Trade is Essential for Jobs
– a Value Chain Perspective for Sweden
Abstract

How many jobs in Sweden are supported by trade, and how important are global value chains for jobs in the Swedish economy? This report examines how employment in Sweden is linked with international trade, capturing the relationship to both domestic and global value chains. The results show that nearly 30 per cent of jobs in Sweden are supported by trade. The majority of these jobs are in the services sectors, especially for suppliers to the exporting part of the economy. This means that trade barriers potentially hurt both employment in the exporting sector and, through domestic value chains, employment among domestic manufacturing and services suppliers.

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1. Introduction

The Swedish economy is often described as highly dependent on trade, with exports accounting for around 45 per cent of the Swedish GDP. But how important is international trade for employment in Sweden? By using input-output analysis this report shows how many Swedish jobs are supported by trade, both directly and indirectly.

A forthcoming report by the OECD shows that the number of jobs depending on trade has never been higher (Miroudot 2015). In large part this can be attributed to the development of trade in global value chains, i.e. the development of a fragmentation of production, both domestically and internationally. The development in global value chains has led to economies today being more interconnected through trade than ever before.

This report sheds light on international trade and employment for Sweden by analysing the relationship from a traditional perspective as well as a value chain perspective. In order to take into account both perspectives, different measures are used which capture employment that is supported both directly and indirectly by exports as well as employment supported by consumption taking place abroad. This highlights the link between employment and exports both within domestic value chains in Sweden and internationally through trade in global value chains.

In addition, we take into account the interconnectedness between different industries within the domestic value chains, studying the relationship between employment and intermediate exports, total exports and foreign final demand, for both goods and services. By calculating the number of jobs in Sweden that rely on bilateral trade with 39 other countries, we show how the Swedish labour force is connected to foreign value chains and foreign final demand through trade.

The report is structured as follows: Section 2 gives a background to recent developments in international trade with respect to the labour market and the relationship between trade and employment. Section 3 introduces different measures of the relationship between international trade and employment, and results from the different measures are presented in section 4. Finally, section 5 provides conclusions for the report.
2. **Value chains and employment in the Swedish economy**

Fragmentation of production processes between firms and countries is more prominent now than ever before. Firms can now divide production into distinct steps which can be performed by different firms and in different parts of the world. Seeking to lower the costs of production and increase productivity, firms consider the option of outsourcing and offshoring part of their production. Outsourcing has generally meant an increase in the share of trade in intermediate goods and services. Outsourcing of non-core tasks, of which many are services, has also meant that services industries have increased in importance (National Board of Trade 2010), also resulting in a higher share of services sector jobs supported by trade.

The development of manufacturing firms using, producing and selling more services is often referred to as servicification. Servicification implies that the links between manufacturing and services have become more intertwined. Services trade has also grown at a higher rate than trade in manufactured goods in recent years, which has led to a larger share of services in total Swedish exports. In order to study the relevance of servicification for Swedish employment, it is necessary to look at employment supported by total exports as well as exports of intermediate services and goods.

The development towards global value chains also means that traditional ways of measuring trade do not give the complete picture. The fact that exports are, to a considerable extent, comprised of imported goods and services skews the trade picture, especially when it comes to bilateral trade balances. To give a more adequate and complete description, it is necessary to look at where the value added is created. In the same manner, it is possible to distribute the labour contribution to production, both geographically and by sector.

To capture which countries and sectors support Swedish employment and by how much, it is necessary to follow value added throughout trade flows. We therefore need to disentangle the interconnectedness within the Swedish domestic value chains, i.e. all steps within Sweden that are necessary to produce Swedish exports, for both goods and services. Doing so allows us to measure all employment both directly and indirectly supported by exports.

The developments in global value chains, consisting of an increased trade in intermediates, changes the bearing that trade has on the economy. While part of Swedish exports is shipped directly as final goods or services to the final destination for consumption, other parts of the export will be used as inputs for further processing before going to the final destination for consumption or use. By applying a value chain perspective, it is possible to discern which countries are users of Swedish intermediates and which countries are the final users or consumers of products exported from Sweden.
3. Method

This section presents the different measures used to estimate the relationship between trade and employment. Readers interested in the technical derivation of the different measures can find a detailed description in annex 2.

