primary intermediates make up a relatively small share of total intermediate imports, with shares in total intermediate imports ranging from around 11% in Cambodia and Viet Nam to around 30% in the PRC.

Conversely, specific intermediates account for most intermediate imports, ranging from 41% of total intermediates in Myanmar to 68% in Cambodia. Given the dominance of intermediates in the import basket, it is unsurprising that consumer and capital goods account for relatively small shares of imports. In the PRC and Viet Nam, the share of consumer imports is particularly low at less than 10% of total imports, possibly reflecting the fact that these countries are more self-sufficient in terms of their

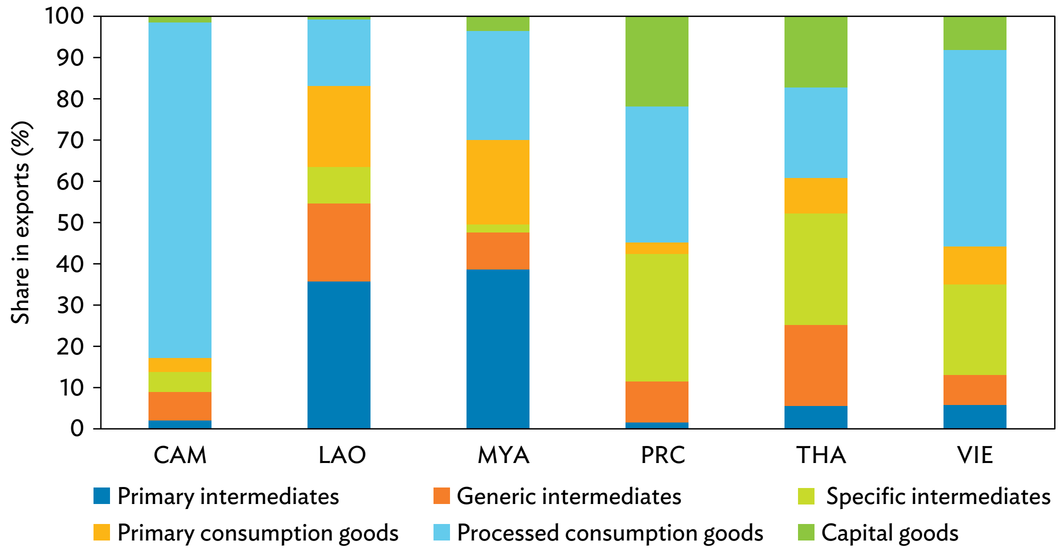
Figure 10.1: Import Structure of Greater Mekong Subregion Members, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade.

Figure 10.2: Export Structure of Greater Mekong Subregion Members, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade.

consumption goods. Shares of consumption goods imports are considerably higher in some of the other countries, notably the Lao PDR (27%) and Myanmar (29%). In summary, these results suggest that GMS members rely heavily on intermediate imports, with specific intermediates accounting for relatively large shares of intermediate imports. This suggests that the GMS members are engaged in GVC activities, and that these GVC activities may rely, to a large extent, on processing and assembly activities. To confirm this view, the analysis will now consider the export side.

Figure 10.2 shows the export structure for 2016. While intermediate goods make up a considerable share of total exports—as would be expected given the typically large share of intermediates in trade—the share of intermediates in total exports tends to be lower than the share in total imports and lower than the average share of intermediates in global trade. The figure reveals that the GMS members appear to be intensive exporters of consumption goods, with export shares of consumption goods at least 15 percentage points higher than the corresponding shares in imports. The share of consumption goods reached 85% of total exports in Cambodia, and it is above 35% in all other countries except Thailand. Thailand and the PRC are interesting examples in that the shares of capital goods and customized intermediate goods are high. When combined with the relatively high share of customized imports, the data suggest that these two economies may be engaged in intermediate processing to a greater extent than in final assembly activities. Processed consumption goods account for the greater share of consumption exports in most GMS members, accounting for over 90% of consumption goods exports in the PRC and Cambodia and above 80% in Viet Nam. Only the Lao PDR's share of processed consumption goods in total consumption exports (45%) is below 50%. These goods thus account for a greater share of GMS exports than they do for the world as a whole.

The conclusion from this analysis is that GVC activity in the GMS often relies, to a large extent, on the processing and assembly of final goods, with a heavy reliance on foreign (i.e., imported) customized intermediate goods. In the Lao PDR and Myanmar, primary intermediate exports account for a relatively large share of exports (between 35% and 40% of exports), suggesting the importance of natural resource endowments in their exports.

10.4 The Role of Greater Mekong Subregion Partners in Global Value Chain Activity

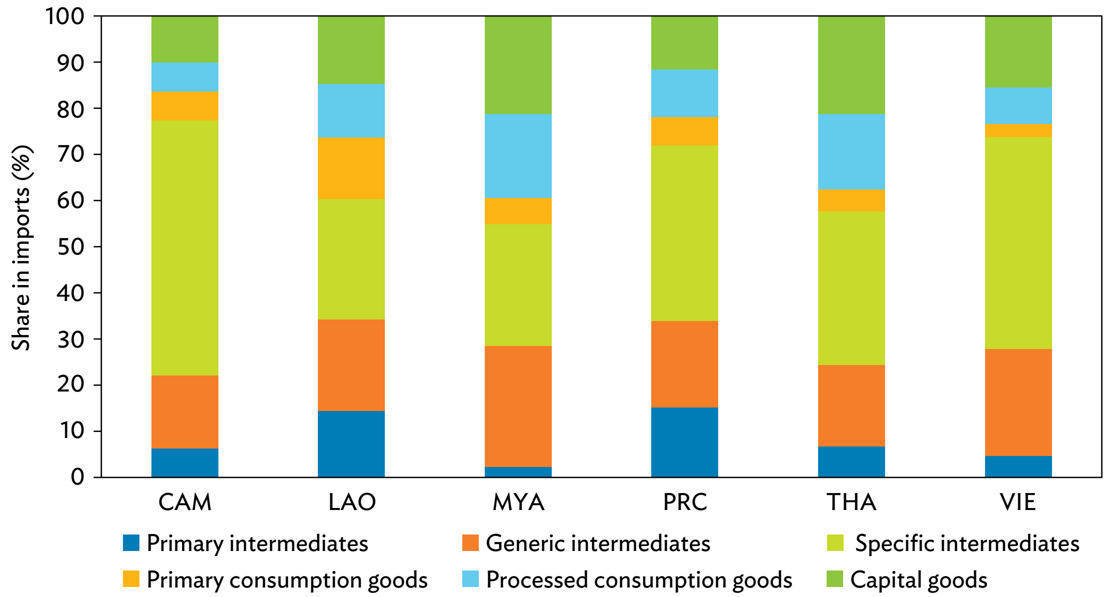
The previous section has shown that the GMS members rely, to a large extent, on the import of specific intermediate goods and on the export of processed final goods. This section examines the extent to which this pattern of GVC participation for particular GMS members is influenced by the remaining members. Do the other GMS members act, for instance, as a source for intermediate imports for particular members, and do they provide a market for processed final goods?

Analogous to Figures 10.1 and 10.2, the composition of imports from and exports to other GMS members are reported in Figures 10.3 and 10.4, respectively. The resulting import and export structures of each GMS member with respect to the other GMS members are, to a large extent, similar to those with all countries, implying that intra-GMS trade structures look quite similar to overall trade structures for the GMS. However, there are certain differences. For example, intra-GMS import shares of primary intermediate goods are lower than the corresponding shares for all countries. Conversely, specific intermediates account for a higher share of intra-GMS imports than imports of these products from all countries. The shares of consumption goods in intra-GMS imports of Cambodia, the Lao DR, and Myanmar are lower than the corresponding import shares for all countries; while the PRC, Thailand, and Viet Nam report higher shares of these goods in intra-GMS imports than imports from all countries, with processed consumer goods the major reason for these higher shares.

The differences in the composition of exports to all countries and intra-GMS exports are more pronounced. The shares of consumption goods in intra-GMS exports are much smaller than the corresponding shares of exports to all countries. In some cases, these differences are relatively small, e.g., the share of consumption goods in intra-GMS exports is around 3 percentage points lower than the share for all countries in the Lao PDR and around 7 percentage points lower in Thailand. In other members, however, the differences are much greater: around 16 percentage points lower in the PRC and Myanmar, 24 percentage points lower in Viet Nam, and 59 percentage points lower in Cambodia.

Conversely, the share of intermediate goods in intra-GMS exports is higher than in exports to all countries, with the difference between the two shares as low as 3 percentage points in the Lao PDR and as high as 53 percentage points in Cambodia. Interestingly, with the exception of the PRC, exports of primary intermediates and generic intermediates account for most of the difference in the intra-GMS export shares of intermediates vis-à-vis all countries, with the export shares of primary and generic intermediates significantly larger for intra-GMS exports than for exports to all countries.

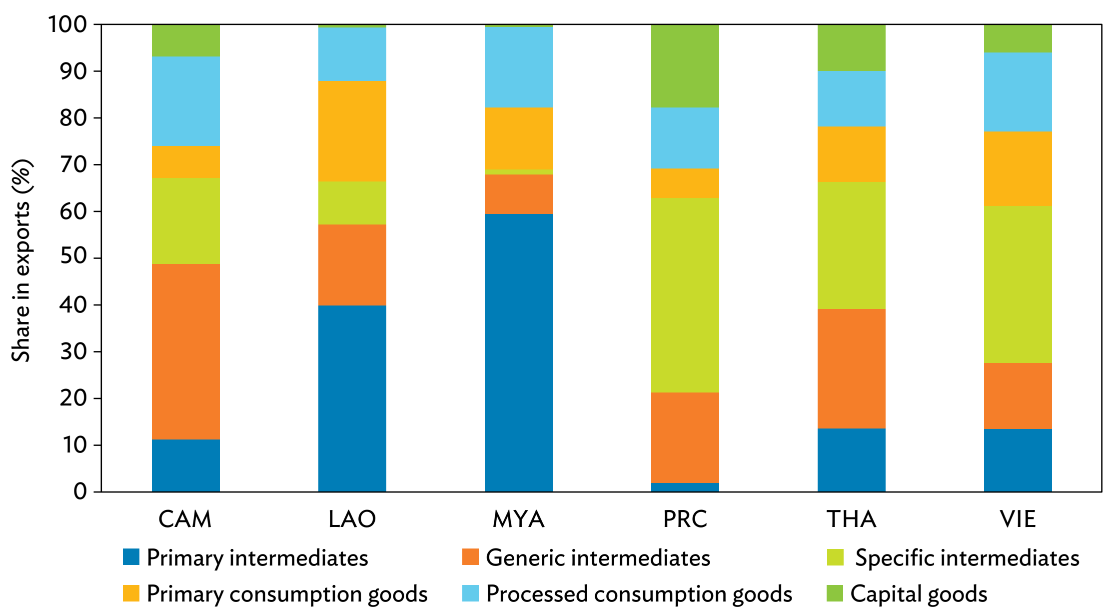
Figure 10.3: Structure of Greater Mekong Subregion Imports from Other Members, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade.

Figure 10.4: Structure of Greater Mekong Subregion Exports to Other Members, 2016

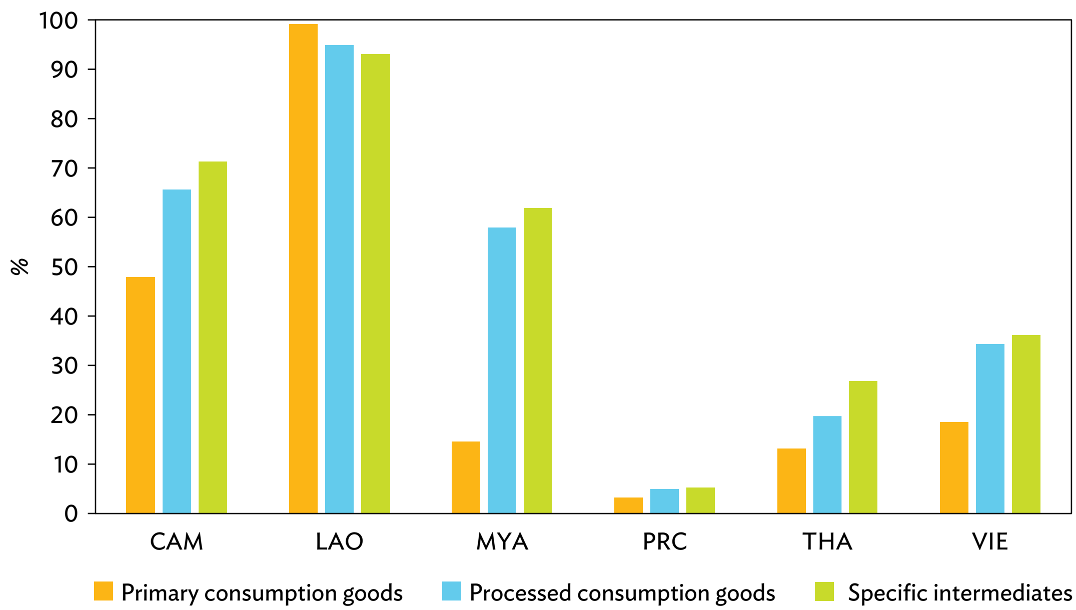


CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade.

To shed further light on the differences in export and import structures when considering intra-GMS trade vis-à-vis trade with the rest of the world, Figure 10.5 reports the share of intra-GMS imports in total imports for the three different categories of intermediate imports, i.e., primary, generic, and specific. Except for the PRC, the intra-GMS share of imports of intermediates is relatively high. Excluding the PRC, imports from the five other GMS members (out of a sample of 155 countries in total) account for a minimum of 13% of primary intermediates imports in Thailand to 99% in the Lao PDR. The share of intra-GMS imports of generic and specific intermediates in total intermediate imports tends to be higher than the share of primary intermediates, with the figure confirming the view that other members are an important source of intermediate goods for GMS members, something that is particularly the case for specific intermediates (i.e., those intermediates most strongly associated with GVC participation).

Figure 10.5: Share of Intra-Greater Mekong Subregion Imports in Total Intermediate Imports, 2016

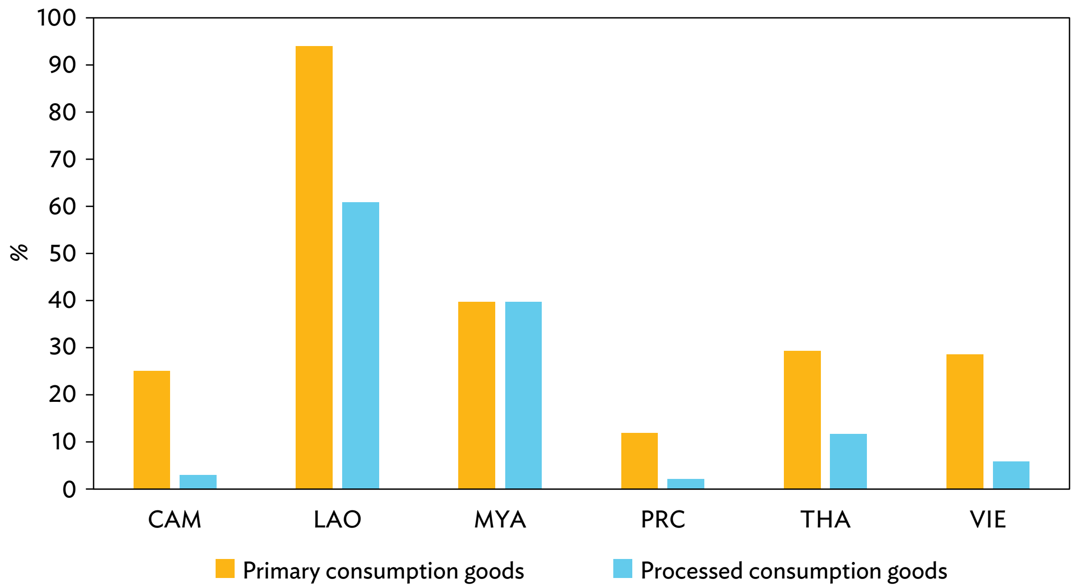


CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade.

Finally, Figure 10.6 shows the share of intra-GMS exports in total exports of consumption goods split into primary and processed goods. Processed consumption goods are most strongly associated with GVC (e.g., assembly) activity. The figure shows that, while intra-GMS exports of primary consumption goods often account for a significant share of total exports, the importance of GMS members as destinations for exports of processed consumption goods is usually relatively small. This is particularly true in the PRC, Cambodia, and Viet Nam, with a somewhat higher share in Thailand and relatively larger shares in the Lao PDR and Myanmar. The figure thus suggests that, for most GMS

Figure 10.6: Share of Intra-Greater Mekong Subregion Exports in Total Exports of Consumption Goods, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade.

members, intra-GMS exports are not an important source of demand for processed consumption goods, with markets farther afield driving demand for such products from the GMS.

10.5 Conclusions

This chapter has used detailed trade data to discuss the positioning of GMS members in GVCs and how they interact with one another within these GVCs. While using data for exports and imports of goods has limitations, the data provide important insights. First, there is some evidence to suggest that most GMS members are engaged in GVCs largely as assemblers, i.e., by intensively importing specific intermediates, processing and assembling final products, and exporting processed consumption goods. In the PRC and Thailand, the evidence suggests that they are also intensively engaged in exporting specific intermediates within GVCs. Second, the data suggest that regional value chains are important in the sense that other GMS members are often important sources of specific intermediates (i.e., GMS members account for relatively high shares of specific intermediate imports). Third, the results indicate that, in most cases, the regional (i.e., GMS) market is not an important destination for processed consumption goods produced by GMS members within GVCs. Combined, these results suggest that regional value chains and regional integration can be an important stepping stone for entering and upgrading in GVCs and serving world markets, by providing GMS members with the intermediate goods needed to produce processed consumption goods that serve global markets.

Chapter 11

Positioning within Global Value Chains: Part II

11.1 Introduction

Chapter 10 relied on disaggregated trade data to analyze the involvement of the Greater Mekong Subregion (GMS) in global value chains (GVCs). While such an approach is useful, it is at the same time limited since it is not possible to relate trade flows to GVC participation with a strong degree of certainty. Likewise, the data do not include information on services. Moreover, the approach does not allow for an analysis of sectoral value chains, since it is not possible to determine the sectors' imports of intermediate goods (though, in many cases, an examination of the specific products could provide clues).

In this chapter, the analysis moves beyond the use of goods trade statistics and considers data collected from global input–output tables. The data allow for a more thorough understanding of GVC participation (and the positioning within GVCs) by tracking the supply and use of intermediate inputs across countries and sectors. These datasets, combined with additional data on sectoral value added and final exports, can be used to construct indicators of GVC participation and positioning (see the Appendix for further details on the construction of these indicators).

The analysis in this chapter complements Chapter 10 by (i) providing information on GVC participation of GMS members at the sectoral level and (ii) providing information on more standard and commonly used indicators of GVC positioning.

11.2 Sectoral Engagement of Greater Mekong Subregion Members in Global Value Chains

The Eora global supply chain database used in this analysis has information on 26 sectors (Table 11.1) for 190 countries over the period 1990–2015.[47] The analysis in this section concentrates on the period 2000–2015.[48]

The analysis begins by considering the extent of sectoral engagement in GVCs by GMS members. This relies on two indicators (see the Appendix for more details on construction of these indices):

[47] A drawback of the use of input–output tables is that the main databases tend to lag somewhat, meaning that the latest data that the study has is for 2015.

[48] The Eora global supply chain database is at https://worldmrio.com/.

(i) foreign value added embodied in exports as a share of total exports (FVA) and (ii) domestic value added in the exports of third countries as a share of domestic value added (DVX).[49] FVA captures the share of foreign value added in a sector's exports and is often considered to capture downstream participation in GVCs.[50] A high share implies that the sector relies heavily on imported intermediate goods to produce

Table 11.1: List of Sectors in the Eora Global Supply Chain Database

Sector Number	Sector Name
1	Agriculture
2	Fishing
3	Mining and quarrying
4	Food and beverages
5	Textiles and wearing apparel
6	Wood and paper
7	Petroleum, chemical, and non-metallic mineral products
8	Metal products
9	Electrical and machinery
10	Transport equipment
11	Other manufacturing
12	Recycling
13	Electricity, gas, and water
14	Construction
15	Maintenance and repair
16	Wholesale trade
17	Retail trade
18	Hotels and restaurants
19	Transport
20	Post and telecommunications
21	Financial intermediation and business activities
22	Public administration
23	Education, health, and other services
24	Private households
25	Others
26	Re-export and re-import

Source: Eora global supply chain database.

49 Often, DVX is also calculated as a share of total sectoral domestic exports. The study uses total sectoral value added instead because it forces the variable to lie between 0 and 1. In the data, the study finds a number of cases where the value of DVX is very large when calculated as a ratio of total sectoral exports. This can be the case if a sector is itself relatively non-tradable, but it does supply a large amount of value added to other domestic sectors, which are highly tradable. In such cases, the sectoral value of exports can be very low, but the value added that it supplies to third countries (indirectly through other domestic sectors) can be high. This is true in some services sectors, e.g., public administration in the PRC in later periods.

50 As noted in the introduction to Chapter 10, downstream GVC activities include distribution activities as well as marketing and after-sales services, among other things. These activities are not captured in the analysis with distribution activities being a so-called margin industry in input–output tables. In the analysis, therefore, downstream activity can generally be associated with final assembly activities.

goods for exports. DVX captures the share of domestic value-added (in total sectoral value added) that is embodied in the exports of third countries and is often used as an indicator of upstream GVC participation. A high share implies that the sector supplies a relatively large amount of intermediate goods to third countries that are then used to produce their exports. In some studies, the sum of these two variables, i.e., GVC = FVA + DVX, is used as an indicator of overall GVC involvement.

Figures 11.1(a)–11.1(f) report the FVA values in 2000 and the change in FVA between 2000 and 2015 for each GMS member across the 25 sectors.[51] It is worth mentioning that, because the values are calculated as ratios to total exports, differences in relative sizes of the GMS members are largely eliminated.

The study highlights the following findings:

(i) With the exception of Viet Nam, the values of FVA have tended to fall between 2000 and 2015. This may well reflect the relative decline in trade and GVC performance in the period following the Global Financial Crisis.

(ii) The PRC (Figure 11.1(a)) is relatively highly integrated into downstream GVCs in electrical and machinery equipment; transport equipment; petroleum, chemicals, and non-metallic minerals; textiles and wearing apparel; and construction. These sectors also tend to be relatively important for the other five GMS members, reflecting the fact that these sectors are often strongly associated with GVC activity.

(iii) Other sectors also appear more or less relevant in other GMS economies. For example, in Cambodia (Figure 11.1(b)), recycling and other manufacturing have relatively high FVA values, as do primary and low-tech manufacturing sectors such as fishing, mining and quarrying, and food and beverages.

(iv) Mining and quarrying are less important in the Lao PDR (Figure 11.1(c)), but fishing has high values of FVA (though in both the Lao PDR and Cambodia the values decline significantly over time). Core GVC sectors—electrical and machinery equipment; transport equipment; and petroleum, chemicals, and non-metallic minerals—are relatively less important in the Lao PDR, while textiles and apparel, maintenance and repair, fishing, recycling, and other manufacturing have the highest values of FVA.[52]

(v) Myanmar (Figure 11.1(d)) stands out among the GMS members. It has low FVA values in all sectors except for relatively high values in fishing, mining and quarrying, and recycling.

(vi) Thailand (Figure 11.1(e)) has high values of FVA in many sectors, most notably the core GVC sectors of electrical and machinery equipment and, most obviously, transport equipment.

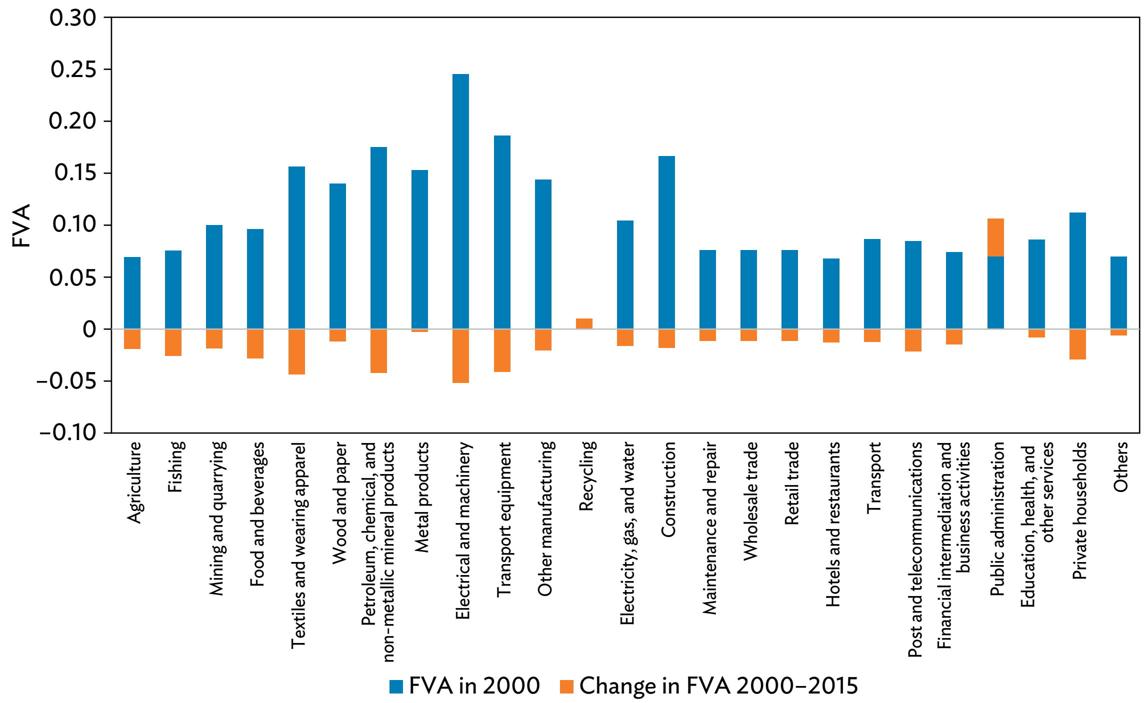
(vii) Sectors that are important in Thailand are also important in the case of Viet Nam (Figure 11.1(f)), as are other core GVC sectors such as metal products. But unlike other GMS members, Viet Nam has bucked the trend for falling FVA, with increases in FVA across many sectors between 2000 and 2015, notably in textiles and apparel.

[51] Re-imports and re-exports were dropped from this analysis.

[52] Sectors such as private households are not discussed, given their relatively small size and the general lack of involvement that these sectors are considered to play in GVCs.

Figure 11.1: Foreign Value Added

(a) People's Republic of China



(b) Cambodia

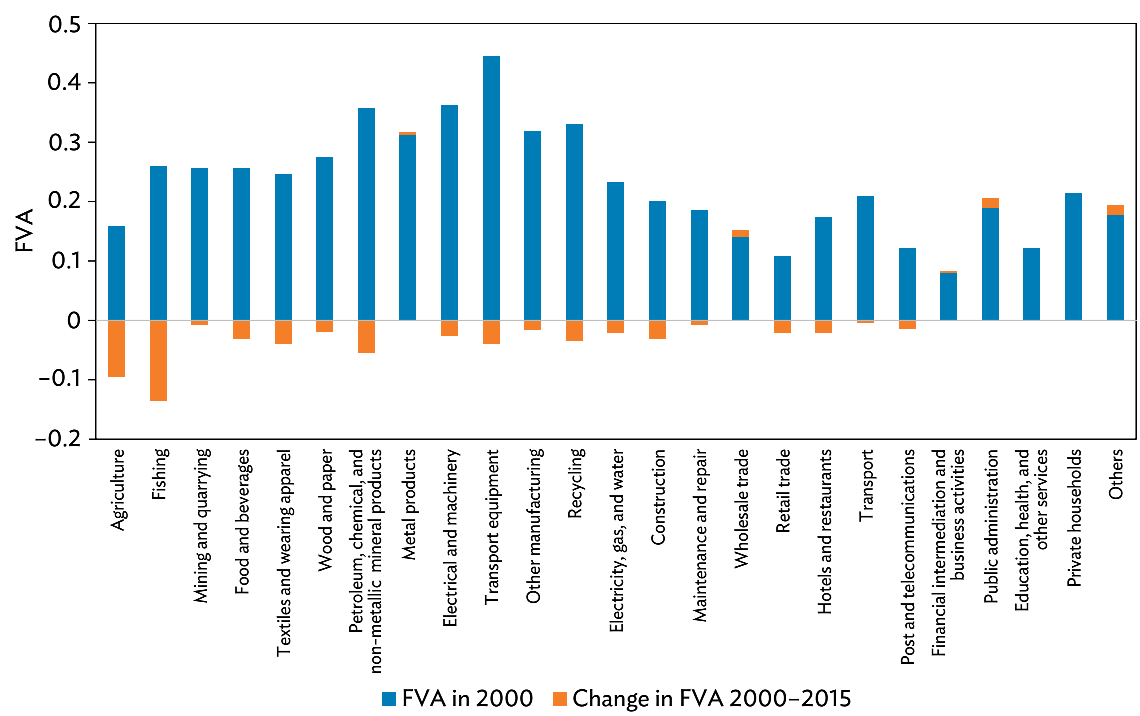


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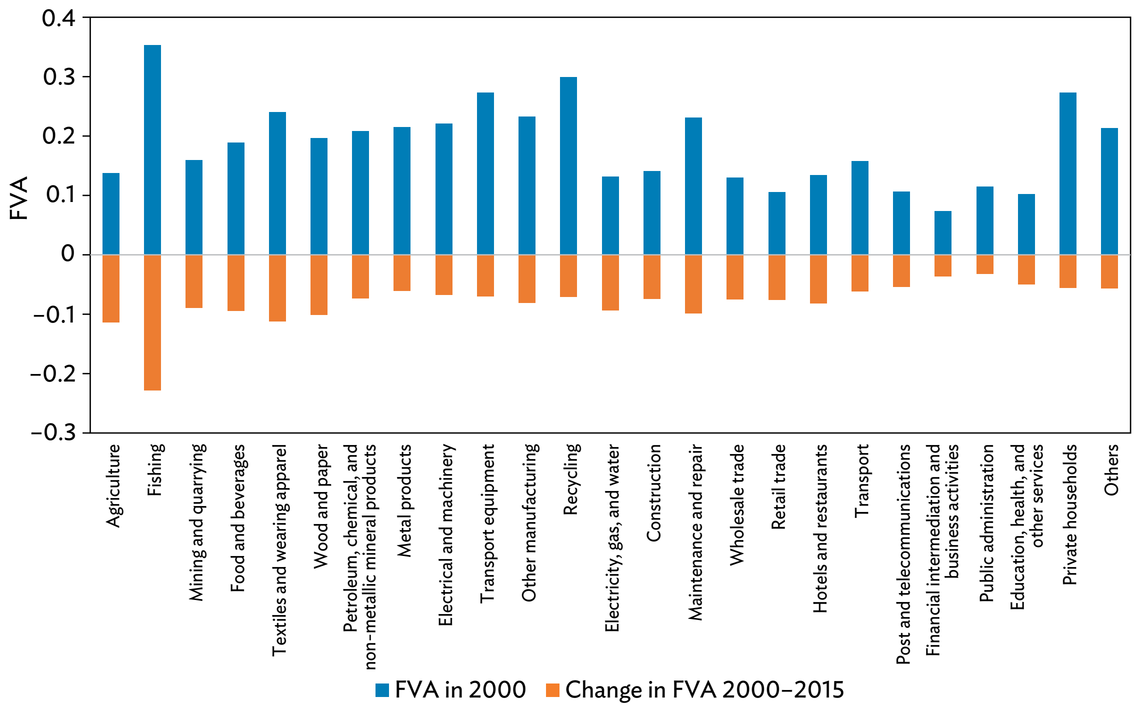
Figure 11.1 *continued*

(c) Lao People's Democratic Republic



(d) Myanmar

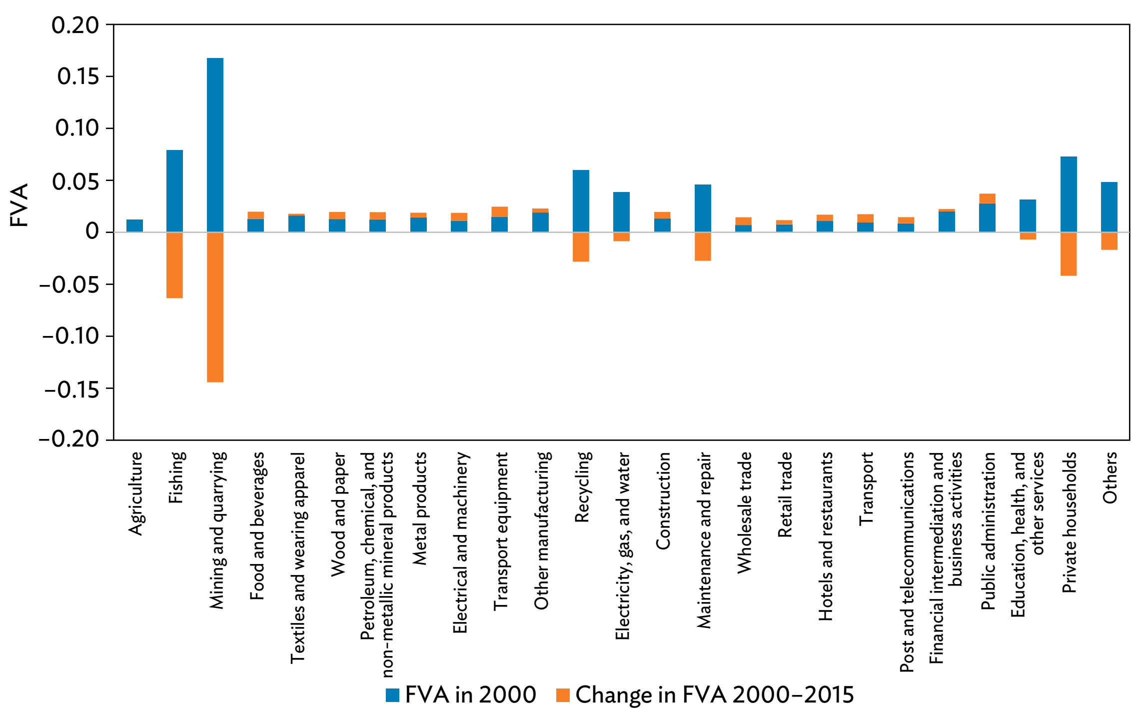


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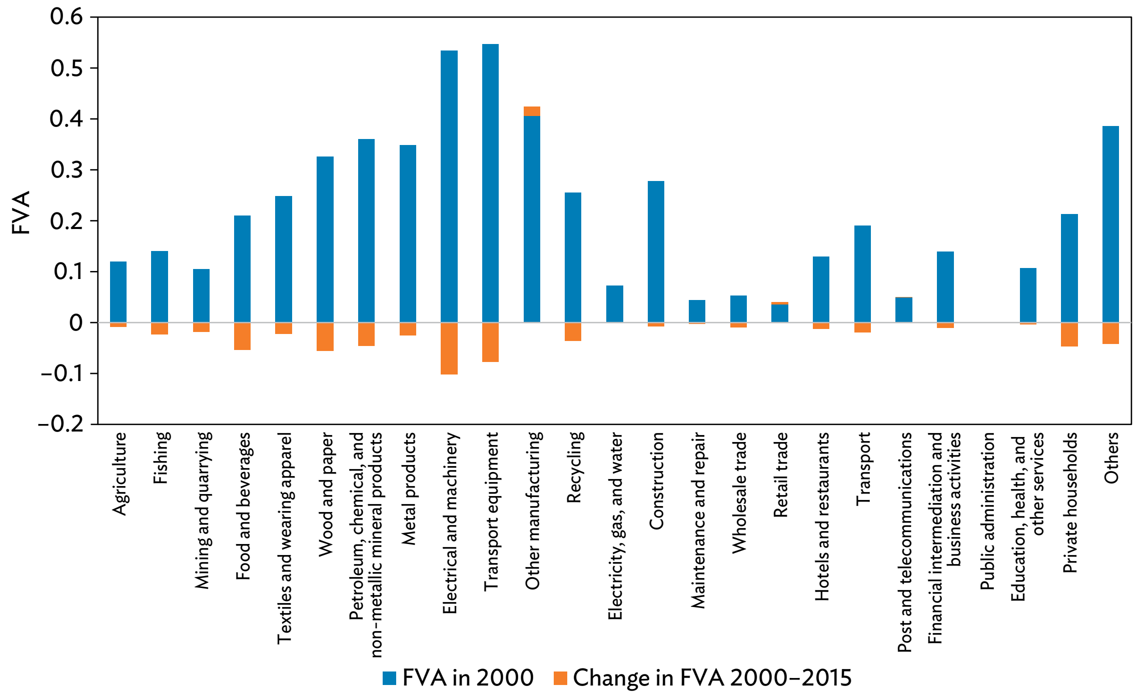
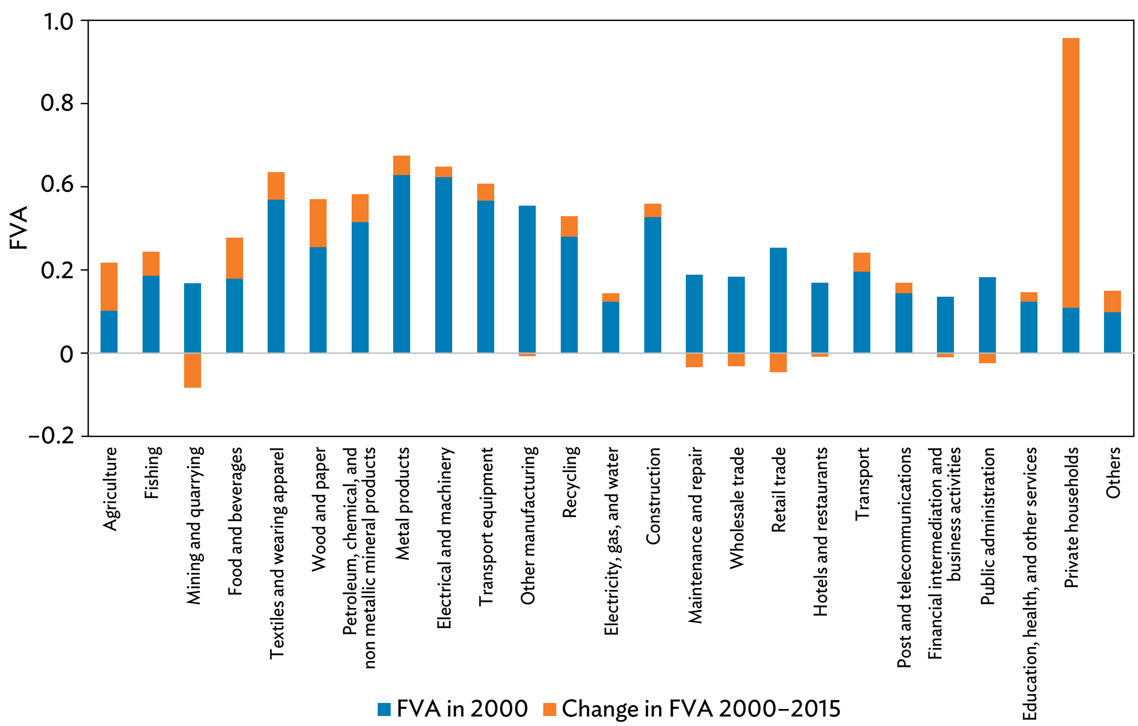
Figure 11.1 *continued*

(e) Thailand



(f) Viet Nam



FVA = foreign value added.

Source: Authors' calculations based on Eora data.

The values for DVX, an indicator of upstream GVC participation, are much more varied than the FVA values, as shown in Figures 11.2(a)–11.2(f). The most significant findings are:

(i) In the PRC (Figure 11.2(a)), recycling, mining and quarrying, and metal products had the highest values in 2000, while public administration registered the largest increase between 2000 and 2015.

(ii) For Cambodia (Figure 11.2(b)), recycling is again an important sector in terms of upstream participation, as is agriculture. Mining and quarrying, wood and paper, and metal products are also important sectors, while electrical and transport equipment have relatively high values that also increased over time.

(iii) The Lao PDR (Figure 11.2(c)) has relatively high values of DVX across a broad range of sectors, with the relatively low value in textiles and wearing apparel perhaps the major outlier. Values of DVX fell across all sectors between 2000 and 2015.

(iv) In contrast to the results for FVA, values of DVX in Myanmar (Figure 11.2d) tend to be relatively large across many sectors. Values are particularly large for mining and quarrying, with relatively high values also reported in retail trade, construction, recycling, electrical and machinery, and metal products. Interestingly, Myanmar reports relatively low values of DVX in agriculture as well as other low-tech sectors, such as food and beverages and textiles and wearing apparel.

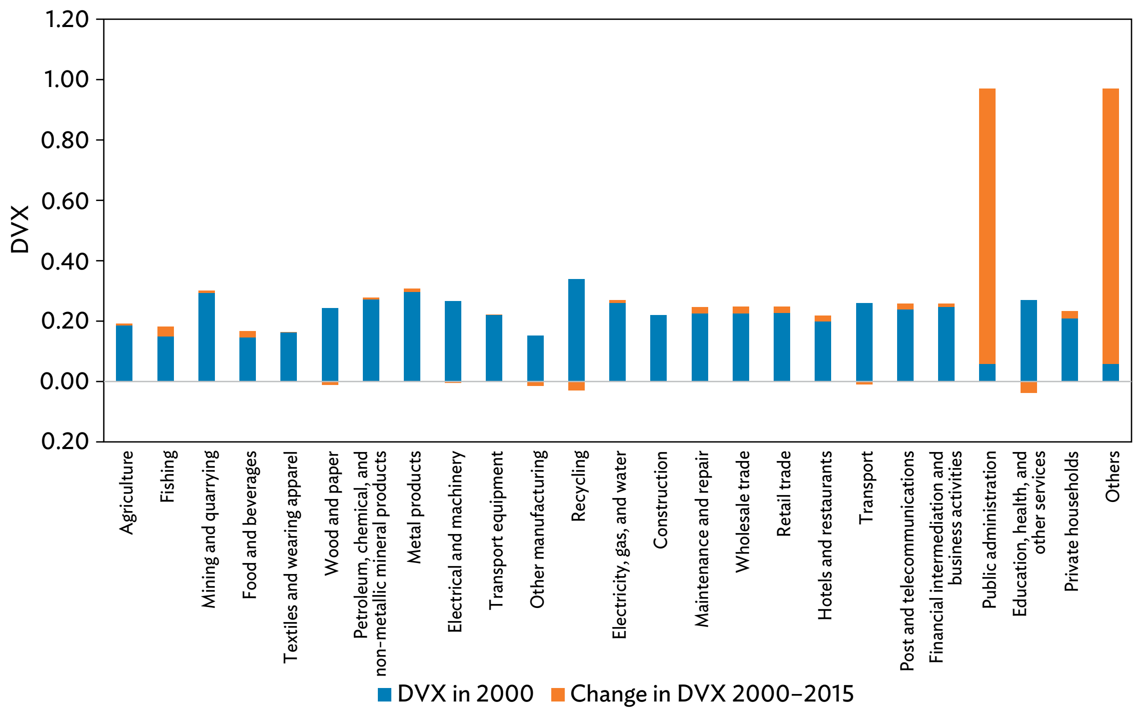
(v) Thailand (Figure 11.2(e)) has relatively low values of DVX across many sectors, with construction as well as public administration, and to a lesser extent mining and quarrying and metal products, the major exceptions.

(vi) Viet Nam (Figure 11.2(f)) had low values of DVX in 2000 across most sectors, but rose relatively rapidly across most sectors between 2000 and 2015. Excluding public services and households, the sectors that had the highest values of DVX in 2015 include construction, transport equipment, and fishing.

These findings provide some important insights in understanding GVC participation by the GMS economies. The results suggest that most GMS members are actively involved in those sectors that are most commonly associated with GVCs, i.e., electrical and machinery, textiles, transport equipment, and others. The results also suggest that there are differences across members and that the members are engaged at different points in GVCs. The obvious example here is Myanmar, which has very low values of FVA across sectors but reports much larger values of DVX, suggesting upstream engagement in GVCs.

Figure 11.2: Domestic Value Added

(a) People's Republic of China



(b) Cambodia

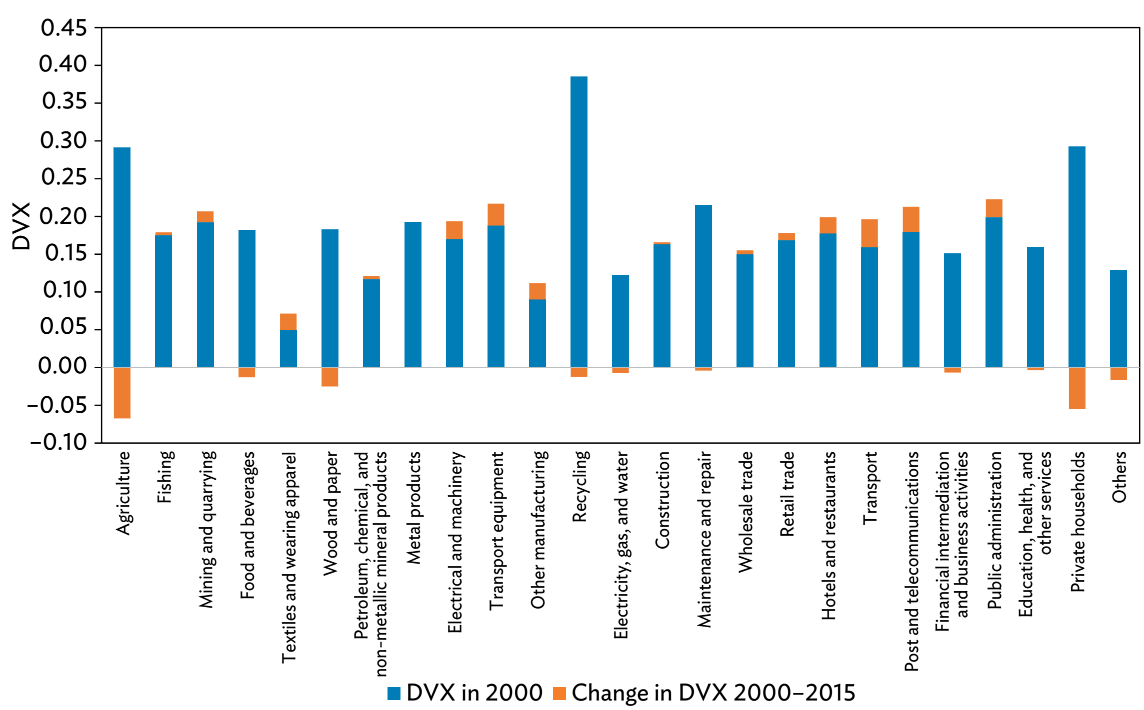


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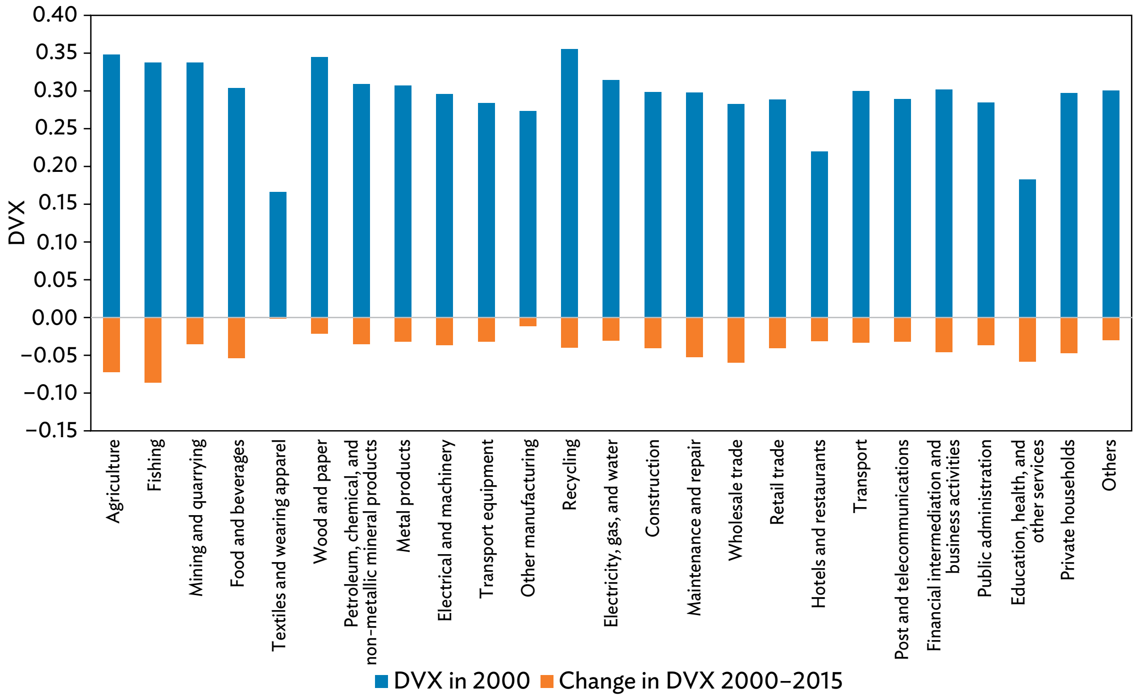
Figure 11.2 *continued*

(c) Lao People's Democratic Republic



(d) Myanmar

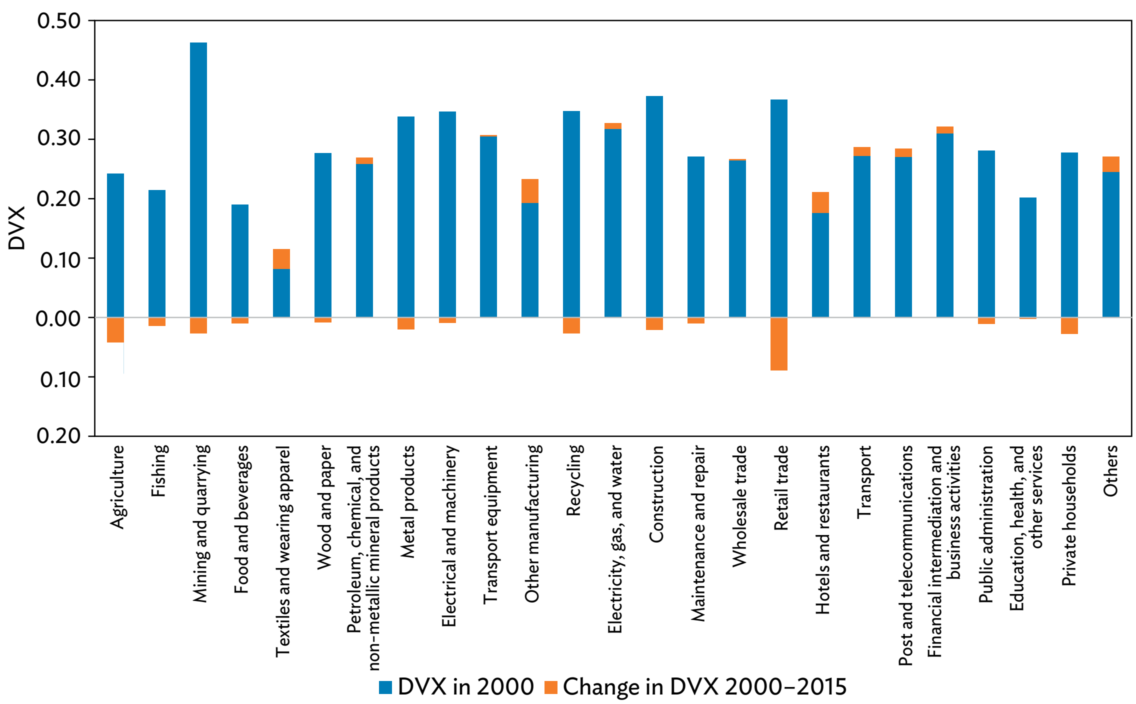


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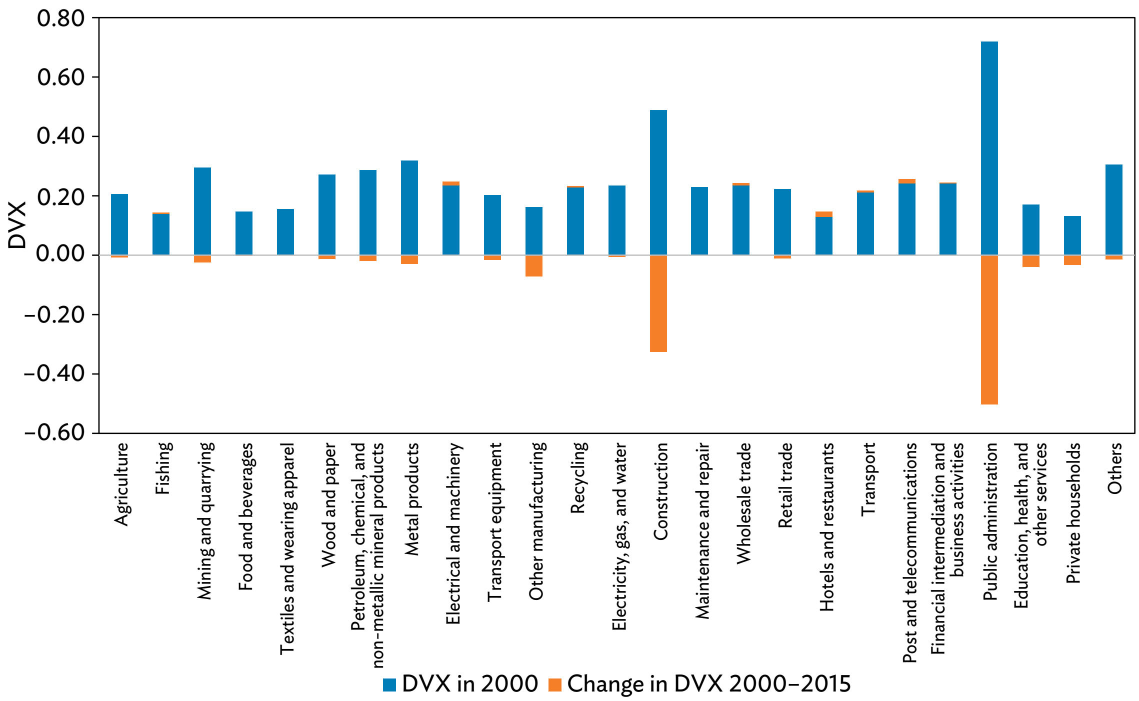
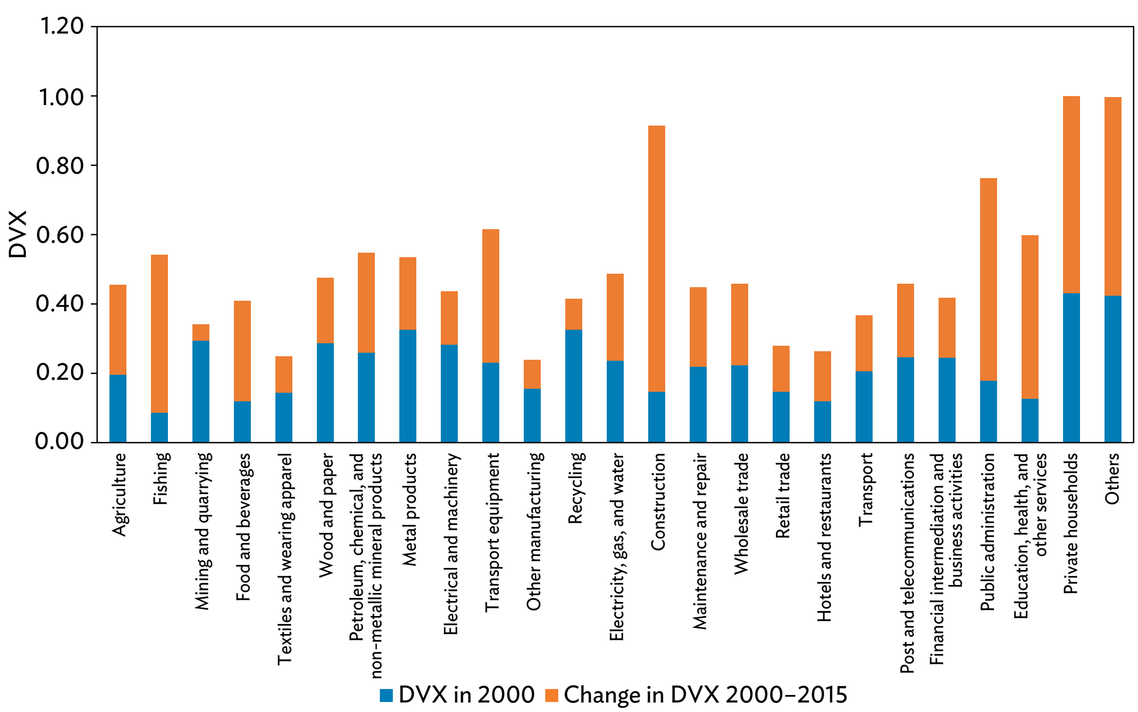
Figure 11.2 *continued*

(e) Thailand



(f) Viet Nam



DVX = domestic value added.

Source: Authors' calculations based on Eora data.

11.3 Positioning of Greater Mekong Subregion Members in Global Value Chains

This section builds on the previous analysis by considering in further detail GMS members' positioning in sectoral GVCs. As already discussed, FVA and DVX capture two different dimensions of GVC participation, namely downstream and upstream participation, respectively. These two indicators are combined to construct a measure of overall GVC positioning:

$$GVCp = \frac{FVA}{FVA + DVX}$$

This indicator therefore lies between 0 and 1, with higher numbers indicating a higher share of FVA in the sum of FVA and DVX. Consequently, higher values of this indicator are associated with higher levels of downstream production. In principle, a value of $GVCp$ greater than 0.5 indicates that FVA (i.e., downstream GVC production) is dominant, though in the analysis below different thresholds are used to distinguish between upstream, downstream, and a middle position within GVCs. This indicator will be used to discuss the GVC positioning of each sector and each GMS member in 2000, along with the change between 2000 and 2015. The results are reported in Figures 11.3(a)–11.3(f). The most salient findings are:

(i) In the PRC (Figure 11.1(a)), focusing on the primary and manufacturing sectors only shows that it is engaged in relatively downstream GVC production in textiles and wearing apparel, electrical and machinery, and other manufacturing. Such results align well with the commonly held view that the PRC is engaged in assembly activities in these sectors, although it has moved relatively upstream in these sectors between 2000 and 2015. Conversely, the PRC is engaged in relatively upstream production in agriculture and mining and quarrying, with the results on mining and quarrying again in line with expectations that the PRC is engaged in the extraction phase of this sector.

(ii) Results for Cambodia (Figure 11.3(b)) suggest that it is engaged in downstream production in many sectors, most notably textiles and wearing apparel but also recycling and other manufacturing, among others. Upstream engagement in GVCs is particularly pronounced in agriculture, mining and quarrying, and petroleum.

(iii) The Lao PDR (Figure 11.3(c)) has generally lower values of the GVC positioning index when compared to Cambodia, suggesting on average more upstream participation. At the same time, those sectors that were found to be relatively downstream in Cambodia, e.g., textiles and wearing apparel, recycling, and other manufacturing are also relatively downstream in the Lao PDR. Many sectors show a high degree of upstream activity including mining and quarrying, food and beverages, petroleum, metal products, and electrical and machinery.

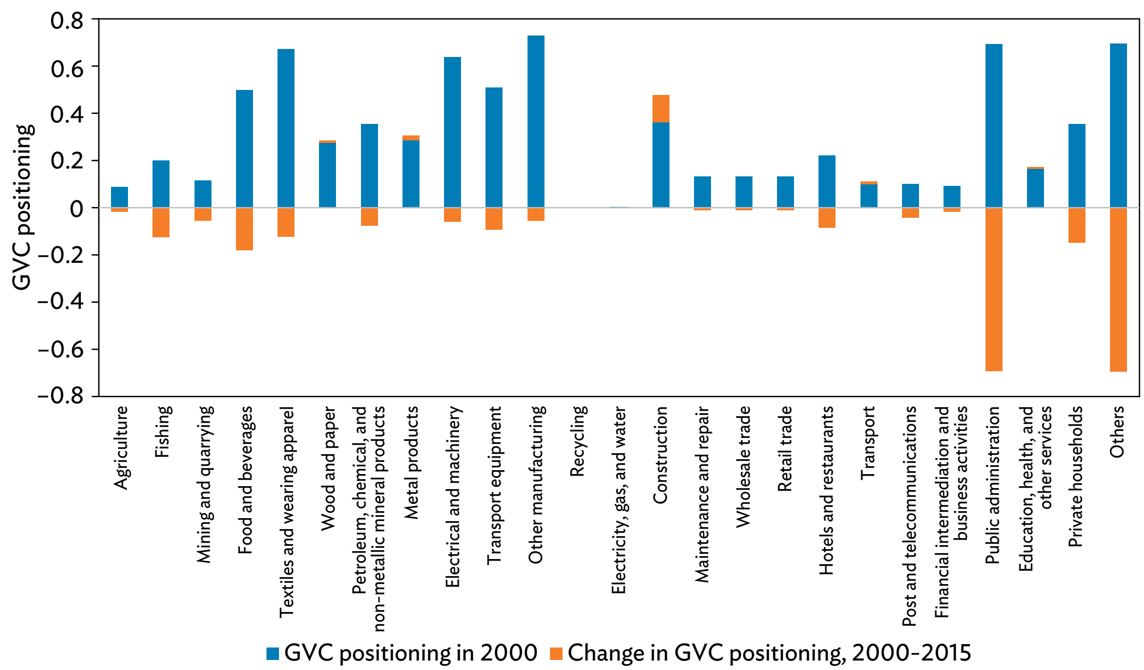
(iv) Myanmar (Figure 11.3(d)) is an interesting case in that it has relatively low values in terms of GVC positioning across all sectors. While the values are below 0.5 in all sectors, they are somewhat high in recycling and textiles and apparel. They were also relatively high in fishing and mining and quarrying in 2000, but these sectors moved more upstream between 2000 and 2015.

(v) Thailand (Figure 11.3(e)) has a high degree of downstream production in many sectors, including electrical and machinery, transport equipment, and other manufacturing, confirming the view that Thailand is engaged in assembly activity in many GVC sectors. The upstream participation of Thailand tends to be in the primary sectors.

(vi) Viet Nam (Figure 11.3(f)) also has relatively high values of the GVC positioning index in many sectors, suggesting downstream participation in GVCs. These sectors include electrical and machinery, other manufacturing, food and beverages, and textiles and wearing apparel. With the exception of fishing, upstream participation is largely confined to primary sectors.

Figure 11.3: Global Value Chain Positioning

(a) People's Republic of China



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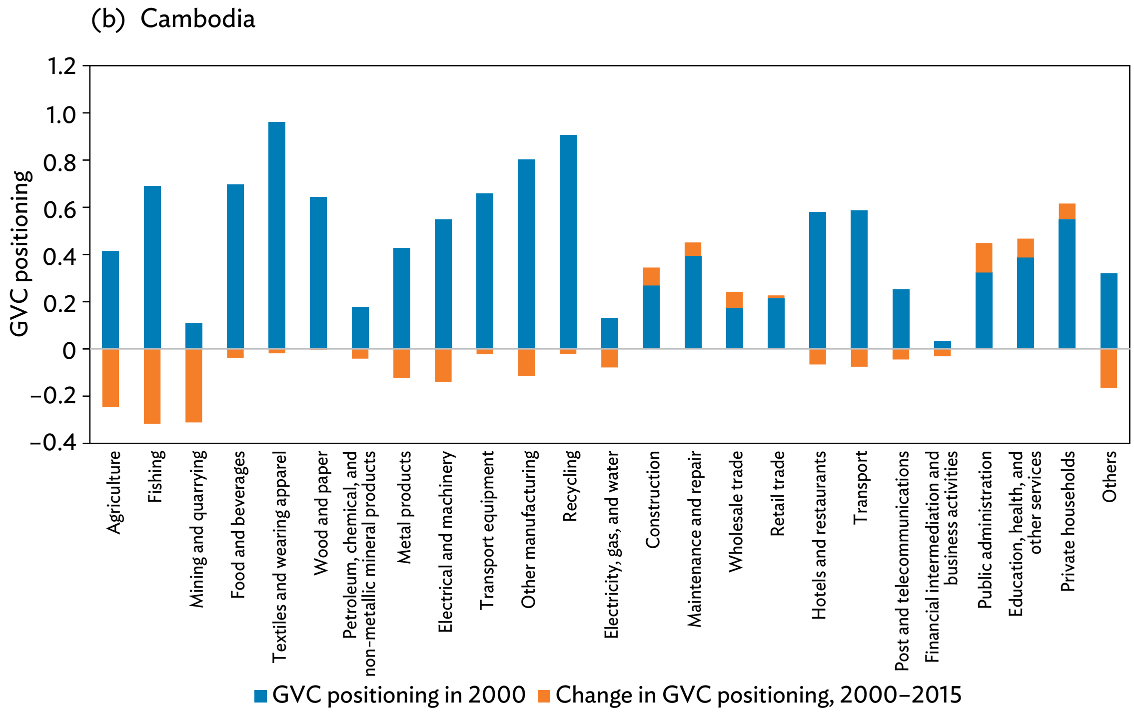

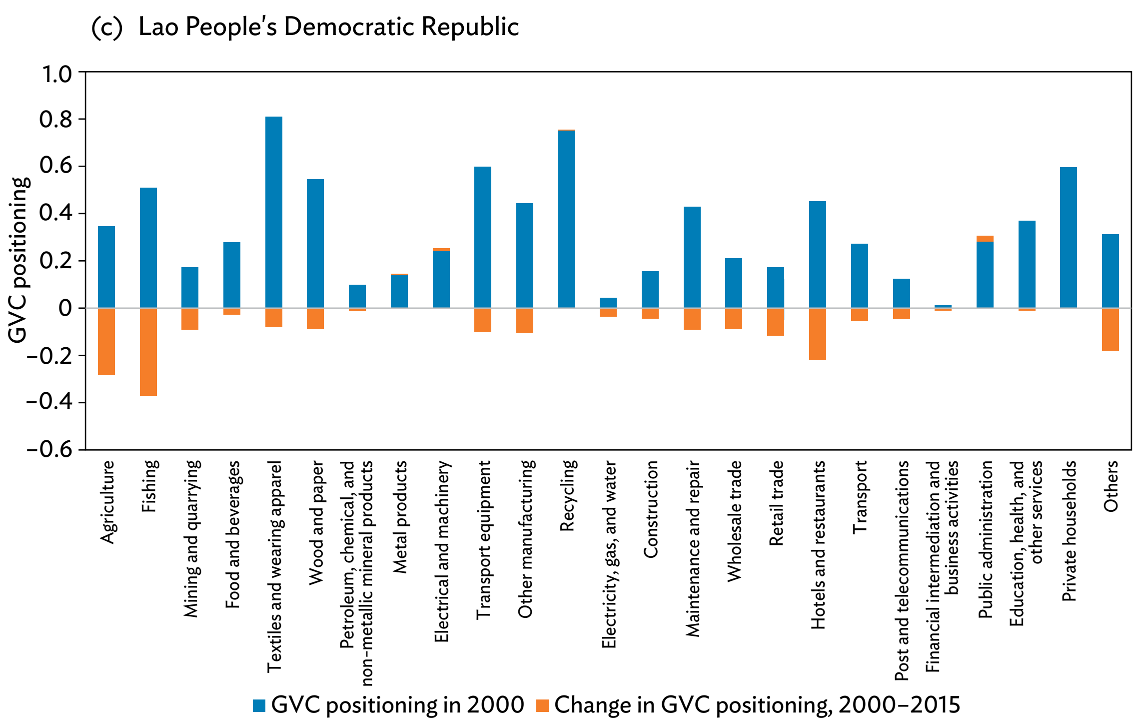

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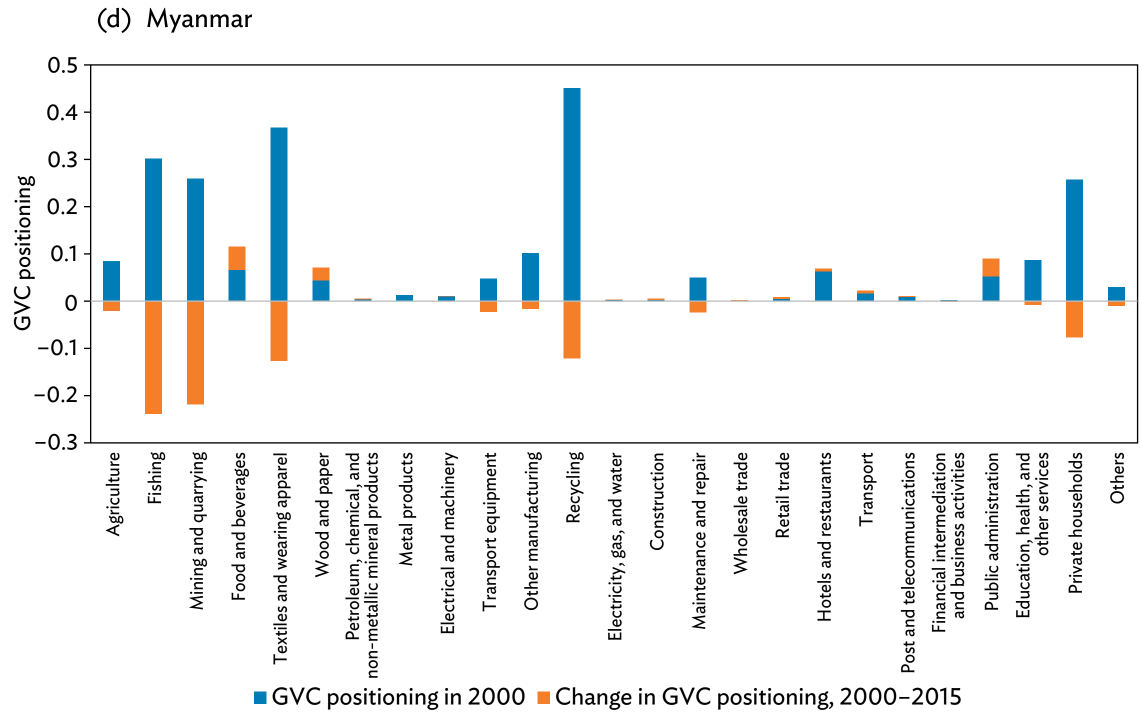

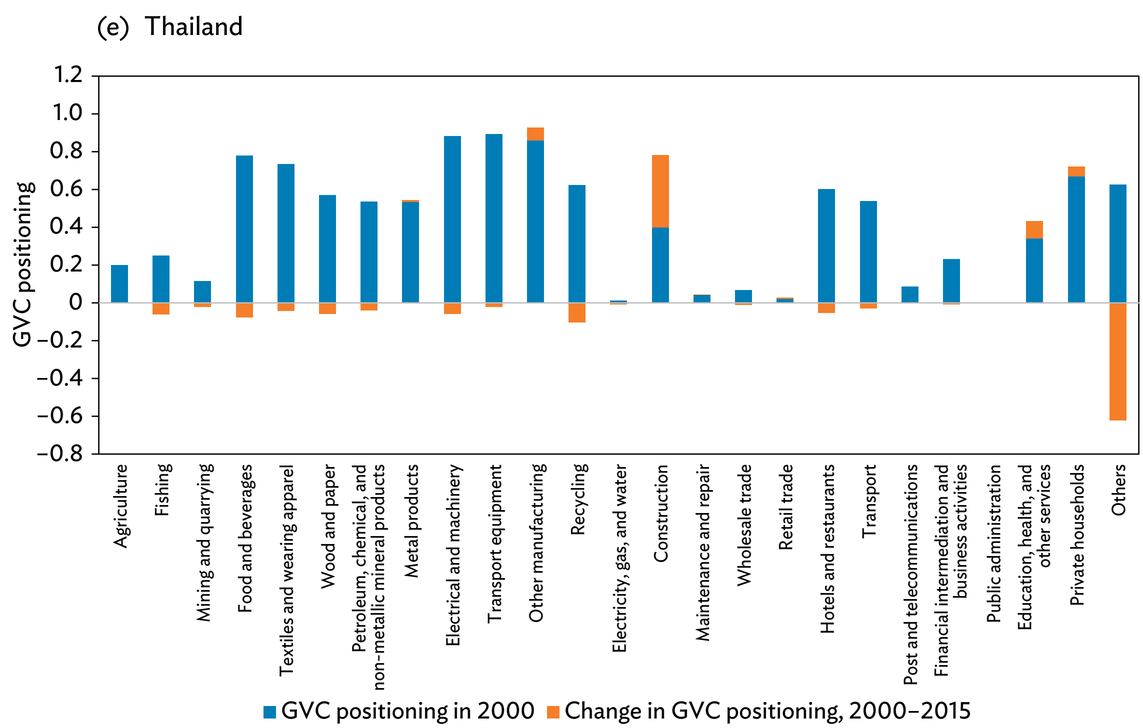

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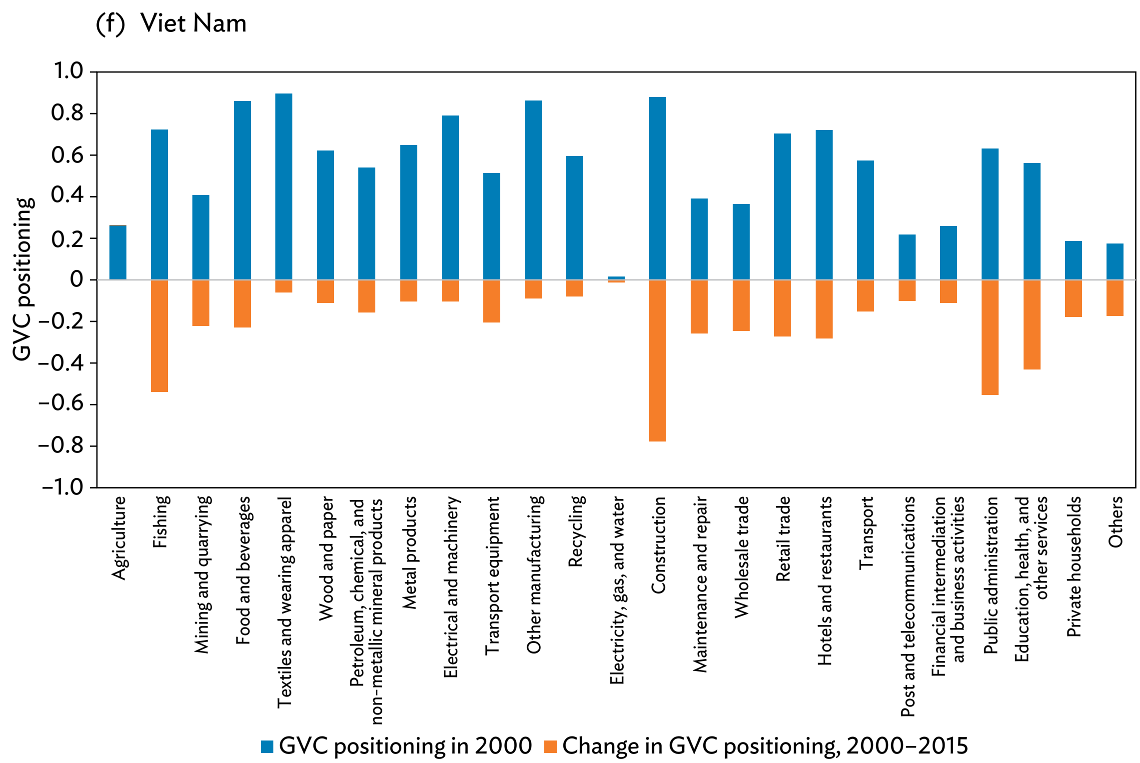


GVC = global value chain.

