Import content of exports

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1. Introduction

In the year 2006, Germany exported for the fourth time in a row more goods than any other country in the world. In the German press this achievement is often referred to as Germany being the world champion in the export of goods.

This leading position of Germany's merchandise trade is however not always seen positively. On the one hand the growth in the German exports is judged as an evidence for the international competitiveness of the Germany economy. On the other hand it is pointed out that the German exports contain an ever larger portion of foreign inputs which are produced totally or partially in low-wage countries, whereas in Germany only the trademarks and product designs are developed and the packaging and selling is taking place. Hans-Werner Sinn, a German economist and president of the renowned Ifo-Institute in Munich entitled this development as the "bazaar economy".

This caused a wide public discussion in Germany about the importance of imported products used in the production process in Germany from end of 2003 onward. The Federal Statistical Office was able to contribute to this discussion with information based on input-output-tables using the so called "open quantity model" of the input-output analysis. It was possible to divide the whole value added incorporated in exports into the domestic contribution and the contribution of foreign countries. The results of the analysis showed that the import content of German exports has risen in the last decade. But on the other hand the share of the gross domestic product depending on the

foreign demand for German goods has also increased during the same period. 2004 the German Council of Economic Experts, an important committee for scientific political advice on economic issues, commented on the results of the input-output-analysis in its report[1]. German industry associations and German press have been interested in the results of input-output-analyses as well.

Similar effects on the economic development caused by the changes in the international division of labour analysed here for Germany may also have happened in other industrialised countries during the last decade. Therefore, it is difficult to judge the development of the import content of the German exports and the influence of the foreign demand on the German gross domestic products without making a comparison with the developments in other industrialised countries. Unfortunately only little information is available to draw international comparisons in this area. In Germany the institute for economic research (Institut für Wirtschaftsforschung), Halle analysed the import content of exports for Germany, France, Netherlands, Belgium and Denmark for the years 1995 and 2000[2].

Since 1991 (the first full year after the reunification of Germany) the foreign trade statistics recorded an average growth of the trade surplus of 22.0% annually (the exports grew in average by 6.8% annually and the imports by 5.8% annually). Information about the imports used in the domestic production process for exports are not available from foreign trade statistics. Exports of goods of foreign origin are only recorded as such if the goods were merely resold and not domestically processed in any form. Data about the value of exports and imports for inward and outward processing are being collected in foreign trade surveys separately, but these kinds of transactions are underestimated since inward and outward processing is often not declared as such.

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[1] Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung, Jahresgutachten 2004/2005, Erfolge im Ausland – Herausforderung im Inland, 2004, 359 – 361.

[2] Brautzsch, H.-U., Ludwig, U., Ganz Westeuropa auf dem Weg in die „Basarökonomie"?, in: Hamburgisches Welt-Wirtschafts-Archiv (HWWA), Wirtschaftsdienst 8/2005, 513 – 517.

So in order to investigate the share of foreign goods and inputs, i.e. semi-finished goods, in the German exports, an analysis with the input-output tables of the Federal Statistical Office has been carried out. The current paper will show the results of this analysis based on input-output-tables from 1995 to 2003 and additional data for imports and exports up to the year 2006. The methodological background of the analysis is described in the annex of this document.

2. Import dependence of the German exports of goods

The increasing international integration in the production of goods and in the merchandise trade leads to a growing share of foreign value added contained in the German exports. This concerns goods that are imported temporarily into Germany as merchandise goods, goods imported for inward processing for account of a third party and goods that are used as an input for the domestic production of the goods to be exported. The share of these kinds of imports in the German exports has considerably grown particularly in the second half of the 1990s. Their share rose from 31.1% in 1995 to 40.1% in the year 2000. After that the share of these goods has only changed marginally during three years. First estimates show that it has then increased again to almost 44.8% in the year 2006.

The value of the goods which are brought into Germany as merchandise goods or for inward processing for account of a third party and are afterwards re-exported has tripled in the last ten years. The value is recorded by the foreign trade statistics and is treated – according to the concepts of the national accounting – as exports of foreign goods. The recording of the domestic production is limited to the trade margin and to the value of the inward processing. In the year 1995, the share of the imported merchandise goods and of the goods imported for inward processing was 12.4% of the total exports. This share increased continuously to 16.8% in the year 2000 and reached 20.4% in the year 2006.

Table 1: Import dependence of the German exports of goods (1995 to 2006)

year	total exports	exports of foreign goods [1]	exports of domestic goods			for outward processing
			remaining in the exterior			
			total value [2]	containing		
				imported inputs [3]	domestic value added [4]	
Billion Euros						
1995	386	48	325	72	253	13
1996	405	52	340	74	265	13
1997	456	64	378	88	290	13
1998	489	71	404	96	308	13
1999	511	78	421	106	316	12
2000	599	101	485	140	345	14
2001	640	107	518	149	369	15
2002	656	115	527	145	382	15
2003	671	119	537	149	387	15
2004	738	142	581	164	417	15
2005	795	155	626	186	441	14
2006	911	186	710	222	488	16
total export = 100						
1995	100	12.4	84.1	18.6	65.5	3.4
1996	100	12.8	83.9	18.4	65.5	3.3
1997	100	14.1	83.0	19.4	63.6	2.9
1998	100	14.6	82.7	19.7	63.0	2.7
1999	100	15.2	82.4	20.7	61.7	2.4
2000	100	16.8	80.9	23.3	57.5	2.3
2001	100	16.8	80.9	23.3	57.6	2.3
2002	100	17.5	80.2	22.1	58.1	2.2
2003	100	17.7	80.0	22.3	57.7	2.3
2004	100	19.2	78.8	22.2	56.6	2.0
2005	100	19.5	78.7	23.3	55.4	1.8
2006	100	20.4	77.9	24.4	53.5	1.7