Estimating the relationship between international trade and employment is far from trivial. Up until recently, there were very few consistent datasets that could be used to connect international trade and employment. Previous research using similar approaches to study the relationship between trade and jobs in global value chains are e.g. Timmer et al. (2013) and Growth Analysis (2014) who study jobs supported by manufacturing value chains; a forthcoming paper by Miroudot (2015) analyses the link between global value chains, jobs and productivity. The most recently published study, to our knowledge, Arto et al. 2015, conducted for the European Commission, estimates employment supported by export to the external market, i.e. outside the EU. They estimate that more than 763 thousand jobs in Sweden are supported by export to countries outside the EU.

Our calculations are based on the World Input-Output Database (WIOD), covering 35 industries and 40 countries for the period 1995-2011. Altogether, WIOD covers some 85 per cent of the world economy. The database covers the (then) 27 EU member states and 13 other major trading partners to the EU. For tables listing the countries and industries in WIOD, see annex 1.

An advantage of using WIOD is that it contains socioeconomic satellite accounts, including data on employment, which are consistent with other parts
of the database. Employment and jobs are used interchangeably in this paper and measure the number of persons engaged, which includes employees as well as self-employed persons.

We use five different measures to show how employment in Sweden is related to international trade:

i. jobs directly supported by gross exports,
ii. jobs directly and indirectly supported by gross exports,
iii. jobs directly and indirectly supported by foreign final demand,
iv. jobs directly supported by exports of intermediate goods and services,
v. jobs directly and indirectly supported by exports of intermediate goods and services.

The first measure can be seen as the traditional way of looking at the relationship between trade and employment, i.e. the number of persons in the export sector who are supported by exports. The two following measures take value chains into account but in different ways. Measure (ii) takes the domestic value chains into account and links persons engaged in producing input to the exporting sectors as well as persons engaged in the exporting part of the Swedish economy. Measure (iii) includes the whole value chain, both domestically and internationally. Focusing on the part of Swedish production that is finally consumed in another country, the measure includes both exports that go directly to the country for final consumption and the part that ends up in the recipient country indirectly after further processing in a third country. By looking at where exports are finally consumed, it is possible to see which countries’ consumption are most important for employment in Sweden.

Measures (iv) and (v) can be seen as GVC dependent jobs, i.e. only jobs supported by exports of intermediate goods and services that are further processed in third countries. Measure (iv) computes the number of jobs supported directly within the exporting part of the economy, by Swedish exports of intermediate goods and services. Measure (v) shows the number of jobs supported throughout the total Swedish economy by exports of intermediate goods and services.
4. Results

This section presents the results for the different measures presented in the previous section.

4.1 Nearly thirty per cent of employment is supported by trade

Figure 1 and Table 1 show the number of persons in Sweden engaged in production, directly or indirectly, supported by international demand, i.e. either directly engaged in exports from Sweden or indirectly as employed in sectors providing input to the exporting sectors.

Table 1. Employment in Sweden, supported by export

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<td>664</td>
<td>754</td>
<td>696</td>
<td>666</td>
<td>678</td>
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<tr>
<td>Directly and indirectly</td>
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<td>1 251</td>
<td>1 259</td>
<td>1 410</td>
<td>1 287</td>
<td>1 283</td>
<td>1 329</td>
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<tr>
<td>Share of total employment (%)</td>
<td></td>
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</tr>
<tr>
<td>Directly</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Directly and indirectly</td>
<td>27</td>
<td>29</td>
<td>29</td>
<td>31</td>
<td>29</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

Source: WIOD and authors’ calculations

The blue series in Figure 1 describes the number of persons engaged in the first tier of export, i.e. directly in the exporting sectors. The yellow series also includes employees supported indirectly, i.e. subcontractors in all tiers, to the exporting sector. The number of persons supported by exports within the exporting sector amounted in 2011 to 678 thousand, representing an increase of 20 per cent since 1995. The share of total employment engaged in the exporting sector has remained stable over the period with a share of around 15 per cent, an increase of one percentage point when comparing 2011 with 1995.