Source: Authors' calculations based on Eora data.

This section has discussed the positioning of GMS members within GVCs. A number of interesting patterns emerge:

(i) The PRC, Thailand, and Viet Nam tend to be engaged, on average, in more downstream GVC activity than the other three GMS economies. In the PRC and Thailand, this is particularly true in sectors that are considered traditional GVC sectors, e.g., electrical and machinery and transport equipment. Other sectors in Viet Nam appear to be relatively downstream, including food and beverages.

(ii) Cambodia, the Lao PDR, and Myanmar tend to be engaged further up the value chain, acting as providers of raw materials, primary products, and other intermediate goods for other countries' exports.

(iii) There are differences across these three countries, however. While Cambodia is engaged in downstream engagement in a number of sectors, Myanmar reports a relatively high degree of upstream production across all sectors.

In the next chapter, the study will examine whether these differences in GVC positioning have implications for potential wage developments.

11.4 Conclusions

This chapter has provided information on GVC participation of GMS members along two dimensions: (i) the sectoral level and (ii) the positioning of GMS members within GVCs.

In terms of sectoral GVC participation, GMS members are engaged in sectors that are most commonly associated with GVCs, e.g., electrical and machinery, textiles, transport equipment, and others. Despite this, there are differences in both the intensity of GVC engagement and positioning within GVCs. For example, Myanmar has only been able to enter into upstream GVCs (i.e., a supplier in GVCs), while other members have moved into more downstream GVC participation, at least in certain sectors. This is particularly true for the more advanced GMS economies (i.e., the PRC, Thailand, and Viet Nam).

Efforts to develop and raise average wages through GVCs often require either a movement toward new GVCs and/or a movement to different positions in the value chain. An important requirement for such a move is to attract foreign direct investment and to attract the right kind of foreign direct investment (i.e., foreign investment aimed at producing particular parts of the value chain). Other important factors involve developing capabilities (e.g., human capital in a broad sense, appropriate institutions, and trade policies that facilitate integration into GVCs) as well as encouraging technology transfer, which depends on the willingness of the donor country or firm and the ability of the receiving country or firm to negotiate. Given the importance of regional value chains, the GMS could play an important role in encouraging technology transfer within the region, with links created between firms at different stages of the regional value chain becoming a potentially important source of information and technology.

Appendix

Measuring Positioning within Global Value Chains

To measure GVC participation, the study uses information from the multi-region input–output (MRIO) tables from the Eora global supply chain database. A country's exports can be split into a component that captures domestically produced value added and another that captures imported value added that is incorporated into a country's exports. A complete analysis of GVCs will also account for the fact that a country's exports need not constitute final goods only, but may also be used as inputs into other country's production (and exports). Koopman et al. (2011), among others, have developed indicators of GVC participation that allow one to split the foreign and domestic value-added content of exports, with the foreign value-added share indicating the share of a country's exports that consists of inputs that have been produced in other countries, and thus do not add to the gross domestic product of the country of interest.[53] The approach of Koopman et al. (2011) also allows one to calculate the share of a country's value-added exports embodied as intermediate inputs in other countries' exports, what Koopman et al. (2011) refer to as "indirect value-added exports." Combined, these two measures provide a comprehensive description of GVC participation. The former indicates the extent to which a country's exports comprise value added created abroad, and thus captures the extent of GVC participation for downstream firms and industries, while the latter captures the contribution of the domestic sector to the exports of other countries, thus indicating the extent of GVC participation for relatively upstream sectors that have relatively few inputs from either domestic or foreign sources.

The calculation of foreign value added in trade requires an MRIO table, which builds on national input–output tables by breaking down the use of products by origin. The rows in an MRIO table indicate the use of gross output from a particular industry in a particular country and comprise two main components. The first is intermediate use, which provides information on intermediate use by both domestic industries and industries in other countries. The second is information on final demand, which is again split between demand for final goods from both domestic and foreign sources. The columns of the MRIO table provide information on the amounts of intermediates needed for the production of gross output. The column sum thus gives the sum of the domestic and foreign production of intermediates that are used in the production of output in a particular industry and country. Combining this sum with the sum of value added generated in each industry and country gives the value of gross output. The information given by an MRIO table can be translated into a standard input–output matrix form by stacking all industries and countries, such that we have $(n \times i)$ rows and columns, with n being the number of countries and i the number of industries. Gross output can then be expressed as

$$x = Z + y$$

$$x = Ax + y$$

$$(I - A)x = y$$

$$x = (I - A)^{-1}y = Ly$$

[53] See also Johnson and Noguera (2012) and Foster-McGregor and Stehrer (2013).

with x being gross output, Z intermediate demand, y final demand, I the identity matrix, A the technological coefficient matrix (i.e., the ratio of intermediate use to gross output by intermediate), and L the Leontief inverse. In addition, to calculate trade in value added, two row vectors v and e are required, where each element of v represents the share of value added per unit of output by country and industry, and each element of e represents aggregate exports (i.e., sum of intermediate inputs exported abroad and exports of final goods) by country and industry. The trade in value added matrix can then be written as

$$\begin{pmatrix} T_v^{11} & \dots & T_v^{1n} \\ \vdots & \ddots & \vdots \\ T_v^{n1} & \dots & T_v^{nn} \end{pmatrix} = \begin{pmatrix} v^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & v^n \end{pmatrix} \begin{pmatrix} L^{11} & \dots & L^{1n} \\ \vdots & \ddots & \vdots \\ L^{n1} & \dots & L^{nn} \end{pmatrix} \begin{pmatrix} e^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & e^n \end{pmatrix}$$

with v^n an $i \times 1$ (diagonalized) row vector giving the value added per unit of output for each industry in country n, L^{nn} the $i \times i$ Leontief inverse for country n, and e^n the $i \times 1$ (diagonalized) row vector of total exports for each industry in country n. The first column of the trade in value added matrix describes the value added contained in the exports of country 1 and can be split into a domestic and foreign component. The term T_v^{11} gives the domestic value-added content of exports. The term T_v^{j1} $(j \neq 1)$ gives the foreign value-added content of exports of country 1 generated by country j. Summing up these terms for all j, i.e., $\sum_{j=2}^{J} T_v^{j1}$, gives the total foreign value added in the exports of country 1. The sum of the domestic and foreign value-added content of exports of country 1 is equal to total exports of country 1. Taking the ratios of T_v^{11} and $\sum_{j=2}^{J} T_v^{j1}$ to total exports then gives the share of exports of country 1 that are due to domestic (DVX) and foreign (FVA) value added. An analogous interpretation holds for all other columns.

The trade in value added matrix can also be used to obtain information on the domestic value added that enters as an intermediate input in the value added exported by other countries. This is found by looking at the rows, rather than the columns, of the T_v matrix. The term T_v^{12}, for example, which can be written as $T_v^{12} = v^1 L^{12} e^2$, indicates the value of country 2's exports that depends on value added from country 1. Summing along the row (and excluding the diagonal term) thus provides an indicator of the value added of a country that enters as an intermediate input into the value added exported by all other countries. In the literature, this value is also often taken as a share of total sectoral domestic exports. This study uses total sectoral value added instead because it forces the variable to lie between 0 and 1, with the resulting variable being referred to as DVX.

To capture the overall participation of countries and sectors in GVCs, the study combines the FVA and DVX measures by summing up the foreign value added used in a country's own exports and the value added supplied to other countries' exports, and taking the sum as a ratio to gross exports, i.e., $GVC = FVA + DVX$. To capture the positioning of a country within GVCs, the analysis also uses the information embodied in the FVA and DVX variables. As mentioned above, the FVA variable captures the extent of foreign value added embodied in a country's exports, and thus indicates downstream participation in GVCs, while the DVX variable captures the extent of a country's value-added exports embodied in third-country exports, thus indicating upstream activity in GVCs. Based on this, the analysis constructs a measure of GVC positioning as $GVCp = FVA/(FVA + DVX)$. As such, higher values of the variable GVCp are associated with a higher share of FVA in overall GVC participation, thus indicating a country or a sector that is relatively downstream (i.e., closer to the final consumer) in GVCs.

Chapter 12

Global Value Chains and Wages

12.1 Introduction

This chapter extends the analysis in the two previous chapters on global value chains (GVCs) by considering the relationship between GVC positioning and wage developments. Because the main data set used in the previous chapter (the Eora database) does not have information on wages, the analysis in this chapter will use an alternative data set (which in general does not cover Greater Mekong Subregion (GMS) members) to examine whether there are observable differences in wages across value chains (e.g., agricultural value chains versus manufacturing value chains) and at different positions within value chains. An important aspect of development involves increasing the well-being of a country's inhabitants, which can be best achieved by providing high-paying jobs. The aim of this chapter is to examine how and whether GVCs can be an important means of encouraging higher wages and, if so, what changes in the GMS members' GVC engagement would have to be undertaken, i.e., jumping to new value chains or moving to different positions within a value chain, in order to achieve these gains.

12.2 Global Value Chain Positioning and Wages

The literature defines four types of upgrading in GVCs:[54]

(i) **process upgrading:** transforming inputs into outputs more efficiently by reorganizing the production system or introducing superior technology,

(ii) **product upgrading:** moving into more sophisticated product lines,

(iii) **functional upgrading:** acquiring new functions (or abandoning existing functions) to increase the overall skill content of the activities, and

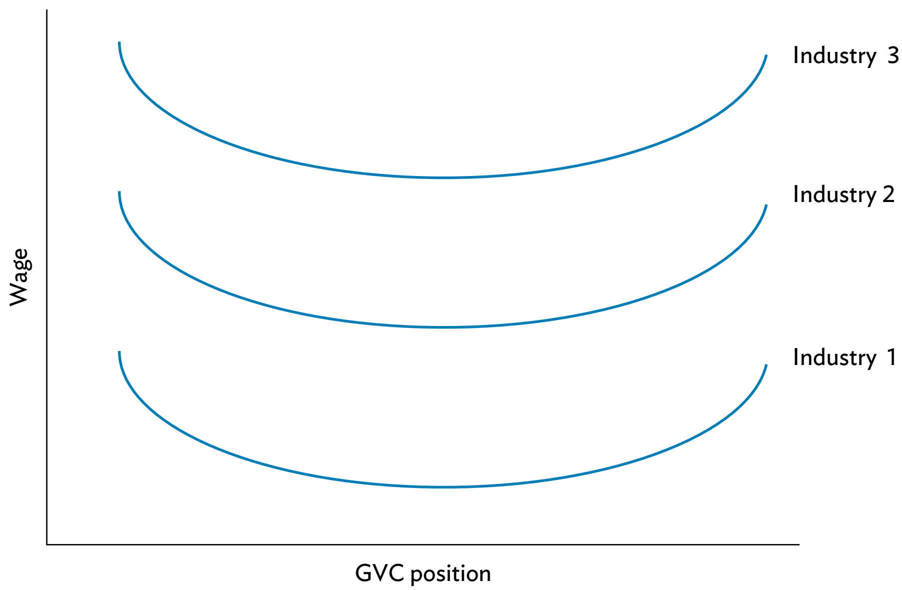
(iv) **chain or inter-sectoral upgrading:** moving firms into new but often related industries.

Of these four types, it would be difficult to capture process upgrading using the aggregated (sectoral) data available (the study would need firm-level data). Capturing product upgrading to any great extent is also unlikely. It is possible, however, to capture functional upgrading (the movement to different positions within value chains) and chain upgrading (the movement to new value chains). Indeed, the analysis in Chapter 11 provides an initial insight into the positioning of GMS members within GVCs, with GVC indicators providing information on which value chains in general GMS members are most active in.

[54] Humphrey (2004).

This chapter examines whether there is any relationship between wages and the particular value chains countries are engaged in, and their position within those value chains. To give a very stylized example, consider Figure 12.1. The idea behind this figure is that there are two ways to achieve higher wages in GVCs: (i) move to different positions along the value chain (i.e., along one of the curves); and (ii) move to a new value chain (i.e., a shift to a different value chain). The curves in the figure are drawn to reflect the well-known smile curve. But in reality, these relationships need to be estimated, with the actual relationship taking many potential shapes.[55]

Figure 12.1: Stylized Example of Upgrading and Wages



GVC = global value chain.

Source: Authors' elaboration.

To discuss a country's position within GVCs and wages, the analysis has to move away from the Eora database, which does not include information on wages, and instead use the World Input–Output Database (WIOD).[56] This database has information on wages but includes only one GMS member, the PRC. The study uses the WIOD to examine the relationship between wages and both GVC type and position, and then applies the resulting typology to the Eora data.

In addition to having a different set of economies, the WIOD also uses a different industry classification. To allow for a comparison and to reduce the dimensionality of the data, the analysis

[55] The smile curve usually relates value added—rather than wages—to GVC positioning, such that potentially different patterns can be expected as well as different patterns across different sector types. The consideration of wages rather than value added may be particularly relevant for other economies. Since GVCs are often driven by large multinationals, value added is likely to reflect the return to capital for these large foreign multinationals as well as to domestic wages. Concentrating on wages then provides a better indicator of the impact of GVCs on local development opportunities.

[56] World Input–Output Database. www.wiod.org; and Timmer et al. (2005).

concentrates on a set of 18 sectors from the WIOD, which result from an aggregation of more sectors. These 18 sectors are the most traded sectors within GVCs and have a corresponding sector in the Eora database. Full details of the methodology for estimating the relationships between wages and GVC type and positioning, as well as a list of the sectors used in the analysis and their descriptions, are provided in the Appendix. In the main text, the analysis begins by focusing on the resulting estimated relationships.

Table 12.1 summarizes information on average wage rates by sector for the set of economies in the WIOD considered for comparison with the GMS members. Given that these economies are relatively heterogenous, the analysis refers to them as other economies.[57] Wages are, on average, relatively low in agriculture and other primary sectors (e.g., fishing) as well as in certain low-tech manufacturing sectors (e.g., textiles and wood, paper, and printing) and low-tech services (e.g., trade). Interestingly, wages

Table 12.1: Wage Rates by Sector in the World Input–Output Database for Other Economies, 2000–2015 Average

Sector	Mean	Standard Deviation
Agriculture	10,067	6,831
Textiles	10,323	5,500
Other manufacturing	13,902	11,677
Fishing	15,406	7,587
Wood, paper, and printing	12,764	6,849
Trade	17,108	9,088
Construction	15,762	6,598
Food	14,226	7,178
Maintenance and repair	19,630	9,263
Metal products	15,646	7,306
Transport	19,167	7,691
Electrical and machinery	17,712	6,807
Post	19,241	7,278
Petroleum, chemical, and non-metallic mineral products	20,761	7,506
Transport equipment	19,404	7,210
Electricity, gas, and water	27,276	13,278
Financial intermediation and business activities	28,096	13,351
Mining	26,195	7,733

Notes: The World Input–Output Database (WIOD) reports information on compensation to employees (in national currency and current prices) and number of employees, which the study uses to construct an average wage. To make the data comparable, wages are deflated using the consumer price index to express them in 2010 prices and then converted to 2010 international purchasing power parity (PPP) dollars using the PPP conversion rate for 2010.
Other economies are Bulgaria; Brazil; Czechia; Croatia; Hungary; India; Indonesia; Latvia; Lithuania; Malta; Mexico; Poland; the People's Republic of China; Romania; the Russian Federation; Slovakia; Slovenia; Taipei,China; and Turkey.

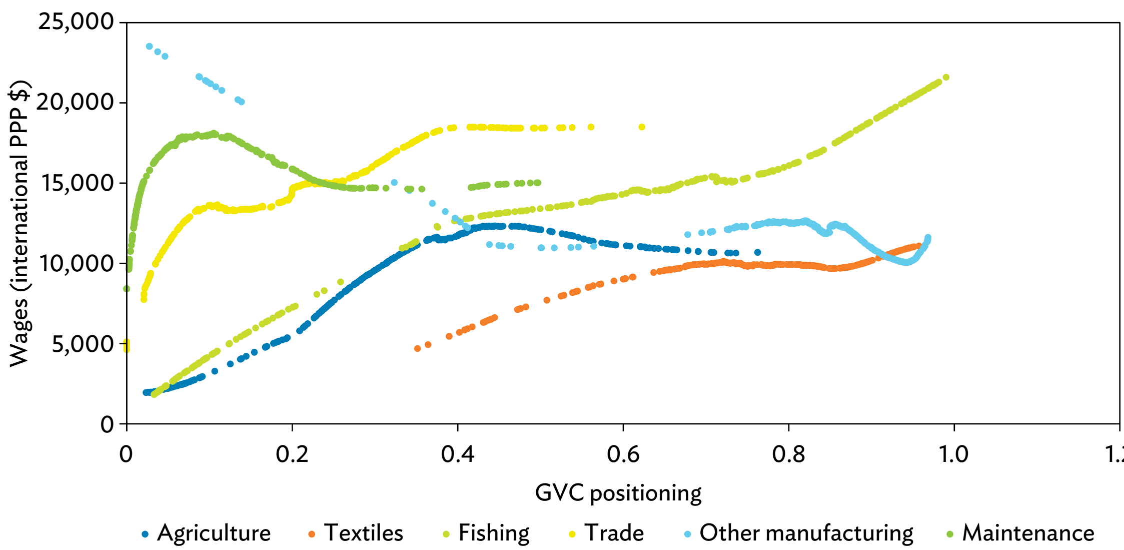
Source: Authors' calculations based on the WIOD.

[57] Other economies: Because there are only a few true developing economies in the WIOD, the group of economies considered for comparison with the GMS also includes many transition economies (including those within the European Union) that have relatively high levels of income, but which are often considered outsourcing locations for rich-country firms. The economies in this group are Bulgaria; Brazil; Czechia; Croatia; Hungary; India; Indonesia; Latvia; Lithuania; Malta; Mexico; Poland; the People's Republic of China; Romania; the Russian Federation; Slovakia; Slovenia; Taipei,China; and Turkey.

are highest in some high-tech services (notably finance) and in mining, with wages in some high-tech manufacturing sectors (e.g., transport equipment and electrical and machinery) somewhat lower. In general, however, these results align with the study's expectations and suggest that specializing in agriculture and low-tech manufacturing and services are unlikely to generate high wages. A movement into more sophisticated manufacturing and services provides a more promising way of engaging in GVCs to raise wage levels. While mining also tends to have relatively high wages, it is important to note that mining tends to be highly capital intensive and is not a big source of labor demand.

After considering wages by sector, the analysis will now proceed to examine the relationship between GVC positioning and wages. The methodology and full results are reported in the Appendix. Figures 12.2–12.4 report the estimated relationships between wages and GVC positioning for the set of other economies in the WIOD, with Figure 12.2 reporting results for low-wage sectors, Figure 12.3 for medium-wage sectors, and Figure 12.4 for high-wage sectors.[58] Higher values of the GVC positioning variable indicate more downstream production within GVCs. In Figure 12.2, there is a positive relationship between wages and GVC positioning for trade, fishing, and textiles, indicating that more downstream production is associated with higher wages. The case of textiles is particularly interesting as, while wages rarely rise above 10,000 PPP $, they are at least twice as high for downstream participation (e.g., values around 0.9 and above) than for upstream participation

Figure 12.2: Estimates of the Relationship between Wages and Global Value Chain Positioning in Low-Wage Sectors for Other Economies



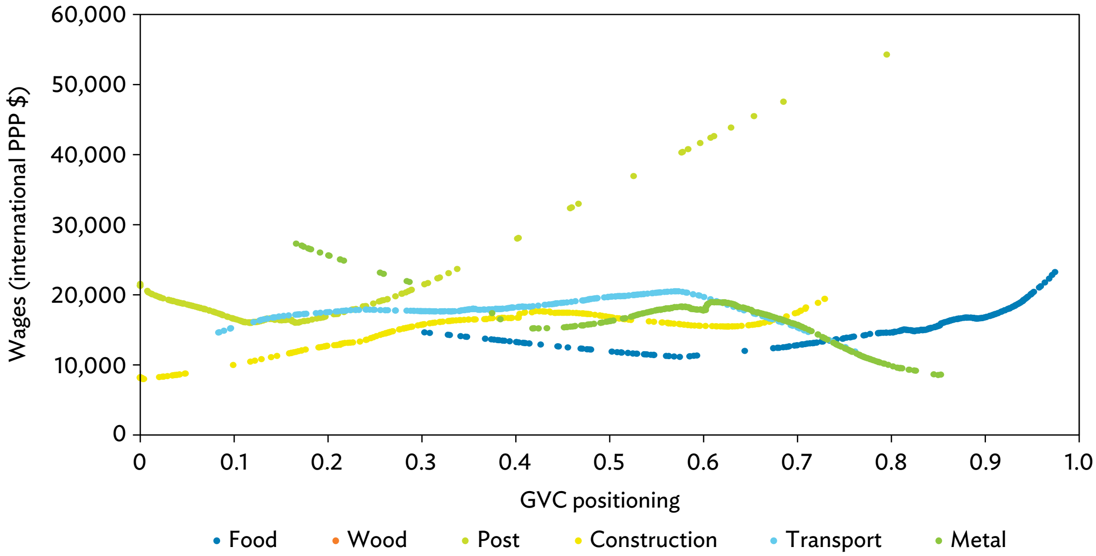
GVC = global value chain, PPP = purchasing power parity.

Note: Other economies are Bulgaria; Brazil; Czechia; Croatia; Hungary; India; Indonesia; Latvia; Lithuania; Malta; Mexico; Poland; the People's Republic of China; Romania; the Russian Federation; Slovakia; Slovenia; Taipei,China; and Turkey.

Source: World Input–Output Database.

[58] See the Appendix for further details on the construction of these figures. Also note that the classification of sectors as low-, medium-, or high-wage is based on the average wage levels reported for the full set of WIOD countries (Table A12.2).

Figure 12.3: Estimates of the Relationship between Wages and Global Value Chain Positioning in Medium-Wage Sectors for Other Economies

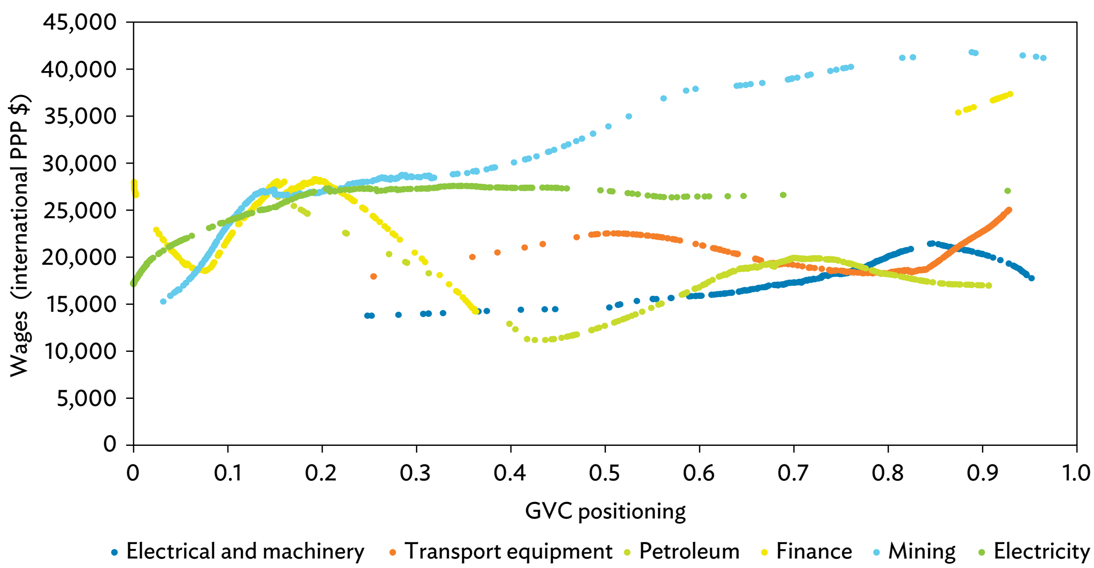


GVC = global value chain, PPP = purchasing power parity.

Note: Other economies are Bulgaria; Brazil; Czechia; Croatia; Hungary; India; Indonesia; Latvia; Lithuania; Malta; Mexico; Poland; the People's Republic of China; Romania; the Russian Federation; Slovakia; Slovenia; Taipei,China; and Turkey.

Source: World Input–Output Database.

Figure 12.4: Estimates of the Relationship between Wages and Global Value Chain Positioning in High-Wage Sectors for Other Economies



GVC = global value chain, PPP = purchasing power parity.

Note: Other economies are Bulgaria; Brazil; Czechia; Croatia; Hungary; India; Indonesia; Latvia; Lithuania; Malta; Mexico; Poland; the People's Republic of China; Romania; the Russian Federation; Slovakia; Slovenia; Taipei,China; and Turkey.

Source: World Input–Output Database.

(e.g., values around 0.35).[59] The association is generally negative for other manufacturing, however. For agriculture and maintenance, the figure shows a hump-shaped relationship between wages and GVC positioning. Conversely, in Figure 12.3, nonlinearities appear to be the norm. The figure shows a hump-shaped relationship between wages and GVC positioning for transport and a U-shaped relationship for food. In other sectors, more complicated nonlinear relationships exist. Nonlinearities also appear for many of the sectors reported in Figure 12.4 (e.g., finance, petroleum, and transport equipment). The analysis finds a positive association between wages and GVC positioning for mining, but a hump-shaped relationship for electricity and electrical and machinery.

Based on the results in Figures 12.2–12.4, a general summary and typology is constructed in Table 12.2 (see Appendix for further details). These results are based on a set of economies that were chosen from the WIOD for comparison with the GMS members. It is important to note that the only GMS member in this group is the PRC. Table 12.2 reports a grid with GVC positioning (split into upstream, downstream, and middle) along the horizontal axis and wages (split into low, medium, and high) on the vertical axis, for the group of economies considered for comparison with the GMS members. Based on the analysis, each of the 18 aggregated sectors is then assigned to one of the resulting nine cells, with each sector type appearing (potentially) three times. This grid shows how

Table 12.2: Typology of the Relationship between Wages and Global Value Chain Positioning for Other Economies in the World Input–Output Database

		GVC Positioning		
		Upstream	Middle	Downstream
Wages	High	Metals, mining	Mining, post, electricity	Mining, post, electricity
	Medium	Trade, other manufacturing, maintenance, construction, post, wood, finance, electrical and machinery, electricity	Metals, agriculture, trade, other manufacturing, maintenance, construction, food, transport, wood, transport equipment, petroleum, finance, electrical and machinery	Agriculture, other manufacturing, construction, food, transport, metals, wood, transport equipment, textiles, petroleum, electrical and machinery
	Low	Agriculture, fish	Textiles, fish	Fish

GVC = global value chain.

Notes: Other economies are Bulgaria; Brazil; Czechia; Croatia; Hungary; India; Indonesia; Latvia; Lithuania; Malta; Mexico; Poland; the People's Republic of China; Romania; the Russian Federation; Slovakia; Slovenia; Taipei,China; and Turkey.
Some sectors are not included in all GVC positioning segments due to lack of data.

Source: Authors' elaboration based on an analysis of the World Input–Output Database.

[59] Note that the pattern tends to be the reverse when considering all WIOD countries, with more upstream GVC participation associated with lower wages in textiles.

sectors can move into higher-wage activities by changing their position in a GVC. For example, in the case of electricity, the results suggest that being engaged in upstream GVCs is associated with medium wages, while middle and downstream engagement is associated with high wages. In other words, a path for increasing wages through electricity GVCs is to move into downstream production.

The cells in Table 12.3 show GVC positioning of each sector for each GMS member (based on values for the sectors in 2015, the latest period in the Eora database). This allows for an easy comparison between a member's positioning within GVCs in a particular sector and the associated wages for that sector (shown in Table 12.2) in the group of other economies (listed in footnote 57). The table provides a framework to consider whether GVC positioning levels are optimal in terms of wages and, if not, in which direction members should try to move in GVCs.

Table 12.3: Global Value Chain Positioning of Sectors by Greater Mekong Subregion Member

	GVC Positioning		
	Upstream	Middle	Downstream
PRC	Agriculture, fishing, trade, maintenance, food, wood, post, transport, metals, petroleum, finance, mining, electricity	Textiles, construction, electrical and machinery, transport equipment	Other manufacturing
Cambodia	Agriculture, trade, post, metals, petroleum, finance, mining, electricity	Fishing, maintenance, food, wood, construction, transport, electrical and machinery, transport equipment	Textiles, other manufacturing
Lao PDR	Agriculture, fishing, trade, food, post, construction, transport, metals, electrical and machinery, petroleum, finance, mining, electricity	Other manufacturing, maintenance, wood, transport equipment	Textiles
Myanmar	Agriculture, textiles, fishing, trade, other manufacturing, maintenance, food, wood, post, construction, transport, metals, electrical and machinery, transport equipment, petroleum, finance, mining, electricity		
Thailand	Agriculture, fishing, trade, maintenance, post, finance, mining, electricity	Wood, transport, metals, petroleum	Textiles, other manufacturing, food, construction, electrical and machinery, transport equipment
Viet Nam	Agriculture, fishing, trade, maintenance, post, transport equipment, finance, mining, electricity	Food, wood, transport, metals, petroleum	Textiles, other manufacturing, construction, electrical and machinery

GVC = global value chain, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Authors' elaboration based on an analysis of the World Input–Output Database.

Looking at textiles, for example, the table shows that Cambodia, the Lao PDR, Thailand, and Viet Nam are engaged in downstream GVCs, a position that is associated with relatively high wages in textiles production. It was noted, for example, that downstream participation in textiles is associated with wages that are twice as high as upstream participation, implying that efforts to maintain and move into more upstream production would therefore be an objective for these GMS members in this sector, as well as for Myanmar that is engaged in relatively upstream GVC participation in textiles (see Bair and Gereffi (2001) for an example of such a movement in Mexico). Agriculture presents a converse example. While downstream GVC participation is also associated with higher wages in the agriculture sector, GMS members are engaged in upstream participation in GVCs in this sector. Efforts to move toward more downstream participation would then be associated with higher wages. In terms of individual members, Myanmar is engaged in upstream activities in all aggregated sectors, meaning that it possesses many opportunities to enhance wages by moving to more downstream production. In contrast to Myanmar as well as the Lao PDR, Cambodia has been able to move into downstream and middle value-chain activities in many GVCs, sectors that in some cases may allow it to generate higher wages.

12.3 Global Value Chain Positioning and Wages in the People's Republic of China

The analysis presented above and in the Appendix is based on a summary of data for a broad range of countries. It thus captures average effects for a group of heterogeneous economies. It is also instructive, therefore, to consider developments for specific countries. WIOD provides data on wages for only one GMS member—the PRC. This section will examine the observed relationships between GVC positioning and wages in the PRC for the set of sectors considered above.[60]

The analysis splits the sectors into three groups: (i) primary sectors and low-tech manufacturing (Figure 12.5); (ii) other manufacturing sectors (Figure 12.6); and (iii) services and other sectors (Figure 12.7). The three figures show, for each sector, wages and GVC positioning (measured by the index GVCp) for the PRC for each year over the period 2000–2014. Given that it is important to consider not just the wage rate but also the level of employment generated at these wages, the figures also report information on the relative size of employment in the sectors (i.e., the size of the bubbles).[61]

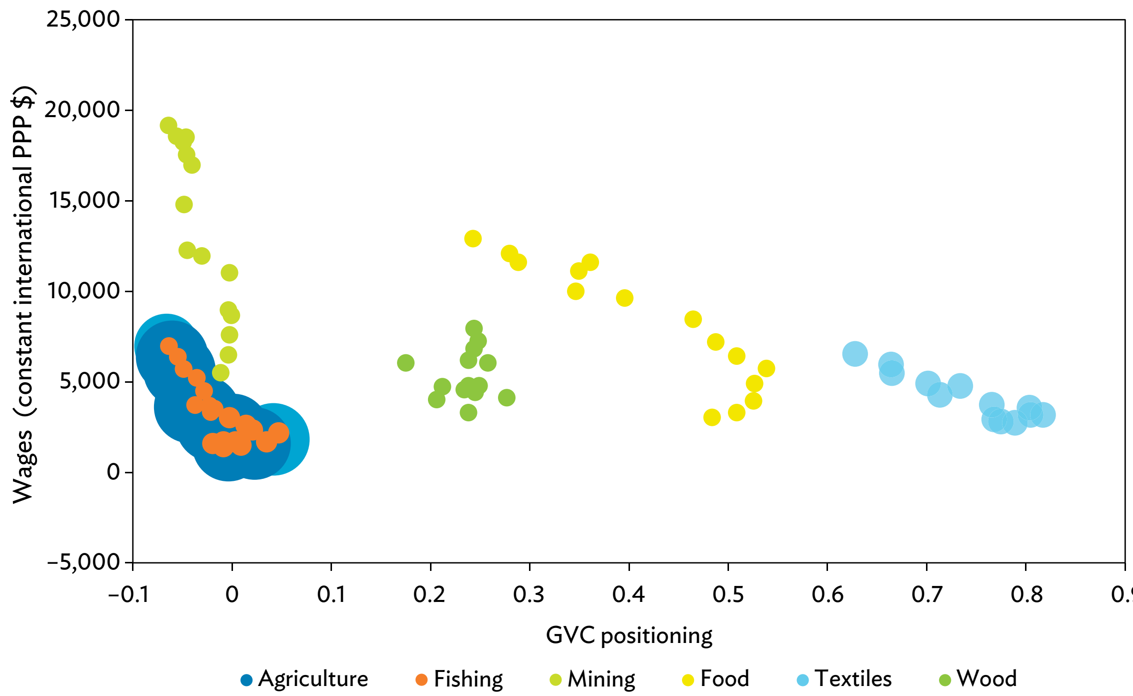
Looking first at the primary and low-tech sectors, Figure 12.5 shows that, in most cases, there is a negatively sloped relationship between GVC positioning and wages, which suggests that moving away from relatively downstream participation (assembly activities) in these sectors in the PRC to more upstream positioning would lead to higher wages. This is true for agriculture, fishing, food, and textiles. It is also the case that these sectors often appear at very different points in the range of GVC ositioning, with agriculture in general very upstream and textiles generally very downstream. In

60 Note that there is no data for maintenance and repairs for the PRC; hence, the analysis is left with 17 sectors.

61 Note that the size of the bubbles only gives a measure of the relative size of employment within each figure and not across figures (i.e., the sector with the highest level of employment is agriculture, which therefore shows up as the largest bubbles in Figure 12.5, but the bubbles look a similar size or smaller than some sectors in Figures 12.6 and 12.7 that have lower employment levels).

the other two sectors—mining and wood—a relationship is more difficult to discern, especially with mining, which shows widely different wages despite any major movement in GVC positioning. In all of these sectors, wages tend to be relatively low, usually below the 10,000 international PPP $ threshold that the study uses to distinguish low wages.

Figure 12.5: Relationship between Global Value Chain Positioning and Wages in Primary and Low-Tech Manufacturing Sectors in the People's Republic of China

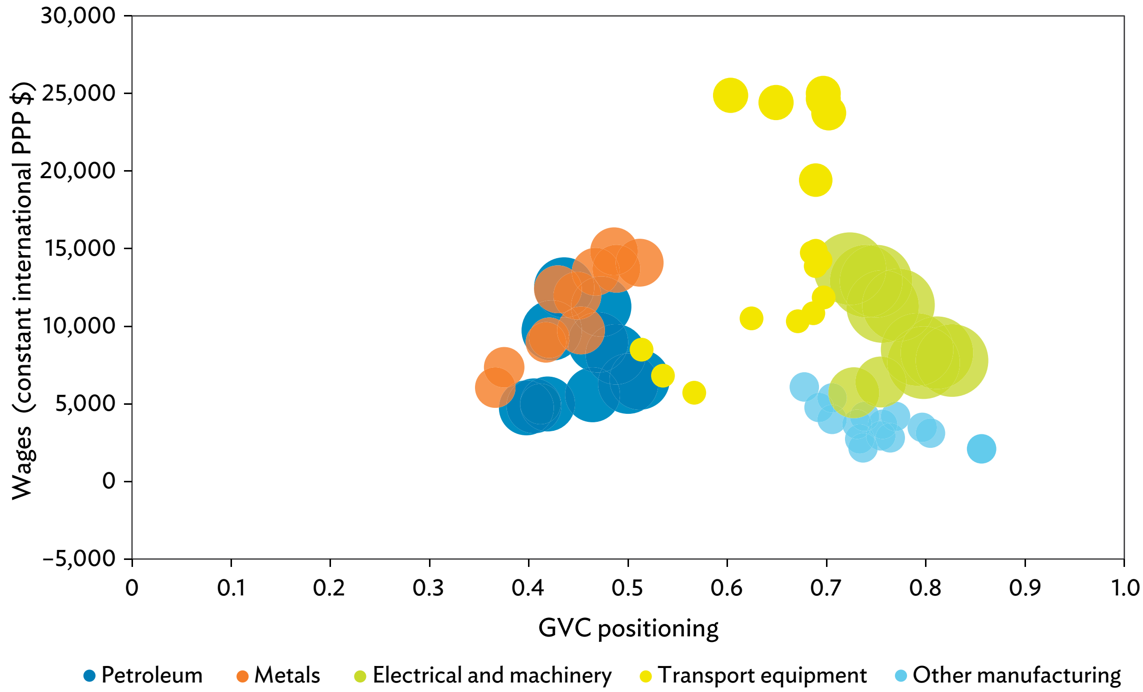


GVC = global value chain, PPP = purchasing power parity.

Source: World Input–Output Database.

When considering the remaining manufacturing sectors (Figure 12.6), the relationships between GVC positioning and wages are also difficult to discern in many cases. In the case of other manufacturing, there is a negative association between wages and GVC positioning, implying that higher wages are associated with more upstream GVC participation. Metals shows the opposite pattern. For the other three sectors, however, there are widely different wages at similar levels of GVC positioning. These sectors also tend to show somewhat lower variation in the level of GVC positioning than metals and other manufacturing. With the exception of transport equipment, these sectors tend to have relatively low wages, usually below 15,000 international PPP $.

Figure 12.6: Relationship between Global Value Chain Positioning and Wages in Medium- and High-Tech Manufacturing Sectors in the People's Republic of China



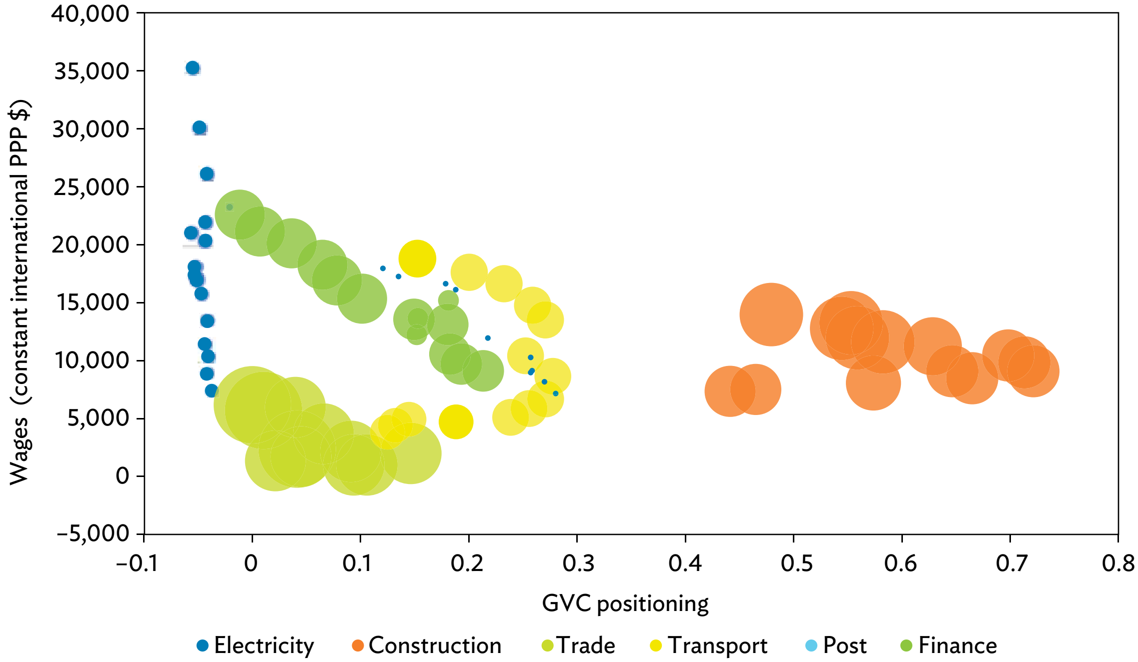
GVC = global value chain, PPP = purchasing power parity.

Source: World Input–Output Database.

Finally, Figure 12.7 shows that, in most cases, there is generally a negative association between wages and GVC positioning in the services sectors. This is true for construction, trade, finance, and post. For electricity and transport, however, wages differ at similar levels of GVC positioning. There are opportunities for relatively high wages (i.e., > 20,000 international PPP $) in a number of sectors, notably electricity, post, and finance. Where such possibilities exist, they tend to involve upstream participation in GVCs. However, it should be noted that, with the partial exception of finance, these sectors are not major generators of employment.

Overall, the results for the PRC suggest that, in most sectors, upstream participation in GVCs is associated with higher wages. At the same time, irrespective of positioning, wages in most sectors tend to remain relatively low (i.e., < 15,000 international PPP $). This suggests that, when considering the impact of GVCs on wages, positioning within GVCs may have been less important in the PRC than the specific GVCs it entered into.

Figure 12.7: Relationship between Global Value Chain Positioning and Wages in Services and Other Sectors in the People's Republic of China



GVC = global value chain, PPP = purchasing power parity.

Source: World Input–Output Database.

12.4 Conclusions

This chapter has discussed the relationship between GVC positioning and wages. The evidence indicates that, while patterns vary across sectors and between developed and other economies, upstream GVC participation tends to be associated with relatively low wages. Efforts to shift to a more downstream position is then, in many cases and especially for other economies, expected to be associated with higher wages. The results thus suggest that GMS members such as Myanmar should look to move to a more downstream position within GVCs.

Appendix

Data

The dataset used to consider the relationship between GVC positioning and wages is the World Input–Output Database (WIOD, www.wiod.org). WIOD has data on global input–output tables for a set of 43 economies (plus the rest of the world) and 56 sectors over the period 2000–2014, along with corresponding data on socioeconomic accounts that allow for the construction of wages and other relevant variables. Note that only one of the GMS economies is in the WIOD, namely the PRC. Conversely, while the commonly used Eora database has input–output tables for all GMS members (along with many other economies), it does not have information on wages. For this reason, the study uses the WIOD to examine the general relationship between GVC positioning and wages, before using the Eora database to analyze the positioning of GMS members in GVCs and the likely paths that GMS economies could take to help increase wages.

To make the analysis simpler, the study focuses on only a subset of the 56 different WIOD sectors (i.e., those sectors considered to be more tradable in general), further aggregating some of these sectors to make them consistent with the Eora dataset. The list of 56 sectors is reported in Table A12.1, along with information on the aggregated sectors considered in the analysis.[62]

Table A12.1: List of Sectors and Aggregation

Sector	Sector Code	Sector Type
Crop and animal production, hunting, and related service activities	A01	Agriculture
Forestry and logging	A02	Agriculture
Fishing and aquaculture	A03	Fishing
Mining and quarrying	B	Mining
Manufacture of food products, beverages, and tobacco products	C10–C12	Food
Manufacture of textiles, wearing apparel, and leather products	C13–C15	Textiles
Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	C16	Wood, paper, and printing
Manufacture of paper and paper products	C17	Wood, paper, and printing
Printing and reproduction of recorded media	C18	Wood, paper, and printing
Manufacture of coke and refined petroleum products	C19	Petroleum, chemical, and non-metallic mineral products
Manufacture of chemicals and chemical products	C20	Petroleum, chemical, and non-metallic mineral products
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21	

continued on next page

[62] Note that the analysis continues to construct all of the variables for each of the 56 sectors, and then uses the simple (unweighted) average to aggregate them into the broader sectors.

Figure A12.1 *continued*

Sector	Sector Code	Sector Type
Manufacture of rubber and plastic products	C22	Petroleum, chemical, and non-metallic mineral products
Manufacture of other non-metallic mineral products	C23	Petroleum, chemical, and non-metallic mineral products
Manufacture of basic metals	C24	Metal products
Manufacture of fabricated metal products, except machinery and equipment	C25	Metal products
Manufacture of computer, electronic, and optical products	C26	Electrical and machinery
Manufacture of electrical equipment	C27	Electrical and machinery
Manufacture of machinery and equipment n.e.c.	C28	Electrical and machinery
Manufacture of motor vehicles, trailers, and semi-trailers	C29	Transport equipment
Manufacture of other transport equipment	C30	Transport equipment
Manufacture of furniture; other manufacturing	C31–C32	Other manufacturing
Repair and installation of machinery and equipment	C33	
Electricity, gas, steam, and air conditioning supply	D35	Electricity, gas, and water
Water collection, treatment, and supply	E36	Electricity, gas, and water
Sewerage; waste collection, treatment, and disposal activities; materials recovery; remediation activities and other waste management services	E37–E39	
Construction	F	Construction
Wholesale and retail trade; repair of motor vehicles and motorcycles	G45	Maintenance and repair
Wholesale trade, except of motor vehicles and motorcycles	G46	Trade
Retail trade, except of motor vehicles and motorcycles	G47	Trade
Land transport and transport via pipelines	H49	Transport
Water transport	H50	Transport
Air transport	H51	Transport
Warehousing and support activities for transportation	H52	Transport
Postal and courier activities	H53	Post
Accommodation and food service activities	I	
Publishing activities	J58	
Motion picture, video, and television program production; sound recording and music publishing activities; programming and broadcasting activities	J59–J60	
Telecommunications	J61	
Computer programming, consultancy, and related activities; information service activities	J62–J63	Financial intermediation and business activities
Financial service activities, except insurance and pension funding	K64	Financial intermediation and business activities

continued on next page

Figure A12.1 *continued*

Sector	Sector Code	Sector Type
Insurance, reinsurance, and pension funding, except compulsory social security	K65	Financial intermediation and business activities
Activities auxiliary to financial services and insurance activities	K66	Financial intermediation and business activities
Real estate activities	L68	Financial intermediation and business activities
Legal and accounting activities; activities of head offices; management consultancy activities	M69–M70	Financial intermediation and business activities
Architectural and engineering activities; technical testing and analysis	M71	Financial intermediation and business activities
Scientific research and development	M72	Financial intermediation and business activities
Advertising and market research	M73	Financial intermediation and business activities
Other professional, scientific, and technical activities; veterinary activities	M74–M75	Financial intermediation and business activities
Administrative and support service activities	N	
Public administration and defense; compulsory social security	O84	
Education	P85	
Human health and social work activities	Q	
Other service activities	R–S	
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T	
Activities of extraterritorial organizations and bodies	U	

n.e.c. = not elsewhere classified.

Notes: This table provides the list of sectors covered by the World Input–Output Database (WIOD). A blank in the "sector type" column indicates that this sector is not considered in the subsequent analysis, either because the sector is largely not traded or it does not have a corresponding sector in the Eora dataset.

Source: Authors based on the WIOD.

Constructing Wage Rates

WIOD reports information on labor compensation (in millions of national currency) and the number of persons engaged (in thousands). The study uses this data along with data on the consumer price index and the international PPP conversion rate from the World Bank's World Development Indicators to construct a comparable measure of wages rates across economies and time. Specifically, the steps are (i) construct average wage rate as the ratio of labor compensation in national currency to the total number of employees, (ii) deflate these wage rates in national currencies using the consumer price index from the World Development Indicators to find real wages in national currency at 2010 prices, and (iii) use the PPP conversion rate for 2010 to convert wage rates in 2010 national currency into 2010 international PPP dollars.

Table A12.2 reports some basic information on wages rates in the sample of 43 WIOD economies, with descriptive statistics (mean, standard deviation, minimum, and maximum) reported for each of the aggregated sectors. The mean value is calculated as the unweighted average of all economies, subsectors, and time periods in the database. The sectors are ordered in terms of average wages.

Table A12.2: Descriptive Statistics on Wages Rates, 2000–2014

Sector	No. of Observations	Mean	Standard Deviation	Minimum	Maximum
Agriculture	630	16,639	9,160	1,254	39,247
Textiles	630	23,253	14,858	2,079	91,760
Fishing	596	23,939	17,492	1,185	82,630
Trade	621	25,613	11,685	2,082	48,612
Other manufacturing	630	26,810	20,272	1,902	193,296
Maintenance and repair	610	28,292	13,713	3,052	57,915
Food	630	28,676	14,001	2,396	55,142
Wood, paper, and printing	630	29,142	15,670	1,957	58,074
Post	544	30,507	13,309	4,680	69,854
Construction	614	30,461	15,796	2,444	62,394
Transport	630	33,489	14,974	2,914	59,741
Metal products	630	34,064	17,709	4,092	77,811
Electrical and machinery	630	36,821	19,663	5,069	93,714
Transport equipment	630	38,026	19,730	5,579	86,777
Petroleum, chemical, and non-metallic mineral products	630	38,330	20,794	3,620	112,700
Financial intermediation and business activities	630	43,507	20,004	7,269	99,683
Mining	625	47,257	25,528	5,519	126,386
Electricity, gas, and water	627	50,239	26,236	5,957	125,650

Notes: The table reports descriptive statistics on wages (in constant international purchasing power parity $) for all World Input–Output Database (WIOD) economies. Data are aggregated to the level of the 18 sectors, with the mean value the unweighted average across economies, time periods, and subsectors.

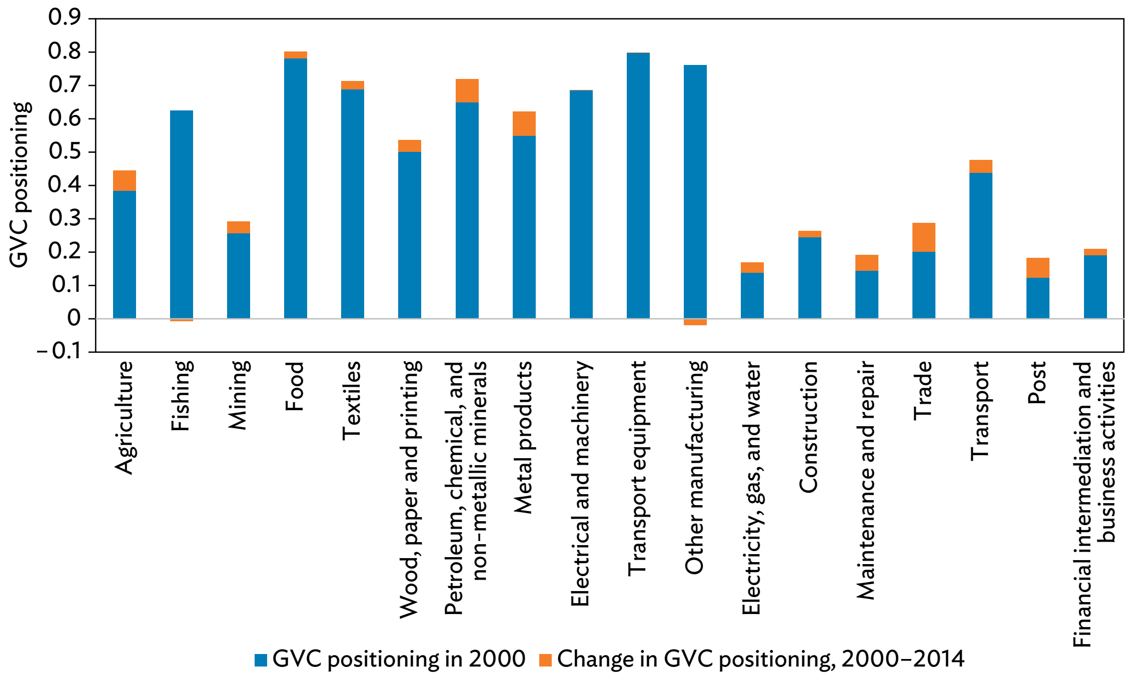
Source: Authors based on the WIOD.

The wage rates reported in Table A12.2 are largely in line with expectations. Primary sectors (agriculture and fishing) and low-tech manufactures (e.g., textiles and other manufacturing) have relatively low average wages, while finance, mining, and high-tech manufacturing, such as electrical and machinery, have relatively high average wages. These initial descriptive results, therefore, provide some support for the idea that wages are positively correlated with the technological sophistication of the sector. This further suggests that chain upgrading, i.e., the movement across value chains, in particular toward more sophisticated value chains, can be considered an important means of upgrading in terms of wages. However, as the analysis will show, positioning within value chains can also play an important role.

Global Value Chain Positioning and Wage Rates for Developed and Other Economies

The study further splits the sample of WIOD economies into two separate sets of developed[63] and other economies.[64] Using data from the WIOD and aggregating to the set of 18 sectors (using simple weighted averages across subsectors), Figures A12.1 and A12.2 report the average positioning of developed and other economies, respectively, in the 18 sectors in 2000 and the change in positioning of these sectors between 2000 and 2014 (see section 11.3). The patterns across developed and other economies are largely similar. In particular, values of the global value chain positioning (GVCp) variable are relatively large in both developed and other economies for most of the manufacturing sectors, including high-tech manufacturing sectors such as electrical and machinery and transport equipment. Such results indicate that the average developed and other economies are engaged in downstream production in these sectors.

Figure A12.1: Global Value Chain Positioning by Sector for Developed Economies



GVC = global value chain.

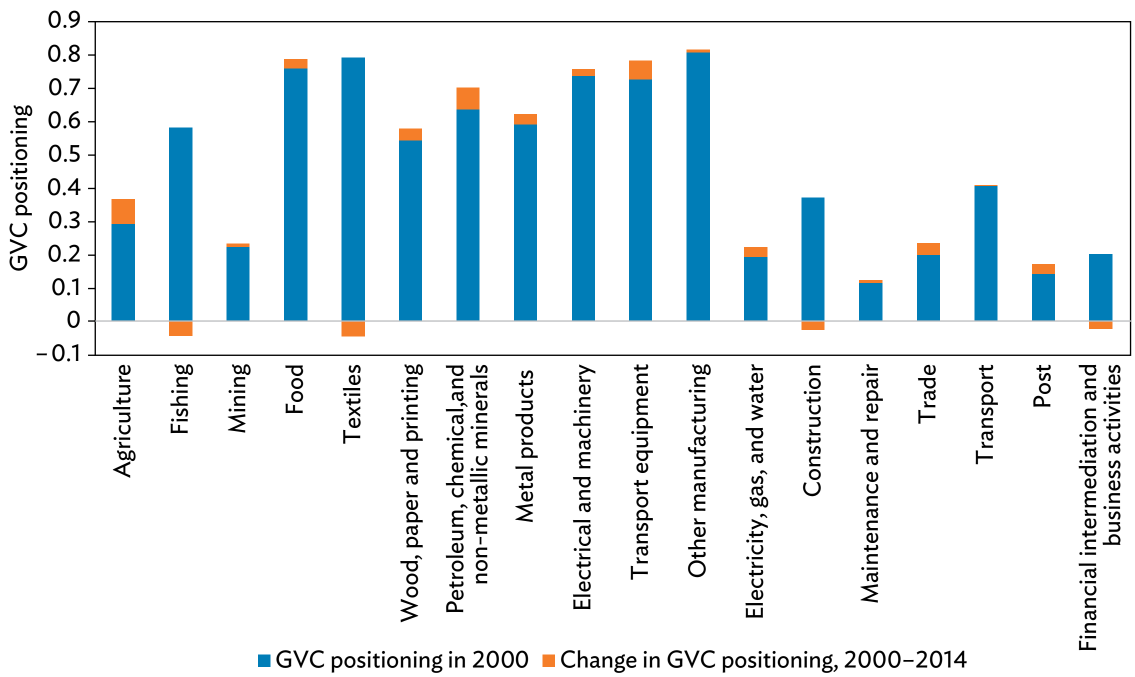
Source: Authors' calculations based on the World Input–Output Database.

[63] Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Republic of Korea, Luxemburg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

[64] There are only a few low- and middle-income economies in the WIOD. The analysis refers to these as other economies. This list includes transition economies (including those within the European Union) that have relatively high incomes but which are often considered outsourcing locations for firms from high-income economies. The set of economies considered is listed in footnote 57.

The values also suggest that the other economies are engaged in somewhat more downstream activity in textiles, wood, metal, and electrical and machinery. Conversely, developed economies tend to be engaged in more downstream GVC activity in primary sectors. Positioning in services sectors tends to be generally lower than for manufacturing, with relatively small differences in positioning between developed and other economies. Changes over time also tend to be fairly small for both developed and other economies.

Figure A12.2: Global Value Chain Positioning by Sector for Other Economies



GVC = global value chain.

Source: Authors' calculations based on the World Input–Output Database.

Table A12.3 reports developments in average wages for each of the 18 sectors and for developed and other economies separately. The figures indicate many similarities for developed and other economies, with wages relatively low in agriculture, low-tech manufacturing, and services and relatively high in mining in both sets of economies. However, there are also some differences. In the other economies, wages in construction are relatively low and wages in maintenance and repair are relatively high. The table thus suggests some caution in using the data for all economies in drawing conclusions for GMS members, with results from the set of other economies perhaps the most relevant for them.

Table A12.3: Descriptive Statistics on Wage Rates for Developed and Other Economies

	Developed Economies				Other Economies			
Sector	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
Agriculture	22,068	7,040	6,468	39,247	10,067	6,831	1,254	27,908
Textiles	33,935	11,214	14,455	91,760	10,323	5,498	2,079	26,189
Fishing	32,253	17,154	8,089	82,630	13,902	11,677	1,185	62,228
Trade	33,778	7,045	19,479	48,612	15,406	7,587	2,082	32,236
Other manufacturing	38,413	20,353	7,109	193,296	12,764	6,849	1,902	29,105
Maintenance and repair	36,883	9,959	9,865	57,914	17,108	9,088	3,052	56,943
Food	39,344	8,377	18,076	55,142	15,762	6,598	2,396	29,236
Wood, paper, and printing	41,465	8,356	18,101	58,074	14,226	7,178	1,957	33,604
Post	37,616	10,442	4,680	69,854	19,630	9,263	5,381	51,771
Construction	42,479	9,263	16,227	62,394	15,646	7,306	2,447	35,158
Transport	45,319	7,131	24,015	59,741	19,167	7,691	2,914	36,780
Metal products	47,573	11,429	18,982	77,811	17,712	6,807	4,092	32,218
Electrical and machinery	51,343	13,988	23,094	93,714	19,241	7,279	5,069	38,862
Transport equipment	52,289	14,639	17,137	86,777	20,761	7,506	5,579	41,935
Petroleum, chemical, and non-metallic mineral products	53,964	14,346	19,100	112,700	19,404	7,210	3,620	34,246
Financial intermediation and business activities	56,915	13,697	35,340	99,683	27,276	13,278	7,269	73,102
Mining	62,807	22,274	24,647	126,386	28,096	13,351	5,519	79,764
Electricity, gas, and water	69,892	18,505	37,039	125,650	26,195	7,733	5,957	45,975

Max. = maximum, Min. = minimum, Std. Dev. = standard deviation.

Notes: The table reports descriptive statistics on wages (in constant international purchasing power parity $) for the set of developed and other economies in the World Input–Output Database (WIOD). Data are aggregated to the level of the 18 sectors, where the mean value is the unweighted average across economies, time periods, and subsectors.

Source: Authors' calculations based on the WIOD.

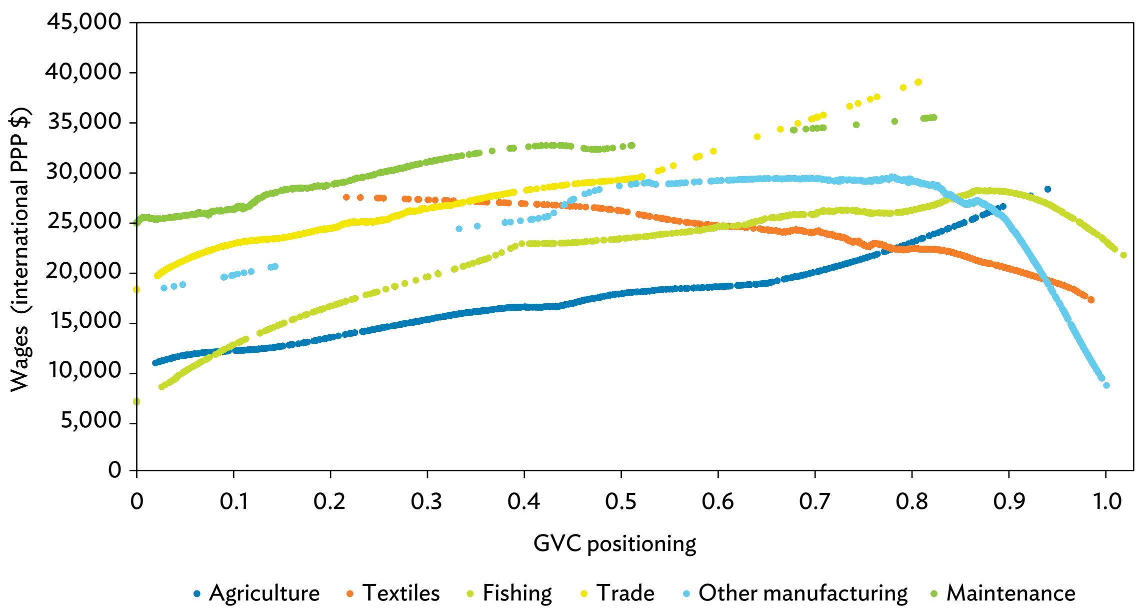
Identifying the Relationship between Global Value Chain Positioning and Wages

The study uses the locally weighted scatterplot smoothing (LOWESS) estimator to estimate the relationship between wages and GVC positioning. LOWESS is a nonparametric method that is used to create a smooth line through a scatter plot to identify a relationship between two variables. The basic idea of this method is straightforward and involves fitting simple (e.g., polynomial) regression models to localized subsets of data using weighted least squares, thus allowing one to build up a function that explains the deterministic part of the variation in the data. The analysis uses this estimator for each of the 18 sectors to estimate the relationship between wages and GVC positioning using data for all years, economies, and subsectors. The analysis is repeated for the subset of developed and other economies.

Figures A12.3–A12.5 report results from the LOWESS estimator for all economies and time periods in the WIOD. To make the results easier to follow, the analysis splits up the 18 sectors into three groups of six: (i) Figure A12.3 reports results for the six sectors with the lowest average wages; (ii) Figure A12.4 shows results for the six sectors with average wages in the middle of distribution; and (iii) Figure A12.5 reports results for the six sectors with the highest average wages. Note that lower values of the GVC positioning variable imply more upstream engagement in GVCs, while higher values imply more downstream engagement.

In terms of the sectors with the lowest wages (Figure A12.3), the study finds a range of patterns. In most cases, wages tend to be relatively low for low values of GVC positioning (i.e., upstream production) and rise as production moves more downstream. In some sectors (other manufacturing and fishing), wages then start to fall at the highest levels of GVC positioning, although in the case of fishing the decline does not offset the initial increase. The exception to this rising wage pattern is textiles, where wages decline with higher values of the GVC positioning variable.

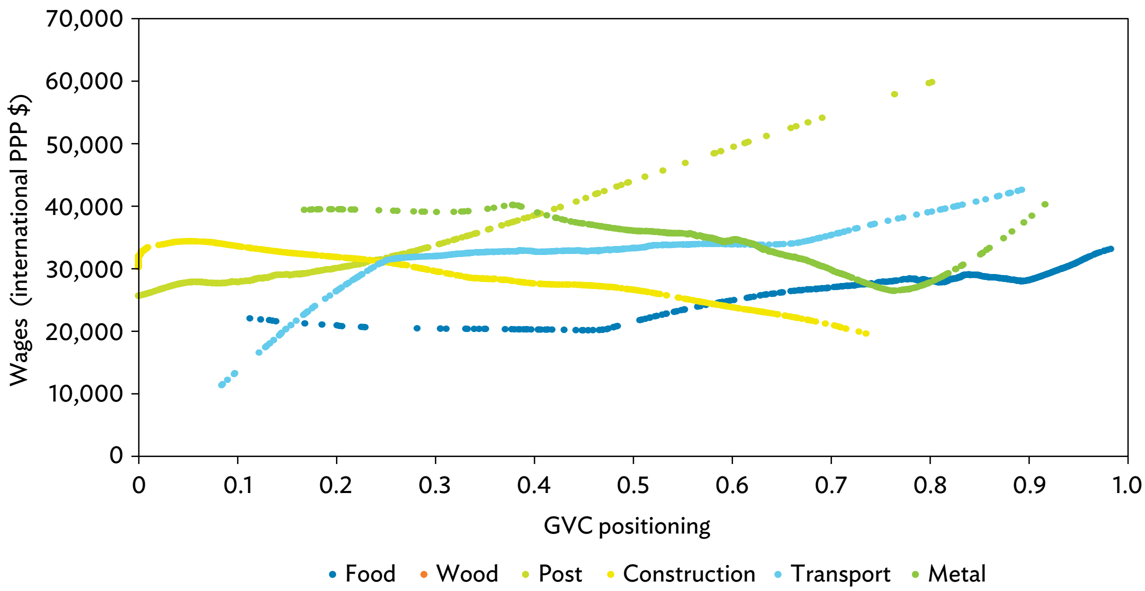
Figure A12.3: LOWESS Estimates of the Relationship between Wages and Global Value Chain Positioning in Low-Wage Sectors for All Economies



GVC = global value chain, LOWESS = locally weighted scatterplot smoothing, PPP = purchasing power parity.
Source: World Input–Output Database.

Patterns for the six sectors in the middle of the wage distribution are also varied (Figure A12.4). In the case of food, post, and transport, the evidence suggests that wages have a tendency to rise with higher values of the GVC positioning variable. Conversely, for construction and metal products, the figure shows the opposite relationship, with wages declining with higher values of the GVC positioning variable (i.e., more downstream production), although there is somewhat of an increase in wages at the highest levels of GVC positioning in the case of metal products.

Figure A12.4: LOWESS Estimates of the Relationship between Wages and Global Value Chain Positioning in Medium-Wage Sectors for All Economies



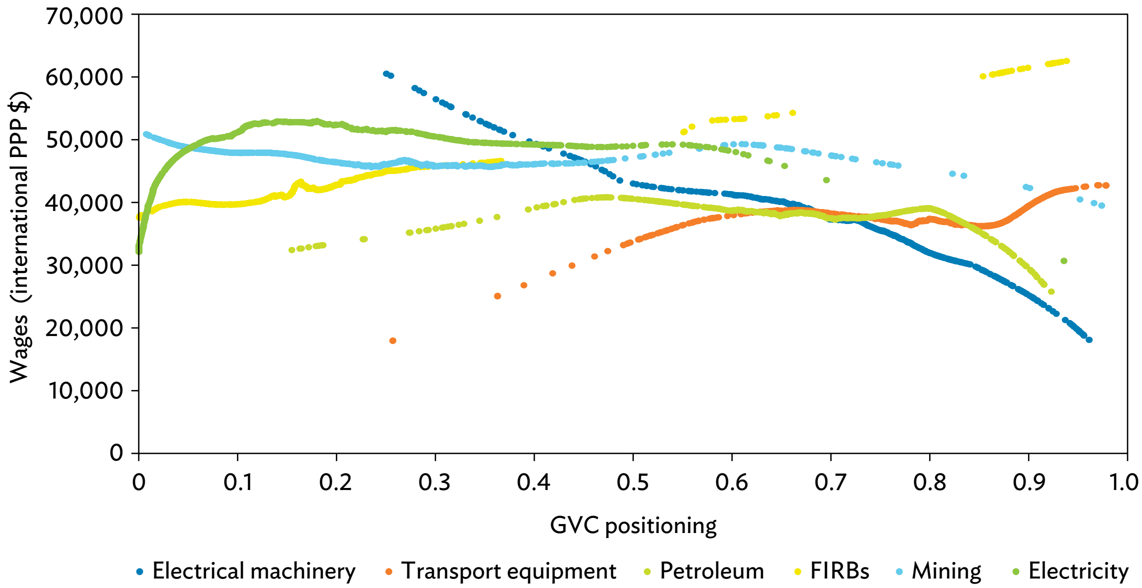
GVC = global value chain, LOWESS = locally weighted scatterplot smoothing, PPP = purchasing power parity.
Source: World Input–Output Database.

In the sectors with the highest average wages, the analysis finds the most varied relationship between wages and GVC positioning (Figure A12.5). For finance and business services and transport equipment, the positive association between wages and GVC positioning observed elsewhere tends to be followed. However, for electrical and machinery and to a lesser extent mining, there is a negative association between wages and GVC positioning, while for petroleum and electricity, the analysis finds a hump-shaped relationship, with wages initially increasing as production becomes more downstream before falling at higher values of the GVC positioning variable.

Overall, the study finds quite different relationships between GVC positioning and wages, though in a majority of sectors the evidence seems to indicate that more downstream production is associated with higher wages. Based on these results, there is little evidence of the smile curve in terms of wages and GVC positioning.

Using the results of the LOWESS estimator, a typology of sectors was created based on the relationship between wages and GVC positioning in these sectors. For this purpose, a number of (arbitrary) thresholds were introduced. For GVC positioning, the analysis uses thresholds of around 0.33 and 0.66 to differentiate between upstream (<0.33), downstream (>0.66), and middle (between 0.33 and 0.66) positioning within GVCs. For wages, the analysis uses thresholds at 25,000 and 40,000 international PPP $ to differentiate between low wages (<25,000), high wages (>40,000), and average wages (between 25,000 and 40,000). Using this rough typology and the results reported in Figures A12.3–A12.5, the resulting typology is reported in Table A12.4.

