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International Trade in Intermediate Inputs: The Case of the Automobile Industry

by

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Abstract:

International trade statistics and input-output tables are analyzed in order to test the hypothesis that international production networks have become more relevant. The share of imported inputs in the gross output value of the motor vehicle industry has grown significantly during the last two decades. Moreover, some low-income countries have become strong exporters of automobile parts, but this trade is mainly regional rather than global. Detailed results are presented in case studies on four major producers (the United States, Japan, Germany and the UK).

Keywords: international trade; intermediate inputs; international outsourcing.
JEL classification: F14, J31, L63.

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1. Introduction

Globalization is a process of economic integration that involves international trade, international capital flows, the international diffusion of technologies and the organization of production networks on an international scale. The development of 'international production sharing activities' (Yeats 1998) has been an evolving process. Historically, the earliest forms of this process involved the production of primary commodities in developing countries, processing in industrial countries and (partly) re-exportation of the final good. Escalation in import tariff systems of industrial countries and high transaction costs have contributed to this exchange pattern. In the second half of the 20th century, a different form of production sharing emerged. This involved the relocation of some (mostly labor-intensive) stages of the production process to low-income countries within multinational enterprises or enterprise networks. For example, electronic components produced in industrial countries were assembled in South East Asia for international firms, and wearing apparel was assembled virtually all over the world from textiles produced in third countries.

Until recently, this process of increasing interdependence through international input-output-relations did not attract very much attention in the economics profession. In most textbooks on international trade, the international division of labor is still depicted as specialization of countries in final goods. However, some contributions[1] to the 'trade-and-wages debate' highlighted the increasing relevance of international trade in intermediate goods and the consequences of 'international outsourcing'[2] for

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1 Campa and Goldberg (1997) and Hummels et al. (1998) described the facts. Feenstra and Hanson (1996), Jones (1996), Deardorff (1998) and Venables (1999) provided different theoretical insights.

2 Outsourcing ('outside resource using') refers to the fragmentation of a production process in sequential stages (i.e., the opposite of vertical integration) and the development of new input-output relations; moreover, the stage outsourced could be either a service activity (e.g., maintenance, logistics) or a production activity (e.g., the supply of intermediate inputs). In contrast, 'relocation of production' usually refers to the deployment of a complete production process, that is, it disregards international trade in inputs.

the labor markets in high-income countries. The main argument is that, due to increasing import competition from low-wage countries, those stages of the production process in advanced countries that are relatively unskilled-labor intensive are deployed to other countries. Hence, domestic goods prices are affected not only by world market prices for competing final goods, but also by the changes in prices of imported inputs and the resulting substitution of imported inputs for domestic value added. This causes the domestic production process (i.e., the remaining value adding stages) to change its factor intensity, and this also affects domestic factor prices. In contrast, many empirical studies attribute higher skill intensity only to technology which could be mistaken if outsourcing is important. Hence, international outsourcing could possibly provide an explanation for unskilled-labor saving technical progress, hitherto treated as exogenous (Diehl 1999).

The automobile industry is essentially an assembly industry. It brings together an immense number and variety of components, many of which are manufactured by independent firms in other countries. There are three major processes prior to final assembly: the manufacture of bodies, of engines and transmissions, and of other components (e.g., electrical components, braking systems, wheels, tires, windscreens, exhaust systems). How far vehicle manufacturers carry out the separate parts of the production sequence themselves varies considerably. Moreover, the automobile industry is often regarded as one of the most fragmented and hence most global manufacturing industries (see Nunnenkamp 2000 for references). This assumption is usually corroborated with firm-level case studies. If the magnitude and nature of global production sharing is to be assessed on industry level, one faces the difficulty that production data are not sufficiently disaggregated to analyze intrasectoral changes. This is in contrast to the analysis of international trade data which sufficiently differentiate between components and final goods (Appendix Table 1). The recent revision of the International Standard Industrial Classification of the UN (ISIC, Rev. 3; effective 1995) makes it somewhat easier to assess the relevance of internationally traded inputs (Appendix Table 2).

The next section provides a broad overview of global trends in the production and international trade of automobiles and automobile parts. It will be shown that the automobile industry in major countries has undergone a process of vertical disintegration, but international trade in automobile parts has not increased significantly faster than trade in finished vehicles. The intrasectoral and geographical pattern of international trade in automobile parts is analyzed in more detail in the third section for four major automobile producers (the United States, Japan, Germany, and the United Kingdom). It will be shown that the cost share of imported intermediate inputs has increased in general. Low-wage countries have gained in importance as suppliers of automobile parts although the bulk of international trade in automobile parts is still between high-income countries. The fourth section concludes.

2. Production and trade of automobiles and automobile parts: global trends

Between 1960 and 1995, the world production of automobiles has almost tripled. At the same time, major changes occurred in the global distribution of the industry (Vickery 1996; Dicken 1998, Chapter 10). The share of Japan in the total passenger car production of the world increased from only about 1 percent in 1960 to about 18 percent in 1999,[3] whereas the share of the United States decreased from more than half of the world total to about 25 percent (Table 1). Even more dramatic was the decline of the UK automobile industry. Its share declined from about 11 percent of the world total in 1960 to a mere 4 percent in 1999. Within the EU, Germany and France remain the dominant producers with 11 and 6 percent of the 1999 world total, respectively. Their shares have declined by less then the UK share over this period. The most impressive growth in automobile production in Europe occurred in Spain,

3 Japan's share was about one quarter of the world total in the 1980s. Since then, Japan's domestic automobile production has fallen back, but this largely reflected the fact that an increasing proportion of Japanese vehicle production is now carried out in overseas Japanese plants. The temporarily strong Yen may have contributed to the accelerated relocation activities.

whose share in world total increased from only about half a percent of the world total in 1960 to about 5 percent in 1995.

Table 1 — Production of automobiles, 1960 and 1999

	1960				1999			
	Passenger cars		Trucks and buses		Passenger cars		Trucks and buses	
	1,000 units	share in total	1,000 units	share in total	1,000 units	share in total	1,000 units	share in total
Canada	325	2.6	71	2.2	2,821	6.0	224	2.6
France	1,175	9.3	194	6.1	2,784	5.9	386	4.5
Germany	1,817	14.4	238	7.5	5,307	11.3	377	4.4
Italy	620	4.9	50	1.6	1,410	3.0	291	3.4
Spain	41	0.3	10	0.3	2,209	4.7	644	7.5
UK	1,354	10.7	458	14.5	1,787	3.8	186	2.2
USA	6,696	52.9	1,198	37.8	11,761	25.0	1,263	14.7
Australia	166	1.3	33	1.0	303	0.6	18	0.2
China PR	n. a.	n. a.	n. a.	n. a.	565	1.2	1,259	14.6
India	19	0.2	26	0.8	649	1.4	168	2.0
Japan	165	1.3	308	9.7	8,100	17.2	1,795	20.8
Korea Rep.	n. a.	n. a.	n. a.	n. a.	2,362	5.0	481	5.6
Malaysia	n. a.	n. a.	n. a.	n. a.	257	0.5	16	0.2
Taiwan	n. a.	n. a.	n. a.	n. a.	246	0.5	104	1.2
Argentina	11	0.1	49	1.5	225	0.5	80	0.9
Brazil	37	0.3	97	3.1	1,049	2.2	235	2.7
Mexico	n. a.	n. a.	n. a.	n. a.	1,391	3.0	142	1.6
Czech Rep.	n. a.	n. a.	n. a.	n. a.	348	0.7	27	0.3
Poland	n. a.	n. a.	n. a.	n. a.	521	1.1	19	0.2
Russia	100[a]	0.8	400[a]	12.6	947	2.0	229	2.7
Turkey	n. a.	n. a.	n. a.	n. a.	218	0.5	74	0.9
Total	12,650[b]	100.0	3,167[b]	100.0	47,136[c]	100.0	8,610[c]	100.0

[a]Estimated. — [b]Total of the countries reported. — [c]Corrected for double counting (cf. VDA).

Source: Ward's 1964 Automotive Yearbook; VDA, International Auto Statistics 2000; own calculations.

Outside the triad (Japan, the United States and Western Europe) some important locations for automobile production have emerged. One center is Latin America where Mexico, Brazil, and Argentina together account for about 6 percent of world total. Another more recent location is South Korea with about 5 percent of world total. A third center is the former Soviet Union and Eastern Europe. In the former Soviet Union the automobile production is in serious disarray, whereas the former

state-owned automobile industries in Poland, the Czech Republic, Hungary and Slovenia are in various stages of transition, commonly through joint ventures with foreign manufacturers. In most of the other developing countries, the bulk of automobile production is simply assembly of imported components, although the 'local content' varies significantly (ILO 2000). In some cases, e.g., Thailand, the automobile industry consists only of assembly of completely knocked-down (CKD) vehicles imported from the home plants.

Another important element of the globalization of the automobile industry is the increasing role of international trade. Both export orientation and import market penetration in the major producer countries have steadily increased during the last three decades. For example, exports of the large Western European countries and Mexico have increased to levels of 40 percent of domestic production or more (Table 2). By contrast, the export orientation of large countries, especially the United States, is only moderate. Significant increases were recorded for the case of Japan (mainly in the 1970s), Spain (1980s) and South Korea (1990s). Import market penetration has reached levels of 30 percent or above in most countries (Table 3), in some countries at a spectacular speed (UK in the 1970s, Spain in the 1980s, Italy and Mexico in the 1990s). By contrast, import penetration is still at a very low level in Japan and South Korea, and relatively moderate in Germany. Differences in the respective indicator values are probably related to the existence of 'national champions' rather than to trade protection, except for the case of South Korea where import barriers have only recently been removed.

At this aggregate level, however, the question cannot be answered whether the increasing role of international trade is only due to intra-industry trade in finished vehicles or to an increasing trade in intermediate products.[4] Only the latter would

4 For an analysis of German intra-industry trade in automobile products see Heitger et al. (1999: 117-123).

support the hypothesis of emerging international production networks. The case studies (next section) shed some light on this issue.

Table 2 — Export orientation[a] in the motor vehicle industry[b], 1970-1995

	1970	1975	1980	1985	1990	1995
United States	9.7	16.2	15.6	11.2	15.1	16.2
Japan	9.1	18.1	26.9	33.4	24.7	21.7
France	30.5	40.2	40.7	45.4	43.4	43.7
Germany	31.9	35.3	37.6	44.9	40.7	38.0
Italy	30.8	36.1	26.0	23.7	27.3	49.5
Spain	n. a.	n. a.	19.8	33.8	38.9	n. a.
United Kingdom	26.5	29.9	34.0	30.4	35.1	35.3*
Korea Rep.	n. a.	n. a.	n. a.	n. a.	n. a.	26.0
Mexico	n. a.	n. a.	n. a.	n. a.	26.8	56.0

[a]Exports in percent of gross output value. — [b]ISIC (Rev.2) section 3843. — *1994.

