New measures have opened up insights into the extent and complexity of global production networks. The chapters in this timely book deploy new tools to understand how global value chains change the nature of global economic interdependence, and to assess how that in turn changes our understanding of policies in this new environment.

The authors bring to bear a wide variety of methodological tools and data, and perspectives ranging from the firm-level micro economy to the global macro economy. The book has two broad themes. The first is national economies' heightened exposure to adverse shocks (natural disasters, political disputes, recessions) elsewhere in the world as a result of greater integration and interdependence. The second theme is focused on the evolution of global value chains at the firm level and how this will affect competitiveness in Asia. It also traces the past and future development of production sharing in Asia.

Employing an array of the latest methods and data to study global value chains, the book will prove a valuable resource for international organizations and regional bodies who have an active interest in anything related to global supply chain analysis. Researchers, academics and students in the fields of international trade and economics will also find its assessment of the evolution of global value chains at the firm level, and how this affects competitiveness in Asia, to be an insightful guide.

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1. Asia and global production networks: implications for trade, incomes and economic vulnerability

Benno Ferrarini and David Hummels

1. INTRODUCTION

Global value chains (GVCs) involve the production of goods and services through interlinked stages of production scattered across international borders. The international exchange of intermediate inputs, as opposed to final consumer goods, is a phenomenon as old as trade itself. What is new in the global economy is rapid growth in the extent and the complexity of global value chains. Nowhere in the world is production fragmented quite as much, or GVCs quite as complex or as fast growing, as in Asia.

As a consequence, there has been a widespread recognition by policy makers, practitioners and scholars in the field of international economics that global value chains should figure more prominently in their policies, advice and research. Early academic work focused primarily on measurement of the extent, geographic orientation, and growth in GVCs (Arndt and Kierzkowski 2001; Hummels, Ishii and Yi 2001; Grossman and Rossi-Hansberg 2008; Kimura 2006; Johnson and Noguera 2012). Among international bodies, the World Trade Organization (WTO) Secretariat launched its “Made in the World” initiative in 2010, and has collaborated since with the Organisation for Co-operation and Economic Development (OECD) to establish a statistical platform (OECD-WTO TiVA) to quantify GVCs and to increase measurement capacity. Reports have thus proliferated by international bodies, including the World Bank (Cattaneo et al. 2010), IDE/JETRO and WTO (2011), OECD (2013), and UNCTAD (2013), and various think tanks and other bodies, such as the World Economic Forum (2012) and the Fung Global Institute (Park et al. 2013; Elms and Low 2013).

New measures have opened up insights into the extent and complexity of global production networks. For example, Figure 1.1 shows a network graph based on the OECD-WTO TIVA indicator of value added embodied in 2009 gross exports by source country.¹ Three hubs – the United States
Note: Based on OECD-WTO TiVA database, accessed 5 October 2013.

Source: Authors’ calculations.

Figure 1.1 Global value chains in 2009
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(US), Germany and the People’s Republic of China (PRC) – are seen at the center of a tightly knit web of value added transfers mainly among regional economies engaged in split production processes. The US is positioned at the center of the global supply chains both as the largest gross exporter of goods and services and as the main exporter of US value added embodied in other countries’ exports. Germany and the PRC follow in the ranks in terms of gross (direct) and value added (indirect) exports. Compared to the US, these economies are positioned further downstream the value chains, involving a substantial share of value added inflows and outflows. In the European regional network, horizontal integration prevails, with value added flowing in both directions among country pairs. Asian production networks are more hierarchical. At the top, countries such as Japan – and the US from outside the region – inject value added through the provision of key components and services to the PRC, the hub downstream, as well as through Malaysia, Thailand and to a lesser extent the other Association of Southeast Asian Nations economies as well as India. Other key players, right at the center of the regional networks, are the Republic of Korea, Taipei, China, as well as Singapore, each economy exporting high shares of foreign value added in reflection of their strong GVC involvement.

Baldwin and Forslid (Chapter 10) in this volume provide a deeper insight into the genesis and development of the Asian production networks, drawing on the latest data and insights that have become available during the past two years, while Escaith (Chapter 9) delves into methodological issues concerning measuring and mapping of trade associated with GVCs’ activities.

