Making Room for China:
a Global Value Chain Approach

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Abstract

In this paper we provide a new metric for the contributions of countries to global value chains. It is based on an input-output analysis of vertically integrated industries, taking into account trade in intermediate inputs within and across countries. The value of global manufacturing output is allocated to labour and capital employed in various regions in the world. Using a new world input-output database, we find that an increasing part of the output value in Chinese manufacturing is captured as income by production factors outside China, up to 32 per cent in electrical machinery in 2006. The value captured by China in foreign production appeared to be smaller, but also increasing over time. We also find that the growth of Chinese manufacturing has led to major changes in the income of production factors around the world. Overall labour income related to global manufacturing in the EU and NAFTA changed only marginally, even for low- and medium-skilled workers. In contrast, incomes in Japan declined for all production factors, in particular medium-skilled labour and capital.

1. Introduction

Since the 1960s the global economy is rapidly integrating through spectacular increases in international trade in goods and services. Initially this process mainly involved integration within Europe, and in the triad of Europe, the US and Japan. This was followed by the rise of East-Asia and later the other newly industrialising countries in Asia, led by Japan in a pattern of development known as the flying geese. More recently, India and in particular China started to take part in this process as well. The increasing integration of world markets was accompanied by a fragmentation of production processes as activities once done in the home economy were increasingly off shored. Fostered by rapidly falling communication, coordination and transport costs, the various stages of manufacturing needed not be performed near to each other. For example, whereas in the past the production of personal computers took mainly place within the U.S., now the separate phases of design, component production, assembly, testing and packaging are scattered around the world. This great unbundling of tasks, also known as fragmentation, off shoring or vertical specialisation, has deep implications for the organisation and coordination of activities around the globe. Through the trade of intermediate goods and services, global production networks developed quickly in manufacturing industries such as textiles, automotive and electronics industries, and also increasingly in various services industries. This increased competitive pressures around the world. The rise of China has raised fears about the hollowing out of industrial activity in Europe and the US, not only in basic low-tech manufacturing, but increasingly also in more sophisticated industries and services. Between 1995 and 2006 the share of China in global manufacturing exports increased from 4 % to 11%. Its share in manufacturing of electrical equipment (ISIC industries 30-33) increased even more dramatically from 4% to 22%.[1] These statistics are often taken as prima facie evidence of the increasing sophistication of Chinese production and associated competitive threats to the rest of the world.

However, export statistics can be misleading as the value of exports of a country conveys little information on the value actually added in the exporting country. The latter is much more relevant for any assessment of where value is created and captured in today's global production networks. For example, Dedrick et al. (2010) show that for a number of electronic products (iPods and laptops) that are manufactured in China, less than 3 per cent of the export value is actually captured by the Chinese activities. The major part of the value is captured by firms in the US, Japan, Korea and Taiwan through delivery of sophisticated intermediate inputs. The value added by China in production of these high-tech goods is rather limited, and mainly consists of low-skilled assembly services. Such analyses clearly bring out the limitations of export statistics as an indicator for

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[1] Source: World Input-Output database, see Table 1.

competitiveness. But so far we do not know to what extent these product case studies are representative for overall Chinese exports, and they convey little information on possible trends in the share of the global value aded captured by China. This is the main motivation for the analysis in this paper.

In this paper we introduce a new metric that allows us to analyse the value that is added in various stages of regionally dispersed production processes. It is based on a new industry-level database that combines national input-output tables, bilateral international trade statistics and production factor requirements. A crucial characteristic of this metric is the explicit recognition of national and international trade in intermediate products. It is the first attempt to quantify and track the process known as the slicing of global value chains (Krugman, 1995). The value chain of output is sliced into income for labour and capital in various regions in the world. In this approach, a country can increase its income domestically through increased value of local production of final goods and an increased share of domestic value added in this value, or by capturing a larger share of foreign value chains. Our global value chain (GVC) metric will not only show in which countries value is being added, but also by which type of production factor such as low- and high-skilled labour or capital. One of the main concerns of the global fragmentation process is the uneven effects on remuneration of various groups of labourers and capital owners, both within and across countries. The GVC metric will indicate possible trends in where profits are reaped and to whom wages are paid. In this paper we will focus in particular on the increasing prominence of China in various manufacturing value chains, and identify how this has impacted wages and profits in other countries. Our aim is to establish a series of stylised facts that can serve as a starting point for deeper analysis of the causes of these global shifts.

Our approach is closely related to the work on measures of vertical specialisation. The seminal work of Hummels et al. (2001) has spurred various attempts to measure the factor content of trade flows such as Reimer (2006), Johnson (2008) and Trefler and Zhu (2010). Other authors aim to measure the factor content of trade for specific countries such as Feenstra and Hong (2010) for China.[2] We follow this literature by acknowledging the important role of international trade in intermediate products. But rather than focussing on the factor content of trade of individual countries we analyse vertically integrated value chains. In addition, detailed data on production factors allows us to analyse trends in income of labour and capital inputs, and not only overall value added. This allows for a sharper focus on the impact of for example changes in factor endowments on the shares countries capture in the global value chains.

   Our GVC metrics also provide additional quantitative evidence for the trends in global production networks that have been analysed in more qualitative terms by for

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[2] See also de Backer and Yamano (2007). Foster and Stehrer (2010) provide a recent overview.

example Kaplinsky (2000), Gereffi (1999) and Sturgeon, van Biesebroeck and Gereffi (2008). These studies focus on the development of global production networks in particular industries such as textiles and automobiles, and analyse how these increasingly complex systems are governed and coordinated.

The rest of the paper is organised as follows. In Section 2 we introduce our new GVC metric by means of an iPod value chain example. We then present our mathematical approach that is based on Leontief's decomposition technique well known from input-output analysis. In Section 3, the construction of the new WIOD database is discussed and data sources described, including those for China. Results of the GVC decompositions for detailed manufacturing industries are discussed in Section 4. Section 5 concludes.

2. Quantifying global value chains (GVCs)

In this section we introduce our new GVC metric. We start with an example of a product GVC to illustrate the various concepts involved, based on the case study of Apple's iPod by Linden at al. (2010). This example shows the existence of intricate regional production networks feeding into each other, underlining the importance of distinguishing direct and indirect contributions to production. In section 2.2 we outline our proposal for generalising this approach and introduce a GVC metric for broad product categories such as wearing apparel or electronics. It is based on the measurement of embodied (direct and indirect) production factor services from various countries in the value of a set of final goods through the use of a world input-output table.

2.1 Global value chain of an iPod
Linden et al. (2009) and Dedrick et al. (2010) provide a detailed analysis of the various activities in the production of the so-called Video iPod, the 30GB version of Apple's fifth generation iPods. Their case study shows the strong global fragmentation of the production process of high-end electronic products. The lead firm in this production chain is Apple, a US multinational company, that has designed the iPod and organises its production. The iPod is manufactured in mainland China through assembling of several hundreds of components and parts. Based on professional industry sources, Linden et al. traced the origins and values of the various components and found that most of them, in particular the more expensive ones did not originate from China, but from Japan, the US, Korea, Taiwan and other Asian countries. In addition, some of these components, such as the Japanese hard-disc drives are themselves the end-product of a global production chain as they are assembled out of more elementary components manufactured elsewhere.

In Figure 1, a highly stylised representation of the main stages of the global production network of the iPod is provided. The figure shows how components are imported into China to be assembled into the iPod, which is subsequently exported to the warehouses of the lead firm Apple in the US, before being sold to final customers throughout the world through various distribution and retail channels. The main components of the iPod are the hard disc drive (HDD) and display from Japan, processors from the US and the battery from South Korea, alongside hundreds of other small components. For the production process also various business services inputs are needed, as well as energy. We also indicated the production chain of the hard disc drive (HDD) which is the major component of the iPod. This chain is led by Toshiba, a Japanese firm, but assembly takes place in China and the Philippines, based on components sourced from around the world. The production of the other components for the iPod have not been detailed any further.

[Fig 1 about here]

Within the iPod production chain, each participant purchases inputs and then adds value which becomes part of the cost for the next stage of production. The sum of the value added by all participants in the chain equals the final product price paid by the customer. This is indicated in two rows below the figure which indicate the price at a particular point in the production chain and the value added at a particular production stage (based on Table A2 from Dedrick et al. 2010 and Table 1 from Linden et al. 2009). The final consumer price of the iPod in the US is 299$. Of this, about 75$ is added by distribution and retailing services. In this case of US customers, this value is provided by mainly US wholesalers and retailers, but this value could also be captured by other countries in case the iPod is sold in other markets. Apple, a US company, is estimated to capture about 80$ of each iPod.[3] In this paper we do not analyse the margins generated after the production of the final good, and focus instead on the distribution of the good's value as represented by its ex-factory value.

The ex-factory price of the iPod when shipped from China is about 144$. The value added in China through assembling is rather limited and estimated at around 4$ only. The remainder of about 140$ represents cost to the Chinese assembler as high-value components have to be sourced from elsewhere such as the Japanese HDD making up about half of the factory iPod price (73$), the display (23$), the processors (13$), the battery (3$) and the rest (29$). Linden et al. (2010) also show for some other high-end electronic products such as notebooks that the assembling done by Chinese factories captures at most 3 per cent of the ex factory price

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[3] This is compensation for Apple's provision of intangible services such as software and designs, market knowledge, intellectual property, system integration and cost management skills and a high-value brand name.

However, the contribution of China to the iPod value chain is not limited to its iPod assembling activities, as Chinese factories are also involved in the production chains of some of the components, in particular in the assembling of the HDD and also in the manufacturing of some of its components. Unfortunately, Linden at al. (2009) do not further decompose the contribution of China in these upstream activities but hypothesize that the overall Chinese contribution to the iPod value chain will be very limited due to the capital-intensive production process of most electronic components. In our analysis we will try to uncover the total contribution of Chinese production factors in the various stages of production.

The iPod example clearly illustrates the basic concept of a global value chain. Value is added at various stages of production through the utilisation of production factors labour and capital (including tangible capital such as machinery and land, as well as intangible capital such as software and knowledge). Through the use of intermediate products, value added in previous stages is embodied in the value of the final product. It provides a clear picture of how the final product value is sliced by the various firms and regions involved. To assess the contribution of Chinese production factors, one has to add up the value added by Chinese factories at the various stages of production. This includes not only the direct contribution through assembly of the final product but also the indirect contributions through intermediate inputs. The latter can be sizeable particularly in situations where production relies heavily on the use of imported intermediates.

The case study of the iPod might not be representative for the overall capture of China in the GVC in electronics. More generic and mature electronic products might provide greater opportunities for China to capture a larger part of the value. To analyse this we introduce our new GVC metric that is based on more aggregate industry data rather than product-level analysis.

2.2 A new GVC metric

Our aim is to decompose the value of a final product into the value added by various production factors in various regions in the world. The approach follows the standard approach in the input-output literature and traces the amount of factor inputs needed to produce a certain amount of final demand (see e.g. Miller and Blair, 2009). Variations of this approach are also used in the bourgeoning literature on trade in value added (e.g. Reimer 2006 and Trefler and Zhu, 2010). The key element in this approach is that not only direct, but also indirect contributions are taken into account. The value of the final product will not only contain value added by production factors in the industry producing the final product, but also by factors employed in other domestic and foreign industries through the use of intermediate inputs. The size of these indirect effects depend on the interrelatedness of production as will be represented in a world input-output table.

More formally, let $g=1,..,G$ index products, let i and $j=1,..,N$ index countries and let $f=1,..,F$ index production factors.[4] Every product is consumed as a final product and/or used as an intermediate input. Let Y_{ij} be a $G \times 1$ vector denoting j's usage of intermediate inputs produced in country i. For all variables in this section with two subscripts, the first indicates the producer and the second the user. Country i's output Q_i is split between production for final consumption C_{ij} and for intermediate inputs:

$$Q_i \equiv \sum_j \left(C_{ij} + Y_{ij} \right) \qquad (1)$$

Let $B_{ij}(g,h)$ be the amount of intermediate input g used to produce one unit of good h, where g is made in country i and h is made in country j. Let $Q_j(h)$ be a typical element of Q_j. Then $B_{ij}(g,h)Q_j(h)$ is the amount of input g used to produce $Q_j(h)$ and $\Sigma_h B_{ij}(g,h) Q_j(h)$ is the amount of intermediate input g produced in country i and used by country j. Restated, $\Sigma_h B_{ij}(g,h)Q_j(h)$ is the gth element of Y_{ij}.

Country j's vector of imports from country i is defined by

$$M_{ij} \equiv C_{ij} + Y_{ij}, \quad j \neq i \, , \qquad (2)$$

and country i's exports to the world is

$$X_i \equiv \sum_{j \neq i} \left(C_{ij} + Y_{ij} \right) . \qquad (3)$$

In a consistent framework, the exports of country i must equal the sum of all imports from country i:

$$X_i = \sum_j M_{ij} \qquad (4)$$

This completes the definition of the variables that we will use.

To decompose the value of products into the various value added parts, we will construct a regional input-output table of the world economy where each region is a country. This will allow us to track the movement of intermediate inputs both within and across countries. Let **B** be the world input-output matrix with intermediate input coefficients of dimension (NG x NG).

