The Rise of Global Manufacturing Value Chains: A New Perspective based on the World Input-Output Database

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1. Introduction

As coordination and transport costs decline, production processes increasingly fragment across borders. This has profound implications for the geographical location of production, the patterns of trade and the functioning of labour markets (Feenstra, 2010). However, national statistical systems were not designed to measure many of the transactions occurring in today's global economy. Houseman and Mandel (2015) provide an overview and identify biases and gaps in national statistics, examine the magnitude of the problems they pose, and propose solutions. As a prominent example, traditional measures of competitiveness such as revealed comparative advantage based on gross export values have lost their meaning. For example, booming exports of electronics suggest that China has rapidly improved in competitiveness since the late 1990s. But recent product case studies suggest that European, Japanese, and U.S. firms still capture major parts of these value chains, as they specialize in high value-added activities such as software, design, branding, and system integration. China and other emerging countries are mainly involved in the assembling, testing and packaging activities, which are poorly compensated. A typical finding is that China keeps less than four percent of a product's export value as income for its labor and capital employed in the production process of electronic goods (Ali-Yrkkö et al. 2011; Dedrick, Kraemer, and Linden 2010). In today's world countries do no longer compete in products. Instead they are specialising in particular activities within a global production network.

The aim of this chapter is to outline a new method and database that have been recently used to analyse the deep changes in international production. It is based on the World Input-Output Database (WIOD) which provides a global input-output table describing flows of goods and services within, as well as across, countries. In addition, it contains data on the factor content of production at the industry level for 40 countries. As such the

WIOD can be seen as the international equivalent of the national KLEMS-databases described elsewhere in this volume. In this chapter we will summarize the main findings of our work analysing the value that is added in various stages of regionally dispersed production processes.[1] A central concept in this line of work is the income generated in a country by participating in global manufacturing production, abbreviated by the term "GVC income" (for global value chain income). It indicates to what extent a country can compete with other nations in terms of activities related to global manufacturing. These activities take place in manufacturing industries, but also in services industries. We take this concept as a starting point to answer three main questions: how far has international fragmentation progressed? Which countries have increased their competitiveness in global production networks? And is there a change in the factor income distribution within global networks?

The chapter is organised as follows: in section 2 we outline our accounting framework for value added in global value chains. We define a global value chain (GVC) of a final good as the set of all value-adding activities needed in its production. It is identified by the country-industry in which the last stage of production takes place, say German automobile industry. A GVC includes the value added in this last industry, as well as in all other industries in the same country or abroad where previous stages of production take place. To decompose value added in production, we make use of a standard tool in input-output analysis using Leontief's demand driven model in an international setting. New metrics of fragmentation and GVC incomes of countries and production factors are discussed. The empirical analysis is based on the World Input-Output Database (WIOD), which combines national input-output tables, bilateral international trade statistics, and data on production factor requirements. A crucial characteristic of this database is the explicit measurement of national and international trade in intermediates. In Section 3 we discuss the major features of this database.

The remainder of the chapter outlines the main empirical findings, based on an analysis of global production of all manufacturing goods taken together, denoted by the term manufactures.[2] Section 4 provides an analysis of the international fragmentation of production and shows how foreign value added in production increases rapidly, in particular outside regional blocs. In section 5 we analyze trends in GVC income shares across regions and major countries in the world. A major shift in production from advanced to emerging regions is established. We also show that only about half of the

[1] In general, research on this topic has been booming since the mid-2000s and we do not aim to provide an overview of all the work. See Amador and Cabral (2014) for an overview and references.
[2] Timmer et al. (2015) provides a more detailed analysis of the global automotive industry.

GVC income originates in the manufacturing sector itself, which indicates the importance of inter-industry linkages in the production of manufacturing goods. In Section 6 we focus more in-depth on the role of different factors of production. We show how in advanced countries GVC income generated by capital and high-skilled labor is increasing, while incomes for medium- and low-skilled workers in manufactures production decline. Section 7 concludes and argues for the need for a closer integration of national KLEMS-type databases in order to study global production.

2. Accounting for Value Added in Global Value Chains

In this section we outline our new accounting method for value added in global production. It is based on information from world input-output tables to describe the international fragmentation of specific value chains. We decompose the value of a final product into the value added shares generated in all countries that contribute to its value chain. Thus, the measure does not only take into account the value added by the immediate suppliers of intermediates, but also valued added by suppliers further upstream. This can be elucidated by referring to Figure 1, which is an extension of a diagram in Hummels et al. (2001). It refers to a simplified world economy consisting of three countries and depicts a value chain of a final product for which the last stage of production takes place in country 3. We call this the *country-of-completion*. To produce it, factor inputs are needed in country 3, generating domestic value added. In addition, intermediate inputs are needed, some of which are produced within the country itself and some of which are imported from country 2. To produce these, country 2 in its turn adds value. This is not limited to the industries producing the exported intermediate products (the first-tier suppliers in the production of the final product), but also involves industries in country 2 that act as second-tier suppliers by producing materials and components that are needed for the production by the first-tier exporters. Finally, second-tier suppliers are not only located in country 2, but also in country 1, such that country 1 also adds value. Based on information of the various production linkages in the production of the final product considered, the values added by countries 1, 2 and 3 can be calculated.

[Figure 1 about here]

More formally stated, we will study value chains of final products that are identified by the last stage of production: a particular industry i located in a specific country j, denoted by (i,j).[3] To produce good (i,j), activities in industries $l = 1,\ldots,L$ in each of the countries $k =$

[3] Industries producing wholesale and retail services, and transport services industries are not considered as industries-of-completion. Our data is at basic prices and hence the margins generated by these industries in delivery to the final consumer are not taken into account (see Section 3).

1,…,*K* are needed. To decompose its value, we need to start with finding the levels of gross output associated with the production of (*i,j*). These can be estimated by applying standard input-output methods to global input-output tables. Global input-output tables contain information on the values of intermediate input flows among all country-industries in the world, as well as on the values of flows from each of these country-industries to final use in each of the countries. These tables also contain information on value added generated in each of the country-industries. Combining information on values of sales and value added per dollar of sales leads to estimates of value added in each of the *SN* industries as a consequence of final demand for product (*i,j*). For this we use an equation that has been a standard tool in input-output analysis (see Miller and Blair, 2009):

$$\mathbf{g} = \hat{\mathbf{v}}(\mathbf{I} - \mathbf{A})^{-1}(\mathbf{Fe}) \qquad (1)$$

In this equation, **g** is the vector of value added created in each of the *LK* country-industries involved in a value chain. The choice for a specific final output matrix **F** determines which value chain is considered. Final output is output delivered for household consumption and investment demand.[4] **e** is a summation vector. $(\mathbf{I-A})^{-1}$ is the well-known Leontief inverse, the use of which ensures that value added contributions in all tiers of suppliers are taken into account. **v** is a vector with value added over gross output ratios, for each of the country-industries.[5] See Los et al. (2015a) for a technical discussion of the derivation of Equation (1).

