Input-Output-Analysis of the Import Content of Production

A comparison between FRA, GER and NETH

Franco-German Conference

19-20 June 2008 in Berlin
**Subject**

Import content of national production

**Starting point**

Fragmentation = new phenomenon of the international division of labour

**Consequences of international fragmentation**

Foreign trade, production and employment
State of the Art

Impact of fragmentation on export economy

Traditional Model

\[ x_{ex} = (I - A_d)^{-1} \ast ex \]
\[ im_{ex} = A_{im} \ast (I - A_d)^{-1} \ast ex \]
\[ balance = x_{ex} - im_{ex} \]

Impact of fragmentation on total economy???

How to model the production process behind the inputs imported comparable with the export induced domestic output?
How to identify the domestic output adequate to imported inputs?
Import Modeling in Input-Output-Framework

Type A: Imports structured by sectoral origin

Type B: Imports structured by sectoral use

Type C: Identification of complementary vs. competitive imports

Type D: Import Matrices structured by intermediate and final use
Type D: Import matrices

where:

- $X_{ij}^d$ = Matrix of Intermediate Inputs Domestically Produced
- $Y_{il}^d$ = Final Demand for Goods Domestically Produced
- $X_{ij}^{im}$ = Matrix of Imported Intermediate Goods
- $Y_{il}^{im}$ = Final Demand for Imported Goods
- $x_{i.}^d$, $x_{j.}^d$ = Gross Output of Domestic Goods
- $x_{i.}^{im}$ = Total Imports
- $Z_{ij}$ = Matrix of Primary Inputs
Alternatives to Calculate Total Effects of Imports on Production by the Standard Static Open Input-Output-Model

Model A: „Imputation-Model“

Model B: „Technology - Model“

Model C: „Fragmentation-Model“
Model A: „Imputation-Model“

Total Export-induced Output

\[(1) \quad x^{ex} = (I-A^d)^{-1} \ast ex\]

Total Import for the Output of Total Final Demand Goods

\[(2) \quad im = A^{im} \ast (I-A^d)^{-1} \ast y^d\]

*where:*

\[A^d, A^{im}\] Matrices of Technological Coefficients of Intermediate Inputs Produced Domestically or Imported

\[y^d\] Final Demand
Model B: „Technology-Model“

Assumption: All intermediate inputs required for production of export goods as well as for the import-adequate production are produced domestically.

\[ x^{\text{ex}} = (I-A)^{-1} \ast \text{ex} \]
\[ x^{\text{im}} = (I-A)^{-1} \ast \text{im} \]

The model describes exclusively technological relations.

where:

\[ A \] Matrix of Technological Coefficients of Intermediate Inputs,
\[ x^{\text{ex}} \] Total export-induced production technologically induced,
\[ x^{\text{im}} \] Total import-adequate production technologically induced,
Model C: „Fragmentation-Model“

The exports induce - directly and indirectly - output of goods in the national economy. The losses of outputs in the national economy, which in case of the displacement by imported goods occur, amount to goods necessary for the (hypothetical) total domestic production of these imported goods:

\[
\begin{align*}
(5) \quad x^{ex} &= (I-A^d)^{-1} \ast ex \\
(6) \quad x^{im} &= (I-A^d)^{-1} \ast im
\end{align*}
\]

where:

- \(x^{ex}\) Total export-induced production,
- \(x^{im}\) Total import-adequate production.
German Exports and Imports between 1985 and 2002\textsuperscript{a} (without re-exports)

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>268.0</td>
<td>379.3</td>
<td>568.5</td>
<td>632.8</td>
</tr>
<tr>
<td>Imports</td>
<td>237.1</td>
<td>342.5</td>
<td>532.4</td>
<td>505.3</td>
</tr>
<tr>
<td>Balance</td>
<td>30.9</td>
<td>36.8</td>
<td>36.1</td>
<td>127.5</td>
</tr>
</tbody>
</table>

\textit{Memo:} Export rate\textsuperscript{a} in %

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Export rate</td>
<td>30.9</td>
<td>23.4</td>
<td>31.2</td>
<td>32.7</td>
</tr>
</tbody>
</table>

\textsuperscript{a} The figures for the year 1985 refer to the Federal Republik of Germany before reunification.