Source: OECD, STAN; own calculations.

Table 3 — Import market penetration[a] in the motor vehicle industry[b], 1970-1995

	1970	1975	1980	1985	1990	1995
United States	13.0	16.7	23.7	26.1	30.2	28.7
Japan	0.7	1.0	0.9	1.0	3.5	4.0
France	17.5	22.2	28.0	36.7	38.8	39.4
Germany	11.3	13.4	14.9	17.7	22.8	24.1
Italy	21.0	22.5	29.9	27.2	33.7	49.6
Spain	n. a.	n. a.	10.7	20.1	35.9	n. a.
United Kingdom	7.0	16.6	32.7	41.7	45.8	45.6*
Korea Rep.	n. a.	n. a.	n. a.	n. a.	n. a.	8.5
Mexico	n. a.	n. a.	n. a.	n. a.	7.5	29.0

[a]Imports in percent of apparent domestic consumption. — [b]ISIC (Rev.2) section 3843. — *1994.

Source: OECD, STAN; own calculations.

A rough indicator for the relevance of externally supplied components is the degree of vertical integration, i.e., the ratio of value added to total production value. By this indicator, the automobile industry moved gradually towards external sourcing over the period 1970-1995 (Table 4). In 1970, most industrial countries had a value added share of 35 percent or higher, with the notable exception of the United Kingdom. 25 years later, the share was in the range of 25 to 30 percent. Some countries proceeded

very fast in this restructuring process, most notably Italy, South Korea and the United States. However, this trend is not necessarily related to *international* outsourcing. External inputs are provided either by specialized domestic suppliers in the same industry (e.g., car bodies or combustion engines), by domestic suppliers in other industries (e.g., outsourcing of administrative activities to specialized suppliers of business services), or by suppliers from abroad. Input-output tables with separate transaction tables for domestic and imported inputs can be used to address this issue (see next section).

Table 4 — Vertical integration[a] in the motor vehicle industry[b], 1970-1995

	1970	1975	1980	1985	1990	1995
United States	39.6	30.0	25.7	30.4	21.4	26.4
Japan	33.8	31.7	28.6	28.4	26.8	28.1
France	35.6	36.1	35.1	28.9	31.0	29.4
Germany	38.8	36.8	35.4	34.6	30.8	30.1
Italy	42.5	37.4	28.1	25.1	25.6	24.6*
Spain	n. a.	n. a.	37.4	27.5	30.4	n. a.
United Kingdom	25.5	24.7	30.5	27.6	27.0	22.5*
Korea Rep.	36.5	25.7	20.4	25.5	26.4	26.1
Mexico	26.6	23.2	27.7	30.3	25.1	25.8

[a]Value added in percent of gross output value. — [b]ISIC (Rev.2), section 3843. — *1994.
Source: OECD, STAN; own calculations.

A first impression of the relevance of international production networks can be gained from world trade data, disaggregated by product category:

During the period 1980-1995, world trade in automobile parts accounted for about one third of total world trade in automobile products (Table 5). This ratio has remained relatively stable which, at first sight, does not support the hypothesis of increasing international sourcing activities. However, three qualifications are in order:

- The ratio is given in nominal terms. To the extent that the price of parts has increased by less than that for finished vehicles, the magnitude of international sourcing is underestimated.

Table 5 — World imports of automobiles and parts thereof, 1980, 1990 and 1995

Products	Code (SITC Rev. 2)	1980*	1990	1995	1980-1990	1990-1995
		(bill. US$)			annual average rate of change (percent)	
Passenger motor vehicles exc. buses	781	59.5	162.5	232.0	+ 10.5	+ 7.4
Motor vehicles for transport of goods	782	19.2	35.7	47.0	+ 6.4	+ 5.7
Buses and tractors for semi-trailers	783	4.0	6.2	15.8	+ 4.5	+ 20.5
Trailers, transport containers etc.	786	2.4	4.9	6.8	+ 7.3	+ 6.8
Sub-total finished products		85.1	209.3	301.6		
Combustion engines for motor v.	713.2	4.7	14.8	23.0[e]	+ 12.0	+ 9.3
Parts for combustion engines[a]	713.9	5.3	12.3	19.6[e]	+ 8.8	+ 9.7
Chassis fitted with engines	784.1	2.9	2.7	2.6[e]	- 0.8	- 0.6
Car bodies, parts and accessories for motor vehicles	784 ex. 784.1	30.7	71.1	114.9[e]	+ 8.8	+ 10.1
Electrical equipment for motor vehicles; parts	778.3	3.0	7.4	11.0[e]	+ 9.4	+ 8.1
Sub-total parts		46.6	108.3	171.1		
Total vehicles and parts		131.7	317.6	472.7	+ 9.2	+ 8.3
thereof: parts		35.3 %	34.1 %	36.2 %		
Memo: Total world exports	0-9	2,001	3,437	5,012	+ 5.5	+ 7.8
thereof: manufactures	5-8 less 68	1,085	2,423	3,745	+ 8.4	+ 9.1

[a]Includes parts of engines for other transport equipment (except aircraft). — [e]Partially estimated; see Table 6 in the annex. — *Only market economies.

Source: See Tables 3-6 in the appendix.

- The growth of international trade in some automobile parts, namely engines, has outpaced that of trade in finished vehicles over the whole period, whereas international trade in other parts (e.g., chassis with engines mounted) stagnated.

The latter is probably due to the bulky character of this product which does not allow mass shipments at competitive prices.

- Global production networks may have expanded even if the share of automobile parts in total trade remained virtually constant after the previously mentioned corrections. To some extent, automobile parts are delivered to assembly plants[5] abroad which were established for re-export rather than for the respective domestic market. In that case, exports of finished automobiles and imports of parts increase at the same pace.

A second impression of the relevance of international production networks can be gained from the geographical pattern of world production and trade in automobile parts. A comparison of the relative position of countries in 1995 reveals some interesting aspects (see Table 6):

- The major producers of automobiles are at the same time the major producers of automobile parts. About two thirds of all parts are produced in the United States, Japan and Germany.
- The relative importance of the production of parts in a country can be measured by their value share in the total output of the automobile industry (second column). Accordingly, the production of automobile parts is relatively important in Japan, China, Mexico and Portugal (share of 40 percent or more), whereas it is less important in countries like Sweden and Belgium (share below 20 percent).[6]

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5 It has to be noted that CKD vehicles are often recorded as finished vehicles in international trade statistics.

6 However, this indicator seems to be less reliable. One would expect that the share of apparent consumption (i.e., domestic production plus imports minus exports) of parts in total output of the automobile industry is in the same order of magnitude in all countries. Given the large variance of this share, it is doubtful whether the output values recorded in industrial surveys for the production of parts fully include intra-firm supplies. If that presumption holds, a low share would simply reflect the fact that the industry of the respective country is highly vertically integrated.

Table 6 — Production and international trade of automobile parts, 1995

	Production of bodies and parts (ISIC 3420, 3430)		Exports of parts for motor vehicles (SITC 784)		Imports of parts for motor vehicles (SITC 784)		Memo: Total automobile prod. (ISIC 3410-3430)
	mill. US$	percent[a]	mill. US$	percent[b]	mill. US$	percent[b]	mill. US$
Austria	1,778	27.7	1,355	76.2	1,693	95.2	6,425
Belgium	3,137	15.4	3,075	98.0	6,230	198.6	20,337
Canada	13,341	18.3	7,683	57.6	14,714	110.3	72,899
France	19,873	22.6	10,324	51.9	5,731	28.8	88,075
Germany	46,308	26.5	21,932	47.4	12,926	27.9	174,799
Italy	12,580	34.1	6,053	48.1	2,492	19.8	36,837
Japan	212,715	50.6	19,656	9.2	1,455	0.7	420,540
Netherlands	2,354	34.4	1,575	66.9	2,593	110.2	6,848
Sweden	2,715	14.8	3,688	135.8	2,507	92.3	18,332
UK	12,892	29.2	5,240	40.6	9,272	71.9	44,210
USA	128,521	35.7	23,817	18.5	21,156	16.5	360,079
Australia	n. a.	n. a.	302	n. a.	1,168	n. a.	n. a.
China PR	15,488	51.1	378	2.4	897	5.8	30,305
Korea Rep.	16,762	36.8	667	4.0	1,304	7.8	45,496
Taiwan	4,598	n. a.	1,334	29.0	1,542	33.5	n. a.
Thailand	n. a.	n. a.	140	n. a.	3,022	n. a.	n. a.
Argentina	n. a.	n. a.	546	n. a.	1,169	n. a.	n. a.
Brazil	n. a.	n. a.	1,471	n. a.	1,486	n. a.	n. a.
Mexico*	8,803	41.5	2,308	26.2	1,343	15.3	21,204
Czech Rep.	n. a.	n. a.	488	n. a.	438	n. a.	2,880
Hungary	470	37.3	250	14.1	160	9.0	1,260
Poland	n. a.	n. a.	124	n. a.	753	n. a.	3,589
Portugal	1,771	40.4	354	20.0	1,026	57.9	4,380
Russian Fed.	n. a.	n. a.	197	n. a.	287	n. a.	9,512
Slovenia	n. a.	n. a.	145	n. a.	356	n. a.	n. a.
Spain	9,158	25.8	4,186	45.7	6,063	66.2	35,434
Turkey	n. a.	n. a.	182	n. a.	768	n. a.	n. a.

[a]Share in total production of the automobile industry. — [b]Ratio to production of bodies and parts. — *1994.

Source: OECD, ISIS; EUROSTAT, DAISIE; UNIDO, Industrial Statistics; UN, Yearbook of International Trade Statistics 1997; Statistical Handbook of the Republic of China (Taiwan) 1998; VDA, International Auto Statistics 1999; own calculations.

- The relative importance of international production networks can be measured by the trade intensity of automobile parts (i.e., the ratio of exports or imports to domestic production of parts). High values for both indicators (e.g., for the case of Canada and Western Europe) can be interpreted as intrasectoral specialization in open markets. The interpretation of low values of both indicators (e.g., Japan, South Korea and China) is less clear: they may indicate either restricted market access or a high degree of vertical integration in the domestic industry. Low export orientation may also reflect insufficient international competitiveness.
- There are large differences with respect to the balance of international trade in automobile parts and components, even within the group of high-income countries. Large net exporters are Japan, Germany, France, Italy, Mexico and Sweden, whereas trade is almost balanced in the United States. Large net importers are Canada, Spain, UK, Belgium, Thailand, Australia, Argentina, Portugal and the Netherlands. To some extent, this supports the hypothesis of international production networks since large-scale assembling activities for subsidiaries of multinational enterprises are located in the countries in the group of net importers.
- Some low-income countries have become important suppliers of parts on a regional level (e.g., Mexico for the United States and Spain for Western Europe). Moreover, the international orientation of the Eastern European automobile producers has changed significantly in the mid-1990s. However, exports of parts from low-income countries do not account for a sizable share of total imports of high-income countries. The share of Latin America, Asian DCs, Eastern Europe and the EU periphery[7] in global imports of the triad was roughly one sixth in 1995.