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[4] We follow the convention of Trefler and Zhu (2010) to introduce matrix algebra only at a later stage to facilitate interpretation.

$$B \equiv \begin{bmatrix} B_{11} & B_{12} & \cdots & B_{1N} \\ B_{21} & B_{22} & \cdots & B_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ B_{N1} & B_{N2} & \cdots & B_{NN} \end{bmatrix}$$

where $\mathbf{B}_{ij}$ is the GxG matrix with typical elements $B_{ij}(g,h)$.[5] The matrix $\mathbf{B}$ describes how a given product in a country is produced with different combinations of intermediate products. The diagonal sub-matrices track the requirement for domestic intermediate inputs, while the off-diagonal elements track the requirements for foreign intermediate inputs.

We will also need the following NG x NG matrices:

$$Q \equiv \begin{bmatrix} diag\, Q_1 & 0 & \cdots & 0 \\ 0 & diag\, Q_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & diag\, Q_N \end{bmatrix}, \quad C \equiv \begin{bmatrix} diag\, C_{11} & diag\, C_{21} & \cdots & diag\, C_{N1} \\ diag\, C_{12} & diag\, C_{22} & \cdots & diag\, C_{N2} \\ \vdots & \vdots & \ddots & \vdots \\ diag\, C_{1N} & diag\, C_{2N} & \cdots & diag\, C_{NN} \end{bmatrix}$$

where diag X indicates a diagonal matrix of vector X with the elements of X on the diagonal and zero's otherwise.

We will rely on the fundamental input-output identity introduced by Leontief (1949) which states that $\mathbf{Q} = \mathbf{BQ} + \mathbf{C}$ which can be written as $\mathbf{Q} = (\mathbf{I} - \mathbf{B})^{-1}\mathbf{C}$ with $\mathbf{I}$ an (NC x NC) identity matrix.[6] $(\mathbf{I} - \mathbf{B})^{-1}$ is famously known as the Leontief inverse. It represents the total production that is – directly and indirectly – required to produce for final demand. To see this, let Z be a vector column with first element representing the global consumption of iPods produced in China, and the rest zero's. This is equal to the final output of the Chinese iPod industry. Then BZ is the vector of *direct* intermediate inputs, both Chinese and foreign, needed to assemble the iPods in China. But these intermediates, such as the hard-disc drive, need to be produced as well. B^2Z indicates the intermediate inputs directly needed to produce BZ, such as the HDD components, and so on. Thus $\sum_{n=2}^{\infty} B^n Z$ represents all indirect intermediate inputs needed. By adding the final output, direct and all indirect intermediate input requirements, the total gross output needed to produce a unit of final output is given by $Z + BZ + \sum_{n=2}^{\infty} B^n Z = \sum_{n=0}^{\infty} B^n Z = (I - B)^{-1} Z$.

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[5] Note that we use coefficients here, that is the B-elements are divided by gross output in the industry.
[6] See Miller and Blair (2009) for an introduction to input-output analysis.

Using this identity, we can derive production factor requirements for any vector Z. We define matrix **F** as the direct factor inputs per unit of *gross output* with dimension FN x NG. This matrix considers country- and industry-specific direct factor inputs. An element in this matrix indicates the share in the value of gross output of a production factor used directly by the country to produce a given product, for example the value of low-skilled labour used in the Chinese electronics industry to produce one dollar of output. The elements in **F** are direct factor inputs in the industry, because they do not account for production factors embodied in intermediate inputs used by this industry. For this we need to define a matrix **A** (FN x NG) as follows:

$$A = F(I - B)^{-1} \qquad (5)$$

where **A** is the matrix of factor inputs required per unit of final demand. Note that **A** includes both direct and indirect factor inputs, and contains coefficients. The *amounts* of factor inputs that can be attributed to observed levels of final demand can then be found by using the expression

$$K = AC \qquad (6)$$

in which **K** is the (FN x NG) matrix of amounts of factor inputs attributed to each of the NG final demand levels. Each column of K provides the domestic and foreign factor inputs needed for the production of final output of a particular good g in country j. A typical element in K indicates the amount of a production factor f from country i, embodied in final output of g in country j. By the logic of Leontief's insight, the sum of all elements in a column will be equal to the final output of this product. Thus we have completed our decomposition of the value of final output into the value added by various production factors around the world.

For various applications we are also interested in amounts of factors associated with specific subgroups of final demand, such as final demand for world electronics, final demand for Dutch products or final domestic demand in Germany. In these cases we modify **C** by setting all values to zero, except for the final demand flows of interest.

3. Data construction

To implement the new GVC metric empirically, one needs data on bilateral trade flows at the industry level. This type of information however is not systematically collected through surveys. Instead researchers have to rely on datasets constructed outside the official statistical systems. Various alternative datasets have been built in the past of which the GTAP database is the most widely known and used (Narayanan and Walmsley, 2008). Other datasets are provided by the OECD (Yamano and Ahmad 2006) and IDE-JETRO (2006). However, all these databases provide only one or a limited number of

benchmark year input-output tables which preclude an analysis of developments over time. And although they provide separate import matrices, there is no detailed breakdown of imports by trade partner. For this paper we use a new database called the World Input-Output Database (WIOD) that aims to fill this gap. The WIOD provides a time-series of world input-output tables from 1995 onwards, dinstinguishing between 35 industries and 59 product groups. Using a novel approach national input-output tables of forty major countries in the world are linked through international trade statistics, covering more than 85 per cent of world GDP. The construction of the world input-output tables will be discussed in section 3.1.

Another crucial element for this type of analysis are detailed value-added accounts that provide information on the use of various types of labour (distinguished by educational attainment level) and capital in production, both in quantities and values. While this type of data is available for most OECD countries (O'Mahony and Timmer, 2009), it is not for most developing countries. In Section 3.2 we describe our data strategy, with a particular emphasis for the Chinese data that is most important for the topic of this paper, but at the same time the most challenging.

3.1 World Input-Output Tables (WIOTs): concepts and construction
In this section we outline the basic concepts and construction of our world input-output tables. Basically, a world input-output table (WIOT) is a combination of national input-output tables in which the use of products is broken down according to their origin. Each product is produced either by a domestic industry or by a foreign industry. In contrast to the national input-output tables, this information is made explicit in the WIOT. For each country, flows of products both for intermediate and final use are split into domestically produced or imported. In addition, the WIOT shows for imports in which foreign *industry* the product was produced. This is illustrated by the schematic outline for a WIOT in Figure 2. It illustrates the simple case of three regions: countries A and B, and the rest of the world. In WIOD we will distinguish 40 countries and the rest of the World, but the basic outline remains the same.

[Figure 2 about here]

The rows in the WIOT indicate the use of output from a particular industry in a country. This can be intermediate use in the country itself (use of domestic output) or by other countries, in which case it is exported. Output can also be for final use[7], either by the country itself (final use of domestic output) or by other countries, in which case it is exported. Final use is indicated in the right part of the table, and this information can be

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[7] Final use includes consumption by households, government and non-profit organisations, and gross capital formation.

used to measure the C matrix defined in section 2. The sum over all uses is equal to the output of the industry, denoted by Q in section 2.

A fundamental accounting identity is that total use of output in a row equals total output of the same industry as indicated in the respective column in the left-hand part of the figure. The columns convey information on the technology of production as they indicate the amounts of intermediate and factor inputs needed for production. The intermediates can be sourced from domestic industries or imported. This is the B matrix from section 2. The residual between total output and total intermediate inputs is value added. This is made up by compensation for production factors. It is the direct contribution of domestic factors to output. We prepare the F matrix from section 2 on this information after breaking out the compensation of various factor inputs as described in Section 3.2.

As building blocks for the WIOT, we will use national supply and use tables (SUTs) that are the core statistical sources from which NSIs derive national input-output tables. In short, we derive time series of national SUTs and link these across countries through detailed international trade statistics to create so-called international SUTs. These international SUTs are used to construct the symmetric world input-output. The construction of our WIOT has three distinct characteristics when compared to e.g. the methods used by GTAP, OECD and IDE-JETRO.

First, we rely on national supply and use tables (SUTs) rather than input-output tables as our basic building blocks. SUTs are a more natural starting point for this type of analysis as they provide information on both products and industries. A supply table provides information on products produced by each domestic industry and a use table indicates the use of each product by an industry or final user. The linking with international trade data, that is product based, and factor use that is industry-based, can be naturally made in a SUT framework. In contrast, an input-output table is exclusively of the product or industry type, requiring additional assumptions before it can be used in combination with trade and factor input data.[8]

Second, to ensure meaningful analysis over time, we start from industry output and final consumption series given in the national accounts and benchmark national SUTs to these time-consistent series. Typically, SUTs are only available for a limited set of years (e.g. every 5 year) [9] and once released by the national statistical institute revisions are rare. This compromises the consistency and comparability of these tables over time as statistical systems develop, new methodologies and accounting rules are used, classification schemes change and new data becomes available. These revisions can be substantial especially at a detailed industry level. By benchmarking the SUTs on consistent time series from the National Accounting System (NAS), tables can be linked

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[8] As industries also have secondary production a simple mapping of industries and products is not feasible.

[9] Though recently, most countries in the European Union have moved to the publication of annual SUTs.

over time in a meaningful way. This is done by using a SUT updating method (the SUT-RAS method) which is akin to the well-known bi-proportional (RAS) updating method for input-output tables as described in Temurshoev and Timmer (2011).

Third, to split use of domestic output and imports, we do not rely on the standard proportionality method popular in the literature and applied for example in GTAP. In those cases, a common import proportion is used for all cells in a use row, irrespective the use category. E.g. no distinction is made between imports of car parts and components and imports of finished cars. While the latter is imported for intermediate use, the latter is for final use. We find that import proportions differ widely across use categories and importantly, also across country of origin. For example, imports by the Czech car industry from Germany contain a much higher share of intermediates than imports from Japan. This type of information is reflected in our WIOT by using detailed product level trade data.

Our basic data is import flows of all countries covered in WIOD from all partners in the world at the HS6-digit product level taken from the UN COMTRADE database. Based on the detailed product description at the HS 6-digit level products are allocated to three use categories: intermediates, final consumption, and investment, based on a revised classification of Broad Economic Categories (BEC) as made available from the United Nations Statistics Division. Another novel element in the WIOT is the use of data on trade in services. As yet no standardised database on bilateral service flows exists. These have been collected from various sources (including OECD, Eurostat, IMF and WTO), checked for consistence and integrated into a bilateral service trade database (see Stehrer et al., 2010, for details).

Based on the national SUTs, National account series and international trade data, international SUTs are prepared for each country. As a final step, international SUTs are transformed into an industry-by-industry type world input-output table. We use the so-called "fixed product-sales structure" assumption stating that each product has its own specific sales structure irrespective of the industry where it is produced (see e.g. Eurostat, 2008). For a more elaborate discussion of construction methods, practical implementation and detailed sources of the WIOT, see the Data appendix.

3.2 Factor input requirements

For factor input requirements we collected country-specific data on detailed labour and capital inputs for all 35 industries. This includes data on hours worked and compensation for three labour types (low-, medium- and high-skilled labour) and data on capital stocks and compensation. These series are not part of the core set of national accounts statistics reported by NSIs; at best only total hours worked and wages by industry are available from the National Accounts. Additional material has been collected from employment and labour force statistics. For each country covered, a choice was made of the best statistical source for consistent wage and employment data at the industry level. In most

countries this was the labour force survey (LFS). In most cases this needed to be combined with an earnings surveys as information wages are often not included in the LFS. In other instances, an establishment survey, or social-security database was used. Care has been taken to arrive at series which are time consistent, as most employment surveys are not designed to track developments over time, and breaks in methodology or coverage frequently occur.

Labour compensation of self-employed is not registered in the National Accounts, which as emphasised by Krueger (1999) leads to an understatement of labour's share. This is particularly important for less advanced economies that typically feature a large share of self-employed workers in industries like agriculture, trade, business and personal services. We make an imputation by assuming that the compensation per hour of self-employed is equal to the compensation per hour of employees. Capital compensation is derived as gross value added minus labour compensation as defined above.

The main data source for relative wages by educational attainment and broad sectors of the economy for China are the China Household Income Project (CHIP) survey, 2002. The CHIP study is considered the best available data source on household income and expenditures and the only available source for wage data by educational attainment. The CHIP survey is split into an urban and a rural survey. These two surveys were combined, resulting in about 18,500 observations on wages per hour, level of education, and broad sector of activity (after cleaning the dataset by dropping the 1st and 99th percentile of wage per hour). The broad sectors distinguished are agriculture, other industries, manufacturing, transport, storage and communication, distributive trade, other market services, and government services. The yearly wage from work is measured as the sum of total income, subsidy for minimum living standard, living hardship subsidies from work unit, and monetary value of income in kind. We distinguish three classes:

- Low-skilled: Never schooled; Classes for eliminating illiteracy; Elementary school; and Junior middle school
- Medium-skilled: Senior middle school (including professional middle school) and Technical secondary school
- High-skilled: Junior college; College/University; Graduate

4. Global Value Chains Decompositions

The standard metric to measure China's penetration in the global market is based on the value of exports. In Table 1 we provide for the value of manufacturing exports worldwide in 1995 and 2006 and the share of China. In all fourteen manufacturing industries, this share has increased. In total, China increased its share more than threefold. It improved its position in markets like textile, wearing apparel and footwear, rubber and plastics in

which China has been a dominant player since the 1980s. More recently, it also captures larger global export market shares in machinery (electrical, transport and other machinery), chemicals and metals. Its share in electrical machinery increased even six fold up to 22%, including among others exports of computers and peripherals, telecommunication equipment, semi-conductors and precision instruments. Given the high-tech nature of these products, these developments are often seen as an indication of the rapid development of Chinese technological capabilities. Increasingly, China is able to also compete in markets for more advanced products, putting increasing stress in segments of the global markets that were traditionally dominated by Europe, East-Asia and the US.

