GLOBAL VALUE CHAIN DEVELOPMENT REPORT 2017

MEASURING AND ANALYZING THE IMPACT OF GVCs ON ECONOMIC DEVELOPMENT

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Foreword by Michael Spence

The global economy is evolving rapidly. It presents a complex and ever-changing picture. And it is important. The trends, opportunities, and challenges affect the lives of every person on the planet. But the forces at work and the results for trade, the structure of economies and employment, incomes, and human capital values have been and still are at best incompletely understood.

There is a growing body of research on the impacts of globalization and digital technology on individual economies. And there has been a huge and productive effort to reconfigure and refine trade data so as to expose the complex value-added structure of trade in goods and services, led by the Organisation for Economic Co-operation and Development, the World Bank, the World Trade Organization, and a number of other institutions.

What has been largely missing is a comprehensive and detailed picture of the dynamic network structure of the global economy. How economies are linked, specialize, and grow (or not) is captured in the way global value chains (GVCs) are put together. That is what this report is about. It is a huge contribution to our deepening understanding of what the global economy really means and how it is changing. One can think of it as a different viewpoint, complementary to the single-economy studies that focus on structural shifts and economic performance at the national level and that try to capture the impacts of trade and technology on growth, incomes, jobs, and more.

The insights in this volume are far too numerous to document in a foreword. I encourage everyone, scholars, policymakers, and leaders in business and civil society organizations as well as curious and at times concerned citizens, to read the studies. If we do this, it will expand our shared understanding of the forces at work and facilitate productive discussion of how to adapt and benefit from the global economy and how to deal with some of the distributional challenges that come with it. It is natural to see globalization through the lens of its effects on the domestic economy. But it is eye opening to see it also as a complex evolving network.

Here is a small sample of the insights that emerge from this valuable collection of studies.

Global trade looks very different when detailed quantitatively in value-added terms rather than as gross flows of exports and imports. Complex value chains (a growing fraction of global trade, especially trade in high-value manufacturing and services), with multiple participants and numerous cross-border flows, are literally invisible when the focus is on gross flows.

Bilateral trade balances shift in a major way when viewed in value-added terms. While economists may deem these to be not so important, they are politically salient and strongly influence public sentiment and hence attitudes toward trade, trade agreements, and indeed fairness.

Services are extremely important and represent a growing fraction of trade. But to see that in detail, one needs to break down manufacturing value chains to expose the very large services components that are embedded in them. This point deserves emphasis. A careful study of GVCs in sectors classified as manufacturing (presumably because a physical product is delivered to the final consumer—which may be a firm that is producing something else) reveals that a large fraction of the value added is in services, broadly defined, with the fraction depending on the industry. These services are both upstream and downstream from the physical production of components and from assembly. Advanced economies, where the higher valued-added components tend to be located, thus show up in GVCs in the upstream and downstream components. This gives rise to a picture of GVCs composed of the participants along the value chain correlated with their stage of development, referred to as a "smile curve" because of its shape. This report does a superb job of moving the quantitative analysis forward on this front.

Barriers to trade in services are declining, slowly, but are much higher than those in the movement of goods, narrowly construed. These barriers have multiple sources, including regulation, legal institutions, infrastructure, and simple capacity.

The patterns of specialization across countries are much more visible and clearly defined when viewed through the lens of complex value-added chains. Through this lens you can detect, with much greater precision, where employment is created, what drives productivity growth, and what factors are affecting income distribution in a wide range of developed and developing countries.

As China's incomes rise and the tradables side of its economy shifts away from labor-intensive process manufacturing and assembly, one would think that these components of complex GVCs would shift to lower income countries, creating growth and development opportunities and momentum. To some extent, this is happening and will expand. But there are impediments. This volume makes it clear that low wages are not enough.

Connectivity and, with it, reasonably efficient processes for logistics and for meeting standards and regulatory requirements are critical. And lots of countries currently lose out on this front. In the report, these issues are brought into sharp focus by distinguishing between wages and unit labor costs and by highlighting the factors that can differentially drive a wedge between the two. Clearly, for competitiveness, unit labor costs are the critical factor.

There are many more insights in this volume. I was especially interested in the way the evolving pattern of specialization in production and services within global supply chains helps explain the divergent distributional impacts of globalization across developed and developing countries.

The report helpfully distinguishes elements of an economy that are tradable and the large set that are nontradable. Clearly the tradables set is expanding with the support of enabling technology. For example, small and medium-size businesses can access global markets in a way that was simply impossible before because the transaction costs of doing so were prohibitively high. But the nontradables part of any economy remains very large. The linkages between the tradables and nontradables parts of an economy on both the supply and demand sides are crucial in understanding the growth patterns. This volume makes a good start at exposing the linkages between the tradables and nontradables sides of an economy. These linkages are complex. On the supply side they come through labor market shifts, and on the demand side through spillover effects of rapid income growth arising from specialization and growth on the tradables side. There is more to do here, but this volume is a very good start.

In trade and in economies generally, your neighborhood matters. Michael Porter and others in the classic book, *The Competitive Advantage of Nations,* documented that in virtually every industry there are a relatively small number of concentrated centers of excellence where efficiency and innovation are high. Proximity and agglomeration benefits matter. We continue to see these patterns today, whether they be in autos, electronics, financial centers, or in innovation hubs like that in Shenzhen in southern China. This has obvious implications for trade, particularly in services, including those contributing to manufacturing GVCs.

The report argues that connectivity in the networks that define the evolving architecture of GVCs is important. This is another aspect of neighborhood mattering. GVCs properly documented in value-added terms provide a detailed picture of the network connectivity of an individual economy and hence of which parts of the global economy will strongly influence that economy and its various sectors.

Under the heading of neighborhood effects, the authors find that even well-structured and connected economies with relatively low unit labor costs and high connectivity will suffer if their immediate neighbors fall short on the same metrics. "Bad neighbors" have a depressing effect on trade and presumably on growth. This may result from depressing effects on local trade or other factors. One suspects this negative spillover is more significant in the case of landlocked countries, but that is speculation on my part.

The *Global Value Chain Development Report* is the result of intensive and detailed work in assembling and analyzing data on the structure of economies and on how they are linked. It creates a much clearer picture of evolving patterns of independence. It also presents a much clearer picture of comparative advantage.

No country has a comparative advantage in making iPhones. What they do have is comparative advantage in generating elements of the iPhone GVC, in key services, components, and assembly. The multinationals are the architects of the supply chains. And there are firms that are specialists in structuring GVCs in various groups of industries—firms that are not associated with the production of a particular set of products. One might think of them as pure GVC architects.

Trade is a microeconomic phenomenon. Countries don't trade GDP. They specialize in trade in goods and services. And now we see that specialization for much of trade needs to be thought of in terms of components of GVCs. With value-added trade and GVCs you can see in detail, really for the first time, how trade catalyzes growth, especially in developing countries, and how it relates to employment, productivity, and income growth.

I learned a tremendous amount from the research reported in this volume, and I highly recommend it to all who are interested in growth and development, in trade and international investment, and in policies that promote or retard growth and development.

Michael Spence
Nobel Laureate in Economics

Foreword by Pol Antràs

On 19 April 2017, international trade economists celebrated the 200th birthday of their field. The date marks the publication of David Ricardo's *Principles of Political Economy and Taxation*. Its landmark chapter 7, "On Foreign Trade," introduced the concept of comparative advantage to economics. In his famous example, David Ricardo demonstrated that it was in England's interest to exchange cloth for wine with Portugal even if English workers could produce both goods more efficiently than workers in Portugal could.

Although the concept of comparative advantage is as relevant today as it was 200 years ago, the nature of international trade flows has changed dramatically in recent decades. The information and communication revolution (and the attendant radical decline in the cost of processing and transmitting information at long distances), a wave of regional trade agreements in various corners of the world, and the fall of the Berlin Wall (which brought into the capitalist system hundreds of millions of workers) led to the disintegration of production processes across borders, as firms found it more profitable to organize production on a global scale. World production is now structured into global value chains (GVCs) in which firms source parts, components, and services from producers in several countries and in turn sell their output to firms and consumers worldwide. The typical "Made in" labels in manufactured goods have become archaic symbols of an old era. Today, most goods are "Made in the World."

The rise of GVCs has naturally captured the attention of international trade economists eager to bridge the apparent gap between the new characteristics of the international organization of production and the standard methods used to collect, manipulate, and interpret international trade statistics. In particular, a remarkable body of work has devised ingenious empirical methods to disentangle the value-added and intermediate input contents of gross bilateral international trade flows. It has also developed theoretical models for interpreting the new data and offering insights into the likely consequences of future trade liberalization episodes.

This report offers a superb overview of some of the key developments in this body of work and breaks new ground on the study of the rise of GVCs. I have spent the better part of my academic career thinking about the growing disintegration of production processes across countries, and yet the various chapters here have revealed a great number of new insights.

From the initial chapters that masterfully overview and document several empirical facts related to the participation of various countries in GVCs and their relative positioning within those chains, to the subsequent five chapters focused on specific topics, the report offers an enormous amount of food for thought. What are the consequences of the cascading effects of trade costs along GVCs? What is the role of GVC participation in escaping the middle-income trap? How does services trade complement and support merchandise trade in GVCs? What are the consequences of variation in institutional quality for the geography of GVCs? And how should one design trade policy in the new age of GVCs?

These are questions I feel much better equipped to answer after working through this fascinating report. I am sure it will be a very useful reference for academics and practitioners for years to come.

Pol Antràs
Robert G. Ory Professor of Economics
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Partners

The World Bank is an international development institution established by the Articles of Agreement adopted by its member countries. The World Bank's overarching mission is to reduce poverty, improve living conditions, and promote sustainable and comprehensive development in its developing member countries. It has two ambitious goals to anchor its mission: end extreme poverty within a generation and boost shared prosperity. It will achieve these goals by providing loans, concessional financing, technical assistance, and knowledge-sharing services to its developing member countries and through partnerships with other organizations.

The Institute of Developing Economies (IDE–JETRO) is a government-affiliated research institute that conducts basic and comprehensive research on economics, politics, and social issues in developing countries. Through its research, IDE–JETRO contributes to knowledge on developing economies and better understanding of the regions to the government and public.

The Organisation for Economic Co-operation and Development (OECD) is an international and intergovernmental organization comprising the world's main industrialized market economies whose mission is to promote policies that will improve the economic and social well-being of people around the world: Better Policies for Better Lives. The OECD does this by providing a forum for governments to share experiences and seek solutions to common problems.

The Research Center of Global Value Chains is a global academic think tank headquartered at the University of International Business and Economics, focusing on basic and interdisciplinary research on the development of global value chains and their implications for global economies.

The World Trade Organization (WTO) is an international organization that deals with the global rules of trade between countries. It administers agreements, negotiated and signed by its members, which provide the legal ground rules for international commerce. The purpose is to help trade flow as freely as possible for the economic development and the welfare of its members' citizens. The WTO is serviced by a secretariat that provides expert, impartial, and independent support to member governments, including research, analysis, and statistical information related to the role and developments of trade in the global economy.

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This first report draws contributions from 16 background papers presented and discussed at the conference "Making Global Value Chains Work for Economic Development and Shared Prosperity" in Beijing during March 17–18, 2016, organized by the RCGVC and the China Development Research Foundation. Drafts of the eight chapters of the report were presented and discussed at the second Authors' Conference in Washington, DC, during November 28–29, 2016, organized by the World Bank. The editors thank the authors of background papers and individual chapters and the discussants and participants in the two conferences for insightful comments and suggestions that helped draft and improve the chapters (see appendix 1 for the programs).

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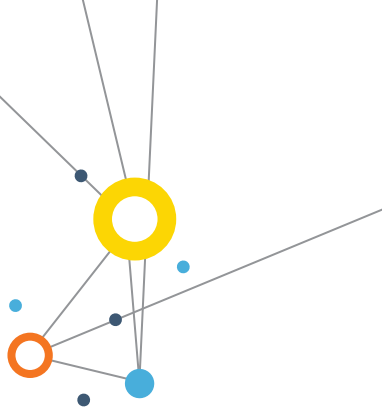
Editors: David Dollar, Jose Guilherme Reis, and Zhi Wang.

Abbreviations and acronyms

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
CEPII	Institute for Research on the International Economy
EU	European Union
FDI	Foreign direct investment
G7	Group of Seven
G20	Group of Twenty
GDP	Gross domestic product
GVC	Global value chain
ICT	Information and communication technology
IDE–JETRO	Institute of Developing Economies–Japan External Trade Organization
NAFTA	North American Free Trade Area
OECD	Organisation for Economic Co-operation and Development
UN	United Nations
WTO	World Trade Organization



Executive summary

DAVID DOLLAR

Global value chains (GVCs) break up the production process so different steps can be carried out in different countries. Many smart phones and televisions, for example, are designed in the United States or Japan. They have sophisticated inputs, such as semiconductors and processors, which are produced in the Republic of Korea or Chinese Taipei. And they are assembled in China. They are then marketed and receive after-sale servicing in Europe and the United States. These complex global production arrangements have transformed the nature of trade. But their complexity has also created difficulties in understanding trade and in formulating policies that allow firms and governments to capitalize on GVCs and to mitigate negative side effects.

Today's official statistical information systems, designed to measure economic activity in a pre-GVC world, have struggled to keep pace with these changes. Conventional measures of trade, important though they remain, measure the gross value of transactions between partners and so are not able to reveal how foreign producers, upstream in the value chain, are connected to final consumers at the end of the value chain. For example, conventional statistics suggest that the Republic of Korea exports a lot to China. In fact, much of this trade consists of components that are ultimately destined for the European and U.S. markets. So it would be more accurate to say for these products that Korea exports a lot to advanced consumer markets.

The importance of the GVC phenomenon has stimulated researchers to develop statistics and analysis based on the value added in trade. The GVC phenomenon also demands that researchers analyze the discrete tasks or phases in the production process. Data are now available on the value added traded among major economies during 1995–2014. This first *Global Value Chain Development Report* draws on the expanding research that uses data on the value added in trade. Its main objective is to reveal the changing nature of international trade that can be seen only by analyzing it in terms of value added and value chains.

A natural place to start is with the theoretical foundation of GVCs (chapter 1). Why do we care about analyzing GVCs? For two main reasons. First, GVCs provide new opportunities for developing countries to increase their participation in global trade and to diversify their exports. Without GVCs, a developing country would have to be able to produce a complete product in order to expand into a new line of business. Historically, developing countries have tended to export unprocessed raw materials, suggesting that the jump to producing finished goods was difficult. Today, because of the opportunities for integrating in specific parts of the value chain, many developing countries are exporting primarily manufactured goods. (In the spirit of this report, it would be more accurate to say that they export primarily manufacturing value added.) The development of GVCs has no doubt contributed to this diversification of exports. Still, only a small number of developing economies are deeply involved in GVCs, China being the best example. So how can developing countries deepen their involvement in GVCs? And how can they move up the value chain?

A second reason to analyze valued added in trade and GVCs is that data on the gross value of trade can be misleading. This report highlights how shifting the analysis to value added radically changes the picture.

Characterizing global value chains

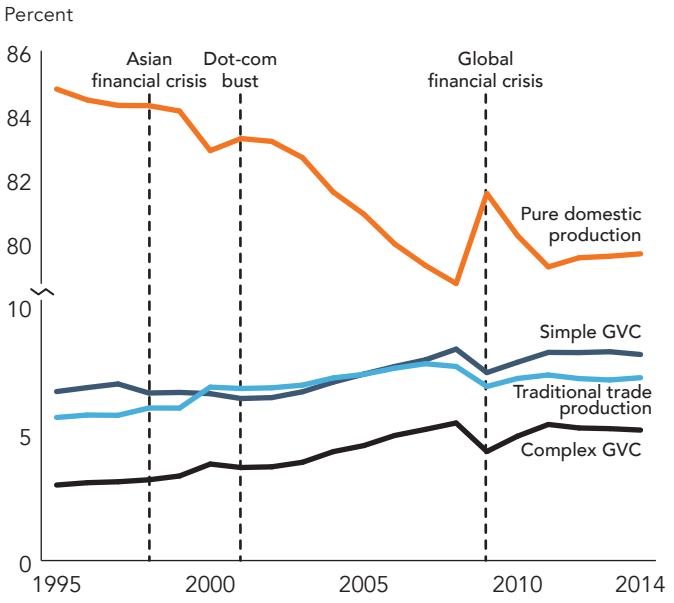
To capture the variation in the extent of offshoring and production sharing by sector and country, the report develops a GVC index system that includes three indexes to characterize the nature of GVCs: a production length index for the average number of production stages and complexity of the value chain, a participation index for the intensity of a country-sector's engagement in GVCs, and a position index for the location of a country-sector pair on a GVC—that is, the relative distance of a particular production stage to both ends of a GVC (chapter 2). All these indexes are built through a system of global input-output tables that underpin all trade in value added data and that provide the basis for decomposing gross domestic product (GDP) into broad categories of activity based on forward industrial linkages.

Pure domestic value-added production activities are those that are completely produced and consumed within one country, such as a haircut. When these goods or services are exported to another country, that transaction conforms to the classical idea of trade, with production occurring completely in one country and consumption in another. República Bolivariana de Venezuela exporting oil to the United States is an example. Value added created by production across national borders (embodied in intermediate trade flows) are GVC activities, which can be further decomposed into simple and complex cross-border production-sharing activities based on the number of border crossings. In simple GVCs value added crosses national borders only once during the production process, with no indirect exports via third countries or re-exports or re-imports. In complex GVCs value added crosses national borders at least twice (Wang and others 2017). Using the GVC index system, the report characterizes cross-border production-sharing patterns and GVC activities for 35 sectors and more than 40 countries over 20 years based on the World Input-Output Database (Timmer and others 2015).

Global value chains were expanding until the global financial crisis

It will come as no surprise that, in general, GVC production has been increasing during the modern era of globalization. Most value added is still domestically produced and consumed, but the share of this part of GDP declined markedly until the global financial crisis, shrinking from 85% of global value added in 1995 to less than 80% in 2008 (figure 1). Different types of trade all expanded their shares during this period, but the most rapid increase was for complex GVCs. The 2008–09 global financial crisis was naturally a disruption, but trade rebounded fairly quickly. What is surprising is the lack of further expansion in the shares of either traditional trade or GVC trade since 2011. The share of purely domestic value added has increased slightly since 2008. It is too soon to know for sure, but it may be that the process of deeper integration associated with GVCs has stalled or even started to reverse. Still, throughout this period, GVC trade

FIGURE 1 Global value chains were expanding, until the financial crisis



Source: University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

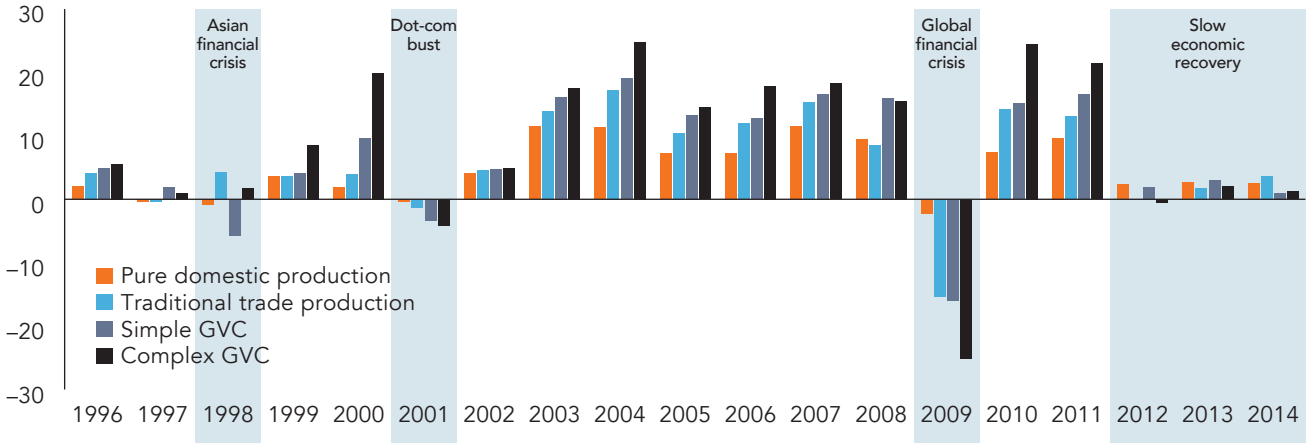
(simple and complex combined) accounted for 60–67% of global trade in value-added terms, reflecting the importance of the GVC phenomenon.

Further insight into the changing pattern of value-added creation can be gained by looking at the nominal growth of value added separately for purely domestic production, traditional trade, and GVCs between 1995 and 2014 (figure 2). From 1996 through 2007 value added in complex GVCs grew faster than other components of GDP (so its share was rising). This was especially pronounced in 2002–08, the heyday of GVC expansion. The acceleration of GVC expansion occurred shortly after China joined the World Trade Organization (WTO), and China's growing participation in GVCs is probably one factor at work here. During 2002–08 not only was the share of GVCs rising, but the rate of nominal value-added growth was also very high in all parts of value added because of rapid real growth, moderate inflation, and appreciation of most currencies against the U.S. dollar. The period 2009–11 then represents the crisis and initial rebound. What is striking since 2011, however, is how slowing rates of GDP growth appear to have had a disproportionate impact on GVC channels, particularly for complex GVCs, which were the key driver of growth in preceding economic cycles.

The decomposition also allows for the characterization of different stages along GVCs: at each stage value added is counted as the gross output of some industry. This report also draws new insights on the changing pattern of GVCs through a new type of "smile curve" (chapter 2). The smile curve is best explained through an example, as in figure 3. For China's exports of

FIGURE 2 Nominal growth rates of different value-added creation activities, 1996–2014

Percent



Source: University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

electrical and optical equipment in 1995 and again in 2009, the data points are represented by circles indicating country-sector pairs that contribute in production, with the letters denoting the country and the number the industry. The size of the circles represents the absolute value added gained by joining the value chain (in millions of constant U.S. dollars). An estimated curve is fitted through these points, and the shape of the curve is that of a "U" or a "smile." The vertical axis plots labor compensation per hour in the country-sector, indicating high- versus low-value-added activities. The horizontal axis plots the total forward linkage–based production length between global consumers of electrical and optical equipment and a specific participating industry in the corresponding GVC.

The logic of the smile shape is as follows. Research and design activities for critical components of the electrical and optical equipment occur early in the production process (left side of the figure). These knowledge activities tend to be high-value-added activities in GVCs and tend to be carried out in more advanced economies. For example, in the 1995 curve Japan and the United States (JPN28 and USA28) are in the upper left corner, reflecting the high-value-added contributions from these two countries' financial services sector. The Chinese industry that manufactures the good, Chinese electrical and optical (CHN14), is at the bottom point of the curve, reflecting assembly activity at low wages. The activities closest to the consumer are marketing, logistics, and after-product servicing. These market knowledge industries are also high value added, as shown by the upward-sloping part of the smile curve on the right. And they tend to be carried out in advanced economies, where the mass consumption products are eventually purchased by households.

The comparison of the same country-sector export in 1995 and 2009 reveals that the smile curve for this product has deepened. Compensation in the USA28 industry rose from about $25 an hour to $60 an hour, whereas Chinese wages remained very low on the smile curve. But the bubble that shows the total value added produced by CHN14 expanded about 10-fold. China may have held a low position in the value chain throughout this period, but it brought a huge number of workers from its impoverished countryside to work in the related factories.

Figure 3 captures anxieties felt by both rich and poor countries in contemplating contemporary trade. Rich-country electorates worry that manufacturing is being hollowed out—that is, that semiskilled production jobs have moved to developing countries or, to the extent that such jobs still remain in advanced economies, have suffered downward pressure on wages. Poor countries worry that they are trapped in low-value-added activities and are locked out of the higher value-added activities in design, key technological inputs, and marketing.

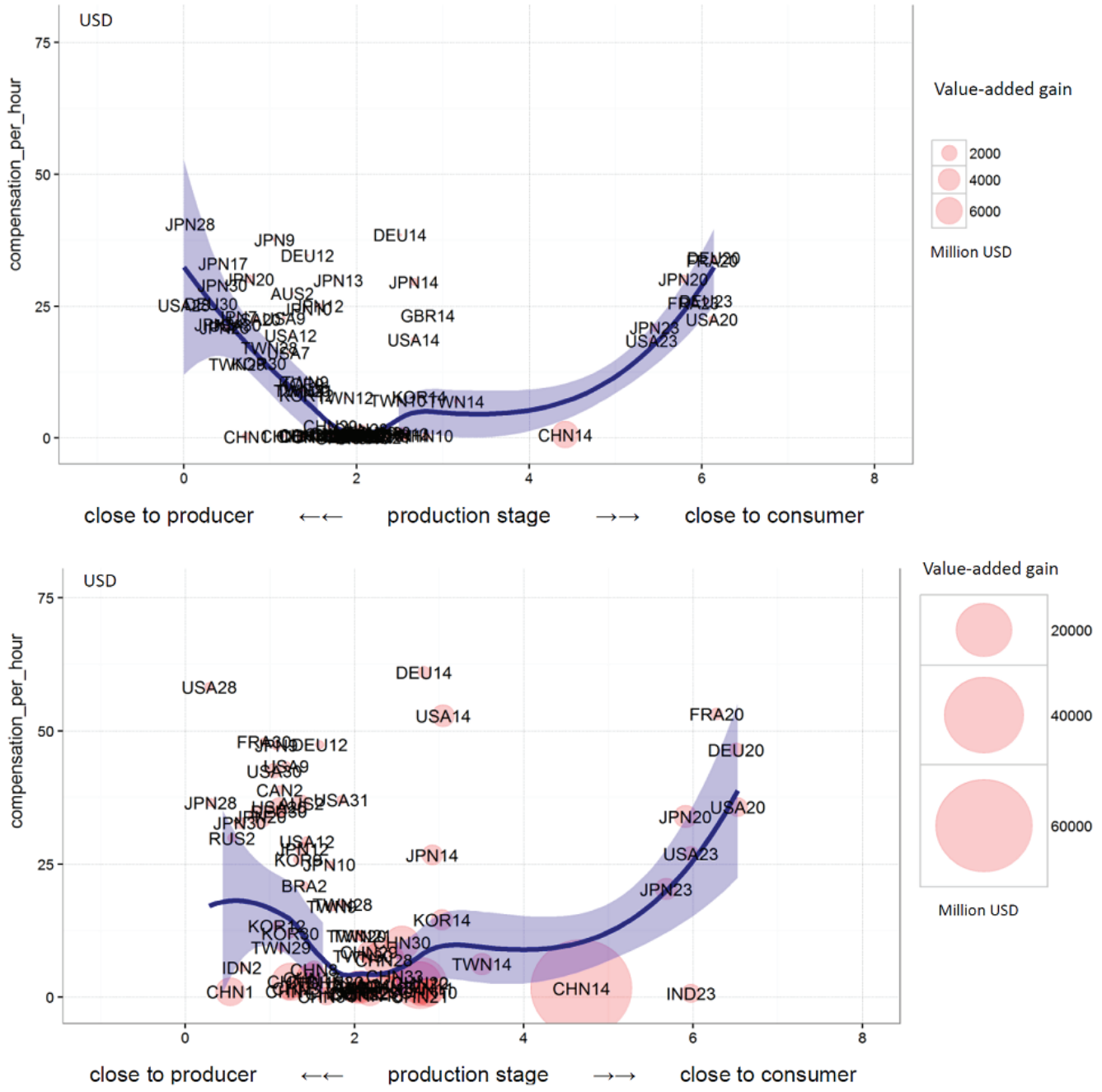
Within-country distributional impacts

The changes in technology and global trade highlighted by the smile curves can also be seen in statistics on factor use and income distribution in developed and developing countries. Here, this is shown using the information and communication technology industry in the United States and China as examples (figures 4 and 5).

For the United States the left panel in figure 4 tracks the evolution of factor return shares (left scale) and labor productivity (right scale). Labor's share in returns rose from 60% to more than 70%, highlighting the important role of human capital in this high-tech industry. Over 15 years the share of medium- and low-skilled workers in the total number of hours worked declined (middle panel), while the share of high-skilled workers (college educated and above) increased sharply, from about a third to a half of total hours worked. The distribution of compensation across skill levels (right panel) reveals that proportionally more of the benefit went

FIGURE 3 The estimated smile curve for China's exports of electrical and optical equipment deepened between 1995 and 2009

Compensation per hour ($)



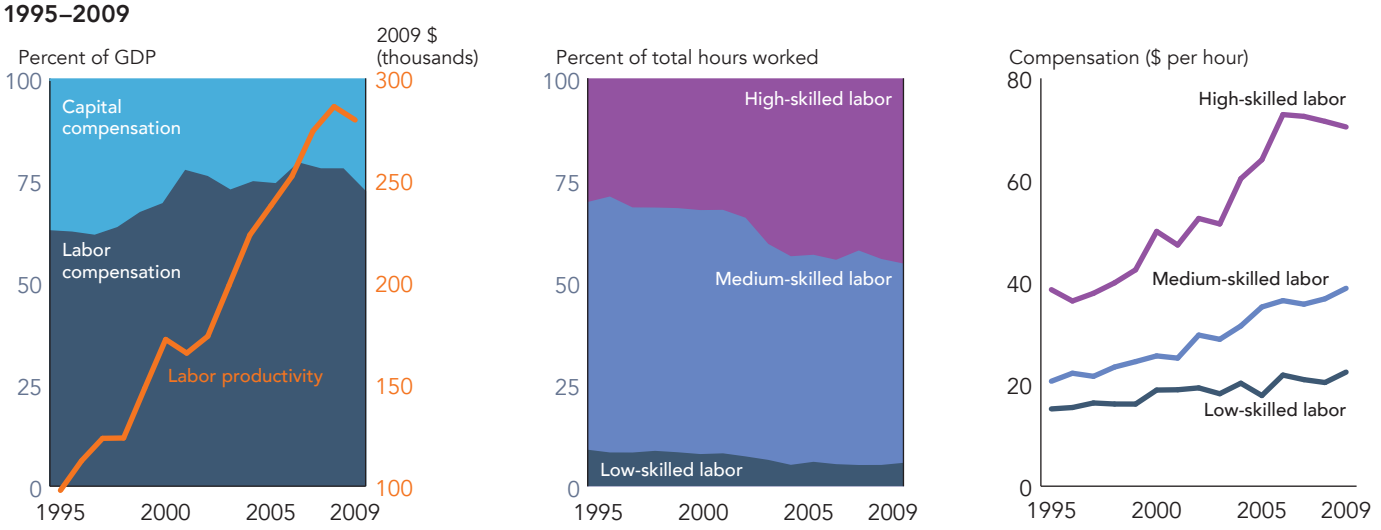
Source: Meng, Ye, and Wei 2017.

Note: See annex 2.2 in chapter 2 for a key to country abbreviations and sector codes.

to high-skilled workers; compensation was flat for low-skilled workers and increased only slightly for medium-skilled workers. These shifts are consistent with the overall transformation of the information and communication technology industry in the United States over the period, which went from producing goods to primarily designing and providing support services.

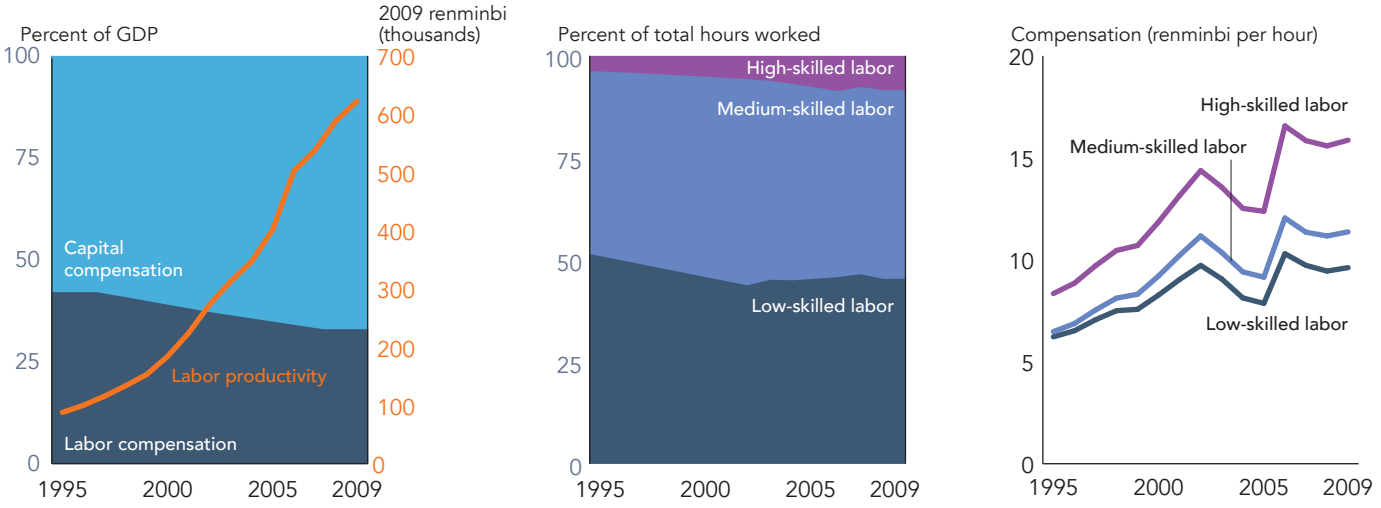
Now consider the analogous analysis for China's information and communication technology industry (see figure 5). The first thing to notice is that labor productivity growth was phenomenal, increasing some six times over 15 years (right scale, left panel). During the period, labor's share dropped from more than 40% to about 30%, while capital's share rose from less than 60% to nearly

FIGURE 4 Efficiency and factor income distribution in the information and communication industry in the United States, 1995–2009



Source: Meng, Ye, and Wei 2017.

FIGURE 5 Efficiency and factor income distribution in the information and communication industry in China, 1995–2009



Source: Meng, Ye, and Wei 2017.

70% (left scale). Clearly, capital was able to reap much of the benefit of the productivity gain. It should be emphasized that the gain accrued to the capital deployed in China, and that included multinational corporations engaged in GVCs. Other research has shown that most of the value added in China's exports has come from the domestic private sector, and multinational corporations produce a substantial amount as well. Thus, much of the benefit from the expansion of Chinese GVCs has gone to private owners of capital. But there have also been significant wage increases for all workers—albeit starting from a very low base (right panel). The big proportional gain went to skilled labor, whose compensation nearly doubled (right panel). Compensation for medium-skilled workers (with high school degrees) went up about 80%. Even low-skilled workers saw their pay rise more than 50%. The distribution of hours worked by different skill classes in China is basically a mirror image of that for the United States. The overwhelming share of labor input in China's information and communication technology industry over the period was low- and medium-skilled, though their shares did decline somewhat, from more than 95% of hours to 90% (middle panel of figure 5). High-skilled input was very small, about 5% of hours by the end of the period.

These distributional findings shed some light on the growing protectionist sentiment in some advanced economies—and on the fact that globalization remains popular in developing

countries that are deeply involved in GVCs, such as China, Mexico, and Viet Nam. These findings do not permit drawing strong causal conclusions, but the analysis is consistent with a story in which the benefits from GVC-related trade have been distributed highly unevenly. For the United States the big winners appear to be high-skilled workers and multinational corporations. GVCs have enabled them to benefit from enormous productivity gains in developing countries such as China. Ordinary workers in the United States have not seen much (if any) benefit. In China ordinary workers have benefited. Even at the beginning of the period factory wages in China were far ahead of rural incomes. And those wages doubled over 15 years. The wage gains are a driving factor behind the impressive decline of absolute poverty in China. Relatively speaking, however, the big benefits in China accrued to the small number of high-skilled workers and to the owners of capital, including foreign investors.

Developing country participation in global value chains

Witnessing this rise of GVCs, stakeholders in developing countries typically want to see their country more involved in value chains and moving to higher value-added activities within the chains over time. GVC research can help identify factors associated with integration into GVCs, such as the related issues of developing country involvement in GVCs, trade costs, and the middle-income trap (chapters 3, 4, and 5).

For the involvement of developing countries in GVCs, geography clearly matters. The world seems to have three interconnected production hubs for the extensive trade in parts and components (figure 6): one centered on the United States, one on Asia (China, Japan, Republic of Korea), and one on Europe (especially Germany). Figure 6 shows the important bilateral flows of parts and components, with the countries that are most deeply involved highlighted in blue. China aside, developing countries are generally on the periphery and tend to trade with the hub that is geographically closest. Many developing regions are barely involved at all. Most African countries are far from existing hubs. And within developing countries, it is large firms that tend to be involved in global production networks. In Latin America, for instance, small firms rarely trade outside the region.

Unit labor costs and trade costs

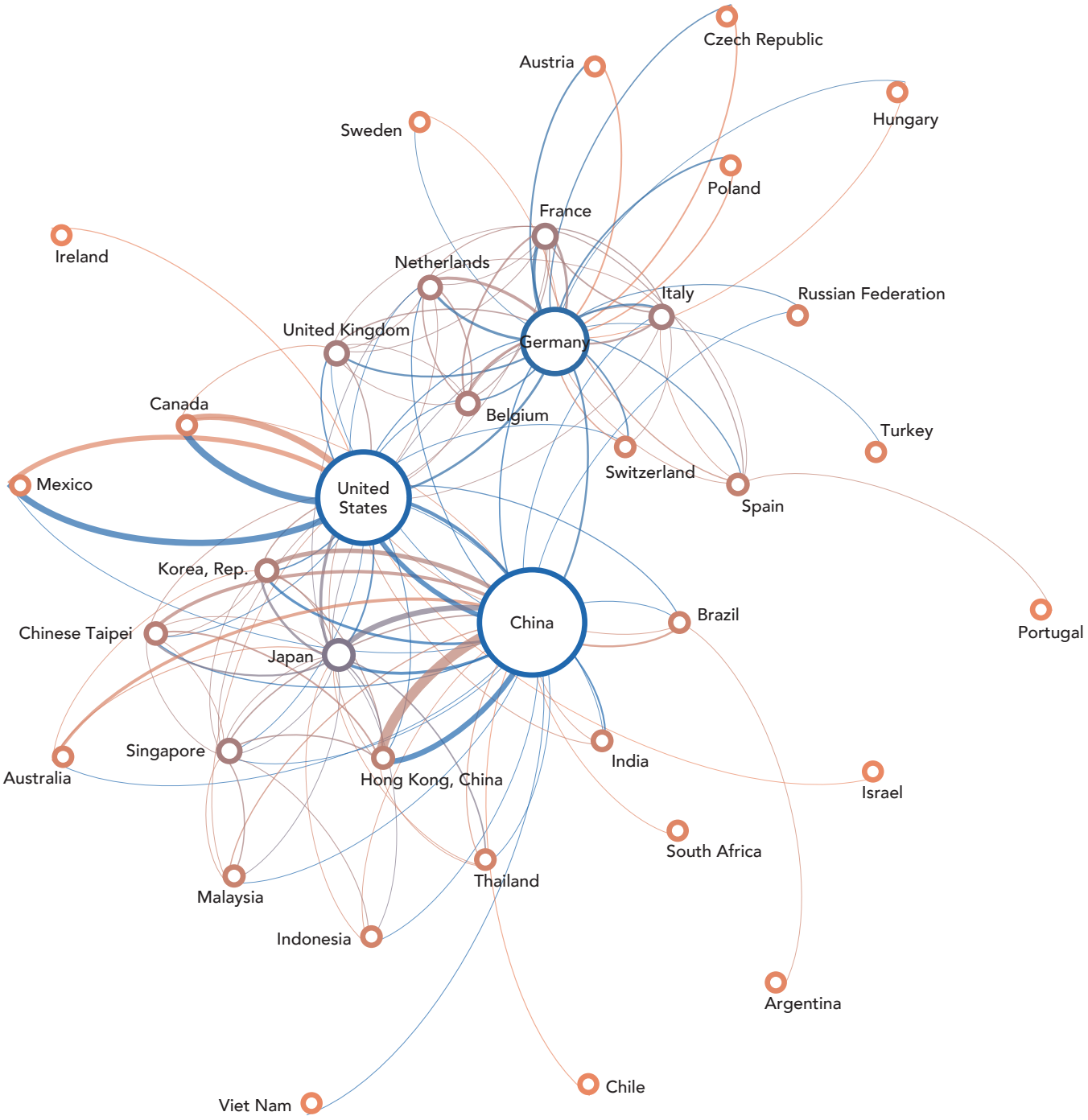
How to explain the differential participation of developing countries in GVCs? Low wages are often thought to be an important factor. But low wages exist across developing countries, yet only a few locations are involved in GVCs. Low unit labor costs (the ratio of average wages to per capita GDP) turn out to be much more important than low wages. Figure 7, which plots unit labor costs against wages in 2000 and 2010 for a large number of developing countries, show no positive relationship between them because labor productivity varies so much across countries. Countries with high labor productivity will have higher wages and still be low-cost producers. The countries more deeply involved in GVCs (identified in orange in figure 7) all stand out as having low unit labor costs, but not necessarily low wages. In contrast, in each time period there is a circle of countries that have very low wages but high unit labor costs. These are mostly African economies. Other costs in the production process offset any potential advantage from low wages.

One of the most important impediments for developing countries is trade costs, examined in chapter 4. Today, nontariff trade costs (freight, insurance, and other cross-border-related fees) tend to be much larger than any remaining import tariffs as products travel through production stages. Those trade costs, which vary by country and sector, have a monetary dimension (for example, transportation, insurance, and other fees) but also a more intangible dimension that encompasses information costs, nonmonetary barriers (regulation, licensing, and so on), insecure contracts, and weak trade governance leading to uncertainty. These impediments to trade can be expressed as ad valorem tariff equivalents and are generally much higher than tariffs. In sectors with complex value chains, such as motor vehicles, computers, and machinery, trade costs are more than four times higher than tariffs. In traditional traded goods, such as agricultural products, minerals, and wood, these trade costs tend to be less of an impediment.

So while weak transportation links, inefficient customs clearance, bureaucracy, and red tape all tend to impede trade, their effects are most pernicious in sectors requiring that parts move back and forth across borders. The costs of impediments cascade. Countries with very high trade costs will not be able to participate in GVCs, and any exports are likely to be traditional goods, often primary products. Developing countries try to address this problem by establishing special export processing zones, which have superior logistics and expedited customs clearance (as well as through duty drawbacks on any remaining import tariffs). The problem with this second-best approach is that it limits participation in GVCs to the small number of firms in the export processing zones, while other domestic firms, especially small ones that might become parts suppliers, are left to stumble in a world with high transaction costs. A better approach is to improve trade facilitation for all firms in the economy.

China provides some interesting lessons. China is known for having started its economic reform with four special economic zones that fit the model of export processing zones, with favored infrastructure and customs clearance. What is less known is that within a short time China had expanded these benefits to more than 30 cities nationwide. Competition among the cities has enabled quite a few of them to emerge as locations with low trade costs and deep participation in GVCs. Research into the value added of trade has shown that the majority of the domestic value added in China's exports comes from private domestic firms. Foreign firms are often the processing exporters from China, but the successful expansion of value chains to domestic firms within China has resulted in most of the value added coming from the domestic private sector.

FIGURE 6 Trade in components shows three interrelated production hubs



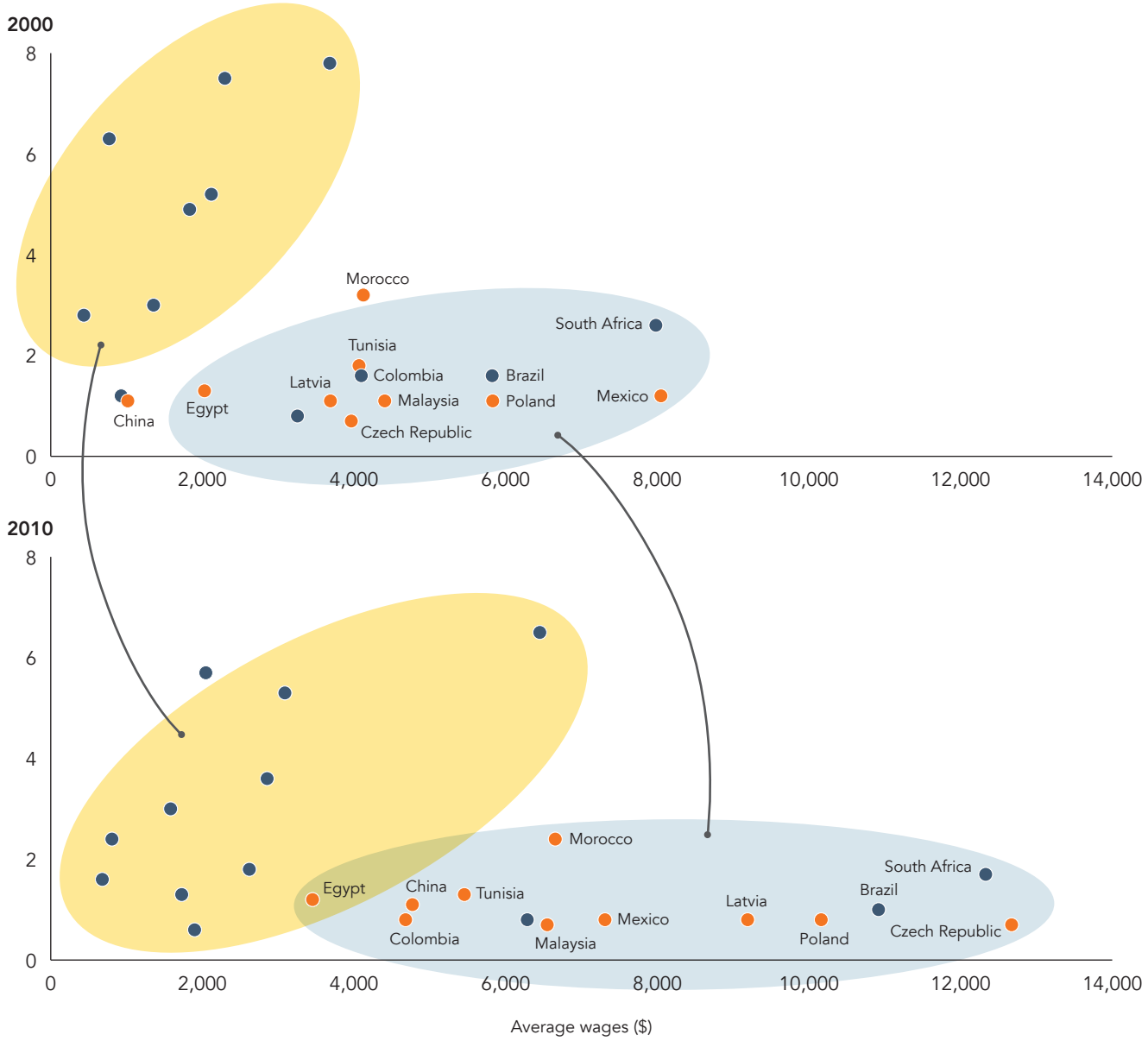
Source: Diakantoni and others 2017, based on the UN Comtrade database (https://comtrade.un.org).

Note: Includes the 61 economies in the Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database and their most important bilateral gross trade flows. The color of the nodes (and their export flows) is from blue to red, blue indicating the highest degree of centrality.

Further evidence on the importance of reducing transactions costs comes from the World Bank's Logistics Performance Index, which captures how well infrastructure and bureaucracy work together to move goods through the production process and on to consumers. A clear relationship emerges between better logistics performance and deeper involvement in GVCs when the Logistics Performance Index is plotted against a centrality indicator of each country's role in GVCs (an indicator that ranks

FIGURE 7 Developing countries deeply involved in global value chains have low unit labor costs but not low wages, 2000 and 2010

Unit labor costs (ratio of average wages to GDP per capita)



Source: Ceglowski and others 2015.

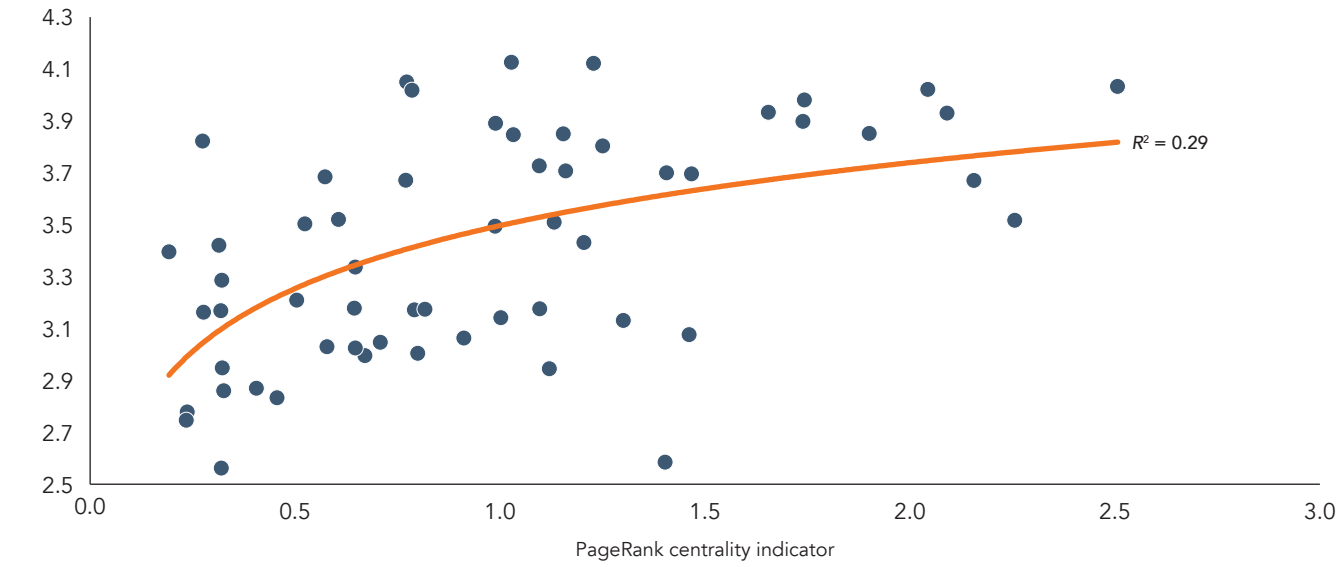
Note: Unit labor costs are the ratio of average wages to per capita GDP.

a country or industry's centrality to GVCs taking into account direct and indirect trade flows to and from trading partners in the global production network; figure 8). The link is not that tight (R^2 = 0.29), however, indicating that other factors are at work as well. But it is interesting that there are no countries in the lower-right quadrant: no countries with poor logistics performance are central to GVCs. For countries that want to get more involved in GVCs, trade facilitation and infrastructure are obvious places to start.

Global value chains and the middle-income trap

One of the most hotly debated issues in development is the "middle-income trap" (chapter 5). This is the idea that it is relatively easy to grow from low income to middle income, by imitating successful countries and expanding factors of production (labor force growth and investment). But it is harder to move from middle income to high income, which in general is based more on innovation and creativity than on extensive growth.

FIGURE 8 Relationship between the Logistics Performance Index and a centrality measure of country involvement in global value chains



Source: Diakantoni and others 2017.

Note: The centrality indicator ranks a country's centrality to global value chains, taking into account direct and indirect trade flows to and from trading partners in the global production network.

It turns out that there is mixed empirical evidence for a middle-income trap. Chapter 5 finds substantial upward mobility between 2000 and 2015, particularly for middle-income countries, with 79 of 133 countries that were low or middle income in 2000 improving their income status and none declining.

While there is only weak evidence for a generalized growth slowdown in middle-income countries, there is still the concern that in any period some countries are moving ahead rapidly while others are stagnating or moving ahead less rapidly. Furthermore, problems of the structural transformation of industries are quite specific to middle-income countries, and this more limited understanding of a middle-income trap is usefully explored in the chapter. One clear empirical regularity is that upwardly mobile countries have considerably more involvement in GVCs than do languishing countries. Care is required in interpreting this kind of association, but it is consistent with the notion that GVCs have given developing countries new opportunities to participate in a global division of labor. For the countries that have been able to respond effectively to the opportunities, that has in turn led to faster productivity growth and economic advance.

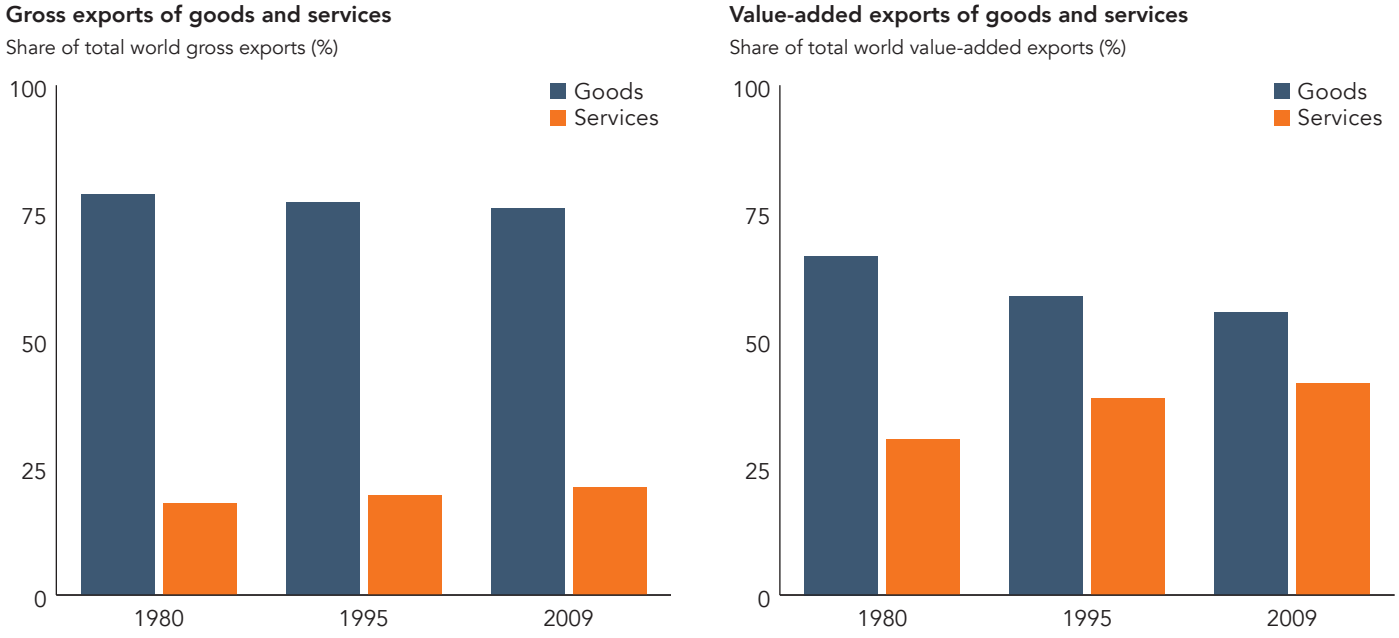
Services and trade restrictiveness

A key perception of international trade that changes when value added replaces gross value in the analysis concerns the relative role of goods and services (chapter 6). In 1980 the split between trade in goods and direct trade in services was 80:20. By 2008 that ratio had barely changed (left panel of figure 9). Most of the goods trade was manufactures, with the remainder being agricultural and mining products. Economists refer to many services as "nontradables," meaning that they cannot be directly traded internationally. Haircuts and dry cleaning are common examples. Higher end services such as health care and legal advice are also hard to directly trade internationally. That is starting to change with some remote services trade, but statistically the share is very small.

However, analysis of value added shows that the share of services in trade nearly doubled between 1980 and 2008 (right panel of figure 9). Another way of looking at this statistic is that much of the value in manufactured goods comes from inputs of services industries. The reasons for these developments are variants of the older arguments for why the share of services in GDP tends to grow: the splintering or outsourcing of services activities from manufacturing firms; the growing importance in a GVC world of connecting services like telecommunications and transport; the growing services component in sophisticated manufacturing goods, such as software in cars; and the increase in relative prices of services tasks because manufacturing tasks are easier to offshore to lower cost locations.

This tendency for value-added exports of services to be greater than the direct export of services is true in all major economies, though the share varies considerably. Figure 10 ranks countries in the services share of value added exported and in the services share of gross exports, which is smaller in every case. In general, developed countries have services shares in

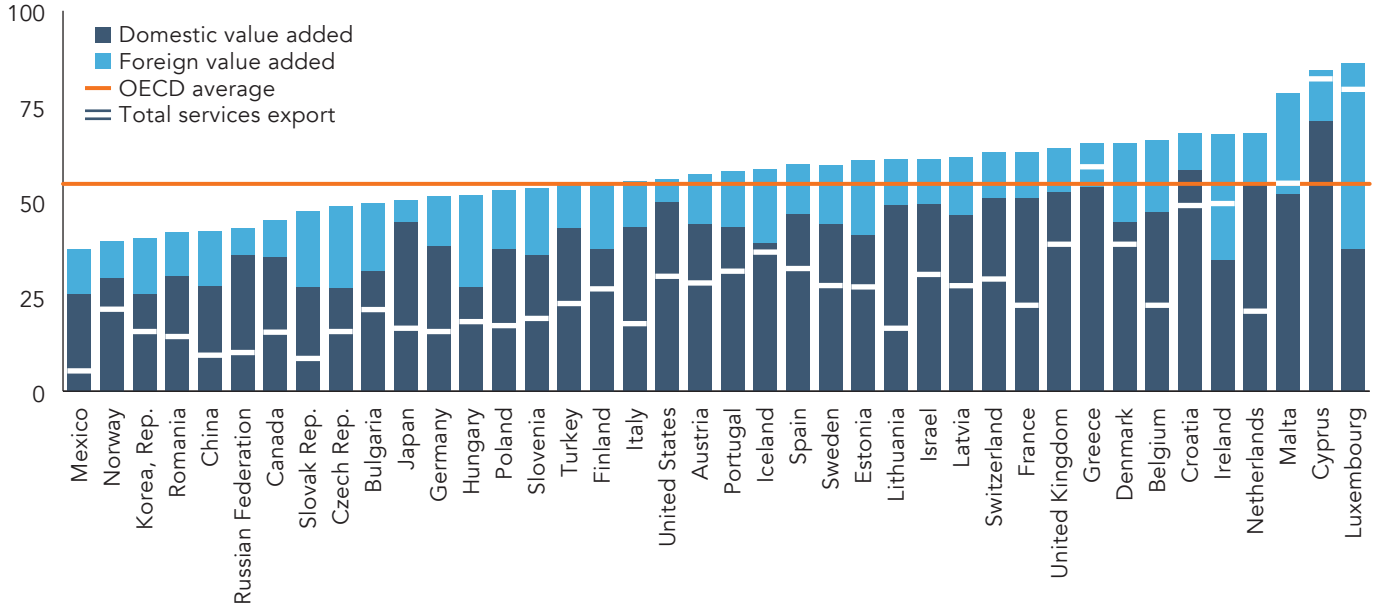
FIGURE 9 The share of services is higher and has increased more sharply in trade in value added than in trade in gross terms, 1980, 1995, and 2009



Source: Authors' calculations based on Johnson and Noguera 2016.

FIGURE 10 The share of services in exports is higher for developed countries, 2011

Percent



Source: Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database 2015.

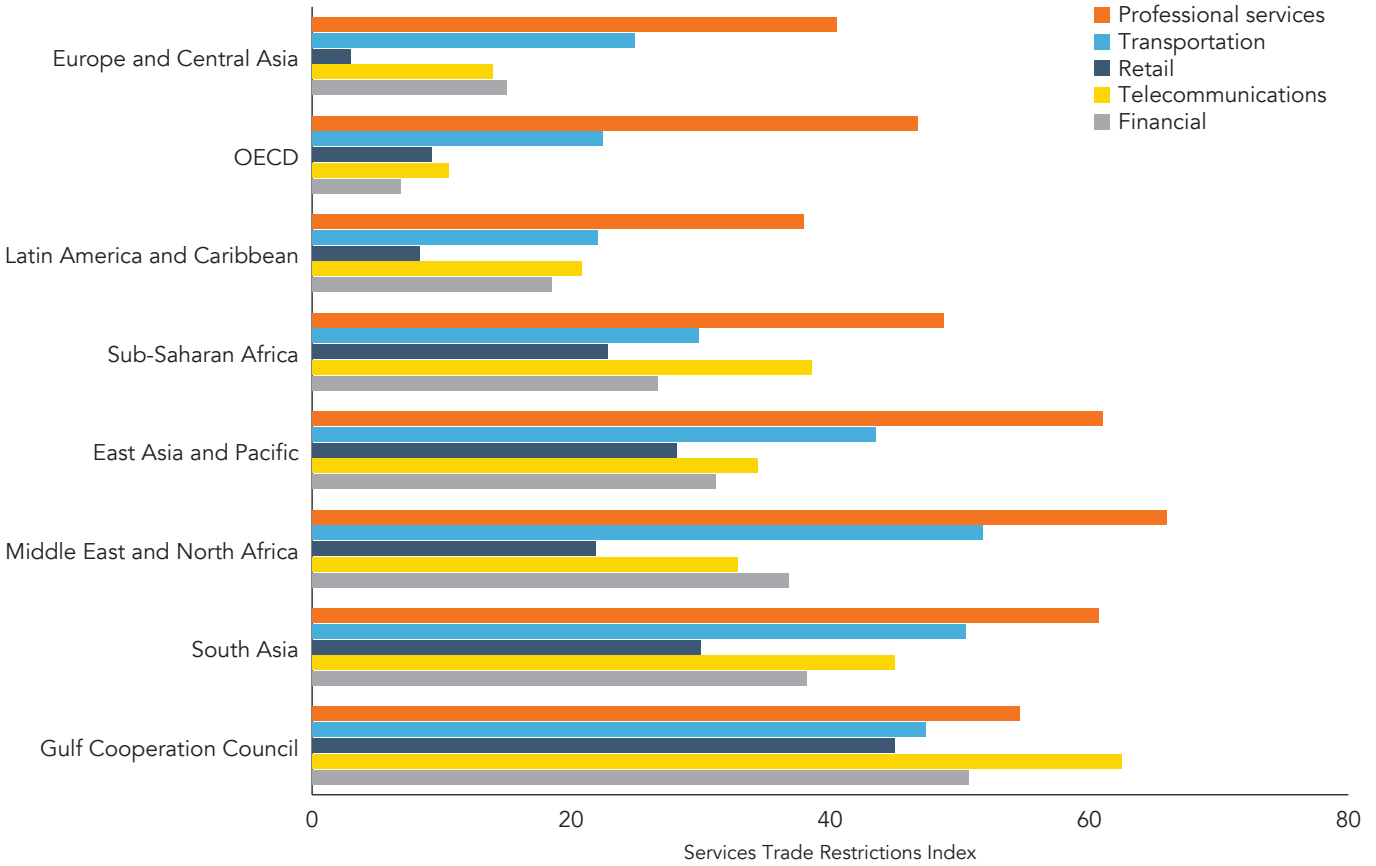
value-added exports above 50%. About 55% of the value added exported from the United States comes from services sectors. The shares are even higher for European economies. For the Netherlands, well known as an exporter of agricultural products and manufactures, services account for nearly 70% of the value of its gross exports.

Emerging market economies that are major exporters of manufactured products have somewhat lower but still surprisingly high services shares. For example, China, Mexico, and Viet Nam have very little direct export of services, but in value added terms about 40% of their exports come from services. They can expect that share to rise as they develop further and move up the value chain.

While the links between manufacturing and services are deepening, many developing countries continue to carry out dualistic policies between manufacturing and services. Protection tends to be stronger against imports of services, even though more-open policies would help countries develop more-competitive and more-productive services sectors, which in turn would feed into more-competitive and more-productive manufacturing sectors. Figure 11 shows measure of import protection in key services sectors for different regions. As the benchmark, Organisation for Economic Co-operation and Development (OECD) countries are very open to imports of financial, telecommunications, and retailing services and moderately open to trade in transportation services. Professional services, such as law, medicine, and architecture, on the other hand, remain relatively protected. For many services it is difficult to trade internationally without investment in establishing a local presence. OECD economies are also very open to direct investment in services sectors, contributing to their competitive character and high-productivity outcomes.

Developing countries have embraced import openness for manufactured products, especially machinery and parts that enable them to participate in the international division of labor. But they continue to protect imports of services (see figure 11). Countries in East Asia and Pacific have much higher levels of protection than OECD countries. Countries in Latin America and

FIGURE 11 Developing countries maintain high restrictions on services trade



Source: Borchert, Gootiiz, and Mattoo 2014.

Note: This figure compares the restrictiveness of services trade policy across countries based on the World Bank Services Trade Restrictions Index, which ranges from 0 (completely open) to 100 (completely closed).

Central Asia are modestly more open but still less open than OECD countries. Countries in Africa and South Asia, home to most of the world's remaining extreme poor, are generally the most closed. For developing countries wishing to participate more in GVCs and to move up the value chain, one obvious measure is to open services to import competition and direct foreign investment. Improved access to finance, communications, transport, and other services, through reform in general foreign direct investment in particular, enhances manufacturing firms' productivity and other aspects of the performance of downstream firms.

Institutions and deep trade agreements

Another way to think about products that have complex value chains is that they are contract-intensive goods. That is, they often involve many exchanges among different firms, each facing some risk of contract nonperformance by others in the chain. GVC research shows that, other things equal, countries with better institutions such as stronger property rights and rule of law participate more in GVCs (chapter 7). Research for this report found a similar result within China across a large number of cities. Cities with better measures of contract enforcement, faster customs clearance, and deeper financial systems participated more in GVCs.

The idea of improving institutions and lowering trade costs across the board through better infrastructure, control of corruption, reduction of red tape, and zero tariffs on imported inputs (including services) is clear. But developing country leaders naturally wonder how to pursue this agenda. It turns out that one effective route is through "deep" trade agreements, agreements that go beyond simple tariff cutting and involve legal commitments on laws and regulations (chapter 8). The different rounds of agreements within the framework of the WTO have involved primarily reducing import tariffs, and these have had the most effect on trade in manufactures. It has proved more difficult to go beyond tariff cutting in the WTO. Although significant progress has been made in recent years with the WTO Trade Facilitation Agreement, the abolition of agricultural export subsidies, and several other agreements, progress has stalled within the WTO on new global agreements. Preferential trade agreements—in which a group of like-minded countries negotiate agreements on policy areas that build on WTO commitments—have proliferated. In practice, the most important areas concern services trade, investment, competition policy, and intellectual property rights protection.

Between 1958 and 2014, 279 preferential trade agreements were notified to the WTO. This report rates the "depth" of each agreement based on the number and share of legally enforceable provisions. The North American Free-Trade Agreement among Canada, Mexico, and the United States is a deep agreement, as is the Trans-Pacific Partnership, which has been negotiated but not yet ratified or implemented among 12 Asia–Pacific economies. Because deep integration often involves leveling the playing field for investment, intellectual property, and competition policy, participation in deep preferential trade agreements turns out to be an effective way to expand involvement in GVCs. The new areas covered in these agreements facilitate the operations of complex production structures that span multiple borders. Participating in deep preferential trade agreements increases a country's trade in parts and components, an important measure of GVC activity.

While strengthening institutions and reducing trade costs, perhaps through deep preferential trade agreements, are effective routes for developing countries to become more involved in GVCs, some sobering research shows that in addition to one's own institutions, the quality of neighboring countries' institutions matters as well. In contract-intensive sectors (such as those with complex value chains), countries with "bad" neighbors have fewer exports, even after controlling for the country's own institutions. This result implies that deep agreements would be more effective if a group of neighboring economies all signed up for the same agreement. In the case of the Trans-Pacific Partnership, for example, several countries in the Association of Southeast Asian Nations (ASEAN), such as Singapore and Viet Nam, are partners to the agreement, as are several Latin American countries (such as Chile, Mexico, and Peru). The benefits would be greater if all of ASEAN countries and the Pacific countries in Latin America signed on. In the wake of the 2016 U.S. presidential election, U.S. President Donald Trump pulled the United States out of the agreement, but the remaining 11 countries are discussing whether to proceed without the United States.

For developing countries the agenda of reform needed to participate more deeply in GVCs is challenging. Moreover, access to finance remains an issue in less advanced economies that are prone to market and public governance failures. While joining GVCs improves the prospects of attracting private foreign direct investment, the poorest countries may still require substantial additional financing, if only to improve the public transport and telecommunication infrastructure as well as trade facilitation. In this respect, the 2015 Addis Ababa Action Agenda provides a new global financing framework to mobilize and deliver the resources, technology, and partnerships needed to improve many of the structural and institutional conditions required for fostering export-oriented industrial activities (UN 2016).

Toward more inclusive globalization

This report provides some insight into how GVCs are advancing the development process and how they are creating distributional conflict, especially in advanced countries. The rapid productivity growth within GVCs shows that they are an efficient form of production. They have enabled developing countries in particular to move into new activities and rapidly raise their productivity. To be sustainable, however, globalization needs to become more inclusive in at least three dimensions.

First, in developing countries deeply involved in GVCs, virtually the entire population benefits from the expanded trade and faster growth, though not all to the same extent. In developed

countries, by contrast, the benefits of expanded international trade and investment are highly concentrated among the very skilled in the workforce and the owners of capital. Both groups are already high up in the income distribution, and globalization increases their share of the pie.

There is no simple agenda to spread the benefits more widely. A protectionist sentiment is arising in developed countries. Historical evidence suggests that cutting themselves off from the global market through import restrictions will almost certainly backfire. That is likely to lead to slower global growth and poor results all around. Evidence has shown that effective responses may include active labor market policies to provide training and retraining so that workers have the skills demanded in the market, a stronger safety net of minimum income support, and support to communities hit hard by changes in production arising from trade or technological change. Also important is developing more detailed official national data that can inform policymakers. Considerable improvements have been made on the data front in recent years, notably through trade in value added–type measures. But with few exceptions these provide a wide-angled view, whereas what is increasingly needed is a more granular view, at least a view that zooms in on workers, occupations, and skills.

Second, while GVCs have enabled many developing countries to increase their participation in global trade and raise their productivity, too many countries and regions are still left out. East Asia, in particular, has taken advantage of the opportunities provided by globalization. But increasingly, the remaining extreme poor are concentrated in South Asia and Africa. Countries in these regions can help themselves through further trade and investment liberalization, especially trade facilitation that improves infrastructure and import or export processes so that goods can move easily around the world. One of the interesting trends identified in GVC research is that more and more of the value added traded in the world comes from services sectors. Opening services sectors to foreign trade and investment is a smart strategy for deepening integration. Participating in deep trade and investment agreements can advance that agenda, and such agreements will be most powerful if they involve several neighboring countries.

A third dimension of inclusion concerns small firms and the informal sector. Most job creation in the world is in small and medium-size firms, so GVC involvement by these firms is crucial for maximizing the positive impact from trade. Poor infrastructure, corruption, and red tape tends to hamstring smaller companies more than larger ones since large firms can often finance their own infrastructure and finds ways to operate in corrupt and bureaucratic environments. Special export zones can be a way for a developing country to begin to participate in GVCs, but for the benefits to spread throughout the economy, it is important that the zones are seen as stepping-stones to economywide improvements.

References

Borchert, I., B. Gootiiz, and A. Mattoo. 2014. "Policy Barriers to International Trade in Services: Evidence from a New Database." *The World Bank Economic Review* 28 (1): 162–88.

Ceglowski, J., S. Golub, A. Mbaye, and V. Prasad. 2015. "Can Africa Compete with China in Manufacturing? The Role of Relative Unit Labor Costs." Working Paper 201504, Development Policy Research Unit, University of Cape Town, Cape Town, South Africa.

Diakantoni, A., H. Escaith, M. Roberts, and T. Verbeet. 2017. "Accumulating Trade Costs and Competitiveness in Global Value Chains." World Trade Organization (WTO) Working Paper Economic Research and Statistics Division (ERSD) 2017–2, WTO, Geneva.

EC (European Commission). 2013. World Input-Output Database. Brussels: EC. Available at: http://www.wiod.org/release13.

———. 2016. World Input-Output Database. Brussels: EC. Available at: http://www.wiod.org/database/wiots16.

Johnson, R., and G. Noguera. 2016. "A Portrait of Trade in Value Added over Four Decades." NBER Working Paper No. 22974, NBER, Cambridge, MA.

Meng, B., M. Ye, and S.-J. Wei. 2017. "Value-added Gains and Job Opportunities in Global Value Chains." IDE Discussion Paper No. 668, IDE–JETRO, Chiba City, Japan.

OECD (Organisation for Economic Co-operation and Development) and WTO (World Trade Organization). 2015. Trade in Value-Added (TiVA) database. Paris: OECD. Available at: http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm.

Timmer, M., R. Stehrer, and G. de Vries. 2015. "Occupations in Global Value Chains: Patterns of International Specialisation." OECD Trade Policy Paper, OECD, Paris.

UIBE (University of International Business and Economics). Global Value Chain Index database. Available at: http://139.129.209.66:8000/d/daedafb854/.

UN (United Nations). 2016. *Addis Ababa Action Agenda: Monitoring Commitments and Actions*. New York: UN.

———. UN Commodity Trade Statistics Database (Comtrade). New York: UN. Available at: https://comtrade.un.org/.

Wang, Z., S.-J. Wei, X. Yu, and K. Zhu. 2017. "Measures of Participation in Global Value Chains and Global Business Cycles." Working Paper 23222, National Bureau of Economic Research, Cambridge, MA.

World Bank. 2016. *Connecting to Compete 2016: The Logistics Performance Index and Its Indicators*. Washington, DC: World Bank.

CHAPTER 1

Analytical frameworks for global value chains: An overview

SATOSHI INOMATA, IDE–JETRO

In a keynote speech at a seminar on global value chains (GVCs), Richard Baldwin delivered wittily, with his mischievous smile, a rather provocative statement: "The term 'global value chains' doesn't describe what we see today in the world economy"[1] because:

- The world economy is not global; it remains regionally segregated, such as Factory Asia, Factory Europe, and Factory North America.
- What matters is not value (added) but jobs, especially good jobs.
- Production systems are not configured as a linear sequence of production stages like chains but consist of complex networks of hubs and spokes.

This is alarming. However, it is also true that many people now use the term "GVCs"—often inconsistently across contexts.

With that as the backdrop, this chapter cultivates some common ground for approaching this new area of academic interest by tracing the development of relevant studies. This is not an encyclopedic literature survey; it focuses only on the strands of research that explicitly consider vertical (supply–use) relations of cross-border production sharing and their impact on distributing value among the parties—which is at the heart of GVC studies.[2]

The first section of the chapter considers why GVC studies are important from the viewpoint of their contribution to the history of international trade theories. The second traces the development of the GVC concept, with some reference to the evolution of global production networks. The third introduces the main theoretical achievement in GVC studies. The fourth summarizes the challenges for a quantitative description of GVCs, particularly for the innovative use of multicountry input-output tables. The fifth addresses pressing issues for advancing GVC research. The last section presents some meta-methodological considerations on the development of GVC analyses.[3]

The global value chain paradigm: New-New-New Trade Theory?

Since David Ricardo established the foundation of international trade theory two centuries ago, mainstream thought, from Heckscher-Ohlin to Samuelson, has hinged on three classic premises (figure 1.1):

- Markets are perfectly competitive, and producers operate at constant returns to scale.
- An industry consists of homogeneous producers.
- Countries trade only final products—traditionally phrased as Portuguese wine for English cloth—and each product is made using the production factors of only the exporting country.

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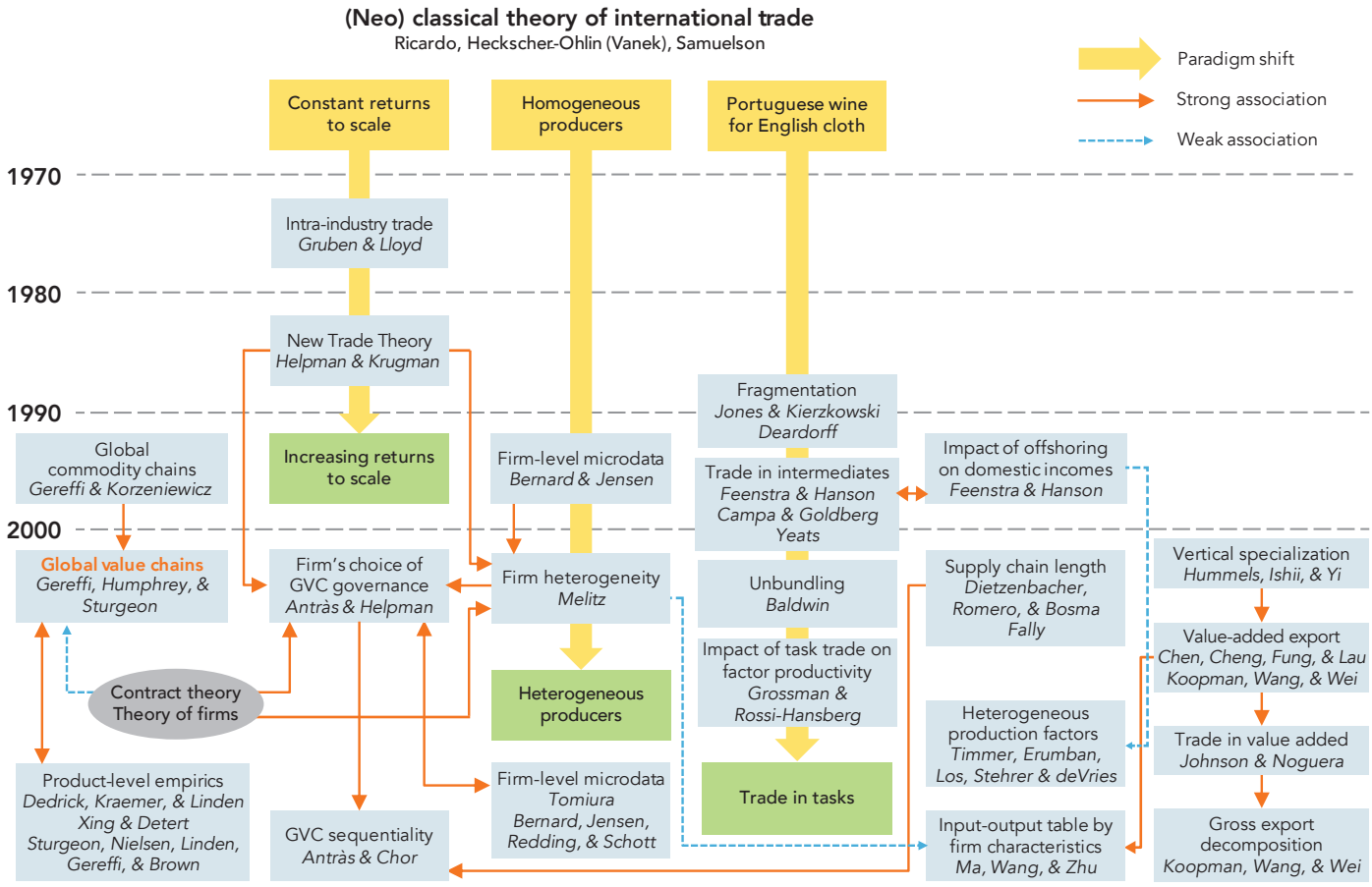
FIGURE 1.1 Genealogical map of analytical frameworks for global value chains



Source: Author's drawing.

The first premise was shaken in the 1970s and 1980s when a new school of thought, New Trade Theory, emerged. Its key feature, pioneered by Krugman (1979, 1980) and generalized by Helpman and Krugman (1985), was the theoretical scope for considering production technology with increasing returns to scale (paired with the love of variety), which underpins the analytical frameworks of international trade under imperfect competition. The models provided a plausible explanation for the prevalence of intra-industrial trade between countries with similar technology and resource endowments—a phenomenon that cannot be explained by the orthodox notion of comparative advantage.[4]

The evolution of theoretical frameworks is generally driven by the need to fill a gap between a newly discovered stylized fact and the predictions of prevailing models. Just as the empirical findings on intra-industry trade, notably those of Grubel and Lloyd (1975), were followed by New Trade Theory, so too was the second classic premise of homogeneous producers reconsidered following evidence in the late 1990s. Bernard and Jensen's (1995, 1999) detailed examination of firm-level microdata revealed substantial heterogeneity in firm productivity between exporters and nonexporters in a given industry. Melitz (2003) pioneered an explanation for these observations, advancing in the quest for what was later called New-New Trade Theory. By assuming a fixed cost of entering export activities, the model considers the mechanism of a firm's endogenous selection on market entry or exit and thereby provides a powerful explanation for the coexistence of heterogeneous firms within an industry.[5]

A third wave of reconstructing classical theory is now under way, and the literature on GVCs is generally linked to this development strand. With the dramatic advance of transportation modes and information and communication technology, production processes can now be "sliced" into several production segments, each corresponding to a particular task—such as design, parts procurement, assembly, and distribution. These segments are relocated, often across national borders, to the places where the tasks can be performed most efficiently. Thus the core subject of the literature today is not only the movement of final products, as classical theories have focused on (under the third premise), but also the cross-national transfer of tasks, or the value added generated by these tasks.

The main characteristic of the GVC paradigm is the variety of its intellectual origins. The initial theory of production fragmentation (Jones and Kierzkowski 1990) was followed by

increasing observations of trade in intermediate goods (Feenstra and Hanson 1996b; Campa and Goldberg 1997; Yeats 1998), which brought about further elaboration of key concepts such as unbundling (Baldwin 2006) and trade in tasks (Grossman and Rossi-Hansberg 2008a).

In parallel, methodological frameworks also advanced in sociology. Drawing on analytical scopes of academic fields, from business management to industrial organization theory, a comprehensive study on the structure and mechanism of value distribution among countries led to the term "global value chains" (Gereffi, Humphrey, and Sturgeon 2005).

The empirical aspect of GVC studies is newer. Earlier value-added analyses based on firms' business records (Dedrick, Kraemer, and Linden 2008; Xing and Detert 2010) are now complemented by input-output analysis, in which various GVC metrics were devised using multicountry input-output databases, such as trade in value added (Johnson and Noguera 2012) and supply chain length (Dietzenbacher, Romero, and Bosma 2005; Fally 2011).

One of the key integrating forces was Antràs and Helpman (2004), who featured the legacies of both the New Trade Theory (increasing returns to scale) and the New-New Trade Theory (firm heterogeneity) in a study based on the frameworks of contract theory, while contract theory can be associated with sociologists' approaches to GVCs. The properties of the model were carried over to Antràs and Chor (2013), who further incorporated the methodological progress in input-output economics.

The interdisciplinary characteristic of the GVC paradigm allows for large-scale research collaboration across the social sciences, as demonstrated in this report. Topics in the GVC literature, some of which are highly politically relevant, include:[6]

- Industrialization strategy (full-set versus GVC-driven industrialization).
- Labor issues (impact of globalization on employment and income distribution).
- Regional development (trickle-down effect through domestic production linkages).
- Innovation and technological spillovers (learning through GVC participation).
- Economic crisis (propagation of external shocks on production and trade).
- Supply chain resilience (impact of natural or human-caused disasters on supply chains).
- Environmental protection (carbon footprints and global governance).
- Consumer protection (food safety and certification).
- Poverty alleviation (fair trade and corporate social responsibility).
- Trade regimes (World Trade Organization and regional trade agreements).
- National accounts (statistical bias of gross trade data).

Concept development

The concept of GVCs did not follow a linear development path. The basic images of the term were conceived and fostered in various scientific subfields in different ways at different times. The ideas only recently started to cross over academic borders, and they continue to evolve along dynamic interactions of theories and empirics.

Unbundling economies: Baldwin's historical perspective

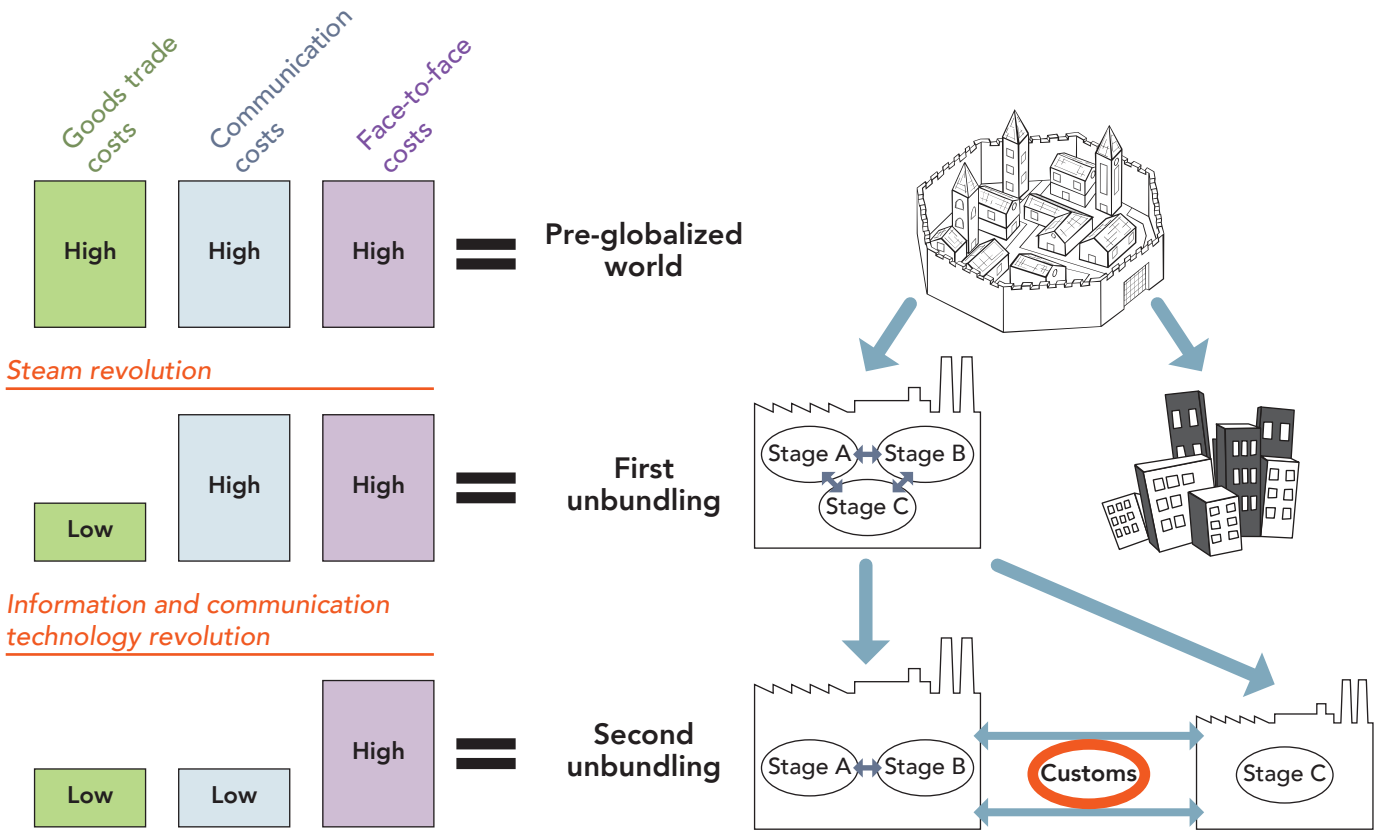
When the movement of goods, people, and ideas was not as frictionless as it is today, economic activities were organized mostly within the boundaries of a small-scale community (figure 1.2).[7] Farmers harvested wheat and milled flour for a bakery a few blocks away, and the baker baked loaves of bread for the neighbors who walked into the shop every morning. Economic self-sufficiency was achieved with the points of production and consumption in close proximity. Extraterritorial business was rare, except perhaps for the merchant voyages of a sailing ship or the Silk Road caravans. And those cross-border trades dealt only with a handful of luxury items such as spices and silk products, sold at high prices to compensate for the risk incurred and the time spent during the journey.

International trade began to develop at the beginning of the 19th century when steam engines rapidly improved land transport (by locomotives) and water transport (by steamships), triggering unprecedented expansion of trade activities beyond local communities. The economies of scale from mass logistics further lowered transportation costs. The point of consumption was unbundled from the point of production, and goods travelled all over the world in search of the most profitable markets.

Paradoxically, the geographical unbundling of economies between production and consumption coincided with the agglomeration of production activities in large-scale factories in industrial zones. Because of the increase in potential customers created by international trade, the mass production system became an appropriate manufacturing mode at the time. The key to high productivity in manufacturing is the division of labor, as seen in Adam Smith's classic example of pin-making,[8] where workers specialize in a particular task to raise their competencies through intensive learning of a specific routine. However, division of labor entails delicate coordination among the different stages because the variety of tasks must collectively produce a homogeneous product. Accordingly, the different productive functions were brought together under the same roof (a factory) to facilitate communication and create harmony among the various tasks.

The information technology revolution in the 1980s completely changed this picture. With telexes, facsimiles, and the Internet—along with high-speed international communication networks—it became cheaper and easier to coordinate production units in different locations. Sales forecasts and procurement schedules could be instantly delivered to production lines, and the electronic profiles of minute product designs and specifications could be shared with and adjusted by every production site. Productive functions no longer had to be confined within proximate spaces. The technological unbundling of production activities has accelerated, with some segments relocated across borders to exploit the cost differentials of production factors in various countries.

FIGURE 1.2 Three cascading constraints of globalization



Source: Adapted from Baldwin 2013.

Vertical integration

Richard Baldwin's unbundling concept captures one important aspect of the dynamics of the world economy. But there is another critical dimension of the analytical perspective for the development of GVCs.

In the beginning of the 20th century Henry Ford devised and implemented a business model that aimed to integrate various segments (functions) of a production process under a single capital and management umbrella through the acquisition of a variety of companies. The model, later known as a vertical integration strategy, became a modus operandi in the era of mass production.[9]

Early studies of vertical integration focused on market imperfections. A firm integrates other entities to redress pre-existing market power distortions, such as double marginalization, free-riding, or entry foreclosure (Tirole 1989).

Another strand of thought considers the preclusion of transaction costs as a main motive for vertical integration, where internalizing production activities is a measure to avoid the potential costs of establishing formal business relations at arm's length.

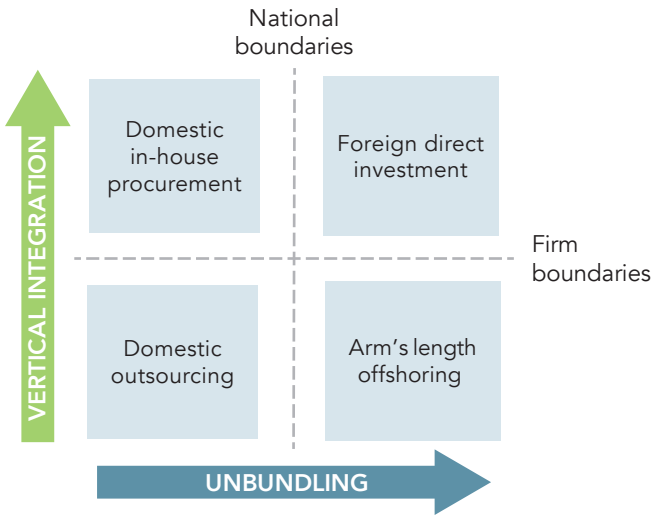
Given these benefits of integration, why then do some firms not choose to integrate? Because the internal arrangement of activities involves nontrivial administrative and bureaucratic costs. Accordingly, the governance schemes are chosen to minimize the production inefficiencies attributed to a trading relationship by weighing the transaction costs of spot-market dealings against the bureaucratic costs of unified hierarchical organizations (firms).[10]

From the viewpoint of transaction cost economics the costs of concern include not only the direct costs of writing, monitoring, and enforcing contracts, but also the ex post performance inefficiencies caused by contractual hazards within the relationship. One of the basic tenets of transaction cost economics is that contracts are incomplete—in that the terms of exchange between the parties cannot be disciplined ex ante because of information asymmetry.[11] When the parties are locked in to the transaction, the incompleteness of contracts evokes contractual hazards of various types, yet vertical integration pre-empts these hazards by internalizing ex post quasi-rents into the unified objective function of the integrated firm. So vertical integration becomes a preferred mode of organizing value chains when the benefit of attenuating the opportunistic behavior of parties within the relationship outweighs the cost of inefficiently allocating resources associated with bureaucratic arrangements (Joskow 2003).

And today vertical integration in the multicountry dimension refers to the emergence of business entities called multinational corporations. Foreign direct investment by multinational corporations is the main driver of global production networks, decisively influencing the distribution of value added across countries.[12]

Accordingly, there are four modes of organizing value chains, along the axes of whether the task is done in-house or outsourced and of whether it is carried out domestically or across national borders (figure 1.3).

FIGURE 1.3 Modes of organizing value chains



Source: Author's drawing, based on Kimura and Ando 2005.

Value chains and global value chains

The term "value chains" was conceived in business management studies. Porter (1985) tailored the concept as a basic framework for developing a corporate strategy to promote firm competitiveness by directing attention to the entire system of activities involved in producing and consuming a product. A corporate entity is first decomposed into a set of business activities with individual functions that constitute analytical units for diagnosing the firm's competitive advantage. When a firm has a relatively atomized organizational structure, the task of each unit (business activity)—such as product design, materials procurement, marketing, and distribution—tends to be defined in a way to pursue the individual objective of that particular unit, which may or may not conflict with the objective of other units. However, in the value chain perspective all activities should be collectively organized to ensure the optimal functioning of the corporate entity as a whole. To this end, the nature of linkages between activities (value chains) is carefully examined—just as if drawing an anatomical chart of a firm—to internalize potential externalities through cross-functional coordination, which is an important source of the firm's competitive advantage.[13]

In contrast, GVC studies originated in sociology. Unlike Porter's value chain concept, which is concerned primarily with how firm strategies can be renovated by shifting the focus to the configuration of business activities, GVC studies consider the generation and transfer of value within the system as a consequence of firm efforts to optimize production networks and, conversely, the mechanism of how the value distribution structure affects the firm's choice of the organizational form of international production networks. GVC analysis is not a global extension of Porter's value chain approach because the scope and motivation differ, as described below.[14]

Typology of global value chains

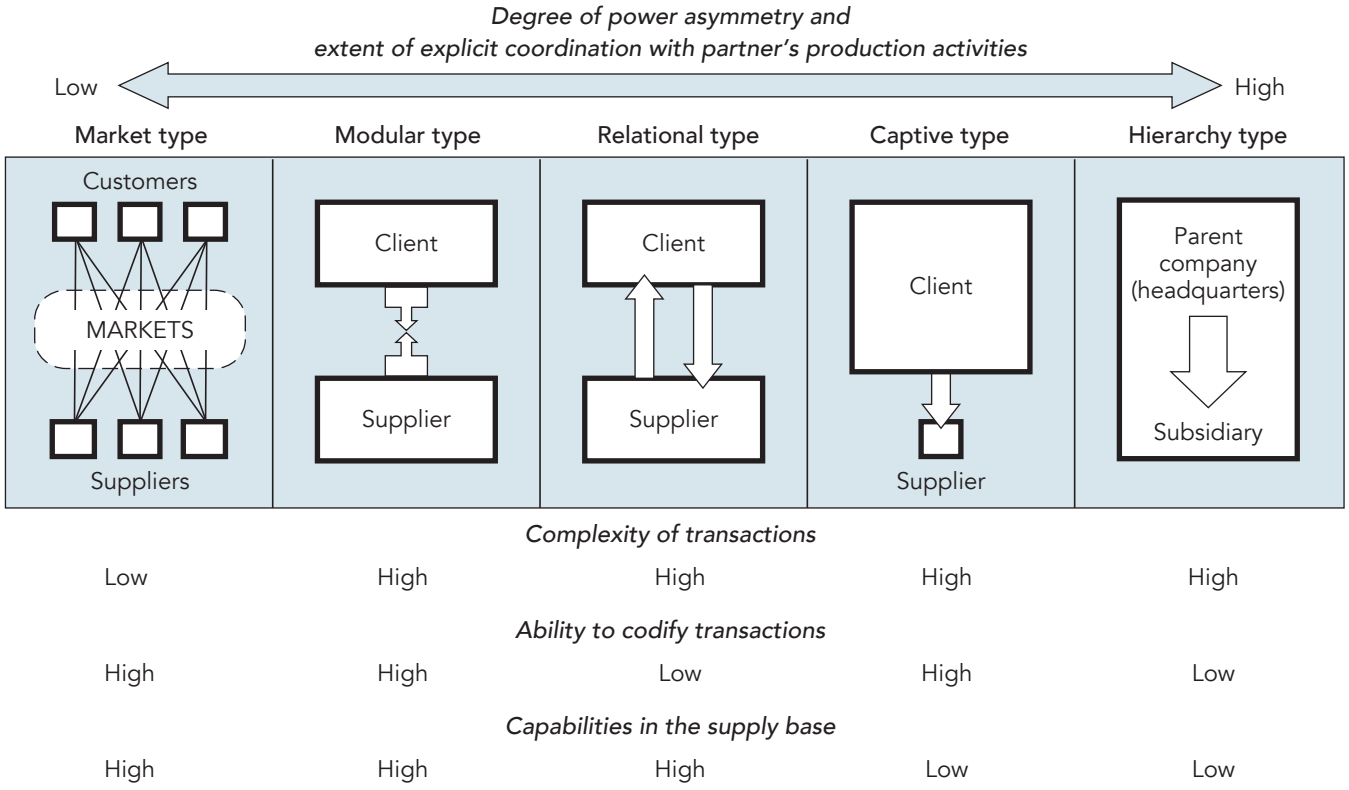
The main objective of GVC studies is to explore the interplay between value distribution mechanisms and organization of the cross-border production–consumption nexus. The concept was first collectively framed in the discussions of the Global Value Chains Initiative (2000–05), sponsored by the Rockefeller Foundation,[15] and further crystallized by Gereffi, Humphrey, and Sturgeon (2005), whose analytical focus rests on the governance structure of organizing international production networks. Who are the players in the game? What kinds of rules exist? Is it a competitive or a cooperative play? What generates the winning opportunities? In answering these questions, GVC studies pay attention to the forms of transactions, codified or otherwise, between stakeholders. This is because the way transactions are made reflects the structure of power relations between the parties, which ultimately determines the scope and magnitude of value distributions within the game.

The vertical integration type of GVC is based on the hierarchical structure that assumes an absolute and unidirectional control of the parent company over its subsidiaries. The activities and performance of subsidiaries are strictly monitored and assessed in line with their headquarter management strategies. In contrast, outsourcing options tend to generate leveled relationships between clients (buyers) and subcontractors (service suppliers), and the power exercise is more or less mutual, unlike the vertical integration type.

Within this dichotomy, Gereffi, Humphrey, and Sturgeon (2005) set out a GVC typology in a higher resolution spectrum in accord with power relations between the contracting parties. Figure 1.4 illustrates five variants of GVC governance. The rectangles represent the firm's boundary, and their size indicates the strength of bargaining power in relation to the other party. The arrows show the direction and extent of business intervention in the partners' activities, which can be supportive, such as to draw "win-win" scenarios in the long-term perspective, or predatory, by focusing on uptakes of quick profits in the short run. Toward the right of the diagram, the clients (the headquarters in the case of the "hierarchy" type) possess greater bargaining powers and so are considered to exert a strong influence over the distribution of value added. (See annex 1.1 for a detailed description.)

Gereffi, Humphrey, and Sturgeon (2005) also considered the dynamics of the GVC configuration by factoring out three parameters: complexity of transactions, ability to codify transactions, and capabilities in the supply base (known as the "3 C's model"–Complexity, Codifiability, and Capabilities). For example, the

FIGURE 1.4 Typology of global value chains



Source: Author's drawing, based on Gereffi, Humphrey, and Sturgeon 2005.

shift in the type of value chains from market to relational is associated with an increase in the complexity of transactions. The shift from relational to modular assumes an increase in the ability to codify transactions. And the improving capabilities in the supply base, other things equal, drive value chains from the captive type toward the market type. And so on.[16]

By probing the mechanism of GVC configurations, the model helps identify the policy instruments to facilitate the transformation of value chains from one type to another, especially in the light of industrial upgrading and the GVC-driven growth of developing countries.[17]

Economic modeling

In principle, economists' analytical focus on GVCs has been on three issues: the mechanism of the fragmentation of production processes,[18] the impacts of offshoring on domestic factor incomes and welfare, and the firm's choice of an organizational form of GVCs.