All in all, the analysis of aggregate data provides only limited insights. Thus we proceed to a more detailed analysis by means of case studies in the next section.

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7 In the following, this group consists of Greece, Ireland, Portugal, Spain, and Turkey. Usually, the term ‘EU periphery’ refers only to low-income countries which are members of the EU. However, Turkey was included because it signed an Association Agreement with the EU in 1973.

3. International trade in automobile parts: case studies

Since the 1970s, major changes in the ways in which automobiles are developed and manufactured have occurred (Hartley 1992). One is the increasing use of just-in-time methods, another trend is the increasing use of entire sub-assemblies ('modules') rather than individual components. Such modules may be made by the assembler but in many cases they are made by outside suppliers. The source of such changes is the leading Japanese producers. Womack et al. (1990) use the term 'lean production' to contrast with the mass production techniques which have pervaded the industry. In their view, 'lean production combines the best features of both craft production and mass production — the ability to reduce costs per unit and dramatically improve quality while, at the same time providing an even wider range of products and even more challenging work' (Womack et al. 1990: 277). A major requirement of flexible production forms is that the relationship between the customer and suppliers of modules has to be extremely close in functional terms, with design and production of components being carried out in very close consultation. These new organizational methods may have biased international production networks towards geographical proximity. The analysis of international trade in automobile parts by region will shed some light on this issue.

Information derived from input-output-tables can be used to analyze the role of international outsourcing.[8] The share of imported inputs in the gross output value of the motor vehicle industry increased significantly in 1970-1990 (Table 7). It reached about 20 percent in the UK and about 10 percent in Germany and in the United States, but was still very low in Japan. To some extent, this increase is matched by a decrease of the value added share, but the share of inputs purchased from domestic suppliers has also decreased, most notably in the UK. The only exception is Japan where the share of domestic inputs has increased. This reflects the fragmentation of

8 Note that the most recent input-output-tables in the OECD database are for 1990. Meanwhile, input-output-tables for 1995 are available but have not been used since the internationally agreed method for the compilation of input-output-tables has changed significantly in the early 1990s (cf. Bleses and Stahmer 2000).

the production process in the Japanese motor vehicle industry through multi-tier customer-supplier relationships (Smitka 1991).

Table 7 — Cost components[a] in the motor vehicle industry[b], 1970-1990

	Germany			United Kingdom		
	1970*	1978	1990	1968	1979	1990
domestic inputs	58.4	53.2	57.3	65.5	52.0	49.9
thereof: from motor vehicle industry	17.1	15.1	15.3	24.4	7.0	7.3
imported inputs	6.4	8.1	11.7	3.9	11.7	20.8
thereof: from motor vehicle industry	2.0	3.5	5.4	0.5	5.4	8.0
value added	35.2	38.8	31.0	30.6	36.3	29.4

	Japan			United States		
	1970	1980	1990	1972	1982	1990
domestic inputs	68.6	73.5	77.4	62.3	64.6	59.8
thereof: from motor vehicle industry	25.5	28.8	43.9	24.2	21.7	21.8
imported inputs	0.7	1.1	1.3	3.9	6.5	10.2
thereof: from motor vehicle industry	0.0	0.1	0.3	2.2	3.6	6.1
value added	30.7	25.4	21.3	33.9	28.9	30.0

[a]In percent of gross output value. — [b]ISIC (Rev. 2) section 3843. — *Own calculations from revised 1970 input-output-table for Germany.

Source: OECD-DSTI; Statistisches Bundesamt.

Inputs produced by the automobile industry of other countries account for only about half of all imported inputs. At first sight, this could be interpreted as substitution of foreign suppliers of non-specific materials for domestic suppliers rather than as a reorganization of the production process within the automobile industry. However, even though many inputs for the motor vehicle industry are produced in other industries (e.g., electrical equipment, windscreens, plastic materials; cf. Appendix Table 1), they still are designed according to the specific

needs of the motor vehicle industry. Hence, the increase of the imported inputs share clearly supports the hypothesis that international outsourcing in the motor vehicle industry has become more relevant.

In the following, international trade in automobile parts is analyzed in detail for four major automobile producers (the United States, Japan, Germany and the UK). Three indicators are considered: first, the commodity structure of international trade in automobile products; second, the export orientation and the import market penetration of the automobile industry by subsectors; and third, the composition of imports of automobile parts[9] by region. Whenever possible, information about the trade policy of the respective country (including regional free trade agreements) and about firm strategies is added to explain specific developments. The first indicator will be used to identify the type of parts which are increasingly traded internationally. The second indicator will be used to find out whether imports and/or exports of intermediate products have gained in importance for these countries. The third indicator will be used to identify whether the relevance of low-income countries as suppliers of intermediate inputs has increased; moreover, it allows to test the hypothesis that globalization is largely a phenomenon on the regional rather than the global level.

An important objective of the case studies is to test indirectly whether the increasing trade in automobile parts has contributed to the labor market developments in these countries, i.e., the increased unemployment of less-skilled workers in Europe and the increased skill premium in the United States. If automobile parts are mainly imported from other high-income countries, international outsourcing cannot be used as the main explanation for the labor market developments in high-income countries. However, this must not be the case if low-income countries have gained considerable shares in the market for automobile parts.

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9 Härtel and Jungnickel (1996: 279) objected that international trade in automobile parts includes spare parts for previously sold vehicles. However, the share of spare parts is estimated to be below 15 percent.

a. The case of the US

During the last two decades, the United States was a large net importer of finished vehicles whereas the trade in automobile parts was almost balanced (Table 8). Automobile parts accounted for more than half of the exports of all automobile products but only for less than 30 percent of total imports. However, imports of automobile parts have grown significantly faster than exports. Consequently, the United States has become a net importer of engines and electrical equipment for vehicles in 1995.

Table 8 — US trade with motor vehicles and parts, 1980 and 1995

	Code	Exports (bill. US$)		Change[a]	Imports (bill. US$)		Change[a]
	(SITC)	1980	1995	(percent)	1980	1995	(percent)
Cars	781	4.3	16.8	+ 9.6	18.0	66.1	+ 9.1
Trucks	782	2.1	5.3	+ 6.2	2.1	10.2	+11.1
Buses	783	0.5	1.4	+ 7.6	0.2	2.2	+16.0
Trailers	786	0.2	0.9	+ 9.1	0.0	0.6	+21.1
Engines	713.2	0.9	3.7	+10.2	0.8	6.3	+14.7
Parts thereof	713.9	1.6	3.4	+ 5.0	0.9	3.3	+ 9.5
Parts and acc.	784	7.6	23.8	+ 7.9	5.5	21.2	+ 9.4
Electrical eq.	778.3	0.3	1.5	+10.1	0.3	2.0	+14.3
Total trade		17.5	56.8	+ 8.2	27.8	111.9	+ 9.7
thereof: parts[b]		59%	57%		27%	29%	

[a]Annual average rate of change for the period 1980-1995. — [b]Share of engines and parts thereof, parts and accessories and electrical equipment in total trade.

Source: OECD, ITCS; own calculations.

The liberal US trade regime made room for this development. Import tariffs on automobile products are very low in the United States, ranging from 0 to 4 percent in general. Higher rates, up to 25 percent, apply only for trucks (GATT 1994). However, voluntary export restrictions on Japanese passenger cars to the United States were terminated only in 1994 (WTO 1998).

Within the automobile industry, the production of parts was always more export-oriented than other subsectors, recording an export share of about one quarter of domestic production (Table 9). This may be explained by the long standing cooperation between firms in the US and in Canada which accounts for the bulk of the US parts exports. By contrast, the import market penetration for automobile parts was lower than for finished vehicles.

Table 9 — Export orientation[a] and import penetration[b] in the US automobile industry[c]

	Export orientation			Import penetration		
	1985	1990	1995	1985	1990	1995
Automobiles and engines*	9.5	10.0	11.4	34.1	29.9	29.3
Automobile bodies and trailers*	0.7	1.7	2.1	1.5	1.4	1.6
Automobile parts and accessories*	25.6	25.7	24.4	24.1	27.5	22.7
Total automobile industry	12.5	12.9	13.9	29.4	27.2	25.5

[a]Exports in percent of domestic production. — [b]Imports in percent of apparent domestic consumption. — [c]ISIC (Rev.3) sections 3410, 3420 and 3430. Correspondence between production data (ISIC Rev.3) and import data (SITC Rev.3) as follows: ISIC 3410 = SITC 781+782+783+784.1+713.2; ISIC 3420 = SITC 784.2+786.1; ISIC 3430 = SITC 784.3. — *Data prior to 1995 not strictly comparable due to the introduction of the revised classification (ISIC Rev.3).

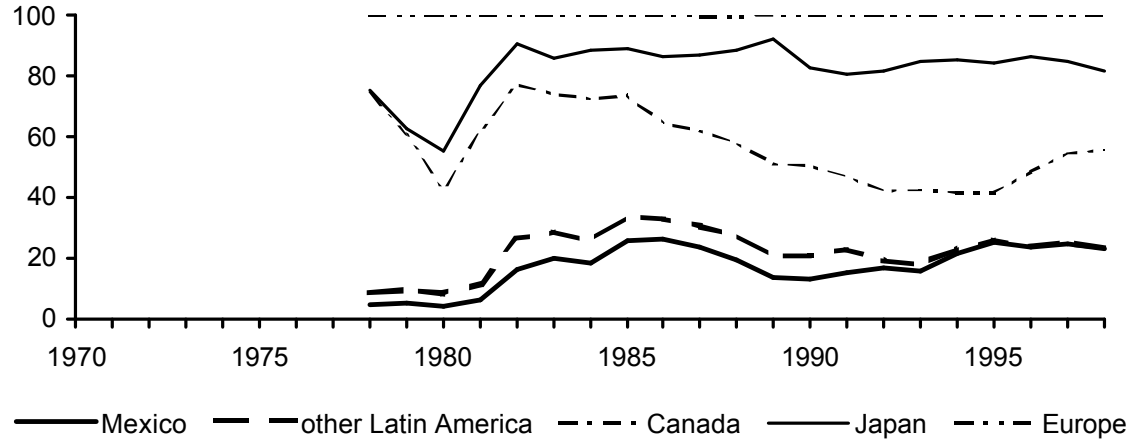
Source: OECD, ITCS; EUROSTAT, DAISIE; own calculations.

The regional structure of US imports of automobile parts has recorded two significant shifts.