[Table 1 about here]

The example of the iPod in section 2 illustrated that this type of analysis might be misleading. The case study suggested that China mostly carried out assembly activities on high-value intermediate inputs imported from other countries. Assembly is intensive in low-skilled labour and will add only a minimal amount of value to the end-product. Rather than focusing on the output, or export, value of a product, one should measure the value added by domestic labour and capital during production. In section 3 we proposed such a measure and this will be applied here using the data from the WIOT.

The relevant output for a global value chain decomposition is the output of final products, that is, products that are consumed (or invested) by final users. These final users can be domestic or foreign. Output for intermediate use will remain in the production system and should not be taken into account to avoid possible double-counting. In the last two columns of Table 2 we provide the final output of manufacturing industries in China in 1995 and 2006, sorted on their 2006 value. This value will be lower than the output value of the industry, as the latter also contains the production of intermediate goods. It will also differ from the export value, as exports include goods for intermediate use and exclude domestic final consumption. Industries which mainly produce goods used as inputs by other industries, such as petroleum, wood, paper and non-metallic minerals, have only very small final output measures.

In 2006 China delivered 254 billion US$ worth of electrical goods to Chinese and overseas final users. Alternatively, the final output value can be interpreted as the expenditure of consumers worldwide on electrical goods produced in China. Our GVC metric will decompose this expenditure value into income received by production factors in various regions in the world. If all intermediate inputs used in the production of electrical goods (directly and indirectly) are locally produced, all value is generated in China and equal to final output. When foreign intermediate inputs are used, either directly by the industry itself, or indirectly through the use of domestic intermediate inputs which production relies on imports, the ratio of domestic value added and final output will be less than one. In section 3 we outlined, how this ratio can be calculated. Based on this

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methodology, the value of final output from Chinese manufacturing added by foreign production factors is calculated. The foreign shares are given in the first two columns of Table 2.

[Table 2 about here]

The share of foreign value added has steadily increased between 1995 and 2006. For total manufacturing, it increased from 14% in 1995 to 21% in 2006, and this trends is reflected in most industries. The share is particularly high in electrical machinery: almost one third of the output value is generated by labour and capital employed outside China. It indicates that the case-study of the iPod, although useful in high-lighting the issue of foreign value added in local production, was not representative for overall Chinese production. A large share of production consists of less advanced electrical products which offer more opportunities for the use of local intermediates. At the same time, it does indicate that the Chinese export value of electronics is overestimating the value added in China itself. This has interesting implications for the interpretation of bilateral trade imbalances such as between the US and China as in value-added terms the imbalance will be smaller.[10] The share of foreign capture of Chinese final manufacturing output is not outstanding from an international perspective. In Appendix table 2 we provide this share for all 40 countries in the WIOD, ranked from low to high. Small open economies typically have domestic shares below 65% in 2006. Large countries, both developing and advanced have somewhat larger domestic shares than China, between 80 and 88%. In all countries the domestic share has declined over time.

In food manufacturing the foreign share is much lower than in other industries, as it relies strongly on the domestic agricultural sector for sourcing its inputs. Similarly, in other manufacturing (incl. toys, sporting goods and furniture) local content of intermediate input is high. Interestingly, the foreign share declined slightly in textiles, wearing apparel and footwear. Already in 1995 this share was much higher than for other Chinese industries, reflecting the early development of these industries based on participation in global production networks, in particular through the establishment of export processing zones. More recently, the textile industry started to move away from mere assembling and integrated backwards into local agriculture (e.g. cotton production) and chemical industries (e.g. artificial fibres), while outsourcing the assembly activities to even lower wage countries like Vietnam (Gereffi, 1999).

In Figure 3 we provide a decomposition of final output value of Chinese manufacturing in 1995 and 2006 by region. All values are in million US$ using current

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[10] To the extent that production for exports is more based on foreign intermediates than production for the domestic markets, our estimated share is an under limit. Implicitly our analysis assumes that the production technology for exports and domestic consumption is identical as we use a national table. Based on a separate input-output table for export industries, a study by Powers et al. (2010) suggest that the foreign share in value added will be higher for these industries.

exchange rates, and the 2006 values have been deflated by the US CPI to a 1995 basis.[11] Clearly, the value of Chinese final output has rapidly increased and most of this increase in expenditure is captured by local labour and capital. Foreign production factors also benefitted. Both NAFTA (US, Canada and Mexico) and the EU (all 27 EU countries) increased their value. In particular East Asia (Japan, South Korea and Taiwan) and Other (rest of the world besides NAFTA, EU and East Asia) captured a sizeable part of the Chinese value chains. East Asia benefitted strongly of the increasing value in Chinese electrical machinery, but also in the other manufacturing industries. This is shown in Figure 4 that shows the value chains for some important manufacturing industries.

Figure 4 also highlights the importance of an analysis of vertically integrated sectors rather than individual manufacturing industries. We split the value added by the industry in which the product is produced, and value added by other domestic industries. Typically, the value added outside the producing industry is larger than the value added within due to strong domestic inter-industry production linkages. For example, electrical machinery manufacturing relies strongly on material inputs like metal, plastics and non-metallic minerals, but also on energy and a whole range of supporting services like transportation, distribution, communication, finance and other business services. The value added by these industries to the final output of electrical machinery is more than 50% higher than the value added by labour and capital employed in the electrical machinery sector itself. Similar ratios are found for other sectors.

[Figure 3 about here]
[Figure 4 about here]

While foreign countries share in Chinese value chains, China might also participate in foreign value chains. This has attracted much less attention, but might be important insofar China is exporting goods and services for intermediate use by other countries. To measure this, we apply the same decomposition technique to the final output flows from manufacturing industries worldwide, excluding Chinese final production. This allows us to analyse the share of China in foreign value chains. The results are given in Table 3. In the rows, the share of our five main regions (China, East Asia, EU, NAFTA and other) in the final output from manufacturing in East Asia, EU, NAFTA and other is given. The last columns indicate the absolute amount for each region. The table shows that in each region the main contribution is by regional production factors as to be expected. But these domestic shares are decreasing, just as in the case of China. E.g. the share of non-EU value added in final EU output has increased from 11% in 1995 to 17% in 2006, and similarly for East Asia. Also for NAFTA the foreign share (that is non-NAFTA) has increased to 13%. However, the major part of the increases in "foreign" value added is due to increases from the rest-of-the-world (that is countries outside China, EU, East Asia

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[11] The US CPI rose by 28% in the period from 1995 to 2006.

or NAFTA) and not so much to China. The share of China in non-Chinese final output has increased from a mere 0.4% in 1995 to 1.8% in 2006, being higher for East Asia indicating regional integration of the Chinese industry. The last columns indicate the total value added by Chinese production factors to final non-Chinese output. In 2006 it is around 114 billion US$ which is sizeable, but smaller than the 181 billion of foreign value added to Chinese chains.

[Table 3 about here]

In order to have a complete picture of the contribution of China and other regions to final manufacturing output world wide, the previous estimates of Tables 2 and 3 can be combined. Table 4 indicates for each manufacturing industry, the share of a region in worldwide output of the industry. The last two columns indicate the total global value.[12] So for example, it indicates that worldwide expenditure on transport equipment has steadily increased between 1995 and 2006. At the same time, the distribution of the income flows related to the production of transport equipment across regions has changed as well. The EU, China and the rest of the world increased their share, while it decreased in East Asia and NAFTA. China increased its share to 8%. For electrical and also other machinery, the Chinese share is growing even more quickly to 16% in 2006. In these industries, East Asia, NAFTA and also the EU are losing value shares. These are important industries in global expenditures on manufacutring products.

Our previous analyses have indicated that China's increasing share is only to a limited extent related to its increasing share in foreign value chains. Rather it is due to a rapid expansion of production in Chinese chains. And although the foreign share in the Chinese chains is growing, the overall amount of Chinese value added is growing. Overall, for total manufacturing, China is capturing about 11% of worldwide manufacturing expenditure in 2006, up from 5% in 1995. The shares of the EU and NAFTA declined somewhat, but the major loss is in East Asia (see Figure 6). While South Korea and Taiwan are still increasing their share, the income share of Japan in global manufacturing production has been declining rapidly. Japanese domestic manufacturing production value declined and a larger share of this value was captured by foreigners that delivered intermediate inputs such as China and other Asian countries. This was not compensated for by increasing Japanese shares in foreign value chains.

[Table 4 about here]
[Figure 6 about here]

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[12] For comparisons, global value added in manufacturing was about 6,200 bil 95US$ in 2005, up from 5,700 bil in 1995. This is the amount of wages and rent paid out to labour and capital employed in the manufacturing sector. The value added related to global manufacuring production is higher, because it also involves value added generated in other sectors.

Lastly, we will study which type of production factors have benefitted from the changes in the regional distribution of global value added related to manufacturing production. Increasing trade and integration of the world markets has been related to increasing unemployment and stagnating relative wages of low- and medium-skilled workers in developed regions. On the other hand, it offered new opportunities for developing regions to employ their large supply of low-skilled workers. We decomposed value added into four parts: income for capital and income for labour, split into low-, medium- and high-skilled labour. High-skilled labour is defined as workers with college degree or above. Medium skilled workers have secondary schooling and above, including professional qualifications, but below college degree, and low-skilled have below secondary schooling. The income for capital is the amount of value added that remains after subtracting labour compensation. It is the gross compensation for capital, including profits and depreciation allowances.

In Figure 7, we provide graphs of the income of the four production factors related to global final manufacturing output in each region. The income for labour increased somewhat for all skill-types. It increased sharply for Chinese labourers, in particular for medium-skilled workers. Low-skilled workers in the rest of the world also rapidly increased their share. High-skilled income is still predominantly captured in the EU, NAFTA and East Asia. Surprisingly, the figures suggest that the largest increases are in the income of capital in China and in the rest of the world. This increase was at least as big as the change in labour income. It might be related to the low wage-rental ratios in these regions that were still characterised by a abundant surplus of low-skilled workers. Some countries also contribute value added to global manufacturing mainly through the delivery of natural resources that are highly capital intensive in production. The interaction between income distributions within the OECD (in particular the wage premium of high-skilled workers) and across the OECD and other countries will be analysed in future research, using both employment numbers and wages.

As a final note it should be stressed that the country dimension in the GVC analysis is based on location of production and not on ownership of production factors. It provides the share captured by capital and labour employed in a particular country, but is silent on ownership. In the case of labour income, this is relative unproblematic as for most countries cross-border labour migration is relatively minor. Hence labour income paid out in a particular industry mostly benefits the workers of the country in which production takes place. This is less clear for capital income. For example, many Chinese textile factories are owned by non-Chinese, and a sizeable part of capital income might end up in foreign hands. The extent of this will depend on the importance of foreign ownership in a particular industry and country.

[Figure 7 about here]

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5. Concluding remarks

A global value chain perspective has profound implications for one's thinking of competitiveness and growth. It highlights the importance of global production networks and the increasing interrelation of production across national boundaries through the trade of intermediate goods and services. The value of production output, or exports, in a country does not necessarily reflect the amount of value that is added by local production factors. It is the latter part that is paid out as income to local labour and capital. Increasing a country's competitiveness and growth is about capturing a larger share of the existing global value chains, in particular in early phases of development (Porter 1990). In this paper we proposed a new metric that is based on analysis of vertically integrated industries both within and across countries. The value chain of output is sliced into income for labour and capital in various regions in the world. In this approach, a country can increase its income domestically through increased value of local production of final goods and an increased share of domestic value added in this value, or by capturing a larger share of foreign value chains. We used this new GVC measure to analyse China's growing role in the world economy. Three main conclusions stand out.

First, we found that an increasing part of the output value in Chinese manufacturing is captured as income by production factors outside China. This share increased from 14 per cent in 1995 to 21 per cent in 2006. In electrical machinery it was even 32 per cent in 2006. This is captured mostly by East Asia and other countries outside the EU and NAFTA. Clearly, a sizeable part of Chinese production in manufacturing still consists of low value-added activities such as assembling, testing and packaging.

Second, in turn China captured an increasing share of foreign production values. In 2006 this amounted to 1.8 per cent of foreign final manufacturing output, up from 0.4% in 1995. However in 2006 the value captured by China in foreign production was still smaller than the value of Chinese production captured by other countries and China "lost" on a net basis. Hence the growing income of China was solely related to an increase in value of production of final goods in China

Third, the growth of Chinese manufacturing production has led to major changes in the income of various production factors around the world. Between 1995 and 2006, the income of labour and capital related to global manufacturing production did not decrease in the EU and NAFTA. This was true even for the low- and medium-skilled workers. In contrast, in East Asia, in particular in Japan, the income values declined for all production factors, in particular medium-skilled labour and capital. Further analysis should indicate to what extent this decline was due to a decline in wages and rents, or the amount of labourers and capital stock employed. We also found a sharp increase of the income of low-skilled workers and of capital outside these regions. The increase in value

added related to manufacturing output in the rest of the world seems to be as least as large as that of China.