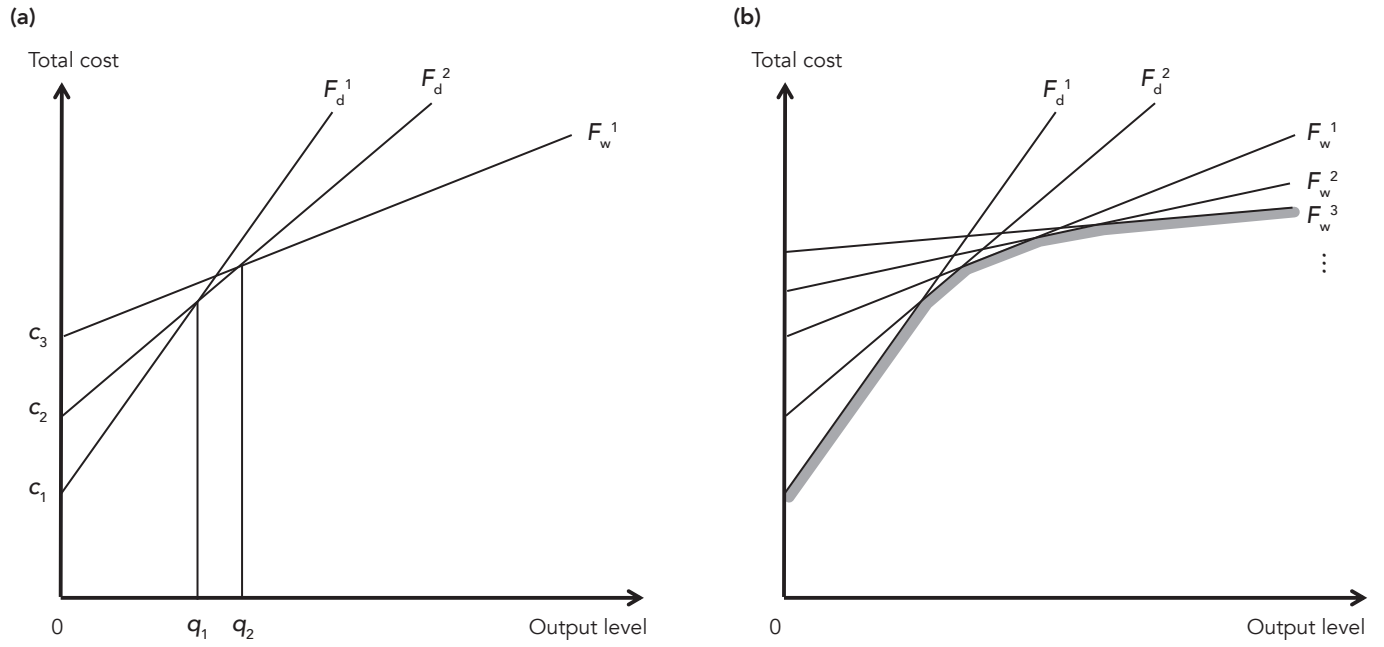
Mechanism of the fragmentation of production processes

Jones and Kierzkowski (1990) provide a model of outsourcing and set out the factors that affect the degree and form of the fragmentation of production activities. Figure 1.5a illustrates the relation between output level (market size) and total cost of production for a firm whose production technology contains elements of increasing returns to scale. The line $\mathbf{F_d}^1$ represents the cost schedule of the traditional method, with all production stages concentrated in one location. When a part of the production process is outsourced to a domestic partner, two things occur, as shown in the movement of the cost curve from $\mathbf{F_d}^1$ to $\mathbf{F_d}^2$. First, the curve becomes flatter, indicating an improvement in productivity caused by the division of labor. Second, the curve shifts upward, indicating an increase in fixed costs (from c_1 to c_2) because of the need for coordination between the production units in different locations.[19] Here, the least costly form of production will switch from the traditional method to outsourcing at the output level q_1.

When outsourcing options are enlarged to include the international context, two other aspects are also taken into account.

- Production factor costs are considered to be more diverse between countries than within a country, so productivity will rise more when outsourcing takes place across borders in accord with comparative advantage.
- Connecting production units in different countries is more costly than connecting production units within the same country. International logistics is generally more expensive, marked up by import duties and costs for clearing customs and the like. There also are nontrivial communication costs for coordinating production units in countries with different languages, legal systems, and business ethics.

FIGURE 1.5 Optimal form of outsourcing options



Source: Author's drawing, based on Jones and Kierzkowski 1990.

These features are represented by line $\mathbf{F_w^1}$, which has a flatter slope for increased productivity and a higher intercept for an extra top-up of the fixed cost (from c_2 to c_3). Then, the optimal form of production will switch from domestic outsourcing to cross-border outsourcing (offshoring) at the output level q_2.

In this light, it is possible to consider where multiple countries are involved in the production process ($\mathbf{F_w^2}$, $\mathbf{F_w^3}$, …). Different schedules can be drawn for various outsourcing options, as in figure 1.5b, and the shaded boundary defines the optimal form of production arrangement at each level of output.

The model's implications for a global production arrangement are threefold. Other things being equal, the production process will be more prone to international fragmentation when:

- The targeted market is larger, so that it has more room to absorb the increased supply of goods from the organization of more efficient divisions of labor across borders.
- The costs of connecting the production activities in different countries are less inhibitive.
- The countries in the production networks are more diverse in their factor costs, so there is a better chance for offshoring firms to exploit comparative advantage.

Impacts of offshoring on domestic factor incomes and welfare

The offshoring model was further developed to address income distribution and welfare—a natural response to mounting political concerns about the potentially detrimental effect of offshoring on the domestic labor market (the industrial hollowing-out problem).[20]

Traditionally, the effect of international trade on the labor market has been considered in regard to a resource shift between industrial sectors caused by import competition, without much attention to the change in the within-sector composition of different types of labor. Newer globalization literature seizes on this point, recognizing that offshoring is a cross-border movement of a production activity corresponding to a task for a particular type and skill of labor.[21]

Feenstra and Hanson (1996a, 1996b) considered the impact of offshoring that follows the liberalization of foreign ownership in developing countries. Substantial movements of capital from developed countries to developing countries are accompanied by transfers of some segments of production processes that are considered more skill-intensive by the standard of developing countries but less skill-intensive by the standard for developed countries. Accordingly, the demand for labor becomes skewed toward higher skilled labor in the light of the respective skill standard of each economy, so the relative wages of low-skilled labor fall in both developed and developing countries.[22]

Grossman and Rossi-Hansberg (2008a) then introduced a "trade in tasks" concept to explain how an increase in offshoring feasibility affects the productivity and factor incomes of the offshoring country. They emphasized the need to shift the analytical focus from goods, as in the conventional trade theory (Portuguese wine for English cloth), to tasks that line up in a production process, in order to capture the rising prevalence of offshoring activities in a firm's business strategies.

In the model the offshoring feasibility is parameterized as an improvement in the coordination capability between the firm's

headquarters and its foreign suppliers through transportation and communication technologies. The sensitivity to the change in offshoring feasibility is assumed to vary across different types of tasks. Some tasks (such as those akin to codified description) are easy to offshore, while others (such as those relying on personal tacit knowledge) are not.[23]

The impact of the improved prospect for offshoring is considered through three channels:

- *A labor-supply effect.* Moving some tasks to foreign countries frees up the domestic labor that would otherwise carry out these tasks, so it has an effect analogous to increasing the supply of labor in the market. Such an implication, widely discussed in the mass media and political circles, generally evokes opinions against a firm's offshoring activities for fear of lowering the real wages of offshored labor or losing domestic jobs when wages are sticky.
- *A relative-price effect.* A country offshores low-skilled labor when its cross-country comparative advantage is weaker in that type of task than in the tasks of high-skilled labor. The country would then specialize in exporting goods that are intensive in high-skilled labor, as conventional trade theory predicts. Accordingly, if an increase in exports leads to a deterioration in the country's terms of trade, it would create a negative impact on the welfare of its high-skilled labor through the Stolper–Samuelson mechanism. (However, this effect comes into play only when the country is large enough to affect the international relative prices of goods.)
- *A productivity effect.* This effect is a unique feature of the model that is not fully considered in other studies on the topic. When the prospect for offshoring improves—say, by an increase in communication capabilities—an offshoring firm's profitability will rise in proportion to the extent that the firm relies on the offshoring business. Such a productivity effect is equivalent to the consequence of factor-augmenting technological progress, so it is able to bring a positive impact on the employment of domestic workers (across all industries) whose task levels are similar to those of offshored labor.

The net impact of offshoring on factor incomes is the sum of these three effects. And in most cases the empirical consideration is reduced to whether the productivity effect will dominate the other two effects—if so, the argument turns in favor of offshoring activities.[24]

Firm's choice of an organizational form of global value chains

The factors that determine whether a transaction is mediated through markets or within firm boundaries have long been a subject of inquiry in industrial organizational theory. The question has been addressed in many ways since Ronald Coase documented his insights on the nature of the firm,[25] and it has been brought into the international context in studies on intrafirm trade and multinational corporations.

Antràs (2003), one of the earliest efforts in pursuing this direction, synthesized firm theory under incomplete contracts (Grossman and Hart 1986) and international trade theory under imperfect competition (Helpman and Krugman 1985) to explain the asymmetric prevalence of intrafirm trade in capital-intensive industries and between capital-abundant countries. The firm's dual motives for minimizing transaction costs (by assigning property rights) and factor costs (by exploiting comparative advantages) are analyzed in the unified theoretical framework. The model expands the margins of analytical scope in figure 1.3 to cover the range of value chain variations for both spatial and organizational dimensions.

Antràs and Helpman (2004) introduced another dimension to the analysis: firm heterogeneity. Drawing on Melitz (2003), Antràs and Helpman investigated the impact of within-sector heterogeneity in firm productivity on the firm's globalization decision. The model predicts that different degrees of entry cost to global activities bring about the productivity ranking among firms on the choice of globalization modes. The most productive firms would choose to undertake foreign direct investment, the next most productive firms would choose to engage in arm's length offshoring, and so on down to the least productive firms, which would choose to engage only in domestic procurement.

Further to these approaches, Antràs and Chor (2013) shed new light on the line of analyses by considering a technological ordering of production stages—a crucial attribute of value chains—to address the traditional make-or-buy question for each segment of a production process along a value chain. Incompleteness of contract, as previously defined, entails strategic consideration by a lead firm (final good producer) in choosing the form of value chain governance. And the key prediction of the model is that the lead firm should differentiate the governance forms between upstream and downstream suppliers for optimizing the gains from the set of transactions.

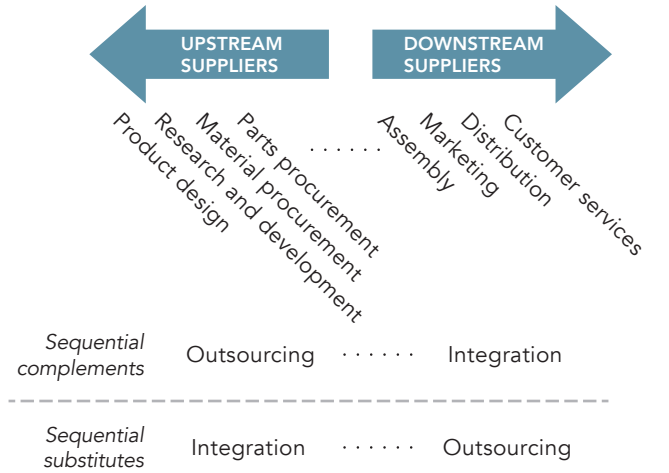
The model identifies two types of value chains, determined by the nature of the final product: sequential complements and sequential substitutes. The type of sequentiality that characterizes the production process affects the lead firm's decision on the governance arrangements along that value chain (figure 1.6). For sequential complements the lead firm chooses to integrate downstream suppliers while outsourcing its upstream production stages. For sequential substitutes upstream suppliers are vertically integrated, while the transactions with downstream suppliers are carried out at arm's length. (See annex 1.2 for a brief description of the argument.)[26]

The property-rights theory on the firm's choice of an organizational form is highly resonant with the sociologists' analytical insights about value chain governance because, broadly speaking, both approaches engage the contractibility of transactions as a core parameter of the models. The topic is thus one of the most promising areas for extensive interdisciplinary dialogue on synergetic development of the GVC analysis.

Empirical challenges

The rapid progress of empirical analysis on GVCs has been backed up by two substantial changes in the research environment. One

FIGURE 1.6 Sequential choices for organizing value chains



Source: Author's drawing.

is the increasing availability of relevant data and statistics, especially multicountry input-output tables and firm-level microdata. The other is the advance in data-processing capacity of personal computers for handling these massive datasets as well as the information and communications infrastructure that allows for efficient shared use of the databases. What was impossible 20 years ago is common practice today, and the empirical challenges of GVC analysis are entering a new phase of development.

Mapping global value chains by firm business records

The initial efforts to quantitatively describe GVCs can be found in studies that use firm-specific business records. These studies typically aim to identify the composition of inputs procurement or the sales networks of a product on the basis of data provided by the manufacturers themselves or from the teardown reports of private consulting companies—or, for the average breakdown of an industry's generic product type, the information from the relevant industry associations (Sturgeon and others 2013).

Earlier studies of this kind include Dedrick, Kraemer, and Linden (2008), who analyzed the value-added structure of four representative products—Apple's iPod and video iPod and Hewlett Packard's and Lenovo's laptop personal computers—using information from business reports.[27] They found that a video iPod with a retail price of $299 in 2005 was associated with a breakdown of $144 for the product's factory cost, $75 for distribution margins and $80 for the profit of the lead firm (Apple), while within the factory cost only $3.86 was estimated for the assembly services in China. The original motivation of the study was to investigate how firms benefit from technological innovation through production sharing, but it came to elucidate a separate and even more alarming question about the validity of conventional trade statistics based on gross values.

In this context, Xing and Detert (2010) addressed U.S.–China trade imbalances. iPhones were not sold in China in 2009, which implies that China's exports of iPhones to the United States were equivalent to the U.S. trade deficit of the product in relation to China. The study shows that the U.S. deficit of $1.9 billion for iPhone trades is reduced to $73 million if viewed in value-added terms and broken down to include the deficits with other countries such as Japan and Germany, which are the core parts suppliers.

These product-level approaches are useful in drawing the actual structure of production chains because they directly use data provided by individual firms rather than resorting to statistical inference. But the weakness is apparent in the flipside.[28]

First, these approaches have limited applicability when considering macroeconomic issues such as trade policies, because the analytical focus is cast only on a particular product or on the activity of a few firms. This is far from sufficient to capture the entire value flows in the national context.

Second, as Dedrick, Kraemer, and Linden (2008) pointed out, most firm data do not explicitly present compensation of employees, an important component of value-added items in the national accounting framework, but merge it with other types of production costs.

Third, because values are generated at every point of the production process, the value-added analysis should be able to trace all the production stages along the entire supply chain. However, the product-level approach considers only the value-added structure of direct input suppliers (the first tier), leaving the rest of the value-added stream untracked. For example, a hard-disk drive in an iPhone contains subparts produced in different countries and thereby requires further decomposition of the value-added sources.

Mapping global value chains by input-output tables

Given the limitations of the conventional approach, multicountry input-output tables have received increased attention. A multicountry input-output table provides a comprehensive map of international transactions of goods and services in a massive dataset that combines the national input-output tables of various countries at a given point of time. Because the tables contain information on supply–use relations between industries and across countries—which are totally absent from foreign trade statistics—it is possible to identify the vertical structure of international production sharing. And unlike the product-level approach, input-output analysis covers an entire set of industries that make up an economic system, thus enabling the measurement of cross-border value flows for a country or region. Theoretically, such analysis has the capacity to track the value-added generation process of every product in every country at every production stage.

The input-output approach has weaknesses as well. Sturgeon and others (2013) pointed out the limitations of (multicountry) input-output analyses arising from the statistical characteristics of input-output tables. First, the table's sectoral classification is based on industrial categories so that the value-added of a specific task such as product design or assembly cannot be identified. Second, transactions are recorded on a domestic basis, so production activities are circumscribed by territorial borders rather than by the nationality that the produced goods

are associated with, which may cause (analytically) inappropriate attribution of value added among countries.[29] Third, information on the nature of specific transactions is totally absent from input-output statistics, making qualitative analyses of value chains difficult, if not impossible.

In a nutshell the product-level approach is relevant for analyzing qualitative aspects of individual value chains, such as the form of governance arrangement or the mode of technological transfer between parties, while the multicountry input-output approach captures a general picture of value chain configuration in the larger context from a systematic point of view. They are not exclusive substitutes but must be employed in a complementary manner, depending on the type of research questions.

GVC studies using input-output tables have become increasingly common in the last decade. Their origin can be traced back to Hummels, Ishii, and Yi (2001), who introduced the concept of vertical specialization—defined as the amount of imported intermediate inputs used to produce an exported good or, put differently, the import content of exports, which is presented as a measure of international production sharing.

Chen and others (2004) first brought the idea into the value-added context in relation to the statistical distortion caused by ignoring the presence of processing trade and by measuring international trade in terms of gross exports. Here the long-debated issue of U.S.–China trade imbalances was fully considered in the value-added perspective. Koopman, Wang, and Wei (2012) further developed and methodologically formalized the approach for separating China's national input-output matrices into two components, one for the export processing sectors and one for the rest of the economy.[30] They showed that the foreign content of value added in China's manufacturing exports was about 50% in 2002, more than double what would have been obtained by a straightforward application of the vertical specialization metric. It quantitatively demonstrates the importance of measuring trade in value added terms, as well as the significant analytical impact of overlooking processing trade.

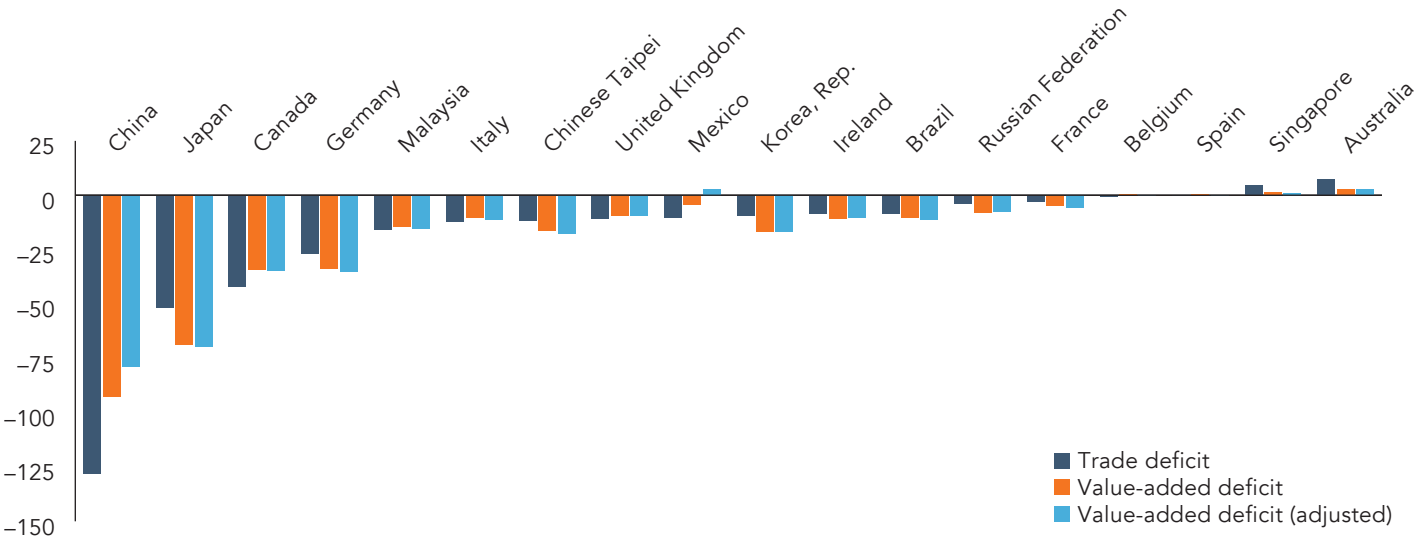
While these empirical exercises rely on the national input-output tables of individual countries, Daudin, Rifflart, and Schweisguth (2006) used the database of the Global Trade Analysis Project to construct a multicountry input-output table of 70 countries and their composite regions in order to calculate the domestic value-added content of exports, alongside indices of vertical specialization and regionalization. Johnson and Noguera (2012) calculated the ratio of value-added exports to gross exports as a metric of international production sharing, again using the Global Trade Analysis Project database.[31] They extensively discussed the impact of production sharing on the scale of bilateral trade balances with respect to multiple countries, not to mention the U.S. trade deficit with China, which shows a 30–40% drop in value added terms from the traditional calculation (figure 1.7).[32]

Bems and Johnson (2012) present an interesting extension of the trade in value added approach to international macroeconomics by proposing the concept of the value-added real effective exchange rate. Real effective exchange rates are commonly used to measure country export competitiveness by evaluating the magnitude of price adjustments necessary to clear the external imbalances or, put differently, the extent of nominal exchange rate misalignments.

Conventional real effective exchange rates are often calculated from a weighted basket of consumer price indices, where weights are based on bilateral gross trade flows. However, with

FIGURE 1.7 Bilateral trade and value-added balances for the United States, by partner, 2004

$ (billions)



Source: Author's drawing, based on Johnson and Noguera 2012.

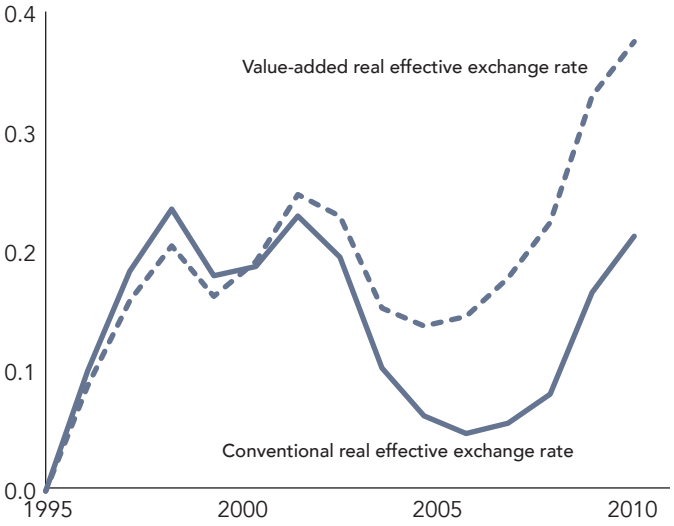
rapid globalization, conventional rates became an inappropriate measure in two respects. First, because real effective exchange rates are used to assess country export competitiveness in the world market, approximating price developments with consumer price indices is not ideal because consumer price indices summarize the prices of products whose value-added origins could be fragmented across different countries. Second, using the same line of logic, the values of gross trade flows cannot serve as unbiased weights because they do not represent today's economic reality of increasing production sharing among countries.

The value-added real effective exchange rate overcomes these problems by using gross domestic product (value-added) deflators, instead of consumer price indices, to measure price changes, and bases its weights on value-added bilateral trade flows, instead of gross trade flows. Figure 1.8 shows that the gap between China's conventional and value-added real effective exchange rates increased substantially from 2000 onward.[33]

One of the most recent achievements in this strand of analyses is from Koopman, Wang, and Wei (2014), who devised a full decomposition method of gross exports into various sources of value added. Gross exports are first decomposed into four categories: domestic value added absorbed abroad, domestic value added first exported then returned home, foreign value added, and pure double-counted terms; each category is then further decomposed by trading mode (figure 1.9). The result is a complete picture of the value-added generation process, in which various preceding formulas for measuring value-added trade are systematically integrated into a single accounting framework. In particular, the method enables the isolation of double-counting elements in gross exports, which have long haunted trade economists conducting empirical analyses.

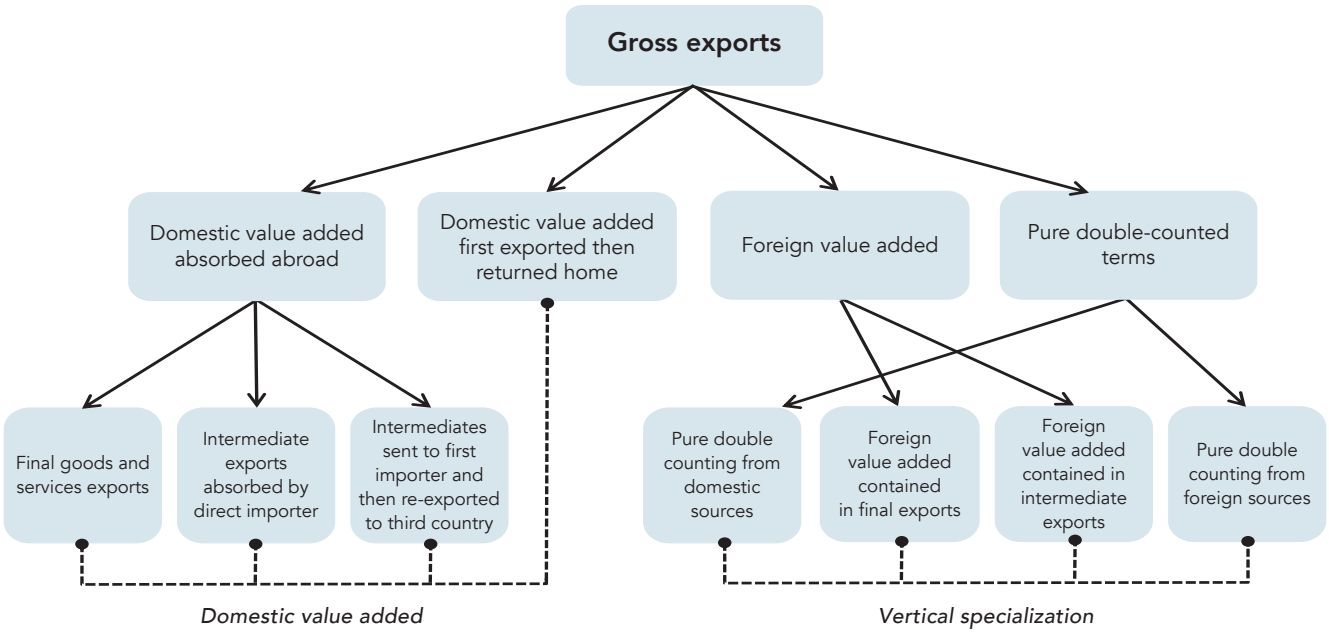
FIGURE 1.8 China's real effective exchange rates

Change from 1995 value (%)



Source: Author's drawing, based on Bems and Johnson 2012.

FIGURE 1.9 Gross trade accounting framework



Source: Author's drawing, based on Koopman and others 2016.

Note: This figure is a revised version from the one presented in Koopman, Wang, and Wei 2014 in response to the comment by Los, Timmer, and de Vries 2016.

For trade policies the channels of domestic value added first exported then returned home have important implications. For example, the antidumping measure that the European Commission imposed on the import of footwear from China and Viet Nam in 2006 is known to have had a detrimental impact on service industries in the European Union because these imported items contained considerable value added originating in the European design and distribution sectors. Such consequences could have been avoided by due reference to a detailed presentation of the value-added sources of traded products.[34]

Heterogeneity considered

Another important development in the quantitative analyses of GVCs, with a theoretical foundation in Melitz (2003), is accounting for within-sector heterogeneity in firm characteristics when constructing input-output tables. Conventional input-output tables do not differentiate the input structure of different types of producers in the same industry. However, export-oriented firms, especially those in the processing trade, generally have higher import intensity in sourcing intermediate inputs than do domestic-oriented producers. This implies that conventional input-output tables, which provide information only on the average input structure across all types of producers, may bias analytical results for countries where processing trade is prevalent (notably China and Mexico).

As stated earlier, Koopman, Wang, and Wei (2012) were first to formally address this problem, by presenting a method to split the Chinese input-output tables into subaccounts that align export processing activities with the rest of the sector. Tang, Wang, and Wang (2014) further elaborated the approach, by considering variation in such firm characteristics as size (large scale or small to medium scale) and ownership structure (domestic or foreign, private or state-owned). They also used the Chinese input-output tables but combined them with data from China's industrial census and trade statistics by firm type. Importantly, the information on ownership structure allows the impact of China's privatization program on domestic value-chain upgrading to be assessed.

Ma, Wang, and Zhu (2015) integrated these approaches by considering firm heterogeneity in dual dimensions—trading mode (processing exporters or normal exporters plus nonexporters) and firm characteristics (domestic-owned or foreign-owned). Using the information of ownership structure, they worked out the distribution of domestic value added according to factor ownership, which contributes to the conversion of measurement from gross domestic product to gross national income by taking into account firm heterogeneity.[35]

Heterogeneity can also be considered from a geographic perspective. The current setup of multicountry input-output tables regards a country as a point of transaction in global production networks. However, a national economy has a spatial dimension. Brazil and China cannot be treated the same way in the input-output matrices that Costa Rica and Singapore are. Inomata and Meng (2013) introduced the Transnational Interregional Input-Output Table for China, Japan, and Korea, constructed by the Institute of Developing Economies, which links the interregional input-output tables of respective countries into a single matrix to account for regional heterogeneity within a country in a multicountry input-output framework. The table allows for economic linkages across borders to be studied on a region-to-region basis—say, between Huanan in China and Kyushu in Japan.[36]

Domestic linkages between regions are particularly relevant when considering regional (within-country) development. For example, China built strong economic linkages with neighboring countries after the launch of the Reform and Open-Door Policy in 1978, but the benefit of economic globalization was not equally shared within the country. Income disparities immediately widened between coastal and inland regions, and it took time for the positive impact from abroad to trickle down to inner China through domestic linkage effects. In this sense, regional aspects are crucial in accounting for the process of economic development, especially for spacious and less integrated economies.[37]

Finally, consider heterogeneity in labor markets. The impact of GVCs on employment has been the subject of heated discussion, especially around the industrial hollowing out problem. Earlier globalization debates addressed the issue primarily in terms of the industrial structural change brought about by opening the domestic economy to global competition (leading to identification of declining, stagnant, and expanding industries). The current arguments from the GVC perspective engage in more microscopic analysis by looking into the wealth distribution at the task level within production chains, often epitomized by the so-called "smiley curve."

Along these lines, Timmer and others (2014) conducted empirical research on value-added distribution among heterogeneous labor markets with different types of skill (upon recognizing that each task in the production processes can be associated with a particular level of labor skill). They employed the European Commission–funded World Input-Output Database augmented by the EU KLEMS database for information on factor inputs, in which three types of labor (low skilled, medium skilled, and high skilled) were identified on the basis of educational attainment. For most of the countries in the database the value-added share of high-skilled labor increased substantially from 1995 to 2008, while that of less-skilled labor declined. The results agree with the findings of Feenstra and Hanson (1996a, 1996b) and have important implications for recent political events in Europe and the United States.

Distance matters: "length" analyses of value chains

The theory of fragmentation predicts that if the production process of a good has the potential for further segmentation by the change in production technologies or consumption markets, then there is an opportunity for a finer division of labor that will lead to better allocation of resources and lower marginal cost of production. This is especially true with access to international markets, because the differences in factor endowments (and thus comparative advantage) are even more salient across borders.[38]

Accordingly, the study on fragmentation concerns the number of production stages in a production process—comparing alternative technologies that produce the same good, one with few

production stages and another with many. Empirical research requires an overall perspective for the entire structure of the production sequence. What matters is not only the strength (magnitude) of production linkages, but also the length of the linkages, determined by the number of production stages.

The traditional input-output approach to analyzing production networks is generally concerned with the interconnectedness or strength of linkages between industries. The "length" dimension of production linkages was first addressed by the input-output model of average propagation length developed by Dietzenbacher, Romero, and Bosma (2005). The average propagation length model represents the average number of production stages lining up in every branch of production networks, so it effectively measures an industry's fragmentation.[39] Dietzenbacher and Romero (2007) further applied the model to the international context by analyzing the cross-national linkages of major European economies using the 1985 European multicountry input-output table.

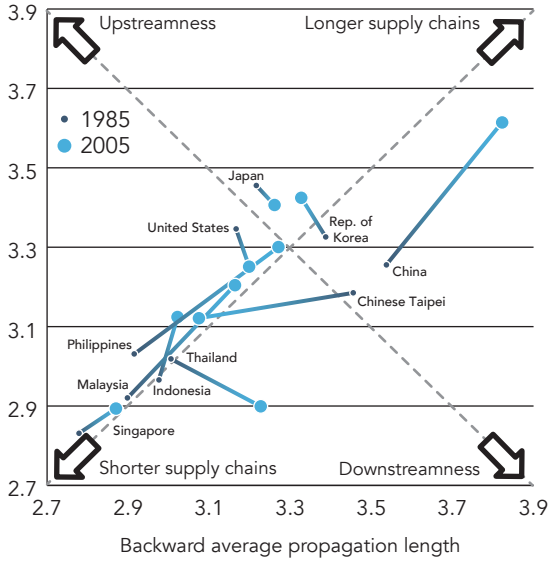
Fally (2011) developed a model for measuring fragmentation that was based on a philosophy similar to that of the average propagation length model. The major difference is that Fally's model, as well as Antràs and others' (2012) variation, captures the average number of production stages by pegging the endpoint of the sequence at final consumption, which enables measuring the distance to final demand of a product along the production chains. Those studies rely on national input-output tables of the United States and other selected countries, but De Backer and Miroudot (2012) later applied Fally's (2011) model to the intercountry input-output tables of the Organisation for Economic Co-operation and Development covering 56 countries for 1995, 2000, and 2005.[40]

One application of the "length" model in the GVC context is to identify countries' (or industries') relative position within the global production system. If a country's representative production chains toward final products are longer than those toward primary products, the country is considered to operate in a relatively upstream position (and conversely if a country's representative production chains toward final products are shorter than those toward primary products, the country operates in a relatively downstream position). Because the average propagation length can be measured both in forward (cost-push) and backward (demand-pull) directions along production lines, it is possible to identify the relative position of a country within the global production networks by comparing the pairs of forward-length and backward-length values.

Inomata (2008) and Escaith and Inomata (2013) are among the earliest efforts to develop the idea of measuring the relative production positions of countries. They elucidated the structural change of the regional production system in two dimensions, using data for East Asia (figure 1.10). With the horizontal axis for backward average propagation length and the vertical axis for forward average propagation length, the bottom-left to top-right direction presents the changes in the entire length of the supply chains that countries participate in, and the top-left to bottom-right direction draws the relative line position of each

FIGURE 1.10 Relative line position of countries in the regional production networks of East Asia, 1985, 2005

Forward average propagation length



Source: Author's drawing, based on Escaith and Inomata 2013.

country within the regional production networks (as determined by the ratio of forward and backward average propagation lengths). For example, China moved along the path that is farthest from the bottom-left to top-right diagonal, indicating that it stayed in the most downstream segment of the regional supply chains throughout the period, which reflects the country's dominant role as a final assembler of regional products.[41]

The line position of industries and countries within a production system is particularly important for considering the variations in sectoral characteristics along value chains—for example, value-added ratios as signified by the "smiley curve" (Baldwin, Forslid, and Ito 2016; Ye, Meng, and Wei 2015) or the mode of value chain governance (Antràs and Chor 2013).

So, what's next?

Perhaps the most pressing issue for the GVC research community is to accelerate the development of relevant data. Until now, a large share of empirical work for testing GVC governance models of firm theory has relied on data from official merchandise trade statistics.[42] Some country databases (such as the Related Party Trade Database from the U.S. Census Bureau) contain information on whether shipping involves transactions between related or nonrelated parties, which can be used to sketch out the presence of multinational firms in international trade.[43]

Despite the observable advantages of the data (notably accessibility and availability), researchers face several challenges to using it appropriately. Antràs (2011) set out four of them. First, the product-level information aggregates the sourcing decisions

of multiple firms, so some approximation is imposed for testing the model of firm-level sourcing behavior. Second, the data do not provide information about the users of the products being shipped, so it is impossible to identify which sector of the economy has absorbed the imported product (or even whether it is for intermediate use or final consumption). Third, as for the shipping between related parties, the data tell neither which party is owned by whom, nor the degree of control or ownership share of the parent company. The second and third points pose a practical problem when relating observations in intrafirm trade with the characteristics of importers (headquarters, in the case of backward integration), as modeled in Antràs (2003). Fourth, the data report only the information on incoming and outgoing shipments from the viewpoint of a home country. But multinational firms often engage in global sourcing, involving shipments between third countries (for example, Apple headquarters in the United States may source Korean Samsung's inputs being shipped to Foxconn factories in China for assembly).

Firm-level microdata, which have become increasingly available in recent years, may provide the information needed to develop empirical tools that overcome these problems.[44] The benefit of the datasets rests on their representativeness of various aspects of firm operations. For example, the Basic Survey of Japanese Business Structure and Activities (Kigyo-katsudou kihon chosa toukei) by Japan's Ministry of Economy, Trade, and Industry, has annual survey data (mandatory under the Statistics Act of Japan) that cover multiple types of information on firms, such as sales, costs, employment, capital expenditures, exports, imports, and foreign direct investment.[45]

Even so, unlike those Japanese data, many firm-level microdata come from one-shot industrial surveys and thus are available only for particular countries in particular years. The datasets also differ in the dimensions of representativeness. Accordingly, in order to apply these datasets to a general equilibrium setup like the input-output system, they should be used, for example, to provide combined structural information for estimating the relevant coefficients along with appropriate constraints and a balancing algorithm.

Another aspect to consider is the integration of databases, especially of multicountry input-output tables. Currently, various institutions construct competing tables, each designed for a specific analytical objective, so their presentation format, sectoral classification, and types of ancillary information (such as environmental accounts) differ.[46]

A team at the University of Sydney recently launched the Global Multi-Region Input-Output Lab, which aims to build a cloud-computing platform that allows participants to use each other's individually developed statistical resources. The information from the aforementioned multicountry input-output databases, together with national accounts and foreign trade statistics, are expected to be input in the platform. Then, a highly detailed regional-sectoral taxonomy (the root classification) linked to the data pool will serve as a feedstock from which researchers can choose any combination of regions or sectors to assemble the multicountry input-output tables most suited to their research interests. By developing a Wikipedia-like common e-infrastructure, the lab's setup optimizes the use of available information, enhances flexibility in data construction, and saves resources by avoiding duplication of work among different institutions (Lenzen and others 2017).

Meta-methodological considerations

GVC studies have evolved along three distinctive modes of analyses: spot analysis, sequence analysis, and network analysis. Gary Gereffi's earlier model, global commodity chains, considered the power relation between a lead firm and a set of multiple subcontractors that operate at different tiers along production chains (Gereffi and Korzeniewicz 1994). "One versus many" was thus the basic setup for analyzing the nature of governance. In contrast, Gereffi, Humphrey, and Sturgeon (2005) and later studies moved the analytical target to one-to-one transactions within a particular pair of a lead firm and a supplier (Bair 2008). So the modal shift in GVC studies among sociologists was from sequence (that is, one versus many) to spot (that is, one versus one) analysis—or, in the Euclidean sense of the word, from one-dimensional to zero-dimensional spatiality.

In international trade theories the analytical focus of GVC studies has been primarily on a particular supply–use relation between trading partners, especially for a firm's "make-or-buy" choice of intermediate inputs. The dominant mode of analysis has thus been spot analysis, yet Antràs and Chor (2013) have opened a new path toward sequence analysis by considering a technological ordering of production stages (from zero-dimensional to one-dimensional spatiality).

Input-output economics has by its nature always been concerned with a sequence, whether in the traditional Leontief impact models or in the latest supply chain length models. However, recent work engages network theory by applying the concept of network centralities to input-output matrices (Carvalho 2012; Escaith 2014) and thereby shows some movement from sequence to network analysis (from one-dimensional to two-dimensional spatiality).

These observations suggest that the analytical frameworks of GVC studies are diverging rather than converging over time—and that the prospect for overall consolidation of methodologies is limited in the near future. However, this is not necessarily bad news. The diversity and multiplicity of methodological frameworks imply that a wider scope of analysis is available. It is only a matter of how best to combine the relevant frameworks in an appropriate way for each research question, just as with integrating various tasks into an optimal configuration of production chains. Keeping and facilitating interdisciplinary dialogues are essential, and the *Global Value Chain Development Report* will serve as a core platform for this end.

ANNEX 1.1
Typology of global value chains

Gereffi, Humphrey, and Sturgeon (2005) set out a typology of five global value chains (GVCs) on the basis of the structure of power relations between the contracting parties.

Market-type global value chain

Producing a commodity of a generic nature does not require any specific investment in production facilities for a particular transaction, so both customers and suppliers have countless choices for alternative partners. They are connected mainly through open spot-market transactions in a shoulder-to-shoulder relationship. Also, the procurement of a generic commodity will not necessitate an exchange of detailed product specification between contractors because the key information is mostly reduced to the preset price of the product that can be found in a book of catalogs. The transaction cost for changing business partners is almost negligible, leaving the value chains in a constant state of flux because of their high price elasticity.

Modular-type global value chain

In business management or industrial engineering the word "module" generally refers to a composite of subcomponents grouped by the types of functions that are assumed in making up the final product.[47] The possibility of different combinations of differentiated modules enables producers to design multiple variants of a product. By the same token, if a complex transaction can be accommodated in the supply base by adjusting the combination of multipurpose equipment, the supplier will not have to incur transaction-specific investment (no hold-up problem) and is thus able to spread the equipment's use across a wide range of potential clients. Even though the information to be delivered between the contractors may be considerable (say, for producing a complex product), the relative codifiability of transactions, as presumed in this type of GVC governance, compresses the volume of interventions, and the supplier is able to take overall control of its own production process. This implies that the transaction cost for changing business partners remains relatively low.

Relational-type global value chain

When the manufacturing process involves specialized equipment (for example, the mold for a product of a particular shape), transactions become asset-specific, and the contracting parties become mutually dependent. The equipment for a specific purpose has limited scope for alternative uses, so its productivity will drop considerably when it is applied in other contexts. Accordingly, the service suppliers (the holders of the specialized equipment) are not motivated to look for other potential clients. But it is also difficult, or at least costly, for the client to expect the same level of performance from other third suppliers without these specialized facilities. As a result, both parties have little incentive to search for alternative business relations. Further, reinvestment in the specialized equipment for raising productivity deepens the asset-specificity of the transaction, thus trapping the parties in even more mutually dependent relationships.

Captive-type global value chain

This type of transaction assumes an overwhelming disparity in power exercise among the parties, as seen in the business relations between a lead firm of global brands and its subcontracting local small companies. Service suppliers are expected to follow the client's instructions word for word and are subject to strict surveillance on product quality and delivery times. Unlike suppliers in the market-type GVC, captive service suppliers have neither sufficient productive capacity to enjoy the scale of mass production, nor the specialized production facilities needed to claim its uniqueness, as attributed to the suppliers in the relational-type GVC. The availability of only mediocre production capability greatly narrows their opportunities to look for alternative business relations, imposing a captive position toward their clients.

Hierarchy-type global value chain

As stated earlier, this type of GVC generally refers to the relations within a vertically integrated firm, as with multinational corporations.

ANNEX 1.2

Governance arrangements along a production sequence

In the setup of Antràs and Chor (2013), in which a contract is incomplete, a lead firm (final good producer) and a supplier (intermediate input producer) need to bargain ex post over their respective share of an incremental surplus (quasi-rent) generated at the corresponding stage of the production sequence. Following Grossman and Hart (1986), the lead firm acquires a better bargaining position and thus gains a higher share of the surplus when its supplier is integrated than when its supplier remains independent.[48]

Since the supplier's investment is assumed to be relation-specific to the lead firm's final product (for example, investing in the mold for a distinctive shape), the investment has no value outside this production sequence, which causes a familiar hold-up problem, such that the vertically integrated supplier tends to underinvest in its production capacity in anticipation of exploitation by the lead firm.

So the lead firm faces tradeoffs. If it integrates the supplier, it can extract a higher share of the surplus from that particular production stage, but doing so may induce underinvestment by the supplier, which would constrain the output or quality of the final product.

Here, the lead firm's strategic space depends critically on the nature of the final product that it produces. Suppose that the product has a quite elastic market demand, so that the lead firm is able to generate larger revenues by producing more. Since the investment decision of each intermediate input supplier depends on the prospect of final product turnover, which further depends on how much the upstream suppliers prior to the current production stage have already invested in their production capacities, it follows that higher investment by upstream suppliers induces more investment by downstream suppliers.

In contrast, if the lead firm has substantial market power and thus operates along an inelastic downward-sloping demand curve, the firm's revenue function becomes highly concave to (quality-adjusted) output, and marginal revenues fall at a relatively fast rate along the production sequence. As a result, the large upstream investment dampens the revenue prospect of downstream suppliers by reducing the value of undertaking future investment. The former investment options of suppliers are called sequential complements, and the latter sequential substitutes.[49] And the type of sequentiality that characterizes the production process affects the lead firm's decision about the organizational form of value chains.

Recall the lead firm's tradeoffs: the rent-extraction opportunities by integration, on the one hand, and the investment inefficiencies caused by such integration, on the other. On this basis, the lead firm should weigh the costs and benefits of integrating the suppliers.

For sequential complements the investment-curbing effect of integration is more costly in upstream production stages because it dampens the positive spillover of investment incentives to the downstream suppliers. So the lead firm should seek better bargaining positions by integrating downstream segments of the production process, rather than upstream ones. For sequential substitutes, the potential underinvestment by the upstream suppliers can be compensated for by the downstream suppliers. The lead firm is then able to place a relatively high weight on the rent-extraction motive in the upstream stages without worrying too much about the overall underinvestment.

The corollary of the argument is summarized in figure 1.6 by a couple of the lead firm's decisions about the organization of value chains.

Notes

1. Global Value-Chain Training and Research Workshop, June 30–July 11, 2014, University of International Business and Economics, Beijing, China.
2. A particular concern is the difficulty of delineating a boundary between GVC studies and international trade literature. Apparently, these two areas overlap in many respects, and the relevant work is frequently cross-referenced. However, the characterization of GVC studies stated here aims to limit the number of references relating to the vast range of important literature in international economics.
3. Throughout this chapter the following terms are considered to carry more or less the same meaning: international (cross-border) production sharing, international (cross-border) fragmentation of production, the second unbundling, trade in tasks, and vertical specialization, each referring to the process and consequence of offshoring activities.
4. This theoretical breakthrough paved several development pathways in the days that followed. Aided by the analytical model of oligopoly formalized in the theory of industrial organization, it factored in the strategic aspects of trade policies using the language of game theory. Also, the element of increasing returns was further embodied and advanced in other subfields of economics, such as the endogenous growth model and the new economic geography (spatial economics).
5. As a result, industry became an inappropriate analytical unit for the study of international trade. See the later discussion on firm heterogeneity for the empirical challenges to tackle this problem.
6. A more extensive discussion of these topics can be found in many other GVC-related materials. See especially the comprehensive review in OECD (2013).
7. See Baldwin (2006) for the comprehensive argument of his view introduced in this section.
8. Smith (1776, p. 15): "One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving, the head; … and the important business of making a pin is, in this manner, divided into about eighteen distinct operations, which, in some manufactories, are all performed by distinct hands…."
9. Ronald Coase is said to have opened the horizon for theorizing about the mechanism of vertical integration. Until then, a firm was conceptualized as a production set that defines and implements the most efficient arrangement for transforming inputs into outputs through multiple interactions with markets. That is, markets and firms were considered to be complementary in their respective functions. Coase's insight about the nature of the firm has altered this view. Markets and firms are more like substitutes, in the sense that they are just different types of coordination arrangements for resource allocation; one through the price mechanism and the other through entrepreneurship. So, for the issue of vertical integration, "What has to be explained is why one integrating force (the entrepreneur) should be substituted for another integrating force (the price mechanism)" (Coase 1937, p. 398).
10. Milberg and Winkler (2013) point out that transaction cost economics essentially operates within the static framework of constrained optimization such that firms would choose the most efficient form of value chain governance (make-or-buy) in the face of a given set of transactional and bureaucratic cost structures. The resource-based approach, in contrast, focuses on the dynamic interplay among parties, where lead firms actively engage in strategic maneuvers for turning the cost structures to their own favor, such as spurring competition among suppliers or promoting supply-base capabilities. It is also important to consider the role of government in affecting the choice of value chain arrangement where markets may fail. The provision of public goods such as transport infrastructure gives a straightforward example. The underinvestment caused by the hold-up problem presents another case of market failure due to information asymmetry which calls for government intervention to, say, tighten up contract enforcement schemes. These issues are discussed in chapter 1 of Blyde (2014), with respect to Latin American and Caribbean economies.
11. For example, even in the case of a dispute, the arbitrator cannot judge whether the delivered good may accord with the product specification or whether the supplier has put sufficient effort into its productive activities. Contracts cannot be written on sales revenues, either.
12. Firms may carry out foreign direct investment for market-seeking purposes (horizontal foreign direct investment) rather than for exploiting factor cost differences (vertical foreign direct investment). In the former case, foreign direct investment may not be associated with vertical integration.
13. For example, the Toyota Production System, well known for its just-in-time delivery, can be considered as an ultimate form of value chain management, where information sharing and task coordination across different divisions are implemented and achieved at the highest level of synchronization.
14. There are other terminologies of a similar kind in the field. Global supply chain is a generic label for a physical input-output sequence of value-adding activities across borders, used mainly in business studies that focus on logistics management or trade facilitation (how to reduce costs and lead times for delivery). Global commodity chain, as developed in Gereffi and Korzeniewicz (1994, p. 2), addresses wealth distribution by showing "how production, distribution, and consumption are shaped by social relations (including organizations)…." In this sense, global commodity chains can be considered a predecessor to the GVC concept in spirit, though their analytical frameworks are somewhat different (producer-driven and buyer-driven chains of global commodity chains, compared with the five types of GVC governance in figure 1.4).
15. See Gereffi and Kaplinsky (2001).
16. Sectoral examples include bicycles (from hierarchy to market), apparel (from captive to relational), fresh vegetables (from market to relational), and electronics (from hierarchy to modular).
17. The governance structure of value chains is particularly important for generating and diffusing the knowledge-based capital that leads to innovation and industrial upgrading. See the case studies in Kawakami and Sturgeon (2011) for East Asian economies and Blyde (2014) for Latin American and Caribbean economies about the industries that are learning and upgrading through participation in GVCs.
18. Deardorff (2001, p. 122) defines fragmentation as "the splitting of a production process into two or more steps that can be undertaken in different locations but that lead to the same final product."
19. The original setup in the study postulates that the firm invests in a new production facility for the fragmented tasks rather than outsourcing

them, so there is an extra span in the upward shift of the cost curve in the diagram.

20. *The Economist* 2004.
21. In the United States the issue has evolved in a wider context: whether jobs are destroyed by foreign competition or by technological progress. U.S. workers are competing with cheap labor abroad and with robots at home, and which of those is a worse enemy has been a topic of heated debate. See, for example, Spence (2011) for a discussion of the impact of globalization on U.S. job markets along the dimensions of tradeable versus nontradeable sectors and high-skilled versus low- and medium-skilled labor.
22. However, the declining relative wage does not necessarily make unskilled workers worse off because, from a general equilibrium perspective, the increased supply of goods to the market brought about by finer division of labor may lower the goods prices of both countries through trade, perhaps offsetting the nominal wage reduction.
23. See, for example, Blinder (2009). In the base model of Grossman and Rossi-Hansberg (2008a) only low-skilled labor is assumed to be feasible for offshoring.
24. The implication of offshoring between similar countries is discussed in Grossman and Rossi-Hansberg (2008b).
25. See endnote 9. Legros and Newman (2014) give an overview for the recent arguments on firm boundaries.
26. For the empirical specification the study refers to the latest development in quantifying an industry's upstreamness and downstreamness by employing the input-output model of Antràs and others (2012). Also, Alfaro and others (2015) develops the benchmark model of Antràs and Chor (2013) with three extensions. First, it considers asymmetric differences in input contractibility; second, it incorporates the productivity heterogeneity of final good producers (as in Antràs and Helpman 2004); and third, it accommodates the case in which integration is not feasible for certain segments of the production processes because of external factors.
27. If nonacademic literature is included, Tempest's (1996) account of the Barbie Doll is one of the earliest.
28. The product-level approaches introduced here should be strictly distinguished (in terms of the scope of analyses) from the strand of studies using industrywide microdata of firms, such as those available from industrial censuses.
29. The efforts to alleviate these potential drawbacks are introduced below in the section on firm heterogeneity.
30. The same exercise is carried out in De La Cruz and others (2011) for Mexico, where processing trade is also prevalent.
31. Los, Timmer, and de Vries (2015) implement a similar exercise but with a different motivation. They conduct a longitudinal analysis of the tension between a force toward regionalization and one toward globalization in the organization of international production networks. They conclude that increasing globalization (less segmentation into regional blocs) has been a dominant trend during the period of analysis.
32. To be precise, the Institute of Developing Economies was the first to develop and publish such measurements in the 1980s for seven Asian countries and the United States using the reference year of 1975. However, the measurements were called the impact of final demand on value added rather than trade in value added. The major database for trade in terms of value added today is the Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database. The latest release (reference year 2015) covers 34 industries for 64 countries (including rest of the world). For a general description of the data, see www.oecd.org/sti/ind/tiva/tivasourcesandmethods.htm. For a quick guide to the concept of the trade in value added, see Inomata (2014) or WTO and IDE–JETRO (2011).
33. The increasing gap between the values of two indicators is accounted for mainly by the shift of the base from consumer price index to gross domestic product deflators, rather than the change in weights from gross to value added terms.
34. One of the key properties of the accounting framework for trade in value added is the mathematical identity between a country's total trade balance measured in gross terms and that in value added terms. Kuboniwa (2014a, 2014b) provide rigorous proofs of the relevant propositions.
35. Similar efforts have been made by Ahmad and others (2013) for Turkey, by Fetzer and Strassner (2015) for the United States, and by Piacentini and Fortanier (2015) for member countries of the Organisation for Economic Co-operation and Development. Liu and others (2016) extend the method to the application in environmental analyses. If carbon emissions from production activities are regarded as negative value added, the carbon footprint analysis using multicountry input-output tables can also be considered one form of GVC studies (especially the topic on the political interplay among countries over production-based accounts and consumption-based accounts of carbon emissions).
36. Other efforts with a similar motivation include Cherubini and Los (2013) for Italy, Dietzenbacher, Guilhoto, and Imori (2013) for Brazil, and Meng, Wang, and Koopman (2013) for China. These studies embed the respective country's interregional input-output table in the European Commission–funded World Input-Output Database.
37. See further discussion in Meng, Wang, and Koopman (2013).
38. See the model of Jones and Kierzkowski (1990).
39. However, Dietzenbacher, Romero, and Bosma (2005) do not explicitly use the word "fragmentation."
40. Recent studies aim to decompose the length model into domestic and international segments, which enables one to depict the "genuine" international fragmentation of the production process. These efforts include Hagiwara (2016) on the average propagation length model and Wang and others (2016) on the Antràs and others (2012) model.
41. The more formal documentation of the idea is in Miller and Temurshoev (2015) and Wang and others (2016), although their models have different specifications and are more rigorously articulated than those in Inomata (2008) and Escaith and Inomata (2013).
42. See, for example, Antràs (2003) and Bernard and others (2010).
43. In the U.S. data, partners are related if either party owns at least 10% of the other party.
44. Tomiura (2007) is one of the earliest studies using firm-level microdata. It applies the data to an investigation of the relation between firm productivity and globalization decisions and derives results that are consistent with the predictions of Antràs and Helpman (2004) about the productivity ranking of different globalization modes.

45. The data cover only medium and large firms with 50 or more employees and whose paid-up capital is more than 30 million yen. However, given that global sourcing matters for large enterprises, the threshold is unlikely to limit the analyses.
46. The European Commission–funded World Input-Output Database and EXIOBASE, the Organisation for Economic Co-operation and Development's Inter-Country Input-Output Tables, Purdue University's Global Trade Analysis Project Multi-Regional Input-Output Database, and the University of Sydney's Eora Database, among others. Dietzenbacher and Tukker (2013) introduce the major multicountry input-output table projects, and Inomata and Owen (2014) discuss the analytical implication of using different databases.
47. For example, a modular car may consist of a power-management module (a composite of compressors and charge controls), a drive-assisting module (a composite of sensors, cameras, light emitting diodes), and so on.
48. Grossman and Hart (1986) define integration as the purchase by one firm of the residual rights of control over another firm's assets. While transaction cost economics is concerned with inefficiencies arising from both the ex post haggling by the parties over quasi-rents and the consequent ex ante underinvestment (and its negative impact on ex post performance), the property-rights literature focuses on the impact of property-rights assignment (the choice of organizational form) on ex post bargaining, which is assumed to be efficiently conducted, and that, in turn, affects the party's decision about ex ante investment.
49. More specifically, sequential complementarity and substitutability are determined by the relative magnitudes of (1) the market demand elasticity for the final product and (2) the elasticity of substitution among intermediate inputs. If (1) is larger than (2), the investment options are sequential complements; otherwise, they are sequential substitutes. In the usual sense of the word the suppliers' investments are always complementary. Only when the standard complementarity of intermediate inputs is dominated by the effect of a quick erosion of revenue prospect due to the low demand elasticity of the final product does the relation turn from complements to substitutes.

References

Ahmad, N., S. Araujo, A. Lo Turco, and D. Maggioni. 2013. "Using Trade Microdata to Improve Trade in Value-Added Measures: Proof of Concept Using Turkish Data." In *Trade in Value Added: Developing New Measures of Cross-Border Trade*, edited by A. Mattoo, Z. Wang, and S-J. Wei, 187–219. Washington, DC: World Bank.

Alfaro, L., P. Antras, D. Chor, and P. Conconi. 2015. "Internalizing Global Value Chains: A Firm-Level Analysis." National Bureau of Economic Research (NBER) Working Paper No. 21582, NBER, Cambridge, MA.

Antràs, P. 2003. "Firms, Contracts, and Trade Structure." *Quarterly Journal of Economics* 118 (4): 1375–1418.

———. 2011. "Grossman-Hart (1986) Goes Global: Incomplete Contracts, Property Rights, and the International Organization of Production." NBER Working Paper No. 17470, NBER, Cambridge, MA.

Antràs, P., and D. Chor. 2013. "Organizing the Global Value Chain." *Econometrica* 81 (6): 2127–204.

Antràs, P., D. Chor, T. Fally, and R. Hillberry. 2012. "Measuring the Upstreamness of Production and Trade Flows." *American Economic Review: Papers & Proceedings* 102 (3): 412–16.

Antràs, P., and E. Helpman. 2004. "Global Sourcing." *Journal of Political Economy* 112 (3): 552–80.

Bair, J. 2008. "Analysing Global Economic Organization: Embedded Networks and Global Chains Compared." *Economy and Society* 37 (3): 339–64.

Baldwin, R. 2006. *Globalisation: The Great Unbundling(s).* Helsinki: Economic Council of Finland.

———. 2013. "Global Supply Chains: Why They Emerged, Why They Matter, and Where They Are Going." In *Global Value Chains in a Changing World,* edited by D. Elms and P. Low, 13–59. Geneva: World Trade Organization.

Baldwin, R., R. Forslid, and T. Ito. 2016. "Unveiling the Evolving Sources of Value Added in Exports." Joint Research Program Series No. 161, Institute of Developing Economies–Japan External Trade Organization (IDE–JETRO), Chiba City, Japan.

Bems, R., and R. Johnson. 2012. "Value-Added Exchange Rates." NBER Working Paper No. 18498, NBER, Cambridge, MA.

Bernard, A. B., and J. B. Jensen. 1995. "Exporters, Jobs, and Wages in U.S. Manufacturing, 1976–1987." Brookings Papers on Economic Activity, Microeconomics Vol. 1995 (pp. 67–119), Washington, DC.

Bernard, A. B., J. B. Jensen, S. J. Redding, and P. K. Schott. 2010. "Intrafirm Trade and Product Contractibility." *American Economic Review: Papers & Proceedings* 100 (2): 444–48.

Blinder, A. 2009. "How Many U.S. Jobs Might Be Offshorable?" *World Economics* 10 (2): 41–78.

Blyde, J. S., ed. 2014. *Synchronized Factories: Latin America and the Caribbean in the Era of Global Value Chains.* New York: Springer.

Campa, J., and L. Goldberg. 1997. "The Evolving External Orientation of Manufacturing Industries: Evidence from Four Countries." NBER Working Paper No. 5919, NBER, Cambridge, MA.

Carvalho, V. M. 2012. *Input-Output Networks: A Survey.* A report for the European Commission (EC) under the Complexity Research Initiative for Systemic Instabilities consortium agreement. Brussels: EC.

Chen, X., L. Cheng, K. C. Fung, and L. Lau. 2004. "The Estimation of Domestic Value-added and Employment Induced by Exports: An

Application to Chinese Exports to the United States." In *China and Asia: Economic and Financial Interaction*s, edited by Y. W. Cheung and K. Y. Wong. New York: Routledge.

Cherubini, L., and B. Los. 2013. "Regional Employment Patterns in a Globalizing World: A Tale of Four Italies." Paper presented at the Bank of Italy workshop, "Global Value Chains: New Evidence and Implications," Rome, June 22.

Coase, R. 1937. "The Nature of the Firm." *Economica* 4 (16): 386–405.

Daudin, G., C. Rifflart, and D. Schweisguth. 2006. "Who Produces for Whom in the World Economy?" Document de travail No. 2009–18, Observatoire Francais des Conjonctures Economiques, Paris.

Deardorff, A. V. 2001. "Fragmentation in Simple Trade Models." *North American Journal of Economics and Finance* 12 (2): 121–37.

De Backer, K., and S. Miroudot. 2012. "Mapping Global Value Chains." Working Paper Series No. 1677, European Central Bank, Frankfurt.

Dedrick, J., K. Kraemer, and G. Linden. 2008. *Who Profits from Innovation in Global Value Chains? A Study of the iPod and notebook PCs.* Report prepared for the Sloan Industry Studies Annual Conference, Boston, May 1–2.

De La Cruz, J., R. B. Koopman, Z. Wang, and S. J. Wei. 2011. "Estimating Foreign Value-Added in Mexico's Manufacturing Exports." Office of Economics Working Paper, 2011–04A, U.S. International Trade Commission, Washington, DC.

Dietzenbacher, E., and A. Tukker. 2013. "Global Multiregional Input-Output Frameworks: An Introduction and Outlook." *Economic Systems Research* 25 (1): 1–19.

Dietzenbacher, E., and I. Romero. 2007. "Production Chains in an Interregional Framework: Identification by Means of Average Propagation Lengths." *International Regional Science Review* 30 (4): 362–83.

Dietzenbacher, E., I. Romero, and N. S. Bosma. 2005. "Using Average Propagation Lengths to Identify Production Chains in the Andalusian Economy." *Estudios de Economia Aplicada* 23 (2): 405–22.

Dietzenbacher, E., J. Guilhoto, and D. Imori. 2013. "The Role of Brazilian Regions in the Global Value Chain." School of Economics, Business and Accounting Working Paper 2013–15, University of São Paulo, São Paulo.

The Economist. 2004. "The Great Hollowing-Out Myth." February 19.

Escaith, H. 2014. "Mapping Global Value Chains and Measuring Trade in Tasks." In *Asia and Global Production Networks: Implications for Trade, Incomes and Economic Vulnerability,* edited by B. Ferrarini and D. Hummels, 287–337. Mandaluyong, Philippines and Cheltenham, U.K.: Asian Development Bank and Edwards Elgar Publishing.

Escaith, H., and S. Inomata. 2013. "Geometry of Global Value Chains in East Asia: The Role of Industrial Networks and Trade Policies." In *Global Value Chains in a Changing World,* edited by D. Elms and P. Low, 135–57. Geneva: World Trade Organization.

Fally, T. 2011. *On the Fragmentation of Production in the US*. Boulder, CO: University of Colorado-Boulder.

Feenstra, R. C., and G. H. Hanson. 1996a. "Foreign Investment, Outsourcing, and Relative Wages." In *The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati,* edited by R. C. Feenstra, G. M. Grossman, and D. A. Irwin, 89–127. Cambridge, MA: Massachusetts Institute of Technology (MIT) Press.

———. 1996b. "Globalization, Outsourcing, and Wage Inequality." *American Economic Review* 86 (2): 240–45.

Fetzer, J. J., and E. H. Strassner. 2015. "Identifying Heterogeneity in the Production Components of Globally Engaged Business Enterprises in the United States." Working Paper WP2015–13, Bureau of Economic Analysis, Washington, DC.

Gereffi, G., J. Humphrey, and T. Sturgeon. 2005. "The Governance of Global Value Chains." *Review of International Political Economy* 12 (1): 78–104.

Gereffi, G., and M. Korzeniewicz, eds. 1994. *Commodity Chains and Global Capitalism*. Westport, CT: Praeger.

Gereffi, G., and R. Kaplinsky, eds. 2001. *The Value of Value Chains: Spreading the Gains from Globalisation*. Special issue of the Institute of Development Studies Bulletin (IDS) Bulletin. Brighton, U.K.: IDS.

Grossman, G. M., and E. Rossi-Hansberg. 2008a. "Trading Tasks: A Simple Theory of Offshoring." *American Economic Review* 98 (5): 1978–97.

———. 2008b. "Task Trade between Similar Countries." NBER Working Paper No. 14554, NBER, Cambridge, MA.

Grossman, S., and O. Hart. 1986. "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." *Journal of Political Economy* 94 (4): 691–719.

Hagiwara, T. 2016. "Decomposition of Average Propagation Length." Paper presented at the 24th International Input-Output Conference, Seoul, July 4–8.

Helpman, E., and P. Krugman. 1985. *Market Structure and Foreign Trade*. Cambridge, MA: MIT Press.

Hummels, D., J. Ishii, and K-M. Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of International Economics* 54 (1): 75–96.

Inomata, S. 2008. "Average Propagation Lengths: A New Concept of the 'Distance' between Industries, with an Application to the Asia-Pacific Region." *Sangyo-Renkan* 16 (1): 46–55.

———. 2014. "Trade in Value Added: Concept, Development, and an East Asian perspective." In *A World Trade Organization for the 21st Century,* edited by R. Baldwin, M. Kawai, and G. Wignaraja, 48–70. Cheltenham, U.K.: Edward Elgar.

Inomata, S., and A. Owen. 2014. "Comparative Evaluation of MRIO Frameworks." *Economic Systems Research* 26 (3): 239–44.

Inomata, S., and B. Meng. 2013. "Transnational Interregional Input-Output Tables: An Alternative Approach to MRIO?" In *Sustainability Practitioner's Guide to Multi-Regional Input-Output Analysis,* edited by J. Murray and M. Lenzen, 33–42. Champaign, IL: Common Ground Publishing.

Johnson, R. C., and G. Noguera. 2012. "Accounting for Intermediate Production Sharing and Trade in Value Added." *Journal of International Economics* 86 (2): 224–36.

Jones, R., and H. Kierzkowski. 1990. "The Role of Services in Production and International Trade: A Theoretical Framework." In *The Political Economy of International Trade,* edited by R. Jones and A. Krueger, 31–48. Oxford, U.K.: Basil Blackwell.

Joskow, P. L. 2003. "Vertical Integration." In *Handbook of New Institutional Economics,* edited by C. Menard and M. Shirley, 319–48. New York: Springer.

Kawakami, M., and T. Sturgeon, eds. 2011. *The Dynamics of Local Learning in Global Value Chains: Experiences from East Asia*. New York and Basingstoke, U.K.: Palgrave Macmillan.

Kimura, F., and M. Ando. 2005. "Two-dimensional Fragmentation in East Asia: Conceptual Framework and Empirics." *International Review of Economics and Finance* 14 (3): 317–48.

Koopman, R., Z. Wang, and S. Wei. 2012. "Estimating Domestic Content in Exports when Processing Trade is Pervasive." *Journal of Development Economics* 99 (1): 178–89.

———. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *American Economic Review* 104 (2): 259–94.

Koopman, R., Z. Wang, S. Wei, and K. Zhu. 2016. "Tracing Value-Added and Double Counting in Gross Export: Reply to the Comment by Bart Los, Marcel Timmer, and Caaitzen J. de Vries." Draft Manuscript.

Kuboniwa, M. 2014a. "Trade in Value Added Revisited: A Comment on R. Johnson and G. Noguera, Accounting for Intermediates: Production Sharing and Trade in Value Added." Discussion Paper Series A, No. 599, Institute of Economic Research, Hitotsubashi University, Tokyo.

———. 2014b. "Fundamental Theorem on the Relationship between Trade Balances in Value Added and Gross Terms: Amendment." Discussion Paper Series A, No.600, Institute of Economic Research, Hitotsubashi University, Tokyo.

Legros, P., and A. Newman. 2014. "Contracts, Ownership, and Industrial Organization: Past and Future." *Journal of Law Economics and Organization* 30 (S1): i82-i117.

Lenzen, M., A. Geschke, M. Abd Rahman, Y. Xiao, E. Dietzenbacher, S. Inomata, K. Kanemoto, B. Los, D. Moran, R. Reyes, H. den Bäumen, A. Tukker, T. Walmsley, T. Wiedmann, R. Wood, and N. Yamano. 2017. "The Global MRIO Lab—Charting the World Economy." *Economic Systems Research* 29 (2): 158–86.

Liu, Y., B. Meng, K. Hubacek, J. Xue, K. Feng, and Y. Gao. 2016. "'Made in China': A Reevaluation of Embodied CO2 Emissions in Chinese Exports Using Firm Heterogeneity Information." *Applied Energy* 184: 1106–13.

Los, B., M. Timmer, and G. de Vries. 2015. "How Global Are Global Value Chains? A New Approach to Measure International Fragmentation." *Journal of Regional Science* 55 (1): 66–92.

———. 2016. "Tracing Value-Added and Double Counting in Gross Exports: Comments." *American Economic Review* 106 (7): 1958–66.

Ma, H., Z. Wang, and K. Zhu. 2015. "Domestic Content in China's Exports and Its Distribution by Firm Ownership." *Journal of Comparative Economics* 43 (1): 3–18.

Melitz, M. J. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71 (6): 1695–725.

Meng, B., Z. Wang, and R. Koopman. 2013. "How are Global Value Chains Fragmented and Extended in China's Domestic Production Networks?" IDE Discussion Paper Series No. 424, IDE–JETRO, Chiba, Japan.

Milberg, W., and D. Winkler. 2013. *Outsourcing Economics: Global Value Chains in Capitalist Development*. Cambridge, U.K.: Cambridge University Press.

Miller, R., and U. Temurshoev. 2015. "Output Upstreamness and Input Downstreamness of Industries/Countries in World Production." *International Regional Science Review*.

Ng, F., and A. Yeats. 1999. "Production Sharing in East Asia: Who Does What for Whom, and Why?" Policy Research Working Paper 2197, World Bank, Washington, DC.

OECD (Organisation for Economic Co-operation and Development). 2013. *Interconnected Economies: Benefitting from Global Value Chains*. Paris: OECD.

Piacentini, M., and F. Fortanier. 2015. "Firm Heterogeneity and Trade in Value Added." OECD Working Paper No. 2015/23, OECD, Paris.

Porter, M. E. 1985. *Competitive Advantage, Creating and Sustaining Superior Performance*. New York: Free Press.

Smith, Adam. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations*. Reprinted in 1976. Oxford, U.K.: Oxford University Press.

Spence, M. 2011. "The Impact of Globalization on Income and Employment: The Downside of Integrating Markets." *Foreign Affairs* 90 (4): 28–41.

Sturgeon, T., P. Nielsen, G. Linden, G. Gereffi, and C. Brown. 2013. "Direct Measurement of Global Value Chains: Collecting Product- and Firm-Level Statistics on Value Added and Business Function Outsourcing and Offshoring." In *Trade in Value Added: Developing New Measures of Cross-Border Trade*, edited by A. Mattoo, Z. Wang, and S-J. Wei, 289–320. Washington, DC: World Bank.

Tang, H., F. Wang, and Z. Wang. 2014. "The Domestic Segment of Global Supply Chains in China under State Capitalism." Working Paper No. 186, Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute, Dallas.

Tempest, R. 1996. "Barbie and the World Economy." *Los Angeles Times*, September 22.

Timmer, M., A. Erumban, B. Los, R. Stehrer, and G. de Vries. 2014. "Slicing Up Global Value Chains." *Journal of Economic Perspectives* 28 (2): 99–118.

Tirole, J. 1989. *The Theory of Industrial Organization*. Cambridge, MA: MIT Press.

Tomiura, E. 2007. "Foreign Outsourcing, Exporting, and FDI: A Productivity Comparison at the Firm Level." *Journal of International Economics* 72 (1): 113–27.

Wang, Z., S. Wei, X. Yu, and K. Zhu. 2016. "Characterizing Global Value Chains." Working Paper No. 578, Stanford Center for International Development, Stanford, CA.

WTO (World Trade Organization) and IDE–JETRO (Institute of Developing Economies–Japan External Trade Organization). 2011. *Trade Patterns and Global Value Chains in East Asia: From Trade in Goods to Trade in Tasks*. Geneva: WTO.

Xing, Y., and N. Detert. 2010. "How the iPhone Widens the United States Trade Deficit with the People's Republic of China." Asian Development Bank Institute (ADBI) Working Paper Series No 257, ADBI, Tokyo.

Yeats, A. J. 1998. "Just How Big is Global Production Sharing?" Policy Research Working Paper 1871, World Bank, Washington, DC.

Ye, M., B. Meng, and S-J. Wei. 2015. "Measuring Smile Curves in Global Value Chains." IDE Discussion Paper No. 530, IDE–JETRO, Chiba, Japan.

CHAPTER 2

Recent trends in global trade and global value chains

CHRISTOPHE DEGAIN, BO MENG, AND ZHI WANG

During a long period after World War II, global trade grew several times faster than global GDP. Since 2012, however, the world may have entered a period of trade growth that is almost in line with GDP growth. Is this pattern cyclical or structural? Can value-added trade data and information on global value chains (GVCs) help explain these developments? Are GVCs, which involve intermediate products crossing national borders, unwinding? What does this trend mean for developing countries? This chapter addresses these questions through in-depth analysis of available trade and global input-output statistics.

The chapter looks first at the changing patterns of trade in global intermediate goods during the last two decades and analyzes the major factors driving these changes. Then it describes the structural change in global production and analyzes its relevance for the recent global trade slowdown by distinguishing GVC and non-GVC activities in GDP and final goods production. Last, it discusses the income distribution issues resulting from the development of GVCs and potential contributions to recent trade slowdowns and the growing antiglobalization sentiment. It does this by numerically estimating the "smile curve," a graphical outline of the value-added potential of each production stage in a value chain for various industries, based on recently developed GVC length and participation indexes (box 2.1).

The value-added creation structure that has emerged during the slow economic recovery since 2012 is quite different from the three previous growth periods of the last 20 years. First, there has been a reduction in cross-country production sharing in complex GVCs during the current economic recovery, contrary to the rapid production globalization driven by the growth of complex GVC activities in previous periods. Second, again unlike the production structure of the previous economic growth periods, the recent economic recovery has been driven mainly by traditional trade to satisfy foreign demand and pure domestic production activities in the United States and several major emerging economies, such as China. Third, participation in simple GVCs has been mixed, rising in some developed economies but falling in most emerging Asian economies.

GVC production length (the average number of production stages between primary inputs and final products) has shortened, reflecting mainly the declining number of national border crossings. The production length before and after national border crossings has actually increased, indicating the potential deepening division of labor within national borders despite the decline in cross-border production-sharing activities. The reduced number of national border crossings for production can be observed in all countries, regardless of whether their GDP grew or shrank during this period.

Changes in the global production structure are consistent with three factors. First is the rising tide of protection around the globe after the global financial crisis. Second is the substitution of domestically produced intermediate inputs for imported

Other contributors to this chapter include Xin Li from Beijing Normal University on intermediate goods trade, Xinding Yu from the University of International Business and Economics on the global macroeconomic circle, and Ming Ye from the Organisation for Economic Co-operation and Development on the smile curves.

BOX 2.1

Identifying global value chain activities with new indicators

The rise of global value chains (GVCs) in the past two decades has dramatically altered the world economy. But with the increasing complexity and sophistication of cross-border production-sharing activities, the use of only official trade data (such as gross exports and imports) and GDP statistics has not revealed the significance and nature of changes in the global business cycle. An important reason is that indicators based on official trade and production data cannot identify and distinguish which types of trade are GVC activities and which are not, thus making it difficult to evaluate the relation between changes in global trade and changes in GDP growth. This chapter introduces recently developed GVC indicators, which make it possible to decompose a country or sector's GDP and final goods production into GVC and non-GVC activities (see box 2.2). Applying this new GVC accounting system to the most up-to-date intercountry input-output databases (World Input-Output Database 2013, 2016; Asian Development Bank Multi-Region Input-Output Database 2016[1]) makes it possible to identify the production length (more or fewer production stages between primary inputs and final goods) and degree of participation (simple or complex) in GVCs at country and sector levels.

Note

1. The Asian Development Bank Multi-Region Input-Output Database data cover a time-series intercountry input-output table, compiled by the Asian Development Bank in 2016 using the World Input-Output Database and other Asian countries' input-output tables.

intermediate inputs in major emerging developing economies, such as China. And third is the technology innovation and reshoring that deepened the domestic division of labor for major developed economies, such as Japan and the United States. Whether such changes are temporary or permanent can be determined only as more data become available.

Complex GVCs were the most important driving force for globalization and the growth of global GDP during 1995–2000 and 2000–08. But during 2012–15, complex GVC–related cross-border production-sharing activities declined. Industry upgrading occurred within emerging economies, especially in China, accompanied by a decline in processing trade. Trade protectionism has increased because of the slow pace of economic recovery after the financial crisis.

Smile curves show that countries and sectors, depending on their position and degree of participation, can show very different value added and job gains along GVCs. Joining a GVC increases economic efficiency, but this can have a distributional impact.

Intermediate trade in manufactured goods and global business cycles

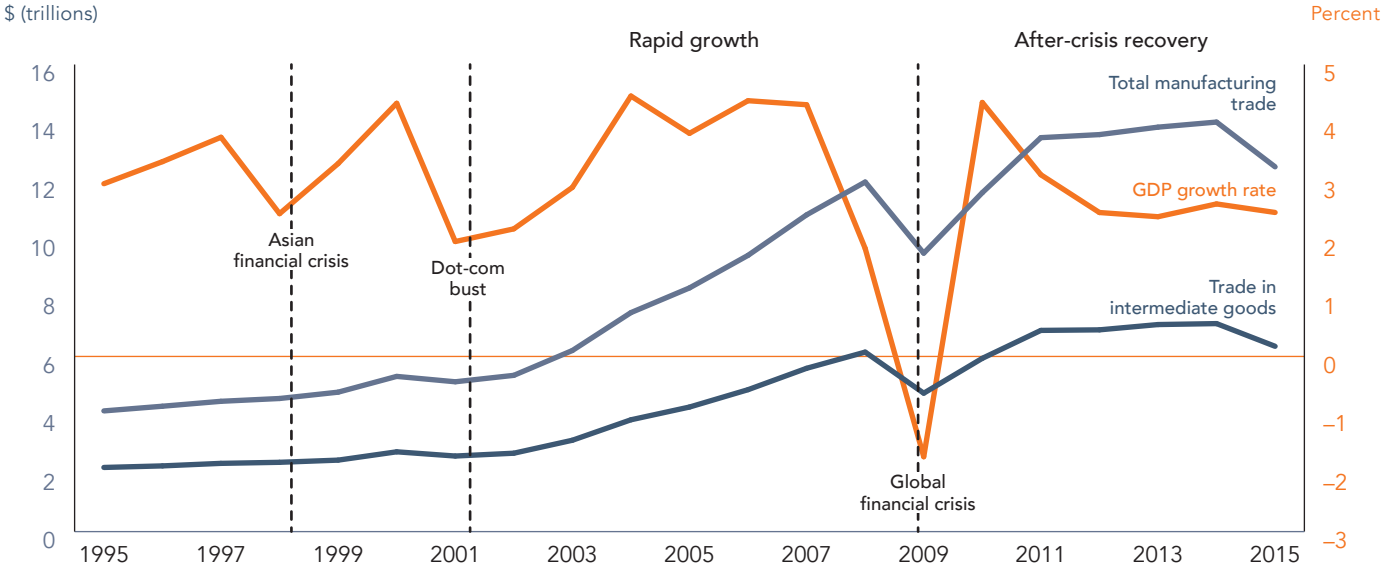
The global economy recently went through three short downturns centered on the 1997–98 Asian financial crisis, the 2000–01 dot-com bust, and the 2008–09 global financial crisis (figure 2.1). The global financial crisis precipitated the only global recession, defined by negative GDP growth for a period of at least two consecutive quarters. And it seems to have had a structural impact on the global economy, both on economic growth and on patterns of trade. Global GDP grew at about 4% a year during the precrisis and postrecovery periods of both the Asian financial crisis and the dot-com bust, suggesting that about 4% is the steady state for the world economy. GDP growth initially recovered to about 4% after the global financial crisis but then fell back and stabilized at roughly 2.5%, hinting that structural factors in addition to cyclical factors may be affecting global economic growth (see figure 2.1).

The 2008–09 global financial crisis may have also changed the pattern of global trade. Unlike the 1997 Asian financial crisis, the global financial crisis had large negative impacts on both the level and the growth of trade. The rapid trade growth from 2001 to 2008 contrasts sharply with the much slower growth starting in 2009. The decline in intermediate goods trade in 2015 pushes the world economy closer to precrisis levels, thus challenging the recovery six years after the crisis. There seems to be a clear link between the patterns of trade and the global business cycle. What roles have cross-country production sharing and GVCs played in such a global business cycle? As GVCs involve intermediate goods crossing national borders, trade in such goods provides the first piece of information to help understand what is going on.

The evolution of global manufacturing trade from 1995 to 2015 exhibits six phases (see figure 2.1). The Asian financial crisis severely damaged domestic demand in several Asian economies over 1995–2000, but total manufacturing trade still grew, albeit slowly, and reached a low peak in 2000. Due to the dot-com bust in 2000–01, manufacturing trade declined slightly. In 2001–08, and accompanying China's accession to the World Trade Organization (WTO) at the end of 2001, total manufacturing trade increased substantially. With the 2008–09 global financial crisis, however, total manufacturing trade dropped sharply. But then in 2010–14, it showed a rapid V-shaped recovery, before dropping again slightly in 2014–15.

There is no clear indication of which product type contributes more to growth in total manfacturing trade, intermediate

FIGURE 2.1 Trends in global GDP and manufacturing trade before and after recent economic downturns, 1995–2015



Source: For real GDP growth rate, World Development Indicators database; for trade in goods, data on total imports from the Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

or final goods. Trade in intermediate goods contributed more than trade in final goods did to the growth of total manufacturing trade in 2001–08 and 2009–14 and to its decline in 2000–01 and 2008–09 (table 2.1). Trade in final goods contributed more to the growth of manufacturing trade during 1995–2000 and to its recent decline in 2014–15.

The weight of intraregional exports in trade in intermediate and final manufactured goods over 1995–2015 for Europe, the Americas, Asia, and the rest of the world highlights the large shares of intraregional linkages among them (figure 2.2). It confirms that GVCs are organized mainly at the regional level, similar to findings by Baldwin and Lopez (2013) using data from 2009.

Despite a 6% decrease in the share of intra-Europe trade in total European intermediate goods trade during 1995–2015 (due largely to the emergence of China), intra-Europe trade remained substantial in both exports and imports—at around 70% in 2015—showing that European industrial inputs originate essentially from European supply chains.

The share of intra-Americas exports in intermediate goods trade also gradually increased (from 51% in 1995 to 58% in 2015), while the share of intra-Americas imports in intermediate goods trade drifted downward and reached its lowest point in 2015 (41%, down from 48% in 1995). The shares of manufacturing inputs in trade within both North and South America are relatively low, but those between North America and South America are higher. North American exports of intermediate goods to South America accounted for 14% of its total exports of intermediate goods in 1995 and 25% in 2015. The share of South American exports to North America rose from 40% to 50% in the same period.

The two way intra-Asia trade in intermediate goods fluctuated while increasing overall between 1995 and 2015 and reached more than two-thirds of total manufacturing trade during the period. Similar to Europe, this highlights the sustainable

TABLE 2.1 Contribution to the change in global manufacturing trade by trade type, 1995–2015

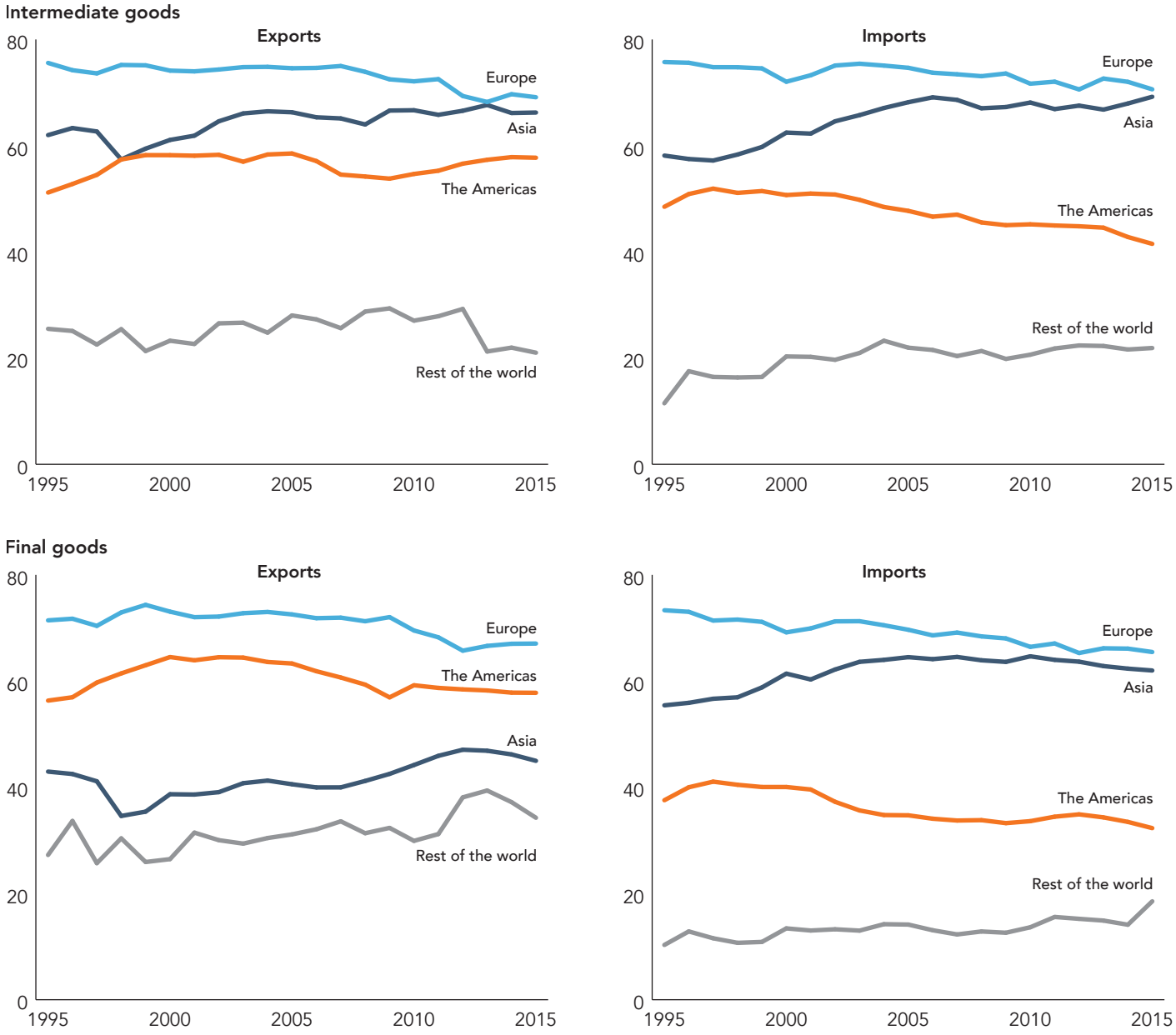
Percent

	Contribution to growth of total manufacturing trade			Contribution to decline in total manufacturing trade		
Trade type	**1995–2000**	**2001–08**	**2009–14**	**2000–01**	**2008–09**	**2014–15**
Trade in intermediate goods	45.3	52.0	50.2	79.0	55.4	47.0
Trade in final goods	54.7	48.0	49.8	21.0	44.6	53.0

Source: Authors' calculations based on data from the Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

FIGURE 2.2 Evolution of intraregional trade in intermediate and final manufactured goods, 1995–2015

Percent of regional total



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

industrial linkages arrangement of "Factory Asia." About 60% of Asia's exports of final manufactured goods over the period went to extraregional markets, but only about 40% of the Americas' exports did, an imbalance that began to change after the global financial crisis. Compared with Asia and the Americas, Europe's final goods trade has been more balanced during the last two decades, with a slight decline in intraregional trade from more than 70% in 1995 to about 66% in 2015.

GVCs are still largely regional, despite the trend of increasing globalization before the recent global financial crisis (see also annex 2.1). Developing economies are increasingly participating in GVCs through exports and imports of intermediate manufactured goods. And some emerging economies are upgrading along GVCs—for example, China tends to export more intermediate goods to other low-income downstream countries to support their final goods exports to the global market.

Decomposing domestic value added and final goods production into global value chain and other activities

A country's GDP by industry can be decomposed into four types based on whether there are cross-border production-sharing activities (box 2.2; Wang and others 2017a).

The first two production processes described here are pure domestic production activities. No domestic factor content crosses national borders for production purposes, so there is no cross-country production-sharing:[1]

1. *Production of domestically produced and consumed value added, or pure domestic production.* This involves domestic value added produced to satisfy domestic final demand, with no participation in international trade; an example is a haircut. This is labeled V_D in the figure in box 2.2.
2. *Production of value added embodied in the export of final goods and services, or traditional trade.* This involves domestic value added produced to satisfy foreign final demand. Domestic factor content is embodied in final goods that cross national borders for consumption only; therefore, it is very similar to traditional trade, such as "French wine for English cloth."[2] This is labeled V_RT.

In the next two production processes, domestic value added is used in production activities outside the source country and is contributed by the source country's production factors to cross-country production-sharing GVC activities:

3a. *Simple cross-border production-sharing activities, or simple GVCs.* This involves domestic value added crossing national borders for production only once. Value added is embodied in intermediate exports and used by trading partners to produce domestic goods consumed in the direct

BOX 2.2
Identifying which types of production are global value chain activities and which are not

Global value chains (GVCs) depend on products and services that are used as inputs in production processes that cross national borders, so the first major issue in measuring GVCs is separating final and intermediate use in customs trade statistics. But thousands of products are classified by customs product codes (such as the U.S. 10-digit Harmonized Tariff Schedule), and even within the 10-digit product groups, the heterogeneity is tremendous. So properly identifying final use is not easy. Furthermore, measures of supply chain trade or cross-border production-sharing appearing in the literature—such as vertical specialization (Hummels, Ishii, and Yi 2001) and import to produce and import to export (Baldwin and Lopez 2013)—are recursive concepts with pervasive double counting.

To overcome these difficulties, factor content or value-added trade is emerging as the mainstream measure of cross-border production-sharing activities. Since production factors such as land, labor, and capital are relatively easy to classify, production activities based on factor content can be classified according to a uniform standard, which makes analytical work tractable. When traditional trade dominated international commerce, factors were less mobile across countries, and factor content embodied in final goods crossed national borders only for consumption. In today's world economy dominated by regional and global value chains, some production factors directly cross a national border, such as foreign direct investment, while many others still do not but are instead embedded in final and intermediate trade flows across national borders.

The production decomposition method used in this report, based on System of National Accounts standards and adopted from Wang and others (2017a), classifies embedded factor content as GVC or non-GVC activities according to whether they cross national borders for production. Value-added creation is classified as a GVC activity only when embedded factor content crosses a national border for production purposes. Domestic and foreign factor content in various production activities are distinguished using domestic input-output coefficient matrixes and import input-output coefficient matrixes in an inter-country input-output table, including their local and global Leontief inverse matrixes.

From a factor content perspective a complete decomposition of a country-sector's value added or final goods production needs to consider both forward and backward industrial linkages (Wang and others 2017a). The forward linkage–based decomposition views a country-sector's engagement in GVC activities from a producer perspective. It classifies as GVC production activities the portion of GDP created (in a country-sector) by domestic production factor content that crosses borders for production at least once. It classifies as domestic production the portion of GDP created by domestic factor content that stays within national borders over the entire production process. It decomposes values but not goods. The backward industrial linkage–based decomposition views a country or sector's engagement in GVC activities from a user perspective. It traces all primary factor inputs embodied in the final goods produced by the country-sector

(continued)

BOX 2.2 *(continued)*

Identifying which types of production are global value chain activities and which are not

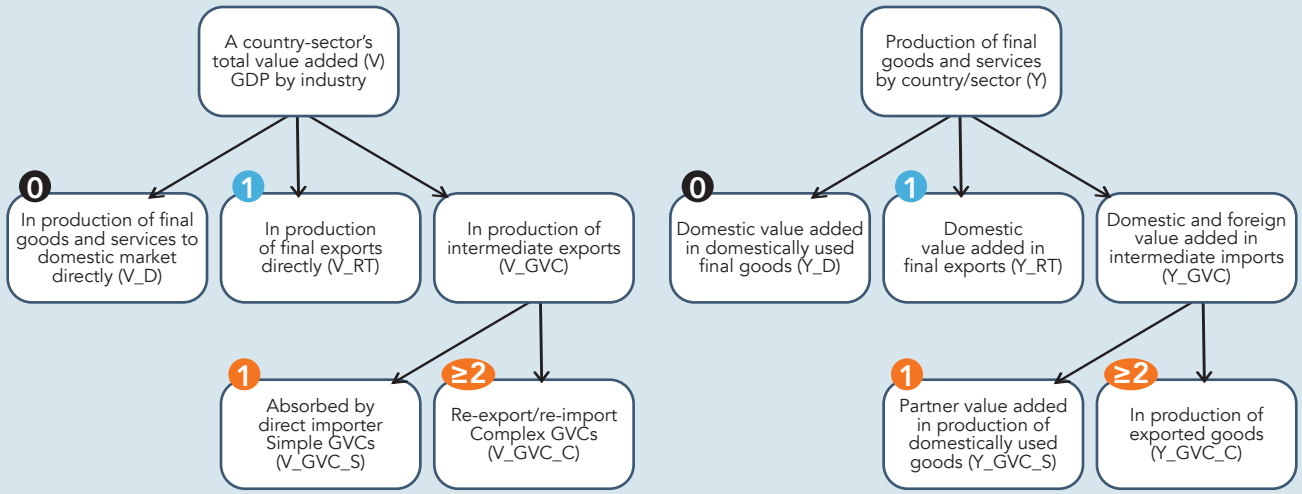
to the original country-sector sources and consistently classifies embodied domestic or foreign factor content into GVC and non-GVC production activities based on whether they have crossed a national border for production.

Both ways to decompose production activities in a country-sector pair include the four types described in the text. Factor content or value added in types 1 and 2 involves no cross-border production activities and satisfies domestic (type 1) and foreign (type 2) demand. Factor content or value added in type 2 crosses borders once but only for consumption activities since all value-added embodied in the good's intermediate inputs are derived from domestic sources; therefore, it is traditional trade in value added terms (French wine for English cloth). Factor content in type 3 is embodied in trade in intermediate goods and can be decomposed further into two types. Type 3a is value added embedded in intermediate goods absorbed by the direct importer and in which cross-border production activities are conducted, but only within the direct importing country (without further border crossing)—thus, these are simple GVCs. Type 3b is value added that crosses borders at least twice to satisfy domestic and foreign final demand, respectively—thus, these are complex GVCs. These last two types measure cross-country production-sharing activities. They exclude domestic value added measured by the first two types because those production activities are accomplished completely within national borders and so can be treated as pure domestic production activities.

Decomposing GDP and final goods production by country or sector

Forward linkage-based: Producer perspective
Which types of GDP production activities belong to GVCs?

Backward linkage-based: User perspective
Which types of final goods production belong to GVCs?



Source: Adapted from Wang and others 2017a.

Note: Numbers in circles are number of border crossings Blue circles represent border crossings for consumption. Orange circles represent border crossings for production.

importing country. No indirect exports via third countries or re-exports or re-imports of the source countries' factor content occur. For example, Chinese value added is embodied in its steel exports to the United States and used in U.S. house construction. This is labeled V_GVC_S.

3b. ***Complex cross-border production-sharing activities, or complex GVCs.*** This involves domestic value added that is embodied in intermediate exports and used by a partner country to produce exports (intermediate or final) for other countries. Domestic factor content crosses the border at least twice and is used by the partner country to produce intermediate or final product exports either for re-export to the home country (such as an Apple engineer's salary embodied in an iPhone bought by an American consumer) or for re-export to other countries (such as Japanese value added embodied in electronic chips installed in China-made toy exports to the United States). This is labeled V_GVC_C.

Global value chain production activities in the global business cycle

The four types of value-added creation activities were decomposed following the GDP decomposition method proposed by Wang and others (2017a) and using the recently released World Input-Output Database (Timmer et. al. 2016). The global production structures in different types of value-added creation activities were then plotted for the past two decades (figure 2.3).

The changing relative importance of different types of value-added creation activities in the global business cycle

Before the 2008–09 global financial crisis, the dominant trend in production activities was the decline of pure domestic production activities. Although all trade-related production activities were increasing, cross-border GVC production-sharing activities were growing faster than traditional trade production activities. Then four important events affected the global production pattern.

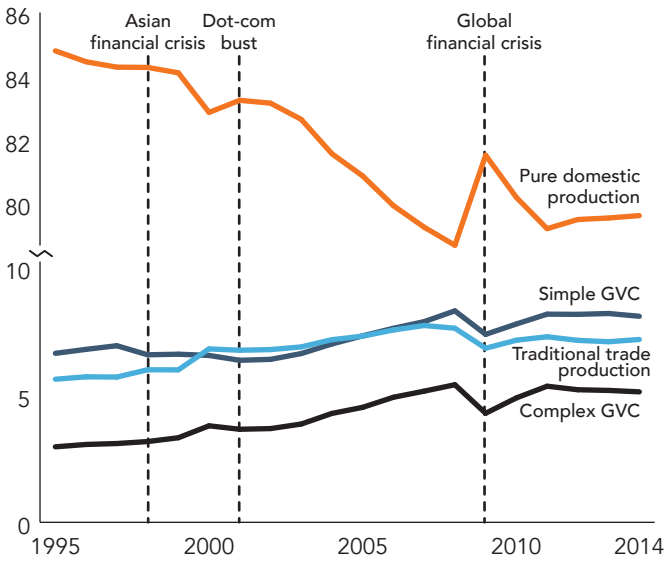
- First, the financial crisis struck several Asian developing countries in 1997–98. GDP growth declined more than 1 percentage point, but trade in manufactured products was less affected (see figure 2.3; as shown later, the impact was mainly on pure domestic production).
- Second, the 2000–01 dot-com bust resulted in a minor setback for globalization that was similar to the effect of the 2008–09 global financial crisis but on a much smaller scale. Pure domestic production activities increased, and cross-border production-sharing activities (both simple and complex GVCs) decreased in 2001.
- Third, as the global economy recovered in 2001 and China joined the WTO at the end of that year, production globalization resumed in 2002 and accelerated from 2003 until 2008. Up dramatically were GVC production activities as a share of total global production, as were complex cross-border production-sharing activities as a share of total GVC production activities (figure 2.4).
- Fourth, the 2008–09 global financial crisis caused a significant setback in production globalization. The share of pure domestic production activities rose and the share of all trade-related production activities fell, especially the cross-border production-sharing activities of complex GVCs (see figures 2.3 and 2.4). But unlike the recoveries after the 1997–98 Asian financial crisis and the 2000–01 dot-com bust, the recovery after the 2008–09 global financial crisis was short. The production globalization trend not only slowed, but there were signs of reversal (see below).

The changing growth rate of different value-added creation activities in the global business cycle

Some stylized facts emerge from closer analysis of the rate of change for the different types of value-added creation activities

FIGURE 2.3 Trends in production activities as a share of global GDP, by type of value-added creation activity, 1995–2014

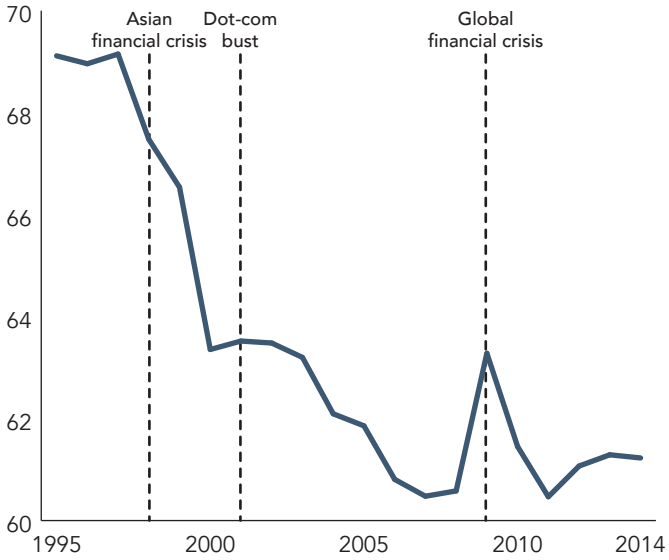
Percent



Source: University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

FIGURE 2.4 Simple global value chain production activities as a share of total global value chain production activities, 1995–2014

Percent

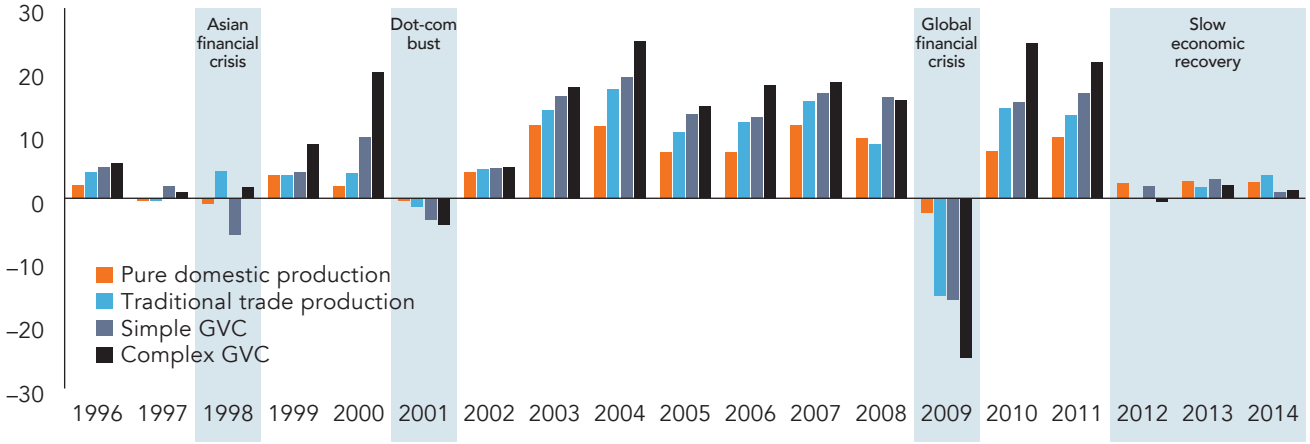


Source: University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

Note: At the global level the forward and backward industrial linkage–based decomposition methods give the same results.