Taking domestic value chains into account, exports supported 1 329 thousand persons in 2011 throughout the economy, almost twice the number supported in the exporting sector alone. This represents nearly 30 per cent of total employment in Sweden. Over the period 1995-2011 international trade has become relatively more important for domestic suppliers providing inputs to the exporting sector than for the exporting sector itself. The number of jobs supported directly by exports increased by 20 per cent over the period 1995-2011, whereas the number of jobs supported indirectly increased even more, by 23 per cent. This highlights the importance of domestic value chains when considering the relationship between trade and employment.
Figure 2. Employment, directly supported by export of goods and services, shares (%)

Source: WIOD and authors' calculations

Figure 3. Employment, directly and indirectly supported by export of goods and services, shares (%)

Source: WIOD and authors' calculations

Figure 4. Employment, directly supported by export of intermediate goods and services, shares (%)

Source: WIOD and authors' calculations

Figure 5. Employment, directly and indirectly supported by export of intermediate goods and services, shares (%)

Source: WIOD and authors' calculations
4.2 Services are more important in the domestic parts of the value chains

Over the period 1995-2011, services’ share of total employment supported by exports has increased. From having accounted for 25 per cent of jobs supported by exports in 1995, services sectors accounted for 45 per cent of jobs in 2011, see Figure 2. This share has increased almost every year during the period, with an annual average increase of close to four per cent.

The importance of services is also evident when looking at employment supported by exports throughout the whole economy. In 1995, services sectors accounted for 46 per cent of the total number of jobs supported by export, a share that increased to 62 per cent in 2011, see Figure 3.

Figures 4 and 5 describe how the distribution of employment supported by exports of intermediate goods and services has developed over time, in Figure 4 for the exporting sector and in Figure 5 throughout the economy. While employment in services sectors in the exporting part of the economy has increased from 30 per cent in 1995 to 53 per cent in 2011, the same development for employment supported throughout domestic value chains increased from 48 to 66 per cent. This shows that services are more important for exports of intermediates than for all (intermediate and final) goods and services (Figures 2 and 3). It also shows that services sectors are even more important as subcontractors for exports of intermediates. Altogether, this highlights the importance of services sectors for Swedish participation in global supply chains compared with total exports.

4.3 Which countries are important for Swedish employment

The same set of measures as in the previous section are used to describe which countries are most important for employment in Sweden with the addition of a measure looking at where Swedish exports are consumed, i.e. the last step in the value chains. Starting with employment supported by gross exports, we use measure (i) for the exporting part of the economy and measure (ii) for all employment throughout the economy which is supported by gross exports measures (i) and (ii).

In 2011, the US market supported most jobs directly in the Swedish exporting sectors. The ten most important markets for supporting Swedish jobs in the exporting sectors were the USA, Ger-

![Figure 6. Employment supported by export, directly and directly and indirectly, 2011, th. persons engaged](chart)

* Values for China refer to 2008

**Source:** WIOD and authors’ calculations
Germany, China, Denmark, Finland, the UK, France, the Netherlands, Belgium and Italy. Together and using this measure, they supported 47 per cent of the total number of jobs in Sweden. Exports to EU(27) supported 39 per cent of the total.