Figure A12.5: LOWESS Estimates of the Relationship between Wages and Global Value Chain Positioning in High-Wage Sectors for All Economies



GVC = global value chain, FIRBs = finance and business services, LOWESS = locally weighted scatterplot smoothing, PPP = purchasing power parity.

Source: World Input–Output Database.

Table A12.4: Stylized Typology of Sectors Based on LOWESS Estimates—All Economies

		GVC Positioning		
		Upstream	Middle	Downstream
Wages	High	Metals, electricity, mining, finance, electrical and machinery	Post, electricity, mining, finance, electrical and machinery	Post, electricity, mining, finance
	Medium	Textiles, maintenance, wood, post, construction, petroleum	Trade, other manufacturing, transport, textiles, maintenance, wood, construction, petroleum, metals, transport equipment	Fish, trade, food, transport, maintenance, wood, petroleum, metals, electrical and machinery, transport equipment
	Low	Agriculture, fish, trade, other manufacturing, food, transport	Agriculture, fish, food	Agriculture, other manufacturing, textiles, construction

GVC = global value chain, LOWESS = locally weighted scatterplot smoothing.

Note: Due to a lack of data, transport equipment is not included in the upstream GVC dimension.

Source: Authors' elaboration based on an analysis of the World Input–Output Database.

To better capture the relationship between wages and GVC positioning for GMS members, the analysis described above is repeated for the set of other economies included in the WIOD. Results of the LOWESS estimation with other economies only is reported in Figures 12.2–12.4 of the main text. In constructing the typology for other economies, a different set of thresholds is adopted for wages, reflecting the different wage levels in other economies. In particular, the study uses thresholds of 10,000 and 25,000, such that low wages are classified as a wage level less than 10,000 international PPP $, average wages are classified as a wage between 10,000 and 25,000 international PPP $, and high wages are classified as a wage above 25,000 international PPP $. The resulting classification is shown in Table 12.2 of the main text.

The analysis in the main text is forced to use the Eora database, since the WIOD does not have data on most GMS members. The study applies the typology developed using the WIOD to the Eora dataset. There is a number of steps in this process where problems may arise. It is not clear, for example, that the results obtained using wage data from the WIOD would apply to a broader set of economies. There is also a certain degree of arbitrariness in the classification of sectors in the WIOD and a similar level of arbitrariness when classifying the different Eora sectors. Similarly, there is a degree of arbitrariness in terms of the thresholds imposed when defining low, medium, and high wages, and when defining upstream, middle, and downstream GVC participation. In short, therefore, the results presented should be treated with a certain degree of caution.

Chapter 13

The Role of Preferential Trade Agreements in the Greater Mekong Subregion

13.1 Introduction

The number of preferential trade agreements (PTAs) across the world has increased dramatically in recent decades. The reasons for this are varied, but they certainly include the stalled process of multilateral liberalization through the Doha round of trade negotiations of the World Trade Organization. In addition to the rising number of agreements, we have also witnessed a number of other changes in the composition of these agreements. In recent years, PTAs have become less regional, with many agreements also involving relatively large numbers of signatories. PTAs also increasingly involve "developing–developing country" partnerships, as opposed to the earlier agreements that were often signed among developed countries. However, perhaps of most importance, is the increasing breadth of PTAs, with agreements moving beyond direct trade policy instruments (e.g., tariffs, quotas, etc.) to consider other aspects of policy, such as investment, labor regulations, intellectual property rights, services trade, environmental protections, standards, and so on.[65]

The aim of a PTA is to encourage trade flows among PTA members. PTAs are usually thought to have two main effects. First, they are expected to have a trade-creation effect, with lower trade barriers between members of an agreement encouraging trade flows between themselves. Second, PTAs may also have a trade-diversion effect, with lower trade barriers between members displacing efficient countries outside of the agreement and reducing their trade flows to members of the agreement. The existing empirical evidence suggests that PTAs have strong trade-creation effects (with some studies also providing evidence of trade diversion).[66]

While there is some evidence that recent PTAs are signed between increasingly distant partners, it remains the case that most agreements tend to be regional in nature, with agreements often signed between neighboring countries. Existing agreements between Greater Mekong Subregion (GMS) members and with other countries create a "spaghetti bowl" of agreements that can encourage trade between countries within the region, but in some cases may also limit trade through trade diversion effects.

[65] Following Hofmann et al. (2017), the term preferential trade agreement (PTA) is used throughout the chapter. It is preferred to the term Regional Trade Agreement, since many agreements are not between countries within the same region or in close geographical proximity. Also, Free Trade Areas - like currency unions, common markets and other agreements - are a subset of the PTA in the database we use (i.e., these are deeper in that they remove tariffs and other barriers to trade as opposed to offering preferential access - that is, lowering trade barriers, but not eliminating them). The use of the term PTA is meant to be the most general.

[66] For a meta-analysis of existing studies, see Cipollina and Salvatici (2010).

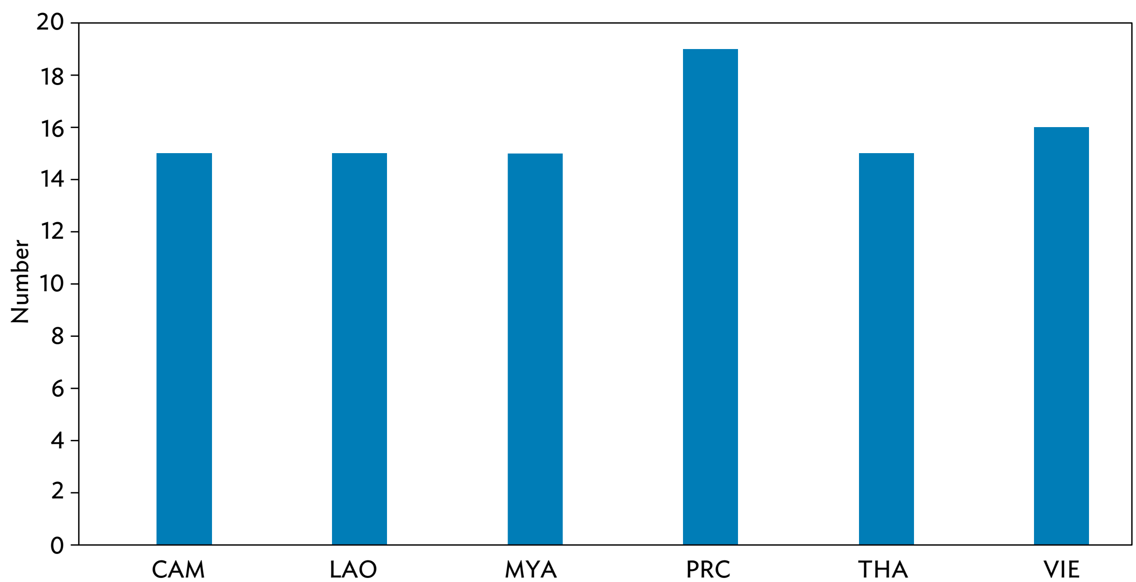
This chapter considers the extent to which GMS members are engaged in PTAs, before examining the effect of these PTAs on export flows, both at the aggregate and sectoral levels.

13.2 Number and Breadth of Preferential Trade Agreements in the Greater Mekong Subregion

The analysis begins by reporting the number of PTAs that the GMS economies belonged to in 2015.[67] A full list of PTAs which GMS members belong to is provided in the Appendix. The focus on the year 2015 serves two purposes: (i) to provide a stronger link to the regression analysis that follows (which uses export data for 2016); and (ii) to examine the breadth of these trade agreements using the data set by Hofmann, Osnago, and Ruta (2017).

Figure 13.1 reports the number of PTA partners by GMS member. In 2015, each GMS member had between 15 and 19 PTA partners. The PRC had 19 partners followed by Viet Nam with 16, while the remaining members all had 15. All GMS members have some form of trade agreement among themselves through the ASEAN free trade area and its extension to the PRC (ASEAN–PRC free

Figure 13.1: Number of Preferential Trade Agreement Partners in 2015 by Greater Mekong Subregion Member



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

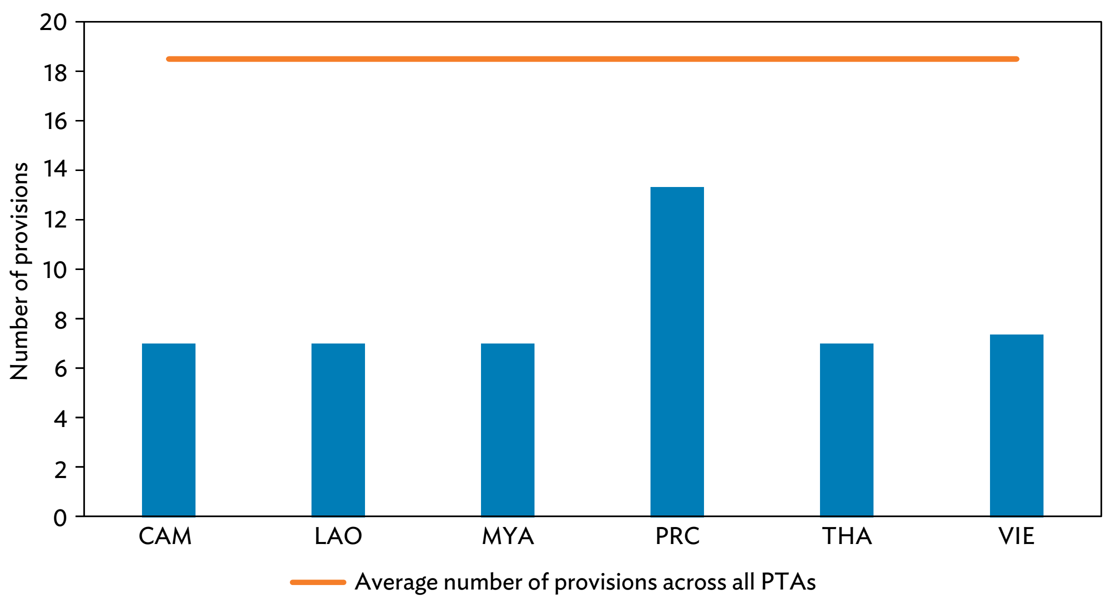
Source: Hofmann, Osnago, and Ruta (2017).

[67] The Regional Comprehensive Economic Partnership agreement was signed on 15 November 2020. It concluded 8 years of negotiations among the members of the Association of Southeast Asian Nations (to which the six GMS members belong), Australia, the PRC, Japan, the Republic of Korea, and New Zealand. It is not included in the analysis in this chapter because by this date, this study was finalized. Likewise, its members need to ratify it.

trade area). In addition, the PRC had agreements with other economies in the region (Hong Kong, China; Brunei Darussalam; Indonesia; Malaysia; Pakistan; the Philippines; and Singapore) along with Switzerland, Chile, Costa Rica, New Zealand, and Peru. The other five GMS members had agreements with Australia, Iceland, Indonesia, India, Japan, the Republic of Korea, Malaysia, New Zealand, the Philippines, and Singapore, while Viet Nam also had an agreement with Chile. Since 2015, a number of other agreements have been signed and/or come into force.[68]

Figure 13.2 reports an indicator of the breadth of the PTAs. The indicator is the average number of provisions in the PTAs signed by individual GMS members, where provisions refer to a list of 52 areas that Hofmann, Osnago, and Ruta (2017) define and map (see Appendix for further details of the provisions). The figure reveals that, on average, PTAs in the GMS members appear relatively narrow. PTAs in Cambodia, the Lao PDR, Myanmar, and Thailand have on average 7 provisions, while PTAs in Viet Nam have 7.4 provisions. The average number of provisions in the PRC is 13.3, which is significantly higher than in the other countries. These numbers are also below the average depth for all agreements (18.5), suggesting that the average PTA in the GMS is relatively narrow.[69]

Figure 13.2: Average Breadth (52 Provisions) of Preferential Trade Agreements in 2015 by Greater Mekong Subregion Member



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, PTA = preferential trade agreement, THA = Thailand, VIE = Viet Nam.

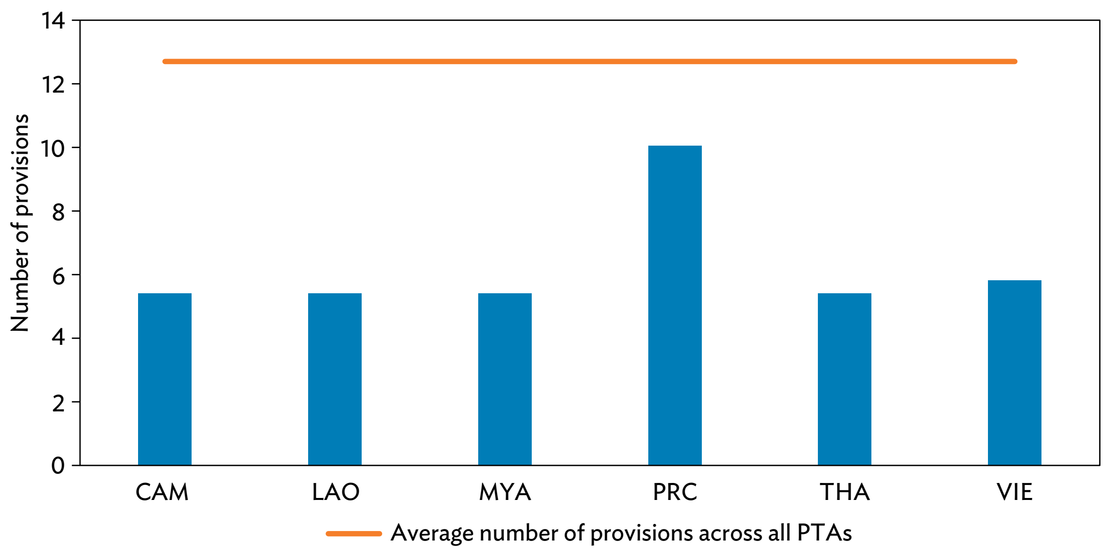
Source: Hofmann, Osnago, and Ruta (2017).

[68] For more information, see the World Trade Organization's Regional Trade Agreements Database. https://rtais.wto.org/UI/PublicAllRTAList.aspx.

[69] This average is calculated as the average breadth across all agreements as opposed to the average across all country pairs (the latter would give more weight to those agreements that comprise more countries, such as the European Union).

While the number of provisions appears relatively small out of the full set of 52 provisions, the analysis comes to a somewhat different conclusion when considering a narrower set of "core" provisions, i.e., the basic set of rules for market access and the smooth functioning of global value chains (GVCs) (Figure 13.3). In this case, GMS members tend to have around a third of the 18 core provisions, except for the PRC, where around 10 of the 18 provisions are included in its PTAs on average. Despite this, the depth of agreements for GMS members remains below the average for all agreements (12.7) when considering this narrower set of provisions.

Figure 13.3: Average Breadth (18 Core Provisions) of Preferential Trade Agreements in 2015 by Greater Mekong Subregion Member



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, PTA = preferential trade agreement, THA = Thailand, VIE = Viet Nam.

Source: Hofmann, Osnago, and Ruta (2017).

13.3 Effects of the Presence of Preferential Trade Agreements on Export Flows

This sections examines whether the presence of a PTA between country pairs increases exports between the country-pair.[70] The approach involves estimating a gravity model (for the year 2016) that includes an indicator capturing the presence or otherwise of a PTA between country pairs.[71] Gravity models are widely used in the empirical trade literature. In these models, trade flows depend on the geographical

[70] Results when using an indicator of the breadth of PTAs as opposed to their simple presence gives results that are consistent with those presented in this chapter.

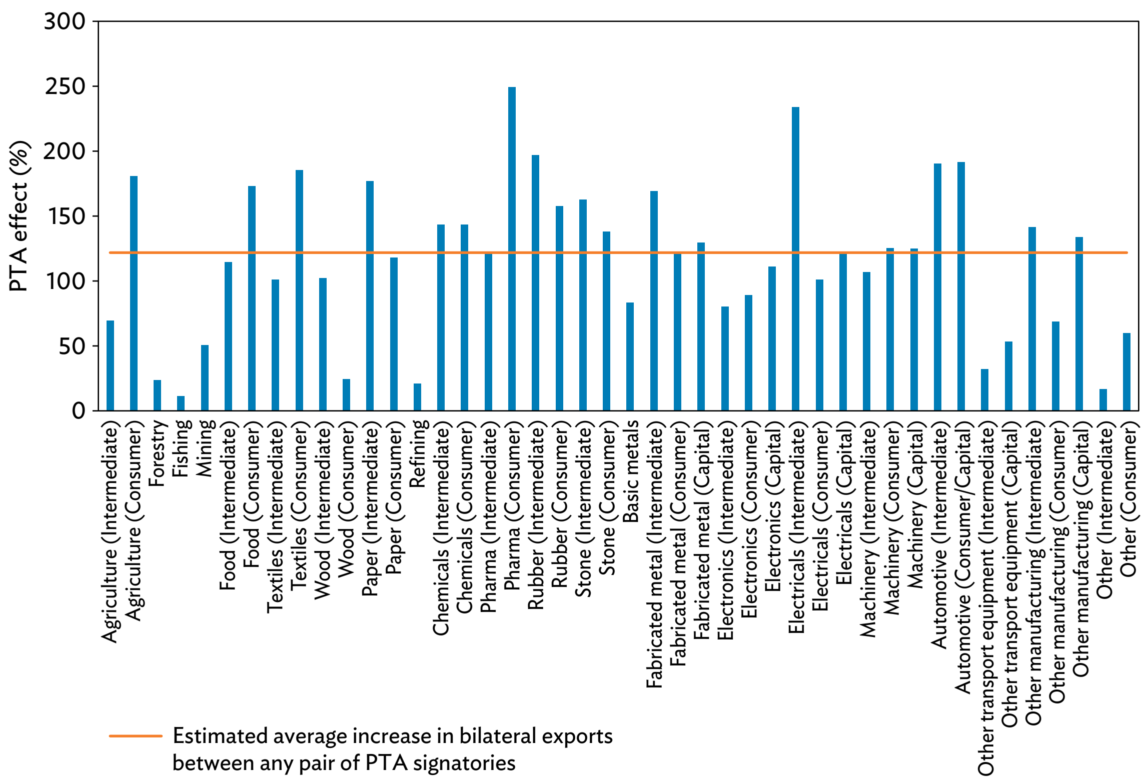
[71] Further details on the estimation of the gravity model can be found in Chapter 6. The gravity model estimated in this chapter is based on data for 2016 and includes standard controls (e.g., distance, gross domestic product per capita, whether countries are landlocked, common language, common border, and preferential trade agreements) alongside controls for multilateral resistance using the approach of Baier and Bergstrand (2009b).

distance between countries (with geographic neighbors possibly trading more), the economic size of trade partners, and other natural and policy-related trade barriers. Policy trade barriers include those associated with tariffs and other nontariff barriers that are often removed through the signing of PTAs.

The model used in this analysis is the same as the model explained in Chapter 6 (details are in that chapter's Appendix), with the focus in this chapter on the estimated effects of PTAs using that model. While the initial model is estimated for a broad sample of countries, the analysis in this section further estimates the model for the set of GMS members as exporters for purposes of comparison. The model is estimated for total exports and for exports of each of the 44 sectors.

Figure 13.4 reports the estimated effects of PTAs on bilateral export flows for the full sample of countries (i.e., around 155 countries). The blue bars indicate the estimated average effect of signing a PTA between any two countries, on each sector's exports (44 sectors). The horizontal orange line indicates that the estimated average effect of signing a PTA between any two countries on bilateral exports is around 120%, relative to pre-PTA exports, i.e., slightly more than a doubling of exports.[72]

Figure 13.4: Estimated Preferential Trade Agreement Effect for Different Sectors and Total Exports for All Countries



PTA = preferential trade agreement.

Notes: The figure reports the estimated effect of PTAs on total exports (orange line) and exports of individual sectors (see Appendix for sector definitions). Results are based on a gravity model using export data for the year 2016.

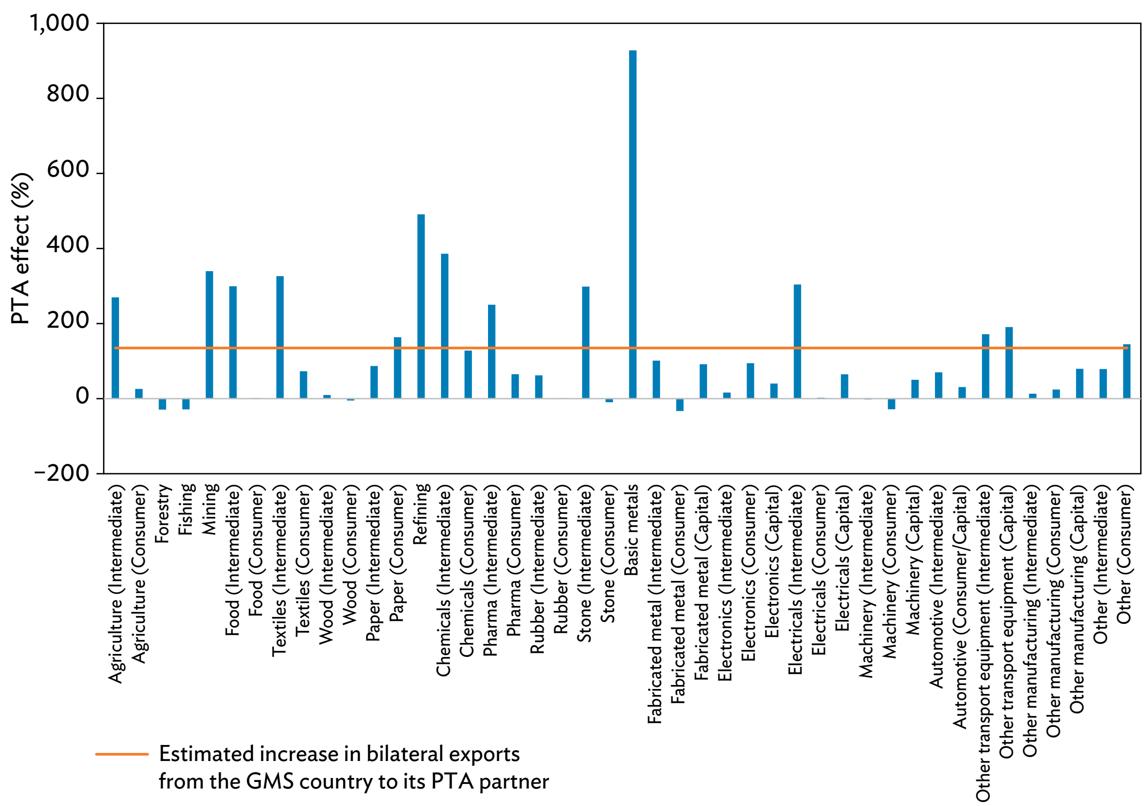
Source: Authors' estimates.

[72] This percentage effect is derived from the regression.

While this estimated impact appears large, it is not different from the impact found in the literature. Considering results at the sectoral level, the study finds a high degree of heterogeneity, with small effects of PTAs in sectors such as forestry, fishing, refining, other transport equipment (intermediate and capital goods), and other goods (intermediate and consumer goods). In other sectors, the effects of PTAs are relatively large and well in excess of the estimates for total exports. These sectors include pharmaceuticals (consumer goods), rubber and plastic, electricals (intermediate goods), and automotive (intermediate and consumer/capital goods).

Moving beyond the effects for all countries, Figure 13.5 reports the results for the GMS members (as exporters) only.[73] The blue bars indicate the estimated average effect of signing a PTA with another country, on a GMS member's sectoral exports (44 sectors) to its PTA partner. The figure also shows

Figure 13.5: Estimated Preferential Trade Agreement Effect for Different Sectors and Total Exports for Greater Mekong Subregion Members



PTA = preferential trade agreement.

Notes: The figure reports the estimated effect of PTAs on total exports (orange line) and exports of individual sectors (see Appendix for sector definitions). Results are based on a gravity model using export data from the Greater Mekong Subregion economies for the year 2016.

Source: Authors' estimates.

[73] Results are obtained from a gravity model restricted to observations where only GMS members are considered as exporters.

(orange line) that signing a PTA by a GMS member (with any country) is associated with an estimated increase in bilateral exports from the GMS country to its PTA partner, of around 130% relative to pre-PTA exports.[74] Results at the sectoral level show more variation than for the full set of countries, with many sectors reporting a relatively small effect of PTAs on exports. There is a number of sectors, however, where PTAs appear to have a large positive effect on exports from GMS members. These sectors include mining, food (intermediate goods), textiles (intermediate goods), refining, chemicals (intermediate goods), stone and glass (intermediate goods), basic metals, and electricals (intermediate goods). The fact that many of the sectors with the largest PTA effects include intermediate exports may hint at the importance of PTAs in the GMS for facilitating GVC activity.

13.4 Border and Behind-the-Border Provisions

Moving beyond the simple PTA effect, this section looks at distinguishing between PTA measures that are applied at the border and those applied behind the border. Provisions on tariff reductions, anti-dumping, countervailing measures, Trade-Related Investment Measures (TRIMS), Trade-Related Intellectual Property Rights (TRIPS), customs, export taxes, sanitary and phytosanitary standards (SPS), technical barriers to trade (TBT), and movements of capital are considered border provisions, while those related to state enterprises, state aid, competition policy, intellectual property rights (IPRs), investment, public procurement, and the General Agreement on Trade in Services (GATS) are considered behind-the-border provis ions. Indicators of border and behind-the-border provisions are constructed as the number of these provisions in each PTA. This part of the analysis will focus on results for the full sample of countries in the gravity model.[75] The results in Figure 13.6 provide support for the view that, while border provisions promote aggregate exports, behind-the-border provisions constrain aggregate exports. Effects at the sectoral level are generally consistent with the results for aggregate exports, with behind-the-border provisions found to impact negatively on exports in most sectors (with the exception of forestry and refining). The impact of border provisions, however, are consistently positive and mostly relatively large.

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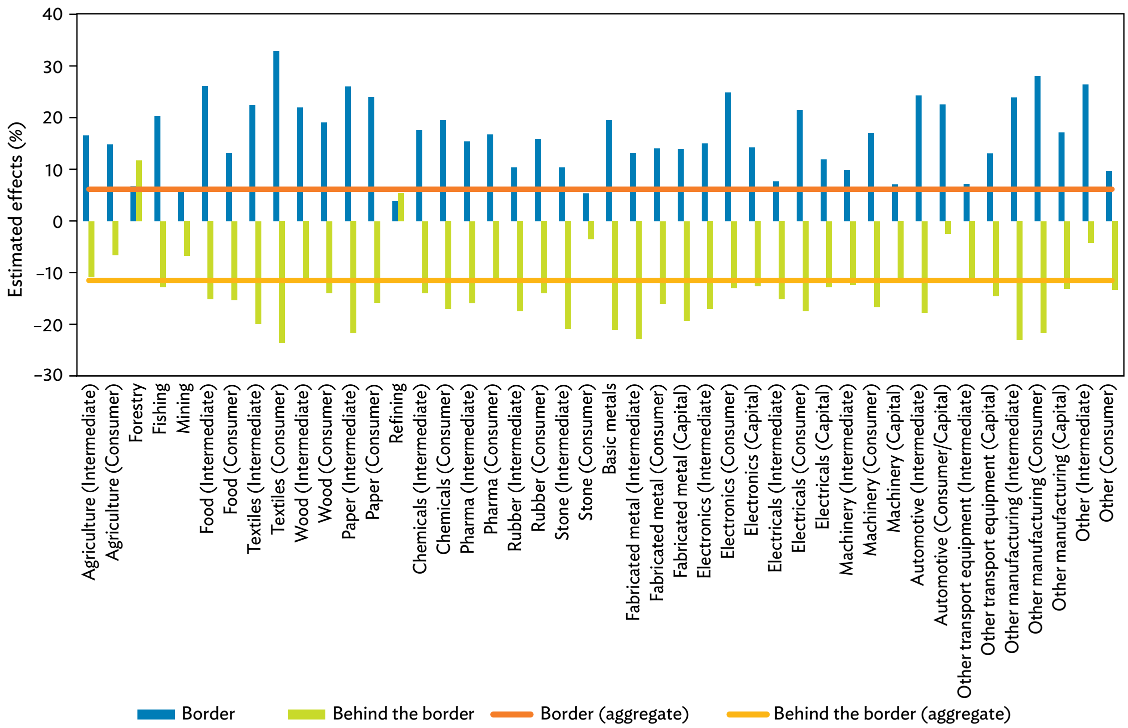
[74] This percentage effect is derived from the regression.

[75] The lack of variation in the border and behind-the-border indicators for the set of GMS economies results in effects that are largely insignificant when focusing on the GMS sample.

Figure 13.6: Estimated Effects of Border and Behind-the-Border Provisions in Preferential Trade Agreements



PTA = preferential trade agreement.

Notes: The figure reports the estimated effect of PTAs on total exports (orange line) and exports of individual sectors (see Appendix for sector definitions). Results are based on a gravity model using export data from the Greater Mekong Subregion economies for the year 2016.

Source: Authors' estimates.

13.5 Conclusions

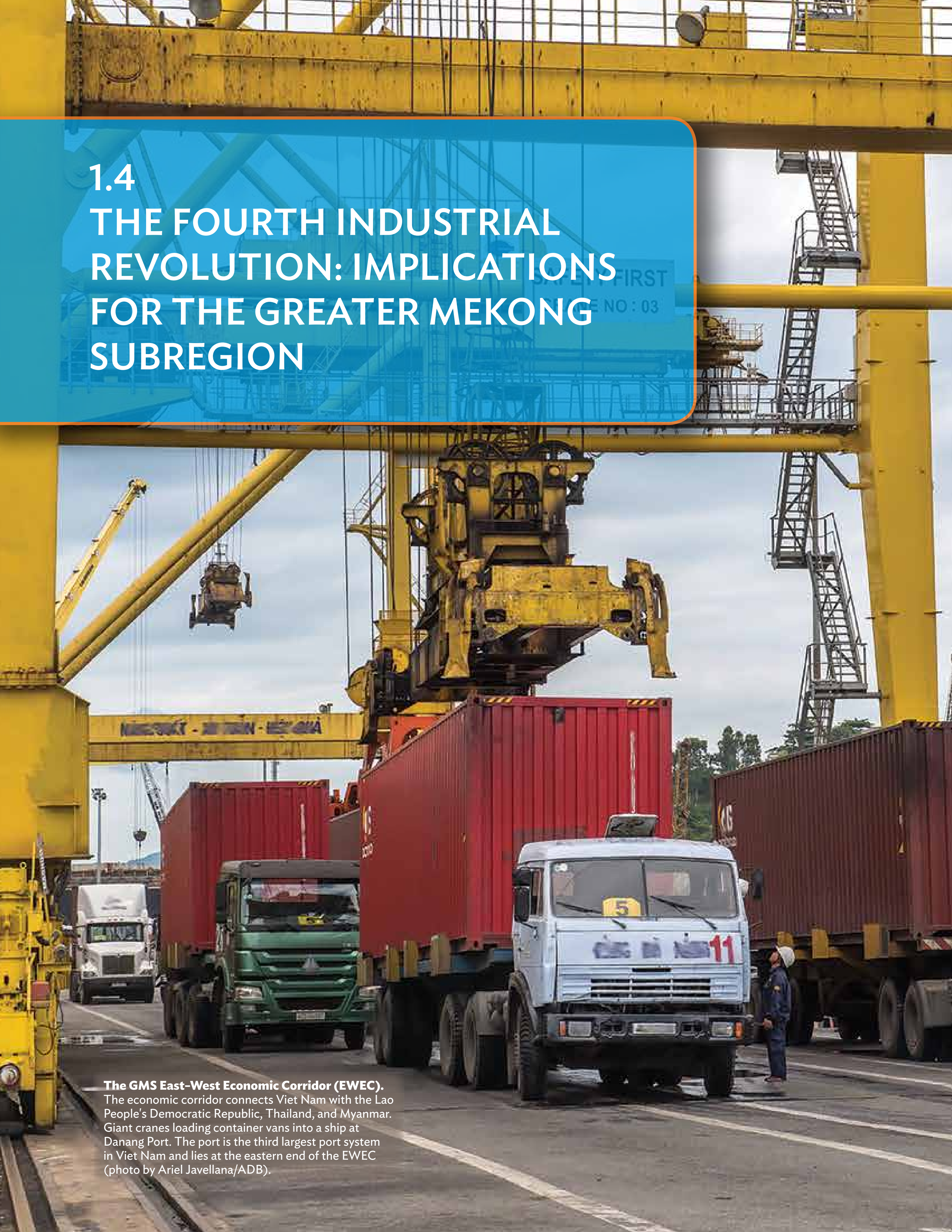
This chapter has considered the impact of preferential trade agreements on exports of GMS members. The analysis indicates that GMS economies tend to belong to a relatively small number of PTAs, with many of them signed among themselves or with other countries in the region. With few exceptions, the GMS members are not involved in PTAs with developed countries or with countries outside of the broader Asian region.

The results in the chapter further show that entering into a PTA with other countries is an important means of expanding exports, a result that is true at the aggregate level and also across a variety of sectors. In the case of GMS members, PTAs have often played a significant role in driving exports of intermediate goods and could be seen as an important facilitator of GVC participation.

Finally, the results indicate that the construction of a PTA appears to be an important determinant of the impact of PTAs, with behind-the-border provisions tending to lower exports between PTA partners and border provisions tending to increase such flows.

Photo by Lu Guang/ADB.

1.4 THE FOURTH INDUSTRIAL REVOLUTION: IMPLICATIONS FOR THE GREATER MEKONG SUBREGION



The GMS East–West Economic Corridor (EWEC). The economic corridor connects Viet Nam with the Lao People's Democratic Republic, Thailand, and Myanmar. Giant cranes loading container vans into a ship at Danang Port. The port is the third largest port system in Viet Nam and lies at the eastern end of the EWEC (photo by Ariel Javellana/ADB).

Chapter 14

The Fourth Industrial Revolution: Production and Use of Industry 4.0 Technologies

14.1 Introduction

New and emerging technologies are widely considered to be shaping the new industrial landscape. A key feature of these technologies, typically associated with the so-called fourth industrial revolution (4IR), is the growing interconnection and complementarity between digital and physical production systems. These technologies include robotics, additive manufacturing, artificial intelligence, the internet of things, and big data. While much of this discussion has concentrated on their effects in the developed world, in particular the benefits of increased productivity and the costs in terms of labor demand (especially for low-skilled workers), the increased use of these technologies also creates opportunities and risks for countries in the developing world.

On the one hand, the increased use of these technologies globally generates risks for developing countries by eroding their competitive advantage in low-cost, low-skilled labor. Indeed, there is some evidence to suggest that the share of occupations that are at risk of significant automation may actually be higher in developing countries than in developed countries (World Bank 2016). These negative impacts of 4IR technologies are particularly relevant in the context of global value chains, with firms in developed countries potentially able to reshore activities that were previously offshored to developing countries.

On the other hand, these technologies may allow countries in the developing world to take advantage of potential export opportunities in manufacturing activities. This would be the case, for example, if firms invested in these technologies in order to improve productivity, which in turn would allow them to become more competitive and able to succeed in export markets.

This chapter considers the rising importance of the production and use of 4IR technologies at the global level before examining the positioning of Greater Mekong Subregion (GMS) members in this global landscape. One way in which the study achieves this is by developing a simple taxonomy of countries according to their production (exports) and use (imports) of such products and identifying where in this taxonomy GMS members appear. To do this, the analysis uses detailed trade data to identify exports and imports in these technologies.[76]

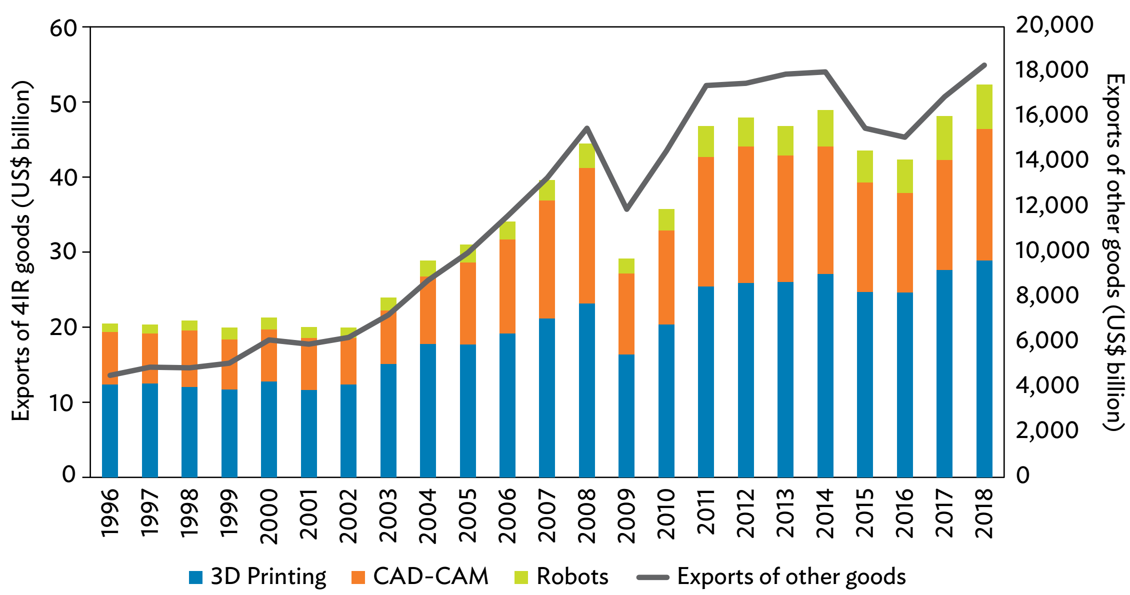
[76] The approach adopted in this chapter follows closely the methodology described in Foster-McGregor, Nomaler, and Verspagen (2019). See the Appendix for further details.

14.2 World Trade in 4IR Goods

Figures 14.1 and 14.2 show world export values and volumes, respectively, in 4IR technologies, distinguishing between three categories of 4IR goods—three-dimensional (3D) printing, computer-aided design and computer-aided manufacturing (CAD-CAM), and robots—for the period 1996–2018. For comparison, the corresponding values and volumes for other goods are also reported in the figures (on the secondary axis).

A first thing to note is that exports of 4IR technologies make up just a fraction of overall exports, either by value or volume, with 4IR export values accounting for less than a half of 1% of world exports. A second thing to note is that developments in world exports of 4IR technologies track developments in overall exports closely, with 4IR exports rising until around the financial crisis in 2008 and then rising more slowly in the years after the crisis. The composition of 4IR exports shows that 3D printing accounts for the majority of 4IR exports, around 60% of 4IR export values in 1996 (dropping to 55% in 2018). Exports of CAD-CAM products account for around a third of export values in both 1996 and 2018, with a somewhat higher share (40%) in the middle of the period. Robots account for a minority share of exports of 4IR goods, accounting for just 5% of 4IR export values in 1996. However, this share has more than doubled between 1996 and 2018, increasing to 11% in 2018.

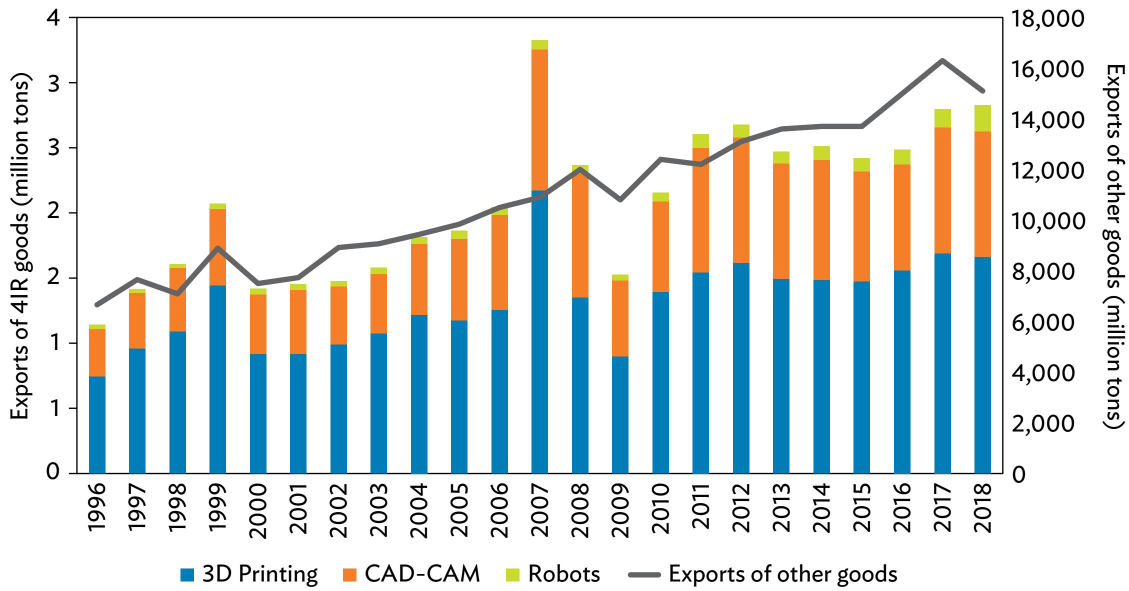
Figure 14.1: World Export Values in 4IR Goods



3D = three-dimensional, 4IR = fourth industrial revolution, CAD-CAM = computer-aided design and computer-aided manufacturing.

Source: Authors’ calculations based on United Nations Comtrade data.

Figure 14.2: World Export Volumes in 4IR Goods



3D = three-dimensional, 4IR = fourth industrial revolution, CAD-CAM = computer-aided design and computer-aided manufacturing.

Source: Authors' calculations based on United Nations Comtrade data.

Figures 14.3 and 14.4 report the average values of 4IR exports (Figure 14.3) and imports (Figure 14.4) by country for the period 2016–2018. Figure 14.3 indicates that exports of 4IR products are dominated by developed countries in North America and Europe along with large emerging and developing economies, such as the PRC, India, Turkey, and Thailand. Export values of 4IR products are low in Africa as well as in parts of Latin America and Asia.

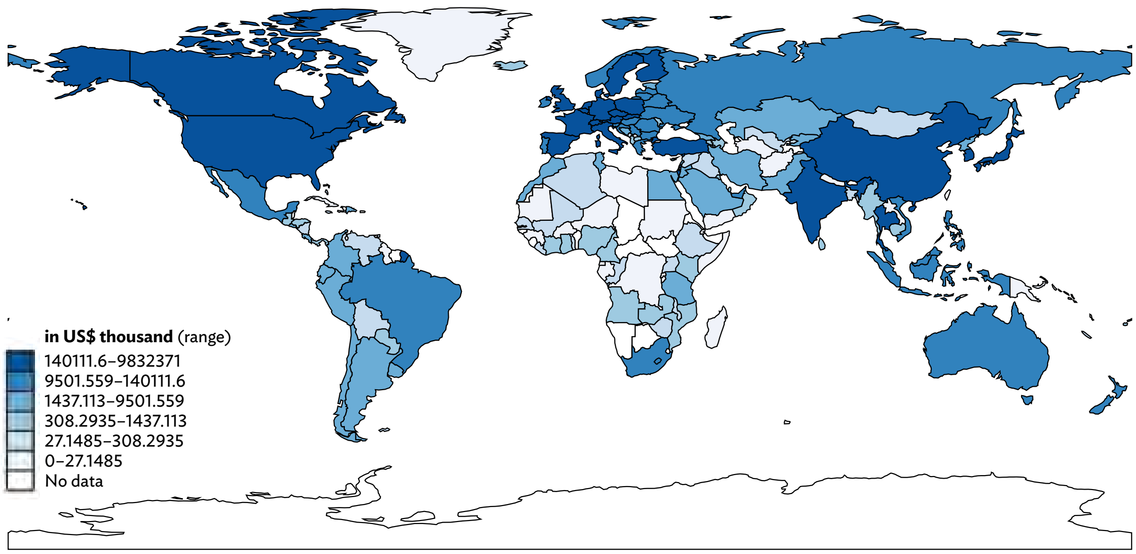
14.3 Exports and Imports of 4IR Products by Greater Mekong Subregion Members

Figures 14.5 and 14.6 combine information on 3D printing, CAD-CAM, and robots to examine developments in exports (Figure 14.5) and imports (Figure 14.6) of 4IR products by GMS economies.

Figure 14.5 shows that, starting from a low level in the late 1990s, exports of 4IR goods by the PRC has increased dramatically during 2000-2018. Aside from the PRC, Thailand is the only other GMS member with significant exports of 4IR products.

Figure 14.6 also indicates that the PRC accounts for the majority of imports of 4IR products in the GMS, although the trend is more variable (with declining values in the late 1990s and early 2010s, for example). Imports of 4IR products in Thailand and Viet Nam are also significant, with the increase in Viet Nam's imports relatively rapid and sustained since about 2010. The other three GMS members show very low values of imports of 4IR products.

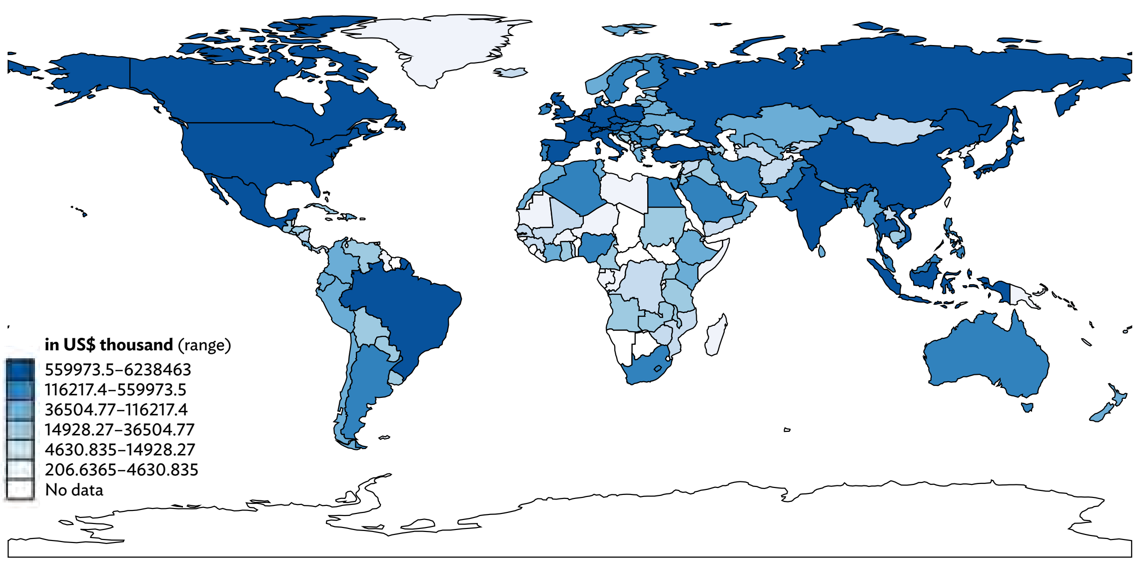
Figure 14.3: Export Values of 4IR Products by Country, 2016–2018 Average



4IR = fourth industrial revolution.

Source: Authors' calculations based on United Nations Comtrade data.

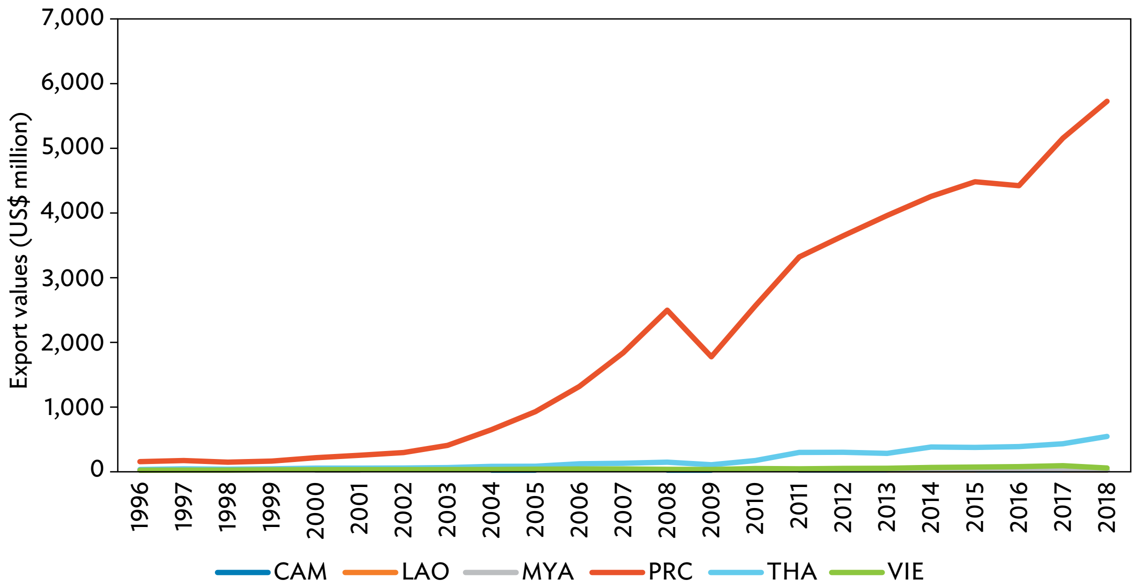
Figure 14.4: Import Values of 4IR Products by Country, 2016–2018 Average



4IR = fourth industrial revolution.

Source: Authors' calculations based on United Nations Comtrade data.

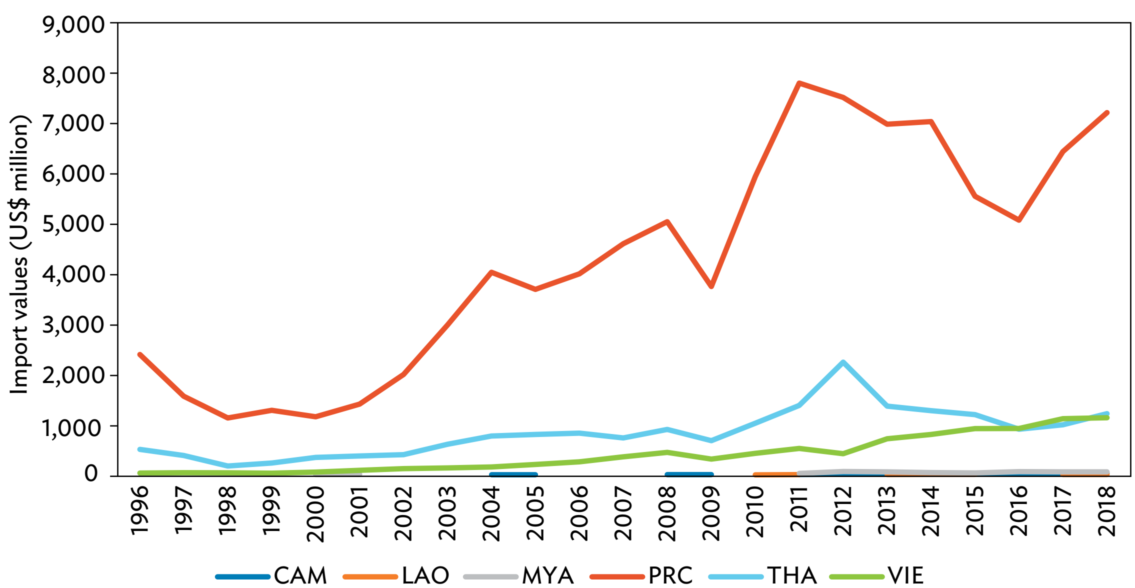
Figure 14.5: Exports of 4IR Goods by Greater Mekong Subregion Member



4IR = fourth industrial revolution, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on United Nations Comtrade data.

Figure 14.6: Imports of 4IR Goods by Greater Mekong Subregion Member

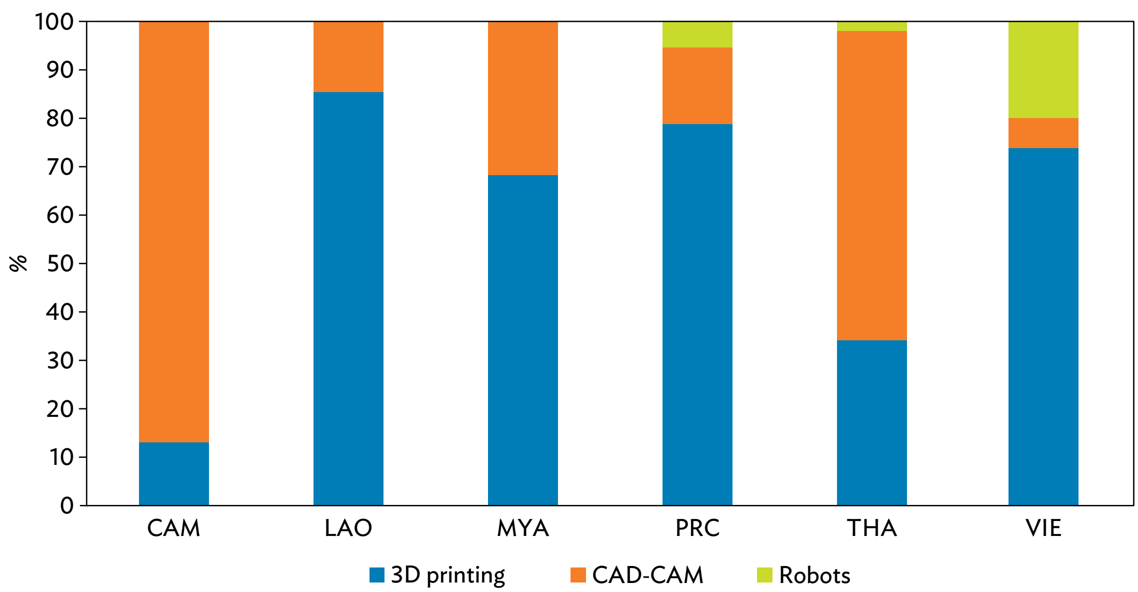


4IR = fourth industrial revolution, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on United Nations Comtrade data.

Figures 14.7 and 14.8 show the composition of 4IR exports and imports, respectively, in 2018. For most countries, the compositions of exports and imports align with that of the aggregate world picture, with exports and imports of 3D printing goods accounting for the majority of exports, while exports and imports of robots account for the lowest shares. There are some exceptions, however. For example, the shares of CAD-CAM products in total 4IR exports of Cambodia and Thailand are relatively high. The share of robots in total 4IR exports is also relatively high in Viet Nam. On the imports side, the share of robots in total 4IR imports is larger in the PRC than in other GMS members.

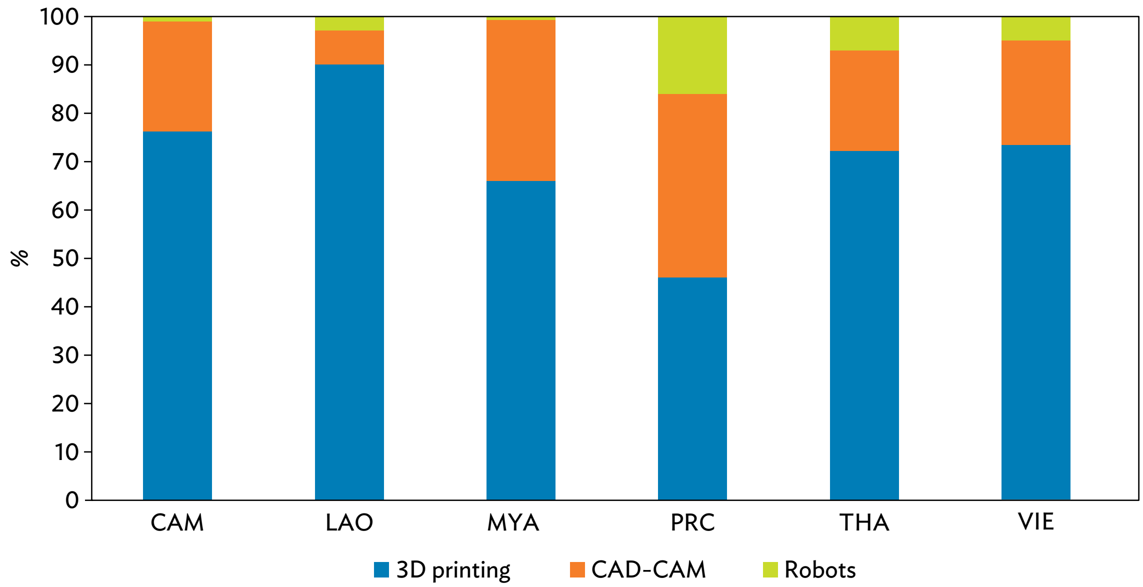
Figure 14.7: Composition of 4IR Exports by Greater Mekong Subregion Member in 2018



3D = three-dimensional, 4IR = fourth industrial revolution, CAD-CAM = computer-aided design and computer-aided manufacturing, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on United Nations Comtrade data.

Figure 14.8: Composition of 4IR Imports by Greater Mekong Subregion Member in 2018



4IR = fourth industrial revolution, CAD-CAM = computer-aided design and computer-aided manufacturing, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on United Nations Comtrade data.

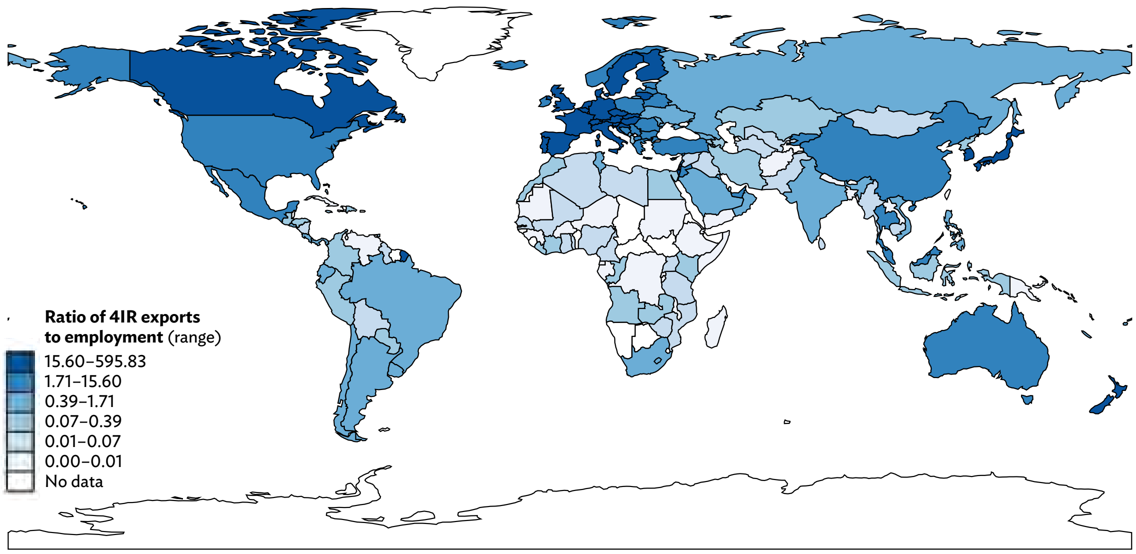
14.4 Intensity of 4IR Production and Use in Greater Mekong Subregion Economies

The previous section showed that 4IR exports of the GMS members are dominated by the PRC, with the country also accounting for the majority of 4IR imports. Given differences in economic size, this is perhaps not surprising. In this section, therefore, the analysis moves beyond looking at levels of exports and imports to concentrate on the intensity of 4IR exports and imports. In particular, the analysis will focus on the ratio of exports and imports to employment. The former captures the intensity of production of 4IR technologies and the latter the intensity in use of 4IR technologies.

Figures 14.9 and 14.10 report on the ratios of exports and imports, respectively, to employment (2016–2018 average) for all countries for which the analysis has data. By focusing on the intensity of exporting and importing 4IR products rather than simply the level of exports and imports, the study finds somewhat different results.

For example, export intensity of 4IR products is relatively high in many European countries, which is consistent with the results for export levels. However, export intensities of 4IR products in the US as well as some of the larger developing countries (including the PRC) are lower than what their export levels suggest, implying that the focus on values inflates the importance of 4IR exports for certain larger countries. Results for imports in Figure 14.10 provide a very similar set of conclusions, with the larger developing countries becoming relatively less important as destinations for 4IR products when considering intensity rather than the level of imports.

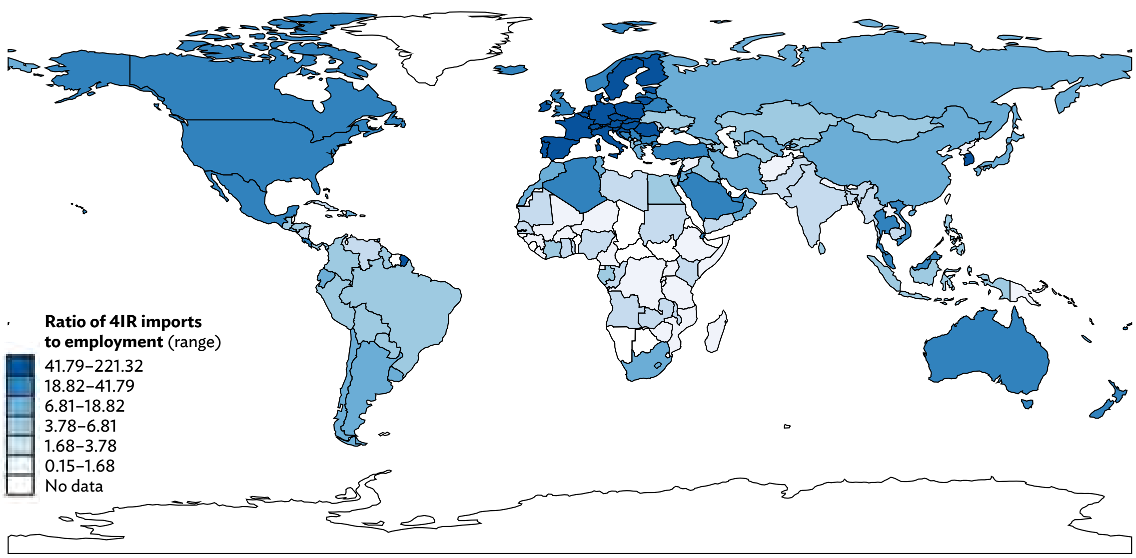
Figure 14.9: Ratio of 4IR Exports to Employment by Country, 2016–2018 Average



4IR = fourth industrial revolution.

Source: Authors' calculations based on United Nations Comtrade data.

Figure 14.10: Ratio of 4IR Imports to Employment by Country, 2016–2018 Average



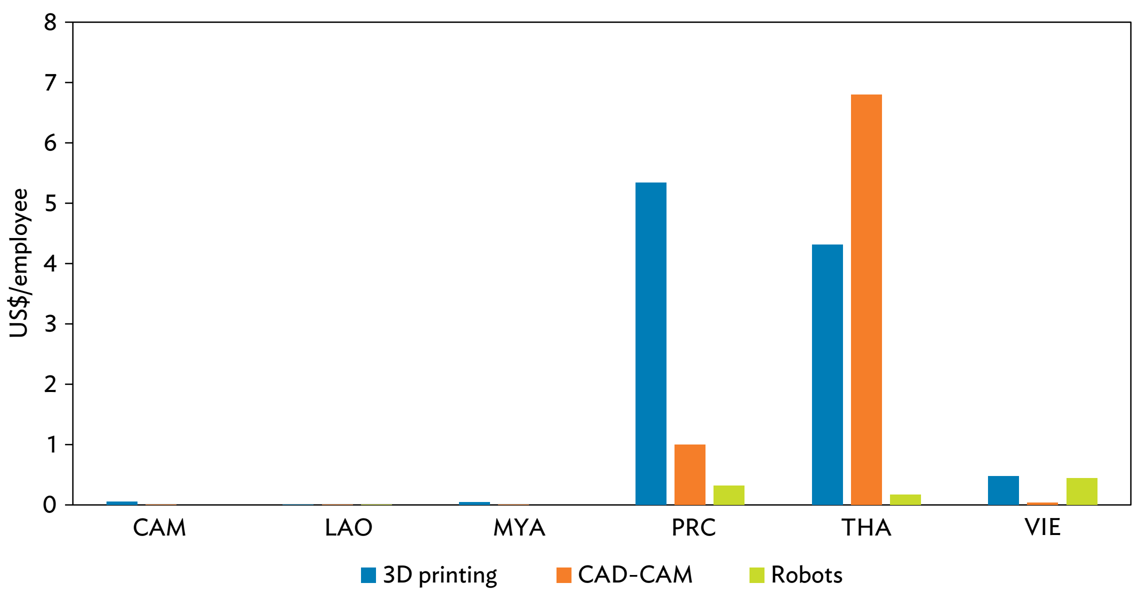
4IR = fourth industrial revolution.

Source: Authors' calculations based on United Nations Comtrade data.

Moving on to GMS economies, the next two figures show the ratios of 4IR exports (Figure 14.11) and imports (Figure 14.12) to employment for 2018, split up into the 4IR subcategories (i.e., 3D printing, CAD-CAM, and robots). Figure 14.11 confirms earlier results from analyzing export levels that most GMS members are not heavily engaged in the export of 4IR products. This is true for Cambodia, the Lao PDR, Myanmar, and Viet Nam. The PRC has a relatively high export intensity in 3D printing, but values for the other two 4IR product types are low. Interestingly, Thailand has a similarly high intensity in 3D printing exports and an even higher intensity in CAD-CAM exports. The export intensity of robots remains low, however. Therefore, when considering intensity rather than levels, the performance of Thailand in two of the three 4IR products is relatively strong and even stronger than the PRC in CAD-CAM exports.

Looking at the intensity of imports (Figure 14.12), the study finds generally higher values of import intensity when compared with the values for export intensity. Import intensity is particularly high for Thailand and Viet Nam, especially in the case of 3D printing technologies and, to a lesser extent, CAD-CAM technologies. Intensities for robot imports remain low in comparison to the other two 4IR technologies, but larger than the intensities reported on the export side. Interestingly, import intensities are significantly lower for the PRC than for Thailand and Viet Nam. This may reflect an issue of size (i.e., the PRC is still importing a great deal in terms of value, but when expressed as a share of employment the numbers are relatively low), but could also reflect a relatively large production sector for these technologies in the PRC, which then negates the need to import vast amounts of these technologies.

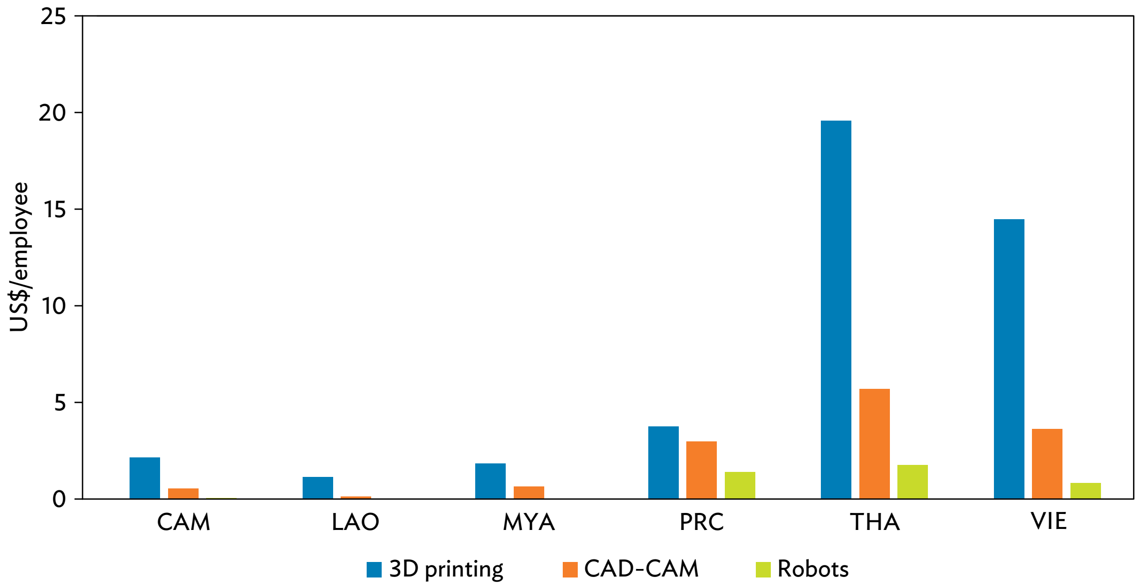
Figure 14.11: Ratio of 4IR Exports to Employment by Greater Mekong Subregion Member, 2016–2018 Average



3D = three-dimensional, 4IR = fourth industrial revolution, CAD-CAM = computer-aided design and computer-aided manufacturing, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on United Nations Comtrade data.

Figure 14.12: Ratio of 4IR Imports to Employment by Greater Mekong Subregion Member, 2016–2018 Average



3D = three-dimensional, 4IR = fourth industrial revolution, CAD-CAM = computer-aided design and computer-aided manufacturing, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on United Nations Comtrade data.

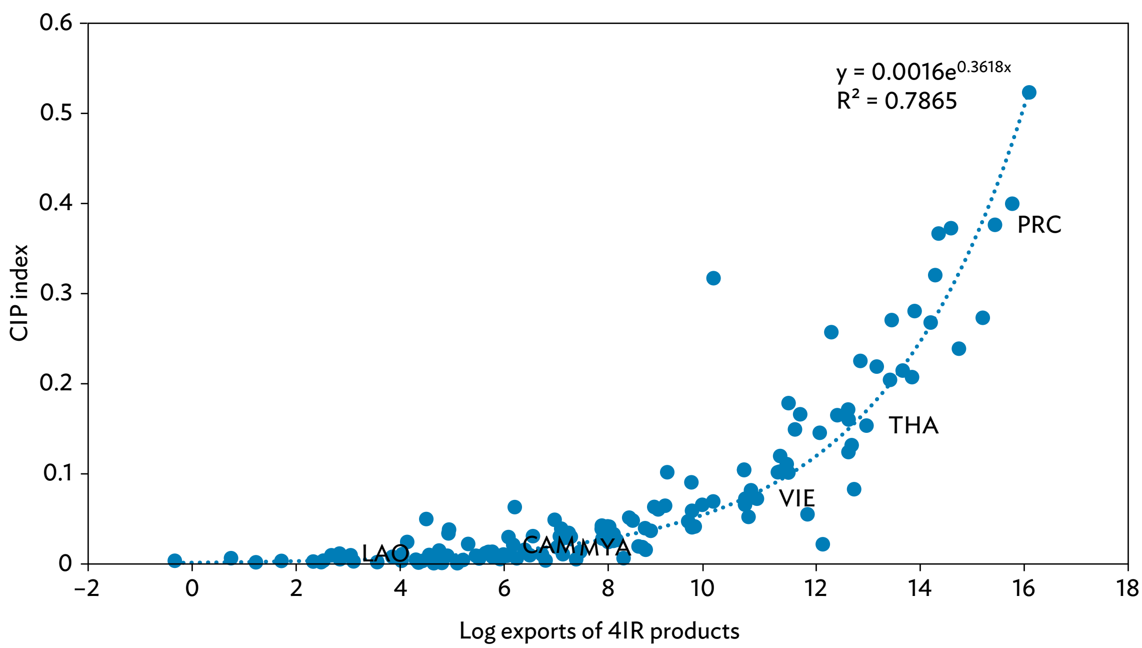
Import intensities for the other three countries are in general smaller than those of the PRC, Thailand, and Viet Nam but are also larger than the corresponding export intensities. While the intensities for robots and CAD-CAM technologies are negligible in these three countries, the intensities for 3D printing are larger and suggest the possibility that these countries are specialized in the use of this particular 4IR technology. This is something that the study will return to later in this chapter.

14.5 4IR Production and Use and Manufacturing Performance

Before analyzing the specialization pattern of both imports and exports of 4IR technologies in GMS economies, it is worthwhile considering whether there is any relationship between the production (export) or use (import) of 4IR technologies and manufacturing performance. Finding such relationships may suggest, for instance, that better-performing manufacturing sectors are in a better position to become specialized in the production of 4IR technologies as well as to use such technologies.

The next two figures present the correlation between the log of exports (Figure 14.13) and imports (Figure 14.14) and the United Nations Industrial Development Organization's competitive industrial performance (CIP) index, an indicator of an economy's ability to produce and export manufactured goods competitively. Figures 14.13 and 14.14 indicate a positive association between both the log of exports and CIP and the log of imports and CIP, suggesting that higher levels of production and use of 4IR technologies are associated with higher levels of manufacturing performance. GMS members tend to be very close to the fitted lines in the two figures, although Viet Nam appears to have a relatively low level of CIP compared with its level of imports of 4IR technologies.