Finally, we would like to stress that the results in this paper are preliminary. They are based on the world input-output database (WIOD) that is currently under development. In the upcoming year this database will be further improved. For example, the current database uses current exchange rates to convert national currencies into a common denominator. We are currently working on constant price tables as well, by using national deflators and relative prices across countries (PPPs). Also we are adding quantity and price data for labour and capital. The data will be made public starting in the autumn of 2011 with full data availability by May 2012, free of charge through our website www.wiod.net. Although the results are still preliminary, we hope that the paper illustrated the usefullness of a global value chain metric in analysing the trends in global trade, production and incomes.

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Data Appendix: Construction of the World Input-Output Table

In this section we outline the construction of the WIOT and discuss the underlying data sources. As building blocks we will use national supply and use tables (SUTs) that are the core statistical sources from which NSIs derive national input-output tables. In short, we derive time series of national SUTs and link these across countries through detailed international trade statistics to create so-called international SUTs. These international SUTs are used to construct the symmetric world input-output table.

Three types of data are being used in the process, namely national accounts statistics (NAS), supply-use tables (SUTs) and international trade statistics (ITS). Importantly, this data must be publicly available such that users of the WIOT are able to trace the steps made in the construction process. Moreover, official published data is more reliable as checking and validation procedures at NSIs are more thorough than for data that is ad-hoc generated for specific research purposes. The data is being harmonised in terms of industry- and product-classifications both across time and across countries. The WIOD classification list has 59 products and 35 industries based on the CPA and NACE rev 1 (ISIC rev 2) classifications. The product and industry lists are given in Appendix Tables 1 and 2. This level of detail has been chosen on the basis of initial data-availability exploration and ensures a maximum of detail without the need for additional information that is not generated in the system of national accounts. The 35-industry list is identical to the list used in the EUKLEMS database with additional breakdown of the transport sector as these industries are important in linking trade across countries and in the transformation to alternative price concepts (from purchasers' to basic prices, see below).[13] Hence WIOD can be easily linked to additional variables on investment, labour and productivity in the EU KLEMS database (see www.euklems.net, O'Mahony and Timmer, 2009). The product list is based on the level of detail typically found in SUTs produced by European NSIs, following Eurostat regulations and is more detailed than the industry list. It is well-known that non-survey methods to split up a use table into imported and domestic, such as used in WIOD, are best applied at a high level of product detail.

In Appendix Table 1 we provide an overview of the SUTs used in WIOD. For some countries full time-series of SUTs are available, but for most countries only some or even one year is available. This is indicated in the table. In some cases SUTs for a particular year were available, but have not been used as they contained too many errors or inconsistencies to be useful. Also, for some non-EU countries SUTs are not available, but only IOTs. For these countries a transformation from IOT to SUT has been made by assuming a diagonal supply table at the product and industry level of the original national

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[13] In addition, in WIOD the EUKLEMS industry 17-19 is split into textiles and wearing apparel (17-18) and footwear (19) because of the large amount of international trade in these industries.

table which is often more detailed than the WIOD list. Appendix Table 1 provides details about the size of the original SUTs and IOTs and their price concept. The tables have been sourced from publicly available data from National Statistical Institutes and for many EU countries from the Eurostat input-output database.[14] To arrive at a common classification, correspondence tables have been made for each national SUT bridging the level of detail and classifications in the country to the WIOD classification. This involved aggregation and sometimes disaggregation based on additional detailed data. While for most European countries this was relatively straightforward, tables for non-EU countries proved more difficult. National SUTs were also checked for consistency and adjusted to common concepts (e.g. regarding the treatment of FISIM and purchases abroad). Undisclosed cells due to confidentiality concerns were imputed based on additional information. The adjustments and harmonisation are described in more detail on a country-by-country basis in Erumban et al. (2010).

In the first step of our construction process we benchmark the national SUTs to time-series of industrial output and final use from national account statistics. In Figure 3 a schematic representation of a national SUT is given. Compared to an IOT, the SUT contains additional information on the domestic origin of products. In addition to the imports, the supply columns in the left-hand side of the table indicate the value of each product produced by domestic industries. The upper rows of the SUT indicate the use of each product. Note that a SUT is not necessarily square with the number of industries equal to the number of products, as it does not require that each industry produces one unique product only. A SUT must obey two basic accounting identities: for each product total supply must equal total use, and for each industry the total value of inputs (including intermediate products, labour and capital) must equal total output value.

Supply of products can either be from domestic production or from imports. Let S denote supply and M imports, subscripts i and j denote products and industries and superscripts D and M denote domestically produced and imported products respectively. Then total supply for each product i is given by the summation of domestic supply and imports:

$$S_i = \sum_j S_{i,j}^D + M_i \qquad (1)$$

Total use (U) is given be the summation of final domestic use (F), exports (E) and intermediate use (I) such that

$$U_i = F_i + E_i + \sum_j I_{i,j} \quad (2)$$

The identity of supply and use is then given by

$$F_i + E_i + \sum_j I_{i,j} = \sum_j S_{i,j}^D + M_i \qquad \forall i \qquad (3)$$

The second accounting identity can be written as follows

$$\sum_i S_{i,j}^D = VA_j + \sum_i I_{i,j} \qquad \forall j \qquad (4)$$

This identity indicates that for each industry the total value of output (at left hand side) is equal to the total value of inputs (right hand side). The latter is given by the sum of value added (VA) and intermediate use of products.

Typically, SUTs are only available for a limited set of years (e.g. every 5 year) [15] and once released by the national statistical institute revisions are rare. This compromises the consistency and comparability of these tables over time as statistical systems develop, new methodologies and accounting rules are used, classification schemes change and new data becomes available. These revisions can be substantial especially at a detailed industry level. Therefore they are benchmarked on consistent time-series from the NAS in a second step. Data was collected for the following series: total exports, total imports, gross output at basic prices by 35 industries, total use of intermediates by 35 industries, final expenditure at purchasers' prices (private and government consumption and investment), and total changes in inventories. This data is available from National Statistical Institutes and OECD and UN National Accounts statistics. National SUTs are in national currencies and need to be put on a common basis for the WIOT. This is done by using official exchange rates from IMF. This data is used to generate time series of SUTs using the so-called SUT-RAS method (Temurshoev and Timmer 2009). This method is akin to the well-known bi-proportional updating method for input-output tables known as the RAS-technique. This technique has been adapted for updating SUTs.

Timeseries of SUTs are derived for two price concepts: basic prices and purchasers' prices. Basic price tables reflect the costs of all elements inherent in production borne by the producer, whereas purchasers' price tables reflect the amount paid by the purchaser. The difference between the two is the trade and transportation margins and net taxes. Both price concepts have their use for analysis depending on the type of research question. Supply tables are always at basic price and often have additional information on margins and net taxes by product. The use table is typically at a purchasers' price basis and hence needs to be transformed to a basic price table. The difference between the two tables is given in the so-called valuation matrices (Eurostat 2008, Chapter 6). These matrices are typically not available from public data sources and hence need to be estimated. In WIOD we distinguish 4 types of margins: automotive trade, wholesale trade, retail trade and transport margins. The distribution of each margin type varies widely over the purchasing users and we use this information to improve our estimates of basic price tables, see Erumban et al. (2010) for more detail.

In a second step, the national SUTs are combined with information from international trade statistics to construct what we call international SUTs. Basically, a

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[15] Though recently, most countries in the European Union have moved to the publication of annual SUTs.

split is made between use of products that were domestically produced and those that were imported, such that

$$I_{i,j} = I_{i,j}^D + I_{i,j}^M \quad \forall i, j$$

$$F_i = F_i^D + F_i^M \quad \forall i \quad (5)$$

$$E_i = E_i^D + E_i^M \quad \forall i$$

where E_i^M indicates re-exports. This breakdown must be made in such a way that total domestic supply equals use of domestic production for each product:

$$\sum_j I_{i,j}^D + F_i^D + E_i^D = \sum_j S_{i,j}^D \quad \forall i \qquad (6)$$

and total imports equal total use of imported products

$$\sum_j I_{i,j}^M + F_i^M + E_i^M = M_i \quad \forall i \qquad (7)$$

So far we have only considered imports without any geographical breakdown. To study international production linkages however, the country of origin of imports is important as well. Let k denote the country from which imports are originating, then an additional breakdown of imports is needed such that

$$\sum_k \sum_j I_{i,j,k}^M + \sum_k F_{i,k}^M + \sum_k E_{i,k}^M = \sum_k M_{i,k} = M_i \quad \forall i \quad (8)$$

Bilateral international trade data in goods is collected from the UN COMTRADE database (which can be downloaded for example via the World Integrated Trade Solutions (WITS) webpage at http://wits.worldbank.org/witsweb/). This data base contains bilateral exports and imports by commodity and partner country at the 6-digit product level (Harmonised System, HS). Calculations used for the construction of the international USE tables are based on import values. Alternatively, we could have relied on export flow data. However, it is well-known that official bilateral import and export trade flows are not fully consistent due to reporting errors, etc. and hence this choice would make a difference. Following most other studies, we choose to use imports flows as these are generally seen as more reliable than export flows. Data at the 6-digit level often contains confidential flows which only appear in the higher aggregates. These confidential are allocated over the respective categories (see Stehrer, et al., 2010, for details).

Ideally one would like to have additional information based on firm surveys that inventory the origin of products used, but this type of information is hard to elicit and only rarely available. We use a non-survey imputation method that relies on a classification of detailed products in the ITS into three use categories. Our basic data is import flows of all countries covered in WIOD from all partners in the world at the HS6-digit product level taken from the UN COMTRADE database. Based on the detailed product description at the HS 6-digit level products are allocated to three use categories:

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intermediates, final consumption and investment.[16] This resembles the well-known correspondence between the about 5,000 products listed in HS 6 and the Broad Economic Categories (BEC) as made available from the United Nations Statistics Division. These Broad Economic Categories can then be aggregated to the broader use categories mentioned above. For the WIOD this correspondence has been partly revised to better fit the purpose of linking the trade data to the SUTs (see Stehrer et al. 2010, for details).

For services trade no standardised database on bilateral flows exists. These have been collected from various sources (including OECD, Eurostat, IMF and WTO), checked for consistence and integrated into a bilateral service trade database. As services trade is taken from the balance of payments statistics it is originally reported at BoP codes. For building the shares a mapping to WIOD products has been applied. For these service categories there does not exist a breakdown into the use categories mentioned above; thus we either used available information from existing import use or symmetric import IO tables; for countries where no information was available we applied shares taken from other countries. (see Stehrer et al., 2010, for details)

Based on our use-category classification we allocate imports across use categories in the following way. First, we used the share of use category l (intermediates, final consumption or investment) to split up total imports as provided in the supply tables for each product i. The resulting numbers for intermediates are allocated over using industries by proportionality assumption. Similarly, final consumption is allocated over the consumption categories (final consumption expenditure by households, final consumption expenditure by non-profit organisations and final consumption expenditure by government). Investment was allocated to column gross fixed capital formation. [17] This yields the import use table. Finally, each cell of the import use table is split up to the country of origin where country import shares might differ across use categories, but not within these categories. Note that here are discrepancies between the import values recorded in the National Accounts on the one hand, and in international trade statistics on the other. Some of them are due to conceptual differences, and others due to classification and data collection procedures (see extensive discussion in Guo, Web and Yamano 2009). As we rely on NAS as our benchmark we apply shares from the trade statistics to the NAS series. Thus, to be consistent with the imports as provided in the SUTs we use only shares derived from the ITS rather than the actual values.

Formally, let $m_{i,k}^{l}$ indicate the share of use categories l (intermediate, final consumption or investment) in imports of product i by a particular country from country k defined as

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[16] A mixed category for products which are likely to have multiple uses was used as well; this category was allocated over the other use categories when splitting up the use tables.

[17] At a later stage we shall use information from existing imports SUTs or IOTs.

$$m_{i,k}^l = \frac{\tilde{M}_{i,k}^l}{\tilde{M}_i} \text{ such that } \sum_k \sum_l m_{i,k}^l = 1 \qquad (9)$$

where $\tilde{M}_{i,k}^l$ is the total value from all 6-digit products that are classified by use category l and WIOD product group i imported from country k, and $\tilde{M}_i$ the total value of WIOD product group i imported by a country. These shares are derived from the bilateral international trade statistics and applied to the total imports of product i as given in the SUT timeseries to derive imported use categories. $I_{i,j,k}^M$ is the amount of product group i imported from country k and used as intermediate by industry j. It is given by:

$$I_{i,j,k}^M = m_{i,k}^l M_i \frac{I_{i,j}}{I_i} \quad \forall j \qquad (10)$$

where $I_i = \sum_j I_{i,j} \quad \forall i$ such that $\frac{I_{i,j}}{I_i}$ is the share of intermediates of product i used by industry j. Similarly, let f denote the final use categories (final consumption by households, by non-profit organisations and by government). Then the amount of product group i imported from country k and used as final use category f, $FC_{i,f,k}^M$, is given by:

$$FC_{i,f,k}^M = m_{i,k}^{FC} M_i \frac{FC_{i,f}}{FC_i} \qquad (11)$$

The amount of product group i imported from country k and used as investment, $GFCF_{i,k}^M$, is given by:

$$GFCF_{i,k}^M = m_{i,k}^{GFCF} M_i \qquad (12)$$

Finally, we derive the use of domestically produced products as the residual by subtracting the imports from total use as follows:

$$I_{i,j}^D = I_{i,j} - \sum_k I_{i,j,k}^M \quad \forall i, j$$
$$FC_{i,f}^D = FC_{i,f} - \sum_k FC_{i,f,k}^M \quad \forall i \qquad (13)$$
$$GFCF_i^D = GFCF_i - \sum_k GFCF_{i,k}^M \quad \forall i$$

Note that our approach differs from the standard proportionality method popular in the literature and applied e.g. by GTAP. In those cases, a common import proportion is used for all cells in a use row, irrespective the user. This common proportion is simply calculated as the share of imports in total supply of a product. We find that import proportions differ widely across use categories and importantly, within each use category they differ also by country of origin. Our detailed bilateral approach ensures that this type of information is reflected in the international SUTs and consequently the WIOT.