\textsuperscript{b} Share of exports (without re-exports) in GDP.

Sources: Federal Statistical Office of Germany; own calculations.
Composition of Exports

- In % -

Sources: Federal Statistical Office of Germany; EUROSTAT, own calculations.
### Total Effects of Exports and Imports on German Employment between 1985 and 2002\(^a\) (without re-exports)

<table>
<thead>
<tr>
<th></th>
<th>Employees in 1 000 persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export effects</td>
<td>5 729</td>
</tr>
<tr>
<td>Losses by Imports</td>
<td>4 746</td>
</tr>
<tr>
<td>Balance</td>
<td>983</td>
</tr>
<tr>
<td><strong>Memo:</strong> Balance in % of total employment</td>
<td>3.9</td>
</tr>
</tbody>
</table>

\(^a\) The figures for the year 1985 refer to the Federal Republic of Germany before reunification.

*Sources: Federal Statistical Office of Germany; own calculations.*
## Exports and Imports of the Netherlands and France (without re-exports)

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th>Netherlands</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>2001</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Euro bn</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>568.5</td>
<td>190.3</td>
<td>274.4</td>
</tr>
<tr>
<td>Imports</td>
<td>532.4</td>
<td>164.4</td>
<td>272.1</td>
</tr>
<tr>
<td>Balance</td>
<td>36.1</td>
<td>25.9</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Memo:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export rate(^a) in %</td>
<td>31.2</td>
<td>50.2</td>
<td>21.6</td>
</tr>
</tbody>
</table>

\(^a\) Share of exports (without re-exports) on GDP.

*Sources: EUROSTAT, own calculations.*
# Total Effects of Exports and Imports on Employment in the Netherlands and France (without re-exports)

<table>
<thead>
<tr>
<th>Employees in 1 000 persons</th>
<th>Germany</th>
<th>Netherlands</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>2001</td>
<td>2000</td>
</tr>
<tr>
<td>Export effects</td>
<td>7 520</td>
<td>2 147</td>
<td>3 473</td>
</tr>
<tr>
<td>Losses by Imports</td>
<td>6 735</td>
<td>1 409</td>
<td>3 262</td>
</tr>
<tr>
<td>Balance</td>
<td>785</td>
<td>738</td>
<td>211</td>
</tr>
</tbody>
</table>

**Memo:**
Balance in % of total employment
2.0 8.9 0.9

*Sources: EUROSTAT, own calculations.*
## Components of Total Employment Effects of Exports and Imports in Germany in 2002

<table>
<thead>
<tr>
<th></th>
<th>Exports</th>
<th></th>
<th>Imports</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Total Export Effect</td>
<td>Total</td>
<td>Total Imports a</td>
</tr>
<tr>
<td></td>
<td>Employees (in %)</td>
<td></td>
<td>Losses by Imports</td>
<td></td>
</tr>
<tr>
<td>Business services</td>
<td>2.3</td>
<td>15.7</td>
<td>15.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Machinery</td>
<td>12.8</td>
<td>8.3</td>
<td>4.1</td>
<td>5.8</td>
</tr>
<tr>
<td>Motor vehicles, trailers and semi-trailers</td>
<td>18.0</td>
<td>6.1</td>
<td>2.9</td>
<td>8.6</td>
</tr>
<tr>
<td>Chemicals</td>
<td>8.0</td>
<td>2.6</td>
<td>2.2</td>
<td>8.0</td>
</tr>
</tbody>
</table>

* a Without re-export.

Sources: Federal Statistical Office of Germany; own calculations.
Conclusions for Germany, France and the Netherlands

- Positive balance between gains due to improving competitive capacities and the losses caused by increasing import content in the total economy.

- Production of Export Goods and import-adequate production are less labour intensive compared to the average.

- Import-adequate production is in Germany and in the Netherlands more labour intensive as the export production. The reverse can be observed in France.
Thank You for Your Attention