FIGURE 2.5 Nominal growth rates of value-added creation activities during the global business cycle at the global level, 1996–2014

Percent



Source: University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

year by year for the three growth periods and the three economic downturns.

Before 2000–01, growth was slow for all types of value-added production activities, but GVCs, especially cross-border production-sharing activities of complex GVCs, increased every year, even during the 1997–98 Asian financial crisis, and began to accelerate toward the end of the period (figure 2.5). Global economies took off in 2003–08 after the 2000–01 dot-com bust, and there was a dramatic expansion of GVCs, especially those with complex production-sharing activities. Economic recovery was rapid for two years following the 2008–09 global financial crisis. But the growth rate fell sharply for all types of GDP production in 2012–14, with an obvious slowdown in cross-border production-sharing GVC activities.

Before the 2000–01 dot-com bust and the 2008–09 global financial crisis, trade-related production activities, especially complex GVC production-sharing activities grew much faster than pure domestic production activities. During the crises, pure domestic production activities were least affected (0.5% in 2001 and 1.7% in 2009). While the production of traditional trade was the second-least affected type of value-added creation activity, cross-border GVC production activities, especially for complex GVCs, were the most affected, falling 4% in 2001 and 17% in 2009 for simple GVCs and 6% and 29% for complex GVCs. But the two types of GVC production activities also had the fastest postcrisis recovery. So, despite the difference in magnitude, the impact of the two economic crises on types of value-added creation activities was similar.

The impacts of the 2000–01 dot-com bust and the 2008–09 global financial crisis on the global production pattern had many similarities, but the recoveries from the two shocks were very different. Although the recovery of production globalization was quick in 2010 and 2011, the growth rate slowed significantly after that. Total global GDP still grew during 2012–14, but in a reversed pattern. The growth of pure domestic production activities was slow but steady, faster than that of complex cross-border production sharing activities, which had negative or near zero growth. And the growth of simple cross-border activities (those with only one border crossing) increased much faster than that of complex GVC activities. Both patterns were completely different from those during the earlier economic recoveries.

To minimize the impact of price fluctuations in crude oil and bulk commodities (the "commodity super-cycle") on the nominal GDP growth rate in figure 2.5, growth rates were examined at the sector level (figure 2.6). The growth patterns just discussed still hold for both forward and backward linkage–based decomposition of production activities, and there is no significant difference between manufacturing and services.

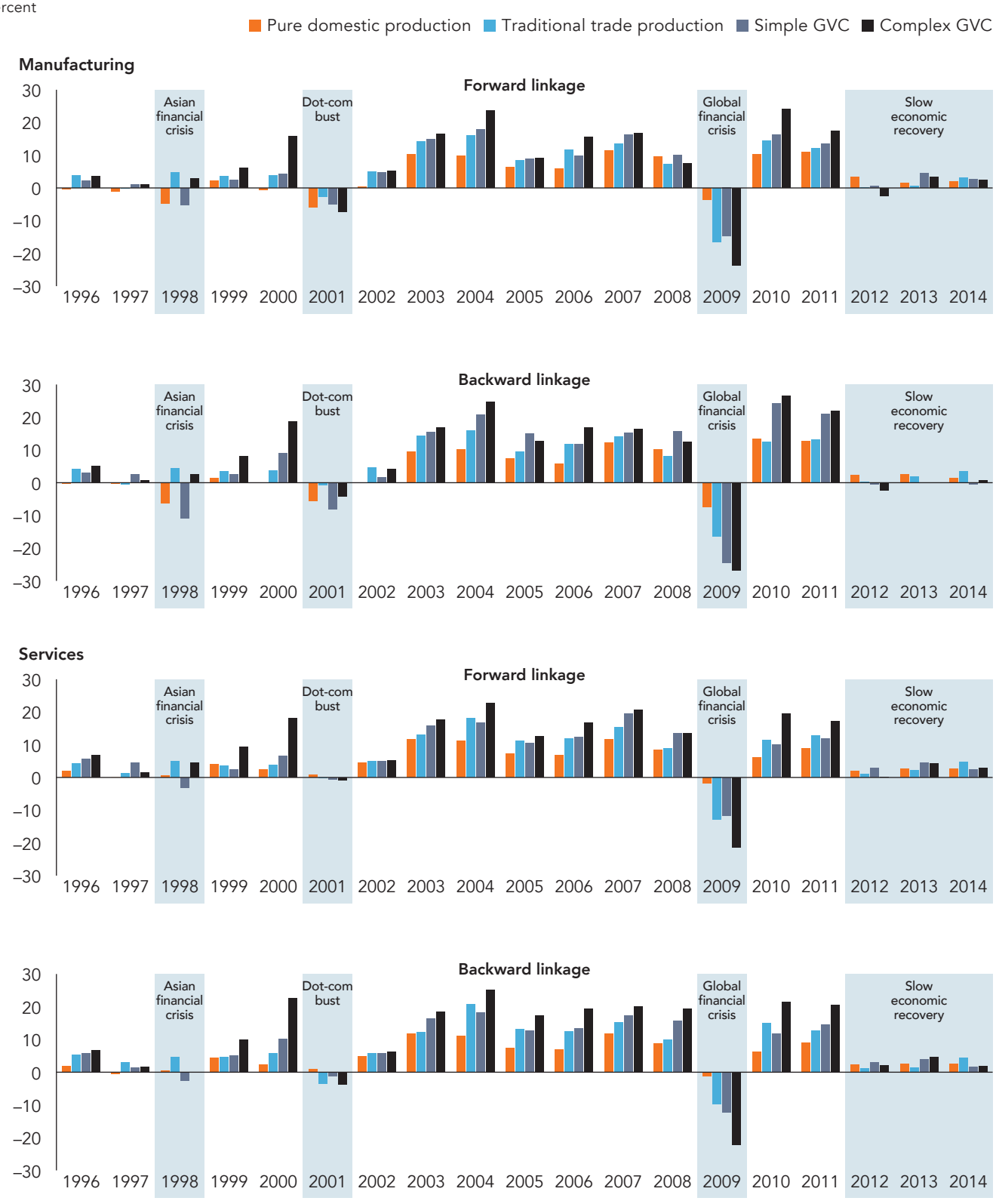
The new pattern of global production during the economic recovery after the global financial crisis

Signs of a different pattern of global production emerged during the slow economic recovery following the quick rebound in 2010 and 2011. At the global level the share of both types of cross-border production-sharing GVC activities declined, whereas the shares of pure domestic and traditional trade value-added creation activities increased, implying a nearly 3 percentage point decline in the aggregate GVC participation rate globally between 2011 and 2015 (figure 2.7).

To exclude the effects of fluctuations in commodity and crude oil prices, the decomposition is further broken down into four broad economic sectors (agriculture, manufacturing, mining, and services) and into both forward and backward industrial linkages. The results confirm the relative decline of GVC production activities (figure 2.8). The general pattern of change in the global production structure among the four types of value-added creation activities holds for most sectors, except for the forward linkage–based decomposition of pure domestic production in services

FIGURE 2.6 Nominal growth rates of value-added creation activities during the global business cycle at the manufacturing and services sector level, by forward and backward linkages, 1996–2014

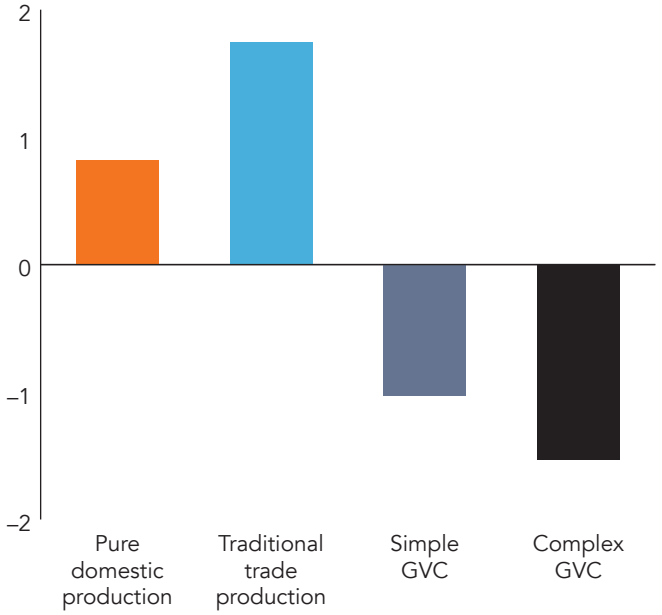
Percent



Source: University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

FIGURE 2.7 Structural changes in different types of value-added creation activities at the global level between 2011 and 2015

Share in 2015 minus share in 2011 (percentage points)



Source: University of International Business and Economics global value chain indexes derived from the 2016 Asian Development Bank Multi-Region Input-Output Database.

and the backward linkage–based decomposition of traditional trade in agriculture.

After 2011, complex GVC activities declined in all G7 countries and in major Asian emerging economies except Viet Nam (figure 2.9). In backward linkage–based decomposition the changes in simple GVC activities were mixed across countries. At the same time, implying weak domestic demand for major world economies, pure domestic production declined in almost all G7 countries except the United States and in China and a few other emerging economies. The share of production for traditional trade, which satisfies foreign demand, increased for all G7 and most Asian emerging economies.

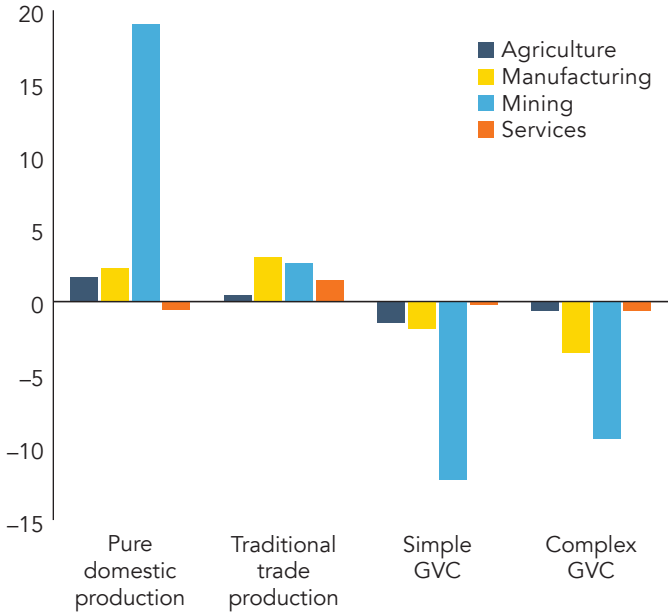
To ensure the robustness of these results, the changes in major portions of production activities based on the decomposition of both forward and backward linkages were compared for the four largest economies ranked by GDP—the United States, China, Japan, and Germany (figure 2.10). This analysis confirms the production structure changes identified at the aggregate level.

The structure of value-added creation during the slow economic recovery since 2011 is quite different from that during the three previous economic growth periods in the last 20 years. First, unlike the rapid production globalization driven by the growth of complex GVC activities in previous periods, during the current economic recovery the pattern was reversed, with less cross-border production-sharing activities in complex GVCs. Again contrary to the production structure of the previous economic growth periods, the current economic recovery has been driven mainly by traditional trade production to satisfy foreign

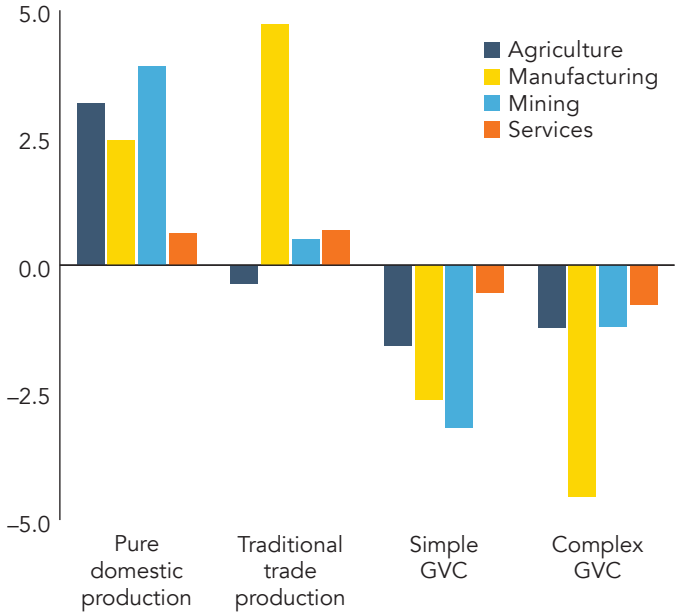
FIGURE 2.8 Structural changes in different types of value-added creation activities at the sectoral level between 2011 and 2015

Share in 2015 minus share in 2011 (percentage points)

Forward linkage



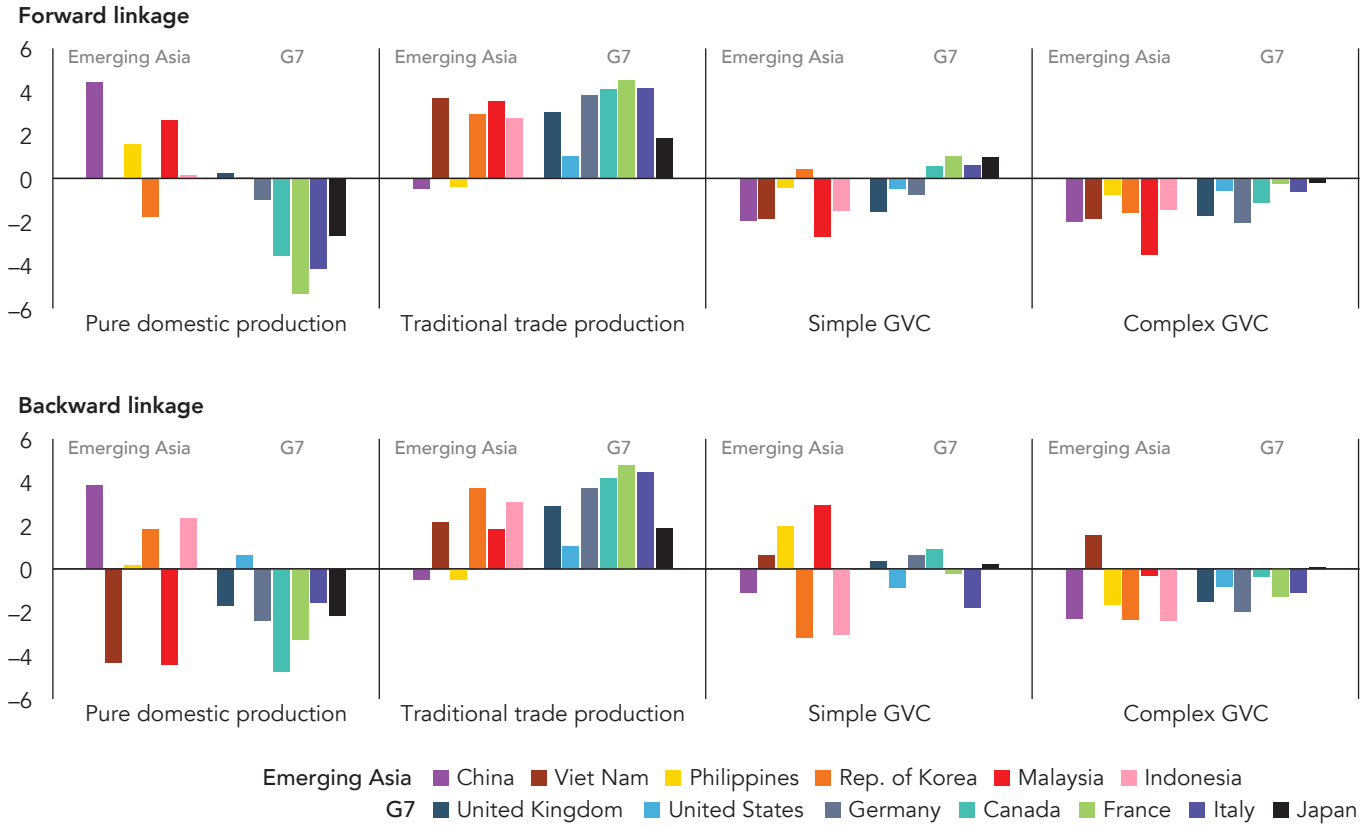
Backward linkage



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

FIGURE 2.9 Structural changes in different type of value-added creation activities between 2011 and 2015 at the country level

Share in 2015 minus share in 2011 (percentage points)



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

demand and the growth of pure domestic production in the United States and several other major emerging economies, such as China. Finally, in the current growth period, participation in simple GVCs has been mixed, increasing for some developed economies but decreasing for most emerging Asian economies.

Factors behind the slow growth of GDP during the recent economic recovery

GDP growth has been slower during the recent economic recovery than during the previous growth period (figure 2.11) for two key reasons:

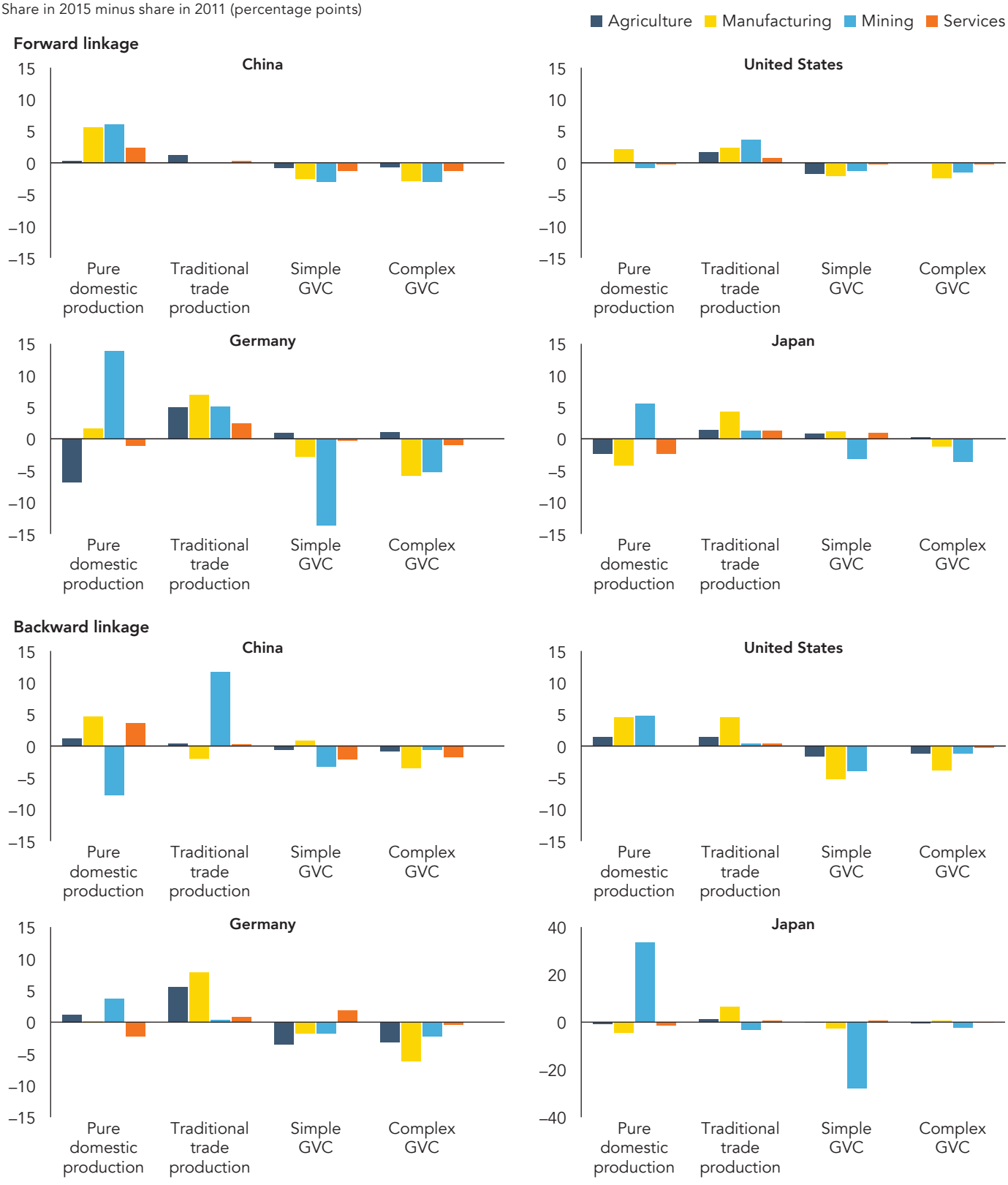
- *Weak domestic demand.* The average annual growth rate of pure domestic production (orange points in figure 2.11) declined significantly, reflecting weak domestic demand for most economies. The growth rate of traditional trade production activities (blue points) for foreign demand actually grew more rapidly in the second period for most of the 48 economies in the Asian Development Bank (ADB) data sample than in the first period.
- *The slowdown of production globalization.* The average growth rate of both complex GVC value-added creation activities (black points) and simple GVC activities (gray points) declined, with the average growth rate of complex GVC activities declining more.

The impact of these two factors is even clearer when the 48 economies in the ADB database are divided into two groups based on positive and negative GDP growth during 2011–15 (figure 2.12). Compared with GDP in 2011, GDP in 2015 increased in 24 economies and decreased in 24 economies. Decomposing the total GDP of each group into GVC and non-GVC production activities shows the following:

- The change in pure domestic production to meet domestic demand explained the largest portion of the change in GDP for both groups; all economies with negative GDP growth experienced a significant decrease in pure domestic production.
- Traditional trade production increased, while cross-border production-sharing GVC activities decreased. In contrast, during the precrisis period (2003–08) cross-border production-sharing GVC activities grew much faster than traditional trade-related domestic production activities.
- The decline of cross-border production-sharing GVC activities was driven by complex GVC activities. Simple GVC activities

FIGURE 2.10 Structural changes in different type of value-added creation activities between 2011 and 2015, at the country and sector levels

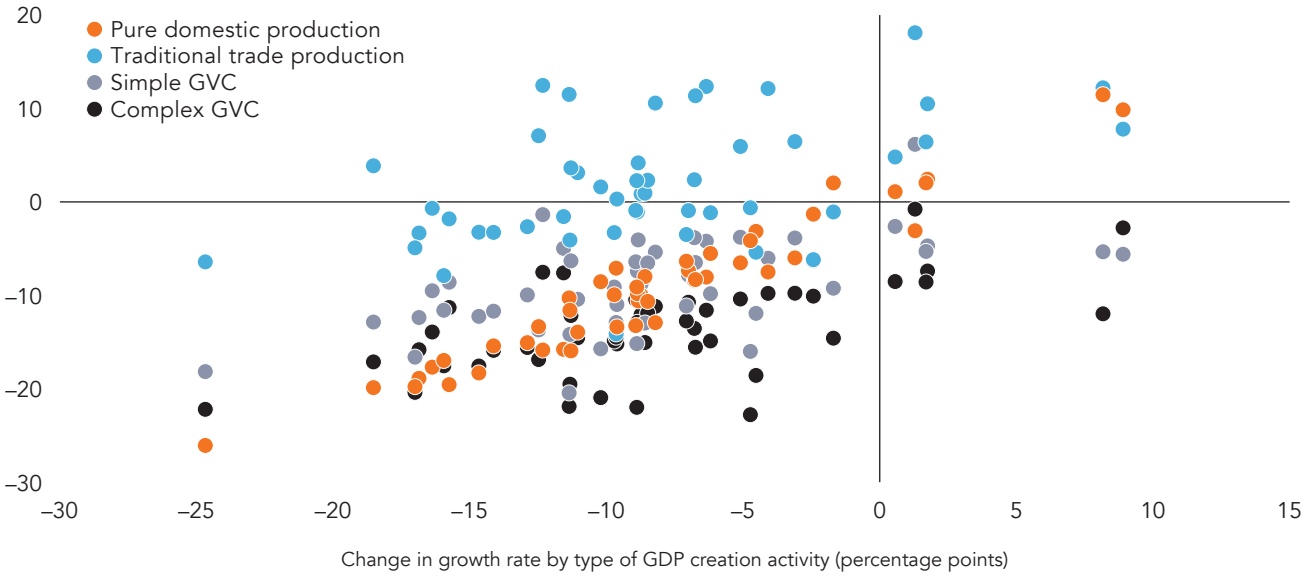
Share in 2015 minus share in 2011 (percentage points)



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

FIGURE 2.11 Change in average annual growth rate by type of value-added creation activity between 2003–08 and 2011–15

Change in GDP growth rate (percentage points)



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

declined in countries with negative GDP growth during 2012–15 but kept growing in countries with positive GDP growth. Even in the country group with positive growth in total cross-border production-sharing GVC activities, the production activities of complex GVCs declined. In contrast, complex GVC activities were the fastest growing portion of GDP production in most countries during the precrisis period (2003–08).

Network analysis based on decomposing bilateral gross trade flows, proposed by Koopman, Wang, and Wei (2014), confirms the decline of complex GVC activities during 2011–15 (box 2.3).

Why complex cross-border production-sharing activities declined during the recovery following the financial crisis

What drives the recent pattern of global production? The measure of total and GVC production length proposed by Wang and others (2017b) can shed light on this question.

Average production length is a measure of the average time that value added created by production factors employed in a country or sector is counted as gross output in the economy. When value added is used as an input in a production stage, either as a primary or intermediate input, it is counted as gross output where it is used. Therefore, the length of a production chain is the number of times value added is counted as an output in the production chain from the first time it is used as a primary input until it is absorbed by a final product. It reflects the complexity of production processes. So the finer the division of labor, the longer the production length, which can be computed as the ratio of value added to its induced gross output.

Newly released data from the World Input-Output Database (Timmer and others 2016) can be used to decompose production length for the four types of value-added creation activities based on the decomposition of domestic value added into GVC and non-GVC activities (figure 2.13). The units here are the average number of stages in the production process: that is, at each stage, value added is counted as the gross output of some industry.

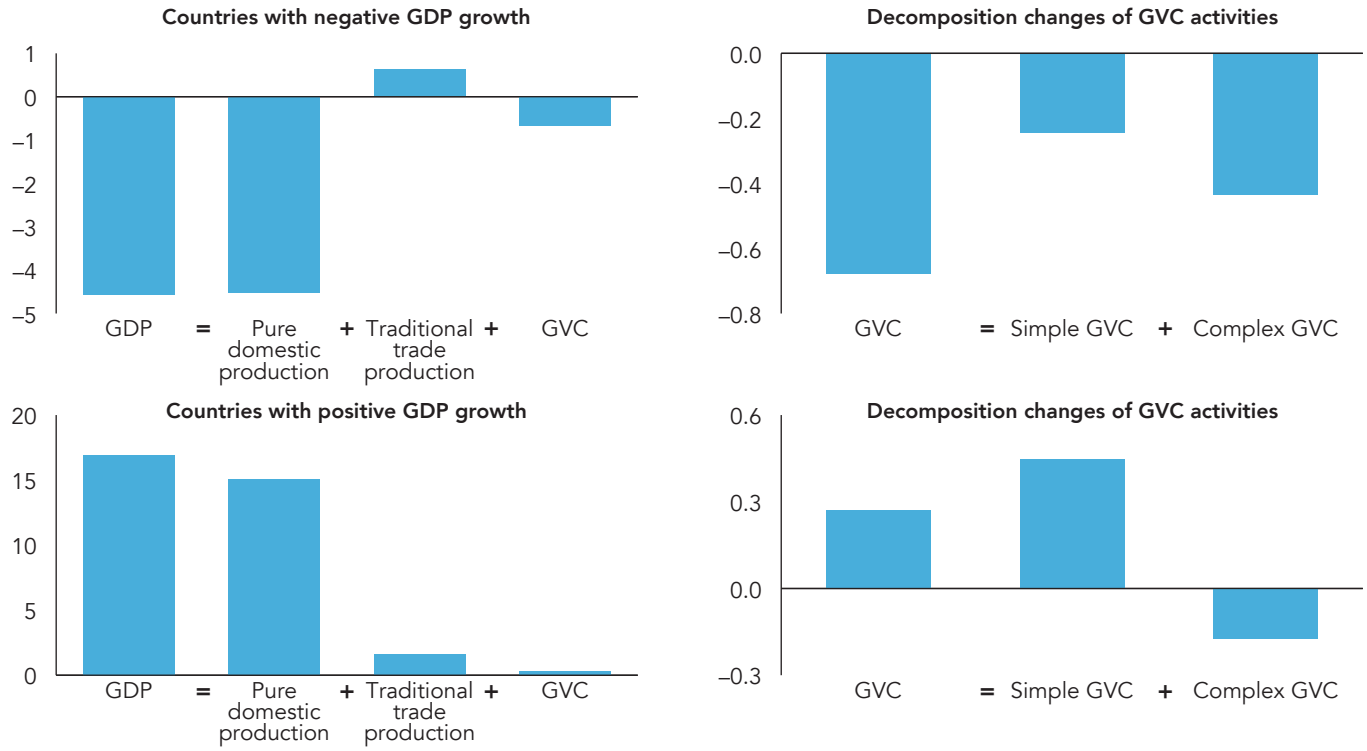
This decomposition of production length reveals several patterns. First, the breakdown of the production process into more stages is not a general phenomenon, either within or among countries. The length of domestic production chains is quite stable, though production chains for traditional trade increased very slightly. The main reason that production chains have lengthened, on average, is that the length of value-added production activities that cross national borders increased significantly during 2002–12 for both simple and complex GVCs, but especially for complex GVCs. This pattern changed during the recovery period, however. At the global level, production length increased during 2011–15 for all value-added production activities except complex GVC production, which declined (figure 2.14), running counter to its pattern in the precrisis period.

Second, the decline in production length of complex GVC activities can also be observed clearly at the sector level (figure 2.15). For almost all country-sector pairs except agriculture and mining in emerging economies, the production length of complex GVC activities declined. The decline in manufacturing was more severe in emerging economies than in advanced economies, and the opposite was true for the decline in services. The production length of simple GVC activities in manufacturing also increased in emerging economies but not as much as in advanced economies. The direction of change is again opposite for services in advanced economies.

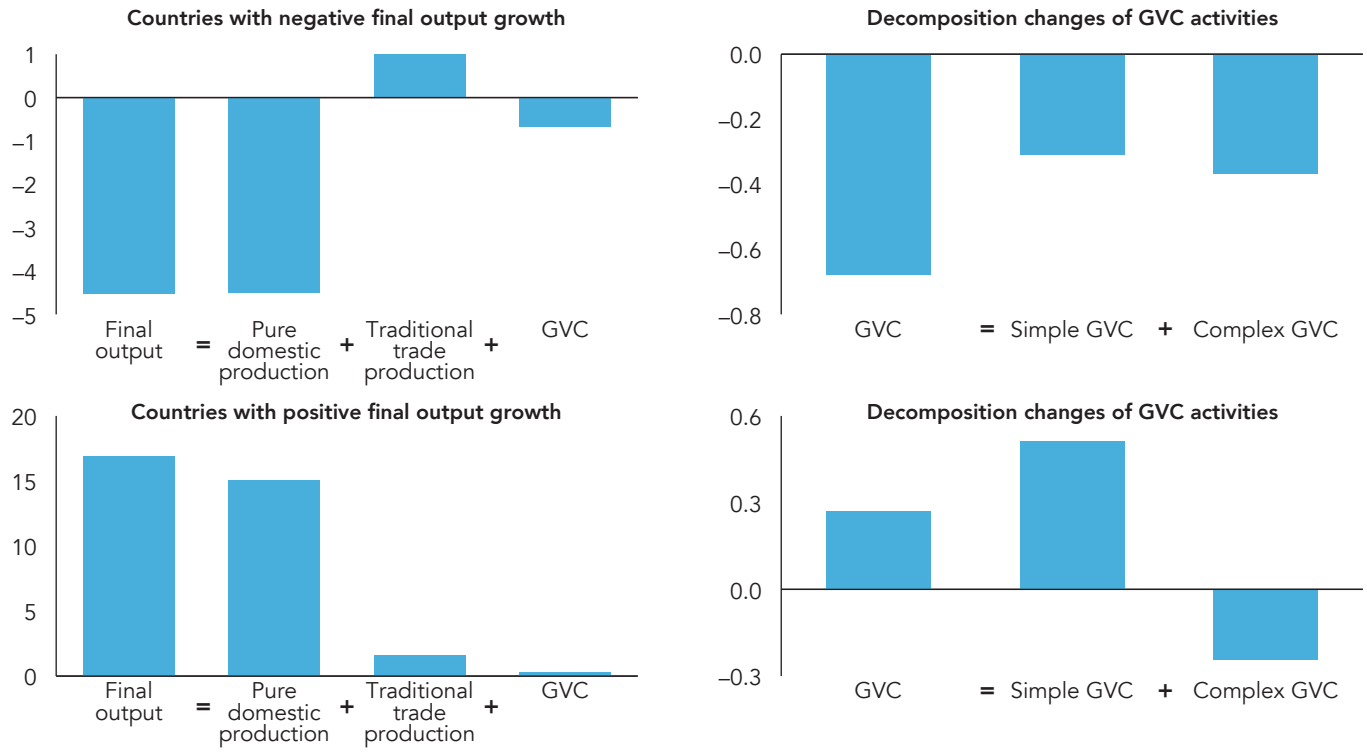
FIGURE 2.12 Changes in growth of different types of value-added creation activities between country groups with positive and those with negative GDP growth between 2011 and 2015

$ (trillions)

Forward linkage



Backward linkage



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

BOX 2.3

The evolution of cross-border production sharing in complex global value chains

Given the complexity and sophistication of cross-border production-sharing, network analysis can illuminate the evolution of global value chains (GVCs) (box figure). For simplicity, the analysis considers vertical specialization (Hummels, Ishii, and Yi 2001) as an example and uses network tools (Zhong and others 2014) to show the topology of foreign value added embodied in manufactured exports (one part of complex GVCs) at the bilateral level.

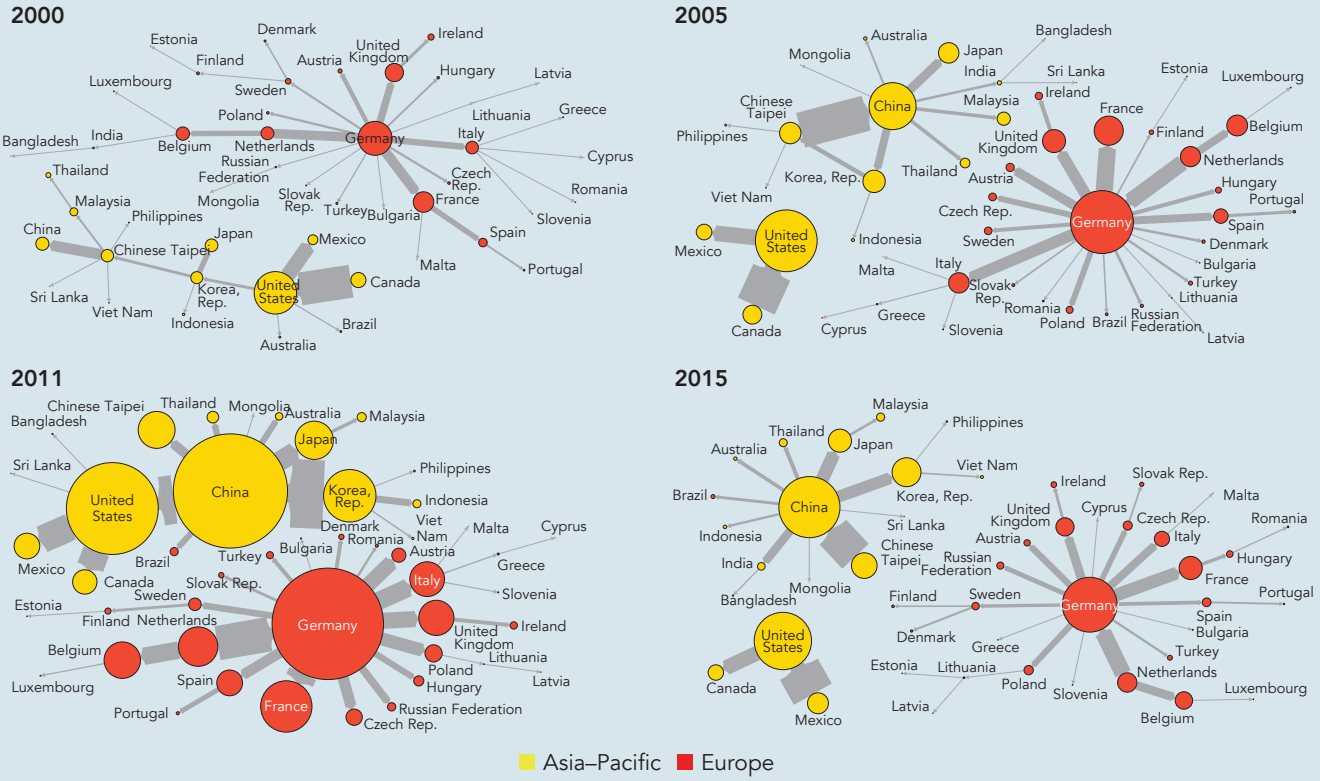
In 2000 the entire network was dispersed, and the European community (with Germany as the core) had no connection with the Asia–Pacific community. The United States was the core of the Asia–Pacific community, with strong connections to Canada, Mexico, Brazil, and Australia. The United States also had a "chain" connection with Japan through the Republic of Korea and had connections with China through Korea and Chinese Taipei. Korea and Chinese Taipei, a sub-hub in the Asia Pacific community, were linked with most Association of Southeast Asian Nations (ASEAN) economies.

In 2005 the Asia Pacific community separated into two groups: the United States maintained connections only with Canada and Mexico, while China became the new core of the East Asia + Association of Southeast Asian Nations community, with strong connections to Japan, the Republic of Korea, and Chinese Taipei.

In 2011 dramatic changes were evident across the entire network, and the magnitude of connections strengthened. China became the core of the Asia–Pacific community by transferring a large portion of foreign value added to other countries. The relative distance between the European and Asia–Pacific communities shortened, reflecting that complex GVCs had developed globally, and more countries joined GVCs through some of the main hubs (the United States, China, Germany, and the Republic of Korea).

In 2015 a recession likely occurred in the complex GVCs networks; in particular, the North American Free Trade Area, East Asia + ASEAN, and Europe were again isolated. This phenomenon is consistent with the decline of complex GVCs.

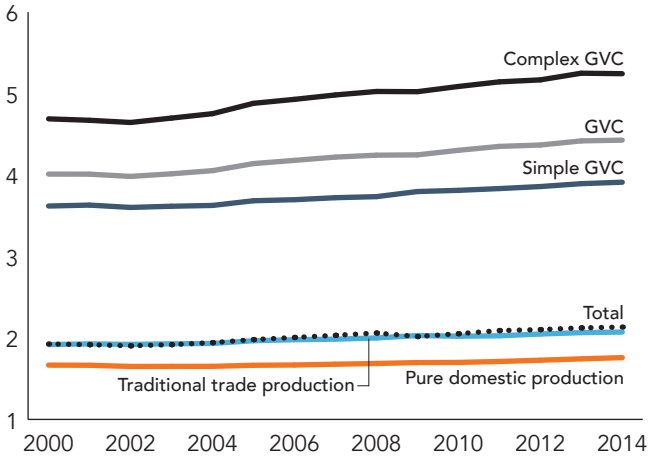
The typology of foreign value added embedded in bilateral manufactured exports, 2000–15



Source: Author's calculation based on Xiao and others' 2017 method and data from Asian Development Bank Inter-Country Input-Output Tables.

FIGURE 2.13 Trend in production length by different types of value-added creation activities, world average, 2000–14

Average number of stages in the production process



Source: University of International Business and Economics global value chain indexes derived from the 2016 World Input-Output Database.

Finally, the main reason for the decline in complex GVC production length is the declining number of national border crossings for production. The production length before and after national border crossing actually increased, indicating the potential deepening division of labor within national borders despite the decline in cross-border production-sharing activities. The reduced number of national border crossings for production can be observed in every country in the ADB database (figure 2.16), regardless of whether its GDP grew or declined during this period.

Caution is required in interpreting these conclusions because official statistics always lag behind the real world economy. For example, many aspects of new economies, such as cross-border business-to-business e-commerce, are not easy to measure under the current national account system, so the analysis may underestimate cross-border production-sharing activities. However, stylized facts on changes in the global production structure as summarized from the data are consistent with the following factors.

- The rising tide of protection around the globe after the global financial crisis.
- The substitution of domestically produced intermediate inputs for imported intermediate inputs in major emerging economies, such as China. When the domestic division of labor deepens in emerging economies, more intermediate inputs are produced domestically, so the domestic value chain lengthens, and cross-border production-sharing activities may decline as major emerging economies upgrade along GVCs.
- Technological innovation and reshoring also deepen the domestic division of labor for major developed economies, such as the United States and Japan.

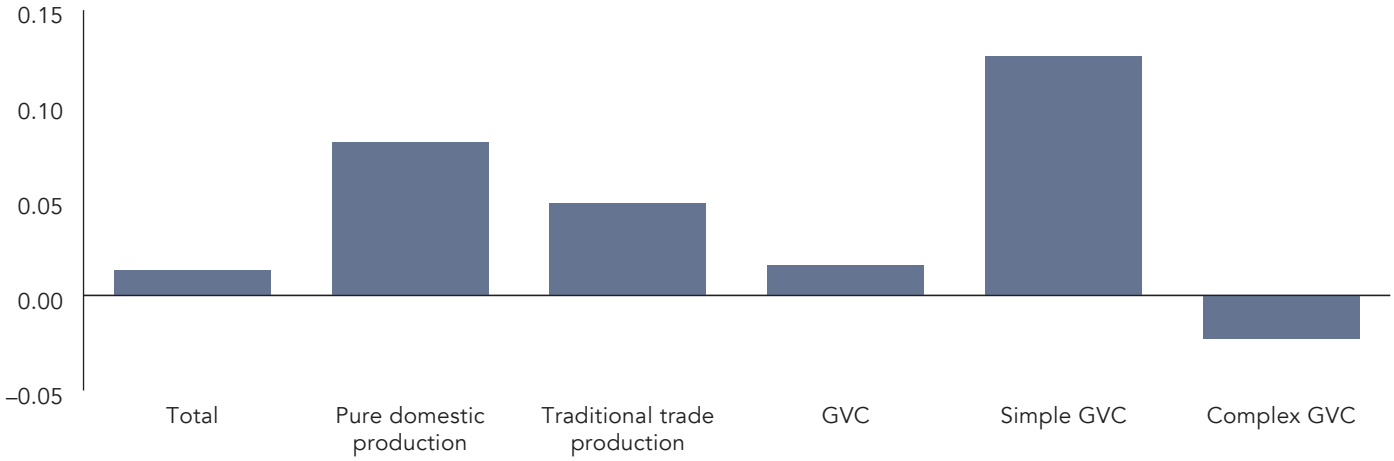
It remains to be seen whether such changes are temporary or permanent.

Measuring smile curves in global value chains: Creation and distribution of value added and job opportunities

From a development perspective, GVCs have at least three positive aspects. First, by linking into GVCs, firms, especially in

FIGURE 2.14 Change in production length for different types of value-added creation activities at the global level between 2011 and 2015

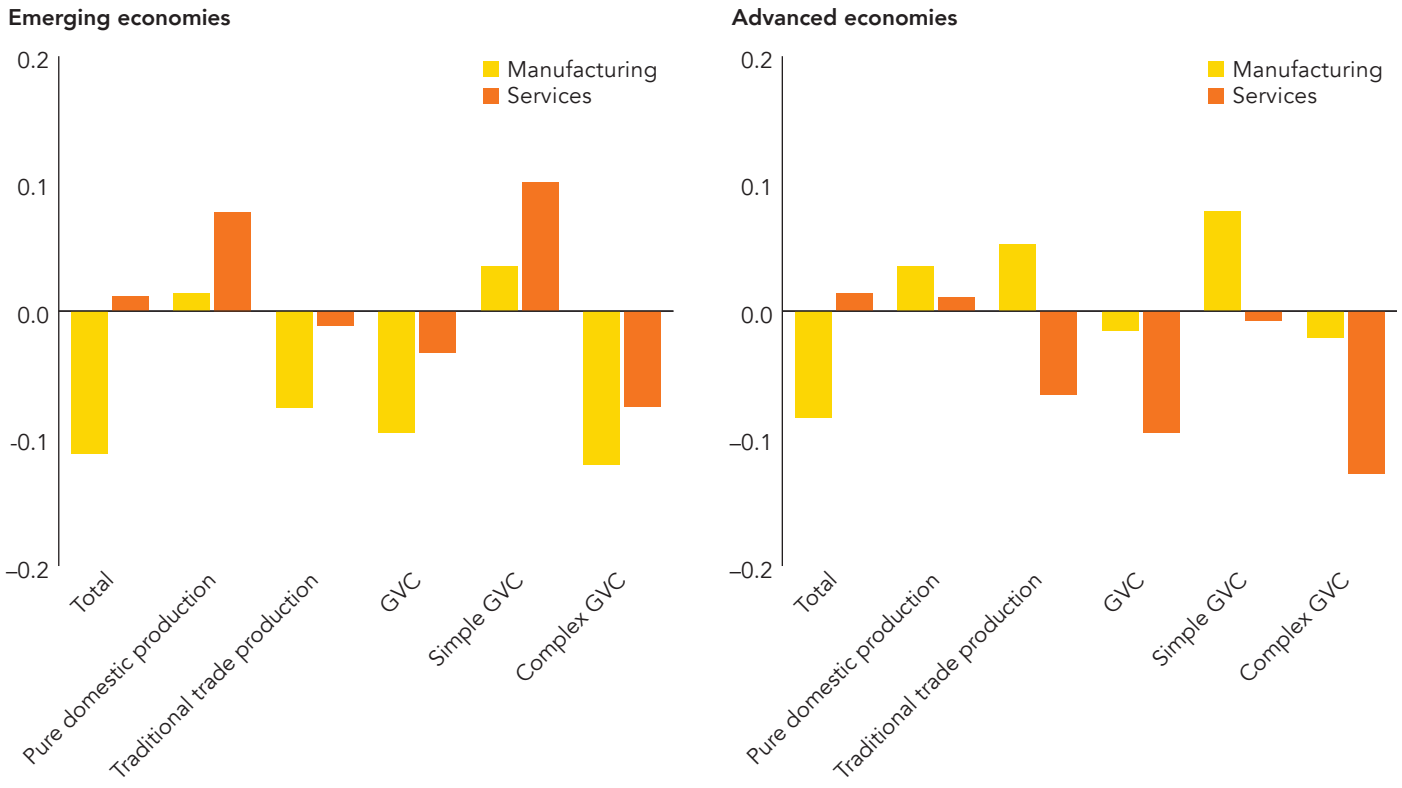
Number of stages



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

FIGURE 2.15 Change in production length for different types of value-added creation activities at the sector and economy levels between 2011 and 2015

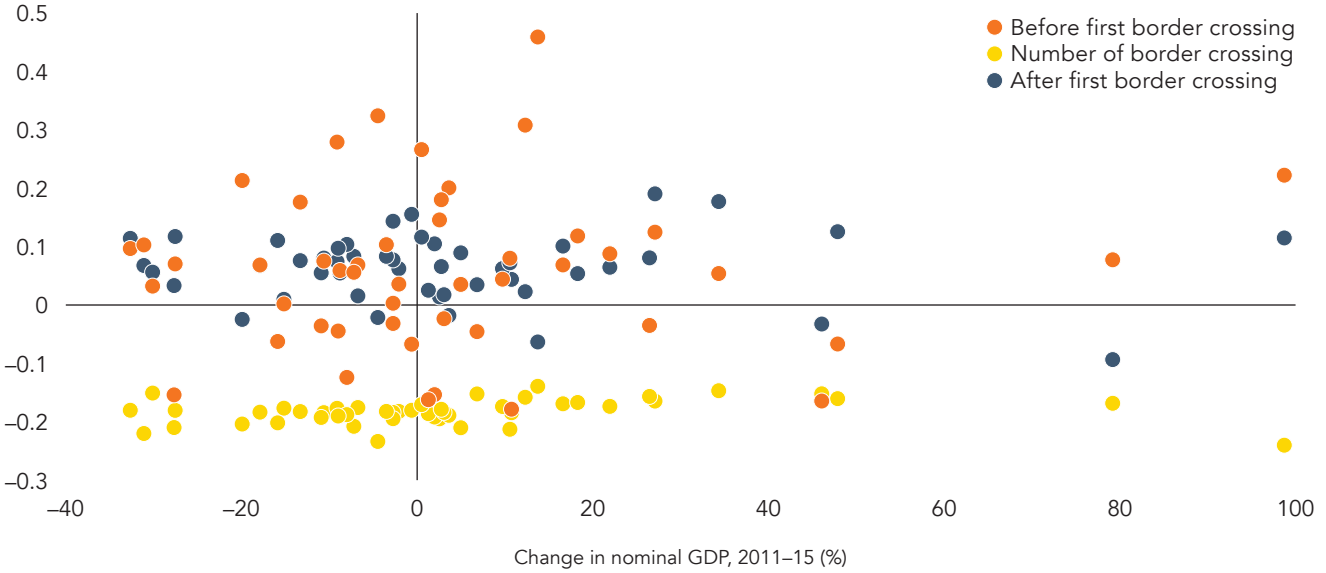
Number of stages



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

FIGURE 2.16 The decline in the number of border crossings drives the declining length of global value chain production at the country level between 2011 and 2015

Difference in number of border crossings between 2011 and 2015



Source: University of International Business and Economics global value chain indexes derived from 2016 Asian Development Bank Inter-Country Input-Output Tables.

developing economies, do not need to build the entire course of production capacity for a product. Instead, they can use their comparative advantage to concentrate on a specific production process or task, which enables them to integrate into the global economy more rapidly than was possible in the previous industrialization period (Kowalski and others 2015). Second, becoming a part of GVCs can create more job opportunities (UNCTAD 2013). For example, jobs are created in developing countries through iPhone assembly in China, call center operations in the Philippines and India, Nike shoe production in Viet Nam, and automobile and auto parts production in Mexico and Thailand. Third, GVCs also provide the opportunity for technology transfers or spillovers from developed countries to developing countries through local learning (Pietrobelli and Rabellotti 2010; Kawakami and Sturgeon 2012).

However, as mentioned in OECD, WTO, and World Bank Group (2014, p. 4), "Gains from GVC participation are not automatic. Benefits of GVCs can also vary considerably depending on whether a country operates at the high or at the low end of the value chain." Thus, developed and developing countries may face quite different costs and risks in joining GVCs (Baldwin, Ito, and Sato 2014). Because of differences in comparative advantage across countries in GVC participation, developed countries tend to engage in high-end and intangible production activities, such as research and development, design, and brand building in the prefabrication stages and in after-sales services and marketing in the postfabrication stages. Thus, these countries may worry about the hollowing out of their economies as manufacturing jobs are offshored to low-technology, low-wage countries. Developing countries, in contrast, tend to focus on low-end and tangible production activities such as manufacturing and assembly. So, they may worry that they are getting the wrong types of jobs and that their economies could be locked in to the bottom of the GVC "smile curve," which presents an outline of the value-added potential of each production stage in a value chain for various industries.

The concept of the smile curve was first proposed around 1992 by Stan Shih, the founder of Acer, a technology company headquartered in Chinese Taipei (Shih 1996). In the personal computer industry, Shih observed that both ends of the value chain bring higher value added to the product than the middle part. The logic of the smile curve has been widely used and discussed in the context of GVCs. However, most research has focused on product-level case studies rather than the economy-wide implications.

Smile curves can help answer numerous questions at the economy level. What is the relationship between developed and developing countries in the creation and distribution of value added and job opportunities in GVCs? Do smile curves exist for country or industry GVCs? If yes, have smile curves deepened or flattened over the years? Have developing countries been locked into the low end of GVCs? Which policies can help countries maintain or improve their competitiveness on the smile curve? And how can developing countries integrate into GVCs successfully and then move up from the low end to the high end of the smile curve? Answers to these questions are crucial for designing development strategies, industrial policies, and international governance. This section considers several highly fragmented exporting industries in some countries to show how value added and job opportunities are created and distributed in GVCs along various smile curves.

China's information and communication technology industry export-related smile curves: Distribution of value added and job opportunities

Ye, Meng, and Wei (2015) and Meng, Ye, and Wei (2017) consistently measure both the value-added gain from GVC participation and the distance (total production length) between producers and consumers. Following their approach, smile curves can be drawn for various GVCs. A good starting point would be the iPhone, labeled "Designed by Apple in California; assembled in China." But it is difficult to isolate the iPhone industry in existing intercountry input-output databases. Here, the first step is to examine the information and communication technology (ICT) industry (industry 14, Electrical and Optical Equipment, in the World Input-Output Database) as a proxy to show how, and to what extent, countries and industries are involved in the GVCs for China's ICT product exports.

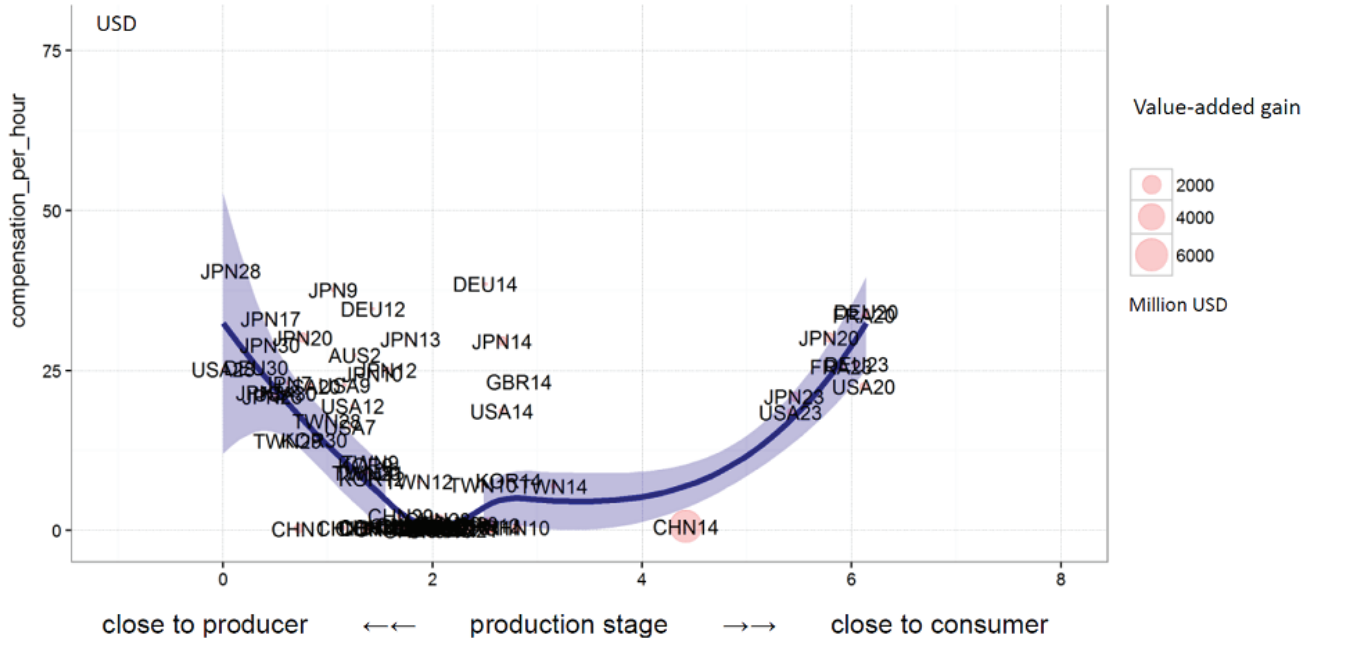
In figures 2.17 and 2.18 the y-axis shows labor compensation per hour (a proxy for technology level or a first-order approximation of labor productivity in current U.S. dollars), and the x-axis denotes distance, measured by the total forward linkage–based production length between global consumers of ICT products and a specific participating industry in the corresponding GVC. The 2013 version of World Input-Output Database data are used here, covering 41 economies and 35 industries, with the total number of GVC participants ($41 \times 35 = 1{,}435$) represented as a circle in the figure. The size of the circle represents the absolute value added gained by joining the corresponding GVC (threshold equals 0.1% of the total value added gain). The smooth line is fitted by local polynomial regression–smoothing weighted by its value-added gain, and the shadowed area represents the confidence interval around the smooth line. Using the smile curve can lead to an understanding of the participants (countries and industries) of a specific GVC as well as their positions and gains in the chain.

The plotted GVC for China's ICT exports to the world market clearly appears as a smile curve; to save space, only values for 1995 and 2009 are shown (see figures 2.17 and 2.18). Several stylized facts emerge from these curves:

- China had the largest value-added gain in this GVC. China's ICT industry (CHN14) was the most affected industry based on China's production of ICT exports through domestic backward and intra-industrial linkages.
- Several other Chinese domestic industries whose lowest labor compensation placed them at the low end of the smile curve also benefited by participating in prefabrication stages

FIGURE 2.17 Estimated smile curve for China's exports of electrical and optical equipment, 1995

Compensation per hour ($)

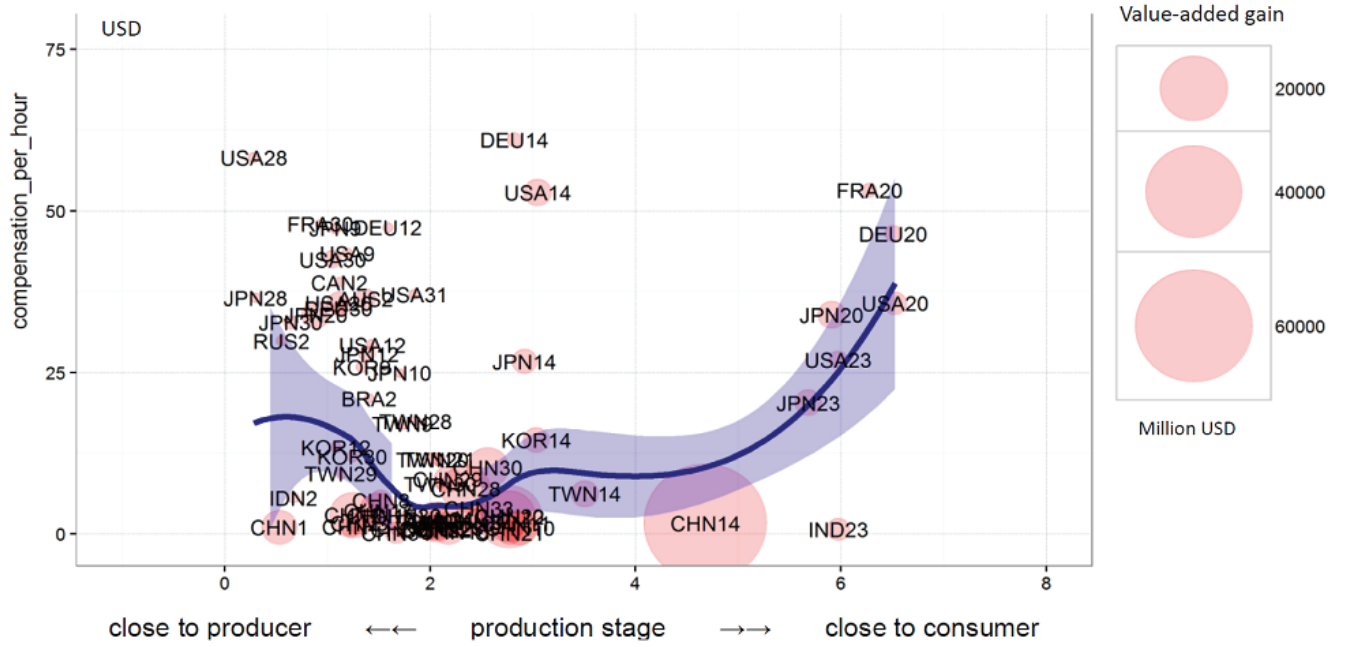


Source: Meng, Ye, and Wei 2017.

Note: See annex 2.2 for a key to country abbreviations and sector codes.

FIGURE 2.18 Estimated smile curve for China's exports of electrical and optical equipment, 2009

Compensation per hour ($)



Source: Meng, Ye, and Wei 2017.

Note: See annex 2.2 for a key to country abbreviations and sector codes.

of this GVC (CHN12 basic metals, CHN28 financial intermediation, CHN20 wholesale, CHN9 chemicals, CHN30 renting of machinery and equipment and other business activities, CHN2 mining, CHN10 rubber and plastics). This was due to the fact that most intermediate inputs needed directly and indirectly to produce China's ICT exports were presumed to come from the Chinese domestic market.

- ICT industries in other economies (DEU14, USA14, JPN14, KOR14, TWN14), located in the upstream portion of this GVC, also obtained a relatively large part of the value-added gain. The main reason is that a majority of transactions involved cross-border, intra-industry trade, given the broad industry classification in the World Input-Output Database. This result is also consistent with the finding of a case study of the iPhone's supply chain that Japan, the Republic of Korea, Chinese Taipei, and the United States were the main suppliers of parts and components for iPhone assembly in China (Xing and Detert 2010).
- Renting machinery and equipment and other business activities (30) and financial intermediation (28) provided by foreign countries (USA30, USA28, JPN30, JPN28, KOR30, and KOR28) are located at the high end of the prefabrication stages of this GVC, with higher labor compensation. ICT products produced in China, dominated by foreign-invested enterprises, may need inputs of intermediate services directly imported from the United States, Japan, and the Republic of Korea. But this kind of service may also be embodied in the intermediate goods produced in the United States, Japan, and the Republic of Korea and exported to China to support the production of China's ICT goods indirectly through various GVC routes.
- Postfabrication service industries with higher labor compensation per hour—such as wholesale (20) and inland transportation (23) in the United States, Japan, Germany, and France—were the main beneficiaries in the postfabrication stage of this GVC. China's ICT goods exported to the United States, Japan, and Germany had to be delivered to their domestic consumers mainly through those countries' domestic wholesale and transportation service industries.

Changes in China's information and communication technology industry export-related smile curves over time

China's ICT industry was located at the low end of the GVC in 1995 and that position did not change much between 1995 and 2009—for two likely reasons. One is the relatively high share of processing trade in this industry, which can explain China's position on the x-axis of figures 2.17 and 2.18 measuring production distance. China's participation in the GVC at the early stage reflects its acceptance of outsourcing tasks such as assembling iPhones. Compared with the traditional production of ICT products, assembly is much more labor-intensive and depends on more foreign parts and components. In addition, export products processed in China are intended for export only (no domestic consumption), so more foreign after-service industries have been involved in the postfabrication stages in this GVC than might otherwise be the case. Thus, China's ICT value-added activities are naturally located in the middle of this smile curve. Another reason is that labor compensation per hour in current U.S. dollars increased slightly during the target years but not to a very high level because of the abundant labor supply in China. This explains the almost unchanged position of China's ICT on the y-axis.

The confidence interval of the smile curve widened considerably between 1995 and 2009. This widening was driven mainly by the expanding differentials for labor compensation per hour among GVC participants. The labor compensation of U.S. ICT workers (USA14) soared from $18.10 an hour in 1995 to $52.20 in 2009, while for China (CHN14) labor compensation went up only slightly, from $0.60 an hour in 1995 to $1.60 in 2009. In other words, the U.S. ICT industry concentrated increasingly on high-tech production of more complex intermediate goods (such as computer processors), as China took on more tasks using its low-skilled labor (such as assembling final products). Also changing the confidence interval is the deep involvement of more foreign and Chinese domestic service industries in this GVC, who wanted a large share of the value-added gain.

China's other domestic participating industries are at the low end of the smile curve, but their value-added gain has risen in absolute terms (note the change in circle size between 1995 and 2009 in figures 2.17 and 2.18). In other words, China's domestic industries, without directly exporting goods to the world market, also participate in GVCs by providing intermediate goods and services to its exporting industries, like ICT.

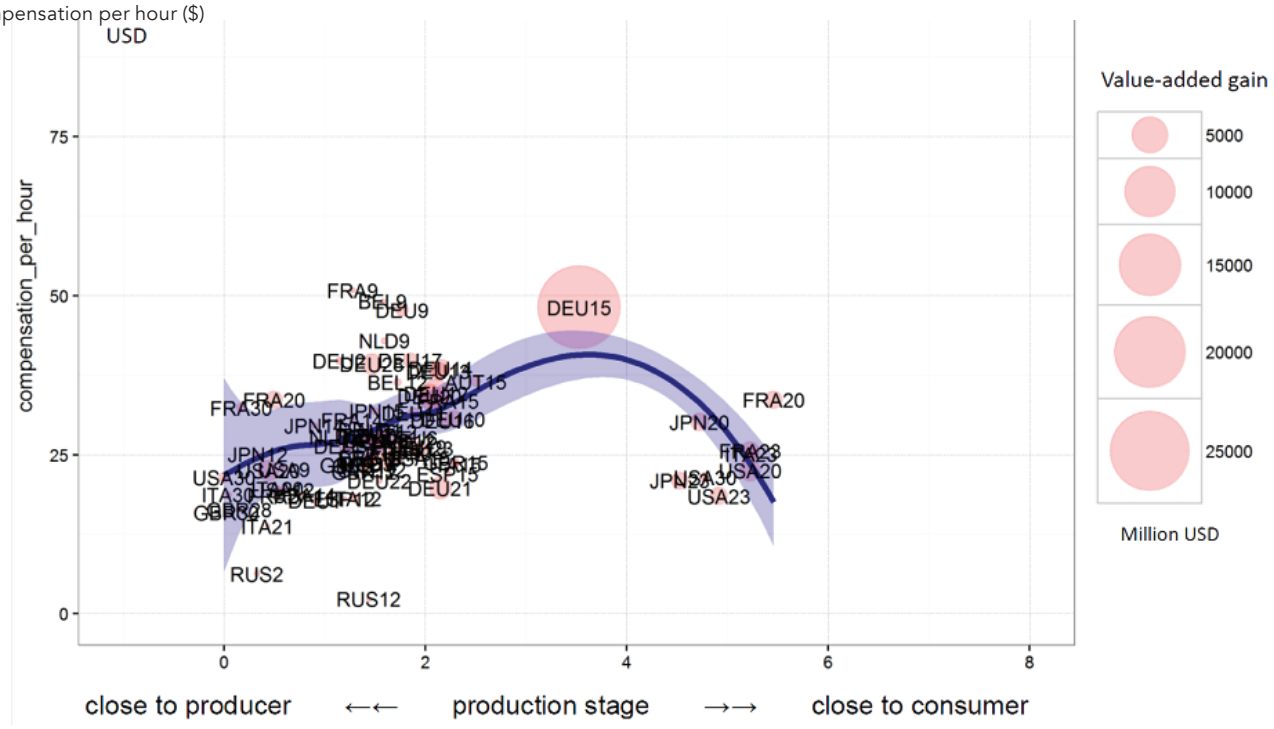
Global value chains can also frown

For an inverted smile curve, consider value-added activities in the German auto industry. Given the higher labor compensation in Germany's auto industry and lower labor compensation in both upstream and downstream industries, the entire GVC looks like an inverted smile curve—a frown (figures 2.19 and 2.20). To some extent, this may reflect the successful transition of the German auto industry from traditional mass producer to mass customizer and to individual design based on digital technology and artificial intelligence. The mass customized and individual design manufacturing stage accounts for a relatively large portion of the total value gain, while the traditional high-end design and sales functions account for only a small portion of total value gain and mostly in foreign countries. This is contrary to intuitions from the smile curve, in which traditional manufacturing stands at the low end of the GVC, such as China's ICT exports. But it could also reflect the ongoing structural change in global GVCs, such as the emergence of the customer to manufacturing business model in several industries.

The most important changes between 1995 and 2009 were the increasing number and variation of foreign participants and the increasing length of the curve. In 1995 developed European countries, the United States, and Japan dominated foreign participants, while in 2009 more countries and industries were involved, especially in Eastern Europe, China, and the Republic of Korea. This clearly reflects the increasing diversity and

FIGURE 2.19 Estimated smile curve for Germany's automobile exports production, 1995

Compensation per hour ($)

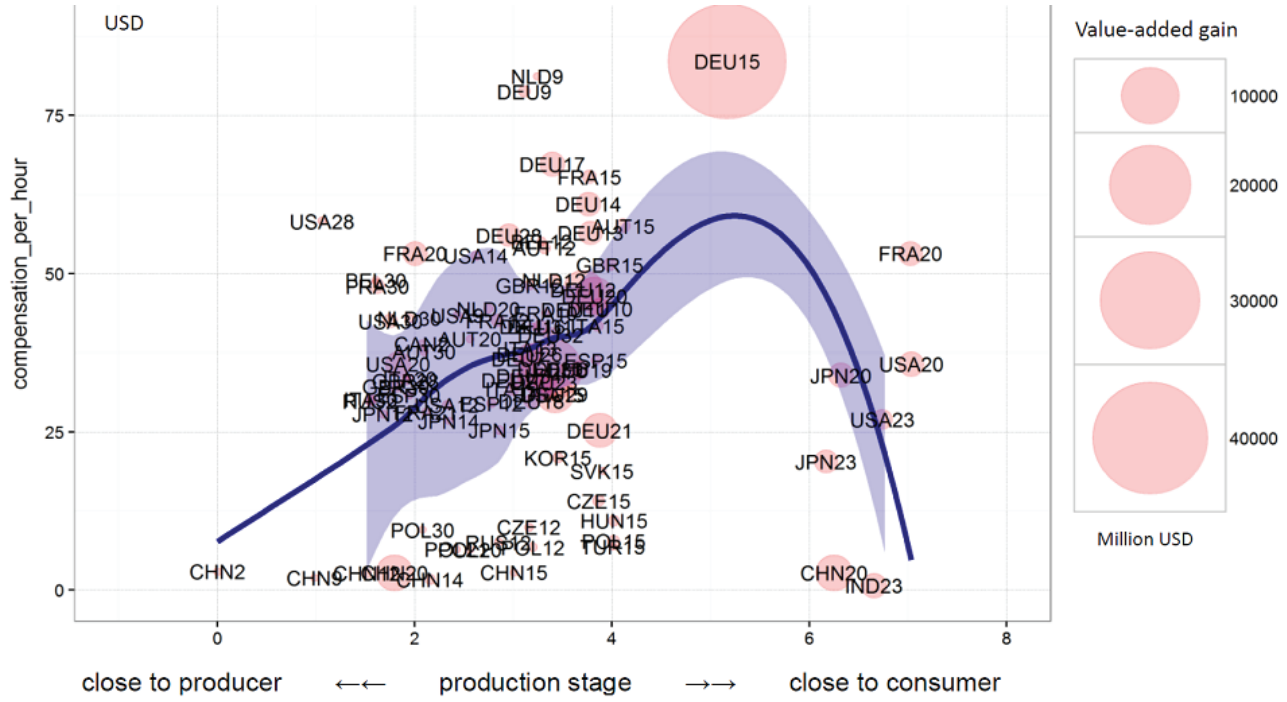


Source: Meng, Ye, and Wei 2017.

Note: See annex 2.2 for a key to country abbreviations and sector codes.

FIGURE 2.20 Estimated smile curve for Germany's automobile exports production, 2009

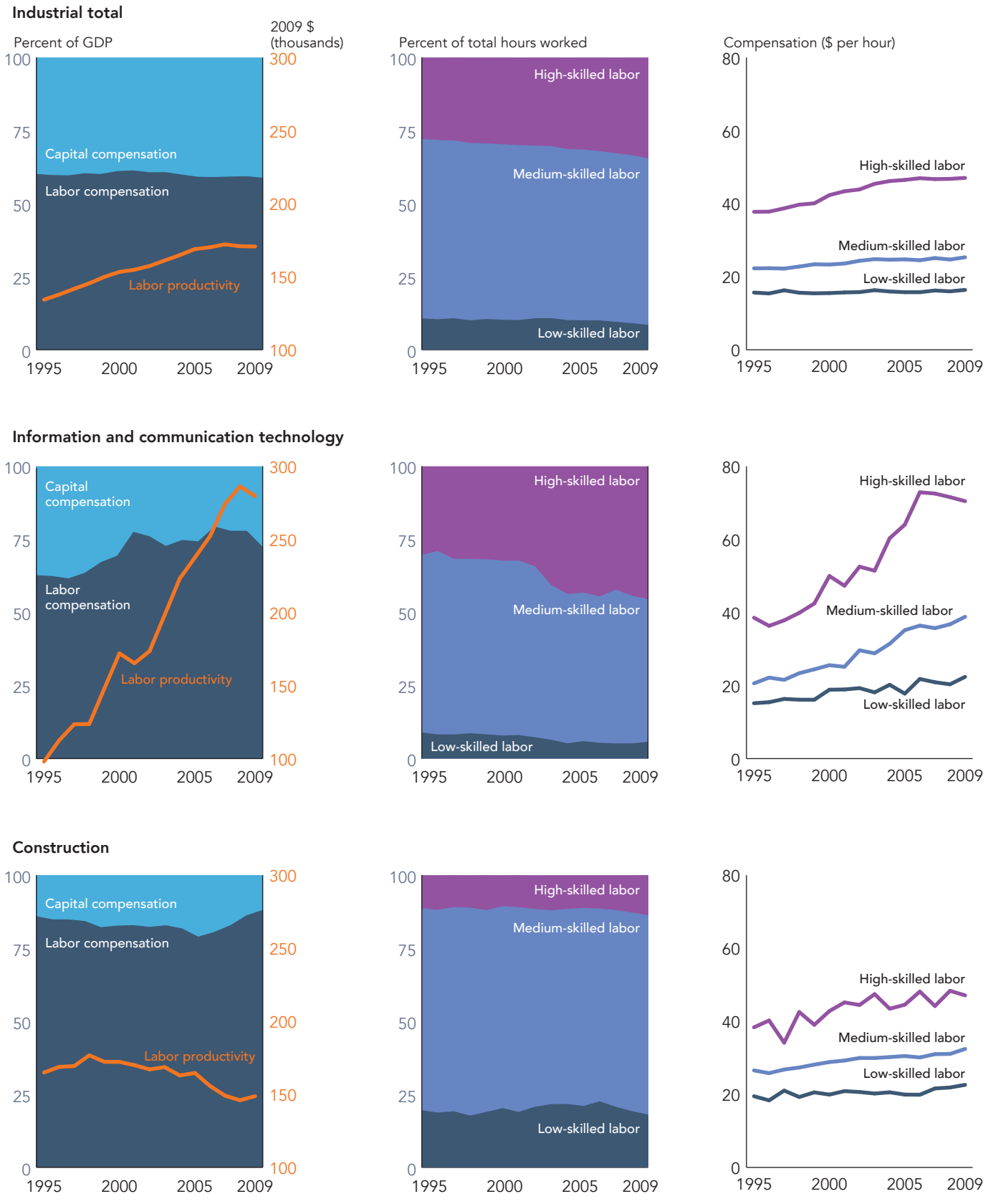
Compensation per hour ($)



Source: Meng, Ye, and Wei 2017.

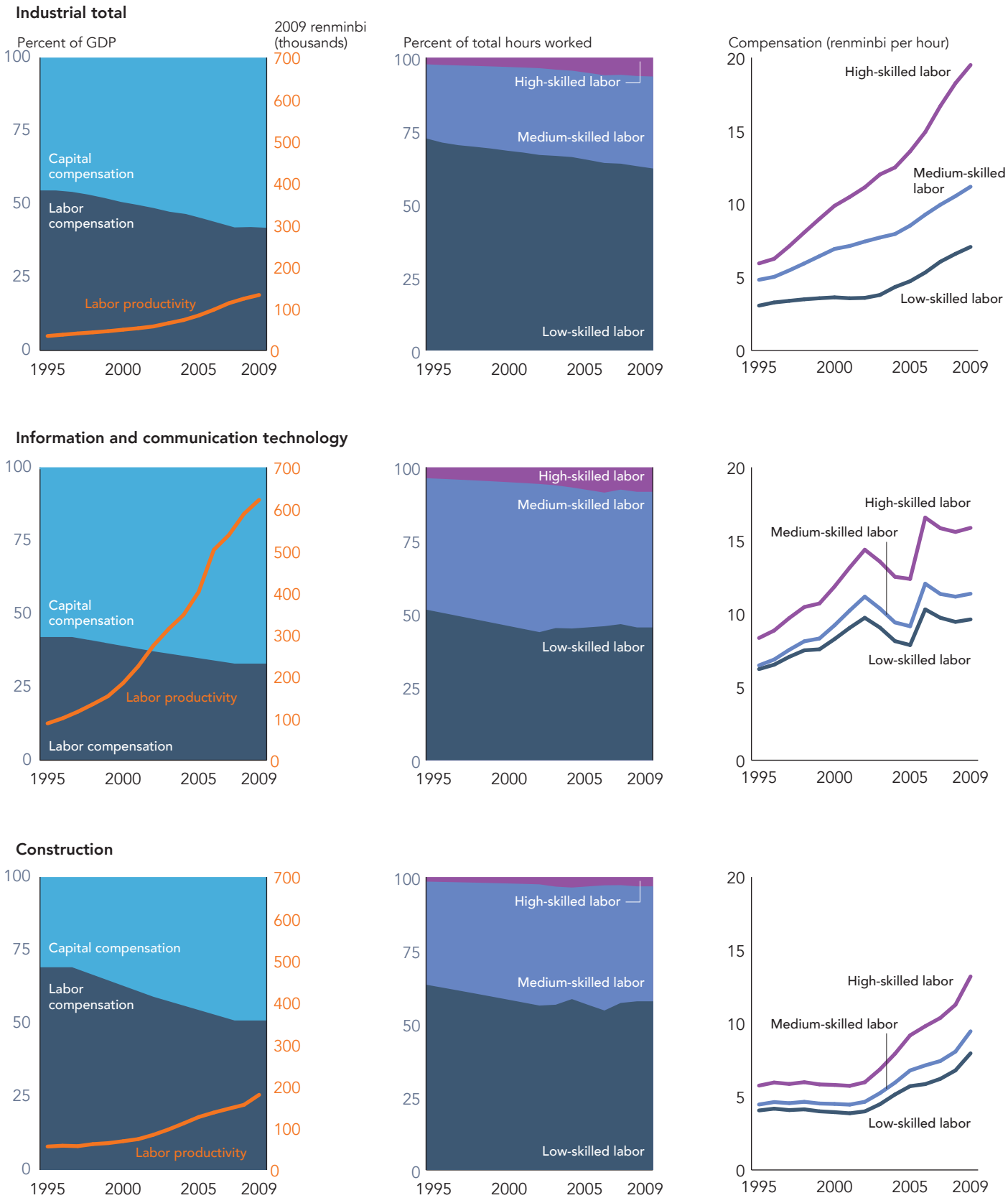
Note: See annex 2.2 for a key to country abbreviations and sector codes.

FIGURE 2.21 Labor productivity and income distribution for the United States, 1995–2009



Source: Meng, Ye, and Wei 2017.

FIGURE 2.22 **Labor productivity and income distribution for China, 1995–2009**



Source: Meng, Ye, and Wei 2017.

complexity of international fragmentation in Germany's auto exports. In addition, given the increase in labor compensation and absolute value-added gain in Germany's auto industry and the relatively low labor compensation of upstream participants from China, the slope of the entire curve became much steeper.

Labor productivity and income distribution in global value chains

Smile curve mapping can be a touchstone for better understanding various country and industry positions and value-added gains from participating in GVCs. The empirical results presented so far raise an important issue about the relation between economic efficiency and income (or job opportunity) distribution along GVCs from the perspective of economic development. Following Meng, Ye, and Wei (2017), this section considers the ICT industry, an industry dominated by international production sharing, and the construction industry, one of the most domestic-oriented industries (relatively less influenced by international trade). It also considers the United States and China as country comparisons since both are active in GVCs. The United States joins GVCs mainly from upstream—such as exporting complex intermediate goods, parts, and components—or through foreign direct investment outflows to developing countries. China joins GVCs mainly from downstream—such as exporting assembled final goods—or through foreign direct investment inflows (before the global financial crisis).

U.S. labor productivity (measured as output per person economically engaged, in 2009 national currency) increased rapidly from 1995 to 2009 as the U.S. economy became more efficient, with income distribution between capital and labor a relatively stable in their shares in total value added (figure 2.21). But high-skilled workers received more job opportunities, with increased compensation per hour, while medium- and low-skilled workers lost jobs gradually, with only a small increase in pay for medium-skilled workers and almost no change in compensation for low-skilled workers over the 15 years for which data are available. This phenomenon was more pronounced in ICT industries, while no significant change was observed in the income distribution between skilled and unskilled workers in construction. In other words, the rise of GVCs (and technological innovation) may lead to greater efficiency in the U.S. economy but may also leave low-skilled workers worse off, especially in industries with more outsourcing of production tasks to low-wage developing countries such as China.

For the same industries in China, the evolution is very different, but it may be highly correlated with the U.S. phenomenon. China's labor productivity also increased, but more value added was distributed to capital than to labor (figure 2.22). The gain accrued to the capital deployed in China, and that would include multinational corporations involved in GVCs. Given this, and the very large portion of low-skilled workers in China's domestic labor market, the slow growth in compensation per hour for low-skilled workers should come as no surprise.

China, with the world's largest pool of low-skilled labor, meets the United States, the world's largest capital-abundant country, through GVCs. This intersection generates very different but highly correlated income distribution changes. The United States is facing the challenge of job offshoring for medium- and low-skilled workers and downward pressure on their wages. Until 2009, China faced the challenge of unequal income distribution between capital and labor, with very low compensation for low-skilled labor. In the United States the big winners appear to be high-skilled workers and multinational corporations. GVCs enabled them to benefit from the enormous productivity gains in developing countries such as China. In China, by contrast, ordinary workers benefited. Even at the beginning of the process, factory wages in China were far ahead of rural incomes. And those wages doubled over 15 years. This is one of the driving factors behind the impressive decline of absolute poverty in China. But the really big benefits in China accrued to the small number of high-skilled workers and to the owners of capital, including foreign investors.

In summary, while developed and developing countries may face quite different costs and risks in joining GVCs, doing so may lead to efficiency improvements. But without proper domestic labor market adjustment policies and universal-coverage safety nets, as well as better international governance, medium-skilled and especially low-skilled workers can become the most easily injured groups in both developed and developing economies.

Conclusions

The rise of GVCs has dramatically changed the world economy. After explaining the changing patterns of global GDP and trade growth and the limitation of traditional trade indicators, this chapter showed how to use the most recent GVC indicators to decompose country and sector GDP and final goods production into GVC and non-GVC activities. These new indicators were also used to identify the production length and degree of participation (simple or complex) in GVCs at the country and sector levels. This analysis found that complex GVC-related cross-border production-sharing activities were the most important force driving globalization and the growth of global GDP during 1995–2000 and 2000–08 before declining during 2012–15.

Why did complex GVC activities decline? As industrial upgrading occurred in emerging economies, especially in China, processing trade declined. Trade protectionism may have increased due to the slow pace of economic recovery after the 2008–09 global financial crisis. And some types of manufacturing jobs may have returned to source countries (reshoring) in response to technology innovation.

Smile curve analysis was used to show how these new phenomena affect the distribution of value added and job opportunities in GVCs across countries. This analysis shows that countries and sectors can achieve very different value added and job gains along GVCs depending on their position and degree of participation. Joining a GVC increases economic efficiency, but this can have a distributional impact. The remaining chapters in this report discuss how to resolve the distribution issue and help participants from developing countries move up the smile curve.

ANNEX 2.1

Shifting roles in global value chains for intermediate and final goods

Rising impact of Eastern European economies in intra-Europe exchanges of intermediate products

During the last two decades, especially since joining the European Union in 2004, Eastern European countries have developed intensive bilateral trade linkages in industrial inputs with other European countries (figure A2.1.1). Joining the European Union and adopting EU regulations have been conducive to the development of these ties within European GVCs. The Czech Republic, Hungary, and Poland, the largest players in intraregional trade in manufacturing inputs among the European economies, accounted for more than 11% of intra-Europe exports in intermediate goods in 2015, a share that more than quadrupled since 1995.

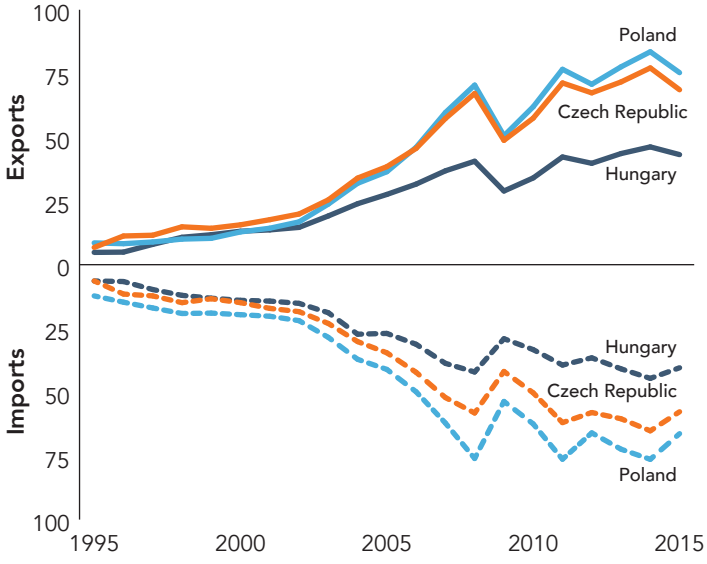
Germany is by far the main trading partner for Eastern European economies in both regional and global value chains, with most of the trade involving intermediate rather than final goods. The share of intermediate goods in total Eastern European exports to Germany fluctuated around 60% between 1995 and 2015. In the same period, Germany accounted for 30% of Poland's exports and 27% of its imports of manufacturing inputs. The shares for the Czech Republic stood at 36% and 32%. The two economies' main trade with Germany is in medium-technology intermediates related to chemicals (excluding pharmaceuticals), machinery and equipment, and motor vehicles. Furthermore, the comparable size of exports and imports of manufacturing inputs between the two economies and Germany ($55 billion and $48 billion in 2015) suggests the two-way trade usually found in supply chains, with Germany acting both upstream and downstream for its Eastern European partners.

Figure A2.1.2 highlights the divergence of final and intermediate exports from the Polish motor vehicles industry after 2009 and reveals a change in the position and role of Poland in European car production chains. Poland reduced its exports of final cars while developing a specialization in the upstream production of medium- and high-technology car parts. The production and export of final cars are facilitated by other European partners, such as the Czech Republic, that increasingly export automobiles for various foreign car makers to the European market ($4.5 billion in 2015, with a 2000–15 average growth rate of 8%).

Poland's upgrading along the production chain is also confirmed through its bilateral trade with Czech industries. Bilateral exports of manufacturing inputs between Poland and the Czech Republic increased rapidly between 2000 and 2015, at an average annual rate of 13.7%. Poland is a net exporter to the Czech Republic ($7.1 billion exports of manufacturing inputs versus $3.5 billion imports), and the Czech Republic's share in Poland's

FIGURE A2.1.1 Eastern European economies' trade of intermediate manufactured goods with Europe, 1995–2015

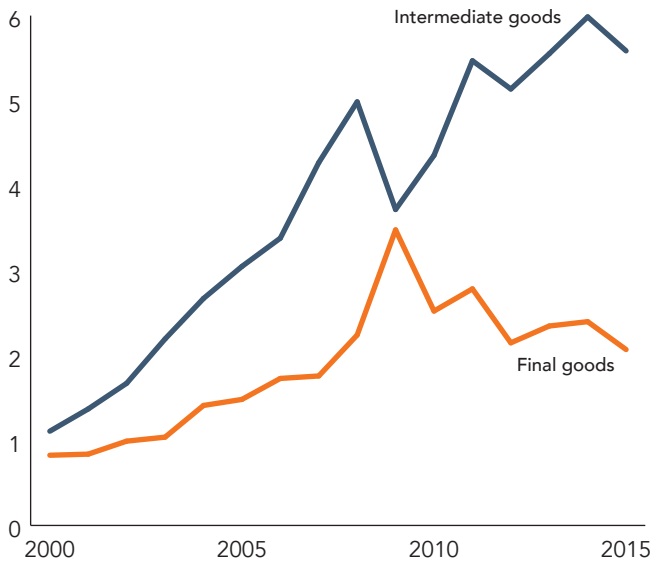
$ (billions)



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

FIGURE A2.1.2 Poland's exports of final and intermediate goods (motor vehicles) to Germany, 2000–15

$ (billions)



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

total exports of manufacturing inputs doubled during that period, reaching 8% in 2015.

In 2015 approximately 80% of the intermediate goods exchanged between the two countries relied on medium technologies. Between 2000 and 2015 a significant shift occurred between the medium–low and the medium–high technology inputs exchanged by the two economies. The share of medium–high goods Poland exported to the Czech Republic rose 13 percentage points while that of medium–low intermediate goods fell almost proportionally, reflecting a larger upgrade of Polish manufacturing industries in the European production chains than of its neighbor's manufacturing industries (figure A2.1.3). This is largely a result of the substantial increase in Poland's exports to the Czech Republic in motor vehicles and transport equipment. Exports from the two sectors rose by around 27% a year on average between 2000 and 2015, when they made up nearly 50% ($3.4 billion) of Poland's exports of manufacturing inputs to the Czech Republic.

The inverse evolution is observed for medium technology exports from the Czech Republic to Poland. Between 2000 and 2015 Czech industries gradually began to specialize in medium–low technology intermediate goods for export to Poland, and bilateral exports of medium–high technology goods fell. This is the typical situation in GVCs: partner countries specialize in industrial technologies and tasks that complement each other. Poland took the lead for the production and export of medium–high technology inputs, while the Czech Republic specialized in medium–low technology.

The share of high-technology intermediates in Czech exports to Poland increased between 2000 and 2015, reaching 4.2% of total inputs sent to Poland, thus reflecting a high level of specialization for some Czech companies and raising the potential of developing foreign market share.

The Czech Republic's exports to Poland are quite diversified, mainly machinery equipment, chemicals, and motor vehicles. The share of motor parts exports to Poland decreased drastically in 2000–15 as Poland took the lead and upgraded in that industry. In contrast, exports to Poland from the machinery sector (medium–low technology) increased 10-fold.

Rising role of Mexico in intra-NAFTA trade in intermediate manufactured goods

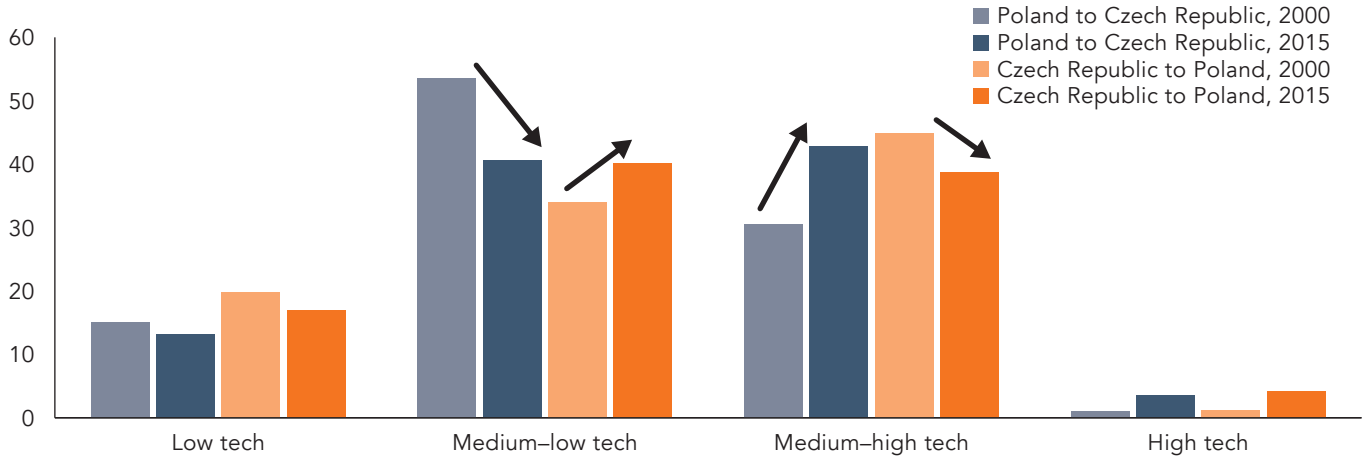
North American Free Trade Area (NAFTA) exports of manufacturing inputs for Canada, Mexico, and the United States were 52.6% in 2015, up from 45.4% in 1995, indicating that supply chains have been developed and consolidated.

One major feature of the evolution of intra-NAFTA trade is the growing role of Mexico in the exchange of manufacturing inputs among NAFTA countries (figure A2.1.4). Mexico's share in intra-NAFTA trade of intermediate goods increased continuously between 1995 and 2015, while Canada's share declined progressively and the U.S. share varied within a large range. Although the United States was the main destination of intra-NAFTA exports of industrial inputs over the period, with a 24.5% share in 2015, Mexico rose and surpassed Canada as the second export destination within NAFTA, receiving 15.3% of NAFTA exports of industrial inputs in 2015. Mexico's GVC-related trade in intermediate goods is essentially with the United States, with 83% of Mexico's exports in manufacturing intermediates destined for the United States in 2015.

Mexico developed its exports of inputs to the United States mainly in machinery and transport equipment, which accounted for 70.4% of Mexico's exports of intermediate manufactured goods to the United States in 2015 ($51 billion for machinery and $32 billion for transport equipment). Within machinery, the electrical machinery and apparatus sector

FIGURE A2.1.3 Bilateral exports of Poland and Czech Republic, by manufacturing technology, 2000 and 2015

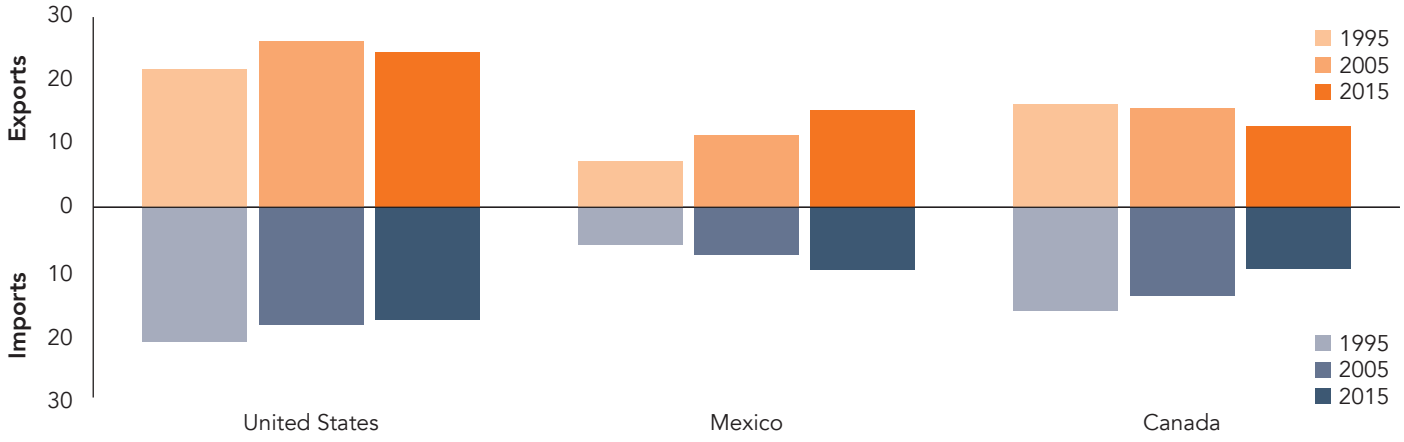
Share in total exports of intermediate manufactured goods (%)



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 3.

FIGURE A2.1.4 Intra-NAFTA trade in intermediate manufactured goods, by main destination and origin, 1995, 2005, and 2015

Share in total NAFTA trade (%)



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

amounted to half the exported intermediate goods in 2015. Exports of auto parts to the United States, $29 billion in 2015, had the fastest growth of all exporting industries to the United States in 2009–15, an annual average of 18.4%. In recent years Mexico supplanted Canada as the main provider of automotive components to the U.S. market. And Mexico's imports of auto parts from the United States grew at a similar pace (16.8% on average between 2009 and 2015), but at a slightly lower magnitude ($22 billion).

Mexico not only trades car components with the United States but also exports final vehicles. In 2015 Mexico became the world's seventh largest car producer and the largest in Latin America, with 3.4 million vehicles. A comparison of the growth of Mexico's car exports to the United States with its trade in car parts (import and exports) finds that the three trade flows followed similar upward trends, with average increases of 17–19% between 2009 and 2015 (figure A2.1.5). This highlights the interdependency between the export of final cars and the import of parts and accessories when growth in vehicle production inevitably leads to an increased demand for imports of car parts and a wider range of components for assembly companies.

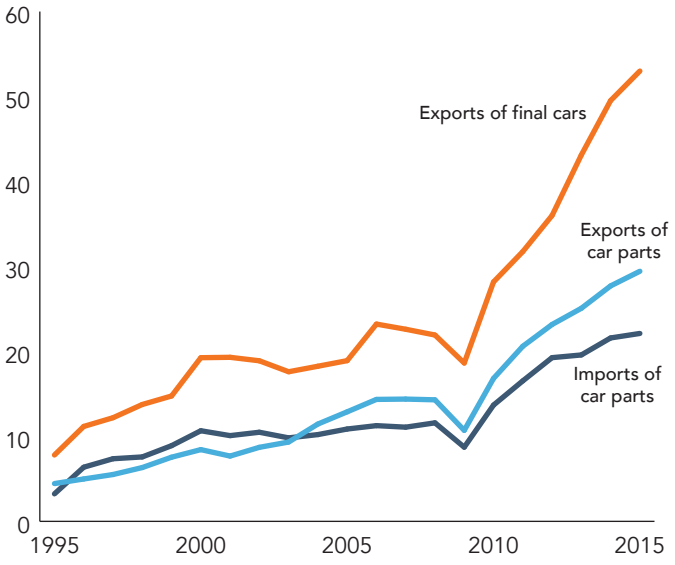
Shifts in the division of labor in Asian global value chains

Over the past two decades production networks in Asia have developed tremendously and have become increasingly fragmented, providing incentives and opportunities to less-industrialized economies to join the manufacturing process. For instance, labor-intensive assembling of final goods used to be the major comparative advantage of China, but such assembly is now being transferred out of China as emerging economies from the Association of Southeast Asian Nations have been increasingly integrated into Factory Asia.