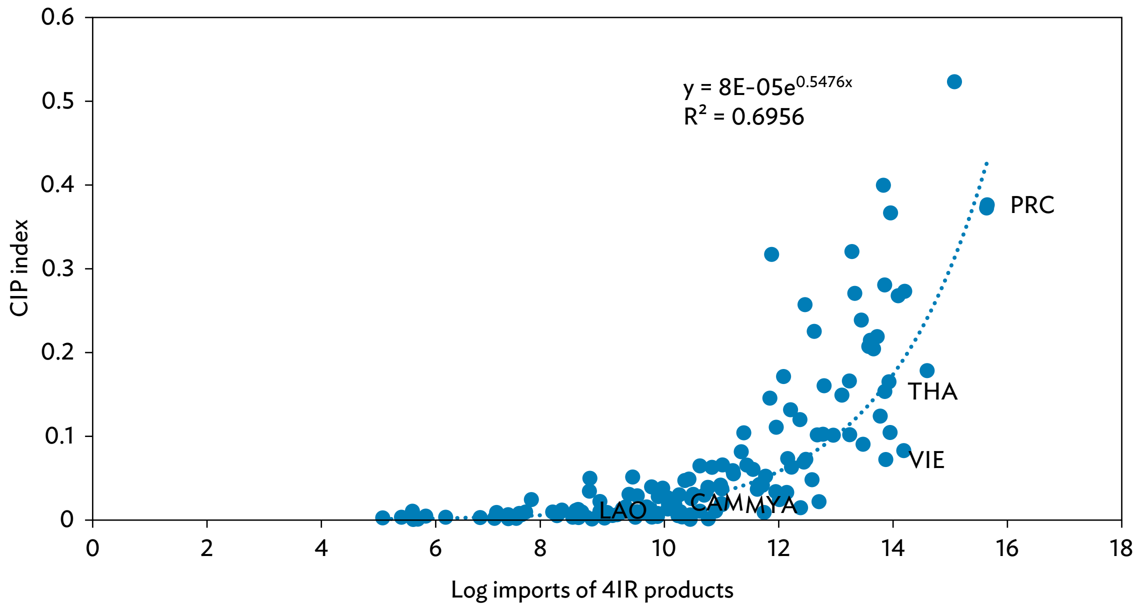
Figure 14.13: Association between 4IR Exports and United Nations Industrial Development Organization's Competitive Industrial Performance (CIP) Index, 2016–2018 Average



4IR = fourth industrial revolution, CAM = Cambodia, CIP = competitive industrial performance, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

Figure 14.14: Association between 4IR Imports and United Nations Industrial Development Organization's Competitive Industrial Performance (CIP) Index, 2016–2018 Average



4IR = fourth industrial revolution, CAM = Cambodia, CIP = competitive industrial performance, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

14.6 Specialization in 4IR Products

This section discusses whether countries specialize (captured by the concept of revealed comparative advantage (RCA) used in Chapter 3) in either the export (production) or import (use) of 4IR technologies.[77] The approach adopted here is to compare information on whether a country had a specialization in specific 4IR technologies at the start of 1996–1998 and at the end of 2016–2018. Figures 14.15–14.17 report on exports of 4IR products and Figures 14.18–14.20 report similar results for imports of 4IR products. In these figures, each dot represents a country's RCA in the periods 1996–1998 and 2016–2018. For ease of presentation, the figure labels only the GMS members in the sample.

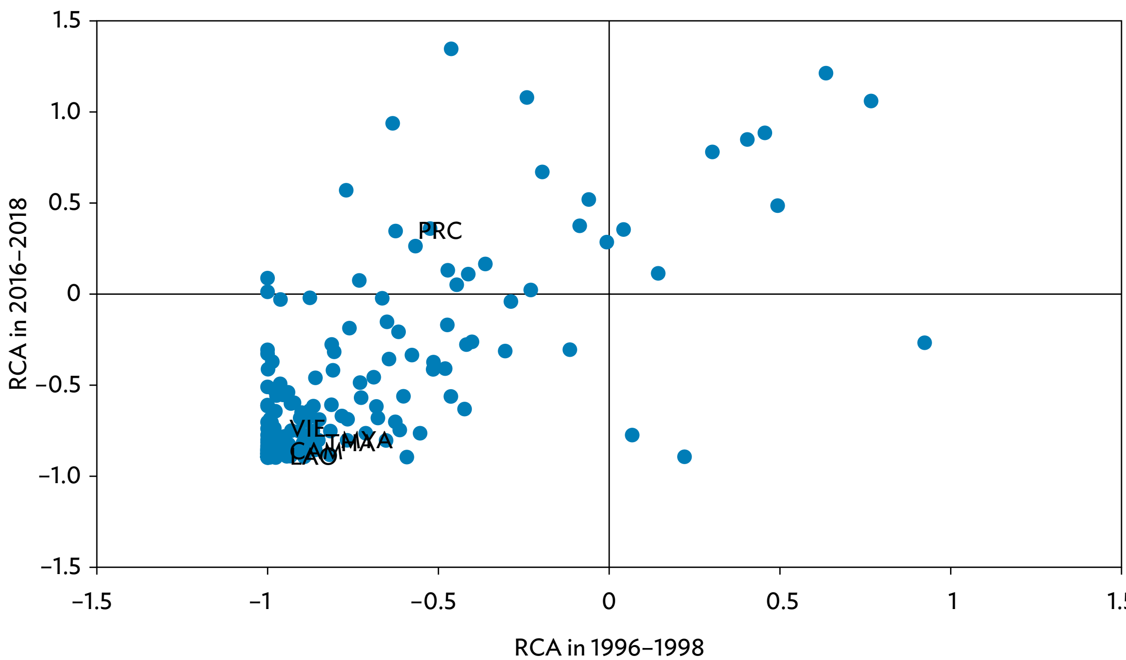
Figures 14.15–14.17 show that there are relatively few countries with export specialization in any of the 4IR technologies, confirming earlier results. In terms of the GMS members, there is also little evidence of a specialization in 4IR technologies for most of the members. However, there is some evidence that the PRC has developed a specialization in the export of 3D printing technologies, while Thailand has developed a comparative advantage in the export of CAD-CAM products. Other

[77] As in Chapter 3, the RCA index is normalized such that numbers greater than zero indicate that a country exports a product with RCA.

countries tend to be far away from specialization in the export of 4IR products, though both PRC and Viet Nam have moved toward becoming specialized in CAD-CAM technologies and the PRC shows some evidence of moving toward a specialization in robots.

In the case of imports, Figures 14.18–14.20 show that the PRC has maintained a comparative advantage in all three 4IR technologies in both periods, with its specialization in robots increasing over time. Other countries have developed a specialization in certain 4IR products, with Thailand either maintaining or developing comparative advantage in CAD-CAM products and robots, Myanmar developing a comparative advantage in 3D printing products, and Viet Nam developing a comparative advantage in CAD-CAM technologies. The remaining GMS members have not developed any import specialization in any of the 4IR technologies.

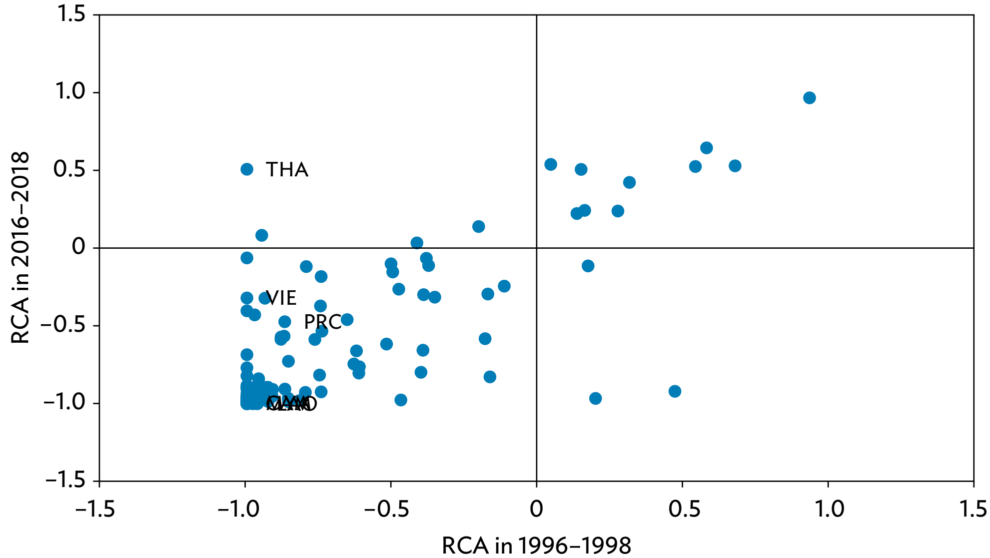
Figure 14.15: Specialization in Exports of 3D Printing Equipment



3D = three-dimensional, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, RCA = revealed comparative advantage, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

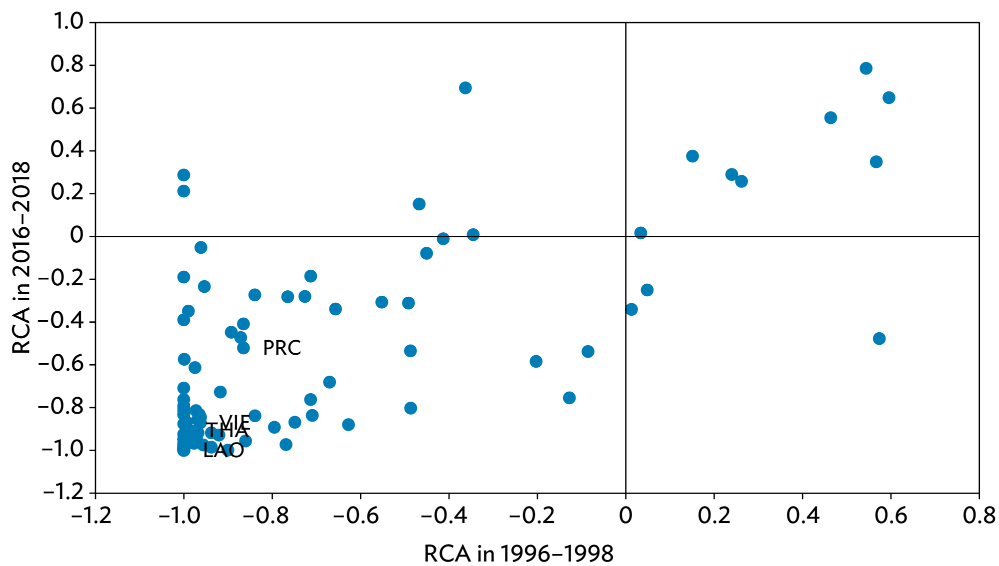
Figure 14.16: Specialization in Exports of CAD-CAM Products



CAD-CAM = computer-aided design and computer-aided manufacturing, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, RCA = revealed comparative advantage, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

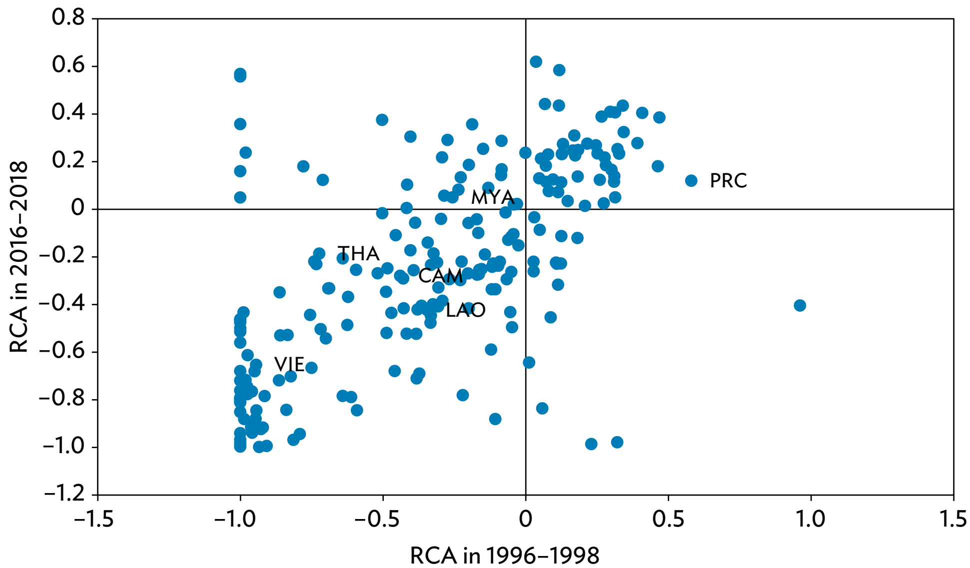
Figure 14.17: Specialization in Exports of Robots



LAO = Lao People's Democratic Republic, PRC = People's Republic of China, RCA = revealed comparative advantage, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

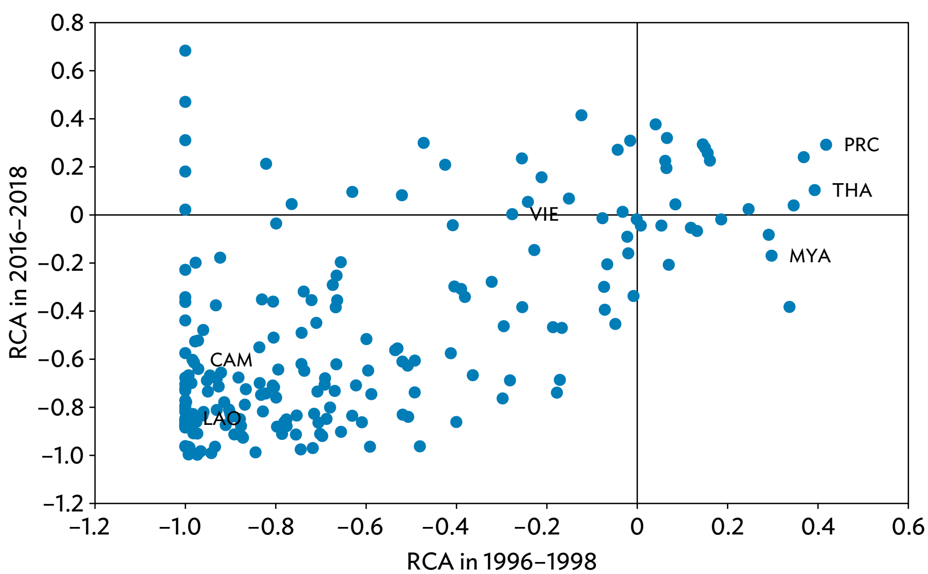
Figure 14.18: Specialization in Imports of 3D Printing Equipment



3D = three-dimensional, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, RCA = revealed comparative advantage, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

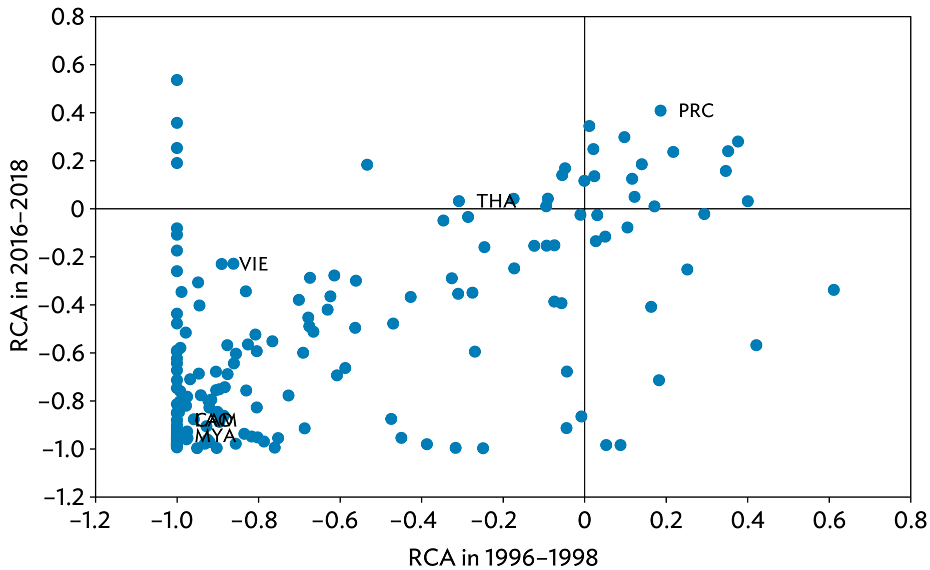
Figure 14.19: Specialization in Imports of CAD-CAM Products



CAD-CAM = computer-aided design and computer-aided manufacturing, CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, RCA = revealed comparative advantage, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

Figure 14.20: Specialization in Imports of Robots



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, RCA = revealed comparative advantage, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from United Nations Comtrade and United Nations Industrial Development Organization.

14.7 A Typology of 4IR Production and Use

Using the concepts of exports and imports with comparative advantage, this section presents a typology of countries according to their production and use of 4IR technologies. The approaches that the study adopts are (i) categorize countries as leading producers or users of 4IR technologies if they, on average, have an RCA in the export or import of 4IR technologies over the period 2016–2018; (ii) categorize countries as emerging producers or users of 4IR technologies if they did not have an RCA in the period 2016–2018, but if there was a significant movement toward obtaining RCA (with a threshold of 0.1) between 2010–2012 and 2016–2018; and (iii) categorize countries as followers in the production or use of 4IR technologies if they did not have an RCA in the period 2016–2018 and if there was no strong move toward obtaining RCA between 2010–2012 and 2016–2018. Given that countries can either be exporters or importers (or both) of 4IR technologies, countries will appear twice in the typology. Table 14.1 summarizes the definitions for the typology.

Table 14.1: Summary of 4IR Typology of Countries

Leading Producers Specialized in exporting 4IR technologies, i.e., an average RCA index greater than one over the period 2016–2018	**Leading Users** Specialized in importing 4IR technologies, i.e., an average RCA index greater than one over the period 2016–2018
Emerging Producers No export specialization in 4IR products over the period 2016–2018, but there is an increase in the value of RCA of more than 0.1 between 2010–2012 and 2016–2018	**Emerging Users** No import specialization in 4IR products over the period 2016–2018, but there is an increase in the value of RCA of more than 0.1 between 2010–2012 and 2016–2018
Follower Producers No export specialization in 4IR products over the period 2016–2018 and either a decrease or only a small increase in RCA (i.e., less than 0.1) between 2010–2012 and 2016–2018	**Follower Users** No import specialization in 4IR products over the period 2016–2018 and either a decrease or only a small increase in RCA (i.e., less than 0.1) between 2010–2012 and 2016–2018

4IR = fourth industrial revolution, RCA = revealed comparative advantage.

Source: Adapted from United Nations Industrial Development Organization (2020).

Based on data for 216 countries and territories, Table 14.2 reports the number of countries and territories classified in each of the six different categories in Table 14.1 for both exports and imports (Table A14.1 in the Appendix reports the full classification of countries and territories). The resulting typology aligns well with some of the descriptive evidence presented above. In particular, the analysis categorizes relatively few countries and territories as leading and emerging producers, consistent with the results above highlighting the large degree of concentration in exports of 4IR products. On the users (import) side, however, there are many more that can be classified as either leading or emerging users.

Table 14.2: Classification of Countries and Territories according to 4IR Typology

	Producers	Users
Leaders	12	51
Emerging	15	44
Followers	189	121

4IR = fourth industrial revolution.

Note: Table A14.1 in the Appendix lists all countries and territories in each category.

Source: Authors' calculations based on United Nations Comtrade data.

Table 14.3 reports information on where the GMS members appear in the typology. The table reveals that no GMS member can be classified as a leading producer of 4IR technologies, but that the PRC and Thailand are emerging producers of these products. Conversely, when considering GMS members as users of 4IR technologies, the study finds more evidence of GMS members playing a leading role. The PRC, Thailand, and Viet Nam are leading users of 4IR technologies according to the study's definition, with Cambodia emerging as a user in the most recent period. This leaves the Lao PDR and Myanmar as followers in terms of users of these technologies. As such, the study can tentatively categorize the GMS members into three groups: (i) the PRC and Thailand as emerging producers and leading users of 4IR technologies; (ii) Viet Nam and Cambodia as followers in production, but leading or emerging users; and (iii) the Lao PDR and Myanmar as followers in both production and use.

Table 14.3: Classification of Greater Mekong Subregion Members according to 4IR Typology

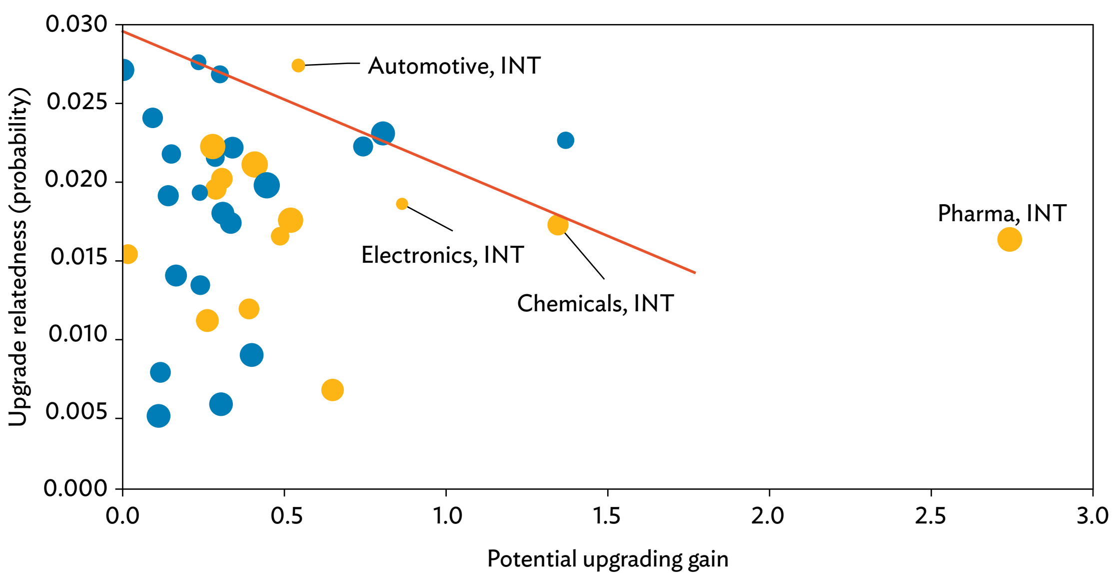
	Producers	Users
Leaders		PRC, Thailand, Viet Nam
Emerging	PRC, Thailand	Cambodia
Followers	Cambodia, Lao PDR, Myanmar, Viet Nam	Lao PDR, Myanmar

4IR = fourth industrial revolution, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: Authors' calculations based on United Nations Comtrade data.

This section closes with a reference to the analysis of upgrading paths in Chapter 7. The upgrading paths analyzed in that chapter are forward-looking projections. Another way of looking into the future is by way of technology foresight, which tries to explore which directions technological change may take in the future. In this respect, many analysts predict that industrial technology will be greatly influenced by a combination of further digitalization (including artificial intelligence), robotization, and additive manufacturing (3D printing).

Many countries have developed policy foresight activities addressing Industry 4.0. among the GMS members. Thailand has been particularly active in this sense. The study uses Thailand's Industry 4.0 report in order to identify the industrial sectors that will likely drive the country's Industry 4.0.[78] The country's upgrading triangles are shown in Figures 14.21 and 14.22. The yellow

Figure 14.21: Short-Run Upgrading Triangle of Thailand's Industry 4.0

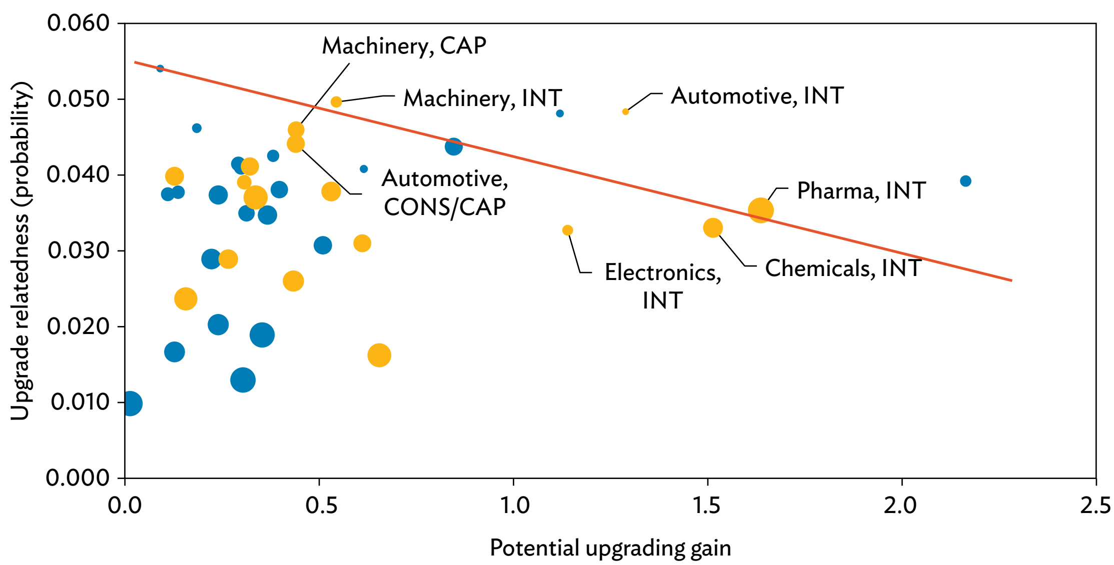


INT = intermediate goods.
Note: The yellow circles are sectors that have been identified in Thailand's Industry 4.0.
Source: Authors.

[78] Thailand 4.0 Reinvigorates ASEAN and Connects Thailand to the Global Community. https://www.bangkokpost.com/business/1881535/thailand-4-0-reinvigorates-asean-and-connects-thailand-to-the-global-community (accessed 31 May 2020).

circles in the figures are sectors that have been identified by the Government of Thailand as playing a role in the country's transition to Industry 4.0. Similar to the analysis in Chapter 7, Figure 14.21 shows the short-run upgrading path, while Figure 14.22 shows the long-run path.

Figure 14.22: Long-Run Upgrading Triangle of Thailand's Industry 4.0



CAP = capital goods, CONS = consumer goods, INT = intermediate goods.

Note: The yellow circles are sectors that have been identified in Thailand's Industry 4.0.

Source: Authors

The figures reveal that several sectors (e.g., intermediate automotive, intermediate pharmaceuticals, and intermediate chemicals) identified by the government are on the slope of the triangle, i.e., along the main policy trade-off line, thus presenting good opportunities for upgrading (i.e., either by providing relatively easy upgrading opportunities or by providing relatively large improvements in competitiveness). Nevertheless, many other such sectors are inside the upgrading triangle, indicating that these sectors may not provide the most efficient opportunities for achieving upgrading.

In the short run, intermediate automotive products is the most accessible Industry 4.0 sector for upgrading in Thailand. The strongest expected upgrading gain in the short run comes from intermediate chemical and pharmaceutical products. In the long-run upgrading path, many more Industry 4.0 sectors move closer to the trade-off line. The machinery sector (intermediate and investment products) and automotive consumer and investment products are expected to be more easily accessible to producers in Thailand in the longer run.

14.8 Conclusions

This chapter has discussed the positioning of GMS members in the production and use of technologies associated with the 4IR. After a general discussion noting that the production (export) of 4IR technologies is highly concentrated in the developed world and a small number of the larger developing countries and that the use (import) of 4IR technologies is somewhat less concentrated, the chapter goes on to consider the intensity of production and use of 4IR technologies and the association between 4IR production and use and manufacturing performance. On this latter issue, there appears to be a strong positive association between the production and use of 4IR technologies and manufacturing performance, suggesting the importance of succeeding in the production and use of these technologies.

Turning to the GMS economies, the results of the analysis indicate that, while the PRC dominates in terms of the value of both exports and imports of 4IR technologies, other GMS members appear engaged when considering the intensity of production and use, as captured by the value of exports and imports per employee. This is the case for Thailand on the export side, in particular with regard to exports of CAD-CAM and 3D printing technologies; and for both Thailand and Viet Nam on the import side, where they both have a relatively high import intensity in 3D printing technologies. Despite this, there are few examples of specialization (i.e., comparative advantage) in any of the three specific 4IR technologies (i.e., 3D printing, CAD-CAM, and robots) in either production (export) or use (import). In the case of exports, the PRC exports with comparative advantage 3D printing technologies, while Thailand exports with comparative advantage CAD-CAM technologies. There is no other specialization on the export side.

In the case of imports, the PRC and Thailand have developed specialization (i.e., comparative advantage) in some 4IR technologies, with the PRC having a specialization in all three 4IR technologies and Thailand maintaining or developing specialization in CAD-CAM and robots. Two other countries, Viet Nam and Myanmar, have also developed specialization in specific 4IR products, with Myanmar obtaining specialization in the use of 3D printing and Viet Nam in the use of CAD-CAM technologies. Based upon specialization patterns in production and use and the most recent changes in these patterns, the study has developed a typology of countries according to their involvement with 4IR technologies—considering the aggregate of all three 4IR technologies—and suggested the following categorization of GMS members: (i) the PRC and Thailand as emerging producers and leading users of 4IR technologies; (ii) Viet Nam and Cambodia as followers in production, but leading or emerging users; and (iii) the Lao PDR and Myanmar as followers in both production and use. The approach thus suggests a heterogeneous performance in terms of involvement in 4IR.

The 4IR offers opportunities in terms of allowing countries to engage in the production of new products associated with it. There are also potential costs and benefits associated with the use of these technologies through possible reshoring and enhanced productivity. At present, few GMS economies appear ready to be heavily involved in the production of these new technologies, but most members show some potential to be able to benefit from the use of these technologies. The further development of these technological opportunities can be an important way in which GMS members can upgrade and succeed through global value chains and global integration more generally.

Appendix

To identify the sources and diffusion of 4IR technologies, the study makes use of the United Nations Comtrade dataset, as collated through CEPII's BACI database. In particular, the study identifies specific products that are associated with these technologies. In principle, five specific 4IR technologies are of interest, namely: (i) industrial robots, (ii) additive manufacturing (or 3D printing), (iii) computer-aided design and computer-aided manufacturing (CAD-CAM) techniques, (iv) big data and cloud computing, and (v) artificial intelligence and machine learning. How these technologies are identified in the trade data are described in further detail below.

For a number of reasons, it is very difficult to identify big data and cloud computing and artificial intelligence and machine learning in the trade data. First, the most important part of this technology is software, which is very hard to find in the trade classification (i.e., the Harmonized System (HS) of classification). Second, to the extent that these technologies depend on hardware, it is usually generic hardware (e.g., fast computers, large storage), and these systems are multipurpose. Thus, even if the study can distinguish this type of hardware in the trade data, it cannot distinguish the hardware's specific use for these technologies. Finally, to the extent that these technologies are embodied in manufacturing capital goods (e.g., a "smart" sewing machine), the trade classification system does not distinguish between "normal" and "smart" versions of these products. The study therefore does not attempt to identify these technologies in the trade data and instead concentrates on the remaining three technologies.

For industrial robots, the study finds that this term occurs once in the HS classification as "Industrial robots, not elsewhere specified or included" (HS 847950). The corresponding 4-digit class (HS 8479) is "Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter." Turning to additive manufacturing (or 3D printing), Abeliansky, Martinez-Zarzoso, and Prettner (2015) define 3D printing in the HS scheme as a single class: HS 847780. This is defined as "Other machinery" in the 4-digit product class (HS 8477) "Machinery for working rubber or plastics or for the manufacture of products from these materials, not specified or included elsewhere in this Chapter." This 4-digit product class contains several other 6-digit classes: 847710 ("Injection-molding machines"); 847720 ("Extruders"); 847730 ("Blow moulding machines"); 847740 ("Vacuum moulding machines and other thermoforming machines"); 847751 ("Other machinery for moulding or otherwise forming: For moulding or retreading pneumatic tyres or for moulding or otherwise forming inner tubes"); 847759 ("Other machinery for moulding or otherwise forming: Other"); and 847790 ("Parts"). In the analysis, the study combines these different 6-digit codes into an indicator of additive manufacturing. Finally, for CAD-CAM techniques, the study finds in the HS system several classes in chapter 84 ("Nuclear reactors, boilers, machinery and mechanical appliances parts thereof") that refer to numerically controlled machines or machine tools. These are 845811 ("Horizontal lathes: Numerically controlled"); 845891 ("Other lathes: Numerically controlled"); 845921 ("Other drilling machines: Numerically controlled"); 845931 ("Other boring-milling machines: Numerically controlled"); 845951 ("Milling machines, knee-type: Numerically controlled"); 845961 ("Other milling machines: Numerically controlled"); 846011 ("Flat-surface grinding machines, in which the positioning in any one axis can be set up to an accuracy of at least

0.01 m: Numerically controlled"); 846021 ("Other grinding machines, in which the positioning in any one axis can be set up to an accuracy of at least 0.01 mm: Numerically controlled); 846031 ("Sharpening (tool or cutter grinding) machines: Numerically controlled"); 846221 ("Bending, folding, straightening or flattening machines (including presses): Numerically controlled"); 846231 ("Shearing machines (including presses), other than combined punching and shearing machines: Numerically controlled"); and 846241 ("Punching or notching machines (including presses), including combined punching and shearing machines: Numerically controlled"). Once again, these different 6-digit HS codes are combined to capture CAD–CAM technologies.

Caution should be used when interpreting the results in this chapter. Given the imperfect overlap between these technologies and the HS codes, it is inevitable that the study will also be capturing earlier vintages of technology (e.g., third industrial revolution technologies) in these classifications. Despite this, the data should provide an insight into the use of advanced technologies in these domains and provide insights into the means of identifying the countries with the capabilities to use these technologies (and therefore potentially benefit from such technologies).

Table A14.1: List of Countries and Territories by 4IR Typology

	Producers	Users
Leaders	Austria, Croatia, Czechia, Denmark, Germany, Israel, Italy, Japan, Republic of Korea, Slovakia, Slovenia, Switzerland	Algeria, Argentina, Austria, Azerbaijan, Bangladesh, Belarus, Bhutan, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Costa Rica, Cote d'Ivoire, Croatia, Czechia, Ecuador, El Salvador, Ethiopia, Fiji, French Southern Territories, Germany, Hungary, India, Indonesia, Iran, Italy, Kenya, Lithuania, Malawi, Malaysia, Mexico, Nigeria, Pakistan, People's Republic of China, Peru, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, South Africa, Thailand, Tokelau, Tunisia, Turkey, Turkmenistan, Uganda, Uzbekistan, Viet Nam
Emerging	Bahrain, Belgium, Bulgaria, Christmas Island, Fiji, Georgia, Kyrgyz Republic, Lebanon, Lithuania, Malta, Nauru, People's Republic of China, Sweden, Thailand, Uruguay	Albania, Belgium, Brunei Darussalam, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Christmas Island, Cocos, Cuba, Cyprus, Dominica, Dominican Republic, Falkland Islands, France, French Polynesia, Gabon, Ghana, Greece, Greenland, Guinea, Haiti, Honduras, Japan, Kyrgyz Republic, Malta, Mauritania, Mauritius, Montserrat, Morocco, Niger, Nepal, Northern Mariana Islands, Palau, Sierra Leone, Spain, Sudan, Timor-Leste, Turks and Caicos, United States, Vanuatu, Virgin Islands, Zimbabwe
Followers	Afghanistan; Albania; Algeria; American Samoa; Angola; Anguilla; Antarctica; Argentina; Armenia; Aruba; Australia; Azerbaijan; Bahamas; Bangladesh; Barbados; Belarus; Belize; Benin; Bermuda; Bhutan; Bolivia; Bosnia and Herzegovina; Brazil; Brunei Darussalam; Burkina Faso;, Burundi; Cambodia; Cameroon; Canada; Cape Verde; Cayman Islands; Central African Republic; Chad; Chile; Cocos; Colombia; Comoros;	Afghanistan; American Samoa; Andorra; Angola; Anguilla; Antarctica; Armenia; Aruba; Australia; Bahamas; Bahrain; Barbados; Belize; Benin; Bermuda; Burkina Faso; Canada; Cayman Islands; Chad; Chile; Colombia; Comoros; Cook Islands; Curaçao; Democratic Republic of Congo; Denmark; Djibouti; Egypt; Equatorial Guinea; Eritrea; Estonia; Finland; Gambia; Georgia; Gibraltar; Greenland; Guam; Guatemala;

continued on next page

Figure A12.1 *continued*

	Producers	Users
	Cook Islands; Costa Rica; Cote d'Ivoire; Cuba; Curaçao; Cyprus, Democratic Republic of the Congo; Djibouti; Dominica; Dominican Republic; Ecuador; Egypt; El Salvador; Equatorial Guinea; Eritrea; Estonia; Ethiopia; Falkland Islands; Finland; France; French Polynesia; French Southern Territories; Gabon; Gambia; Ghana; Gibraltar; Greece; Greenland; Grenada; Guam; Guatemala; Guinea; Guinea-Bissau; Guyana; Haiti; Honduras; Hong Kong, China; Hungary; Iceland; India; Indonesia; Iran; Iraq; Ireland; Jamaica; Jordan; Kazakhstan; Kenya; Kiribati; Kuwait; Lao People's Democratic Republic; Latvia; Liberia; Libya; Macao, China; Madagascar; Malawi; Malaysia; Maldives; Mali; Marshall Islands; Mauritania; Mauritius; Mexico; Micronesia; Moldova; Mongolia; Montenegro; Montserrat; Morocco; Mozambique; Myanmar; Nepal; Netherlands; Netherlands Antilles; New Caledonia; New Zealand; Nicaragua; Niger; Nigeria; Niue; Norfolk Island; Northern Mariana Islands; North Macedonia; Norway; Oman; Pakistan; Palau; Palestine; Panama; Papua New Guinea; Paraguay; Peru; Philippines; Poland; Portugal; Qatar; Republic of Congo; Romania; Russia Federation; Rwanda; Saint Barthélemy; Saint Kitts and Nevis; Saint Helena; Saint Lucia; Saint Martin; Saint Pierre and Miquelon; Saint Vincent and Grenadines; Samoa; San Marino; Sao Tome and Principe; Saudi Arabia; Senegal; Serbia; Seychelles; Sierra Leone; Singapore; Sint Maarten; Solomon Islands; Somalia; South Africa; South Sudan; Spain; Sri Lanka; Sudan; Suriname; Syria; Tajikistan; Tanzania; Timor-Leste; Togo; Tokelau; Tonga; Trinidad and Tobago; Tunisia; Turkey; Turkmenistan; Turks and Caicos; Uganda; Ukraine; United Arab Emirates; United Kingdom; United States; Uzbekistan; Vanuatu; Venezuela; Viet Nam; Virgin Islands; Wallis and Futuna; Yemen; Zambia; Zimbabwe	Guinea-Bissau; Guyana; Hong Kong, China; Iceland; Iraq; Ireland; Israel; Jamaica; Jordan; Kazakhstan; Kiribati; Kuwait; Lao People's Democratic Republic; Latvia; Lebanon; Liberia; Libya; Macao, China; Macedonia; Madagascar; Maldives; Mali; Marshall Islands; Micronesia; Moldova; Mongolia; Montenegro; Mozambique; Myanmar; Nauru; Netherlands; Netherlands Antilles; New Caledonia; New Zealand; Nicaragua; Niue; Norfolk Island; Norway; Oman; Palestine; Panama; Papua New Guinea; Paraguay; Philippines; Qatar; Republic of Congo; Republic of Korea; Rwanda; Saint Barthélemy; Saint Helena; Saint Kitts and Nevis; Saint Lucia; Saint Pierre and Miquelon; Saint Vincent and Grenadines; Samoa; San Marino; Sao Tome and Principe; Saudi Arabia; Senegal; Seychelles; Singapore; Sint Maarten; Solomon Islands; Somalia; South Sudan; Sri Lanka; Suriname; Sweden; Switzerland; Syria; Tajikistan; Tanzania; Togo; Tonga; Trinidad and Tobago; Ukraine; United Arab Emirates; United Kingdom; Uruguay; Venezuela; Wallis and Futuna; Yemen; Zambia

Source: Authors.

Chapter 15

The Fourth Industrial Revolution: Automation Risk of Industry 4.0 Technologies

15.1 Introduction

A recent strand of literature has argued that new technologies associated with the fourth industrial revolution (4IR), e.g., advanced robotics, machine learning, artificial intelligence, etc., will have a negative impact on employment, with certain occupations that can be substituted with these technologies possibly disappearing.

While these concerns are not new, with similar arguments made during past industrial revolutions, many have suggested that this time may be different. Harari (2018), for example, argues that humans possess just two kinds of abilities—physical and cognitive. Over the course of the 20th century, technological progress was associated with eliminating low-skilled, physically intensive tasks and jobs, creating jobs requiring cognitive skills that were more difficult to automate while replacing physically intensive occupations. The more recent technological advances, however, are also replacing jobs requiring cognitive skills, raising doubts about future employment possibilities when machines are more capable than humans at both physical and cognitive tasks.

In line with these arguments, empirical studies have estimated the risk of automation for particular occupations and used these results to estimate the share of jobs in a country that is at risk of automation. Table 15.1 provides a summary of some of these studies, which have estimates for one or more Greater Mekong Subregion (GMS) members except Myanmar.

The seminal study in this literature is by Frey and Osborne (2017). The authors estimated that 47% of jobs in the United States (US) are at risk of automation in the next 10–20 years. Subsequent studies for other Organisation for Economic Co-operation and Development (OECD) countries also predicted a high median-job automation risk, although country-level estimates for overall automation risk were generally lower (the main difference between Frey and Osborne's results and those of the OECD relates to the number of workers that were placed in the high-automation risk category). Other studies have adopted a similar approach to consider automation risk in developing countries, with some studies reporting results for different GMS members.

Table 15.1: Summary of Existing Results of Automation Risk in the Greater Mekong Subregion
(share of occupations at risk, %)

	World Bank (2016) Unadjusted	World Bank (2016) Adjusted	Chang and Huynh (2016)	World Bank (2014a)
PRC	77	55		
Cambodia	78	41	57	
Lao PDR				71
Myanmar				
Thailand	72	52	44	
Viet Nam			70	

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Notes: World Bank refers to the 2016 World Development Report (WDR); the unadjusted figures adopt the approach and results of Frey and Osborne (2017), while the adjusted results account for diffusion lags in technology. World Bank (2014a) refers to results reported in a presentation of the WDR outline in Berlin (www.worldbank.org/content/dam/Worldbank/Publications/WDR/WDR%202016/WDR16_Berlin_Mishra.pdf).

Source: Authors.

The World Bank's World Development Report (2016) constructed estimates of automation risk for a set of developed and developing countries. The sample includes three GMS members—the PRC, Cambodia, and Thailand. Using the Frey and Osborne (2017) approach, the results indicate that about 77%, 78%, and 72% of occupations in the PRC, Cambodia, and Thailand, respectively, are susceptible to automation. When adjusting for the fact that the diffusion of new technologies is likely to take more time in the context of developing countries, the numbers fall. The estimated risk of automation drops to 41% in Cambodia and, while the numbers for the PRC and Thailand also fall, they still remain high at 55% and 52%, respectively. In another study, the World Bank (2014a) further estimates that 71% of jobs in the Lao PDR are at high risk of automation.[79]

In a separate study for the International Labour Organization, Chang and Huynh (2016) constructed indicators of automation risk for five Association of Southeast Asian Nations (ASEAN) members—Cambodia, Indonesia, the Philippines, Thailand, and Viet Nam.[80] Their study shows that, across these five countries, around 56% of employment is at high risk of automation in the next decade or two. Looking at individual countries, the study finds that automation risk is lowest in Thailand, where just 44% of employment is at a high risk of automation. Automation risk is somewhat higher in Cambodia at 57%—consistent with the World Bank (2016) study—and even higher in Viet Nam, where 70% of employment is at high risk of automation. In the two remaining countries in the sample—Indonesia and the Philippines—automation risk is at 56% and 49%, respectively.

These results suggest that between 40% and 80% of employment in the GMS is at risk of automation in the next decade or two, which is alarming.

[79] These estimates are based on the World Bank's Skills Toward Employment and Productivity (STEP) surveys, which are surveys that take place in urban areas only.

[80] Chang and Huynh (2016) use the automation risk probabilities from Frey and Osborne (2017), applying them to labor force survey data from the five ASEAN countries.

This chapter argues that these estimates are unlikely to be true. While the structure of employment in the GMS economies is likely to change dramatically over the next two decades, much of this is likely to be due to the adoption of older (pre–4IR) technologies and will involve a movement toward more "high-quality" jobs. To understand why these estimates of automation risk are likely to overexaggerate the true risk of automation, it is useful to begin with a description of how these estimates are developed.

15.2 Estimating Automation Risk

There have been numerous recent attempts to estimate the risk of automation in jobs or occupations, although mostly for developed countries. This literature generally takes a task-based approach to evaluate jobs. Occupations are classified as either routine or nonroutine: routine tasks involve explicit and codifiable procedures that are, in general, more amenable to automation, while nonroutine tasks involve judgment, problem-solving, intuition, persuasion, and creativity; and are less prone to automation.

The approach adopted in much of the recent literature follows the method developed by Frey and Osborne (2017). Frey and Osborne reviewed the literature on machine learning and artificial intelligence and concluded that there seem to be technological bottlenecks corresponding to three main job task categories: perception and manipulation tasks (i.e., recognizing objects and configurations of objects and manipulating them); creative intelligence tasks (i.e., finding nonroutine solutions to nonroutine problems); and social intelligence tasks (i.e., interacting with humans in a social way).[81]

Frey and Osborne (2017) argued that jobs that contain a large degree of tasks in these three categories will not be easily automated in the near future—taken to be 10–20 years—but that other jobs may be. They asked a panel of experts (in machine learning) to assess a set of 70 job descriptions in terms of the potential to be automated (i.e., whether the job descriptions included the identified bottlenecks or not) over the coming decades, with jobs classified as either automatable or not automatable. The approach thus takes a fairly narrow view, focusing only on the technological feasibility of occupations being automatable at some point in the future.

Using information from the US Department of Labor's O*NET database on the mix of knowledge, skills, and abilities that occupations require, and relating these to the technological bottlenecks identified above (Table 15.2), Frey and Osborne predicted the probability of automating these 70 jobs, classifying jobs with a probability of 70% or more as jobs at a high risk of automation. In addition, using information on the indicators of bottlenecks for other occupations (i.e., for a further 632 occupations not in their database), the authors make an out-of-sample prediction to assign a risk of automation to a total of 702 different occupations. Taking these estimates of automation risk to the data on the structure of employment in the US, Frey and Osborne (2017) then calculate the share of current employment that is at a high risk of automation and find that 47% of US employment is at high risk.

[81] Frey and Osborne (2017) used nine variables to characterize the three non-automatable activities: finger dexterity, manual dexterity, and cramped workspace/awkward positions capture perception and manipulation tasks; originality and fine arts capture creative intelligence tasks; and social perceptiveness, negotiation, persuasion, and assisting and caring for others capture social intelligence tasks.

Table 15.2: O*NET Variables That Serve as Indicators of Bottlenecks to Computerization

Computerisation Bottleneck	O*NET Variable	O*NET Description
Perception and manipulation	Finger dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects
	Manual dexterity	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects
	Cramped work space, awkward position	How often does this job require working in cramped work spaces that require getting into awkward positions?
Creative intelligence	Originality	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem
	Fine arts	Knowledge theory and techniques required to compose, produce, and perform works of music, dance, visual arts, drama, and sculpture
Social intelligence	Social perceptiveness	Being aware of others' reactions and understanding why they react as they do.
	Negotiation	Bringing others together and trying to reconcile differences
	Persuasion	Persuading others to change their minds or behavior
	Assisting others and caring for others	Providing personal assistance, medical attention, emotional support, or other personal care to others such as coworkers, customers, or patients

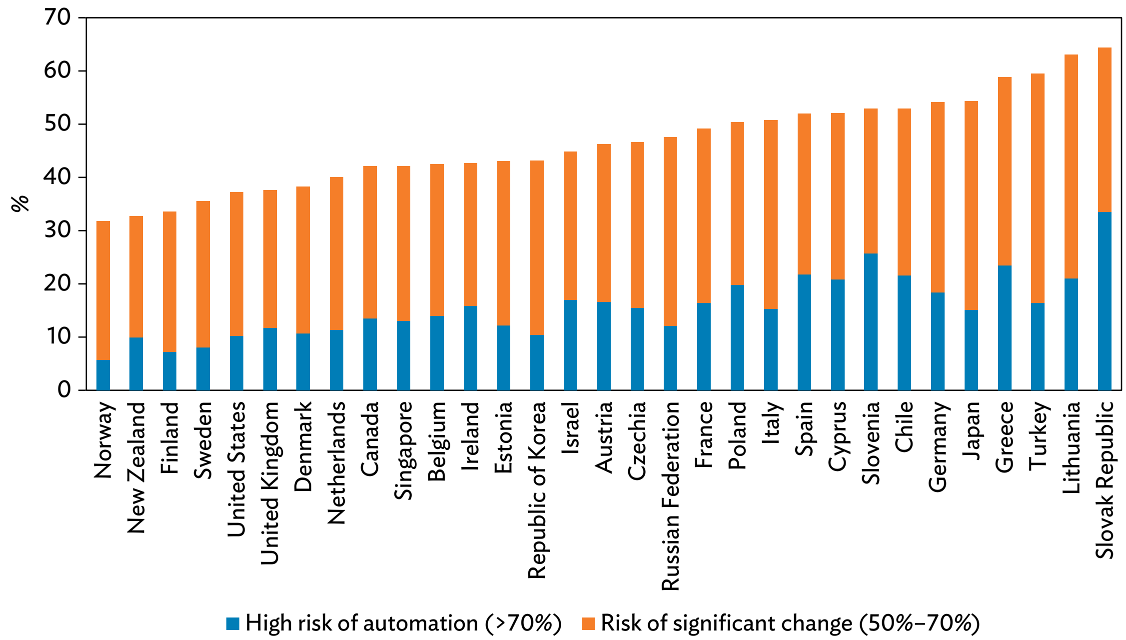
Source: Frey and Osborne (2017).

A similar approach was adopted by Nedelkoska and Quintini (2018), who used a broader database that covers the entire OECD, further estimating the risk of automation at the level of individuals rather than jobs.[82] This has advantages since two individuals in the same job code may have different automation risks because they answer differently to the task-related questions (i.e., they have the same job code but do different tasks within that job code).

Nedelkoska and Quintini (2018) find a smaller share of employment in the high-risk group but still a median risk of automation of 48%. For the OECD as a whole, they find that 16.6% of jobs are at a high risk of automation (i.e., greater than 70% chance) and 30.2% of jobs have a significant risk of automation (i.e., between 50% and 70%). However, these averages hide a great deal of variation across the OECD. In the Slovak Republic, 33.6% of jobs are at a ***high*** risk of automation—the largest share in the OECD—while Norway has the smallest share at 5.7% (Figure 15.1). When combined with the share of jobs that are at a ***significant*** risk of automation, Norway still has the lowest overall risk of around 31% and the Slovak Republic has the highest at around 65%.

[82] A study by Arntz, Gregory, and Zierahn (2016) also considers specific jobs for the entire OECD.

Figure 15.1: Variation in Job Automation across Countries
(share of jobs at significant and high risk of automation, %)

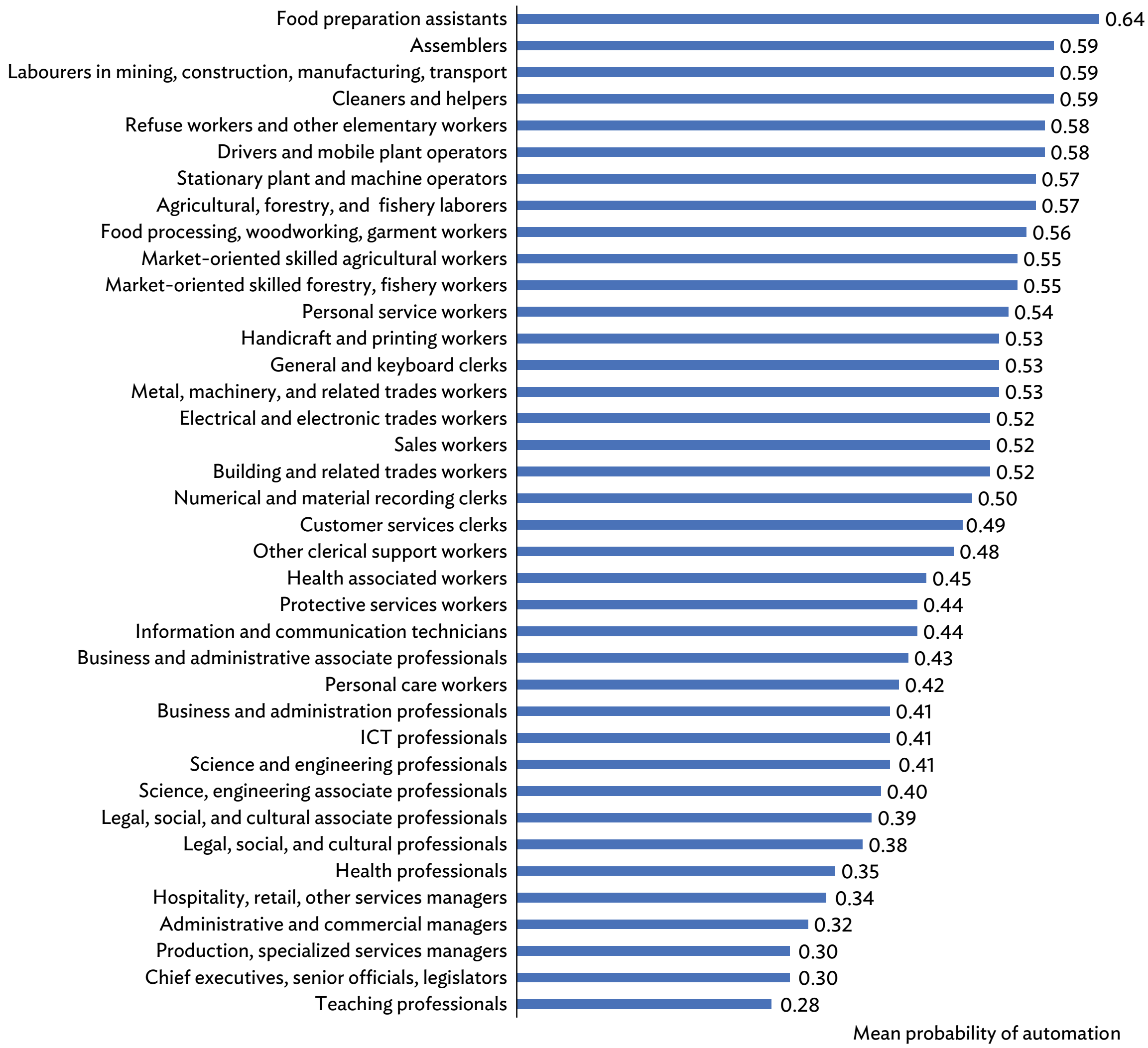


Source: Nedelkoska and Quintini (2018).

An important finding in this literature is that the structure of employment is an important driver of differences in automation risk across countries. Figure 15.2 reports the estimated average probability of automation risk by occupation in Nedelkoska and Quintini (2018). The figure reports large differences in automation risk across occupations. Certain occupations are at a relatively high average risk of automation, including food preparation assistants; cleaners and helpers; laborers in mining, construction, manufacturing; and assemblers. These are occupations that tend to involve routine and repetitive activities. Other occupations have a much lower risk of automation, including teaching professionals; production and specialized services managers; and chief executives, senior officials, and legislators. These are occupations that are nonroutine and non-repetitive. Countries with a specialization pattern that involves a higher share of occupations at a high risk of automation will, in general, have a higher overall automation risk.

The analysis undertaken for developed countries has been adapted to a developing country setting by the World Bank (2016). When applying the Frey and Osborne (2017) method to a dataset of around 40 developing and transition countries, the results indicate that the risk of automation is higher for developing countries than the automation risk found by Frey and Osborne (2017) and Nedelkoska and Quintini (2018) for developed countries. To a large extent, this likely reflects differences in economic structure—developing countries have an economic structure (i.e., a sectoral structure) that involves a large share of occupations at a high risk of automation. Estimates of the share of employment susceptible to automation range from around 55% in Uzbekistan to more than 80% in Ethiopia.

Figure 15.2: Average Probability of Automation Risk by Occupation



ICT = information and communication technology.

Source: Nedelkoska and Quintini (2018).

In summary, the recent empirical literature relies on a task-based approach that essentially categorizes jobs into routine and nonroutine, with routine jobs at a higher risk of automation. Based on this approach, most studies find that a significant share of jobs are at risk of automation, with this risk usually higher in the developing world.

15.3 Why Automation Risk May Be Exaggerated

In response to this empirical literature, a number of criticisms and a number of factors have been raised to question whether the risk of automation is indeed likely to be so high. This section reviews some of these arguments.

Atkinson and Wu (2017) critique the Frey and Osborne methodology by arguing that the authors did not manually assess the likelihood of automation in each of the 702 occupations. Instead, Frey and Osborne relied on expert—but subjective—judgments for just 70 of the occupations, which they then used to estimate the probability of automation using information on a small number of characteristics of the occupations before predicting, out of sample, the remaining 632 occupations. This approach has led to a number of anomalies, with occupations such as fashion models, barbers, and carpet installers classified as at high risk of automation. It can also be argued that the approach overestimates the risk of other occupations that are considered routine, but which are unlikely to be automated given the dexterity required for the activities associated with the occupation. Various tasks associated with cleaners and helpers, for example, are unlikely to be at risk of automation (e.g., bed makers, bathroom cleaners, etc.). One explanation for the lack of consistency with certain expectations is that the explanatory variables do not provide enough details to capture the nuances of the different activities being undertaken.[83] Another explanation is that the subjective assessments of whether an occupation is at risk of automation were based on a limited set of information about the job content of occupations.[84] Frey and Osborne (2017) also estimate automation risk at the occupation level, ignoring any differences in terms of jobs and activities within occupations. When considering specific jobs, Arntz, Gregory, and Zierahn (2016) and Nedelkoska and Quintini (2018) find a much lower risk of automation.

A further critique of the Frey and Osborne approach is that it focuses exclusively on the technological feasibility of automation, that is, the only characteristic for determining the risk of automation for an occupation is whether it is likely to be technologically feasible to automate an occupation in the near future. While this can also be considered an advantage of the approach, by allowing for a forward-looking perspective on automation risk, the approach does ignore other dimensions that are highly relevant in the decision to automate, such as whether it makes economic sense to automate a job, which would depend on the relative costs of automation versus labor. This is likely to be a significant determinant of the decision to automate, especially in the developing world where wages tend to be low and where workers are likely to remain competitive for some time. This is obviously the case for the GMS economies that remain relatively low-tech, with relatively low wage rates, and where investments in automation technology are likely to remain less profitable for firms for quite some time. A further relevant factor in developing countries is likely to be the skill levels of workers, with a lack of skilled workers slowing the process of automation.

83 In some cases, the coefficients of the bottlenecks are also against what would be expected (i.e., they do not act as bottlenecks).

84 Coelli and Borland (2019).

Related to this is the fact that the approach focuses on a relatively narrow set of technologies associated with the 4IR, in particular, machine learning. These technologies are likely to rely on infrastructure, institutions, and skills that may not be in place in many developing countries. In short, many of these new technologies may not be directly relevant for many countries at an early stage of development, which rely on highly labor-intensive activities and have not as yet embraced previous technologies to any large degree. Moreover, other forms of technology—for example, those associated with mechanization—may be more important determinants of employment demand and could also be prerequisites for countries to develop and use 4IR technologies.

A further shortcoming of the approach worth highlighting is that it looks only at the risk of automation of existing jobs and occupations, but says nothing about new jobs, occupations, and sectors that may arise in response to the development of new technologies associated with the 4IR. Throughout history, jobs have been destroyed by developments in technology, but technology has also helped create new jobs and occupations. Indeed, job creation and job destruction are a normal part of the development process.

While the above discussion suggests that omissions and shortcomings in the approach in much of the recent literature may exaggerate the extent of automation risk, there are also forces that are likely to work in the other direction, raising the risk of automation. The obvious example in this respect revolves around the role of international trade and global value chains, with the effects of automation on jobs in the developing world working in a more indirect manner—through automation in the developed world leading to developing countries losing comparative advantage due to reshoring, particularly in sectors that use low-skilled and routine jobs intensively.

Finally, it is important to highlight that, while the risk of job losses from technology associated with the 4IR are likely to be overblown, developing countries will undergo a great deal of job churning in the next decades. Consistent with the historical experience of developed countries, the study expects that jobs will be lost in agriculture—with employment shares dropping from over 50% to around 5% during the course of development—and created in manufacturing and particularly in services. Technology will be an important driver of such job churning, through the increased mechanization of the agriculture sector, for example, but this will be technology associated with earlier industrial revolutions. Moreover, this job churning will generally be associated with a movement toward higher-quality and ultimately higher-paid jobs, which can be seen as a benefit for an economy. In short, policy needs to be focused on ensuring structural change that involves moving into more complex activities that are associated with higher wages. The digitalization of agriculture, or the introduction of digital technologies in rural areas, has the potential to transform agriculture and encourage such structural change. This is already happening in many developed and in some developing countries. It is important to understand what digitalization of agriculture means and entails.

In the agriculture and food sector, the spread of mobile technologies, remote-sensing services, and distributed computing are already improving smallholders' access to information, inputs, markets, finance, and training. In fact, 70% of the poorest 20% in developing countries have access to mobile phones. However, for the digitalization of agriculture to truly impact and revolutionize the sector, in the sense of changing every part of the agrifood chain, major transformations in farming systems, rural economies, and natural resource management will be required (Trendov, Varas, and Zeng 2019).

The digitalization of agriculture is already taking place in developed countries, for example, by integrating the agrifood sector as a key focus within existing national digital strategies that aim to transform industry and society. In developing countries, most of the e-agriculture services are embedded within e-government or information and communication technology (ICT) strategies where the main objective is to provide basic e-agriculture services, such as early alert notifications and general information. Many small-scale farmers in the developing world remain isolated from digital technologies and lack the skills to use them. There are powerful reasons why this is happening, in particular the fact that agriculture in most developing countries is still labor intensive. In advanced economies, on the other hand, agriculture is much more capital intensive, and hence the introduction of digital technologies is much easier.

The transformation of agriculture will require a series of conditions to use these technologies: (i) basic conditions such as availability, connectivity, affordability, ICT in education, and supportive policy and programs (e-government) for digital strategies; and (ii) enabling conditions such as use of internet, mobile phones, and social media; digital skills and support for agricultural entrepreneurship; and an innovation culture. All this requires the development of information technology infrastructure and networks in rural areas. It also requires education and digital literacy. Indeed, education is the most critical factor to accelerating innovation and digital transformation.

Digital entrepreneurship involves the transformation of existing businesses through novel digital technologies and the creation of new enterprises characterized by the use of digital technologies to improve business operations. It also involves the invention of new digital business models and engaging with customers and stakeholders through new digital channels. Developed countries are so far leaders in establishing an entrepreneurial culture. Developing countries such as Armenia, Rwanda, Turkey, and Zambia are also rapidly pursuing opportunities that digitalization offers. The problem is that, despite the rapid growth of digital agricultural technologies, most ICT-enabled solutions have yet to be demonstrated at scale. Small and medium-sized enterprises often struggle to move from the application stage to fully realized businesses.

Examples of digital transformation in agriculture are:

(i) **Mobile applications** provide price information to farmers and help them plan their production process. An example is the M-Farm application in Kenya, which led farmers to change their cropping patterns. Some farmers reported receiving higher prices at market. Another example is the EMA-i, which is an early warning application developed by the Food and Agriculture Organization of the United Nations to facilitate quality and real time livestock disease reporting captured by animal health workers in the field. Digital technologies can also help farmers anticipate and respond to pest attacks, crop failures, and climatic changes through timely weather-based agro-advisory messages.

(ii) **Agricultural robots (agro-robots)** are becoming a key trend that will deeply influence agriculture in the coming decades. Small lightweight agro-robots are being deployed to help farmers measure, map, and optimize water and irrigation use. They are replacing traditional high-mass tractors, which contribute to the re-aeration of the soil. Naïo Technologies has developed the Dino agro-robot to help farmers manage crop weeding with a high level of precision and at a much faster rate.

(iii) **Guidance systems** (a modality of precision agriculture) during planting and fertilizer application can lead to cost savings in terms of seed, fertilizer, and tractor fuel, and can reduce working hours in the field. Variable rate technologies and drones can also reduce water and pesticide use, as well as labor costs.

(iv) **Enterprise resource planning** software offers a set of tools that share a common process and data model, covering end-to-end operational processes such as accounting, analytics, inventory management, customer relationship management, and human resources management. Enterprise resource planning can help transform a farm into a more cost-efficient business. MyCrop is a technology enabled initiative for farmers—a sustainable, data-driven, scalable, intelligent, self-learning, real time, and collaborative agrifood system—which serves as a farm management solution and a predictive analytics and monitoring tool. It empowers farmers through delivering information, expertise, and resources to increase productivity and profitability. It combines big data, machine learning, smart phones/tablets, etc. Likewise, AliBaba's "ET Agricultural Brain" is an artificial intelligence program that uses facial, temperature, and voice recognition designed to help pig farmers assess each pig's health.

(v) **Blockchain** has been used to detect poor food quality in food chains, thus allowing early responses. It can also provide consumers with information on the origin of their food. This is being used, for example, by Walmart to keep track of every bag of spinach and lettuce.

As noted in Chapter 8, agriculture is still a large employer in most GMS economies. A significant portion of this labor is surplus employment. Thus, the problems and dilemmas of the GMS members are largely employment related. Many of the technologies described above require financial resources, large farm sizes, and close integration with other technologies and agrifood chain processes. The implementation and use of these technologies pose challenges for small-scale farmers. Traditionally, development has involved the migration of workers out of agriculture and into manufacturing and services. Most activities in the latter two sectors have higher productivity than agriculture, and this differential has been an important source of growth and key to allowing wage increases. Once the number of surplus workers in agriculture declines, productivity in the sector can increase. This migration is what subsequently allowed the mechanization of the countryside (e.g., use of standard tractors) and what would lead to further increases in productivity. It is important to stress that a necessary condition for this to happen is the migration of workers out of agriculture. The mechanization and digitalization of agriculture will not happen while the share of employment of the sector in total employment is still, for example, at 40%. Otherwise, the introduction of such technologies, similar to mechanization through standard tractors, would simply exacerbate the rural unemployment problem.

What this means is that the introduction in agriculture of new digital technologies discussed earlier will still require workers to migrate to manufacturing and services. Unless this happens, the agriculture sector will not modernize, and productivity will not increase. It is also important that policy makers in the GMS understand the use of new digital technologies in their particular context, e.g., which technologies are appropriate for different crops (rice, palm oil, pineapple), farm sizes, and management practices.

15.4 Conclusions

This chapter has summarized and discussed a recent strand of literature that estimates the risk of job automation, with a focus on the existing evidence for GMS economies. While the evidence is somewhat fragmented, the International Labour Organization and the World Bank have constructed automation risk estimates for five of the six GMS members. The estimates are found to vary depending on the particular study and on the assumptions made about diffusion lags. There are further important differences in automation risk across the set of GMS economies. Despite this, the results indicate that the GMS members are at a significant risk of automation, with estimates suggesting that between 40% and 80% of jobs are at risk, depending on the country and the study.

While the results from these studies are quite pessimistic in terms of the potential for job losses due to automation, there is a number of factors that suggest that these estimates may exaggerate the risk of automation. First, the approach adopted focuses on a specific set of technologies associated with the 4IR and concentrates on the technological feasibility of automating occupations. As such, it ignores economic aspects such as the relative costs of automation versus labor, which may favor labor in the GMS economies for quite some time. Second, it also ignores the possibility that other conditions and capabilities, e.g., infrastructure, institutions, human capital, and so on, may affect the feasibility of automating jobs, which again suggests that automation risk in the GMS economies may be considerably lower than predicted. Finally, it is important to keep in mind that there will be a large amount of job churning during the course of development, with jobs lost in agriculture and generated in manufacturing and especially services. These job losses will be partly due to older forms of technological progress—associated with mechanization, for example—rather than technologies associated with the 4IR. Historically, such job losses due to structural change and mechanization across the course of development are usually offset by the creation of new jobs, with workers moving to different occupations in other sectors.

To the extent that automation risk is a problem in the GMS economies, however, a number of important determinants of automation risk have been identified, with education levels being an important factor. Results indicate that the jobs of workers with high levels of education are at lower risk of automation. This suggests that higher education and training can help develop competencies that are more difficult to automate. The economic structure is also an important driver of automation risk, with low-tech manufacturing sectors (e.g., food production, garments, and footwear) and low-tech services (e.g., wholesale and retail trade) having a high risk of automation. This has implications for industrial policy and suggests that efforts should be made to move away from such sectors, a suggestion in line with recommendations in other chapters to upgrade by moving to different value chains and sectors.

Even within sectors, however, there are differences in the extent of automation risk. An example is computers and electronics, where an employment structure focused on assembly presents a high risk of automation. Such an outcome suggests that a movement away from assembly activities and toward other stages of the value chain can be a way of insulating a country from automation. In short, a potential solution to the problem of automation risk is to upgrade both within and across sectors. Discussions in other chapters provide some suggestions on how to do this and in which directions upgrading can take place. An important part of such a strategy will involve an upgrading of the skills of the labor force.

PART 2

THE ROLE OF CITIES AS ENGINES OF GROWTH

The BTS Skytrain tracks. The tracks along with a network of elevated highways and pedestrian walkways, help ease traffic along Rama IV Road. This area is one of Bangkok's busiest commercial and business hubs (photo by Lester Ledesma).

Chapter 16

Urbanization Patterns in the Greater Mekong Subregion

16.1 Introduction

This chapter analyzes how key patterns of urbanization are unfolding in the Greater Mekong Subregion (GMS). To do so, the chapter uses two sets of data. The first dataset is based on official statistics on key features of urbanization, as compiled by the United Nations' World Urbanization Prospects (WUP) database and the Chinese provincial statistical yearbooks. The WUP database also contains projections of how urbanization trends may look like until 2050. One drawback of this dataset is that, as it is based on official statistics, the information on urbanization is not necessarily comparable across countries. Further, in many countries, the definitions used to determine whether a given human settlement is rural or urban tends to change slowly over time. For example, in many countries, outdated municipal boundaries continue to be used to define whether a geographic area is rural or urban.

To overcome both problems, the chapter uses a second dataset based on nighttime lights (NTL) as captured by satellite imagery and developed by the Asian Development Bank (ADB) (2019). NTL are used to define cities to provide a consistent measure of urbanization across countries from 1992 to 2016. To distinguish between administratively defined cities from cities defined using NTL, the term "natural city" is used for the latter.

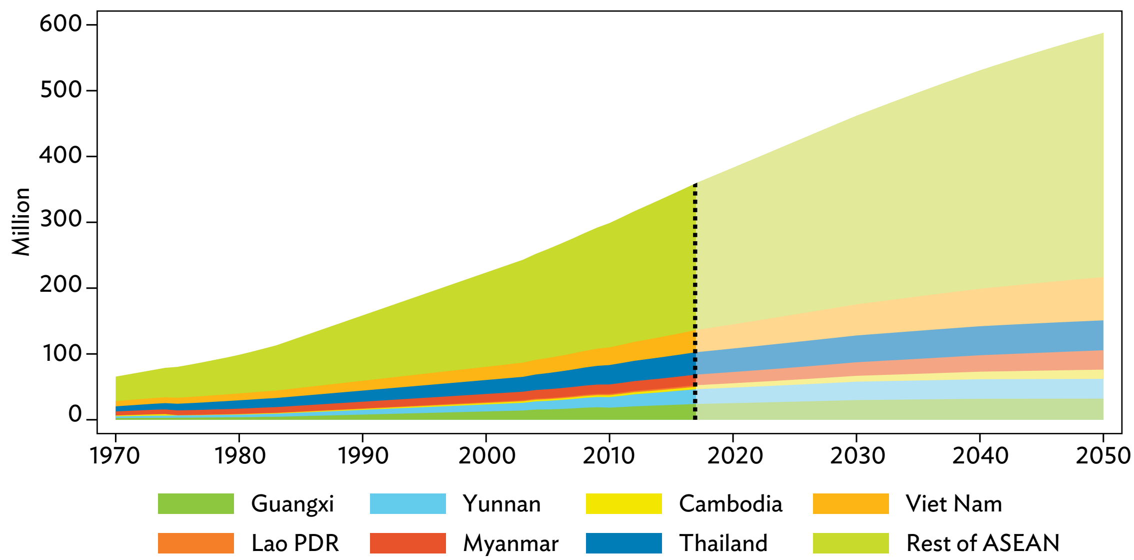
16.2 Urbanization in the Greater Mekong Subregion Based on World Urbanization Prospects Data

Urbanization Rates and Trends

According to official statistics, the number of urban inhabitants in the GMS (which includes Cambodia, the Lao PDR, Myanmar, Thailand, Viet Nam, and the PRC's Guangxi Zhuang Autonomous Region and Yunnan Province) increased nearly fivefold, from 28.4 million in 1970 to 136.3 million in 2017 (Figure 16.1). While this growth was substantial, it was slightly lower than for the Association of Southeast Asian Nations (ASEAN) as a whole, which increased more than fivefold from 60.2 million to 313 million.[85] It is also worthwhile to note that, in 1970, the five ASEAN countries in the GMS accounted

[85] Among the ASEAN countries outside of the GMS, urban population in Indonesia grew the fastest, from 19.6 million in 1970 to 144.3 million in 2017, with an annual average growth rate of 4.3%.