All values are defined in accordance with the concepts of national accounting. The sums differ from the total aggregates due to rounding differences.
[1]) Exports of goods of foreign origin and exports after inward processing (without the value of the processing itself)
[2]) Including the value of inward processing itself.
[3]) Imported goods and services used directly for the production of the exported goods or used for the production of goods for intermediate consumption on an earlier stage of the production process indirectly attributed to exports.
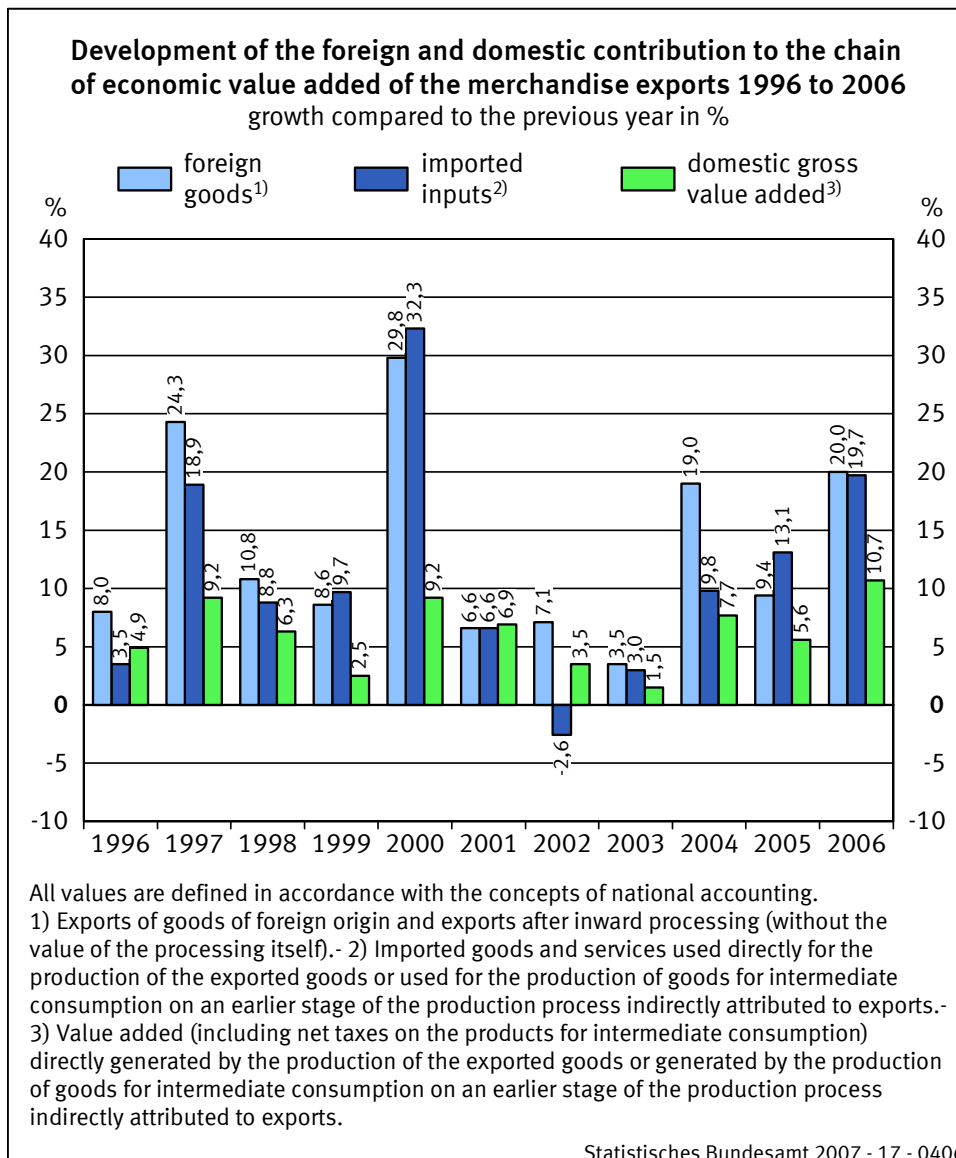[4]) Value (value added including net taxes on the products for intermediate consumption) directly generated by the production of the exported goods or generated by the production of goods for intermediate consumption on an earlier stage of the production process indirectly attributed to exports.

Domestic products, which leave Germany only temporary for outward processing, are also recorded by the foreign trade statistics. However, they play only a minor role with a share of 1.7% of the total exports in the year 2006. These exports will be treated in this paper separately, because in the national accounting the goods exported for outward processing are accounted for as inputs from domestic production and only the payment for the processing through the foreign firm is accounted for as imported inputs.