The main result of this calculation for our purposes is that we are able to decompose the value of a final product into value added contributions in any country in the world. As we are using tables that involve all regions in the world, this decomposition is exhaustive. Denote the final output value of product (*i,j*) by FINO(*i,j*) and the value added by industry *l* in country *k* in its production by VA(*l,k*)(*i,j*). The vector **g** contains the matching VA(*l,k*)(*i,j*) levels for each (*i,j*), such that

$$\mathrm{FINO}(i,j) = \sum_{l,k} \mathrm{VA}(l,k)(i,j) \qquad (2)$$

Summed over all countries, the value added contributions to the production of (*i,j*) are equal to the final output value of (*i,j*). This accounting scheme is illustrated in Figure 2 where global value chains are represented by the columns. There is one column for each final product, characterised by the country-industry-of-completion, with cells showing the origin of the value added. Note that the delivering industries are domestic as well as

[4] Note that all final demand for the output of (*i,j*) is considered, so it includes both domestic and foreign demand. Johnson and Noguera (2012) provide an analysis of value added absorbed by foreign demand, and call this value-added exports. See also Los et al. (2015b) for an analysis of the importance of foreign demand for Chinese growth.

[5] Matrices are indicated by bold capital symbols and (column) vectors by bold lowercases. Hats denote diagonal matrices with the corresponding vector on the main diagonal.

foreign. The sum across all participating industries in a GVC makes up the gross output value of the final product, given in the bottom row. As all final products are consumed somewhere in the world, final output values will equal global expenditure on the product. Thus the summation of final output across all columns equals world GDP which is measured from the expenditure side.

This decomposition framework allows us to define a number of interesting metrics. We define our measure of foreign value added (FVA) as all value added outside the country-of-completion *j*:

$$\mathrm{FVA}(i,j) = \sum_{k \neq j} \mathrm{VA}(k)(i,j) = \mathrm{FINO}(i,j) - \mathrm{VA}(j)(i,j) \qquad (3)$$

Note that $\mathrm{VA}(j)(i,j)$ is the value added domestically. To measure the importance of foreign value added, we express it as a share of all value added in the production of (*i*,*j*):

$$\mathrm{FVAS}(i,j) = \mathrm{FVA}(i,j)/\mathrm{FINO}(i,j) \qquad (4)$$

We will use this share to measure the extent of international fragmentation of value chains in Section 4. Subsequently, we decompose FVAS(*i*,*j*) into the value added share of the region to which the country-of-completion belongs, and the remaining value added share that is added outside the region.

As an example, in Table 1, we provide the decomposition for the final output of the transport equipment manufacturing industry in Germany, in short "German cars". The table indicates the geographical origin of the final output of German cars in 1995 and in 2008 and reveals striking developments. Between 1995 and 2008, the share of domestic value added decreased rapidly from 79 to 66 per cent of the value of a German car. Value added from Eastern Europe increased. This is well documented in case studies: with the new availability of cheap and relatively skilled labour, firms from Germany relocated parts of the production process to Eastern Europe (Marin, 2011). But perhaps surprisingly, value added from other countries in Europe increased by nearly the same amount. At the same time, the industry quickly globalised by sourcing more and more from outside Europe. Countries outside Europe actually accounted for more than half of the increase in foreign value added.

[Table 1 about here]

A second set of metrics are related to the contribution of countries to global production. It is defined as the income generated in a country by participating in global manufacturing production of a particular set of products, abbreviated by the term "GVC income", for global value chain income (Timmer et al., 2013). It answers the question how much value a country add to the global production of a particular set of products. Rather than looking at the columns in Figure 2, this metric is based on information in the rows. A particular

row in Figure 2 provides information on the value added from a particular country-industry to all global value chains in the world. Obviously, this includes value added in the production of its own final products, but also value added to production in other GVCs, by means of delivering intermediate inputs. Note that this includes value added delivered directly to the industry-of-completion, but also indirectly through other industries. An element in the final column of Figure 2 provides this summation across the row and is equal to the value added in an industry.[6]

In this chapter we focus on the contribution to the global production of final manufacturing goods, denoted by the term "manufactures." Production systems of manufactures are highly prone to international fragmentation, as activities have a high degree of international contestability: they can be undertaken in any country with little variation in quality.[7] GVC income of a country is then defined as the contribution of its industries to the global production manufactures. More formally,

$$\mathrm{GVC}(k) = \sum_{i \in manu} \sum_{l,j} \mathrm{VA}(l,k)(i,j) \qquad (5)$$

The GVC income of country *k* in global production of manufactures is equal to the sum of value added by all its industries *l* to the production of all final manufacturing goods *i* where the last stage of production takes place in any country *j* in the world. Note that this includes not only activities in the manufacturing sector, but also production activities in all other sectors, such as agriculture, utilities, business services, and so on, that provide inputs in any stage of the production process.[8]

[6] Note that VA(*l*,*k*) summed across all industries in all countries equals world GDP as measured from the production side. Our accounting framework for GVCs thus obeys an important accounting convention: both the columns and the rows add up to world GDP as global final expenditure must be equal to global value added.

[7] Ideally, one would like to cover value added in all activities that are internationally contestable, and not only those in the production of manufactures. An increasing part of world trade is in services, and only (part of) intermediate services are included in GVCs of manufactures. GVCs of services cannot be analysed however, as the level of observation for services in our data is not fine enough to zoom in on those services that are heavily traded, such as for example consultancy services. The lowest level of detail in the WIOD is "business services" which for the major part contains activities that are not internationally traded, and hence are much less interesting to analyse from a GVC perspective This is all the more true for other services, such as for example personal or retail services. They require a physical interaction between the buyer and provider of the service and a major part of the value added in these chains is effectively not internationally contestable. More detailed data on trade in, and production of, services is needed before meaningful GVC analyses of final services can be made.

[8] It is important to note that GVCs of manufactures do not coincide with all activities in the manufacturing sector: some activities in the manufacturing sector are geared toward production of intermediates for final nonmanufacturing products and are not part of manufactures GVCs. For example, the production of concrete for the construction industry.

We then define world GVC income as the GVC income summed over all countries. Note that this will be equal to world expenditure on manufacturing goods as we model all regions in the world in our empirical analysis. By definition, any dollar spent on final goods must end up as income for production factors somewhere in the world. The competitiveness of a country in global production of manufactures can then be traced through expressing its GVC income as a share of world GVC income: $\mathrm{GVC(k)}/\sum_k \mathrm{GVC(k)}$

[Figure 2 about here]

3. World Input-Output Database (WIOD)

Central in the WIOD is a time-series of world input-output tables. A world input-output table (WIOT) can be regarded as a set of national input-output tables that are connected with each other by bilateral international trade flows. This is illustrated by the schematic outline for a WIOT involving three countries in Figure 3. A WIOT provides a comprehensive summary of all transactions in the global economy between industries and final users across countries. The columns in the WIOT contain information on production processes. When expressed as ratios to gross output, the cells in a column provide information on the shares of inputs in total costs. Such a vector of cost shares is often referred to as a production technology. Products can be used as intermediates by other industries, or as final products by households and governments (consumption) or firms (stocks and gross fixed capital formation). The distribution of the output of industries over user categories is indicated in the rows of the table. An important accounting identity in the WIOT is that gross output of each industry (given in the last element of each column) is equal to the sum of all uses of the output from that industry (given in the last element of each row).

[Figure 3 about here]

In addition to a national input-output table, imports are broken down according to the country and industry of origin in a WIOT. This allows one, for example, to trace the country of origin of the chemicals used in the food industry of country A. The combination of national and international flows of products provides a powerful tool for analysis of global production networks as will be shown in section 2. While national tables are routinely produced by national statistical institutes, WIOTs are not, as they require integration of national account statistics across countries. It is this gap that the WIOD project aimed to fill.