China still runs large trade surpluses in final goods with EU countries and the United States, along with a trade deficit in intermediate goods with other industrial countries. But it has already become an important supplier of manufactured intermediate goods for many lower-wage countries in its neighborhood, such as Cambodia, India, Malaysia, Thailand, and Viet Nam. Similar to China, these emerging Asian economies all run surpluses

FIGURE A2.1.5 Mexico's trade with the United States in final and intermediate goods related to motor vehicles, 1995–2015

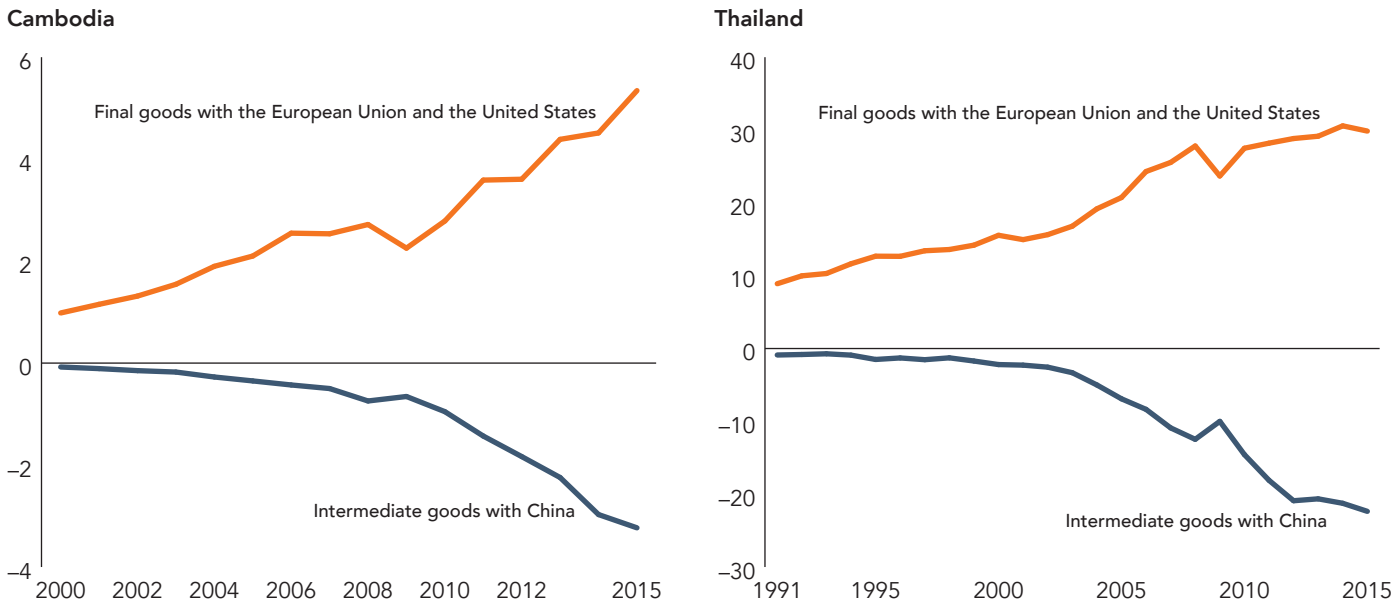
$ (billions)



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

FIGURE A2.1.6 Evolution of net trade in intermediate and final manufactured goods of Cambodia and Thailand with China, the European Union, and the United States, 2000–15 and 1991–2015

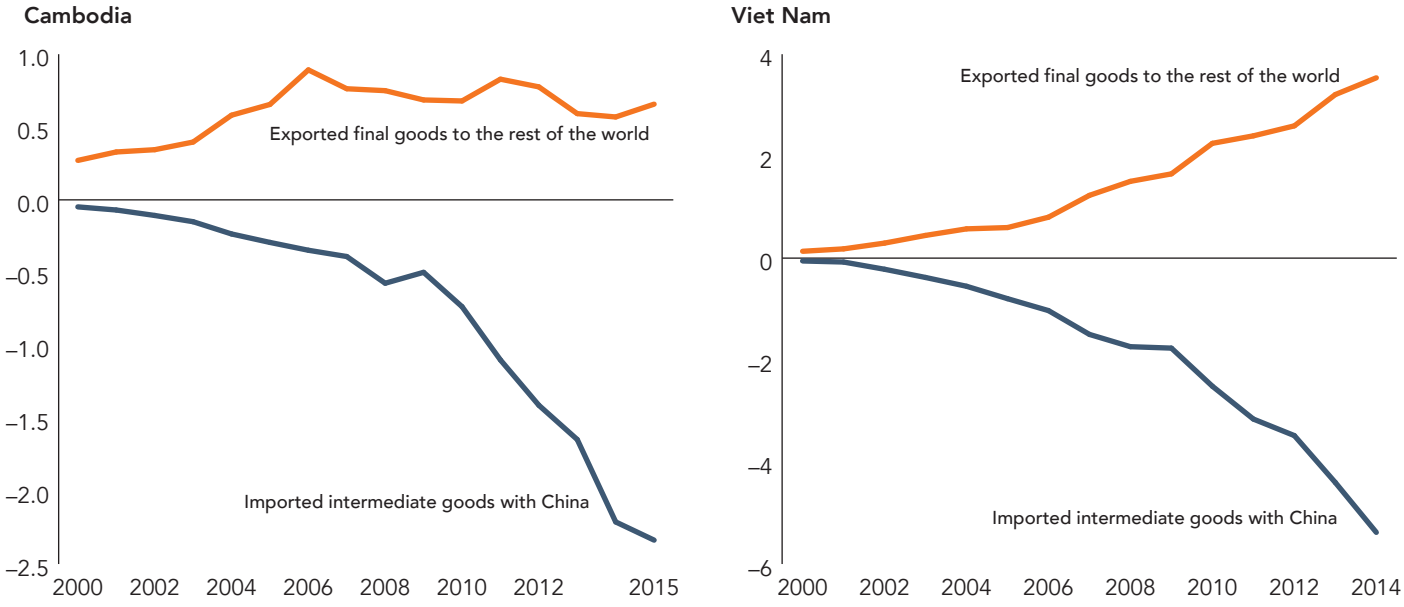
$ (billions)



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

FIGURE A2.1.7 Evolution of net trade in intermediate and final textile products of Cambodia and Viet Nam with China and the world, 2000–15

$ (billions)



Source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-use database, International Standard Industrial Classification, Revision 4 (2016 edition).

on manufactured final goods with the United States and EU countries (figure A2.1.6). Despite the fact that China is still a global center for the final assembly of numerous manufactured products, some labor-intensive final assembly activities have shifted to other low-cost economies.

Breaking down Asian trade by sector and end-use according to Organisation for economic Co-operation and Development technology intensity also reveals triangular trade relations (figure A2.1.7). Less developed economies, such as Cambodia, partnered with China in the textile industry, mainly by importing low-technology fabrics for manufacturing final goods for EU and U.S. consumer markets.

The level and type of industrial partnership between Southeast Asian economies and China depend on their endowment and stage of development. As illustrated in figure A2.1.7, low- and middle-income countries, such as Cambodia and Viet Nam, absorb labor-intensive manufacturing inputs from China for their production and export. Upper-middle-income countries, such as Malaysia and Thailand, and larger economies, such as India, tend to import medium–low or medium–high technology inputs from China since they have already upgraded in the chain and have the industrial capacity to produce and export high-technology products.

ANNEX 2.2
Key to country abbreviations and sector codes

TABLE A2.2.1 Country abbreviations

AUS	Australia	DNK	Denmark	IRL	Ireland	POL	Poland
AUT	Austria	ESP	Spain	ITA	Italy	PRT	Portugal
BEL	Belgium	EST	Estonia	JPN	Japan	ROM	Romania
BGR	Bulgaria	FIN	Finland	KOR	Korea, Rep.	RUS	Russian Federation
BRA	Brazil	FRA	France	LTU	Lithuania	SVK	Slovak Republic
CAN	Canada	GBR	United Kingdom	LUX	Luxembourg	SVN	Slovenia
CHN	China	GRC	Greece	LVA	Latvia	SWE	Sweden
CYP	Cyprus	HUN	Hungary	MEX	Mexico	TUR	Turkey
CZE	Czech Republic	IDN	Indonesia	MLT	Malta	TWN	Chinese Taipei
DEU	Germany	IND	India	NLD	Netherlands	USA	United States
						RoW	Rest of the world

Source: World Input-Output Database, 2013 release.

TABLE A2.2.2 Sector codes

1	Agriculture, hunting, forestry, and fishing
2	Mining and quarrying
3	food, beverages, and tobacco
4	Textiles and textile products
5	Leather, leather and footwear
6	Wood and products of wood and cork
7	Pulp, paper, paper, printing, and publishing
8	Coke, refined petroleum, and nuclear fuel
9	Chemicals and chemical products
10	Rubber and plastics
11	Other nonmetallic mineral
12	Basic metals and fabricated metal
13	Machinery, not elsewhere classified
14	Electrical and optical equipment
15	Transport equipment
16	Manufacturing, not elsewhere classified; recycling
17	Electricity, gas, and water supply
18	Construction
19	Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel
20	Wholesale trade and commission trade, except of motor vehicles and motorcycles
21	Retail Trade, except of motor vehicles and motorcycles; repair of household goods
22	Hotels and restaurants
23	Inland transport
24	Water transport
25	Air transport
26	Other supporting and auxiliary transport activities; activities of travel agencies
27	Post and telecommunications
28	Financial intermediation
29	Real estate activities
30	Renting of machinery and equipment and other business activities
31	Public administration and defense; compulsory social security
32	Education
33	Health and social work
34	Other community, social, and personal services
35	Private households with employed persons

Source: World Input-Output Database, 2013 release.

Notes

1. This means that the production of final goods and services can be classified as GVC production only when it is combined with foreign factor content (value added) or returned domestic value added. See backward industrial linkages based on the decomposition in Wang and others (2017a) for details. The production of foreign affiliates may also be considered a type of GVC activity since current residence-based national account rules treat all firms within national borders as domestic firms; therefore, they treat foreign affiliates' value-added creation as part of domestic GDP production. No intercountry input-output table currently exists that can be used to separate production activities between domestic firms and foreign affiliates. So the GDP decomposition method here may underestimate GVC production activities.
2. In David Ricardo's time, exports were 100% domestically produced value added, while today, foreign value added is always embodied in final product exports from a country; therefore, domestically produced value added becomes only a part of exports. However, using the decomposition method applied here, we are still able to compute the portion of "classical trade" analytically.

References

ADB (Asian Development Bank). Inter-Country Input-Output Tables (database). Mandaluyong, Philippines: ADB.

———. Multi-Regional Input-Output (MRIO) Tables (database). Mandaluyong, Philippines: ADB. Available at: http://www.wiod.org/otherdb#ADB.

Baldwin, R., and J. Lopez-Gonzalez. 2013. "Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses." National Bureau of Economic Research (NBER) Working Paper No. 18957, NBER, Cambridge, MA.

Baldwin, R., T. Ito, and H. Sato. 2014. *The Smile Curve: Evolving Sources of Value Added in Manufacturing*. Joint Research Program Series. Chiba City, Japan: Institute of Developing Economies–Japan External Trade Organization.

EC (European Commission). 2013. World Input-Output Database. Brussels: EC. Available at: http://www.wiod.org/release13.

———. 2016. World Input-Output Database. Brussels: EC. Available at: http://www.wiod.org/database/wiots16.

Hummels, D., J. Ishii, and K. Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of International Economics* 54 (1): 75–96.

Kawakami, M., and T. J. Sturgeon, eds. 2012. *The Dynamics of Local Learning in Global Value Chains: Experiences from East Asia*. London: Palgrave Macmillan.

Koopman, R., Z. Wang, and S-J. Wei. 2014. "Tracing Value-added and Double Counting in Gross Exports." *American Economic Review* 104 (2): 459–94.

Kowalski, P., J. Lopez-Gonzalez, A. Ragoussis, and C. Ugarte. 2015. "Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies." Organisation for Economic Co-operation and Development (OECD) Trade Policy Papers No. 179, OECD, Paris.

Meng, B., M. Ye, and S-J. Wei. 2017. "Value-added Gains and Job Opportunities in Global Value Chains." IDE Discussion Paper No. 668, IDE–JETRO, Chiba City, Japan.

Mudambi, R. 2008. "Location, Control, and Innovation in Knowledge-Intensive Industries." *Journal of Economic Geography* 8 (5): 699–725.

OECD (Organisation for Economic Co-operation and Development). 2016. Bilateral Trade in Goods by Industry and End-use (BTDIxE) database, International Standard Industrial Classification of All Economic Activities (ISIC), Revision 3. Paris: OECD. Available at: http://stats.oecd.org/Index.aspx?DataSetCode=BTDIXE_I3.

OECD (Organisation for Economic Co-operation and Development), WTO (World Trade Organization), and World Bank. 2014. *Global Value Chains: Challenges, Opportunities, and Implications for Policy*. Report prepared for submission to the G20 Trade Ministers Meeting, Sydney, July 29.

Pietrobelli, C., and R. Rabellotti. 2010. "Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?" Working Paper Series 232, IDE, Chiba City, Japan.

Richard, R., and J. Lopez-Gonzalez. 2013. "Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses." NBER Working Paper No. 18957, NBER, Cambridge, MA.

Shih, S. 1996. *Me-Too is Not My Style: Challenge Difficulties, Break through Bottlenecks, Create Values*. Taipei: The Acer Foundation.

Timmer, M., B. Los, R. Stehrer, and G. de Vries. 2016. *An Anatomy of the Global Trade Slowdown based on the WIOD 2016 Release*. Groningen Growth and Development Centre Research Memorandum 162. Groningen, Netherlands: University of Groningen.

UIBE (University of International Business and Economics). Global Value Chain Index database. Available at: http://139.129.209.66:8000/d/daedafb854/.

UNCTAD (United Nations Conference on Trade and Development). 2013. *World Investment Report 2013—Global Value Chains: Investment and Trade for Development*. New York and Geneva: UN.

Wang Z., S. Wei, X. Yu, and K. Zhu. 2017a. "Measures of Participation in Global Value Chain and Global Business Cycles." NBER Working Paper No. 23222, NBER, Cambridge, MA.

———. 2017b. "Characterizing Global Value Chains: Production Length and Upstreamness." NBER Working Paper No. 23261, NBER, Cambridge, MA.

World Bank. World Development Indicators (database). Washington, DC: World Bank. Available at: http://data.worldbank.org/data-catalog/world-development-indicators/.

Xiao, H., T. Sun, B. Meng, and L. Cheng. 2017. "Complex Network Analysis for Characterizing Global Value Chains in Equipment Manufacturing." *PLoS ONE* 12 (1): e0169549.

Xing, Y., and H. Detert. 2010. "How the iPhone Widens the United States Trade Deficit with the People's Republic of China." Working Paper 257, Asian Development Bank Institute, Tokyo.

Ye, M., B. Meng, and S. Wei. 2015. "Measuring Smile Curves in Global Value Chains." IDE Discussion Paper No. 530, IDE–JETRO, Chiba City, Japan.

CHAPTER 3

From domestic to regional to global: Factory Africa and Factory Latin America?

NADIM AHMAD AND ANNALISA PRIMI

Global value chains (GVCs) have been drivers of growth in developed and emerging economies for many years, perhaps best characterized by China's experience. Export-driven growth is about generating higher overall value added, employment, and income through more efficient (and, ideally, higher productivity) production. The process of generating higher value added is typically referred to as upgrading. But the scale of integration within GVCs has varied, with many low-income countries, particularly in Sub-Saharan Africa, integrating only at the primary (commodity) part of the value chain, with little diversification or upgrading to higher value-added activities. And unlike most other regions—particularly Europe, North America, and Southeast Asia—Sub-Saharan Africa and, to a lesser extent, South America show little intraregional integration. In part, that reflects thick borders that add to trade costs, especially in landlocked African economies, but it also reflects a "spaghetti bowl" of regional trade agreements.[1] Better trade facilitation measures—such as establishing a single window for customs clearance, reducing tariffs, improving transport and logistics—are policy levers that governments can pull to deepen regional and global connectivity within value chains and to facilitate upgrading within firms.

The development of the Organisation for Economic Co-operation and Development–World Trade Organization (OECD–WTO) Trade in Value-Added database, and similar initiatives such as the World Input-Output Database, have transformed the ability to understand integration and assess the benefits of integration into GVCs. But while the literature on GVCs has generated a rich new vocabulary that describes the various forms of upgrading, the terms can in turn be misunderstood. At least on the surface, the various forms of upgrading have also presented a conundrum to policymakers. The evidence reveals the importance of having access to cheap and efficient imports for exports. In most countries and industries around the world, the foreign content of exports has risen considerably over the past two decades. But upgrading can also involve the development of strong domestic upstream supply chains to exporting firms. In simple terms, therefore, the policy conundrum is whether to emphasize increasing the foreign content or the domestic content of exports.

This chapter provides a brief overview of upgrading and GVC terminologies, providing insights on interpretability pitfalls. It offers evidence of the complementarities between strong domestic supply chains and imports and then demonstrates the importance of strong regional value chains for integration at a global level. And to illustrate the complementarities, it ends with examples of broad and targeted policies that countries are implementing for the motor vehicle value chain.

What is upgrading?

The concept of upgrading has its origins in international trade theory, where it indicates a shift toward the production of higher value goods. But with the increasing international fragmentation of production, the definition has incorporated the notion that goods are produced through a combination of specific tasks within a value chain, each generating a proportion of the good's overall value. This has given rise to the term "moving up the value chain," whereby firms upgrade by engaging in a task within

the value chain that extracts a higher share of the overall value of the good (higher value added), typically referred to as functional upgrading.

Functional upgrading

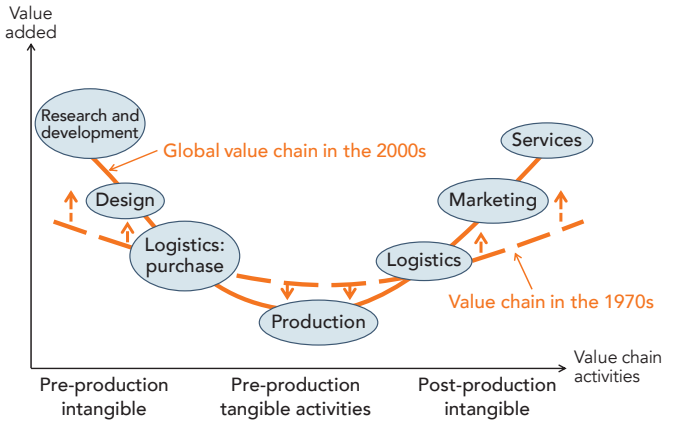
Functional upgrading is usually associated with higher labor productivity, since the move to a higher value part of the chain typically (but not always) requires higher skills. Notwithstanding the high correlation between productivity growth and profit growth, profit remains the primary driver for where firms position themselves in the value chain. From the perspective of the firm, upgrading may involve a move to a part of the value chain where relative labor productivity is lower but profits are higher. Indeed, a firm may take a lower overall part of the value of the final good at the end of the chain (even if overall sales of the final good remain unchanged). That is one reason why care is needed when deriving messages on upgrading using data on the domestic value-added content of output.

Upgrading also has implications for social cohesion and overall economic growth. Thus the country perspective on upgrading may differ from the firm perspective, a point often overlooked. Upgrading can result in higher profits and higher employment creation for the firm but lower overall productivity and lower overall GDP. For a country, however, the driver for functional upgrading is to increase GDP, as well as labor productivity and employment. Government intervention to ensure that upgrading occurs in a way that incentivizes the firm to upgrade to a higher skilled (higher labor productivity) part of the value chain can thus affect outcomes. For example, high tariffs on imports of capital goods could push firms to activities with low capital intensity (typically low labor productivity) and thus with lower domestic value added in order to maximize profits.

Partly for these reasons, care is needed in interpreting the "smile curve" developed by Acer's CEO Stan Shih to illustrate the position of Chinese Taipei in the electronics value chain. The smile curve accurately describes the decomposition of value of a given product into the underlying stages (tasks) of production (at least for typical manufactured products; figure 3.1). But it does not follow that firms will necessarily seek to position themselves in tasks at the extreme ends of the curve, typically those that extract a higher share of the overall value.

The same holds for the national perspective. Countries clearly would like firms to position themselves at the higher value ends of the curve, since these are typically the tasks associated with higher labor productivity, but other considerations are also in play. Countries with a focus on higher social inclusion and lower inequality, for example, may want firms to position themselves in the higher employment part of the curve, particularly if that is where they have a comparative advantage and if doing so results in high volumes of output—recall that where to position along the value chain is as much a volume game (sales) as a ratios game (share of overall value). In addition, a low share of the overall value of a product does not necessarily equate with low productivity. There are examples of specialized and capital-intensive niche activities with high labor productivity in the manufacturing part of the value chain. Indeed, in many OECD economies, labor productivity is typically higher in manufacturing (often the low value part of the smile curve) than in business services (typically at the extreme ends; figure 3.2).

FIGURE 3.1 The smile curve of the global value chain, 1970s and 2000s

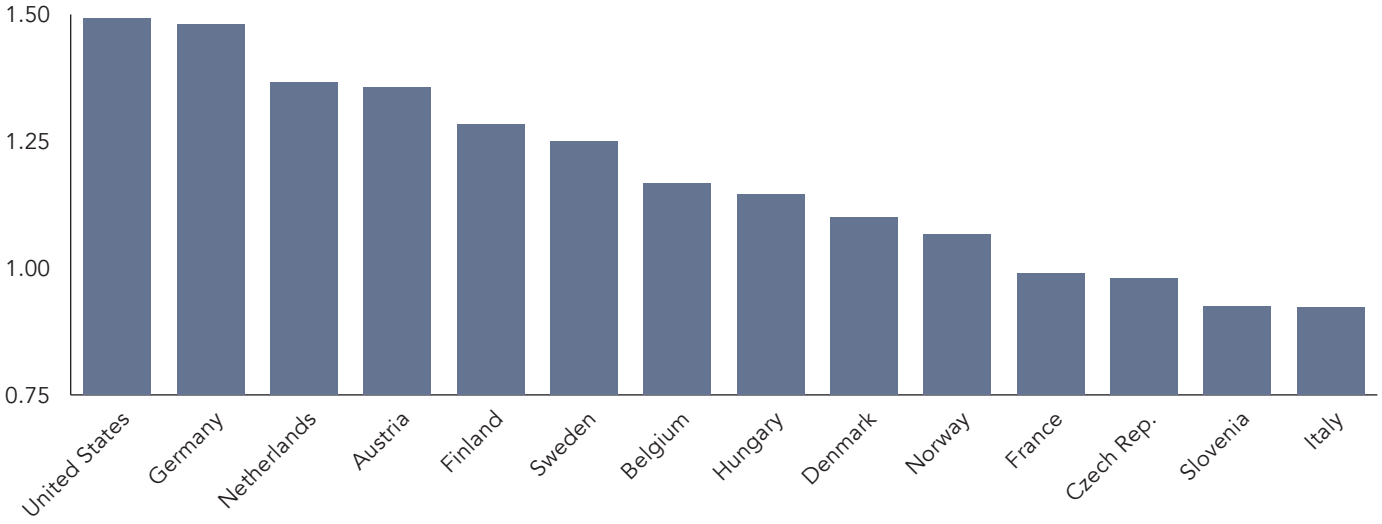


Source: Author's analysis based on Shih 1996 and Gereffi, Humphrey, and Sturgeon 2005.

Functional upgrading goes beyond existing firms moving to different parts of the value chain. In a national context, it can also occur as new firms enter the market, often through new supply chains driven by lead firms (generally foreign affiliates) that provide (easier) indirect access to international markets for these new (upstream) entrants. Additional value is thus created through upstream domestic supply chains. Lead firms can also encourage incumbents to upgrade through process and product upgrading facilitated by technology and human capital spillovers from the lead firms. Typically, this process results in higher overall domestic value-added content of exports within a specific value chain as new entrants and incumbents, capitalizing on comparative advantages (such as proximity), displace less competitive foreign imports. This process highlights the one-time complementarity between importing for exports and eventually creating upstream supply chains.

The data point to this type of upgrading for textiles in China, although not unambiguously, as the data may also point to other forms of upgrading, including the more general case of functional upgrading.[2] For example, the foreign content of China's textile exports fell from 43% in 1995 to 26% in 2011. Some of that content was displaced by the Chinese textiles industry, but by far the biggest contributor was the Chinese service sector, which displaced upstream foreign services providers (figure 3.3). Indeed, the Chinese textile industry's contribution to the value of gross textile exports remained broadly steady (suggesting limited classic functional upgrading in the firm or sector), but its share of domestic value added in textile exports fell from just under 50% in 1995 to just over 40% in 2011, as Chinese firms began to occupy other parts of the GVC for textiles.

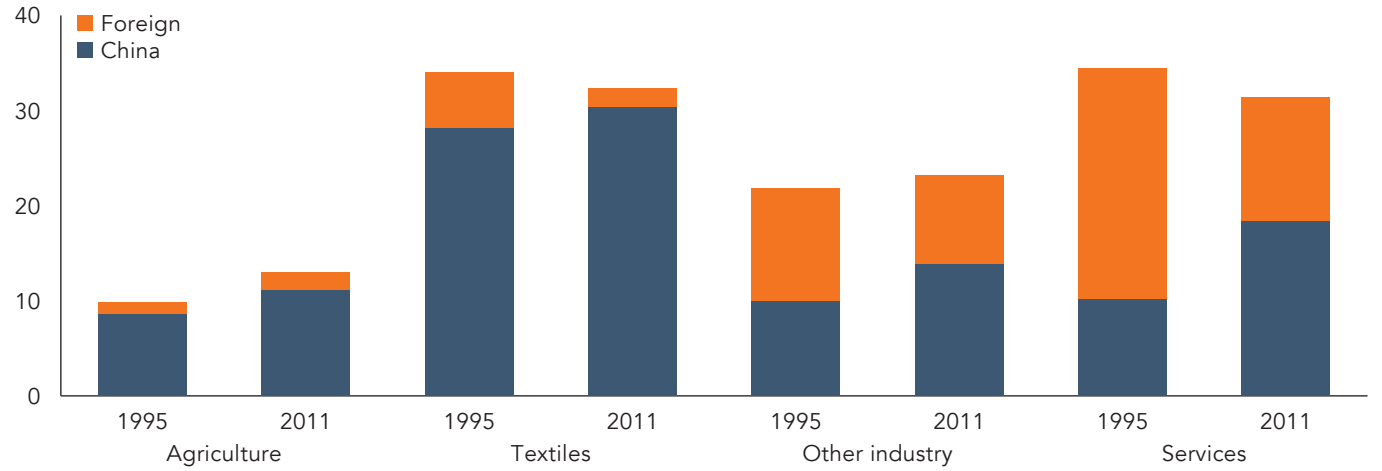
FIGURE 3.2 Labor productivity: Manufacturing relative to business services in selected Organisation for Economic Co-operation and Development countries, 2010



Source: Author's analysis based on Shih 1996 and Gereffi, Humphrey, and Sturgeon 2005.

FIGURE 3.3 China's exports of textiles, by origin of value added, 1991 and 2011

Percent



Source: Author's analysis based on Organisation for Economic Co-operation and Development–World Trade Orgnization Trade in Value-Added database.

Product upgrading

Another mechanism for upgrading is by producing higher value products (product upgrading), as the firm seeks to increase profits through sales of higher value products rather than moving to a different part of the value chain. This typically manifests itself as higher domestic value-added content through price rather than displacement (of imports) effects, as well as higher labor productivity. The aggregated Trade in Value-Added database–type measures of trade make it difficult to observe this type of upgrading. But analyses of detailed merchandise trade statistics can provide insights—for example, by looking at the (growing) diversification of products (and relative unit value prices) within a particular product group and country.

Process upgrading

Process upgrading typically refers to improved production methods that more efficiently transform intermediate inputs into final products, particularly through innovations in the production process or new technologies (see, for example, Humphrey and Schmitz, 2000, 2002, 2004). In theory, this type of upgrading should also generate higher domestic value content of production and higher labor productivity, since fewer intermediate

inputs are needed, especially if the innovations are related to knowledge-based capital that allows for higher rent extraction. Again, this can manifest itself as upgrading in upstream domestic suppliers that respond to competition from foreign producers.

Intersectoral upgrading

Another common form of upgrading is intersectoral, extracting higher value by entering new product value chains. For example, Chinese Taipei used its competence in producing televisions to make monitors and eventually (through functional upgrading) to make computers (Humphrey and Schmitz 2002).

Integration for growth: Imports for exports

The ability of firms to organize production processes into discrete tasks has transformed the nature of trade and the scope for firms (and countries) to participate in global production networks. This reorganization of global production has opened opportunities not only for multinational companies and leading exporting firms in advanced economies, but also for firms in emerging and developing economies. Firms in advanced economies are able to outsource to more cost-competitive countries, while emerging and developing economies can enter GVCs by taking advantage of a new tradable commodity in which they have comparative advantages—namely labor.

This is intuitive for firms that are able to source cheaper inputs, but concerns remain that the reallocation of resources induced by such changes may work imperfectly. Although debate continues on the benefits of trade for economic growth, the growing body of evidence points to a positive relationship between increases in imported intermediates and increases in competitiveness and indeed in exports at a broader level. This positive association has been demonstrated to occur through two channels: through the use of a greater variety of intermediates (also more competitively priced) and through technology transfers embodied in the imported products, which is also seen in the greater boost to productivity through imports from developed economies (Bas and Strauss-Kahn 2014). Similarly, a positive relationship has been found between imports and GDP, though with gains distributed unevenly across sectors (Kummritz 2014).

Further evidence of a positive relationship comes from a study using OECD–WTO Trade in Value-Added database data on foreign and domestic value added embodied in exports that relates changes in domestic value added in exports to structural and policy factors (Kowalski and Lopez-Gonzalez 2016; see annex 3.1 for a full description of the variables and data sources).[3] The study controls for structural determinants using the ratio of capital to labor, the intensity of skill, and the country's relative productivity. The policy determinants are the quality of domestic institutions, revealed investment openness, and trade policy stance. To identify the role of foreign inputs, the study takes foreign value added (by sector) to produce exports but with a temporal lag to avoid mechanical associations or reverse causality with the dependent variable.[4] The study also includes a measure of geographic spillovers from neighboring countries (the distance-weighted domestic value added in final demand of partner countries) and a measure of domestic demand linkages, which help control for the size of the economy (captured indirectly through the domestic value added used for final domestic consumption).[5]

Strong domestic supply chains and strong international supply chains drive export growth

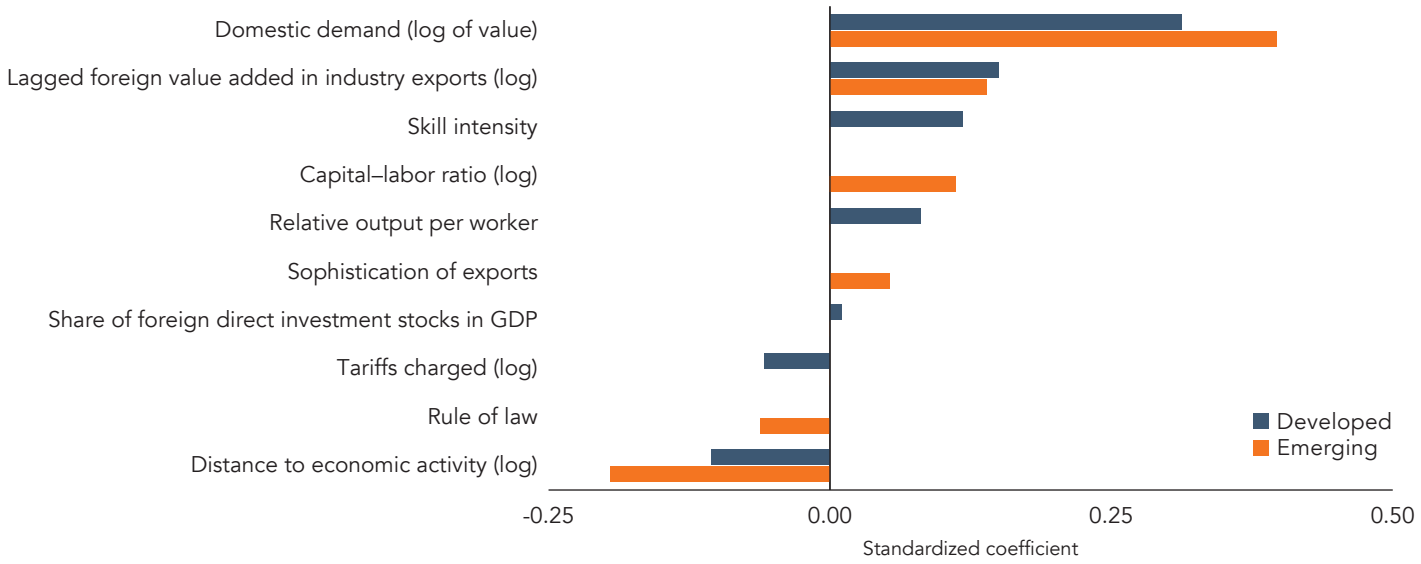
Demand linkages with the domestic economy, proxied through the domestic value added of a sector in domestic demand, is the most significant determinant of growing domestic value added in exports for both developed and emerging economies (figure 3.4). But foreign value added used in the production of exports is the second most significant component in developed economies and the third most significant in emerging economies, clearly illustrating the complementary nature of imports for export growth. For example, in emerging economies a 1 percentage point increase in the import content of exports translates into roughly a 0.1 percentage point increase in the value of exported domestic value added. Distance to economic activity (measured as the distance-weighted domestic value added in the final demand of partner countries) is also an important determinant of value added in exports. But it is almost twice as important in emerging economies as in developed economies, possibly capturing the constraints imposed from less developed transportation networks. Tariffs, even if low, also have an impact in developed economies and marginally (albeit not statistically significant) in emerging economies (see table A3.1.1 in annex 3.1).

Not all drivers affect emerging and developed economies equally

There are also some differences in significant factors between emerging and developed economies.[6] For example, the production of more sophisticated products (even though this may capture only insertion in processing parts of the value chain) is associated with growing domestic value added in exports in emerging economies only, while skill intensities are significant in developed economies only, likely reflecting the differing nature of integration between the two types of economies (see figure 3.4). Increases in capital–labor ratios are also an important determinant in emerging economies but not in developed economies. On the surface, this may point to low wages as an important determinant of integration in emerging economies, but the result is more nuanced.

Capital–labor ratios can also be loosely proxied by the inverse of unit labor costs, which in turn reflect the ratio of average compensation costs divided by average productivity.[7] The covariance with productivity may partly explain why productivity on its own was not a significant determinant for emerging economies. But the key point is that it is not average wages alone that determine integration in emerging economies but the combination of wages and productivity. And the higher the unit labor costs (the lower the capital–labor ratio), the lower the degree of

FIGURE 3.4 Significant determinants of a change in domestic value added in exports for developed and emerging economies



Source: Kowalski and Lopez-Gonzalez 2016.

Note: The figure shows the standardized coefficients of the determinants of changes in domestic value added in exports across agriculture, manufacturing, and services. The regression results are in table A3.1.1 in annex 3.1. No significance was found for depth of free trade agreements, share of exports covered by free trade agreements, or concentration of exports.

export-driven growth (and in turn integration). This result may in part explain why economies with an abundance of unskilled cheap labor still struggle to integrate in GVCs, despite rising wages in other parts of the world. For example, despite a four-fold increase in average wages in China between 2000 and 2010, its unit labor costs (at the economy level) were little changed and remained significantly below those in most economies in Africa (table 3.1). And Sub-Saharan African economies that generally saw little change in average wages between 2000 and 2010 still had high unit labor costs relative to other countries (figure 3.5).

Nor do the drivers affect all sectors equally

A similar pattern emerges at the sectoral level, but the importance of foreign inputs for manufacturing exports is more stark (figure 3.6), while domestic (demand) linkages are most important for the services sector (reflecting the importance of integration by services as upstream suppliers to manufacturers).[8] Perhaps not surprising, given the limited role of foreign intermediates in services, foreign inputs are less important for services. Structural factors such as relative output per worker are also important, but skill intensity does not appear to be significant for services, though it is difficult to discount the possibility that this may to some extent reflect an aggregation effect that cannot differentiate between underlying high-skilled workers (such as software developers) and low-skilled workers (such as cleaners) within the industry grouping, as well as the different nature of the underlying integration process.

Promoting the creation of more sophisticated products has a positive effect only on manufacturing activities (not services), and surprisingly this is also the case for share of foreign direct investment (FDI) stocks in GDP, though that may reflect differences in the outward orientation of inward FDI (FDI in manufacturing to serve export markets as opposed to FDI in services to serve domestic markets, including final demand). As for emerging and developing economies, tariffs on imports also act as a drag on domestic value added in exports at the sectoral level, including the services sector, reflecting that in most economies upstream services content accounts for around a third of the value added of manufactured exports. Puzzlingly, increasing the share of exports covered by free trade agreements does not appear to lead to increased exports of value added.

Domestic supply chains are an important stepping stone for improving participation in global value chains

An important result of Kowalski and Lopez-Gonzalez's (2016) study relating changes in domestic value added in exports to structural and policy factors is the co-incidence of domestic demand (a proxy for internal domestic supply chains) and foreign inputs in export-driven growth, highlighting the complementarity of the two for export growth. Further evidence of this complementarity is provided by Beverelli and others' (2016) study of the relationship between upstream domestic supply chains and the foreign value added of exports (as a measure of GVC participation). They found a robust relationship between domestic value chains and future participation in GVCs. The study estimated that a 1 percentage point increase in domestic integration raises GVC backward integration by 0.5% over the short run.

TABLE 3.1 Average wages and unit labor costs in manufacturing in selected developing and emerging economies, 2000 and 2010

Region and country	2000		2010	
	Average wages (U.S. dollars)	Unit labor cost (ratio of average wages to GDP per capita)	Average wages (U.S. dollars)	Unit labor cost (ratio of average wages to GDP per capita)
Sub-Saharan Africa				
Burundi	—	—	3,261	14.9
Cameroon	3,088	5.3	—	—
Ethiopia	771	6.3	807	2.4
Ghana	1,832	4.9	—	—
Kenya	2,118	5.2	2,854	3.6
Malawi	436	2.8	2,045	5.7
Mauritius	3,254	0.8	6,285	0.8
Senegal	3,680	7.8	6,450	6.5
South Africa	7,981	2.6	12,331	1.7
Tanzania	2,296	7.5	1,581	3.0
North Africa				
Egypt	2,028	1.3	3,453	1.2
Morocco	4,123	3.2	6,654	2.4
Tunisia	4,066	1.8	5,455	1.3
Latin America				
Brazil	5,822	1.6	10,918	1.0
Colombia	4,096	1.6	4,680	0.8
Mexico	8,048	1.2	7,310	0.8
Asia				
Bangladesh	—	—	680	1.6
China	1,016	1.1	4,770	1.1
India	1,356	3.0	2,619	1.8
Indonesia	929	1.2	1,897	0.6
Malaysia	4,405	1.1	6,548	0.7
Viet Nam	—	—	1,727	1.3
Eastern Europe				
Czech Republic	3,964	0.7	12,673	0.7
Latvia	3,689	1.1	9,191	0.8
Poland	5,829	1.1	10,162	0.8

Source: Ceglowski and others 2015.

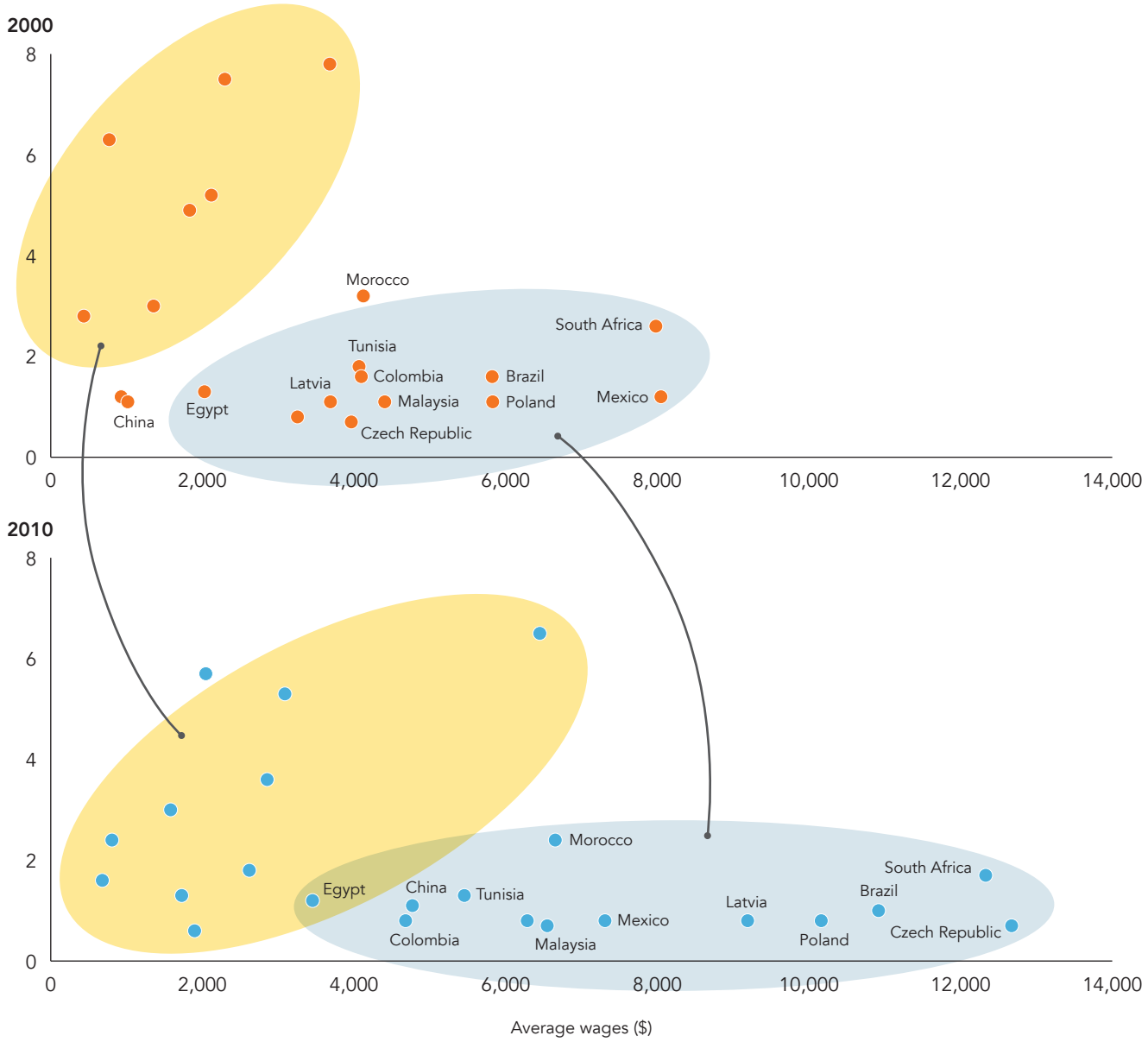
Note: — is not available.

Regional value chains as enablers of integration into global supply chains

The analysis so far offers two takeaway messages for countries looking to drive growth through integration in global value chains. The first is that imports can be an important driver of export growth. The second is that strong domestic supply chains provide an important launching pad for integration at a more global level. But another important takeaway message, often overlooked in the debate on GVCs, is that it matters where a country is located: it matters who its trading partners are, especially how integrated the partners are into regional and global value chains, and how far the country is from poles of economic activity (including markets). The composition of firms within an economy also matters. In most economies, particularly emerging economies, the majority of firms are small or medium size. The

FIGURE 3.5 Evolution of unit labor costs and average wages, 2000 to 2010

Unit labor costs (ratio of average wages to GDP per capita)



Source: Ceglowski and others 2015.

Note: Unit labor costs are the ratio of average wages to per capita GDP.

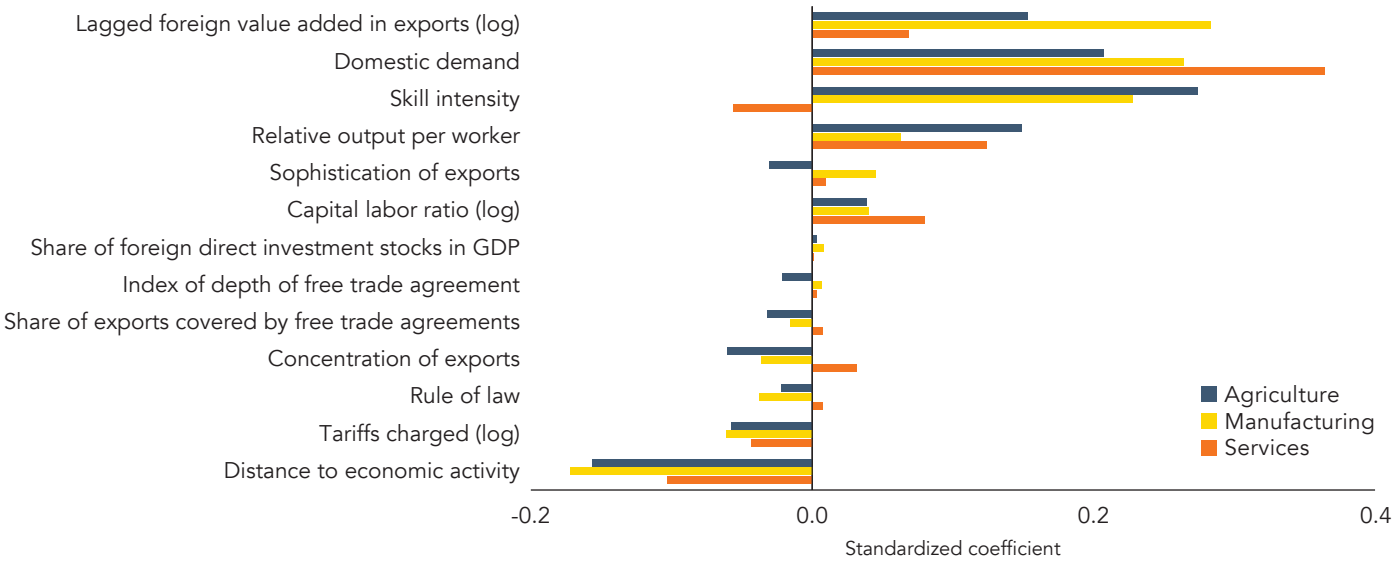
evidence points strongly to a lower likelihood of direct engagement in trade the smaller the firm, reflecting additional barriers—lower probability of financing, lower economies of scale, higher relative fixed costs in dealing with regulation, and so on.

The fact that geography matters, coupled with the fact that strong domestic supply chains are important enablers of integration into global supply chains, leads the debate toward regional value chains as enablers. Currently the best statistical tool used to measure GVC integration comprehensively is the OECD–WTO Trade in Value-Added database, which has data on 63 countries. It provides strong evidence of increased integration in GVCs in most economies based on foreign value added in exports, backward linkages, forward linkages, domestic value added in other countries' exports, and standard GVC participation indices (figure 3.7).

Intraregional integration is unequal—and poor in Africa and Latin America

Although the coverage of countries in the OECD–WTO Trade in Value-Added database reflects a significant proportion of world output and world trade, it remains patchy in many regions,

FIGURE 3.6 Determinants of change in domestic value added in exports, by sector

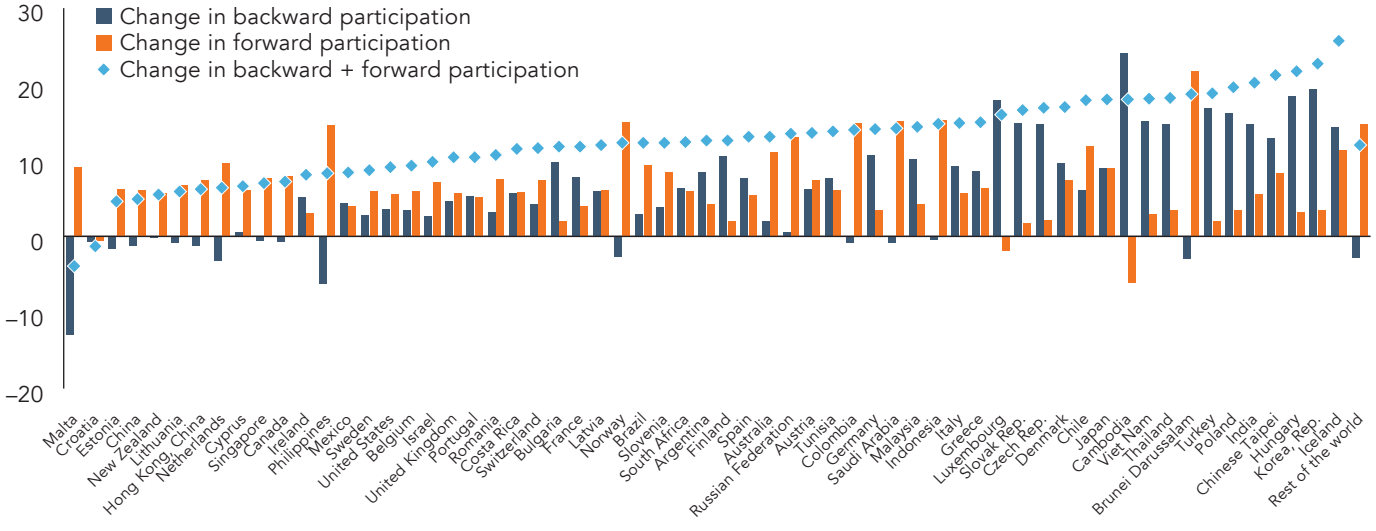


Source: Kowalski and Lopez-Gonzalez 2016.

Note: The figure shows the standardized coefficients of the determinants of changes in the domestic value added in exports across agriculture, manufacturing, and services. The regression results are in table A3.1.1 in annex 3.1.

FIGURE 3.7 Changes in measures of integration into global value chains between 1995 and 2011 for the 63 economies in the Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database

Change (percentage points)



Source: Author's analysis based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database.

notably Africa and Latin America. That limits its ability to provide insights on the nature of regional value chains. And where evidence does exist, it points strongly to very weak regional participation (intraregional trade) outside Asia, Europe, and North America relative to extraregional trade (figure 3.8).

For regions not covered, notably for Africa, conventional (gross trade) statistics provide similar messages of weak regional integration (figure 3.9).

Moreover, where integration does occur, it is very much at the low-value end of GVCs for low-income countries, with exports of natural resources a significant form of integration and imports of intermediate parts generally satisfying domestic demand (figure 3.10).

Poor integration is stifling convergence

Many countries that have integrated into GVCs have found themselves "captive participants," experiencing difficulties in scaling up as a result of being locked into low-value tasks or as providers of commodities at the beginning of the value chain. With seemingly limited ability to upgrade or diversify, they are often hostage to price competition that keeps wages low or to the vagaries of commodity prices (the resource curse). And this low-value form of integration appears to have, at least in part, inhibited greater improvement in economic convergence and stymied the upgrading process (figure 3.11). Most African economies, for example, have experienced only a 0–2 percentage point increase in GDP per capita in the last two decades relative to U.S. levels (although in some cases this amounts to doubling relative GDP per capita and sometimes even more, as in Angola's case).

The stylized fact that a limited ability to integrate has gone hand in hand with limited income convergence can also be seen in measures of economic complexity, which provide a broad indication of a country's upgrading (relative to other countries; Hausmann and others 2011).[9] Most African economies show little change in ranking on these measures over the last two decades (where 1 indicates the highest complexity and 124 the lowest). Notable exceptions are North African economies, reflecting, at least in part, their geography—their proximity to European markets and value chains (figure 3.12).

The pattern is similar in Latin America and the Caribbean, with gains generally observed only in economies that improved their integration into North American value chains, such as Costa Rica (figure 3.13).

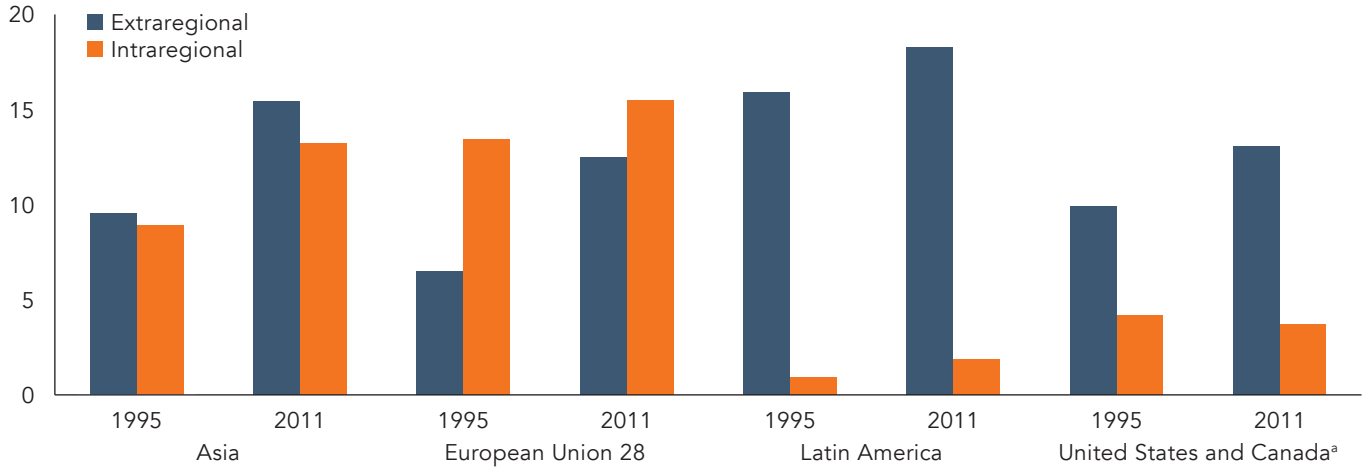
This contrasts starkly with countries in Asia and former transition economies in Eastern Europe (figure 3.14).

There is a positive correlation between change in economic complexity ranking over the last two decades (where a negative entry reflects greater economic complexity) and change in the foreign content of exports for countries with a more than 5 percentage point change in the foreign content of exports (figure 3.15).[10] But for countries with a smaller change in foreign content, the data point to a negative correlation.

Important here is the relative performance of countries in regions not well covered in the Trade in Value-Added database and how representative they may be for their regions as a whole: Argentina, Brazil, Chile, Colombia, and Costa Rica for Latin America and Saudi Arabia, South Africa, and Tunisia for the

FIGURE 3.8 Intraregional and extraregional value chains, by region, for the 63 economies in the OECD–WTO Trade in Value-Added database, 1995 and 2011

Foreign value added content of gross exports as percent of total value added in exports



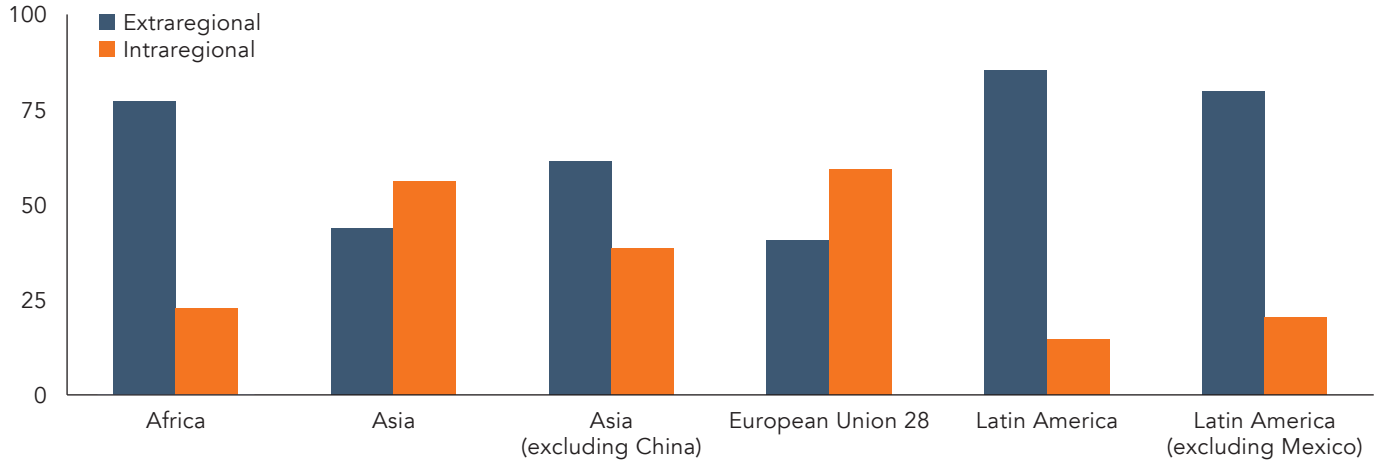
Source: Author's analysis based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database.

Note: The regional classification is limited to countries in the Trade in Value-Added database. Asia includes Brunei Darussalam; Cambodia; Hong Kong, China; India; Israel; Japan; the Republic of Korea; Malaysia; the Philippines; Saudi Arabia; Singapore; Chinese Taipei; Thailand; Turkey; and Viet Nam. Latin America includes Argentina, Brazil, Chile, Colombia, Costa Rica, and Mexico.

a. A significant share of extraregional trade reflects trade with Mexico.

FIGURE 3.9 Extraregional and intraregional trade in intermediates, 2014

Percent of total intermediates trade

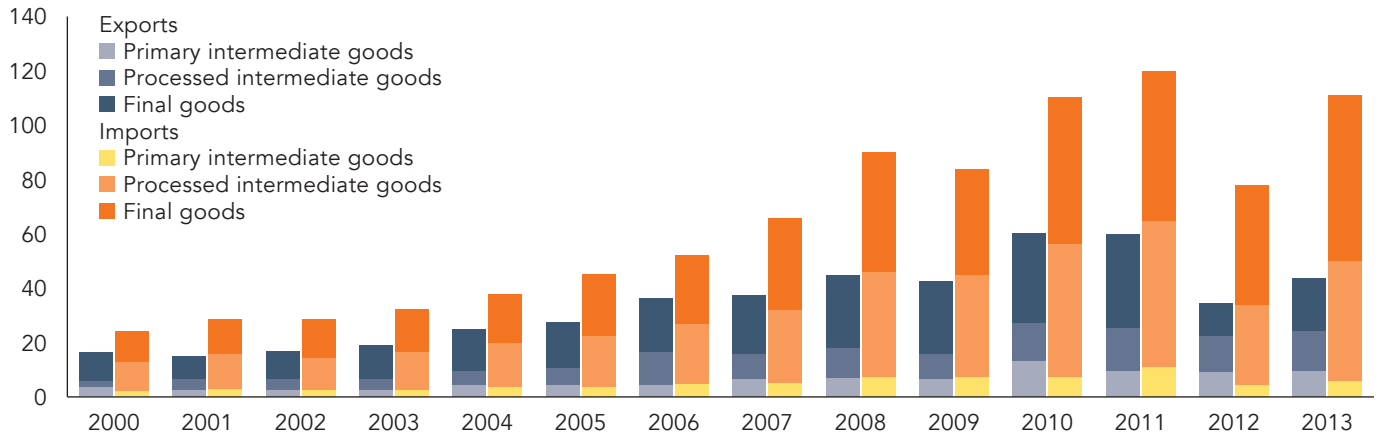


Source: Author's analysis based on data from the UN Comtrade database for Africa and Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database for other regions.

Note: Trade in intermediates is defined as total trade (the sum of gross exports and gross imports) in the sectors classified as primary and processed food and beverages destined mainly for industry, other industrial supplies, fuels and lubricants other than processed motor spirits, and parts and accessories for capital goods and transport equipment. The composition of macro-geographic (continental) regions follows the UN methodology (http://unstats.un.org/unsd/methods/m49/m49regin.htm). Countries in the Trade in Value-Added database, by region, are as follows: Asia includes Brunei Darussalam; Cambodia; Hong Kong, China; India; Israel; Japan; the Republic of Korea; Malaysia; the Philippines; Saudi Arabia; Singapore; Chinese Taipei; Thailand; Turkey; and Viet Nam. Latin America includes Argentina, Brazil, Chile, Colombia, Costa Rica, and Mexico.

FIGURE 3.10 Composition of trade in low-income countries by intermediate and final goods, 2000–13

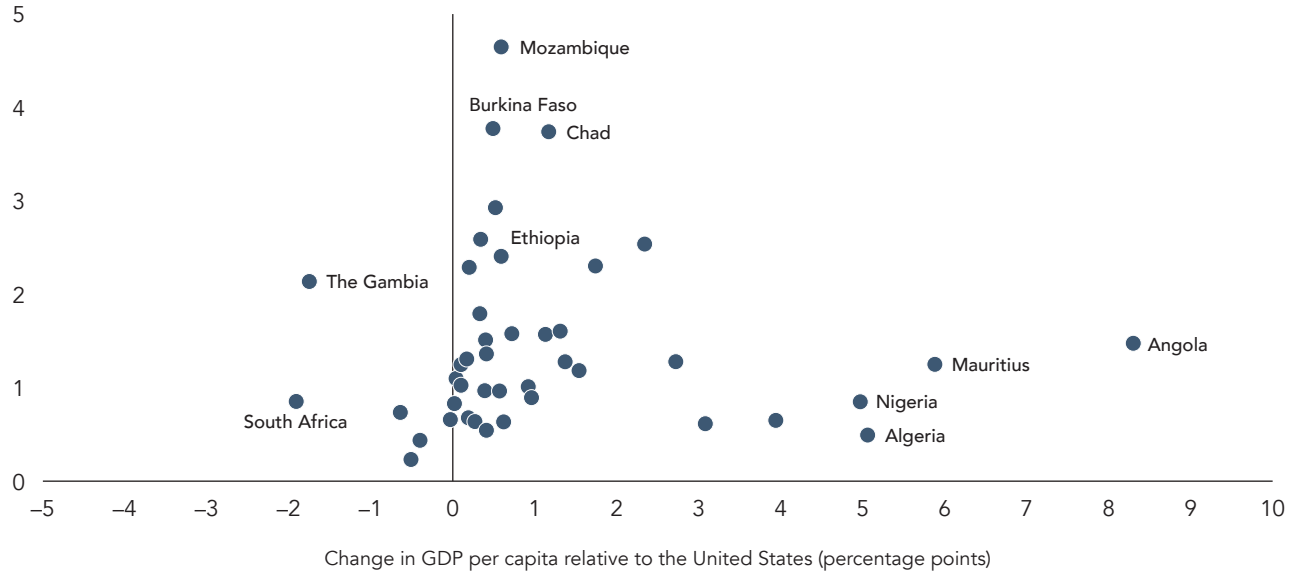
$ (billions)



Source: Author's analysis based on UN Comtrade database.

FIGURE 3.11 Convergence in income per capita and exports in Africa relative to the United States between 1995 and 2014

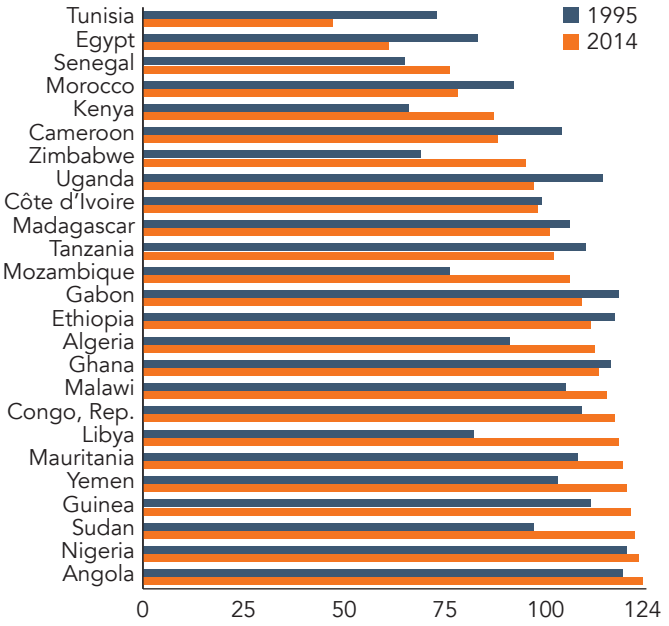
2014 export volume (index, 1995 = 1 relative to the United States)



Source: Author's analysis based on World Development Indicators database 2016.

FIGURE 3.12 Economic complexity rankings in Africa, 1995 and 2014

Rank (1 = highest, 124 = lowest)

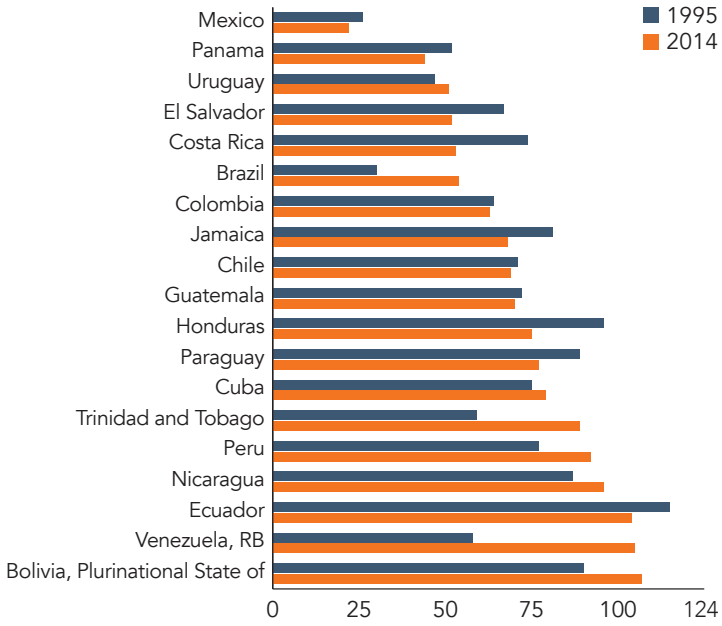


Source: Hausmann and others 2011.

Note: Rankings are among 124 economies, with a ranking of 1 reflecting the highest complexity and 124 the lowest.

FIGURE 3.13 Economic complexity rankings in Latin America and the Caribbean, 1995 and 2014

Rank (1 = highest, 124 = lowest)

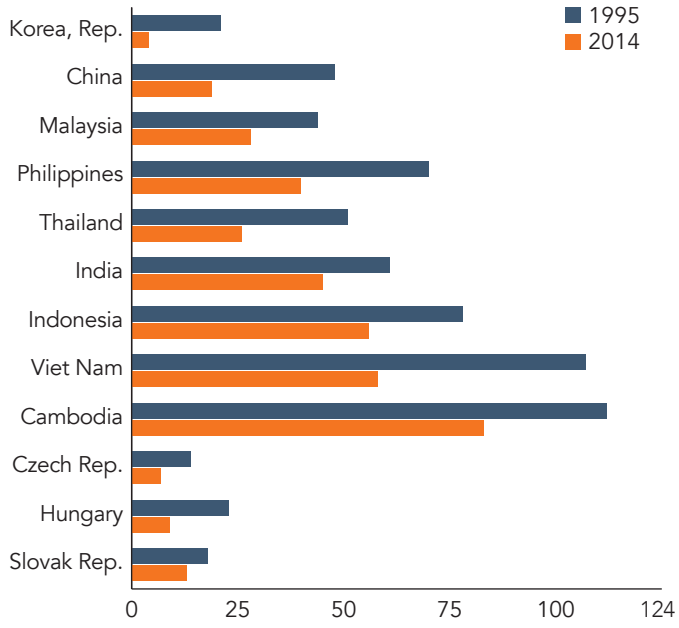


Source: Hausmann and others 2011.

Note: Rankings are among 124 economies, with a ranking of 1 reflecting the highest complexity and 124 the lowest.

FIGURE 3.14 Economic complexity rankings in Asia and Central Europe, 1995 and 2014

Rank (1 = highest, 124 = lowest)



Source: Hausmann and others 2011.

Note: Rankings are among 124 economies, with a ranking of 1 reflecting the highest complexity and 124 the lowest.

Middle East and Africa. Costa Rica and Tunisia, for example, have seen a marked improvement in both integration and economic complexity rankings, but this largely reflects integration though North American and European production chains and their proximity to those chains and markets. The same access for other countries in their regions may not be as straightforward.

But there is scope for improved intraregional integration

Of particular interest is the technological content of exports by region. As expected from interpreting figures 3.12 and 3.13, the technological content of exports is generally lower in Africa and Latin America than in other regions (figure 3.16), explaining in large part the poor performance in their economic complexity and, potentially, their economic convergence. But intraregional integration, where it does occur, is typically in higher value (technology) production. Intraregional trade is a small share of activity in these two regions, but it does point to the potential to improve regional integration by accelerating structural transformation and to the ability of intraregional integration to serve as a launching pad for greater global integration in higher value products.

For example, despite Africa's abundance of primary commodities, they also account for an important share (35%) of the continent's imports, indicating missed opportunities for sourcing commodities internally. Intra-Africa trade has grown only modestly, from 11.0% of total exports in 2002 to 15.7% in 2014, emphasizing its considerable unrealized potential. The potential is similar in Latin America and the Caribbean. On (unweighted) average in 2014, countries in Latin America and the Caribbean (except for Mexico) exported 10 times more products within the region than to China, 7 times more to the European Union, and 2 times more to the United States (table 3.2).

Further differences emerge in Latin America and the Caribbean by the size of exporting firms. Small and medium-size firms (almost 15,000) export predominantly within the region (figure 3.17). Firm-level customs data show that the number of large firms that exported globally fluctuated between 500 and 1,000 in 2011 (in Bolivia, Chile, Costa Rica, Ecuador, El Salvador, Guatemala, and Uruguay). However, although increased exports by small and medium-size firms can be an important driver of improved regional integration (and then global integration) as well as of improved inclusiveness, the contribution of their exports remains limited because of their low share in the overall value of exports (around 6% in 2011, much lower than in more developed regions such as Europe).[11] And given the high concentration of commodity exports, the contribution of smaller firms as upstream suppliers to larger firms integrated within existing value chains is also likely to be limited, certainly when compared with other regions (OECD and World Bank 2015).

Enhancing regional trade agreements for regional trade

A surprising result from the analysis by Kowalski and Lopez-Gonzalez (2016) was the negative relationship between the share of exports covered by free trade agreements and value added in exports. A number of factors might explain this. For example, in emerging economies most extraregional trade is in commodities, so diverging price effects could play a role. For example, higher values of commodity exports to countries with which the exporting country has no free trade agreement could create an inverse correlation. In addition, the scope and depth of regional trade agreements matter. In some regions, regional trade agreements may have only limited benefits, if they are not also part of more comprehensive liberalization and facilitation policies, including multilateral and unilateral efforts.

Despite a proliferation of free trade agreements and regional trade agreements, nontariff barriers to trade remain high in Africa. Trade costs within Africa are only slightly lower than trade costs with the rest of the world, at 313–337% in ad valorem equivalent (UNECA 2013). Indeed, as many as 10 African countries have higher trading costs with their intraregional partners than with the rest of the world. And in the median African country, document preparation to export or import takes 25% more time than in the rest of the world, while customs procedures are 30% more expensive (ESCAP and World Bank Trade Cost Database).

In the Asia–Pacific region, formal trade agreements may not have been a crucial driver of GVC trade at the intraregional level because economies are already connected through the regional production networks of multinational corporations. In addition, the effectiveness of regional trade agreements for exports appears to depend on the level of development of the exporting and importing economies. For example, regional trade agreements appear to have a greater impact for low-income countries when exporting to high-income countries than when exporting to another low-income country.

FIGURE 3.15 Correlation of change in economic complexity rankings and change in foreign value-added content of exports between 1995 and 2014

Change in foreign value added content of exports

Source: Hausmann and others 2011.

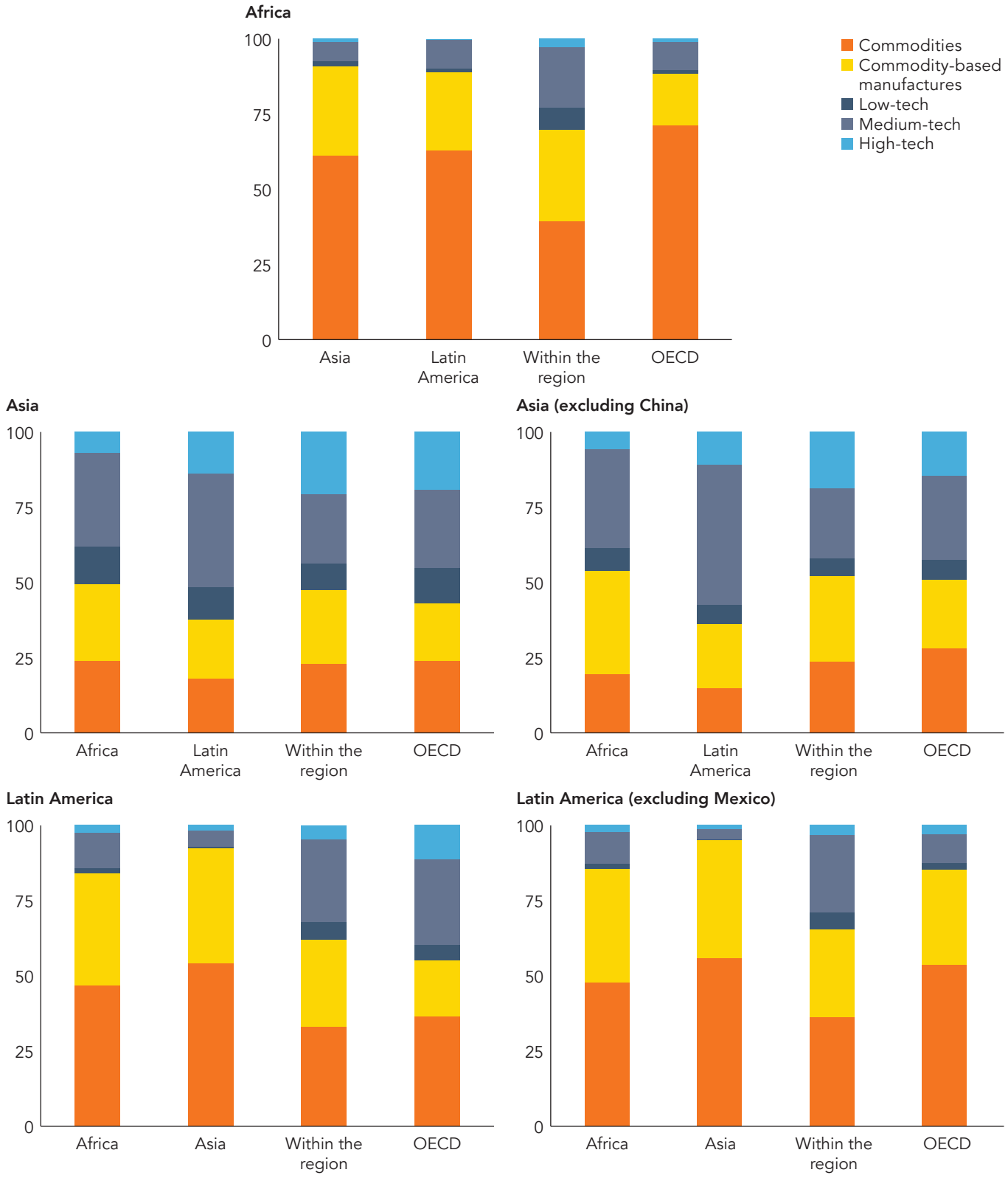
Another possibility is that the multitude of overlapping free trade agreements and regional trade agreements impede rather than promote exports by adding to the complexity of managing trade, particularly for small and medium-size firms, for which barriers to entry are already high. In general, higher intraregional trade is associated with fewer overlaps of regional trade agreements. For example, Europe, with the highest level of intraregional trade, also seems to have the simplest structure, whereas Latin America and Africa, with poor intraregional trade, have the most complex arrangements (figure 3.18).

National experience with value chain upgrading and integration: Automotive sector

There is no single solution to GVC policymaking. Country-specific factors shape how countries integrate into GVCs: where they are located, the size and relative income of their neighbors, their relative income, the structure of their economy, the scope and nature of trade agreements, and endowments of physical and human capital, to name but a few. So GVC policymaking requires a whole supply chain approach, which is largely country

FIGURE 3.16 Regional exports by share of technological intensity, 2014

Percent



Source: UN Comtrade database.

Note: The figure shows the cumulative total exports for each region between 2013 and 2014. The technological classification follows Lall 2000 and Aboal and others 2015. OECD group refers to members up to the end of 1993.

TABLE 3.2 Number of exported products by destination from countries in Latin America and the Caribbean, 2014

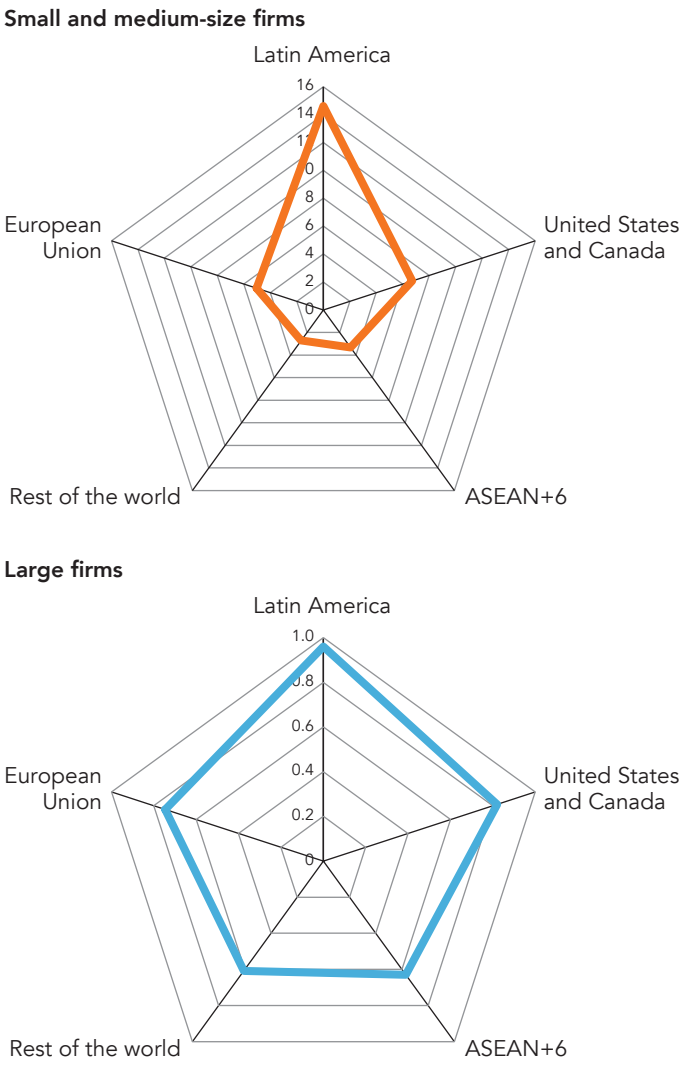
Source country	Destination region or country: Latin America and Caribbean	China	European Union	United States
Antigua and Barbuda	17	—	4	11
Argentina	3,358	359	1,488	1,333
Bahamas	17	4	8	45
Barbados	906	40	259	475
Belize	75	5	26	85
Bolivia, Plurinational State of	566	51	278	273
Brazil	3,779	1,402	2,937	2,786
Chile	2,932	327	1,472	1,291
Colombia	3,176	277	1,375	1,762
Costa Rica	2,791	273	1,033	1,690
Dominican Rep.	2,281	203	1,223	2,151
Ecuador	1,883	109	940	1,052
El Salvador	2,442	44	466	1,149
Guatemala	3,198	113	637	1,361
Guyana	471	29	94	294
Honduras	1,485	757	682	1,531
Jamaica	470	38	252	337
Mexico	3,756	1,401	2,830	4,052
Nicaragua	1,837	52	304	923
Panama	289	32	66	156
Paraguay	968	63	408	287
Peru	3,034	249	1,599	1,772
Saint Lucia	355	6	188	848
Uruguay	1,367	108	786	453
Venezuela, RB	920	16	168	618

Source: Economic Commission for Latin America and the Caribbean using data from the UN Comtrade database.

Note: A product is defined at the six-digit code level in the Harmonized System.

— is not available.

FIGURE 3.17 Number of exporters in Latin America and the Caribbean by main export destination, 2011



Source: Economic Commission for Latin America and the Caribbean using data from national customs offices.

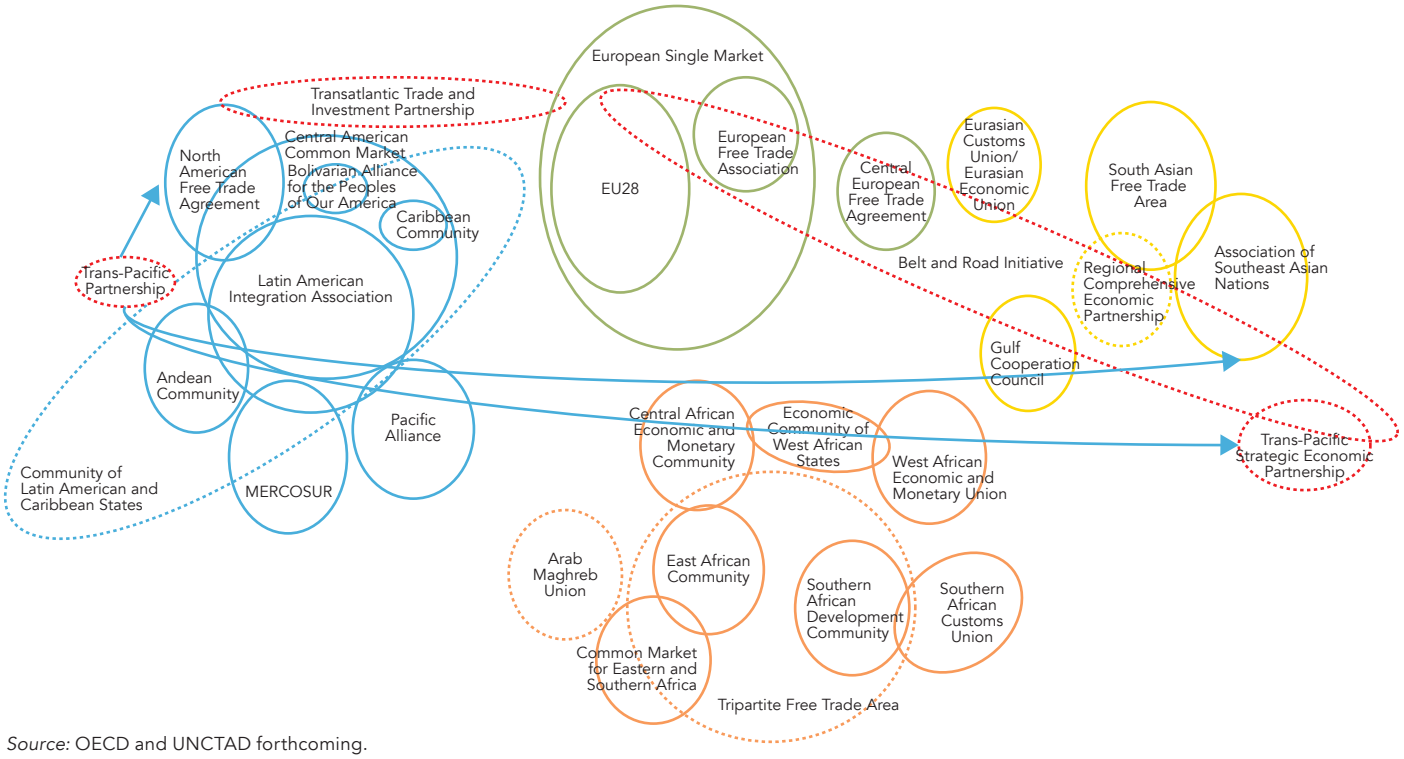
Note: Data cover exports from Bolivia, Chile, Costa Rica, Ecuador, El Salvador, Guatemala, and Uruguay.

specific. That makes it useful to draw lessons from actual country experiences. This section does that by synthesizing the results of questionnaires developed by the OECD Development Centre to target policy measures in the automotive sector.

Although the automotive industry is highly concentrated, with only a few countries (companies) contributing to global production, its value chain is especially fragmented, both geographically and by tasks (research and development, design, testing, and assembly and production), with significant upstream chains. In all regions the automotive industry contributes no more than a third of overall final export value, less than services in all regions except Asia, where the automotive industry contributes marginally more (figure 3.19). In Latin America, services contribute nearly twice as much (more than 40%) as the automotive sector.

The high fragmentation in the industry has provided broad scope for integration for a variety of countries—and not just those with a significant motor vehicle industry. That, in turn, shapes the policy tools for improving the nature and space of integration. And in many countries—especially those with

FIGURE 3.18 Selected regional and megaregional agreements, 2016

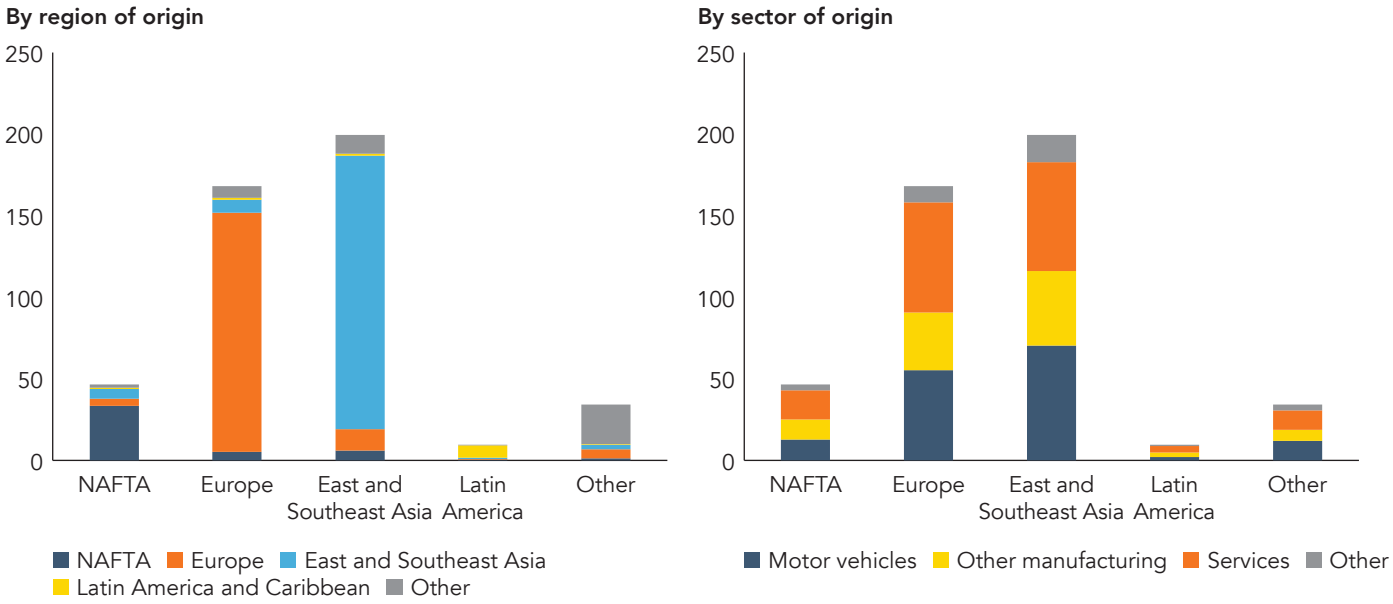


Source: OECD and UNCTAD forthcoming.

Note: The size of circles is proportional to the number of members that are parties to the agreement. Dashed lines indicate selected announced megaregional initiatives.

FIGURE 3.19 Gross exports of motor vehicles and parts by region and origin of value added, 2011

$ (billions)



Source: Author's analysis based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database 2015.

Note: NAFTA is the North American Free Trade Area.

negligible automotive sectors, but also those with large automotive sectors—a strong policy focus is on the upstream part of the motor vehicle chain, where two-thirds to three-quarters of total value is created.

Of the 15 countries that responded to the OECD questionnaire, 5 are implementing targeted programs for the industry (Brazil, Colombia, France, Morocco, and Uruguay), four follow a horizontal approach (Costa Rica, Czech Republic, Mexico, and Turkey), and the rest, with small automotive industries, are focusing on linkage opportunities through other activities (Chile, Dominican Republic, Ethiopia, Ireland, Peru, and Singapore).

Targeted programs

Even in these specific categories, countries adopt different approaches to improve growth (table 3.3), often in parallel with broader multidimensional strategies (table 3.4). For example,

TABLE 3.3 Main characteristics of targeted programs to promote the automotive industry in selected countries, 2014

Characteristic	Brazil	Colombia	France	Morocco	Uruguay
Program name	Inovar-Auto[a]	Production Transformation Program	Plan Automobile	Pact for Industrial Resurgence–Automotive	Automotive Industry Export Promotion Regime
Responsible Institution	Ministry of Development, Industry and Foreign Trade	Ministry of Trade, Industry and Tourism	Ministry of Economic Regeneration and E-economy	Ministry of Industry, Trade, Investment and E-economy	Ministry of Industry, Energy, and Mining
Timeframe	2013–17	2009–32	Began in 2012, no termination date	2009–15	1992 (expired in 2015 following World Trade Organization rules)
Objective					
Strengthening national supply chain	Strengthen national supply chain (reaching a minimum investment of 1% of gross revenues net of taxes of qualified companies)	Achieve revenues (including exports) of at least $3.4 billion and exports of $1.1 billion and create at least 33,000 jobs by 2032	Strengthen linkages among local suppliers	Increase GDP by 12 billion dirhams and create 70,000 new jobs by 2015; setup second- and third-tier factories	Promote exports in certain industrial segments, mostly focused on MERCOSUR
Green targets	Increase energy efficiency of vehicles (efficiency goal of 1.82 megajoules per kilometer for all cars sold in the country by 2017)		Develop affordable green vehicles		
Innovation	Increase research and development and engineering capacities (0.5% of gross revenues from sales of goods and services, matching with grants from the National Fund for Scientific and Technological Development)	Promote innovation through the Center for Technological Development of the Automotive Industry	Increase innovation content		
Territorial dimension	National initiative	National initiative, in coordination with regional competitiveness commissions	National initiative in coordination with local authorities	National initiative, with territorial dimension (Tanger, Keintra, and Casablanca)	National initiative
Budget	—	—	1.4 billion euros	—	—
Monitoring and evaluation	Brazilian Agency for Industrial Development is in charge of developing a monitoring system for the program	National Planning Department is in charge of monitoring and evaluation	No evaluation foreseen	A monitoring committee with private and public stakeholders has been established	No evaluation carried out or foreseen
Links	http://inovarauto.mdic.gov.br/	www.ptp.com.co	www.redressement-productif.gouv.fr/plan-soutien-a-filiere-automobile	www.emergence.gov.ma/MMM/Automobile/Pages/prqMaroc.aspx	

Source: Author's compilation based on country responses to the OECD questionnaire, "Targeted Programmes to Promote the Automotive Industry."

Note: — is not available.

a. In November 2016 the World Trade Organization ruled that this program's subsidies were illegal; it is currently being reformulated.

TABLE 3.4 Multi-institution and multidimensional policy mix targeted to the automotive industry, 2014

Type of incentive and country/responsible institution	Description/ beneficiaries	Conditions	Innovation content
Finance			
Fiscal incentives			
Brazil, Ministry of Industry and Foreign Trade	Multinational and domestic companies	Minimum requirements of research and development and investments in engineering and business information technology	Development of domestic technology; adoption of foreign frontier technology
Colombia, Bancoldex	Domestic companies	No	No
France, Ministry of Research	All companies carrying out research and development	No	All innovation activities
Morocco, Ministry of Economy and Finance	Total exemption for five years for all companies located in special economic zones	Beneficiaries need to be located in special economic zones	No
Uruguay	Tax credit linked to export performance	Local content requirement (20% of national value added)	No
Matching funds/grants			
Colombia, Innpulsa Colciencias	Domestic companies, specific line for small and medium-size firms	Cooperation among local suppliers	Adaptation to domestic market
France, Ministry of Economy	All companies carrying out research and development on future cars	No	Future-oriented research and affordable green vehicles
Morocco	State contribution of up to 10% of total investment	Beneficiaries need to be located in special economic zones	No
Skills			
Brazil, Ministry of Industry and Education)	Technical, vocational, and higher education	Cooperation among private sector, local universities, and training institutes	—
Colombia, National Learning Service and Centre for Technological Development of Automotive Industry	—	—	—
Morocco	Creation of training institute for skills for the automotive sector; grants for training	Partnerships with private sector	—
Business services			
Brazil, Brazilian Agency for Export Promotion	Domestic and multinational companies	The company should operate in Brazil (or be willing to relocate)	—
Colombia, Bancoldex	Domestic companies	—	—
Morocco, Industrial Platforms offer a one-stop shop for business services	—	—	—
Demand-side support			
Public procurement			
Brazil, Ministry of Planning and Agrarian Development	Multinational and domestic companies	Companies capable of giving after-sale assistance over all national territory	Special incentives for adaptation to local markets
Colombia, Agency for Efficient Purchase	Domestic companies	No	Special incentives for adaptation to local markets
France	Domestic companies	25% of purchased cars are hybrid or electric	Green cars
Other			
France, Ministry of Environment	Taxes on high emission vehicles and fiscal incentives to buy green cars	—	Green cars
Standards			
Brazil, National Institute for Metrology, Quality and Technology	—	—	—

Source: Author's compilation based on country responses to the OECD questionnaire, "Targeted Programmes to Promote the Automotive Industry."

Note: — is not available.

Mexico and Turkey, with relatively large automotive industries, are developing strong assembly capacities with an emphasis on adding value though higher (quality) upstream domestic value chains. Some countries are strengthening domestic industrial capacities, such as Inovar-Auto in Brazil,[12] the Production Transformation Program in Colombia, and the Plan Automobile in France. Another approach is to capitalize on FDI; Morocco's target is to increase the attraction of FDI in second- and third-tier upstream operations, while Colombia is looking at developing domestic technological capabilities. Another approach is to strengthen export capacities, as in Uruguay, by upgrading through free trade agreement (MERCOSUR) chains.

The approaches also differ in time horizons. The Colombian program is part of a long-term (2032) strategy of production transformation. Brazil and Morocco follow multiyear planning, while France has no predetermined end date. Uruguay ended its regime in 2015 in line with WTO requirements.

Countries have set job targets (Colombia and Morocco), export targets (Brazil, Colombia), or investment targets (Brazil). Brazil and France have targets linked to "green" cars and sustainable development. Brazil and Colombia also target technological development and innovation. Colombia, for example, has a new Center for Technological Development of the Automotive Industry.

Horizontal strategies

Similarly heterogeneous strategies can be observed in countries that identified the automotive industry as a priority area within a broader horizontal strategy (Costa Rica, Czech Republic, Mexico, and Turkey) rather than as a targeted strategy. In the Czech Republic, for example, the National Incentive Scheme, which covers manufacturing, technology, and business services, sets out the conditions for attracting FDI—tax incentives, grants for job creation and training, preferential rates for land and infrastructure use, and grants for capital investment. But it also sets conditions for the investors—notably job creation targets (table 3.5).

In Mexico, a variety of horizontal programs can benefit the automotive sector (table 3.6). They include programs that support the development and uptake of information and communication technologies (PRODIAT and PROSOFT) and incentives for innovation (CONACYT), for strengthening local suppliers (NAFIN), and for attracting FDI and promoting regional development (ProMexico).

Turkey introduced an investment incentives system in 2012 with the objectives of promoting production transformation and specialization in higher value-added activities, increasing jobs, and reducing territorial disparities. The system targets both domestic and foreign companies and includes four categories of incentives by type of investment: general, regional (broken down into six regions based on socioeconomic criteria), large scale, and strategic. Each includes a different mix of incentives (table 3.7). The different schemes are applied taking into account the characteristics of the region in which the investment is made.

TABLE 3.5 Policy mix of the National Incentive Scheme, Czech Republic, 2014

Policy mix	• Corporate income tax relief • Partial corporate income tax relief • Job creation grants • Training and retraining grants • Site support • Cash grant on capital investment				
Beneficiaries	**Manufacturing firms**		**Technology centers**		**Business support services centers**
Conditions	Regular ▼	Strategic ▼	Regular ▼	Strategic ▼	Regular ▼
	Minimum investment of 100 million koruna ($5 million) within three years. This limit is reduced in regions with high unemployment. Investors' own equity must equal at least half the investment. Minimum investment in new machinery of 50 million koruna ($2.5 million).	Minimum investment of 500 million koruna ($25 million) within three years. Minimum investment of 250 million koruna ($12.5 million) in new machinery. The investor must create at least 500 new jobs.	Minimum investment of 10 million koruna ($0.5 million) within three years. Investors' own equity must equal at least half of the investment. Minimum investment of 5 million koruna ($0.25 million) in new machinery. The investor must create at least 40 new jobs.	Minimum investment of 200 million koruna ($10 million) within three years. Minimum investment of 100 million koruna ($5 million) in new machinery. The investor must create at least 120 new jobs.	Creation of at least 40 new jobs at software development centers. Creation of at least 100 new jobs at other business support services centers (shared services centers and high-tech repair centers).
Eligible costs	Long-term assets, when the value of machinery equals at least half the value of acquired assets.				
Maximum state aid	40% of total eligible costs (30% in Southwest regions and for investment in low-tech sectors)		40% of total eligible costs.		

Source: Author's compilation based on country responses to the OECD questionnaire, "Targeted Programmes to Promote the Automotive Industry."

TABLE 3.6 Horizontal programs that can support the automotive sector in Mexico, 2014

Characteristic	Technological development		Promoting innovation	Financing for suppliers	Attracting foreign direct investment
	PRODIAT	PROSOFT	CONACYT	NAFIN	ProMexico
Objectives	Business services, training, certifications, and fiscal incentives to allow smaller firms to become suppliers of larger companies	Promoting use of information and communication technologies to increase productivity	Fund for technological development and innovation	Financing for working capital and fixed-asset acquisition to suppliers of any industry to promote growth and increase local content	Financial incentives to attract foreign direct investment and promote national and regional development
Year of introduction	2009	2008	2009	—	—
Time of frame	Three-year program, but with annual budget approval	—	Budget is approved annually by congress	Upon exhaustion of current budget	—
Main responsible institution	Ministry of Economy	Ministry of Economy	National Council for Science and Technology	NAFIN (development bank for small and medium-size firms)	Ministry of Economy
Territorial dimensions	Federal	Federal	Federal	Federal	Federal with matching resources from states
Budget	200 million pesos approved in 2014 ($154 million)	700 million pesos approved in 2014 ($54 million)	4 billion pesos approved in 2014 ($308 million)	500 million pesos ($385 million)	—
Links	www.economia.gob.mx/mexico-emprende/programas/7107-programa-para-el-desarrollo-de-las-industrias-de-alta-tecnologia-prodiat-para-el-ejercicio-fiscal-2012	www.prosoft.economia.gob.mx/	www.conacyt.mx/index.php/fondos-y-apoyos/programa-de-estimulos-a-la-innovacion	www.nafin.com/portalnf/content/sobre-nafinsa/sala-de-prensa/boletin_15_14.html	www.economia.gob.mx/conoce-la-se/programas-se/informes-de-evaluaciones-externas/promexico

Source: Author's compilation based on country responses to the OECD questionnaire, "Targeted Programmes to Promote the Automotive Industry."

Note: — is not available.

TABLE 3.7 Turkey's investment incentives system, 2014

Incentive	General investment incentives	Regional investment incentives	Large-scale investment incentives	Strategic investment incentives
Value-added tax exemption	✔	✔	✔	✔
Customs duty exemption	✔	✔	✔	✔
Tax reduction		✔	✔	✔
Social security premium support (employers' share)		✔	✔	✔
Income tax withholding allowance		✔	✔	✔
Social security premium support (employees' share)		✔	✔	✔
Land allocation		✔	✔	✔
Interest rate support		✔		✔
Value-added tax refund (with minimum investment of 500 million Turkish lira)				✔

Source: Author's compilation based on country responses to the OECD questionnaire, "Targeted Programmes to Promote the Automotive Industry."

Broader policies supporting upstream integration

Even in countries with only small upstream providers to the automotive sector, such as Ireland, horizontal programs can be important. Enterprise Ireland, the agency developing Irish enterprises in world markets, provides direct support (subject to EU state aid guidelines) to foster high-potential startups by offering research and development grants and tools for expansion, internationalization, capacity development, and productivity. In addition, Ireland's global sourcing strategy develops strong domestic supplier chains to multinational enterprises in the country. In Chile and Peru, both net importers of vehicles, the focus is on developing upstream capacities in copper, rubber products (tires), design, and textiles.

Special economic zones

Several countries also reported using special economic zones, including Morocco, Costa Rica, the Dominican Republic and Colombia. Morocco has targeted the broader automotive sector through the creation of integrated industrial platforms. Tanger Automotive City and Kenitra Automotive City are linked to Tanger and Casablanca special economic zones, which host automotive assembly multinational corporations to create local clusters of competences.

Costa Rica's FDI attraction policy has been linked to special economic zones. It also promotes local suppliers (Costa Rica Provee) and supports science and industry links to increase the innovation content of domestic companies.

A variety of upstream suppliers to the automotive industry have established manufacturing operations in special economic zones in the Dominican Republic. In addition to fiscal incentives, foreign companies are attracted to skilled human resources in disciplines related to the automotive industry, such as electrical and electronics manufacturing and injection molding. A free trade regime, managed by the National Free Zones Council, offers fiscal incentives to attract domestic and foreign companies that manufacture goods or provide export services. The council also establishes links between companies inside and outside the special economic zones, and the government has invested in promoting human capital in disciplines related to the main industries operating in the special economic zones (in partnership with the National Institute for Vocational Training). The Dominican Republic is now shifting toward technology-intensive sectors and higher value-added activities, including the automotive industry, capitalizing on preferential access to the U.S. and EU markets.

Conclusions

There is no unique solution or approach to capitalizing on GVCs. Who or where a company is matters almost as much as the what and how, and indeed largely, determines how it integrates. Also clear, certainly from the upgrading stories in many economies, is that companies are not necessarily static, and countries can take many actions to overcome barriers to integration.