Proper measurement is an appropriate first step in understanding the extent of GVCs, but it is only a beginning. What remains is a far harder task: to understand how GVCs change the nature of global economic interdependence, and how that in turn changes our understanding of policies appropriate in this new environment. The chapters in this volume are focused on this harder task. The authors bring to bear a wide variety of methodological tools and data, and perspectives ranging from the firm-level micro economy to the global macro economy to help understand how GVCs are reshaping interdependence in Asia.

2. ANALYTICAL TOOLS TO ASSESS THE IMPLICATIONS OF GVCs FOR TRADE, INCOMES AND ECONOMIC VULNERABILITY

We have two broad themes. We start with a topic of great concern to scholars and policy makers. Greater integration and interdependence
can lead to efficiency gains, but it can also expose national economies to adverse shocks (natural disasters, political disputes, recessions) elsewhere in the world. This suggests several important but underexplored questions. One, to what extent do global value chains serve to transmit and even magnify shocks across national borders? Two, when a national economy absorbs the blow from an international shock, what are the most important response margins? That is, do firms respond to the failure of a key supplier or a drop off in foreign demand by shifting to new partners? If not, do these trade shocks result in large changes in output and employment, or are they absorbed through changes in factor and product prices? Of course, shocks need not be abrupt to have important effects at the macroeconomic level. Rebalancing current account surpluses may take years or decades, and the ways in which rebalancing is absorbed will depend critically on how nations are linked through GVCs in both consumption and production.

Our second theme is focused on the evolution of global value chains at the firm level and how this will affect competitiveness in Asia. Global value chains allow firms to specialize in stages of production in which they excel, leaving remaining stages to other firms or other nations. Conceptually this is a straightforward proposition – applying the principle of comparative advantage to exchanging stages of production rather than final goods. What remains unclear are the sources of advantage at the firm level. Perhaps firm advantages are based on technological sophistication, the realization of scale economies, arbitrage of policy differentials, or simply, factor input costs. Also unclear is how firm advantages trade off against the greater coordination costs of realizing these advantages in a far-flung “global factory”. Various chapters explore theory and data at the firm level to understand the evolution of GVCs within and across countries.

2.1 Disaster Impact Assessments with the GTAP Supply Chain Model

Walmsley, Hertel and Hummels (Chapter 2 in this volume) and Hertel, Hummels and Walmsley (Chapter 3 in this volume) provide a set of tools for analyzing global value chains in a full general equilibrium context. Their approach can be thought of as a bridge between two important literatures related to GVCs: multi-region input–output (MRIO) analysis and computable general equilibrium (CGE) analysis. In a MRIO analysis researchers link national input–output tables with trade data to construct an international, multi-region IO table. Rather than examine total input usage for each industry, as is the case in national tables, a MRIO provides information on the source of these inputs. With this disaggregation a researcher can calculate the share of foreign versus domestic value added
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in output and exports for a particular industry, or further break foreign value added into specific source countries. That is, a MRIO distinguishes the value of Korean and Chinese steel used in the Japanese automobile industry, enabling researchers to examine how the Republic of Korea and the PRC are differentially affected by a shock to Japan. Such tables provide the basis of most trade in value added statistics and macro level assessments of global value chains. Additional details on the strengths and weaknesses of this approach can be found both in Walmsley et al. (Chapter 2) and in Escaith (Chapter 9).

The challenge for a MRIO comes when a researcher wants to go beyond a static look at the data and consider changes to the world economy. That is, a MRIO describes a particular pattern of input–output use that prevailed at a point in time, but is not well suited to analyzing what will happen to that pattern should there be a significant shock to an economy. To answer such questions requires a full computable general equilibrium model that can track behavioral responses in production, consumption, and trade.