The foreign demand for German products is equal to the exported goods from domestic production remaining in the exterior. The share of these goods decreased from 84.1% in 1995 to 80.9% in the year 2000 and reached 77.9% in the year 2006. At the same time the share of the foreign inputs used in the domestic production process increased more and more.

The contribution of the intermediate consumption supplied from abroad to the chain of economic value added of certain commodity groups can be estimated with the standard demand-side input-output model using the input-output tables of the Federal Statistical Office of Germany. The modelling procedure is described in the annex.

Graph 1:

Development of the foreign and domestic contribution to the chain of economic value added of the merchandise exports 1996 to 2006
growth compared to the previous year in %

All values are defined in accordance with the concepts of national accounting.
1) Exports of goods of foreign origin and exports after inward processing (without the value of the processing itself).- 2) Imported goods and services used directly for the production of the exported goods or used for the production of goods for intermediate consumption on an earlier stage of the production process indirectly attributed to exports.- 3) Value added (including net taxes on the products for intermediate consumption) directly generated by the production of the exported goods or generated by the production of goods for intermediate consumption on an earlier stage of the production process indirectly attributed to exports.

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The result of this input-output analysis shows, that the share of the imported inputs in the total export increased strongly from 18.6% in 1995 to 23.3% in the year 2000. Following this growth, the share of the foreign inputs decreased slightly during the following years and then increased again reaching 24.4% in the year 2006.

The German nominal economic growth originating from the export of goods rose during the years 1995 to 2000 by an average of 6.4% annually. This was considerably lower than the average growth of the total German merchandise export with a yearly growth rate of 9.2%. Since the year 2000 the average nominal economic growth originating from the export of goods was 6.0%, the average growth of the total merchandise exports was 7.2% and therefore only a little bit higher.

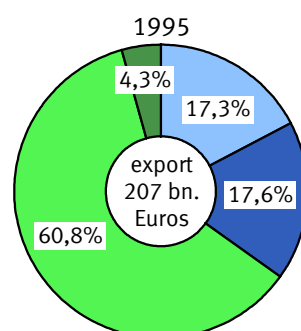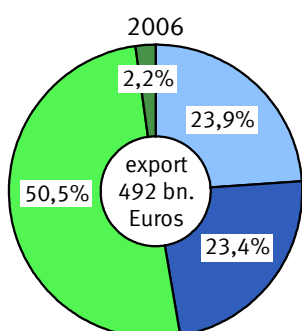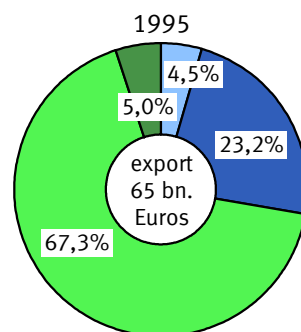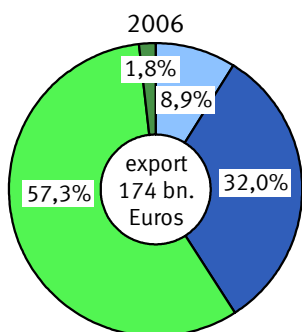3. **Import dependence of exports by product groups: chemical products, machinery and motor vehicles**
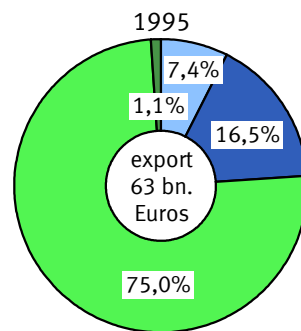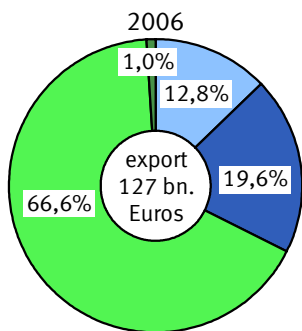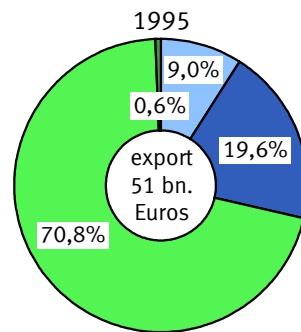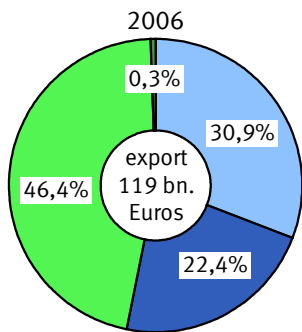
The most important export goods – chemical products, machinery and motor vehicles – show great differences in its dependences on imports. In the year 2006 the German exports of machinery (goods of foreign origin, goods imported for inward processing, and the inputs supplied from abroad) contained 32.4% foreign value added, which was clearly less than the average of 44.8% foreign value added contained in the total of exported goods. The foreign value added contained in chemical products was relatively high accounting for 53.3%. The foreign value added included in the German exports of motor vehicles was with 40.9% somewhat below the average.