Barriers to trade, whether at the border or behind the border, can severely impede integration, but they are not the only obstacles. Countries need strong domestic supply chains coupled with unhindered access to imports. And it is no coincidence that economies making inroads in GVCs (as shown here for the automotive sector) focus policy as much on the improved functioning of these domestic chains as on improved access to foreign markets. Strong domestic chains are almost a precondition for sustainable and long-term success in GVCs. The spoils of export success accrue to different sectors, most notably to small and medium-size firms, which struggle for direct access to foreign markets, especially in emerging economies. Domestic chains also provide greater scope for functional upgrading. In many economies policy and partnerships nudge lead firms toward developing stronger competitiveness through technology transfers and training and greater scope for upstream incumbents to also upgrade through process and product upgrading.

But for many economies the road to success is not exclusively in their own hands. Where the countries are matters as much as who they are, and certainly for Sub-Saharan Africa and, to a lesser extent, Latin America, distance from more developed and higher income markets matters, especially for landlocked economies. And just as strong domestic chains matter for global integration, so too do strong regional chains. For many economies, regional chains are a necessary intermediate step.

It is possible, of course, that even without targeted action, the benefits from GVCs will begin to trickle down—in much the same way that GVCs are trickling inward in central China from the coast. This could happen as countries in Africa and Latin America that are on the periphery of richer regions begin to develop as a result of larger spillovers southward from the European and North American poles of activity and westward from Asian poles of activity. But there is no guarantee that this will happen, especially with trade slowing and signs emerging that the GVC engine may be stalling, especially with growing calls for protectionism in richer markets and emerging signs of reshoring, and with automation on the horizon.

Worryingly, the evidence suggests that new free trade agreements that overlap with existing arrangements may not improve regional trade, especially if they are not broad in their liberalization and facilitation policies. It is perhaps no coincidence that in Sub-Saharan Africa and Latin America, with significant shares of small and medium-size firms and relatively low regional integration, overlapping agreements create a spaghetti bowl—adding barriers that many firms are ill equipped to deal with. In this respect, the more comprehensive multilateral agreements such as the Common Market for Eastern and Southern Africa–East African Community–Southern African Development Community Tripartite Free Trade Area, with 26 African countries and 58% of the continent's GDP, bode well. Similar arguments could be made for Asia, but the starting point here differs. Integration has been facilitated by significant FDI flows, drawn in part by lower unit labor costs, and significant poles of higher income, with multinationals better equipped to handle the multiple layers of free trade agreements.

Improving regional integration may also help address competitiveness gaps that exacerbate those caused by geography (and indeed costs related to poor infrastructure). This is especially important since entry to GVCs through cheap labor alone does not seem to be enough. What appears to matter is the combination of labor and productivity, in other words unit labor costs. Despite, for example, the recent rise in China's labor costs, its unit labor costs appear to have remained competitive with those of Sub-Saharan Africa and Latin America. It is important, therefore, to make inroads in improving productivity, particularly through FDI, bringing much needed capital, technology, and know-how. But FDI has to be coupled with policies that can extract maximum spillovers through robust domestic supply chains, including a more robust entrepreneurial environment.

Efforts to increase and preserve participation in GVCs in the years to come may face a more difficult economic environment, reinforcing the need to better understand the challenges, the drivers of success, and the barriers that impede it. The diversity of success stories and the diversity of failures point to pragmatism and a realization that there is no one-size-fits-all approach. Different pathways exist, each delivering specific results and entailing a different balance of risks and gains, depending on the characteristics of a country, including its market structure and policy approach. For developing countries today, it is crucial to look forward and anticipate changes in the global organization of production in order to adapt to the future of production and services delivery.

ANNEX 3.1

Result, variables, and data sources for the study by Kowalski and Lopez-Gonzales (2016)

The annex tables present information and detailed results from the Kowalski and Lopez-Gonzales (2016) model analysis of changes in domestic value added in exports.

TABLE A3.1.1 Determinants of changes in the domestic value added in exports (standardized coefficients)

Variable	(1) All countries	(2) Developed economies	(3) Emerging economies
Capital–labor ratio (log)	0.0739*** (0.0163)	0.0280 (0.0195)	0.112*** (0.0299)
Skill intensity	0.0928*** (0.0354)	0.118*** (0.0343)	0.844 (1.027)
Relative output per worker	0.0978*** (0.0276)	0.0802*** (0.0291)	–0.119 (0.138)
Share of foreign direct investment stocks in GDP	0.00512*** (0.00172)	0.0103*** (0.00245)	–0.00497 (0.00315)
Rule of law	–0.0250 (0.0157)	0.0303 (0.0208)	–0.0615** (0.0280)
Lagged foreign value added in industry exports (log)	0.151*** (0.0177)	0.150*** (0.0196)	0.139*** (0.0349)
Tariffs charged (log)	–0.0507*** (0.00794)	–0.0586*** (0.0105)	–0.0131 (0.0114)
Share of exports covered by free trade agreements	–0.00930 (0.00635)	0.00403 (0.00689)	0.0256 (0.0186)
Index of depth of free trade agreements	0.00222 (0.00581)	–0.00134 (0.00669)	–0.00414 (0.0120)
Sophistication of exports	0.0257* (0.0139)	0.0119 (0.0149)	0.0527** (0.0250)
Concentration of exports	–0.00507 (0.00976)	–0.0171 (0.0119)	0.0167 (0.0206)
Domestic demand (log of value)	0.327*** (0.0276)	0.312*** (0.0322)	0.397*** (0.0734)
Distance to economic activity (log)	–0.130*** (0.0250)	–0.105*** (0.0289)	–0.195*** (0.0504)
Constant	–0.167*** (0.0357)	–0.206*** (0.0418)	–0.138 (0.226)
Number of observations	10,882	7,394	3,488
R-squared	0.649	0.641	0.667
Number of repeating sections	1,838	1,250	588

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Kowalski and Lopez-Gonzales 2016.

Note: Numbers in parentheses are robust standard errors. Regressions are at the sectoral level using a fixed-effects specification that restricts the variance to the country-sector dimension and thus captures the impact of changes in the independent variables on the dependent variable. This setup controls for time-invariant country-sector omitted variables. See table A3.1.2 for a description of the variables and table A3.1.3 for descriptive statistics.

TABLE A3.1.2 Description of variables

Variable	Description	Source
Domestic value added in exports (log)	Domestic value added used by industry to produce exports	OECD Inter-Country Input-Output Tables
Capital–labor ratio (log)	Aggregate economywide capital-to-labor ratio	Penn World Tables
Skill intensity	High-skilled workers divided by low skilled workers (aggregate)	International Labour Organization
Relative output per worker	Country output per worker divided by average global output per worker	International Labour Organization
Share of foreign direct investment stocks in GDP	Aggregate share of foreign direct investment stock in country	United Nations Conference on Trade and Development
Rule of law		Worldwide Governance Indicators
Lagged foreign value added in industry exports (log)	Foreign value-added use by industry to produce exports	OECD Inter-Country Input-Output Tables
Tariffs charged (log)	Weighted average applied tariffs (weights from BACI data)	Trade Analysis Information System
Share of exports covered by free trade agreements	Weighted average trade covered by free trade agreements if countries share an agreement all their exports are considered to be covered	Trade Analysis Information System and Design of Trade Agreements Database
Index of depth of free trade agreements	Count of deep provisions in free trade agreements	Design of Trade Agreements Database
Sophistication of exports	EXPY variable calculated following Hausmann-Herfindahl indicators of concentration normalized	BACI
Concentration of exports	EXPY variable calculated following Hausmann-Herfindahl indicators of concentration normalized	BACI
Domestic demand (log of value)	Domestic value added from industry that is consumed domestically	OECD Inter-Country Input-Output Tables
Distance to economic activity (log)	Distances weighted domestic value added in consumption of other countries	Centre d'Etudes Prospectives et d'Informations Internationales Geography

Source: Kowalski and Lopez-Gonzales 2016.

TABLE A3.1.3 Descriptive statistics

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Domestic value added in exports (log)	14,302	6.58192	2.28415	–9.876943	13.53801
Capital–labor ratio (log)	14,518	11.70262	0.88856	8.13445	12.84867
Skill intensity	14,450	10.62023	43.35979	0.07450	358.80000
Relative output per worker	14,518	1.00000	0.60184	0.05052	3.59928
Share of foreign direct investment stocks in GDP	14,042	5.12193	7.57578	–16.40000	67.20000
Rule of law	12,036	0.79489	0.86737	–1.19000	1.98000
Lagged foreign value added in industry exports (log)	12,118	4.80752	2.81482	–12.79376	12.37180
Tariffs charged (log)	14,280	1.35067	0.75808	0.00000	3.34222
Share of exports covered by free trade agreements	11,628	0.56681	0.27757	0.00000	0.99390
Index of depth of free trade agreements	14,518	112.60660	116.49580	0.00000	366.00000
Sophistication of exports	14,076	9.69665	0.26274	8.26598	10.38535
Concentration of exports	11,832	0.05517	0.10275	0.00288	0.68158
Domestic demand (log of value)	14,756	11.81066	1.86974	7.47943	16.33693
Distance to economic activity (log)	14,518	13.40891	0.32243	12.43798	13.91208

Source: Kowalski and Lopez-Gonzales 2016.

Notes

1. According to the World Bank's 2016 Logistics Performance Index, 6 of the 10 lowest ranked countries were in Africa: Somalia, Mauritania, Equatorial Guinea, Sierra Leone, Lesotho, and Zimbabwe.
2. An additional complication should be recognized in attempting to look for signs of functional upgrading (in the classic case where an existing firm upgrades to a higher value part of the chain) using official national aggregated (and not firm-level) statistics. These data typically aggregate firms on the basis of their core activity, usually measured on the basis of their main source of value added. So firms that engage in functional upgrading may appear in different industrial activity codes over two periods, hampering the ability to observe their evolution. But this is not necessarily a complicating feature when investigating functional upgrading at the national (rather the firm) level.
3. Timmer and others (2014) showed that emerging economies specialize in capital-intensive activities, which suggests that financial development can be important for GVC integration and upgrading. Harrison, Lin, and Xu (2014) showed that the key factors explaining Africa's disadvantage at the firm level are lack of infrastructure, low access to finance, and political competition.
4. A fixed-effect model is used that controls for country-sector and year characteristics. This restricts the variance of the dependent variable to temporal changes in domestic value added embodied in exports and controls for sector and country effects that do not vary over time. While this reduces the incidence of unobserved heterogeneity, concern remains about possible correlations between lagged changes in the foreign value added used to produce exports and current changes in the specialization measures. If prior changes are correlated with current changes driven by a common trend, the estimates will be biased. Further checks to account for the dynamic nature of these processes (through the use of a difference generalized method of movements specification) confirmed the robustness of the results.
5. This variable does not overlap with the dependent variable since it captures value added engaged in different activities.
6. Interestingly, positive changes in the rule of law reduce rather than increase domestic value addition in emerging countries. Although this is at odds with the common perception that better institutions lead to better economic outcomes, it likely reflects threshold effects. In other words, when considering the relatively low current rating of emerging economies on the rule of law, a positive association of value-added exports with the rule of law may arise only after a certain threshold has been reached. Perhaps surprisingly, the analysis reveals no correlation with inward FDI. This may reflect, at least in part, disproportionate investment in many emerging economies in existing (rather than greenfield) natural resource activities, coupled with volatile price effects.
7. A simple view of the capital–labor ratio can be given by the share of labor in overall value added relative to capital's share. The capital–labor ratio (C/L) can be described simply as $C/(C + L)$, where C is the return to capital and L the return to labor and $C + L$ = value added (GDP). Unit labor costs reflect average wages divided by average productivity, or $L/(C + L)$ or $1 - C/(C + L)$.
8. See also Lopez-Gonzalez, Meliciani, and Savona (2015).
9. The economic complexity indicator provides a broad measure of the relative complexity of products and countries by ranking the diversity of products produced by a country with products weighted by complexity based on their ubiquity. Tracking movements over time can therefore provide insights into the relative upgrading (in complexity of production) of countries. Unweighted values of diversity and ubiquity are initially defined as follows, with $M_{cp} = 1$ if country c produces product p, and $M_{cp} = 0$ otherwise:

$$\text{Diversity} = k_{c,0} = \sum_p M_{cp} \tag{3.1}$$

$$\text{Ubiquity} = k_{p,0} = \sum_c M_{cp} \tag{3.2}$$

Weighted values are generated through an iterative procedure:

$$k_{c,n} = \frac{1}{k_{c,0}} \sum_p M_{cp} \times k_{p,N-1} \tag{3.3}$$

$$k_{p,n} = \frac{1}{k_{p,0}} \sum_c M_{cp} \times k_{c,N-1} \tag{3.4}$$

Inserting equation 3.4 into equation 3.3 gives:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} \quad \frac{1}{k_{p,0}} \sum_{c'} M_{c'p} \times k_{c',N-2} \tag{3.5}$$

$$k_{c,N} = \sum_{c'} k_{c',N-2} \sum_p \quad \frac{M_{cp} M_{c'p}}{k_{c,0} k_{p,0}} \tag{3.6}$$

and it follows that:

$$\text{kc,N} = \sum_{c'} \tilde{M}_{cc'} k_{c',N-2} \tag{3.7}$$

where

$$\tilde{M}_{cc'} = \sum_p \frac{M_{cp} M_{c'p}}{k_{c,0} k_{p,0}} \tag{3.8}$$

Equation 3.7 is satisfied when $k_{c,N} = k_{c,N-2} = 1$. This is the eigenvector of $\tilde{M}_{cc'}$ associated with the largest eigenvalue. Since this eigenvector is a vector of ones, it is not informative, and the eigenvector associated with the second largest eigenvalue ρ is taken. This is the eigenvector that captures the largest amount of variance in the system and is used as the measure of economic complexity. The economic complexity index (ECI_c) for a given country c is therefore defined as:

$$ECI_c = \frac{\rho_c - < \rho >}{stdev\,(\rho)} \tag{3.9}$$

where $< >$ represents an average over all countries, *stdev* reflects the standard deviation of ρ over all countries, and ρ_c is the second-largest eigenvalue of $\tilde{M}_{cc'}$.

10. Some care is needed in interpreting the relationships between foreign value-added content and economic complexity, especially for determining any causality, partly reflecting the nature of economic complexity measures—for example, increased specializations in natural resource exports are likely to generate lower rankings of complexity. In addition, the economic complexity rankings are based on gross trade statistics, so countries that integrate in low-value processing tasks at the end of complex products will, all other things equal, have higher economic complexity measures. Moreover, changes in the foreign value-added content of exports are a far from perfect measure of GVC integration. For example, countries that upgrade through stronger upstream domestic content are likely to see declines in their foreign content but not necessarily lower GVC integration, which partly

explains China's position. Equally, the upper and lower bound ranking of countries necessarily invalidates a linear relationship between the two measures, which explains the omission of the top 20 ranked countries in 1995 from the charts. Japan, Germany, and Switzerland, for example, whose foreign content of exports increased 6–10 percentage points over the period, retained their rankings as first, second, and third, almost throughout the period.

11. See, for example, the OECD–Eurostat Trade by Enterprise Characteristics database (www.oecd.org/std/its/trade-by-enterprise-characteristics.htm).
12. In November 2016 the World Trade Organization ruled that Inovar's subsidies were illegal; it is currently being reformulated. In addition, Brazil implemented a targeted program in 2014 to facilitate upstream integration (Productive Linkage Automotive Sector) by small and medium-size firms: the program includes targeted training by automakers to enhance the production and innovation capacities of their suppliers. Mexico also introduced a technology development program for industry in 2009 (PRODIAT) run by the Ministry of Economy to reduce the information gap between large companies and potential domestic suppliers. The program also offers financial support for certification to allow small and medium-size firms to operate as subcontractors.

References

Aboal, D., P. Garda, B. Lanzilotta, and M. Perera. 2015. "Innovation, Firm Size, Technology Intensity, and Employment Generation: Evidence from the Uruguayan Manufacturing Sector." *Emerging Markets Finance and Trade* 51 (1): 3–26.

Bas, M., and V. Strauss-Kahn. 2014. "Does Importing More Inputs Raise Exports? Firm-Level Evidence from France." *Review of World Economics* 150 (2): 241–75.

Beverelli, C., R. B. Koopman, V. Kummritz, and S. Neumueller. 2017. "Domestic Value Chains as Stepping Stones to Global Value Chain Integration." CTEI Working Paper No. 2017-04. Center for Trade and Economic Integration, Graduate Institute, Geneva.

Ceglowski, J., S. Golub, A. Mbaye, and V. Prasad. 2015. "Can Africa Compete with China in Manufacturing? The Role of Relative Unit Labor Costs." Working Paper 201504, Development Policy Research Unit, University of Cape Town, Cape Town, South Africa.

ESCAP (Economic and Social Commission for Asia and the Pacific) and World Bank. ESCAP-World Bank Trade Cost Database. Bangkok: ESCAP. Available at: http://www.unescap.org/resources/escap-world-bank-trade-cost-database.

Gereffi, G., J. Humphrey, and T. Sturgeon. 2005. "The Governance of Global Value Chains." *Review of International Political Economy* 12 (1): 78–104.

Harrison, A., J. Yifu Lin, and L. C. Xu. 2014. "Explaining Africa's (Dis)Advantage." *World Development* 63 (c): 59–77.

Hausmann, R., C. Hidalgo, S. Bustos, M. Coscia, S. Chung, J. Kimenez, A. Simoes, and M. Yildirum. 2011. *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. Cambridge, MA: Harvard University, Center for International Development.

Kowalski, P., and J. Lopez-Gonzalez. Forthcoming. "Global Value Chains and Developing Countries: Drawing on Foreign Factors to Enhance Domestic Performance."

Kummritz, V. 2014. "Global Value Chains: Benefiting the Domestic Economy." Working Papers 2014–05, Centre for Trade and Economic Integration, Geneva.

Lall, S. 2000. "The Technological Structure and Performance of Developing Country Manufactured Exports, 1995–1998." *Oxford Development Studies* 28 (3): 337–69.

Lopez-Gonzalez, J., M. Meliciani, and M. Savona. 2015. "When Linder Meets Hirschman: Inter-Industry Linkages and Global Value Chains in Business Services." Working Paper Series 2015–20, Science Policy Research Unit, University of Sussex, Brighton, U.K.

OECD (Organisation for Economic Co-operation and Development). Productivity Statistics (database). Paris: OECD. Available at: http://www.oecd.org/std/productivity-stats/.

OECD (Organisation for Economic Co-operation and Development)–UNCTAD (United Nations Conference on Trade and Development. Forthcoming. *Transforming Economies*. Paris and Geneva.

OECD (Organisation for Economic Co-operation and Development) and World Bank. 2015. *Inclusive Global Value Chains: Policy Options in Trade and Complementary Areas for GVC Integration by Small and Medium Enterprises and Low-Income Developing Countries*. Report prepared for submission to the G20 Trade Ministers Meeting, Istanbul, Turkey, 6 October 2015.

OECD (Organisation for Economic Co-operation and Development) and WTO (World Trade Organization). 2015. Trade in Value-Added (TiVA) database. Paris: OECD. Available at: http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm.

Shih, S. 1996. *Me-Too is Not My Style: Challenge Difficulties, Break through Bottlenecks, Create Values*. Taipei: The Acer Foundation.

Timmer, M., A. A. Erumban, B. Los, R. Stehrer, and G. de Vries. 2014. "Slicing Up Global Value Chains." *Journal of Economic Perspectives* 28 (2): 99–118.

UN (United Nations). UN Commodity Trade Statistics Database (Comtrade). New York: UN. Available at: https://comtrade.un.org.

UNECA (United Nations Economic Commission for Africa). 2013a. *Economic Report on Africa 2013: Making the Most of Africa's Commodities: Industrializing for Growth, Jobs and Economic Transformation*. Addis Ababa, Ethiopia: UNECA.

———. 2013b. *Trade Facilitation: An African Perspective*. Addis Ababa, Ethiopia: UNECA.

———. 2013c. *Assessing Regional Integration in Africa VI: Harmonizing Policies to Transform the Trading Environment*. Addis Ababa, Ethiopia: UNECA.

World Bank. 2016a. *Connecting to Compete 2016: The Logistics Performance Index and Its Indicators*. Washington, DC: World Bank.

———. 2016b. World Development Indicators (database). Washington, DC: World Bank. Available at: http://data.worldbank.org/data-catalog/world-development-indicators/.

CHAPTER 4

Accumulated trade costs and their impact on domestic and international value chains

HUBERT ESCAITH

According to trade analysts, trade costs—together with the relative size of the exporting and importing economies—are among the main determinants of bilateral trade patterns. More important from a trade and development perspective, trade costs influence the competitiveness of domestic firms on the international market and the success of policies to join and move up global value chains (GVCs). Although trade costs have declined over the past decades, their relevance has increased with the surge of fragmented supply chains and the greater competition in a "small world" in which everybody cooperates and competes with everybody.

The reduction in transportation costs, the progressive decline in tariff duties and other customs barriers, and the progress in information and communication technology connectivity have "flattened the planet" by reducing transaction costs, which has in turn contributed to the rapid expansion of global trade since 1985. After reviewing the domestic value added embodied in the final expenditure of markets of ultimate destination over time, Johnson (2014) and Johnson and Noguera (2016) identified five stylized facts that explain the lessening of trade frictions.[1] But as Anderson and van Wincoop (2004) noted, "The death of distance is exaggerated. Trade costs are large, even aside from trade policy barriers and even between apparently highly integrated economies."

The decline in trade frictions stalled after the 2008–09 global financial crisis (Escaith and Miroudot 2015), and the new emphases are on reducing transaction costs and facilitating trade. In the geographically fragmented production networks that have emerged since the mid-1990s, trade in intermediate goods accounts for more than half the volume of international transactions. More than in traditional bilateral trade in final goods, transaction costs (border and behind-the-border costs of trade) are crucial elements of the competitiveness of firms and partly determine their ability to participate in global production networks. These trade frictions are mainly an exogenous cost factor for the operators of international supply chains, who may mitigate the negative impacts through leaner production management but cannot alter the underlying causes. Facilitating trade remains largely the domain of public action.

Trade costs such as applied tariffs, transportation and insurance costs, and other border taxes and fees are amplified as they pass through the steps associated with modern supply chains. This so-called cascade effect arises because trade costs accumulate as intermediate goods are imported and then re-exported farther downstream, going through different processing nodes before reaching the final consumer. Thus, trade costs reduce the gains from trade that countries expect from participating in GVCs.

From the exporting firm perspective the financial impact of trade costs is magnified in the "trade in tasks" rationale that

This chapter builds on Diakantoni and others (2017), Yu and others (2016), and Hayakawa, Laksanapanyakul, and Yoshimi (2016). The author wishes to recognize the comments received on preliminary drafts at the two meetings of the Making Global Value Chains Work for Economic Development project in 2016 (Beijing in March and Washington in November) and the suggestions by the revisers on the final draft.

governs GVCs. In contrast to a large integrated firm concentrating most production processes under the same roof, specialized processing firms that spread their manufacturing over multiple locations need to recoup the associated trade cost, which applies to the full value of the good, from the smaller fraction of value added at each productive stage. This larger relative weight of transaction expenses on the profitability of individual business operations explains why trade along GVCs is particularly exposed to trade costs.

This chapter measures international trade costs from the value chain perspective and reviews their implications at the industry, national, and global levels. Trade frictions increase the production cost 18% in a single stage of the value chain. Most of the additional expenses result from deficient logistic and trade facilitation conditions, many of which fall under the control of domestic policymakers. Trade costs are not only damaging for domestic firms willing to join GVCs, they also affect all trade partners and generate systemic losses. Using network analysis that goes beyond the traditional bilateral dimension of international trade, this chapter identifies where investment in trade facilitation would have the highest social returns from a multilateral perspective.

Tariffs, cascading transaction costs, and competitiveness

Distance, transportation costs, and tariffs are only some of the factors that affect trade costs; there are many others, some of them not directly measurable, such as uncertainty (see Anderson and van Wincoop 2004 or Ferrantino 2012 for a review of trade costs and border barriers and their measurement). One way of understanding these factors is to associate them with the set of frictions that tend to reduce trade. Samuelson (1954) depicts trade shrinking under the effect of frictions in the same way that an iceberg melts while moving through the sea. International economics has overwhelmingly relied on Samuelson's hypothesis that frictions are proportional to value (ad valorem "iceberg transport cost").

An extensive literature has explored the influence of trade costs, especially using the gravity model. Head and Mayer (2013) showed that the magnitude of estimated elasticity of gross trade in goods varies across studies depending on the sample and methodology used but centers around –1. Baldwin and Taglioni (2011) showed that for GVC trade the standard gravity model used by most studies performs poorly when applied to bilateral flows where parts and components trade is important.[2] Noguera (2012) applied a gravity model to trade in value added and found that the bilateral trade cost elasticity of value-added exports was about two-thirds that of gross exports and that bilateral value-added exports increased with both bilateral trade agreements (a result also found in trade in final goods) and agreements with other countries.

Nominal tariffs are the most visible cross-border transaction cost. Tariff duties increase the domestic price of tradable goods by adding a tax to their international or free market price. When duties are specific (particularly for agricultural products), analysts compute ad valorem equivalents. This chapter shows that tariffs are not the biggest trade costs despite being the most visible, as for the iceberg.

For transportation costs the situation is more complex. In practice, transportation costs depend on the nature of the good (perishable or not, bulky or not), the mode of transport, and the distance between producers and consumers. Lewis (1994) identified several factors besides freight costs that contribute to logistics costs, including interest charges on goods awaiting shipment, on goods in transit, and on goods held as safety stock, as well as the loss, damage, or decay of goods between manufacture and sale.

Because tariffs have become a less frequent barrier to trade, the contribution of transportation to total trade costs—shipping plus insurance—has become more evident and more important. Hummels (2007) found that median transport expenditures were half as much as tariff duties for U.S. imports in 1958, equal to tariff duties in 1965 and three times higher than aggregate tariff duties in 2004.

Time matters, especially in GVC trade organized along complex international supply chains. See, for example, Hayakawa, Laksanapanyakul, and Yoshimi (2016), who concentrated on the time spent in the import process, including cargo handling and customs clearance. Those are the key components of the ad valorem time-related trade costs that are shifted onto the import price of imported inputs. If those costs are passed on to the price of exports, the demand for these exported products becomes smaller as time gaps lengthen.

Trade cost magnification and accumulation through global value chains

When manufacturing is geographically segmented and organized as an international production network, trade costs at each step of the production process are incorporated into production costs and passed on to the next step through a higher free-on-board value of the processed good. The trade costs propagate through the supply chain, cascading from upstream to downstream to the final consumers.

The impact of cascading transaction costs is amplified as intermediate goods are further processed by importing countries and then re-exported. If tariff accumulation is ultimately paid by the final consumer,[3] tariff magnification relates to the processing firms' financial returns (gross profits). GVC suppliers are mainly price takers, and high trade costs translate into reduced value added. For the processing firm at each step of the supply chain, the additional costs have to be compensated for out of the value added generated by the fees the firm receives for processing the imported inputs and re-exporting them to another GVC participant. Unlike a fully integrated firm, which builds a product from stage A to Z and cashes in the full commercial value of the gross output, the processing firm can count on only the smaller share of value added it creates (its processing fees).

It is thus important to measure the impact of trade costs not in proportion to the total value of the output (unlike the "iceberg" metaphor in conventional trade analysis) but in proportion

to the value added generated at each step of the supply chain. The latter value is often much smaller than the full commercial value of the intermediate good to which trade costs apply, so the financial impact of trade costs on the processing firm's competitiveness and profitability in a GVC context is said to be amplified.

To see how amplification affects the bottom line of an exporting firm, take an export processing firm that uses imported inputs that cost a hypothetical value of 40 (excluding trade costs) to produce a final good that sells on the international market for 100 (table 4.1). The value added of 60 generated at international prices is split between employee remuneration (40) and gross profit (20). If the processing firm is a price taker and the cost of labor is exogenously fixed, any increase in trade costs (10 in the example) will reduce gross profit. The impact of trade costs on the input procurement cost is magnified on what truly matters for the firm: the share of value added that remains as gross profit, once other production costs have been paid. In this example, an added trade cost of 25% leads to a reduction of 50% in gross profit.

Obviously, this is a simple example, and the firm's profitability depends on many other factors, including returns to scale. The firm should thus decide whether the higher volume of sales that may be expected from joining a GVC compensates for the lower profit margin per unit of output. While the exporting decision depends on factors beyond the scope of this chapter, higher trade costs lower the probability of exporting compared with selling on the domestic market.

Koopman, Wang, and Wei (2014) illustrated the accumulation and amplification effects of tariffs based on actual data (table 4.2). Column 1 reports the standard tariff on a country's exports (the trade-weighted tariff rate applied by a country's trading partners in ad valorem equivalent). Column 2 reports the share of imported content in final goods exports. These imported intermediate inputs are used to produce exports of final goods and thus incur multiple tariff charges. Column 3 reports the tariff rate on imported inputs as a share of free-on-board export value (trade-weighted average tariffs for intermediate inputs from the other countries and regions that are used in the exporting country to produce final good exports). The sum of the two tariffs is in column 4.

Column 5 provides the first-order accumulation effect of using imported intermediate inputs to produce exports. It represents the accumulation cost-push effect of the length of the supply chain increasing by a single processing step if tariffs were the only factor that augmented the trading costs. For instance, one additional stage of production increases the trade costs of Viet Nam's merchandise production by 80% of its standard tariff. Column 6 reports the gross effective tariff rate on output, which equals the standard tariff rate in column 2 divided by the domestic content share (which is 1 minus column 2) and weighted by trade.[4] Column 7 reports the implied magnification ratio due to the presence of vertical specialization. These effects are generally larger than the tariff accumulation factor in column 5.

The magnification effect worsens the impact of trade costs for low-income developing economies, because the share of domestic value added is usually lower in their manufactured exports than those of developed countries, and their trade costs are higher. Considering that value added is used mainly for the remuneration of employees and invested capital, higher-than-average trade costs result in lower salaries and reduced investment in order to maintain competitiveness at world market prices. So reducing tariffs and nontariff trade costs globally through multilateral agreement is fully consistent with the interests of developing economies because it lowers the cost of their GVC participation and improves their potential for upgrading.

For domestic firms, lowering their trade costs on the import of intermediate inputs for domestic manufacturing production would greatly reduce the magnification effects, as demonstrated in column 5. Lowering such costs in other countries would greatly reduce the effective tariff rate in their export markets, as seen in columns 6 and 7, because of the lower domestic value-added share in most developing countries' manufacturing exports.

Even if trade costs have decreased over the past decades as a result of technological progress and trade policies, their influence through cost accumulation and magnification is expected to become stronger as participation in GVCs increases, especially in manufacturing industries. As discussed in chapter 2, the average length of total production shows a clear upward trend at the world level, especially after 2002. The relative importance of pure domestic production activities is diminishing, though the trend was temporarily interrupted by the global financial crisis, when the value added embodied in complex and simple GVC production-sharing activities had increased rapidly, until 2011. Further, the average production length of complex multistage production-sharing arrangements increased by 0.36 between 2002 and 2011, much faster than the lengthening of production in simple production sharing and pure domestic production. Moreover, trade frictions remain substantial and are exposed to the return of protectionist sentiments. Using more recent 2011–14 World Input-Output Database data, Timmer and others (2016)

TABLE 4.1 Amplification effect of trade costs on value added and profit margin

	Processing for export	
Profit and costs	No trade costs	With trade costs
Imported intermediate input (free on board)	40	40
Trade cost on inputs	0	10
Value added	60	50
Labor	40	40
Profit	20	10
Export price (free on board)	100	100

Source: Adapted from Diakantoni and others 2017.

Note: Simple example based on hypothetical values, for illustrative purposes only.

TABLE 4.2 Magnification effect on tariff costs under global value chain trade, 2004

Country/region	(1) Standard tariff (%)	(2) Share of imported content in final goods exports (%)	(3) Tariff on imported inputs (% of free-on-board export value)	(4) Two-stage tariffs (1+3) (%)	(5) Accumulation effect (4 ÷ 1)	(6) Gross effective tariff rate in export market (%)	(7) Magnification ratio (6 ÷ 1)
Advanced economies							
Australia–New Zealand	15.55	0.13	0.34	15.89	1.02	27.00	1.74
Canada	1.60	0.38	0.24	1.84	1.15	7.05	4.41
Western European Union	6.16	0.12	0.24	6.40	1.04	12.09	1.96
Japan	6.22	0.12	0.05	6.27	1.01	11.19	1.80
United States	4.38	0.13	0.17	4.55	1.04	9.19	2.10
Emerging Asia							
China	6.17	0.29	1.91	8.08	1.31	21.42	3.47
Indonesia	7.53	0.30	1.34	8.87	1.18	24.39	3.24
Malaysia	3.55	0.46	2.11	5.66	1.59	20.93	5.90
Philippines	5.57	0.39	1.07	6.64	1.19	22.47	4.03
Thailand	8.16	0.40	4.23	12.39	1.52	36.54	4.48
Viet Nam	10.71	0.43	8.62	19.33	1.80	55.10	5.14
India	7.82	0.18	2.98	10.80	1.38	22.08	2.82
Other emerging economies							
Brazil	12.27	0.13	1.22	13.49	1.10	22.77	1.86
EU accession	2.41	0.34	0.55	2.96	1.23	12.67	5.26
Mexico	0.88	0.31	1.00	1.88	2.14	6.36	7.23
Russian Federation	5.36	0.18	1.61	6.97	1.30	17.23	3.21
South Africa	7.15	0.20	1.11	8.26	1.16	22.11	3.09

Source: Yu and others 2016.

found that international fragmentation of production probably stalled in recent years, a slowdown that is reviewed in more detail in chapter 2.

Transaction costs and domestic value added

This section focuses on the implication of trade costs for the production function of industries, their operational costs, and ultimately their gross margins. In a GVC environment where firms trade in tasks or in such business functions as research and development, logistics, and manufacturing services, trade costs affect profitability and competitiveness. Trade in tasks is often called trade in value added, because what firms exchange in their business-to-business transactions along GVCs are not products but value added. Monetary trade costs (tariffs, transportation, and other financial costs identified by Lewis [1994]) increase the price of the value added on the domestic market, creating an anti-export bias in a trade in tasks perspective.

An intuitive way of understanding this effect is to extend table 4.1 to a case where a domestic firm chooses between selling on the domestic market (at a price that includes the effect of nominal protection) and exporting at the world price. While trade frictions lower the gross profits when the firm exports its product, the same trade costs have the effect of increasing the profit margin when the product is sold (at a higher price) on the domestic market (table 4.3).

The intuition behind the calculation of the net effect on value added to the domestic price (called the effective rate of protection) is as follows. The theoretical referent is a neoclassic economy where countries have access to the same technologies and will choose the combination that best fits their resource endowments. In a frictionless trade environment the world price of a given product is unique. If the price charged by domestic producers is higher than the world price, consumers will shift to imported products. Similarly, if the domestic price is lower,

TABLE 4.3 Influence of trade cost on value added and profit margin, domestic versus export prices

Profit and costs	Domestic market		Export market	
	No trade costs	With trade costs	No trade costs	With trade costs
Imported intermediate input (free on board)	40	40	40	40
Trade cost on inputs	0	10	0	10
Value added	60	75	60	50
Labor	40	40	40	40
Profit	20	35	20	10
Export price (free on board)	..	..	100	100
Domestic market price	100	125	..	..

Source: Diakantoni and others 2017.

Note: Example is based on hypothetical values, for illustrative purposes only. The ad valorem trade cost (25%) is the same for input and output products.

domestic producers would rather export their product and sell it at the higher world price.

Because of trade costs, the domestic price of tradable products is higher than the world price. Producers gain because they are able to sell at a higher price, with the markup corresponding to the ad valorem trade cost. But they have to pay a higher price for the inputs used in production. That will be the case for imported inputs, but also—and this is a key assumption of the underlying model—for the domestically produced goods. If a downstream firm producing a final good for the domestic market is able to increase its prices in proportion to the nominal protection received because of trade costs, this is also the case for upstream firms producing intermediate inputs.

The net effect for a firm gives a higher rate of value added per unit of output than the free-trade benchmark when the additional cost of production is lower than the nominal protection received (or a lower rate of value added per unit of output when the additional cost of production is higher than the nominal protection received). Nominal protection in the domestic market for goods that are a firm's inputs raises production costs and thus provides negative incentives to export. The service sector is always on the losing side (there is no nominal protection on its output, but it has to pay an additional cost for its tradable inputs). So are consumers. But because services are usually less tradable than goods, it is understood that service providers can pass on the additional costs to their customers.

Extended effective protection rates and the relative price of value added

The method used here to estimate the impact of trade costs across several countries and industries is adapted from the effective protection rate theory introduced by Balassa (1965) and Corden (1966). Their original formulation calculated effective protection rates by deducting the additional production cost that manufacturers had to pay because of the tariff charged on tradable inputs from the additional benefit generated by selling their product at a price higher than the free-trade market price, thanks to the duties charged on competitive imports. The result is the rate of value added at domestic prices (selling price minus cost of intermediate inputs required for the production) and is compared with the hypothetical value added that would have resulted from the operation if no custom duties had been levied. In table 4.3 the effective rate of protection is 25%, corresponding to the additional gains (15) reported to the value added under free trade (60).

Effective rates can be calculated because of the availability of international input-output matrices, which are also used to measure trade in value added, as in the Organisation for Economic Co-operation and Development (OECD)–World Trade Organization (WTO) Trade in Value-Added database. As mentioned, the calculation also relies on the simplifying hypothesis of perfect competition and substitutability between imported and domestic products. Domestic industries are expected to raise their price in order to benefit from the additional costs due to tariff and freight costs applied to the imported goods that compete with their products. In that situation international transaction costs influence the domestic price of all inputs, whether imported or domestically produced. This ad valorem increase in the price of competing goods is the extended tariff and transport nominal protection.

When all applied tariffs are most-favored-nation tariffs that do not discriminate between trading partners and when transportation costs are proportional to the value of the imported good, the extended tariff and transport effective protection is the difference between the nominal tariff and transport protection enjoyed on the output minus the weighted average of tariff and transport paid directly (imported goods) or indirectly (domestic goods) on the inputs required for production. The weights applied to the additional tariff and transport costs on inputs are derived from the technical coefficients of the input-output matrix.[5] The extended tariff and transport effective protection rate is obtained by dividing this result by the value added that the industry would have enjoyed in the absence of tariff and transport costs. A formal presentation of the calculation is in annex 4.1.

Impact on competitiveness and export-led growth strategies

When the tariff and trade cost schedules are flat, the extended effective protection rate equals the nominal rate of tariff and transport protection. In table 4.3 that rate equals the rate of nominal protection (25%). But it will differ when there is variance in the tariff and nontariff trade costs, because some sectors are more effectively protected than others. With tariff and transport cost escalation (most-favored-nation tariffs rising with the degree of processing or transportation and insurance costs increasing more than proportionally to the unit value of the goods), downstream domestic industries producing final goods

for the domestic market will benefit from a higher effective protection on their value added. By contrast, upstream industries producing unprocessed inputs and basic parts and components will have a low extended effective protection rate—and possibly a negative one if the sum of tariff and transport margins paid on inputs is higher than the margin of protection received on the output.

Therefore, downstream industries registering a high extended effective protection rate on their production will have little incentive to export because the rate of return from exporting is lower than that from selling on the domestic market.[6] Even upstream industries supporting a negative effective protection rate will still be better off selling on their domestic market, and the result holds for all domestic firms, but the anti-export bias is stronger for highly protected industries. This hurtful effect of escalation is particularly relevant for developing countries that want to diversify their export basket away from basic commodities.

Trade frictions reduce the competitiveness of domestic firms in the most frequent situation where they are price takers and compete on the global market at international prices. When a domestic firm exports, it loses the additional benefit due to the nominal protection it receives on its output while still paying the additional cost on inputs purchased domestically. The only way to compensate for the additional costs and lower profits at export would be to reduce the value-added cost—for example, by paying lower wages or retaining less profit.[7]

This loss of cost competitiveness is particularly critical in a GVC context, when the customers on the export market are foreign lead firms that make their "make-or-buy" decisions as well as their choice of offshore localization on the basis of tight cost and profit margins. For this reason, policymakers have developed several strategies, from duty drawbacks (the exporter can redeem the value of the tariff duties and other indirect taxes paid on inputs used for exports) to free export processing zones (industrial parks installed in fiscal enclaves).

Such schemes (duty drawbacks and export processing zones) fall short of providing a first-best policy when the policymakers' ultimate objective is to use GVCs as a path toward industrialization. Even if the typical arrangement in a supply chain contract is for the lead-firm or supply-chain manager to cover the international costs of procurement, an exporting firm will still face the higher cost of purchasing its inputs domestically. So the high tariff and transport protection in place outside export processing zones will limit the possibility of developing domestic interindustry links (second-tier domestic suppliers), even if a domestic firm can join an international supply chain.[8]

Take the most favorable case of a first-tier supplier operating from an export processing zone in an international supply chain where the foreign lead firm covers the costs of transportation of the intermediate inputs and the re-export of the processed good. In that situation the first-tier supplier does not have to pay any transaction costs. Yet, even when duty drawbacks or tariff exemptions (as in export processing zones) correct for trade frictions and allow domestic producers to purchase inputs at international prices, export-oriented firms still have a disincentive to purchase inputs internally because their second-tier domestic suppliers would not be able to benefit from the duty exemption.

Duty drawbacks and export processing zones compensate the exporting firm for the additional production costs caused by tariffs only when it uses imported inputs. Such a strategy effectively prices out domestic suppliers when nominal tariffs and trade costs are high. Second-tier national suppliers of a domestic exporting firm are usually not entitled to draw back the trade margins paid on their imports. Even if they were able to do so through some complex and arcane administrative mechanisms, they would still be at a disadvantage when using nonimported inputs (because nominal tariff and transport protection raises the domestic price of all tradable products, regardless of whether they are actually imported). The only possibilities for second-tier domestic suppliers to avoid tariff and transport costs would be to use only imported inputs or to exert downward price pressure on their own domestic suppliers to recoup lost competitiveness. While the anti-export bias is a well-known result from a traditional trade-in-final-goods perspective, the anti-upgrading corollary is new and relevant only from the vertical specialization perspective typical of GVCs, where a "buy" decision arising from a make-or-buy assessment implies arbitraging between domestic and foreign suppliers.

Trade costs per sector and country

Diakantoni and others (2017) applied the extended effective protection rate methodology by crossing OECD-WTO Trade in Value-Added database data on 61 economies and the underlying OECD Inter-Country Input-Output Tables. The detailed tariff data for 2006 and 2011 were sourced from the WTO. Nontariff costs were taken from Duval, Saggu, and Utoktham (2015). These trade costs do not proceed from a direct calculation but are indirectly derived from a gravity model applied to Trade in Value-Added database data: the trade frictions may result from a direct monetary cost (such as transportation, insurance, and other fees) as in the extended effective protection rate approach, but they may also arise from more subjective aspects, such as the ease or difficulty of gathering relevant information and other nonmonetary barriers (regulation, licensing), insecure contracts and weakness in trade governance leading to uncertainty, differences in consumer taste, and so on. Nontariff trade measures are particularly relevant for GVCs because they may constrain the production process itself (box 4.1). The monetary component, according to the experts who build the database, is believed to account for only one-third of these costs; this is the value retained in the extended effective protection rate application.

The first effect of tariff and nontariff trade costs is to protect domestic producers from competitive imported products by increasing the import price by a trade margin of 20% to the international price of competing imports (averaged across all sectors in 2011), 17% for nontariff costs and 3% for tariff costs, including 2.5% preference margin (table 4.4).[9] Trade costs vary by a factor larger than four between the highest (food products) and the lowest (mining). Ranked by trade costs, the top five sectors are food products (35%), motor vehicles (27%), other

BOX 4.1

Tariff and nontariff measures

Among trade costs, nontariff measures have a specific role because they interfere with industrial norms, whose regulation may also be considered trade enhancing. Nontariff measures considered by the World Trade Organization (WTO) concern mostly regulations and standards, which are dealt with under sanitary and phytosanitary measures and the technical barriers to trade. Nontariff measures are not only normative; they also include such quantitative measures as safeguards, countervailing or antidumping measures, and other quantitative restrictions imposed against discriminative policy measures by trading partners.

With the lowering of tariff duties over the past decades, awareness is growing that nontariff measures are imposing new restrictions on trade, especially with the rising importance of global sourcing within global value chains (GVCs). Since the global financial crisis of 2008–09 the WTO primary monitoring and surveillance mechanism has been based on its periodic Trade Policy Reviews. Transparency mechanisms are also present in many regional trade agreements. Ing, Cadot, and Walz (2016) developed an index of nontariff measure transparency, based on WTO notification requirements. They show that transparency varies positively with income (except for non–Organisation for Economic Co-operation and Development high-income countries). The index also varies across regions, high in the Association of Southeast Asian Nations (ASEAN) and low in Africa and the Middle East. It may not be a coincidence that ASEAN is much better inserted in GVCs than the two other regions and that the top five countries are Austria, Denmark, Ireland, Germany, and Sweden, all economies with an important GVC sector.

In theory, tariffs are trade restrictions imposed to protect domestic producers, while nontariff measures are set to protect domestic consumers. Moreover, the use of international standards by either exporters or importers is likely to promote trade. The compliance of arm's length suppliers with public and private norms (International Organization for Standardization standards on quality) substitutes for closer and more expensive lead-firm monitoring of the quality of traded intermediate inputs. By contrast, cumbersome and unharmonized nontariff measures increase trade costs, if only because they entail more complex customs procedures. When not harmonized, nontariff measures are therefore expected to be trade-restrictive, especially for smaller firms or firms in less technologically advanced countries.

Discussions of the protectionist nature of nontariff measures are ongoing. Attempts to assess the trade impacts of nontariff measures have led to the development of "tariff equivalent" methods, which seek to estimate the ad valorem tariff that would have a trade-restricting effect equal to the nontariff measure in question (Ferrantino 2012). Adopting a specific GVC perspective, Ghodsi and Stehrer (2016) provided new ad valorem equivalents for nine types of nontariff measures, capturing the effects of these policy measures' intensity across sectors, importers, and exporters. Interestingly, some providers (such as Canada) may actually benefit from what would be conceived as restrictive measures, while others (such as Bulgaria) incur larger losses. Less advanced countries may therefore be more affected by stringent nontariff measures. The effect is also differentiated by industry and by type of nontariff measure: technical barriers to trade improve the cost efficiency of the inputs for the production of electrical and optical equipment, while sanitary and phytosanitary measures, tariffs, and average bilateral trade-restrictiveness indices increase the costs of inputs for these industries. Ghodsi and Stehrer (2016) concluded that regulated nontariff measures that enhance information symmetries reduce trade costs and increase market efficiencies.

transport equipment (24%), agriculture (22%), and textiles (21%). The bottom five are computers (17%), other nonmetallic mineral products (17%), chemicals (17%), pulp, paper, and publishing (16%), and mining (8%). Commodities or primary goods such as mining, wood, or paper imported products face the lowest trade costs: tariffs are usually low, and the products are shipped in bulk, using sea freighters. At the other extreme, food products combine the disadvantages of being expensive to transport (as for perishable products) and being heavily protected by tariffs.

Considering that the protection received on output translates into an increase in the production cost for the users of those intermediate products, the weight on competitiveness is substantial. Using the technical coefficient of the OECD Inter-Country Input-Output Tables as weights, Diakantoni and others (2017) found that the additional production cost due to tariffs on imported inputs was about 5.5%, after preferential treatments were included. Even so, the distribution of costs is skewed toward the higher range (7% and above). And this calculation takes into account only the direct cost of trade margins on imported inputs and not the indirect effect of also increasing the domestic market price of all products, regardless of whether they are imported.

Factoring in the impact of trade costs on the imported and domestic cost of inputs requires computing extended effective protection rates relative to a free-trade situation. This free-trade benchmark is not directly observable, but Diakantoni and others (2017) used German industries as the international benchmark because the German economy showed the lowest country/sector trade costs in their sample. Comparisons with this benchmark show that trade costs on inputs can greatly affect the competitiveness of industries. The average non-German motor vehicle

TABLE 4.4 Incidence of trade costs on output and input prices, 2006–11

	Nontariff				Most-favored-nation tariff				Preferential tariff				Total including preferences			
	Outputs		Inputs[a]		Outputs		Inputs[a]		Outputs		Inputs[a]		Outputs		Inputs[a]	
Sector	2011 (%)	Change, 2006–11 (percentage points)	2011 (%)	Change, 2006–11 (percentage points)	2011 (%)	Change, 2006–11 (percentage points)	2011 (%)	Change, 2006–11 (percentage points)	2011 (%)	Change, 2006–11 (percentage points)	2011 (%)	Change, 2006–11 (percentage points)	2011 (%)	Change, 2006–11 (percentage points)	2011 (%)	Change, 2006–11 (percentage points)
001 Agriculture	16.1	0.4	2.9	0.1	11.7	–3.9	3.0	–0.7	5.6	–2.4	0.2	0.0	21.8	–2.0	3.1	0.0
002 Mining	7.3	0.1	2.2	0.0	0.6	–0.5	0.5	–0.1	0.8	–0.5	0.1	0.0	8.1	–0.4	2.3	0.0
003 Food	25.5	1.1	3.7	0.2	18.5	–2.2	6.3	–1.4	9.0	–3.7	0.5	–0.2	34.5	–2.6	4.2	0.1
004 Textiles	15.5	0.2	4.8	0.2	10.2	–1.5	2.9	–0.5	5.4	–1.9	0.5	–0.1	20.8	–1.7	5.3	0.1
005 Wood	18.2	0.2	3.0	0.1	4.3	–1.1	2.8	–0.7	2.5	–1.3	0.3	–0.1	20.7	–1.1	3.3	0.0
006 Pulp, paper	14.7	0.1	3.3	0.1	2.3	–1.0	1.3	–0.4	1.7	–0.8	0.2	–0.1	16.5	–0.7	3.5	–0.1
007 Coke, petroleum	19.0	0.2	7.0	0.2	2.8	–0.7	0.9	–0.3	1.3	–0.8	0.2	–0.1	20.3	–0.6	7.2	0.1
008 Chemicals	15.1	0.1	5.0	0.1	3.1	–0.6	1.6	–0.4	1.7	–0.7	0.3	–0.1	16.8	–0.6	5.3	0.0
009 Rubber, plastic	16.4	0.1	5.5	0.1	6.5	–1.3	2.1	–0.5	3.6	–1.5	0.4	–0.1	20.0	–1.3	5.8	0.0
010 Other mineral products	13.7	0.1	3.6	0.1	5.5	–0.1	1.4	–0.2	3.1	–1.2	0.2	–0.1	16.8	–1.0	3.8	0.0
011 Basic metals	16.9	0.0	6.1	0.1	2.3	–0.9	1.2	–0.4	1.5	–0.9	0.3	–0.1	18.4	–0.9	6.5	0.0
012 Metal products	15.2	0.0	5.0	0.1	4.8	–1.2	1.5	–0.5	3.0	–1.2	0.4	–0.2	18.2	–1.2	5.3	–0.1
013 Machinery not elsewhere classified	17.9	0.1	6.6	0.1	3.2	–0.6	1.7	–0.4	1.9	–0.7	0.4	–0.1	19.8	–0.5	7.0	0.0
014 Computer, electronic equipment	16.1	0.2	6.6	0.1	2.1	–0.4	1.3	–0.3	1.2	–0.6	0.4	–0.1	17.3	–0.4	7.0	0.0
015 Electrical machinery	17.9	0.2	6.6	0.2	4.3	–0.8	1.8	–0.4	2.6	–1.1	0.5	–0.2	20.5	–0.8	7.0	0.0
016 Motor vehicles	22.4	0.5	8.3	0.2	9.9	–2.0	3.1	–0.7	4.9	–1.9	0.7	–0.2	27.3	–1.4	9.0	0.0
017 Other transport	21.0	0.5	7.1	0.2	3.1	–0.3	1.8	–0.3	2.6	–1.1	0.4	–0.1	23.6	–0.5	7.6	0.0
018 Manufacturing not elsewhere classified	19.2	0.4	5.5	0.2	4.7	–1.3	1.8	–0.5	3.4	–1.2	0.4	–0.1	22.5	–0.8	5.9	0.1
Average[b]	17.1	0.2	5.2	0.1	5.5	–1.1	2.1	–0.5	3.1	–1.3	0.4	–0.1	20.2	–1.0	5.5	0.0

Source: Yu and others 2016.

Note: Presents the main results obtained for 2011 and the changes observed since 2006, the initial and final year being imposed by data availability.

a. Imported products only, using the 2011 technical coefficients of international input-output matrix as weights.

b. Simple average across countries or sectors.

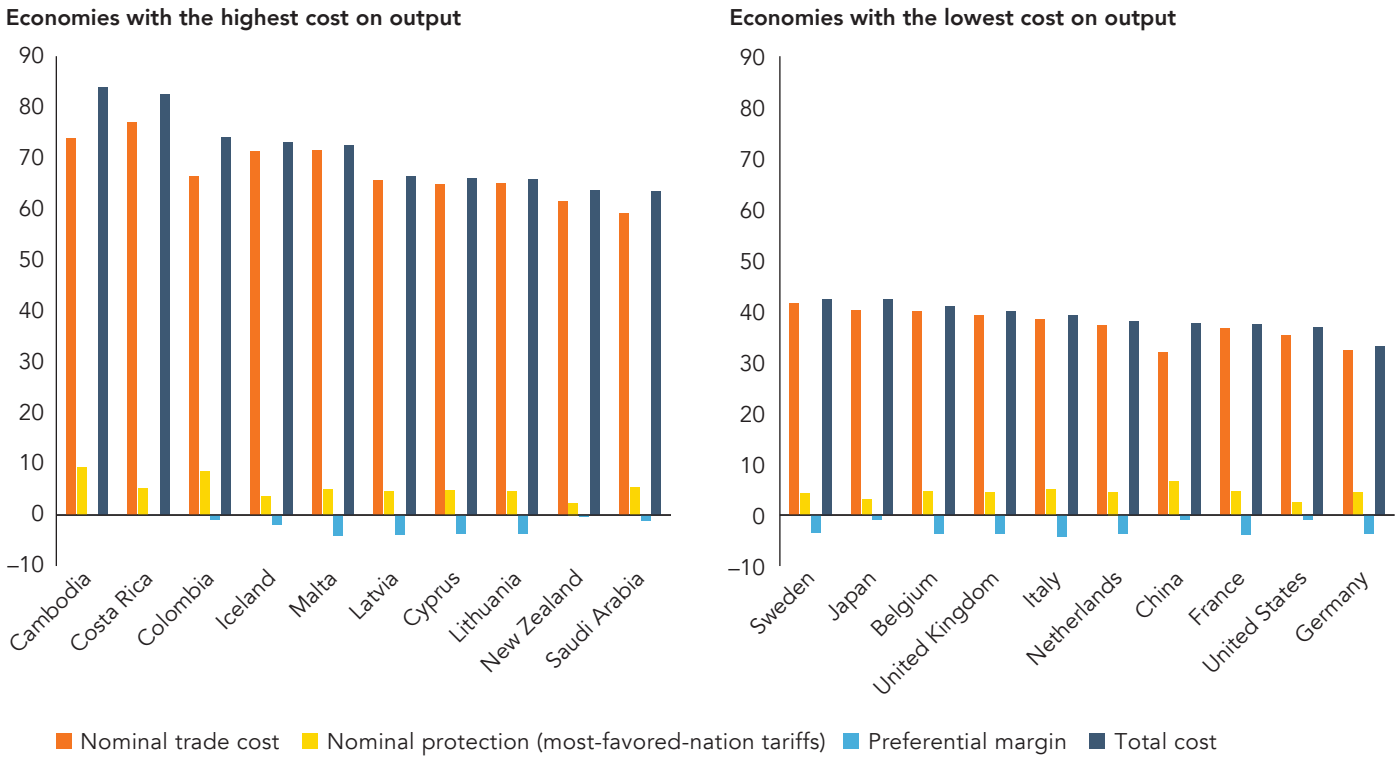
industry, a sector closely associated with GVCs, would register a gross margin 27% lower than the benchmark firm. Benefiting from drawbacks would reduce this loss, but the home industry would still lag behind the international competitor by a margin of about 20% if it continued sourcing other inputs domestically. Food industries also have little incentive to export: their value added would be 18% lower than the benchmark (14% with drawbacks). When the industry relies heavily on imported inputs, as in the case of petroleum products, drawback schemes can yield an improvement of 10 percentage points.[10] But this remains an exception; on average, drawbacks improve the competitiveness of domestic exporters by a margin of only 4–5 percentage points.

This loss of competitiveness varies by country according to trade costs (figure 4.1). The highest trade costs are in small developing economies (such as Cambodia and Costa Rica). Small developed countries can also face high costs when they are isolated from the main markets, as for small islands (Malta and Cyprus as well as New Zealand). Two factors may increase freight rates: the geographic distance between main trading partners and the small size of individual shipments. Except for China, the economies facing the lowest import costs are all developed economies.

Nominal tariff protection (as measured by most-favored-nation tariffs on industry output) declined between 2006 and 2011 in a majority of the countries surveyed. Tunisia, the Republic

FIGURE 4.1 Ten countries with the highest and lowest trade cost in all sectors, 2011

Additional production cost due to trade costs as a share of production cost (%)



Source: Diakantoni and others 2017.

Note: Total trade cost includes the preference margin.

of Korea, Argentina, Brazil, and India applied the highest nominal protection in 2011—between 11% and 15%—and Hong Kong, China; China; Singapore; New Zealand; the United States; and Brunei Darussalam the lowest, between 0% and 2.5%.

The cost of tariffs is much lower than other transaction costs, estimated at an ad valorem tariff equivalent of 17%. Moreover, though tariffs have been decreasing, nontariff trade costs for inputs increased globally in 2011 over 2006, probably a result of increased uncertainty in the post-crisis era (Escaith and Miroudot 2015).[11] Trade frictions would translate into an average increase of 17–32% of the production cost in a single stage of the value chain. Unless compensated for by savings on other aspects of production (either unsustainable ones such as low remuneration for labor and investment or export subsidies) or by improving total factor productivity, those higher costs reduce the international competitiveness of the industries in these countries. As the next sections show, reducing trade costs in one or several countries has important positive spillover effects on other trading partners.

Extension and application to Canada and China

To lower trade costs and improve the competitiveness of manufacturers, the Canadian government decided in 2010 to unilaterally eliminate tariffs on a broad range of manufacturing inputs and equipment. The elimination covered 1,541 tariff lines, most of them immediately (381 were gradually removed through 2015). Other trade costs were expected to be lowered, because customs procedures became simpler as importers would no longer need certify compliance with preferential rules of origin. The incidence of the measure is sizable: in 2010 intermediate goods accounted for 47.5% of Canada's gross imports and capital goods for 18.9%. Obviously, the trade cost reduction will also benefit other countries by facilitating their access to the Canadian market.

Ciuriak and Xiao (2014) calculated that such benefits exceeded those from mutual tariff elimination under any of the major preferential trade agreements that Canada had been pursuing. In comparing estimated gains from unilateral liberalization and preferential liberalization through trade agreements, they noted that not only did the gains from the unilateral route come without the trade distortions associated with regional trade agreements, but they were easier to realize since the question of rules of origin and the use of preferences did not enter the equation.

Focusing on tariffs, Yu and others (2016) used the Canadian example to study how partially or completely eliminating tariffs on imported intermediate inputs can help a country integrate into GVCs and enhance its trade competitiveness. They applied a computable general equilibrium model to quantitatively analyze the impact of intermediate inputs tariff reduction on reducing multistage production costs, promoting GVC-related trade activities,

and accelerating the structural adjustment of China and the world economy under three policy scenarios. They looked at the implication for China of a similar initiative and explored three policy scenarios to analyze the impact of liberalizing intermediate goods trade on the global economy. The first scenario is China's unilateral elimination of tariffs on imported intermediate goods (the Canada scenario). The second covers a regional trade agreement between China and the Asian and East African countries included in China's Belt and Road Initiative, reducing bilateral import tariffs on intermediate goods trade to zero but maintaining tariffs for non–regional trade agreement countries. In the third scenario, all Group of 20 (G20) member countries completely eliminate tariffs on intermediate goods imported from all countries.

The first scenario—unilateral trade liberation of intermediate goods—would enhance China's economic growth and trade with the rest of the world. Relative to the baseline, China's real GDP would increase 1.2%, its exports would rise 5.7%, and its imports would rise 6.6%. China's unilateral trade liberalization on intermediate goods imports would generate a small positive spillover effect, and the real GDP of the rest of the world would increase 0.01%, with exports expanding 0.17% and imports 0.25%. The second scenario—bilateral tariff reduction on intermediate goods trade between China and the Belt and Road region—would stimulate the economic growth and trade of signatory countries. If bilateral tariffs on intermediate goods were exempted completely, real GDP would increase 0.43% for China and 0.42% for the Belt and Road region. China's imports would rise 2.8%, and its exports would rise 3.2%, and trade in the Belt and Road region would grow 1.5%. GDP would increase 0.43% for China and 0.40% for the other signatories. However, the bilateral trade agreement creates trade diversion and leads to some negative economic effects on nonmember countries: their exports would decline 0.04%, and their imports would decline 0.03%.

If, as in the third scenario, G20 countries act jointly and unilaterally eliminate tariffs of intermediate goods imports, no diversion would take place, and the economic impact would be considerable. Real GDP would rise 1.35% for the European Union, 0.23% for the United States, 0.61% for Japan, 0.56% for other advanced G20 members (Canada and Australia), 1.87% for China, and 3.32% for other new emerging/developing G20 members. Exports would rise 3.1% for the European Union, 1.2% for the United States, 4.3% for Japan, 1.9% for other advanced G20 members, 13.5% for China, and 8.6% for other new emerging/developing G20 members, and imports would rise 2.3% for the European Union, 1% for the United States, 5.2% for Japan, 2.2% for other advanced G20 members, 13.4% for China, and 7.5% for other new emerging/developing G20 members. According to the authors, trade liberalization would help exploit the comparative advantage of those countries and facilitate their economic upgrading. For example, the value added of tertiary industries and their GDP share in the United States, European Union, and other advanced G20 countries would rise substantially. The secondary industries in many developing G20 countries would also grow much faster. For example, the value added of secondary industries in China would rise by $67 billion, and its GDP share by 0.35 percentage point.

The results illustrate the interdependency of national industries through trade in intermediate inputs and the importance of reducing trade costs in as many lead economies as possible. The next section looks at the systemic effect of trade costs and their spillover effects through close-knit interindustry trade interactions.

Cascading transaction costs in the world trade network

By measuring the impact of trade costs on the effective value added, the extended effective protection rate measures the magnification effect of tariff and transport costs on individual firms' value added and competitiveness. This section turns to the entire international supply chain and examines trade costs as a cascading source of transborder cost-push transmission.

Accumulation of trade costs along international supply chains

GVC trade is characterized by multiple border crossings that generate double counting in traditional trade statistics because processing goods will cross several borders before reaching the final consumer. Correcting for this statistical bias was one of the initial objectives of measuring trade in value added. Double counting arises when goods in process cross successive borders. These successive border crossings open the door to potentially explosive embodied tariffs along GVCs.

For example, Yi (2003), Ma and Van Assche (2010), and Ferrantino (2012) highlighted the nonlinearity in the way transaction costs negatively affect trade flows in a trade in tasks perspective. Ferrantino (2012) showed that when trade costs apply in proportion to the value of a good, the total cost of delivering the product through the supply chain down to the final consumer increases exponentially with the number of production stages. For example, if the average ad valorem transaction cost is 10%, accumulated transaction costs in a five-stage supply chain lead to an ad valorem tariff equivalent of 34%. Doubling the number of stages by slicing up the supply chain more than doubles the total delivery costs, since the tariff equivalent is 75%.

Recent statistical advances on trade in value added and related trade costs allow accumulation to be measured with actual data. Rouzet and Miroudot (2013) formalized a measure of the cumulative tariffs embodied in trade in intermediates along international supply chains. Although nominal tariffs are low in most OECD economies, indirect tariffs can add a major burden by the time a good reaches its final user. For example, products imported from India into the European Union have paid a series of tariffs totaling 3.7%, 52% of which is directly levied at the EU border and 48% of which results from duties on intermediate inputs imported by India at previous production stages.

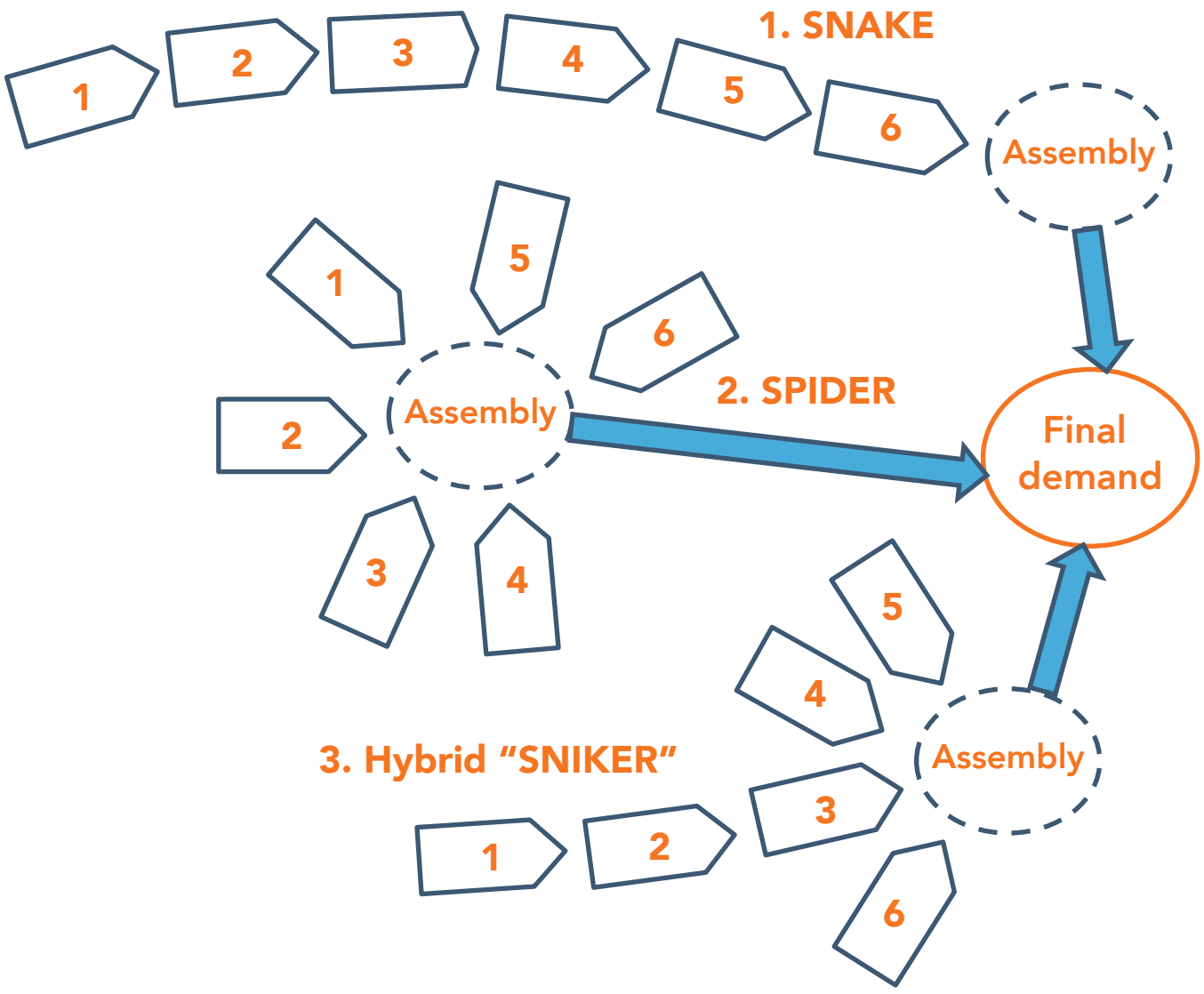
Building on the pioneering ideas of Wang and others (2016), who enhanced the analytical tools, Muradov (2016b) developed a similar analytical framework that decomposes sector value added or value of its final products along various value chain paths and

measures the length of each component.[12] The decompositions of GVCs at the sector level reveal substantial variation in the length and importance of the relevant parts of the value chain. Using the international input-output matrices behind the OECD–WTO Trade in Value-Added database, Muradov (2016b) found that, overall, industries are moving downstream along the value chain in two-thirds of the 34 sectors. As in Johnson and Noguera (2016), the results show that GVCs are also gaining importance over domestic value chains in both upstream and downstream directions.

Of special interest for this chapter, the GVC decompositions allow the trade costs accumulated along GVCs to be estimated. Muradov (2016a) found that the direct impact of tariffs (paid on imports) was almost always more significant than the accumulated tariffs embodied in the cost of production of the products. The largest indirect tariffs were for Indonesia (3.76% direct, 1.33% indirect), Australia (2.44%, 1.30%), Chinese Taipei (2.52%, 1.28%), and Japan (1.39%, 1.28%). The indirect cost due to tariffs was higher than the direct one only in countries with low nominal protection: Luxembourg (0.18%, 1.02%), Malta (0.38%, 0.69%), the Russian Federation (0.73%, 1.27%), and Greece (0.72%, 0.92%).

In practice, the accumulation effect is lower than the simple exponential formula suggested—for several reasons. The first is the geography of supply chains. While the image of a chain implicitly projects a succession of sequential steps, most supply chains are not linear but are defined by a hub and spoke pattern. Figure 4.2 shows the topological differences between "spiders" and "snakes" types of GVC organization (Baldwin and Venables 2010).

FIGURE 4.2 The global value chain zoo: spiders, snakes, and hybrid "snikers"



Source: Diakantoni and others 2017, based on Baldwin and Venables 2010.

In the spider first-tier suppliers of parts and components are arranged around a central assembly plant that ships the end product to its final destination. Unbundling costs are lower in the hub and spoke configuration: inputs cross a border at most twice, once as a part and once embodied in final output. In a snake each task is embodied in goods during processing, which are shipped again to the next production stage. At each stage the gross commercial value of the good in process increases, leading to cascading transaction costs. Diakantoni and others (2017) showed that the accumulated trade costs are greatly reduced in the spider. In real life, actual supply chains are "snikers"—hybrids of spiders and snakes.

The other important mitigating factor identified by Diakantoni and others (2017) is endogenous to the development of GVCs: supply chains can prosper and develop only when trade costs are low. And only when trade costs are below a certain threshold will a lead firm find it profitable to internationally outsource part of the production.[13] GVCs are Coasian constructs that exist only when the incremental benefit from improved complexity (GVC length) is higher than the increased transaction cost (box 4.2).

Not only is the total accumulated trade cost bounded by GVC efficiency, but for a given structure of efficiency gains the length of the GVC is negatively correlated with trade costs. As Yi (2003) showed, the relationship is not linear, and trade costs have to be greatly reduced before GVCs start expanding. It is therefore unrealistic to extrapolate accumulating trade costs along longer GVCs where ad valorem trade costs do not decrease. The net result between the decrease in ad valorem trade costs (the exogenous factor) and the resulting increase in GVC length may lead to relatively small increases in total accumulated costs ex post.

Consider a simple simulation exercise based on the hypothesis that, for a given product, GVC expansion is endogenous to trade costs (figure 4.3). When trade costs are above a certain threshold, the length of the GVC measured in border crossings is 0: the places of production and consumption coincide, without a border crossing. Only when trade costs fall beyond certain thresholds does it become profitable to shift part of the production to another country that offers efficiency gains larger than the additional trade cost incurred. When trade costs are further reduced, new outsourcing opportunities may increase production efficiency by enlarging the supply chain.

BOX 4.2

Transaction costs, trade, and foreign direct investment

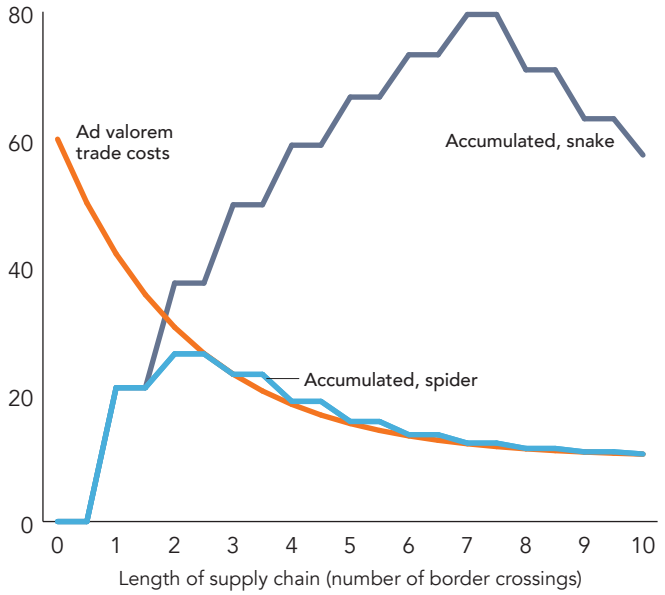
Ronald Coase posited that corporations exist to economize on the transaction costs of markets. After they reach some size, organizational complexity becomes overwhelming, and the firm faces diseconomies of scale and scope. What Coasian economists call transaction costs include all impediments to cooperation and encompass the trade costs discussed here. One aspect of this question, the "make-or-buy" decision (vertical specialization), is central to the rise of GVCs and has been discussed from an international trade perspective by Grossman and Helpman (2002, 2003, 2005), who analyzed the determinants of international outsourcing as a function of trade and transaction costs. As firms adopt increasingly complex organization and sourcing strategies and as global value chains grow in length and layers, lower transaction costs become even more essential, especially when just-in-time management models make transport and communication a critical component of competitiveness.

Indeed, an increasingly important component of transaction cost, especially in GVCs, is information cost. Information and communication technologies enable firms to better monitor assets and operation (Head and Ries 2008), communicate with foreign suppliers and customers (Oldenski 2012), and substitute for the transfer of technology embodied in traded intermediates (Keller and Yeaple 2013). An emerging strand of research analyzes the role of communication costs in determining the patterns of trade and multinational activity.

Similarly, firms engage in vertical foreign direct investment (when they fragment production or slice up the value chain because vertical foreign direct investment is motivated by comparative advantages, unlike older horizontal foreign direct investment, which is motivated by market access) because of cost considerations arising from countries' factor cost differences (Alfaro and Chen 2017). Distance has become less an obstacle for foreign direct investment, as it did for trade. Using U.S. foreign direct investment outflow and inflow data for 2001 and 2010, they found that the share of U.S. outward foreign direct investment concentrated within 5,000 kilometers fell from around 30% to around 20%.

This change suggests an expansion of foreign direct investment flow across space in an era when transportation and communication costs have declined. The trend may also reveal that firms are less risk-averse when it comes to investing overseas because they perceive that global economic governance, in particular competition policy, has improved. A growing number of bilateral trade agreements have included chapters on competition policy that allow foreign affiliates to compete on more equal footing with domestic firms. As discussed in chapters 7 and 8 of this book, business climate and contractual enforcement influence not only make-or-buy decisions, but also the choice between international outsourcing (arm's length subcontracting) and offshoring through foreign direct investment when rules lack sufficient binding force for disciplining business practices.

FIGURE 4.3 Ad valorem and accumulated trade costs in snakes and spiders



Source: Diakantoni and others 2017.

When GVCs are spiders, the marginal decrease in the ad valorem trade costs may compensate for the additional cost of further fragmenting the chain (at the third split). When GVCs are snakes, the decreasing ad valorem trade costs apply to an increasing accumulated value of trade in intermediate goods. In this case the mitigating effect of lower ad valorem trade costs is not as strong as for spiders because the trade costs accumulate exponentially (Ferrantino 2012). But the additional unit cost is decreasing, and the net effect becomes negative after a certain point (the seventh split).[14] Established GVCs are also vulnerable to a reversal in the decreasing trend in ad valorem trade costs. If the ad valorem trade costs start increasing again, the GVC length is gradually shortened.

Cascading costs and trade facilitation: A world trade network perspective

Monetary costs are only one of the many facets of trade costs. The accumulation of trade frictions from beginning to end of production networks goes against the raison d'être of GVCs, which require participants to operate in time-critical decentralized systems. To realize cost savings in production networks, intermediate products must be worked on and shipped between production locations and onward into retail distribution systems (and then to the final consumer) as efficiently and quickly as possible.

Time lost waiting at borders (and related costs of storage and the like) are deadweight economic costs within the network. The time required to import depends on various elements, such as the efficiency of cargo handling at ports. The import process also takes longer when customs physically inspect cargo. Such delays in importing have large effects on firms' activities. For one, the delays require importers to pay extra storage costs. Further, particularly when producers use imported inputs, delays require producers to reconsider initial production schedules, reducing their productivity. Djankov, Freund, and Pham (2010) found that each additional day a product was delayed by border formalities equated to adding 70 kilometers on average to the distance between trading partners. The effect was particularly pronounced for time-sensitive agricultural goods, where a day's delay reduced a country's relative exports by 6%.

Hayakawa, Laksanapanyakul, and Yoshima (2016) demonstrate that longer import time reduces export shipment frequency and exports per shipment—and thus total exports. A longer import time raises the marginal cost of production by lowering the production efficiency and increasing the storage cost. This raises the marginal cost and lowers the firm's total operating profit. Given that firms have to pay fixed costs for each export shipment, the total operating profit will not cover the total fixed costs unless the firm reduces the number of export shipments. As a result, firms that experience longer import times are more likely to reduce the number of export shipments.

In Thailand doubling the number of days to import would reduce total exports an estimated 3.3% and the number of export shipments an estimated 2.9%.[15] Import time also has a major effect on import patterns. Increased import time reduces import shipment frequencies but raises imports per shipment. Specifically, doubling the number of days to import would reduce the number of import shipments an estimated 3.6% and increase imports per shipment an estimated 0.1%. As a result, total imports would be reduced. In sum, the time spent in one stage has effects on both upstream and downstream stages in international production networks.

In a competing GVC market this has clear implications for upgrading. In apparel value chains the most profitable segments are in the fashion industry, which is known to run on a high degree of uncertainty. With ever-changing trends it is even harder to predict the market and thus to forecast the required raw materials and supplies: only suppliers able to switch production rapidly and adapt to fast turnovers are likely to be considered to supply this high value-added segment. Less flexible ones will remain confined to the high-volume–low-value segments, competing on low production costs.

More generally, it is largely accepted by analysts that all downstream final-good producers prefer timely delivery of (imported) intermediate inputs. Hummels and Schaur (2012) modelled exporters' choices between fast-but-expensive air cargo and slow-but-cheap ocean cargo. Shorter delivery times of shipments lead to greater benefits because they allow importers to optimize production flows. If final-good producers can receive and use imported inputs exactly when they need those inputs, they are assumed to be able to transition smoothly into the production processes, realizing greater production efficiency.

In a trade network this bilateral effect is compounded because the efficient organization of production flows between two trading partners also depends on the efficiency of upstream

and downstream GVC partners: the production chain will be as swift as its slowest link. Bilateral trade frictions should therefore be analyzed from a multiplayer perspective, including not only the other bilateral trading partners, as in conventional gravity models, but also indirect participants that are farther upstream or downstream in the supply chain. Improving the effectiveness in processing trade with a minimum of frictions will not have the same impact on the world trade network as improving logistic and trade facilitation in a country playing the role of a GVC hub.

Network and graph analysis applied to trade in intermediate inputs identifies key players by computing centrality indicators. If a trading partner (a node or a vertex, in network analysis) "influences just one other node, who subsequently influences many other nodes (who themselves influence still more others), then the first node in that chain is highly influential" (Borgatti 2005, p. 61). A player's centrality is therefore a function of both its own importance in the world trade economy and the centrality of the trading partners it is associated with.

Trade in intermediate goods is organized along three large regional clusters—East Asia, centered on China; Europe, centered on Germany; and North America, centered on the United States—and dense extraregional exchanges (figure 4.4). The East Asia and Europe regional value chains include several smaller clusters organized around, for example, Japan and the United Kingdom.

To assess the contribution of each economy as a GVC trade facilitator, Diakantoni and others (2017) computed the PageRank centrality indicator, which is a more robust centrality indicator than alternative specifications, for each partner. They then compared the PageRank indicator with various trade and transportation indicators, including the World Bank's Logistics Performance Index, the most appropriate for the purpose (figure 4.5).

Trading partners are ranked according to their network centrality and compared with their relative performance in timeliness (as measured by a trade facilitation index). An ideal situation would be to have a perfect fit between GVC centrality and trade-cost efficiency. When that is not the case, the analysis identifies where trade facilitation investments would have the largest global impact. The hypothesis is that investments in upgrading trade-facilitation performance will have a large positive spillover and be highly profitable for global welfare when they improve the situation of a key player. A perfect fit between centrality and trade facilitation would show all countries aligned on the diagonal, which is far from the case. There is a large mismatch between the quality of trade and transport facilitation and the role of each economy in the world trade network.

The benefits of improving trade facilitation are usually measured using the traditional bilateral trade perspective, which is only part of the bigger GVC picture. The OECD has estimated the bilateral benefits of reducing trade costs from full implementation of the WTO Trade Facilitation Agreement at 16.5% of total costs for low-income countries, 17.4% for lower-middle-income countries, 14.6% for upper-middle-income countries, and 11.8% for OECD countries. Together, these estimates imply that a 1% reduction in trade costs has the potential to increase bilateral trade by 2.8–4.5% (WTO 2015; G20 TIWG 2016). While the direct benefits of trade facilitation will be proportionally higher for countries not well integrated into international trade because of their high trade costs, the global benefits will be higher if key traders at the core of GVCs undertake trade facilitation investments (see figure 4.5). Improving trade facilitation for economies below the line would benefit the entire trade community by reducing accumulated trade costs—the farther from the line, the higher the expected benefits. Six countries (among the 61 in the Trade in Value-Added database) are particularly relevant from this perspective: Indonesia, the Russian Federation, Brazil, India, China, and Italy.

The network approach also suggests that the global benefits will be higher when trade facilitation investments go to the key GVC traders. As mentioned by Hayakawa, Laksanapanyakul, and Yoshimi (2016), trade costs often take the form of customs delays due to processing issues such as inconsistencies in Harmonized System codes between importers and customs, particularly when the correct applicable Harmonized System code is unclear for a product. Those issues can be solved without huge investment costs—for example, by implementing an advance ruling system that expedites the delivery of shipments because importers and other related parties can inquire about tariff classifications and duty rates prior to import.

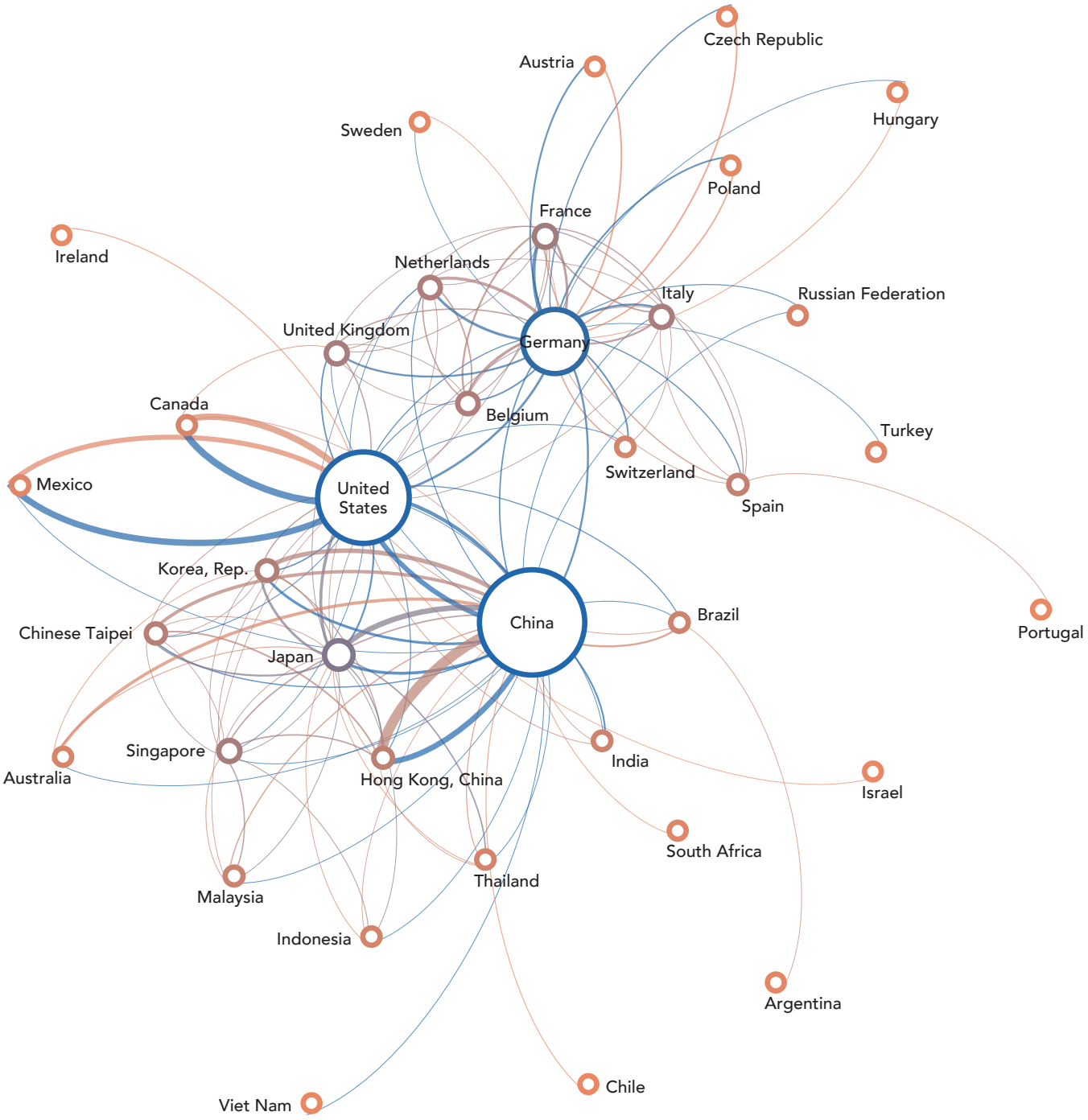
Conclusions

The accumulation and magnification effects of cascading trade costs explain why complex GVCs cannot develop when those costs are above a certain threshold (Yi 2003). When the production of a final good is fragmented across several countries, trade costs increase the purchase price of inputs, parts, and components. The additional production cost increases the sale price and is transmitted to the next production step. Those costs accumulate in the supply chain through a cascading effect and are ultimately embodied into the higher price paid by the final consumer.

Overall, trade frictions would translate into an average increase of 18% of the production cost in a single stage of the value chain. Most of the trade frictions result from transportation costs and deficient logistic and trade facilitation conditions: their incidence is estimated at an ad valorem tariff equivalent of 17%. While some of these nontariff costs are outside the realm of national policymakers (as with geographic distance from the trading partner or sharing a common language), many fall under the control of domestic policy (logistics performance, cost of doing business, and so on).

Cascading trade costs not only penalize final consumers, they also erode the competitiveness of domestic industries on international markets and lower the effectiveness of export-led industrialization strategies. Steep trade cost escalation creates a large anti-export bias on complex manufactured goods when value added is the traded commodity. This bias creates additional obstacles for export diversification and GVC upgrading. Besides tariff and transportation, nonmonetary costs, particularly delays

FIGURE 4.4 Graphical representation of trade in intermediate goods, 2011



Source: Diakantoni and others 2017, based on the UN Comtrade database (https://comtrade.un.org).

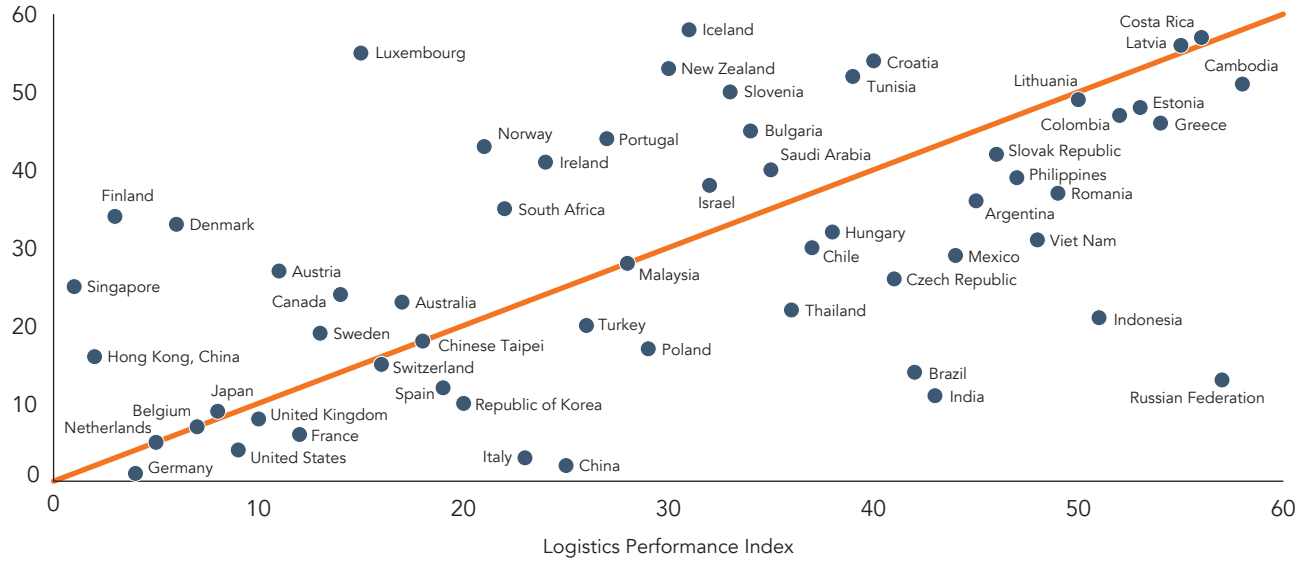
Note: Includes the 61 economies in the Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database and their most important bilateral gross trade flows. The color of the nodes (and their export flows) is from blue to red, blue indicating the highest degree of centrality.

and uncertainty, are particularly relevant when the manufacture of merchandise is fragmented across several countries. Delays in a just-in-time business model disrupt the whole supply chain and render the entire process inoperable.

Trade costs vary by sector and country. Outside agriculture, the costliest sectors, as measured with the extended effective protection margin, are motor vehicles, transport equipment, petroleum products, computers, and machinery. Primary sectors

FIGURE 4.5 PageRank scores and Logistics Performance Index values, 2011

PageRank centrality indicator



Source: Diakantoni and others 2017.

Note: The diagonal line shows equal ranking on the Logistics Performance Index and on PageRank.

carry the lowest trade costs because they require few inputs in the production chain. Small and low-income countries tend to suffer more from trade costs: Cambodia ranks as the most expensive country in additional trade costs.

The smaller domestic value added share in developing economies' manufactured exports, compared with that in developed countries' economies, tends to amplify the impact of trade costs through the magnification effect. From a trade and development perspective higher-than-average trade costs marginalize low-income countries and prevent them from joining international supply chains. They may still compete by further reducing the wages paid to workers and the gross profit retained by the firm, but such a race to the bottom would severely limit their potential for industrial and social upgrading.

Many developing countries intend to lower their trade costs by setting up duty drawback schemes and export processing zones. But the effect is limited in time and scope, because they compensate exporting firms for the additional production costs only when they use imported inputs. Such strategies tend to price-out second-tier domestic firms. These mitigating policies are only second-best alternatives to fully fledged trade facilitation when it comes to deepening domestic interindustrial links. Reducing tariff and nontariff trade costs globally through multilateral agreements is thus fully consistent with the interests of developing economies because it lowers their cost of GVC participation.

Finally, in a production network, bilateral trade costs tell only part of the story. In a close-knit network, competitiveness also depends on the costs faced by trading partners and by trade competitors. Poor trade facilitation among countries that rank highly in GVC trade (at or close to the heart of regional networks) impose a systemic cost both to themselves and to the rest of the trade community. The welfare benefits of the WTO Trade Facilitation Agreement from gains from trade will be enjoyed by the implementing economy, by its direct trading partners, and by the entire community. This magnified effect of trade facilitation is directly attributable to the way trade costs accumulate in GVCs.

ANNEX 4.1

Extended effective protection rates and the relative price of value added

Effective protection rates, in their original formulation, are calculated by deducting the additional production cost that manufacturers have to pay because of the tariff charged on tradable inputs from the additional benefit generated by selling their product at a price higher than the free-trade market price, thanks to the duties charged on competitive imports. The effective rate of protection (*EEPR*) on tradable good *j* is the difference between V_j, the value added obtained on the domestic market (with prices influenced by trade costs), and V^*_j, the value added that would be generated in the absence of policy and natural trade barriers, expressed as a proportion of the frictionless value added. It is given by the expression:

$$EEPR_j = (V_j - V^*_j) / V^*_j \qquad \text{(A4.1.1)}$$

Substituting products for industries, equation A4.1.1 can be expressed in standard input-output notation:

$$EEPR_j = \frac{p_j \times t_j - \sum_i (t_i \times a_{ij})}{p_j - \sum_i a_{ij}} - 1 \qquad \text{(A4.1.2)}$$

where p_j is the nominal price of output *j* at the frictionless trade price; a_{ij} are elements of the matrix **A** of technical coefficients in an input-output matrix at the frictionless trade price of inputs *i*;[16] t_j is 1 + the rate of ad valorem tariff and transport nominal protection on sector *j*, where $t_j \geq 1$; and t_i is 1 + the rate of ad valorem nominal tariff and transport protection on inputs purchased from sector *i*, where $t_i \geq 1$. *i* can be equal to *j* when a firm purchases inputs from other firms in the same sector of activity. In an intercountry framework *i* also includes the partner dimension [*c*] because inputs from sector *i* might be domestic or imported.

In the trade literature this expression is often simplified into:

$$EEPR_j = \frac{t'_j - \sum_i (t'_i \times a_{ij})}{1 - \sum_i a_{ij}} \qquad \text{(A4.1.3)}$$

where t'_i and t'_j are the rates of ad valorem protection, where $t'_i > 0$.

To analyze more precisely the impacts of trade costs on competitiveness as well as some mitigating measures that the exporting country could implement, it is important to distinguish between the costs of domestic (superscript *h*) and foreign inputs (superscript *f*). Extended effective protection rates can be written as:

$$EEPR_j = \frac{t_j - [\sum_i (t_i \times a^f_{ij}) + \sum_i (t_i \times a^h_{ij})]}{1 - \sum_i a_{ij}} - 1 \qquad \text{(A4.1.4)}$$

where a^f_{ij} is the intermediate consumption *i* from the foreign country required to produce one unit of output *j* and a^h_{ij} is the intermediate consumption *i* from the home country required to produce one unit of output *j*.

Even when duty drawbacks or tariff exemptions correct for trade frictions and allow domestic producers to purchase inputs at international prices (as in export processing zones), export-oriented firms still have a disincentive to purchase inputs internally from second-tier domestic suppliers, represented by the sum $[\sum_i (t_i \times a^h_{ij})]$. The first-tier domestic suppliers exporting their products to other participants in the international supply chain remain at a disadvantage to their free-trade competitors (right side of equation A4.1.5) when they source some of their inputs from other local suppliers or outsource some of their tasks to them:

$$(1 - [\sum_i a^f_{ij} + \sum_i (t_i \times a^h_{ij})]) < (1 - \sum_i a_{ij}) \qquad \text{(A4.1.5)}$$

In other words, export processing zones or drawbacks price-out domestic suppliers when nominal tariffs and trade costs are high. To summarize the main implications of the formal model, even in the absence of tariff and transport cost escalation and a flat extended effective protection rate, trade frictions reduce the competitiveness of domestic firms, most frequently when they are price takers and compete on the global market at international prices.

ANNEX 4.2

Measuring the length of global value chains and the number of border crossings

The analysis of trade costs embodied in multistage international production processes is often carried out using international input-output models. The calculations have been made possible by the availability of the underlying input-output tables: Koopman and others (2010) estimate the cumulative effect of transportation and tariff margins using Global Trade Analysis Project Multi-Country Input-Output tables; Tamamura (2010) uses the Institute of Developing Economies–Japan External Trade Organization international tables to estimate the impact of regional trade agreements.

Length is most often estimated using the concept of average propagation length applied at the international level in Dietzenbacher and Romero (2007) for major European countries and by Inomata (2008) for Asia. The average propagation length represents the average number of production stages lining up in every branch of all the given supply chains. It is a shorthand representation for an industry's level of fragmentation, which relies on weighting the distance index by successive powers k of the technical coefficient matrix **A**. $\mathbf{A}^k$s are regarded as progressive impacts of the initial demand when supply chains are sliced at the kth stage of the production process. The average propagation length is defined as:

$$APLj\text{–}i = 1 \times \frac{a_{ij}}{(l_{ij} - \delta_{ij})} + 2 \times \frac{[A^2]_{ij}}{(l_{ij} - \delta_{ij})} + 3 \times \frac{[A^3]_{ij}}{(l_{ij} - \delta_{ij})} + \ldots \quad \text{(A4.2.1)}$$

where l_{ij} is Leontief inverse coefficients $[I - A]^{-1}$ and δ_{ij} is a Kronecker delta product that is $\delta_{ij} = 1$ if $i = j$ and $\delta_{ij} = 0$ otherwise.

In other words, the average propagation length is the weighted average of the number of production stages that an impact from industry j goes through until it ultimately reaches industry i, using the strength of an impact at each stage as a weight. By construction, the average propagation length shows a rapidly decaying effect after the second round, because of the low value of the nondiagonal coefficients in the Leontief matrix. As a result, the value of the additional element of the average propagation length suite falls rapidly to zero after the second production stage. That the $\mathbf{A}^k$s tend toward zero when k increases is actually a condition for the suite to converge to the Leontief inverse $[\mathbf{I} - \mathbf{A}]^{-1}$, a result central to most GVC indicators. The smaller the value of extra-diagonal technical coefficients, the faster is the convergence to zero.

This is particularly true for the international coefficients (those outside the bloc-diagonal matrices representing the domestic interindustrial exchanges) and reflects the fact that most countries are largely self-sufficient in intermediate inputs. Therefore, the foreign component of $\mathbf{A}^k$ (coefficients outside the bloc-diagonal of domestic industries) is rapidly insignificant from an economic perspective when k increases.[17]

The length of the GVCs can be factored in by using geographic distance or monetary transportation costs between two inter-related industries instead of counting production stages, as in the average propagation length formulation shown in equation A4.2.2. This calculation was suggested by Los and Temurshoev (2012). Once the distance between the supplying firm and its clients (d_{ij}) is known, a vector of input-weighted distance from customers to suppliers provides a geographical distance (d_{ij} is in kilometers) or an economic one (if d_{ij} is in monetary terms). The distance covered by the global value chain between its initiation and the final consumer is given by:

$$\mathbf{D}: \quad (\mathbf{I} - \mathbf{A'})^{-1}\, \mathbf{D^*} \qquad \text{(A4.2.2)}$$

where $\mathbf{D^*}$ is a diagonal input-weighted matrix of supplier-to-client distance by industry and country.[18] Miroudot and Nordström (2015) adapt this methodology to measure the length of the external network of suppliers, sourcing the distance from the GeoDist database maintained by the Centre d'Études Prospectives et d'Informations Internationales (Mayer and Zignago 2011).

Another way of looking at GVC length is to estimate the number of border crossings from the first step (most upstream sector/country) to final demand. Such a decomposition also allows an industry to be located in relation to its situation in the supply chain (upstream or downstream). Wang and others (2016) synthesize the various backward and forward measures by defining a GVC position index based on a thorough decomposition of the contribution of each production stage to the total value. Their index measures the distance from any production stage between the final demand and the initial factor inputs in a production line by a combination of production links based on both forward and backward links. The length of the international part of supply chains (the one subject to cumulative tariff and transportation costs) varies from country to country and sector to sector.

Muradov (2016a) proposes a new approach to quantify the accumulation of trade costs and the average number of backward and forward border crossings. When the input-output coefficients are calculated at basic prices (the most common situation), trade costs can be integrated into the **A** matrix by adding an additional row of trade margins. His method also relies on the use of an alternative to the Leontief matrix to compute a "global" inverse, disaggregating ex ante (instead of ex post, as in other approaches) the diagonal and off-diagonal blocs corresponding to, respectively, domestic and international transactions in the **A** matrix. Diakantoni and others (2017) discuss the interpretation of those trade margins when some of the trade costs are embodied in domestic inputs.