Walmsley et al. (Chapter 2) provide a detailed discussion of how to embed MRIO-like data on global value chains into GTAP, a widely used CGE tool for world trade analysis. The resulting model is called GTAP-SC (“Supply Chain”). This methodological piece includes a discussion of the challenges and choices involved in reconciling disparate data sources on GVCs. The chapter then provides a series of exercises meant to illustrate how MRIO and CGE approaches differ when analyzing changes to global value chains. The authors show that standard MRIO analysis is actually an extremely restrictive version of a CGE analysis in which one assumes that output can instantaneously and costlessly adjust to any shock to the system. The GTAP-SC model allows for much more general responses, including evaluating how shocks lead to price changes, which in turn induce substitution in production and consumption, both within and across countries. The results here are illuminating in themselves, but readers may find them even more useful as a kind of guidebook to pursuing their own analysis of GVCs.

Hertel et al. (Chapter 3) employ the GTAP-SC model to evaluate two major disasters that reduce output and productivity: the first in the electronics sector in Taipei, China and the second at the Port of Singapore. The model traces through effects on goods and factor markets, focusing on the distribution of effects as a function of GVC linkages to these sectors. A clear distinction arises between sectors and countries that are vertically linked to the disrupted area versus sectors and countries that are substitutes. Vertically linked sectors suffer while substitutes enjoy tremendous growth as they at least temporarily replace the disrupted production.
A novel part of the analysis is the ability to evaluate changes that occur at different time horizons. For example, at very short time horizons, output quantities may be slow to respond to shocks, so all adjustment must occur through prices. At medium horizons, some factors of production (unskilled labor) may be mobile across firms, while others (capital to build factories) are not, which allows for adjustment to occur through a mix of price and quantity changes. Similarly, by varying substitution parameters in the model, the authors can experiment with inputs as vitally necessary (very difficult to replace), or commodities (easy to replace) to gauge the resulting impact.

2.2 Natural Disasters Impact Assessment through Regression Analysis

We can think of Hertel et al. (Chapter 3) as a stylized simulation of what might happen in some future disastrous event, tracing through the effects on output, trade, employment, wages, and prices. Puzzello and Raschky (Chapter 4) also examine natural disasters, but they focus on disasters that have actually occurred and econometrically examine the linkage between these disasters and trade flows. They draw on a comprehensive database of natural disasters (drought, earthquakes, floods, wind storms) that provides data on the number of persons affected, numbers killed, and estimated dollar damage for all countries worldwide during the period 1995–2010. Using this data, they construct measures of the vulnerability of global value chains to natural disasters. For each country and industry, these measures capture the proportion of inputs provided by suppliers struck by at least one large natural disaster in a given year.

Next, they estimate a regression model that explains a country’s exports at the industry level as a function of, among other factors, the vulnerability to natural disasters of that country-industry’s supply chain. The causal channel here is straightforward. If an industry relies heavily on inputs whose supply is disrupted by a disaster, it should raise costs or lower production for that industry, and this will show up in reduced international competitiveness and exports. This is not inevitable, of course. It may be that, while firms purchase inputs from abroad they are not truly dependent on them. Rather, they may find it relatively easy to switch away from a disaster-struck supplier to an alternative vendor, with costs, competitiveness and exports unimpeded.

These authors reveal a set of interesting facts. They find that manufacturing products are highly exposed to large natural disasters abroad, which is consistent with the high incidence of input trade in the manufacturing sector. Asia and North America are the regions most vulnerable to
large natural disasters both at home and abroad, both because they are more disaster prone and because production there is more globalized. The regression estimates show that higher supply chain vulnerability to large natural disasters significantly reduces exports, and that the effects are larger when large disasters happen at home. More complex industries are little affected by disasters at home, but are affected by disasters abroad. This is consistent with the idea that firms find it relatively easy to substitute away from affected inputs when they are domestically sourced inputs, but find it difficult to do the same for imported inputs.