In the case of motor vehicles, the export of imported foreign goods and cross border processing plays only a minor role. But the contribution of inputs supplied from abroad to the domestic production of these goods is very high. In the year 1995 the contribution of imported inputs to the total value of exported motor vehicles was 23.2%, it than increased to 29.7% in the year 2000 and increased further to a considerably high level of 32.0% in the year 2006. The relocation of parts of the car manufacturing into other countries is reflected by these figures.

Graph 2:

Developement of the import dependence of German exports by product groups

- foreign goods[1]
- imported inputs[2]
- domestic gross value added[3]
- domestic goods for outward processing

chemical products

2006
- 0,3%
- 30,9%
- 46,4%
- 22,4%
- export 119 bn. Euros

1995
- 9,0%
- 0,6%
- 19,6%
- 70,8%
- export 51 bn. Euros

machinery

2006
- 1,0%
- 12,8%
- 66,6%
- 19,6%
- export 127 bn. Euros

1995
- 7,4%
- 1,1%
- 16,5%
- 75,0%
- export 63 bn. Euros

motor vehicles

2006
- 1,8%
- 8,9%
- 57,3%
- 32,0%
- export 174 bn. Euros

1995
- 4,5%
- 5,0%
- 23,2%
- 67,3%
- export 65 bn. Euros

other goods

2006
- 2,2%
- 23,9%
- 50,5%
- 23,4%
- export 492 bn. Euros

1995
- 4,3%
- 17,3%
- 17,6%
- 60,8%
- export 207 bn. Euros

All values are defined in accordance with the concepts of national accounting.
1) Exports of goods of foreign origin and exports after inward processing (without the value of the processing itself).- 2) Imported goods and services used directly for the production of the exported goods or used for the production of goods for intermediate consumption on an earlier stage of the production process indirectly attributed to exports.- 3) Value added (including net taxes on the products for intermediate consumption) directly generated by the production of the exported goods or generated by the production of goods for intermediate consumption on an earlier stage of the production process indirectly attributed to exports.

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Looking at chemical products, it can be observed that in the second half of the 1990s more and more imported inputs were used in the domestic production of the exported chemicals. The contribution of imported inputs to the total value of exported chemicals rose from 19.6% in the year 1995 to 28.4% in the year 2000 and then decreased again and amounted to 22.4% in the year 2006. The reason for this development is that the export of goods with a foreign origin and the export of foreign goods after inward processing have gained considerably importance. The share of these kinds of exports rose from 12.4% in the year 2000 to 30.9% in the year 2006. This development was predominantly caused by changes in the international integration of the pharmaceutical industry.

In the machinery industry cross-border processing plays no important role; also the trade of goods of a foreign origin is low. In total the share of foreign goods in the export of machinery increased from 7.4% in 1995 continuously to 11.4% in the year 2000 and it amounted to 12.8% in the year 2006. The contribution of imported inputs to the total value of exported machinery increased from 16.5% in 1995 to 20.1% in the year 2000 and stayed nearly at this level since then.

4. **The development of the share of gross domestic product depending on foreign demand for German products**
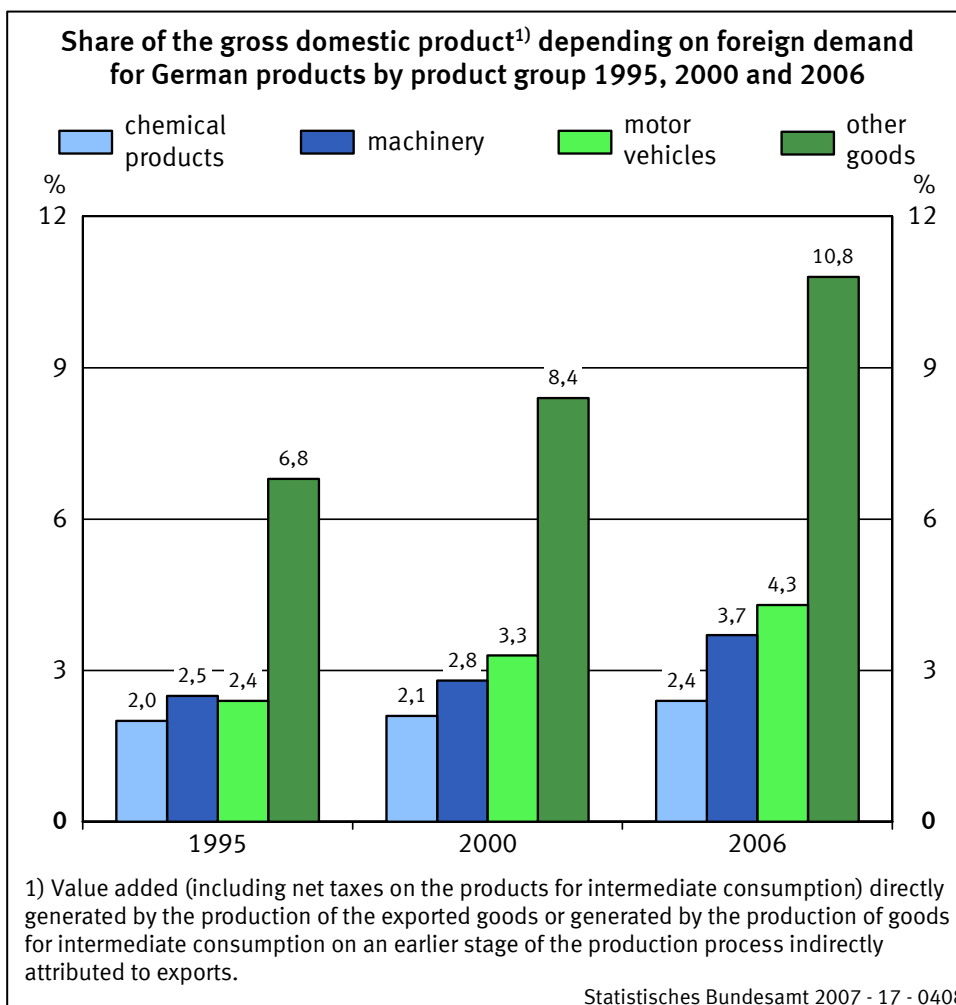
In the year 2006, the German exported goods contributed 21.2% to the German gross domestic product. In the year 1995 their share was only 13.7%. In Germany, the combined domestic production of chemical products, machinery and motor vehicles accounted for roughly half of the total domestic gross value added generated by the exports of goods.