The second release of the WIOD in November 2013 provides a time-series of world input-output tables (WIOTs) from 1995 to 2011. It covers forty countries, including

all twenty-seven members of the European Union (as of 1 January 2007) and thirteen other major economies: Australia, Brazil, Canada, China, India, Indonesia, Japan, Mexico, Russia, South Korea, Taiwan, Turkey and the United States (see Appendix Table 1 for a full list). These countries have been chosen by considering both the requirement of data availability of sufficient quality and the desire to cover a major part of the world economy. Together, the countries cover more than 85 per cent of world GDP in 2008 (at current exchange rates). In addition, a model for the remaining non-covered part of the world economy is estimated, called the "rest of the world" region. To address several important research questions it is crucial to have a full model of the world economy. The values in WIOTs are expressed in millions of US$ and market exchange rates were used for currency conversion. All transaction values are in basic prices reflecting all costs borne by the producer, which is the appropriate price concept for most applications. International trade flows are accordingly expressed in "free on board" (fob) prices through estimation of international trade and transport margins.

The WIOTs have an industry-by industry format as many applications require such a square matrix reflecting the economic linkages across industries. They provide details for 35 industries mostly at the 2-digit ISIC rev. 3 level or groups thereof, covering the overall economy. These include agriculture, mining, construction, utilities, fourteen manufacturing industries, telecom, finance, business services, personal services, eight trade and transport services industries and three public services industries. This level of detail was dictated by the available data, reflecting the lowest common denominator across countries. The WIOTs are built up from published and publicly available statistics from national statistical institutes around the world, plus various international statistical sources such as OECD and UN National Accounts.

The World Input-Output Database has a number of distinguishing characteristics when compared with other data initiatives.[9] First and above all, the WIOTs from WIOD have been specifically designed to trace developments over time through benchmarking to time-series of output, value added, trade and consumption from national accounts statistics. Second, WIOD is based on official and publicly available data from statistical institutes to ensure a high level of data quality. In particular, it is constructed within the framework of the international System of National Accounts and obeys its concepts and accounting identities. This obviously restricted the number of countries that could be covered in WIOD as there is a trade-off between quality and coverage. Third, the WIOTs have been constructed on the basis of sets of national supply and use tables (SUTs) that are the core statistical sources from which statistical institutes derive national input-output tables. SUTs provide a more natural starting point for building WIOTs than national input-

[9] See Tukker and Dietzenbacher (2013) for an overview of existing global input-output databases.

output tables, which are the basic building blocks in other initiatives. Input-output tables contain less information and are typically derived from SUTs with additional assumptions. Moreover, SUTs can easily be combined with trade statistics that are product-based and employment statistics that are industry-based and allow one to take the multi-product nature of firms into account. Dietzenbacher et al. (2013) and Timmer et al. (2015) discuss how WIOD dealt with four major challenges in data construction: harmonisation of basic supply and use tables data; derivation of time-series; disaggregation of imports by country of origin and use category, and global closure.

Fourth, apart from the WIOTs themselves, the WIOD also provides tables with underlying data and statistics that have been used to construct the WIOT. Examples are national and international supply and use tables, as well as valuation matrices with product-specific trade and transportation margins and net taxes. In addition, the WIOD provides data on the quantity and prices of factors inputs, including data on workers and wages by level of educational attainment and capital inputs. These data are provided in the so-called *Socio-economic accounts* and can be used in conjunction with the WIOTs as similar industry classifications are used. This greatly enhances the scope of analysis, as shown in the next section. Finally, the WIOD is yet the only database that is publicly available and for free at www.wiod.org.

4. Increasing international fragmentation of production

Previous studies of globalisation tended to claim that international production fragmentation is mainly taking place within regional trade blocs rather than being a truly global phenomenon. This claim is often based on observations of increasingly denser networks of intermediate input flows between countries belonging to the same region (e.g. Baldwin and Lopez-Gonzalez, 2013). However, gross trade flows are no longer representative of the value added flows, and the value added content of trade between countries within a region might well be lower than between countries across regions. As shown above, global value chain decompositions provide a particularly useful tool to analyse the geographical distribution of value added in production. In this section we focus on the global production of manufactures and answer the question whether this process is mainly taking place within a regional bloc (regional fragmentation) or also involves fragmentation outside blocs (global fragmentation).

To analyse the geographical distribution of value added in the production of manufactures we use the decomposition given in equation (1) where F is chosen as one unit of final demand for manufactures coming from a given country-of-completion. For

each country-of-completion we indicate the amounts of value added that originates domestically, regionally and globally. Regional value added is all value that is added outside the country-of-completion, but in the region to which this country-of-completion belongs. Global value added is the value added in all countries outside this region. By definition the domestic, regional and global value added shares add up to unity as in equation (4). In line with Baldwin and Lopez-Gonzalez (2013), we distinguish three major regional trading blocs: EU, including the 27 member countries of the European Union as of 2011; NAFTA, the North-American Free Trade Agreement countries: Canada, Mexico and the US; and East Asia comprising China, Japan, South Korea and Taiwan. While the latter region does not have an exclusive multilateral trade agreement amongst its members, it is characterized by strong international trade and investment links.

In Table 2 we provide decomposition results for 2008, and the change in shares between 1995 and 2008. The results for the 24 countries are grouped by trade bloc and sorted within blocs according to final output value. So, for example, the table shows that the final output value of manufactures in Germany in 2008 was 950 billion US$, of which 14% was generated within Europe but outside Germany, and 16% outside Europe. Since 1995, value added outside Germany has increased by 12 percentage points, of which 8 percentage points outside the EU.

The first major finding is that in all countries, except in Canada, the share of domestic value added has declined between 1995 and 2008, and in some countries even by up to 15 percentage points. Production is indeed fragmenting internationally at a fast pace. Nevertheless, the share of domestic value added is still substantial in 2008. For major countries in Europe, domestic shares are in-between 65 to 75 percent, and higher at about 80% in the US and Japan. Smaller countries typically have lower domestic shares, which drop to less than 55% in the cases of Belgium and the Netherlands. The second finding is that value chains are becoming truly globalised: since 1995 global shares increased much faster than regional shares in all countries as more and more intermediates are sourced from outside the region. Los et al. (2015a) provide further evidence that this trend is pervasive across various manufacturing product groups.

[Table 2 about here]

5. Trends in GVC incomes in global production of manufactures

As shown so far, the value added contribution of countries to domestic production chains is generally declining. This also implies that their contribution to foreign value chains is increasing. To analyse a country's competitiveness one therefore has to measure its

contributions to all production chains, domestic and foreign. This was defined in section 2 as a country's "GVC income": the income of all domestic production factors that have been directly and indirectly used in the production of final manufacturing goods, see equation (5). These indirect contributions are explicitly accounted for through the modeling of input-output linkages across sectors. And to calculate this GVC income we choose F in equation (1) as the vector of worldwide consumption of manufactures.

Figure 3, Panel A, provides a comparison of the GVC incomes in advanced and emerging regions in the production of final manufacturing goods, based on equation (5). The GVC income share of advanced countries (East Asia plus the United States, Canada, Australia, and the EU15) has been declining from almost three-quarters in 1995 to just above half of world GVC income.[10] Emerging regions have rapidly increased their shares, and almost all of this increase was realized after 2003. It should be kept in mind that international competition is not a zero-sum game, and declining shares in global GVC do not necessarily mean an absolute decline in GVC income in a region. On the contrary, in real terms, world GVC income on manufactures (deflated by the U.S. Consumer Price Index) has increased by about one-third over the period 1995–2008. Panel B shows that the increase in the GVC income in emerging countries has always been higher than in advanced countries, reaching a peak in 2008 at a time when advanced countries' GVC income stalled. The drop in the crisis year of 2009 was large for all countries, but recovery occurred much faster in the emerging economies.