2.3 Impact Assessment of Current Account Rebalancing in Asia

While natural disasters are an excellent laboratory for examining abrupt changes to GVCs and the world economy, not all shocks are abrupt or unanticipated. Even slow moving changes can have profound effects if they fundamentally reorder patterns of production and consumption. Levchenko and Zhang (Chapter 7) examine one such shock, current account rebalancing in Asia. A country running a trade surplus is spending less than the value of its output. Rebalancing – an elimination of the trade surplus – then by construction increases the country’s total spending. Classical theory predicts that an elimination of a trade surplus in a country: (i) increases both relative and real incomes; (ii) appreciates the real exchange rate; (iii) increases the employment share in the non-traded sector; and (iv) reduces exports. All of these effects are reversed in the trade deficit countries as the trade imbalance is eliminated.

While useful starting points, classic theory on rebalancing is based on stylized small-country or two-country models that are too simplistic to reliably gauge the magnitudes involved. The real world features many heterogeneous countries with highly asymmetric trade relationships between them. While this distinction is non-existent in two-country models, in the real world the elimination of the PRC’s trade surplus will likely have a very different global impact than the elimination of Japan’s trade surplus, as those two countries occupy different positions in the world trading system. Since there are differences in the nature and orientation of global value chains feeding inputs into traded and nontraded sectors, rebalancing will have differential effects on these suppliers.

Levchenko and Zhang base their analysis on a quantitative Ricardian-Heckscher–Ohlin framework that features 75 countries (including 14 from developing Asia), 19 tradeable and 1 non-tradeable sector, multiple factors of production, as well as the full set of cross-sectoral input–output linkages forming a global supply chain. They begin with a baseline equilibrium that matches the observed levels of trade imbalances in each country.
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in 2011, and then compare outcomes to a counterfactual scenario in which each country is constrained to have balanced trade.

In their sample of 14 developing Asia countries, seven have trade surpluses and seven trade deficits in 2011. Rebalancing leads to the following effects. The surplus countries experience a large increase in wages relative to the US, 17.5 percent on average. There is a modest (at the median, 4 percent) increase in the share of labor employed in the non-traded sector as these countries stop transferring income abroad and instead use it to purchase domestically produced goods and services. The trade-weighted real exchange rate (RER) for the surplus countries in developing Asia appreciates slightly, 1.47 percent on average. While one might expect larger adjustments given the magnitude of the rebalancing involved, it is important to keep in mind patterns of trade. Much of these countries’ trade is with each other, and thus even as they are all appreciating relative to the US, their trade-weighted appreciation is much smaller. The Republic of Korea and Taipei, China even experience modest RER depreciations.

The impact of external rebalancing on welfare is much smaller than on either relative wages or RERs. At the median, these countries experience a rise in welfare of 0.4 percent, two orders of magnitude less than the average increase in the relative wage. This is sensible: as these countries’ relative wages rise dramatically, so do domestic prices. The net impact is positive (with the sole exception of the Republic of Korea), but much smaller than the gross changes in either wages or price levels. For countries running deficits, the adjustments are the opposite of the surplus countries, and of similar magnitudes, though welfare losses are much more substantial. Finally, the authors track the changes due to rebalancing through global value chains. A country’s welfare changes due to global rebalancing are strongly positively correlated with whether it exports mostly to the deficit or to surplus countries. Thus, multilateral trade relationships are crucial for fully understanding the importance of rebalancing.

2.4 Monetary, Exchange Rate Policy and Business Cycle Analysis in Light of GVCs

Continuing with a macroeconomic focus, Chinn (Chapter 8) offers a broad look at how GVCs change the measurement and estimation of key macroeconomic variables and relationships. In a world where all trade is in final goods and all goods are traded, the real exchange rate is easily defined and measured as the nominal exchange rate net of the price level for final goods at home and abroad. In the presence of global value chains, real exchange rates are conceptually difficult. Chinn reviews two approaches in the literature, which turn on whether consumers have
preferences over value-added (i.e. consumers care about each stage in production and so real exchange rates must reflect where each stage took place), or only over the final good, in which case global value chains only matter to the extent that multi-stage production reduces the price of that good. This literature shows that accounting for GVCs gives a picture of the RER that differs significantly from conventional measures. For example, using a GVC adjusted RER, the PRC’s effective exchange rate appreciated 11.4 percentage points more than was implied using conventional measures. These adjusted measures also significantly change our measurement and interpretation of how the RER affects trade quantities (i.e. the elasticity of trade with respect to movements in the RER) and prices (the degree of pass-through).