Notes

1. Measuring the input use and value-added contributions along the production chain from beginning to end since the mid-1970s, the five stylized facts are the ratio of world value-added to gross exports (an indicator of GVC trade) has fallen over time, by roughly 10 percentage points; this ratio has fallen for manufacturing but has risen outside of manufacturing; changes have been heterogeneous across countries, with fast growing countries seeing larger declines in the ratio of their value-added to gross exports; declines in value added to export ratios have been larger for proximate partners that entered into regional trade agreements; and declines in value added to export ratios have been larger for country pairs that entered into regional trade agreements.
2. The author shows that in the presence of trade in intermediates GDP is not a good proxy for economic mass. As Noguera (2012) explains, deriving a gravity equation for bilateral value-added trade is complicated by the nonlinear relationship between the value added and final-good demands. Trade costs affect trade in value added through their effect both on bilateral gross trade and on production sharing arrangements, but also through the trade costs corresponding to other pairs of countries in the supply chain.
3. In competitive markets GVC trade exists only when trade costs are lower than the efficiency gains of fragmenting the supply chain and outsourcing the tasks. So by definition accumulating trade costs have an upper limit. In a competitive market where all efficiency gains are translated to the price of the final product, any increase in trade costs will be paid by the consumer. In a semi-monopolistic market the efficiency gains will accrue mainly to the lead firm.
4. The effective tariff rate on output differs from the effective rate of protection as it is usually understood in trade analysis and is used later in the chapter. It contemplates only the nominal protection on output but excludes the additional production cost on inputs.
5. Input coefficients a_{ij} are calculated by dividing input values of goods and services used in each industry by the industry's corresponding total output. That is, $a_{ij} = z_{ij} / X_j$, where z_{ij} is a value of good/service i purchased for the production in industry j, and X_j is the total output of industry j. Thus, the coefficients represent the direct requirement of inputs for producing just one unit of output of industry j.
6. The exporting firm is considered to be a price taker that cannot impose higher prices and will have to compete on the global market at international prices. Incidentally, this result explains why small firms do not export as much as large firms in the more realistic situation where some of the trade costs are not ad valorem fees but are sunk costs.
7. This tactic may be used to gain a contract, but it is not sustainable in the long term if the firm wishes to retain skilled staff or invest and expand its production capacity.
8. The negative impact of high extended effective protection rates on second-tier domestic suppliers and the perspective of GVC upgrading in developing countries derives from the fact that tariff and transportation costs influence the domestic price of all inputs, including domestically produced ones (goods, but also services).
9. The last year for which Trade in Value-Added database data were available is 2011, and 2006 is the first one where preferential tariffs were available for all trade partners on a comparable basis.
10. Even when the extended effective protection rate is negative, as in the mining sector, trade frictions still reduce the competitiveness of domestic firms when they compete on the global market at international prices while still paying domestic prices for their inputs.
11. The nontariff trade costs from Duval, Saggu, and Utoktham (2015) include factors other than freight and insurance costs.
12. The paper is also of interest since it surveys the state of the art and brings together the results of alternative decompositions. The presentation of these decomposition techniques, which rely on the international input-output matrix and its mathematical properties, would require complex calculus. For example, the decomposition of the number of transactions along the downstream value chain in Muradov (2016b) results in as much as twelve indicators (see annex 4.2 for an introduction).
13. In practice, the lead firm may have strategic objectives in international outsourcing that go beyond pure cost-efficiency, but this chapter focuses only on value added and production costs.
14. Intuitively, the existence of an inflection point can be explained as follows: when trade costs are very high, accumulated cost is 0 because no trade takes place; when trade is frictionless, accumulated trade costs are also 0 because there are no trade costs. So, between these two extreme positions, accumulated trade costs should increase with the length of the GVC up to a maximum, then decrease afterward.
15. The authors use transaction-level export and import data from 2007 to 2011 that cover all commodity exports and imports in Thailand.
16. Input coefficients a_{ij} are calculated by dividing input values of goods and services used in each industry by the industry's corresponding total output. That is, $a_{ij} = z_{ij} / X_j$, where z_{ij} is a value of good/service i purchased for the production in industry j, and X_j is the total output of industry j. Thus, the coefficients represent the direct requirement of inputs for producing just one unit of output of industry j.
17. This is true for the industry average, represented in an input-output matrix. This average is prone to aggregation bias, and export-oriented industries may be much more reliant on imported inputs than the average domestic firm. This can be observed in the Trade in Value-Added database, which distinguishes several types of firms in China and Mexico.
18. For each domestic industrial sector, an average distance to international supplier is calculated, weighting the distance to the supplier's country by its share in the total inputs imported by the domestic industry. From a purely international trade perspective, domestic interindustry commerce should be set to 0 (the distance between two domestic firms is nil), but this is an oversimplification for some developing countries, where most people live in coastal areas and inland transportation is more expensive than international freight.

References

Alfaro, L., and M. Chen. 2017. "Transportation Cost and the Geography of Foreign Investment." In *Handbook of International Trade and Transportation*, edited by B. Blonigen and W. Wilson. Cheltenham, U.K.: Edward Elgar Publishing.

Anderson, J., and E. van Wincoop. 2004. "Trade Costs." National Bureau of Economic Research (NBER) Working Paper No. 10480, NBER, Cambridge, MA.

Balassa, B. 1965. "Tariff Protection in Industrial Countries: An Evaluation." *Journal of Political Economy* 73 (6): 573–94.

Baldwin, R., and A. Venables. 2010. "Spiders and Snakes: Offshoring and Agglomeration in the Global Economy." NBER Working Paper No. 16611, NBER, Cambridge, MA.

Baldwin, R., and D. Taglioni. 2011. "Gravity Chains: Estimating Bilateral Trade Flows When Parts and Components Trade is Important." NBER Working Paper No. 16672, NBER, Cambridge, MA.

Borgatti, S. 2005. "Centrality and Network Flow." *Social Networks* 27 (1): 55–71.

Ciuriak, D., and J. Xiao. 2014. *Should Canada Unilaterally Adopt Global Free Trade?* Ottawa: Canadian Council of Chief Executives.

Corden, W. M. 1966. "The Structure of a Tariff System and the Effective Protection Rate." *Journal of Political Economy* 74 (3): 221–37.

Diakantoni, A., H. Escaith, M. Roberts, and T. Verbeet. 2017. "Accumulating Trade Costs and Competitiveness in Global Value Chains." World Trade Organization (WTO) Working Paper Economic Research and Statistics Division (ERSD) 2017–2, WTO, Geneva.

Dietzenbacher, E., and I. Romero. 2007. "Production Chains in an Interregional Framework: Identification by Means of Average Propagation Lengths." *International Regional Science Review* 30 (4): 362–83.

Djankov, S., C. Freund, and C-S. Pham. 2010. "Trading on Time." *The Review of Economics and Statistics* 92 (1): 166–73.

Duval, Y., A. Saggu, and C. Utoktham. 2015. "Value Added Trade Costs in Goods and Services." United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) Trade and Investment Working Paper 01, ESCAP, Bangkok.

Escaith, H., and S. Miroudot. 2015. "World Trade and Income Remain Exposed to Gravity." In *The Global Trade Slowdown: A New Normal?,* edited by B. Hoekman, 127–60. London: Centre for Economic Policy Research.

Ferrantino, M. 2012. "Using Supply Chain Analysis to Examine the Costs of Non-Tariff Measures (NTMs) and the Benefits of Trade Facilitation." WTO Working Paper ERSD-2012–02, WTO, Geneva.

G20 TIWG (Trade and Investment Working Group). 2016. "Discussion Paper on Monitoring and Reducing Trade Costs." Second Meeting of the Trade and Investment Working Group, Nanjing, China, April 4–5.

Ghodsi, M., and R. Stehrer. 2016. "Non-Tariff Measures Trickling through Global Value Chains." Productivity, Non-Tarrif Measures and Openness (PRONTO) Working Paper, Vienna Institute for International Economic Studies, Vienna.

Grossman, G., and E. Helpman. 2002. "Integration versus Outsourcing in Industry Equilibrium." *Quarterly Journal of Economics* 117 (1): 85–120.

———. 2003. "Outsourcing versus FDI in Industry Equilibrium." *Journal of the European Economic Association* 1 (2–3): 317–27.

———. 2005. "Outsourcing in a Global Economy." *Review of Economic Studies* 72 (1): 135–59.

Hayakawa, K., N. Laksanapanyakul, and T. Yoshimi. 2016. "Effect of Import Time on Export Pattern." Institute of Developing Economies (IDE) Discussion Paper No. 566, IDE–Japan External Trade Organization, Chiba, Japan.

Head, K., and J. Ries. 2008. "FDI as an Outcome of the Market for Corporate Control." *Journal of International Economics* 74 (1): 2–20.

Head, K., and T. Mayer. 2013. "What Separates Us? Sources of Resistance to Globalization." *Canadian Journal of Economics* 46 (4): 1196–1231.

Hummels, D. 2007. "Transportation Costs and International Trade in the Second Era of Globalization." *Journal of Economic Perspectives* 21 (3): 131–54.

Hummels, D., and G. Schaur. 2012. "Time as a Trade Barrier." NBER Working Paper No. 17758, NBER, Cambridge, MA.

Ing, L.-Y., O. Cadot, and J. Walz. 2016. "Transparency in Non-Tariff Measures: An International Comparison." Fondation pour les Études et Recherches sur le Développement International (FERDI) Working Paper 182, FERDI, Clermont-Ferrand, France.

Inomata, S. 2008. "A New Measurement for International Fragmentation of the Production Process." IDE Paper 175, IDE–JETRO, Chiba, Japan.

Johnson, R. 2014. "Five Facts about Value-Added Exports and Implications for Macroeconomics and Trade Research." *Journal of Economic Perspectives* 28 (2): 119–42.

Johnson, R., and G. Noguera. 2016. "A Portrait of Trade in Value Added over Four Decades." NBER Working Paper No. 22974, NBER, Cambridge, MA.

Keller, W., and S. R. Yeaple. 2013. "The Gravity of Knowledge." *American Economic Review* 103 (4): 1414–44.

Koopman, R., W. Powers, Z. Wang, and S-J. Wei. 2010. "Give Credit Where Credit Is Due: Tracing Value Added in Global Production Chains." NBER Working Paper No. 16426, NBER, Cambridge, MA.

Koopman, R., Z. Wang, and S-J. Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *American Economic Review* 104 (2): 459–94.

Lewis, D. 1994. "Freight Mode Choice: Air Transport Versus Ocean Transport in the 1990's' Flight." Cambridge, MA: Transportation Laboratory, Massachusetts Institute of Technology.

Los, B., and U. Temurshoev. 2012. "Distance-Based Measures of Globalization in a World with Fragmented Production." Presentation at the World Input-Output Database (WIOD) Conference on Causes and Consequences of Globalization, Groningen, Netherlands, April 24–26.

Ma, A. C., and Ari Van Assche. 2010. "The Role of Trade Costs in Global Production Networks Evidence from China's Processing Trade Regime." World Bank Working Paper 5490, World Bank, Washington, DC.

Mayer, T., and S. Zignago. 2011. "Notes on CEPII's Distances Measures: The GeoDist Database." Centre d'Études Prospectives et d'Informations Internationales (CEPII) Working Paper 2011–25, CEPII, Paris.

Miroudot, S., and H. Nordström. 2015. "Made in the World." European University Institute (EUI) Robert Schuman Centre for Advanced Studies Working Paper 2015/60, EUI, Florence.

Muradov, K. 2016a. "Trade Costs and Borders in the World of Global Value Chains." Nineteenth Annual Conference of Global Economic Analysis, Washington, DC, June 15–16.

———. 2016b. "Structure and Length of Value Chains." Draft paper submitted to the workshop on Regional/Multi-Regional Input-Output Analysis, Osnabrück, Germany.

Noguera, G. 2012. "Trade Costs and Gravity for Gross and Value Added Trade." Job Market Paper, University of California, Berkeley and Columbia University, Berkeley, CA. and New York, NY.

OECD (Organisation for Economic Co-operation and Development) and WTO (World Trade Organization). n.d. Trade in Value-Added (TiVA) database. Paris: OECD. Available at: http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm.

Oldenski, L. 2012. "Export Versus FDI and the Communication of Complex Information." *Journal of International Economics* 87 (2): 312–22.

Rouzet, D., and S. Miroudot. 2013. "The Cumulative Impact of Trade Barriers Along the Value Chain: An Empirical Assessment Using the OECD Inter-Country Input-Output Model." Paper prepared for the 16th Annual Conference on Global Economic Analysis, Shanghai, June 12–14.

Samuelson, P. 1954. "The Transfer Problem and the Transport Costs." *The Economic Journal* 64 (254): 264–89.

Tamamura, C. 2010. "Cost Reduction Effects of 'Pseudo FTAs' in Asia: Application of a Price Model Based on a Multilateral I/O table." IDE Discussion Paper No. 226, IDE–JETRO, Chiba, Japan.

Timmer, M., B. Los, G. de Vries, and R. Stehrer. 2016. *An Anatomy of the Global Trade Slowdown based on the WIOD 2016 Release*. Groningen Growth and Development Centre Research Memorandum 162. Groningen, Netherlands: University of Groningen.

Wang, Z., S.-J. Wei, X. Yu, and K. Zhu. 2016. "Characterizing Global Value Chains." Working Paper 578, Stanford Center for International Development, Stanford, CA.

World Bank. 2016. *Connecting to Compete 2016: The Logistics Performance Index and Its Indicators*. Washington, DC: World Bank.

WTO (World Trade Organization). 2015. *World Trade Report 2015—Speeding up trade: benefits and challenges of implementing the WTO Trade Facilitation Agreement*. Geneva: WTO.

Yi, K.-M. 2003. "Can Vertical Specialization Explain the Growth in World Trade?" *Journal of Political Economy* 111 (1): 52–102.

Yu, X., R. Wang, J. Yang, and Z. Wang. 2016. "Policy Options on Intermediate Goods Trade under the Era of Global Value Chains." University of International Business and Economics, Beijing.

CHAPTER 5

The middle-income trap and upgrading along global value chains

JAKOB ENGEL AND DARIA TAGLIONI

After acting as the primary drivers of global growth in the years immediately following the 2007–08 global financial crisis, emerging and developing economies experienced a substantial decline. Having exceeded 4% a year from 2010 to 2014, their growth declined to 3.4% in 2015 and to an expected 3.5% in 2016, with commodity producers projected to grow only 0.4% in 2016 (figure 5.1; World Bank 2016a). The end of the commodity boom and concerns about financial stability in many emerging economies led Haldane (2015, p. 13) to argue that after the Anglo-Saxon crisis of 2008/09 and the euro-area crisis of 2011/12, "we may now be entering the early stages of Part Three of the [crisis] trilogy, the 'Emerging Market' crisis of 2015 onwards." Many emerging economies face high corporate debt and excess capacity, leaving them vulnerable to unexpected domestic or global events (IMF 2016). And many of the world's largest middle-income countries—including Argentina, Brazil, China, Indonesia, Nigeria, and the Russian Federation—have seen substantial slowdowns.[1] In this economic climate, gaining better understanding of different growth trajectories and the obstacles middle-income countries face in sustaining rapid growth becomes all the more relevant.

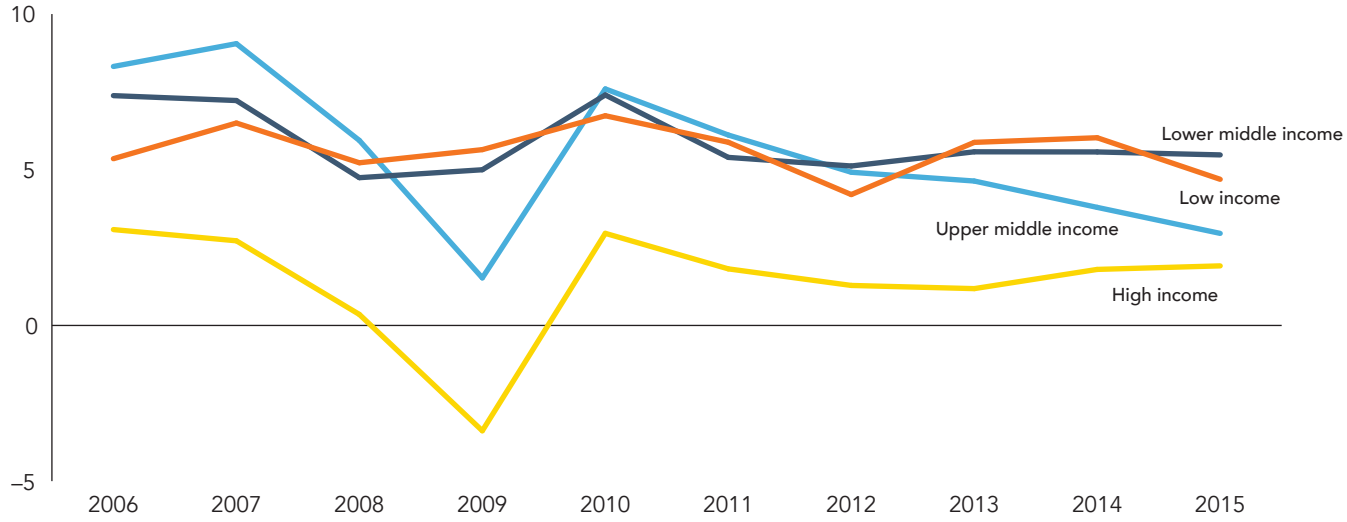
This chapter examines in greater depth the middle-income trap—in which high sustained growth becomes increasingly difficult once a country reaches GDP per capita of around $10,000. The term, coined by Gill and Kharas (2007) in relation to growth prospects in Asia, remains ambiguous and is interpreted in various ways, producing different empirical findings and policy recommendations. Indeed, a trap specific to middle-income countries is disputed (see Pritchett and Summers 2014; Im and Rosenblatt 2013; Roy and others 2016), and the data tend to show substantial upward mobility between 2000 and 2015, particularly for middle-income countries, with 79 of 133 countries that were low or middle income in 2000 improving their income status and none declining (table 5.1).

After addressing some of the definitional issues, the chapter reviews recent cross-country and case-study literature on the middle-income trap—its causes and its possible solutions.

It then links the middle-income trap to the emergence and growing significance of trade through global value chains (GVCs). The role of GVCs in trade and investment flows dominates academic and policy debates on trade and industrial development (see Gereffi 2014; Taglioni and Winkler 2016). One characteristic of GVC trade is the denationalizing of comparative advantage, which could allow countries to industrialize by joining GVCs rather than by building their own (Baldwin and Lopez-Gonzalez 2015). So integration into GVCs has been widely viewed as a strategic pillar for developing countries to become more competitive, to develop the skills and human capital of their labor force, and to acquire technology to industrialize and move into higher value-added production. Whether such economic upgrading is happening—and if so, where and how—remains subject to much debate and speculation.

This chapter surveys these two debates—on the middle-income trap phenomenon and on countries' ability to grow and develop through GVC participation—and asks whether integration into GVCs can help countries avoid a middle-income trap and, if so, why and under what circumstances. The primary focus is examining how the factors that are hypothesized to contribute to growth slowdowns at middle income may also impede economic upgrading through GVCs. The literature is limited on

FIGURE 5.1 GDP per capita growth, by income group, 2006–15



Source: World Development Indicators database.

TABLE 5.1 Share of all countries in a given income group in 2000 and 2015

Percent

		Income group in 2015				
		Low income	Lower middle income	Upper middle income	High income	Total
Income group in 2000	Low income	47.6	47.6	4.8	0.0	**100**
	Lower middle income	0.0	37.7	58.5	3.8	**100**
	Upper middle income	0.0	0.0	51.4	48.6	**100**
	High income	0.0	0.0	0.0	100.0	**100**
	Total	**14.6**	**24.4**	**25.8**	**35.1**	**100**

Source: World Bank County and Lending Group Classification (see https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups).

the relationship between the two debates, but empirical analyses have found some evidence that GVC participation supports escape from the dynamics hypothesized in the middle-income trap literature, albeit with substantial variation (Kummritz and others 2016; Boffa and others 2016). However, this chapter does not assign causality; it instead asserts that while GVC integration can support sustained high growth rates for middle-income countries, a certain level of development and industrial complexity also tends to be a prerequisite for participation in more sophisticated, higher value-added GVCs.

The chapter makes four central claims:

- The two debates have existed mostly independent of each other, but they should be bridged. The factors that constrain GVC participation and upgrading provide a more granular perspective of tasks, products, and industries—and a more coherent and applicable set of policy recommendations to address the causes of growth slowdowns and structural stagnation.
- The need for developing countries to adapt to trade through globally integrated value chains in goods, services, and information presents a partial but important conceptual paradigm and policy framework to identify levers for middle-income countries to converge with richer countries. The economic complexity and institutional sophistication required to upgrade into higher value-added tasks and products over time—in the context of the emergence of globally integrated lead firms—are lacking in many middle-income countries.
- The institutional, macroeconomic, trade, and industrial policies required for successful GVC participation can also address economic stagnation among trapped middle-income countries.

- Emerging technological changes are likely to further complicate the ability to develop by integrating into and upgrading within GVCs unless countries explicitly address the links between production and distribution and between economic and social change. This informs a broad set of policy recommendations that—while requiring more nuanced targeting and adaptation specific to each country and sector—provide a promising framework for overcoming difficulties specific to middle-income countries in the age of automation and digitization.

The chapter first goes into greater depth on the debates surrounding the middle-income trap and clarifies the main terms. It then provides a framework for viewing transitions from low- to middle-income status and from middle- to high-income status through a GVC lens—and the GVC-related factors that mediate these transitions. It then examines emerging technological and economic factors and trends that are likely to make efforts to escape the middle-income trap through participation in GVCs more complex in the medium term and offers some potential policy solutions.

Definitions and implications of the middle-income trap

The term "middle-income trap" was coined almost a decade ago by Gill and Kharas (2007), who discussed three transformations that modern growth theory predicted middle-income countries in East Asia would experience. First was the slowing and reversal of diversification as countries became more specialized in production and employment. Second was the declining importance of investment and the acceleration of innovation. And third was the shift in education systems to equip workers with the skills not just to adjust to new technologies, but also to shape new products and processes. They noted that many Southeast Asian countries stagnated and failed to make the transition to productivity-driven growth. While the term middle-income trap was novel, the concept was not—drawing on earlier work on low-level equilibrium traps (Nelson 1956), poverty traps (Leibenstein 1962; Aazariadis and Drazen 1990; Kraay and Raddatz 2007), and globalization's missing middle (Garrett 2004).

What is the middle-income trap, does it exist, and how can it be measured?

A large and growing body of literature focuses on whether the term is useful for examining the problems facing industrializing countries. As Gill and Kharas (2015) noted, after 10 years and more than 300 articles the term remains poorly defined and backed by almost no formal modeling, with very few exceptions (Agénor and Canuto 2015; Dabús and others 2016). However, two dominant definitions of the middle-income trap have emerged. At its most basic, the trap is seen as sustained economic stagnation. Egawa (2013, p. 2) argues that it is "a situation in which an MIC [middle-income country] falls into economic stagnation and becomes unable to advance its economy to a high-income level for certain reasons specific to MICs" related to "a delay or failure to change the economic structure from an input-driven growth model into a productivity-driven growth model."

Three approaches to assessing when a country is stuck in a middle-income trap have emerged: one on absolute convergence to high-income countries, one on relative convergence, and one on structural change, going beyond income-related measures of development. The approaches are not mutually exclusive, and even studies focused on assessing convergence dynamics—and in many cases not finding any unique middle-income country trap—generally acknowledge that specific structural changes are required for middle-income countries to increase their income.

Absolute convergence. Drawing on Hausmann and others' (2005) definition of growth slowdowns, Eichengreen and others (2013) stipulated three conditions for a growth slowdown to be classified as a middle-income trap: a seven-year average growth rate of GDP per capita of at least 3.5% prior to the slowdown, a decline in the seven-year average growth rate of GDP per capita of at least 2 percentage points, and GDP per capita greater than $10,000 in 2005 international purchasing power parity prices. They find a bimodal middle-income trap at GDP per capita of $10,000–$11,000 and $15,000–$16,000, suggesting that growth in middle-income countries slows in two main stages.

Relative convergence. Felipe and others (2012) focused on how long it took countries to cross income thresholds and defined a lower-middle-income trap as a country failing to attain average growth of income per capita of at least 4.7% a year and an upper-middle income trap as a country failing to attain average growth of income per capita of at least 3.5% a year. The relative approach is exemplified by Aiyar and others (2013), who regressed growth in GDP per capita on lagged income and measures of physical and human capital to come up with a predicted growth rate. The residuals of this regression are defined as actual growth minus estimated growth, and a slowdown takes place when a substantial deviation in actual versus expected growth is sustained over 10 years. Robertson and Ye (2013) likewise used the growth rate of income relative to the United States as their dependent variable. Similarly, Huang (2016) defined this process of stagnation as an economy's ability to continue to grow more rapidly than the United States after reaching middle-income status. Furthermore, not even the World Bank and International Monetary Fund definition of a middle-income country is considered a helpful benchmark by all researchers: Aiyar and others (2013) and Roy and others (2016) assigned a country middle-income status if its GDP range was 15–50% of U.S. income, depending on the specification.

Structural change. A third approach, while not contradicting the relative and absolute convergence approaches, focuses less on quantitative measures of growth slowdowns and more on the structure of the country's economy and on processes of transformation. Dingemans (2016, p. 644) defined Chile's middle-income trap as the country's "inability to (incrementally) diversify and enhance its export trade." Ohno (2009, p. 1) argued that the

defining characteristic of the middle-income trap is a country's failure "to build a national mindset and institutions that encourage constant upgrading of its human capital." Ohno divided the catching-up industrialization process into four stages and identified a middle-income trap as a glass ceiling in manufacturing between stages two and three (figure 5.2). In stages one through three foreign direct investment is critical to promote and sustain growth. Ohno found that Viet Nam's growth in the past two decades was driven largely by liberalization and large inflows of external purchasing power. Rigg and others (2014) took a more sociological approach in their analysis of Thailand and argued that a middle-income trap can be assessed by how individuals and households negotiate—or do not—the skills/employment transition.

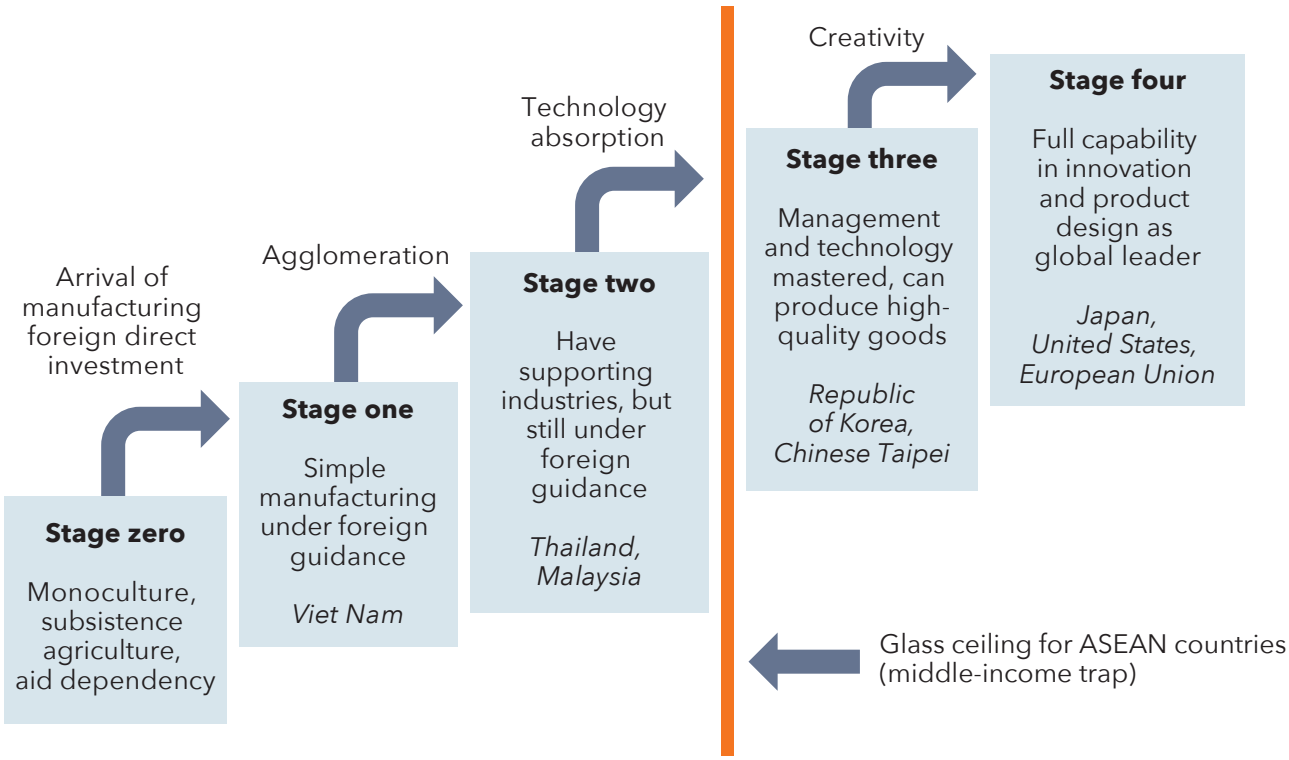
Useful? While most researchers find at least some value in the concept, Pritchett and Summers (2014) demonstrated empirically that there has been little continuity in growth performance historically and found that growth declines are more likely to be sudden and large than gradual and small. Thus, what others may perceive as the middle-income trap is more likely to be a regression to the mean. Im and Rosenblatt (2013, p. 25) rejected the middle-income trap concept arguing that "MICs [middle-income countries] do not really look that different in terms of transitions across the inter-country distribution of income" and display growth trajectories that "do not conform to one clear pattern that can be easily characterized as a 'trap.'"

More recently, Roy and others (2016) found little value in the middle-income trap as an empirical phenomenon. Using various measures of convergence based on catching up with rich countries either as a group or with the United States and based on both the country and individuals as the unit of measurement (accounting for and assuming away distributional changes within countries), they found that while economic divergence was a dominating global phenomenon before the 1980s, there is strong evidence for economic convergence globally since. They then tested whether middle-income countries were negative outliers within an unconditional convergence framework that included all countries and only middle- and high-income countries[2]—and found no evidence for either form of middle-income trap.

What are the main identified causes of middle-income traps, and which countries are affected?

The substantial definitional issues and differing empirical results complicate the notion of a clearly demarcated middle-income trap. Can something unique about industrialization processes for present-day middle-income countries be generalized? Here there is greater convergence, even among the skeptics. The literature assessing the causes of the trap differentiate between structural causes and policy-related and institutional causes.

FIGURE 5.2 Ohno's stages of catch-up industrialization



Source: Ohno 2009.

Moreover, some researchers distinguish between factors that cause the trap and those that perpetuate it (see, for example, Toh 2013). However, there is a general consensus that the trap reflects a country's inability to shift its growth strategy and economic structure toward sustained high growth rates.

In reviewing the previous decade of debate, Gill and Kharas (2015) argued that the middle-income trap occurs when rapidly growing countries with rising wages have tried to sustain an economy based on labor-intensive manufacturing and export-led growth. But as their competitive advantages decline, they have been unable to find alternative sources of demand to replace exports. This has been exacerbated by the declining elasticity of trade to growth in recent years—as well as by rising global competition, increasing currency and balance-sheet risk due to the heightened international financial flows, and for some countries, a lack of the requisite infrastructure while prematurely attempting to become knowledge economies.

Differentiating between structural change and convergence (whether relative or absolute) has implications from a policy perspective. As Paus (2014) noted, even within an income convergence framework there can still be no capability convergence. Jankowska and others (2012) explicitly framed this as an issue of structural transformation, with Latin America unable to compensate for the decreasing labor share in agriculture through its manufacturing sector, but with the Asian newly industrializing countries developing modern sectors in which productivity is both higher than in the traditional sector and sufficiently labor-intensive to transmit the gains to a sizable share of the labor force.

Glawe and Wagner (2016) pointed to two primary theoretical arguments to explain the trap. The first draws on Arthur Lewis's dual-sector model of the economy and sees the trap as reflecting a country's inability to continue boosting productivity by shifting workers from agriculture to industry. The latter argument, derived mostly from more recent developments in growth theory, focuses on a country's ability (or lack thereof) to imitate foreign technologies and develop comparative advantages in new export products. Agénor and Canuto (2015), in broad strokes, attempted to model and extend this line of thinking, arguing that knowledge network effects to developing advanced skills and infrastructure allow countries to evade a lower-growth equilibrium that they see as equivalent to the middle-income trap.

Several studies using absolute and relative convergence definitions have determined the impact of variables that either are correlated with or causally contribute to the trap:

- Eichengreen and others (2013) used a sample of present-day developed countries and found that correlates and determinants of growth slowdowns were more likely in economies with high old-age dependency ratios, high investment rates, and undervalued real exchange rates.
- Aiyar and others (2013) examined 42 variables in seven categories using a weighted average least-squares approach and found the following to be significant determinants of falling into the trap: rule of law, size of government, the regulatory environment, dependency and sex ratios, the share of gross capital inflows, investment public debt in GDP, output diversification, agriculture and service shares, a country's GDP-weighted distance, its degree of output diversification, whether it is involved in a war or civil conflict, and whether it has a tropical climate.
- Bulman and others (2014) used pooled regressions on middle-income countries and found that escapees from the trap had higher growth at all relative incomes, higher total factor productivity growth, faster transformations toward industry, better macroeconomic management, and consistently more export orientation. Furthermore, countries with high secondary and tertiary education and with a larger share of high-tech products in exports are less likely to fall into the trap.

The results, while methodologically distinctive and using differing control variables, provide some consistency in their focus on demography, equity, the macroeconomic framework, and—most prominently—the export structure. In other words there is some consensus that factors seen as important for long-run economic development are important for middle-income countries to sustain GDP growth. This is a useful contribution, but as Paus (2014, p. 25) noted, "it is not clear what these findings mean for policymaking."

Trade and export diversification is central to numerous recent analyses. Felipe and others (2012) compared the export structure of countries in the trap across variables related to their ability to structurally transform and found that escapees had more sophisticated and diversified export baskets than did nonescapees. This is also supported by country case studies. Dingemans (2016) found that the lack of diversification in Chile was caused in large part by the country's inability to promote innovation and develop more complex export products. Paus (2014) likewise saw the main challenge for Latin America as addressing the disjuncture between global competitive pressures and the slow process for firms to learn and countries to implement capability-enhancing policies. Rigg and others (2014) identified the primary failure of inadequate structural transformation at three distinct levels in Thailand: government's inability to develop the population's human capital, firms' failure to develop human capital or exploit what already exists, and individuals' unwillingness to develop human capital and embrace opportunities away from their home villages. The trap is "as much personal as it is structural and institutional" (p. 196).

Several researches have focused on social and demographic factors. Egawa (2013) saw the worsening income distribution as a primary engine of stagnation, while Ozturk (2016) emphasized the presence and size of the middle class. Panther and Flechtner (2015) took the relevance of inequality a step further by examining domestic and international inequality as political economy drivers of the trap, using a large sample of comparative qualitative case analyses. For national inequality multiple intersecting inequalities (income, ownership of assets, access to power) result in low institutional quality, which in turn prevents the adoption of policies that may be opposed by vested interests and would allow the country to transition to a more

productive economy. For international inequality the ability of countries to benefit from globalization and the proliferation of multinational corporations and GVCs are influenced by distributions of power and income at the global level. Ito (2016) made this focus on institutions as the mediating factor for countries either escaping or stuck in the trap more explicit by arguing that countries sort themselves into three equilibria (low income, middle-income trap, and middle-income convergence toward high income), depending on their willingness to carry out fundamental economic and structural reforms. Much recent work deals either explicitly (Woo 2012; Huang 2016) or implicitly with China (World Bank 2013; Pritchett and Summers 2014). In most of these China-focused analyses governance and institutions are particularly relevant.

Both the definitions and the causes inform the classification of countries in the middle-income trap. Some researchers focus on individual countries—Egawa (2013) on Malaysia, China, and Thailand, Dingemans (2016) on Chile, and Ohno (2009) on Malaysia and Thailand. Other researchers take a multicountry approach and come to different conclusions. For example, Felipe and others (2012) considered 35 of 52 countries to be stuck in the trap. Aiyar and others (2013) used a "trap map" based on the seven factors and 42 variables to determine countries most at risk. Panther and Flechtner (2015) examined which countries have achieved convergence with the United States over discreet eight- to-nine-year time periods.

Annex 5.1 illustrates the results of the three cross-country studies that address different points in time. Aiyar and others (2013) examined whether countries risk falling into the middle-income trap in the future. Felipe and others (2012) analyzed countries now in the trap. Panther and Flechtner (2015) assessed whether countries that were middle-income countries at some point in the past 40 years have managed to converge toward the average GDP per capita in high-income countries over discreet nine-year periods. So definitively stating which countries are now in the middle-income trap is an imprecise science.

How can countries escape from the trap?

The broad array of causes for countries entering and becoming stuck in an alleged middle-income trap include macroeconomic and microeconomic factors related to industrial structure, trade profile, demographics, income distribution, macroeconomic management, and the quality of institutions. So how have countries in the past escaped from middle-income status? And what lessons might this hold for countries today? In absolute terms many if not all of today's high-income countries were arguably stuck in some sort of middle-income trap in the 20th century (table 5.2; Im and Rosenblatt 2013).

It is clear by the objective criteria for escaping the middle-income trap (graduating from middle-income country status) that numerous countries, particularly in East Asia and Central and Eastern Europe, have escaped whatever trap dynamics middle-income status might entail. Bulman and others (2014) described this process as part of a momentum hypothesis, where past escapees achieved strong growth in one period, followed by strong growth in the subsequent period. But Im and Rosenblatt (2013, p. 25) are cautious about this inevitability approach, arguing that attempts to grow at rates higher than 7% could lead to "unsustainable polices that eventually create the 'trap'-like pattern of dismal growth that MICs [middle-income countries] are trying to avoid in the first place." So gradualism that focuses on overcoming the institutional factors inhibiting growth might be more promising. Roy and others' (2016) analysis of the structural break in the 1980s when convergence started attributed this to the sharper focus on macroeconomic stability in the 1990s and on the transformational changes that the spread of information and communication technologies engendered in developed economies.

TABLE 5.2 Countries that have escaped the middle-income trap

Reference	Definition of escape from middle-income trap	Countries that have escaped
Agénor and Canuto (2015)	Middle-income countries in the 1960s that became high-income countries by 2008	Equatorial Guinea; Greece; Hong Kong, China; Ireland; Israel; Japan; Republic of Korea; Mauritius; Portugal; Puerto Rico; Singapore; Spain; and Chinese Taipei
Bulman and others (2014)	Middle-income countries in 1960 that became high-income countries by 2009	Greece; Hong Kong, China; Ireland; Japan; Republic of Korea; Puerto Rico; Seychelles; Singapore; Spain; and Chinese Taipei. Cyprus and Portugal, still classified as middle income in 2009, are considered on the verge of escaping
Felipe and others (2012)	Crossing from lower-middle-income status in at most 28 years and from upper-middle-income status in at most 14 years.	No clear list of past escapees, but at their current pace China, Bulgaria, Poland, and Thailand should be able to escape the upper-middle-income trap if they sustain their income per capita growth
Im and Rosenblatt (2013)	Middle-income countries in 1950 that have since become high-income countries (though the authors reject the concept of a middle-income trap)	Austria; Estonia; Finland; Germany; Greece; Hong Kong, China; Ireland; Israel; Italy; Japan; Republic of Korea; Singapore; Slovenia; Spain; and Chinese Taipei
Jankowska and others (2012)	Countries that have attained income convergence with high-income countries	Hong Kong, China; Republic of Korea; Singapore; and Chinese Taipei

The experiences of these countries center policy recommendations primarily on structural, industrial, and trade policies as well as social policy:

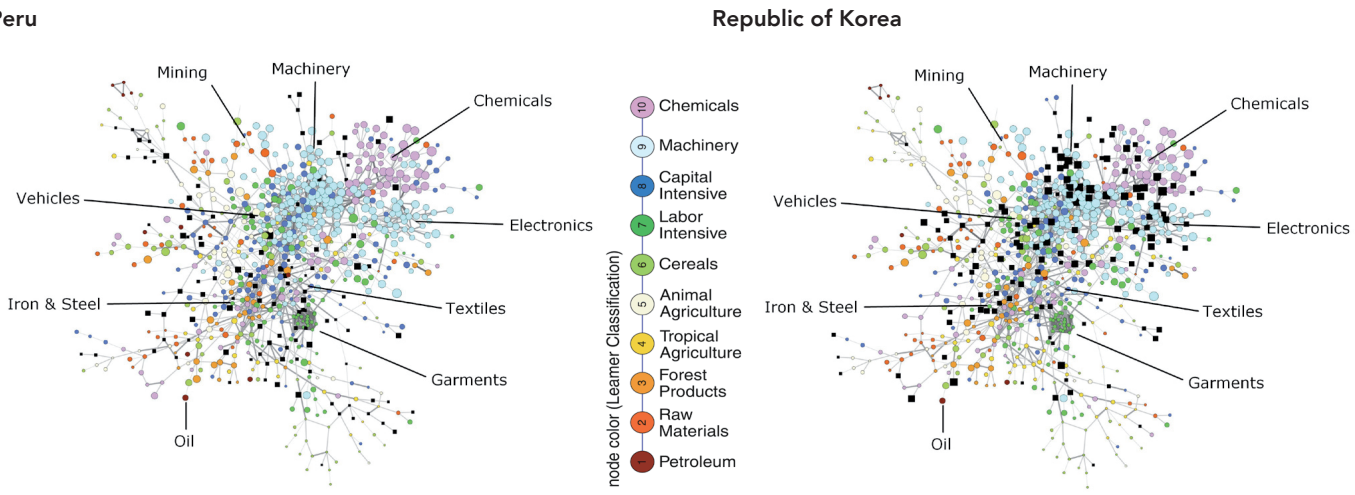
- Macroprudential policies limit the buildup of excessive capital inflows to cushion impacts of potential sudden stops. However, Aiyar and others (2013) see an important role for measures to enhance regional integration, infrastructure investments, and deregulation in areas where private sector activity is excessively stifled. Their threat map aims to provide an analytical tool to assess where these issues may be at play (see table A5.1.1 in annex 5.1).
- Developing knowledge network externalities could link individuals' skill attainment and access to public infrastructure (Agénor and Canuto 2015).
- Skilled workers are needed to move up the value chain from low value-added industries to develop higher value-added activities (Eichengreen and others 2013).
- To avoid the middle-income trap, China, like past escapees, will need to upgrade its industrial structure through new industries with higher levels of technology (Huang 2016). This will require differentiating between state-owned enterprises and non-state-owned enterprises and between product and factor markets.

Jankowska and others (2012) compared the experience of Latin American countries with the Asian newly industrialized countries using a product-space methodology and suggested that diversifying to new products is central to emulating the experience of the newly industrialized countries (figure 5.3). In these countries new production was sequentially developed in industries such as iron, steel, machinery, and electronics through workers with skills and capabilities transferable from existing industries. A central lesson from these past industrialization processes is learning how to produce and export more complex products—a finding that also emerges from the complex systems analysis literature.[3]

Ohno (2009) proposed that Viet Nam develop a proactive industrial policy to internalize skills and technology, develop effective public–private partnerships, and deepen industrial knowledge. Focusing primarily on structural characteristics related to trade, industry, and labor market transformations, Felipe and others (2012) argued that the most direct strategy for a middle-income country to become a high-income country is to acquire a revealed comparative advantage in sophisticated and well-connected products. The focus on linking education to (primarily horizontal) industrial development objectives is a logical corollary for numerous researchers. Pantner and Flechtner (2015) pointed to mobilizing talent through education and providing this talent with the right incentives to assimilate best-practice technologies and organizational routines to adapt and apply them to cutting-edge technologies. Rigg and others (2014) linked this more explicitly to countries moving up the value chain through re-training and re-skilling and sustained investments in upper secondary and tertiary education.

Researchers that focus on the role of inequality in driving trap-like dynamics for middle-income countries see addressing disparities as the central component. Egawa (2013) argued that policies need to address urban–rural disparities, providing benefits for low-income individuals, fiscal redistributive reforms, transfers, as well as equalizing education opportunities. Kahras and Kohli (2011) see social programs and a change in the policymaking mindset that targets the middle class as essential to avoiding the

FIGURE 5.3 Product space maps of Peru and the Republic of Korea in 2009



Source: Jankowska and others 2012.

Note: The product space methodology provides a map of all traded goods displaying relative proximity or similarity between products. The colors on the map represent the Leamer classification, which categorizes products according to labor, capital, and other resource intensiveness. The black squares indicate products in which the country has a revealed comparative advantage.

middle-income trap. All this helps countries mediate three critical transitions—from diversification to specialization in production, from physical accumulation of factors to productivity-led growth, and from centralized to decentralized economic management.

This in turn leads to a focus on institutions. Panther and Flechtner (2015) used a two-level model of the relationship between inequality and the middle-income trap to argue that at the international level ensuring a certain level of domestic equality mediates the benefits of global integration for growth. At the domestic level a focus on economic (over political) equality is central to catch-up policies. At the global level having some independence in policy-setting from dominant external powers is essential for convergence when paired with export diversification. Dingemans (2016) saw the bidirectional relationship between structural change and economic development as driven by institutional change. Chang (2011) argued that increased wealth intensifies the demand for and provision of higher quality institutions and new political actors who demand and shape them. In that sense, moving from a more state-centered approach to export development, not just export promotion, is essential.

Gill and Kharas's (2015) assessment of 10 years of literature on the middle-income trap focused on the need for policymakers to manage a transition to more mature institutions so that capital investments remain efficient even after growth moves from productivity growth stemming from intersectoral resource reallocations to intrasectoral catch-up technological growth.

A new World Bank study (2016b, forthcoming) on Poland's recent high and stable growth sees this as being due in part to the country's institutions transforming in parallel with firms increasing in sophistication and complexity—including providing better foundations for resolving conflict, enforcing contracts, and implementing antitrust and competition laws. This has been bolstered by rapid integration into the EU bloc, boosting productivity through increased trade openness, investment and talent, increased domestic competition and regulatory harmonization, and more certainty through commitments to EU institutions. In comparing new high-income countries (Chile, the Czech Republic, Hungary, the Republic of Korea, Poland, and the Slovak Republic) with trapped middle-income countries (Brazil, Mexico, Romania, and Turkey), the study found that while in the late 1990s these countries were fairly similar in many aspects, by 2015 barriers to entrepreneurship, trade, and investment were much lower in the new high-income countries, which also had lower perceived economic and political risk.

The relevance of global value chain trade for understanding the middle-income trap

While the role of trade through GVCs remains more implicit than explicit in discussions of the middle-income trap, the significance of producing and trading higher value-added goods is a central lesson from the literature. Establishing this link is the focus here. This section first addresses three questions. What is meant by GVC participation and upgrading? How is it measured, and what factors condition countries' ability to upgrade in GVCs? And what is the empirical relationship between GVC participation and the middle-income trap? It then provides a conceptual framework for viewing income transitions through a firm-level GVC lens.

An overview of global value chain participation and economic upgrading

Driven by lower transport, information, and communication costs, technological improvements, and lower barriers to the movement of goods and capital, global patterns of trade and production have changed dramatically over the past decades. Trade is now characterized by the growth and increasing dominance of vertically integrated multinational firms with fragmented value chains stretching across borders. The internationalization (and particularly regionalization) of global production and the development of value-chain trade in both goods and services have changed the prospects for countries to benefit from trade. In this context, understanding a country's current participation in value chains is central to ensuring that its industrial and trade policies can facilitate sustainable productivity gains and increased quality employment in higher value-added sectors. For developing countries this creates opportunities to upgrade into new higher productivity tasks and activities and to integrate into global production networks. But according to some researchers, this is often less an issue of catching up than of fitting into existing GVCs (Whittaker and others forthcoming).

The value chain concept in the industrial organization literature (Porter 1985) has become ever more central to understanding and analyzing the interfirm and intrafirm dynamics and governance of value-chain trade (Gereffi and others 2005). And in trade economics it has increasingly become the dominant framework to understanding the second unbundling of globalization (Baldwin 2006; see Antràs and Rossi-Hansberg 2009 and Ahmad 2013 for overviews of this literature). Viewing trade through a GVC framework involves four paradigm shifts for trade policy (Catteneo and others 2013):

- It implies a move toward a global (or at least regional) view of policy.
- It requires a shift from entire industries to narrower tasks and business functions.
- It requires assessing a country's competitiveness not as endowments and stocks but as flows in which GVCs are the primary channel enabling transfers.
- It implies a change from focusing on tariffs as the most relevant obstacles to trade to focusing on behind-the-border barriers and regulatory measures.[4]

Viewing trade this way requires a revised approach to measuring and analyzing cross-border and cross-industry flows, with value-added trade becoming a more relevant measure of trade flows within GVCs. For individual countries becoming competitive in specific components and tasks to participate in globalized production networks and in turn generate more value domestically over time becomes increasingly important (Taglioni and Winkler 2016). So using multiregion input-output tables allows for tracking

use at the sectoral level and for differentiating between transactions in intermediate and final goods. This has informed a growing literature on the development of value added in trade (see Hummels and others 2001, Koopman and others 2014, and Johnson and Noguera 2012) and a growing number of indicators and indices (Fally 2012, Antras and Chor 2013, and Wang and others 2016).

Measuring value-added trade through multiregion input-output databases has clear benefits (Ahmad 2013):

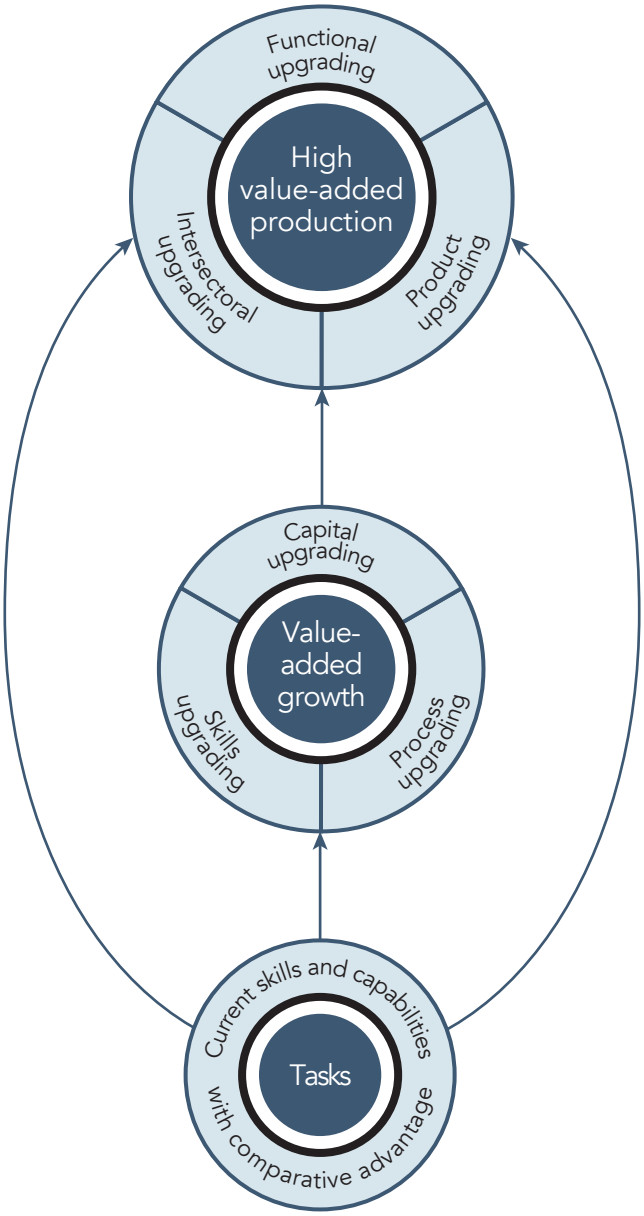
- It makes it possible to understand a country's actual industrial structure and international links among sectors in order to formulate targeted policies and strategies.
- It provides evidence of how nontariff measures or regulatory changes affect upstream and downstream producers.
- It offers better analytical tools to anticipate the impact of potential shocks.
- It enables calculations of the trade's job content and impact on ecosystem services, thanks to satellite accounts of employment and environmental indicators.

However, multiregion input-output tables have some limitations. They cannot measure the links among service sectors very accurately. And they are subject to two simplifying assumptions: the proportionality assumption, that all products (for export and domestic use) have the same import content, and the homogeneity assumption, that the use of inputs is uniform among all firms in a sector.

The new data make it possible to quantify economic upgrading through GVC participation. Drawing on earlier work by Humphrey (2004), Taglioni and Winkler (2016) differentiated four types of economic upgrading based on skills, capabilities, and comparative advantage. Process upgrading is based on efficiency gains and productivity improvements. Product upgrading entails moving into more sophisticated products in an existing value chain. Functional upgrading involves increasing the value-added share by moving toward more sophisticated tasks. And intersectoral upgrading involves moving into new value chains with higher value-added shares (figure 5.4).

The ability of firms to upgrade is determined by improving workers' skills, improving firms' absorptive capacity and technology, and increasing productivity in existing tasks. Lead firms set detailed specifications and requirements that exceed local norms and create opportunities for improving capabilities, technologies, and assets. But this is not always the case: the complexity of GVCs and the power dynamics within their governance structures can lead to stagnation or downgrading (Rossi 2013; Blažek 2015).

FIGURE 5.4 Achieving functional, product, and intersectoral upgrading through skills, capital, and process upgrading



Source: Taglioni and Winkler 2016.

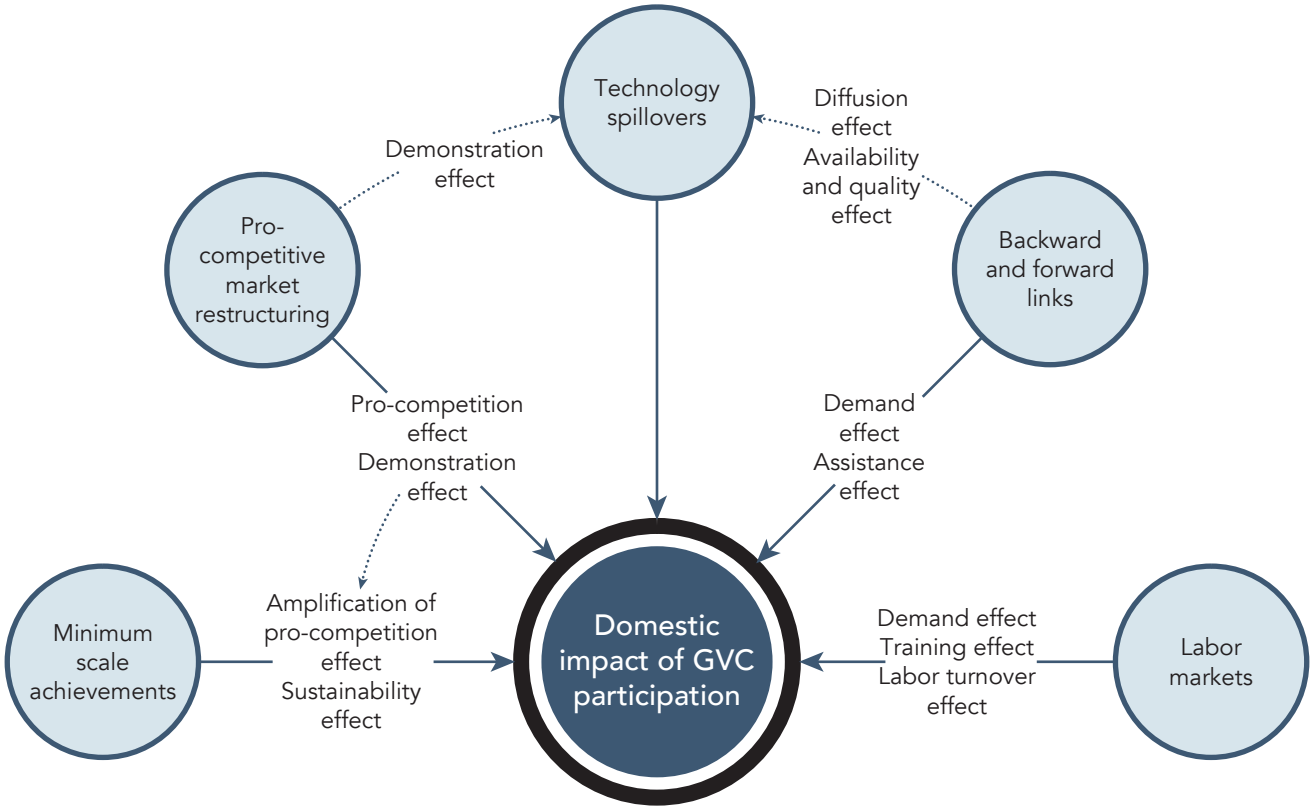
The empirical relationship between global value chain integration and the middle-income trap

A broad literature on the factors likely to influence a country's ability to upgrade in GVCs is based primarily on case studies, with few econometric analyses (until recently). But open economies tend to grow faster and have higher incomes than do closed economies (Wacziarg and Welch 2008; Gill and Kharas 2015).

GVC participation can lead to higher output, productivity, and value added through five main transmission channels: backward and forward links, pro-competitive market restructuring, technology spillovers, minimum scale achievements that amplify pro-competitive effects, and labor market effects, including the demand for skilled workers and their training as well as turnover when trained workers move to local firms (figure 5.5).[5] The individual channels have complex and frequent intermediating effects on each other.

Three main factors link value-chain integration to productivity: foreign direct investment, exporting, and importing inputs

FIGURE 5.5 Transmission channels from global value chain participation to the domestic economy



Source: Taglioni and Winkler 2016.

(Kummritz and others 2016). For foreign direct investment the impact of spillovers on productivity is not conclusive (Görg and Greenaway 2004, Paus and Gallagher 2008). For the link between exporting and economic upgrading, Bernard and Jensen (1999) demonstrated that exporters outperform nonexporters in the same sector and country in productivity, skills, and wages. Is this self-selection or learning by exporting? For self-selection the assumption is that only more productive firms are able to absorb additional trade costs. The learning by exporting literature argues that exporting improves the productivity of firms over time, with the most robust findings for developing countries and nascent industries. Recent research questions the robustness of these early learning by exporting studies (Clerides and others 1998), but Lileevea and Treffler (2007) found learning by exporting effects for Canada, and Fernandes and Isgut (2005) found them for Colombia.

Research on the link between importing inputs and productivity focuses on developed countries. Importing can improve key aspects of competitiveness through three main feedback loops: productivity, innovation, and skills. Easier access to imports tends to improve firm productivity. Grossman and Rossi-Hansberg (2006) showed that offshoring can entail productivity gains similar to technological progress for offshoring countries through lower input costs. Amiti and Konings (2007) showed that a 10% drop in input tariffs leads to a 12% improvement in productivity for importing firms. Bas (2012) showed that for a sample of Argentinian firms, input tariffs facilitate entry into export markets. MacGarvie (2006), drawing on French trade and citation data, and Bøler and others (2015), using a sample of Norwegian firms, found importers to be more innovative and profitable. Skills are relevant for importing and complementary to it. Koren and Csillag (2011) showed that importing more sophisticated machines requires higher skills to operate them and increases the returns to skills.

To test whether GVC participation has enabled countries to upgrade economically, Kummritz and others (2016) used foreign value added in exports and domestic value added re-exported by third countries as respective measures of backward and forward GVC integration and domestic value added generated by a specific sector as the measure of economic upgrading. They tested the impact of national characteristics that may be associated with economic upgrading via GVC participation: infrastructure, connectivity, investment and trade policy, business climate and institutions, financial and labor markets, skills and education, innovation and product standards, as well as labor, social, and environmental standards. They found that overall GVC integration increases a country's domestic value added. Splitting the sample into income groups did not substantially change results,

though GVC integration as a buyer (through foreign value added) is more significant at lower incomes and selling into GVCs has more impact at higher incomes. For countries buying from GVCs air freight infrastructure and road network quality are particularly important. Connectivity, education and skills, and standards compliance are most important for countries selling into GVCs. The researchers concluded that the policy areas thought to be significant for economic upgrading in GVCs largely have the expected impact.

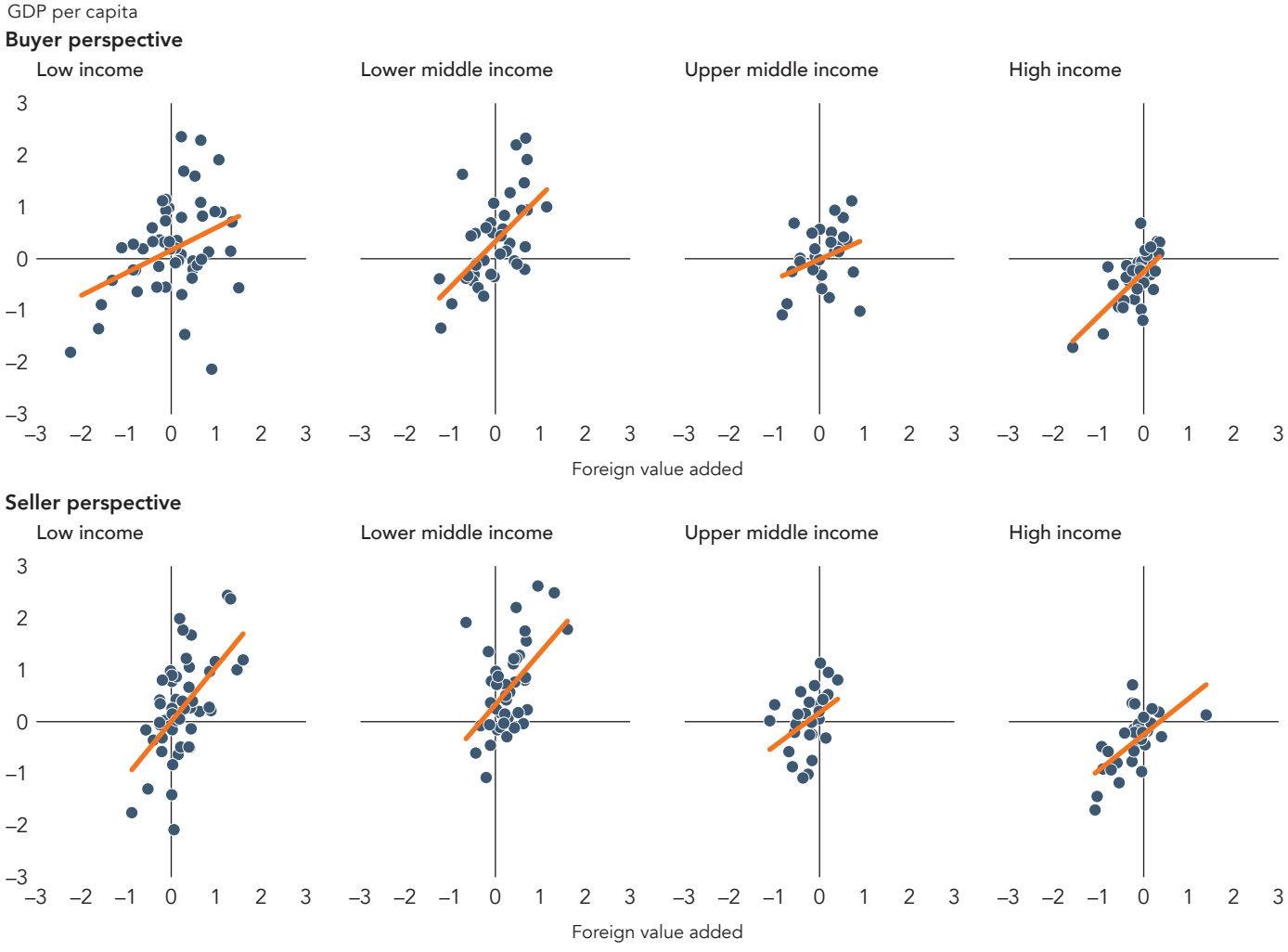
The correlation between GVC integration and GDP per capita depends on income status and the type of integration (figure 5.6; Boffa and others 2016). GVC integration increases GDP per capita, but the gains diminish as income increases. Similarly, growth in output per capita is highest for lower income groups. Some channels for GVC integration depend on industry similarity, with links assumed to be easier when trade is intraindustry. Manufacturing leads to higher GDP gains for buyers, but for services both types of integration—forward and backward—lead to similar GDP increases.

These studies suffer from two main limitations. First, because of the lack of value-added trade data prior to 1990, they permit analysis for only the last 20 years, while much of the middle-income-trap literature goes back 50 years or more. Second, they do not specify the conditions for specific types of institutions and policies to produce greater gains from GVC participation. The next section addresses both limitations in part from a theoretical perspective.

Viewing income transitions through a global value chain lens: bringing in the firm perspective

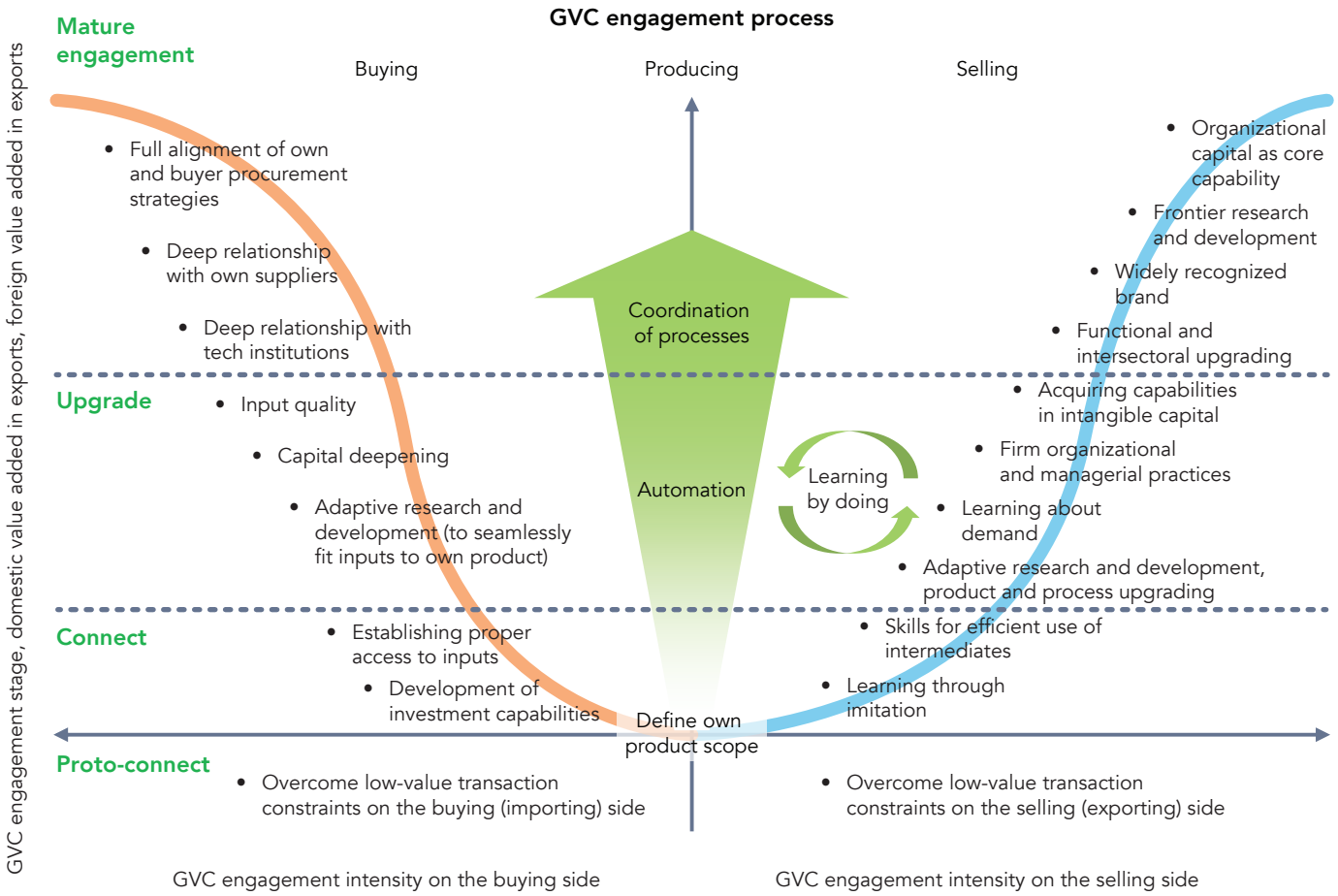
The previous section showed that while integrating into GVCs is associated with sustained growth and development, doing so may become more difficult and complex at higher incomes. This section explicitly adopts a GVC firm-level lens to the income

FIGURE 5.6 Growth of global value chain integration and GDP per capita by income category



Source: Boffa and others 2016.

FIGURE 5.7 How global value chain determinants evolve as the engagement in global value chain changes



Source: Mariscal and Taglioni 2017.

transitions from low to middle to high through a series of diagrams laying out these transitions.

Mariscal and Taglioni (2017) proposed a framework that views firms' connection to GVCs as a dynamic process for the relevance of capabilities to evolve in a continuum (figure 5.7). The first dimension (x-axis) contains the buying, producing, and selling aspects of integration in GVCs, and the second dimension (y-axis) illustrates the degree of GVC engagement, from proto-connecting to connecting to upgrading to mature engagement. The orange lines indicate the growing intensity of engagement on the buying side, and the blue lines indicate the growing intensity of engagement on the selling side. More sophisticated issues tend to appear on the upper section of the diagram, where upgrading meets buying, producing, and selling in increasingly nuanced and complex ways. Connecting usually starts on the buying side: firms that correctly evaluate their core capabilities and have an effective sourcing strategy are more likely to successfully engage in GVCs. However, the sequence of engagement from simpler to more sophisticated, and from buying to selling capabilities, is intended to be illustrative. Rather than tightly allocating capabilities into specific steps on the diagram, most capabilities are shared between elements. The diagram is somewhat selective in reporting the most relevant determinants, since they may vary by industry and GVC.

Engagement starts with the proto-connecting stage, when reaching a minimum scale of transactions is key in both the buying and the selling functions. Intermediaries that play a matching role can help firms move the first steps toward international engagement. The large intermediaries may themselves become companies engaging in GVCs, as traders or by gradually adding value by expanding into processing for some of the immediate upstream or downstream functions.

The pure connection stage is mostly about meeting minimum requirements—a few basic capabilities that allow the firm to connect to either a foreign market or a lead firm. Basic capabilities (such as production or managerial abilities and cheap access to key inputs of the production process) and the ability to correctly evaluate and leverage the firm's core competences are crucial in connecting to GVCs. From a buying perspective this means that the firm can streamline its processes and product scope while

complementing production with proper and effective access to input markets. From a selling perspective the key capabilities are aligning its goals to those of actual and potential buyers and modulating its processes to fit seamlessly in their production processes. At this stage engagement in GVCs is not a robust situation but is unstable and subject to market forces that may exclude the firm from continuing the connection.

Once a firm overcomes the challenges of pure connection, its learning processes and absorptive capacities become more fundamental—learning by exporting, learning from selling to global buyers, and learning to connect decisions on the product scope to the available importing possibilities. At this stage demand-side elements also acquire importance, as the firm needs to make its product known and valued. Efforts will also be made to accumulate customers, although competition will be based mostly on price rather than quality. As the process continues and deepens, process innovation and product innovation will start to matter greatly. Relatedly, firms' organization of skills will change. Middle management will start to become more important than production, and the firm will increasingly focus on its core competences and learn to spin off tasks that are not its comparative advantage.

In the final stage firms upgrade toward the most complex stages of GVC production. Firms are now in direct relation with, or themselves become, lead firms, turnkey suppliers, trading platforms, or global buyers. The relationships between buyers and sellers are seldom the result of market interactions but are geared to modular (or even captive) interaction. Firms connect to the most technologically relevant buyers with good learning potential and virtuous feedback loops through direct and indirect exposure to new ways of managing and organizing production. Meanwhile product complexity also increases, with products both more elaborate and containing more value added.

The evolutionary process in GVCs is unlikely to take place in a vacuum. As firms transition from proto-connecting to connecting to upgrading to mature engagement, a parallel process of development takes place in the hosting economy. The domestic economy will likely have evolved to development stages where an ecosystem of firms starts building up, populating the middle size. The determinants of firm growth will also evolve, increasingly a function of firm capabilities rather than institutional idiosyncrasies.

Reflecting their comparative advantages, firms in low-income countries will tend to be engaged in GVCs in industries such as agriculture and manufacturing, where complexity is limited and price competition is more common than nonprice competition (table 5.3). In these industries buyer–seller relations tend to be either at arm's length or captive. They are captive when the lead firms are technologically very dependent on suppliers, transactions are highly codified, and supplier competence is low. Firm size is not a constraint at this stage, so small firms can easily engage. Once countries graduate to middle-income status, their firms start integrating in GVCs with functions in advanced manufacturing and modern professional services, including preproduction and postproduction high-value added services. In these GVCs buyer–seller relations tend to be more relational, captive, or hierarchical, with substantial know-how transfers. Participating

TABLE 5.3 Trajectories in global value chain engagement

Global value chain engagement stage	Low-income status	Middle-income status	High-income status
Industry complexity	Simple	Intermediate	Complex
Typical specialization	Commodity production in agriculture, light manufacturing, low value-added services	Advanced manufacturing, agri-business and services	Organization capital, coordination and research and development in complex agri-business, manufacturing and services, branding
Typical market structure and average firm size	Predominantly small firms	Some large, missing middle size in the market likely	Complex market structure with several lead firms and conglomerates and a large and dynamic fringe of small to medium-size firms that interact in complex ways
Buyer–seller relational dependence and governance in global value chains	Market relations (or captive, if supplier competence is low, transactions highly codified, and technological dependence high)	Relational or hierarchical	Highly modular and complex vertical and horizontal relationships of interdependence
Typical firm structure and pool of skills	Few organizational layers, narrow set of capabilities, workforce distribution highly skewed toward production functions	Mid-complexity organization and firm structure	Large firm or conglomerate, quantitatively important middle and higher management and research and development staff relative to production functions
Mode of competition	Price-to-quality competitiveness	Increasingly diversified, nonprice competitiveness	Based purely on brand and value added features in highly specialized areas at the technology frontier

Source: Adapted from Mariscal and Taglioni 2017.

firms tend to be medium to large, particularly in manufacturing (Cusolito and others 2016). Firm growth is driven by productivity and capabilities rather than by rent positions. And competition among firms is increasingly based on nonprice features, such as quality, customization, and responsiveness and timeliness in delivery.

Once countries reach high-income status, their firms' engagement in GVCs will likely be predominantly specialized in coordination and high-value added services, such as research and development and branding. Firms are primarily buyers of inputs and components and sellers to end markets—or engaged in modular relationships. Their comparative advantage is based on offering highly specialized products at the technology frontier.

Institutions are central to these processes. Consider three key aspects. First, coordination among different levels of governments has to ensure that policies are not done and undone at different levels or that competition among regions does not erode the fiscal base. Coordination becomes increasingly important at higher levels of development. Second, predictability in policy implementation also matters proportionally with the level of development. Uncertainty could erode good current incentives by exposing firms to unnecessary risk. For example, uncertainty in trade openness policies may freeze the formation of buyer–supplier links as firms find it optimal to wait before engaging in investments that lose all their value unless variable trade costs are actually reduced. Third, policies should be well sequenced. For example, opening to foreign direct investment without actually developing basic infrastructure and institutions is unlikely to generate much investment or many jobs. It may be beneficial to consider gradual increases in competition so that foreign firms do not eradicate all domestic firms and capture all economic rents. To put in place policies conducive to real domestic competition is a sensible requirement before opening to trade or foreign direct investment. Another, more classic example is the coordination between foreign direct investment and trade policies. Since multinational corporations are import-intensive, opening to foreign direct investment to create jobs will not work unless foreign companies can also have access to the foreign services and intermediate goods they require.

There is no one way to optimally sequence policies, since considerations are context-specific. Yet some general regularities in policies are likely to matter at different stages of GVC engagement and development (Taglioni and Winkler 2016). At the initial stages of GVC engagement, policies are best directed toward facilitating efficient use of resources and factors of production and encouraging competition through broad market access (table 5.4). As development takes place and GVC engagement deepens, the institutional setup should focus on helping firms thrive in a complex world—with both imports and exports from and to multiple countries and sourcing and selling to multinational corporations (domestic and foreign).

When a country reaches middle-income status, institutions can help leverage GVC engagement for development by fostering skill building, innovation, and efficient access to capital; by including deep provisions in agreements with key trade partners; by supporting the engagement of more local firms and workers in the GVC network; and by focusing on structural reforms that raise domestic labor productivity and skills. As countries target high-income status, building institutions that allow for contracts to be more complete and for administrative burdens to be lower. They also need to ensure high confidence in the institutions, business friendliness, and stable policies. Labor market–enhancing outcomes for workers at home and more equitable distributions of opportunities and outcomes create social support for a reform agenda aimed at strengthening a country's GVC participation. Climate-smart policy prescriptions can mitigate the challenges for firms from climatic disruptions. Frederick's (2016a, 2016b) work on the apparel GVC in China illustrates this dynamic (box 5.1).

Participating in global value chain trade in the context of a rapidly changing world of industrial production and work

The positive and significant relationship between GDP per capita and integration into GVCs raises questions about the gains of GVC trade for workers in countries at the middle-high income threshold. Over the past few years numerous reports and papers have investigated the impact of technological change on production, trade, and labor markets (West 2015; Oxford Martin School 2016; Chui and others 2016; WEF 2016; KPMG 2016; Autor 2015;

TABLE 5.4 The institutional dimension of global value chain engagement

	Low income	Middle income	High income
Global value chain engagement objective	Attract foreign direct investment and facilitate domestic firm entry into global value chains	Expand and strengthen participation in global value chains, including promoting economic upgrading and densification, and strengthening domestic firms' absorptive capacity	Ensure sustainability and transform global value chain participation into inclusive growth
Institutional setup	Facilitate efficient use of resources and factors of production and encourage competition through broad market access	Foster skills-building and efficient access to capital and include deep provisions in agreements with key trade partners	Target contract completeness, lowering of administrative burden, high degree of confidence in institutions, business friendliness, stable policies, labor market–enhancing outcomes, and climate-smart policies

Source: Adapted from Taglioni and Winkler 2016.

BOX 5.1

Lessons from China for apparel upgrading

China has been remarkably successful in the apparel industry, improving all key areas and growing rapidly. Fredrick (2016) argued that it was able to upgrade (process, product, end-market, function, and intersectoral) by having a distinct value proposition that entailed affordability, reliability, and the development of a good reputation; a broad range of product categories; full-package offerings; and "good-enough" compliance. She attributes this to six factors:

- Industrial polices geared toward upgrading and assessing global dynamics, including grants and loans for technological upgrading, incentives for machinery to make more advanced products while removing incentives for lower-value products; targeting of non-EU and non-U.S. markets as well as the domestic market; investments in textile capabilities and sustained technological investments and growth in key material segments; a "go-out" policy to encourage investment of low value-added segments in neighboring countries; and support for domestic brand development.
- A functional division of labor between sales and production, using agents and intermediates to promote manufacturers and link up with global buyers.
- Investments in connectivity through sourcing offices in Hong Kong, China, and near airports in mainland China that focused on having buyers both close and comfortable.
- Continuous innovation and modifications in production processes to keep costs low and keep up with emerging competitors.
- Developing long-term relationships that built on improvements in quality, speed, and price competition.
- Correctly assessing the tipping points for buyers possibly inclined to change suppliers and not exceeding them.

While China's success cannot be directly replicated, it does have numerous lessons for other countries, including the importance of developing long-term relationships and ties with foreign firms, partnering with Chinese firms both to transfer skills and knowledge and to access the Chinese market, targeting emerging markets without highly developed buyer–supplier relationships, targeting niches within a highly diversified industry, and taking advantage of rising labor costs in China to undercut these suppliers.

Source: Frederick 2016.

Beaudry and others 2016, Eden and Gaggi 2015; Morikawa 2016; Pikos and Thomsen 2016). Researchers have focused on the rapid technological advances in automation, big data analytics, and digitization. They have also looked at manufacturing responses to climate change and other environmental- and resource-related risks, including transitions toward additive manufacturing through three-dimensional printing technologies. And they see the growth of the circular economy as likely to require manufacturers to design products for several cycles of disassembly and reuse.

GVCs are characterized by four features: customized production; sequential production decisions going from the buyer to the suppliers; high contracting costs; and global matching of goods, services, production teams, and ideas (Antràs 2015). All four point to the substantial power that multinational corporations coordinating GVCs have in selecting where to geographically locate individual production tasks. Technological improvements are likely in each of these cases to increase both the sophistication of buyer demands and the supplier capabilities to meet them. A full exploration of these issues is beyond the scope of this chapter, but given their implications for the relationship between GVC participation and declining economic growth and structural stagnation that many middle-income countries experienced, it is worth addressing two aspects of these medium-term developments.

First, the workforce skills required to manufacture even unsophisticated products is likely to increase substantially, requiring not only higher levels of education but also cross-domain skills and tacit knowledge for using new equipment and thinking computationally and analytically and high levels of technical and engineering knowledge. For many middle-income countries this will require a fundamental upgrade of education systems, research institutions, and innovation systems. So the already diminishing advantage that labor-abundant, low-wage countries possess for low-skill manufacturing is likely to diminish further.

Second, re-shoring production to developed economies—given the need for highly skilled workers and, more important, the ability to automate many tasks—is likely to become even greater in coming years, reinforced by the rapidly growing political backlash against globalization and rising economic nationalism in many western countries. Some 70% of clients surveyed in a recent study believe that automation and developments in three-dimensional printing will encourage companies to move their manufacturing closer to home, with North America seen as having the most to gain from this trend and China the most to lose (Oxford Martin School 2016). The jobs of 77% of workers in China and 69% of workers in India are at risk because of automation (World Bank 2016c). In this context the rapidly growing importance of trade in data and information, even within production and manufacturing, is likely to further increase the modularity of work processes and to bypass all but the most sophisticated middle-income countries.

Together, these issues are likely to reinforce concerns of premature deindustrialization, with countries running out of industrialization opportunities sooner and at lower income than earlier

industrializers (Rodrik 2016). The trend may have hit Latin American middle-income countries, both economically and in risks for political stability and democratization. Only recently have firms and governments in developed and developing economies come to terms with the fact that the GVC revolution required a fundamental rethinking of trade and, more broadly, industrial development. These new disruptive technological changes will again require new policies and strategies to adapt.

This points to the challenges for ensuring that the gains from GVC trade for industrializing countries actually benefit workers and households—to the recent and emerging ever-more-complex aspects of the political economy of globalization, particularly for industrializing countries. What is needed? First is a better understanding of what automation is and what globalization is—since narratives have profound political consequences. Second is a sharper focus on the distributional impacts of GVC trade, on adjustment costs, and on displacement—renewing attention to labor market impacts and to the risks of downgrading within GVCs for certain workers even as countries upgrade overall.

Conclusions and policy implications

Can integration into GVCs help countries avoid a middle-income trap? And if so, through what channels and under what circumstances? And how do the factors hypothesized to contribute to growth slowdowns at the middle-income level also impede economic upgrading through GVCs. Inevitably, in bridging two issues for which even definitions are heavily disputed, reviewing the relevant theoretical literature and empirical analysis may have created more shadow than light.

In discussing the middle-income trap, it probably helps to move away from the deterministic framing that the concept can assume, particularly in the eyes of policymakers. The evidence is fairly robust that there is nothing overly probable, let alone inevitable, about growth slowdowns at specific incomes. But problems related to the structural transformation of industries are quite specific to middle-income countries, and this more limited understanding of a middle-income trap is analytically more tractable. The closely linked debates on GVCs and middle-income traps both strongly point to developing countries' need to adapt to a world of global trade and investment operating through globally integrated value chains in goods, services, and information. This presents a partial but important conceptual paradigm for addressing many middle-income countries' inability to converge with Organisation for Economic Co-operation and Development economies. The macroeconomic, trade, and industrial policies required for successful GVC participation can play an important role in the factors that have contributed to economic stagnation both in the recent past and in present-day middle-income countries. There is a reason why many countries find it difficult to graduate to high-income status: capabilities, policies, investment decisions, and institutional processes become highly complex. As economic forces interact in multidimensional, unpredictable, and dynamic ways, it is often difficult for institutions to capture such complexity, adapt swiftly, and set policy priorities. Moreover, many challenges—and thus solutions—are unique to the respective country, sector, and commodity, so adopting previously successful strategies may not help. Indeed, emerging technological changes are likely to further complicate countries' ability to integrate into and upgrade within GVCs.

Even so, policy recommendations can be formulated. First, policymakers and companies in the digital era—in developed and developing countries alike—will have to focus on the key features of the 21st century economy. This includes addressing the interplay between technological (digital) innovation and globalization (increased connectivity and GVCs) and creating an environment conducive to diversification, innovation, and productivity. Second, attention to the macroeconomic, social, and environmental sustainability of a GVC-led development model is also in order.

ANNEX 5.1
Attempts to quantify the middle-income trap

TABLE A5.1.1 Country status relative to indicators associated with middle-income trap

Country	Aiyar and others (2013) "Trap Map" based on seven key factors (higher score signifies greater risk of middle-income trap)	Felipe and others (2012) LMIC trap = not crossed the lower-middle-income segment in at most 28 years UMIC trap = not crossed the upper-middle-income segment in at most 14 years	Panther and Flechtner (2015) Share of four total time periods (1976–2009) during which GDP per capita growth exceeded high-income country average (%)
Albania		LMIC trap	75
Algeria	13	LMIC trap	100
Argentina	12		100
Bolivia, Plurinational State of	12	LMIC trap	0
Botswana		LMIC trap	75
Brazil	8	LMIC trap	75
Bulgaria			100
Cambodia			100
Chile	7		100
China	2		100
Colombia	6	LMIC trap	0
Congo, Rep.		LMIC trap	75
Costa Rica	5		75
Czech Republic			100
Cyprus			75
Dominican Republic		LMIC trap	75
Ecuador	9	LMIC trap	25
Egypt	8	LMIC trap	75
El Salvador	2	LMIC trap	50
Equatorial Guinea			50
Estonia			100
Gabon		LMIC trap	25
Greece			75
Guatemala	11	LMIC trap	25
Honduras	11		50
Hong Kong, China			100
Hungary			100
India	4		100
Indonesia	1		100
Iran	4	LMIC trap	75
Ireland			75

(continued)

TABLE A5.1.1 Country status relative to indicators associated with middle-income trap *(continued)*

Country	Aiyar and others (2013) "Trap Map" based on seven key factors (higher score signifies greater risk of middle-income trap)	Felipe and others (2012) LMIC trap = not crossed the lower-middle-income segment in at most 28 years UMIC trap = not crossed the upper-middle-income segment in at most 14 years	Panther and Flechtner (2015) Share of four total time periods (1976–2009) during which GDP per capita growth exceeded high-income country average (%)
Jamaica		LMIC trap	0
Jordan	11	LMIC trap	50
Korea, Rep.			100
Lebanon		LMIC trap	100
Libya		LMIC trap	50
Malaysia	5	UMIC trap	100
Mauritius			100
Mexico	6		50
Morocco	9	LMIC trap	100
Namibia		LMIC trap	25
Nicaragua			50
Oman			100
Panama	13	LMIC trap	50
Paraguay	10	LMIC trap	25
Peru	12	LMIC trap	75
Philippines	10	LMIC trap	25
Poland			100
Portugal			50
Romania		LMIC trap	75
Russian Federation			100
Saudi Arabia		UMIC trap	25
Singapore			100
South Africa		LMIC trap	25
Sri Lanka		LMIC trap	75
Swaziland		LMIC trap	50
Syria		UMIC trap	100
Thailand	5		100
Tunisia	10	LMIC trap	75
Turkey	3		
Ukraine			100
United Arab Emirates			50
Uruguay	8	UMIC trap	75
Venezuela, RB		UMIC trap	100
Viet Nam	7		50
Yemen, Rep.		LMIC trap	0

Notes

1. Middle-income countries are defined by the World Bank as having a GDP per capita of $1,046–$12,735 in 2014. Countries with a higher GDP per capita are classified as high-income countries, and countries below $1,046 are classified as low-income countries. Upper-middle-income countries have a GDP per capita of $4,126–$12,735, and lower-middle-income countries have a GDP per capita of $1,046–$4,125.
2. This dual interpretation of the middle-income trap is explained as follows. The first is that middle-income countries start growing slower than the average country conditional on their income; the second is that while it may be easy to become a middle-income country, it is difficult to move beyond it.
3. This is also central to much of the work linking complexity economics to economic development (Pugliese and others 2015). While addressing the literature's perceived deficiencies on poverty traps and on processes of economic development more broadly, the researchers pointed particularly to the complexity of economic systems at the outset of industrialization, viewing this a dynamic process where complex network-reinforcing production capabilities and product demand emerges. Using a new measure of complexity, they found that more-differentiated and more-complex economies face lower barriers (in GDP per capita) when starting the transition toward industrialization.
4. There have even been discussions of multilateral trade liberalization through specific value chains rather than through trade policy issues (the case thus far; Hoekman and Jackson 2013).
5. In broad strokes this mirrors the findings of the empirical literature of transmission channels for trade and foreign direct investment.

References

Agénor, P. R., and O. Canuto. 2015. "Middle-Income Growth Traps." *Research in Economics* 69 (4): 641–60.

Ahmad, N. 2013. "Estimating Trade in Value-Added: Why and How?" In *Global value chains in a changing world*, edited by D. Elms and P. Low, 85–105. Geneva: World Trade Organization.

Aiyar, S., R. Duval, D. Puy, Y. Wu, and L. Zhang. 2013. "Growth Slowdowns and the Middle-Income Trap." International Monetary Fund (IMF) Working Paper WP/13/71, IMF, Washington, DC.

Amiti, M., and J. Konings. 2007. "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia." *The American Economic Review* 97 (5): 1611–38.

Antràs, P. 2015. *Global Production: Firms, Contracts and Trade Structure*. Princeton: Princeton University Press.

Antràs, P., and D. Chor. 2013. "Organizing the Global Value Chain." *Econometrica* 81 (6): 2127–2204.

Antràs, P., and E. Rossi-Hansberg. 2009. "Organizations and Trade." *Annual Review of Economics* 1 (1): 43–64.

Autor, D. 2015. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." *The Journal of Economic Perspectives* 29 (3): 3–30.

Azariadis, C., and A. Drazen. 1990. "Threshold Externalities in Economic Development." *The Quarterly Journal of Economics* 105 (2): 501–26.

Baldwin, R. 2006. "Globalisation: The Great Unbundling(s)." *Economic Council of Finland* 20 (3): 5–47.

Baldwin, R., and J. Lopez-Gonzalez. 2015. "Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses." *The World Economy* 38 (11): 1682–1721.

Bas, M. 2012. "Input-Trade Liberalization and Firm Export Decisions: Evidence from Argentina." *Journal of Development Economics* 97 (2): 481–93.

Beaudry, P., D. A. Green, and B. M. Sand. 2016. "The Great Reversal in the Demand for Skill and Cognitive Tasks." *Journal of Labor Economics* 34 (S1): S199–S247.

Bernard, A. B., and J. B. Jensen. 1999. "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of international economics* 47 (1): 1–25.

Blažek, J. 2015. "Towards a Typology of Repositioning Strategies of GVC/GPN Suppliers: The Case of Functional Upgrading and Downgrading." *Journal of Economic Geography* 16 (4): 1–21.

Boffa, M., V. Kumritz, G. Santoni, D. Taglioni, and D. Winkler. 2016. "Overcoming the Middle-Income Trap: The Role of GVC Integration for Climbing-Up the Income Ladder." University of Geneva.

Bøler, E. A., A. Moxnes, and K. H. Ulltveit-Moe. 2015. "R&D, International Sourcing, and the Joint Impact on Firm Performance." *The American Economic Review* 105 (12): 3704–3739.

Bulman, D., M. Eden, and H. Nguyen. 2014. "Transitioning from Low-Income Growth to High-Income Growth. Is There a Middle Income Trap?" World Bank Policy Research Working Paper No. 7104, World Bank, Washington DC.

Cattaneo, O., G. Gereffi, S. Miroudot, and D. Taglioni. 2013. "Joining, Upgrading and Being Competitive in Global Value Chains: A Strategic Framework." World Bank Policy Research Working Paper No. 6406, World Bank, Washington DC.

Chang, H. 2011. "Institutions and Economic Development: Theory, Policy and History." *Journal of Institutional Economics* 7 (4): 473–98.

Chui, M., J. Manyika, and M. Miremadi. 2016. "Where Machines Could Replace Humans – and Where They Can't (Yet)." *McKinsey Quarterly* (July): 1–12.

Clerides, S., S. Lach, and J. Tybout. 1998. "Is Learning-by-Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco." *Quarterly Journal of Economic* 113 (3): 903–47.

Cusolito, A. P., R. Safadi, and D. Taglioni. 2016. *Inclusive Global Value Chains: Policy Options for Small and Medium Enterprises and Low-Income Countries.* Washington, DC: World Bank.

Dabús, C., F. Tohmé, and M. Á. Caraballo. 2016. "A Middle Income Trap in a Small Open Economy: Modeling the Argentinean Case." *Economic Modelling* 53 (C): 436–44.

Dingemans, A. 2016. "Trying to Stay Ahead of the Curve in Chile's Economic Development: Exploring a Way out of the Middle-Income Trap through Pragmatic Export Development." *Development Policy Review*: 34 (5): 643–69.

Eden, M., and P. Gaggl. 2015. "On the Welfare Implications of Automation." World Bank Policy Research Working Paper No. 7487, World Bank, Washington, DC.

Egawa, A. 2013. "Will Income Inequality Cause a Middle-Income Trap in Asia?" Bruegel Working Paper 2013/06, Breugel, Brussels.

Eichengreen, B., D. Park, and K. Shin. 2013. "Growth Slowdown Redux: New Evidence on the Middle-Income Trap." National Bureau of Economic Research (NBER) Working Paper No. 18673, NBER, Cambridge, MA.

Fally, T. 2012. "Production Staging: Measurement and Facts." Working paper, University of Colorado-Boulder, Boulder, CO.

Felipe, J., A. Abdon, and U. Kumar. 2012. "Tracking the Middle-income Trap: What is It, Who Is in It, and Why?" Working Paper No. 715, Levy Economics Institute of Bard College, Annandale-On-Hudson, NY.

Fernandes, A. M., and A. Isgut. 2005. "Learning-by-Doing, Learning-by-Exporting, and Productivity: Evidence from Colombia." World Bank Policy Research Working Paper No. 3544, World Bank, Washington, DC.

Frederick, S. 2016a. "Benchmarking South Asia in the Global Apparel Industry." In *Stitches to Riches? Apparel Employment, Trade, and Economic Development in South Asia,* edited by G. Lopez-Acevedo and R. Robertson, 39–76. Washington, DC: World Bank.

———. 2016b. "Upgrading in the Apparel and Electronics Global Value Chains (GVCs): A Multi-Layered Approach: China Country Case." Background paper, United Nations Industrial Development Organization, Vienna.

Garrett, G. 2004. "Globalization's Missing Middle." *Foreign Affairs* 83 (6): 84–96.

Gereffi, G. 2014. "Global Value Chains in a Post-Washington Consensus World." *Review of International Political* Economy 21 (1): 9–37.

Gereffi, G., J. Humphrey, and T. Sturgeon. 2005. "The Governance of Global Value Chains." *Review of International Political Economy* 12 (1): 78–104.

Gill, I., and H. Kharas. 2007. *An East Asian Renaissance: Ideas for Economic Growth*. Washington, DC: World Bank.

———. 2015. "Middle Income Traps: A Conceptual and Empirical Survey." World Bank Policy Research Working Paper No. 6594, World Bank, Washington DC.

Glawe, L., and H. Wagner. 2016. "The Middle-Income Trap–Definitions, Theories and Countries Concerned: A Literature Survey." MPRA Paper 71196. University of Hagen, Germany.

Görg, H., and D. Greenaway. 2004. "Much Ado about Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?" *The World Bank Research Observer* 19 (2): 171–97.

Grossman, G. M, and E. Rossi-Hansberg. 2006. "Trading Tasks: A Simple Theory of Offshoring." *American Economic Review* 98 (5): 1978–1977.

Haldane, A. 2015. "How Low Can You Go?" Speech delivered at the Portadown Chamber of Commerce, Portadown, Northern Ireland, September 18.

Hausmann, R., L. Pritchett, and D. Rodrik. 2005. "Growth Accelerations." *Journal of Economic Growth* 10 (4): 303–29.

Hoekman, B., and S. Jackson. 2013. Reinvigorating the trade policy agenda: Think supply chain!. *VoxEU,* January 23.

Huang, Y. 2016. "Can China Escape the Middle-Income Trap?" *China Economic Journal 9* (1): 17–33.

Hummels, D., J. Ishii, and K. M. Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of international Economics* 54 (1): 75–96.

Humphrey, J. 2004. "Upgrading in Global Value Chains." World Commission on the Social Dimensions of Globalization Working Paper No. 28, International Labour Office, Geneva.

Im, F. G., and D. Rosenblatt. 2013. "Middle-Income Traps: A Conceptual and Empirical Survey." World Bank Policy Research Working Paper No. 6594, World Bank, Washington, DC.

IMF (International Monetary Fund). 2016. *Global Financial Stability Report: Fostering Stability in a Low-Growth, Low-Rate Era*. Washington, DC: IMF.

Ito, T. 2016. "Growth Convergence and the Middle Income Trap." Center on Japanese Economy and Business Working Papers No. 349, Columbia Business School, New York.

Jankowska, A., A. J. Nagengast, and J. R. Perea. 2012. "The Middle Income Trap: Comparing Asian and Latin American Experiences." Organisation for Economic Co-operation and Development (OECD) Development Center Policy Insights No. 96, OECD, Paris.

Johnson, R. C., and G. Noguera. 2012. "Accounting for Intermediates: Production Sharing and Trade in Value Added." *Journal of international Economics* 86 (2): 224–36.

Kharas, H., and H. Kohli. 2011. "What is the Middle Income Trap, Why do Countries Fall into It, and How Can It Be Avoided?" *Global Journal of Emerging Market Economies* 3 (3): 281–89.

Koopman, R., Z. Wang, and S. J. Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *The American Economic Review* 104 (2): 459–94.

Koren, M., and M. Csillag. 2011. "Machines and Machinists: Capital-Skill Complementarity from an International Trade Perspective." Centre for Economic Policy Research (CEPR) Discussion Paper No. DP8317, CEPR, London.

KPMG. 2016. *Future State 2030: The global megatrends shaping governments*. London: KPMG

Kraay, A., and C. Raddatz. 2007. "Poverty Traps, Aid, and Growth." *Journal of Development Economics* 82 (2): 315–47.

Kummritz, V., D. Taglioni, and D. Winkler. 2016. "Economic Upgrading through Global Value Chain Participation: Which Policies Increase the Value Added Gains?" Policy Research Working Paper No. WPS 8007, World Bank, Washington, DC.

Leibenstein, H. 1962. *Economic Backwardness and Economic Growth: Studies in the Theory of Economic Development*. New York: John Wiley and Sons.

Lileeva, A., and D. Treffler. 2007. "Improved Access to Foreign Markets Raises Plant-Level Productivity…for Some Plants." NBER Working Paper No. 13297, NBER, Washington, DC.

MacGarvie, M. 2006. "Do Firms Learn from International Trade?" *Review of Economics and Statistics* 88 (1): 46–60.

Mariscal, A., and D. Taglioni. 2017. "GVCs as a Source of Firm Capabilities." World Bank, Washington, DC.

Morikawa, M. 2016. "The Effects of Artificial Intelligence and Robotics on Business and Employment: Evidence from a Survey on Japan." Research Institute of Economy, Trade and Industry (RIETI) Research Papers No. 16E066, RIETI, Tokyo.

Nelson, R. R. 1956. "A Theory of The Low-Level Equilibrium Trap In Underdeveloped Economies." *The American Economic Review 46* (5): 894–908.

Ohno, K. 2009. "Avoiding the Middle-Income Trap: Renovating Industrial Policy Formulation in Vietnam." Association of Southeast Asian Nations Economic Bulletin 26 (1): 25–43.

Oxford Martin School. 2016. *Technology at Work v2.0: The Future is Not What It Used to Be*. Oxford, U.K.: Oxford Martin School.

Ozturk, A. 2016. "Examining the Economic Growth and the Middle-Income Trap from the Perspective of the Middle Class." *International Business Review* 25 (3): 726–38.

Panther, S., and S. Flechtner. 2015. "Global and Domestic Inequalities and the Political Economy of the Middle-Income Trap." Paper prepared for the 27th Annual Society for the Advancement of Socio-Economics Conference, London, July 2–4.

Paus, E. 2014. "Latin America and the Middle Income Trap." United Nations Economic Commission for Latin America and the Caribbean Financing for Development Series No. 250, United Nations, Santiago.

Paus, E., and K. Gallagher. 2008. "Missing Links: Foreign Investment and Industrial Development in Costa Rica and Mexico." *Studies in Comparative International Development* 43 (1): 53–80.

Pikos, A. K., and S. L. Thomsen. 2016. "Rising Work Complexity but Decreasing Returns." IZA – Institute of Labor Economics Discussion Paper No. 9878. Bonn: IZA.