In Figure 4 we show the shares of regions in world GVC income in the production of manufactures for the period from 1995 to 2011. The figure plots measures for five groups of countries, namely NAFTA (Canada, Mexico, and the United States); the European Union (EU), consisting of the 27 EU member states; East Asia, consisting of Japan, South Korea, and Taiwan; China; and BRIIAT, which includes Brazil, Russia, India, Indonesia, Australia, and Turkey. In Table 3, additional data for 34 major individual economies can be found for 1995, 2002, 2008 and 2011. The figure illustrates that the share of the NAFTA countries in world GVC income increased during the ICT bubble years, climbing as high as 30 percent, at which point its share was even higher than that of the EU. But it rapidly declined after 2001, reaching a low of 20 percent in 2008. The decline of the advanced nations is particularly due to the demise of East Asia, whose share has been declining rapidly since the mid-1990s. While the shares of South Korea and Taiwan are still increasing, the GVC income share of Japan has been declining rapidly. In

[10] One might hypothesize that shifts in the composition of global manufacturing demand in terms of the type of products being demanded might also be a determinant of the decline of the advanced nations in global manufacturing production. However, the product structure of global demand remained stable over the period 1995 to 2009.

contrast, the EU GVC income share has been relatively stable, only slowly declining over the period from 1995 to 2008. France, Italy, and the United Kingdom slowly lost some shares. The German share dropped rapidly in the latter 1990s, but stabilized afterwards. These drops were compensated by increasing shares for other EU countries, in particular the new member states. As is well known, the aftermath of the global financial crisis hit Europe particularly hard, and its share dropped sharply from 32 in 2003 to 24 percent in 2011. On the flip side, the share of other regions in the world rapidly increased. China is mainly responsible for the increase of the emerging countries' share, because its share accelerated after its accession to the WTO in 2001. In 2007 it overtook East Asia in terms of share. In 2009, the Chinese GVC income share overtook that of the combined countries of BRIIAT. And in 2011 its share was higher than in the U.S., making it the number one country in terms of value added in global production of manufactures.

One might argue that these shifts in regional GVC income shares are unsurprising, given the faster growth of China and other emerging economies vis-à-vis advanced regions. Higher consumption in the home economy would naturally lead to higher GVC incomes. But this is only true to the extent that demand for manufactures has a strong home production bias—that is, a bias mainly geared towards goods with a high level of domestic value-added. Given the high tradability of manufacturing goods, this home bias is not obvious, however. Increased Chinese demand for, say, chemicals or electronic equipment can be as easily served by imports as by Chinese domestic production. And in the latter case, a sizable share could still be captured by advanced countries through the delivery of key intermediate inputs and services. Falling shares in global GVC income for advanced regions in Figure 5 indicate that they failed to capture a large part of the value of the increased market for manufacturing goods in emerging economies. At the same time, the domestic value-added content of their own production declined. Both trends can be interpreted as a loss of competitiveness.

[Figures 4 and 5 about here]
[Table 3 about here]

A number of caveats are in order. Shares in world GVC income are expressed in U.S. dollars using current exchange rates. For income changes over time, we deflate incomes in U.S. dollars to the 1995 U.S. dollar value using the U.S. current price index (CPI). Exchange rates have fluctuated over the period considered: the dollar-to-euro rate.[11] declined sharply over 1995–2001, followed by a steep rise, which by 2007 had returned it to near its 1995 value. The yen-to-dollar rate fluctuated around a long-term constant for

[11] The euro was introduced in 2001. For the period before 2001, we refer here to the DM.

this period. The yuan-to-U.S. dollar rate was effectively constant over this period, slightly appreciating at the end of the 2000s. The choice of the U.S. dollar as numéraire has no impact on the GVC income measure of a country relative to other countries. For example, calculating GVC incomes shares of a country in yen or euros would give identical results. But it will affect the absolute levels of GVC incomes and hence comparisons over time within a country.

Second, one has to keep in mind that the location where the value is being added is not necessarily identical to where the generated income will eventually end up. The building of global production chains is not only through arms-length trade in intermediate inputs; it also involves sizable flows of investment, and part of the value-added in emerging regions will accrue as income to multinational firms headquartered in advanced regions through the ownership of capital. What is needed is to analyze capital income on a national rather than a domestic basis as we do in this chapter. Data on foreign ownership is notoriously hard to acquire, not least because of the notional relocation of profits for tax accounting purposes. Hence, further research is needed in this area (Baldwin and Kimura 1998; Lipsey 2010). The decline in East Asian GVC income is likely overestimated, as it is also related to the offshoring of activities to China, which effectively became the assembly place of East Asia (Fukao, 2003). Income earned by East Asian capital is allocated to the place of production (in this case China) and not by ownership. This difference is probably larger for East Asian countries than for NAFTA or the EU. The latter regions have larger within-region FDI flows, such that they net out in regional aggregate numbers presented here.

The production of manufacturing goods involves a wide variety of activities, which do not only take place in the manufacturing sector. Using the decomposition technique outlined above, one can trace not only the country but also the sector in which value is added during the production process. Typically, the value that is added by activities in the manufacturing sector itself is around half the basic price value of a good, and it declines over time as services activities are outsourced. In Table 4 we provide for each country the share of a sector in the GVC income related to manufactures. This is done for 20 major economies in 1995 and 2008, distinguishing between three broad sectors: 1) natural resources, including the agriculture and mining industries (ISIC Rev. 3 industries A to C), 2) manufacturing, including all manufacturing industries (D), and 3) services including all other industries (E to Q). The table shows that the share of value added in the manufacturing sector has declined between 1995 and 2008 in all countries except South Korea. The unweighted average share across all 20 countries declined from 54 percent to 50 percent. This partly reflects a shift away from traditional manufacturing activities, such

as those carried out by blue-collar production workers, but also the outsourcing of white-collar activities by manufacturing firms to domestic services firms. Contributions from the natural resources sector are high and have increased over the 1995–2008 period in countries such as Australia, Canada, Indonesia, Mexico, Russia,[12] and Turkey. This pattern of value-added suggests that for resource-abundant countries, activities within manufacturing production networks are reinforcing their comparative advantage. Given its low level of development, services contribute relatively much in India, reflecting its well-developed business services sector, which delivers intermediate services to both domestic and foreign manufacturing firms. In China, the share of natural resources is declining, and activities in the services sector are starting to contribute more, but the level is still well below the contributions of services in Europe and the United States. This hints towards a clear pattern of specialization in which advanced countries increasingly focus on non-production activities within manufacturing networks.

[Table 4 here]

6. Value Added by Capital and Labour

How much of the GVC income accrues to the various production factors? Our income data on labor and capital allow us to study which production factors have benefited from the changes in the regional distribution of global value-added. Increasing trade and integration of world markets have been related to increasing unemployment and stagnating relative wages of low- and medium-skilled workers in developed regions. On the other hand, those factors have offered new opportunities in developing regions for countries to employ their large supply of low-skilled workers. To study these trends, we decomposed value-added into capital and three labour types. Labour skill types are classified on the basis of educational attainment levels as defined in the International Standard Classification of Education (ISCED): low-skilled (ISCED categories 1 and 2), medium-skilled (ISCED 3 and 4) and high-skilled (ISCED 5 and 6). Data has been collected for the number of workers involved in production, including employees, self-employed and family workers. Additional imputations of the labour income of self-employed and family workers were made to adjust for the underestimation of the labour income share in the national accounts statistics, in particular for less advanced nations (Gollin, 2002). Capital income is derived as a residual and defined as gross value added minus labor income. It represents

[12] The share of the natural resource sector in Russia is severely underestimated, since part of the oil and gas production is classified under wholesale services rather than under mining in the Russian national accounts. Adding the wholesale sector would almost double the natural resource share in 2008.

remuneration for capital in the broadest sense, including physical capital (such as machinery and buildings), land (including mineral resources), intangible capital (such as patents and trademarks), and financial capital.