Figure 16.1: Urban Population in the Greater Mekong Subregion and the Rest of ASEAN, 1970–2050



ASEAN = Association of Southeast Asian Nations, Lao PDR = Lao People's Democratic Republic.

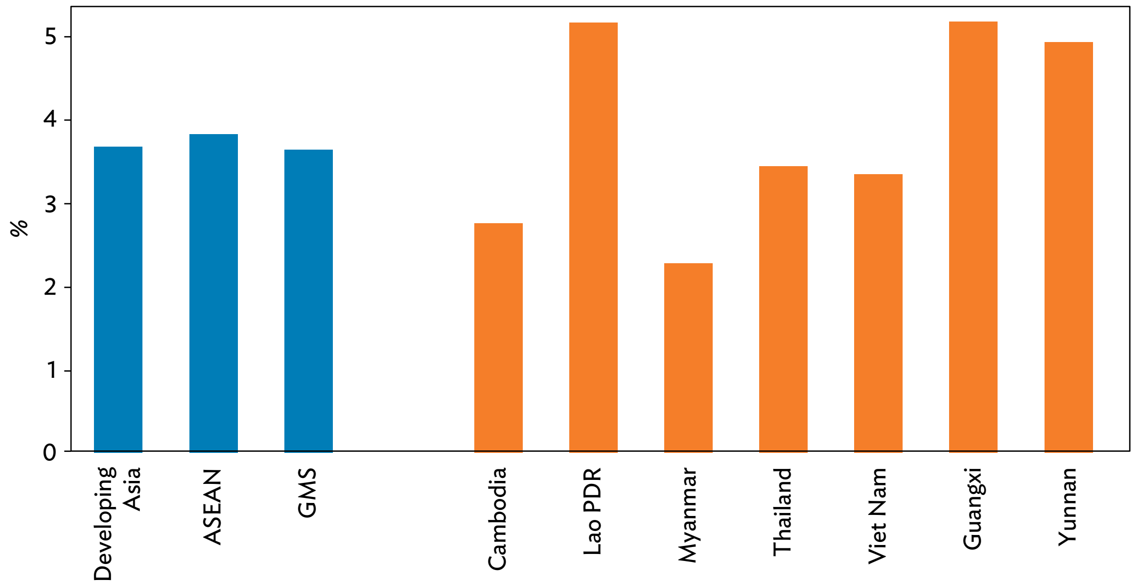
Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects (WUP) and Chinese provincial statistical yearbooks. Projections for Guangxi and Yunnan were obtained by applying national average growth rates projected in the WUP.

for 41.6% of the total population and 38.3% of the urban population in the ASEAN. By 2017, these shares decreased to 37.2% and 28.7%, respectively.

The differences among the GMS members are stark. Figure 16.2 shows that the average annual growth rates of the urban population between 1970 and 2017 was 4.8% for the Lao PDR and Guangxi and 4.6% for Yunnan; both above the average growth rates of 3.6% for ASEAN and 3.4% for developing Asia during the same period. The growth rates of the other GMS members were lower: 2.6% for Cambodia, 2.1% for Myanmar, 3.2% for Thailand, and 3.1% for Viet Nam.

Looking at urbanization rates reveals somewhat similar patterns. Figure 16.3 shows that, back in 1970, Myanmar had the highest share of population living in urban areas (22.8%). At that time, the ASEAN and regional averages were 21.5% and 19.8%, respectively. Thailand and Viet Nam's urbanization rates were close to these averages. Cambodia, the Lao PDR, Guangxi, and Yunnan, however, had significantly lower rates. Almost five decades later (2017), ASEAN's average urbanization rate reached 48.4% and developing Asia's was 45.9%. Among the GMS members, only Thailand (49.2%), Guangxi (49.2%), and Yunnan (46.7%) could match this urbanization level. Urbanization rates increased only moderately in Cambodia and Myanmar. Interestingly, the Lao PDR experienced considerable urbanization, enabling it to go from having the lowest urbanization rate in 1970 to 34.4% in 2017, just marginally behind Viet Nam's 35.2%. Overall, the GMS, except for Thailand, Guangxi, and Yunnan, have lagged behind the rest of the ASEAN countries and even other countries in developing Asia in terms of urbanization rates.

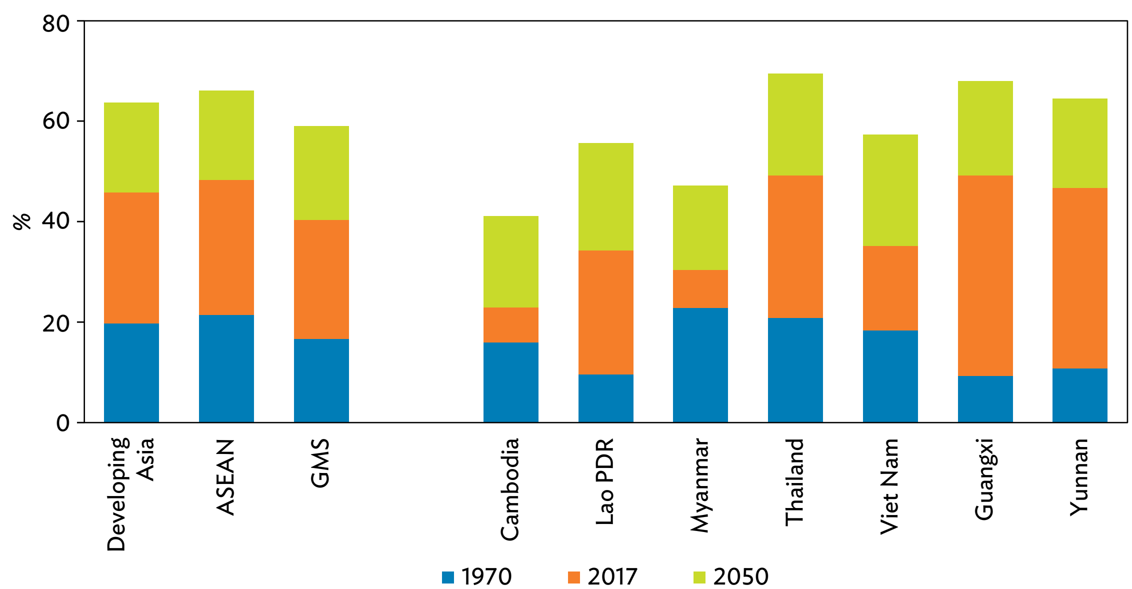
Figure 16.2: Average Annual Urban Population Growth Rate, 1970–2017



ASEAN = Association of Southeast Asian Nations, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic.

Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects and Chinese provincial statistical yearbooks.

Figure 16.3: Urbanization Rates in 1970, 2017, and 2050



ASEAN = Association of Southeast Asian Nations, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic.

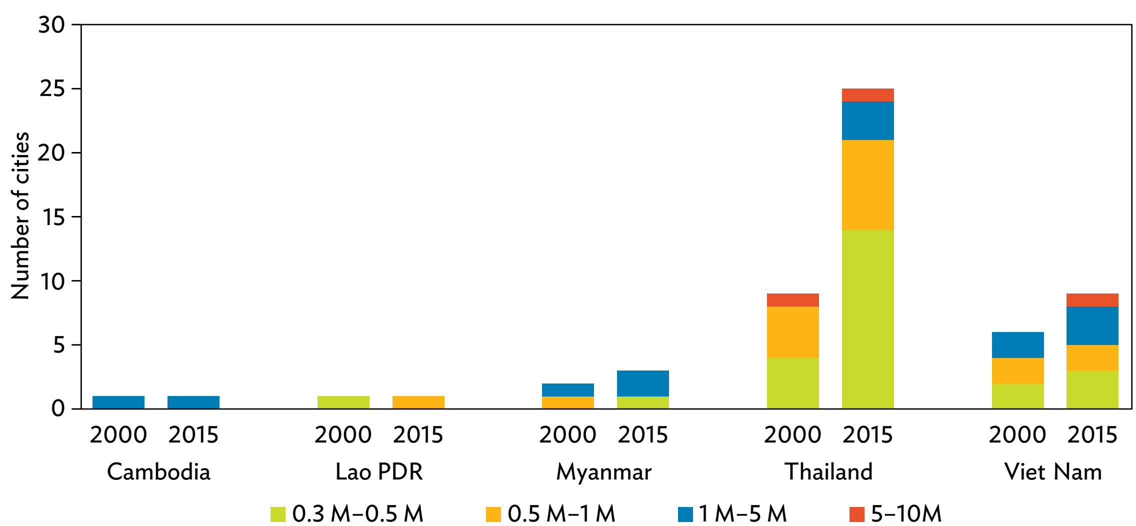
Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects (WUP) and Chinese provincial statistical yearbooks. Projections for Guangxi and Yunnan were obtained by applying national average growth rates projected in the WUP.

A useful feature of the WUP dataset is that it provides projections of urbanization rates, albeit at the country level. For Guangxi and Yunnan, the chapter applies the projected growth rates for the PRC in the WUP. Looking forward, the WUP predicts that urbanization will progress steadily in the GMS through 2050. Total urban population across the seven members is projected to be 216.8 million by 2050, of which 154.7 million will be in Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam (GMS-5), accounting for 29.4% of ASEAN's total urban population. The gap between the GMS and ASEAN or developing Asia as a whole is expected to decline. For instance, urbanization rates are projected to increase by 17.8, 17.8, and 18.7 percentage points, reaching 66.1%, 63.7%, and 59.0% in ASEAN, developing Asia, and the GMS, respectively. As far as individual members are concerned, Guangxi and Yunnan will reach 68.0% and 64.5%, respectively, by 2050, significantly above the GMS average. The Lao PDR, Thailand, and Viet Nam are expected to continue to lead urbanization in the ASEAN members of the GMS, with the highest growth projected for Viet Nam, while Cambodia and Myanmar are expected to play catch-up (Figure 16.1 and green bars of Figure 16.3).

Evolution of City Size Distribution[86]

Trends in urbanization can also be viewed in terms of how the urban population has evolved across cities of different sizes. The WUP contains information on cities with a population above 300,000. These cities can be categorized into those with populations from 300,000 to 500,000; from 500,000 to 1 million; from 1 million to 5 million; from 5 million to 10 million; and above 10 million. As of 2015, no city in the GMS had a population above 10 million. Figure 16.4 shows the number of cities in the remaining four categories in 2000 and 2015 by country.

Figure 16.4: Number of Cities of Different Sizes, 2000 and 2015



Lao PDR = Lao People's Democratic Republic, M = million.

Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects (accessed 5 April 2019).

[86] Data for Guangxi and Yunnan are not available for this subsection.

In 2000, there were only 19 cities with a population above 300,000. These cities were located in Cambodia (1), the Lao PDR (1), Myanmar (2), Thailand (9), and Viet Nam (6). Moreover, the majority of these cities were small, with 7 of them between 300,000 and 500,000 and 7 between 500,000 and 1 million. Only one city, Bangkok, had a population above 5 million.

Fifteen years later, many cities had climbed the size ladder and crossed the threshold for inclusion in the WUP database. As of 2015, there were a total of 39 cities with over 300,000 people. Of the additional 20 cities (with respect to 2000) that had crossed this threshold, 16 were from Thailand, 3 from Viet Nam, and one from Myanmar. Although a majority (28) were still below 1 million, 11 cities had over 1 million people and two cities, Bangkok and Ho Chi Minh City, had more than 5 million people. Although urbanization as a whole has proceeded at a fast pace in the Lao PDR, the country's cities have remained small (below 300,000). Only Vientiane had grown substantially in terms of the number of inhabitants—from 0.44 million in 2000 to 0.64 million in 2015. Cambodia had also only one city, Phnom Penh, with a population above 300,000 as of 2015. The population of Cambodia increased from 1.15 million to 1.78 million over the 15-year period.

Next, the analysis looks at the distribution of the urban population across cities of different sizes and over time for the GMS-5. Table 16.1 shows the shares of urban population in each size category.[87]

Table 16.1: Distribution of Urban Population by Size of City, 2000 and 2015
(%)

		City Size				
Member	Year	5 M–10 M	1 M–5 M	0.5 M–1 M	0.3 M–0.5 M	<0.3 M
Cambodia	2000	0	50.8	0	0	49.1
Cambodia	2015	0	51.7	0	0	48.3
Lao PDR	2000	0	0	0	37.7	62.2
Lao PDR	2015	0	0	29.1	0	70.9
Myanmar	2000	0	28.7	6.8	0	64.5
Myanmar	2015	0	39.11	0	2.4	58.5
Thailand	2000	32.4	0	11.7	7.8	48.0
Thailand	2015	28.7	10.8	14.9	17.7	27.8
Viet Nam	2000	0	30.9	5.9	4.6	58.5
Viet Nam	2015	23.2	18.73	5.7	3.2	49.1
GMS-5	2000	11.5	19.5	7.8	5.2	55.8
GMS-5	2015	19.5	20.3	8.5	8.4	43.2

GMS-5 = Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; Lao PDR = Lao People's Democratic Republic; M = million.

Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects (accessed 5 April 2019).

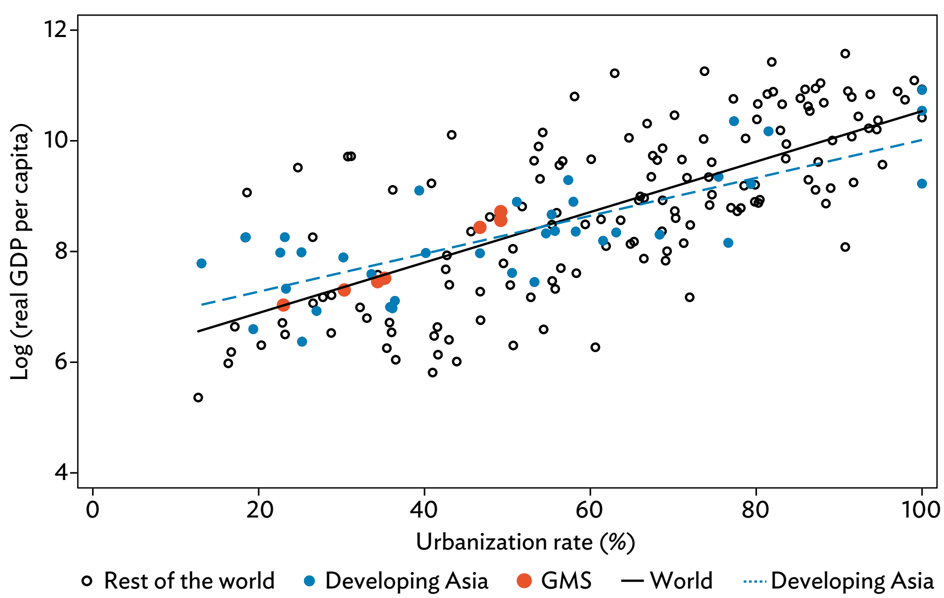
87 The difference between total urban population and the sum of population in all cities above 300,000 is assigned to the category of residents in cities below 300,000.

Table 16.1 shows some clear patterns. First, urban population in cities above 1 million increased between 2000 and 2015. Across the GMS, about 40% of the urban population lived in large cities in 2015, compared to 31% in 2000. This shift is particularly prominent in Myanmar (from 28.7% to 39.1%), Thailand (from 32.4% to 39.5%), and Viet Nam (from 30.9% to 42.0%). Second, the shares of the urban population living in very small cities (below 300,000) generally declined everywhere except in the Lao PDR (as noted earlier). In fact, the decrease in the proportion of the urban population living in those cities was quite significant. In the Lao PDR, the country's fast urbanization coupled with the rise in the share of urban population in cities smaller than 300,000 implies that urbanization has been driven by the emergence of many small cities. Third, in Thailand and Viet Nam, where the population shares of the smallest cities declined, some urban population was absorbed by medium-sized cities (between 300,000 and 1 million). This could be the result of a combination of very small cities growing into medium-sized cities and people moving from very small cities to medium-sized ones. Overall, these numbers suggest that medium-sized cities play a key role in the urban systems of these countries.

Relationship between Economic Growth and Urbanization

It is well recognized that urbanization plays a pivotal role in economic development. Fundamentally, cities are where much structural transformation—the process whereby greater shares of output and employment are accounted for by manufacturing and services—takes place. Thus, one would expect measures of economic development and urbanization to be closely related. Figure 16.5 plots gross domestic product per capita versus urbanization rates in 2017 for the world. It is clear that the two are

Figure 16.5: Per Capita Gross Domestic Product and Urbanization, 2017



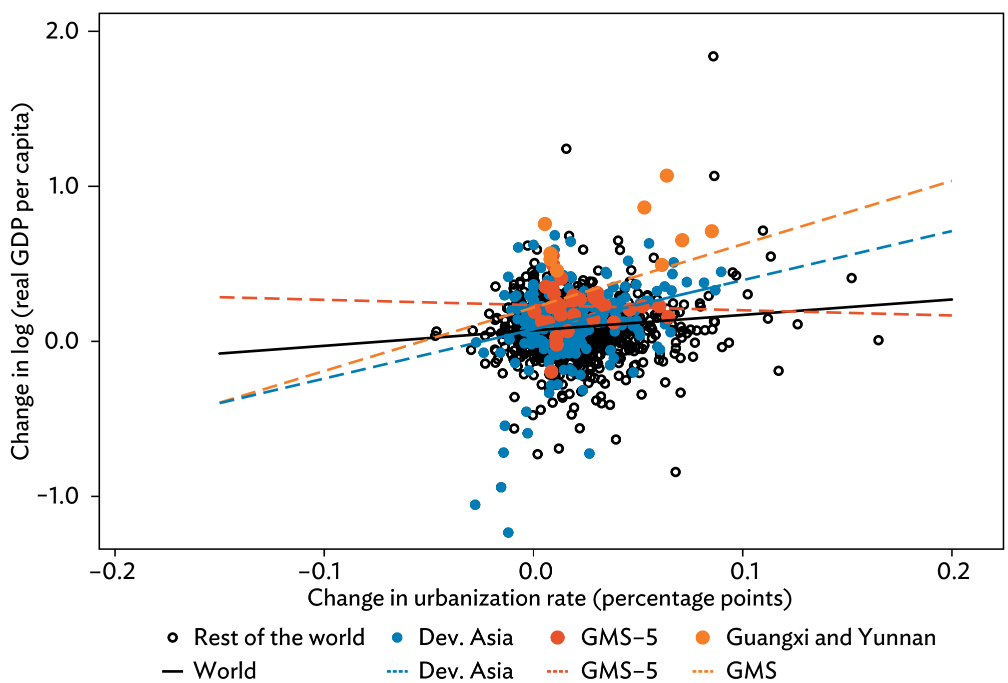
GDP = gross domestic product, GMS = Greater Mekong Subregion.

Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects, Chinese provincial statistical yearbooks, and the World Bank's World Development Indicators.

positively correlated for various combinations of countries—the world as a whole, developing Asia, and even the GMS (includes Guangxi and Yunnan).

To see whether faster rates of urbanization are associated with faster economic growth, changes in gross domestic product per capita and urbanization rates are calculated for every 5 years between 1970 and 2015. Figure 16.6 suggests that there is a positive correlation between these two variables for the world, and that this is even stronger for developing Asia and the GMS. However, the GMS result is driven by the PRC's Guangxi and Yunnan, as shown by the relatively flat fitted line in red for the five GMS members alone (labeled GMS-5 in the chart). This implies that the correlation between changes in urbanization rates and economic growth is weak in these economies.

Figure 16.6 : Five-Year Changes in Per Capita Gross Domestic Product versus Change in Urbanization Rates since 1970



Dev. Asia = developing Asia; GDP = gross domestic product; GMS = Greater Mekong Subregion; GMS-5 = Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; PRC = People's Republic of China.

Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects, Chinese provincial statistical yearbooks, and the World Bank's World Development Indicators (accessed 27 May 2019).

Table A16.1 in the Appendix shows the results of a regression analysis of economic growth on changes in the urbanization rate. These results further confirm the visual impression discussed above. Indeed, the estimated regression coefficients of changes in the urbanization rate are positive and statistically significant for the world, developing Asia, and the GMS (columns 1–3). While the coefficient for the world is about one, the coefficients for developing Asia and the GMS are very high. However, the estimated coefficient turns slightly negative and statistically insignificant when considering the

GMS-5 only (column 4). The results are consistent with the notion that, while these countries have urbanized, urbanization has not been a strong driver of economic growth. One possibility is that urbanization in these countries has not been accompanied by a significant increase in the clustering of productive industries in urban areas. Thus, cities have grown in size and attracted many people, but have failed to catalyze a similar growth in productive economic activities in these cities. As discussed in detail in later chapters, a relatively weak management of cities may be undercutting the full extent of agglomeration economies that are generated when workers and firms concentrate in urban areas. The difference between columns 3 and 4 implies that urbanization has been a forceful driver of economic growth in Guangxi and Yunnan.

16.3 Urbanization Viewed through Nighttime Lights

Urbanization Rates

This section examines urbanization through the lens of NTL data on "natural cities."[88] The dataset covers 1,527 natural cities across Asia and the Pacific. It includes 81 cities in the GMS-5 countries and 33 cities in Guangxi and Yunnan, comparable with the city count (39) from the WUP data. However, the urban population estimated with NTL data is generally smaller than that from the WUP data (Table 16.2). One reason is that the NTL data leave out many small cities or towns, which are officially counted as urban areas in the WUP data. This is why underestimation is more substantial for countries like Cambodia and the Lao PDR, which have many small cities.

Nevertheless, the natural cities dataset shows that urbanization during 2000–2016 has progressed more rapidly than what was captured by the WUP data. Table 16.2 provides a comparison of the average annual growth rates of the urban population estimated with NTL and with WUP data. The NTL growth rates exceed the WUP growth rates in the GMS as a whole, the GMS-5 except for Thailand, ASEAN, developing Asia, and Guangxi.

A few differences between the two datasets are worth noting. First, the WUP data show that urbanization in the GMS has progressed at a pace slightly faster than that of developing Asia and ASEAN. NTL data, however, show that the GMS has been urbanizing at a much faster pace than ASEAN or developing Asia since 2000. This is partly because the GMS members had a low urbanization rate (16.9%) to start with according to NTL data. Given the advantage of consistency in using NTL data to capture trends in urbanization, the study considers the faster pace of urbanization

88 This dataset was constructed by ADB (2019) in three steps. First, NTL were used to delineate human settlements in Asia and the Pacific. These data are available from 1992 to 2016 from the website of the National Oceanic and Atmospheric Administration. After deblurring NTL data, the analysis identified all pixels with positive luminosity values and aggregated those with a single-pixel gap between them; these aggregated spaces represent human settlements. Second, the geo-referenced Global Rural Urban Mapping Project (GRUMP) database was used to identify urban areas among the various human settlements as defined in the first step. Only GRUMP cities with a population above 100,000 in 2000 were considered. In addition, illuminated areas of human settlement greater than 100 km^2 in 2000 were also included as urban areas, even if the associated GRUMP units did not meet the population threshold in 2000. The two sets of urban areas are collectively referred to as natural cities. Third, the population of these natural cities was captured using grid population data from LandScan, which provides global population counts at a spatial resolution of approximately 1 km^2 since 2000. The population of a natural city is estimated to be the sum of all cells falling within or intersecting with the city contour.

Table 16.2: Comparison between World Urbanization Prospects (WUP) and Nighttime Lights Data, 2000–2016

	World Urbanization Prospects			Nighttime Lights		
	Urban Population, 2000 (million)	Urban Population, 2016 (million)	Average Annual Growth, 2000–2016 (%)	Urban Population, 2000 (million)	Urban Population, 2016 (million)	Average Annual Growth, 2000–2016 (%)
Cambodia	2.3	3.6	2.9	1.1	1.8	3.3
Lao PDR	1.2	2.3	4.3	0.4	0.9	4.5
Myanmar	12.5	15.9	1.5	4.1	11.6	6.7
Thailand	19.8	33.4	3.3	16.7	26.2	2.8
Viet Nam	19.6	32.6	3.2	12.7	34.4	6.4
(PRC) Guangxi	14.1	23.3	3.9	3.6	7.9	5.1
(PRC) Yunnan	9.9	21.5	5.0	5.1	10.0	4.3
GMS	79.2	132.5	3.3	43.8	92.7	4.8
ASEAN	198.6	306.0	2.7	140.3	243.2	3.5
Developing Asia	1,119.7	1,783.5	3.0	819.5	1,377.6	3.3

ASEAN = Association of Southeast Asian Nations, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Authors' estimates using data from the United Nations 2018 Revision of World Urbanization Prospects, Chinese provincial statistical yearbooks, and the World Bank's World Development Indicators. Nighttime lights columns are estimated using nighttime lights images from the Defense Meteorological Satellite Program and Visible Infrared Imaging Radiometer Suite of the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018) and grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 August 2018).

indicated by NTL as the preferred interpretation of trends. Second, within the GMS, Myanmar has the highest growth rate, in contrast to what is shown by the WUP data. Viet Nam's NTL growth rate is twice that of the WUP growth rate. A key factor that probably explains these differences is that official statistics are based on administrative boundaries. If a considerable amount of urbanization takes place outside these boundaries, then NTL will capture this activity while the WUP data will not. Third, Thailand's lower growth rate of urbanization using NTL data compared to WUP data may be due to an increase in the number of small towns that would not be counted in the natural cities data.

Evolution of City Size Distribution

Table 16.3 shows the spatial distributions of urban population by city size using NTL data. Compared to what was presented in Table 16.1, which was based on WUP data, a common finding is that the share of the urban population living in large cities (above 1 million population) has increased across the GMS, from 63% in 2000 to 68.6% in 2016. The share of those living in very small cities (below 300,000 population) has decreased considerably in Thailand, Viet Nam, Guangxi, Yunnan, and the GMS as a whole.

Table 16.3: Distribution of Urban Population by City Size Using Nighttime Lights Data, 2000 and 2016

(%)

Member	Year	City Size					
		>10 M	5 M–10 M	1 M–5 M	0.5 M–1 M	0.3 M–0.5 M	<0.3 M
Cambodia	2000	0.0	0.0	99.2	0.0	0.0	0.8
Cambodia	2016	0.0	0.0	90.3	0.0	0.0	9.7
Lao PDR	2000	0.0	0.0	0.0	0.0	81.7	18.3
Lao PDR	2016	0.0	0.0	0.0	78.9	0.0	21.1
Myanmar	2000	0.0	0.0	60.2	21.1	0.0	18.8
Myanmar	2016	0.0	49.8	16.7	4.7	5.4	23.3
Thailand	2000	62.6	0.0	6.6	8.0	7.9	15.0
Thailand	2016	64.8	0.0	9.1	9.4	7.0	9.7
Viet Nam	2000	0.0	42.7	25.4	6.2	5.5	20.2
Viet Nam	2016	37.3	23.8	12.9	8.9	10.3	6.8
(PRC) Guangxi	2000	0.0	0.0	45.6	21.6	7.0	25.8
(PRC) Guangxi	2016	0.0	0.0	57.2	18.6	7.6	16.7
(PRC) Yunnan	2000	0.0	0.0	41.5	0.0	0.0	58.5
(PRC) Yunnan	2016	0.0	0.0	48.0	14.8	18.5	18.7
GMS	2000	23.9	12.4	26.7	9.3	6.3	21.4
GMS	2016	32.1	15.0	21.5	10.6	8.9	12.0

GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, M = million, PRC = People's Republic of China.

Source: Authors' estimates using nighttime lights images from the Defense Meteorological Satellite Program and Visible Infrared Imaging Radiometer Suite of the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018) and grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 August 2018).

However, two differences with respect to the WUP-based results are noteworthy. First, two cities—Bangkok and Ho Chi Minh City—are recognized in the NTL data as mega cities, with populations above 10 million. They each host a large share of the total urban population in their respective countries (64.8% for Bangkok and 37.3% for Ho Chi Minh City). Second, Cambodia and Myanmar had larger urban populations living in cities with 300,000 people or less in 2016 than in 2000 according to NTL data. This suggests that small cities and towns continue to play an important role in the urbanization process of these countries. Viet Nam, which also started with a low urbanization rate, seems to have followed a different path, relying more on larger cities.

An issue related to the distribution of the urban population by city size is that of urban primacy, or the extent of dominance of the largest city in a country. Table 16.4 reports the population and share in total urban population of the prime (largest) and second largest cities of the GMS-5 as of 2016. The degree of primacy can be assessed by either the absolute share of the prime city in total urban population or by the gap in size between the largest and second largest cities. By either criterion, both Cambodia and the Lao PDR had severe primacy issues. Their prime cities, Phnom Penh and Vientiane, account for 90.3% and 78.9% of each country's urban population, respectively, and have populations several times that of their respective second largest city. Thailand ranks third in terms of absolute share of the prime city in total urban population. However, its largest city's population is 13.8 times larger than that of the second largest city, Nakhon Pathom. This exceeds the 12.2 ratio between Phnom Penh and Battambang.

Table 16.4: Prime and Second Largest Cities in the Greater Mekong Subregion, 2016

Country	Prime City	Urban Population 2016 (million)	Share in Urban Population 2016 (%)	Second Largest City	Urban Population 2016 (million)	Share in Urban Population 2016 (%)
Cambodia	Phnom Penh	1.6	90.3	Battambang	0.1	7.4
Lao PDR	Vientiane	0.7	78.9	Savannakhet	0.1	11.3
Myanmar	Yangon	5.8	49.8	Mandalay	1.9	16.7
Thailand	Bangkok	17.0	64.8	Nakhon Pathom	1.2	4.7
Viet Nam	Ho Chi Minh City	12.8	37.3	Ha Noi	8.2	23.8

Lao PDR = Lao People's Democratic Republic.

Source: Authors' estimates using nighttime lights images from the Defense Meteorological Satellite Program and Visible Infrared Imaging Radiometer Suite of the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018) and grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 August 2018).

Expansion of Natural Cities

The NTL dataset allows the study to track the spatial evolution of natural cities over time and compare this with the actual extent of urban development relative to administrative boundaries. Figure 16.7 shows the capital cities of the GMS members in 1992 and 2016. All seven natural cities have expanded dramatically over the last 25 years. Among them, Nay Pyi Taw is a special case in that it was developed as the new capital of Myanmar. Its area grew 345 times. For others, the area covered has typically increased by about 2–9 times, or an average annual growth rate of 3%–10%.

Notably, natural cities like Phnom Penh, Bangkok, and Ha Noi have extended well beyond their administrative boundaries. While these urban areas outside the administrative boundaries are economically integrated with the rest of the city, they may be governed by separate local authorities. Such a situation can give rise to a host of problems insofar as coordinated governance of a natural city is concerned.

Figure 16.7 : Natural Cities of the Capitals of the Greater Mekong Subregion Members, 1992 and 2016

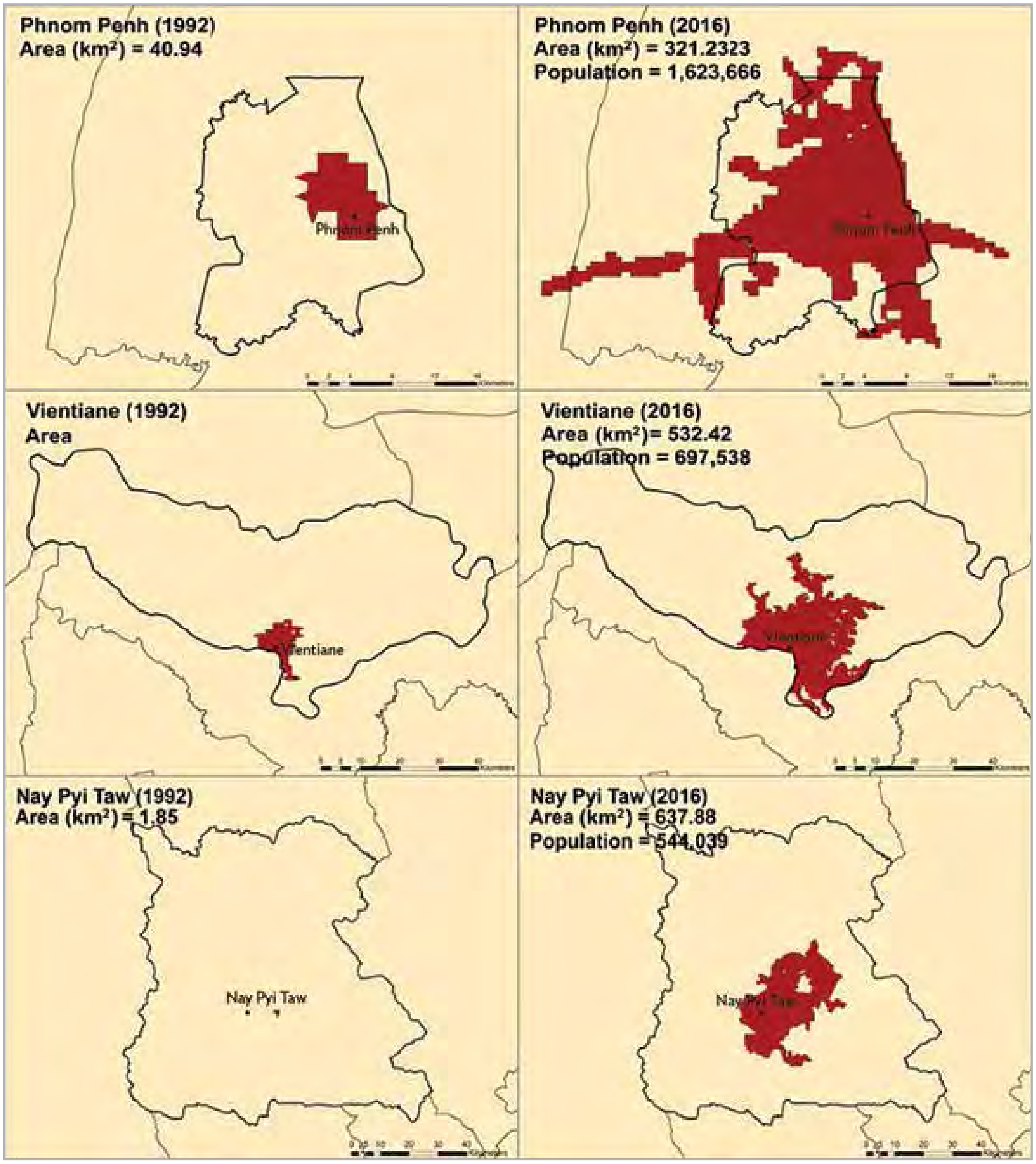


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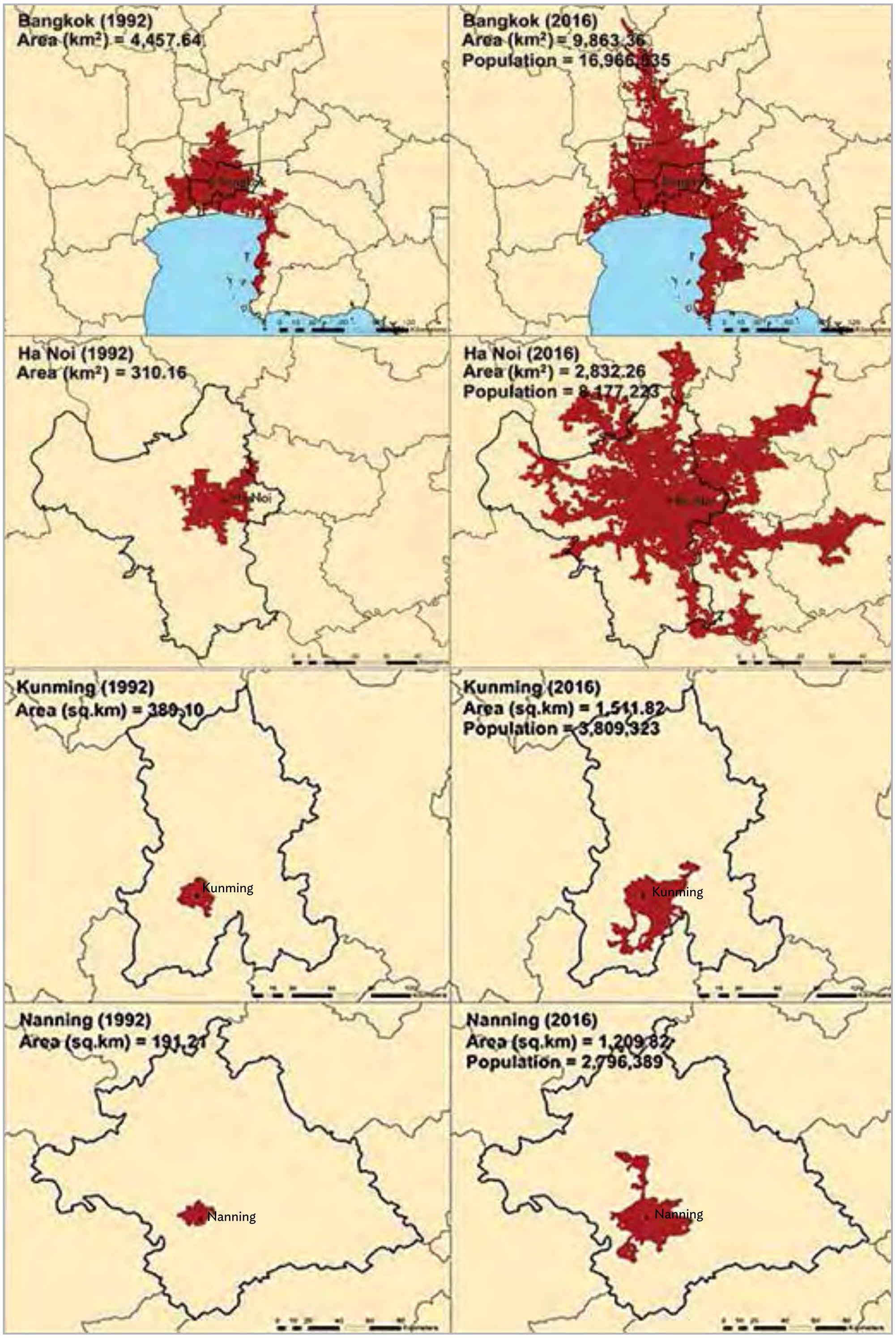
Figure 16.7 *continued*



km² = square kilometer.

Note: Area and population listed for the natural city concept are as available.

Source: Authors' estimates using nighttime lights images from the Defense Meteorological Satellite Program and Visible Infrared Imaging Radiometer Suite of the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018).

Table 16.5 compares the seven natural cities with their respective administrative counterparts. In general, the capital cities, other than Bangkok, have a greater scope for expanding spatially within their administrative boundaries. In the case of Nay Pyi Taw, Kunming, and Nanning, the administrative bodies are more than 10 times larger than the corresponding natural cities. This suggests that there is a vast amount of rural land or area within each administrative city, which ensures room for further urban expansion. At the same time, however, this also means that, rather than just functioning as managers of cities, the governments of these administrative units need to pay attention to rural development and adopt policies to strike a balance between rural and urban areas within their jurisdiction. Bangkok represents the opposite case. Not only are most areas within the administrative city of Bangkok highly developed, but Bangkok's urban area extends well beyond its boundaries. This imposes significant challenges in managing a huge metropolitan area involving multiple parallel local governments.

Table 16.5: Comparison of Natural Cities with Administrative Counterparts

Member	Administrative Counterpart	Administrative Area (km^2)	Administrative Population (million)	Natural City	Area (km^2, 2016)	Population (million, 2016)
Cambodia	Phnom Penh Municipality	375.8	2.1	Phnom Penh	321.2	1.6
Lao PDR	Vientiane Municipality/ Prefecture	3,640.6	0.8	Vientiane	532.4	0.7
Myanmar	Nay Pyi Taw Union Territory	7,095.4	1.2	Nay Pyi Taw	637.9	0.5
Thailand	Bangkok City	1,573.9	8.3	Bangkok	9,863.4	17.0
Viet Nam	Ha Noi City	3,373.5	7.3	Ha Noi	2,832.3	8.2
(PRC) Yunnan	Kunming Prefecture City	21,101.8	6.6	Kunming	1,511.8	3.8
(PRC) Guangxi	Nanning Prefecture City	22,218.5	7.3	Nanning	1,209.8	2.8

km^2 = square kilometer, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Administrative areas are geospatially computed from Database of Global Administrative Areas boundary shapefile (Cambodia, the Lao People's Democratic Republic, the People's Republic of China, Thailand, and Viet Nam) and the Humanitarian Data Exchange boundary shapefile (Myanmar). Administrative populations are obtained from General Population Census of the Kingdom of Cambodia 2019, 2015 Population and Housing Census of Laos, the 2014 Myanmar Population and Housing Census, the 2010 Population and Housing Census of Thailand, Statistical Yearbook of Vietnam 2016, and provincial statistical yearbooks of Yunnan and Guangxi 2016. Natural city data are based on authors' estimates using nighttime lights images from Defense Meteorological Satellite Program and Visible Infrared Imaging Radiometer Suite of the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018) and grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 August 2018).

Emergence of City Clusters

An interesting feature of natural cities is that they started out as geographically independent urban areas in 1992. However, with a continuous expansion of the urban extent of these cities, it is possible that two or more natural cities could become contiguously connected. Indeed, by 2016, such spatially integrated natural cities have become quite common across developing Asia. These integrated urban areas are called "city clusters," and Table 16.6 reports some stylized facts from the perspective of the GMS.

Table 16.6 shows that there are eight city clusters involving 28 natural cities found in the GMS as of 2016. Five of them consist of two natural cities. The other three consist of 3, 5, and 10 natural cities. In total, the eight city clusters host 53.4 million people on a land area of 32,600 square kilometers (km^2), accounting for 57.6% of total urban population and 64.2% of total urban land area. The rest of the 86 natural cities in the GMS remain spatially independent. They jointly account for a smaller share of the total urban population and urban land.

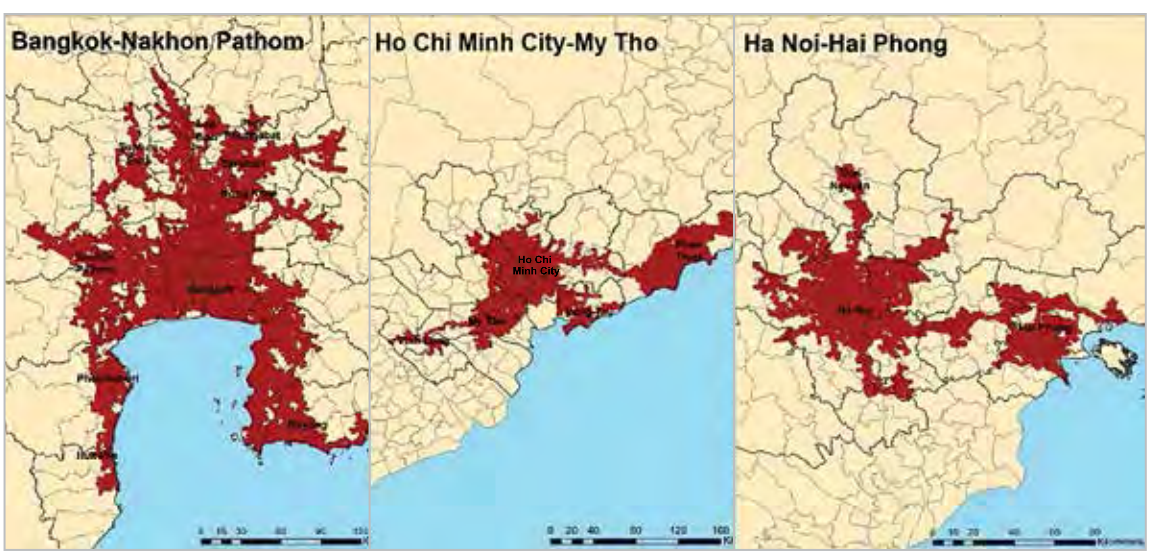
Table 16.6: City Clusters in the Greater Mekong Subregion, 2016

Number of Natural Cities in Each City Cluster	Number of City Clusters	Total Number of Natural Cities	Total Population (million)	Total Area (km^2)
2	5	10	6.4	3,178.7
3 (with Ha Noi)	1	3	10.2	3,838.7
5 (with Ho Chi Minh City)	1	5	16.0	8,768.3
10 (with Bangkok)	1	10	20.7	16,864.0
Total	8	28	53.3	32,649.7
Number of spatially independent natural cities by 2016		86	39.35	18,196.33
Total number of natural cities in GMS		114	92.72	50,846.64

GMS = Greater Mekong Subregion, km^2 = square kilometer.

Source: Authors' estimates using nighttime lights images from the Defense Meteorological Satellite Program and Visible Infrared Imaging Radiometer Suite of the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018) and grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 August 2018).

Figure 16.8: Largest City Clusters in the Greater Mekong Subregion, 2016



Source: Authors' estimates using nighttime lights images from the Defense Meteorological Satellite Program and Visible Infrared Imaging Radiometer Suite of the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018).

There are four city clusters in Viet Nam, two in Guangxi and Yunnan, and two in Thailand. Figure 16.8 illustrates the three largest city clusters in the GMS: Bangkok together with nine other natural cities; Ho Chi Minh City and four other natural cities; and Ha Noi and two other natural cities (all clusters are named after the two largest natural cities in the cluster in the figure). They are all dominated by one large city. Their total populations and areas are given in Table 16.6. The smallest cluster of the three, the Ha Noi–Hai Phong cluster had 10.3 million residents in 2016, while the Bangkok–Nakhon Pathom cluster had 20.7 million residents. By comparison, in the Asia-wide NTL dataset, which contains data for all of ADB's developing member countries plus Japan, there are 29 city clusters in Asia with a population of 10 million or more. The three largest GMS city-clusters rank 12th, 15th, and 27th, respectively, in terms of population.

There is enormous potential for further development of these clusters. For instance, the areas connecting Ho Chi Minh City with Phan Thiet and Ha Noi with Hai Phong are quite "thin" in land area (and likely to be formed around transport networks). More development could spring up in the adjacent areas (unless these areas are not physically suitable, for example, if they are part of a mountainous terrain). At the same time, as with large natural cities that cross different government jurisdictions, intergovernmental coordination is critical for the development of city clusters to make them productive and attractive.

16.4 Conclusions

This chapter has discussed urbanization patterns in the GMS based on the United Nations WUP data and NTL data. The evidence indicates that the GMS has been urbanizing steadily over the last several decades. However, in contrast with the pattern observed for developing Asia as a whole and that of the world, urbanization's association with economic growth tends to be weaker in the GMS-5. This finding suggests that GMS members may not be meeting the full potential of the urbanization process.

Notwithstanding the rapid urbanization already experienced in the GMS, its urbanization rates still lag behind those seen in other parts of ASEAN and developing Asia. Thus, there is clearly much room for continued urbanization. Further, the GMS must not miss the opportunities that urbanization, yet to unfold, can bring. Policies to ensure that urbanization plays a stronger role as engine of growth include making appropriate investments in urban infrastructure (including within-city transport), connectivity across cities and to the hinterland, affordable housing, and ensuring that cities are good places to do business, innovate, and accumulate human capital.

The urban population is increasingly concentrated in cities with 1 million people and above. The flip side is that the shares of both total population and urban population of very small cities (below 300,000) has been decreasing. These shifts in population distributions toward larger cities suggest that policy makers must pay careful attention to the development and management of large cities. In particular, it is critically important that the forces of agglomeration are not overridden by the forces of congestion. At the same time, the issue of urban primacy is serious in Cambodia, the Lao PDR, and Thailand. This probably reflects spatial overconcentration of resources and may be driving economic disparities spatially. These countries may need more medium-sized to large cities as urbanization continues.

Finally, as in many other countries, GMS cities have been expanding beyond their administrative boundaries and forming city clusters. While they reflect spatial agglomerations with great potential, better intergovernmental coordination is needed to improve urban planning and governance if the urbanization process is to deliver on more inclusive and integrated development.

Appendix

Table A16.1: Regression of Economic Growth on Changes in Urbanization Rates

Variables	(1) World	(2) Developing Asia	(3) GMS	(4) GMS-5
Change in urbanization rate (%)	0.996***	3.172***	4.088**	−0.337
	(0.230)	(0.655)	(1.606)	(1.528)
Constant	0.0710***	0.0776***	0.218***	0.235***
	(0.00646)	(0.0175)	(0.0532)	(0.0406)
Observations	1,439	288	43	34
R-squared	0.013	0.076	0.136	0.002
Adj. R-squared	0.0121	0.0726	0.115	−0.0297

GMS = Greater Mekong Subregion; GMS-5 = Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam.

Notes: Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Source: Authors' estimates using data from the United Nations' 2018 Revision of World Urbanization Prospects, Chinese Provincial Statistical Yearbooks, and the World Bank's World Development Indicators (accessed 27 May 2019).

Chapter 17

Urban Agglomeration Economies in the Greater Mekong Subregion

17.1 Introduction

By enabling workers and firms to interact closely, cities are believed to generate increases in productivity through several channels. These benefits are collectively known as "agglomeration economies." This chapter will explore the channels that economic theory suggests are at work and discuss why larger cities are believed to be more productive.[89] The analysis will then empirically show that, consistent with theory and findings for developed countries, firms in bigger Greater Mekong Subregion (GMS) cities tend to be more productive and pay workers more, and they are more likely to engage in innovative activities. However, this does not imply that smaller cities do not have an important role to play. In fact, robust economic growth requires vibrancy in all types of cities, whether small, medium, or large. The chapter will conclude with an explanation of why this is so and its implication for policy makers who need to adopt a balanced approach across cities of different sizes.

17.2 Agglomeration: Theory and Evidence

According to theory, there are three mechanisms that give rise to agglomeration economies: *matching*, *learning*, and *sharing* (Duranton 2015; Behrens and Robert-Nicoud 2015). First, larger (and denser) cities allow a more efficient *matching* between inputs and outputs. For example, a worker is more likely to find a job that best suits their skills and abilities when there are many employers to choose from and vice versa. Second, as large numbers of individuals and organizations interact, spillovers of ideas and knowledge are more likely to take place and lead to *learning*. This learning can be in the form of cutting-edge ideas in high-tech industries (Carlino and Kerr 2015) or even in relatively standard products and production processes. The vibrant garment industry in Dhaka, Bangladesh (Mottaleb and Sonobe 2011) and the soccer ball industry in Sialkot, Pakistan (Atkin et al. 2016) are prominent illustrations of the latter.

Lastly, a larger city size enables greater *sharing* of resources. For example, a larger labor market allows for the development of both deeper individual specialization as well as widely available diverse

[89] In the literature, agglomeration economies are analyzed in terms of city size (i.e., the population of a city) and/or density (i.e., the population of a city divided by its land size). The analysis in this chapter considers only city size. Density can be quite localized within a "natural city"—the chapter's unit of analysis—and is hard to measure exactly and consistently. For example, using the average density for a large natural city could conflate the high-density commercial business district in the city center with the low residential density in the suburbs.

expertise, thereby enhancing efficiencies from the division of labor. Software companies in Bengaluru, India, for example, benefit from a high concentration of law firms specializing in intellectual property rights. Similarly, economies of scale in the provision of physical and institutional infrastructure mean that such amenities are shared more efficiently among city dwellers. It is estimated that doubling city size requires about an 85% increase in infrastructure, whether in total road surface, length of electrical cables, water pipes, or number of petrol stations (Bettencourt and West 2010).

Much of the existing empirical evidence on agglomeration economies is for developed economies and supports the idea that larger and denser cities are more productive and that this relationship is causal, with increases in size or density leading to gains in productivity (Combes and Gobillon 2015). The evidence on agglomeration economies is more limited for developing countries. Only a few countries have been studied, among them India and the PRC, which show that firms and workers in big cities are more productive (Chauvin et al. 2017; Hasan, Jiang, and Rafols 2017). Moreover, not much work has been done on establishing causality due to a lack of appropriate data (such as panel data tracking workers as they move across locations).

Evidence on agglomeration effects in the GMS economies (other than the PRC) remains even more scarce. This chapter will examine whether city size matters for firm outcomes in the GMS. Specifically, it will use the World Bank Enterprise Survey data with geocoded firm locations overlaid on the natural cities data to address whether measures of firm performance are better in bigger GMS cities for otherwise similar enterprises.[90] Such a relationship is necessary for the existence of agglomeration economies, and the analysis treats the presence of agglomeration economies in the data as strongly suggestive of this relationship.

17.3 Agglomeration in the Greater Mekong Subregion: Evidence from Natural Cities

This section examines the relationship between city population size and various measures of firm performance, including labor productivity, whether a firm conducts process and product innovation, and research and development (R&D) activity. The data do not include information on firms located in cities in Yunnan and Guangxi. Thus, the results pertain to the GMS-5 (Cambodia, the Lao PDR, Myanmar, Thailand, and Viet Nam).[91] However, the rich literature from the PRC on agglomeration economies is used to draw conclusions for the GMS as a whole.

As the analysis will show, the study finds a positive association between city size and measures of firm performance, and the association is stronger in GMS-5 than in developing Asia. This is very

[90] One key challenge to identifying the causal relationship between city size and productivity is the “sorting” of firms and workers. Enterprises and workers in bigger cities may be more productive to begin with, for example. Disentangling causality requires longitudinal data that track firms and workers over time and across cities, i.e., data that are not available in most developing economies. This chapter uses cross-sectional data, so it does not attempt to establish causality between city size and firm performance. Instead, it focuses on uncovering patterns that are consistent with and suggestive of the existence of agglomeration economies.

[91] The firms included in the World Bank Enterprise Survey dataset are distributed across 489 natural cities in 25 economies in developing Asia. Information is provided for 2,590 firms across 48 cities in the GMS-5.

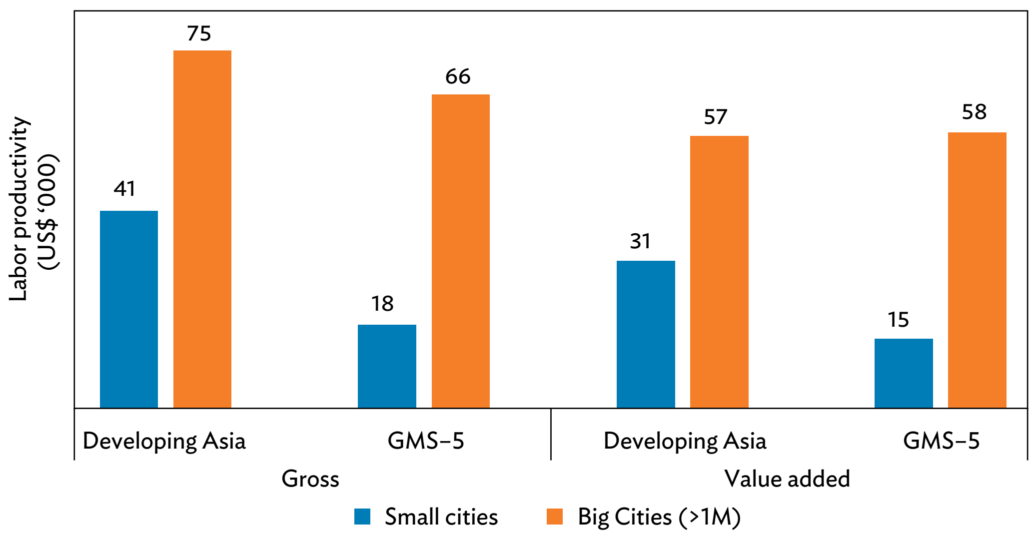
much consistent with the notion that urban agglomeration economies are important in the GMS-5. However, while firms in bigger GMS-5 cities perform quite well in comparison to their counterparts in other parts of the region, firms in smaller GMS-5 cities seem to lag behind in comparison to other small cities in developing Asia.

City Size and Firm Performance

Firm-level data show compelling evidence that larger cities—which are defined as cities with a population of 1 million or more—tend to confer a productivity advantage to their firms. The association is stronger among GMS-5 cities than cities in developing Asia, indicating a stronger agglomeration force at play in the big GMS-5 cities.

A simple comparison between firms by city size shows significant differences in labor productivity between big and small cities (Figure 17.1). Firms in big natural cities, such as Bangkok and Ho Chi Minh City, have higher labor productivity than firms in smaller ones, such as Luang Prabang and Cam Ranh. This holds true both when firm output is measured by total sales (gross output) or

Figure 17.1: Firm Labor Productivity by City Size



	Developing Asia			GMS-5		
	Small Cities	Big Cities (> 1M)	Total	Small Cities	Big Cities (> 1M)	Total
No. of cities	350	139	489	40	8	48
No. of firms	5,872	15,985	21,857	945	1,645	2,590

GMS-5 = Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; M = million.

Notes: Gross labor productivity is measured as total sales divided by the number of employed. Value added labor productivity is measured as total sales less the cost of electricity, fuel, and raw materials and intermediate goods, all divided by the number of employed.

Source: Authors' calculations based on data from the World Bank Enterprise Survey and National Oceanic and Atmospheric Association.

measured by total sales less intermediate inputs (value added). Gross labor productivity of firms in big GMS-5 cities is about four times larger than in small cities, greater than the difference between large and small cities throughout developing Asia. For value-added labor productivity, similar pattern emerges.

After controlling for a series of firm and city characteristics, the positive associations between the firm performance measures and city size remain for the GMS-5 cities and continue to be stronger than for developing Asia. These regression results are summarized in Table A17.1 and presented visually in both panels of Figure 17.2. On average, a doubling of city population in the GMS-5 is associated with a 18.8% increase in firms' gross labor productivity, compared to a 4.3% increase in developing Asia. When firm output is measured in value added, a doubling of city population is associated with 17.8% higher labor productivity in the GMS-5 and 6.8% in developing Asia.

While the firm-level dataset does not cover cities in Yunnan and Guangxi, many studies find similar agglomeration effects in both PRC regions and in the PRC as a whole. A survey of 12,400 manufacturing firms in 120 cities in the PRC points to higher productivity of firms in more highly populated cities (World Bank 2007).[92] Other studies also support the existence of agglomeration economies, specifically that wages tend to be higher in larger cities in the PRC (Chauvin et al. 2017; and Combes, Démurger, and Shi 2013).

It is worth noting that, while firm productivity in big GMS-5 cities are similar to those in big cities in developing Asia as a whole, smaller cities in the GMS-5 perform worse than their counterparts in developing Asia. The trend lines in Figure 17.2 plot labor productivity for a firm with average firm characteristics (such as size, age, foreign ownership, etc.) in a city of a given size and average values for other geographical characteristics in the GMS-5 and developing Asia. All else being equal, there is a small difference, if any, between firms' labor productivity in cities with a population of 10 million or more. However, the gap is much more apparent for cities with a population of less than 1 million.

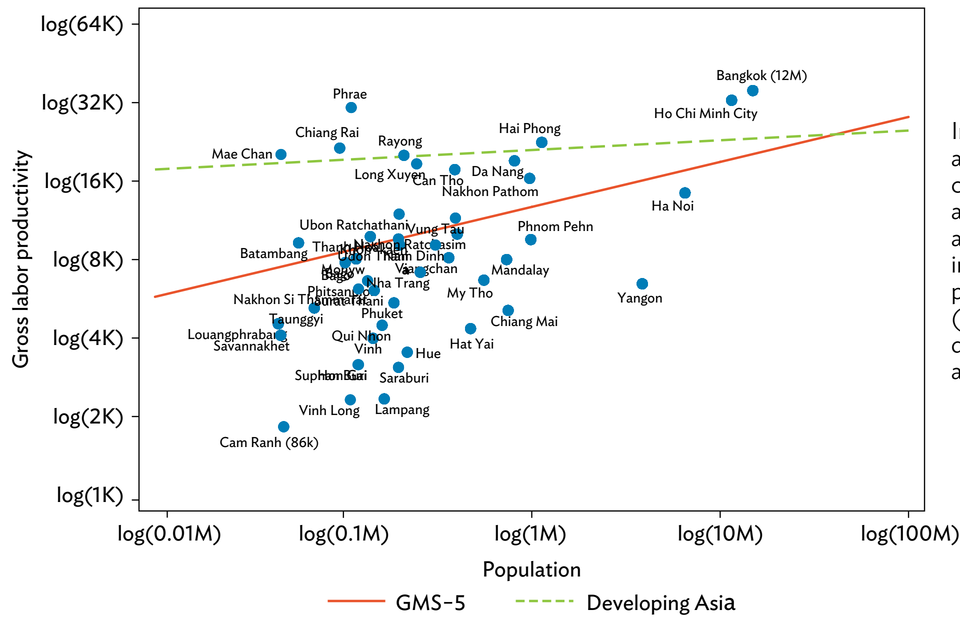
City Size and Innovation by Firms

Firms in large GMS-5 cities also carry out more innovation-related activities. In big cities (i.e., those with a population of more than one million), Figure 17.3 shows that firms are more likely to undertake product and process innovations and invest in R&D. Figure 17.4 plots the correlation of the propensity to innovate and city size after controlling for various firm and city characteristics. Firms located in bigger cities have a higher propensity of engaging in all three innovation-related activities. When compared to counterparts in developing Asia, big GMS-5 cities perform well, all else being equal. The gaps in firms' propensity to innovate between cities in the GMS-5 and in developing Asia narrow as city size increases. This phenomenon is especially evident for process innovation and R&D.

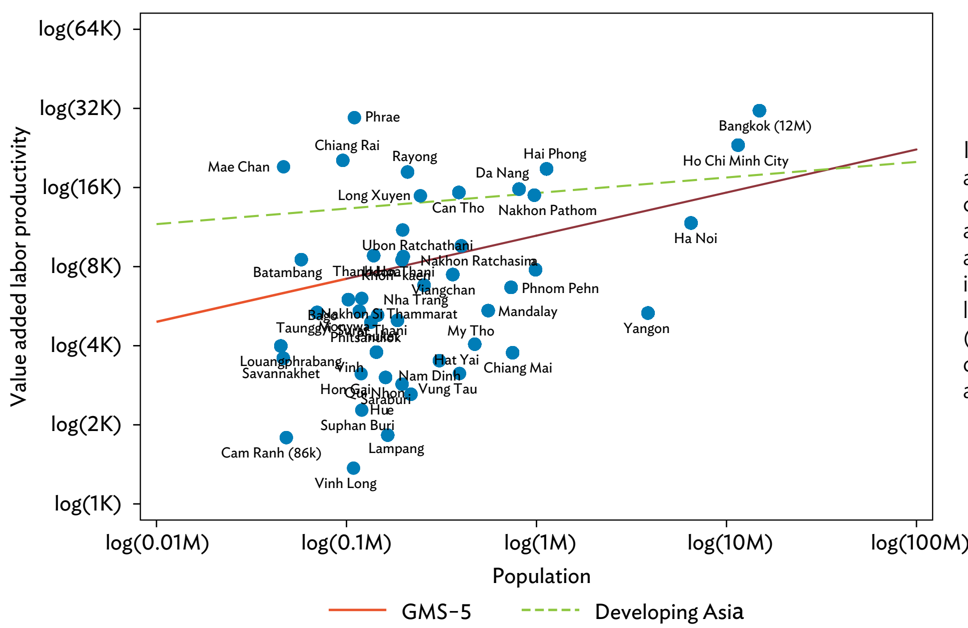
The next step is to investigate whether the benefits of agglomeration that are observed for innovation-related activities are closely linked with the presence of universities, especially highly ranked ones. In developed countries, universities are often viewed as pioneers in pushing the knowledge frontier. Although the knowledge they generate can be transmitted and adopted widely, the

[92] The survey covers 600 firms in six cities in Guangxi (Guilin, Liuzhou, and Nanning) and Yunnan (Kunming, Qujing, and Yuxi).

Figure 17.2: Scatter Plot of City Size against Productivity



In the GMS-5, a doubling of city population is associated with a 18.8% increase in gross labor productivity (4.3% in developing Asia as a whole).



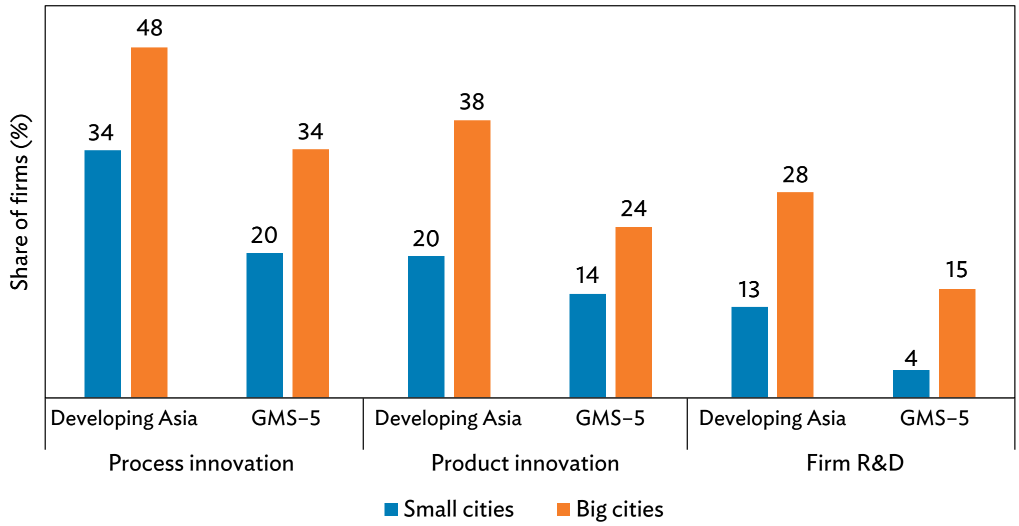
In the GMS-5, a doubling of city population is associated with an 17.8% increase in value added labor productivity (6.8% in developing Asia as a whole).

GMS-5 = Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; K = thousand; M = million.

Notes: City population is natural city population identified from nighttime lights. The trend lines plot labor productivity for a firm with average firm characteristics in a city with a given size and average values of other city characteristics. Results are based on linear regressions of (i) log of gross labor productivity; and (ii) log of value added labor productivity on log of population and controlling for firm characteristics such as age, size, foreign direct investment dummy, headquarters dummy, and share of skilled workers, as well as city characteristics such as log of distance to port, average precipitation, maximum temperature, minimum temperature, terrain ruggedness, and sector, year, and country fixed effects.

Source: Authors' calculations based on data from the World Bank Enterprise Survey and National Oceanic and Atmospheric Association.

Figure 17.3: Firm Innovation Activity by City Size



GMS-5 = Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; M = million; R&D = research and development.

Notes: Process innovation means a firm has introduced a new or significantly improved process. Product innovation means a firm has introduced new goods or services over the three previous fiscal years. Firm R&D means a firm has spent on research and development, excluding market research, in the prior fiscal year.

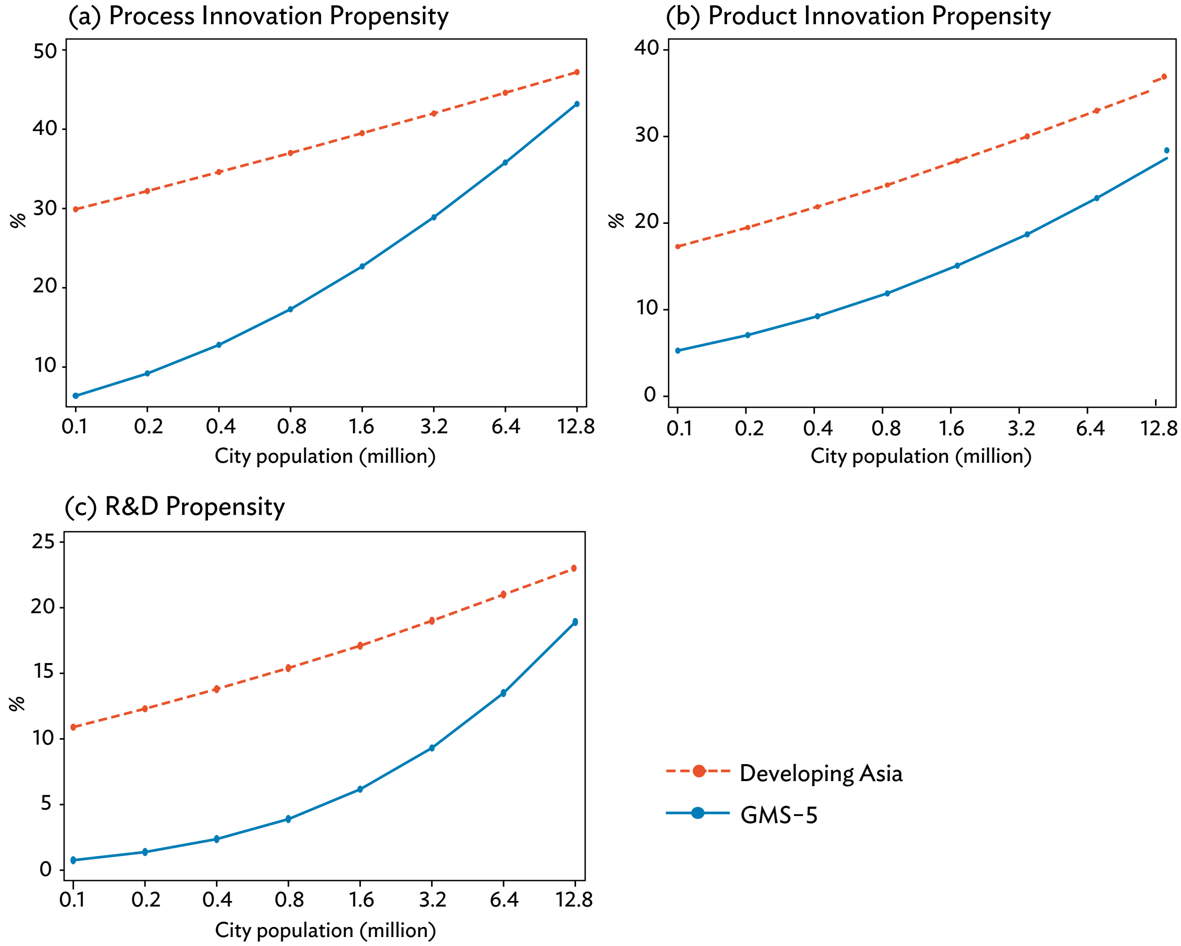
Source: Authors' calculations based on data from the World Bank Enterprise Survey and National Oceanic and Atmospheric Association.

empirical literature shows that the presence of a university often benefits firms in the same geographic vicinity through three forms of university–firm interactions: (i) university–firm collaborations through market-mediated interactions; (ii) unintended knowledge flows from university-based research (D'Este and Iammarino 2010); and (iii) universities as producers of skilled workers (Toivanen and Väänänen 2016). The quality of academic research is also said to indirectly affect the quality of firm innovation (Maietta 2015; Mansfield and Lee 1996).

To test the relationship between university presence and innovation in the Asian context, the analysis maps the top Asian universities from the 2019 QS University Rankings to the natural cities data. Among the 500 top Asian universities, 248 are located in 99 cities across developing Asia. The PRC has 78 top universities across 17 cities, the highest in the sample. But only one of them is in Yunnan and none are in Guangxi.

The GMS-5 economies host 25 top universities in 12 cities (Table 17.1). Most top universities are concentrated in very few big cities. For example, among 18 top universities in Thailand, 12 are located in Bangkok. There is a smaller degree of concentration in Viet Nam, where three big cities host five top universities. As is the case in developed countries, the propensity to innovate is higher in GMS-5 cities with a top university (Figure 17.5). In particular, firms in cities with a top university are about 10 percentage points more likely to engage in process innovation and R&D activities.

Figure 17.4: Correlation of Firm Innovation Propensity and City Population



GMS-5 = Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; R&D = research and development.

Notes: The trend lines indicate the marginal innovation propensity for a firm with average firm characteristics in a city with a given size and average values of other city characteristics. Results are based on a probit regression of an innovation activity dummy on log of population while controlling for firm characteristics such as age, size, foreign direct investment dummy, headquarters dummy, and share of skilled workers, as well as city characteristics such as log of distance to port, average precipitation, maximum temperature, minimum temperature, terrain ruggedness, and sector, year, and country fixed effects.

Source: Authors' calculations based on data from the World Bank Enterprise Survey and National Oceanic and Atmospheric Association.