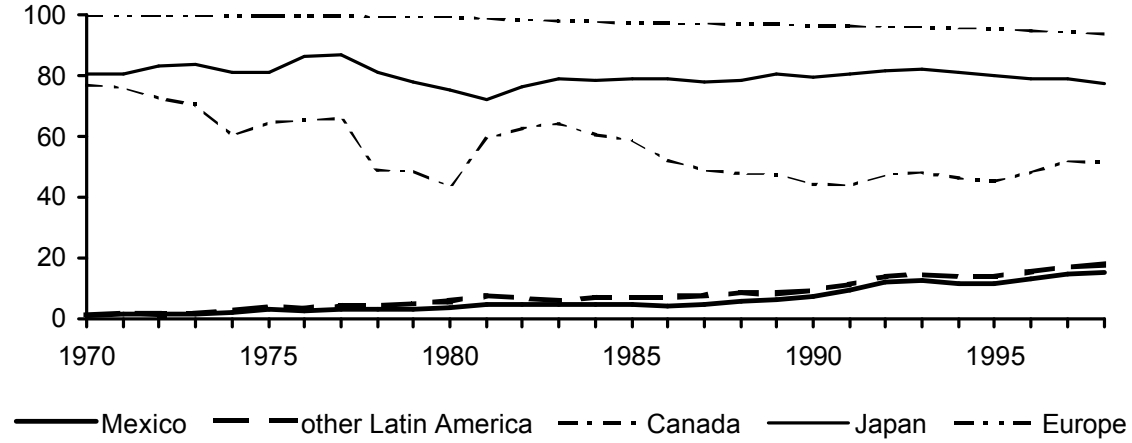
First, the share of Japan has increased since the early 1970s (Figure 1). This was due to increased Japanese production and assembly in the United States, initially based on supplies of parts from the home country (Payne and Payne 1990). In the early 1990s, imports from Japan accounted for about 40 percent of total imports of engines, of parts and accessories, and of electrical equipment. However, this share declined somewhat during the 1990s due to ‘voluntary’ trade restrictions. Japanese automobile

Figure 1 — Geographical composition[a] of US imports of automobile parts, 1970–1998

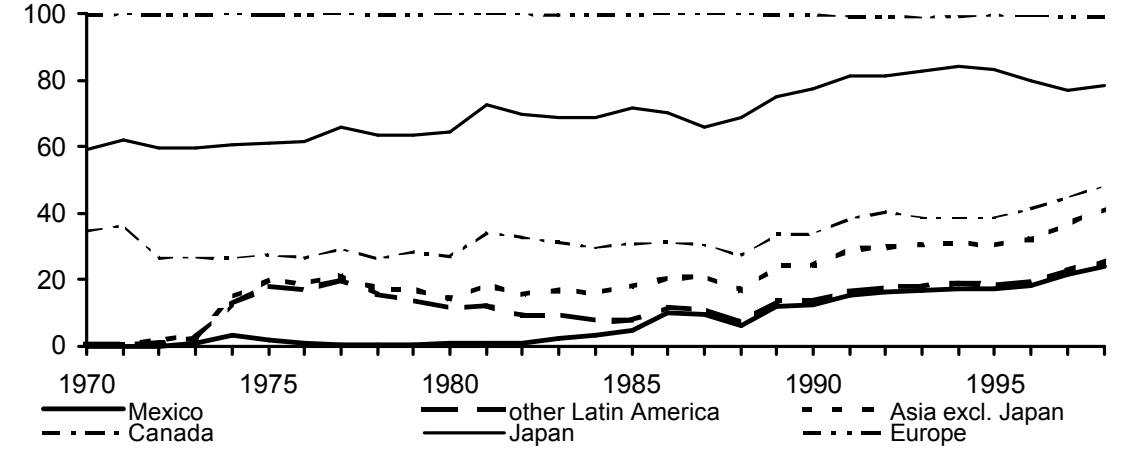
SITC 713.2 – Engines



SITC 784 – Parts and accessories



SITC 778.3 – Electrical equipment



[a]Cumulative shares of total imports (percent).

Source: OECD, ITCS; own calculations.

manufacturers under the 1992 ‘Global Partnership Program’ stated that they expected to increase their purchases of US-made components. This included sharply increased purchases by Japanese auto companies based in the United States[10] of inputs produced in the United States, mainly from Japanese affiliates located in the United States (GATT 1994).

Second, imports from Mexico have gained at the expense of European and Canadian exports. In the mid-1990s, Mexico’s share in all three segments of the US automobile market was already bigger than the European share. It has to be noted that automobile parts are not only imported from Mexico but also exported from the United States to the export processing zones close to the border (‘maquiladoras’). By contrast, other regions played virtually no role, with the exception of other Asian countries as suppliers of electrical equipment.

Regional trade arrangements have fostered this development (Hummels et al. 1998):

- The 1965 Automobile Pact between the United States and Canada reshaped the industry, producing an integrated structure in which production by the major manufacturers was reorganized on a continental rather than a national basis. Canadian plants performed specific functions within the larger continental production system. The 1988 Canada-US Free Trade Agreement also contained important provisions for the automobile industry. In particular, it redefined the level of ‘North American content’ necessary for a firm to claim duty-free movement within the North American market (Eden and Molot 1993).
- The NAFTA (effective 1994) has even more far-reaching implications for the automobile industry because of the lower production costs of the Mexican automobile industry and the fact that it was already becoming increasingly integrated into the North American market through the strategies of multinational

10 In the mid-1990s, about one sixth of all vehicles produced in the US were manufactured in Japanese plants.

producers. Tariffs are to be removed within NAFTA over ten years, the same applies to Mexico's quotas on imports. Mexican import tariffs on cars were immediately reduced by 50 percent. In addition, the US local content rule of origin was sharpened: the requirement was increased from 50 percent (under the US-Canada free trade agreement) to 62.5 percent. This may discourage trade in vehicles made in any NAFTA party with the use of non-NAFTA components (GATT 1994).

In summary, international sourcing is relatively important in the United States, but the causes were different for parts from Japan and parts from Mexico. In the first case, increased imports are the consequence of increased Japanese production within the United States, that is, no outsourcing in the narrow sense. In the second case, production networks emerged between locations in Mexico and the United States.

b. The case of Japan

In the early 1980s, Japanese producers were clearly the least multinational of the major automobile producers, measured by the share of vehicles produced abroad. Japanese firms had established local assembly operations in a number of countries, but before 1982 there was not a single Japanese automobile production plant outside Japan. The spectacular increase of Japanese exports was achieved almost entirely without any overseas production. However, this has changed dramatically during the 1980s. Japanese companies changed their global strategy by locating major production plants in their major markets. The primary stimulus for this change was the increasing opposition in both North America and Western Europe towards the growth of Japanese imports, leading to protectionist measures such as VERs in both regions.

In 1980-1995, Japan was a large exporter of both finished vehicles and automobile parts (Table 10). The share of automobile parts in total exports of automobile products has more than doubled since 1980 and reached more than one third in the 1990s. This clearly indicates the increasing role of Japanese production and assembly plants in North America, East Asia and, more recently, also in Western Europe. In

addition, Japanese component manufactures followed the assemblers because of the use of just-in-time delivery systems (Sleigh 1990). Since the first establishment of production facilities in the United States in the early 1980s, each of the major Japanese firms has made major investments in engine, transmission and components plants within the US. Japanese automobile manufacturers are deeply involved in Asia through a network of assembly plants and joint ventures with domestic firms in Thailand, Malaysia, the Philippines, Indonesia, Taiwan and China PR. In several of these countries Japanese firms dominate the automobile market (Legewie 2000). In comparison, Japanese automobile manufacturers were slower to establish production facilities in Europe; meanwhile, major Japanese plants are located in the UK (see below).

Table 10 — Japanese trade with motor vehicles and parts, 1980 and 1995

	Code	Exports (bill. US$)		Change[a]	Imports (bill. US$)		Change[a]
	(SITC, Rev. 2)	1980	1995	(percent)	1980	1995	(percent)
Cars	781	16.1	41.7	+ 6.5	0.5	10.0	+22.9
Trucks	782	6.4	9.6	+ 2.7	0.0	0.2	+13.5
Buses	783	0.6	1.2	+ 4.9	0.0	0.0	+15.7
Trailers	786	0.5	0.2	- 7.3	0.0	0.2	+23.7
Engines	713.2	0.3	6.0	+22.0	0.0	0.1	+ 5.0
Parts thereof	713.9	0.9	4.6	+11.6	0.0	0.3	+16.9
Parts and acc.	784	2.2	19.7	+15.8	0.1	1.5	+19.5
Electrical eq.	778.3	0.5	2.6	+11.4	0.0	0.2	+13.1
Total		27.5	80.2	+ 7.4	0.6	12.5	+22.4
thereof: parts[b]		14%	38%		29%	16%	

[a]Annual average rate of change for the period 1980-1995. — [b]Share of engines and parts thereof, parts and accessories and electrical equipment in total trade.

Source: OECD, ITCS; own calculations.

By contrast, imports of automobile parts are still tiny both compared to total imports of automobile products and to exports of automobile parts. However, imports of automobile parts have grown significantly faster than exports. Moreover, European

producers recently entered the Japanese market through mergers and acquisitions, e.g., in the case of Renault/Nissan, Mercedes/Mitsubishi, and Bosch/Zexel (ILO 2000), but there is no foreign car manufacturer producing in Japan.

The low level of imports is surprising, since the Japanese trade regime is fully liberalized. Japan applies no import tariffs on finished vehicles and on automobile parts. Moreover, it has not used anti-dumping or countervailing measures in the automobile sector (WTO 1998). Allegedly, the low import penetration ratio is due to other regulations. For example, the United States and other countries repeatedly claimed that Japan's certification procedures have complicated the entry of foreign automobiles into the Japanese market (GATT 1995). In recent years, the United States has claimed that close Japanese intercorporate relationships make it difficult for foreign automotive parts suppliers to compete with Japanese-owned suppliers for original equipment sales to Japanese automobile assemblers (WTO 1998).

Within the automobile industry, the production of automobile parts was always relatively little export-oriented, both compared to other countries and to other subsectors of the Japanese automobile industry. This subsector recorded an export share of only about 10 percent of domestic production (Table 11). Likewise, the import market penetration for automobile parts is still negligible, and never reached the level of finished vehicles. The significant decline of export orientation of the production of finished vehicles from about two thirds in 1980 to about one third in 1995 again indicates the important role of Japanese transplants.

The regional structure of Japanese imports of automobile parts is hard to interpret, given the tiny volumes. However, there was a significant shift towards suppliers from other Asian countries, at the expense of Europe and the United States (Figure 2). This trend is most obvious in the case of electrical equipment, where imports from Asia accounted for 40 percent of total imports in the mid 1990s. Only in the case of engines, the share of Asian suppliers is still small since this market is dominated by imports from the United States. Compared to Western Europe and North America,

East Asian imports of automobile parts account for a larger share of total automobile products, and are growing considerably faster. Hence, production sharing in East Asia is greater than is generally recognized (Ng and Yeats 1999).