Chinn next turns to business cycles. A number of researchers have claimed that deeper integration via global value chains causes a greater degree of business cycle synchronization. Chinn provides static and dynamic exercises to examine whether there have been changes in the extent of synchronization in Asia over time. First, he calculates the correlation of quarterly GDP growth for Asian country pairs over the 1990–1996 and 1999–2012 periods, using a variety of techniques (HP filters, quadratic and log detrending) to isolate business cycle components. Correlation coefficients among Asian country pairs rise significantly, especially those pairs involving the PRC. As an accompanying exercise focused on dynamics, Chinn estimates a non-structural VAR to evaluate the impulse response of each country to output gaps in other countries.

Finally, Chinn analyzes whether global value chains alter the conduct of monetary and exchange rate policy. The starting point is the idea that policymakers will value a stable exchange rate when there is more production sharing, and therefore more commercial transactions whose value will be made uncertain by a fluctuating exchange rate. Further, if countries desire to stabilize, do they stabilize against the US dollar or, owing to the centrality of the PRC in Asian value chains, do they stabilize against the Chinese yuan (CNY)? Previous work using daily currency movements has shown that central banks now place more weight on the CNY than they did prior to 2005. Chinn extends this work to longer horizons, monthly and quarterly movements, and confirms the primary finding that the CNY has risen in importance as a nominal anchor for the region’s currencies.

2.5 The Progression of People’s Republic of China’s Trade through GVC Participation

We turn next to two chapters that are focused on the microeconomics of global value chains at the firm level. Previous chapters in the volume
have employed input–output tables to measure GVCs. This is a standard approach, which is useful for comparability across countries and over time, but it fails to capture significant heterogeneity across firms within industries. An alternative approach is to rely on firm-level data that provides a highly detailed picture of which firms are deeply integrated into GVCs, relying on foreign suppliers and selling to foreign customers, and which are not. Chapters by Swenson (Chapter 6) and Ma and Van Assche (Chapter 5), make use of Chinese customs data that provides a rich picture of these transactions, including product and origin country information for inputs and product and destination detail for exports. These data are further broken out by “processing firms”, which import inputs free of charge and sell their products outside the PRC, and “ordinary firms”, which do not enjoy duty free imports, but can sell output domestically and abroad.

One of the central questions of development relates to the progression of countries through a rising level of production sophistication. At the crudest level this can be characterized as a switch from agriculture to “light” manufacturing to more complex manufacturing, and the literature has provided a variety of ways to characterize technological sophistication. The rise of global value chains upends these traditional distinctions. While a laptop computer may be a highly complex piece of machinery, embodying advanced parts and technology, not all stages of its production are complex or sophisticated. Some assembly stages may be labor intensive, produced capably by workers with few skills or training. This raises the question of whether the apparent rise in the sophistication of Chinese exports (for example, a switch from textiles and apparel to electronics) simply captures Chinese participation in the simplest stages of production.

Swenson (Chapter 6) uses the rich detail in Chinese customs data to characterize changes in the production stage position of PRC firms. Key to her analysis are measures of “upstreamness” and “stages” in production developed by Fally (2012a, 2012b). Suppose we have a production process involving 10 sequential steps. A firm that produces the seventh step has six previous “stages”, and is “upstream” from three subsequent steps. By using very detailed IO tables to measure how far a production stage is from final consumption, then matching this data to traded products, Fally is able to characterize the “upstream” and “stage” measure of a given product. Taking these measures, Swenson can then characterize where Chinese firms sit in sequencing based on the inputs they purchase and the outputs they produce. Over time, a firm can change its position in two ways. For a given production process it can move closer to the point of final consumption (increasing stages and decreasing upstreamness), or further away. Or
it can switch to a more complex production process involving more steps (conceivably increasing both stages and upstreamness).