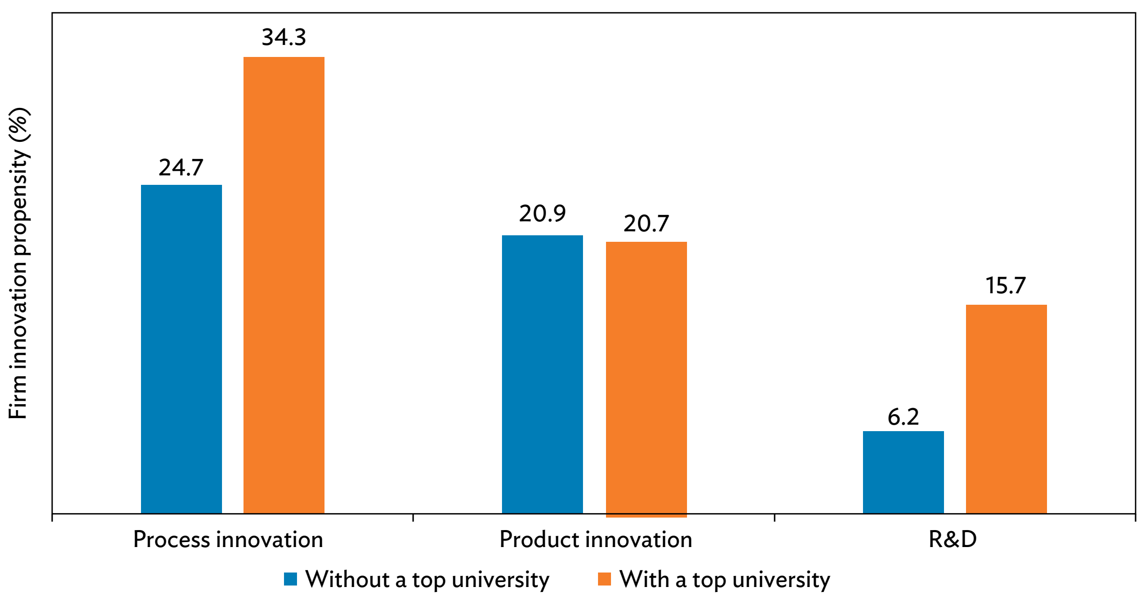
Table 17.1: Distribution of Top Universities

Population	Developing Asia		GMS-5		Thailand	Viet Nam
	No. of Top Universities	No. of Cities	No. of Top Universities	No. of Cities	No. of Top Universities	No. of Top Universities
<0.5 M	20	17	4	4	3 (Chiang Rai, Khon-kaen, Phitsanulok)	1 (Hue)
0.5–1 M	13	13	4	4	3 (Chiang Mai, Hat Yai, Nakhon Ratchasima)	1 (Can Tho)
>1 M	215	69	17	4	12 (Bangkok)	5 (Da Nang, Ha Noi, Ho Chi Minh City)
Total	**248**	**99**	**25**	**12**	**18**	**7**

GMS-5 = Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; M = million.

Source: Authors' calculations based on data from the World Bank Enterprise Survey, National Oceanic and Atmospheric Association, and QS University Ranking.

Figure 17.5: Firm Innovation Propensity and Top University Presence in the GMS-5



GMS-5 = Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam; R&D = research and development.

Notes: Process innovation means a firm has introduced a new or significantly improved process. Product innovation means a firm has introduced new products or services over 3 previous fiscal years. Firm R&D means a firm has spent on research and development, excluding market research, in the prior fiscal year.

Source: Authors' calculations based on data from the World Bank Enterprise Survey, National Oceanic and Atmospheric Association, and QS University Ranking.

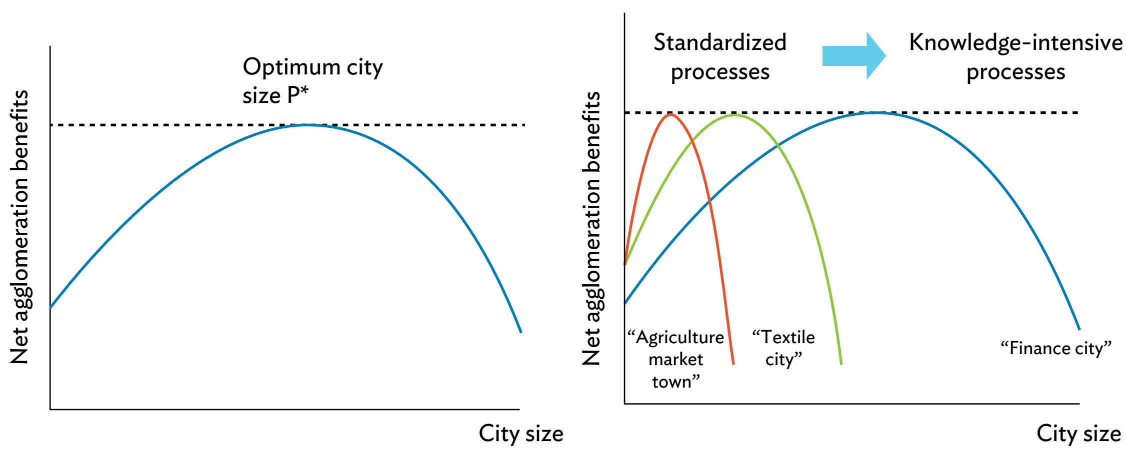
17.4 Managing the Forces of Agglomeration: A Balanced Approach Toward City Size

Taking the results above (and results of related studies on the PRC) as evidence that agglomeration economies are a real and important phenomenon in the GMS, let us now turn to some policy implications. First, while some policy makers may lament the expansion of already large cities, the findings suggest that one reason cities expand is that it pays for firms and workers to locate in a city to benefit from agglomeration economies. To the extent that some GMS economies place barriers to the growth of large cities, for example by restricting migration from rural areas, such barriers will detract from overall productivity growth. The PRC and Viet Nam have policies to restrict the flow of rural migrants to their urban centers.

Second, policies that improve university quality and promote interactions between universities and local firms should have high payoffs. Setting up new universities or new campuses may be prioritized for medium-sized cities without one.

Third, the existence of agglomeration economies does not imply that policy makers should overly concentrate resources on big cities and neglect smaller ones. In the first place, cities can be "too big." There is a tension between agglomeration economies on one side and diseconomies on the other, such as those generated due to traffic congestion, air pollution, and unsanitary living conditions, such as slums in large cities (Fujita, Krugman, and Venables 1999). These diseconomies, discussed in Chapter 18 in detail, can take away from the productivity advantages of cities. As a result, the relationship between city size and net benefits of agglomeration can be represented as an inverted U, as illustrated in Figure 17.6 (left panel). The general idea is that agglomeration effects increase with city size until a point (such as P*) beyond which continued population expansion lessens, rather

Figure 17.6: Net Agglomeration Benefits and City Size



Source: Asian Development Bank, adapted from Fujita, Krugman, and Venables (1999).

than amplifies, net agglomeration effects. While it is difficult to assess whether a given city is past its "optimal" size, local and national governments must act on telltale signs associated with diseconomies (i.e., congestion, pollution, slums, etc.).

In addition, from the perspective of economic efficiency, countries need vibrancy across the full range of cities—small, medium, and large. There are two factors that underlie this argument: (i) although all industries and activities benefit from agglomeration economies, they do so to different degrees; and (ii) diseconomies tend to depend on city size regardless of industries. Thus, consider a city whose main economic activity involves the marketing and trading of agricultural produce versus another that specializes in knowledge-intensive processes such as finance and R&D. While both activities benefit from agglomeration economies, cities specializing in the latter will typically be much larger than those engaged in the former (a fairly standardized product whose production and exchange involves fairly well-established processes and knowledge). Since diseconomies from agglomeration will tend to accumulate equally in both cities—driven mainly by the number of people rather than any other attribute—the city specializing in marketing and trading of agricultural produce will hit peak net agglomeration benefits at a fairly small size (therefore, these cities are better described as towns in common usage). On the other hand, industries that benefit greatly from agglomeration forces are associated with a much larger optimal city size. The right panel of Figure 17.6 captures these relationships.[93]

Last but not least, as seen above, small and medium-sized GMS cities lag behind similarly sized cities in other parts of developing Asia in terms of firm productivity and propensity to innovate. It is possible that, in comparison to other parts of developing Asia, the smaller cities of the GMS have weaker infrastructure, educational institutions that develop more limited human capital, and a poorer climate for encouraging entrepreneurship. In other words, GMS policy makers have perhaps shown a "big city" bias in allocating resources across urban areas.

17.5 Conclusions

Cities create agglomeration economies in the form of productivity gains by enabling workers and firms to interact closely. These productivity gains are believed to be larger in bigger cities because they offer more opportunities for matching inputs and outputs, learning new ideas, and sharing resources. Consistent with this theory as well as evidence in developed countries, the analysis finds that firms in bigger GMS cities tend to be more productive and pay workers more, and they are more likely to engage in innovative activities. However, smaller cities also have an important role to play. In fact, robust economic growth requires vibrancy in cities of all sizes because a city's optimal size—where agglomeration benefits reach their peak—depends on the industries and economic activities of that city. Thus, policy makers need to take a balanced approach across cities of different sizes.

[93] In addition to the fact that there are differences in the importance of agglomeration benefits across industries or activities, some industries or activities have greater potential for beneficial spillovers with one another. This implies that it is more efficient for cities to specialize in a few industries with significant mutual spillovers; otherwise, industries could generate excessive congestion and high land prices for one another.

Appendix

Table A17.1: Regression Results between City Size and Firm Productivity

Variables	Developing Asia		GMS-5	
	(1) log Gross Labor Productivity	(2) log Value Added Labor Productivity	(3) log Gross Labor Productivity	(4) log Value Added Labor Productivity
log Population	0.043*	0.0681**	0.188**	0.178**
	(0.0258)	(0.0264)	(0.0779)	(0.0791)
Other controls	Yes	Yes	Yes	Yes
Sector/year/country FE	Yes	Yes	Yes	Yes
Observations	19,619	19,407	2,303	2,284
No. of cities	486	486	46	46
F statistic	66.34	59.56	10.84	11.28
R-squared	0.36	0.39	0.19	0.22

FE = fixed effects; GMS-5 = Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam.

Notes: Robust standard errors clustered by country in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Ordinary least squares estimator used in all columns. Other controls include firm characteristics such as age, size, foreign direct investment dummy, headquarters dummy, and share of skilled workers, as well as city characteristics such as log of distance to port, average precipitation, maximum temperature, minimum temperature, and terrain ruggedness.

Source: Authors' calculations based on data from the World Bank Enterprise Survey and National Oceanic and Atmospheric Association.

Chapter 18

Managing the City to Be an Engine of Growth

18.1 Introduction

This chapter discusses two agendas that should help policy makers when thinking about how to ensure that their cities serve as engines of economic growth. The first is the basic agenda, which is key to realizing agglomeration economies and ensuring that these are not overwhelmed by negative effects of congestion. Fundamentally, the basic agenda requires that cities work well as labor markets. Of course, cities are much more than places of work. However, cities cannot thrive unless they are attractive places for workers and firms to locate and connect with one another. In practice, this means fast, reliable, and cheap intracity travel; sufficient flexibility for firms and households to relocate within a city; and affordable real estate (ADB 2019).

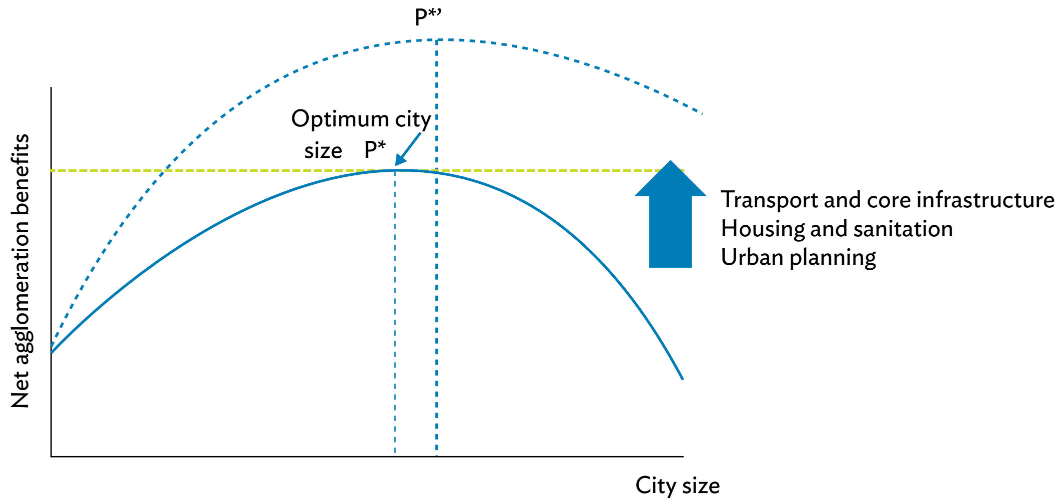
The second or *supplementary agenda* requires that cities have conducive environments for incubation and operations of new and dynamic firms. In practice, this means paying attention to institutions that build human capital, provide conducive business environments, and formulate policies to encourage new economic activities and young firms to operate. The chapter discusses these two agendas in the next two sections.

18.2 The Basic Agenda: Infrastructure, Housing, and Urban Planning

Investments in transport and core infrastructure such as water and sanitation, affordable housing, and appropriate urban planning and land-use regulations ensure that cities do not get overwhelmed by the forces of congestion. This can be seen in Figure 18.1 where investments shift the agglomeration curve upward and to the right, such that net agglomeration benefits are larger for a given city size, and optimal city size is now associated with a larger population.[94]

[94] The shape of the agglomeration expansion curve depends on the type of investments and the underlying characteristics of a city's labor market. The interested reader is referred to Duranton (2008) for a more nuanced treatment.

Figure 18.1: Net Agglomeration Benefits and the Basic Agenda for Managing Cities



Source: Authors, adapted from Duranton (2008).

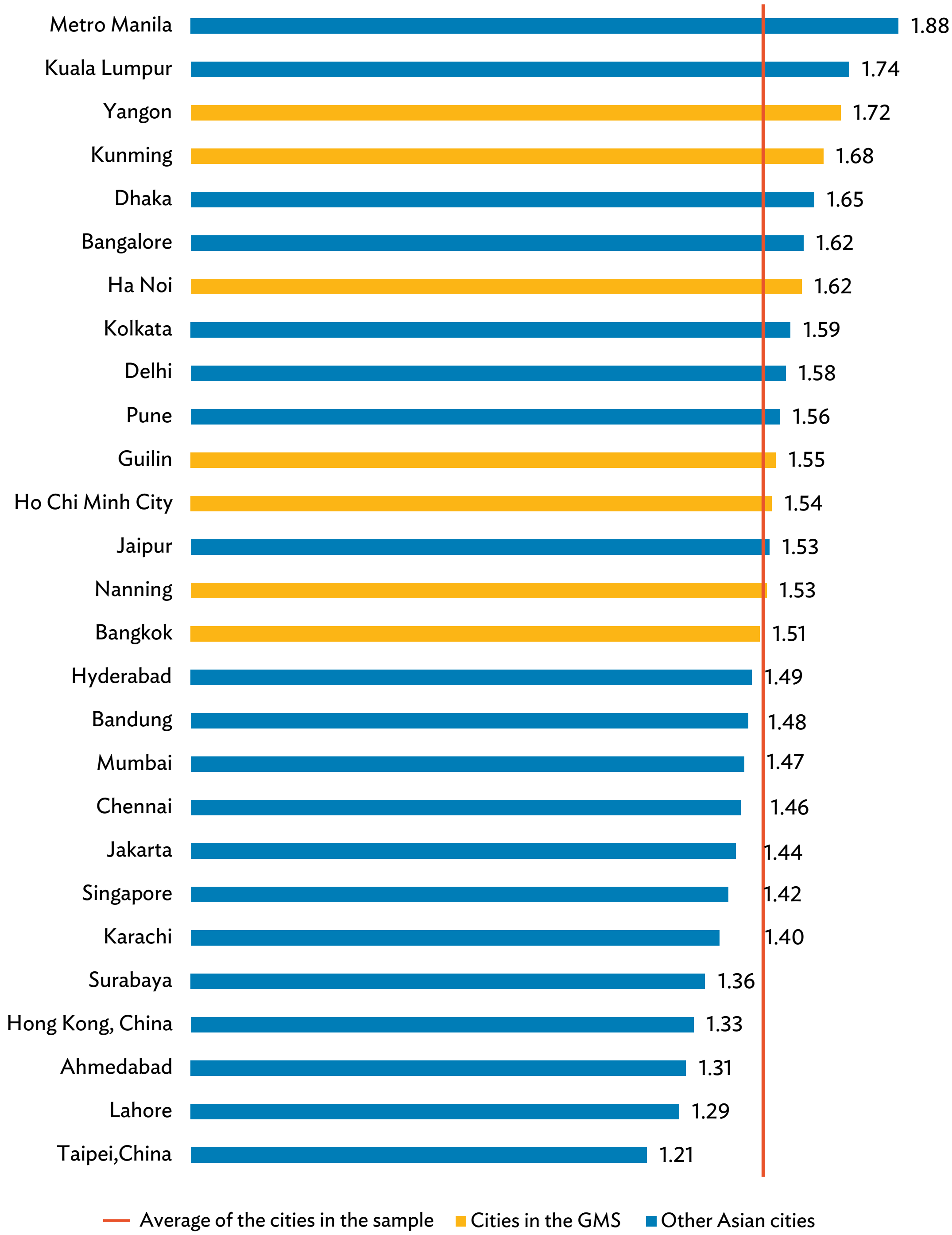
Transportation

While known as vibrant and important cities in the Greater Mekong Subregion (GMS), Yangon, Kunming, and Ha Noi have some of the worst traffic congestion in Asia (Figure 18.2). Six out of the seven GMS cities in Figure 18.2 have congestion indices that are larger than the sample average of 1.52. The index is highest for Yangon at 1.72. This means that, on average, it takes about 72% more time to travel between a given origin–destination within the city during peak hours compared to nonpeak hours. Within the PRC, Kunming in Yunnan has been ranked the 19th most congested city among major Chinese urban areas in 2019. Meanwhile, Nanning and Guilin in Guangxi came in at 43rd and 48th, respectively (Baidu Maps 2020).

Bangkok's congestion index is 1.51. Albeit slightly below the average of the 26 cities in Figure 18.2, this continues to impose significant limitations on Bangkok's potential as an engine of sustainable growth. A 2018 survey shows that average vehicle speed in Bangkok is only 15 kilometers per hour (km/h) and 19 km/h during the morning and evening rush hours, respectively.[95] Moreover, Bangkok traffic jams are estimated to cost $1.95 million a day or $358 million each year (Kasikorn Research Center 2016). Though it is difficult to establish empirically, traffic congestion is believed to contribute to inferior matches between workers and firms, leading to losses in productivity. For example, a well-regarded study of French cities shows that a 10% increase in the number of jobs accessible per worker within 60 minutes is associated with 2.9% higher labor productivity (Prud'homme and Lee 1999).

[95] Thailand Transport and Traffic Policy Planning Office Transportation Statistics. http://www.motoc.mot.go.th/stat/ (accessed January 2019).

Figure 18.2: Road Congestion Index in Selected Asian Cities



GMS = Greater Mekong Subregion.

Notes: Congestion indices show the ratio of time needed to travel between a random origin–destination pair within a city during rush hours compared to non-rush hours. The average of the cities in the sample is 1.52. Data for Guilin, Kunming, and Nanning are not directly comparable to the data for other Asian cities.

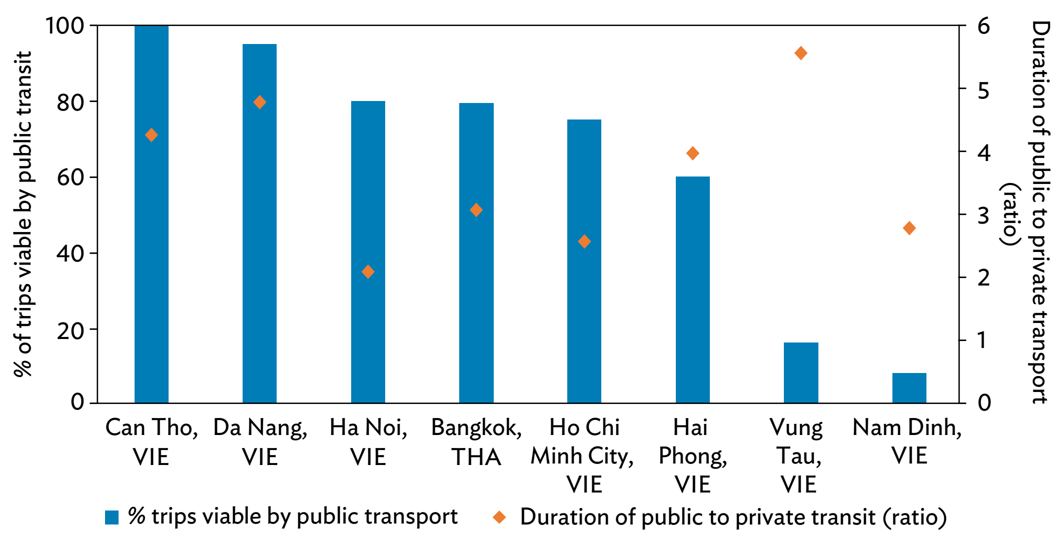
Sources: Authors' calculations based on data from Google Maps (accessed 23 May 2019). Data for Guilin, Kunming, and Nanning are from Baidu Maps (2020) (accessed 14 July 2020).

Traffic congestion results from the inability of the supply of transport infrastructure to keep up with traffic demand. Having a good public transport system is key. Figure 18.3 shows that the extent of public transport network varies significantly across GMS cities. Public transport systems in some Vietnamese cities such as Can Tho and Da Nang have a broad reach, but are severely limited in other cities such as Vung Tau and Nam Dinh. Other studies also suggest that, outside of Bangkok, smaller cities in Thailand such as Chiang Mai and Pattaya have insufficient public transport coverage such that commutes are dominated by private vehicles and informal transport systems (Anantsuksomsri 2019).

While similar data are unavailable for the cities in Guangxi and Yunnan, a 2014 survey of government workers and students in Kunming who commuted between the old city center and the new expansion area in Chenggong reveal that about 45% used private vehicles for their trips, while only 35% used public transport (Yang et al. 2017). Though not strictly comparable, this is higher than the national average in 2015, where private vehicles together with shared transport through hired services such as taxis accounted for 33% of daily trips across all cities in the PRC (Statista 2015).

Even for cities with a relatively wide public transport network such as Ha Noi, Figure 18.3 shows that it can take at least twice the time to cover the same origin–destination locations when using public compared to private transit. The ratios of public-to-private transit time are significantly higher for other cities with low public transport networks, reaching as high as 5.6 for Vung Tau.

Figure 18.3: Availability and Quality of Public Transport in Selected Greater Mekong Subregion Cities



THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on data from Google Maps (accessed 23 May 2019).

Such differentials in public–private travel time suggest important gaps and deficiencies in the public transport network even when a seemingly extensive one is present. For example, Figure 18.3 indicates that around 80% of trips in Bangkok are viable by public transport, and yet a survey from the Office of Transport and Traffic Policy and Planning reveal that 65% of Bangkok residents use private vehicles to commute between their homes and workplaces.[96] This is despite the broad array of public transport modes on offer—mass transit systems such as elevated trains, subways, and buses that are operated or supported by the government. Other public transport modes are available through taxis, motorcycle taxis, public vans, and ferries along the Chao Phraya River. Until 2017, there was also the Bangkok Bus Rapid Transit (BRT) system located in the inner city of Bangkok.

Bangkok's experience highlights the fact that the availability of public transport infrastructure is, by itself, not sufficient to address transport access issues and congestion. Transport systems must not only have wide geographical reach, but also recognize the competing and complementary relationships of the different transport modes in delivering safe, reliable, and affordable connectivity. For example, travel through the ferry and boat systems along the Chao Phraya River can be faster during rush hours, but its uptake is hampered by poor safety records and limited connections to other transport modes. The BRT system, which only lasted 7 years, proved financially unsustainable because various aspects of its design and operation failed to account for its relationship with other transport modes (Wu and Pojani 2016).

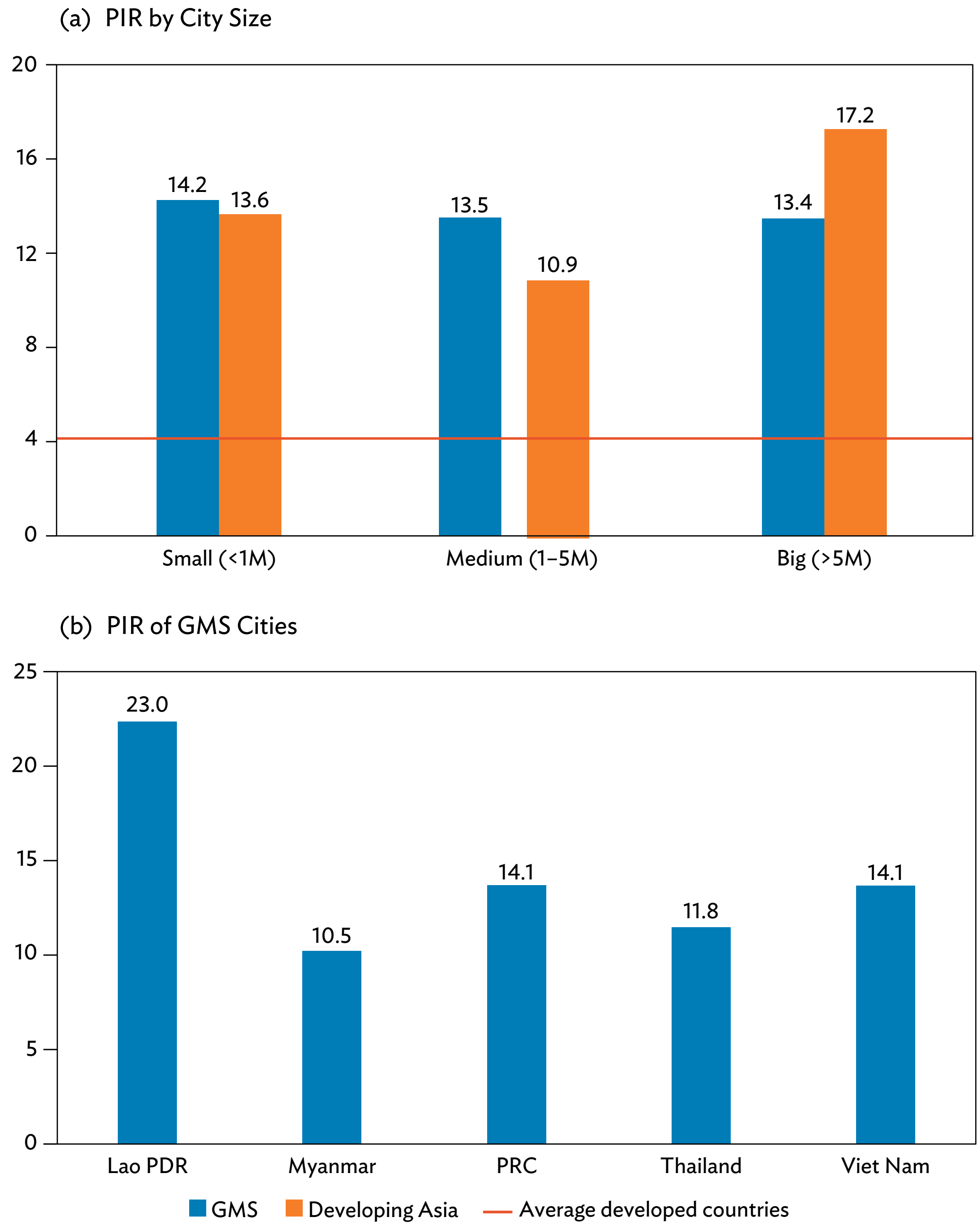
Another example is the rapid uptake of electric bikes in Kunming between 2006 and 2012, which had unintended consequences on transport mode choices. On the one hand, e-bikes were estimated to have interrupted the shift from bicycles to public buses. On the other hand, there also seemed to be an opportunity for car owners to shift to e-bikes for urban trips (Cherry et al. 2016). Understanding the socioeconomic aspects of transport mode uptake and their underlying substitutability and complementarity characteristics can help governments design multimodal transport systems that deliver significant connectivity improvements between the first and last mile of travel.

Affordable and Adequate Housing

Inadequate transportation exacerbates another fundamental issue of urbanization: access to adequate and affordable housing. If people can move around a city efficiently and at an affordable price, then the premium to live in central locations is substantially reduced. Yet the massive inflow of new urban dwellers has overwhelmed many cities, resulting in poorly planned urban expansion. In most cities, demand for housing has continuously exceeded supply, leading to a rapid increase in housing prices. The price-to-income ratios (PIRs) of house prices to annual household incomes are at very high levels across GMS cities, as shown in Figure 18.4. The PIR is highest in the Lao PDR (panel (b)), where it takes 23 times an average household's annual income to own a home in the medium-sized city of Vientiane. Whereas housing prices increase with city size in most Asian countries, the prices are equally high across small, medium, and large cities in the GMS (panel (a)). It is also important to note that the GMS PIR is substantially higher than in developed countries where house prices are on average just four times the average household income (Demographia 2019).

[96] Thailand Transport and Traffic Policy Planning Office Transportation Statistics. http://www.motoc.mot.go.th/stat/ (accessed January 2019).

Figure 18.4: Housing Affordability in the GMS Measured by Price-to-Income Ratios



GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, M = million, m^2 = square meter, PIR = price-to-income ratio, PRC = People's Republic of China.

Notes: City size refers to natural city population identified from nighttime lights. The PIR was computed as the average house price (50 m^2) divided by the mean annual household income. For the PRC, only cities in Guangxi Zhuang Autonomous Region and Yunnan Province are included. There are no data for cities in Cambodia.

Sources: Authors' calculations based on data from Colliers International; Global Property Guide; household income and expenditure surveys, various countries; Knight Frank; Makaan; the National Bureau of Statistics, People's Republic of China; Numbeo; the World Bank's PovcalNet; and Zameen.

Housing affordability and adequacy are intrinsically linked. As housing becomes unaffordable, households typically have no other choice but to live in inadequate housing, which is a dwelling that is substandard and/or relatively remote. It comes therefore as little surprise that a large share of urban populations in the GMS-5 (Cambodia, the Lao PDR, Myanmar, Thailand, and Viet Nam) live in slums, which ranged from 25% in Thailand to 55% in Cambodia in 2014. In comparison, the average for lower middle-income countries was estimated to be 32% (United Nations Statistics Division 2015). People relegated to the informal housing sector lack access to clean water and sanitation infrastructure, as well as access to basic social services such as health and education.

The consequences of housing unaffordability and inadequacy for households in cities are substantial. As households overspend on housing, they are forced to reduce nonhousing consumption, including spending on education and health. As a result, household members may suffer from ill health and their children perform worse at school (Bentley et al. 2011; Bentley, Baker, and Mason 2012; Newman and Holupka 2014; 2015; 2016). Alternatively, households may decide not to spend more on housing, but to reside in housing with physically inadequate conditions. There is a strong relationship between inadequate housing conditions, such as physical defects or overcrowding, and children's well-being (Dockery et al. 2013; Chambers et al. 2015). Another option to keep the housing expenditures low is to live far from employment centers, implying longer commute times, which can have detrimental mental health effects as observed in Latin American cities (Wang et al. 2019).

Addressing the housing problem is at the heart of making cities inclusive and safeguards the future of cities as drivers of growth. For their continuing success, cities need to fundamentally improve housing affordability while maintaining agglomeration-induced productivity growth and urbanization. Based on the experience of other Asian countries, the following are some policy suggestions:

First, GMS-5 countries have tried different policy options to increase housing supply, but many of them have faced issues of limited availability of developable land.[97] To increase housing supply, cities may consider relaxing land-use regulations or expanding administrative or geographic boundaries.

Second, as the housing affordability crises cannot be solved by the public sector alone, active involvement of the private sector is essential to increase housing supply. As low-cost housing can involve higher risk and lower returns from the private sector's perspective, additional incentives are needed to crowd in more private sector investment. Financial incentives and simplified regulatory processes could also help expand private sector involvement in affordable housing supply (Sengupta 2006).

Third, the emphasis of many housing policies in the region has been on promoting homeownership. While homeownership offers certain advantages, such as the accumulation of a physical asset, it also carries risks, such as overborrowing. Homeownership also limits labor mobility, which is essential to reap agglomeration benefits. However, the rental market remains small in most Asian cities. Developing a thriving rental market that offers a healthy mix of both public and private rental housing should therefore be encouraged. The public rental housing stock needs to be expanded and better managed and maintained. The participation of the private sector can be encouraged by providing financial incentives, such as tax exemptions or subsidies for building private rental housing.

[97] Developable land is land with access to amenities, such as transportation, jobs, education, and health care facilities.

Urban Planning and Land-Use Regulations

Of all the factors of production, land is the most immobile and its supply is largely fixed. This has often meant that land is also scarcest in places where agglomeration effects are greatest (World Bank 2009), hence congestion tends to follow. A response to land scarcity has been to build upwards, as evidenced by the ubiquity of skyscrapers in many of Asia's megacities. However, this response is also bound to be limited. Issues of congestion are best addressed by forward-looking land-use planning and regulation.

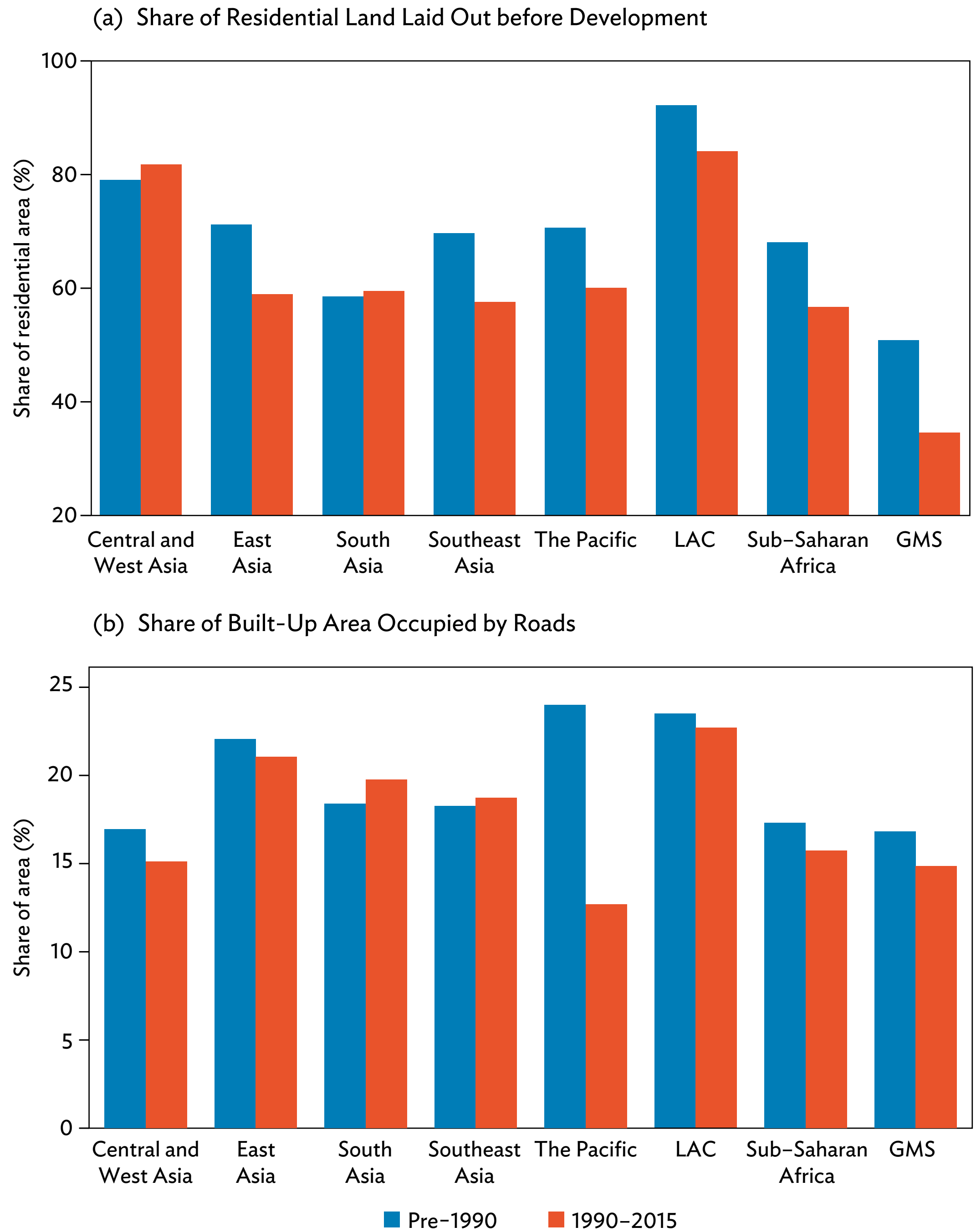
The lack of sufficient basic infrastructure and housing in cities is often tied to poor urban planning. From an economic perspective, this fragments a city's labor market, which increases the costs of responding to market forces for firms and workers. Socially, this may mean poorer neighborhoods without secure connections to a central water supply and sewerage systems or easy access to schools and basic health services.

Figure 18.5 shows that GMS cities have the lowest share of residential areas that have been laid out in a plan prior to development among various developing country groups. Moreover, the region experienced the largest decline since the period before 1990. GMS-5 cities also exhibit some of the smallest shares of built-up area allocated to roads, comparable to those in Sub-Saharan Africa. Meanwhile, Chinese cities appear to have been designed such that public transportation is almost always accessible within walking distance of households and establishments. On average, public transport stations are about 500 meters walking distance for second-tier cities such as Kunming and Nanning, while third-tier cities such as Qujing in Yunnan and Guilin and Liuzhou in Guangxi tend to be around 600 meters away (Statista 2018). Station, street, road, and zoning layouts can have lasting consequences on the trajectory of a city's development. They influence the extent to which congestion takes hold and how difficult it is to address. For example, portioning land uses into uniform rectangular blocks is an effective mechanism for avoiding irregular property shapes, discourages incompatible subdivisions, facilitates connectivity, and encourages forward-looking private investments by providing predictability of developments (O'Grady 2014).

The lag between planning and development can be explained to a large extent by the speed with which urbanization has unfolded in many developing countries. However, this only means that policy makers must strengthen the capacity of their urban planners to respond adequately to ongoing urbanization. Indeed, the expansion of cities in the GMS, and developing Asia more broadly, is expected to continue (as seen in Chapter 16). This can occur either vertically by building taller structures or horizontally by covering larger geographic areas. A study by the World Resources Institute predicts that Bangkok will expand by building upwards, while most GMS cities such as Can Tho, Hai Phong, and Ho Chi Minh City in Viet Nam; Liuzhou and Nanning in Guangxi; Kunming in Yunnan; and Phnom Penh in Cambodia are predicted to grow in geographical coverage (Mahendra and Seto 2019). This means that the latter set of cities have an opportunity to identify potential expansion areas and obtain planning jurisdiction over them before development occurs. Land rights for appropriately spaced arterial road grids, public facilities, and open space must be acquired beforehand.

Negotiations on land-use rights have proven to be one of the major causes of delays and costs inflation for infrastructure development, especially for large transport projects. Negotiations between the government and potentially numerous landowners can become long drawn out processes.

Figure 18.5: Urban Planning in Developing Countries



GMS = Greater Mekong Subregion, LAC = Latin America and the Caribbean.

Notes: City size refers to natural city population identified from nighttime lights. Total of 129 cities. 4 cities in Central and West Asia, 40 cities in East Asia, 25 cities in South Asia, 11 cities in Southeast Asia, 1 city in the Pacific, 26 countries in Latin America and Caribbean, 18 cities in Sub-Saharan Africa, and 4 cities in GMS. These GMS cities are Ho Chi Minh City and Vinh Long in Viet Nam; Bangkok, Thailand; and Myeik, Myanmar.

Source: The Atlas of Urban Expansion (2016) (accessed 30 January 2020).

For example, the high-speed rail project to connect three Thai airports requires the expropriation of 140 hectares of private lands (Anantsuksomsri 2019).

Finally, as forward-looking plans are executed, actual regulations also require some flexibility to address evolving needs within a city. For example, land-use regulations that place rigid restrictions on building heights can needlessly inflate real estate prices and undermine the gains from investments in public transport such as metro rails and BRTs (ADB 2019).

Outside of safeguards for cultural and heritage sites, environmentally sensitive areas, and regulations against speculative activities, well-functioning land markets will allocate scarce land resources to optimal functions. Good transport systems within and across cities can reduce the effective distance of other areas to the center of agglomeration, thus allowing households to move physically farther from the density center, where rents and housing are cheaper. Historically, the decline in transport costs has been accompanied by an expansion of the area sizes of cities (World Bank 2009). This is, in fact, a plausible explanation for the natural city patterns in GMS cities documented in Chapter 16.

18.3 Supplementary Agenda

Cities that offer opportunities for people to develop their human capital become attractive to the young and the talented. At the same time, they are desirable places for production because firms can have access to a key input—labor and the skills and knowhow they embody—while being close to sizeable markets for the goods and services they produce. It is in the interest of cities to facilitate the powerful synergies that arise from the interaction of their labor resources and businesses rather than hinder them. Thus, while physical infrastructure, housing, and urban planning are essential elements of a well-functioning city, investments in soft infrastructure such as human capital through education and a good business environment can substantially enhance a city's capacity to be a center of sustained growth.

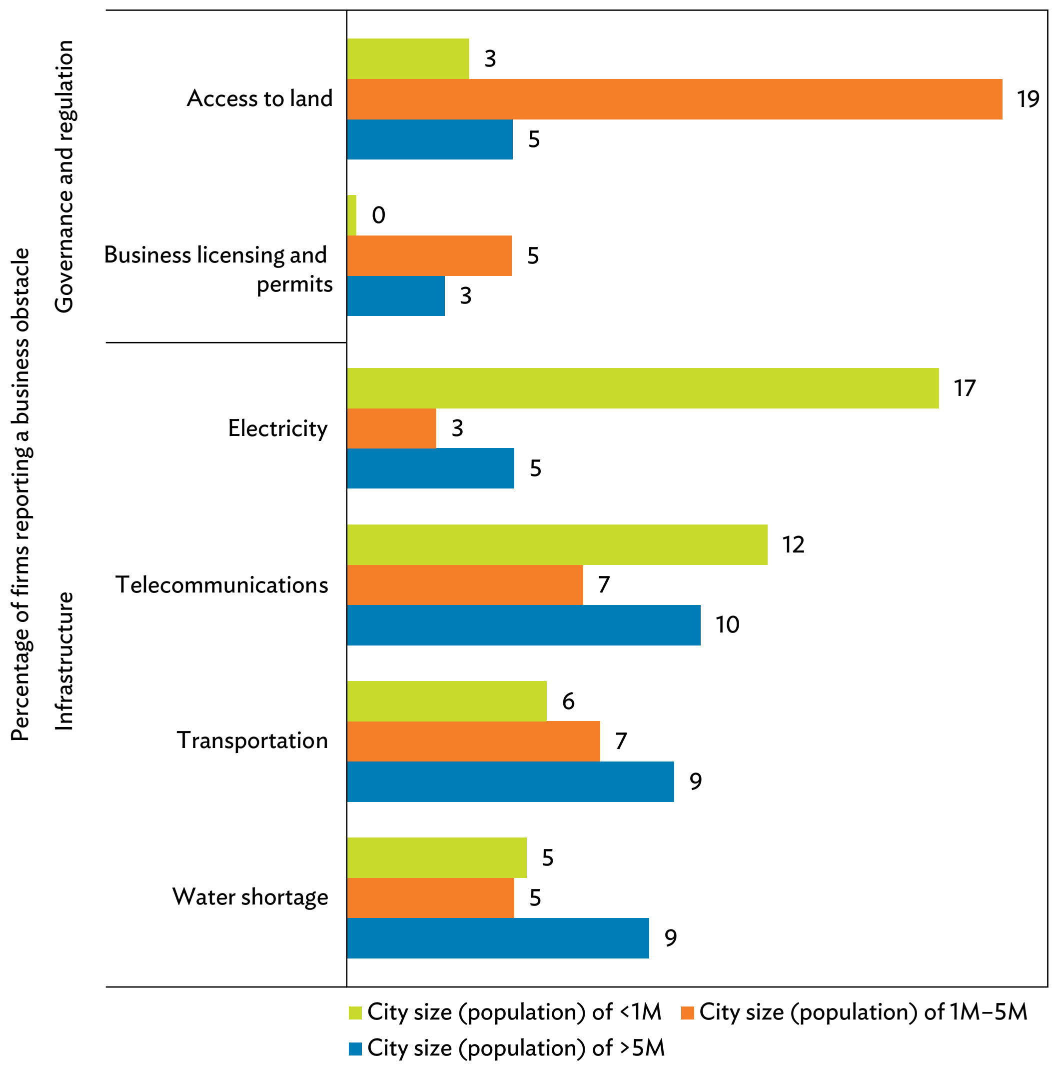
The composition and quality of human capital is a significant feature of a city's attractiveness to laborers and firms (Behrens and Robert-Nicoud 2015). Firms, especially the highly innovative ones, will tend to locate in places where they have steady access to talents. At the same time, motivated and skilled workers will gravitate to places where they have opportunities to acquire skills and to be subsequently rewarded for their efforts. Educational institutions themselves are also sources of new entrepreneurs that are willing to explore and experiment with innovative business solutions, as demonstrated by the role of startups in altering business models and pushing the technological boundaries in various industries.

The discussion in Chapter 17 showed that cities in Asia that have highly ranked universities have substantially greater propensity to engage in innovative activities. The proximity of firms and high-level human capital to one another facilitates knowledge flows and spillovers that set the stage for innovative ideas and practices to occur. In the GMS, Thailand can boast of 18 highly ranked universities, Viet Nam has 7, while the PRC has 78, with 1 in Yunnan. But educational institutions of similar caliber are lacking in the other GMS members.

Local governments can also support workers and firms by providing friendly business environments, which ensure that they are as productive as they can be. Infrastructure, housing, and land-use plans require careful planning, massive investments, and longer time horizons. In the very short to medium term, improving some aspects of the business environment such as addressing corruption can offer immediate gains to businesses. For example, a survey of firms in Viet Nam reveal that 85% of firms in Vinh had to pay out unofficial charges to their city governments. The share is smaller for Ha Noi, but still substantial at 57.1% (Maruichi and Abe 2018).

Figure 18.6 provides a summary of the obstacles that firms perceive they encounter in GMS-5 cities. Infrastructure issues are the most frequently identified problems for firms in the big cities.

Figure 18.6: Firms Reporting Business Obstacles in GMS-5 Cities



M = million.

Notes: City size refers to natural city population identified from nighttime lights. For water shortage, the bars represent the share of firms that experienced water shortage in the previous year. For all other indicators, the bars represent the share of firms that consider an indicator to be a major obstacle to operations.

Source: Authors' calculations based on the World Bank Enterprise Survey (2018).

In particular, 5% of firms cite electricity access, arguably the single most critical infrastructure for modern production, as a limitation to their operations. Even larger proportions of firms identify access to telecommunications (10%), transportation (9%), and water shortages (9%) as obstacles. Problems with electricity and telecommunications are more severe in small cities. Improving business environments through regulations can mitigate these issues, especially when providers of logistics, transport, telecoms, and utilities are themselves private businesses.

Compared to big city firms, fewer businesses in medium-sized cities find infrastructure access problematic. However, 19% of firms complain about access to land as an obstacle to their operations. This is an important issue because medium-sized cities usually serve as the expansion sites for firms that are more established and mature, as discussed in Chapter 19. Admittedly, the majority of the statistics presented in Figure 18.6 is based on perceptions and therefore highly subject to the biases and/or specific circumstances of respondents. The results must therefore be interpreted with caution. Moving forward, more objective locality-specific metrics can complement these perception surveys for more targeted policy responses. Big data using telecoms records and geospatial images can make this a possibility for future research.

Sound business environments can make cities thrive in their roles as engines of growth. The development of the PRC cities of Shenzhen and Pudong into full-fledged urban and commercial centers shows how local governments can make their cities attractive to businesses. The case of the PRC is admittedly unique in that local government performance is explicitly linked to incentives such as political career advancement (Edin 2003; Li and Zhou 2005). The broad economic powers of the local government are held in check by fierce competition among local governments that disciplines officials because firms can relocate away from cities that are managed by incompetent or abusive local governments (Bai, Hsieh, and Song 2019).

Nonetheless, there are also success stories within the GMS such as Saigon South and Hanoi New Town in Viet Nam that emerged from the environment of special economic zones (SEZs) (Gotsch and Peterek 2003; Mahendra and Seto 2019). Like many countries in the world, governments in the GMS have used place-based policies such as SEZs or economic corridors to encourage investments and get around problems of unattractive business environments and various market failures that are difficult to address. These enclaves are typically endowed with better infrastructure and are also made more attractive with tax incentives for potential firms to locate there. The use of SEZs has a relatively recent history for most GMS members (other than Viet Nam and the PRC), which have used them as a means to spur economic activity as well as foster economic integration in the region (ADB 2018a). This is discussed in more detail in Chapter 19. Further research is needed to understand whether these enclaves can form the nucleus around which surrounding cities and towns can become more vibrant. Empirical evidence suggests that their success depends on highly specific contexts (Duranton and Venables 2019). Across countries, such incentives appear to have influenced business location choices, but at the price of inefficiently low tax revenues and a negative-sum game between regions in a country (Deichmann et al. 2005).

18.4 Conclusions

The concentration of people and resources in cities makes these places centers of agglomeration economies and, therefore, engines of growth. However, without appropriate management, the agglomeration benefits can be overshadowed by the negative consequences of congestion. Indeed, GMS cities find themselves confronting traffic congestion, housing informality, and urban sprawl, even as key cities within the region continue to expand in population and area coverage.

As a guiding principle, managing the tension between agglomeration and congestion requires that cities function well as labor markets. In practice, this means sufficient investment in core infrastructure such as transport, water, and sanitation; land use and tax regulations that facilitate adequate and affordable housing; and land-use plans that anticipate expansion areas. These fundamental hard and soft infrastructures are ideally embedded within a milieu conducive to sustained product and process innovations through investments in human capital and friendly business environments.

Chapter 19

System of Cities in the Greater Mekong Subregion

19.1 Introduction

Cities do not exist as isolated islands. Rather, they are connected to one another and to the rural hinterland, through flows of goods, services, and people. For example, small market towns play a key role in ensuring that the food supply chain functions efficiently, linking farmers and their produce to consumers in the big cities. In the language of urban economics, cities thus form a "system," and the economic functions and activities of one city often complement those of other cities (and compete in some cases).

As noted in Chapter 17, countries need vibrancy across a range of small, medium, and large cities. A key implication of this idea is that cities need to be managed well, not just in isolation but as part of an overall system. In this chapter, the analysis will first focus on two factors that underpin how efficiently the system of cities works: (i) the state of intercity transport infrastructure in the Greater Mekong Subregion (GMS) and (ii) the institutions that can coordinate decisions and plans across cities and their administrative units. The analysis will then look into the system of cities not only within a given country, but also across the GMS as a whole.

19.2 Managing the System of Cities

Connecting Cities

Transport infrastructure plays perhaps the most central role in facilitating and sustaining mutually beneficial relationships among key locations within an economy. As an illustration, consider the six panels in Figure 19.1, which show key production centers within the GMS members connected by major road networks. These are complemented by extensive rail networks in most GMS economies.[98]

[98] In Viet Nam, rail lines connect Ho Chi Minh City in the south to as far north as Nanning in Guangxi (Viet Nam Railway Map; https://vietnamrailway.com.vn/vietnam-railway-map). Meanwhile, the Thailand rail network links 47 of its 77 provinces with one another (Thailand Ministry of Transport Transportation Statistics; http://www.motoc.mot.go.th/stat/; accessed January 2019). Upon completion in 2021, the Lao PDR's first rail system is expected to connect the cities of Vientiane and Luang Prabang to the town of Boten in the north, which borders Yunnan (Smith 2020). In Cambodia, rail services connect Phnom Penh to Aranyaprathet, Thailand in the northeast and links the port cities of Phnom Penh and Sihanoukville within the country.

Figure 19.1: Intercity Transport Connection in the Greater Mekong Subregion

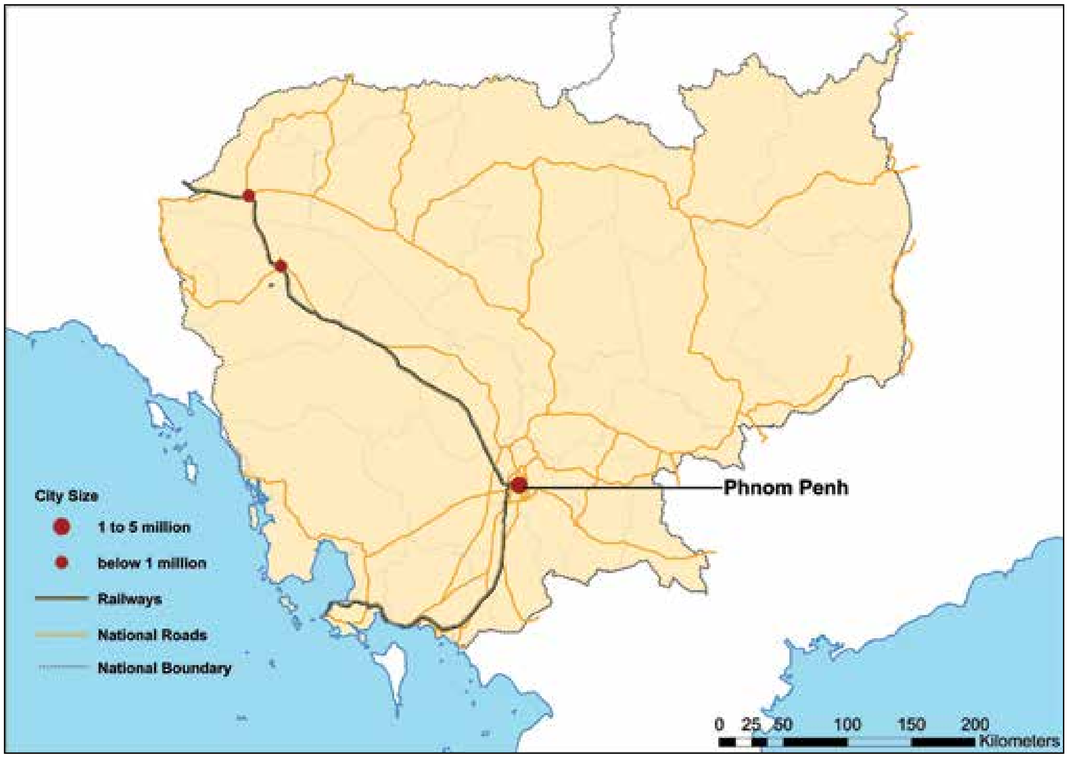


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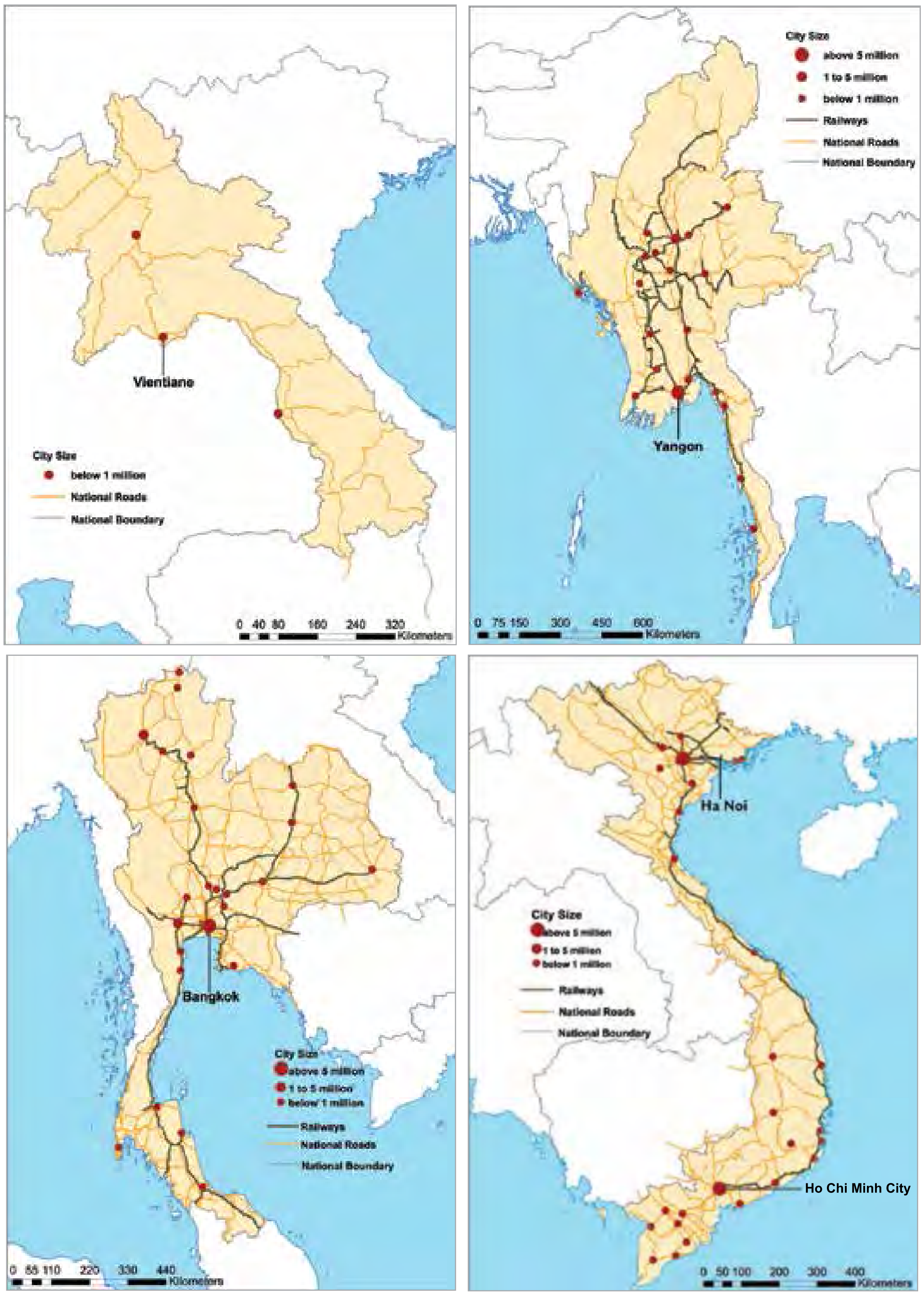
Figure 19.1 *continued*



Lao PDR = Lao People's Democratic Republic.

Note: City size refers to natural city population identified from nighttime lights.

Source: Asian Development Bank estimates using nighttime lights images from the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018), grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 August 2018), and roads and railways from OpenStreetMap (accessed 4 April 2019).

These transport links are key to facilitating the interrelationships between cities within a country. Indeed, some economists argue that agglomeration benefits can also arise from the interaction of spatially distant cities if they are well-connected with one another (Johansson and Quigley 2004). This becomes more relevant as economies develop because mature urban systems exhibit greater functional diversity across space. For example, one city may specialize in one or two activities, while another well-connected city specializes in upstream or downstream activities. More generally, large metropolises tend to be characterized by a more diverse set of industries and activities, providing them the ability to serve as efficient incubators for new ideas and nurseries for young firms. As industries mature and their business models stabilize, firms generally move to smaller cities that are more specialized (Duranton 2015).

The spatial evolution of the automotive industry in Thailand appears to follow a pattern of gradual geographical diffusion consistent with patterns of a maturing urban system. The industry started in Bangkok in the 1960s, while newer automotive parts firms in the 1990s established themselves in the peripheries of Bangkok and in the eastern region of Thailand (Kuroiwa, Techakanont, and Keola 2017). In Viet Nam, Ho Chi Minh City in the south functions as the country's center for exports, business services, and telecommunications. The northern region, with activities centered in the cities of Ha Noi and Hai Phong, specialize in processing of agricultural products and production of standardized automotive parts. The central region is currently dominated by marine-based industries, although the government aims to develop the area as a hub for oil and gas, ship building, and high-tech industries (Abe 2013; Dezan Shira & Associates 2020).

Institutions for Coordination and Planning

City Clusters and Metropolitan Governance

The simplest way of seeing the need for institutions for coordinating and planning policies and investments within a system of cities is by considering city clusters. These are a subset of the system of cities and were described in Chapter 16, i.e., cities that are administratively distinct but are geographically contiguous. Effective mechanisms of metropolitan governance are important for city clusters.

A good metropolitan governance structure allows governments at all levels—constituent cities, peri-urban areas, as well as state and provincial governments—to develop comprehensive plans and policies and to benefit from economies of scale in infrastructure investment and in the delivery of public services. For example, land use at the regional level requires metropolitan governance to decide optimal locations for industrial parks, water treatment and solid waste facilities, and transport hubs (ADB 2019). To be effective, a metropolitan governance structure needs clearly and legally defined geographic boundaries that are matched with autonomy and accountability for revenue and expenditure functions (Bird and Slack 2014). This is not easy to execute in practice, but it is something that must be a priority for policy makers.

Beyond City Clusters

The need for a strong national and regional coordination system of governance also comes out clearly for cities located far from one another (as seen from Figure 19.1).

One area of coordination covers investment decisions on transport infrastructure. Ongoing intercity transport infrastructure projects and plans are often very costly. But their benefits will be weak if they proceed without a high degree of coordination and planning involving officials from different cities and agencies. For example, the Thai rail network and airports do not have a proper feeder transport system to the cities. Heavy reliance on private or informal public vehicles causes traffic congestion in bypass roads around the city centers of major Thai provinces. People's attempts to minimize the impact of traffic on their commutes have in turn contributed to urban sprawl (Anantsuksomsri 2019).

A forward-looking plan that accounts for geographic multimodal connections at the national and regional levels can prevent not just traffic congestion but also sprawl. A holistic and multimodal approach to transport system design can also tap into underutilized means of intercity travel such as inland waterway transport. Thus far, the GMS members' intercity transport tends to rely heavily on road and rail, whereas air transport is only viable for higher-value goods.

Transport networks are not only meant to link megacities and secondary cities with one another. Smaller agricultural market towns are also essential in a country's portfolio of places. It makes sense for agriculture, agro-processing, and labor-intensive industries, such as leather work and wood products, to be in places with easy access to raw materials since they are less likely to benefit from agglomeration economies (World Bank 2009). Moreover, smaller towns are potentially more important than large cities for reducing rural poverty (Gibson et al. 2017). This is highly relevant for GMS members where poverty remains most prevalent in the rural areas. Nonetheless, realizing the poverty-reducing potential of small towns also rests on reliable transport links to rural areas and to larger markets in cities.

Some Policy Challenges

With competing transport needs across space and amidst limited resources, the issue of priority inevitably arises. Specifically, how much of the public investment program for infrastructure should policy makers allocate to bigger cities rather than smaller ones? Big cities have an edge in attracting private investment because agglomeration economies promise high returns. Thus, these cities should be encouraged to draw on the private sector to meet a portion of their own investment finance needs. In this way, big cities need not be in direct competition with public funding for infrastructure in other places. For example, build-operate-transfer public–private partnership arrangements are widely used for infrastructure projects, such as the network of municipal waste to energy plants in primary and secondary cities in Viet Nam (ADB 2018b). Another option is land-value capture mechanisms, where capital costs of construction could be recovered through resultant private land-value increases from the infrastructure (Abiad, Farrin, and Hale 2019).

An efficiently functioning system of cities can give rise to an important policy challenge. For example, while improved transport connections enhance the spatial allocation of economic activities, they can also unintentionally harm some locations. The national trunk highway system of the PRC, built from the 1990s to 2007, demonstrated that the lower trade costs between large metropolitan areas and their peripheral counties led industries in the latter to relocate to the core cities. This has led to slower growth for the peripheral counties (Faber 2014).

Historical patterns suggest that spatial concentration of economic activities within countries intensifies in the early years of development as income rises, especially for rural-based economies. Eventually, a development threshold is reached such that income growth no longer coincides with greater geographical concentration, as seen in high-income countries today (World Bank 2009). However, this means that the hollowing out of some places in response to the spatial reconfiguration of economic activities may be inevitable in the short to medium term.

The appropriate public response depends on the reasons why a city or locality has been left behind or is lagging and the specific problems that arise with it. For example, if the outmigration of young people leads to demographic imbalance, institutions for better elderly care should be provided. Geographical remoteness can be alleviated by connection to larger markets and productivity-enhancing investments for agricultural production.

As a general rule, one of the most important responses to spatial inequalities is to invest in human capital in a spatially neutral manner. In other words, the residents of small and remote towns, as much as those of large well-connected cities, must have access to good quality education and health care. Together with policies that do not hinder workers to move to other locations, such investments enable a convergence in living standards across different locations despite a tendency toward geographical concentration of economic activities. This has been the experience of high-income countries.

19.3 System of Cities across the Greater Mekong Subregion

The geographic configuration of the GMS presents an important setting for viewing its cities as part of a system that extends beyond its national economies. The intercity relationships within countries discussed in the earlier subsection can naturally extend across cities in the GMS. Indeed, spatial production patterns of key GMS exports such as automotive parts, electronics, food, and apparel suggest that production networks operate with an implicit but nonetheless keen recognition of the mutual benefits from these cross-GMS interactions. The panels in Figure 19.2 illustrate existing production networks for different industry groups. Different stages of production span across GMS cities, although the involvement of each city varies by the final product produced.

For the automotive industry, panel (a) of Figure 19.2 shows that the majority of the research and development, standardization, and global distribution activities are centered in Bangkok and its vicinity and various production centers in Guangxi and Yunnan of the PRC. The centrality of Bangkok to the auto industry is clearly visible in the case of Denso, a global supplier of automotive systems and components for auto manufacturers.

Figure 19.2: Value Chain Production and Trade in Greater Mekong Subregion Cities

(a) Automotive

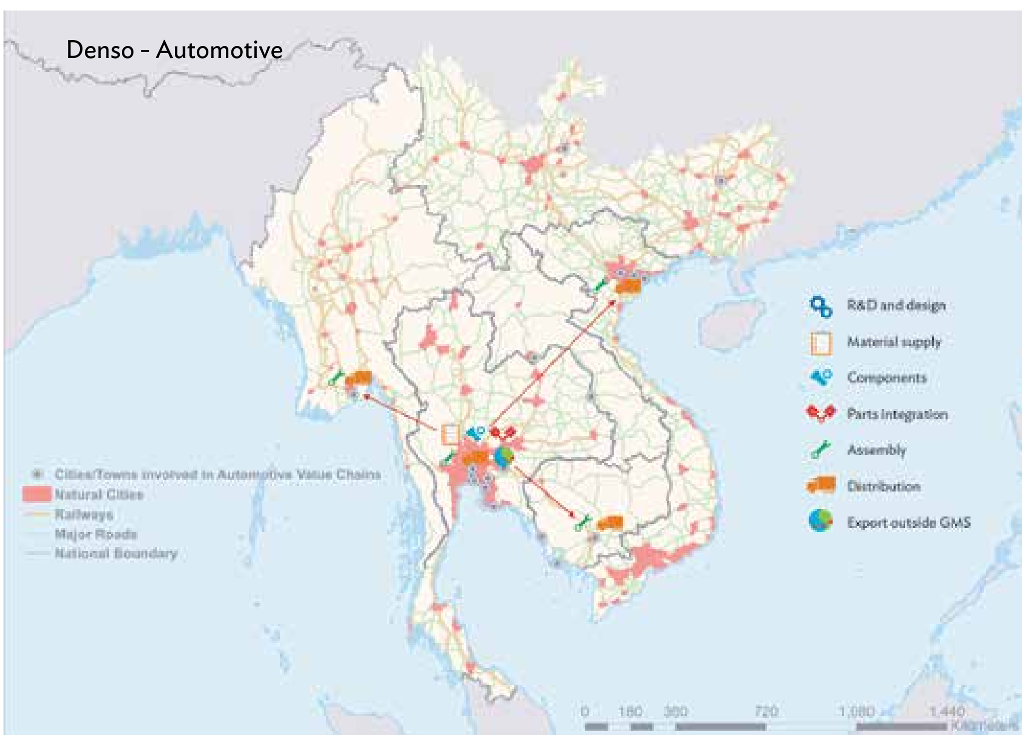


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Figure 19.2 *continued*

(b) Electronics and Agricultural Machinery

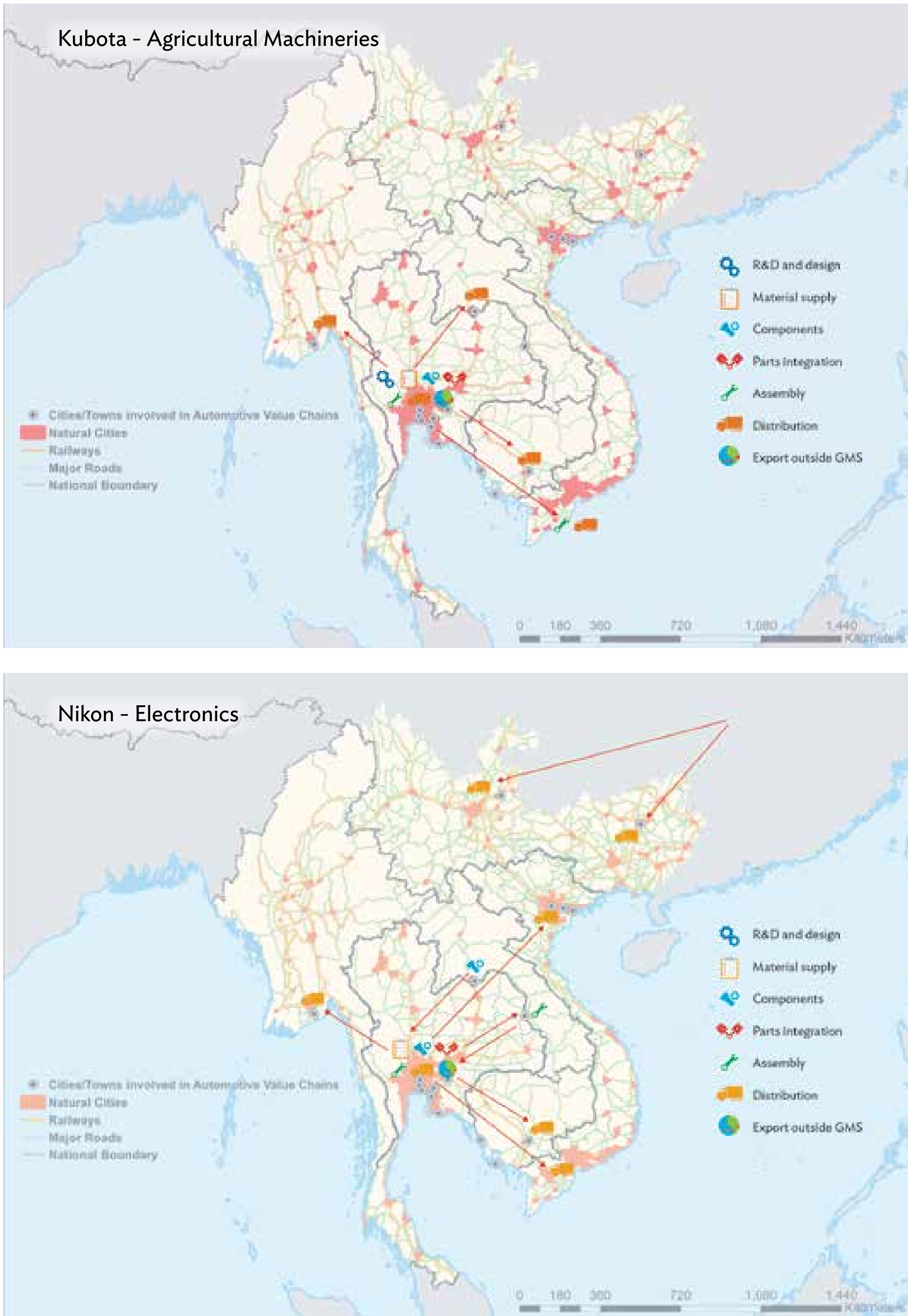

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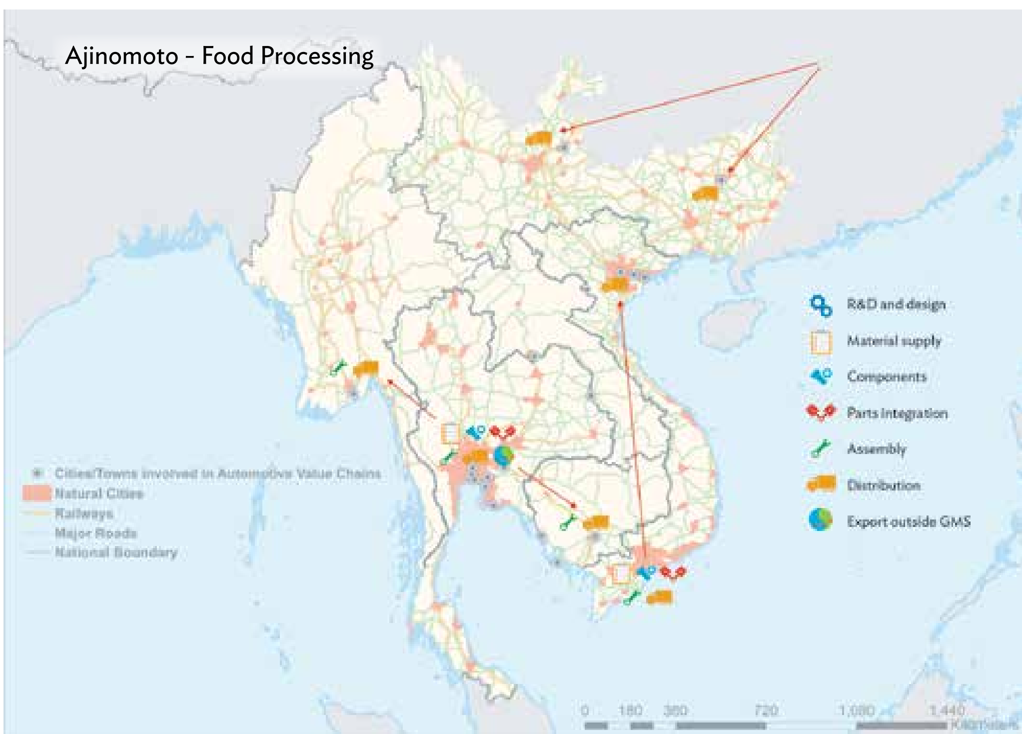
Figure 19.2 *continued*

(c) Apparel and Food Processing



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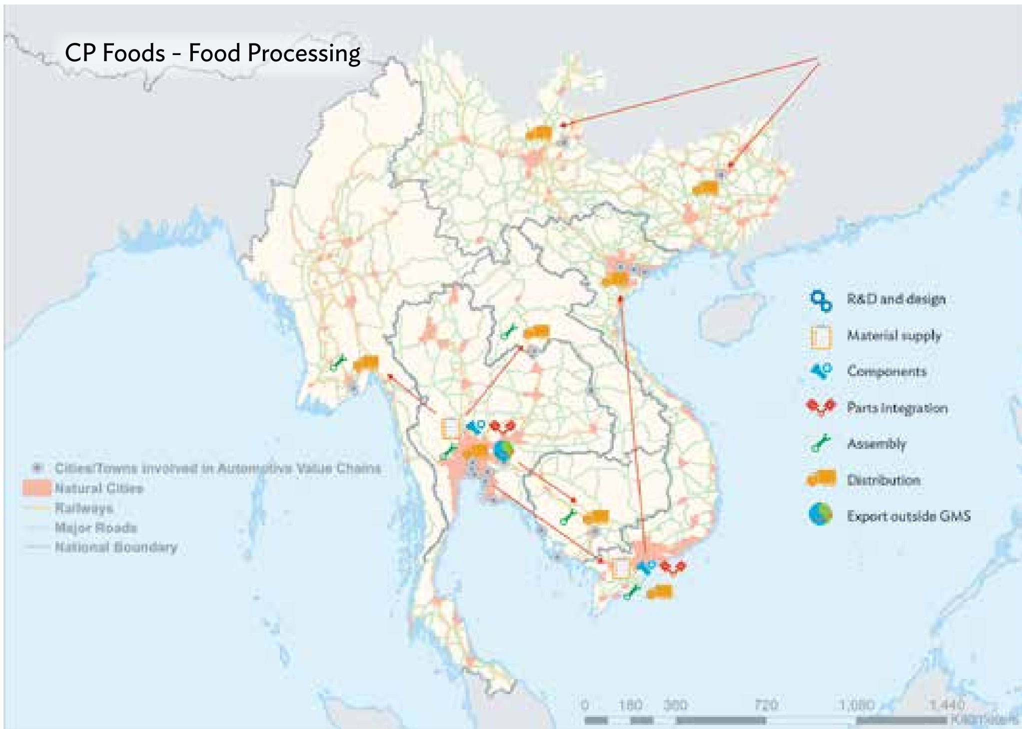


ADB = Asian Development Bank, ASEAN = Association of Southeast Asian Nations, GMS = Greater Mekong Subregion, R&D = research and development.