In the last ten years especially the motor vehicles increased its contribution to the gross domestic product from 2.4% in the year 1995 to presently 4.3%. This was achieved even though or maybe because of the relocation of parts of the production chain into other countries.

Although the foreign demand for machinery products did not increase as strongly as for motor vehicles, also the machinery produced for export could increase its contribution to the gross domestic product from 2.5% in the year 1995 to presently 3.7%. As in the production of machinery only comparably few foreign inputs are used, the increase in the foreign demand for German machinery caused a relatively strong impulse on the domestic value added.

Graph 3:

Share of the gross domestic product[1] depending on foreign demand for German products by product group 1995, 2000 and 2006

Legend: chemical products | machinery | motor vehicles | other goods

1) Value added (including net taxes on the products for intermediate consumption) directly generated by the production of the exported goods or generated by the production of goods for intermediate consumption on an earlier stage of the production process indirectly attributed to exports.

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The increase in the exports of chemical products on the other hand, did not result in an increase of its contribution to the gross domestic product. This is due to the growing share of imported foreign inputs over the last years. The contribution of the chemical sector to gross domestic product currently accounts for about 2.4%.

The present analysis confirms that the economic development of Germany during the last ten years was supported by its export activities. However, as the share of imports in the German exports increases, the economic growth induced by the German exports still fell behind the increase of the German exports: From 1995 to 2006 the German exports increased by an average of 8.1%. The domestic value added of these goods increased by an average of 6.2%. This increase is nonetheless remarkable considering that the nominal gross domestic product itself increased during the same period only by an average of 2.0%. Apart from the weak economic activity in Germany until the year 2005 this might have been caused by the increasing foreign inputs used for domestic production and by the increasing demand of the domestic consumers and investors for foreign goods.
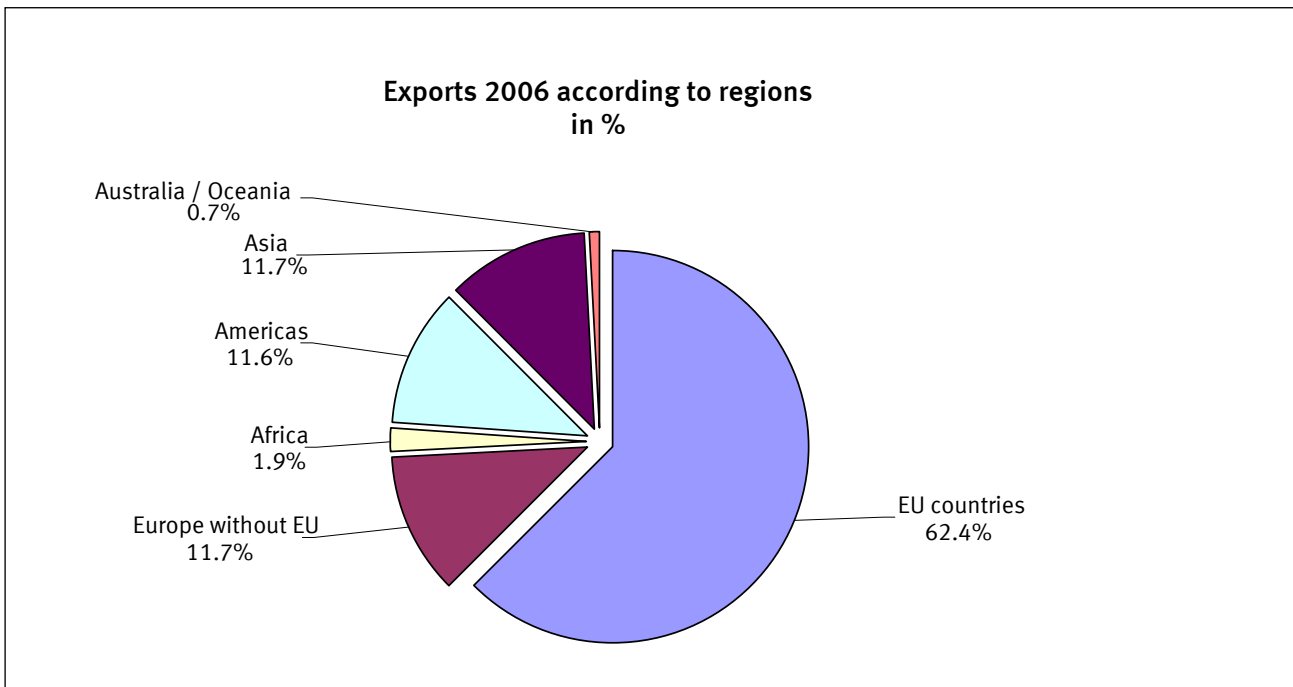
Taking into account the increase in the international integration of production and trade it has to be expected that also in the future the growth of the German exports, the domestic consumption and domestic investment will not develop at the same pace. The input-output tables of the Federal Statistical Office offer a useful instrument for the analysis of these differences.