As a final step, international SUTs are transformed into a world input-output table. IO tables are symmetric and can be of the product-by-product type, describing the

amount of products needed to produce a particular good or service, or of the industry-by-industry type, describing the flow of goods and services from one industry to another. In case each product is only produced by one industry, the two types of tables will be the same. But the larger the share of secondary production, the larger the difference will be. The choice for between the two depends on the type of research questions. Many foreseen applications of the WIOT, such as those described in the next sections, will rely heavily on industry-type tables as the additional data, such as employment or investment, is often only available on an industry basis. Moreover, the industry-type table retains best the links with national account statistics.

An IOT is a construct on the basis of a SUT at basic prices based on additional assumptions concerning technology. We use the so-called "fixed product-sales structure" assumption stating that each product has its own specific sales structure irrespective of the industry where it is produced. Sales structure here refers to the proportions of the output of the product in which it is sold to the respective intermediate and final users. This assumption is most widely used, not only because it is more realistic than its alternatives, but also because it requires a relative simple mechanical procedure. Furthermore, it does not generate any negatives in the IOT that would require manual rebalancing. Application of manual ad-hoc procedures would greatly reduce the tractability of our methods. Chapter 11 in the Eurostat handbook (Eurostat, 2008) provides a useful and extensive discussion of the transformation of SUTs into IOTs, including a mathematical treatment.

The full WIOT will contain data for forty countries covered in the WIOD. Including the biggest countries in the world, this set covers more than 85 per cent of world GDP. Nevertheless to complete the WIOT and make it suitable for various modelling purposes, we also added a region called the Rest of the World (RoW) that proxies for all other countries in the world. The RoW needs to be modelled due to a lack of detailed data on input-output structures. Imports from RoW are given as as share of imports from RoW from trade data applied to the imports in the supply table. Hence, exports from the RoW are simply the imports by our set of countries not originating from the set of WIOD countries. Exports to RoW from the set of WIOD countries or, equivalently, imports by the ROW are defined residually to ensure that exports from all countries (incl. RoW) equal the imports by all countries (incl. RoW). Production and consumption in the ROW will be modelled based on totals for industry output and final use categories from the UN National Accounts, assuming an input-output structure equal to that of an average developing country. Also, at a later stage we will add in a separate oil-producing region that will be useful in particular in environmental applications.

For an elaborate discussion of construction methods, practical implementation and detailed sources of the WIOT, see Erumban et al. (2011, forthcoming).

Table 1 Value of global manufacturing exports

ISIC rev.3 code	Industry name	China 1995 (% share)	China 2006 (% share)	World 1995 (mil US$)	World 2006 (mil US$)
30t33	Electrical and Optical Equipment	3.5	21.5	705,244	1,663,185
34t35	Transport Equipment	0.5	2.8	563,506	1,259,334
27t28	Basic Metals and Fabricated Metal	3.6	8.2	383,145	966,682
24	Chemicals and Chemical Products	0.9	4.9	393,183	915,115
29	Machinery, Nec	1.0	7.4	396,235	774,182
15t16	Food, Beverages and Tobacco	3.5	6.1	251,295	423,211
17t18	Textiles and Textile Products	15.6	34.3	240,058	422,347
23	Coke and Refined Petroleum	1.0	1.3	83,304	398,623
25	Rubber and Plastics	6.4	13.3	110,520	253,962
21t22	Pulp, Paper,Printing and Publishing	1.3	1.8	145,106	226,569
36t37	Manufacturing, Nec; Recycling	4.6	14.7	93,291	218,570
26	Other Non-Metallic Mineral	6.9	12.0	63,763	110,200
20	Products of Wood and Cork	3.8	8.3	51,849	91,898
19	Leather and Footwear	19.3	37.3	47,270	82,726
	Total manufacturing	3.5	11.2	3,527,768	7,806,605

Note: The last two columns indicate the values of global manufacturing exports. The first two columns indicate the share of China in these values. In million current US$, using exchange rates for currency conversion. Sorted by 2006 export value.
Source: Calculations based on World Input-Output Database.

Table 2 Value of Chinese manufacturing final output

ISIC rev.3 code	Industry name	Foreign 1995 (% share)	Foreign 2006 (% share)	Total 1995 (mil US$)	Total 2006 (mil US$)
30t33	Electrical and Optical Equipment	19.1	32.1	44,552	254,400
15t16	Food, Beverages and Tobacco	8.3	10.2	76,111	191,399
29	Machinery, Nec	13.5	22.3	33,062	188,934
17t18	Textiles and Textile Products	16.8	16.4	59,452	153,067
34t35	Transport Equipment	15.2	22.8	24,944	120,025
36t37	Manufacturing, Nec; Recycling	13.3	13.6	9,549	56,792
19	Leather and Footwear	19.1	17.4	22,784	54,768
27t28	Basic Metals and Fabricated Metal	14.8	22.6	15,441	26,962
24	Chemicals and Chemical Products	14.7	23.5	13,732	23,841
25	Rubber and Plastics	17.1	23.3	6,530	15,816
26	Other Non-Metallic Mineral	10.2	15.9	11,708	7,125
21t22	Pulp, Paper,Printing and Publishing	13.5	17.4	5,456	4,498
20	Products of Wood and Cork	12.9	15.8	4,614	3,974
23	Coke and Refined Petroleum	18.4	36.9	1,649	3,111
	Total manufacturing	14.2	21.0	329,584	1,104,709

Note: The last two columns indicate the value of final demand for Chinese manufacturing output. The first two columns indicate the share of foreign value added in these values. In million current US$, using exchange rates for currency conversion. Sorted by 2006 value.
Source: Calculations based on World Input-Output Database.

Table 3 Value of manufacturing final output in world, excluding China

	EU 1995 (%)	EU 2006 (%)	EastAs 1995 (%)	EastAs 2006 (%)	NAFTA 1995 (%)	NAFTA 2006 (%)	Other 1995 (%)	Other 2006 (%)	Total 1995 (%)	Total 2006 (%)	Total 1995 (mil 95 US$)	Total 2006 (mil 95 US$)
CHN	0.3	1.4	0.6	2.9	0.3	1.8	0.3	1.7	0.4	1.8	21,657	113,622
EU	89.2	83.2	1.8	2.6	3.9	3.8	5.7	6.8	35.6	34.9	2,066,282	2,203,624
EastAs	1.5	1.6	91.5	82.7	2.5	2.0	2.6	1.8	22.6	14.0	1,309,748	882,460
NAFTA	4.0	3.8	3.3	3.2	90.7	86.6	2.3	2.4	27.6	28.3	1,602,726	1,782,450
Other	5.0	10.0	2.8	8.6	2.6	5.9	89.0	87.2	13.8	21.0	802,382	1,325,786
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	5,802,796	6,307,942

Note: Contributions of value added in regions (in rows) to value of manufacturing final output in other regions (columns). In million 1995 US$, using exchange rates for currency conversion and US CPI for deflation to 1995 $.
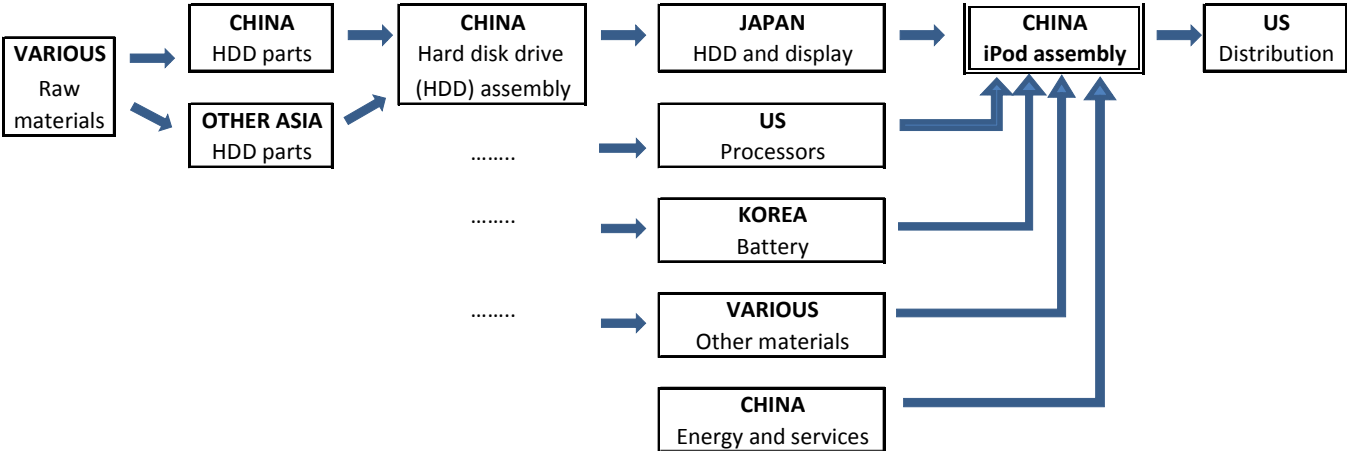
Source: Calculations based on World Input-Output Database.

Table 4 Value added contribution of regions to global manufacturing final output

		CHN 1995 (%)	CHN 2006 (%)	EU 1995 (%)	EU 2006 (%)	EastAs 1995 (%)	EastAs 2006 (%)	NAFTA 1995 (%)	NAFTA 2006 (%)	Other 1995 (%)	Other 2006 (%)	TOTAL 1995 (mil 95 US$)	TOTAL 2006 (mil 95 US$)
15t16	Food, Beverages an	4.8	9.1	33.4	31.3	20.2	11.4	24.6	26.1	16.9	22.1	1,504,803	1,590,235
17t18	Textiles and Textile	11.2	24.7	32.6	26.2	18.0	7.2	19.1	10.8	19.1	31.1	470,594	434,139
19	Leather and Footwe	18.7	34.8	40.3	31.0	14.5	5.3	9.1	7.2	17.3	21.7	100,241	104,814
20	Products of Wood a	8.0	7.6	32.7	43.3	29.2	17.6	22.0	21.5	8.0	9.9	52,001	40,905
21t22	Pulp, Paper,Printing	2.2	2.0	45.6	40.8	4.6	3.2	39.5	42.2	8.1	11.8	232,940	250,453
23	Coke and Refined P	1.1	1.7	25.9	16.8	12.9	5.6	30.3	30.8	29.9	45.1	202,410	445,902
24	Chemicals and Cher	3.3	3.8	41.2	38.5	10.8	5.8	32.4	33.7	12.3	18.2	382,444	515,689
25	Rubber and Plastics	6.1	10.4	40.0	34.9	15.6	9.7	24.2	27.0	14.1	18.0	94,113	104,589
26	Other Non-Metallic	19.0	9.2	45.6	44.8	9.7	5.7	14.3	25.7	11.5	14.6	56,022	56,182
27t28	Basic Metals and Fa	6.4	8.4	39.9	38.0	26.4	16.7	14.9	16.6	12.4	20.2	218,956	238,873
29	Machinery, Nec	4.4	16.0	33.4	32.6	32.8	20.8	21.3	17.7	8.0	12.8	705,365	805,750
30t33	Electrical and Optica	4.8	16.5	24.6	23.2	32.0	20.5	27.2	23.7	11.4	16.1	835,811	1,004,933
34t35	Transport Equipmer	2.5	7.9	33.5	34.7	22.3	16.9	33.5	28.3	8.1	12.2	967,678	1,219,646
36t37	Manufacturing, Nec	3.0	12.4	40.9	34.9	13.4	6.3	28.4	27.7	14.2	18.6	309,002	358,885
	Total manufacturing	5.0	11.1	33.8	31.2	21.7	13.2	26.3	25.2	13.3	19.4	6,132,379	7,170,997

Note: Contributions of value added in regions to global final demand of manufacturing. In million 1995 US$, using exchange rates for currency conversion and US CPI for deflation to 1995 $.

Source: Calculations based on World Input-Output Database.

Figure 1 Global value chain of the iPod.