Table 11— Export orientation[a] and import penetration[b] in the Japanese automobile industry[c]

	Export orientation			Import penetration		
	1985	1990	1995	1985	1990	1995
Automobiles and engines*	60.5	43.4	34.3	2.5	8.4	8.3
Automobile bodies and trailers*	3.3	1.1	1.3	0.0	0.3	0.3
Automobile parts and accessories*	9.6	8.7	10.2	0.4	0.7	0.9
Total automobile industry	33.3	24.2	20.3	1.0	3.5	3.7

[a]Exports in percent of domestic production. — [b]Imports in percent of apparent domestic consumption. — [c]ISIC (Rev.3) sections 3410, 3420 and 3430. Correspondence between production data (ISIC Rev.3) and import data (SITC Rev.3) as follows: ISIC 3410 = SITC 781+782+783+784.1+713.2; ISIC 3420 = SITC 784.2+786.1; ISIC 3430 = SITC 784.3. — *Data prior to 1995 not strictly comparable due to the introduction of the revised classification (ISIC Rev.3).

Source: OECD, ITCS; EUROSTAT, DAISIE; own calculations.

In summary, Japanese manufacturers participated in production networks largely in the form of supplying parts to foreign subsidiaries, later followed by local sourcing of parts. By contrast, imports of parts from low-income countries for plants located in Japan were still very low, although they grew much faster than imports from high-income countries. However, the economic crisis of the 1990s has forced Japanese manufacturers to reorganize their production networks, and that may soon change the picture (Park et al. 1999).

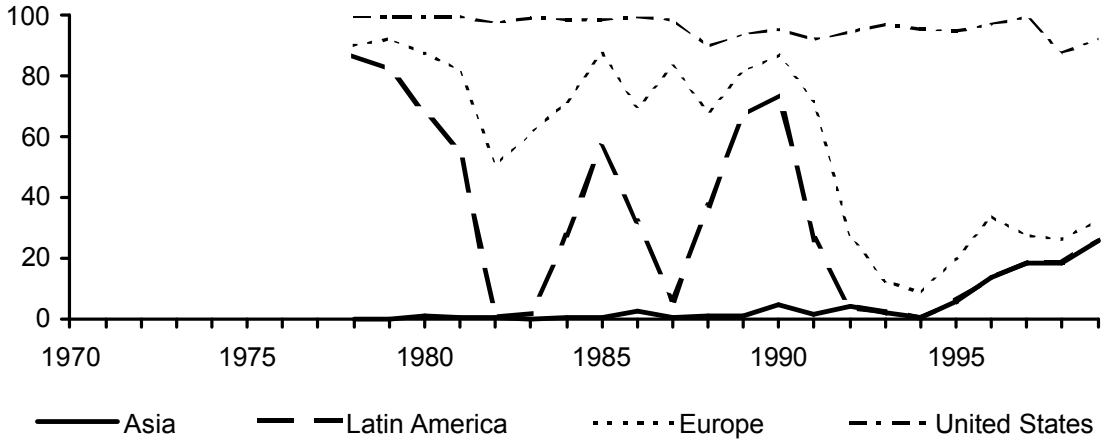
c. The case of Germany

In the period under consideration, Germany was always a net exporter both of finished vehicles and of automobile parts. Automobile parts accounted for about one third both in total exports and in total imports of automobile products (Table 12). However,

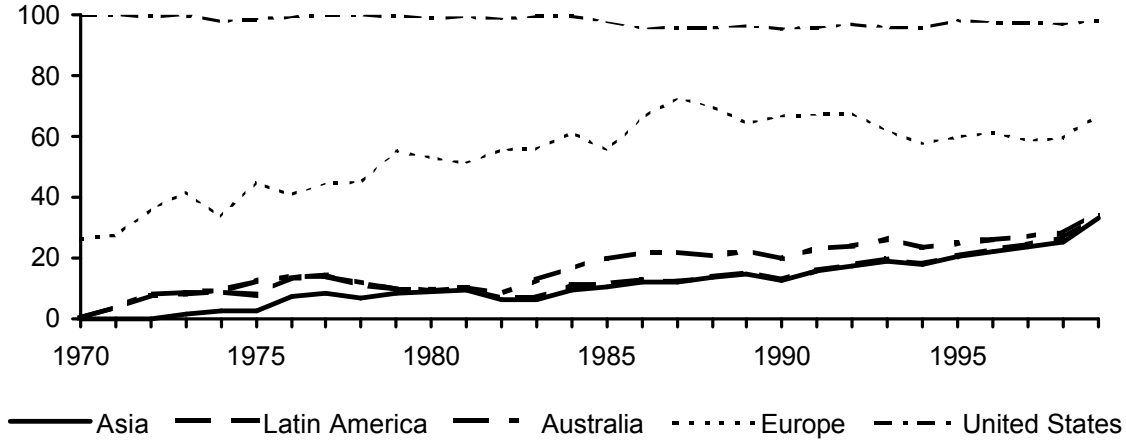
imports of automobile parts have grown considerably faster than exports, with the exception of electrical equipment. In the segment of vehicle engines, Germany has even become a net importer, albeit a small one.

Figure 2 — Geographical composition[a] of Japanese imports of automobile parts, 1970–1999

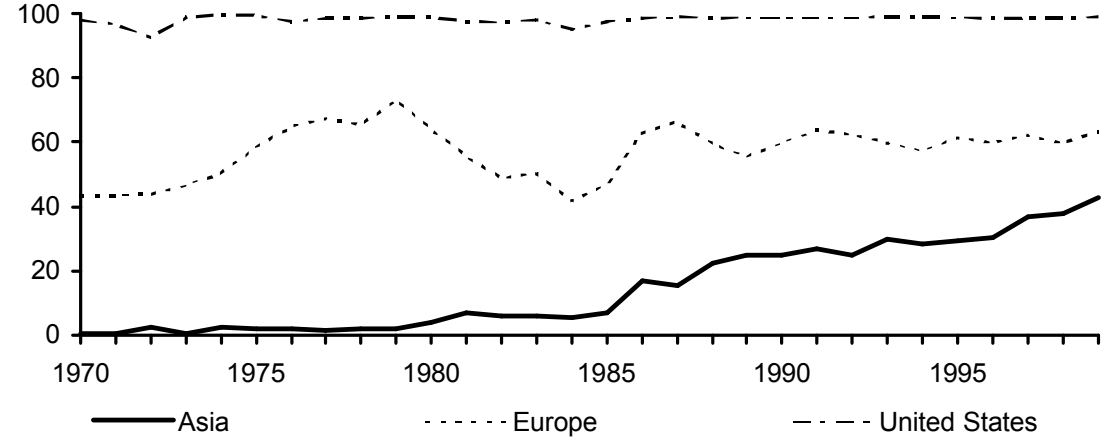
SITC 713.2 – Engines



SITC 784 – Parts and accessories



SITC 778.3 – Electrical equipment



[a]Cumulative shares of total imports (percent).

Source: OECD, ITCS; own calculations.

Table 12 — German trade with motor vehicles and parts, 1980 and 1995

	Code	Exports (bill. US$)		Change[a]	Imports (bill. US$)		Change[a]
	(SITC, Rev. 2)	1980	1995	(percent)	1980	1995	(percent)
Cars	781	14.6	48.6	+ 8.4	4.8	23.3	+11.0
Trucks	782	3.9	6.1	+ 3.1	0.6	3.4	+12.9
Buses	783	1.1	4.2	+ 9.4	0.1	1.6	+23.4
Trailers	786	0.8	1.8	+ 5.1	0.2	0.7	+ 8.4
Engines	713.2	0.8	2.5	+ 7.3	0.4	2.7	+13.6
Parts thereof	713.9	1.2	3.6	+ 7.4	0.3	1.2	+11.0
Parts and acc.	784	6.6	21.9	+ 8.3	2.1	12.9	+13.0
Electrical eq.	778.3	0.7	1.5	+ 8.8	0.3	1.0	+ 9.0
Total		29.7	90.2	+ 7.7	8.8	46.8	+11.8
thereof: parts[b]		32%	33%		35%	38%	

[a]Annual average rate of change for the period 1980-1995. — [b]Share of engines and parts thereof, parts and accessories and electrical equipment in total trade.

Source: OECD, ITCS; Statistisches Bundesamt; own calculations.

The common trade policy of the EU was not as liberal as in the case of the US or Japan. Import tariffs for automobile products in the EU ranged between 0-22 percent in 1997, with a simple average of 7 percent (WTO 1997). Moreover, the tariff structure shows some escalation: rates were about 20 percent on buses and trucks and 10 percent on passenger cars, whereas the rates on parts were only 4.5 percent (EU-TARIC 1995). In 1991, the European Commission negotiated an agreement with the Japanese government which phased out all national import restrictions but limited Japanese automobile imports to a given percentage of total EU vehicle sales for a transitional period of seven years (1993-1999). Japan agreed to monitor its direct exports, whereas exports of vehicles from Japanese brand-name plants within the EU were explicitly excluded (GATT 1993). This monitoring of export levels has been completely abolished as from 1 January 2000 (European Commission 2000).

The production of automobile parts in Germany was always very trade-oriented, both in absolute levels and compared to the production of finished vehicles (Table 13). Export shares stood at about three quarters of domestic production, and import

market penetration at about 50 percent.[11] This shows clearly the important role of parts produced in Germany for assembly plants in other countries, foremost in Western Europe. Two factors are behind this: first, international production sharing within multinational corporations (Ford, GM and VW), and second, technologically advanced, specialized suppliers (e.g., Bosch for electronic parts or ZF for transmissions; cf. Meissner et al. 1994). The export orientation of the production of bodies and trailers is only moderate, but still significantly larger than in the United States.

Table 13— Export orientation[a] and import penetration[b] in the German automobile industry[c]

	Export orientation			Import penetration		
	1985	1990	1995	1985	1990	1995
Automobiles and engines*	53.6	49.6	48.1	21.9	30.1	31.8
Automobile bodies and trailers*	19.3	14.8	14.5	7.2	9.3	6.9
Automobile parts and accessories*	75.0	76.4	54.6	50.1	57.9	41.6
Total automobile industry	55.7	52.5	48.2	24.9	32.6	32.8

[a]Exports in percent of domestic production. — [b]Imports in percent of apparent domestic consumption. — [c]ISIC (Rev.3) sections 3410, 3420 and 3430. Correspondence between production data (ISIC Rev.3) and import data (SITC Rev.3) as follows: ISIC 3410 = SITC 781+782+783+784.1+713.2; ISIC 3420 = SITC 784.2+786.1; ISIC 3430 = SITC 784.3. — *Data prior to 1995 not strictly comparable due to the introduction of the revised classification (ISIC Rev.3).

Source: OECD, ITCS; Statistisches Bundesamt; EUROSTAT, DAISIE; own calculations.