5. Geographical distribution of the German trade

The input-output analysis with which the presented findings were calculated does not provide information on the geographical distribution of Germany's exports. This information is provided by the common foreign trade statistics.

The major export markets of Germany are within the European Union. Almost two thirds of all exports in 2006 went into the other 24 member countries. About 15% of the trade with the European Union went into the ten new member states. (The trade with these ten countries tippled since 1995.) If one adds to the exports into the European Union also the exports to other European countries, it can be shown that three quarters of all German exports stayed within Europe.

Graph 4:

**Exports 2006 according to regions
in %**

- Australia / Oceania 0.7%
- Asia 11.7%
- Americas 11.6%
- Africa 1.9%
- Europe without EU 11.7%
- EU countries 62.4%

The remaining quarter of the German exports is distributed in equal parts on the American and

Asian continent. Africa as well as Australia and Oceania play only a minor role for the German

export industry. Analysing the exports to the Americas and to Asia a little closer, it can be noted

that the trade with these regions is very concentrated on a few trading partners. Nearly 90% of the

exports to the Americas go into the three NAFTA member countries, Canada, Mexico and the

United States. Something similar can be shown for Asia, where more than a quarter of the exports

to this region go to the Peoples Republic of China. Adding to this the exports going to Japan and to

the Republic of Korea, almost half of the German exports to Asia go to these three countries.

Concerning the ranking of the particular countries, it has to be pointed out that eight out of the ten

major trading partners of Germany are members of the European Union. Traditionally the most

important single country of Germany is France receiving about 10% of all German exports in 2006.

France was followed by the United States with about 9% and the United Kingdom with about 8% of

all German exports. The two largest trading partners among the ten new EU member states are

Poland occupying the tenth place and the Czech Republic on the thirteenth place. (Twenty years ago Poland was on the 29th place and Czechoslovakia was not even among the first thirty trading partners.)

The exports into the ten new EU member states accounted for 9.3% in 2006; in 2001 their share was only 7.7%. The importance of the German trade with the ten new member states can only be assessed correctly if one looks at the share of these countries in the exports of other European Union member states. In 2005 the ten new countries had a share of only 3.5% in all French exports and a share of only 2.3% in all British exports. Out of the other 14 old member states only Austria had with 12.2% a higher trading share with the ten new states than Germany. On the import side the same can be observed, only Austria had a higher trading share with the ten new member states than Germany. 9.9% of all Austrian imports came from these countries compared to 9.4% of all German exports.

As most of the ten new member states of the EU are geographically close to Germany and as it is known that the wage level in these countries is considerably lower than in Germany, it can be assumed that a large portion of the processing transactions and of the foreign inputs shown in the previous sections is coming from these countries. As an example: The Volkswagen group has production plants in Poland, in the Czech and the Slovak Republic and in Hungary not counting other new EU countries were suppliers of the Volkswagen group are based.

6. Summary

The present paper showed that the import content of German exports has risen from about 31% in 1995 to about 45% in 2006. But on the other hand the share of the gross domestic product depending on the foreign demand for German goods has also increased from 14% to 21% during the same period. Therefore, it can be shown that the strong growth in the German export of goods

helped to partially outbalance the negative effects of the weak economic activity in Germany up to the year 2005 caused by reluctance in the consumer spending and in the capital expenditure.

Annex: Methodological background of the input-output analysis

Using the so called "open quantity model" of the input-output analysis it is possible to divide the whole value added incorporated in exports into the domestic contribution and the contribution of foreign countries. This analysis is based on information about goods flows and production-related interactions within a national economy and with the rest of the world shown in the input-output tables. The combined input-output tables for domestic output and imports as well as input-output tables for domestic output and the import matrix show the supply of goods and their use by product groups and homogeneous branches, which are delimited in a uniform manner in the rows and columns, or by final uses categories, i.e. exports. Producing units are "units of homogeneous production", defined by production-related variables, which in input-output tables are aggregated to form homogeneous branches. German input-output tables can be downloaded free of charge from the Statistics Shop of the Federal Statistical Office at www.destatis.de/shop, searching for the keyword "input-output".