		CHINA HDD parts	**CHINA** Hard disk drive (HDD) assembly	**JAPAN** HDD and display	**CHINA** iPod assembly	**US** Distribution	
VARIOUS Raw materials		**OTHER ASIA** HDD parts	....	**US** Processors			
			....	**KOREA** Battery			
			....	**VARIOUS** Other materials			
				CHINA Energy and services			

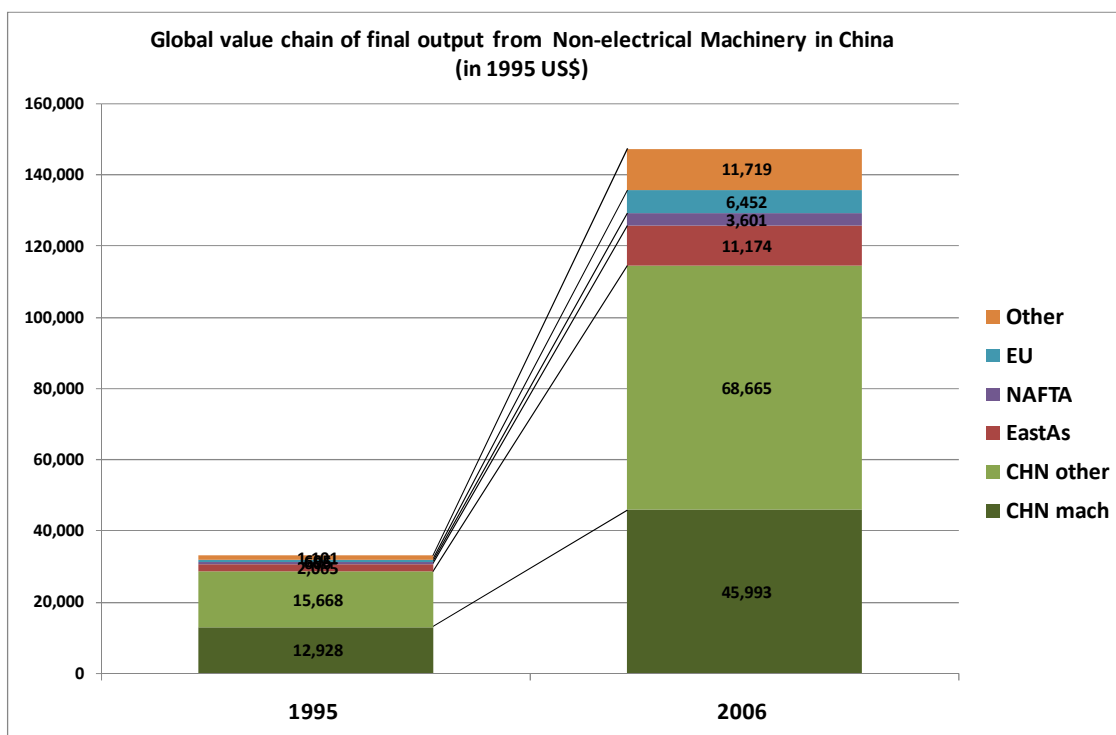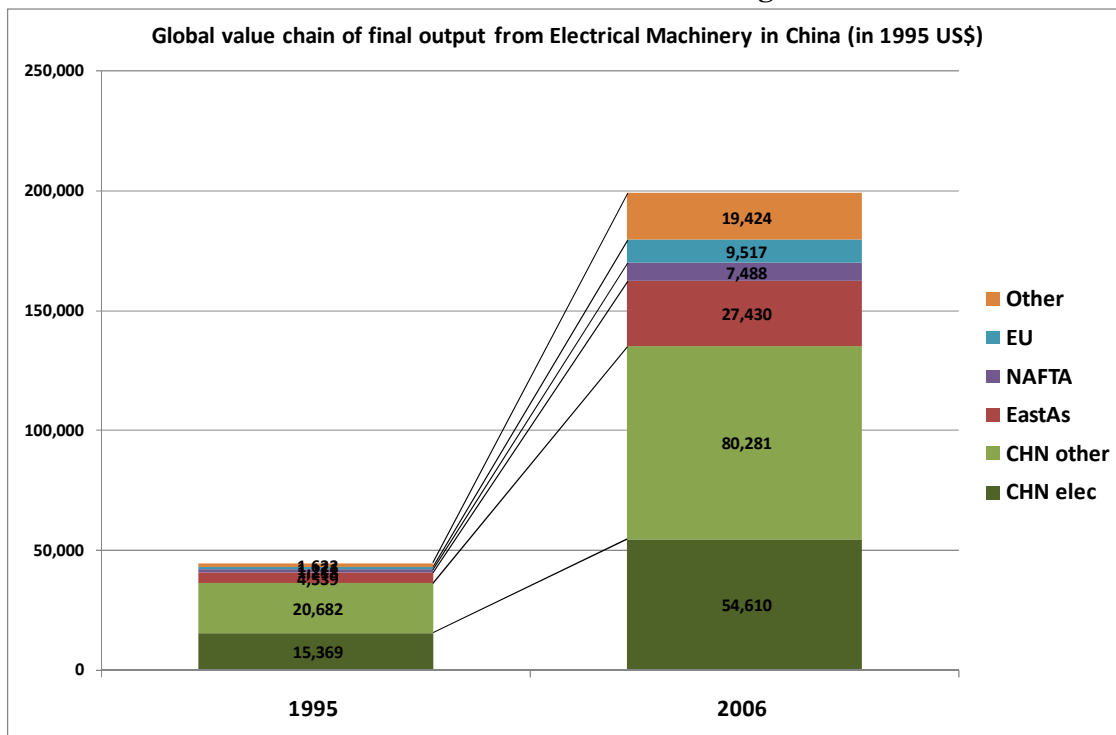|										
Value added (in $)		n.a		n.a		n.a	87*		4	75
Price (in $)	0		n.a		n.a		53*	140	144	299

Source: stylised representation based on information in Linden et al. (2009) and Dedrick et all (2010).

Note: * assuming that all value is added at this stage, except for the hard disk drive.

Figure 2 Schematic outline of World Input-Output Table (WIOT), three regions

		Country A Intermediate use *Industry*	Country B Intermediate use *Industry*	Rest of World Intermediate use *Industry*	Country A Final domestic use	Country B Final domestic use	Rest of World Final domestic use	Total
Country A	*Industry*	Intermediate use of domestic output	Intermediate use by B of imports from A	Intermediate use by RoW of imports from A	Final use of domestic output	Final use by B of exports from A	Final use by RoW of exports from A	Output in A
Country B	*Industry*	Intermediate use by A of imports from B	Intermediate use of domestic output	Intermediate use by RoW of imports from B	Final use by A of exports from B	Final use of domestic output	Final use by RoW of exports from B	Output in B
Rest of World (RoW)	*Industry*	Intermediate use by A of imports from RoW	Intermediate use by B of imports from RoW	Intermediate use of domestic output	Final use by A of exports from RoW	Final use by B of exports from RoW	Final use of domestic output	Output in RoW
		Value added	Value added	Value added				
		Output in A	Output in B	Output in RoW				

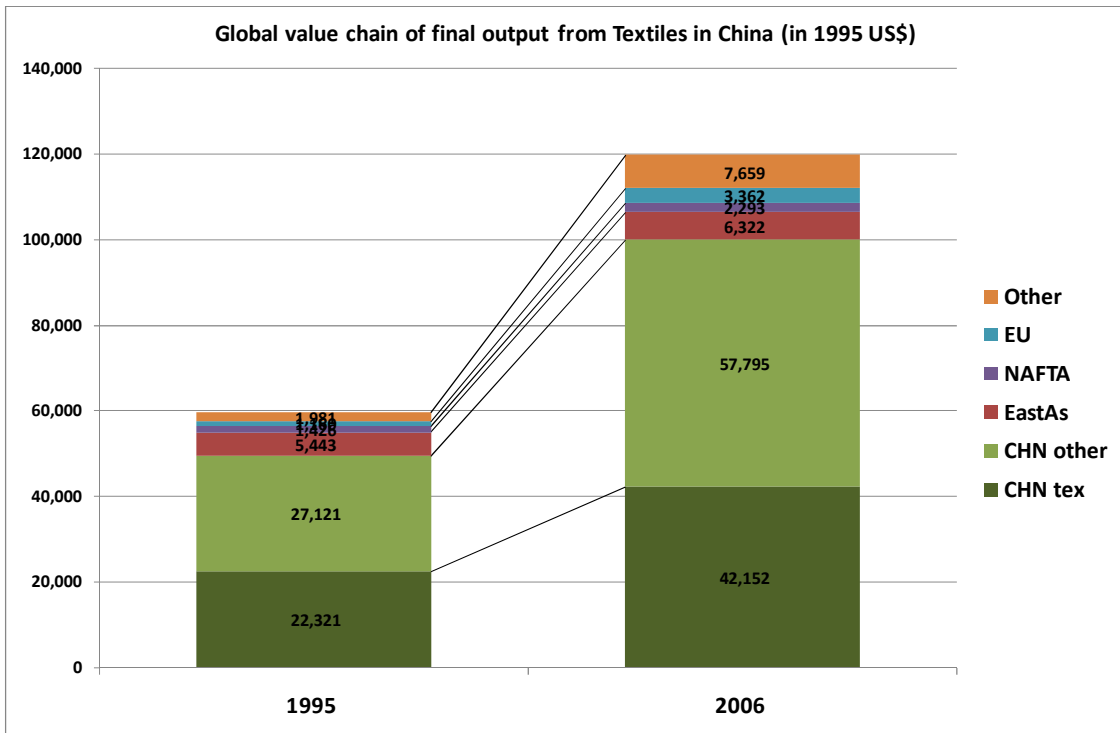**FIGURE 3 Global value chains of Chinese manufacturing industries**

Global value chain of final output from Electrical Machinery in China (in 1995 US$)

Global value chain of final output from Non-electrical Machinery in China (in 1995 US$)

Global value chain of final output from Transport machinery in China (in 1995 US$)

Global value chain of final output from Textiles in China (in 1995 US$)

FIGURE 4 Global value chains of Chinese manufacturing industries

Global value chain of final output from Total manufacturing in China (in 1995 US$)

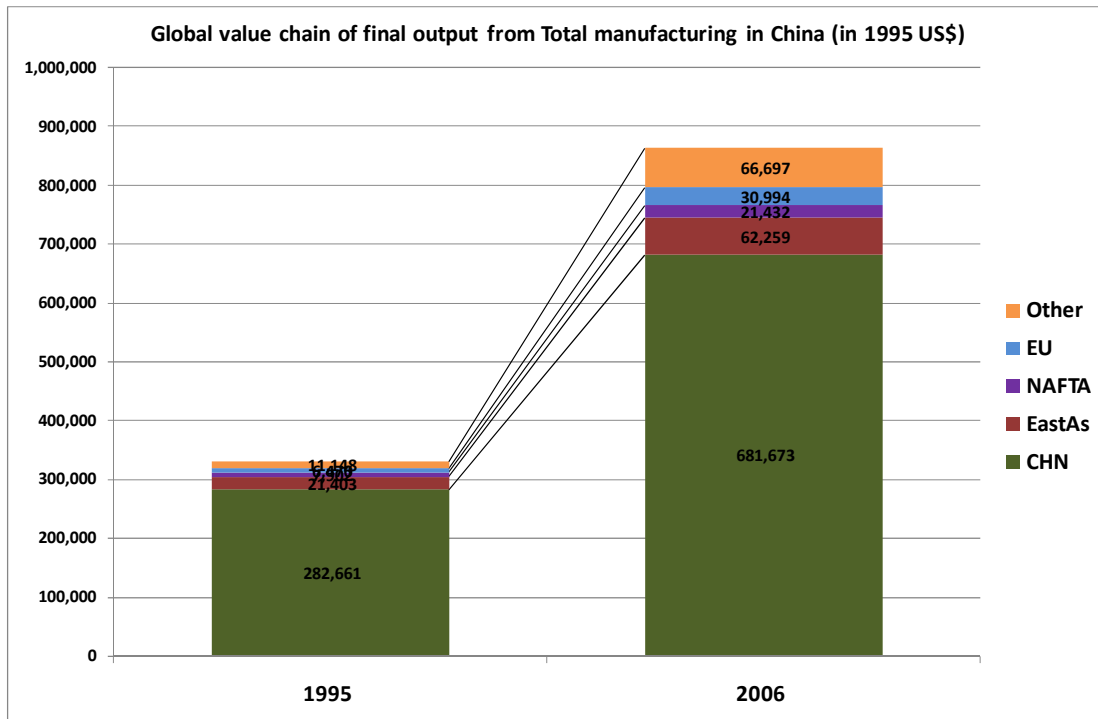| Region	1995	2006
Other	11,148	66,697
EU		30,994
NAFTA		21,432
EastAs	21,403	62,259
CHN	282,661	681,673

FIGURE 5 Value added contribution of regions to manufacturing final output in world, excluding China (in 1995 US$)

Value added contribution of regions to manufacturing final output in world, excluding China (in 1995 US$)

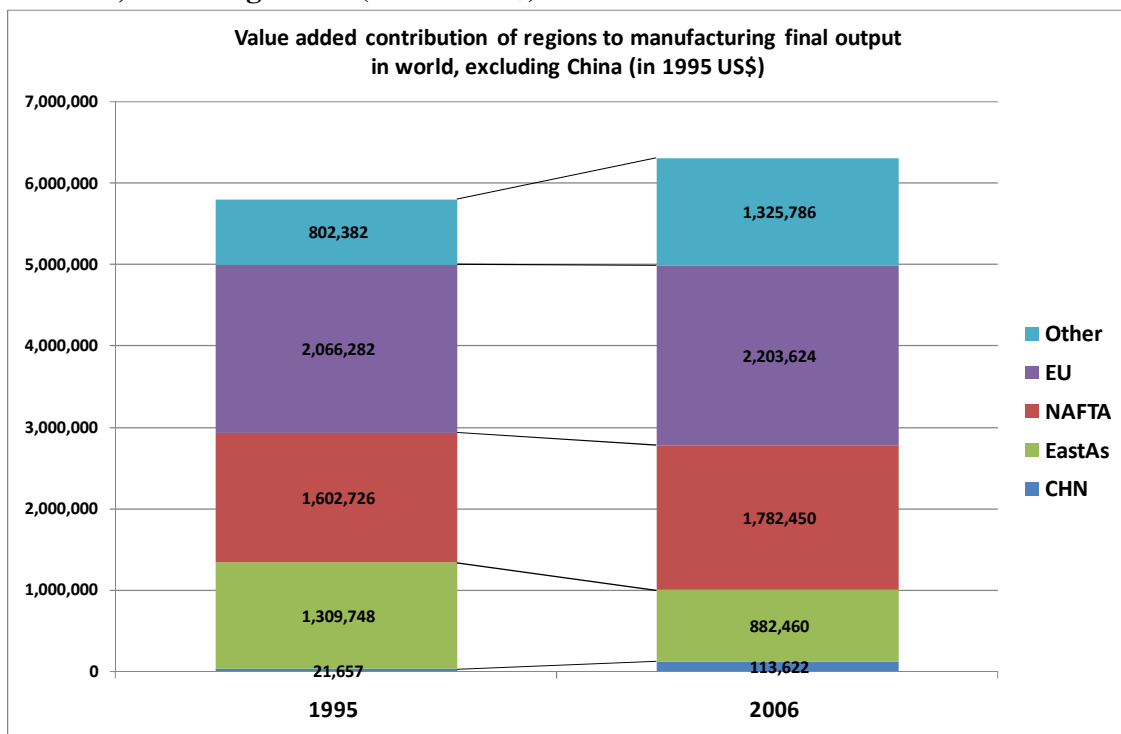| Region	1995	2006
Other	802,382	1,325,786
EU	2,066,282	2,203,624
NAFTA	1,602,726	1,782,450
EastAs	1,309,748	882,460
CHN	21,657	113,622