Sources:

Panel (a): ADB based on Abe (2013); ASEAN–Japan Centre (2020); Kobayashi (2017); Kobayashi and Jin (2013); Auto-Che (http://auto-che.com/p/yunnan.html); Lao Investment Promotion Department (2020); and Denso (https://www.denso.com/global/en/news/news-releases/2017/20171204-g01/).

Panel (b): Nikon (https://www.nikon.co.jp/corporate/profile/group/#oversea); Tokyo Coil Engineering (https://www.tokyocoil.com/en/company-en/access-en); and Kubota (https://www.kubota.com/network/).

Panel (c): Garment Manufacturers Association in Cambodia (https://www.gmac-cambodia.org/our_member); Wonderland Laos (http://wonderlandlaos.blogspot.com/p/blog-page_96.html); Myanmar Textile and Garment Industry Guide (https://www.textiledirectory.com.mm/); Yellow Pages listings of Viet Nam garment factories (https://www.yellowpagesvn.com/tagclass/40112370/garment-manufacturing-companies-in-vietnam.html); and Ajinomoto (https://www.ajinomoto.com/aboutus/group/global_network).

Viet Nam's involvement in global automotive production has also increased substantially in the last 5 years. However, production has been concentrated in low-technology products such as tires, seats, glass, batteries, and cable harnesses, rather than engines and transmission systems (Dezan Shira & Associates 2020). This may change with large investments into integrated automotive production from Thaco and Groupe PSA in the central region's Quang Nam province in anticipation of greater domestic demand (EIU 2019).

Cities in Cambodia, the Lao PDR, and Myanmar are relative late comers in the automotive production chain and their participation has mostly been driven by foreign investments. Cambodia was initiated into automotive production through a Korean cable company in 2005. Production capacities for auto assembly and parts such as cables, lights, lighting poles, lighters, and electrical parts received a large boost from the Thailand Plus One Strategy of Japanese automotive and electronic firms in their efforts to mitigate production risks in the aftermath of the 2011 Bangkok floods (Tongurai and Fujioka 2018). Nonetheless, the entire production chain remains tightly linked among GMS cities. In the case of Cambodia, components are mostly produced in Phnom Penh and to a lesser extent in Bavet City near the border with Viet Nam, which are then exported to other GMS members. Figures from 2012 to 2016 reveal Thailand (54%), the PRC (15%), and Viet Nam (2.6%) to be among the top five destinations for Cambodia's exports of electronic components (Seyhah and Vutha 2019).

The production network for agricultural machineries and electronics is typified by Kubota Corporation and Nikon in panel (b) of Figure 19.2. Kubota is a global company known for its tractors and other farm equipment. Nikon, on the other hand, is known for its precision technologies, especially in opto-electronics. Their spatial production networks tend to follow the automotive network because of overlaps and commonalities in parts and production processes involved.

Apparel production networks represented in panel (c) of Figure 19.2 show a more geographically diffused distribution of tasks, where designs could come from Bangkok, Guangxi, Ha Noi, and Ho Chi Minh City, while materials, components, assembly, and local and global marketing are carried out in many GMS cities. An exception is the Lao PDR, where exporters who are mostly in Vientiane have activities that are mostly limited to assembly and exporting (ERIIT 2018).

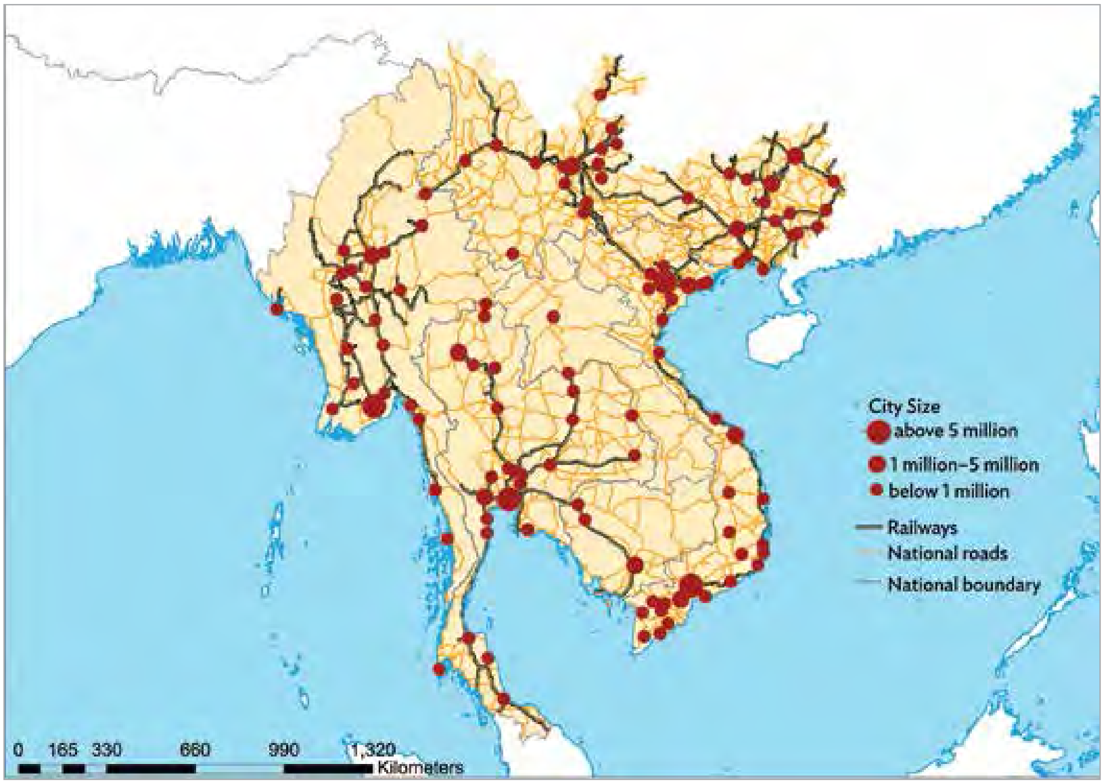
Production networks for food processing are illustrated through the examples of Ajinomoto and the CP Food Group. Bangkok and Ho Chi Minh City figure prominently as activity hubs in the food processing industries, while most other GMS cities are primarily engaged in assembly, packaging, and local distribution. Meanwhile, food processing activities in Guangxi and Yunnan are more tightly linked to the rest of the PRC than to the other GMS economies.

As in the case of intercity relationships within national economies, the GMS-wide production links among GMS cities is made possible and spurred by transport infrastructure, which reduce a variety of costs. Greater possibilities for trade through lower transport costs makes specialization viable and creates opportunities to reorganize supply chains. More established industries in Thailand, Viet Nam, Guangxi, and Yunnan can outsource more standardized production processes to relative latecomers into the global value chain (GVC) trade, such as Cambodia, the Lao PDR, and Myanmar, where costs of production are likely lower.

Figure 19.3 shows the major road and rail networks that connect key GMS cities with one another. Region-wide connectivity through transport is in fact a fundamental component of the GMS Economic Cooperation Program. The co-location of key border crossings with cities and townships point to the potential of particular locations in enhancing production relationships across the GMS.

However, notwithstanding the extensive GMS road network, there are bottlenecks within the road system that stem from poor road quality (ADB 2016). For example, a major arterial link from Bangkok to Dawei in Myanmar, identified as part of the Southern Economic Corridor, remained unpaved in 2019 (Ishida 2019). Moreover, the GMS-wide railway system remains relatively underdeveloped in comparison to other country groups with contiguous land mass (ADB 2016). This has tangible consequences for production location choices and, consequently, for its networks. For example,

Figure 19.3: Greater Mekong Subregion Major Road and Rail Network



Note: City size refers to natural city population identified from nighttime lights.

Source: Asian Development Bank estimates using nighttime lights images from the National Oceanic and Atmospheric Administration (accessed 1 April 2017 and 10 August 2018), grid population data from LandScan Datasets of the Oak Ridge National Laboratory (accessed 31 August 2017 and 31 August 2018), and roads and railways from OpenStreetMap (accessed 4 April 2019).

while Thailand is the top destination for Cambodia's electronics parts and subassembly components, manufacturers in Cambodia choose to locate in Phnom Penh or Bavet City, which are more than 700 kilometer (km) and 840 km away from Bangkok, respectively. Few firms locate in the special economic zone in Poipet City near the border with Thailand, which is just 260 km away from Bangkok because of transport issues (Seyhah and Vutha 2019). A geographically more efficient production configuration may occur with the opening of the Poipet, Cambodia–Aranyaprathet, Thailand railway line for commuters in 2019 and for freight in 2020.[99]

While roads and rails form a majority of cross-GMS trade transport, navigation along the Mekong River also offers a potential for supporting the GVC production network. This could be particularly important for the landlocked the Lao PDR, where even for a vessel of small size, inland water transport could be almost four times cheaper in US dollar per 1,000 ton-kilometer than road transport between Luang Prabang and Simao in the PRC. The cost savings for inland water transport between Simao

[99] Royal Railways (Cambodia) Phnom Penh–Poipet Line. https://railtravelstation.com/royal-railway-cambodia/phnom-penh-poipet-line/.

and Chiang Kong, Thailand and between Phnom Penh and Cai Mep, Viet Nam are smaller, but still substantial at about half the cost of road transport (Mekong River Commission 2016). Inland water transport is particularly suited for transporting bulky and heavy products, such as petroleum and cement, which are likely to benefit the most from scale transport. However, the navigational limits of rivers mean that using inland water transport requires multimodal connections that allow for interface between different transport modes and their associated cargo-handling facilities. For example, the inland river port of Phnom Penh is connected to the seaport of Sihanoukville by a 226 km highway and a 269 km rail line (Mekong River Commission 2016). This Phnom Penh-Sihanoukville transport corridor accounts for 75% of Cambodia's trade traffic (World Bank 2014b). Yet freight forwarders complain that the costs of moving containers between the two ports through rail is similar to using lorry all the way because of deficits in last-mile services, such as multimodal freight transfer facilities on both ends (Railway Gazette International 2019).

Development of transport and communication infrastructure that affects the costs of setting up a production network in different locations are closely followed by businesses, who are key driving forces in the geographical configuration of GMS production networks. A majority of the electronics and garments production in Cambodia and the Lao PDR have been established within special economic zones by companies from Japan, the PRC, and the Republic of Korea and lately from Thai and Vietnamese firms (ERIIT 2018; Seyhah and Vutha 2019). These investments started mostly from a reconfiguration of production stages and locations within a single company, but are increasingly becoming joint ventures or arms-length in nature over time (Elms and Low 2013). This has important implications on the opportunities of cities to specialize and develop capabilities in products and services beyond the confines of the firm that introduced them.

19.4 Conclusions

Cities exist and, moreover, function as economic centers within a network of places within a country. Economic vibrancy in cities as well as in small towns and rural areas require that infrastructure and policies recognize the interdependence of this portfolio of places. Two key elements underpin the dynamism of these spatial relationships. The first is physical connectivity through transport infrastructure, and the second is institutions for coordinating decisions and plans across cities and administrative units. These elements become ever more important as city systems in the GMS mature and exhibit greater functional specialization.

In the GMS, the interdependent nature of cities goes beyond national boundaries and cuts across the entire region as demonstrated in the value chain of production of automotive parts, electronics, food processing, and apparel manufacturing. Securing and sustaining the role of the GMS as a key player in the GVC trade entails investments in connectivity infrastructure, both hard and soft, which must be coordinated sequentially and geographically for optimal production configuration. To this end, the GMS benefits from having a forum that has existed for close to 30 years to coordinate its plans and policies.

The chapter concludes by echoing the recommendations arising from Chapter 18 in emphasizing core infrastructure investments in key GMS cities and towns with a forward-looking view of their likely role in the spatial distribution of production activities. Anticipatory regulations and investments in younger and smaller towns can prevent the negative effects of congestion such as traffic, environmental degradation, and informality, which are extremely expensive if not impossible to reverse once they become entrenched. Good connections among large agglomerations, smaller cities and towns, and rural areas within a country are key to reducing the costs of setting up a geographically dispersed network of production activities that enables economies to arrive at a more efficient and sustainable, specialized, and productive allocation of activities across space. This must be supported by spatially neutral policies that enable the convergence of living standards across the board, even for places where economic activities may be thin. As the various stages of a production process cross national economies in the GMS, cost-reducing investments must be coordinated geographically and sequentially to attain optimal returns from them. To this end, the GMS has the benefit of a forum that has existed for close to 30 years to coordinate its plans and policies.

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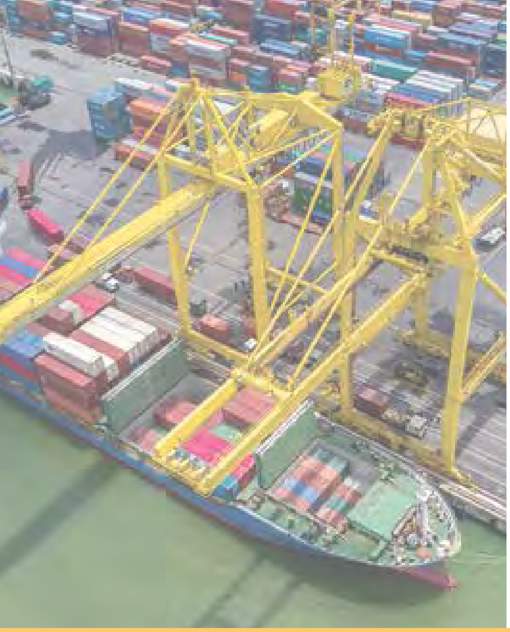


PART 3

THE NEED TO IMPROVE THE QUALITY OF ROAD INFRASTRUCTURE AND CONNECTIVITY TO ENHANCE TRADE INTEGRATION AND CONNECT COMPETITIVE CITIES

Chapter 20

Evaluating Road Connectivity in the Greater Mekong Subregion Using Online Routing Systems

20.1 Introduction

The major goal of the Greater Mekong Subregion (GMS) program is to assist GMS members to achieve economic growth through cross-border subregional cooperation. Logistic infrastructure development, especially roads, lies at the heart of this program. Better road connectivity is generally understood to be beneficial for economic development. In this respect, the GMS program has contributed to the rapid expansion of total road length in the subregion since the 1990s. Nonetheless, the quantity and quality of the existing roads are very different among GMS members. To assess road connectivity in the GMS, this chapter uses information on actual road distance against the shortest possible distance between districts as well as the time and average speed needed to travel between districts. These measures, calculated at the national and district levels, are taken to be proxies for road quality.

This is a data-intensive task because the number of pairs of districts (i.e., at a subnational level) even in a small country like Cambodia can exceed 10,000. For example, Cambodia has 176 districts based on the latest database of global administrative boundaries (GADM).[100] Therefore, the number of all possible pair distances is (176*175)/2=15,400. This is a large number, and it is not difficult to see the significant financial and time costs of driving between all of the district pairs. It becomes impossible for a driver on the ground to identify the shortest distance between such a large number of districts. This chapter proposes a way to measure these distances by using online tools with very minimal financial and time costs.

In particular, this chapter shows how OpenStreetMap (OSM)-based online routing systems can be used to evaluate the degree of connectivity and the quality of roads at the national and district levels. Although the analysis examines only road infrastructure, the same methodology may be applied to other modes of transport, i.e., railway, maritime, and air using other free or commercial online routing services such as Google Maps (Google), Bing (Microsoft), Maritime Traffic, FlightRadar24, etc. The financial and time costs of using such paid services would still be much lower than actual field surveys. Likewise, the chapter does not undertake an analysis of multimodal transport. Railway transport is still largely a domestic service within the GMS. There are currently only two scheduled cross-border

[100] The GADM database for use in geographic information system software is available at https://gadm.org/.

passenger and cargo trains, one between Thailand and the Lao PDR and the other between Viet Nam and Guangxi. There is not much that can be analyzed in the context of the GMS. The same holds for multimodal transport analysis involving air routes. The importance of multimodal transport in actual connectivity is indisputable. Multimodal transport networks that facilitate access to a limited number of industrial agglomerations and major international ports would undoubtedly strengthen the connectivity among regions in the GMS and with the rest of the world.

20.2 OpenStreetMap and Road Connectivity Evaluation

OpenStreetMap is a free, editable map of the whole world built and maintained by volunteers largely from scratch and released with an open-content license.[101] OSM started in the United Kingdom in 2004. Since then, it has expanded rapidly. Spatial information such as the shape of roads, buildings, and points of interest has been added by volunteers around the world. As of March 2020, there were about 6 million registered users worldwide, out of which about 5,000 actively contribute to update OSM by uploading or editing spatial data daily. Many noncommercial online routing systems have been developed based on OSM data. Because of OSM, it has become possible to identify road distance and even the expected time needed to travel between virtually any two points within the GMS. Although the quality of OSM is not always the same as that of major commercial online routing systems such as Google Maps or Bing (Microsoft), it is accurate enough in most cases, thanks to the vast amount of spatial data available from the widespread use of GPS-equipped mobile devices. The online routing system used with OSM data in this chapter is the Open Source Routing Machine (OSRM).[102]

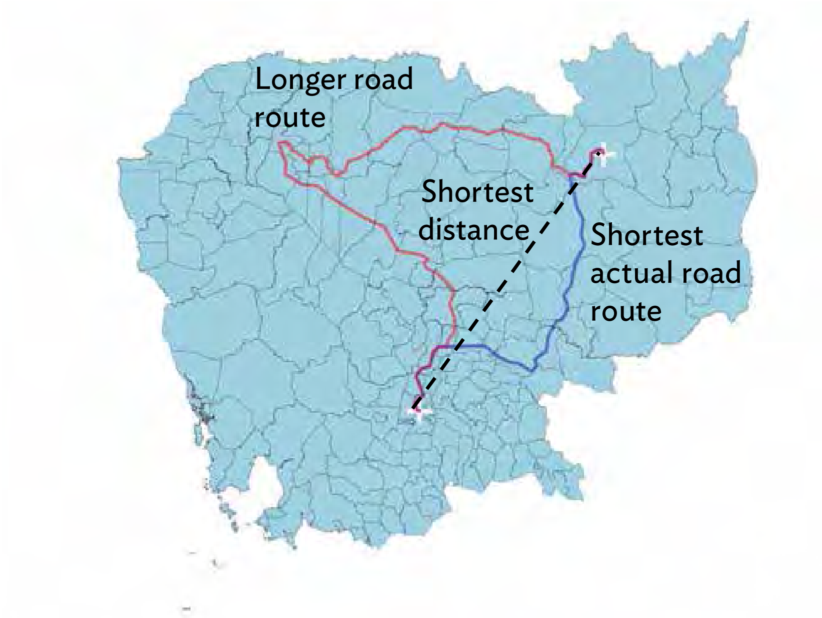
Online routing systems based on OSM provide two types of information that are important to evaluate road connectivity. First, it provides actual routes, i.e., road distance, connecting any pair of origin and destination. Straight-line distance is often used as a proxy for the best possible connectivity between two regions, districts, countries, etc. Such an indicator of connectivity is static, representing the shortest distance, and may not reflect the reality on the ground. Figure 20.1 shows three possible routes connecting Phnom Penh, Cambodia's capital, and a district in the country's northeast. The red and continuous blue lines show two possible routes, the red one being much longer. The continuous blue line is the shortest actual road route. The dashed blue line is the shortest possible distance between Phnom Penh and the district. The analysis in this chapter is based on comparing the continuous blue line to the dashed blue line. The ratio of actual road distance (continuous blue line) to the straight-line distance (dashed blue line) reveals how close the existing road is to the best possible route.

In addition to routes, most online routing systems also provide information on trip duration (based on information such as road surface type), elevation, etc. This information can be used to evaluate the quality of the road.

[101] About OpenStreetMap: https://wiki.openstreetmap.org/wiki/About_OpenStreetMap.

[102] OSRM is available at http://project-osrm.org/.

Figure 20.1: Shortest versus Actual Road Distance



Source: Authors' illustration based on database of global administrative boundaries and Open Source Routing Machine.

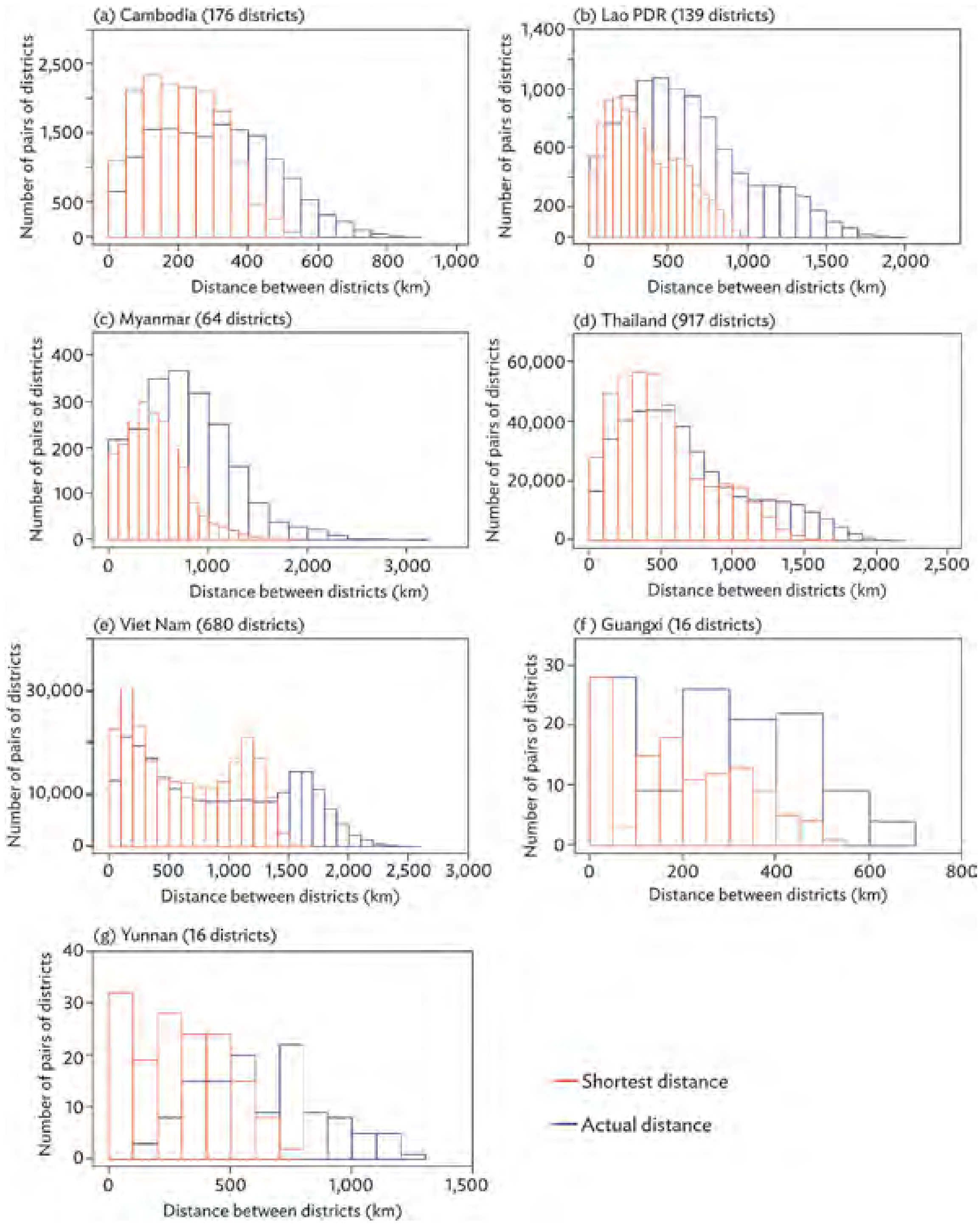
20.3 Shortest versus Actual Road Distances

As mentioned, one way to evaluate the degree of road connectivity is to compare the actual road distance between any two regions (at a subnational level) against the shortest distance, i.e., a straight line between them. We can consider the straight-line distance as the best-case scenario, since no road above ground is shorter than that straight line. The degree of connectivity can therefore be computed by taking the ratio of the actual road distance to the straight-line distance. Overall, the smaller the ratio between actual and shortest distances, the better connected a region is with other regions. This ratio is a positive number equal to or greater than one. In other words, actual road distance is always equal to or longer than the straight-line distance.

Panels (a)–(g) in Figure 20.2 show histograms of the number of district pairs at different distances, for both actual road distance (blue bars) and shortest distance (green bars, dashed line in Figure 20.1).[103] For example, the first bar in panel (a) shows that Cambodia has 1,104 pairs of districts connected by a straight line within 50 kilometers (km) from each other, but only 647 pairs of districts within this range are connected by actual roads (like the continuous blue line in Figure 20.1). When districts are much farther from each other, the number of district pairs connected by actual roads becomes greater than the number connected by straight lines. At a distance of 350 km–400 km between districts, for example, there are 1,089 pairs of districts connected by a straight line but

[103] The number of districts shown is based on the latest GADM data.

Figure 20.2: Shortest versus Actual Road Distance between Districts in the Greater Mekong Subregion



km = kilometer, Lao PDR = Lao People's Democratic Republic.

Note: Island districts not connected by bridge to the main land are excluded.

Source: Authors' calculations based on database of global administrative boundaries and Open Source Routing Machine.

1,550 pairs of districts connected by actual roads. Further to the right, the graph shows that there are no pairs of districts connected by a straight line that are within 600 km–650 km of each other, but there are 314 pairs of districts within this range connected by actual roads.

The difference between the number of blue and red pairs of districts depends on the availability of roads, which in turn depends on characteristics such as the landscape and the shape of the territory of each country. It is more difficult to construct straight-line roads in a mountainous landscape (e.g., the Lao PDR) than in a flat area (e.g., Cambodia and Thailand). Likewise, the geometric shape of a territory would also make constructing straight-line roads difficult. For example, Viet Nam is long, narrow, and curved, implying that a straight-line road would have to cross into another country. Domestic roads connecting districts in the north and south of Viet Nam would have to stretch through a long and winding territory. Inevitably, these roads would have to be substantially longer than straight-line roads.

The comparison between actual and straight-line roads can be further appreciated by looking once again at the graphs in Figure 20.2. In Cambodia, for example, the longest distance between two districts connected by a straight line is 600 km (last blue bar), while the longest actual road distance between two districts is 900 km (last red bar), that is, a 50% difference. For Viet Nam (panel (e)), this ratio is 53%, slightly larger than Cambodia's. In the mountainous areas of the GMS, the ratio is much higher: in the Lao PDR (panel (b)), Myanmar (panel (c)), and Yunnan (panel (g)); the corresponding differences are 81%, 85%, 62%, respectively.

A summary of the ratios of average actual distance to average shortest distance, as well as the number of districts in each GMS member, is shown for all members in Table 20.1.

Table 20.1: Ratio of Actual Road to Shortest Distance between Districts in the Greater Mekong Subregion

	Cambodia	Lao PDR	Myanmar	Thailand	Viet Nam	(PRC) Guangxi	(PRC) Yunnan
Average road distance/ average shortest distance	1.46	1.73	1.66	1.33	1.41	1.40	1.72
Number of districts	176	139	63	917	680	16	16

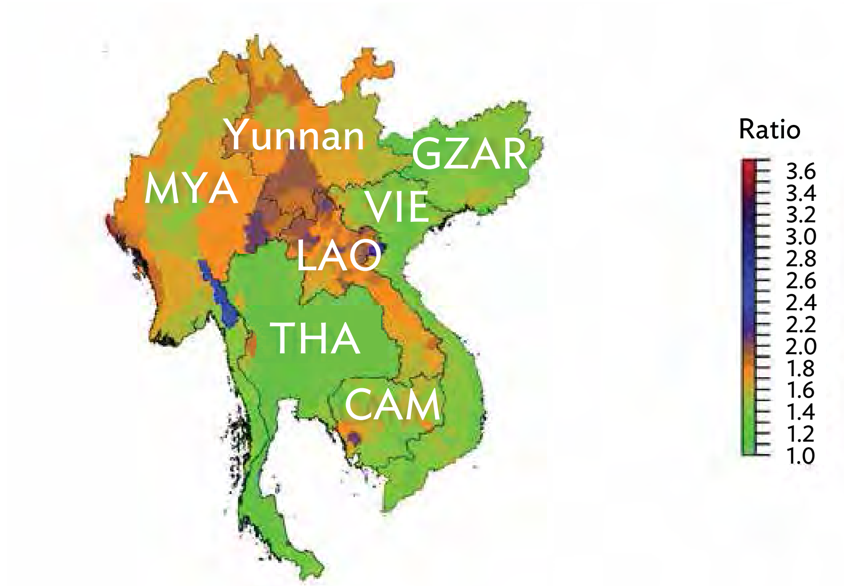
Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Authors' calculations based on database of global administrative boundaries and Open Source Routing Machine.

The table shows that Thailand has the lowest ratio. This is followed by Guangxi and Viet Nam, where average actual road distance is about 40% more than the average straight-line distance. Despite having similar ratios, Guangxi's per capita GDP was more than double Viet Nam's per capita income in 2017, so road connectivity does not seem to depend exclusively on the level of income. Cambodia has the next highest ratio and, although road infrastructure development is still at an early stage in Cambodia, average road distance is just 46% more than the average straight-line distance. This is probably due to the near-circumference shape of its territory and a less mountainous landscape than the Lao PDR, Myanmar, and Yunnan, where average road distance is longer than the shortest distance by 73%, 72%, and 66%, respectively. The mountainous landscape in these areas is likely the main reason for the lack of more direct roads rather than income. Yunnan's per capita GDP, for example, was almost twice that of Viet Nam in 2018, but Yunnan is well-known for its mountainous landscape. The average elevation in Yunnan is about 2,000 meters, with the highest point at over 5,000 meters above sea level.

Figure 20.3 shows, with different colors, the average ratios of road distances to straight-line distances by district for each member of the GMS.

Figure 20.3: Ratio of Road Distance to Straight-Line Distance in the Greater Mekong Subregion by District



CAM = Cambodia, GZAR = Guangxi Zhuang Autonomous Region, LAO = Lao People's Democratic Republic, MYA = Myanmar, THA = Thailand, VIE = Viet Nam.

Source: Authors' calculations based on database of global administrative boundaries and Open Source Routing Machine.

Cambodia

The degree of road connectivity by district in Cambodia varies between 1.33 (33%) and 2.02 (102%). Connectivity with the rest of the country is poor in the northeastern and southwestern parts of the country. This roughly corresponds to the poorer and mountainous districts of the country.

Lao People's Democratic Republic

The ratios of road distance to straight-line distance in the districts of the Lao PDR are relatively higher than in Cambodia, varying between 1.50 (50%) and 2.20 (120%). As expected, connectivity is worse in the mountainous northern parts of the country. Total road distance is at least twice the total of the shortest distances in many northern districts. There is a significant gap between the better-connected western parts of the country and the worse-connected eastern parts.

Myanmar

The gap between the better- and the worse-connected districts is largest in Myanmar in the GMS. Connectivity by district varies between 1.38 (38%) and 3.63 (263%). This means that, for some districts, the sum of road distances to all other districts is nearly three times the sum of all straight-line distances.

Thailand

The average level of connectivity in Thailand is the best in the GMS. However, there are a few districts along the areas bordering Myanmar where connectivity is between 1.6 (60%) and 1.8 (80%). Connectivity is also generally worse in areas bordering Cambodia and the northern districts of the Lao PDR.

Viet Nam

The degree of connectivity by district in Viet Nam varies between 1.3 (30%) and 1.87 (87%). The coastal areas are generally well-connected, whereas the mountainous western areas bordering the Lao PDR are not as well-connected with the rest of the country.

Guangxi and Yunnan

Guangxi has the smallest variation in connectivity in the GMS. Its ratios are between 1.29 (29%) and 1.53 (53%), thus the variation between the best- and worst-connected district is only about 24%. The variation in Yunnan is also not very large, about 36%, where the ratios are between 1.54 (54%) and 1.90 (90%). However, most districts in the western parts of Yunnan are not well-connected, the result of poor average connectivity in the province.

20.4 Road Quality in the Greater Mekong Subregion

The analysis in the previous section shows how close the actual roads are to the shortest possible distance. This information is very useful, but it does not say anything about the quality of the roads. To evaluate quality, the analysis uses the time matrix of trips between all districts within each GMS member as well as selected members of the European Union (EU). For comparison purposes, the analysis computes the average speed in Table 20.2. The average speed (km/h) is derived by dividing the straight-line distance (km) by the number of hours (h) it would take to travel on the actual road. This captures both how close the existing road is to the shortest distance and the quality of the road.

The table shows that, in Germany, the average straight-line distance of all pairs of districts is about 304 km, and it takes on average 4 hours to drive this distance, at an average speed of about 73 km/h. The average travel speed is about the same for France. The average travel speed is about 60 km/h and above in other EU countries, except in Bulgaria (48 km/h).

On the other hand, the highest average speed in the GMS is about 57 km/h in Guangxi. Thailand is the only other GMS member besides Guangxi where average speed is over 50 km/h. Average speed in the Lao PDR and Myanmar is 29 km/h and 31 km/h, respectively, much lower than in Bulgaria. Overall, the quality of GMS roads is far behind that of the EU.

Table 20.2: Average Shortest Distance, Average Time, and Average Speed between Districts in the Greater Mekong Subregion, and in Selected European Union Countries

Country/Province	Average Straight-Line Distance (kilometer)	Average Time (hour)	Average Speed (km/h)
Germany	303.67	4.02	72.93
France	403.41	5.51	72.57
Sweden	379.21	5.70	64.65
Italy	447.35	7.20	63.76
Belgium	82.24	1.26	63.45
Austria	182.78	2.97	59.42
(PRC) Guangxi	237.95	4.08	57.17
Thailand	504.58	9.22	53.07
Bulgaria	189.74	3.84	47.99
(PRC) Yunnan	340.66	8.42	41.02
Viet Nam	641.86	17.43	35.22
Cambodia	212.20	6.27	33.07
Myanmar	489.18	17.55	30.73
Lao PDR	362.93	12.62	28.52

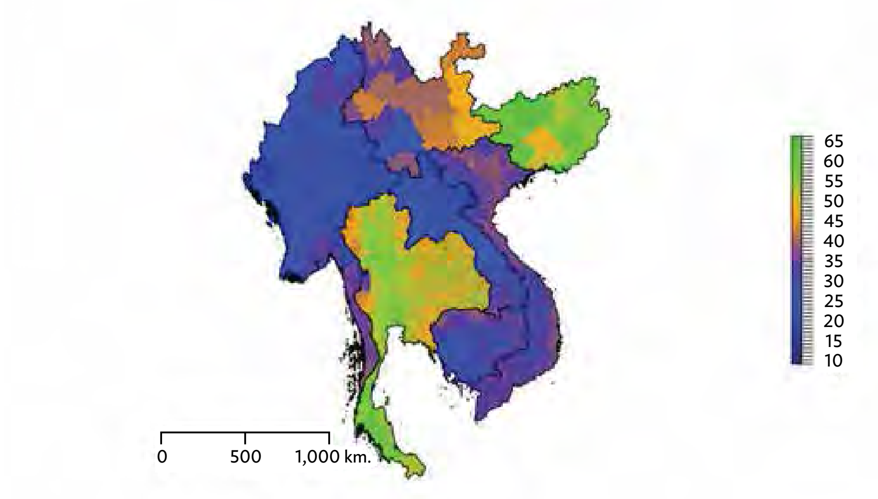
km/h = kilometer per hour, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Note: Straight-line distance, time, and speed are averaged separately. This means that average time multiplied by average speed is not equal to average distance.

Source: Authors' calculations based on database of global administrative boundaries and Open Source Routing Machine.

Figure 20.4 shows average travel speed to other districts within each GMS member. For members that have many districts with poor connectivity, average speed is low because it is the average of travel to all other districts. This is true for Cambodia, the Lao PDR, Myanmar, and Viet Nam. For Thailand, districts in the middle of the country from north to south have better access to all other districts.

Figure 20.4: Average Travel Speed between Districts in the Greater Mekong Subregion

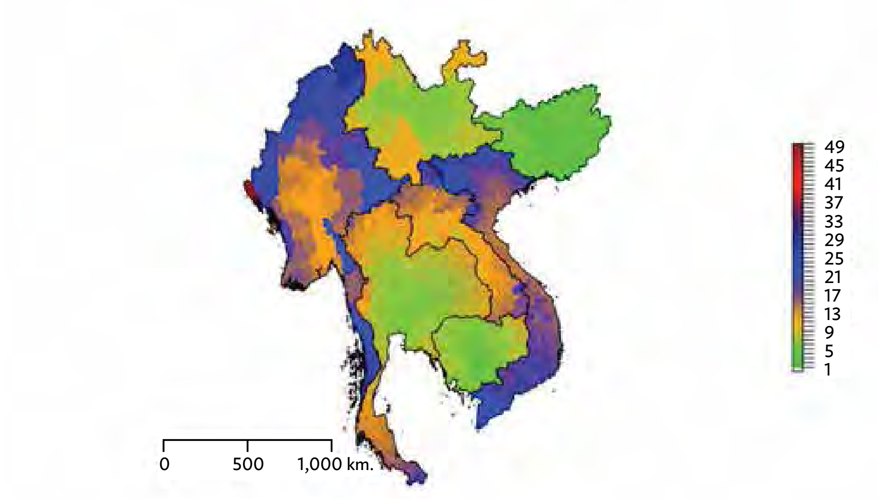


km = kilometer.

Source: Authors' calculations based on database of global administrative boundaries and Open Source Routing Machine.

Finally, Figure 20.5 shows the average travel time to other districts within each GMS member. There are district pairs in the GMS where average travel time exceeds 24 hours. This is the case in some pairs of districts in the Lao PDR, Myanmar, and Viet Nam, whose territories stretch from north to south with significant mountainous areas. The average travel time to other districts in Cambodia is well below 24 hours because of its near-circumference shape and less mountainous landscape.

Figure 20.5 : Average Travel Time between Districts in the Greater Mekong Subregion



km = kilometer.

Source: Authors' calculations based on database of global administrative boundaries and Open Source Routing Machine.

20.5 Conclusions

The analysis in this chapter has shown how an online routing service can provide an efficient tool to evaluate connectivity at the subnational level. The analysis shows that problems of connectivity between districts in the GMS arise from two sources. The first is the lack of roads closer to the straight-line distance between two districts. This is especially true for districts with difficult landscapes. This by no means suggests that there should be straight-line road connections between any two pairs of districts in the GMS. That would be extremely inefficient and harmful to the environment if substantial natural landscapes had to be cleared to make way for roads. In fact, it is mostly normal for travel distances to be substantially higher than the straight-line distance between districts close to one another. However, the road network must be considered very inefficient if one has to travel, for example, 600 km between districts that are only 300 km apart.

The second source of connectivity problems is the poor quality of the road system. The quality of road the system is significantly worse than that in developed countries, especially for GMS members with relatively low per capita income, such as the Lao PDR, Myanmar, and Cambodia. The quality of Thailand's road system is significantly better than that of the rest of the GMS except Guangxi; but it is only a little better than Bulgaria's in the EU when it comes to connectivity between districts within a country.

Chapter 21

Greater Mekong Subregion Connectivity with Major Markets

21.1 Introduction

Connectivity is a cornerstone of regional economic cooperation and integration (UNESCAP 2014). Being connected to major markets is essential for a subnational region such as a district to prosper economically. In this chapter, the analysis investigates the connectivity of districts to major markets in the Greater Mekong Subregion (GMS) using online routing systems data based on OpenStreetMap. The degree of connectivity between a district and a major market is evaluated using three measures: (i) comparing actual road distance to the distance over a straight line, (ii) expected travel time, and (iii) average speed. Information is obtained from online routing systems for each pair of origin and destination. The ratio of road distance to straight-line distance reveals how close the existing road infrastructure is to the shortest possible distance between the origin and the destination. Travel time and speed provide additional information on the quality of the roads.

Specifically, the chapter examines the connectivity of each district to its own capital city, which is often the largest domestic market. It then assesses how connected the districts are to all other GMS capitals. The chapter also analyzes the districts' connectivity to major international ports in the GMS. Ports are the most efficient gateway through which GMS districts can trade with the world. Finally, the chapter estimates market potential at the district level.

21.2 Connectivity with Own Capital City in the Greater Mekong Subregion

This section examines the connectivity of each of the 2,050 districts in the GMS with their own capital cities. These are Phnom Penh, Vientiane, Yangon (instead of Myanmar's new capital Nay Pyi Taw), Bangkok, Nanning, Kunming, and Ha Noi. Due to its economic relevance, Ho Chi Minh City in Viet Nam is added to this list. The number of districts in the global administrative boundaries (GADM) database at level 2 is 2,050.

Table 21.1 provides the ratio of actual road distance to straight-line distance in the GMS and selected members of the European Union (EU). The best possible case is a ratio of one.

In the EU, the results indicate that the ratio is slightly above 1.3 in mountainous Italy and Austria, and it is significantly higher in Bulgaria, the member with the lowest per capita income. The ratio among EU members with normal elevation, such as Germany and France, is just below 1.3. This is the benchmark that the GMS members should aim to achieve by adding new roads that are closer (than the actual ones) to the straight-line distance in order to lower their ratios.

The average in the GMS is currently about 1.47, with only Thailand having cleared the benchmark of 1.3. The ratio is significantly higher than the benchmark in the Lao PDR, a mountainous and poor country, as it is in Yunnan, which is also mountainous but significantly richer. The ratio is 1.39 in Cambodia, lower than in Viet Nam and the average of the GMS, but this is likely the result of its flat landscape and near-circumference shape of its territory. In short, Table 21.1 shows that more roads closer to the straight-line distance are still needed in the GMS. The exception is Thailand, where the problem is road quality or other factors such as congestion.

Table 21.1: Ratio of Road Distance to Straight-Line Distance in the Greater Mekong Subregion and Selected European Union Countries

GMS	Cambodia	Lao PDR	Myanmar	Thailand	Viet Nam	(PRC) Guangxi	(PRC) Yunnan
To the capital city	Fair	Poor	Fair	Good	Fair	Fair	Poor
Average	1.39	1.71	1.48	1.25	1.41	1.49	1.60
Minimum	1.05	1.21	1.16	1.11	1.15	1.16	1.33
Maximum	2.09	4.80	3.73	2.46	2.50	1.92	1.95
Europe	**Austria**	**Belgium**	**Bulgaria**	**France**	**Germany**	**Italy**	**Sweden**
To the capital city	Fair	Fair	Poor	Good	Good	Fair	Fair
Average	1.34	1.27	1.60	1.28	1.27	1.37	1.28
Minimum	1.17	1.15	1.10	1.11	1.11	1.15	1.11
Maximum	1.62	1.49	7.49	1.79	1.78	2.17	2.08

EU = European Union, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Note: Qualitative ranking is based on average values: 1.00–1.25 = good, 1.26–1.50 = fair, and 1.51 or higher = poor.

Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

Since it is not easy to show the ratios for all 2,050 GMS districts in one table, Figure 21.1 instead shows the ratios of road distance to straight-line distance for each district in the GMS on a map. The map provides information not only on the location of the districts that lack shorter roads to connect to the capital, but also to what extent it lacks this connectivity. Figure 21.1 shows that there is substantial room for improvement in western and eastern Myanmar, northern Lao PDR, several parts of Cambodia, and Guangxi and Yunnan.

In order to evaluate the quality of the road network as well as congestion, the analysis compiles information on connectivity based on the time and average speed needed to travel from each district

Figure 21.1: Ratio of Road Distance to Straight-Line Distance between Each District and Its Own Capital in the Greater Mekong Subregion
(Phnom Penh, Vientiane, Yangon, Ha Noi, Ho Chi Minh City, Bangkok, Nanning, and Kunming)

km = kilometer.

Note: The white background for Kunming and Nanning is produced by the software when calculating the distance to itself, which is zero. The white background also appears in the other capitals but is not visible.

Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

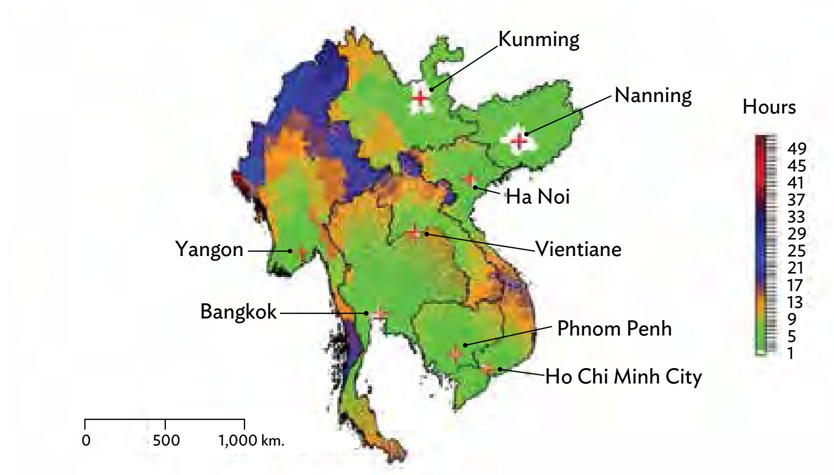
to the capital city. Figure 21.2 shows the time needed to travel from each of the 2,050 districts in the GMS to their respective capitals. In Guangxi, the maximum time needed among its 16 districts is 6 hours. This is followed by Yunnan with 11 hours, Cambodia with 13 hours, and Thailand with 15 hours. It takes up to 20 hours to travel from some districts in the Lao PDR and Viet Nam to their capitals, even though they might be only a few hundred kilometers away by straight-line distance. Finally, in Myanmar, travel time to the capital is over 50 hours.

Figure 21.3 illustrates the average travel speed needed to reach the capital city. In general, the average speed for districts around the capital is low as a result of congestion. This is true even for Bangkok, which has the best road network in the GMS. Average speed increases for districts farther away from Bangkok. This is not the case for Cambodia, the Lao PDR, Viet Nam, and Myanmar, where the average speed remains low for districts farther away from the capital.

Tables 21.2 and 21.3 summarize the time, distance, and average speed to reach the capital cities in the GMS and selected EU countries. Average speed is about 50 kilometers per hour (km/h) in Cambodia, the Lao PDR, Myanmar, and Viet Nam. The average increases to about 70 km/h in Thailand, Guangxi, and Yunnan. Average speed is about 66 km/h in Bulgaria, lower than the average speed for the selected EU countries, about 85 km/h. The highest average speed to the capital is almost 100 km/h in Germany. In short, the key to improving connectivity between districts and the capital city in the GMS lies in adding roads close to the straight-line distance in districts with mountainous landscapes.

Figure 21.2: Time Needed to Reach the Capital from Each District in the Greater Mekong Subregion

(Phnom Penh, Vientiane, Yangon, Ha Noi, Ho Chi Minh City, Bangkok, Nanning, and Kunming)



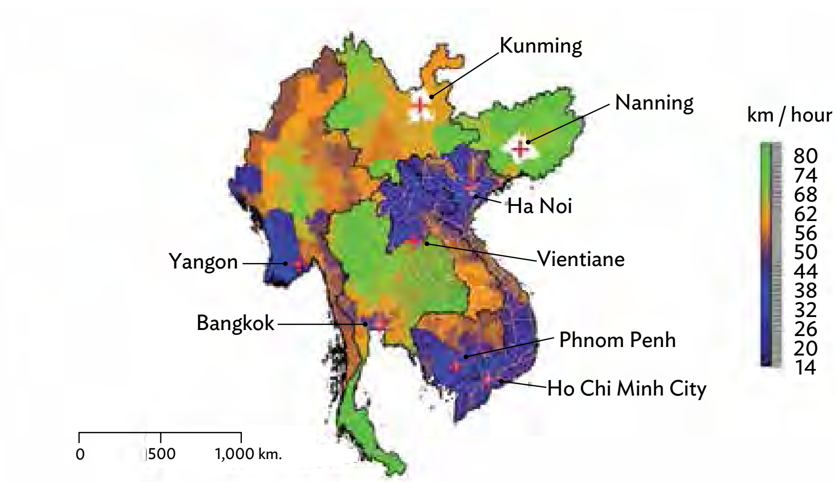
km = kilometer.

Note: The white backgrounds for Kunming and Nanning are the result of calculating the distance from these two capitals to themselves, which is zero. The white background also appears in the other capitals, but it is not visible. This is because the administrative boundaries of Kunming and Nanning are much larger than those of the other capitals.

Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

Figure 21.3: Average Travel Speed to Reach the Capital in the Greater Mekong Subregion

(Phnom Penh, Vientiane, Yangon, Ha Noi, Ho Chi Minh City, Bangkok, Nanning, and Kunming)



km = kilometer.

Note: The white backgrounds for Kunming and Nanning are the result of calculating the distance from these two capitals to themselves, which is zero. The white background also appears in the other capitals, but it is not visible. This is because the administrative boundaries of Kunming and Nanning are much larger than those of the other capitals.

Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

Table 21.2: Travel Time, Distance, and Average Speed to the Capital from Each District in the Greater Mekong Subregion

	Cambodia	Lao PDR	Myanmar	Thailand	Viet Nam	(PRC) Guangxi	(PRC) Yunnan
To the capital	Poor	Poor	Poor	Good	Poor	Good	Fair
Average duration (h)	4.67	9.32	13.06	6.61	5.56	3.68	6.67
Minimum duration (h)	0.63	0.38	0.32	0.43	0.22	2.72	3.31
Maximum duration (h)	13.26	20.16	51.35	15.27	19.57	5.94	11.06
Average distance (km)	225.10	472.26	715.69	479.55	267.42	275.47	461.78
Minimum distance (km)	10.64	10.18	5.53	8.29	6.42	203.35	210.63
Maximum distance (km)	665.70	913.98	2,232.82	1,191.85	936.76	500.09	773.55
Average speed (km/h)	48.20	50.67	54.80	72.54	47.33	74.85	68.31

h = hour, km = kilometer, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Note: Qualitative ranking is based on average speed: up to 60 km/h = poor, 61–70 km/h = fair, and 71 km/h and above = good. For Myanmar, it is from Yangon and for Viet Nam, it is from both Ha Noi and Ho Chi Minh City.

Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

Table 21.3: Travel Time, Distance, and Average Speed to the Capital from Each District in Selected European Union Countries

	Austria	Belgium	Bulgaria	France	Germany	Italy	Sweden
To the capital	Good	Good	Fair	Good	Good	Good	Good
Average duration (h)	2.66	1.10	3.27	4.39	4.67	5.80	4.33
Minimum duration (h)	0.41	0.42	0.30	0.90	0.91	1.10	0.35
Maximum duration (h)	6.79	1.70	6.51	15.79	8.41	13.55	15.47
Average distance (km)	245.47	82.42	221.91	429.28	475.17	516.65	389.03
Minimum distance (km)	7.13	21.54	14.54	49.46	44.67	71.04	18.29
Maximum distance (km)	650.29	148.36	491.60	1,249.68	839.34	931.03	1,301.63
Average speed (km/h)	85.87	71.13	66.65	94.80	99.52	90.48	87.08

h = hour, km = kilometer.

Note: Qualitative ranking is based on average speed: up to 60 km/h = poor, 61–70 km/h = fair, and 71 km/h and above = good.

Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

21.3 Connectivity with Other Capital Cities in the Greater Mekong Subregion

Since cross-border cooperation is one of the expected major engines of growth in the GMS, this section examines connectivity of districts to other members' capitals compared to their own. Table 21.4 provides the average ratio of road distance to straight-line distance to each of the capitals in the GMS for all 2,050 districts. The table reveals that some GMS districts are better connected with capitals across the border than with their own. For example, on average, districts in Cambodia are better connected with Bangkok (1.26) and Ho Chi Minh City (1.29) than with Phnom Penh (1.39). The same holds true for districts in the Lao PDR, Myanmar, and Viet Nam, whose connectivity with Bangkok is better than their connectivity with their own capital by 42% (1.72–1.30), 5% (1.55–1.50), and 10% (1.43–1.33), respectively. Bangkok is undoubtedly a much larger market than the capital cities of Cambodia, the Lao PDR, and Myanmar, with significantly easier access for many districts in these three countries. Although connectivity with one's own capital needs to be improved, the relatively better connectivity with large markets across the border is the reason why cross-border cooperation is likely to be a more efficient way to achieve high growth in the GMS.

Table 21.4: Ratio of Road Distance to Straight-Line Distance in the Greater Mekong Subregion Capitals

From districts in / To	Phnom Penh	Vientiane	Yangon	Bangkok	Ha Noi	Ho Chi Minh City	Nanning	Kunming
Cambodia	1.39	1.35	1.40	1.26	1.44	1.29	1.44	1.50
Lao PDR	1.46	1.72	1.55	1.30	1.74	1.37	1.61	1.67
Myanmar	1.45	1.84	1.55	1.50	1.83	1.36	1.63	1.65
Thailand	1.51	1.44	1.55	1.27	1.53	1.40	1.45	1.53
Viet Nam	1.39	1.52	1.54	1.33	1.43	1.39	1.46	1.43
(PRC) Guangxi	1.43	1.46	1.76	1.37	1.38	1.47	1.44	1.44
(PRC) Yunnan	1.51	1.86	1.58	1.49	1.50	1.46	1.39	1.61

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

The map in Figure 21.4 shows the ratio of road distance to straight-line distance to the GMS capitals by district. The districts whose connectivity with the GMS capitals is relatively worse than other districts have more or less the same poor connectivity with their own capital. The only exception is the southern part of Thailand, whose connectivity to the GMS capitals is worse than other districts in the GMS, but its connectivity to Bangkok is relatively strong. This is likely due to the location of these southern districts. The straight-line distance of these districts to three out of the eight capitals in the GMS (Bangkok, Phnom Penh, and Ho Chi Minh City) is very short but goes over the sea. For example, while the shortest straight-line distance between the southernmost parts of Thailand

Figure 21.4: Ratio of Road Distance to Straight-Line Distance between Each District and Other Capitals in the Greater Mekong Subregion

(Phnom Penh, Vientiane, Yangon, Ha Noi, Ho Chi Minh City, Bangkok, Nanning, and Kunming)

km = kilometer.

Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

and Ho Chi Minh City is well under 1,000 km, the actual road distance is well over 2,000 km. Since building a bridge several hundred kilometers long is hardly an option for the GMS, the best logistic infrastructure to improve the connectivity of southern Thailand with the GMS capitals should be, for example, the improvement of ferry lines.

Table 21.5 shows the average time needed to reach the capitals from all districts for each member. When connectivity is evaluated by travel time, each member's capital city is generally the largest, best-connected market for each member. It takes districts in Cambodia about 4.7 hours on average to reach Phnom Penh, compared to about 8 hours to Ho Chi Minh City. It takes districts in the Lao PDR about 9.39 hours on average to reach Vientiane, compared to about 14.28 hours to Bangkok. It is not difficult to see that the time needed to reach Bangkok or Ho Chi Minh City is much shorter for districts in border areas in Cambodia and the Lao PDR. Given the difference in market size, it is easy to understand how districts along the border in Cambodia, the Lao PDR, and to a lesser extent Myanmar have focused more on cross-border trade rather than on trade with their own capital cities.

The average time to reach the GMS capitals is highest in Myanmar. On average, it takes about nine additional hours to reach all GMS capitals from Myanmar's districts than from districts in Cambodia, the Lao PDR, or Thailand. This is also longer than for districts in Guangxi and Yunnan, generally considered to be less well-integrated with other members of the GMS. Although many factors matter for why it takes longer for districts in Myanmar to reach the capitals, the lack of border gates between Myanmar and other members of the GMS is the most serious issue.

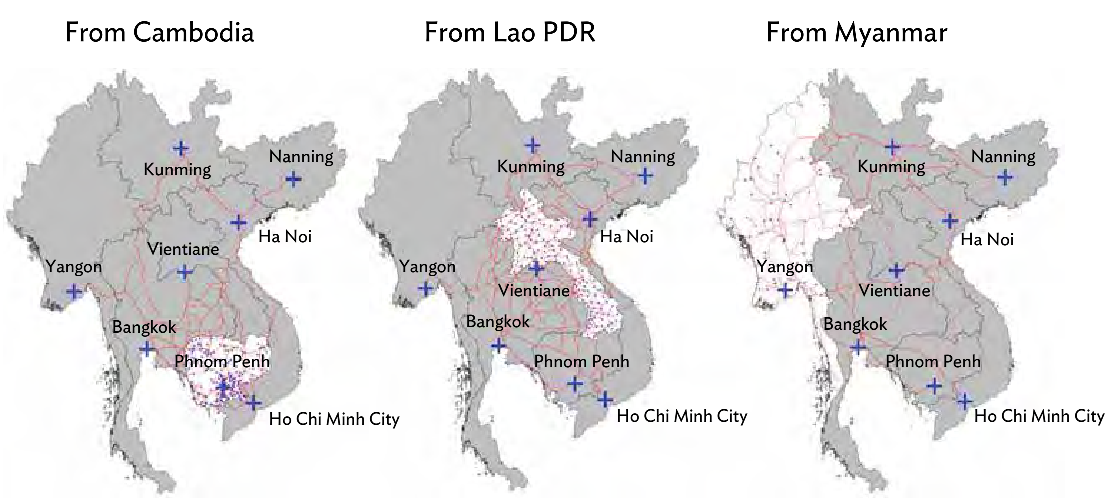
Table 21.5: Average Time Needed to Reach the Greater Mekong Subregion Capitals
(hours)

From districts in \ To	Phnom Penh	Vientiane	Yangon	Bangkok	Ha Noi	Ho Chi Minh City	Nanning	Kunming	Average
Cambodia	4.70	14.59	24.07	10.71	24.67	7.97	30.54	34.91	19.02
Lao PDR	19.39	9.39	22.48	14.28	15.72	22.04	21.11	22.23	18.33
Myanmar	32.52	25.44	13.28	22.32	31.83	36.68	32.37	25.14	27.44
Thailand	14.79	9.69	17.31	6.61	22.14	18.83	27.67	27.73	18.09
Viet Nam	18.19	17.88	31.36	20.66	15.36	17.78	20.51	24.82	20.82
(PRC) Guangxi	32.84	21.87	35.68	30.24	8,96	35.16	3.97	11.68	24.49
(PRC) Yunnan	37.43	26.08	25.43	28.61	14.58	40.14	13.63	7.21	24.13

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

Figure 21.5 shows the routes from all districts in Cambodia, the Lao PDR, and Myanmar to the GMS capitals. It shows all points where cars and trucks can cross the border by land or over bridge. Cambodia and the Lao PDR have many border gates with the other GMS members, approximately within 100 km from one another along their borders with Thailand and Viet Nam. On the contrary, Myanmar has only five border gates along its nearly 2,500 km border with Thailand. As a result, although many districts in eastern Myanmar are physically quite close to large cities in the other GMS members, the actual time needed to reach these cities is very long because travelers need to drive

Figure 21.5: Routes to the Greater Mekong Subregion Capitals from All Districts in Cambodia, the Lao People's Democratic Republic, and Myanmar



Lao PDR = Lao People's Democratic Republic.
Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries

along an existing road and go to one of the very few border gates. In the GMS, cross-border activity has to go through borders because it is not a customs union. Therefore, putting in place the necessary border gates to efficiently facilitate cross-border economic activity is an important policy measure to push forward regional integration in the GMS.

21.4 Connectivity with Major International Ports in the Greater Mekong Subregion

Major international ports are the gateway to trading with the world. However, not all international ports in the GMS can be considered major international ports. Many international ports function only as feeder ports that transfer goods to the nearest major international port. Due to monetary and time costs, firms may trade through almost any international port, but they can only participate in the international production network through major international ports.

Table 21.6 shows the world's top 50 ports by volume of container throughput in 2018. In the GMS, three ports, namely Bangkok, Ha Noi (Hai Phong), and Ho Chi Minh City, qualify as major international ports. The container cargo throughput of Thailand's biggest port, located about 130 km south of Bangkok, handled about 8 million twenty-foot equivalent unit (TEU) of container cargo in 2018.

Table 21.6: Container Cargo Throughput in 2018
(million TEU)

Rank	Port	Economy	2018
1	Shanghai	PRC	42.01
2	Singapore	Singapore	36.6
3	Ningbo-Zhoushan	PRC	26.35
4	Shenzhen	PRC	25.73
5	Guangzhou	PRC	21.92
6	Busan	ROK	21.66
7	Hong Kong, China	PRC	19.6
8	Qingdao	PRC	19.31
9	Tianjin	PRC	16
10	Jebel Ali	UAE	14.95
11	Rotterdam	Netherlands	14.5
12	Port Klang	Malaysia	12.32
13	Antwerp	Belgium	11.1
14	Xiamen	PRC	10.7
15	Kaohsiung	Taipei,China	10.45
16	Dalian	PRC	9.77
17	Los Angeles	US	9.46

continued on next page

Table 21.6 *continued*

Rank	Port	Economy	2018
18	Tanjung Pelepas	Malaysia	8.96
19	Hamburg	Germany	8.77
20	Keihin Ports	Japan	8.14
21	Long Beach	US	8.09
22	Laem Chabang	Thailand	8.07
23	Tanjung Priok	Indonesia	7.8
24	New York and New Jersey	US	7.18
25	Colombo	Sri Lanka	7.05
26	Yingkou	PRC	6.5
27	Suzhou	PRC	6.36
28	Ho Chi Minh City/Cai Mep	Viet Nam	6.33
29	Bremen/Bremerhaven	Germany	5.48
30	Valencia	Spain	5.18
31	Manila	Philippines	5.05
32	Jawaharlal Nehru Port Trust	India	5.05
33	Piraeus	Greece	4.91
34	Algeciras	Spain	4.77
35	Hai Phong	Viet Nam	4.76
36	Lianyungang	PRC	4.75
37	Mundra	India	4.44
38	Savannah	US	4.35
39	Colon	Panama	4.32
40	Jeddah	Saudi Arabia	4.12
41	Santos	Brazil	4.12
42	Rizhao	PRC	4
43	Felixstowe	UK	3.85
44	Northwest Seaport Alliance	US	3.79
45	Tanger Med	Morocco	3.47
46	Barcelona	Spain	3.42
47	Vancouver	Canada	3.4
48	Salalah	Oman	3.39
49	Fuzhou	PRC	3.34
50	Marsaxlokk	Malta	3.31

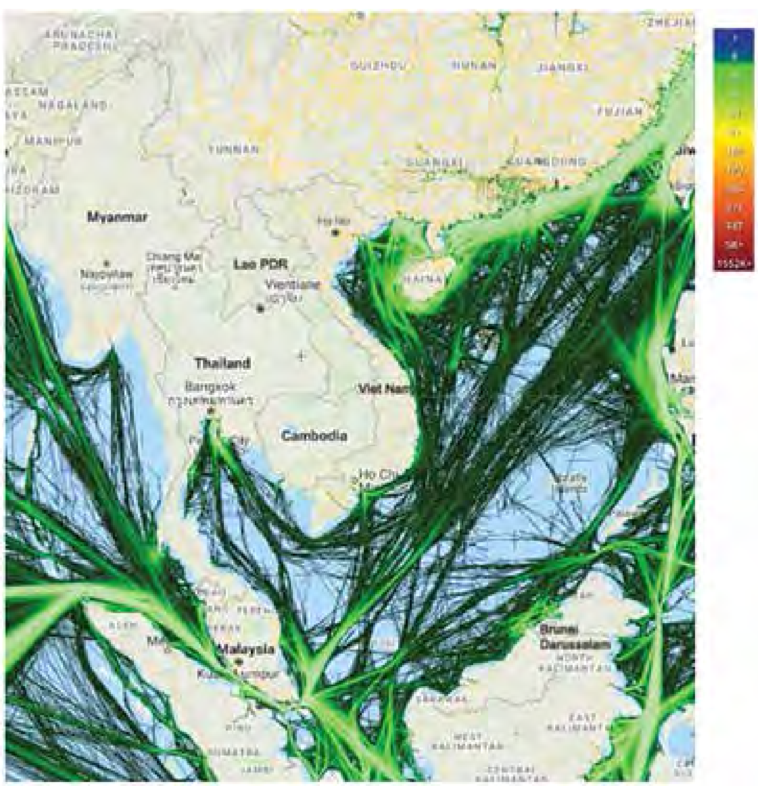
PRC = People's Republic of China, ROK = Republic of Korea, TEU = twenty-foot equivalent unit, UAE = United Arab Emirates, UK = United Kingdom, US = United States.

Sources: Port authorities, IHS Markit: Ports & Terminals Guide, and Alphaliner.

The two major Vietnamese ports in Ha Noi and Ho Chi Minh City handled about 4.7 million TEU and 6.3 million TEU, respectively. The biggest ports in Myanmar (Yangon) and Cambodia (Sihanoukville) handled only about 1.2 million TEU and 0.5 million TEU, respectively. Finally, Da Nang (central Viet Nam) handled less than 0.5 million TEU.

The cost that firms must consider in order to decide which ports to use entails other considerations besides the transport cost arising from distance or travel time. One such cost is the waiting time after reaching port. This is substantially longer at ports with a smaller number of arriving and departing cargo ships. Figure 21.6 shows the number of ships, measured as cargo density in terms of number of routes (where each arrival and the following departure is counted as one route), that visit all GMS ports and surrounding areas. The figure shows that the number of ships that arrive in Bangkok, Ha Noi, and Ho Chi Minh City (in light green, 29 routes) is much higher than the corresponding figures for the ports of Yangon and Sihanoukville (in dark green, 5 routes). This is why multinational corporations operating in the GMS have mainly used the former three ports to trade. It is not uncommon for industrial parts and finished goods to be imported into Myanmar via Bangkok. Most multinational corporations in Savannakhet (central Lao PDR) import and export through the port of Laem Chabang, located south of Bangkok and about 730 km away, instead of through Da Nang, which is 480 km away. If the ports in

Figure 21.6: Cargo Ship Density of Ports in the Greater Mekong Subregion, 2017
(number of routes per 95 square kilometers per year)

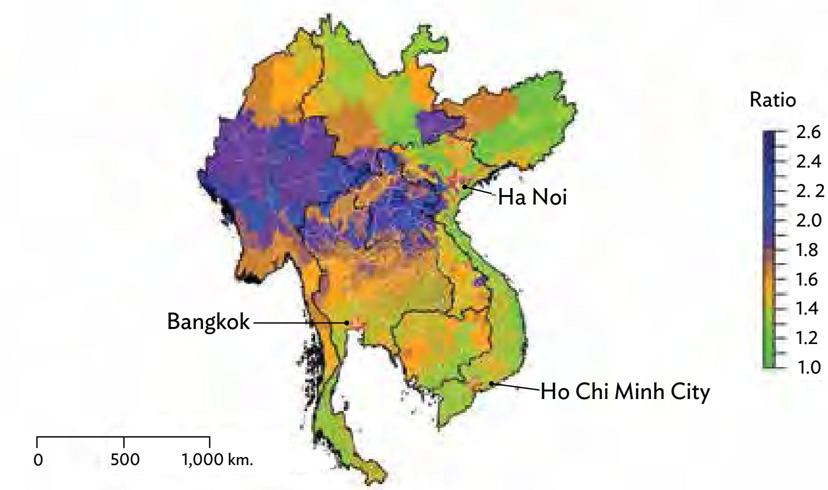


Lao PDR = Lao People's Democratic Republic.
Source: Marine Traffic (www.marinetraffic.com).

Yangon and Da Nang, for example, expanded and became major international ports, this would benefit enormously many districts that now have to use one of the three GMS major international ports.

Lastly, Figure 21.7 shows a map of the ratio of road distance to straight-line distance to the major international ports in the GMS by district. It illustrates how new road networks would potentially reduce the travel distance to major GMS ports for districts in western Myanmar all the way to northern Thailand and the Lao PDR. In addition, as mentioned earlier, it is clear that districts in Myanmar or even some parts of Thailand, the Lao PDR, and Yunnan would benefit if ports in Yangon could increase traffic and become one of the major international ports in the GMS.