At first the analysis distinguishes between exports produced abroad and exports produced in Germany. Information about exports produced abroad is available from the foreign trade statistics. They include foreign goods only temporarily brought into Germany for merchandising and for inward processing. The lack of information about the intermediate consumption of German products in the production processes abroad force the input-output analysis to assume that Germany does not contribute to the value added of these temporary imports.

At second information about intermediate consumption supplied from abroad and used in the domestic production process is needed. Foreign trade statistics do not provide any information about the use of imports. Therefore input-output accounts have to calculate an import matrix showing the intermediate use of commodities by product groups and branches as well as final domestic uses by product groups and different categories of uses supplied from abroad only

indirectly. Detailed information about imports by kind of product from the foreign trade statistics is used as a valuable source. It has to be combined with data from different economic statistics about supply and use of goods and services, i.e. cost structure surveys and statistics on materials and goods received in mining and manufacturing industries, balanced in the framework of national accounts.

At third all branches supply to the domestic production process of exports products for intermediate consumption. By deriving the so called "Leontief inverse" and the input coefficients for intermediate consumption supplied by foreign countries from the input-output tables, the imported inputs indirectly needed for the domestic production of the exports can be estimated as well.

German input-output tables show imported and domestic products for intermediate consumption by 71 product groups and 71 homogeneous branches and also imported and domestic products for final use by 71 product groups and 7 categories of uses. The input-output table for domestic production is used for estimating the foreign contribution to the chain of value added of German exports. For Germany a comparable time series of input-output tables is available for the years 1991 to 2000 according to the concepts before the revision of national accounts in April 2005. Input-output tables according to the concepts of national accounts after the revision in April 2005 are available for the reference years 2000 to 2003. Data about imports and exports by 71 product groups is published for the reference years 1991 to 2005. Using additional data about inputs and exports by product groups of the year 2006 from foreign trade statistics, it was possible to update the input-output analysis up to the year 2006. Since the most current input-output table refers to the year 2003 not all changes of the production processes in the years 2004 to 2006 could be taken under consideration. But very detailed annual data about imports by kind of products from trade statistics up to the year 2006 was a valuable source for estimating the developments in the intermediate consumption of imported products up to 2006.

The following assumptions are necessary for calculating the total impact of the foreign demand for German products on intermediate inputs supplied from abroad:

- Within one homogeneous branch the input structure is the same for all products, even though usually different products are produced.

- No products from Germany are used in the production process of goods abroad which are exported then to Germany and are used in Germany as imported inputs.

The result of the input-output analysis improves with the number of product groups shown in the input-output tables. It is important, that the product groups are homogeneous enough to form reliable input structures for the analysis under consideration. The highly aggregated German input-output table of the year 2000 used for the following example is only suitable for demonstration purposes.

Table 1 shows in bold letters, which part of the input-output table for domestic output are needed for modelling the impact of exports on intermediate inputs supplied from abroad.

Table 1: Pattern of the input-output table at basic prices for domestic output

Use / Supply	Input by homogeneous branches J= (1,…,n)	Final uses by categories	Total uses
Domestic output by products i = (1,2,…,n)	**Intermediate consumption (X)**	Final consumption expenditure (y_c) Gross capital formation(y_I) **Exports (y_e)**	**Total uses (p)**
Imported products	**For intermediate consumption (v_1')**	For final uses	Total uses
Net taxes on products	For intermediate consumption (v_2')	For final uses	Total uses
Value added by components (primary inputs)	Compensation of employees (v_3') Other taxes on products (v_4') Consumption of fixed capital (v_5') Net operating surplus (v_6')		
Total domestic supply	**Domestic output (p')**		

The matrix of intermediate consumption supplied domestically *(X)*, the row vector of intermediate consumption supplied from abroad *(v_1')*, the row vector of domestic output *(p')* and the column vector of exports (y_e) are the parts of the input-output table for domestic output necessary for the analysis under consideration. The element x_{ij} of matrix *X* shows for the homogeneous branch *j* the intermediate consumption of the domestic output of product group *i* directly used for the production of the whole domestic output of product group *j*, the element v_{1j} of row vector *(v_1')* the intermediate consumption of all imported products directly used by the homogeneous branch *j* and the element p_j of row vector *p'* the domestic output of the product group *j* produced by the homogeneous branch *j*.

To give an impression about the procedure of the analysis under consideration, in the following a highly aggregated German input-output table of the year 2000 shows only three product groups, respectively products from:

- primary sector: products of agriculture, forestry and fishing
- secondary sector: products from mining and quarrying, manufactured products, energy and construction work
- tertiary sector: services

Table 2: German input-output table of the year 2000 at basic prices for domestic production in Billion Euros

Use Supply	Input of homogeneous branches of				Final uses			Total uses
	Primary sector	Secon-dary sector	Tertiary sector	total	Final domestic use	Exports	total	
Domestic output of products from								
Primary sector	**4.4**	**25.9**	**2.2**	32.5	13.4	**4.2**	17.6	50.1
Secondary sector	**8.1**	**509.7**	**117.8**	635.6	518.3	**472.1**	990.4	1626.0
Tertiary sector	**9.9**	**295.8**	**551.5**	857.2	1152.6	**100.3**	1252.9	2110.1
Total	22.4	831.4	671.5	1525.3	1684.3	**576.6**	2260.9	3786.2
Imported products	**3.8**	**264.6**	**89.7**	**358.1**	179.8	94.0	273.8	631.9
Net taxes on products	1.1	8.8	36.7	46.6	160.5	-0.8	159.7	206.3
Total	27.3	1104.8	797.9	1930.0	2024.6	669.8	2694.4	4624.4
Gross value added	22.8	521.2	1312.2	1856.2				
Output	**50.1**	**1626.0**	**2110.1**	**3786.2**				