FIGURE 6 Value added contribution of regions to world manufacturing final output (in 1995 US$)

Value added contribution of regions to world manufacturing final output (in 1995 US$)

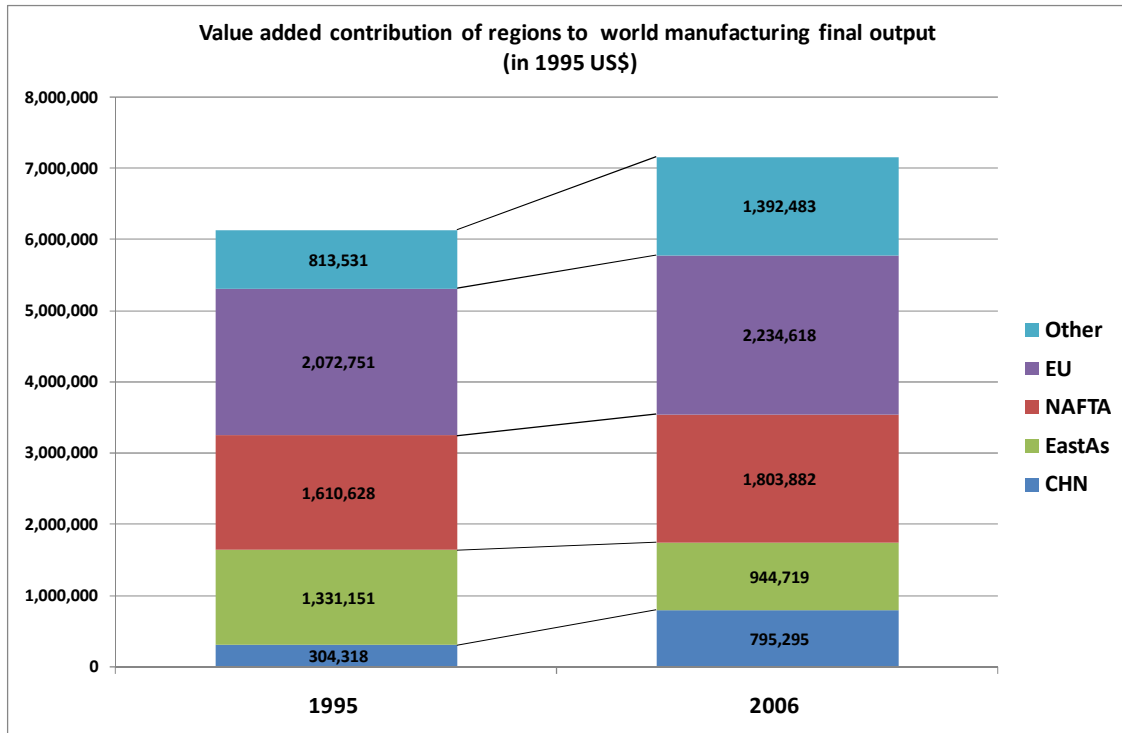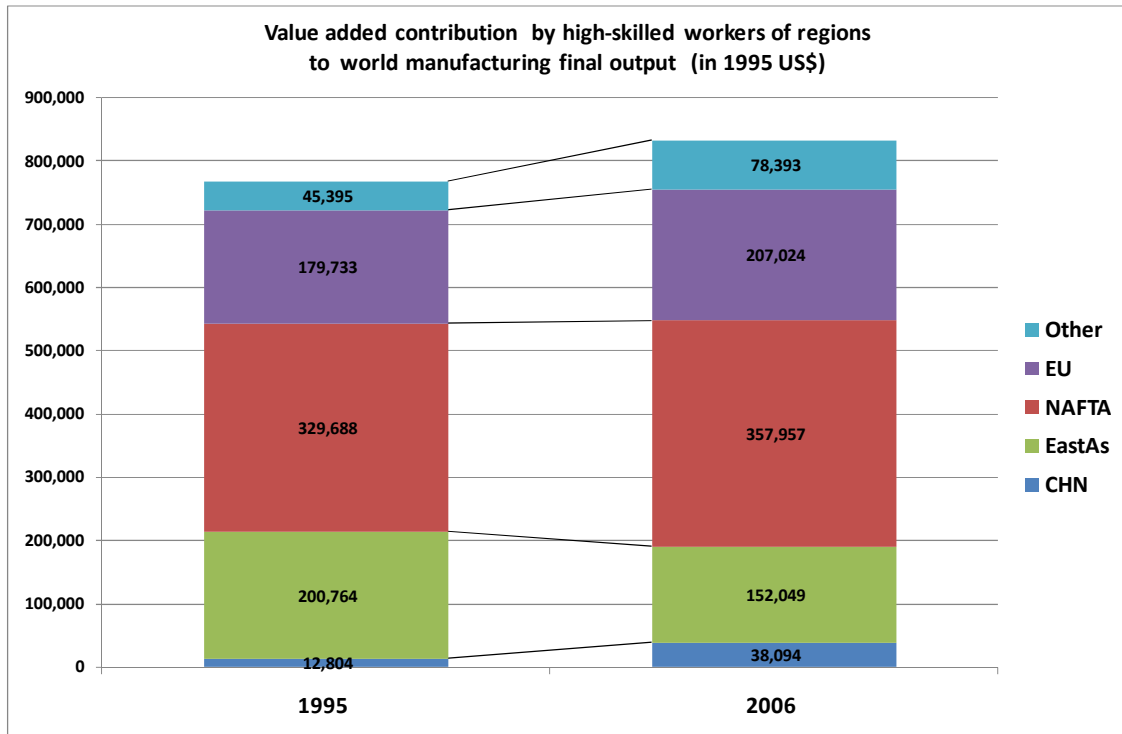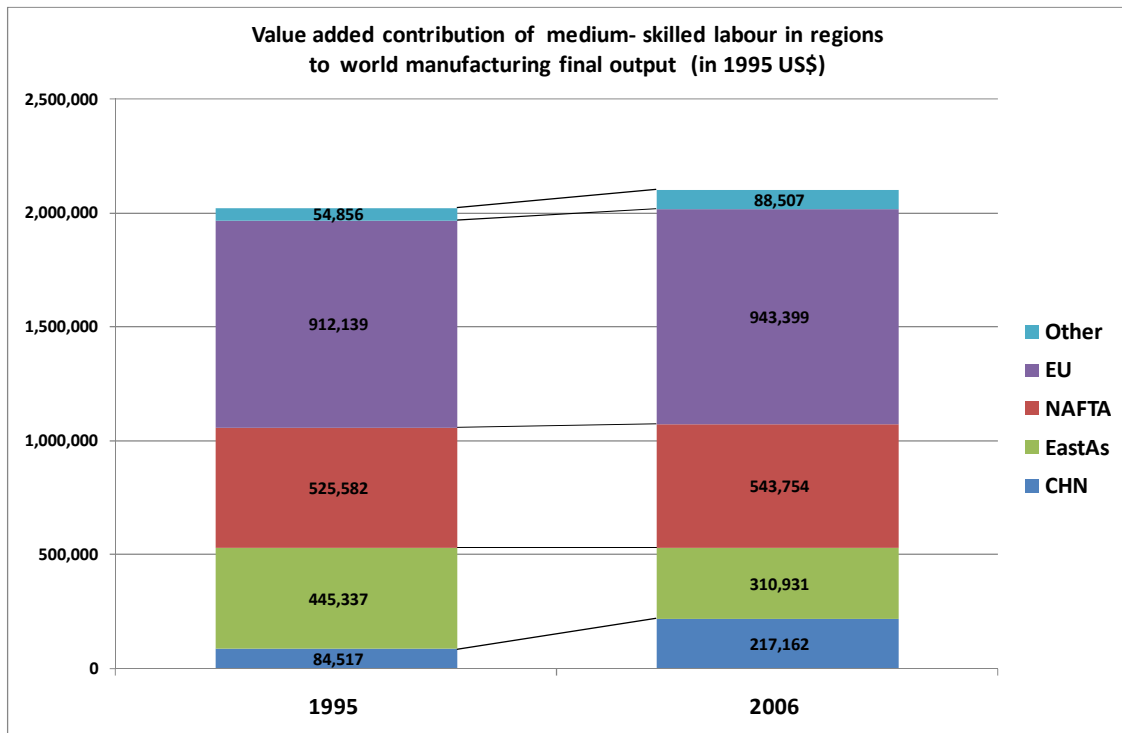|	1995	2006
Other	813,531	1,392,483
EU	2,072,751	2,234,618
NAFTA	1,610,628	1,803,882
EastAs	1,331,151	944,719
CHN	304,318	795,295

FIGURE 7 Value added contribution of regions to world manufacturing final output (in 1995 US$), various production factors

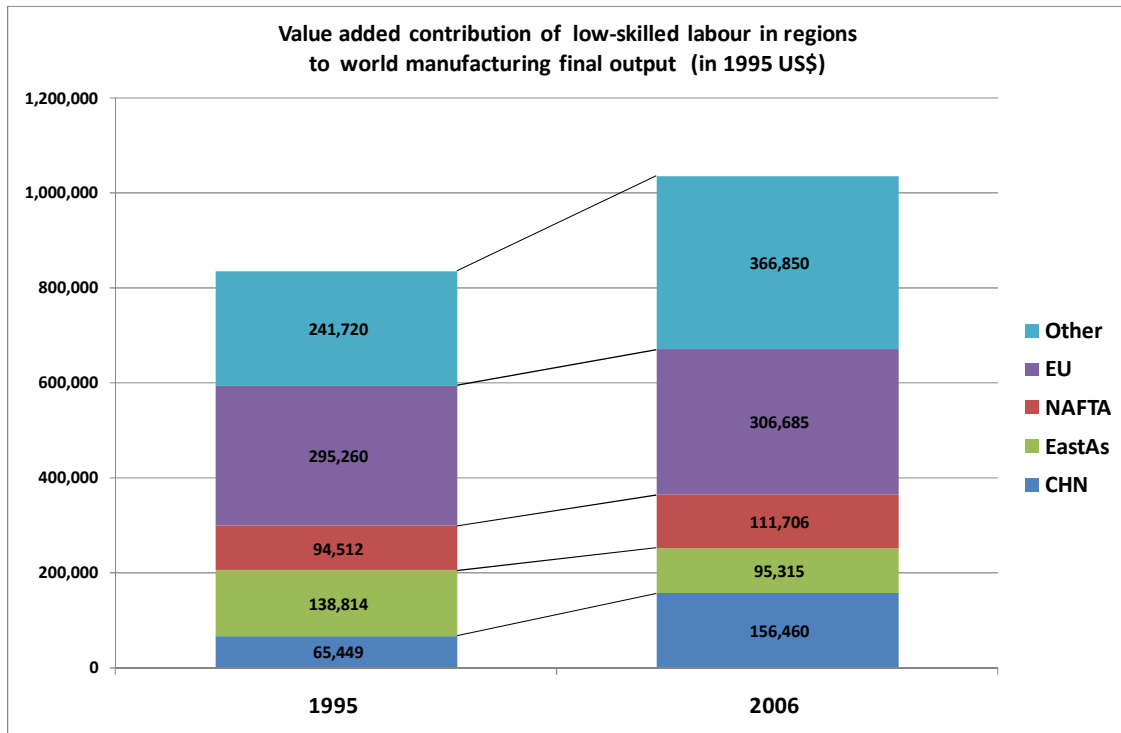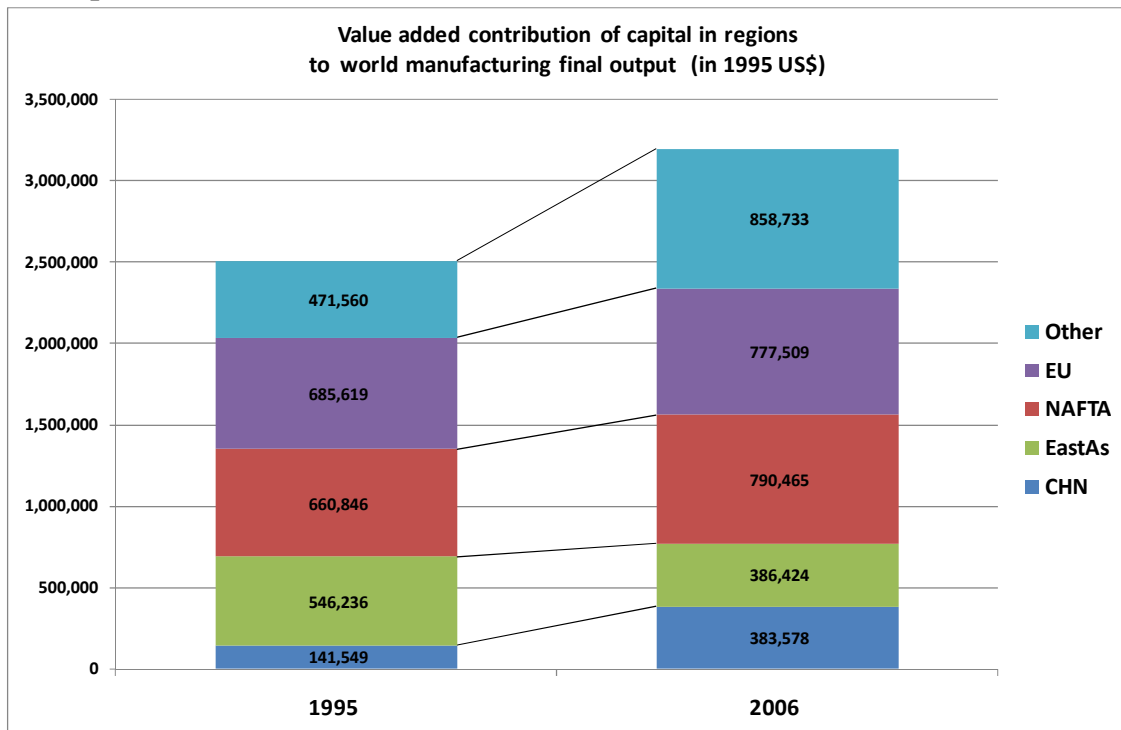**(a) High-skilled workers**