In the aggregate, Swenson finds that Chinese firms have increased both the stages and upstreamness, consistent with the view that they are switching to production processes that involve increasingly long production chains. Swenson next provides an alternative measure of complexity, the number of distinct inputs used in production. Based only on a count of distinct HS6 product lines imported, there is a decline in the number of inputs. This could reveal falling complexity, or it could reveal a move along the production chain further from final consumption. For example, production of a microchip could involve relatively few parts, while assembly of a laptop computer could involve many parts.

The initial work focuses on aggregate behavior of the Chinese economy so Swenson next exploits firm-level data. She relates growth in imports and exports to the position of these products in the value chain as measured by Fally’s stages/upstreamness variables, while using fixed effects to control for unobservables. There are striking differences between imports and exports. Import growth is greater for products that exhibit higher stages and upstreamness (products with longer chains), while export growth is smaller for these products. Swenson also explores an alternative way to see a similar relationship. She focuses on the probability of exit, that is, identifying products that were imported (or exported) at some point by a Chinese firm, but then cease to be, as a function of their position in the value chain. Here the results are mixed and depend highly on goods type. All in all, this chapter represents a wholly novel way to evaluate the changing advantages of firms within multi-stage production processes.

2.6 Trade Policy Shocks and Production Relocation by Processing Firms in the People’s Republic of China

Ma and Van Assche (Chapter 5) also employ the PRC customs data, but in pursuit of a very different objective. They are interested in how global value chains allow firms to circumvent trade policy barriers. The authors begin with a model of heterogeneous firms similar to Melitz (2003), but introduce two vertical stages of production: headquarters services produced at home, and manufacturing, which is footloose. The mobility of manufacturing makes it profitable for some firms to circumvent tariffs and produce abroad. A key insight is that global value chains increase the elasticity of bilateral exports with respect to tariffs. The reason is that a tariff hike has two effects. First it raises prices and lowers export sales for firms who continue to produce at home. Second, it induces a subset of firms to stop exporting and relocate production to avoid the tariff. Note that while
global value chains amplify the effect of the tariff on manufacturing at home, it dampens the effect on headquarters activities, which continue to operate and provide services to manufacturing plants abroad. This result is complementary to recent studies that find offshored assembly activities are more vulnerable to business cycle shocks than corresponding domestic activities.

Next, Ma and Van Assche investigate the prediction that vertically specialized trade is more sensitive to a country-specific tariff hike than exports that are part of local value chains. They draw on both firm-level (2000–2006) and provincial level (1997–2009) data from the PRC’s customs statistics, distinguishing Chinese firms based on customs regimes (processing and ordinary trade). The processing trade regime is used primarily by exporting firms in the PRC that are part of a global value chain, while the ordinary trade regime is used by exporting firms that have more extensive domestic value chains. Apart from legal treatment, this distinction is clear in the data: processing exports embody less than half as much domestic value added than ordinary exports, and foreign-owned firms play a much more dominant role in the processing trade regime than in the ordinary trade regime. To measure country-specific trade policy shocks, they use antidumping cases against the PRC at the HS6 digit level as identified in the World Bank’s Global Antidumping Database (GAD). Ma and Van Assche find strong evidence that processing exports are more sensitive to the imposition of antidumping measures than ordinary exports, and consistent with the theoretical model, this is mostly due to the extensive margin effect.

2.7 Measuring Global Value Chains

We conclude with two chapters that address broad conceptual issues highlighting the rise and future development of global value chains in Asia.

Escaith (Chapter 9) returns to the issue of measurement of global value chains, setting in context the varied efforts by researchers and policy institutes around the world. He strongly advocates for a process of theory before measurement, or put another way, for researchers to understand what questions they are trying to answer, and what measurement and data organization tools are appropriate in that context. He reviews work on input–output table based approaches, such as those used in the chapters by Walmsley et al., Puzzello and Raschky, and to some extent in those by Chinn and by Levchenko and Zhang. While these authors draw on extensive work elsewhere and employ it in varied applications, readers may find their explanations somewhat terse. Escaith’s chapter provides a more detailed exegesis, including the economic assumptions implicit in these
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calculations. As an example, Chinn describes two methods for calculation of the real exchange rate in the presence of GVCs, and these approaches turn on whether consumers have preferences over value added or preferences over final goods. This is conceptually very close to the problem described by Escaith in terms of using network theory to understand GVCs. Can we think of consumers valuing electronic components from Thailand independently of the way they are integrated into the network of computer production throughout Asia?