In Table 5 we provide a breakdown of GVC income by labor and capital for major regions. This is a breakdown of the GVC income discussed in the previous section. At the global level, the most important finding is that the share of GVC income that goes to labor is coming down, while the share of capital is increasing. In addition, medium- and low-skilled workers are losing out to high-skilled workers. The income shares for low- and medium-skilled workers dropped by about 4 percentage points over the 1995-2008 period. Income shares for high-skilled workers increased by 1.5 percentage points and for capital more than 6 percentage points. The trends appear to have changed over time. Up to the early 2000s the decline of low-skilled and increase of high-skilled shares dominated. Since then the divergent trends in medium-skilled labour and capital shares dominate, which provides suggestive evidence in favour of the routinization hypothesis. According to the "routinization hypothesis" put forward by Autor et al. (2003), information technology capital complements highly educated workers engaged in abstract tasks, substitutes for moderately educated workers performing routine tasks, and has little effect on less-skilled workers performing manual and services tasks. Timmer et al. (2014) find similar evidence for a larger set of GVCs and discuss possible reasons. Further econometric analysis is needed to disentangle effects of substitution and possible biases in technical change.

The global trend is reflected within regions. In all regions, the compensation for capital is increasing relative to labor. Particularly in emerging regions, this increase is important and occurs faster than the labor income increase.[13] This might be related to the low wage/rental ratios in these regions that were still characterized by an abundant surplus of low-skilled workers from agricultural and informal urban sectors. In advanced regions, the increasing importance of capital might be a reflection of the increased investment in so-called intangible assets, which are becoming increasingly important for growth in advanced nations (see Corrado et al, in this volume).

[13] It is important to note that the share captured by capital in emerging markets is known to be overestimated. Our approach is based on domestic production accounting for the location of the production factor and is silent on the ownership, as discussed before. In the case of labor income, this is unproblematic, as for most countries cross-border labor migration is relatively minor. Hence labor income paid out in a particular country mostly benefits the workers of the country in which production takes place.

As expected, GVC income for low-skilled workers has increased strongly in China and in other emerging economies while declining in the advanced regions. In the United States and East Asia, the decline was particularly pronounced for medium-skilled workers. Within Europe, medium-skilled workers in Germany lost the biggest share, and in other European countries the income share going to low-skilled workers also declined. Income for high-skilled workers related to global manufacturing went up in most EU countries. This is not simply the result of a strong supply of higher-skilled labor replacing medium skilled workers but essentially carrying out the same activities. If this were the case, the wages for high-skilled workers should have dropped and the increase in GVC income of high-skilled workers would be limited. However, relative wages for high-skilled workers did not show this pattern (see Timmer et al. 2013).

[Table 5 about here]

7. Concluding remarks

With the availability of new global input-output tables, novel perspectives on trade, growth and jobs have been developed. In this chapter we introduced the global-value-chain approach which highlights the importance of global production networks and the increasing interrelation of consumption, production, and income across national boundaries through the trade of goods and services. We analyzed the value-added of production for a wide set of manufacturing products. This was done through a newly developed accounting method in which we built upon an input-output modeling of the world economy in the tradition of Leontief. The results based on the World Input-Output Database show that, first, international fragmentation in the production of manufactures has been on-going since 1995 as shown by increasing shares of foreign value added in production. In particular, value added from outside the region to which a country belongs has been rising fast. Second, this has been accompanied by a rapid shift towards higher-skilled activities in advanced nations. And third, these activities are increasingly carried out in the services sector and no longer in the manufacturing sector itself. As such, the shift contributes to the so-called job polarization in advanced economies, as the displaced manufacturing workers are likely to be absorbed into personal and distributional services, where low-skilled employment opportunities are still growing (Goos, Manning, and Salomons 2014). Emerging economies are taking up increasing shares in global GVC income, much of which has been driven by rapid growth in China after its accession to the WTO in 2001. We also find increasing intertwining of manufacturing and services

activities, which argues against a myopic view of job creation in manufacturing or fears for de-industrialisation. Rather than focusing on the particular sector in which jobs are lost or created, the discussion should be led by a view toward the activities that are carried out in GVCs, irrespective of the sector in which they are ultimately classified. Thinking in terms of sectors is basically a relic of a world where fragmentation of production, both domestically and international, had not progressed far.

Although the model to measure GVC income is relatively straightforward, it is clear that the validity of the findings relies heavily on the quality of the database used. The contributions in Houseman and Mandel (2015) provide a good overview of the various measurement issues that arise, in particular in the context of international trade flows. Possible solutions are discussed as well, indicating future priorities of statistical programs. Alongside new measures of exports and imports there is the ongoing need for high-quality series of national input-output tables, as well as detailed accounts of the labour and capital inputs into production. The KLEMS databases described in this volume provide unique and indispensable information to analyse the impact of trade and technological change on labour markets and more generally welfare. The World KLEMS initiative is therefore highly instrumental in bringing this work forward. We believe that the future development of this type of data should ideally be shouldered by its incorporation in regular statistical programs. Given the international nature of the global input-output tables, this must involve coordination by international agencies. Therefore we welcome the current OECD-WTO initiative in taking this work forward in the international statistical community (OECD and WTO, 2013). Together with national KLEMS-type database, the global input-output tables will be an indispensable tool to understand future developments of the global economy.

References

Ali-Yrkkö, J., P. Rouvinen, T. Seppälä and P. Ylä-Anttila (2011), *Who Captures Value in Global Supply Chains?*, ETLA Discussion Papers, No 1240, ETLA: Helsinki.

Amador, J. and Cabral, S. (2014), "Global Value Chains: A Survey of Drivers and Measures." *Journal of Economic Surveys*. doi: 10.1111/joes.12097

Autor, David H, Frank Levy and Richard J. Murnane. 2003. "The Skill Content of Recent Technological Change: An Empirical Exploration." *The Quarterly Journal of Economics*, 118 (4): 1279-1333.

Baldwin, R.E. and J. Lopez Gonzalez (2013), "Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses", NBER Working Paper 18957.

Baldwin, R.E. and F. Kimura (1998), "Measuring U.S. International Goods and Services Transactions", in: R.E. Baldwin, R. E. Lipsey, and J.D. Richardson (eds.), *Geography and Ownership as Bases for Economic Accounting*, NBER Chicago, pp. 49-80.

Corrado, C., J.Haskel, C.Jona-Lasinio and M. Iommi, (2015), "Intangible Capital and Growth in Advanced Economies: Measurement Methods and Comparative Results", this book.

Dedrick, J., K.L.Kraemer and G. Linden (2010), "Who Profits From Innovation in Global Value Chains? A Study of the iPod And Notebook PCs", *Industrial and Corporate Change*, vol. 19 (1), pp. 81-116.

Dietzenbacher, E., B. Los, R. Stehrer, M. Timmer and G.J. de Vries (2013), "The Construction of World Input-Output Tables in the WIOD Project", *Economic Systems Research*, vol. 25(1), pp. 71-98.

Feenstra, R. (2010) *Offshoring in the Global Economy: Microeconomic Structure and Macroeconomic Implications*, MIT Press.