Value added contribution by high-skilled workers of regions to world manufacturing final output (in 1995 US$)

- Other
- EU
- NAFTA
- EastAs
- CHN

	1995	2006
Other	45,395	78,393
EU	179,733	207,024
NAFTA	329,688	357,957
EastAs	200,764	152,049
CHN	12,804	38,094

(b) Medium-skilled workers

Value added contribution of medium- skilled labour in regions to world manufacturing final output (in 1995 US$)

- Other
- EU
- NAFTA
- EastAs
- CHN

	1995	2006
Other	54,856	88,507
EU	912,139	943,399
NAFTA	525,582	543,754
EastAs	445,337	310,931
CHN	84,517	217,162

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(c) Low-skilled workers

Value added contribution of low-skilled labour in regions to world manufacturing final output (in 1995 US$)

	1995	2006
Other	241,720	366,850
EU	295,260	306,685
NAFTA	94,512	111,706
EastAs	138,814	95,315
CHN	65,449	156,460

(d) Capital

Value added contribution of capital in regions to world manufacturing final output (in 1995 US$)

	1995	2006
Other	471,560	858,733
EU	685,619	777,509
NAFTA	660,846	790,465
EastAs	546,236	386,424
CHN	141,549	383,578

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Appendix Table 1 National supply-use and input-output tables used for construction of WIOD

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Australia		SUT (106c * 106i)							SUT (233c * 53i)	SUT (233c * 53i)			
Austria	SUT (59c * 59i)		SUT (59c * 59i)		SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)		
Belgium	SUT (59c * 59i)		SUT (59c * 59i)		SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)			
Brazil						SUT (110c * 55i)	SUT (110c * 55i)	SUT (110c * 55i)	SUT (110c * 55i)	SUT (110c * 55i)	SUT (110c * 55i)	SUT (110c * 55i)	
Bulgaria						SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)			
Canada			SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	SUT (BP) (473c*1 22i)	
China			SUT(PR) (40c * 40i) & IO(PR) (124c * 124c)					SUT(PR) (42c * 42i) & IO(PR) (122c * 122c)					SUT(PR) (42c * 42i) & IO(PR) (135c * 135c)
Cyprus*						SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Czech Republic	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)		
Denmark		SUT (59c * 59i)			SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)		
Estonia			SUT (59c * 59i)		SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Finland	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
France	SUT (59c * 59i)		SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Germany	SUT (59c * 59i)		SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Greece						SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Hungary				SUT (59c * 59i)	SUT (59c * 59i)			SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
India				SUT(FC) (115c * 115i)					SUT(FC) (130c * 130i)			SUT(FC) (130c * 130i)	
Indonesia	IO (172c * 172c)					IO (175c * 175c)					IO (175c * 175c)		

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Appendix Table 1 National supply-use and input-output tables used for constructing of WIOD (continued)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ireland						SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)			SUT (59c * 59i)		
Italy	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)		
Japan	IO(PR) (108i * 108i)					IO(PR) (108i * 108i)							
Korea	IO(PR) (402c*402i)					IO(PR) (404c*404i)					IO(PR) (403c*403i)		
Latvia													
Lithuania		SUT (59c * 59i)		SUT (59c * 59i)					SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)		
Luxembourg	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Malta						SUT (59c * 59i)	SUT (59c * 59i)						
Mexico									SUT (79c * 79i)				
Netherlands	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Poland		SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)						SUT (59c * 59i)		
Portugal	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Romania						SUT (59c * 59i)			SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Russia	SUT (110c *59i)												
Slovak Republic	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Slovenia						SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Spain	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Sweden	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	
Taiwan		IO (596c*160i)					IO (610c*160i)					IO (554c*165i)	
Turkey		SUT(PR) (97c*97i)		SUT (97c*97i)				SUT (59c*59i)					
United Kingdom	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)	SUT (59c * 59i)				
USA	SUT(PR) (130c * 130i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)	SUT(PR) (66c * 65i)		

Note: All tables are at purchasers' prices unless otherwise indicated (PR stands for producer prices, FC for factor cost and BP for basic price), i stands for industry dimension and c for commodity. * Cyprus SUTs based on Greece.

Appendix Table 2 Value added contribution of regions (in columns) to manufacturing final output value in countries (in rows)

	own country 1995	own country 2006	CHN 1995	CHN 2006	EastAs 1995	EastAs 2006	EUnew 1995	EUnew 2006	EUold 1995	EUold 2006	NAFTA 1995	NAFTA 2006	Other 1995	Other 2006	Total (mil US$) 1995	Total (mil US$) 2006
EST	56.8	36.3	0.4	4.1	1.6	4.3	1.7	4.0	25.2	26.2	3.7	3.7	10.6	21.4	1,057	3,017
SVK	65.8	43.6	0.2	2.1	0.9	3.8	8.0	7.4	14.7	24.4	1.3	2.3	9.1	16.4	5,770	19,277
BEL	52.1	44.0	0.5	1.9	2.4	2.5	0.7	1.4	33.3	32.9	7.2	5.7	3.8	11.5	71,978	110,051
LUX	54.9	45.3	0.2	1.0	1.1	1.8	0.4	1.1	37.0	39.9	3.4	3.5	3.0	7.4	2,248	6,073
MLT	48.1	48.2	0.7	2.0	2.2	2.5	0.7	0.9	36.7	31.6	4.1	4.4	7.6	10.4	756	1,155
HUN	67.4	48.6	0.2	3.4	1.0	4.7	2.1	3.8	19.3	25.4	1.4	3.7	8.7	10.5	15,662	36,472
IRL	61.5	48.7	0.5	2.5	2.7	2.5	0.3	0.5	21.7	12.6	9.5	27.2	3.9	6.1	26,916	72,485
LTU	62.1	49.3	0.1	1.2	0.6	1.1	1.1	5.0	13.8	13.4	1.5	1.4	20.8	28.6	1,644	6,799
CZE	65.6	51.2	0.2	2.6	0.9	3.6	4.0	4.3	20.2	24.3	1.6	2.7	7.4	11.2	15,856	45,848
NLD	61.3	53.5	0.5	1.9	2.1	2.8	0.5	0.9	17.2	20.1	11.3	6.6	7.0	14.3	96,820	152,719
TWN	66.3	53.6	1.2	6.6	12.4	13.9	0.2	0.5	6.1	5.0	9.1	7.4	4.7	13.1	87,417	95,430
CYP	65.9	53.7	0.7	1.0	2.5	0.9	1.2	0.6	19.2	10.9	3.2	1.6	7.3	31.2	795	2,468
SVN	64.8	54.0	0.3	1.1	1.2	1.6	2.5	3.3	22.7	28.6	2.3	2.1	6.3	9.4	5,503	8,189
BGR	68.5	54.6	0.2	1.7	0.5	1.3	1.3	2.3	12.5	25.5	1.2	2.6	15.8	12.0	4,153	8,809
AUT	72.3	59.3	0.2	1.1	1.1	1.3	1.5	3.2	15.4	22.3	2.0	2.7	7.6	10.0	51,237	69,937
LVA	57.0	59.5	0.1	1.1	0.7	0.9	3.2	5.4	20.9	16.8	1.5	1.6	16.5	14.8	878	3,331
PRT	68.2	61.5	0.2	0.9	1.6	1.0	0.3	0.7	18.2	22.5	4.8	2.2	6.7	11.3	30,916	40,111
SWE	70.4	62.1	0.2	1.5	1.4	3.0	0.7	1.7	19.4	18.4	2.5	3.9	5.4	9.3	52,440	84,850
FIN	73.7	63.6	0.3	2.1	2.5	3.2	0.6	1.3	11.4	13.0	6.3	3.2	5.3	13.5	23,779	39,645
DNK	73.8	65.2	0.3	1.3	1.0	1.7	0.7	1.4	16.5	18.4	1.8	3.2	5.8	8.7	35,732	49,021
ESP	77.3	66.0	0.2	1.2	1.1	1.1	0.3	0.9	12.8	16.4	2.8	2.6	5.4	11.8	143,673	227,359
ROM	73.0	66.1	0.3	1.2	0.7	1.1	1.1	2.2	14.5	14.8	1.5	1.9	8.9	12.7	11,286	33,156
POL	82.1	66.4	0.2	1.4	0.6	2.1	1.0	1.9	10.7	16.5	1.1	2.1	4.5	9.7	34,594	86,951
CAN	66.3	67.0	0.5	1.7	2.9	2.4	0.1	0.2	5.5	3.7	21.9	20.8	2.7	4.2	128,830	223,711
FRA	78.2	69.0	0.2	1.1	1.4	1.3	0.3	0.9	11.3	15.7	4.3	3.2	4.3	8.8	325,086	440,046
KOR	76.3	69.0	1.4	4.1	5.4	5.5	0.2	0.2	4.1	4.1	5.8	4.2	6.8	12.8	125,082	196,175
GRC	78.0	70.8	0.2	0.8	0.9	1.3	0.8	1.0	11.7	10.5	2.2	1.4	6.3	14.1	25,325	37,150
DEU	81.1	71.2	0.3	1.4	1.7	1.6	1.1	2.4	8.7	12.1	3.1	3.0	4.1	8.4	631,705	752,086
ITA	78.9	72.0	0.3	1.2	1.0	0.9	0.7	1.1	10.2	10.3	3.7	2.6	5.3	11.9	308,074	453,630
ROW	77.3	72.1	0.2	2.9	5.4	2.7	0.4	1.0	10.7	13.1	4.0	3.9	1.9	4.2	143,067	285,587
GBR	77.1	73.0	0.4	1.3	2.0	1.4	0.4	0.7	10.8	12.1	4.5	3.4	4.9	8.0	249,623	346,501
MEX	75.7	73.3	0.2	2.3	1.9	2.3	0.1	0.1	2.9	3.0	17.8	15.6	1.5	3.4	123,312	323,184
TUR	81.3	74.3	0.5	1.4	1.2	1.2	0.6	1.0	8.1	8.3	2.0	1.8	6.4	11.9	65,130	153,313
CHN	85.8	79.0	-	-	6.5	7.2	0.1	0.2	1.9	3.4	2.4	2.5	3.4	7.7	329,584	1,104,709
USA	88.2	80.9	0.3	1.7	2.5	1.9	0.1	0.2	3.7	3.7	2.5	5.1	2.7	6.5	1,352,719	1,869,388
IND	89.4	81.9	0.4	2.1	1.0	1.1	0.1	0.2	3.4	3.5	1.1	1.9	4.6	9.4	123,698	265,835
IDN	83.0	82.6	0.7	1.9	6.1	2.9	0.1	0.1	4.3	3.7	2.4	1.9	3.4	6.9	71,790	110,555
AUS	84.8	83.1	0.5	1.5	2.8	1.8	0.1	0.1	4.7	3.4	3.1	2.8	4.0	7.3	57,419	95,247
JPN	93.1	84.9	0.5	2.3	0.5	1.1	0.0	0.1	1.2	1.8	2.5	2.6	2.2	7.2	1,120,226	927,429
BRA	90.7	86.7	0.2	0.8	1.0	1.1	0.1	0.1	2.7	3.6	2.1	2.6	3.2	5.1	173,618	243,959
RUS	89.0	87.8	0.2	0.8	0.7	2.1	1.0	0.7	4.3	4.9	0.8	0.9	4.0	2.9	56,983	147,215

Source: Calculated based on WIOD.