Table 2. EU(27) shares (%) of employment supported by exports

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Directly</td>
<td>51.4</td>
<td>48.5</td>
<td>46.1</td>
<td>43.7</td>
<td>41.9</td>
<td>38.1</td>
<td>38.8</td>
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<tr>
<td>Directly and indirectly</td>
<td>52.6</td>
<td>49.8</td>
<td>48.0</td>
<td>45.6</td>
<td>43.9</td>
<td>41.1</td>
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</table>

Source: WIOD and authors’ calculations

When also including jobs indirectly supported by exports, the numbers naturally increase. The positions in the ranking are largely unchanged with the exception of Germany, which switches ranks with the USA as exports to Germany support more jobs indirectly through the domestic value chains compared with exports to the USA. Exports to the ten countries that support most employment throughout the value chains in Sweden account for 48 per cent of the total numbers of persons supported by export. The importance of EU(27) increases somewhat when including those who are indirectly supported by export. In 2011, exports to EU(27) supported 42 per cent of the total number of jobs supported directly and indirectly by exports.

To illustrate the relationship between exports and employment through the interconnection of global value chains, measure (iii) is introduced in Figure 7. This measure refers to employment in Sweden supported by foreign final demand. This incorporates Swedish employment throughout all tiers of production (i.e. measure (iii) above).

The difference between measure (ii) (total employment supported by exports) and measure (iii) (total employment supported by foreign final demand) shows how Swedish produced goods and services are traded over the world, shifting from the first country of destination in several steps and finally arriving in the country where final consumption will eventually take place. In relation to the USA, measure (iii) is larger than measure (ii), showing that the USA is more important as a market for final consumption of Swedish products than as a direct trading partner. 139 thousand jobs in
Sweden are supported by final consumption in the USA, making it the most important country for employment in Sweden in this respect. Germany and Denmark on the other hand are larger direct trading partners than final consumers of products produced by the Swedish workforce. This implies that firms in Germany and Denmark use Swedish produced inputs for further production and subsequent export.

The USA, China and Germany together supported 24 per cent of Swedish employment supported by foreign final demand. Considering earlier results published by the National Board of Trade, these results are not surprising. Employment in Sweden supported by international trade follows the pattern of trade in value added as shown in e.g. National Board of Trade (2013), where the USA came out as the major recipient of Swedish value added in 2008, accounting for almost 12 per cent of total value-added exports.

The last relationship in this report illustrates the importance of Swedish exports of intermediate goods and services for employment in Sweden, by country. Today, the large bulk of international trade is not in final products for consumption but trade in intermediate goods and services used for further processing. This is a result of the fragmentation of production with different stages of the production process dispersed across different countries. Studying which countries are important for Swedish jobs through exports of intermediate goods and services gives a picture of the importance of trade with different countries for Swedish participation in global value chains.

Figure 8 contrasts measures (iv) and (v), i.e. employment supported by Swedish export of intermediate goods and service, in (iv) in the exporting part of the economy, and in (v) throughout the Swedish economy. As for gross export, Germany and the USA switch ranks when moving from employment supported within the exporting sector alone to employment supported throughout the economy. While the USA is the most important country for jobs directly supported by exports of intermediates, Germany is the most important when also including subcontractors. Thus, Germany and the USA are the most important countries for jobs in Sweden supported by trade through the global value chains.
5. Concluding remarks

This report presents the relationship between trade and employment for Sweden from a value chain perspective.

• Exports support nearly 30 per cent of jobs in Sweden

The traditional way of measuring employment in the exporting sector shows that 15 per cent of the total number of employees in Sweden are supported by exports. This measure underestimates the relationship between trade and employment.

• Subcontractors account for almost half of the total number of jobs supported by exports

Taking into account the number of jobs that are indirectly supported by trade, i.e. the suppliers to the exporting sectors, almost doubles the number of employed persons supported by trade, increasing the share of total employment supported by trade to 29 per cent. Hence, when studying the importance of trade and possible effects of trade policy for employment, it is necessary to look at the links in the domestic value chains in addition to the relationship between exporting sectors and employment. Consequently, distorting trade measures may have an affect not only on employment in the exporting parts of the Swedish economy but also on domestic suppliers.

Over the period 1995-2011, the share of the total Swedish labour market that directly and indirectly relies on exports has remained stable.

• Services sectors are increasing in importance

45 per cent of jobs in the exporting part of the economy originated from the services sectors. Services became even more important when adding the indirectly employed. In total, 62 per cent of jobs in the Swedish economy that relied on exports were employed in the services sectors. Since 1995, services have increased in importance both for the directly employed in the exporting part of the economy and even more so in the supplying sectors.