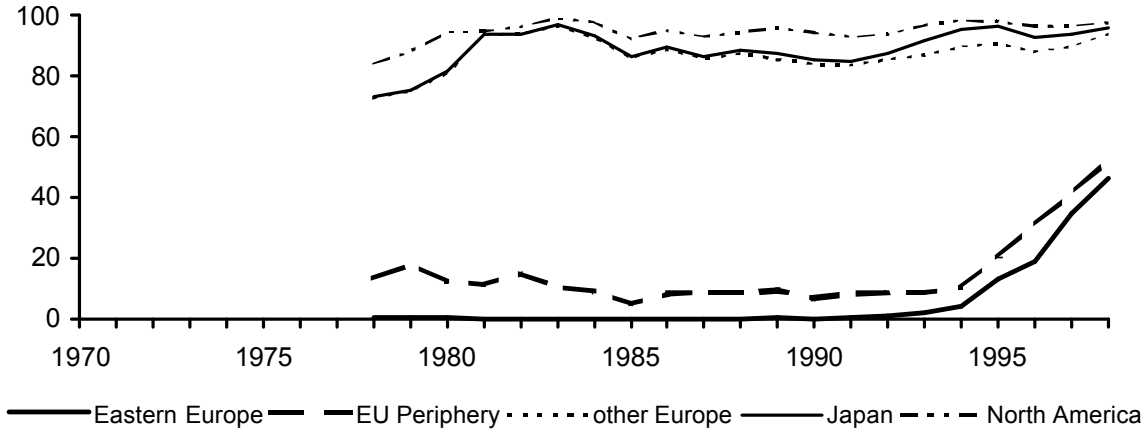
German imports of automobile parts were always concentrated on Western Europe, accounting for 80 percent of total imports (Figure 3). However, two significant shifts were recorded: First, the share of suppliers at the European periphery[12] increased to

11 No explanation could be found for the significant decline in both ratios from 1990 to 1995. The previously mentioned change of the industrial classification system in the early 1990s may be the reason.

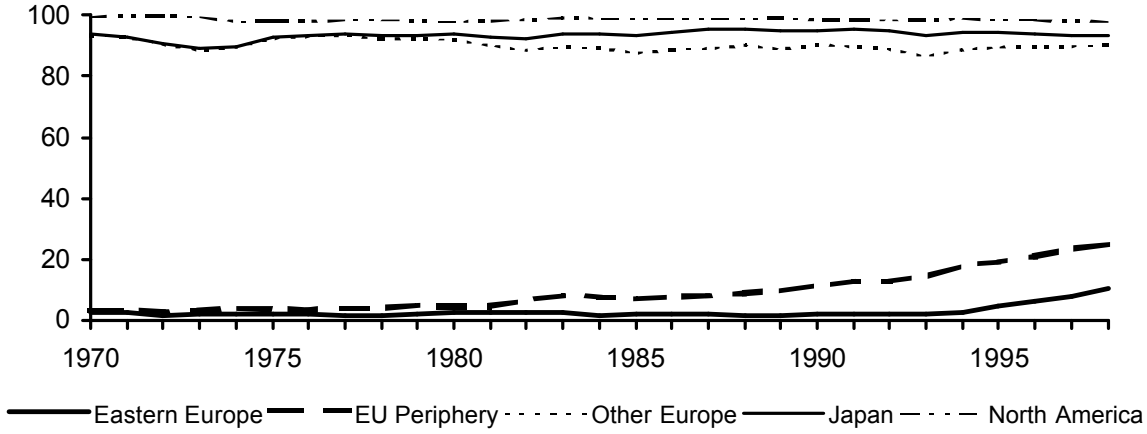
12 Greece, Ireland, Portugal, Spain, and Turkey.

Figure 3 — Geographical composition[a] of German imports of automobile parts, 1970–1998

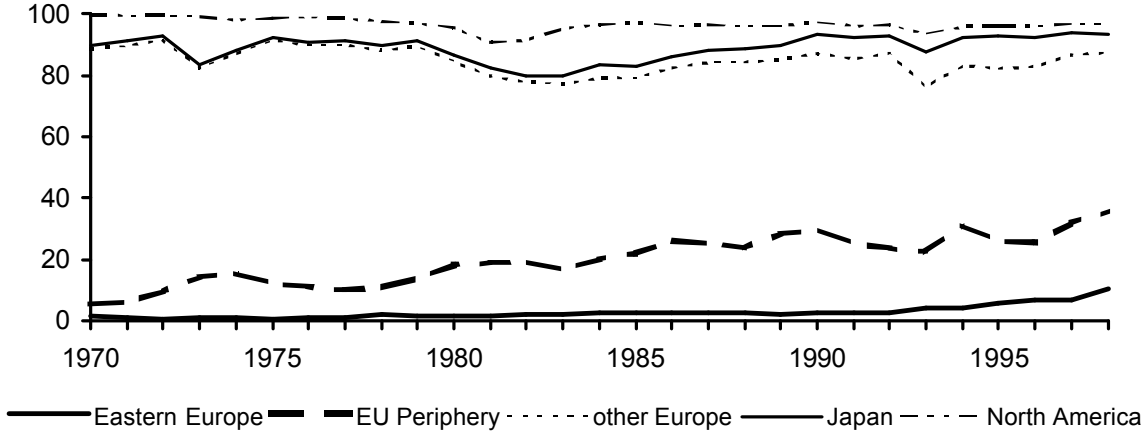
SITC 713.2 – Engines



SITC 784 – Parts and accessories



SITC 778.3 – Electrical equipment



[a]Cumulative shares of total imports (percent).

Source: OECD, ITCS; Statistisches Bundesamt; own calculations.

almost 20 percent in the case of automobile parts and about one quarter in the case of electrical equipment. Second, the share of suppliers in Eastern Europe has increased since 1993, most notably in the case of vehicle engines where it stood at more than 40 percent in 1998.

Both shifts are clearly driven by labor-cost differentials and were facilitated by the European integration process and the opening-up of Eastern Europe to foreign direct investment.[13] This was at the expense of other Western European countries, since the share of other regions remained relatively small and almost constant over the whole period. Only in the case of electrical equipment, other regions[14] accounted for more than 10 percent of total German imports.

The intra-European production sharing can be illustrated with the case of VW:[15]

Prior to the opening up of Eastern Europe, VW concentrated its production in two countries in a clear strategy of spatial segmentation. High-value cars were produced in the former West Germany, low-cost, small cars were produced in Spain where VW undertook a massive investment program in the former SEAT company. During 1990, VW moved very rapidly to establish production of small cars in Eastern Germany and to take a majority stake in the Czech firm Skoda. VW has embarked on a major restructuring program which involves reducing the number of vehicle 'platforms' used by the four companies forming the VW group (VW, Audi, SEAT, Skoda) to ensure the maximum sharing of basic structures on which differentiated vehicles can be based. VW is also introducing radically new sourcing arrangements with its key

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13 Meanwhile, Asian automobile manufacturers (most notably Daewoo) are strongly engaged in Eastern Europe, and may use their subsidiaries to serve the Western European car market (Tutak 1999).

14 Countries like China, Brazil, and Mexico with long-standing relations to German automobile manufacturers were major importers of German automobile parts but were not relevant as suppliers of parts for assembly in Germany (Nunnenkamp 1998).

15 In the mid-1990s, about 40 percent of all vehicles produced in Germany are made by the VW group, about 20 percent are made produced by Opel (subsidiary of GM) and about 10 percent by Ford.

suppliers. Outside Europe, VW has major production plants (not only for local markets) in Brazil, China and in Mexico. The latter has effectively replaced much of the production formerly located at VW's Pennsylvania plant, which was closed in 1988 (Dicken 1998: 347).

d. The case of the United Kingdom

In the 1970s and 1980s, the UK automobile industry went through a long period of absolute decline, which first affected the production of finished vehicles and subsequently also that of automobile parts. However, the establishment of new assembly plants in the 1980s and early 1990s brought a dramatic change in the automobile production within the UK.

In the early 1980s, the UK was net exporter of automobile parts and net importer of finished vehicles, but this pattern has been reversed completely. In 1995, automobile parts accounted for only about 40 percent of total exports after almost 60 percent in 1980, and for about 40 percent of total imports after only one quarter in 1980 (Table 14). Imports of automobile parts have grown considerably faster than exports in all segments, in particular in the segment of parts and accessories. Only in the segment of vehicle engines the UK still is a net exporter, albeit a small one, whereas it has become a strong net importer of all other automobile products. Moreover, the UK is still a net importer of finished vehicles, although exports have increased significantly due to the large foreign investments in the UK automobile industry.

Even though the production of automobile parts in the UK has become less export-oriented, this segment is still very trade-oriented, both in absolute levels and compared to the production of finished vehicles (Table 15). Export shares and import market penetration were higher than 70 percent of domestic production in the 1980s, but both ratios decreased during the 1990s. The import market penetration in finished vehicles has always been relatively high in the UK, and reached a level of more than 50 percent during the 1990s. Finally, the export orientation of the production of bodies and trailers increased and, in 1995, it reached a level close to that in Germany.

Table 14 — UK trade with motor vehicles and parts, 1980 and 1995

	Code	Exports (bill. US$)		Change[a]	Imports (bill. US$)		Change[a]
	(SITC, Rev. 2)	1980	1995	(percent)	1980	1995	(percent)
Cars	781	1.9	11.0	+12.2	4.9	15.6	+ 8.0
Trucks	782	1.3	1.3	- 0.0	0.6	2.2	+ 8.9
Buses	783	0.1	0.2	+ 3.5	0.2	0.4	+ 3.7
Trailers	786	0.2	0.5	+ 5.1	0.1	0.3	+ 8.3
Engines	713.2	0.5	1.8	+ 8.7	0.1	0.9	+12.5
Parts thereof	713.9	0.8	1.0	+ 1.6	0.3	1.3	+ 9.7
Parts and acc.	784	3.6	5.2	+ 2.5	1.5	9.3	+13.9
Electrical eq.	778.3	0.2	0.5	+ 7.9	0.2	0.7	+10.4
Total		8.6	21.5	+ 6.3	7.9	30.7	+ 9.5
thereof: parts[b]		59%	40%		27%	40%	

[a]Annual average rate of change for the period 1980-1995. — [b]Share of engines and parts thereof, parts and accessories and electrical equipment in total trade (percent).

Source: OECD, ITCS; own calculations.

Table 15 — Export orientation[a] and import penetration[b] in the UK automobile industry[c]

	Export orientation			Import penetration		
	1985	1990	1995	1985	1990	1995
Automobiles and engines*	21.7	28.6	46.6	41.0	42.2	53.0
Automobile bodies and trailers*	5.5	9.1	12.4	7.5	7.1	5.7
Automobile parts and accessories*	74.5	71.3	49.7	71.0	76.7	64.4
Total automobile industry	31.2	34.9	45.0	43.4	46.4	53.6

[a]Exports in percent of domestic production. — [b]Imports in percent of apparent domestic consumption. — [c]ISIC (Rev.3) sections 3410, 3420 and 3430. Correspondence between production data (ISIC Rev.3) and import data (SITC Rev.3) as follows: ISIC 3410 = SITC 781+782+783+784.1+713.2; ISIC 3420 = SITC 784.2+786.1; ISIC 3430 = SITC 784.3. — *Data prior to 1995 not strictly comparable due to the introduction of the revised classification (ISIC Rev.3).