Porter, M. E. 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Simon and Schuster.

Pritchett, L., and L. Summers. 2014. "Asiaphoria Meets Regression to the Mean." NBER Working Paper No. 20573, NBER, Washington, DC.

Pugliese, E., G. L. Chiarotti, A. Zaccaria, and L. Pietronero. 2015. "Complex Economies Have a Lateral Escape from The Poverty Trap." *PLoS ONE* 12 (1): e0168540.

Rigg, J., B. Promphaking, and A. Le Mare. 2014. "Personalizing the Middle-Income Trap: An Inter-Generational Migrant View from Rural Thailand." *World Development* 59 (7): 184–98.

Robertson, P. E., and L. Ye. 2013. "On the Existence of a Middle Income Trap." Economics Discussion Paper No. 13.12, University of Western Australia, Perth.

Rodrik, D. 2016. "Premature Deindustrialization." *Journal of Economic Growth* 21 (1): 1–33.

Rossi, A. 2013. "Does Economic Upgrading Lead to Social Upgrading in Global Production Networks? Evidence from Morocco." *World Development* 46 (C): 223–33.

Roy, S., M. Kessler, and A. Subramanian. 2016. "Glimpsing the End of Economic History? Unconditional Convergence and the Missing Middle Income Trap." Center for Global Development (CGD) Working Paper 438, CGD, Washington, DC.

Taglioni, D., and D. Winkler. 2016. *Making Global Value Chains Work for Development*. Washington, DC: World Bank.

Toh, T. V. 2013. "The Middle-Income Trap: Issues for Members of the Association of Southeast Asian Nations." Asian Development Bank Institute (ADBI) Working Paper Series No. 421, ADBI, Tokyo.

Wacziarg, R., and K. H. Welch. 2008. "Trade Liberalization and Growth: New Evidence." *The World Bank Economic Review* 22 (2): 187–231.

Wang, Z., S. J. Wei, X. Yu, and K. Zhu. 2016. "Characterizing Global Value Chains." Stanford Center for International Development (SCID) Working Paper 578, SCID, Stanford, CA.

West, D. M. 2015. *What Happens if Robots Take the Jobs? The Impact of Emerging Technologies on Employment and Public Policy*. Washington, DC: Brookings Institution Centre for Technology Innovation.

WEF (World Economic Forum). 2016. *The Future of Jobs: Employment, Skills and the Workforce Strategy for the Fourth Industrial Revolution*. Global Challenge Insight Report. Geneva: World Economic Forum.

Whittaker, H. D., T. Sturgeon, T. Okita, and T. Zhu. Forthcoming. *Compressed Development*. Oxford, U.K.: Oxford University Press.

Woo, W. T. 2012. "China Meets the Middle-Income Trap: The Large Potholes in the Road to Catching-Up." *Journal of Chinese Economic and Business Studies* 10 (4): 313–36.

World Bank. 2013. *China 2030: Building a Modern, Harmonious, and Creative Society*. Washington, DC: World Bank.

———. 2016a. *Global Economic Prospects: Divergences and Risks*. Washington, DC: World Bank.

———. 2016b. *The Role of Global Value Chains in the Rise of Poland and the New High-Income Economies*. Washington, DC: World Bank.

———. 2016c. *World Development Report 2016: Digital Dividends*. Washington, DC: World Bank.

———. n.d. World Bank County and Lending Groups Classification (database). Washington, DC: World Bank. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

———. n.d. World Development Indicators (database). Washington, DC: World Bank. Available at: http://data.worldbank.org/data-catalog/world-development-indicators.

CHAPTER 6

Services trade and global value chains

CECILIA HEUSER AND AADITYA MATTOO

In Moliere's *The Bourgeois Gentleman,* M. Jourdain discovers that he has "been speaking prose all my life, and didn't even know it!" We suspect that many of us have been working on global value chains (GVCs) without quite knowing it. A value chain comprises "the full range of activities that are required to bring a product from its conception, through its design, its sourced raw materials and intermediate inputs, its marketing, its distribution and its support to the final consumer."[1] A GVC emerges when these activities are undertaken by entities based in or from different countries. Several studies of international trade in services inputs and of foreign direct investment in business services are thus potentially relevant to an examination of GVCs.

Two questions arise. What makes a value chain a GVC? And why do services merit special consideration in a discussion of GVCs?

The first question has sometimes been reformulated as "How many 'borders' does a value chain have to cross to qualify as a GVC?" (perhaps analogously to a recent Nobel laureate's question, "How many roads must a man walk down, before you call him a man?"). In the GVC case, some analysts have suggested a fairly precise answer. For example, the widely used GVC participation index proposed in Koopman and others (2010) is determined by the foreign value added embodied in the gross exports of a given country and the domestic value added embodied in the gross exports of third countries. This definition would set a GVC—such as importing to export—apart from value chains that involve a single international transaction, an import or export of intermediate goods. It may well be true that multiple international transactions along a value chain have economic implications that are qualitatively distinct from (the sum of) a series of single international transactions, even though this has not yet been established empirically. However, it may also be true that the implications of even single international transactions along a value chain are economically important and policy relevant. So this chapter adopts a broader view of GVCs that also includes single international transactions, consistent with the approach in chapter 2, covering both simple GVCs, with one border crossing, and complex GVCs, with two or more border crossings (Wang, Wei, and Zhu 2017).[2]

The second question can be reformulated as two questions: Should services be examined separately from goods in a discussion of GVCs? And should they be treated as a single broad category, the same way goods are? Our answer to both questions: In some respects no, in others yes.

In some ways, services play a role similar to that of goods in GVCs, whether they are meant for final consumption or as inputs in the production of goods or other services. In fact, the most detailed analysis of the role of services in value chains—drawing on the new world input-output tables and value-added trade databases—relates only to situations in which services are traded

This chapter draws on three background papers by Van der Marel and Sáez (2016), Miroudot (2016), and Liu and others (2017). The authors thank Laura Alfaro, Maggie Chen, Nick Hope, Gary Hufbauer, Bradford Jensen, Przemyslaw Kowalski, Joscelyn Magdeleine, Andreas Maurer, Marcel Timmer, Zhi Wang, Zhigang Yao, and participants at the Making Global Value Chains Work for Economic Development workshop in Washington, DC, November 2016, for helpful comments.

in a manner akin to how goods are traded. However, services deserve special attention for four reasons, relating to how they are transacted, how they affect downstream sectors, how they are regulated, and how international cooperation can contribute to integrating national markets.

First, the notion of GVCs involving services needs to encompass a broader range of transactions. GVCs need to encompass not only transactions crossing borders, but also transactions within countries between national and foreign entities. While there is good reason to take a similar broad view of GVCs involving only goods, the case is overwhelming for services because focusing only on cross-border trade would ignore the large share of international transactions in services that takes place through consumers traveling to other countries (consumption abroad, or mode 2 in World Trade Organization [WTO] parlance); commercial presence (through foreign investment, or mode 3 in the WTO); and the presence of natural persons (temporary immigrants, or mode 4 in the WTO).[3] Even though the ability to measure the role in GVCs of international services transactions through commercial presence is limited, ways have been found to estimate their economic impact.[4]

Second, the argument that services can have a substantial economic impact because they are vital inputs into producing downstream goods and services may not seem a sufficient reason for separate consideration. After all, goods such as computers are also vital inputs. But two features of services seem to merit special focus. One is that the very existence of GVCs is due to improvements in such services as transport, communication, and computing (or information and communication technology services) that have made it possible to fragment and coordinate production globally. Another is the growing evidence that when GVCs include finance, communications, transport, and professional and other business services in favorable price–quality bundles and diverse varieties, firms perform better. These services enable firms to invest in new business opportunities and better production technology, to exploit economies of scale by concentrating production in fewer locations, to efficiently manage inventories, and to make coordinated decisions with their suppliers and customers. The result can be increased total factor productivity and shifts in the pattern of comparative advantage.

Third, services also differ at least qualitatively from goods in the nature of the policies that both inhibit or encourage the emergence of services-related GVCs. Border measures such as tariffs are much less relevant for services trade than for goods trade, and behind-the-border regulatory measures are much more relevant. Some examples: Cross-border trade in international transport services is impeded by the exclusion of third-country providers and by quantitative restrictions in bilateral agreements. Trade through commercial presence in banking and communication services must confront restrictions on foreign ownership and regulatory requirements that can be discretionary and discriminatory. The presence of foreign professionals is prevented by restrictive visa and work permit rules as well as by a refusal to recognize their qualifications and licenses. And trade in all data-intensive services is threatened by diverging national privacy laws.[5]

Fourth, services markets have seen considerable unilateral liberalization that has facilitated the emergence of GVCs with services as both inputs and outputs. Unfortunately, international cooperation has striven to replicate mostly the goods model of "reciprocal market opening," which has so far delivered little incremental liberalization. Because the impediments are different for services-related GVCs, international cooperation needs to take a different form. In particular, much more could be achieved through a greater emphasis on regulatory cooperation.

The first section below sets the stage by describing the role of services in GVCs, and the second presents the methods and datasets currently used to measure this role. The third examines the patterns that emerge, showing the absolute and growing importance of services in GVCs and suggests possible reasons. The fourth discusses the implications of services' presence in GVCs, particularly for total factor productivity and patterns of comparative advantage. The fifth presents policy implications of the evidence on the impediments to services being part of GVCs, and the sixth argues that these impediments are most effectively addressed through new forms of regulatory cooperation.

The role of services in global value chains

In some ways services play a role analogous to that of goods. But their roles are also different, in that services facilitate the emergence of GVCs in a way that goods do not. Services can be seen as elements in GVCs that are different from the typical cross-border or arm's length trade usually analyzed in the case of goods.[6]

Services global value chains

The emergence of GVCs has increased the opportunities for international specialization not only in final goods and their parts, but also in services and services tasks. In many instances, services represent the end stage of a GVC, with services firms choosing to source their inputs internationally. For example, financial services providers have outsourced and offshored their back-office data-management and analytical tasks, architects their basic design tasks, and doctors the reading of radiological images. In each case, direct interaction with the client is by locally based services providers. It has been suggested that in fragmented production processes of services, value is sometimes created differently from how it is created in goods value chains. Instead of following a linear value chain, in which products move sequentially from upstream to downstream, adding value at each stage (a "snake" formation in the terminology of Baldwin and Venables 2013), value creation in services value chains may occur as a network of activities, such as platform-based communication or transportation networks (a "spider" formation in Baldwin and Venables). In such cases, multiple parts come together to add value simultaneously in forming a final product or component —or through alternative models, such as facilitated user networks (which create value by linking customers, as in insurance or banking services) and solution shops (which create value by solving customer problems; Miroudot 2016).

Services as links in global value chains

One reason to consider some services in GVCs separately from goods is their role in enabling GVCs to emerge. The international fragmentation of production was driven partly by changes in transport, logistics, and information and communication technology services. In particular, lower costs and improvements in these services made it possible for firms to manage production processes that are geographically split (Jones and Kierzkowski 2001a, 2001b). Even though the anecdotal evidence itself is compelling, a serious gap in the literature is not having rigorous empirical evidence on how improved access to these connecting services across space and time has facilitated the emergence of GVCs.

Services as outsourced inputs in global value chains

Besides their role as links between different stages of value chains, services often are important inputs in the production process of manufacturing goods and services. For example, a value chain may start with research, design, and engineering activities that are clearly services inputs when they are outsourced. At the other end of the value chain are other services such as marketing and distribution that are also important stages in ensuring that a product reaches the consumer. Therefore, services are not only support functions that enable GVCs, but they are also crucial inputs in key stages of production.

Yet being vital inputs into goods and services production by itself does not constitute sufficient reason to consider services separately from goods in analyzing GVCs. After all, goods are also vital inputs. The fact that access to some services of sufficiently high quality, low price, and diversity may matter for firm performance is an empirical question akin to the role of information and communication technology goods in determining performance. But the fact that access to services inputs comes through foreign direct investment and the movement of people more often than it does for goods inputs warrants considering services separately and through a broader view of GVCs. The relative importance of digital delivery in services also requires modifying the traditional customs-mediated and customs-measured role of international transactions within GVCs.

Services as in-house inputs in global value chains

Another feature of services as inputs arises in a notion of GVCs that goes beyond arm's length market-based transactions to functions within the firm. It is common for firms to develop their own support services in house, such as research and development activities or information technology capacity. This means that services are produced not only by services firms, but also by manufacturing firms (Kelle 2013), which often export a variety of headquarters services to their affiliates. Some analysts argue that this "servicification" inside firms may need to be considered for a full assessment of the impact of services on trade and value creation (Miroudot 2016). But as noted below, this deconstruction of activities within firms, when taken to the limit, may blur the distinction between goods and services because all tasks could be considered services.

How services participation in global value chains is measured

For a long time, measuring trade in services took a back seat because data on trade in goods was more extensive and readily available. More recently, measuring trade in services has received impetus from the new prominence in international policy and negotiating agendas given to liberalizing trade in services, the increased importance of services in GVCs, and the availability of multicountry input-output tables.

Statistics on trade in value added cover services as links, outsourced inputs, or final products in global value chains

As long as services are final products or inputs supplied by other firms in the production process, input-output tables can help identify their contribution to value added in output or exports (Francois and Woerz 2008; Nordås 2008).

The starting point for analyzing the contribution of services to GVCs is the decomposition of value added in exports by its origin. Following seminal work by Hummels, Ishii, and Yi (2001), an expanding literature has proposed alternative decompositions of trade in value added and measures of participation in GVCs (Koopman, Wang, and Wei 2014; Foster-McGregor and Stehrer 2013; Los, Timmer, and de Vries 2016). As in Miroudot (2016), the analysis here relies on the calculations published by the Organisation for Co-operation and Development (OECD)–WTO Trade in Value-Added database, which features several indicators that account for services value added in trade (OECD 2013).

The main indicator is the total value added (*VA*) of the services sector embodied in gross exports of industry *i* and country *c* as a percentage of total gross exports of *i* of country *c*, ($SERV\ VA_{c,i}$). It is calculated as:

$$SERV\ VA_{c,i} = \sum_{j \in S} V_{c,j}(B_{c,c})_{ji} EXGR_{c,i}/EXGR_{c,i} + \sum_{p} \sum_{j \in S} V_{p,j}(B_{p,c})_{ji} EXGR_{c,p,i}/EXGR_{c,i} \quad (1)$$

where $V_{p,j}$ is the value-added share of services industry *j* in country *p*; *B* is the global Leontief inverse of the intercountry input-output matrix, $B = (I - A)^{-1}$, and therefore its *ji*-th element $(B_{p,c})_{ji}$ represents the total requirements of *j* from *p* to produce a unit of *i* in country *c*; $EXGR_{c,p,i}$ is gross exports from country *c* to country *p* for any given industry *i*; and $EXGR_{c,i}$ is total gross exports for country *c* and industry *i*. The first term then represents all direct and embodied domestic services value added in the exports of product *i* from country *c*, and the second term represents all foreign domestic services value added embodied in the exports of product *i* from country *c*.

The services content of gross exports can then be decomposed into a domestic and a foreign part, and the domestic part can be further decomposed into the direct domestic services industry value added content of gross exports (the value added from the exporting services sectors), the indirect domestic services content of gross exports (the domestic services value added embodied in other exporting industries), and the re-imported domestic services value-added content of gross exports

(domestic services value added in imported intermediate inputs used in exports; figure 6.1).[7] This decomposition can also be analyzed by services type. A similar approach can be used in measuring the services value added embodied in foreign final demand.

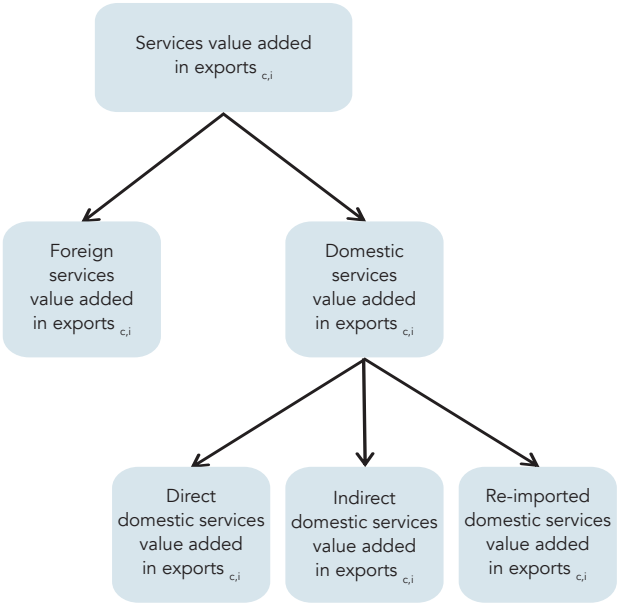
Value-added trade statistics based on multicountry input-output tables are a starting point for understanding the importance of services inputs in GVCs, but these statistics cannot fully capture all services that are relevant to fragmented production processes. In particular, services traded through WTO mode 3 will not be accurately identified as foreign services in traditional value-added measures.

Existing statistics on trade in value added do not fully capture services traded though commercial presence

Since the supply of services through commercial presence abroad is an important way of conducting international transactions in services (mode 3–commercial presence), the distinction between foreign- and domestic-owned firms is particularly relevant for services. Accurately assessing the contribution of services to GVCs requires that the ownership status of the firm that originates the value added affect whether that contribution is classified as domestic or foreign, as this is bound to inform services trade policy.[8]

A GVC accounting framework that allows for this sort of distinction between firms can be similar to the global supply-use/input-output tables commonly used now, such as OECD Inter-Country Input-Output Tables, but it would also need to identify foreign or domestic ownership for each commodity/industry. While such a framework is not currently available, initiatives in this direction are under way by the U.S. Bureau of Economic Analysis (BEA) and the OECD (Fetzer and Strassner 2015; OECD 2015). In both cases the proposed approach is to link existing supply-use tables to ownership and trade data—such as OECD Inter-Country Input-Output Tables to the Activity of Multinational Enterprises Database, or BEA input-output accounts to BEA surveys and U.S. Internal Revenue Service Statistics of Income data.

FIGURE 6.1 Deconstructing services value added in gross exports



Source: Authors' construction.

Services as in-house inputs in global value chains

When services inputs are supplied in-house, value-added analysis does not capture their contribution to GVCs. Additional information is needed to identify these services activities within each production process.

One way to address this issue is to consider business functions, in order to distinguish between the primary or core activity of the firm and support functions such as research and development, sales, marketing, or information technology services. But statistics on business functions have only recently started to be collected in some national surveys (Sturgeon and others 2013).[9] Alternatively, labor force surveys can be used to identify business functions by matching occupation classifications to business functions (Timmer, Stehrer, and de Vries 2015). Each industry is assigned one business function to describe its core activity, which usually covers occupations directly related to the production process. All other business functions are classified as support activities (or secondary business functions) and can be regarded as services activities if they would be classified as services if outsourced. This approach may supplement the usual trade in value added analysis, providing a sense of the role of in-house services in GVCs.[10]

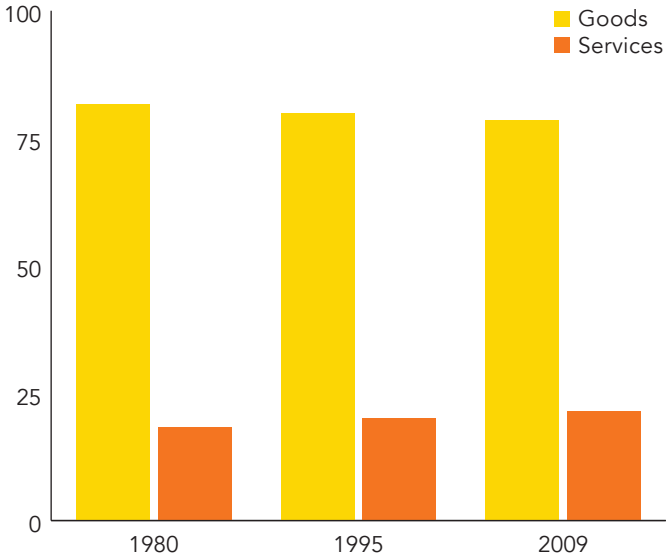
While it is theoretically possible to determine a single core function per industry, it can be difficult in practice to establish what is not a support function. Even if it were feasible to distinguish between tasks that would be services if they had taken place at arm's length (such as bookkeeping) and other tasks that are intrinsically manufacturing or agricultural in nature (such as wood processing), such distinctions slide on a slippery slope and raise the question: What is not a service? Ultimately, almost any task can be conceived of as an arm's length service. For example, one could either directly employ a worker in the horticultural sector or buy "fruit-picking" services from an individual or a firm. So this deconstruction of the firm into constituent tasks could reduce each firm into a bundle of services.

The emerging patterns of services in global value chains

This section presents some stylized facts about the increasing role of services in GVCs—first in aggregate and then across countries and industries. It then discusses why this might be happening. The evidence is obtained by computing the value-added measures described in the previous section using the OECD Trade in Value-Added database. Some results are also presented to illustrate the potential relevance of in-house services in GVCs.

FIGURE 6.2 Gross exports of goods and services as a percentage of total world gross exports, 1980, 1995, and 2009

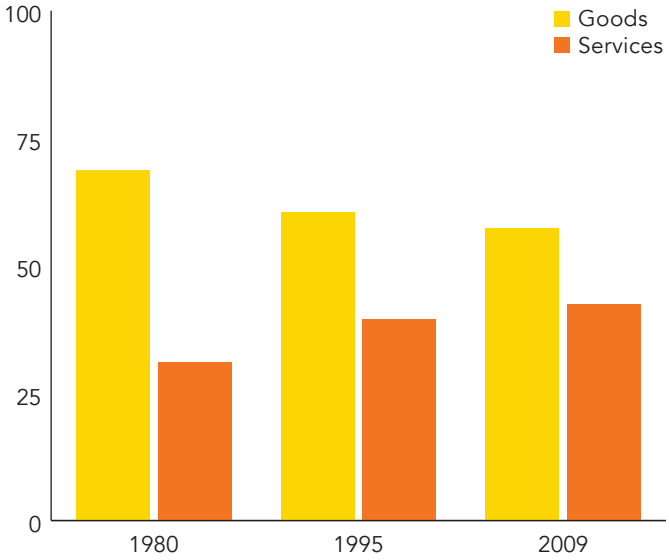
Percent



Source: Authors' calculations based on Johnson and Noguera 2016.

FIGURE 6.3 Value-added exports of goods and services as a percentage of total world value-added exports, 1980, 1995, and 2009

Percent



Source: Authors' calculations based on Johnson and Noguera 2016.

The patterns of services in GVCs

The share of services in value-added trade is large and increasing

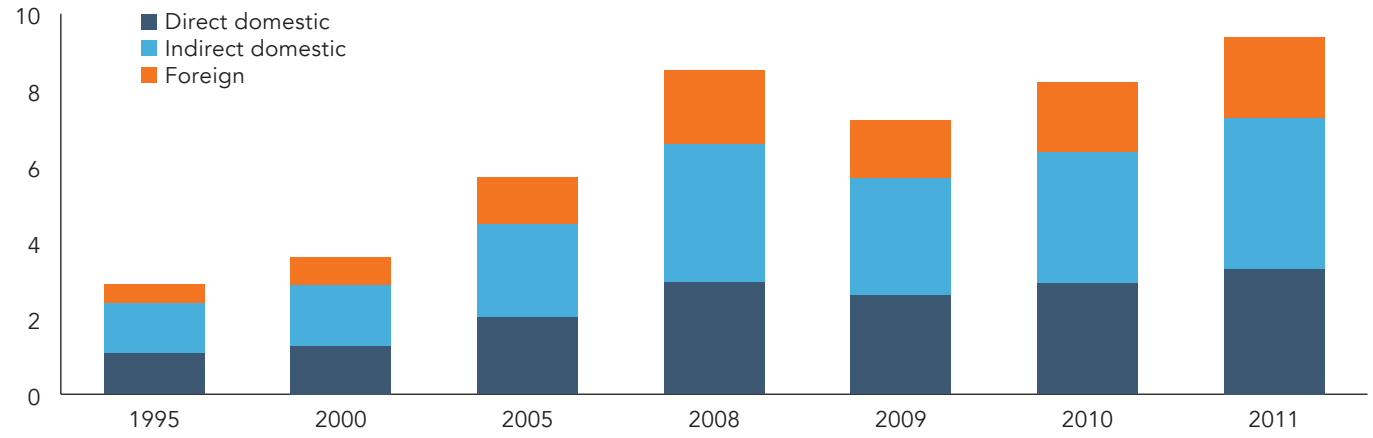
Multiple studies have found that the share of services in trade in value added is both large (significantly larger than the share of services in gross trade) and increasing (OECD, WTO, and World Bank Group 2014). While services as a share of total world gross exports have remained around 20% since 1980, in value-added terms they have increased from below 30% to more than 40% (compare figures 6.2 and 6.3). For Asia, this pattern holds by country as well, with no major differences between developed or developing, high-technology or low-technology, or high-wage or low-wage countries (Baldwin, Forslid, and Ito 2015).

The increasing share of services in value-added trade was driven by services embodied in exports

Now take a closer look at the recent evolution of services value added in exports, decomposed into direct and indirect domestic value added and foreign value added (figure 6.4). While direct exported value added shows a notable increase from 1995–2011,

FIGURE 6.4 Share of direct, indirect, and foreign services value added in world gross exports, 1995–2011

$ (billions)



Source: Miroudot 2016 based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database.

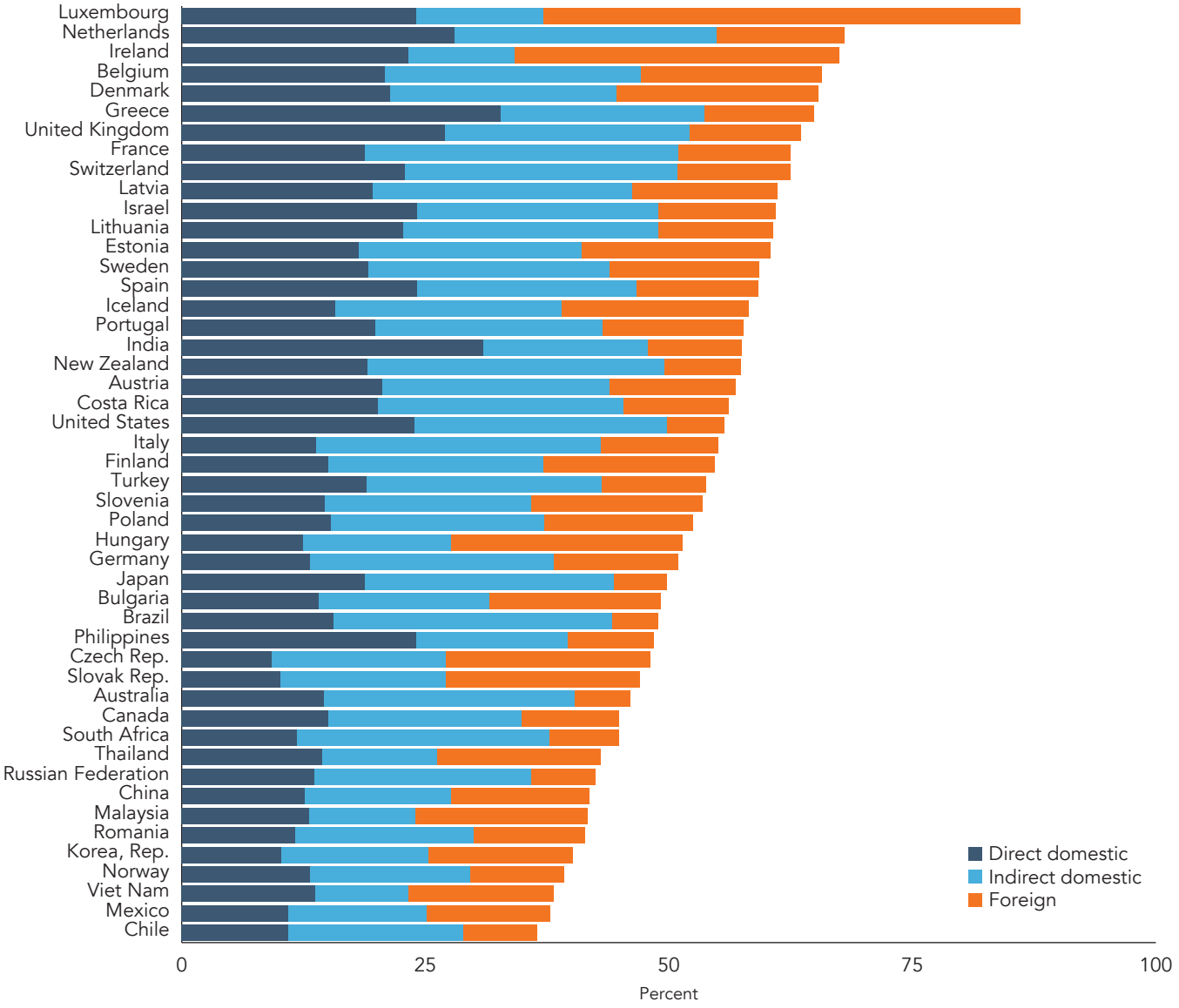
more than 65% of the growth of services value added in exports was due to an increase in services embodied in other exports. Both domestic and foreign embodied services grew, but the foreign services value-added component grew the most.

Figures 6.2–6.4 suggest that an increasing part of manufacturing exports corresponds to services value added and that a growing share of these "additional" services is being sourced abroad. However, since these measures are based on cross-border trade, value added from foreign services traded through commercial presence is counted in the "domestic" category, as previously mentioned. The apparent shift toward foreign services in the decomposition of services value added probably understates what actually happened.

The share of services value added in exports varies significantly across countries

Decomposition of services value added in exports by country in 2011 supports the general observations that the share of services value added is high and that embodied services explain a large share of the total for all countries (figure 6.5). However, countries differ in their share of services value added in exports, ranging from 35% in Chile to close to 90% in Luxembourg. These differences reflect some specialization patterns: countries on the bottom of the figure specialize in exports of commodities (Chile, Norway) or manufactured goods (Republic of Korea, Mexico), while economies on the top are services exporters. Countries specialized in services also

FIGURE 6.5 Direct and indirect domestic services value added and foreign services value added in gross exports, by country, 2011



Source: Miroudot 2016 based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database.

have more indirect (domestic and foreign) services value added in exports because services are mainly produced with other services.

The share of services value added in exports also varies across industries

The share of services value added in exports ranges from 11% in mining to 38% in chemicals and motor vehicles (figure 6.6). Caution in interpreting these results is advised, since value-added measures are based on input-output tables defined by arm's length transactions and thus exclude services provided in-house. Mining exports are in many cases driven by large state-owned enterprises that are likely to provide most services in-house (Miroudot 2016). For example, in Australia, where that is not the case, the share of services value added in exports is 24%.

The decomposition of services value added by type of services seems similar across manufacturing industries (see figure 6.6). Distribution represents about a third of services value added in exports, as do business services, which includes telecommunications services, computer services, professional services, research and development services, consulting, advertising and marketing services, technical testing services, and environmental services. The last third is split among transport, finance, and other services (a category covering construction, hotels and restaurants, government services, health and education, entertainment, and audio-visual services).

Why is the share of services in value-added exports increasing?

Figures 6.2–6.4 reveal an increasing share of services in value added exports, suggesting that the increase may be explained in part by an increase in services value added embodied in exported manufactures.

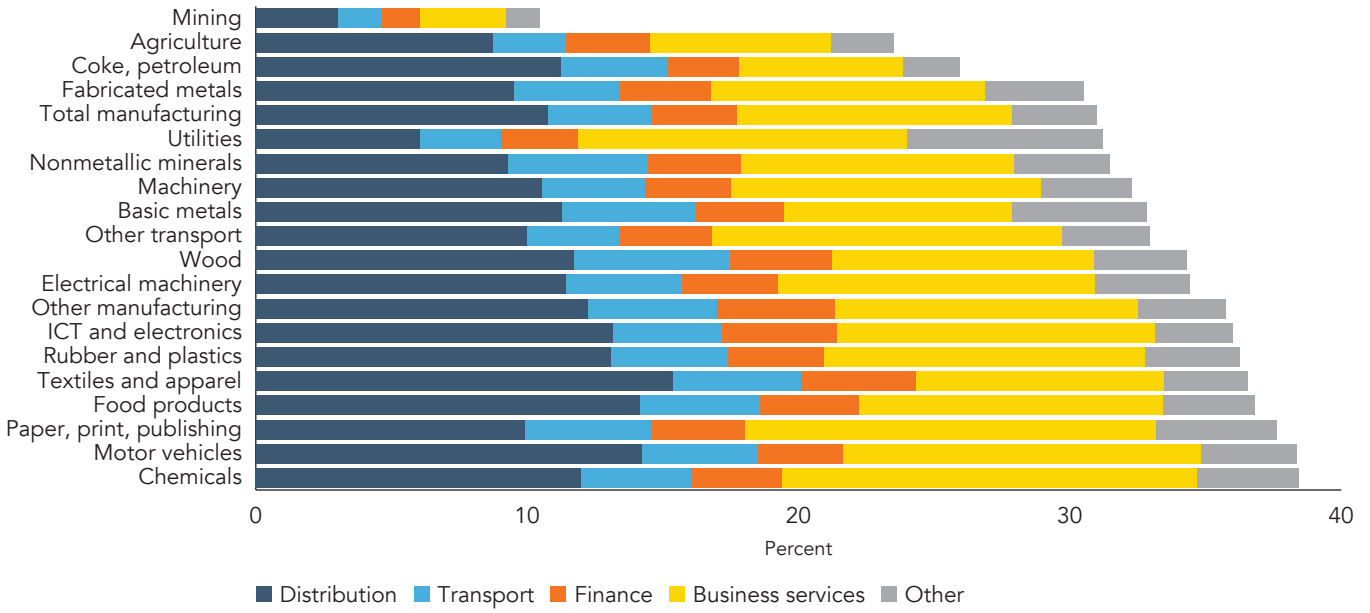
The growing importance of services in the economy has been a matter of discussion for a long time. Bhagwati (1984) set out the main reasons: "splintering" (outsourcing services formerly provided in-house by manufacturing firms), the high-income elasticity of the demand for services, and relative price shifts due to the lower growth of productivity in services than in goods. Splintering was seen as the spontaneous result of the specialization opportunities arising from growth and technical change.

More recently, the increasing importance of services within manufactured goods—servicification, as it has been called—has been extensively documented, in line with the evidence in figures 6.2–6.4.[11] While it has not yet been possible to empirically establish the cause of servicification, Baldwin, Forslid, and Ito (2015) explore its potential sources in a way that echoes Bhagwati (1984). These include reclassification, task-composition shifts in connecting services and final goods, and task–relative price shifts.

Reclassification. Over the past decades, many of the services traditionally sourced in-house by manufacturing firms, and thus classified as manufacturing, began to be sourced at arm's length and classified accordingly as services. The servicification that arises from this reclassification can happen even if there is no change in products, production process, or relative price of inputs. This argument corresponds to Bhagwati's "splintering" reason.

Task-composition shift: connecting services. The emergence of GVCs requires connections among geographically separate

FIGURE 6.6 Decomposition of services value added in world gross exports, by manufacturing industry, 2011



Source: Miroudot 2016 based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database.

production units, which typically involve services links. These links (including telecommunications, transportation, and mailing) contribute to the value added embodied in the final good. So outsourcing and offshoring tend to increase the share of services in a final good's value added.

Task-composition shift: changes in final goods. The second task-composition shift arises from changes in the nature of the final manufactured goods. For example, today's cars contain software, which comes from the services sector. Similarly, many other manufactured goods have become more intensive in services. This argument resembles the argument that the income elasticity of demand for services is high, but in this case technological progress is enhancing the services content and the quality of manufactured goods.

Task–relative price shift. For a variety of reasons, including the need for coordination and face-to-face interaction, offshoring tasks tends to be easier for intermediate goods than for intermediate services. Since the decision to offshore a task is typically driven by cost-reduction motives, there is a natural tendency for offshoring to reduce the relative price of the offshored tasks. If most of the offshored tasks are typically performed by the manufacturing sector, then offshoring would—in a mechanical way—raise services value added in final manufactured goods. This argument is a variant of the differential productivity growth reason but is being driven by differences between goods and services in cost-reducing opportunities through offshoring.

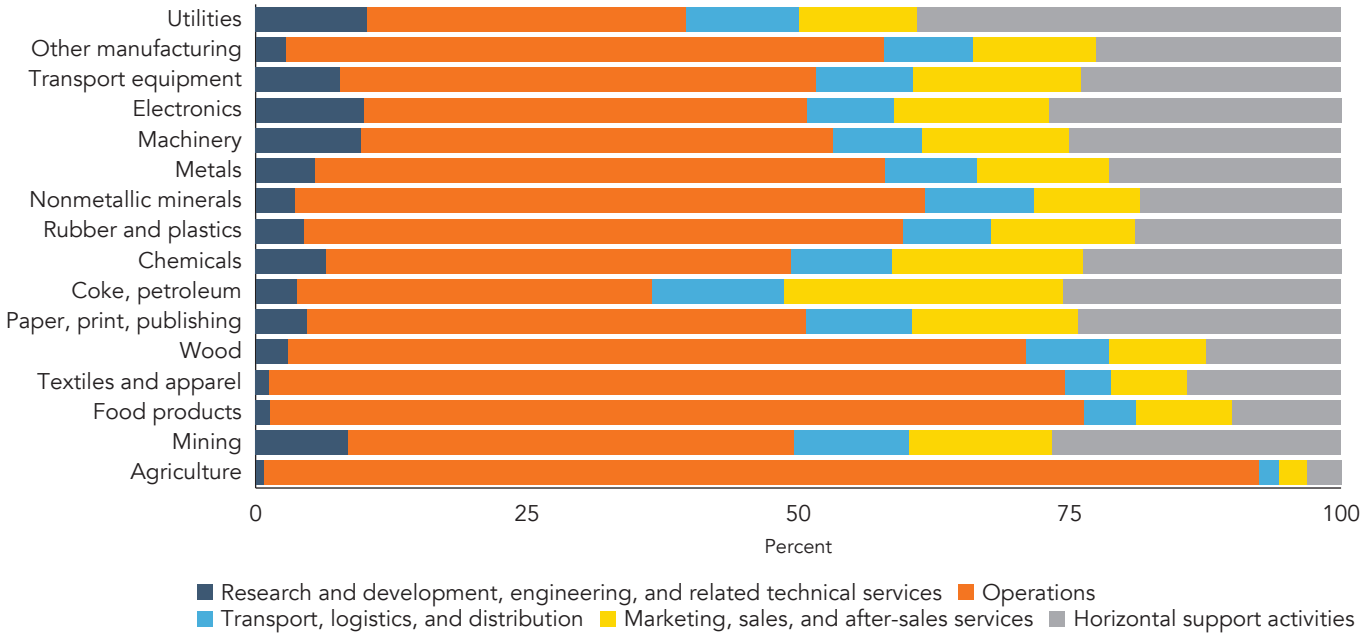
The limits of value-added analysis: In-house services play a large role in manufacturing

As mentioned earlier, services enter GVCs not only as outsourced inputs or final products, but also as inputs frequently provided in-house, which traditional value-added measures do not capture. Illustrating how relevant this omission can be, Miroudot (2016) matched occupation classifications and business functions for 37 countries over 1995–2013. This decomposition of jobs embodied in manufacturing according to business function by industry reveals considerable variation across industries, with employment in core activities (operations) at more than 90% in agriculture, but at only about 33% in coke and petroleum (figure 6.7). This variability carries over to differences across countries as well. On average, the core activities of manufacturing firms account for only 50% of employment, meaning that half the employees of manufacturing firms perform services activities. This suggests that the services value added embodied in manufacturing, and thus the contribution of services to GVCs, could be much higher than that captured by traditional value-added measures.

The implications of services in global value chains

As seen, services constitute the vital connecting links of value chains as well as a range of inputs sourced either at arm's length or in-house. These value chains are "global" not just when transactions cross international boundaries, but also when consumers

FIGURE 6.7 Decomposition of jobs embodied in gross manufacturing exports, by business function by industry, 2011



Source: Miroudot 2016.

or providers do so, especially by establishing a commercial presence abroad.

Growth theories have emphasized that trade in intermediate goods and services generally improves the allocation of capital and labor across sectors and countries (Jones 2011). The literature helps draw out the implications of services in GVCs for two key aspects of economic performance: the growth of productivity and the evolution of comparative advantage.

The literature uses a framework based on Rajan and Zingales (1998) and first applied to services broadly in Arnold, Javorcik, and Mattoo (2011) in a study of the Czech Republic. The typical study examines whether increased access to specific foreign services enhances performance in downstream sectors whose production is relatively intensive in those services. The usual specification takes the following form:

$$Y_{i,t} = \alpha + \beta \times \textit{services linkage}_{j,t-1} + X_{j,t-1} \times \pi + \delta_i + \gamma_t + \varepsilon_{i,t}$$

and

$$\textit{services linkage}_{j,t} = \sum_k a_{j,k} \times \textit{access}_{k,t}$$

where *i* is the firm, *j* is the sector, and **X** is a matrix of sector-level control variables; $Y_{i,t}$ is the outcome of interest (productivity, comparative advantage); and *services linkage*, the key explanatory variable, is the interaction between a measure of a specific sector's dependence on services inputs and a measure of services access (which could be related, for example, to services policy reforms or foreign direct investment inflows).[12] The hypothesis is that sectors using specific services more intensively benefit more from the reform of those services. This general framework becomes clearer in the examples discussed below.

For productivity

India offers a powerful example of the benefits of greater participation in manufacturing value chains by foreign services firms. Conventional explanations of the modest resurgence of Indian manufacturing since the early 1990s have focused on policy reforms in manufacturing industries. But a key factor lies outside manufacturing and in the services sector. Reforms in the 1990s visibly transformed services sectors, with greater openness and improved regulation leading to dramatic growth in domestic and foreign investment. Indian manufacturing firms were no longer at the mercy of inefficient public monopolies but could now source services from a wide range of domestic and foreign providers operating in an increasingly competitive environment. As a result, they had access to better, newer, more reliable, and more diverse business services.

These improvements enhanced firms' ability to invest in new business opportunities and better production technology, to exploit economies of scale by concentrating production in fewer locations, to efficiently manage inventories, and to coordinate decisions with suppliers and customers.

To analyze the link between services reforms and manufacturing productivity in India, Arnold and others (2016) collected detailed information on the pace of reform across Indian services sectors, with a focus on entry and operational restrictions. To make this information amenable to econometric analysis, the authors aggregated it into time-varying reform indexes. They then related the total factor productivity of about 4,000 manufacturing firms to the state of liberalization in services sectors, taking into account other aspects of openness, such as tariffs on output and intermediate inputs as well as foreign direct investment in final and intermediate goods sectors.

The results suggest that pro-competitive reforms in banking, transport, insurance, and telecommunications boosted the productivity of both foreign and locally owned manufacturing firms. A one-standard-deviation increase in the aggregated index of services liberalization resulted in a productivity increase of 11.7% for domestic firms and 13.2% for foreign enterprises. The largest additional effect was for transport reforms, followed by telecommunications and banking reforms.

Several other studies show that access to low-cost and high-quality (domestic or foreign) producer services can promote productivity and economic growth (Hoekman and Mattoo 2008). Using firm-level data for the Czech Republic for 1998–2003, Arnold, Javorcik, and Mattoo (2011) found a positive effect on the productivity of domestic firms in downstream manufacturing as a result of services sector reforms leading to greater foreign direct investment. Using the annual manufacturing survey of Chilean firms, Fernandes and Paunov (2012) found a positive effect of substantial foreign direct investment inflows in producer services sectors on the total factor productivity of Chilean manufacturing firms. Their findings also suggest that services foreign direct investment fosters innovation in manufacturing and offers opportunities for laggard firms to catch up with industry leaders.[13] These benefits arise not just from foreign investment but also from cross-border trade in services. For example, Amiti and Wei (2009a) found that services offshoring by high-income countries tends to raise the productivity of their manufacturing sector.[14]

To investigate whether regulations in domestic services markets have an effect on industries that rely on GVC linkages in services to generate value added, Van der Marel and Sáez (2016) differed from the earlier studies by looking at all downstream sectors rather than just manufacturing. They examined the impact on domestic value added rather than on productivity and on the link to upstream services sectors through backward foreign and domestic linkages. Their key interactive variables were a product of the foreign and domestic backward linkages of services for each downstream sector with services-specific regulatory policies. Both entry restrictions and policies affecting the operations of firms matter, but the strength of their impact depends on the type of backward linkages that are more important for the industry in question. Industries that rely more on backward foreign linkages of services are adversely affected by entry barrier regulations, while those that rely more on backward domestic linkages of services are more sensitive to behind-the-border regulations.

For comparative advantage

Since a large part of goods trade includes trade in embodied services, the development of the domestic services sector and

access to imported services inputs can be expected to influence comparative advantage in manufacturing trade. The impact of services development on manufacturing trade is not straightforward. Since services are used as inputs in the production of manufactured goods, their development can increase manufacturing production. But since services and manufacturing compete for resources, the development of services can be at the expense of manufacturing. For example, the development of the services sector has drawn resources away from manufacturing not just in industrial countries such as the United Kingdom and the United States, but also in developing countries such as India (see, for example, Kochar and others 2006).

Some early studies examined the link between services as inputs in manufacturing and the pattern of manufacturing exports using single national input-output tables. For example, Francois and Woerz (2008) found significant and strong positive effects of increased business services openness (greater imports) on some industries. Their reliance on national data means that inputs cannot be broken down according to their origins, and services inputs are mismeasured due to two-way trade in intermediate products. More recently, Stehrer, Foster, and de Vries (2012), Timmer and others (2013), and Liu and others (2017) used the newly constructed international input-output tables to more precisely measure the embodied services and indirect trade through other sectors.

Liu and others (2017) focused on two key services sectors: financial services and business services. Well-functioning financial sectors are critical in mobilizing resources, stimulating investment, and helping firms (and households) manage risk. Business services cover a variety of critical activities, from software consulting and data processing to management consultancy, engineering, and research and development. Intensive use of these modern services can help manufacturing firms increase productivity, reduce the cost of doing business, expand their input choices, differentiate their products from those of competitors, and strengthen their after-sale customer services. But these are the services that most strongly provoke deindustrialization concerns, such as financial services in industrial countries such as the United Kingdom and the United States and business services in developing countries such as India and the Philippines.

Liu and others (2017) quantified the indirect role of services in international trade in goods and construct new measures of revealed comparative advantage based on domestic value added in gross exports. Embodied services in manufacturing sectors were computed using a method developed by Koopman, Wang, and Wei (2014) and Wang, Wei, and Zhu (2013) that generalizes the vertical specialization measures proposed by Hummels, Ishii, and Yi (2001). Revealed comparative advantage is calculated based on domestic value added in gross exports, as in Koopman, Wang, and Wei (2014) and Wang, Wei, and Zhu (2013), who improved on the traditional (Balassa 1965) measure of revealed comparative advantage by taking into account both domestic production sharing and international production sharing.[15]

In Liu and others' econometric analysis of the impact of services development on revealed comparative advantage in manufacturing sectors, the key explanatory variable is the interaction between a measure of the development of financial (or business) services and the financial (or business) services intensity of each manufacturing sector. Domestic services development has a mixed effect on the revealed comparative advantage of manufacturing exports: services development reduces the revealed comparative advantage of manufacturing exports in manufacturing sectors with low embodied services but increases it in sectors with a high degree of embodied services (figure 6.8).

Liu and others also considered the role of services imports in overcoming the limitations of domestic services markets. In countries with less developed services, manufacturing exports benefit more from access to foreign services inputs. Such a bypass effect is also discussed in a theoretical model by Ju and Wei (2010), which derives the conditions for financial globalization to serve as a substitute for reforms of domestic financial systems. These results suggest that lower services trade barriers can help developing countries bypass inefficient domestic services provision and promote their manufacturing exports through intersectoral linkages.

Direct and indirect value-added exports of services

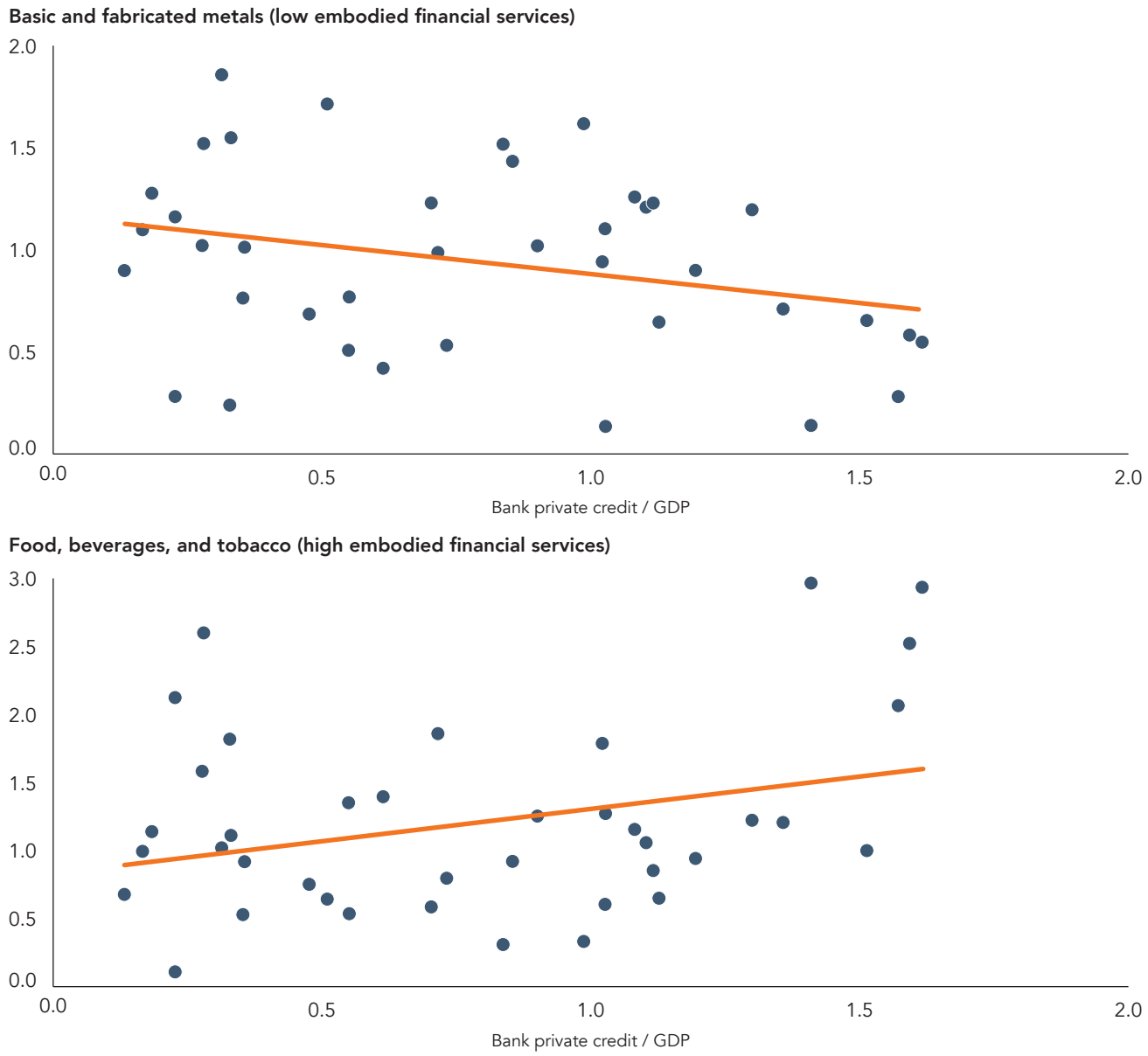
The patterns of direct and indirect domestic value-added exports of services for financial and business services reveal how goods and services value chains and comparative advantage evolve (figures 6.9 and 6.10). The horizontal axis measures direct value-added exports of services and the vertical axis measures indirect domestic value-added exports of services (the value-added exports of services embodied in exports of goods). Lines representing the median shares divide the countries into groups occupying four quadrants.

For financial services, figure 6.9 shows:

- In the bottom left quadrant are Greece, the Russian Federation, and Turkey. The low competitiveness of financial services in these countries is reflected in the low share of direct exports and the low level of embodied exports—which could reflect the low financial services intensity of goods production, the reliance primarily on imported financial services, or both.
- In the top left quadrant are China, India, and the Republic of Korea, which are not yet sufficiently competitive to export financial services directly but which do export a significant share indirectly. That goods sectors in these countries rely significantly on domestically produced financial services could be because financial services in these countries have reached an intermediate level of development at which they can compete in the domestic market but not yet internationally. It could also be that restrictions on cross-border imports in these countries oblige goods producers to use domestically produced services.
- In the top right quadrant are Austria, Belgium, and the Netherlands, whose more developed financial services sector exports both directly and indirectly.
- In the bottom right quadrant are such "mature deindustrializers" as the United Kingdom and the United States, where the

FIGURE 6.8 Financial development and revealed comparative advantage, by degree of embodied services, 2005

Revealed comparative advantage based on domestic value added in gross exports



Source: Liu and others 2017.

Note: The figures show a negative association between the manufacturing revealed comparative advantage and a measure of financial development for a sector with low embodied financial services, but a positive association for a sector with high embodied financial services. Includes data for all Organisation for Economic Co-operation and Development members except Chile, Iceland, Israel, New Zealand, Norway, and Switzerland as well as data for Brazil, Bulgaria, China, Cyprus, India, Indonesia, Lithuania, Malta, Romania, Russian Federation, Chinese Taipei, and rest of the world.

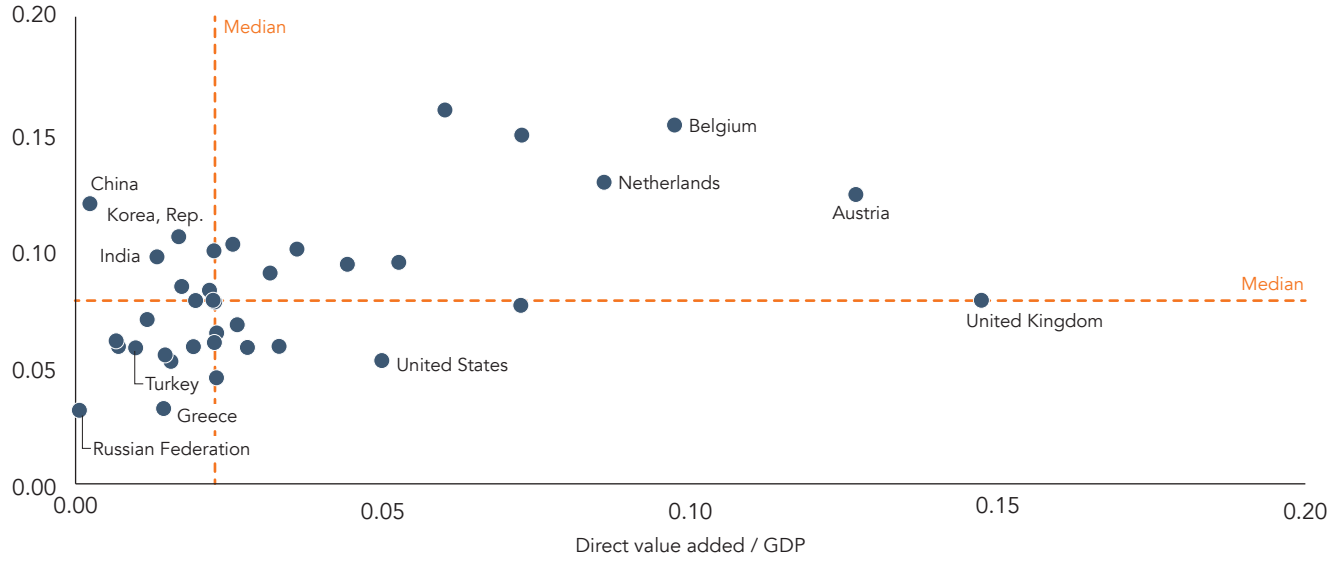
domestic tangible industries have shrunk in importance and financial services are mostly exported directly.

For business services, figure 6.10 shows two interesting differences:

- Given the greater cross-border tradability or openness to trade of business services, there is less scope for an intermediate stage (for countries to populate the top left quadrant). When a country is not competitive in producing these services, it neither exports them, nor do its goods sectors import them. When a country is competitive, it exports both directly and indirectly.
- In the bottom right quadrant, India offers an example of "premature deindustrialization," where direct exports of business services are high but indirect exports are low, perhaps because of the relative weakness of goods sectors.

FIGURE 6.9 Direct and indirect value added exports of financial services as shares of GDP, 1995–2009

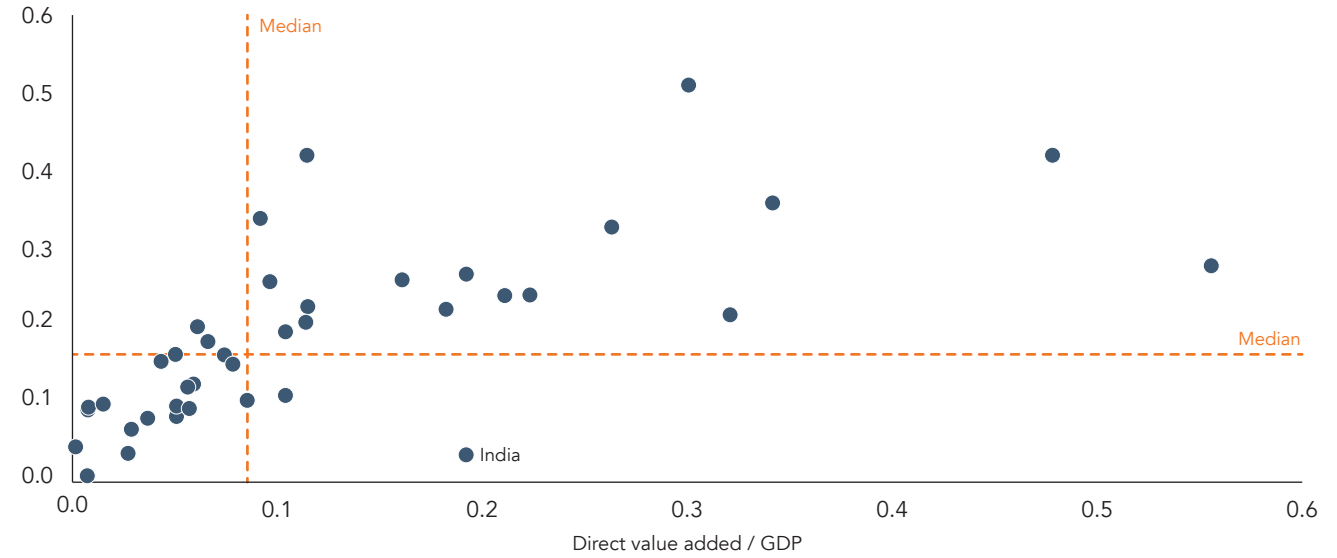
Indirect value added / GDP



Source: Author's calculations based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database.
Note: Includes data for all Organisation for Economic Co-operation and Development members except Chile, Iceland, Israel, Ireland, Luxembourg, New Zealand, Norway, and Switzerland as well as data for Brazil, Bulgaria, China, Cyprus, India, Indonesia, Lithuania, Malta, Romania, and Russian Federation.

FIGURE 6.10 Direct and indirect value-added exports of business services as shares of GDP, 1995–2009

Indirect value added / GDP



Source: Author's calculations based on Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database.
Note: Includes data for all Organisation for Economic Co-operation and Development members except Chile, Iceland, Israel, New Zealand, Norway, and Switzerland as well as data for Brazil, Bulgaria, China, Cyprus, India, Indonesia, Lithuania, Malta, Romania, and Russian Federation.

Policy implications

Two types of policy issues inhibit an enhanced role for services in goods value chains and the emergence of services value chains: explicit restrictions on foreign services and services suppliers, and regulatory divergence across jurisdictions. Explicit restrictions on linking services, such as telecommunications, inhibit the emergence of all GVCs. Restrictions in other services—such as finance, business, education, and health services—either block the emergence of GVCs involving services or increase the associated transaction costs. Regulatory divergence reduces the intercompatibility of goods and services and services components that is needed to enable fragmenting production across jurisdictions. This divergence is one reason that GVCs have been slow to emerge in sectors such as education and health. Regulatory cooperation is necessary not just to address regulatory divergence, but also to facilitate the removal of explicit restrictions.

National policy barriers to international trade in services

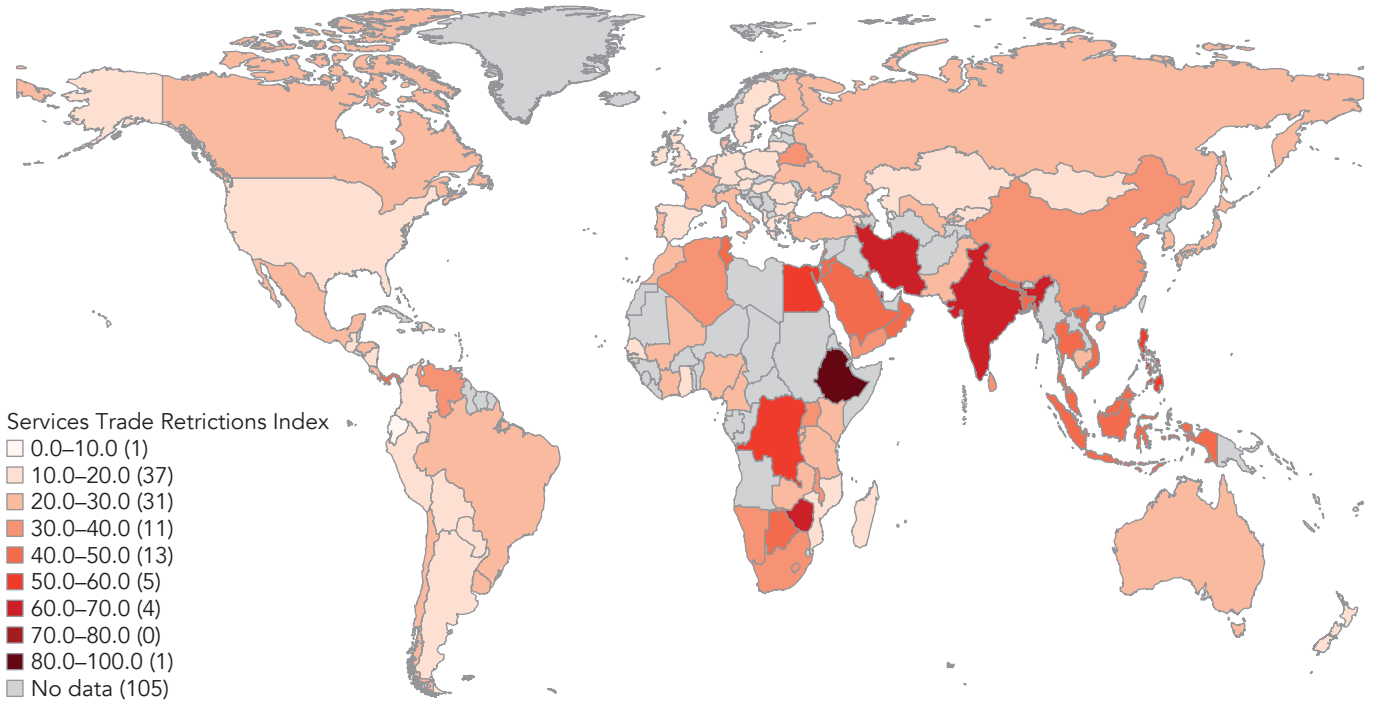
Unlike the rich information on policies affecting trade in goods, information remains limited on policies affecting trade in services.[16] The World Bank Services Trade Restrictions Database reveals interesting policy patterns. Although public monopolies are now rare, and few services markets are completely closed, numerous second-generation restrictions remain on entry, ownership, and operations. Even where there is little explicit discrimination against foreign providers, market access is often unpredictable because the allocation of new licenses remains opaque and highly discretionary in many countries. Regulatory discretion is accentuated by a lack of accountability in a number of countries where regulators are not required to provide reasons for rejecting a license application or where foreign providers do not have the right to appeal regulatory decisions.

Across regions some of the fastest growing countries in Asia and the oil-rich Gulf states have restrictive policies on services, while some of the poorest countries are remarkably open—as measured by the Services Trade Restrictions Index, which takes values from 0 for completely open regimes to 100 for completely closed (map 6.1).[17] Across sectors, professional services and transportation are among the most protected industries in both industrial and developing countries, while retail, telecommunications, and even finance tend to be more open (figure 6.11).[18]

International cooperation and services in global value chains

Much of the openness in services markets and the emergence of services-related GVCs has come from unilateral liberalization. Services trade negotiations have generated an abundance of rules and commitments that have enhanced the transparency

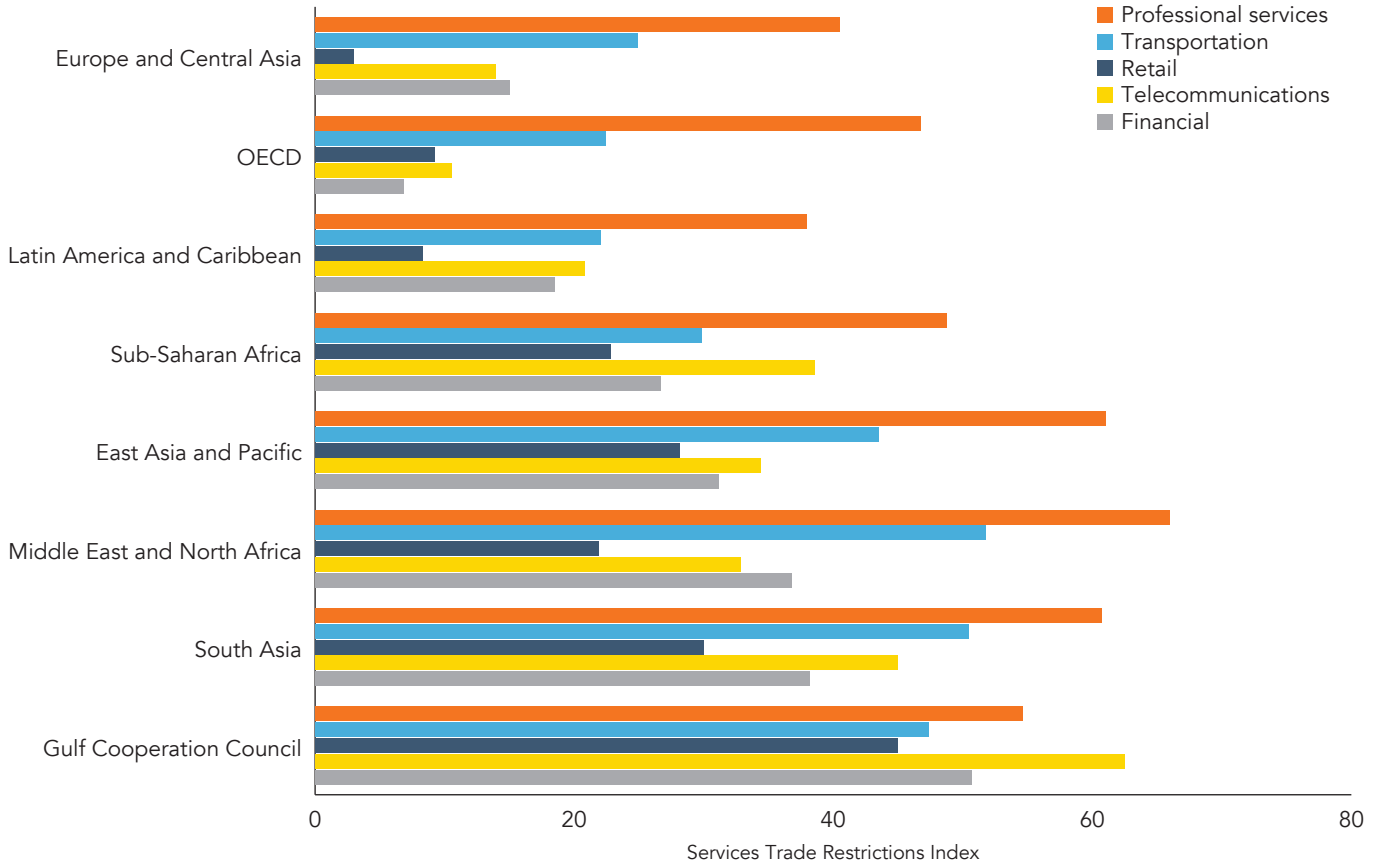
MAP 6.1 Restrictiveness of services trade policy, 2008–10



Source: Borchert, Gootiiz, and Mattoo 2014.

Note: This map compares the restrictiveness of services trade policy across countries based on the World Bank Services Trade Restrictions Index, which ranges from 0 (completely open) to 100 (completely closed), The World Bank Services Trade Restrictions Database covers 103 countries (79 developing) and financial, basic telecommunications, transport, distribution, and selected professional services. Data were collected between 2008 and 2010.

FIGURE 6.11 Services trade restrictiveness by services sector and region



Source: Borchert, Gootiiz, and Mattoo 2014.

Note: This figure compares the restrictiveness of services trade policy across countries based on the World Bank Services Trade Restrictions Index, which ranges from 0 (completely open) to 100 (completely closed). Data were collected between 2008 and 2010.

and security of market access but have not produced much additional liberalization. One reason is a form of "negotiating tunnel vision," which has led to a focus on reciprocal market opening rather than on creating the regulatory preconditions for liberalization. More could be achieved if negotiations offered regulators the opportunity not just to tie their hands (through agreed-on commitments) but also to secure assistance to deal with problems they cannot solve on their own.[19]

One obvious reason for international cooperation is that poorer developing countries do not always have regulatory institutions equipped to deal with international competition. These countries would participate meaningfully in negotiations that offered an opportunity not merely to make binding commitments but also to mobilize assistance for national regulatory reform. Market-opening negotiations now take their course in the WTO or in regional fora with only ad hoc links to international assistance for regulatory reform, including that from institutions such as the International Monetary Fund and the World Bank. It would help establish a credible mechanism for regulatory assistance to support liberalization commitments by developing countries. Then, developing country policymakers would be reassured that any regulatory inadequacies that could undermine the benefits of liberalization would be diagnosed and remedied before any market-opening commitments take effect.

A second obvious reason for cooperation is that regulatory divergence segments markets. Firms must fulfill the regulations of each market separately—such as financial and accounting standards—which reduces the scope for exploiting economies of scale and the intensity of competition in each segment. Regulatory convergence through harmonization or mutual recognition of regulations—or a combination of the two, as has tended to happen in the European Union—creates an integrated market for competition, economies of scale, and GVCs to flourish.

A less obvious case for regulatory cooperation is that even countries with sound national regulatory institutions can find it difficult to address market failures related to services trade that originate outside their jurisdiction. A country will be reluctant to open its financial markets unless it is confident that it can prevent market instability and protect its consumers from unsound foreign financial institutions, to let its citizens' data flow to other

jurisdictions unless it is reasonably certain that that data will be kept secure, or to open its transport and Internet-based services markets unless it is convinced that the gains from liberalization will not be appropriated by international oligopolies. In some cases, such as the supply of services through locally incorporated subsidiaries, the importing country can, at least in principle, deal unilaterally with market failure because the provider is in its jurisdiction. But doing so requires adequate regulatory capacity and could increase the costs of trade by fragmenting markets (say, by requiring local capital adequacy or local servers). In other cases, such as cross-border banking, transport, or data-processing services, addressing market failure efficiently requires the cooperation of the regulator in the exporting country.

A solution to these problems is the assumption of obligations not just by importing countries, but also by exporting countries when negative externalities are transmitted through exports of services. Regional and multilateral negotiations are now structured in a way that requires importing countries alone to make binding commitments to market opening, regardless of the conditions in, or cooperative efforts by, source countries. Instead, market access commitments by importing countries could be made transparently and predictably conditional on the fulfillment of specific conditions by exporting countries. These exporter commitments need not be in the context of trade agreements but could be secured in other existing or new fora for international regulatory cooperation. Then, regulators in importing countries would be reassured that exporting countries will cooperate to protect their consumers' privacy, financial security, and well-being from the consequences of international market failures.

An example of exporting country regulatory commitments: data flows

International data flows provide an example of how such exporting country commitments work. By allowing communication and coordination of production across countries, such commitments have probably been the most important reason for the emergence of GVCs. Governments are taking different approaches to regulating personal data collected by private enterprises. The European Union has the world's most comprehensive legal data protection regime, the Data Privacy Directive adopted in 1995, which it plans to develop further.[20]

The Data Privacy Directive makes it illegal to transfer personal data outside the European Union unless the European Commission has found that the country receiving the personal data provides adequate protection. In the absence of an adequacy decision, data can be transferred to a third country under so-called derogations, the main ones being consent of the data subject, when the transfer is necessary for the performance of a contract between the data subject and the controller or is necessary on important public interest grounds. The directive also allows for a cross-border transfer pursuant to a contract between the controller and the processor that guarantees the same protection of the personal data as under the directive. A global conglomerate can transfer data among its units where it has implemented binding corporate rules that also ensure data protection consistent with the directive.

The U.S.-EU Safe Harbor Framework, recently supplanted by the so called Privacy Shield Agreement, was developed in response to the absence of a finding that the United States provides adequate data protection.[21] The European Commission recognized the Safe Harbor Framework Privacy Principles as providing adequate protection for personal data transfers from the European Union to approximately 3,000 companies in the United States that have signed up to the principles.[22] A key difference between the Safe Harbor Framework and the EU Data Privacy Directive adequacy standards is that the Safe Harbor Framework recognizes the self-regulatory approach with U.S. government enforcement as an effective means of guaranteeing that personal data from the European Union will be accorded privacy protection consistent with the data privacy principles agreed under the Safe Harbor Framework. Under the Safe Harbor Framework, U.S. organizations can either join a self-regulatory privacy program that adheres to the safe harbor principles or self-certify (most common) to the U.S. Department of Commerce that they are complying with the principles. The U.S. Department of Commerce reviews every self-certification and annual recertification submission it receives from companies. The U.S. Federal Trade Commission enforces the Safe Harbor Framework against companies that self-certify as being in compliance.[23]

The exporting country commitments embodied in the Safe Harbor Framework have played a crucial role in allowing data flows between the European Union and the United States even though some concerns were expressed about its operation and effectiveness. Some of these have been addressed in the recent Privacy Shield Agreement, but some shortcomings remain (Hufbauer and Jung 2016). A major remaining problem that can affect the emergence of GVCs is that the agreement applies only to EU–U.S. data transfers and so is not useful for companies that want to transfer data globally—that is, to establish a globally accessible database or a global human resources information system. In sum, the Safe Harbor Framework is an example of remarkably effective, yet imperfect, dynamic regulatory cooperation.

Conclusions

This chapter has illustrated the role of services in GVCs, drawing on selected evidence. For many purposes, services can be treated analogously to goods in both the measurement and the analysis of GVCs. And that is what existing trade in value added databases and the literature that relies on them have tended to do. Even though the share of services in trade in value added varies across countries and industries, it is generally high (and rising) and considerably larger than the share of services in gross trade. While directly exported value added has increased in recent years, close to two-thirds of the growth of services value added in exports is due to an increase in services embodied in exports of other sectors—particularly foreign services, revealing the growing importance of GVCs.

The reasons for these developments are variants of the older arguments for why the share of services in GDP tends to grow: the splintering or outsourcing of services activities from manufacturing firms; the growing importance in a GVC world of connecting services such as telecommunications and transport; the growing services component in sophisticated manufacturing goods, such as software in cars; and the increase in the prices of services tasks relative to manufacturing tasks because manufacturing tasks are easier to offshore to lower cost locations. However, there is little empirical evidence for these arguments, and understanding the reason for these developments should be an area for future research.

For services GVCs there are good reasons to look beyond the traditional arm's length cross-border trade data, which ignore the large share of international transactions in services that take place through commercial presence for foreign direct investment. Initiatives to remedy the commercial presence gap are being taken by the U.S. Bureau of Economic Analysis and the OECD.

Some evidence shows that the emergence of GVCs through foreign direct investment in services can affect downstream sectors. Improved access to finance, communications, transport, and other services, either through general reform or through reform of foreign direct investment, enhances manufacturing firms' productivity and other aspects of the performance of downstream firms. The development of domestic services sectors and access to foreign services can also shift the pattern of comparative advantage. Preliminary evidence suggests that trade in value added data could help in understanding dynamic structural change and deindustrialization—areas that merit more analysis.

Some have called for developing a notion of GVCs that goes beyond arm's length market-based transactions to functions within the firm. It may be feasible to distinguish between tasks that would have been services if they had taken place at arm's length (such as bookkeeping) and other tasks that are intrinsically agricultural or manufacturing in nature (such as wood processing). But such distinctions slide on a slippery slope: ultimately, almost any task can potentially be conceived of as an arm's length service. A horticultural laborer can be hired as a worker in a horticultural firm, or the laborer's "fruit-picking" services can be purchased from an individual or a firm. This kind of deconstruction of a firm into its constituent tasks could reduce each firm to a bundle of services regardless of what it ultimately produces.

Perhaps what really matters is not what a person makes but what the person does. For a long time, notions of economic performance have been closely tied to economic sectors—manufacturing, agriculture, and services. In a world of fragmented production these distinctions are hard to sustain and may not be economically meaningful. Instead, the focus could be on the implications of performing certain tasks. Do product design and marketing offer greater scope for innovation and learning-by-doing and thus for productivity growth than product assembly? Such task-based analysis—perhaps initially focusing on occupational structures—could be more help than the traditional sector-based analysis in comprehending the implications for individuals and countries of the new international division of labor.

Finally, some policies both inhibit and encourage the emergence of services-related GVCs. Even though most services markets are much more open today, thanks to unilateral liberalization, services reforms remain incomplete, and barriers to domestic and foreign competition persist. Most of the policy barriers to competition and to foreign direct investment are not in goods but in services. For example, countries in Southeast Asia that have reaped huge benefits from the liberalization of trade and investment in goods continue to maintain restrictions on foreign presence in services. Trade in transport services, in particular, remains impeded in both industrial and developing countries by the exclusion of third-country providers and by quantitative restrictions in bilateral agreements.

International cooperation in services has attempted to replicate the goods model of reciprocal market opening, but so far that approach has delivered little incremental liberalization. Much more could be achieved through a greater emphasis on regulatory cooperation. First, and most obviously, greater regulatory convergence—as in prudential regulation-intensive financial, health, education, and professional services—is needed to create more-integrated markets in which competition, economies of scale, and GVCs can develop. Second, credible regulatory commitments by exporting countries to safeguard the interests of consumers in importing countries—as for deposit protection when capital flows internationally or privacy when data flow internationally—could also induce greater liberalization of explicit barriers to international transactions by providing importing countries with the regulatory reassurance they need.

Notes

1. https://globalvaluechains.org/concept-tools.
2. A definition that does not include single international transactions also creates a slight awkwardness in the treatment of transactions located at the beginning or at the end of linear value chains. Even if they do not qualify as part of GVCs, the hypothesis must be that the history and the future matter. That is, a final import that involves border crossings at early stages of the value chain and an initial export that will cross other borders at later stages of the value chain should have different implications from those that do not.
3. For example, mode 3 trade exports represented on average 67% of total U.S. exports of services between 2009 and 2014 according to data from the Bureau of Economic Analysis.
4. Mode 2 trade is captured in the balance of payments statistics category "travel" but with limited disaggregation into sectors. Sales of services by foreign natural persons too are also largely covered in balance of payments statistics but are not identified separately from cross-border trade. Data on mode 3 trade in services are not part of balance of payments statistics but are collected separately by some countries, such as the United States and the European Union. Efforts to improve the measurement of mode 3 trade are discussed later in the chapter.
5. Restrictive policies of this sort are inherently difficult to identify and measure. Two initiatives provide evidence on these restrictions: one in the OECD and another in a collaborative project between the World Bank and the WTO. Some evidence regarding these measures is presented later in the chapter.
6. This is not an exhaustive list of how services participate in GVCs. Other relevant aspects, such as bundling goods and services and services as value-creating activities, are discussed in detail in Miroudot (2016).
7. See OECD (2013) for details on the algebraic definitions of these components.
8. More generally, firm ownership, whether domestic or foreign, has been found to be a relevant dimension of firm heterogeneity, with foreign-owned firms often associated with greater exports, higher productivity, more-intensive use of imported intermediates, and different patterns of value added (Fetzer and Strassner 2015). This in itself makes firm ownership a relevant dimension to understand participation in GVCs and the effects it may have in an economy.
9. Examples include the 2010 National Organizations Survey in the United States (Brown, Sturgeon, and Lane 2014) and two Eurostat surveys on the international sourcing of business functions by enterprises (Nielsen 2008).
10. Statistics on business functions based on labor force surveys should be interpreted carefully since comparability across countries may be affected by statistical conventions in the construction of input-output tables. For example, data collected at the enterprise level and the establishment level could yield different information for identical processes on what is provided in-house and what is outsourced.
11. For example, Lodefalk (2013) showed that services embedded in Swedish manufactured goods account for a major and increasing share of Sweden's services exports. Similar evidence is presented for other European countries in Boddin and Henze (2014), Crozet and Milet (2014), Kelle (2013), and Kelle and Kleinert (2010). Baldwin, Ito, and Sato (2014) showed that since the 1990s the share of value added in manufactured products in Asia has shifted decisively away from manufacturing and toward services.
12. The *services linkage* variable can be interpreted as a weighted average across sectors of the access measure of interest, with the weights indicating the sensitivity of sector *j* to input *k* (weight $\alpha_{j,k}$ can, for example, be the share of *k* in total inputs of *j*).
13. Similar results have been found for Sub-Saharan Africa (Arnold, Mattoo, and Narciso 2008) and Indonesia (Duggan, Rahardja, and Varela 2013).
14. While services offshoring has both positive and negative effects on domestic employment, Amiti and Wei (2009b) showed, at least for the United States, that it tends to enhance domestic employment on average.
15. Revealed comparative advantage based on gross exports (used as a dependent variable) can cause an endogeneity problem because the embodied services (used as explanatory variables) are part of gross manufacturing exports. Liu and others (2017) avoided this problem because manufacturing revealed comparative advantage is based on the value added created by the factors employed in manufacturing sectors, excluding the embodied services in gross exports contributed by the factors employed in services sectors.
16. Two major initiatives to address this gap in information are in the OECD and in a collaborative project between the World Bank and the WTO. This section describes information on trade policies for services contained in the earlier World Bank Services Trade Restrictions Database. This database covers 103 countries, five major services sectors—financial services, basic telecommunications, transport, distribution, and selected professional services—and the relevant modes of services delivery. This information, collected in 2008–10, has been subsequently updated only for some countries. Even though there is evidence of few major policy changes in the last few years, the data presented here are best seen as indicating broad patterns rather than the precise current situation in specific countries.
17. The analysis assesses policy regimes in their entirety and assigns them to one of the following five principal categories: completely open (that is, no restrictions at all), completely closed (that is, no entry allowed at all), virtually open but with minor restrictions, virtually closed but with limited opportunities to enter and operate, and a residual "intermediate" category of regimes that allow entry and operations but impose restrictions that are neither trivial nor stringent. It is convenient to assign a value to each of these five categories of regimes on a scale of decreasing openness from 0 to 1 with intervals of 0.25.
18. There is some evidence of recent reform in services sectors. For example, a lifting of foreign equity caps, partly or fully, is observed in Indonesia (air transport, architecture, engineering, telecommunications, distribution services, audiovisual services, and logistics), China (distribution services and maritime transport), and India (air transport, insurance, and broadcasting). Mexico has opened the telecommunications sector and introduced procompetitive reforms.
19. The capture of regulatory barriers by established services providers may also partly explain the limited progress on this front.
20. As a directive, implementation of the Data Privacy Directive is left to EU member states, which vary widely in their enforcement. The European Commission is seeking to update it as a regulation.

21. According to a 1999 opinion from the Article 29 Working Party, the U.S. approach was seen as not providing adequate protection in all cases for personal data transferred from the European Union.
22. The Safe Harbor Framework consists of seven principles that reflect the key elements of the EU Data Protection Directive. The main ones are commitments to give European data subjects notice that a U.S. entity is processing their data; to limit onward transfers of data to countries that also subscribe to the Safe Harbor principles or are subject of an adequacy finding; to take reasonable steps to protect personal data from loss or misuse; to process personal data only for the expressed purposes the organization intends to use it; to give European data subjects access to their personal information and the ability to correct, amend, or delete inaccurate information; and to commit to enforce the principles and give European data subjects access to affordable enforcement mechanisms.
23. To date, the U.S. Federal Trade Commission has brought 10 Safe Harbor–related enforcement actions. The agency acts on referrals from EU data protection authorities and from third-party private dispute resolution providers, as well as on its own.

References

Amiti, M., and S.-J. Wei. 2009a. "Service Offshoring and Productivity: Evidence from the US." *The World Economy* 32 (2): 203–20.

———. 2009b. "Does Service Offshoring Lead to Job Losses? Evidence from the United States." In *International Trade in Services and Intangibles in the Era of Globalization*, edited by M. Reinsdorf and M. J. Slaughter, 227–43. Chicago: University of Chicago Press.

Arnold, J., A. Mattoo, and G. Narciso. 2008. "Services Inputs and Firm Productivity in Sub-Saharan Africa: Evidence from Firm-Level Data." *Journal of African Economies* 17 (4): 578–99.

Arnold, J., B. Javorcik, and A. Mattoo. 2011. "Does Services Liberalization Benefit Manufacturing Firms? Evidence from the Czech Republic." *Journal of International Economics* 85 (1): 136–46.

Arnold, J., B. Javorcik, M. Lipscomb, and A. Mattoo. 2016. "Services Reform and Manufacturing Performance: Evidence from India." *The Economic Journal* 126 (590): 1–39.

Balassa, B. 1965. "Trade Liberalization and 'Revealed' Comparative Advantage." *The Manchester School* 33 (2): 99–123.

Baldwin, R., and A. J. Venables. 2013. "Spiders and Snakes: Offshoring and Agglomeration in the Global Economy." *Journal of International Economics* 90 (2): 245–54.

Baldwin, R., R. Forslid, and T. Ito. 2015. "Unveiling the Evolving Sources of Value Added in Exports." IDE–JETRO Joint Research Program Series No. 161.

Baldwin, R., T. Ito, and H. Sato. 2014. "Portrait of Factory Asia: Production Network in Asia and its Implication for Growth—The 'Smile Curve.'" Joint Research Program Series 159, Institute of Developing Economies–Japan External Trade Organization, Chiba, Japan.

Bhagwati, J. N. 1984. "Splintering and Disembodiment of Services and Developing Nations." *The World Economy* 7 (2): 133–44.

Boddin, D., and P. Henze. 2014. "International Trade and the Servitization of Manufacturing: Evidence from German Micro Data." Working Paper, European Trade Study Group, Münich, Germany.

Borchert, I., B. Gootiiz, and A. Mattoo. 2014. "Policy Barriers to International Trade in Services: Evidence from a New Database." *The World Bank Economic Review* 28 (1): 162–88.

Brown, C., T. Sturgeon, and J. Lane. 2014. "Using a Business Function Framework to Examine Outsourcing and Offshoring by US Organizations." Institute for Research on Labor and Employment (IRLE) Working Paper No. 121–14, IRLE, Berkeley, CA.

Crozet, M., and E. Milet. 2014. "The Servitization of French Manufacturing Firms." Centre d'Études Prospectives et d'Informations Internationales (CEPII) Working Paper 2014–10, CEPII, Paris.

Duggan, V., S. Rahardja, and G. J. Varela. 2013. "Service Sector Reform and Manufacturing Productivity: Evidence from Indonesia." Policy Research Working Paper No. 6349, World Bank, Washington, DC.

Fernandes, A., and C. Paunov. 2012. "Foreign Direct Investment in Services and Manufacturing Productivity: Evidence for Chile." *Journal of Development Economics* 97 (2): 305–21.

Fetzer, J., and E. Strassner. 2015. "Identifying Heterogeneity in the Production Components of Globally Engaged Business Enterprises in the United States." U.S. Department of Commerce, Bureau of Economic Analysis, International Economic Accounts, Washington, DC.

Foster-McGregor, N., and R. Stehrer. 2013. "Value Added Content of Trade: A Comprehensive Approach." *Economics Letters* 120 (2): 354–57.

Francois, J., and J. Woerz. 2008. "Producer Services, Manufacturing Linkages, and Trade." *Journal of Industry, Competition and Trade* 8 (3–4): 199–229.

Hoekman, B., and A. Mattoo. 2008. "Services Trade and Growth." Policy Research Working Paper No. 4461, World Bank, Washington, DC.

Hufbauer, G. C., and E. Jung. 2016. "The US-EU Privacy Shield Pact: A Work in Progress." Policy Brief 16–12, Peterson Institute for International Economics, Washington, DC.

Hummels, D., J. Ishii, and K.-M. Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of international Economics* 54 (1): 75–96.

Johnson, R. C., and G. Noguera. 2016. "A Portrait of Trade in Value Added over Four Decades." National Bureau of Economic Research (NBER) Working Paper No. 22974, NBER, Cambridge, MA.

Jones, C. 2011. "Intermediate Goods and Weak Links in the Theory of Economic Development." *American Economic Journal: Macroeconomics* 3 (2): 1–28.

Jones, R, and H. Kierzkowski. 2001a. "A Framework for Fragmentation." In *Fragmentation: New production patterns in the world economy*, edited by S. W. Arndt and H. Kierzkowski, 17–34. Oxford, U.K.: Oxford University Press.

———. "Horizontal Aspects of Vertical Fragmentation." 2001b. In *Global production and trade in East Asia*, edited by L. K. Cheng and H. Kierzkowski, 33–51. New York: Springer.

Ju, J, and S.-J. Wei. 2010. "Domestic Institutions and the Bypass Effect of Financial Globalization." *American Economic Journal: Economic Policy* 2 (4): 173–204.

Kelle, M. 2013. "Crossing Industry Borders: German Manufacturers as Services Exporters." *The World Economy* 36 (12): 1494–1515.

Kelle, M., and J. Kleinert. 2010. "German Firms in Service Trade." *Applied Economics Quarterly* 56 (1): 51–71.

Kochar, K., U. Kumar, R. Rajan, A. Subramanian, and I. Tokatlidis. 2006. "India's Pattern of Development: What Happened, What Follows." NBER Working Paper No. 12023, NBER, Cambridge, MA.

Koopman, R., W. Powers, Z. Wang, and S.-J. Wei. 2010. "Give Credit Where Credit is Due: Tracing Value Added in Global Production Chains." NBER Working Paper No. 16426, NBER, Cambridge, MA.

Koopman, R., Z. Wang, and S.-J. Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *The American Economic Review* 104 (2): 459–94.

Liu, X., A. Mattoo, Z. Wang, and S.-J. Wei. 2017. "Services Development and Comparative Advantage in Manufacturing."

Lodefalk, M. 2013. "Servicification of Manufacturing – Evidence from Sweden." *International Journal of Economics and Business Research* 6 (1): 87–113.

Los, B., M. Timmer, and G. de Vries. 2016. "Tracing Value-Added and Double Counting in Gross Exports: Comment." *American Economic Review* 106 (7): 1958–66.

Miroudot, S. 2016. "Services in Global Value Chains: From Inputs to Value-Creating Activities." Organisation for Economic Co-operation and Development (OECD) Trade Policy Paper, OECD, Paris.

Nielsen, P. B., ed. 2008. *International Sourcing: Moving Business Functions Abroad*. Copenhagen: Statistics Denmark.

Nordås, H. 2008. "The Impact of Services Trade Liberalisation on Trade in Non-Agricultural Products." OECD Trade Policy Paper No. 81, OECD, Paris.

OECD (Organisation for Economic Co-operation and Development). 2013. *Interconnected Economies: Benefiting from Global Value Chains*. Paris: OECD.

———. 2015. "OECD Expert Group on Extended Supply-Use Tables. Draft: Terms of Reference."

OECD (Organisation for Economic Co-operation and Development) and WTO (World Trade Organization). 2015. Trade in Value-Added (TiVA) database. Paris: OECD. Available at: http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm.

OECD (Organisation for Economic Co-operation and Development), WTO (World Trade Organization), and World Bank Group. 2014. "Global Value Chains: Challenges, Opportunities, and Implications for Policy". Report prepared for submissions to the G20 Trade Ministers Meeting, Sydney, Australia, 19 July 2014.

Rajan, R., and L. Zingales. 1998. "Financial Dependence and Growth." *American Economic Review* 88 (3): 559–87.

Stehrer, R., N. Foster, and G. de Vries. 2012. "Value Added and Factors in Trade: A Comprehensive Approach." World Input-Output Database Working Paper No. 7, European Commission, Brussels.

Sturgeon, T., P. B. Nielsen, G. Linden, G. Gereffi, and C. Brown. 2013. "Direct Measurement of Global Value Chains: Collecting Product- and Firm-Level Statistics on Value Added and Business Function Outsourcing and Offshoring." In *Trade in Value Added: Developing New Measures of Cross-Border Trade*, edited by A. Mattoo, Z. Wang, and S.-J. Wei, 291–321. London: Centre for Economic Policy Research and the World Bank.

Timmer, M., B. Los, R. Stehrer, and G. de Vries. 2013. "Fragmentation, Incomes and Jobs: An Analysis of European Competitiveness." *Economic Policy* 28 (76): 613–61.

Timmer, M., R. Stehrer, and G. de Vries. 2015. "Occupations in Global Value Chains: Patterns of International Specialisation." OECD Trade Policy Paper, OECD, Paris.

Van der Marel, E., and S. Sáez. 2016. "Servicification, Regulation and Economic Performance in GVCs." World Bank Background Paper prepared for the conference, "Making Global Value Chains Work for Economic Development and Shared Prosperity," Beijing, March 17–18.

Wang, Z., S.-J. Wei, and K. Zhu. 2013. "Quantifying International Production Sharing at the Bilateral and Sector Levels." NBER Working Paper No. 19677, NBER, Cambridge, MA.

———. 2017. "Measures of Participation in Global Value Chains and Global Business Cycles." NBER Working Paper No. 23222, NBER, Cambridge, MA.

CHAPTER 7

Institutional quality and participation in global value chains

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One way to think about products that have complex value chains is that they are contract-intensive goods. That is, they often involve many exchanges among different firms, each facing some risk of contract nonperformance by others in the chain. This chapter reviews research on global value chains (GVCs) showing that, other things equal, countries with better institutions such as stronger property rights and rule of law participate more in GVCs.[1] It investigates whether this finding holds up within countries. Using China as an example, it finds that Chinese cities that score better on property rights and government efficiency are more likely to have firms involved in GVCs. It also applies the findings on institutions and GVCs to African economies, which have only a small role in GVCs, finding that many African economies have weak institutions or neighbors with weak institutions, an important reason for their small role in GVCs.

Ever since Ricardian trade theory emerged in 1817, economists have considered that relative comparative advantage in productivity should promote specialization within a country. At the firm level these classical theories describe why firms might participate in GVCs. For example, a firm in China may have a global comparative advantage in production processes that are labor intensive but perhaps a comparative disadvantage in other stages of production. The firm should offshore the processes in which it has a comparative disadvantage and export the labor-intensive portion of production.

But these classical frameworks are inadequate for crafting policies to deepen GVC participation because they do not account for asymmetric information. Consider another example. Policymakers may want to advance the competitiveness of domestic industries that use higher technologies and employ higher skilled workers. The textbook Ricardian solution would be for the government to sponsor investment in technologies that boost the productivity of desirable industries, thus giving these industries a Ricardian comparative advantage. The implication is that the product in this industry could then be exported, thus expanding the country's GVC participation in this industry. But it is not clear that such simple plans for economic development will prove fruitful without a careful consideration of economic institutions. Institutions can resolve or worsen distortions arising from asymmetric information, and classical models remain silent on this point.

To promote GVC participation in industries that drive economic development, policymakers have to improve domestic institutions and take regional initiatives to improve the institutions of neighboring countries. This chapter thus studies how domestic institutional quality and the institutional quality in neighboring countries influence the integration of domestic industries in GVCs. It looks at new empirical research on institutions and GVC participation and on the effects of institutions in neighboring countries. Finally, it examines Africa's involvement in GVCs to show what is holding back its participation.

Institutions and participation in global value chains

The business services industry in China illustrates the challenges that institutions create in expanding global competitiveness in a sector. Chinese policymakers would like to promote the global

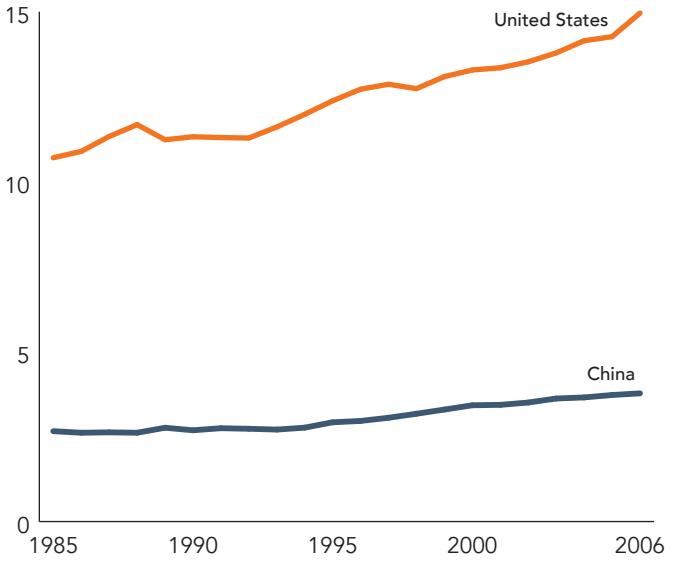
competitiveness of industries that are more skill intensive and higher on the value chain. The business services industry has both of these desired qualities. But it is unclear which policies will build the comparative advantage and deepen GVC participation in business services. Classical trade models might suggest that Chinese business services should already have a comparative advantage. The Chinese economy has an abundance of the primary production factors of business services: both a strong information technology infrastructure and a large, educated work force. Despite these strengths, its business services sector is smaller than that in a developed country such as the United States.

Looking at the share of information, computing, and other business services as a share of total value added for China and the United States over 1985–2005 reveals a clear gap (figure 7.1). This gap should puzzle policymakers who apply classical reasoning. Chinese business services should already have a comparative advantage, but the industry is still small and largely underdeveloped.

This chapter sheds additional light on such puzzles by showing that institutions are fundamentally important, both for comparative advantage and for deepening GVC participation in industries that produce a more complex and customized product. The output of business services fits both categories. The chapter shows the importance of the U.S. legal system in driving the gap between Chinese and U.S. businesses in this sector. By providing strong protection for contract disputes, the U.S. legal system contributes to the U.S. comparative advantage, which makes the United States a leading exporter of business services.

FIGURE 7.1 Value added in business services as a percentage of GDP in China and the United States, 1985–2005

Percent of 2005 GDP



Source: EU KLEMS database and the associated CIP database (http://euklems.net/index.html, accessed 1 September 2016).

Note: The figure shows value added in KLEMS (K-capital, L-labor, E-energy, M-materials, and S-purchased services) industries 71–74 as a share of total value added in the economy.

The case of business services can be extended to other industries. The importance of legal institutions increases as products become more differentiated. In manufacturing the underlying logic is that there is a thinner market for differentiated goods than for commodities. Thin markets, with fewer potential buyers, lead to what is called a "hold-up," where there is an incentive to renegotiate terms after production has begun. For example, the completed engine of a Boeing jet may be more difficult to sell than a shipment of agricultural products if the buyer decides to cancel the order after production is complete. This moral hazard problem leads to market inefficiencies if legal institutions cannot enforce contracts. The legal system can reduce this problem if the court can transfer legal ownership of real property, thus forcing the defaulting party to pay.

Another challenge is that contracts are not complete, in the sense that a contract cannot specify an agreement for every possible contingency. Thus, in many conditions even the best contract will not provide a remedy. A well-functioning legal system can alleviate contract incompleteness if the system equitably protects rights. Both contract enforcement and equitable protection of rights thus interact at an industry level with the contracting intensity of the industry. The more differentiated and contract-intensive the product, the more severe is the asymmetric information problem in the absence of equitable protection and credible enforcement.

Looking at the 10 most and 10 least contract-intensive manufacturing industries, as estimated by Nunn (2007), reveals that the most contract-intensive industries generally have a finished product that incorporates a higher level of technology and thus is higher in economic development (table 7.1). Given this distribution of institutional sensitivity across industries, it is not surprising that institutions have a strong influence on economic growth and development (Robinson, Acemoglu, and Johnson 2005). Policymakers in resource-rich economies and developing economies naturally want to make contract-sensitive industries more globally competitive.