• Effects of trade barriers require a holistic approach on trade and jobs

This implies that it is not only trade barriers that manufacturing exports face that may affect employment in Sweden but also barriers to services trade. Further, since a significant proportion of suppliers to the exporting part of the economy comes from services sectors, the effects of trade barriers to manufacturing goods could trickle down through the domestic value chains and affect employment for domestic services suppliers. Hence, when analysing effects on the labour market from trade barriers to manufacturing goods, the interconnectedness of the services providers should be taken into account.

• Trade through global value chains increases the importance of countries outside the EU

The results also show that destinations outside the EU have become more important in supporting Swedish jobs (Table 2). This is particularly true when we look at where Swedish produced goods and services are finally consumed (Figure 7), whether it is by direct export to the final destination or through exports of intermediary goods or services for further processing into final products abroad. Thus it is not only trade barriers with the country to which exports go directly that could affect employment in Sweden, but also trade barriers further down the value chain.


Annex

1 Country and industry coverage

Table 1 Countries in the WIOD dataset (November 2013 release)

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Source: WIOD and authors’ calculations
## Table 2 Industries in the WIOD dataset (November 2013 release)

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<td>Other supporting and auxiliary transport activities; activities of travel agencies</td>
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<td>Post and telecommunications</td>
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<tr>
<td>Financial intermediation</td>
<td>J</td>
<td>S</td>
</tr>
<tr>
<td>Real estate activities</td>
<td>70</td>
<td>S</td>
</tr>
<tr>
<td>Renting of machinery and equipment and other business activities</td>
<td>71-74</td>
<td>S</td>
</tr>
<tr>
<td>Public admin and defence; compulsory social security</td>
<td>L</td>
<td>S</td>
</tr>
<tr>
<td>Education</td>
<td>M</td>
<td>S</td>
</tr>
<tr>
<td>Health and social work</td>
<td>N</td>
<td>S</td>
</tr>
<tr>
<td>Other community, social and personal services</td>
<td>O</td>
<td>S</td>
</tr>
<tr>
<td>Private households with employed persons</td>
<td>P</td>
<td>S</td>
</tr>
</tbody>
</table>

* International Standard Industrial Classification of all Economic Activities (ISIC), revision 3.0.
** Goods (manufacturing) sectors are denoted G and services sectors S. For the purpose of this paper we classify utilities (Electricity, gas and water supply) as services.
2 Model and Method

WIOD was constructed by harmonizing national Input–Output tables (IO tables) by means of bilateral trade statistics. National IO tables describe how different sectors in the economy are linked together, i.e. how the sectors are dependent on each other for input in order to produce their own output. A national IO table describes how value added (VA) is built up within an economy. WIOD, being a multi-country IO table, does the same on an international level. The difference is that in a multi-country IO table the output can be traced to a geographical source. It is therefore possible to decide whether a product is produced domestically or by a foreign industry. Hence, in a multi-country IO table, it is possible to see both from which industry a product comes and in which country this industry is located. It is also possible to follow Swedish output to determine first, where it is used as input for further production and thereafter, where the Swedish production is finally consumed.

2.1 Leontief’s inverted matrix

In this section, we briefly describe the method used for calculating the relations between trade and employment (persons engaged in production).

The basis for our calculations is Leontief’s linear equation system. It describes the linkages between industries through value chains, i.e. the flow of intermediate goods and services needed to produce for the final demand of each industry.

The cornerstone of the Leontief model is a squared tabulation of the economic flows between sectors, described by the input-output in Table 3. The first \( nxn \) elements of the IO table record intra- and inter-industry transactions of intermediate goods and services, where sales are recorded horizontally and purchases vertically. The \( n+1 \) column ("final demand") records sales to final consumers and the \( n+1 \) row ("value added") outlays on labour and capital that process raw materials and manufactured inputs into more valuable outputs. The shaded columns to the right and at the bottom of the table record the supply/revenue of each industry.