When a methodology becomes dominant, as the MRIO approach has in measuring GVCs, it can become easy to forget its limitations. Escaith reminds us of these problems, and then highlights the different sorts of conceptual questions and problems that can be answered with reference to firm-level data. This points clearly to the strengths of the data approaches employed by Swenson and by Ma and Van Assche.

As we noted at the outset of this chapter, the study of global value chains has progressed beyond infancy but is at best an adolescent literature. There remain a host of interesting questions about GVCs that are little understood. Indeed, Escaith’s simple enumeration of “what should be counted” with respect to GVCs illustrates the fairly limited dimensions of “what has been counted” in the literature extant. Ultimately Escaith’s chapter provides a useful overview of the work to date, and a rich outline of work to do for the ambitious researcher or concerned policy maker.

2.8 The Development and Future of Production Networks in Asia

In a similar vein, Baldwin and Forslid’s Chapter 10 provides a useful overview of how global value chains arose in Asia, and where they are going. They begin with the history, describing globalization as two unbundlings driven first by lower trade costs (tariffs, transportation costs), and second by improvements in information and communication technology (ICT). The first unbundling allowed production and consumption to be separated by great distances, but production stages remained bundled locally, in factories and industrial districts. The ICT revolution unbundled the factories themselves. They illustrate these facts with a series of data displays meant to illustrate the sharp changes in trade volumes and patterns of trade in value added corresponding to the period of the ICT revolution. These displays also provide a useful set of indicators going forward to track the extent and growth of GVCs.

The second part of the chapter provides some simple conceptual theory to help the reader understand driving forces between the second unbundling. The first organizes production into a TOSP (tasks, occupations,
stages, and products) hierarchy, where tasks, or the most granular activities, are bundled in groups to workers of particular occupations, who are themselves bundled into stages, with these stages ultimately bundled into products. For a product like a laptop computer, we could separate design, parts production, assembly, and marketing into four distinct stages. The design stage could involve occupations like electrical engineers or software coders, each of whom has a large set of discrete tasks that must be completed to design a microchip or the computer’s hardware BIOS.

With this setup in hand, the challenge is to think in terms of the optimal aggregation of occupations and stages, that is, how many tasks should be completed by each occupation, and how occupations should be bundled into a given stage. The ICT revolution lowers the cost of communicating between disparate stages (making it lower cost to disaggregate occupations), but it also lowers the marginal benefit of specialization as automation enables individual workers to master more tasks without the loss of efficiency. This simple framework helps us to think through the extent of unbundling, trading off efficiency and coordination costs. A key point here is that relationships are not monotonic; in other words, the model reveals tipping points at which offshoring can increase rapidly or even decrease as costs fall. Further, these costs interact with traditional sources of comparative advantage that may itself evolve. In short, it is not at all obvious whether global value chains in Asia will continue to grow in size and complexity, or whether we have hit a high water mark in their importance.

NOTES

1. Figure 1.1 was drawn with the help of Cytoscape, an open-source platform for complex network analysis and visualization (www.cytoscape.org). The network graph extends across all country pairs, involving more than 3000 connections. To avoid clutter, only the top 5 percent are shown on this map. Also omitted from the map are value added transfers to and from the rest of the world aggregate, as well as self-looping arches in relation to countries’ domestic value added. Shown are the top 5 percent of value added flows among country pairs in 2009, connected by arches whose width is proportional to source countries’ value added embodied in recipient countries’ exports. Individual economies are shown as nodes whose size relates to the gross value of goods and services exports. Darker shades denote economies with lower shares of domestic value added in gross exports, compared to more brightly shaded nodes. The method is described further in Ferrarini (2013).

2. In fact, exports by the US (89 percent) contain a considerably higher share of domestic value added compared with that of Germany (73 percent) and the PRC (68 percent).
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