In addition to legal systems, financial institutions are fundamental to deepening global competitiveness and GVC participation. And as with legal institutions, how important financial institutions are in fostering GVC participation differs across industries. Funding projects in contract-intensive industries can be constrained by asymmetric information, just as in the goods market, partly because asymmetric information in the goods market causes uncertainty in the returns of the investors who own capital in these industries. Indeed, property rights protection is a more binding constraint on investment than external access to finance (Johnson, McMillan, and Woodruff 2002). In addition, transparency and consistency in accounting methods in estimating returns on investment can be more important for projects with complex transactions than for simple exchanges.

TABLE 7.1 Ten most and ten least contract-intensive manufacturing industries

Rank	Most contract intensive	Least contract intensive
1	Photographic equipment manufacturing	Poultry processing
2	Compressor manufacturing	Flour milling
3	Analytical laboratory instrument manufacturing	Petroleum refining
4	Engine equipment manufacturing	Corn milling
5	Electronic component manufacturing	Aluminum sheet manufacturing
6	Packaging machinery manufacturing	Aluminum production
7	Book publishers	Fertilizer manufacturing
8	Breweries	Rice milling
9	Musical instrument manufacturing	Primary nonferrous metal
10	Aircraft engine part manufacturing	Tobacco drying

Source: Nunn 2007.

The role of informal institutions such as social networks is somewhat different from that of formal institutions. Informal institutions can benefit groups that are less likely to participate in GVCs. And they often arise where formal institutions cannot resolve asymmetric information problems (Leff 1978; McMillan and Woodruff 1999; Bigsten and others 2000; Rauch and Trindade 2002; and Guiso, Sapienza, and Zingales 2009). But they are not perfect substitutes. And they do not follow the rule that the institution be equally shared by all agents in an economy. If informal institutions such as social networks favor a group that is less likely to participate in GVCs, they could reduce GVC participation at the industry level.

The expansion of GVCs across international borders encounters meaningful discontinuities for both countries and industries: institutions vary across countries, while sensitivity to these institutions varies across industries. To understand how institutions affect the pattern of GVC participation, Dollar, Ge, and Yu (2016) bring industry- and firm-level evidence to this question. The industry data trace interactions in the value chain through input-output linkages, while the firm data help in understanding the determinants of GVC participation.

Industry evidence

Institutional quality at the country level is positively related to participation in more complex GVCs. The distinction between complex and simple trade flows is made possible by new measures of GVC participation developed by Wang and others (2016) and Wang, Wei, and Zhu (2015), which build on Koopman, Wang, and Wei (2014). This new industry–country measure spans 35 industries and 41 countries from 1996 to 2011. The measure gives a rich picture of GVC participation by decomposing trade flows based on value added. One benefit of this decomposition is that it can differentiate trade flows that cross borders multiple times (complex GVC participation) from those that cross only once (simple GVC participation).

At the industry level, Dollar, Ge, and Yu (2016) found a positive correlation between GVC participation and all measures of institutional quality (see table A7.1.1 in annex 7.1). Country measures of institutional quality, taken from the Worldwide Governance Indicators data set of Kaufmann, Kraay, and Mastruzzi (2010), include rule of law, government effectiveness, political stability, regulatory quality, and absence of violence/terrorism. The key finding is that industries more sensitive to institutions have higher participation in complex GVCs in countries that have better institutions. This result appears to be robust against several different statistical specifications and holds for all measures of institutional quality. The relationship is less robust for simple flows that cross only one border.[2]

There is no support at the industry level for rule of law or government effectiveness significantly affecting simple GVC flows, but Dollar, Ge, and Yu did not rule this possibility out. The point estimates from the statistical exercise are still positive for rule of law and government effectiveness on simple GVC participation, but the standard errors are large enough to make these estimates insignificant. In other words, both rule of law and government effectiveness could be important even for simple GVC participation, but the study is inconclusive on this point. Qualitatively, it is clear that the relationship between institutions and GVCs is statistically more established for complex GVC participation than for simple participation.

The second fact that Dollar, Ge, and Yu (2016) discovered is that complex GVC flows tend to be exported to countries that have worse institutions. They found that the effects of institutional quality on GVC development is completely opposite in upstream source countries than in downstream direct importing countries. Direct importers with weak institutional quality show a faster growth in GVC production linkages with their upstream suppliers. This may support Jones (2011), who found that the availability of intermediate goods is positively related to economic development. Economic development is positively related to institutional quality.

Recall the finding from Nunn (2007) that higher technology industries that produce a more specialized product are more sensitive to institutional quality. Thus, poor institutions can constrict the domestic production of these type of intermediate goods. With fewer domestic intermediate goods available, domestic firms in developing countries can have an incentive to find foreign intermediates. This gives a clear channel for poor institutions to be positively related to foreign sourcing of upstream intermediates. But Dollar, Ge, and Yu (2016) did not explicitly identify this channel, so other channels may be driving faster GVC growth in importers with weak institutional quality. One channel could be processing trade, but again this channel was not explicitly identified.

So, complex GVC participation in contract-intensive industries is significantly influenced by the quality of domestic institutions. Countries with weaker institutions deepen their upstream

GVC participation to countries with better institutions. And the growth of GVC participation is positively related to better institutions. These findings suggest that institutional quality is an important determinant of an industry's ability to fragment its production processes across international borders.

Firm-level evidence for China on domestic institutions and firm and city characteristics

Firm data allow modeling the mechanism that drives a firm's selection into different types of GVC categories. This analysis can help policymakers create policies that increase participation in GVCs. There is strong evidence that local institutions play a significant role in firms' participation in GVCs. This suggests that local governments have considerable scope to affect participation in GVCs both by directly influencing other economic institutions and by indirectly providing support by building appropriate infrastructure.

Dollar, Ge, and Yu (2016) evaluated the firm's participation choice using a cross-section of 11,709 firms in 120 Chinese cities that were surveyed in the World Bank Enterprise Survey. The dataset allows for measurement of the sourcing and exporting behavior of firms. Thus, it is possible to tell whether a firm uses imports in production and whether a firm exports final products. The two categories create four subcategories of firms:

- Those that use domestic inputs strictly for domestic consumption.
- Those that use imports for domestic consumption.
- Those that use imports for foreign consumption (export production).
- Those that use domestic inputs for export production.

These categories define types of participation in GVCs. Complex participation, in this context, can be thought of as firms that import intermediate goods and export their products.

The data also have several measures of institutional quality and other firm and city characteristics that can be used to determine the effect of those characteristics on the probability that a plant will participate in GVC production. The institutional quality characteristics include contract enforcement, access to credit, customs efficiency, and government intervention.[3] These measures can be thought of as proxies for legal, financial, trade, and government institutions. Likewise, firm characteristics such as productivity, capital intensity, and size, as well as city characteristics such as transportation infrastructure and economic development, can be evaluated to determine the most important predictors of GVC participation.

On the quality of local institutions in the Chinese cities studied, the main finding is that firms have a higher probability of participating in GVCs the more contracts are enforceable, the less the government intervenes, the more efficient the customs processes (see table A7.1.2 in annex 7.1), and the better access firms have to credit. But there is some variation in the relationship between institutions and the type of GVC participation. For example, better contract enforcement increases the probability that a firm will participate in exporting, but the effect is not significant for plants that import but do not export. This suggests that foreign buyers may have some sensitivity to contract enforcement and may be more willing to buy from firms in areas with stronger rule of law.

Among firm characteristics ownership type directly influences GVC participation and interacts with institutional quality. The highest probability of GVC participation is in firms with foreign ownership, followed by those with private and corporate ownership. State ownership significantly lowers the probability of GVC participation. Further, how local institutions affect GVC participation also depends on ownership type. The decision of state-owned enterprises to participate in GVCs is not significantly affected by local institutional quality. But there is strong evidence that the decision of foreign firms to participate in GVCs is sensitive to domestic institutions in China, showing that domestic institutional quality is more binding for foreign firms than for state firms. One explanation is that state firms can have stronger informal institutions than foreign firms. For example, they may be able to lean on political connections to manage contract disputes in their favor, whereas foreign firms must rely on the legal system. Thus, informal institutions can crowd out GVC participation to the extent that informal institutions explain different participation rates by ownership type.

At the city level there is evidence in China that lower transportation costs, lower labor costs, higher economic development, and higher innovation are all positively correlated with higher firm GVC participation. Lower transportation costs are often achieved through technology and infrastructure investments, which may be necessary, if not sufficient, to develop deeper GVC participation. Even the best trade channel into an undeveloped region may do little to promote GVC participation if other aspects of the economic environment do not support such participation. However, high transportation costs can certainly restrict GVC participation, especially in resource-based economies where infrastructure still lags behind that in developed countries.

The positive correlation of GVC participation with lower labor costs should be weighed carefully against comparative advantage in China. China has an abundance of labor and a comparative advantage in industries intensive in low-skilled labor. So lower wages should be correlated with higher GVC participation in China. But it cannot be concluded that lowering wages in a sector is generally helpful in promoting GVC participation or comparative advantage.

In sum: Less government intervention, higher customs efficiency, better contract enforcement, and more access to bank loans significantly increase the probability that firms will participate in GVCs.

Institutions in neighboring countries

That a country or locality's institutions affect its participation in GVCs is an intuitive result. What may be more surprising is the evidence, summarized here, that neighboring countries' institutions matter for GVC participation. In particular, neighboring-country institutions may have more impact on the efficiency of business-to-business linkages in industries that tend to be more intensive in contracts.

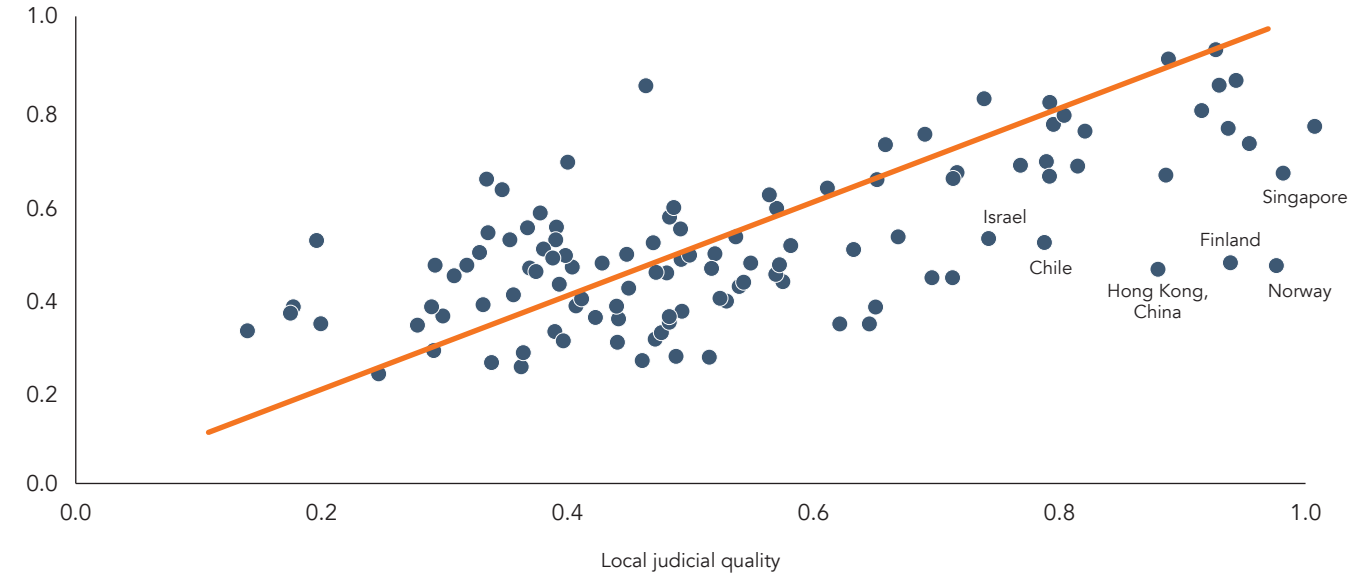
The more differentiated or tailored a good, the thinner is the market for the good and the more severe is the hold-up problem.[4] In other words, highly differentiated goods are more sensitive to the institutional environment. In manufacturing the 747 passenger aircraft, Boeing uses reaction engines, which are not available in open markets and which do not have reference prices established by its manufacturers (firms like Rolls Royce and General Electric). The price, quantity, and especially the characteristics are determined in a usually incomplete negotiation between Boeing and the engine supplier because the engine is a differentiated good adapted to the model of aircraft. In the language of Williamson (1975), there is fundamental transformation that creates a specific relationship. Thus, the quality of domestic institutions is a direct channel that can affect these contract-intensive industries more than less contract-intensive industries, such as undifferentiated agricultural products.

On top of the direct channel, Miranda and Wagner (2015) show that neighbors' institutions could also matter, over and above the effect of own-country institutions. They followed the original work by Nunn (2007) but also included the role of neighboring country institutions, previously missing from the analysis. Own and neighbors' institutions are related, but they can have meaningful differences (figure 7.2). For Chile the neighboring rule of law measure is the average of rule of law of Argentina, Bolivia, and Peru, weighted by their respective GDPs. The diagonal line in figure 7.2 indicates equality between the institutional quality in a country and in that country's neighbors. Most countries are near the diagonal line, but there is variation, with some countries below the line. For example, Hong Kong, China; Singapore; Norway; Finland; Israel; and Chile have neighbors with weaker rule of law than their own. This could be a weak link for value chains when some parts of a productive process can be outsourced to nearby locations.

Using local and neighbors' institutions, Miranda and Wagner (2015) calculated the average revealed comparative advantage by country and industry, separating high contract-intensive industries (high share of differentiated inputs) and low contract-intensive industries, and countries having neighbors with high rule of law (as a measure of contract institutional quality) and those having neighbors with low rule of law. Having neighbors with weak contract enforcement reduces exports in contract-intensive industries (figure 7.3).

Miranda and Wagner (2015) also found that local institutions explain more or less the same amount of variation as the sum of physical and human capital (see table A7.1.3 in annex 7.1). They also explored what makes neighbors' institutions more relevant. Countries that share a common language and common colonial history would be expected to do more business together in contract-intensive sectors than countries that do not share those links. The more similar the countries, the more scope for "nearsourcing"—outsourcing tasks to nearby countries or regions. But precisely in that context, having neighbors with

FIGURE 7.2 Relationship of own and neighboring countries' judicial quality (rule of law)

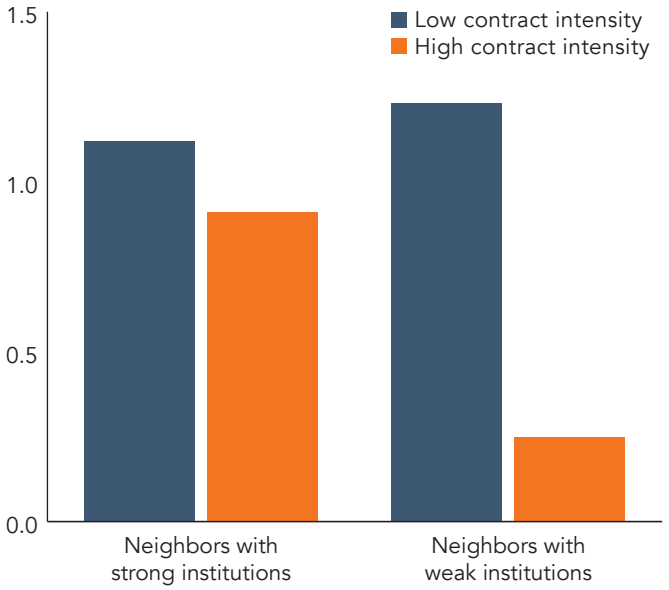


Source: Miranda and Wagner 2015 on local and neighboring countries. The rule of law index is from the Worldwide Governance Indicators 1998, using Nunn 2007 data and GeoDist data from the Institute for Research on the International Economy.

Note: Countries in the figure are those with a common land border with their neighbors. The diagonal line indicates equality between the institutional quality in a country and in that country's neighbors.

FIGURE 7.3 Average revealed comparative advantage across industries and countries, controlling for local institutional effects

Revealed comparative advantage



Source: Miranda and Wagner 2015.

weak institutions appears even more binding for business, since firms would otherwise be connecting with each other much more frequently.

In sum, there seems to be a systematic relationship between what a country produces and the ability of its neighbors to enforce contracts. The analysis here focuses mostly on the lack of contract enforcement upstream, since it uses sectors that have contract-intensive procurement and so they are sensitive to suppliers with poor contract enforcement. Some tests show that downstream contract enforcement could also be important, as in sectors with more contract-intensive output—say, because of the need to customize the product before selling it, which requires certainty.

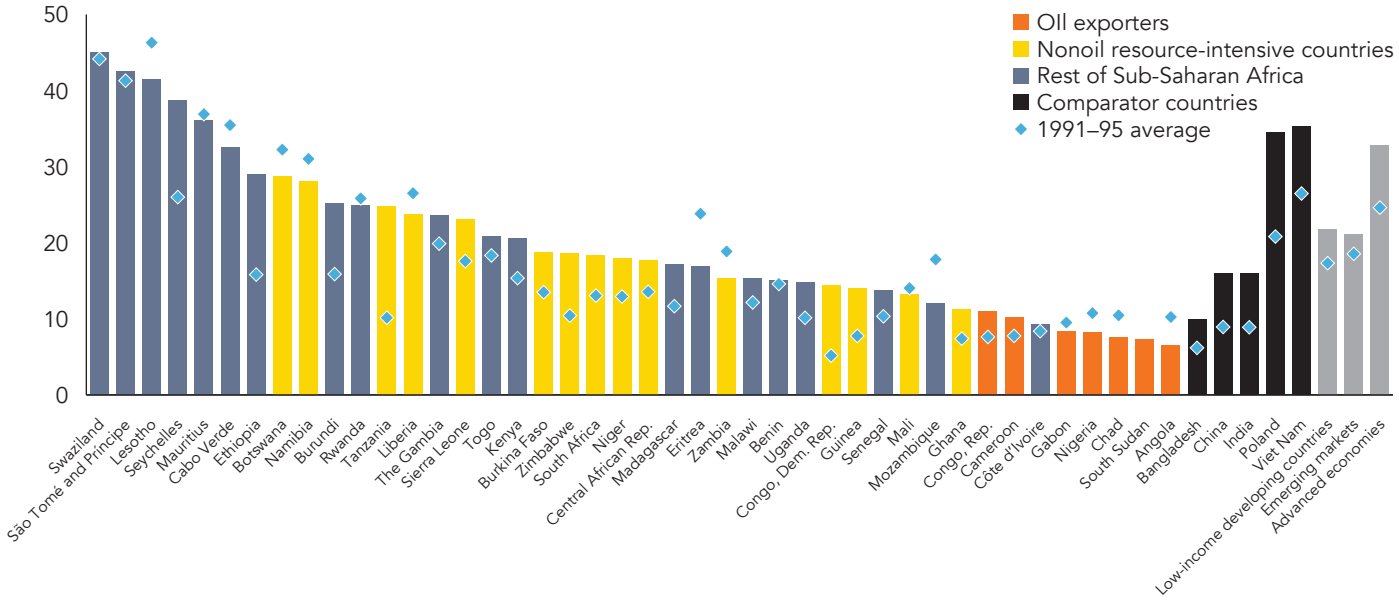
African involvement in global value chains

African economies have had little involvement in GVCs (Dollar 2016). One useful measure of position in the value chain is the share of imported value added in a country's exports, a reflection of economies' integration with each other and with the global economy (figure 7.4). For advanced economies one-third of exports were attributed to imported inputs in 2008–12, up from one-quarter in 1991–95. For low-income economies and emerging market economies other than in Sub-Saharan Africa, the average was 21–22% in 2008–12, up from 17–18% in 1991–95. Among developing economies Poland and Viet Nam are standouts, with imported inputs accounting for more than one-third of their export value.

About two-thirds of Sub-Saharan African economies fall below the average value-chain position for developing countries based on the value of their exports derived from imports (see figure 7.4). Oil exporters such as Angola, Chad, Nigeria, and South

FIGURE 7.4 Depth of integration in global value chains of Sub-Saharan African and comparator countries, 2008–12

Percent of foreign value added in exports



Source: IMF 2015.

Sudan have almost no imported value added in their exports and fall on the far right side of the figure. To some extent these economies are subject to "Dutch disease," with resource exporters tending to have high wages and appreciated exchange rates that make it difficult for them to diversify their exports. But this is only a partial explanation. These countries are all relatively poor, and their oil production is not sufficient to make their citizens wealthy.

On the left of the figure are countries with deeper GVC integration, but they tend to be resource-poor economies with small populations (Cabo Verde, Lesotho, Mauritius, São Tomé and Principe, Seychelles, and Swaziland). Countries with advanced tourism industries that rely on high-value-added imported inputs will also show up as having deep involvement in GVCs. Ethiopia is an interesting case of a populous yet resource-poor country with a high degree of GVC integration, which has grown substantially since 1995.

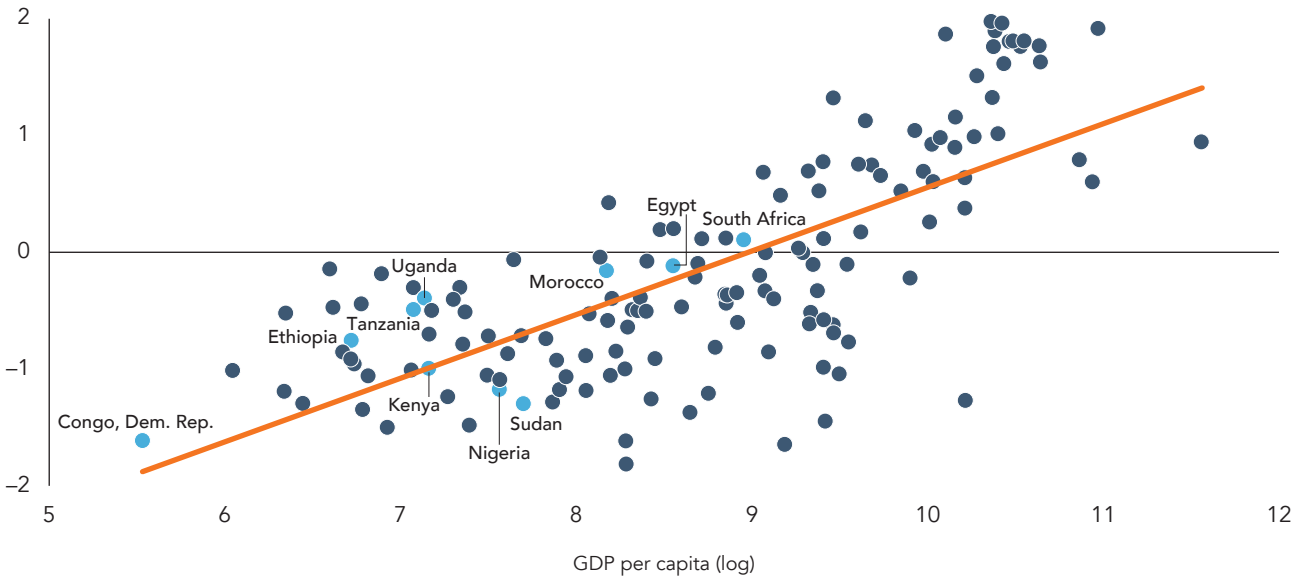
What accounts for Africa's low involvement in GVCs? One factor, as mentioned, is Dutch disease. But many countries in Africa are not resource rich, and yet they still have low involvement in GVCs. And even where Dutch disease is an explanation, it should not prevent the development of modern manufacturing and services sectors. A key issue in most African economies is deficient infrastructure: unreliable power, poor roads and highways, and inefficient ports.

Another issue is economic governance. As discussed, well-developed economic institutions, such as property rights and the rule of law, have significant positive effects on development and on participation in GVCs. The Worldwide Governance Indicators project of the World Bank publishes a Rule of Law Index that "captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann, Kraay, and Mastruzzi 2010, p. 4). All but six African countries are below average for the world (figure 7.5), not too surprising because there is a clear relationship between GDP per capita and the quality of economic institutions, and African countries are relatively poor and, on average, have weak institutions.

But there is a lot of dispersion across African countries. The regression line in figure 7.5 shows the typical relationship between per capita income and the rule of law. Countries above the line have unexpectedly good institutions for their level of development; countries below the line have unexpectedly poor institutions. This is important because countries generally compete with other countries at similar levels of development. If one country has good institutions among its cohort, it can expect to attract more investment and entrepreneurship and grow faster.

In fact, having a robust rule of law relative to level of development is closely correlated with faster growth. Among the large countries in Africa with broadly similar GDP per capita, Ethiopia, Tanzania, and Uganda are well above the regression line, Kenya sits right on the line, and Sudan and Nigeria fall well below the line. Thus, while the countries are at similar levels of development, Ethiopia, Tanzania, and Uganda (especially the last two) have better economic institutions.

FIGURE 7.5 Institutional quality relative to development level in African countries: Association of Rule of Law Index and GDP per capita, 2010



Source: World Bank Worldwide Governance Indicators (www.govindicators.org); Feenstra and others 2015.

Note: The figure plots the Rule of Law Index for 146 countries in 2010 against per capita GDP measured in purchasing power parity (log scale). By design, the index has a mean of zero and a standard deviation across countries of 1.0. Labeled countries are the 10 most populous African countries.

The International Monetary Fund's *Africa Economic Outlook* for 2015 includes an estimate of the effect of improvements in the investment climate on African exports. The thought experiment adjusts different indicators from the average for Sub-Saharan Africa to the average for the rest of the world. The investment climate indicators are an index of infrastructure, credit to the private sector (a measure of financial sector depth and efficiency), a rule of law index, and the level of import tariffs (indicating how open or closed an economy is to world trade). The biggest potential gain—a 42% increase in exports—comes from improving infrastructure (figure 7.6). Credit to the private sector and rule of law are also important, accounting for potential increases in exports of 29% and 28%. African economies already have relatively low trade barriers, so reducing import tariffs to the average for the rest of the world boosts exports only 14%. The specific estimates in this kind of empirical exercise should be taken with caution. But the general point is valid: Africa could expand its involvement in global trade, including GVCs, through improvements in its investment climate, including infrastructure development, stronger financial sectors, and improved property rights and rule of law.

Of particular relevance for Africa are neighborhood effects, or the problem of reforming countries that have some or all neighbors with poor institutions. Some African economies have improved their economic institutions, and they tend to be the ones with faster growth and some initial involvement in GVCs. But in many cases, reformers are bordered by neighbors with poor institutions (map 7.1). There is a pocket of reform in Eastern Africa, including Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. But these countries are neighbored by Central African Republic, Democratic Republic of Congo, Eritrea, Somalia, and Sudan—all with poor institutions. In Western Africa, Ghana and Senegal are relative bright spots, but Guinea-Bissau and Nigeria drag down the neighborhood. The Southern part of Africa around South Africa is another bright spot.

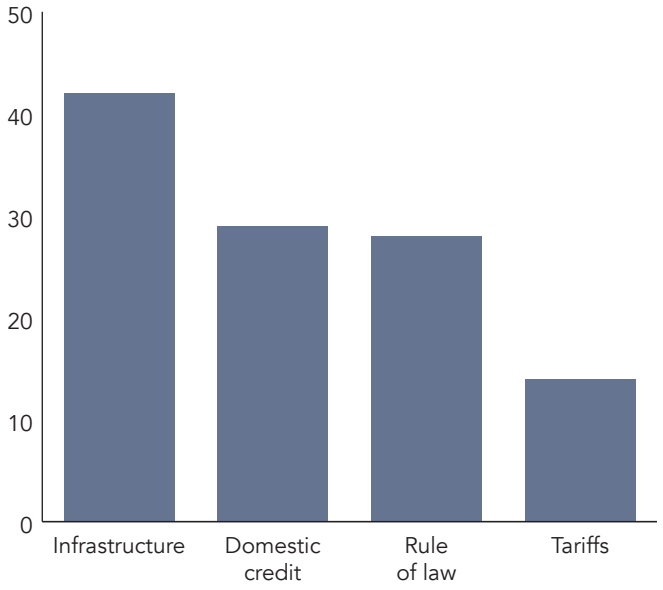
Policy implications

The quality of institutions affects comparative advantage and thus participation in GVCs. The stages of the production process differ in the extent to which they use simple labor, skilled labor, and capital (factor intensity). Activities also differ in their contract intensity. Producing a complete, homogeneous product with no imported content has simple or no contract intensity; growing and exporting bananas is an example. At the other extreme is producing a specialized part for a sophisticated electronics product. If done at arm's length, the purchasing firm has to have considerable confidence in the contract.

Developing countries in general have a lot of simple labor relative to skilled labor and capital. Given those factor endowments, which tend to change only slowly over time, the quality of institutions determines whether countries export simple, undifferentiated products or whether they can embed their production in more sophisticated value chains. Being involved in value chains, in turn, will accelerate technological upgrading, skill

FIGURE 7.6 Potential increase in trade in Sub-Saharan Africa from improvements in investment climate

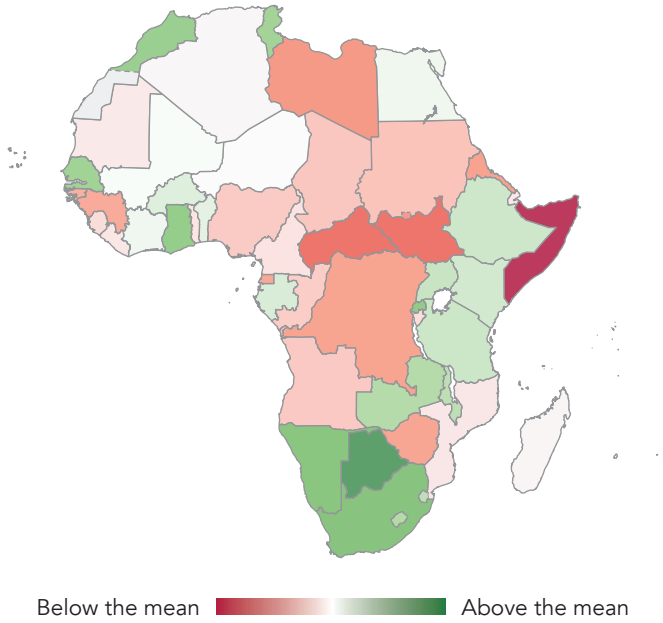
Percent



Source: IMF 2015.

Note: Percent increase in Sub-Saharan Africa's trade if the variable moves from the average for Sub-Saharan Africa to the average for the rest of the world.

MAP 7.1 Rule of law across Africa



Source: Worldwide Governance Indicators 2014.

Note: Countries are color-coded to reflect how strong or weak their institutions are on an index of property rights and rule of law, rescaled to have a mean of zero and a standard deviation of 1.0.

development, and capital accumulation. The quality of institutions relative to development level is crucial.

A general policy recommendation from this analysis is that developing countries need to improve their institutions—provide equitable protection of rights, increase the enforceability of contracts, require more transparency, adopt anticorruption measures, make customs processes efficient, and encourage financial deepening. The focus should be on reducing transaction costs so that a country's firms can easily join GVCs.

Improving institutions across the board is a big challenge, of course, and takes time. So, it is worth considering some shortcuts that can enhance GVC participation. As seen in earlier chapters, deep trade agreements enhance GVC participation, probably because those agreements target specific institutional bottlenecks—such as improving customs administration and strengthening property rights and legal recourse. Deep agreements are going to be most powerful if several countries in a region all participate, improving neighbors' institutions. The Trans-Pacific Partnership had the potential to play this role in the Asia–Pacific region, and the U.S. abandonment of the agreement is a setback. So far China has not shown much interest in deep agreements, but that may change.

ANNEX 7.1

Results for Dollar, Ge, and Yu (2016) and Miranda and Wagner (2015)

TABLE A7.1.1 Summary of Dollar, Ge, and Yu (2016) industry results

Variable	(1)	(2)	(3)	(4)
$Insdep_{ict}$ × $Regulatory_{ct}$	0.040*** (0.010)			
$Insdep_{ict}$ × $Stability_{ct}$		0.042*** (0.008)		
$Insdep_{ict}$ × Gov_{ct}			0.034*** (0.010)	
$Insdep_{ict}$ × Law_{ct}				0.026*** (0.009)
K-$ratio_{ict}$ × ln(K-$endow_{ct}$)	0.0023*** (0.0001)	0.0023*** (0.0001)	0.0026*** (0.0001)	0.0025*** (0.0001)
Skill-$ratio_{ict}$ × ln(Skill-$endow_{ct}$)	0.066*** (0.012)	0.066*** (0.012)	0.065*** (0.012)	0.065***
R-squared	0.716	0.716	0.716	0.716
Fixed effects (country and industry and year)	Yes	Yes	Yes	Yes
Number of observations	8,995	8,995	8,995	8,995

*Significant at 10% level; **significant at 5% level; significant at 1% level.

Note: Dependent variable is $GVCP_{ict}$ (GVC participation index in industry *i* by country *c* at time *t*). Coefficients are reported. Numbers in brackets are robust standard errors. The estimated equation is $GVCP_{ict} = \beta_0 + \beta_1 insdep_{ict} ins_{ct} + \beta_3 k_{ratio_{ict}} \times k_{endow_{ct}} + \beta_2 Skill\ ratio_{ict} \times Skill\ endow_{ct} + \alpha_i + \gamma_c + \delta t + \varepsilon_{ict}$, where $insdep_{ict}$ is a measure of institutional sensitivity and ins_{ct} is one of 4 measures of country level institutional quality (regulatory, stability, government effectiveness, and rule of law). Capital endowments and skill endowments are also interacted with industry- and country-level measures of industrial intensities. The coefficient of interest is β_1, which is reported in the first four rows of this table. More details can be found in Dollar, Ge, and Yu 2016.

TABLE A7.1.2 Summary of Dollar, Ge, and Yu (2016) firm results

Variable	(1) D2E	(2) I2P	(3) I2E	(4) D2E	(5) I2P	(6) I2E	(7) D2E	(8) I2P	(9) I2E	(10) D2E	(11) I2P	(12) I2E
Government intervention	0.437***	1.359***	1.638***									
Custom efficiency				0.428***	1.318***	1.563***						
Contract enforcement							0.406***	1.347***	1.622***			
Access to finance										0.487***	1.360***	1.655***
Ownership structure												
State-owned enterprises	–0.499***	–0.209	–0.572***	–0.51***	–0.210	–0.570***	–0.490***	–0.215	–0.59***	–0.424***	–0.213	–0.585***
Collective-owned enterprises	–0.769***	–0.714***	–0.928***	–0.78***	–0.732***	–0.973***	–0.775***	–0.72***	–0.93***	–0.756***	–0.710***	–0.921***
Private	0.042	–0.068	–0.097	0.050	–0.065	–0.085	0.0190	–0.072	–0.105	0.002	–0.062	–0.084
Hong Kong, China; Macao, China; and Chinese Taipei	0.437***	1.359***	1.638***	0.428***	1.318***	1.563***	0.406***	1.347***	1.622***	0.487***	1.360***	1.655***
Foreign	1.046***	1.621***	2.322***	1.030***	1.599***	2.281***	1.026***	1.605***	2.296***	1.070***	1.611***	2.310***
Firm characteristics												
Size	0.431***	0.434***	0.814***	0.424***	0.426***	0.801***	0.424***	0.426***	0.803***	0.407***	0.423***	0.797***
Age	0.011	–0.004	0.021	0.010	–0.007	0.008	0.008	–0.006	0.012	–0.0003	–0.007	0.011
Capital	–0.054**	0.334***	0.194***	–0.053**	0.336***	0.197***	–0.058**	0.332***	0.190***	–0.061**	0.334***	0.192***
City characteristics												
GDP per capita	–0.033	0.628***	0.448***	–0.080	0.554***	0.303***	–0.090	0.574***	0.350***	–0.028	0.587***	0.380***
City wage	0.348*	–0.420**	0.088	0.309*	–0.471**	0.037	0.540***	–0.339	0.277*	0.126	–0.444**	0.049
Research and development share	1.202***	1.176***	–0.166	1.188***	1.193***	–0.052	0.852***	1.045***	–0.512*	0.158	1.069***	–0.415
Transport cost	–0.253***	–0.138***	–0.363***	–0.26***	–0.106**	–0.294***	–0.237***	–0.15***	–0.37***	–0.269***	–0.163***	–0.405***

*Significant at 10% level; **significant at 5% level; significant at 1% level.

Note: See Dollar, Ge, and Yu 2016 for technical notes. Standard errors are omitted.

TABLE A7.1.3 Summary of Miranda and Wagner (2015) main

	Log of exports from country in industry				
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Neighbor's judicial quality × contract intensity ($z_i Q_c^N$)	0.159*** (0.494)	0.206*** (0.621)	0.252*** (0.675)	0.140*** (0.559)	0.244*** (0.708
Local judicial quality × contract intensity ($z_i Q_c$)	0.200*** (0.395)	0.212*** (0.558)	0.220*** (0.605)	0.161*** (0.469)	0.196*** (0.612)
Other determinants of comparative advantage	No	No	No	Yes	Yes
Skill and capital interaction	No	No	Yes	No	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Fixed effects (country and industry)	Yes	Yes	Yes	Yes	Yes
Number of observations	18,383	8,148	8,148	12,934	7,988
R^2	0.736	0.770	0.772	0.776	0.774

*Significant at 10% level; **significant at 5% level; significant at 1% level.

Note: Dependent variable is ln x_{ic} (natural log of exports in industry *i* by country *c* to all other countries). Standardized beta coefficients are reported. Numbers in brackets are robust standard errors. The estimated equation is ln $x_{ic} = a_c + a_i + \beta z_i Q_c + \beta^N z_i Q_c^N + \gamma X_{ci} + \gamma^N X_{ci}^N + \varepsilon_{ci}$, with X_{ci} as a vector that includes another determinants of comparative advantage and skill and capital interaction for the local country and neighbors (with superscript *N*). All variables except fixed effects are interactions between at least one industry-level variable and at least one country-level variable. All neighboring variables (with superscript *N*) consist of interactions with country-level variables but refer to neighboring countries of country *c*, measured as a weighted average by neighbor's GDP. More details can be found in Miranda and Wagner 2015.

Notes

1. This chapter summarizes the research findings of two background papers. A paper by Dollar, Ge, and Yu (2016) evaluates the impact of domestic institutions on global value chain (GVC) participation and is sponsored by the Research Institute for Global Value Chains at the University of International Business and Economics in Beijing. The second background paper by Miranda and Wagner (2015) examines the impact of foreign institutions in neighboring countries on domestic GVC participation and is sponsored by the Inter-American Development Bank.
2. The estimates of this regression are reported in Dollar, Ge, and Yu (2016).
3. Customs efficiency is a measure of the time needed for goods to clear customs.
4. A measure from Nunn (2007) is used that captures whether an industrial sector is especially sensitive to contracts. Nunn (2007) focuses on the share of an industry's inputs that are differentiated. This is implemented using the input-output matrix of a sector and identifying which sectors tend to have more inputs that are traded on a bilateral business-to-business relation as opposed to an input that can be bought in an arm's length transaction in a formal exchange. The distinction among different goods comes from the classification by Rauch (1999) according to whether inputs are traded in open markets with referenced prices or not. The case without is interpreted as a differentiated good.

References

Bigsten, A., P. Collier, S. Dercon, M. Fafchamps, B. Gauthier, J. W. Gunning, A. Oduro, R. Oostendorp, C. Patillo, M. Soderbom, F. Teal, and A. Zeufack. 2000. "Contract Flexibility and Dispute Resolution in African Manufacturing." *Journal of Development Studies* 36 (4): 1–17.

Dollar, D. 2016. *China's Engagement with Africa: From Natural Resources to Human Resources*. John L. Thornton China Center Monographs. Washington, DC: Brookings Institution.

Dollar, D., Y. Ge, and X. Yu. 2016. "Institutions and Participation in Global Value Chains." Global Value Chain Development Report Background Paper, World Bank, Washington, DC.

Feenstra, R. C., R. Inklaar and M. P. Timmer. 2015. "The Next Generation of the Penn World Table." *American Economic Review*, 105(10), 3150–3182. Available at: www.ggdc.net/pwt.

Guiso, L., P. Sapienza, and L. Zingales. 2009. "Cultural Biases in Economic Exchange?" *Quarterly Journal of Economics* 124 (3): 1095–131.

IMF (International Monetary Fund). 2015. *Regional Economic Outlook: Sub-Saharan Africa, Navigating Headwinds*. World Economic and Financial Surveys. Washington, DC: IMF.

Jäger, K. 2016. "EU KLEMS Growth and Productivity Accounts 2016 release—Description of Methodology and General Notes." The Conference Board Europe. Available at: http://www.euklems.net/TCB/2016/Metholology_EU%20KLEMS_2016.pdf.

Johnson, S., J. McMillan, and C. Woodruff. 2002. "Property Rights and Finance." *American Economic Review* 22 (6): 1335–56.

Jones, C. 2011. "Intermediate Goods and Weak Links in the Theory of Economic Development." *American Economic Journal* 3 (2): 1–28.

Kaufmann, D., A. Kraay, and M. Mastruzzi. 2010. "The Worldwide Governance Indicators: Methodology and Analytical Issues." Policy Research Working Paper No. 5430, World Bank, Washington, DC.

Koopman, R., Z. Wang, and S.-J. Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports." *The American Economic Review* 104 (2): 459–94.

Leff, N. 1978. "Industrial Organization and Entrepreneurship in the Developing Countries: The Economic Groups." *Economic Development and Cultural Change* 26 (4): 661–75.

Mayer, T., and S. Zignago. 2011. "Notes on CEPII's Distances Measures: The GeoDist Database." Centre d'Études Prospectives et d'Informations Internationales (CEPII) Working Paper 2011–25, CEPII, Paris.

McMillan, J., and C. Woodruff. 1999. "Interfirm Relationships and Informal Credit in Vietnam." *Quarterly Journal of Economics* 114 (4): 1285–320.

Miranda, R., and R. Wagner. 2015. "Neighboring Institutions Matter for the Competitiveness of Your Value Chain." Global Value Chain Development Report Background Paper, World Bank, Washington, DC.

Nunn, N. 2007. "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade." *Quarterly Journal of Economics* 122 (2): 569–600.

Rauch, J. 1999. "Networks versus Markets in International Trade." *Journal of International Economics*, 48 (1): 7–35.

Rauch, J., and V. Trindade. 2002. "Ethnic Chinese Networks in International Trade." *Review of Economics and Statistics* 84 (1): 116–30.

Robinson, J., D. Acemoglu, and S. Johnson. 2005. "Institutions as a Fundamental Cause of Long-Run Growth." *Handbook of Economic Growth* 1A: 386–472.

Wang, Z., S.-J. Wei, and K. Zhu. 2015. "Quantifying International Production Sharing at the Bilateral and Sector Levels." NBER Working Paper No. 19677, NBER, Cambridge, MA.

Wang, Z., S.-J. Wei, X. Yu, and K. Zhu. 2016. "Characterizing Global Value Chains." Working Paper No. 578, Stanford Center for International Development, Stanford, CA.

Williamson, O. E. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

World Bank. 1998. Worldwide Governance Indicators (database). Washington, DC: World Bank. Available at: http://info.worldbank.org/governance/wgi/index.aspx#home.

———. 2014. Worldwide Governance Indicators (database). Washington, DC: World Bank. Available at: http://info.worldbank.org/governance/wgi/index.aspx#home.

CHAPTER 8

Preferential trade agreements and global value chains: Theory, evidence, and open questions

MICHELE RUTA

Two phenomena have characterized the trade and trade policy landscape since the early 1990s. The rise of global value chains (GVCs)—the denationalization of production—has changed international trade, with trade in parts and components increasing almost six times between 1990 and 2015, faster than the 4.5 times for other forms of trade. On the policy side, preferential trade agreements are increasing in number and deepening in content.[1] Their number surged from 50 in 1990 to close to 280 in 2015. These agreements are also deepening, in the sense that they cover an expanding set of policy areas, such as investment and competition policy, that go well beyond the traditional focus of preferential trade agreements, such as tariffs.

This chapter analyzes the relationship between preferential trade agreements, particularly "deep" preferential trade agreements, and GVCs. The goal is to answer six policy-relevant questions:

- How have preferential trade agreements evolved?
- In a world with GVCs, why do countries sign preferential trade agreements?
- Do preferential trade agreements increase GVC integration?
- How does the content of preferential trade agreements affect GVC trade?
- How do GVCs affect the choice of preferential trade agreement partners?
- What is the outlook of the relationship between preferential trade agreements and GVCs going forward?

This chapter contributes to the large literature on preferential trade agreements (such as Limao 2016) in several ways. First, based on new World Bank data, it documents how preferential trade agreements have deepened over time and how this evolution is associated with the rise of GVCs. Second, it reviews the theoretical literature on the rationale for the relationship between preferential trade agreements and GVCs and outlines avenues for future research. Third, it discusses empirical research suggesting that deep agreements boost GVC integration and showing how this impact differs across country groups. Finally, it presents a simple framework for thinking about the relationship between preferential trade agreements and GVCs going forward.

While more work is needed, several findings emerge from this review. New data on the content of trade agreements and on participation in GVCs point to a strong positive correlation, with deeper agreements associated with more intense GVC relationships. Economic theory identifies several explanations for this relationship, ranging from the need to internalize cross-border policy spillovers to the benefits of stronger commitments in policies that affect GVC participation. Econometric analysis confirms that deep preferential trade agreements boost participation in GVCs, suggesting that trade agreements can be an effective tool for policymakers to anchor national producers to global and

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regional production processes. Going forward, the future of the relationship between preferential trade agreements and GVCs will depend on continuing trust in the willingness of other partners to preserve an open trading system.

Evolution of preferential trade agreements

New evidence on the evolution of preferential trade agreements offers a basis for discussing the relationship between trade agreements and GVCs. The number of preferential trade agreements has increased dramatically in the last quarter century, from 50 trade agreements in force and notified to the World Trade Organization (WTO) in 1990 to 279 at the end of 2015.[2] This dramatic change has spurred debate among researchers[3] and policymakers on the rationale for preferential arrangements; their impact on the trade flows, growth, and welfare of member and nonmember countries; and their relationship with the broader system of global trade governance.

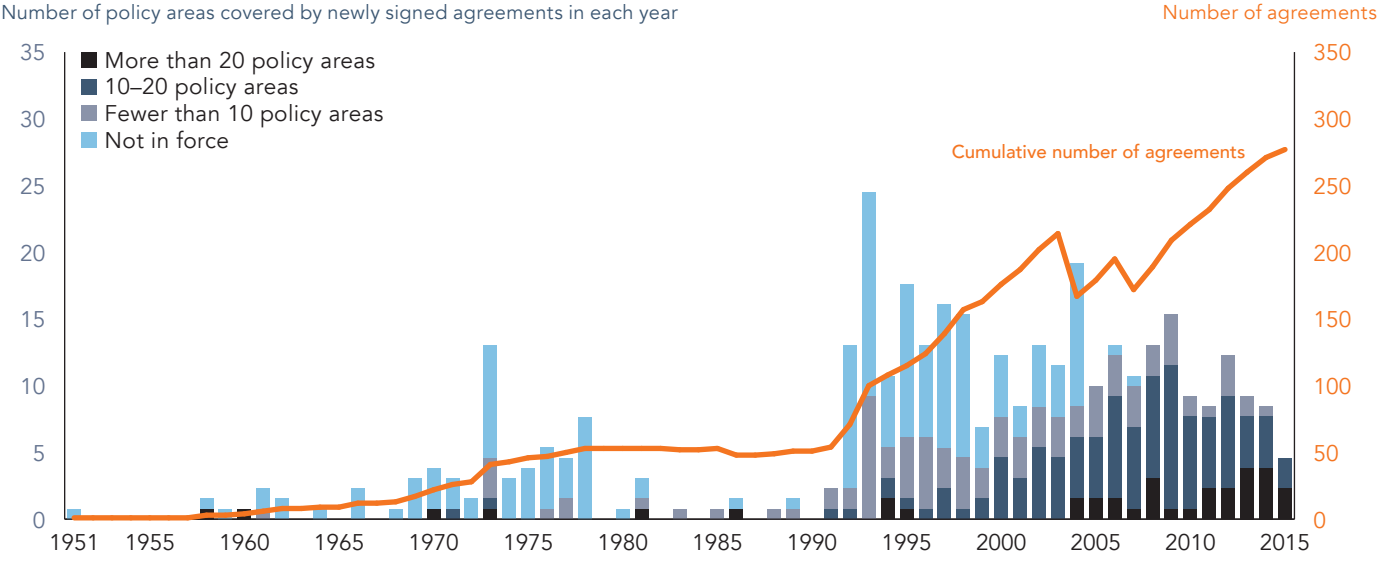
Often overlooked in the literature on trade agreements is that their content—as well as their number—has changed over time. Before the 1990s, trade arrangements involved mostly tariff reductions, but more recent preferential trade agreements include other policy provisions as well. Two recent studies document how several trade agreements cover regulatory areas such as services, investment, competition policy, intellectual property rights protection, and others (Horn, Mavroidis, and Sapir 2010; WTO 2011). Building on the methodology in these studies, Hofmann, Osnago, and Ruta (2017) collected information on all preferential trade agreements in force and notified to the WTO in 2015. Their new database contains information on the inclusion and legal enforceability of 52 policy areas in 279 preferential trade agreements among 189 countries.[4]

The database documents the changing content of preferential trade agreements. A growing number of trade agreements cover more than 20 policy areas, a majority of newly signed preferential trade agreements cover 10–20 policy areas, and a minority focus on fewer than 10 policy areas (figure 8.1).

The new database also allows looking in detail at the content of trade agreements. In addition to tariff reductions, more than half the preferential trade agreements in the database include legally enforceable regulations on some policy areas that fall under the current mandate of the WTO (figure 8.2). These provisions, referred to as "WTO-plus" or "WTO+" in the literature, include customs regulations, export taxes, antidumping measures, countervailing duty measures, technical barriers to trade, and sanitary and phytosanitary standards. Provisions outside the WTO mandate (usually called "WTO-extra" or "WTO-X") include a wide-ranging set of policy areas, from investment to environmental laws and nuclear safety. The inclusion of these provisions in preferential trade agreements and their legal enforceability varies widely by policy area (figure 8.3).

Preferential trade agreement provisions can also be disaggregated in different ways depending on the question under investigation. Following Hofmann, Onsnago, and Ruta (2017), preferential trade agreement provisions are divided here into core and noncore. Core provisions are identified in the literature as economically more meaningful (Baldwin 2008; Damuri 2012) and include the set of WTO-plus provisions and four WTO-extra provisions (competition policy, investment, movement of capital, and intellectual property rights protection) that appear frequently in preferential trade agreements. Almost 90% of agreements include at least one of the core WTO-extra provisions, and one third of preferential trade agreements include all core WTO-extra provisions (see figures 8.2 and 8.3).

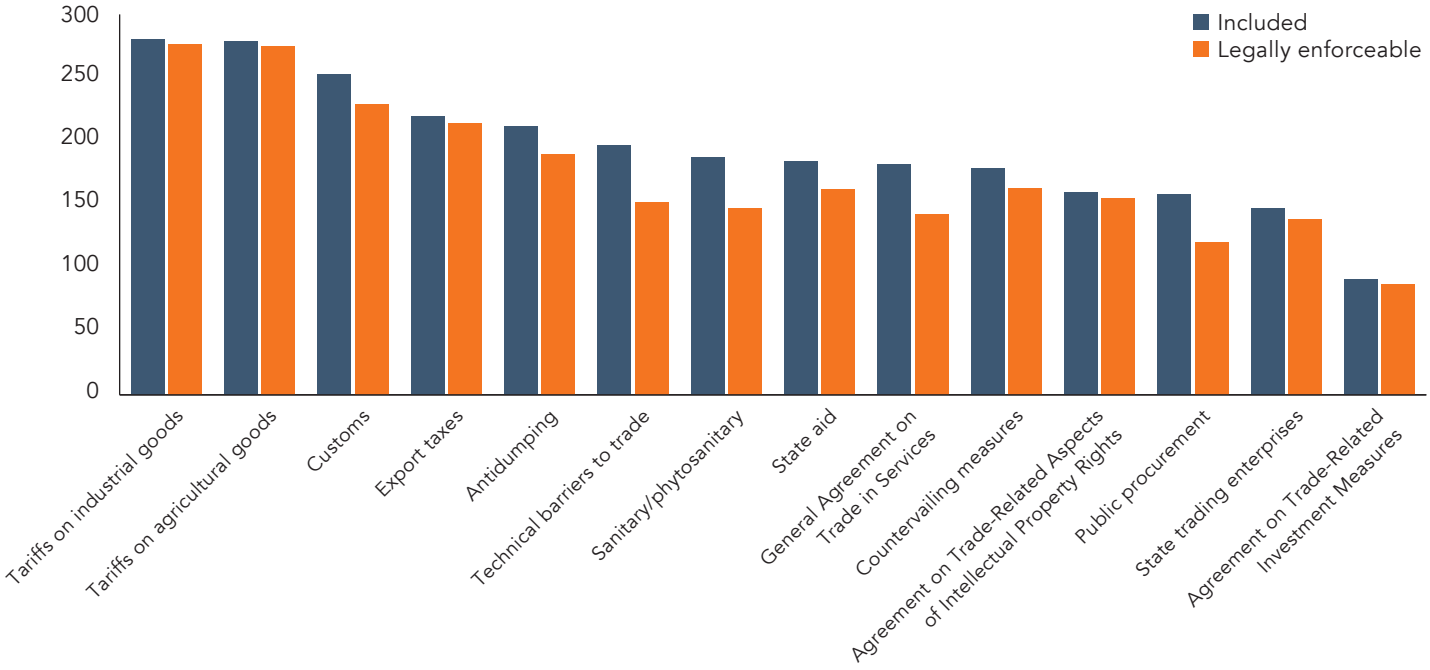
FIGURE 8.1 The number and content of preferential trade agreements, 1951–2015



Source: World Bank Content of Deep Trade Agreements Database (http://data.worldbank.org/data-catalog/deep-trade-agreements).

FIGURE 8.2 "WTO-plus" policy areas in preferential trade agreements, 2015

Number of agreements

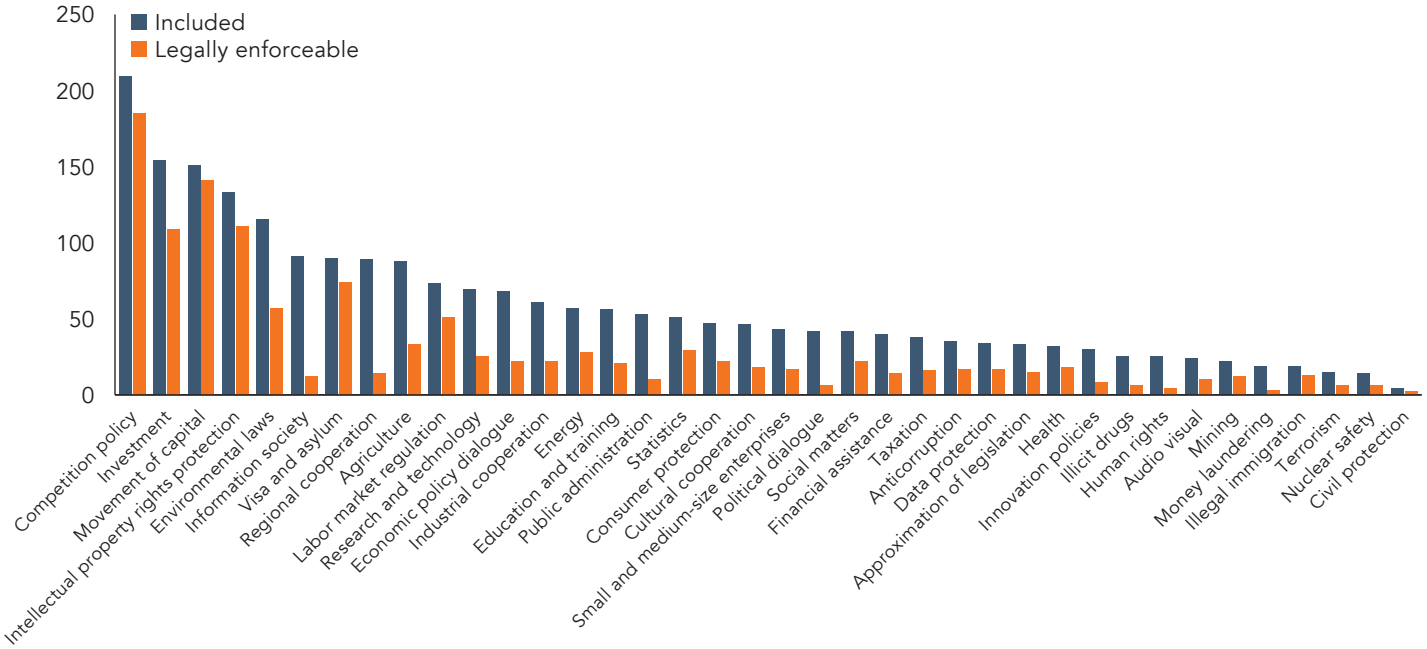


Source: World Bank Content of Deep Trade Agreements Database (http://data.worldbank.org/data-catalog/deep-trade-agreements).

Note: WTO-plus refers to legally enforceable regulations on some policy areas in preferential trade agreements that fall under the current mandate of the World Trade Organization.

FIGURE 8.3 "WTO-extra" policy areas in preferential trade agreements, 2015

Number of agreements



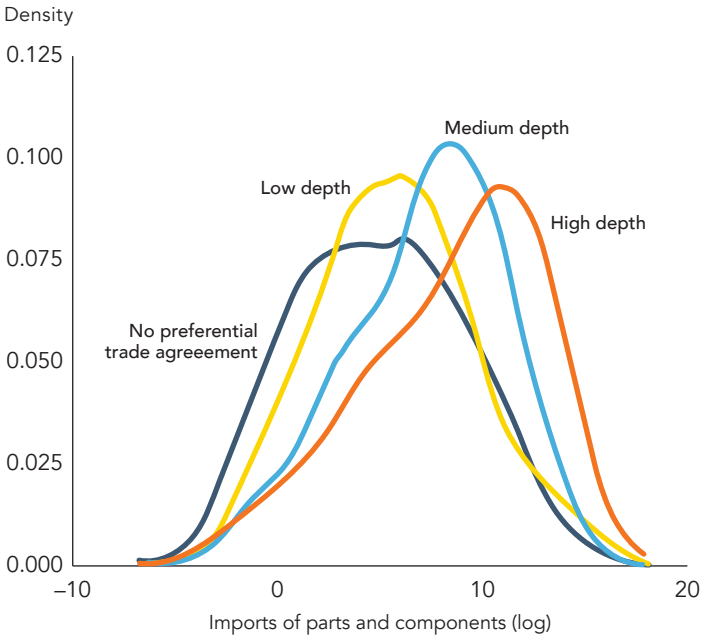
Source: World Bank Content of Deep Trade Agreements Database (http://data.worldbank.org/data-catalog/deep-trade-agreements).

Note: WTO-extra refers to provisions on some policy areas in preferential trade agreements that fall outside the current mandate of the World Trade Organization.

The new data also reveal the changing depth of preferential trade agreements. Hofmann, Osnago, and Ruta (2017) constructed synthetic indexes of depth, which measure the coverage of policy areas in preferential trade agreements. The first index of depth, referred to as "total depth," is the simple count of (legally enforceable) provisions in a preferential trade agreement. Total depth increased from an average of around 8 provisions in the 1990s to more than 17 in 2010–15. An index of "core depth" can be constructed by counting how many core provisions are included and legally enforceable in a preferential trade agreement. Core depth increased from around 7 provisions in the 1990s to almost 14 in 2010–15. Principal component analysis can produce a third index of depth that accounts for most of the variability in the data. Principal component analysis depth increased from around 1 in the 1990s to 2.8 in 2010–15.

The wide country coverage of the new data allows for analysis of the heterogeneity of deep preferential trade agreements across regions and incomes. Europe has the highest number of signed preferential trade agreements, and these preferential trade agreements are the deepest mainly because of the European Community Treaty and the subsequent EU enlargements. The average total depth of EU agreements is 25 provisions. Deep preferential trade agreements are also common for members of the European Free Trade Association (average of 23 policy provisions), Japan (21), and the Republic of Korea (20). Preferential trade agreements signed between developed and developing countries (North–South preferential trade agreements) include on average almost as many provisions (20) as North–North preferential trade agreements (22). But legal enforceability is generally weaker in North–South preferential trade agreements than in North–North agreements. And South–South preferential trade agreements, with an average total depth of 13 provisions, tend to be shallower than other preferential trade agreements.

FIGURE 8.4 Relationship between depth of preferential trade agreements and global value chain trade



Source: Hoffman, Osnago, and Ruta 2017.

Note: Depth of preferential trade agreements is measured by a density index for number of policy areas covered, where 0 means. Global value chains are measured by the log of imports of parts and components.

Global value chains and the rationale for trade agreements

What is the rationale for trade agreements, particularly deep agreements, in a world with GVCs? An extensive literature has examined the motives for trade policy cooperation and the design of trade agreements in a traditional setting, where production is entirely national and not fragmented internationally.[5] The focus generally is on cooperation on tariffs, consistent with the idea that the main problem that trade agreements solve is to internalize the terms-of-trade externality created by unilateral tariffs. But there is a positive correlation between GVC trade (measured as trade in parts and components) and the depth of trade agreements (measured by the number of policy areas covered by the agreements; figure 8.4). This relationship indicates that the rationale for trade agreements may be more complex in the context of GVCs than in settings where production is not fragmented internationally.

Lawrence (1996) first introduced the notion of "shallow" and "deep" trade agreements. Shallow agreements focus on tariffs and other border measures that directly affect market access. Economic theory and evidence suggest a relationship between cross-border production and shallow preferential trade agreements. For instance, Blanchard and Matschke (2015) estimated that a 10% increase in U.S. foreign affiliate exports to the United States is associated with a 4 percentage point increase in the rate of preferential duty-free access. Intuitively, firms that offshore production are more likely to lobby for lower tariffs on products re-imported into the U.S. market. Similarly, domestic firms may choose to locate production stages in another preferential trade agreement member under the expectation that tariffs on re-imported goods will be lower.

Deep agreements go beyond traditional market access issues and include disciplines such as investment, competition policy, and harmonization of product regulations. The new empirical evidence on the relationship between preferential trade agreement depth and GVC trade is the core of the next sections. Here, this relationship is discussed from a theoretical point of view (Antràs and Staiger 2012; Baldwin 2008; WTO 2011; Ederington and Ruta 2016).

A simple way to explain the correlation between GVC trade and depth of preferential trade agreements is that certain behind-the-border policies need to be disciplined in trade agreements for GVCs to operate efficiently. First, the unbundling of stages of production across borders creates new forms of cross-border policy spillovers beyond the traditional terms-of-trade externality. Second, governments may face credibility

problems for behind-the-border measures in the context of GVCs. And third, the costs created by coordination externalities (such as heterogeneous regulations) may be higher in the presence of cross-border production. These spillovers and credibility concerns generate demand for deeper forms of integration.

Despite the rich set of arguments in the literature, many aspects of the relationship between deep preferential trade agreements and GVCs have not been incorporated in formal models. Foremost is the fundamental question of the role that deep agreements play in the presence of GVCs. For instance, Antràs and Staiger (2012) show that behind-the-border policies create cross-border spillovers when production is internationally fragmented. While they indicate that deep provisions in preferential trade agreements may allow governments to internalize these externalities, their model does not provide a formal treatment of this point. Similarly, the commitment rationale for deep agreements has been formalized only for specific provisions (such as domestic subsidies in Brou and Ruta 2013), and this has not been done in a GVC context. Finally, studies of the harmonization of standards and other forms of regulatory cooperation (such as Costinot 2008) generally rely on traditional trade models that assume that production is purely domestic.

Several other interesting questions are also still open. One set of questions relates to the content of deep agreements. A large trade literature has recently investigated the role of institutions in shaping the international organization of production (Antràs 2015). Osnago, Rocha, and Ruta (2015) find evidence that the content of deep preferential trade agreements affects decisions on foreign direct investment, suggesting that the role of specific provisions in shaping GVCs may be relevant. But more work is needed to understand the specific channels. A second area relates to the role of preferential as opposed to multilateral deep integration. Why is deep integration generally taking place in preferential trade agreements? How are preferential trade agreement partners selected in a GVC context? (These questions are returned to below.)

Do deep agreements promote global value chains?

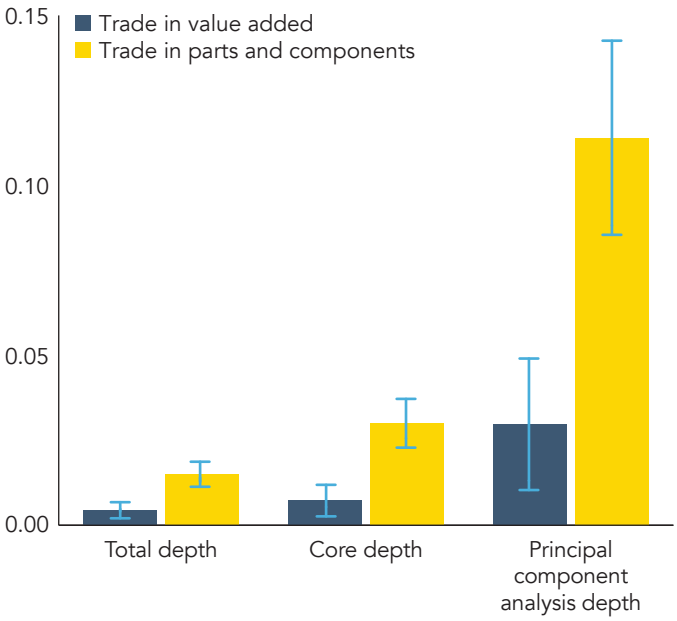
The relationship between GVCs and preferential trade agreements runs in both directions.[6] An important policy question concerns how much trade agreements, particularly deep preferential trade agreements, can boost GVC integration. Osnago, Rocha, and Ruta (2016) used a gravity model to exploit the new World Bank data on the content of preferential trade agreements, using the three measures of the "depth" of preferential trade agreements discussed earlier (total depth, core depth, and principal component analysis depth). Bilateral GVC integration is measured in two ways: trade in parts and components and trade in value added. Data on trade in parts and components have the advantage of being available for a larger set of countries and years covered by the new dataset on preferential trade agreements. Trade in value added is a more precise measure of GVC involvement, but data are limited to a small sample of countries (41) and time coverage is limited to 1995–2011.[7]

The empirical approach is based on the standard augmented gravity model, which has been widely used to assess the impact of preferential trade agreements on trade flows (see Baier and Bergstrand 2007). Unlike in the standard approach, which uses a dummy variable to identify the presence of a trade agreement between a country pair, Osnago, Rocha, and Ruta (2016) used the three measures of the "depth" of preferential trade agreements discussed earlier (total depth, core depth, and principal component analysis depth). Their regressions of the impact of preferential trade agreement depth on GVC trade included a set of fixed effects and control for various determinants of bilateral trade. Signing deep agreements has a large and positive impact on GVC trade (figure 8.5). Adding a provision to a preferential trade agreement increases bilateral trade in parts and components 1.5% and re-exported value added 0.4%. This means that signing the deepest preferential trade agreement in the sample doubles trade in parts and components and increases re-exported value added about 22%.

The analysis of the impact of preferential trade agreements on GVC trade presents two difficult econometric challenges.

FIGURE 8.5 The impact of deep preferential trade agreements on two types of global value chain trade

Marginal trade impact



Source: Osnago, Rocha, and Ruta 2016.

Note: Total depth is the simple count of (legally enforceable) provisions in a preferential trade agreement. Core depth is a count of how many core provisions are included and legally enforceable in a preferential trade agreement. Principal component analysis depth is an index that accounts for most of the variability in the data.

The first is that, as first noted in Johnson and Noguera (2014) and Noguera (2012), value-added trade depends not only on bilateral trade costs, but also on trade costs with third countries. The second challenge is the endogeneity of GVC trade and preferential trade agreements. Osnago, Rocha, and Ruta (2016) attempted to address both problems.

First, to take into consideration the indirect effects that preferential trade agreements by third countries may have on GVC trade of other countries, the depth variable of interest needs to be weighted to take into account the international input-output structure. Following the methodology proposed by Noguera (2012), Osnago, Rocha, and Ruta (2016) found that accounting for the depth of third-country agreements increases the impact of preferential trade agreements on GVCs.

The second empirical concern is endogeneity. Deep preferential trade agreements may stimulate the creation of GVCs by providing common disciplines that allow internalizing cross-border policy spillovers and address credibility problems. But countries already involved in GVCs may be more likely to sign deep preferential trade agreements because cross-border production creates a demand for deep provisions. The fixed-effect approach partially controls for this reverse causality since it compares country pairs before and after a preferential trade agreement is signed. But other time-varying country pair characteristics may not be controlled for. Osnago, Rocha, and Ruta (2016) adopted an instrumental variable approach to address this type of endogeneity, using as an instrument for the depth of the preferential trade agreement between country *i* and country *j* the (weighted) average depth of all the agreements signed by countries *i* and *j* with any other country, excluding the agreements they have in common. Results of the analysis confirm the relevance of deep agreements in boosting GVC trade.

An alternative approach for determining the importance of deep preferential trade agreements for GVCs is to look at the effect of depth on different sectors. The effect of deep preferential trade agreements should be stronger in sectors that are more integrated in GVCs. To test this, Osnago, Rocha, and Ruta (2016) exploited the decomposition of gross exports into value-added components available for 13 manufacturing sectors in the World Input-Output Database for 1995–2011. They augmented a sector-level gravity regression with an interaction term between depth and an index of vertical specialization. The coefficient of the interaction term is consistently positive and significant across specifications and using different variables of depth and provisions. The results suggest that deep preferential trade agreements have a larger impact on GVC-intensive sectors.[8]

Global value chains and the content of preferential trade agreements

This section digs further into the relationship between deep preferential trade agreements and GVCs and explores empirically potential heterogeneity in the effects of deep preferential trade agreements.[9] Following Osnago, Rocha, and Ruta (2016), it considers two dimensions of heterogeneity: splitting the provisions into different categories (WTO-plus and WTO-extra) and dividing preferential trade agreements by the level of development of country pairs (North–North, North–South, and South–South). These extensions allow for investigation of the types of provisions that drive the relationship between deep agreements and GVCs among different sets of countries.

Countries can have different reasons for signing trade agreements, depending on, among other things, the level of liberalization already achieved. World Bank data show that North–North preferential trade agreements and North–South preferential trade agreements tend to have similar depth (number of provisions covered by the agreement) and South–South preferential trade agreements are on average shallower. In addition, the prevalence of WTO-plus and WTO-extra provisions varies according to the level of development of the signatories of the agreement. North–North and North–South preferential trade agreements tend to have more WTO-extra provisions, though for North–South agreements they are less likely to be legally enforceable (figure 8.6). South–South agreements tend to focus on WTO-plus issues, which are the more traditional trade policy areas.

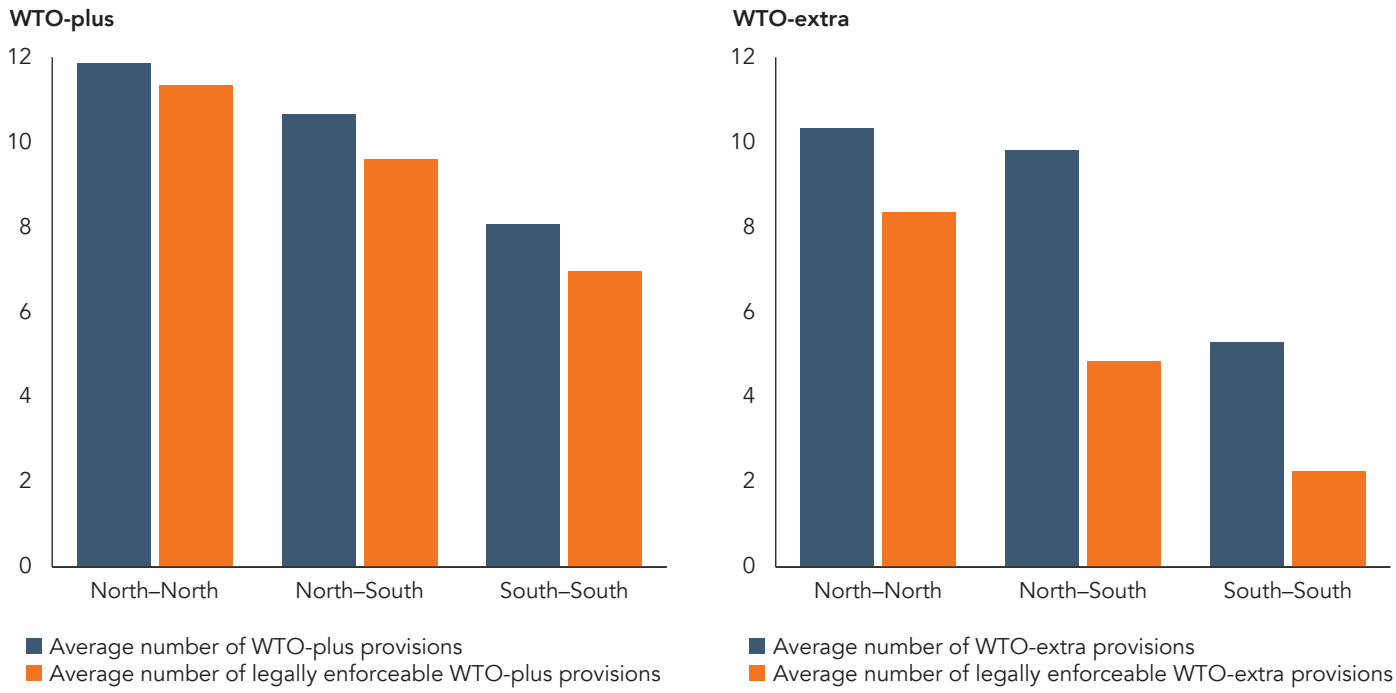
There is no formal theory to guide the analysis of differential effects of deep preferential trade agreements across countries' level of development, but a plausible argument is that deep preferential trade agreements matter for developed and developing economies for different reasons. With trade among developed countries already largely liberalized and domestic institutions robust, North–North deep agreements aim mostly to internalize cross-border policy spillovers. Deep agreements have additional roles for developing countries, since trade generally faces higher barriers and domestic institutions are weaker relative to advanced economies. North–South deep trade agreements offer an anchor to boost GVC participation of developing countries by providing a commitment device for border and behind-the-border policies. Since tariffs between developing countries are often still high, South–South preferential trade agreements affect GVC participation mostly through traditional trade liberalization.

To investigate the effect of the content of preferential trade agreements depending on countries' level of development, Osnago, Rocha, and Ruta (2016) ran three regressions on different groups of countries: North–North, North–South, and South–South. To allow for a broader sample of countries, data on trade in parts and components are used in these regressions to measure the extent of GVC integration among country pairs. In each regression, the key explanatory variable is the number of WTO-plus and WTO-extra provisions in a preferential trade agreement rather than preferential trade agreement depth.

The content of preferential trade agreements matters for GVC integration, and the impact varies by countries' level of development. WTO-plus provisions, such as tariff reduction, drive the effect of deep preferential trade agreements on South–South trade in parts and components. Each additional WTO-plus provision boosts South–South GVC integration 8.3%. WTO-extra provisions, such as investment and competition policy, drive the effects of North–South trade in parts and components. An

FIGURE 8.6 The depth of preferential trade agreements by the type or provisions and the development level of members

Number of provisions



Source: Osnago, Rocha, and Ruta 2016.

Note: WTO-plus provisions include legally enforceable regulations on policy areas that are under the current mandate of World Trade Organization (WTO) customs regulations, such as export taxes, antidumping measures, and technical barriers to trade. WTO-extra provisions are outside the WTO mandate and include a wide-ranging set of policy areas, from investment to environmental laws and nuclear safety.

additional WTO-extra provision in a North–South preferential trade agreement increases GVC integration 4.3%.

Global value chains and the choice of preferential trade agreement partners

From a normative perspective the issue is whether the international fragmentation of production changes the merits of regionalism relative to multilateralism. From a positive perspective the question is whether the presence of GVCs (or the possibility of anchoring a country to them) changes the way countries select their trading partners. This section briefly looks at both issues from a theoretical perspective and then applies the question to China.

The debate on the merits of regionalism versus multilateralism dates back at least to Viner (1950). In traditional models, where production is entirely national and tariffs are the sole instrument of trade policy, preferential trade agreements are suboptimal to a multilateral agreement from a global welfare perspective. However, preferential arrangements may still be efficient from the perspective of an individual country, for both economic and noneconomic reasons. First, countries may benefit from a preferential trade agreement at the expense of other countries not included in the agreement. This would be the case where exports from members displace exports from nonmembers. Second, countries may have noneconomic reasons to sign trade agreements, because preferential trade agreements can strengthen security ties or work as a building block for political integration. As these arguments are beggar-thy-neighbor or noneconomic, preferential trade agreements are an inefficient substitute for multilateral trade liberalization from an economic point of view.

GVCs alter this logic by creating new rationales for preferential trade agreements: the unbundling of stages of production across borders creates new forms of international policy spillovers and time-consistency problems. These in turn generate demand for deeper forms of integration. For deep agreements involving behind-the-border policies, a tradeoff arises between economies of scale and heterogeneity of preferences.[10] This tradeoff is well known in the public economics literature that deals with fiscal federalism (Oates 1999). While noneconomic arguments and new beggar-thy-neighbor gains (such as a "rule of law" externality) may still drive the decisions to form preferential trade agreements, smaller groups can be efficient from an economic point of view as they efficiently trade off the costs and benefits of deep integration. As argued in WTO (2011), deep

preferential trade agreements may complement rather than substitute for the multilateral trading system because they allow for coordinating or harmonizing policies that could not be coordinated or harmonized at the global level.

From a positive perspective the literature on shallow preferential trade agreements struggled with the notion of the ideal trade partner (Schiff and Winters 2003). Two main sets of economic characteristics increase the benefits of forming a preferential trade agreement with a specific partner. The first is trade intensity, which suggests that the two countries are "natural" trade partners. Characteristics such as geographic proximity that increase trade intensity among partners make it more convenient to reduce bilateral tariffs. The second has to do with comparative advantage: complementarities in production or consumption increase the benefit of forming a preferential trade agreement.

Are these characteristics relevant in the context of GVCs? The answer is not obvious, and the literature is not yet developed. Some characteristics still matter. For instance, proximity may be important in selecting preferential trade agreement partners because face-to-face communication is relevant to managing supply chains. Similarly, comparative advantage can be defined at the task level, with complementarities—say, between different stages of production—guiding the choice of preferential trade agreement partners. But other characteristics would appear to matter too, such as cross-country differences in policy preferences. If GVCs require deep agreements to function smoothly, ideal preferential trade agreement partners should not have policy preferences that are too different, since this would increase the cost of coordinating and harmonizing policies.

There is a new focus in the literature on the experience of China in choosing preferential trade agreement partners. To characterize preferential trade agreements from the point of view of GVCs, Cheng and others (2016) borrowed the "smile curve." The horizontal axis represents a continuum of tasks or stages of GVC from upstream to downstream covering research and development, intermediates, assembly, processing, marketing, and after-sale services. The vertical axis depicts the value added generated from various tasks or stages. Based on this notion, Cheng and others (2016) defined vertical preferential trade agreements as agreements driven by comparative advantage at the task level—agreements formed as a result of the vertical division of labor along the supply chain, with member economies locating at different GVC positions.

With this framework in mind, Cheng and others (2016) asked whether China's preferential trade agreements exploit complementarities in production along the supply chain. China has concluded and is implementing 13 preferential trade agreements involving 21 individual economies[11] and is negotiating or has proposed 11 other bilateral and regional preferential trade agreements, along with the 16-member Regional Comprehensive Economic Partnership. By quantifying China's GVC linkage with its preferential trade agreement and non–preferential trade agreement partners, Cheng and others found that GVC complementarities are important in the choice of preferential trade agreement partners for China.

The future of the relationship between deep agreements and global value chains

The past 25 years have been a period of deepening trade agreements and growing intensity of GVCs. Will this trend continue in the next quarter century? Given the growing backlash to globalization in advanced economies, this is no longer a rhetorical question. There are reasons for optimism, as GVCs and preferential trade agreements reinforce each other and make slipping backward less likely. But the future of this relationship should not be taken for granted because cross-border production decisions depend on expectations concerning trading partners' future trade policies. Negative expectations could result in a reversal of the current trends toward GVC expansion and deeper integration.

Some observers have argued that the current globalization backlash has similarities to the backlash of the early 20th century and that this may lead to a prisoner's dilemma, where countries escalate protectionism even though it is not in their interest, as in the 1930s. This pessimistic view of the future of trade relations does not acknowledge that the production structure and trade policy landscape of today are very different from those of the early 20th century.

Trade agreements have stimulated the creation of GVCs by internalizing cross-border policy externalities, lowering trade costs, and providing deeper common disciplines that facilitate the operation of economic activities spanning multiple borders. In turn, GVCs have changed the political economy of trade policy, discouraging protectionism and creating a demand for deep integration. The higher the domestic content of foreign-produced final goods, the lower the tariffs set by governments (Blanchard, Bown, and Johnson 2016) and the higher the GVC trade with partners, the deeper the agreements countries sign (Orefice and Rocha 2014). This two-way relationship between GVCs and preferential trade agreements supports the view that trade disintegration (protectionism, undoing trade agreements) is unlikely.

Despite these dramatic changes, however, the future of the relationship between preferential trade agreements and GVCs should not be taken for granted. GVCs are the result of firms' investment and sourcing decisions, which are endogenous because they depend on expectations of future trade policies. If firms expect a change in future trade policy, they will take this into account in their decisions, possibly leading them to renationalize (part of) their production processes. In this context, expectations can lead to multiple equilibria and give rise to coordination failures. More than the well-known prisoner's dilemma, the current situation may be described as a trust dilemma (or a coordination game) where what is rational to choose depends on beliefs about what others will do.

A simple game illustrates the trust dilemma that may characterize the relationship between preferential trade agreements

and GVCs—referred to here as the trust dilemma of deep integration (table 8.1). Consider two players, Home and Foreign, and assume that each has two strategies. They can opt for deep agreements and GVCs or choose national production and no trade agreement. Each player chooses an action without knowing the choice of the other. If a player chooses to maintain an international production process and a deep agreement, it needs the cooperation of the partner to succeed. Choosing national production and no trade agreement, by contrast, requires no cooperation with the other player but also leads to lower welfare.

The trust dilemma of deep integration has two pure-strategy Nash equilibria. The first is the upper-left corner of table 8.1, where Home and Foreign cooperate (2,2); the second is the lower-right corner, where the two players defect and choose not to cooperate (1,1). With global welfare inferior in the no-cooperation strategy, this equilibrium can be described as a coordination failure. Importantly, this equilibrium can be the result of a self-fulfilling prophecy in that it can be triggered by the belief that the other player will not choose to cooperate.

While only an example, the game shows why continuing trust in the willingness of others to cooperate is essential to the future of the relationship between preferential trade agreements and GVCs. In the past 25 years governments signed deep agreements, and firms fragmented production internationally. These decisions reinforced each other and sustained a cooperative equilibrium (the upper-left corner). In the next 25 years changing expectations for the course of policy could lead to a reversal and result in an inferior equilibrium where production is progressively renationalized and trade agreements undone (the lower-right corner). This coordination failure can be avoided as long as firms' expectations of future trade policy does not induce them to opt for national production, with policymakers offering protection and undoing trade agreements.

TABLE 8.1 The trust dilemma of deep integration

Players: Home, Foreign	Global value chains and deep agreements	National production and no agreement
Global value chains and deep agreements	2, 2	0, 1
National production and no agreement	1, 0	1, 1

Source: Author's elaboration.

Conclusions

New World Bank data on the content of trade agreements show that preferential trade agreements are becoming deeper. First, economic theory indicates that preferential trade agreements and GVC integration are related, as the smooth functioning of cross-border production activities calls for the regulation of behind-the-border policy areas. Theory also points out that, in a GVC context, preferential trade agreements and the multilateral trade system generally complement each other because some policy areas can be more efficiently regulated within smaller groups of like-minded countries. But many important questions on the relationship between preferential trade agreements and GVCs remain open. One is on the content (or, equivalently, the efficient design) of deep preferential trade agreements; another is on the optimal choice of preferential trade agreement partners. The literature has investigated these questions in models of shallow agreements and national production, but not for deep agreements and GVCs.

Second, thanks to the new data on the content of preferential trade agreements and on measures of GVC integration, some progress has been made in illuminating the extent of the relationship between preferential trade agreements and GVCs. Recent evidence shows that deep preferential trade agreements boosts GVC integration and that undoing this depth is likely to hurt GVCs. The content of preferential trade agreements also matters: WTO-extra provisions are key drivers of GVCs for North–South preferential trade agreements, while WTO-plus provisions are important for South–South GVC integration. And an analysis of China's trade agreements indicates that the choice of the "right" preferential trade agreement partners is affected by a country's GVC position, stressing the importance of comparative advantage at the task level among other factors.

On the future of GVCs and deep agreements, there are reasons for optimism and reasons for concern. In the past 25 years governments signed deep preferential trade agreements and firms fragmented production. These decisions reinforced each other and sustained a cooperative equilibrium. In the next 25 years changing expectations for the course of policy could lead to a reversal and result in an inferior equilibrium where production is progressively renationalized and trade agreements undone. Continuing trust in the willingness of others to cooperate to preserve an open system is essential to the future of the relationship between preferential trade agreements and GVCs.

Notes

1. This chapter uses the term "preferential trade agreements" rather than "regional trade agreements" since some of these agreements are not necessarily between countries within the same region or in regional proximity.
2. This section draws on Hofmann, Osnago, and Ruta (2017).
3. See Freund and Ornelas (2010), WTO (2011), and Limao (2016) for recent surveys of the literature on preferential trade agreements.
4. This database offers the most comprehensive and up-to-date data available on the number of trade agreements, countries, and policy areas covered. The database is freely available on the World Bank website at http://data.worldbank.org/data-catalog/deep-trade-agreements.
5. See Maggi (2014), Bagwell, Bown, and Staiger (2015), Bagwell and Staiger (2016), and Grossman (2016) for recent reviews.
6. This section is based on Osnago, Rocha, and Ruta (2016).
7. Data on trade in parts and components come from Comtrade, while the data on trade in value added are based on the decomposition by Wang, Wei, and Zhu (2016) and come from the World Input-Output Database.
8. This section looked at the impact of preferential trade agreements in boosting GVC trade. A related question is whether the undoing of a preferential trade agreement would negatively affect GVCs. Mulabdic, Osnago, and Ruta (2017) studied the effect that EU membership had on GVC and overall trade of the United Kingdom, most notably with its European partners, and then used this information to assess the future of U.K.–EU trade under different scenarios.
9. This section is based on Osnago, Rocha, and Ruta (2016).
10. Maggi (2014) discusses a similar rationale. Specifically, bargaining frictions may be higher for negotiations that involve many countries and complex issues. For this reason, deep provisions may be more efficiently negotiated in a preferential trade agreement or in an agreement involving a subset of members within the WTO, such as a plurilateral or critical-mass agreement.
11. The preferential trade agreements are with Australia; Chile; Costa Rica; Hong Kong, China; Iceland; Macao, China; New Zealand; Pakistan; Peru; the Republic of Korea; Singapore; Switzerland; and the 10-member Association of Southeast Asian Nations (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam).

References

Antràs, P. 2015. *Global Production: Firms, Contracts, and Trade Structure*. Princeton, NJ: Princeton University Press.

Antràs, P., and R. Staiger. 2012. "Offshoring and the Role of Trade Agreements." *American Economic Review* 102 (7): 3140–83.

Bagwell, K, C. P. Bown, and R. W. Staiger. 2015. "Is the WTO Passé?" National Bureau of Economic Research (NBER) Working Paper No. 21303, NBER, Cambridge, MA.

Bagwell, K., and R. W. Staiger. 2016. "The Design of Trade Agreements." In *Handbook of Commercial Policy*, Vol. 1A, edited by K. Bagwell and R. Staiger, 435–529. Amsterdam: North Holland.

Baier S. L., and J. H. Bergstrand. 2007. "Do Free Trade Agreements Actually Increase Members' International Trade?" *Journal of International Economics* 71 (1): 72–95.

Baldwin, R. 2008. "Big-Think Regionalism: A Critical Survey." NBER Working Paper No. 14056, NBER, Cambridge, MA.

Blanchard, E., C. Bown, and R. Johnson. 2016. "Global Supply Chains and Trade Policy." NBER Working Paper No. 21883, NBER, Cambridge, MA.

Blanchard, E., and X. Matschke. 2015. "U.S. Multinationals and Preferential Market Access." *The Review of Economics and Statistics* 97 (4): 839–54.

Brou, D., and M. Ruta. 2013. "A Commitment Theory of Subsidy Agreements." *The B.E. Journal of Economic Analysis & Policy* 13 (1): 239–70.

Cheng, D., X. Wang, Z. Xiao, and W. Yao. 2016. "How Does the Selection of FTA Partner(s) Matter in the Context of GVCs? The Experience of China." Working Paper, Fudan University, Shanghai.

Costinot, A. 2008. "A Comparative Institutional Analysis of Agreements on Product Standards." *Journal of International Economics* 75 (1): 197–213.

Damuri, Y. R. 2012. "21st Century Regionalism and Production Sharing Practice." Center for Trade and Economic Integration (CTEI) Working Paper No. 2012–4, CTEI, Geneva.

EC (European Commission). World Input-Output Database (WIOD). Brussels: EC. Available at: http://www.wiod.org/home.

Ederington, J., and M. Ruta. 2016. "Non-Tariff Measures and the World Trading System." In *Handbook of Commercial Policy*, Vol. 1B, edited by K. Bagwell and R. Staiger. Amsterdam: North Holland.

Freund, C., and E. Ornelas. 2010. "Regional Trade Agreements." *Annual Review of Economics* 2 (1): 139–66.

Grossman, G. 2016. "The Purpose of Trade Agreements." In *Handbook of Commercial Policy*, Vol. 1A, edited by K. Bagwell and R. Staiger, 379–434. Amsterdam: North Holland.

Hofmann, C., A. Osnago, and M. Ruta. 2017. "Horizontal Depth: A New Database on the Content of Deep Agreements." Policy Research Working Paper No. 7981, World Bank, Washington, DC.

Horn, H., P. C. Mavroidis, and A. Sapir. 2010. "Beyond the WTO? An Anatomy of EU and US Preferential Trade Agreements." *The World Economy* 33 (11): 1565–88.

Johnson, R., and G. Noguera. 2014. "A Portrait of Trade in Value Added over Four Decades." Working Paper, Dartmouth College, Hanover, NH.

Lawrence, R. Z. 1996. *Regionalism, Multilateralism, and Deeper Integration*. Washington, DC: Brookings Institution.

Limao, N. 2016. "Preferential Trade Agreements." In *Handbook of Commercial Policy*, Vol. 1B, edited by K. Bagwell and R. Staiger, 279–367. Amsterdam: North Holland.

Maggi, G. 2014. "International Trade Agreements." In *Handbook of International Economics*, edited by G. Gopinath, E. Helpman, and K. Rogoff, 317–90. Amsterdam: Elsevier.

Mulabdic, A., A. Osnago, and M. Ruta. 2017. "Deep Integration and UK–EU Trade Relations." Policy Research Working Paper No. 7947, World Bank, Washington, DC.

Noguera, G. 2012. "Trade Costs and Gravity for Gross and Value Added Trade." Working Paper, University of Warwick, Coventry, U.K.

Oates, W. E. 1999. "An Essay on Fiscal Federalism." *Journal of Economic Literature* 37 (3): 1120–49.

Orefice, G., and R. Rocha. 2014. "Deep Integration and Production Networks: An Empirical Analysis." *The World Economy* 37 (1): 106–36.

Osnago, A., N. Rocha, and M. Ruta. 2015. "Deep Trade Agreements and Vertical FDI: The Devil is in the Details." Policy Research Working Paper No. 7464, World Bank, Washington, DC.

———. 2016. "Deep Trade Agreements and Global Value Chains." Working Paper, World Bank, Washington, DC.

Schiff, M., and L. A. Winters. 2003. *Regional Integration and Development*. Washington, DC: World Bank.

UN (United Nations). UN Commodity Trade Statistics Database (Comtrade). New York: UN. Available at: https://comtrade.un.org/.

Viner, J. 1950. *The Customs Union Issue*. New York: Carnegie Endowment for International Peace.

Wang, Z., S.-J. Wei, and K. Zhu. 2016. "Quantifying International Production Sharing at the Bilateral and Sector Levels." Working Paper, Columbia University, New York.

WTO (World Trade Organization). 2011. *World Trade Report 2011—The WTO and preferential trade agreements: From co-existence to coherence*. Geneva: WTO.

APPENDIX 1
Authors' conferences

First Authors' Conference: Background Papers

Beijing, March 17–18, 2016

Organized by the Research Institute for Global Value Chains at University of International Business and Economics and China Development Research Foundation

Co-sponsored by Bill & Melinda Gates Foundation

Thursday, March 17

8:00 a.m.–8:30 a.m.	**Opening remarks**
Speakers	Dr. Anabel Gonzalez, Senior Director of Trade & Competitiveness Global Practice, World Bank Dr. Hubert Escaith, Chief Statistician, WTO Dr. Nadim Ahmad, Chief of Trade & Competitiveness Statistics Division, OECD Dr. David Dollar, Senior Fellow, Brookings Institution Fang Jin, Deputy Secretary General, China Development Research Foundation Professor Zhao Zhongxiu, Vice President, UIBE
8:30 a.m.–9:30 a.m.	**Characterizing global value chains**
Speakers	Wang Zhi, UIBE, Wei Shangjin, ADB, Yu Xinding, UIBE, and Zhu Kunfu, UIBE
Discussant	Satoshi Inomata, IDE–JETRO
9:30 a.m.–10:30 a.m.	**Global value chains and their domestic foundations**
Speakers	Cosimo Beverelli, Robert B. Koopman, Simon Neumueller, and Victor Kummritz, WTO
Discussant	Meng Bo and Jiyoung Kim, IDE–JETRO
10:45 a.m.–11:45 a.m.	**Estimation of cumulative trade cost along global value-chains**
Speakers	Antonia Diakantoni, Hubert Escaith, Michael Roberts, and Thomas Verbeet, WTO
Discussant	Nadim Ahmad, OECD
11:45 a.m.–12:45 p.m.	**Taxation reform on intermediate imports and its implications for structure adjustment of Chinese economy—a CGE model–based analysis**
Speakers	Wang Fei and Pei Jianso, UIBE, He Jianwu, DRC
Discussant	David Dollar, Brookings institution

2:00 p.m.–3:00 p.m.	**Measuring smile curves in global value chains**
Speakers	Ye Ming, Fudan University, Meng Bo, IDE–JETRO and Wei Shangjin, ADB
Discussant	Ju Jiandong, Shanghai University of Economics and Finance
3:00 p.m.–4:00 p.m.	**Participation of developing countries in global value chains**
Speaker	Przemyslaw Kowalski, Javier Lopez Gonzalez, Alexandros Ragoussis, and Cristian Ugarte, OECD
Discussant	Joseph Mariasingham, ADB
4:15 p.m.–5:15 p.m.	**Middle income trap and GVCs**
Speakers	Gianluca Santoni, Daria Taglioni, Deborah Winkler, World Bank, and Victor Kummritz, WTO
Discussant	Li Zhigang, ADB
5:15 p.m.–6:15 p.m.	**Production transformation in emerging economies**
Speakers	Nadim Ahmad and Annalisa Primi, OECD
Discussant	Yu Jiantuo, CRDF
6:30 p.m.–7:30 p.m.	**Dinner**
Participant	All

Friday, March 18

8:00 a.m.– 9:00 a.m.	**Services trade and GVCs**
Speakers	Erik van der Marel, ECIPE, and Sebastian Saez, World Bank
Discussant	Cosimo Beverelli, WTO
9:00 a.m.–10:00 a.m.	**Services in Global Value Chains: From Inputs to Value-Creating Activities**
Speakers	Sebastien Miroudot, OECD
Discussant	Li Shantong, DRC
10:10 a.m.–11:10 a.m.	**Preferential Trade Agreements and Global Value Chains**
Speakers	Alen Mulabdic, Alberto Osnago, Michele Ruta, World Bank, Nadia Rocha, WTO
Discussant	Andrew Crosby, ICTSD
11:10 a.m.–12:10 p.m.	**How does the Selection of FTA Partner(s) Matter in the Context of GVCs? The Experience of China**
Speakers	Cheng Dazhong, Fudan University, Wang Xinkui, Shanghai WTO Center, Xiao Zhiguo, Fudan University, Yao Weiqun, Shanghai WTO Center
Discussant	Robert B. Koopman, WTO
12:15 a.m.–2:00 p.m.	**ICTSD - WEF Joint Launching of the E15 Report on "Strengthening the Global Trade and Investment System in the 21st Century" in partnership with Caixin Insight Group and UIBE/RIGVCs**
Participant	All
2:00 p.m.–3:00 p.m.	**Micro structure of global imbalance and the development of global value chains**
Speakers	Yang Jun, UIBE, Li Xin, Beijing Normal University, Wang Zhi, UIBE
Discussant	Nick Hope, Stanford Center for International Development
3:00 p.m.–4:00 p.m.	**Local investment climates and participation in global value chains**
Speakers	David Dollar, Brookings, Ge Ying and Yu Xinding, UIBE
Discussant	Hubert Escaith, WTO
4:10 p.m.–5:10 p.m.	**Neighboring institutions matter for the competitiveness of your value chain**
Speaker	Rodrigo Wagner, University of Chile
Discussant	Ma Hong, Tsinghua University
5:10 p.m.-6:00 p.m.	**Keynote speech: The forces driving the future of supply chains and the tradable part of the global economy**
Speaker	Michael Spence, the Noble Prize laureate in Economics

6:00 p.m.–6:30 p.m.	**Closing remarks**
Speakers	Dr. David Dollar, Senior Fellow, Brookings Institution Dr. Anabel Gonzalez, Senior Director of Trade & Competitiveness Global Practice, World Bank Robert B. Koopman, Chief Economist, WTO Dr. Nadim Ahmad, Chief of Trade & Competitiveness, OECD Dr. Ricardo Melendez-Ortiz, CEO, ICTSD Wang Zhi, Professor and Director, RIGVC

Second Authors' Conference: Chapters

Washington, November 28–29, 2016

Monday, November 28

8:30 a.m.–9:00 a.m.	**Opening**
Presenters	Anabel Gonzalez, WBG and Robert Koopman, WTO
9:00 a.m.–10:20 a.m.	**Chapter 1 Historical review of the development of GVCs and analytical frameworks**
Presenter	Satoshi Inomata, IDE–JETRO
Discussant	Juan Blyde, IADB and Robert Koopman, WTO
10:40 a.m.–12:00 p.m.	**Chapter 2 Recent trends in global trade and GVCs**
Presenters	Zhi Wang, UIBE, Bo Meng, IDE–JETRO
Discussants	Gaaitzen de Vries, University of Groningen and Deborah Winkler, WBG
1:30 p.m.–2:50 p.m.	**Chapter 3 Accumulated trade costs and their impact on the development of GVCs**
Presenter	Hubert Escaith, WTO
Discussants	Yu Xinding, UIBE and Jose G Reis, WBG
2:50 p.m.–4:10 p.m.	**Chapter 4 GVCs and the development agenda**
Presenter	Nadim Ahmad, OECD
Discussants	Nadia Rocha, WBG and Heiwai Tang, John Hopkins University
4:30 p.m.–5:50 p.m.	**Chapter 5 The "middle-income trap" and upgrading along GVCs**
Presenter	Daria Taglioni, WBG
Discussants	Gary Gereffi, Duke University and Qi Yinan, UIBE

Tuesday, November 29

9:00 a.m.–10:20 a.m.	**Chapter 6 Services trade liberalization and GVCs**
Presenters	Aaditya Mattoo and Cecilia Heuser, WBG
Discussants	Przemyslaw Kowalski, OECD and J. Bradford Jensen, Georgetown University
10:40 a.m.–12:00 p.m.	**Chapter 7 Local investment climates, institutional quality, and GVCs**
Presenter	David Dollar, Brookings Institution
Discussants	Cosimo Beverelli, WTO and Rodrigo A. Wagner, Tufts University
1:30 p.m.–2:50 p.m.	**Chapter 8 Regional trade agreements and GVCs**
Presenter	Michele Ruta, WBG
Discussants	Dazhong Cheng, Fudan University and Michael Ferrantino, WBG
3:30 p.m.–6:00 p.m.	**Executive summary**
Presenters	David Dollar, Brookings Institution and Zhi Wang, UIBE
Discussants	All

The importance of the global value chain (GVC) phenomenon has stimulated researchers to develop statistics and analysis based on the value added in trade. The GVC phenomenon also demands that researchers analyze the discrete tasks or phases in the production process. Data are now available on the value added traded among major economies during 1995–2014. This first *Global Value Chain Development Report* draws on the expanding research that uses data on the value added in trade. Its main objective is to reveal the changing nature of international trade that can be seen only by analyzing it in terms of value added and value chains.

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