Table 3. Input-Output table

By combining assumptions of fixed input coefficients, constant returns to scale and exogenous final demand, the model boils down to a linear equation system of supply and demand,

\[
\begin{bmatrix}
    y_1 \\
    y_2 \\
    \vdots \\
    y_n
\end{bmatrix}
= \begin{bmatrix}
    \vdots & \vdots \\
    a_{11} & a_{12} & \cdots & a_{1n} \\
    a_{21} & a_{22} & \cdots & a_{2n} \\
    \vdots & \vdots & \ddots & \vdots \\
    a_{n1} & a_{n2} & \cdots & a_{nn}
\end{bmatrix}
\begin{bmatrix}
    y_1 \\
    y_2 \\
    \vdots \\
    y_n
\end{bmatrix}
+ \begin{bmatrix}
    f_1 \\
    f_2 \\
    \vdots \\
    f_n
\end{bmatrix}
\]

(1)

where \( y \) denotes the production vector, \( A \) the input-output matrix per unit of output and \( f \) the final demand vector, and where the matrix product of \( A \) and \( y \) gives the intermediate demands for inputs. The solution to this linear equation system (the general equilibrium) is,

\[
y = (I - A)^{-1}f
\]

(2)
where \([I-A]^{-1}\) is the “Leontief inverse” that computes the input requirements from each sector of the economy to produce the exogenous vector of final demand.

To simplify the notation, we use \(B\) to describe the inverse of Leontief’s matrix:

\[
B = [I - A]^{-1} \tag{3}
\]

The above mentioned model can also be applied to a multi-country setting with \(m\) countries and \(n\) sectors using block-matrix notation. Then, \(A\) denotes the \(mn \times mn\) block matrix, where domestic IO tables are recorded on the block diagonal and the international IO links on the off-diagonal blocks,

\[
A = \begin{bmatrix}
A_{11} & A_{12} & \cdots & A_{1m} \\
A_{21} & A_{22} & \cdots & A_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
A_{m1} & A_{m2} & \cdots & A_{mm}
\end{bmatrix}
\tag{4}
\]

where domestic IO tables recorded on the block diagonal and the international IO links on the off-diagonal blocks. The final demand data are similarly organized in a global matrix \(F\) with \(mxm\) country blocks and \(n\) sectors in each block,

\[
F = \begin{bmatrix}
F_{11} & F_{12} & \cdots & F_{1m} \\
F_{21} & F_{22} & \cdots & F_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
F_{m1} & F_{m2} & \cdots & F_{mm}
\end{bmatrix}
\tag{5}
\]

2.2. ... and employment

To introduce employment into the model, we introduce the vector \(l\). The vector entails the coefficients of employment, calculated as the number of persons engaged needed to produce one unit of output in country \(i\) in sector \(k\), i.e. the number of persons engaged per unit output \(Y\) in country \(i\) in sector \(k\):

\[
l_{ik} = \frac{\text{employment}_{ik}}{Y_{ik}} \tag{6}
\]

By multiplying vector \(l\) with the global Leontief inverse \(B\), we can calculate the number of persons engaged that are needed, both directly and indirectly, to produce one unit for both gross export and final demand.

We start with measure (i), the number of persons engaged in production directly supported by gross export, i.e. only those engaged in the exporting sectors. This can be seen as the traditional way of showing the relationship between trade and employment. In this calculation, multiplication with the Leontief inverse \(B\) is not needed as no indirect effects are sought. The number of persons engaged in the export sector who are supported by gross export is given by the equation:

\[
E = l \cdot x \tag{7}
\]

where \(x\) is a vector of gross export from country \(i\) and sector \(k\) to country \(j\). Measure (ii), the number of persons engaged in the whole economy, supported by gross export, is calculated by multiplying the employment vector \(l\) with the Leontief inverse for the domestic economy (the diagonal blocks in the inter-country IO table), \(BD\) and then gross export \(x\):

\[
EX = l \cdot BD \cdot x \tag{8}
\]