Francois, J. and B. Hoekman (2010), "Services Trade and Policy", *Journal of Economic Literature*, vol. 48(3), pp. 642-92.

Fukao, Kyoji, Hikari Ishido and Keiko Ito (2003). "Vertical Intra-Industry Trade and Foreign Direct Investment in East Asia." *Journal of the Japanese and International Economies*, 17(4): 468-506.

Gollin, D. (2002), "Getting Income Shares Right", *Journal of Political Economy*, vol. 110(2), pp. 458-74.

Goos, M., A. Manning and A. Salomons (2014), "Explaining Job Polarization: Routine-Biased Technological Change and Offshoring", *American Economic Review*, 104(8), pp. 2509-26.

Houseman, Susan N. and Michael Mandel, (eds). (2015), *Measuring Globalization: Better Trade Statistics for Better Policy*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

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

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

Leontief, W. (1949), "Structural Matrices of National Economies", *Econometrica*, vol. 17, pp.273–82.

Lipsey, R.E. (2010), "Measuring The Location of Production in a World of Intangible Productive Assets, FDI and Intrafirm Trade", *Review of Income and Wealth*, vol. 56(s1), p.S99-S110.

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

Los, B., M.P. Timmer and G.J. de Vries (2015b), "How Important Are Exports for Job Growth in China? A Demand Side Analysis", *Journal of Comparative Economics*, 43, pp. 19-32.

Marin, D. (2011), "The Opening Up of Eastern Europe at 20: Jobs, Skills, and 'Reverse Maquiladoras'" in: M. Jovanovic (ed.), *Handbook of International Economics*, Vol. 2, Edward Elgar.

Miller, R.E. and P.D. Blair (2009), *Input-output Analysis: Foundations and Extensions*, Cambridge University Press.

OECD and WTO (2013), "Trade in Value Added: Concepts, Methodologies and Challenges", Joint OECD-WTO note, available at http://www.oecd.org/sti/ind/statisticalqualityoftiva.htm

Timmer, M.P., B. Los, R. Stehrer and G.J. de Vries (2013), “Fragmentation, Incomes and Jobs. An Analysis of European Competitiveness”, *Economic Policy*, vol. 28(76), pp. 613-61.

Timmer, M.P., A.A. Erumban, B. Los, R. Stehrer and G.J. de Vries (2014), “Slicing Up Global Value Chains”, *Journal of Economic Perspectives*, vol. 28(2), pp. 99-118.

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer and G.J. de Vries (2015),"An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production", *Review of International Economics*.

Tukker, A. and Dietzenbacher, E. (2013), “Global Multiregional Input-output Frameworks: An Introduction and Outlook”, *Economic Systems Research*, vol. 25(1), pp. 1-19.

Figure 1. Stylized representation of an internationally fragmented value chain

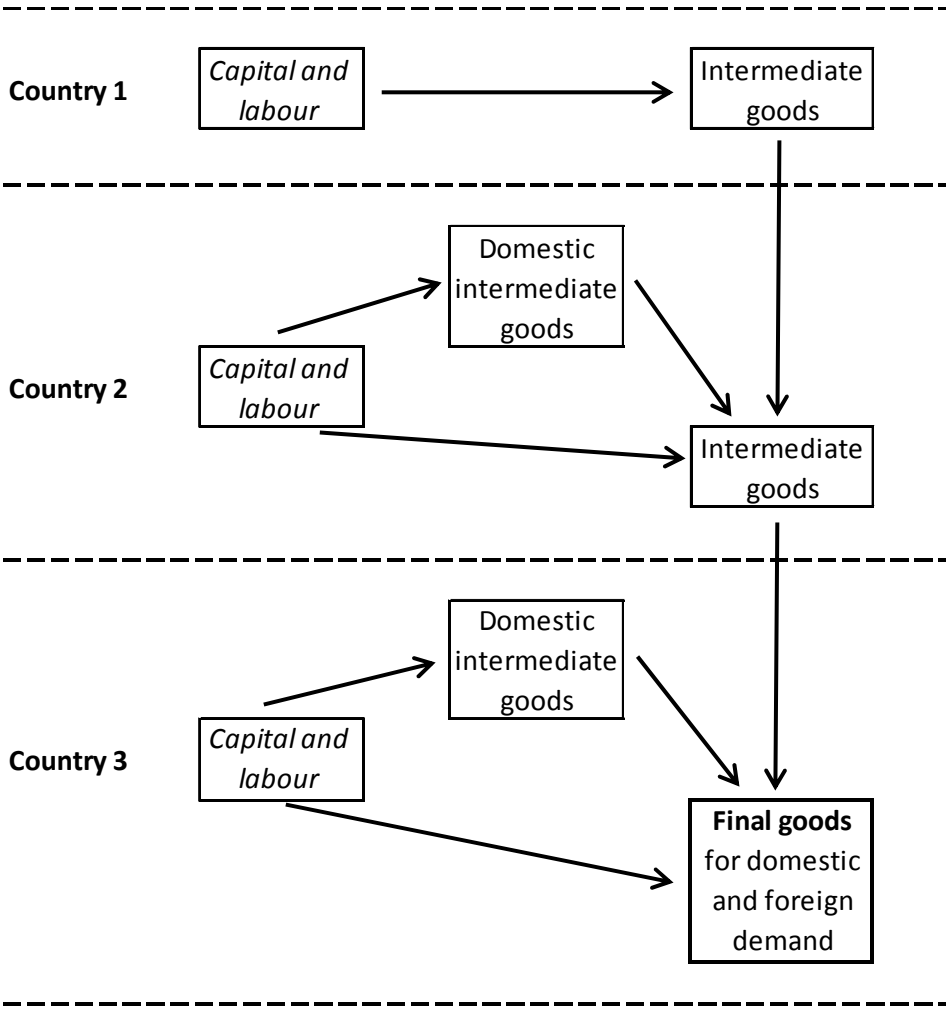


Figure 2 An accounting framework for global value chains

			Final products of a global value chain, identified by country-industry of completion							Value added
			Country 1			…	Country M			
			Industry 1	…	Industry N	…	Industry 1	…	Industry N	
Value added from country-industries participating in global value chains	Country 1	Industry 1								
		…								
		Industry N								
	…	…								
	Country M	Industry 1								
		…								
		Industry N								
Total final output value										**World GDP**

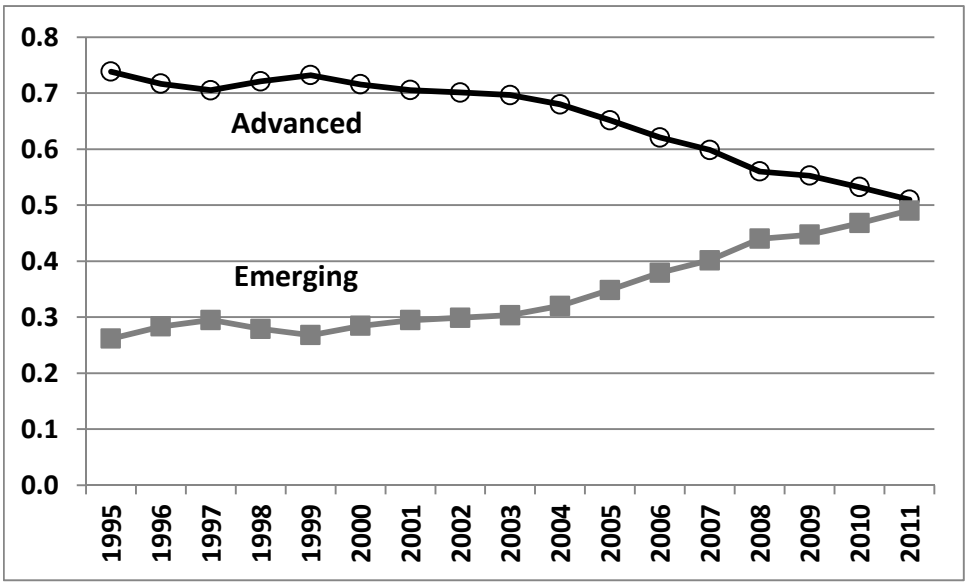
Note: Cell values represent the value added generated in the country-industry given in the row, within the global value chain corresponding to the country-industry of completion given by the column.