The input coefficients or technical coefficients show the input per unit of the output for each homogeneous branch. The element a_{ij} of the matrix A show intermediate consumption of domestic output of the product group i directly used for the production of one unit domestic output of product group j:

$$A = X <p>^{-1} \quad \text{with} \quad a_{ij} = p_j^{-1} x_{ij}; \ i=1,...,n \text{ and } j = 1,...,n; \ <p> \text{ diagonal matrix } of\, p' \qquad (1)$$

The element z_{1j} of the row vector z_1' shows intermediate consumption of imported products of the product group i directly used for the production of one unit domestic output of product group j:

$$z_1' = v_1' <p>^{-1} \quad \text{with} \quad z_{1j} = p_j^{-1} v_{1j}; \text{ and } j = 1,...,n; \ <p> \text{ diagonal matrix } of\, p' \qquad (2)$$

Table 3: German input coefficients for the year 2000 for the domestic production in % of the output

Use Supply	Input of homogeneous branches of			
	Primary sector	Secondary sector	Tertiary sector	total
Domestic output of products from				
Primary sector	**8.8**	**1.6**	**0.1**	0.9
Secondary sector	**16.0**	**31.4**	**5.6**	16.8
Tertiary sector	**19.8**	**18.2**	**26.1**	22.6
Total	44.6	51.2	31.8	40.3
Imported products	**7.7**	**16.3**	**4.3**	9.5
Net taxes on products	2.2	0.5	1.7	1.2
Total	54.5	68.0	37.8	51.0
Gross value added	45.5	32.0	62.2	49.0
Output	100	100	100	100

The Leontief inverse C can be deduced from the matrix of technical coefficients A. The element c_{ji} of the Leontief inverse shows the whole domestic output of the product group j necessary to

produce one unit output of the product group i for final use (i.e. export). The elements of the Leontief inverse contain the production of one unit output for final uses *(unit matrix I)*, the production of domestic intermediate inputs directly used in the production process for final uses (input coefficients A) and the necessary production of domestic intermediate inputs on former stages of the whole domestic production process indirectly due to the final uses ($A^2+A^3+A^4...$) .

$$C=(I-A)^{-1} = I + A + A^2 + A^3 + A^4... \tag{3}$$

Table 4: German Leontief inverse 2000 for domestic production

	Production group of final uses		
	Primary sector	Secondary sector	Tertiary sector
Domestic output of products from			
Primary sector	**1.102**	**0.026**	**0.004**
Secondary sector	**0.287**	**1.493**	**0.113**
Tertiary sector	**0.366**	**0.375**	**1.383**
All sectors	1.755	1.894	1.500

The intermediate consumption supplied from abroad is treated like primary inputs. The row vector of imported products directly and indirectly used to produce one unit of domestic output of different product groups for final uses k' can easily be calculated by multiplying the technical coefficients for intermediate consumption of imported products v_1' by the Leontief inverse C. The element k_i of the row vector k' shows the foreign value added incorporated in one unit domestic output of product group i for final uses, respectively for one unit of exports of the product group i produced in Germany.

$$k'=z_1'C \quad \text{with} \quad k_i = \sum_j z_j c_{ji} = \sum_j p_j^{-1} v_{1j} c_{ji}; \quad i=1,...,n \text{ and } j = 1,...,n; \tag{4}$$

Share of import content of the German domestic output for final uses of the year 2000 by product group

$$k' = (0.077 \ 0.163 \ 0.043) \begin{pmatrix} 1.102 & 0.026 & 0.004 \\ 0.287 & 1.493 & 0.113 \\ 0.366 & 0.375 & 1.383 \end{pmatrix}$$

$$= (0.147 \ 0.261 \ 0.078)$$

Assuming that the import content of the domestic output is the same for domestic final use and for exports, the result for the import content of the exports of this simplified example is 14.7% for products from the primary sector, 26.1% from the secondary sector and 7.8% from the third sector.

The import content of the total export of the domestic output k^{tot} depends on the import content of the different product groups k' and on the composition of the total export by product groups $y_{i,e}$.

$$k^{tot} = k' y_e y_e^{tot^{-1}} \quad \text{with} \quad y_e^{tot} = \sum_{i=1}^{n} y_{i,e} \tag{5}$$

Share of the import content of the German domestic output for final uses of the year 2000

$$k^{tot} = (0.147 \ 0.261 \ 0.078) \begin{pmatrix} 4.2 \\ 472.1 \\ 100.3 \end{pmatrix} \frac{1}{4.2 + 472.1 + 100.3} = 0.228 \tag{6}$$

The import content of the exports from German domestic production calculated from the original input-output table 2000 subdivided by 71 product groups and 71 branches is 27.2 %.