To account for how Swedish production is distributed in global value chains and see how foreign final demand supports Swedish jobs, we replace the vector for gross export \(x\) with the vector for foreign final demand \(f\). To account for global value chains,
the domestic Leontief inverse is replaced with the global version \( B \). Through the global value chains, some of the intermediates exported returns to the country of origin. This part needs to be deducted in order for it not to be double counted. This is done by deducting the labour supported by domestic final demand, i.e. the diagonal elements of the first part of the equation:

\[ \text{EGVC} = \mathbf{l} \cdot \mathbf{B} \cdot \mathbf{f} - \mathbf{l} \cdot \mathbf{B} \cdot \mathbf{f} \cdot \mathbf{ID} \]  

(9)

where \( \mathbf{ID} \) is an identity matrix. In a similar manner as \( \mathbf{E} \), measure (iv) \( \text{EXI} \) is calculated by multiplying directly with export but here also deducting the export of final goods and services:

\[ \text{EXI} = \mathbf{l} \cdot \mathbf{x} - \mathbf{l} \cdot \mathbf{f} \mathbf{x} \]  

(10)

where \( \mathbf{f} \mathbf{x} \) is the export of final goods and services.

Finally, measure (v) \( \text{EVXI} \) follows the same pattern as \( \text{EXI} \), by also including the Leontief inverse:

\[ \text{EVXI} = \mathbf{l} \cdot \mathbf{B} \cdot \mathbf{x} - \mathbf{l} \cdot \mathbf{B} \cdot \mathbf{f} \mathbf{x} \]  

(11)

Summation is done by reporting country, its industries and partner country as a whole. Hence, we show estimates for employment in sector \( k \), supported by the relevant export measure, from country \( i \) to country \( j \). To present detailed estimates for partner country industries as well would be to stretch the underlying statistics and assumptions too far.

2.3 Limitations and assumptions

The Leontief model is based on two core assumptions which can have implications for the analysis. The first assumption is that the input coefficients are constant, i.e. that there are no substitution effects in the model. For example, an increased cost of production for suppliers in Germany does not lead to Swedish industries switching to other supplier countries of the same input, say for instance from France. Since there are no substitution effects, the higher cost will simply not lead to any redistributitional effects. The second assumption is that the input coefficients are the same for production for the domestic market and for exports. This also translates into the most troublesome sub-assumption, that the labour intensity is the same for production for the domestic and export markets. For this reason, some of the results for services sectors in particular should be interpreted with care. The reason why the results for services sectors are more prone to being affected is that some services are difficult and even impossible to trade internationally. In highly aggregated services industries, it is quite possible that some services with high labour intensity are not tradable while some services with low labour intensity are traded a lot. This would give rise to an overestimation of the number of jobs supported by trade.

During the period, Sweden and the world endured an economic and financial crisis with grave consequences for production and trade. One way for firms to manage the rapid shifts in demand was to produce for or sell from inventories. These shifts in inventories are reflected in GDP but have no direct connection to the linkage between export and employment. In order to have a more direct connection between production (and hence employment) on the one hand and export and foreign final demand on the other, calculations have been made using total output excluding changes in inventories:

\[ Y = \text{BNP} - \Delta \text{INVN}, \]  

(12)

where \( \text{INVN} \) denotes inventories and \( \Delta \) the change over time, between \( t \) and \( t-1 \).
Notes

1 For more information on sources and methods in WIOD, see Dietzenbacher et al. (2014).

2 For the years 2010 – 2011, the estimates for persons engaged are forecasts. Results on employment for these years should therefore be treated with care.

3 In market equilibrium, the production of each industry must satisfy both the final demand for its output $f$ and the intermediate needs of all sectors to produce the final demand vector $A[I - A]^{-1} f$. The reason why the final demand vector is multiplied with $A$ and the powers of $A$ is that the suppliers of inputs use inputs themselves, which in turn are produced with yet other inputs all the way back to the initial production stage.