Figure 3 Schematic outline of a World Input-Output Table (WIOT)

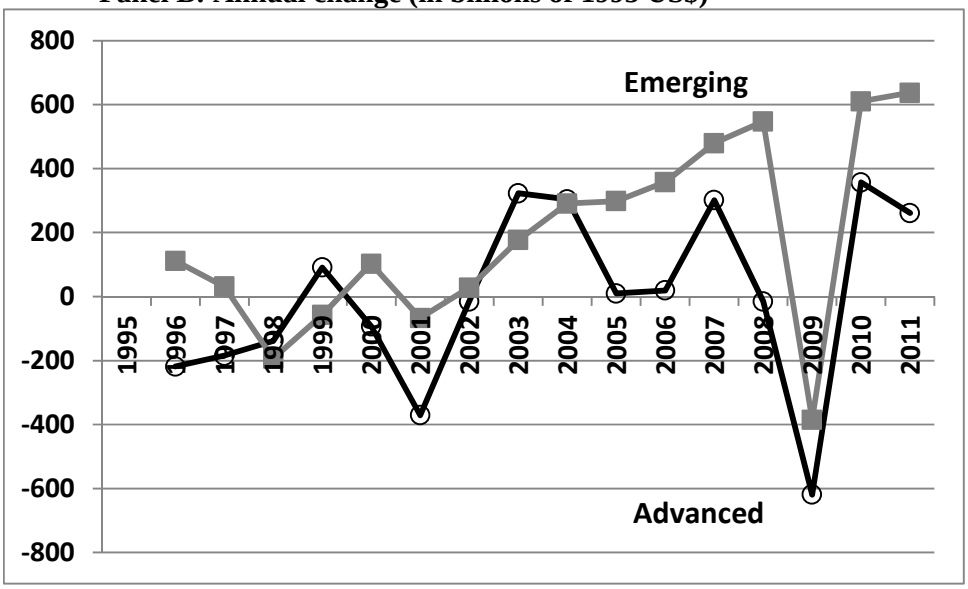
			Use by country-industries							Final use by countries			Total use
			Country 1			…	Country M			Country 1	…	Country M	
			Industry 1	…	Industry N	…	Industry 1	…	Industry N		…		
Supply from country-industries	Country 1	Industry 1											
		…											
		Industry N											
	…	…											
	Country M	Industry 1											
		…											
		Industry N											
Value added by labour and capital													
Gross output													

Figure 4 GVC Incomes in Advanced and Emerging Countries, All Manufactures, 1995–2011

Panel A: Shares in world GVC income



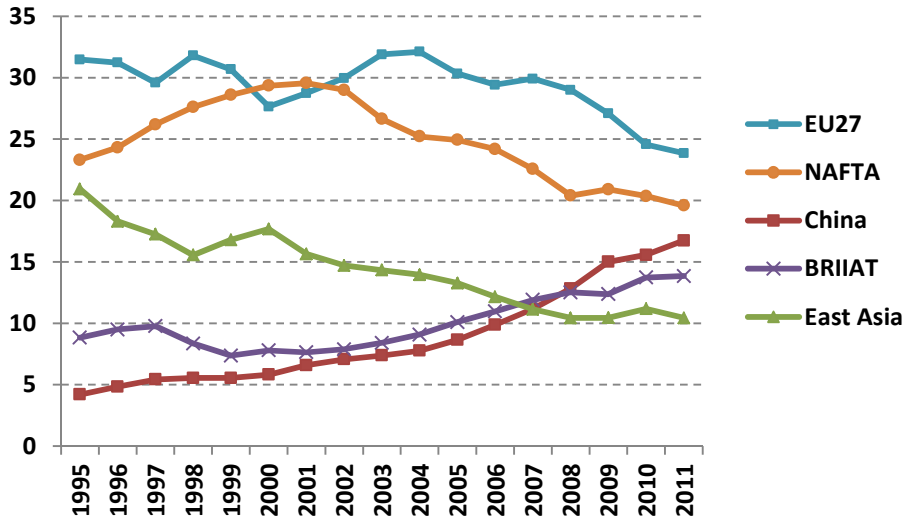
Panel B: Annual change (in billions of 1995 US$)



NOTE: "Advanced" includes EU-15, Japan, Korea, Taiwan, Australia, Canada and the United States. "Emerging" includes all other countries in the world. National currencies converted to U.S.dollars with official exchange rates, deflated to 1995 prices with the U.S. CPI. World GVC income is equal to world expenditures on manufacturing products at basic prices, see section 2.

SOURCE: Authors' calculations based on World Input-Output Database, November 2013 release.

Figure 5 Regional Shares in World GVC Income, All Manufactures, 1995–2011 (%)



NOTE: Value-added by regions in the production of final manufacturing goods (see equation 5). East Asia includes Japan, South Korea and Taiwan. BRIIAT includes Brazil, Russia, India, Indonesia, Australia, and Turkey. EU27 includes all European countries that have joined the European Union as of 1 January 2007. NAFTA includes Canada, Mexico and the United States. Shares do not add up to 100 percent as the remainder is the share of all other countries in the world.

SOURCE: Authors' calculations based on World Input-Output Database, November 2013 release.

Table 1 Value added shares in final output of automotives from Germany (%).

Generated in	1995	2008	change
Germany	78.9	66.0	-12.8
Eastern Europe	1.3	4.3	3.0
Other European Union	11.9	14.3	2.4
NAFTA	2.5	3.1	0.6
East Asia	2.1	4.3	2.2
Other	3.3	8.0	4.7
Total	100.0	100.0	

Notes: Decomposition of final output of the transport equipment manufacturing industry in Germany (ISIC rev. 3 industries 34 and 35) based on equation (2). Eastern Europe refers to countries that joined the EU on 1 May 2004 and 1 January 2007. East Asia refers to China, Japan, South Korea, and Taiwan. Numbers may not sum due to rounding.
Source: Authors' calculations based on the World Input-Output Database, November 2013 release.