Source: OECD, ITCS; EUROSTAT, DAISIE; own calculations.

Two factors were responsible for the surge of foreign direct investment: first, a combination of average labor productivity and relatively low wages made the UK an

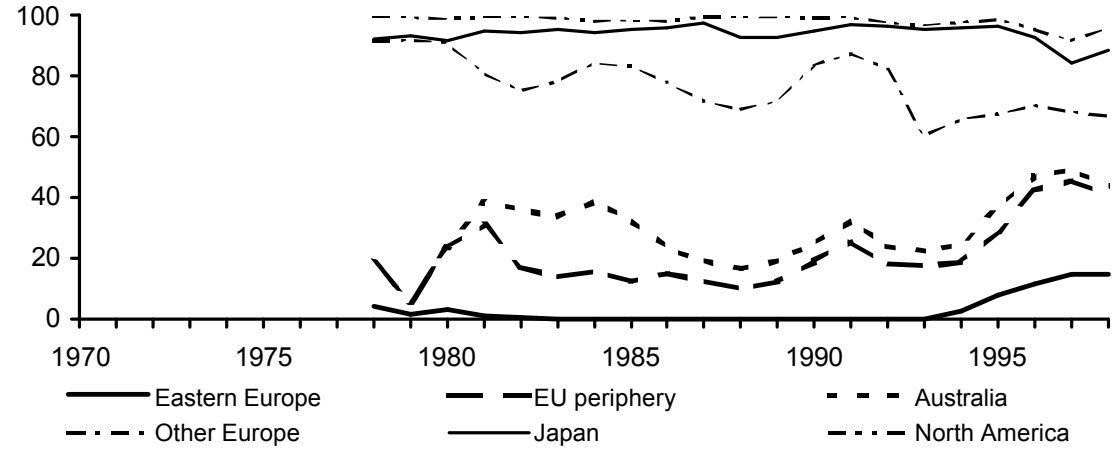
attractive location within Western Europe; second, the Thatcher government guaranteed a liberal trade[16] and investment regime and offered financial incentives. Hence, the UK provided a production base for the (then still coming) Single European Market (Hudson 1995). In the negotiation process for the 1991 'Consensus' between the EC and Japan, the biggest controversy was over the treatment to be accorded to Japanese vehicles manufactured within Europe itself. In this respect, the European Commission insisted on specific levels of local content in vehicle manufacture of foreign producers. As far as Japanese firms in Europe are concerned, a level of 80 percent local content was regarded acceptable (Dicken 1998: 331).

The structure of UK imports of automobile parts differs significantly across segments (Figure 4). Whereas imports from Western Europe dominated in the parts and accessories segment with more than 70 percent of total imports over the whole period, non-European suppliers accounted for about 50 percent of total imports of engines and electrical equipment. Among them, Japanese suppliers held the largest share with more than 20 percent in both segments, whereas suppliers in the EU periphery held a significant (and increasing) share of total UK imports only in the segment of vehicle engines. Suppliers in Eastern Europe have gained a sizable market share in UK imports of vehicle engines since the early 1990s, which was at the expense of suppliers from Western Europe. The share of other regions remained relatively small over the whole period.

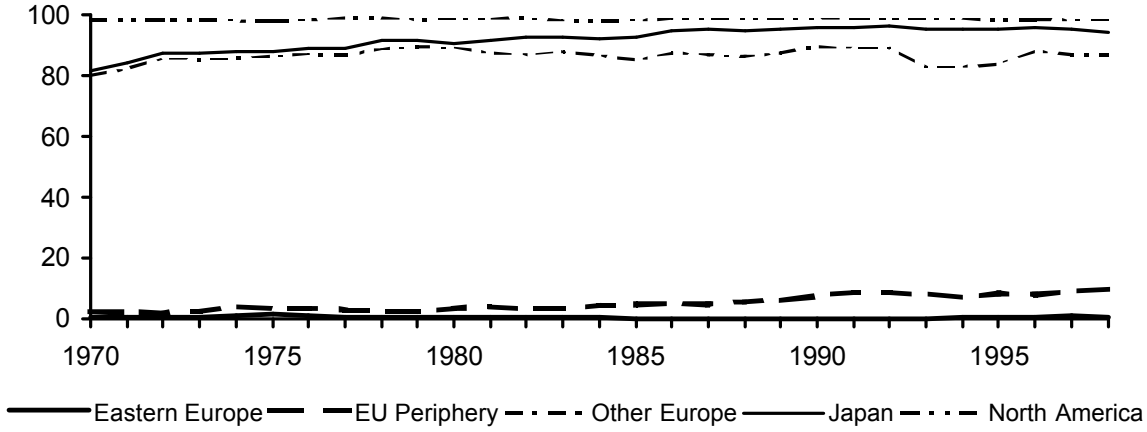
16 Note that Italy and France (but not the UK) applied import quotas for automobile products in the 1980s. The Japanese plans to establish production plants in the UK were probably the main reason for the negotiation of the 1991 'Consensus' on car imports from Japan (see previous section).

Figure 4 — Geographical composition[a] of UK imports of automobile parts, 1970–1998

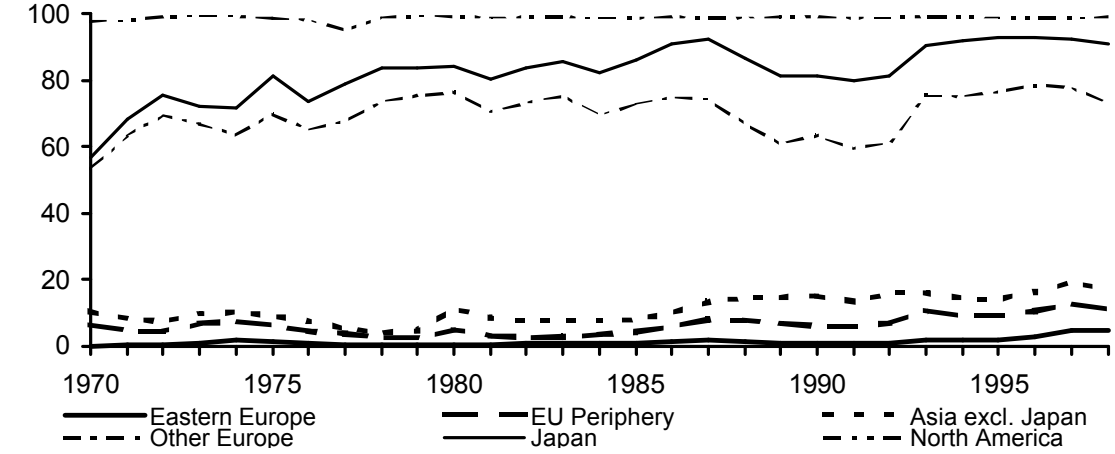
SITC 713.2 – Engines



SITC 784 – Parts and accessories



SITC 778.3 – Electrical equipment



[a]Cumulative shares of total imports (percent).

Source: OECD, ITCS; own calculations.

The intra-European production sharing of the UK can be illustrated with two examples: GM's operations in Europe had long been based upon two separate national subsidiaries: Vauxhall (UK) and Opel (Germany). When Vauxhall's performance became progressively weaker during the 1970s, Vauxhall was relegated to serving the UK market only and much of its production was simple assembly of imported subassemblies from Opel (Dicken 1998: 346).

In the 1990s, Toyota and Honda established plants for the production of cars and engines in the UK. They started at relatively low levels of local content and progressively increased them when local supplier networks were built up and Japanese component suppliers have joined end producers as foreign investors in the UK (Vickery 1996: 195). In contrast to the US, Japanese subsidiaries purchase components mainly from the established Western European suppliers (Hudson 1995).

In summary, the UK is highly involved in regional production networks, mainly as importer of automobile parts. However, information about the specific skill requirements of the production process within the UK is needed to conclude about labor market consequences.

4. Conclusions

Since 1970, some important new locations for automobile production have emerged outside the triad (Japan, the United States and Western Europe). However, not only the import market penetration in the major producer countries has steadily increased during the last three decades, but also their export orientation. A priori, there are two possible explanations: increasing intra-industry trade in finished vehicles or expanding international production networks.

From the analysis of international trade statistics it emerged that trade in automobile parts accounted for a relatively stable fraction of total world trade in automobile products. However, this is not to say that global production networks have not expanded. For example, automobile parts are to some extent delivered to

assembly plants abroad which were established for re-export rather than for the respective local market. In that case, imports of finished automobiles and exports of parts increase at the same pace.

The analysis of the geographical pattern of world production and trade in automobile parts showed that the share of imported parts in total production costs has increased significantly. Moreover, some low-income countries (e.g., Mexico and Spain) have become strong net exporters of automobile parts. This fits the anecdotal evidence on international production networks, e.g., the United States within NAFTA or high-income EU countries with Southern and Eastern Europe. However, exports of automobile parts from low-income countries in Asia, Latin America and Eastern Europe are still relatively small compared to the total imports of high-income countries. Some high-income countries (e.g., Japan and Germany) have been large net exporters of parts during the last two decades. Again, this shows that international production networks are relevant since these exports are servicing large-scale assembling activities of subsidiaries in third countries.

These general findings are corroborated in case studies on four major producers (the United States, Japan, Germany and the UK). Considerable differences were found with respect to the export orientation and import market penetration of the automobile industry in these countries, and in changes of the regional structure of imports of automobile parts. The main conclusion is that international production networks matter but mainly on a regional level.

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Appendix: Statistical tables

Table 1 — Classification of motor vehicles and parts thereof before 1995

ISIC (Rev. 2)	Product description	NACE 1970	SITC (Rev. 1)	SITC (Rev. 2)
3843	Passenger motor cars	ex351	732.1	781
	Buses	ex351	ex732.2	ex783.1
	Lorries and trucks	ex351	732.3	782.1
	Road tractors	ex351	732.5	783.2
	Combustion engines	ex351	**ex711.5**	**ex713.2**
	Chassis with engines	ex351	732.6, 732.7	784.1
	Chassis, frames and other parts (excl. of plastic, windscreens)	ex351, ex352, ex353	732.8 (excl. ex732.89)	784.2, ex784.9
	Pumps and filters[a], crankshafts etc.	ex353	**ex719.2, ex719.64, ex719.93**	**ex742, ex743.6, ex745.27, ex749.3**
	Motorized invalid carriages[b]	**ex365**	ex733.4	ex785.3
	Non-industrial trailers	ex352	ex733.3	786.11, ex786.8
ex3829	Industrial trailers[c], transport containers[c]	**ex315.2**, ex352	ex733.3, 731.63	786.12, 786.13, ex786.8
ex382x/383x	Special purpose vans	ex351	732.4	782.2
ex3551	Rubber tires & tubes	**ex481.1**	**ex629.1**	**ex625**
ex3560	Plastic parts	ex353	ex732.89	ex784.9
ex3620	Windscreens and framed windows	**ex247**, ex353	ex732.89	ex784.9
ex3811/3812	Locks, metal chairs	**ex316**	**ex698.1, ex821.01**	**ex699.1, ex821.1**
ex3831/3839	Batteries, electric lamps, other electrical equipment	**ex343.1, ex343.2, ex347.1**	**ex729.1, ex729.2, 729.4**	**ex778.1, ex778.2, 778.3**
ex3851	Measuring and control equipment	**ex344, ex371**	**ex729.52, ex861.8, ex861.97**	**ex873.2, ex874.3, ex874.8**
ex3853	Clocks	**ex374**	**ex864.2**	**ex885.2**
9513	Repair of motor veh.	**ex671**	n. a.	n. a.