Figure 21.7 : Ratio of Road Distance to Straight-Line Distance between Each District and the International Ports of the Greater Mekong Subregion
(Bangkok, Ha Noi, and Ho Chi Minh City)



km = kilometer.
Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

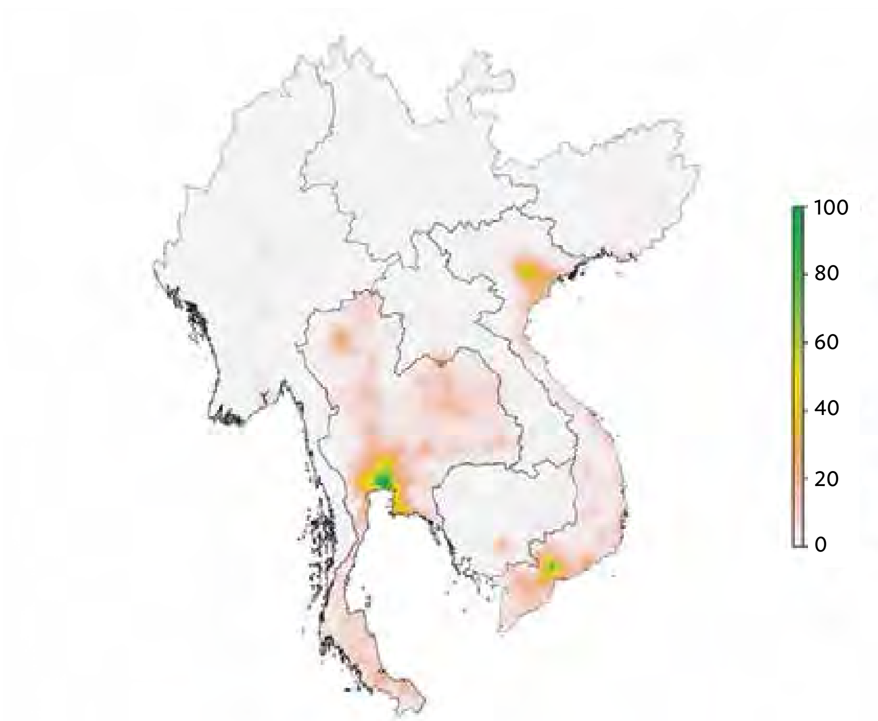
21.5 Market Potential

The economic rationale of connectivity is that better access to a larger market brings about higher economic growth. This is called the *market potential* effect in spatial economics. The market potential of a region is the size of its own market plus that of all other markets, each connected by the pairwise distances among them. This section uses nighttime lights (NTL) information to represent the size of the market of each region. The market size of all districts in the GMS is represented by the sum of NTL.[104]

[104] Specifically, the market potential of a district i is calculated as the sum of its own NTL(i) plus all other NTLs (j) each divided by the distance between each pair i–j. The distance within each district is represented by the radius of the circle with the same area as the actual area. This is necessary to account for the difference in district sizes in the GMS. The districts in Myanmar, Guangxi, and Yunnan, for instance, are much larger than even entire provinces in other GMS members.

Figure 21.8 shows the market potential by district using NTL for 2013. The market potential is normalized to between 1 for the smallest and 100 for the largest. The market potential of Guangxi and Yunnan is likely to be underestimated given their relatively better road infrastructure, although the average district size is comparatively large. Bangkok and its surrounding areas have the largest market potential not only in Thailand but in the whole GMS. Viet Nam has two large areas with high market potential, one in the north and another in the south, but lacks significant large areas in between. Cambodia and the Lao PDR have only relatively significant market potential around the capital cities. Given its relatively large land area and population, Myanmar lacks districts with large market potential when compared to the rest of the GMS.

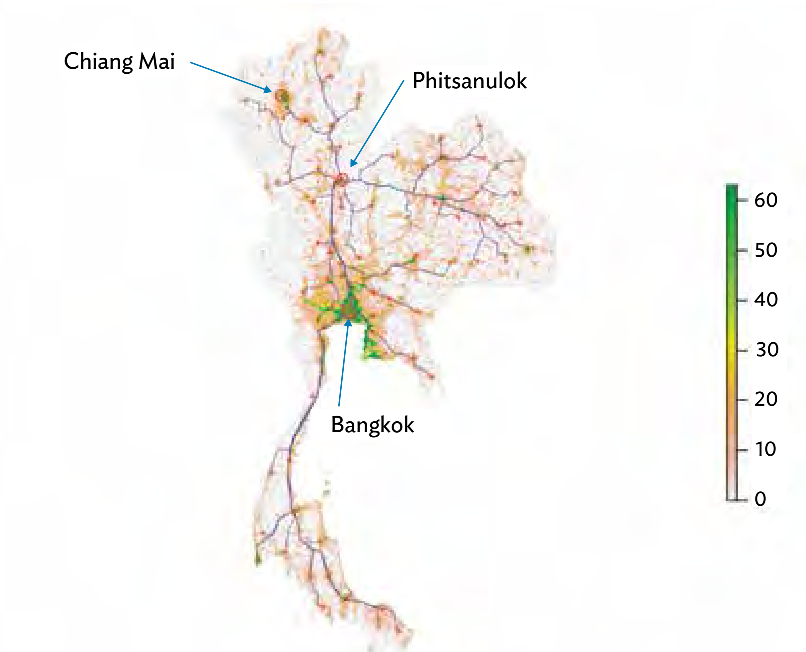
Figure 21.8: Normalized Market Potential by District in the Greater Mekong Subregion, 2013



Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

The question for a district in the GMS is: what is the most efficient way to increase its market potential? The answer is to improve connectivity with a cluster (concentration) of large cities. The analysis will use Thailand as an example to elaborate on this and use provinces instead of districts in order to reduce computational complexity. The question then becomes: what is the best way for Phitsanulok to increase its market potential by improving connectivity? Figure 21.9 shows the level of NTL, or market size, colored from white (0) to green (63). The increase in Phitsanulok's market potential is simulated by reducing the time to drive to Bangkok and to Chiang Mai by 1 hour. Results indicate that the reduction in travel time to Bangkok brings about an increase in market potential between 24% and 154% larger than that obtained by the same reduction in travel time to Chiang Mai.[105] This is because reducing the access time to Bangkok also reduces the time to access other cities between Phitsanulok and Bangkok, and there are more large cities near Bangkok than near Chiang Mai.

Figure 21.9: Connectivity from Phitsanulok Province to All Other Provinces in Thailand

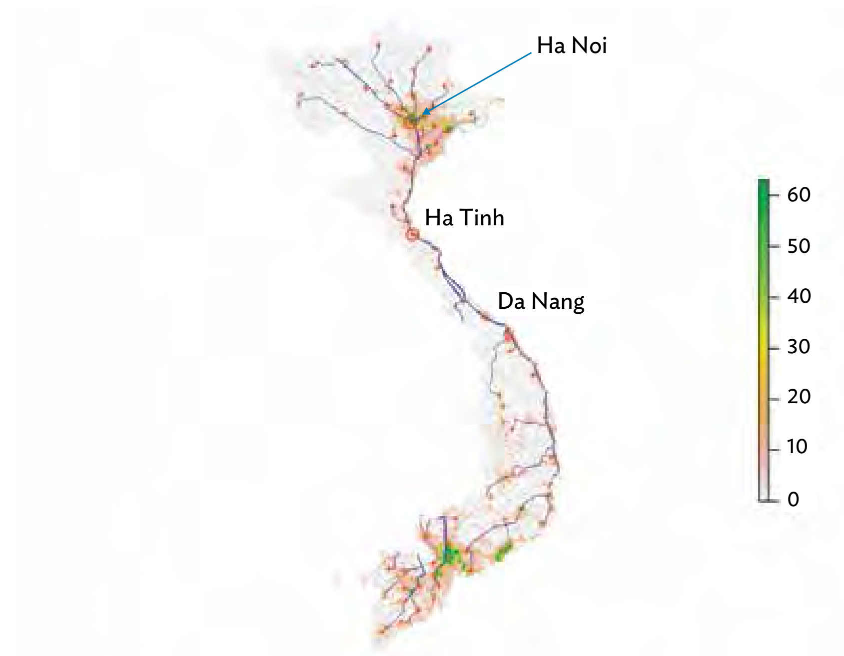


Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

The analysis also performed similar simulations for Ha Tinh province in Viet Nam to estimate the improvement in market potential between shorter travel time to Ha Noi, the capital city, and Da Nang, a major city in central Viet Nam. The location of these provinces is shown in Figure 21.10. The results show that the reduction in travel time to Ha Noi brings about an increase in market potential between 19% and 90% larger than that obtained by the same reduction in travel time to Da Nang. Similar to the case of Thailand, Ha Tinh would be better off with improved connectivity with Ha Noi, the capital city area, which has a higher number of large cities nearby than Da Nang. The lower bound (19%) is also comparable to the case of Thailand (24%), but the upper bound is quite different (90% versus 154%). It is not difficult to see that this is the result of a larger concentration of cities around Bangkok than around Ha Noi. In short, for any region (province or district) in the GMS, improved access to an area with a larger concentration of cities is a more efficient way to increase its own market potential.

105 The differences come from how travel time is taken into account mathematically. For any specific formulation, the difference between improvement toward Bangkok and toward Chiang Mai is larger the stronger the correction of market potential by travel time.

Figure 21.10: Connectivity from Ha Tinh Province to All Other Provinces in Viet Nam



Source: Authors' calculations based on Open Source Routing Machine and database of global administrative boundaries.

21.6 Conclusions

This chapter has examined connectivity as measured by the availability of roads that are close to a straight-line distance and by travel time or speed between districts in the GMS and major markets (economic capital cities), both within and across national borders. The chapter also examined connectivity to major international ports within the subregion. The analysis showed that GMS members with mountainous landscapes, such as the Lao PDR, Yunnan, and Myanmar, lack straight-line roads. The availability of close to straight-line roads in Thailand is comparable to countries in the EU. However, the average time needed to reach the major capitals in the GMS is longer than the time it would take in the EU. This means that quality of roads in the GMS, including relatively rich Thailand, still lags behind the EU.

The lack of border gates is one factor that significantly increases the time needed to reach major markets across borders. This is true for Myanmar, for example, which has few border gates along its borders with other members of the GMS. The region also has few major international ports with a sufficiently large number of arriving and departing ships. These ports are currently concentrated in the eastern and southern parts of the GMS. As a result, there is a large potential for improving connectivity of districts in the western part of the GMS to major international ports. Lastly, simulations have shown how it is possible to efficiently expand the market potential of a district by reducing the time needed to reach a metropolis rather than a typical medium-sized city.

Chapter 22

Trade Facilitation in the Greater Mekong Subregion

22.1 Introduction

In response to multilateral trade liberalization and the formation of dozens of preferential trade agreements (Chapter 13), formal trade barriers have fallen dramatically in recent decades. As a result, attention has shifted to other factors that drive trade flows, most notably to issues related to trade facilitation. The analysis in this chapter complements the previous two chapters which focuses on road quality.

Trade facilitation refers to the simplification and harmonization of international trade procedures, including the activities, practices, and formalities involved in collecting, presenting, communicating, and processing data and other information required for the movement of goods in international trade.[106]

In practice, trade facilitation concerns the ease of moving goods across borders and includes aspects as varied as the efficiency of customs administration, the quality of physical infrastructure, the availability of and access to transport networks, and a competent logistics sector. While not a part of formal trade policy barriers, there is an important policy aspect when considering improvements in trade facilitation. Trade facilitation also has a clear regional dimension and potential impacts on the Greater Mekong Subregion (GMS) since it involves the crossing of borders between two countries. Thus, trade facilitation efforts often include some form of regional infrastructure hub alongside policy reforms.

This chapter uses the gravity model of international trade to examine the impact of trade facilitation efforts on the exports of the GMS economies by considering both a broad measure of trade facilitation along with subindices capturing specific dimensions of trade facilitation. The gravity model used in the analysis is the same as in Chapter 6 (details are provided in the Appendix to that chapter). The approach adopted in this chapter further considers the extent to which the impact of trade facilitation measures on exports depends on the sector of interest, which when linked with other parts of the analysis may lead to essential policy conclusions regarding the appropriate regional infrastructure for different development paths.

[106] The definition of trade facilitation is at http://gtad.wto.org/trta_subcategory.aspx?lg=fr&cat=33121&.

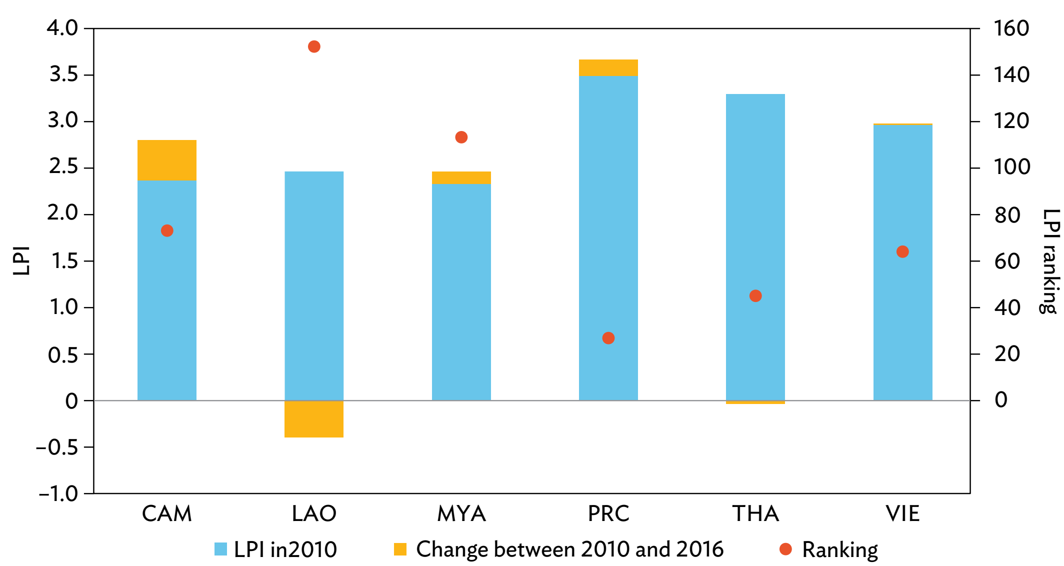
22.2 Developments in Trade Facilitation Indices

The analysis begins by summarizing the information contained in an index of trade facilitation for the GMS members. The data come from the World Bank's Logistics Performance Index (LPI), which aims to capture the relative ease and efficiency with which goods can be moved in and out of a country (a total of 160 countries). The index is a weighted average of a country's scores on six subindices: (i) efficiency of customs and border clearance by border control agencies (i.e., speed, simplicity, and predictability of formalities); (ii) quality of trade and transport-related infrastructure (e.g., ports, railroads, roads, and information technology); (iii) ease of arranging competitively priced shipments; (iv) competence and quality of logistics services (e.g., transport operators and customs brokers); (v) ability to track and trace consignments; and (vi) timeliness of shipments in reaching a destination within the scheduled or expected delivery time.

Figure 22.1 reports the overall value of the LPI for each GMS member for 2010 and the change in the index between 2010 and 2016. While these numbers provide an interesting comparison across the GMS members, they do not say a great deal about how they are doing in a more general sense. As such, the figure also includes the 2016 ranking (the red dots based on the scale on the right-hand axis). For reference, the top five countries in the ranking are Germany, the Netherlands, Sweden, Belgium, and Singapore, all with an LPI score above 4.

Figure 22.1 reveals that the PRC had the highest LPI in the GMS in 2010 and was able to increase the value of the index between 2010 and 2016. The LPIs of Thailand and Viet Nam are also relatively

Figure 22.1: Recent Developments in Trade Facilitation Performance for the Greater Mekong Subregion Economies



CAM = Cambodia, LAO = Lao People's Democratic Republic, LPI = Logistics Performance Index, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

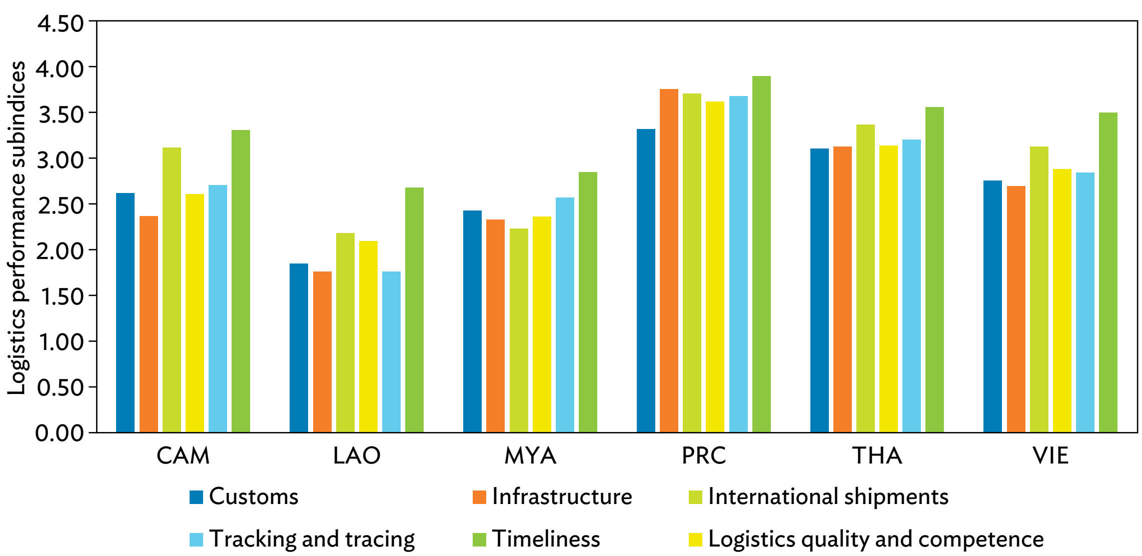
Source: World Bank's Logistics Performance Index (https://lpi.worldbank.org/international/global).

high, but their values have not increased between 2010 and 2016. The other three GMS members have lower LPI values, although Cambodia's score increased significantly between 2010 and 2016 and Myanmar's also showed some increase. Conversely, the Lao PDR's LPI showed some decline. As a landlocked country with the consequent challenges for trade, the relatively low and declining LPI is a concern for this country's trade prospects.

In terms of overall ranking, the PRC ranked relatively high in 2016 (27th), with Thailand and Viet Nam also performing relatively well (45th and 64th, respectively). Cambodia saw a large jump in its ranking from 129th in 2010 to 73rd in 2016. Myanmar jumped 20 positions to 113th, but the Lao PDR dropped from 118th to 152nd.

Figure 22.2 considers the scores on the individual subindices that make up the overall LPI for 2016. There is a great deal of consistency within countries in the values of the individual subindices, albeit with some noticeable differences. In the PRC, for example, the index for customs is somewhat below the values of the other subindices, suggesting that this dimension is bringing down the overall index. Across members, but especially in Cambodia, the Lao PDR, and Viet Nam, the values of the index for timeliness tend to be somewhat higher than those for the other subindices, indicating a relatively good performance in ensuring that goods reach their destination within the scheduled time. In comparison to the other subindices, most GMS members show relatively high values for international shipment (the major exception being Myanmar). Conversely, infrastructure tends to be one of the subindices with the lowest values (the exception being the PRC).

Figure 22.2: Performance of the Greater Mekong Subregion Economies on the Subindices of the Logistics Performance Index, 2016



CAM = Cambodia, LAO = Lao People's Democratic Republic, MYA = Myanmar, PRC = People's Republic of China, THA = Thailand, VIE = Viet Nam.

Source: World Bank's Logistics Performance Index (https://lpi.worldbank.org/international/global).

22.3 Impact of Trade Facilitation on Aggregate Export Flows

This section reports estimates of the effect of the LPI on export flows (using the gravity model explained in Chapter 6). The ultimate aim of trade facilitation measures is to boost exports. This section examines whether the evidence supports this view, i.e., that trade facilitation has been an important driver of exports in the GMS economies and, if so, which dimensions of the trade facilitation measures have been the most effective. Finding important differences in the effects of alternative trade facilitation measures may further inform future policy discussions on the most effective means of facilitating trade. The approach involves estimating a gravity model (for the year 2016) using the LPIs of the exporter (i.e., the origin country) and of the importer (i.e., the destination country).[107] While the model is estimated on a broad sample of countries, the analysis further estimates the differential effect of the LPI for the GMS members (i.e., how much the effect on GMS members differs from the average).[108]

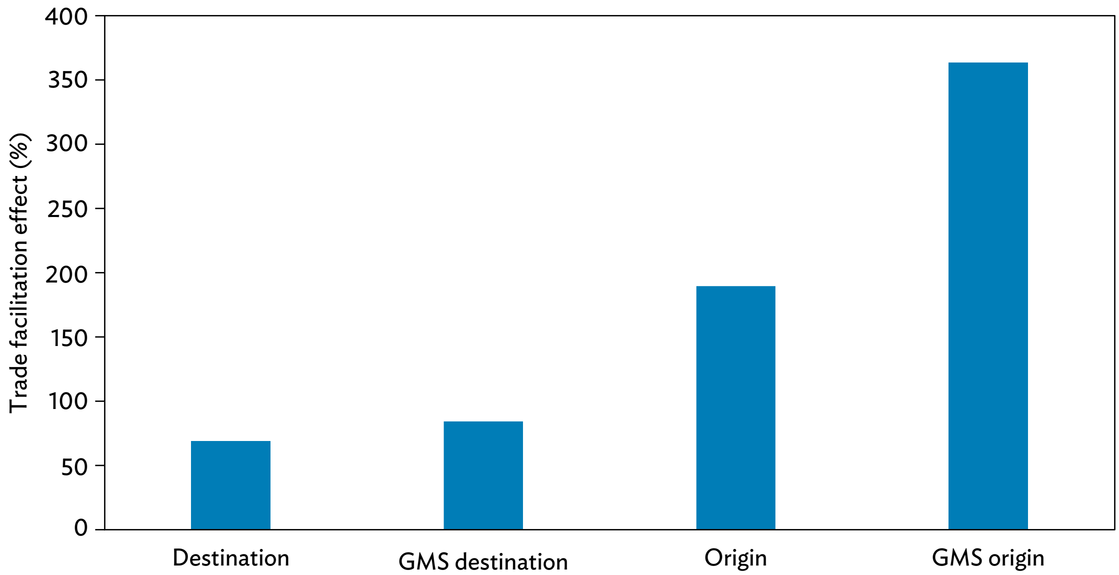
Figure 22.3 reports the estimated coefficients on the LPI of the origin (exporter) and destination (importer) for all countries and the corresponding estimates for the GMS members. The positive values of the estimated effects reported in the figure reveal that higher values of the LPI are associated with higher levels of exports. The results suggest that the LPI in the origin (exporter) country has a larger impact on exports than the LPI in the destination country.

The interpretation of the estimated coefficients in Figure 22.3 is that a one unit increase in the index in the destination country increases exports by 69%, while a similar increase in the origin country increases exports by 190%. Interestingly, the results indicate that the effects of the LPI are stronger for GMS members than for all countries as a whole. The estimates suggest that a one unit increase in the LPI when a GMS member is a destination (importer) country increases imports into the GMS member (i.e., exports from a third country to a GMS member) by 84%, while a similar increase in LPI when a GMS member is the origin (exporter) country increases exports by 364%. Such results emphasize the importance of trade facilitation in a general sense, but particularly so in the case of GMS members, possibly reflecting the importance of trade facilitation in allowing countries to engage in global value chains, where issues such as timeliness are likely to be particularly important.

[107] Further details on the estimation of the gravity model can be found in the chapter on export potential (Chapter 6). The gravity model estimated in this chapter is based on data for 2016 and includes standard controls (e.g., distance, gross domestic product per capita, whether countries are landlocked, common language, common border, and preferential trade agreements) alongside controls for multilateral resistance using the approach of Baier and Bergstrand (2009a).

[108] The approach involves estimating a gravity model of exports for a broad sample (~155 countries) of countries, including the LPI of both the origin and destination country alongside interactions of these variables with dummy variables for GMS members as the origin and destination, respectively. Coefficients on these interaction terms then capture the differential effect of LPI for GMS members relative to the average effect for all countries.

Figure 22.3: Estimated Impact of the Logistics Performance Index on Export Flows, 2016



GMS = Greater Mekong Subregion.

Note: The figure reports the estimated coefficients on the Logistics Performance Index variables from a gravity model of export flows for the year 2016.

Source: Authors.

To shed further light on the factors driving the relationship between LPI and exports, the analysis considers the effects of the individual subindices of the LPI on exports.[109] Figure 22.4 reports the estimated effects of the different subindices on exports for both origin and destination countries. Figure 22.4 reveals that only a subset of the indices exert a statistically significant positive effect on export flows. In particular, infrastructure and international shipping are the major drivers of the effects of the LPI on exports for destination countries (importers), while international shipping and most importantly timeliness are the major drivers of the effect of LPI on exports for origin countries (exporters).

22.4 Impact of Trade Facilitation on Sectoral Export Flows

This section moves beyond considering the effects of trade facilitation on aggregate exports to look at its effect on sectoral exports. Once again, the analysis considers an average overall effect for all countries in the dataset and how the effects for GMS members deviate from this average effect. Results are reported in Figures 22.5 and 22.6. Figure 22.5 reports results for the LPI in the destination country and Figure 22.6 for the LPI in the origin country.

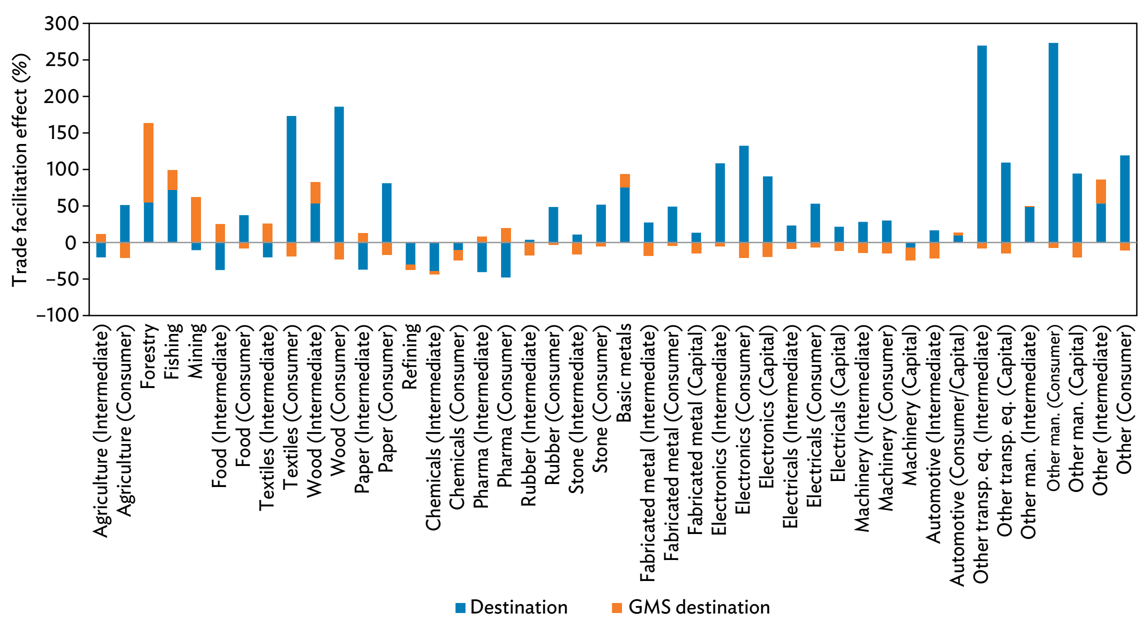
[109] Note that the analysis focuses on the effects for the full sample of countries only. The results from including interaction terms accounting for the effects on GMS members only are found to be quite unstable.

Figure 22.4: Estimated Impact of the Subindices of the Logistics Performance Index on Export Flows, 2016

Note: The figure reports the estimated coefficients on the Logistics Performance Index variables from a gravity model of export flows for the year 2016.

Source: Authors.

Figure 22.5: Impact of Overall Trade Facilitation Index on Sectoral Exports in Destination Countries



GMS = Greater Mekong Subregion.

Notes: The figure reports the estimated coefficients on the Logistics Performance Index variables from a gravity model of export flows for the year 2016. See Appendix for sector definitions.

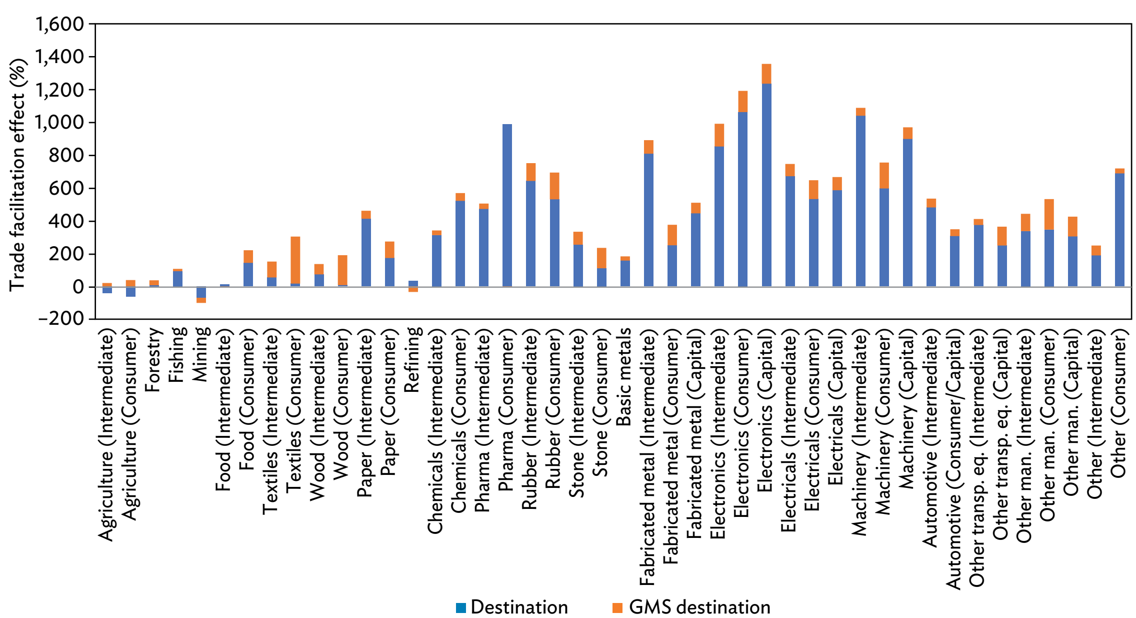
Source: Authors.

Results in Figure 22.5 suggest that there are certain sectors where the effect of LPI in the export destination country is relatively large. These sectors include textiles (consumer goods), wood products (consumer goods), other transport equipment (intermediate goods), and other manufacturing (consumer goods). Other sectors, including electronics, basic metals, and paper, also have relatively large effects of the LPI on exports.

Concentrating on the effects of LPI in the export destination country when a GMS member is a destination country, the analysis finds that, in most sectors, the effects of LPI on exports are largely similar to those for all countries (as represented by the relatively small orange bars in Figure 22.5). There are other sectors, however, where the effects for GMS members differ significantly from the average effect for all countries. This is particularly the case for certain primary and natural resource-based manufacturing sectors such as forestry, fishing, and wood products (intermediates). The effects of trade facilitation in these sectors tend to be significantly larger for GMS members as export destinations than for other countries.

Turning to the effects of the LPI in the origin country in Figure 22.6, the results are somewhat different. With the exception of primary sectors and certain low-tech manufacturing sectors (e.g., food, textiles, wood, and paper), the effects of the LPI in the origin country tend to be relatively large, with values often indicating that a one unit increase in the LPI is associated with an increase in exports in excess of 150%. Interestingly, the results for the GMS members tend to indicate that, across

Figure 22.6: Impact of Overall Trade Facilitation Index on Sectoral Exports in Origin Countries



GMS = Greater Mekong Subregion.

Notes: The figure reports the estimated coefficients on the Logistics Performance Index variables from a gravity model of export flows for the year 2016. See Appendix for sector definitions.

Source: Authors.

most sectors, the effects on exports of the LPI when a GMS member is an origin country (exporter) tend to be higher than the average effect for all countries. This highlights the importance of trade facilitation measures for exporters more generally, further emphasizing the role of trade facilitation measures for GMS members in expanding their exports across a broad range of sectors. The effects of trade facilitation for GMS members tend to be particularly large in the electronics sector as well as in electrical equipment and machinery and equipment.

22.5 Conclusions

This chapter has discussed the World Bank's LPI and provided estimation results on how well GMS members perform in terms of trade facilitation and how trade facilitation impacts trade flows. Performance varies significantly across GMS members. Some—such as the PRC—perform relatively well, while others—notably the Lao PDR—are lagging in terms of the trade facilitation index. Cambodia's relatively large improvement in the trade facilitation index in recent years is noticeable. The importance of these differences is emphasized by the results indicating a strong impact of trade facilitation measures for the exporting country. These effects are found to be important across a broad range of sectors and product types (e.g., consumption, intermediate, and capital goods), highlighting the importance of investments in trade facilitation to encourage exports within the GMS.

Appendix

All the variables, their descriptions, and data sources are listed in Table A22.1.

Table A22.1: Variable Description and Data Sources

Dependent Variable	Description	Data Source
Total exports	**Total country-pair exports for 2016**	**United Nations (UN) Comtrade**
Sector-level exports		
Agriculture (intermediate)	Crop and animal production, hunting and related service activities (intermediate goods)	UN Comtrade
Agriculture (consumer)	Crop and animal production, hunting and related service activities (consumption goods)	UN Comtrade
Forestry	Forestry and logging	UN Comtrade
Fishing	Fishing and aquaculture	UN Comtrade
Mining	Mining and quarrying	UN Comtrade
Food (intermediate)	Manufacture of food products, beverages, and tobacco products (intermediate goods)	UN Comtrade
Food (consumer)	Manufacture of food products, beverages, and tobacco products (consumption goods)	UN Comtrade
Textiles (intermediate)	Manufacture of textiles, wearing apparel, and leather products (intermediate goods)	UN Comtrade
Textiles (consumer)	Manufacture of textiles, wearing apparel, and leather products (consumption goods)	UN Comtrade

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Table A22.1 *continued*

Dependent Variable	Description	Data Source
Total exports	**Total country-pair exports for 2016**	**United Nations (UN) Comtrade**
Sector-level exports		
Wood and products (intermediate)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (intermediate products)	UN Comtrade
Wood and products (consumer)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (consumption goods)	UN Comtrade
Paper and products (intermediate)	Manufacture of paper and paper products (intermediate goods)	UN Comtrade
Paper and products (consumer)	Manufacture of paper and paper products (consumption goods)	UN Comtrade
Refining	Manufacture of coke and refined petroleum products	UN Comtrade
Chemicals (intermediate)	Manufacture of chemicals and chemical products (intermediate goods)	UN Comtrade
Chemicals (consumer)	Manufacture of chemicals and chemical products (consumption goods)	UN Comtrade
Pharmaceuticals (intermediate)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (intermediate goods)	UN Comtrade
Pharmaceuticals (consumer)	Manufacture of basic pharmaceutical products and pharmaceutical preparations (consumption goods)	UN Comtrade
Rubber and plastic (intermediate)	Manufacture of rubber and plastic products (intermediate goods)	UN Comtrade
Rubber and plastic (consumer)	Manufacture of rubber and plastic products (consumption goods)	UN Comtrade
Stone, glass (intermediate)	Manufacture of other non-metallic mineral products (intermediate goods)	UN Comtrade
Stone, glass (consumer)	Manufacture of other non-metallic mineral products (consumption goods)	UN Comtrade
Basic metals	Manufacture of basic metals	UN Comtrade
Fabricated metal (intermediate)	Manufacture of fabricated metal products, except machinery and equipment (intermediate goods)	UN Comtrade
Fabricated metal (consumer)	Manufacture of fabricated metal products, except machinery and equipment (consumption goods)	UN Comtrade
Fabricated metal (capital)	Manufacture of fabricated metal products, except machinery and equipment (capital goods)	UN Comtrade
Electronics (intermediate)	Manufacture of computer, electronic, and optical products (intermediate goods)	UN Comtrade
Electronics (consumer)	Manufacture of computer, electronic, and optical products (consumption goods)	UN Comtrade
Electronics (capital)	Manufacture of computer, electronic, and optical products (capital goods)	UN Comtrade
Electricals (intermediate)	Manufacture of electrical equipment (intermediate goods)	UN Comtrade
Electricals (consumer)	Manufacture of electrical equipment (consumption goods)	UN Comtrade
Electricals (capital)	Manufacture of electrical equipment (capital goods)	UN Comtrade
Machinery (intermediate)	Manufacture of machinery and equipment n.e.c. (intermediate goods)	UN Comtrade

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Table A22.1 *continued*

Dependent Variable	Description	Data Source
Total exports	**Total country-pair exports for 2016**	**United Nations (UN) Comtrade**
Sector-level exports		
Machinery (consumer)	Manufacture of machinery and equipment n.e.c. (consumption goods)	UN Comtrade
Machinery (capital)	Manufacture of machinery and equipment n.e.c. (capital goods)	UN Comtrade
Automotive (intermediate)	Manufacture of motor vehicles, trailers, and semi-trailers (intermediate goods)	UN Comtrade
Automotive (consumer/ capital)	Manufacture of motor vehicles, trailers, and semi-trailers (consumption/capital goods)	UN Comtrade
Other transport equipment (intermediate)	Manufacture of other transport equipment (intermediate goods)	UN Comtrade
Other transport equipment (capital)	Manufacture of other transport equipment (capital goods)	UN Comtrade
Other manufacturing (intermediate)	Manufacture of furniture; other manufacturing (intermediate goods)	UN Comtrade
Other manufacturing (consumer)	Manufacture of furniture; other manufacturing (consumption goods)	UN Comtrade
Other manufacturing (capital)	Manufacture of furniture; other manufacturing (capital goods)	UN Comtrade
Other (intermediate)	Other goods (intermediate goods)	UN Comtrade
Other (consumer)	Other goods (consumption goods)	UN Comtrade
Independent Variables	**Description**	**Data Source**
Gravity variables		CEPII GeoDist
Distance	Simple distance between country pairs	CEPII GeoDist
Contiguity	Dummy indicating whether the two countries are contiguous	CEPII GeoDist
Common language	Dummy for common official or primary language	CEPII GeoDist
Common colonizer	Dummy for common colonizer of origin and destination post-1945	CEPII GeoDist
Colony	Dummy for origin and destination ever in colonial relationship	CEPII GeoDist
Gross domestic product (current United States dollars)	Measure of economic mass of the countries	World Development Indicators
Preferential trade agreement (PTA) Depth	Depth measure created out of binary variables covering 18 core World Trade Organization provisions. An alternative depth measure using all 52 policy areas of PTA was also used for robustness checks.	World Bank (“Horizontal Depth: A New Database on the Content of Preferential Trade Agreements”)
Logistics Performance Index (LPI)	As a measure of the effect of trade facilitation, the analysis used the overall international LPI score for both exporter and importer countries.	World Bank

n.e.c. = not elsewhere classified.

Sources: Dependent variable (total exports) and sector-level exports: United Nations Comtrade. Independent variables: CEPII GeoDist, World Development Indicators, and World Bank (see table).



PART 4

RECOMMENDATIONS

Chapter 23

Recommendations

This final chapter brings together the main recommendations from the analyses in the previous chapters.

The members of the Greater Mekong Subregion (GMS) have performed very well since 1992. Yet, while each member has experienced income convergence within itself (i.e., the poorest districts at the start of the period have grown faster and thus approached the richer ones), GMS members still need to attain cross-country convergence in incomes within the GMS (Thailand being the richest member) and to the world's economic frontier. This key objective is also the underlying rationale of the study, summarized in the introductory chapter, namely to find ways for the GMS members to experience clear convergence in per capita incomes, both within the region and to the global frontier. Accomplishing this requires not only that all members grow, but also that Cambodia, the Lao PDR, Myanmar, and Viet Nam grow substantially faster than the PRC and Thailand in the coming decades.

Growth for all is important, but even more so for the poorest members. The GMS program needs to act as a catalyst to ensure this. The analysis in the introductory chapter showed that cross-country convergence within the GMS and from the GMS members to the global frontier is slow. Clearly, the GMS members are divided into two very distinct groups, one with Cambodia, the Lao PDR, and Myanmar and the other with the PRC and Thailand. Viet Nam appears to be in the middle, but the structure of its economy is becoming increasingly similar to that of the latter two. The GMS program needs to work in close coordination with the first group of three countries to help them move forward faster. Likewise, the more advanced members—the PRC and Thailand—can play a significant role in sharing knowledge and good practices with the rest of the group.

To see progress in the GMS in the coming decades, economic policy should focus on the following three interrelated areas:

(i) Further integrate and enhance engagement with the global economy, upgrade within global value chains (GVCs), maximize the benefits from new technologies, and ultimately shift toward a more complex production structure associated with higher economic growth and wages.

(ii) Enable cities to be engines of growth.

(iii) Improve the quality of road infrastructure and connectivity.

The hope is that the proposals in this study will contribute to achieving the twin objective of fast growth and convergence within the GMS and to the world's frontier. Regional cooperation, by itself, will not be sufficient. Regional cooperation can become a powerful development escalator if it is embedded in a sound development strategy such as the one proposed in this study. The big opportunity for low- and middle-income countries lies in trading with advanced economies, by harnessing their comparative advantage today (cheap labor) but at the same time making sure that they have a clear upgrading strategy (based on technological innovation) and can manage to open niches in areas with synergies, that is, where advances in one part of the economy tend to push forward other parts.

Part 1 (Chapters 1–15)
INTEGRATION INTO THE GLOBAL ECONOMY AND UPGRADING

Encourage the Economic Diversification of the Economies of the Greater Mekong Subregion

While the PRC and, to a lesser extent, Thailand and Viet Nam have been able to diversify their economies significantly, Cambodia, the Lao PDR, and Myanmar rely on a relatively narrow and nonunique set of goods. While many approaches to diversification exist—similar to different upgrading paths and with successful examples of resource-, commodity-, manufacturing-, and services-based attempts at diversification—trade and investment policies are often at the center of such efforts. Policies associated with these successful efforts at diversification include

(i) reforms in the business and investment climate that develop appropriate incentives to invest in new activities;
(ii) trade and investment policies to remove any bias against exporting and to encourage competition in factor markets and major trade services;
(iii) removal of restrictions on imports, which can lower the costs of production and encourage integration within regional and global value chains;
(iv) investments in trade facilitation measures with the aim of improving trade logistics;
(v) policies to support adjustment and appropriate reallocation of resources;
(vi) use of export and investment promotion agencies; and
(vii) development of special economic zones, growth poles, clusters, and economic corridors.

In the context of the GMS economies, particularly the least-diversified GMS members, regional integration can play an important role in diversification efforts, with regional markets as an important source of new market opportunities. Diversifying into high-income markets is often more difficult due to higher levels of competition, different tastes, and enhanced standards, among other things. Thus, regional markets can provide an important stepping stone, allowing for diversification and eventual upgrading that may then lead to successful integration into rich-country markets.

Develop a Strategy for Upgrading the Production Structure of the Greater Mekong Subregion Members

The analysis indicates that the road maps for upgrading are specific to each member and that members face a trade-off between an upgrading path that is relatively easy (but with limited gains) and a path that provides relatively large gains (but is relatively difficult to achieve). Moreover, there are differences between the short-term and long-term opportunities, with the set of long-term opportunities determined by the success or failure in achieving short-term goals. As such, GMS members need to make a choice between a high-risk, high-reward and a low-risk, low-reward option. Below are specific pointers to guide policy makers in making this choice:

(i) In either option, the approach will require both private investment in new production capabilities and (public) industrial policy facilitating this investment. Policies aimed at encouraging private investment in relevant sectors or products will thus be necessary.

(ii) Industrial policy aimed at achieving the upgrading paths will have to be specific to the industry that is targeted because specific capabilities need to be created. The policy will also have to be comprehensive in addressing all production factors that are involved in the process. Hence, human capital (training of workers), entrepreneurship, export promotion, and investment in knowledge and tangible capital will have to be elements of the policy and the upgrading paths.

(iii) Technology upgrading is likely to be an important aspect in encouraging production upgrading. Policies aimed at incentivizing technology adoption and R&D for upgrading are therefore likely to be an important policy (e.g., encouraging firms to license foreign technology, train their workforce, create linkages with local and foreign knowledge institutions, etc.). Efforts should be made to target these incentives to firms and sectors where upgrading possibilities are likely to be highest (i.e., they should be aligned with the general upgrading path adopted).

Encourage Integration and Upgrading Production in Global Value Chains

GVCs can be an important development paradigm to increase output and wages as well as an important source of technology transfer. To engage and upgrade in GVCs, policies are needed at both the macro and micro levels:

(i) Encourage inward foreign direct investment (FDI). GVCs tend to be driven by the activities of large multinational corporations and their foreign FDI activity. Policies to encourage inward FDI are therefore of prime importance in integrating into GVCs. Policies such as bilateral investment treaties, double taxation treaties, and deep PTAs have been shown to encourage FDI inflows under certain circumstances and should be considered in the list of policy options for integrating into GVCs. However, these policies often do not offset the negative impact of weak domestic institutions, which suggests that enforcement of property rights among other domestic factors are important determinants of inward FDI.

(ii) Invest in trade facilitation measures. GVCs also rely upon relatively friction-free trade. This suggests the importance of infrastructure investments and other trade facilitation measures, as well as low tariff and nontariff barriers with partners—both suppliers and downstream users—within GVCs.

(iii) Support programs targeting knowledge-based assets. Once integrated into GVCs, it is imperative that firms upgrade, both to obtain higher value added and for workers to benefit from higher wages. In most cases, this involves a movement toward more downstream production (an exception being the textiles sector). Efforts should be focused on targeting support programs linked to technology and knowledge-based assets and encouraging linkages between multilateral corporations and their affiliates and domestic firms, universities, and research centers.

At the micro level, governments can play a role in linking small and medium-sized enterprises (SMEs)—the dominant firm type in developing countries—to GVCs, and in ensuring that domestic firms have the capabilities to succeed in GVCs. Governments can carry out this role in the following ways:

(i) Act as an intermediary for SMEs to find GVCs they can enter. Efforts in this regard can be channeled through industry and trade associations, providing them with resources to link domestic firms to GVCs.

(ii) Ensure that SMEs are aware of relevant standards, certification, and accreditation, and provide them with the knowledge and incentives to meet global standards.

(iii) Ensure that SMEs have access to and are engaged in innovation and technology capacity efforts.

(iv) Provide training to SMEs on trade issues related to production capabilities, market research, logistics, marketing plans, banking, international law, partners' search, and legal issues.

Further policies at the micro level can aim at facilitating upgrading of domestic firms within GVCs, with the following policies potentially useful:

(i) Provide incentives and support for the development of new activities within firms (e.g., new products, processes, and functions within GVCs) and entry into (new) GVCs. Policies should be smart, time-limited, and specify targets related to indicators of GVC performance (e.g., new product development or upgrading within the value chain).

(ii) Encourage foreign firms' participation in value chains (e.g., by sourcing inputs from upstream domestic firms), while ensuring that they operate in a non-captive way, i.e., create incentives for foreign firms to share knowledge and technology with upstream suppliers and facilitate upgrading.

(iii) Develop local supplier networks in collaboration with foreign firms, e.g., supplier development programs, to increase the domestic value-added share in value chains.

(iv) Implement local content requirements, considering local capacity and the requirement that "local" refers to local value added and not locally owned. Ensure local content when engaging in infrastructure development.

(v) Devote resources to encourage or allow domestic SMEs to become part of industrial clusters and industrial zones, allowing for interaction with foreign firms.

(vi) Use policy (e.g., export taxes on exportable raw materials or basic intermediates and subsidies and tax breaks on downstream production) to encourage downstream engagement in GVCs.

(vii) Use policy (e.g., related to industrial zones and innovation policy) to further develop upstream and downstream linkages in complementary markets, including services, as a means of raising domestic content and shifting comparative advantage within value chains.

(viii) Invest in specific infrastructure necessary to engage in more complex products and more complex value chains. Investment in ICT infrastructure, in particular, is likely to facilitate movement into higher value-added and more high-tech production.

(ix) Cambodia, the Lao PDR, and particularly Myanmar should look to develop GVC activity in more downstream activities within GVCs through functional upgrading. Given the nature of much upstream activity (e.g., raw materials and primary products), a wider variety of policies may be useful, including export taxes on raw materials and support for downstream production. Applied sensibly and effectively, such policies can help encourage downstream GVC production, as in the case of Indonesia's palm oil, for example.

(x) While the PRC, Thailand, and Viet Nam are already engaged in downstream activities in a number of GVCs, they should look to engage in functional upgrading (including upgrading to the more technologically sophisticated and innovative parts of the chain), but should also devote efforts to chain upgrading, i.e., moving into different value chains.

These policies can help achieve integration and upgrading in GVCs, with the encouragement and targeting of FDI being particularly important, as are programs targeting knowledge-based assets.

An important factor to consider in the targeting of these policies is the overall strategy regarding more general upgrading efforts (see below). These policies should focus on those products or sectors that provide the greatest opportunities for upgrading, i.e., increasing the complexity of production.

Develop Trade Policies and Infrastructure Investments to Enhance Trade Integration

All GMS members have trade potential with a broad range of countries, both within Asia and elsewhere. Trade and investment policies should be used to help meet this trade potential. One way to lower trade costs is through preferential trade agreements (PTAs), which have been shown to be an important driver of trade, especially in the context of stalled efforts to liberalize trade at the multilateral level. The formation of PTAs can be an important means to integrate into the global economy, but should be targeted to countries where significant trade potential exists. In the case of the PRC, Thailand, and Viet Nam, these opportunities may exist with developed countries, while for the other three GMS members the focus may need to be on other developing countries, both within and outside Asia. Such PTAs should also focus heavily on border provisions—those aimed at reducing frictions that are applied at the border (e.g., tariffs, quotas, etc.)—which tend to have the greatest trade impact.

Pay Attention to Sectors That Are Important for Employment When Devising Upgrading Paths

While the more complex products and subsectors are unlikely to be in traditional sectors like agriculture, these sectors provide a great deal of value added and employment for developing economies. Upgrading production activities within these sectors, while not enhancing the overall complexity of production in an economy significantly, can have important implications for wages and the quality of work within these sectors. Services sectors are also often important sources of employment, becoming ever more important over the course of development. Specific recommendations to upgrade production in agriculture and services sectors include the following:

(i) Similar to general upgrading paths, GMS members must choose between subsectors that offer high-risk, high-reward and low-risk, low-reward opportunities.

(ii) The development of these subsectors may need to rely to a large extent on foreign markets (certainly for agriculture, but perhaps less so for services, at least some non-tradable services sectors), with trade policies and incentives related to trade used as a means of developing these subsectors.

(iii) An important dimension when considering agricultural markets relates to the quality of production, standards, and certification. Therefore, firms should be encouraged to obtain the relevant international certifications for their production.

Develop an Environment Conducive to Maximizing the Benefits from the Fourth Industrial Revolution

The GMS members are not producers of 4IR technologies. It is of paramount importance that they understand what these technologies are and do, and assess the implications of their adoption.

Nevertheless, future competitiveness and success are likely to be highly dependent upon being able to compete in the global economy using the latest technologies associated with the fourth industrial revolution (4IR). Policies will need to reflect current capabilities of GMS members and pay attention to the potential negative impacts of new technologies, such as those associated with job automation.

For the PRC and Thailand (and to a lesser extent Viet Nam), this will involve policies that facilitate the production of 4IR technologies, either in the assembly of the technologies or the development of new technologies (i.e., innovation). For the remaining GMS members, the focus of policy efforts should be on providing the conditions needed for these economies to use 4IR technologies, further allowing them to compete and making them attractive destinations for GVC activities. The following are relevant policies to achieve these aims:

(i) Encourage innovative activities in the development of 4IR technologies through the establishment of innovation centers and creating linkages between universities, central and local governments, and the private sector.

(ii) Provide incentives for the adoption of the latest technologies associated with the 4IR as well as research and development (R&D) efforts with regard to these technologies.

(iii) Encourage the transfer of technology from abroad through FDI, for example, by developing linkages between foreign firms and domestic firms, local universities, and research institutes.

(iv) Facilitate structural change and a specialization pattern toward sectors or products that are not associated with high automation risk and where new technologies associated with the 4IR are complementary to workers.

(v) Engage in efforts to upgrade within GVCs, moving away from assembly activities, for example, which are often considered to generate relatively low value added and at greater risk of automation.

(vi) Develop a workforce with the requisite skills to develop, produce, and use 4IR technologies. The development of a skilled workforce also has the potential to insulate countries from the negative impacts of 4IR technologies, with evidence suggesting a negative correlation between occupations at risk of automation and education (as well as wage) levels. Policies to achieve these include

   (a) identifying the set of skills that are necessary to develop, produce, and use 4IR technologies, further focusing on manufacturing sectors that use such technologies intensively;
   (b) assessing the existing supply of skills and estimating the "skills gap" in the manufacturing sector, given the changing nature of production due to new technologies;
   (c) developing managerial skills that, along with a lack of technicians and professionals, are considered bottlenecks for firms to become more productive and link up with regional and global markets;
   (d) developing vocational training and collaboration partnerships between providers of education (e.g., technical colleges and universities) and industry to build up the appropriate practical skills needed to use new technologies; and
   (e) ensuring that opportunities for lifelong learning are available that will allow workers to develop the skills necessary to change jobs throughout their careers as certain jobs are automated and others are expanded.

Cambodia and Myanmar are highly specialized in products within sectors with low complexity relative to the global average. The Lao PDR is somewhat less specialized in relatively low-complexity segments in the sectors where it has high export shares. Guangxi and Yunnan along with Thailand and Viet Nam have more diversified export structures, and these economies export with comparative advantage some products with high complexity relative to the global average.

This dichotomy suggests that Cambodia, Myanmar, and to some extent the Lao PDR should consider focusing on increasing diversification across sectors, much more than the other GMS members, in a way that generates higher per capita incomes. Such an approach implies that these three countries should focus on the relatively easy upgrading path, which would provide limited increases in average product complexity, but would increase levels of diversification.

Part 2 (Chapters 16–19)
THE ROLE OF CITIES AS ENGINES OF GROWTH

The analysis of enterprise-level data across cities shows that firms in large GMS cities (i.e., with a population of a million or more) tend to be more productive and pay workers better and are more likely to engage in innovative activities. For example, firms in Bangkok and Ho Chi Minh City, among the biggest cities in the GMS, have the highest labor productivity, consistent with the idea that "agglomeration economies"—which are greater in larger cities because of workers more likely finding jobs that are a good fit, individuals and organizations exchanging ideas and knowledge, and resources that are more easily shared—are a real and important phenomenon in the GMS. They enable GMS cities to carry out their role as an "engine of growth."

Policy makers who are concerned about the further expansion of large cities in the GMS must recognize that agglomeration economies are a reality and that firms and workers alike benefit from locating in large cities. Thus, to the extent that some GMS members place barriers to the growth of large cities, for example, by restricting migration from rural areas, such barriers will detract from overall productivity and wage growth. The PRC and Viet Nam have explicit policies to restrict the flow of rural migrants to their urban centers. While less strictly enforced in Viet Nam, rural migrants are still excluded from accessing basic social services such as insurance, education, and other social programs. Other GMS members do not have explicit rural to urban migration restrictions in place, but instead have efforts that promote a more regionally balanced development, such as in the Lao PDR and Thailand.

At the same time, the existence of agglomeration economies does not imply that policy makers should overly concentrate resources on big cities and neglect smaller ones. There are three reasons to be mindful:

First, it is possible that some large cities are "too big." Factors such as traffic congestion, weak urban planning, and a lack of affordable housing can take away from the productivity advantages of cities. Traffic congestion is indeed a problem in GMS cities. Similarly, the share of urban population living in slums ranges from 25% in Thailand to 55% in Cambodia. While it is difficult to assess whether a given city is past its "optimal" size, local and national governments must act on the telltale signs associated with diseconomies (i.e., congestion, pollution, slums, etc.).

Second, robust economic growth requires vibrancy in all types of cities—small, medium, and large. For example, cities specializing in marketing and trading of agricultural produce are typically efficient at a fairly small size (therefore, these cities are better described as towns in common usage). On the other hand, cities that specialize in finance and modern business services are associated with a much larger city size. Given this, policy makers cannot neglect small and medium-sized cities.

Third, the analysis of enterprise-level data across cities shows that, while firms in bigger GMS cities perform quite well vis-à-vis their counterparts in the rest of developing Asia in terms of enterprise productivity and wages, firms in smaller GMS cities lag behind their counterparts elsewhere. It is possible that, in comparison to other parts of developing Asia, the smaller cities of the GMS have weaker infrastructure, educational institutions that develop more limited human capital, and a poor climate for encouraging entrepreneurship. In other words, GMS policy makers may have shown a "big city" bias in their resource allocation across urban areas. Future research should explore this further.

Managing the City

While cities are much more than places of work, they cannot thrive unless they are attractive places for workers and firms to locate and connect with one another. Two agendas can serve as guides to policy makers for managing the city as a labor market.

The first is the *basic agenda*. It consists of basic issues key to realizing agglomeration economies and ensuring that cities are not overwhelmed by the negative effects of congestion. These cover the state of transport and other urban infrastructure, affordable housing, and urban planning and land-use regulations. The analysis highlights the following recommendations:

(i) Ensure an efficient and affordable multimodal transport system. Granular trip data used to measure congestion show that there is considerable variation in congestion across cities, with large GMS cities tending to have the most severe congestion. In Yangon, Kunming, and Ha Noi, it takes at least 60% longer to travel between a given origin–destination pair during rush hours than during nonpeak hours. Public transport systems also have limited reach. Furthermore, even when formal public transport systems are in place such as in Da Nang and Can Tho in Viet Nam, travel duration by public transport can take four to five times longer than with private transport. Since inadequate mobility within a city fragments the labor market, GMS cities must provide a multimodal public transport system that combines trains and buses and less formal services like tuk-tuks, mini buses, and even ride-sharing to improve mobility. Achieving better mobility might require large new investments in upgrading the transport infrastructure. Those investments should be commensurate with the ongoing expansion of cities. New tools of financing infrastructure, such as land-value capture, need to be considered to help the public sector cope with the challenge.

(ii) Expand the supply of affordable housing, one that is well connected to the transport network and to water, sewerage, and sanitation services. Decent housing is very expensive in the region. In fact, it takes at least 10 years of average household income to be able to afford a home in large GMS cities. It is most expensive in Vientiane, where a household needs to set aside 23 years' worth of income to become a homeowner. Solving the housing challenge requires examining whether better urban and land-use planning can free up space for housing, encouraging the involvement of the private sector (for example, through financial incentives), and developing a thriving rental market that offers a healthy mix of both public and private rental housing.

(iii) Apply better urban planning and land-use regulations, not only within the administrative boundaries of cities, but also in the areas of "urban expansion." Street, road, and zoning layouts can have lasting consequences on the trajectory of a city's development. For example, Kunming and Nanning have been laid out, such that public transport is accessible within walking distance—about 500 meters—of households and establishments. Such configurations influence the extent to which congestion takes hold and how difficult they are to address. This requires reassessing whether some planning norms are outdated and strengthening the capacity of urban planners.

The second or supplementary agenda requires that cities have conducive environments for the incubation and operations of new and dynamic firms. In practice, this means paying attention to institutions that build human capital, providing conducive business environments, and formulating policies to encourage new economic activities and young firms to operate. Specifically, these are the two issues that policy makers must pay attention to:

(i) Ensure that cities offer opportunities for people to develop their human capital. This needs to be understood as much more than ensuring high-quality basic and secondary schools. As the empirical analysis of agglomeration economies indicates, firms in cities with a top-ranked university are 10% more likely to engage in process innovation and R&D activities. Yet, only Thailand, Viet Nam, and Yunnan have top-ranking universities in their cities. Given the importance of innovation to economic growth, GMS economies must consider developing more high-quality universities and distributing them more evenly across the region. Currently, these tend to be concentrated in the few major metropolitan centers in the GMS.

(ii) Provide a good business environment for firms. After all, production takes place in a specific location, typically in or near a city. Access by entrepreneurs to appropriately located land that is well-serviced by the transport network and close to affordable housing for workers are issues that local governments have influence on. They must pay attention to these needs and work closely with other government agencies; for example, agencies that focus on industrial development. For this to happen, GMS policy makers may need to evaluate the role of their local governments and examine whether they are incentivized and equipped to play a more active role in ensuring a good environment for business activity.

Managing the Urban System

Cities are connected to one another and thus form a "system," where the economic functions and activities of one city often complement, but sometimes compete, with those of other cities. There are two factors that underpin an efficient system of cities: the state of intercity transport infrastructure and the organization of institutions that coordinate decisions and plans across cities and their administrative units.

Investing in Transport Links

Transport links are key to facilitating the interrelationships between cities within a country or region and across members in the GMS. Indeed, the geographic configuration of the GMS presents an important setting for viewing its cities as part of a system that extends beyond its economies.

To successfully invest in transportation infrastructure, GMS members must consider the following issues and opportunities:

(i) Address bottlenecks in the road system. Notwithstanding the extensive GMS road network, there are bottlenecks within the road system that stem from poor road quality, such as those that affect the Bangkok–Dawei link. These bottlenecks need to be addressed by making the required investments. Further, there is scope to improve train and even flight links across GMS cities.

(ii) Explore possibilities for using the Mekong River. While roads and rails form a majority of cross-GMS trade transport, navigation along the Mekong River also offers a potential for supporting the GVC production network. This may be particularly relevant for the landlocked Lao PDR. However, the navigational limits of rivers mean that using inland water transport requires multimodal connections that allow for interface between different transport modes and their associated cargo-handling facilities. This is best demonstrated in the case of Cambodia, where 75% of domestic trade traffic is between the major inland river port in Phnom Penh and the major seaport in Sihanoukville about 220 km away.

Coordinating Spatial and Economic Planning

Institutions for better coordination of spatial and economic planning are needed at different geographic scales, ranging from cities in a city cluster to cities far from one another but intimately connected by transport links:

(i) Design an effective structure of metropolitan governance. The growing importance of city clusters in the GMS means that spatial and economic planning must be better coordinated across closely located multiple local government units. The spatial expansion is expected to continue for most GMS cities. This means that the location of industrial parks, water treatment and solid waste facilities, and transport hubs that serve a city cluster needs to be decided upon in a systematic and coordinated manner. An effective system of metropolitan governance is needed for allowing governments at all levels—constituent cities, peri-urban areas, as well as state and provincial governments—to develop comprehensive plans and policies and benefit from economies of scale in infrastructure investment and in the delivery of public services. Designing such a system is not easy, but it must be a priority for policy makers.

(ii) Coordinate intercity transport projects. The need to coordinate spatial and economic planning also applies to cities located far from one another. One area of coordination covers investment decisions on transport infrastructure. Intercity transport infrastructure projects and plans are often very costly. However, their benefits will be weak if they proceed without a high degree of coordination and planning involving officials from different cities and agencies. In the case of the GMS city system, this implies the need for coordination across GMS cities and planning agencies in charge of transport, water, sewage, etc.

Some Dilemmas for Policy

Given the many competing needs for public investments in transport and urban infrastructure across cities and given limited resources, the issue of priority inevitably arises. For example, how much of the public investment program for infrastructure should be focused on bigger cities rather than smaller ones?

Larger cities in the GMS have an edge in attracting private investment because agglomeration economies promise high returns. Thus, they should be encouraged to draw on the private sector to meet a portion of their own investment finance needs. In this way, big cities need not be in direct competition with public funding for infrastructure in other places.

Another dilemma that arises is that improvements in the city system—within economies and across the GMS—may harm some locations. For example, while investments in intercity transport make the system more efficient overall, they may adversely affect some cities and their hinterland.

Similarly, while some small cities benefit from improved connectivity with core cities in a city cluster, others may suffer declines in some lines of business. To address this dilemma, policy makers must take the following steps:

(i) Find out why a city is lagging behind and respond accordingly. The appropriate public response depends on the reasons why a city or locality has been left behind and the specific problems that arise with it. For example, if the outmigration of the young leads to demographic imbalance, institutions for better elderly care should be provided. Geographic remoteness can be alleviated by connecting to larger markets.

(i) Invest in human capital in a spatially neutral manner. As a general rule, this is one of the most important responses to spatial inequalities. In other words, the residents of small and remote cities, as much as those of large well-connected cities, must have access to good quality education and health care. Together with policies that do not place barriers for workers to move to other locations, such investments enable a convergence in living standards across different locations despite a tendency toward geographical concentration of economic activities. This has been the experience of high-income countries.

Part 3 (Chapters 20–22)
THE NEED TO IMPROVE THE QUALITY OF ROAD INFRASTRUCTURE TO ENHANCE TRADE INTEGRATION AND CONNECT COMPETITIVE CITIES

The detailed analysis combining NTL and OSM-based online routing systems to evaluate the degree of connectivity and the quality of roads at the national and district levels of the GMS, leads to the following general recommendations to identify roads where improvements are needed and networks that would generate higher growth, as well as to develop and connect modern and competitive cities:

(i) Make use of volunteer-based and bottom-up online routing systems to evaluate and monitor up-to-date road connectivity more efficiently with less or almost no financial and time costs.

(ii) Improve road connectivity to Bangkok, Ho Chi Minh City, and Ha Noi. This is the most efficient option to increase market potential for most districts in the GMS, except those in Guangxi and Yunnan, which have other large cities close by.

(iii) Develop a metropolitan area similar to Bangkok, Ho Chi Minh City, or Ha Noi somewhere in the western part of the GMS, which would greatly contribute to enhancing the market potential of many districts in Myanmar and the upper part of the GMS.

(iv) Develop a metropolitan area similar to Bangkok, Ho Chi Minh City, or Ha Noi in central Viet Nam, which would greatly contribute to enlarging the market potential of districts in the central part of the GMS, in particular the East–West Economic Corridor.

(v) Improve road connectivity to Ha Noi. The expected contribution of Ha Noi to the upper part of the GMS in terms of market potential is currently obstructed by poor road connectivity with the western part of the region due to a mountainous landscape. Better road connectivity from Ha Noi to the west would not only benefit the Lao PDR but also the upper part of the GMS, including northern Thailand and Myanmar.

(vi) Reduce border crossing time, which is the time elapsed between the arrival at the border and effectively crossing to the other country. This accounts for much of the total transportation time from origin to final destination. A reduction in border crossing time is the cheapest and most efficient way for border-area districts to benefit from larger and closer markets in neighboring members.

(vii) Improve road connectivity in Myanmar, Yunnan, and Guangxi with the rest of the GMS, which would significantly advance cross-border regional cooperation in the GMS.

(viii) Enhance trade facilitation efforts. Opportunities exist for all GMS members to improve their performance in terms of trade facilitation. This is particularly the case for Cambodia, the Lao PDR, and Myanmar. While opportunities exist across all the different dimensions of trade facilitation, the returns from investments appear to be largest for infrastructure, international shipping, and timeliness (i.e., reducing the administrative burden of trade).

(ix) Develop a major international seaport in the western part of the GMS. Most inputs used by firms participating in GVCs in the GMS arrive through sea transport. Having an international seaport with a high traffic volume is essential for a metropolitan area to become a major production base for a GVC. There is currently no major international seaport in the western part of the GMS. Developing one would greatly benefit nearby districts and eventually the entire GMS.

(x) Connect seaports with cross-border railway networks, two of the cheapest modes of long-haul transport. These would enable more firms located in the GMS to participate or penetrate further into GVCs.

Below are specific recommendations for each GMS member.

Cambodia

(i) The areas in most need of roads are the southwestern and northeastern parts of the country.

(ii) Adding paved roads with more than two lanes would increase the average speed between districts (currently 33.07 km/h for all districts).

(iii) It takes well over 5 hours to drive from Phnom Penh to Ho Chi Minh City, a cluster of very large markets, even though the straight-line distance between the two cities is only a little over 200 km. A shorter access time (better-quality roads and less time to cross the border) to Ho Chi Minh City would significantly increase Phnom Penh's market potential as well as districts in the eastern part of Cambodia.

Lao People's Democratic Republic

(i) The lack of roads in the Lao PDR is mainly the result of its very low population density, about 29 persons per km^2, compared to about 81, 90, 135, and 308 persons per km^2 in Myanmar, Cambodia, Thailand, and Viet Nam, respectively. Consolidation of very small districts into medium-sized cities, with special consideration for its social impact, could be an efficient way to increase connectivity between districts.

(ii) Paved and wider mountain roads with a center line would lessen the need to slow down when facing oncoming traffic and would increase average speed (currently 28.52 km/h for all districts) in the mostly mountainous areas of the Lao PDR.

(iii) Due to a lack of roads, it takes over 8 hours to drive from Sam Neua, a city in the north, to Ha Noi, a cluster of large markets, even though the two cities are only 190 km away from one another by straight-line distance. A shorter access time (better-quality roads and less time to cross the border) to Ha Noi would significantly increase the market potential of many districts in the northeast Lao PDR.

Myanmar

(i) The western and eastern parts of the country need more roads.

(ii) Roads of higher quality would increase the average speed between districts (currently 30.73 km/h for all districts).

(iii) Districts in the south, southwest, and northeast have relatively poor connectivity to major markets in the GMS compared to the rest of Myanmar's districts. Besides the country's landscape and the lack of quality roads, the relatively small number of border gates worsens connectivity and the time it takes to reach major markets across its border.

(iv) It takes over 11 hours to drive from Dawei in southern Myanmar to Bangkok, the largest cluster of markets in the GMS, just over 200 km away. Shortening travel time to Bangkok would increase the market potential of districts in southern Myanmar. The same is true for districts in the northeast in relation to large markets in Yunnan.

Thailand

(i) Although Thailand has the best road networks in the GMS, the districts along the border with Myanmar, and to a lesser extent those along the border with the Lao PDR and Cambodia, still need more roads in order to catch up with the rest of the country.

(ii) Roads of higher quality would increase the average speed between districts (currently about 53 km/h for all districts).

(iii) The southern areas of Thailand are not well connected with the rest of the GMS. This is mainly due to the shape of the territory but also to the existence of larger markets further south in Malaysia, which are closer by land. Other modes of transport, such as by sea, could be a better option if this region is to benefit from major markets in the GMS.

Viet Nam

(i) More roads are needed along western land border areas.

(ii) Higher-quality roads would increase the average speed between districts (currently 35.22 km/h for all districts).

(iii) It takes well over 10 hours to drive from central Viet Nam to any major market in the GMS. The presence of a major market in central Viet Nam would benefit greatly not just districts within the country but also those in the central Lao PDR and northeastern Cambodia.

Guangxi

(i) Guangxi's connectivity by land with the rest of the GMS is mainly through the northern part of Viet Nam to the south. Given its market size, second only to Thailand's, and a seaport that has rapidly increased the amount of container throughput, improved connectivity westwards would greatly benefit the northern parts of the GMS.

(ii) Current average speed (57.17 km/h) is slightly higher than in Thailand and the highest in the GMS.

Yunnan

(i) More roads are needed in the southwestern and western parts of the province.

(ii) Higher-quality roads would increase the average speed between districts (currently 41.02 km/h for all districts).

(iii) Yunnan's connectivity with the rest of the GMS is currently through mountainous roads that cross relatively underdeveloped areas of the other GMS members. The northern part of the GMS would benefit significantly if Yunnan were better connected with Myanmar, the Lao PDR, and northern Viet Nam.

Finally, it is also important to improve the components of trade facilitation. The analysis shows that performance varies significantly across GMS members. Some—such as the PRC—perform relatively well, while others—notably the Lao PDR—are lagging in terms of the trade facilitation index. Cambodia's relatively large improvement in the index in recent years is noticeable. To continue improving, the PRC should focus on the efficiency of customs, and Cambodia on the quality of its trade infrastructure. The Lao PDR and Myanmar need to improve all components of trade facilitation. Thailand and Viet Nam score well, but are below the PRC in all components (especially Viet Nam).

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The Greater Mekong Subregion 2030 and Beyond

Integration, Upgrading, Cities, and Connectivity

This publication provides an analysis of key challenges and opportunities for the Greater Mekong Subregion (GMS) to realize its development goals by 2030 and beyond. While the six member countries have made impressive gains in recent decades, much remains to be done to close the gap with the world's most advanced economies. The GMS needs to further integrate into the global economy, significantly upgrade production and exports, enable cities to be engines of growth, and improve the quality of road infrastructure and connectivity.

About the Greater Mekong Subregion Economic Cooperation Program

The Greater Mekong Subregion (GMS) is made up of Cambodia, the Lao People's Democratic Republic, Myanmar, the People's Republic of China (specifically Guangxi Zhuang Autonomous Region and Yunnan Province), Thailand, and Viet Nam. In 1992, with assistance from the Asian Development Bank and building on their shared histories and cultures, the six countries of the GMS launched a program of subregional economic cooperation—the GMS program—to enhance their economic relations. The GMS program covers the following priority sectors: agriculture, energy, environment, health and other human resource development, information and communication technology, tourism, transport, transport and trade facilitation, urban development, and border economic zones.

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ASIAN DEVELOPMENT BANK
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org