Table 2 Regional value added distribution of final output of manufactures by country-of-completion

Country of completion	Final output (US$ mil) in 2008	Value added shares in 2008			Change in shares (2008 minus 1995)		
		Domes-tic	Re-gional	Global	Domes-tic	Re-gional	Global
European Union							
Germany	949,854	0.70	0.14	0.16	-0.12	0.04	0.08
Italy	556,645	0.72	0.11	0.16	-0.07	0.00	0.07
France	512,973	0.69	0.15	0.16	-0.09	0.02	0.08
Great Britain	317,244	0.74	0.12	0.14	-0.04	0.00	0.04
Spain	275,311	0.68	0.15	0.17	-0.10	0.02	0.09
Netherlands	160,488	0.54	0.19	0.27	-0.10	-0.01	0.10
Poland	129,775	0.67	0.18	0.15	-0.15	0.06	0.09
Belgium	113,180	0.45	0.34	0.21	-0.10	0.01	0.09
Sweden	100,815	0.60	0.22	0.18	-0.11	0.04	0.07
East Asia							
China	1,655,179	0.79	0.05	0.16	-0.06	-0.01	0.07
Japan	938,876	0.81	0.03	0.16	-0.13	0.02	0.11
South Korea	242,766	0.59	0.12	0.29	-0.15	0.04	0.10
Taiwan	92,895	0.53	0.13	0.34	-0.14	0.02	0.12
NAFTA							
United States	1,961,475	0.80	0.04	0.16	-0.08	0.02	0.06
Mexico	321,788	0.74	0.12	0.14	-0.02	-0.04	0.06
Canada	237,253	0.68	0.15	0.17	0.00	-0.05	0.05
Other							
Brazil	380,110	0.83	0.03	0.14	-0.07	0.01	0.06
Russia	229,801	0.85	0.07	0.09	-0.02	0.00	0.02
Turkey	189,296	0.78	0.09	0.13	-0.07	0.02	0.05

Notes: Domestic, regional and global value added shares in final output from manufacturing industry in country-of-completion based on equation (2). Regional value added includes value added by countries in the region to which the country-of-completion belongs (European Union, NAFTA or East Asia), but excludes value added in the country-of-completion itself. Global value added is the value added by all countries outside this region. By definition, domestic, regional and global shares add up to 100 per cent. For Brazil the regional value added share refers to the NAFTA countries. For Russia and Turkey the regional value added share refers to countries in the European Union.

Source: Authors' calculations based on the World Input-Output Database, November 2013 release.

Table 3 Country GVC income in production of manufactures (as % of world)

	1995	2002	2008	2011
United States	19.91	23.90	15.81	15.02
Japan	17.52	11.36	7.79	7.59
Rest of the world	11.28	11.39	14.83	15.56
Germany	9.38	7.78	7.64	6.47
France	4.44	4.24	3.79	3.09
Italy	4.39	4.38	4.07	3.15
China	4.21	7.07	12.83	16.73
United Kingdom	3.85	4.18	2.99	2.43
Brazil	2.48	1.63	3.05	3.34
South Korea	2.15	2.08	1.80	2.01
Spain	1.94	1.91	1.97	1.64
Canada	1.88	2.24	2.18	2.40
India	1.72	2.00	2.64	3.20
Mexico	1.50	2.85	2.39	2.17
Netherlands	1.43	1.29	1.37	1.16
Indonesia	1.27	1.07	1.31	1.74
Taiwan	1.26	1.26	0.84	0.83
Russian Federation	1.22	1.26	2.84	2.75
Turkey	1.11	0.90	1.41	1.28
Australia	1.03	1.02	1.29	1.52
Belgium	1.01	0.83	0.80	0.68
Sweden	0.84	0.81	0.81	0.75
Austria	0.76	0.67	0.72	0.60
Denmark	0.55	0.50	0.48	0.37
Poland	0.51	0.61	0.98	0.83
Finland	0.44	0.43	0.42	0.31
Portugal	0.36	0.33	0.31	0.25
Ireland	0.33	0.54	0.47	0.38
Greece	0.31	0.28	0.35	0.25
Czech Republic	0.22	0.32	0.48	0.40
Romania	0.18	0.18	0.37	0.31
Hungary	0.17	0.24	0.31	0.27
Slovenia	0.08	0.09	0.10	0.07
Slovak Republic	0.08	0.10	0.20	0.16

Notes: Contribution of countries to final output of manufactures in any country in the world, based on equation (5). Results for 34 most important countries that are covered in the WIOD database. Countries ranked on share in 1995.

Table 4 Sectoral Shares in Total GVC Income, All Manufactures (% of total)

	Natural resources		Manufacturing		Services	
	1995	2011	1995	2011	1995	2011
United States	0.06	0.09	0.56	0.52	0.38	0.39
Japan	0.04	0.03	0.65	0.61	0.31	0.36
Germany	0.03	0.02	0.61	0.56	0.36	0.42
France	0.07	0.04	0.48	0.45	0.46	0.50
United Kingdom	0.07	0.07	0.60	0.49	0.34	0.44
Italy	0.05	0.03	0.57	0.52	0.38	0.44
Spain	0.09	0.05	0.54	0.52	0.37	0.43
Canada	0.12	0.19	0.54	0.44	0.34	0.37
Australia	0.20	0.26	0.42	0.35	0.37	0.39
South Korea	0.10	0.04	0.62	0.68	0.28	0.28
Netherlands	0.11	0.12	0.49	0.43	0.40	0.45
China	0.21	0.17	0.58	0.57	0.22	0.26
Russian Federation	0.20	0.21	0.42	0.39	0.38	0.40
Brazil	0.13	0.17	0.55	0.46	0.32	0.37
India	0.22	0.18	0.42	0.42	0.35	0.40
Mexico	0.21	0.22	0.49	0.49	0.30	0.29
Turkey	0.09	0.13	0.64	0.50	0.27	0.37
Indonesia	0.22	0.30	0.61	0.54	0.18	0.16
Poland	0.15	0.10	0.53	0.49	0.32	0.42

NOTE: The numbers represent the share of that sector in total value-added for the production of final manufacturing products. “Natural resource” includes the agriculture and mining industries (ISIC Rev. 3 industries A to C), “manufacturing” includes all manufacturing industries (D), and “services” all other industries (E to Q).
SOURCE: Authors’ calculations based on World Input-Output Database, November 2013 release.

Table 5 GVC Income by Production Factor and Region (shares in world GVC income)

	Value-added by labor		Value-added by capital		Value-added total	
	1995	2011	1995	2011	1995	2011
EU 27	21.7	19.1	9.8	9.9	31.5	29
US	12.0	8.9	7.9	6.9	19.9	15.8
East Asia	12.9	6.0	8.1	4.5	20.9	10.4
China	2.1	5.1	2.1	7.7	4.2	12.8
BRIIMT	4.1	6.2	5.2	7.5	9.3	13.6
Other	6.3	7.4	7.9	10.9	14.2	18.3
World	59.1	52.6	40.9	47.4	100	100
Advanced	46.6	34	25.7	21.2	72.3	55.2
Emerging	12.5	18.6	15.2	26.1	27.7	44.8

	Value-added by high-skilled		Value-added by medium-skilled		Value-added by low-skilled	
	1995	2011	1995	2011	1995	2011
EU 27	4.9	6.1	10.1	9.0	6.7	4.0
U.S.	4.1	3.9	6.9	4.5	1.0	0.5
East Asia	3.2	2.1	7.1	3.2	2.5	0.6
China	0.1	0.4	0.7	1.8	1.3	2.9
BRIIMT	0.8	1.4	1.7	3.0	1.7	1.7
Other	0.8	1.4	2.2	2.9	3.3	3
World	13.8	15.4	28.7	24.4	16.6	12.8
Advanced	12.3	12.1	24.1	16.7	10.2	5.1
Emerging	1.6	3.2	4.6	7.7	6.4	7.7

NOTE: “East Asia” includes Japan, South Korea, and Taiwan. “EU 27” designates the countries that had joined the EU by 1 Jan. 2007. “BRIIMT” includes Brazil, Russia, Indonesia, India, Mexico, and Turkey. “Other” is the rest of the world. Skill categories classify workers by their educational attainment levels. World income is equal to world expenditures on manufacturing products at basic prices.

SOURCE: Authors’ calculations based on World Input-Output Database, November 2013 release.