[a]In ISIC (Rev. 3) and NACE (Rev. 1) included in 'non-electrical machinery'. — [b]In ISIC (Rev. 3) and NACE (Rev. 1) included in 'other transport equipment'. — [c]In ISIC (Rev. 3) and NACE (Rev. 1) included in 'motor vehicles'. — Codes in bold types refer to items that are not classified in manufacturing of motor vehicles in the respective classification system.

Table 2 — Classification of motor vehicles and parts thereof since 1995

ISIC (Rev.3)	Product description	NACE Rev.	SITC (Rev. 3)	CN 1991
3410	Passenger motor cars	3410	781.2	8703 (excl. 8703.1)
	Other passenger motor vehicles		781.1	8703.1
	Public-transport passenger motor vehicles		783.1	8702
	Motor vehicles for the transport of goods		782.1	8704
	Special purpose motor vehicles		782.2	8705
	Road tractors for semi-trailers		783.2	8701.2
	Chassis fitted with engines for motor v.		784.1	8706
	Engines for motor vehicles; parts		**713.2, ex713.9**	**8407.3, 8408.20, ex8409.9**
3420	Bodies (incl. cabs) for motor vehicles	3420	784.2	8707
	Trailers of the caravan type		786.1	8716.1
	Trailers for the transport of goods		786.22	8716.3
	Parts of trailers		ex786.89	ex8716.9
	Transport containers		786.3	**8609**
3430	Parts and accessories of motor vehicles	3430	784.3	8708
ex2912	Pumps and filters for motor vehicles; parts	**ex2912**	**742.2, ex742.91, 743.63, 743.64, ex743.95**	**8413.30, ex8413.91, 8421.23, 8421.31, ex8421.99**
ex2921	Agricultural tractors and trailers	**2931, 2932**	**ex722.41**, 786.21	ex8701.1, 8716.2
ex3140	Batteries	**ex3140**	**ex778.1**	**ex8507**
ex3190	Electrical equipment for motor vehicles	**3161**	**778.3**	**8511, 8512**
5020	Maintenance and repair of motor vehicles	**5020**	n. a.	n. a.

Codes in bold types refer to items that are not classified in manufacturing of motor vehicles in the respective classification system.

Table 3 — Major exporters and importers of motor vehicles, 1980

	Exports (mill. US$)			Imports (mill. US$)		
	Passenger motor cars	Vans, motor lorries	Buses, road tractors	Passenger motor cars	Vans, motor lorries	Buses, road tractors
SITC Rev.2	781	782	783	781	782	783
World*	59,327	22,342	3,804	59,517	19,184	3,980
Japan	16,115	6,434	566	452	29	2
Germany	14,582	3,856	1,077	4,832	551	68
France	6,748	1,530	221	3,244	989	500
Belgium	4,600	734	150	2,248	563	97
USA	4,245	2,142	475	18,017	2,093	242
Canada	3,966	2,343	108	3,827	1,063	7
Italy	2,448	825	268	4,957	1,068	136
UK	1,949	1,297	91	4,903	626	240
Spain	1,496	211	45	362	75	17
Sweden	1,197	1,176	50	748	215	60
Netherlands	383	383	357	1,738	480	109
Brazil	327	356	103	n. a.	n. a.	n. a.
Austria	159	251	37	1,276	324	82
Ireland	122	12	4	470	107	24
Yugoslavia	118	29	40	167	106	29
Mexico**	91	24	2	n. a.	77	404
Singapore	89	35	2	209	144	12
Denmark	75	34	6	260	189	35
Australia	72	28	0	529	502	45
Korea Rep.	50	42	6	n. a.	29	n. a.
Argentina	37	17	6	239	235	n. a.
Portugal	13	98	1	190	285	36

*Only market economies. — **1979.

Source: UN, International Trade Statistics Yearbook 1982; OECD, ITCS.

Table 4 — Major exporters and importers of motor vehicles, 1995

	Exports (mill. US$)			Imports (mill. US$)		
	Passenger motor cars	Vans, motor lorries	Buses, road tractors	Passenger motor cars	Vans, motor lorries	Buses, road tractors
SITC Rev.2	781	782	783	781	782	783
World	232,767	46,400	16,468	232,007	47,052	15,763
Germany	48,602	6,111	4,172	23,255	3,417	1,592
Japan	41,674	9,616	1,162	9,993	195	18
Canada	26,000	6,952	2,133	9,795	3,101	1,100
Belgium	18,023	1,659	1,299	7,631	891	628
USA	16,799	5,318	1,431	66,127	10,193	2,239
France	15,212	2,434	2,240	14,590	3,033	2,443
Spain	15,098	1,365	534	6,106	909	316
UK	11,008	1,290	152	15,581	2,247	413
Italy	8,017	2,646	127	13,299	1,457	666
Mexico	7,522	1,850	10	439	123	16
Korea Rep.	7,242	797	364	263	220	3
Sweden	4,261	220	400	1,838	372	52
Netherlands	2,625	1,124	1,382	6,694	1,242	409
Austria	1,669	683	153	4,288	705	321
Portugal	1,134	489	36	2,064	520	69
Czech Rep.	708	154	54	627	205	96
Slovenia	699	n. a.	22	611	n. a.	n. a.
Poland	659	182	9	466	113	64
Russian F.	608	242	35	n. a.	370	300
Brazil	455	519	148	3,143	736	142
Australia	390	82	17	3,208	1,384	155
Turkey	251	42	143	3,277	178	192
Argentina	239	427	9	773	311	35
Hungary	186	20	115	418	219	42
Taiwan	30	23	2	2,340	192	93

Source: UN, International Trade Statistics Yearbook 1997; OECD, ITCS.

Table 5 — Major exporters and importers of parts for motor vehicles, 1980

	Exports (mill. US$)			Imports (mill. US$)		
	Parts and accessories for motor vehicles	therein: Chassis fitted with engines	Trailers and transport containers	Parts and accessories for motor vehicles	therein: Chassis fitted with engines	Trailers and transport containers
SITC Rev.2	784	784.1	786	784	784.1	786
World*	32,934	1,420	3,603	33,556	2,913	2,423
USA	7,597	436	245	5,510	1,583	33
Germany	6,643	270	838	2,071	21	218
France	3,720	13	473	1,903	20	325
UK	3,599	210	245	1,490	19	88
Canada	2,715	0	20	5,343	55	90
Japan	2,168	153	500	101	0	7
Italy	1,942	44	186	1,011	36	94
Sweden	1,063	166	120	779	5	78
Belgium	838	12	163	3,356	48	148
Spain	418	2	53	494	7	12
Netherlands	345	23	121	946	9	273
Brazil	252	32	27	188	n. a.	n. a.
Yugoslavia	220	0	60	249	1	10
Mexico	244	4	2	1,500	5	19
Austria	141	2	59	342	2	65
Switzerland	109	1	25	263	n. a.	93
Denmark	108	3	53	198	49	54
Singapore	83	0	8	183	3	11
Australia	82	0	8	461	n. a.	20
India	72	23	1	55	n. a.	n. a.
Argentina	63	15	4	218	n. a.	8
Korea Rep.	20	0	226	123	2	n. a.
Ireland	21	0	16	29	4	27
Thailand	10	0	n. a.	232	172	n. a.

*Only market economies.

Source: UN, International Trade Statistics Yearbook 1982; OECD, ITCS.

Table 5 (continued) — Major exporters and importers of parts for motor vehicles, 1980

	Exports (mill. US$)			Imports (mill. US$)		
	Engines for motor vehicles	Parts of engines for transp. eq.	Electrical equipment for vehicles	Engines for motor vehicles	Parts of engines for transp. eq.	Electrical equipment for vehicles
SITC Rev.2	713.2	713.9	778.3	713.2	713.9	778.3
World*	3,523	6,690	2,791	4,744	5,307	3,020
USA	871	1,619	344	807	861	272
Germany	888	1,221	666	402	259	278
France	408	617	481	309	432	282
UK	503	807	153	149	330	158
Canada	n. a.	408	27	1,041	501	228
Japan	304	877	515	40	31	30
Italy	194	376	197	343	190	209
Brazil	n. a.	*349*[a]	47	n. a.	*165*[a]	27
Spain	95	95	91	108	86	86
Sweden	134	134	21	69	220	124
Belgium	9	53	113	540	138	114
Netherlands	26	112	13	106	146	93
Austria	40	44	16	57	34	60
Yugoslavia	n. a.	*81*[a]	19	n. a.	*168*[a]	36
Mexico**	n. a.	*72*[a]	4	n. a.	*190*[a]	42
Singapore	5	66	18	13	134	46
India	31	30	5	4	34	5
Korea Rep.	0	9	2	61	75	10
Ireland	1	13	1	11	15	8
Thailand	0	1	0	41	98	27

*Only market economies. — **1979. — [a]Total section 713 (‘internal combustion engines and parts’).

Source: UN, International Trade Statistics Yearbook 1982.

Table 6 — Major exporters and importers of parts for motor vehicles, 1995

	Exports (mill. US$)			Imports (mill. US$)		
	Parts and accessories for motor vehicles	therein: Chassis fitted with engines	Trailers and transport containers	Parts and accessories for motor vehicles	therein: Chassis fitted with engines	Trailers and transport containers
SITC Rev.2	784	784.1	786	784	784.1	786
World	122,397	n. a.	9,865	117,506	n. a.	6,799
USA	23,817	249	899	21,156	230	585
Germany	21,932	440	1,776	12,926	143	731
Japan	19,656	657	160	1,455	11	171
France	10,324	64	613	5,731	22	491
Canada	7,683	4	127	14,714	201	574
Italy	6,053	85	368	2,492	41	139
UK	5,240	192	517	9,272	76	291
Spain	4,186	17	89	6,063	129	141
Sweden	3,688	349	70	2,507	1	142
Belgium	3,075	18	344	6,230	48	353
Mexico	2,499	216	237	3,104	56	98
Netherlands	1,575	32	336	2,593	17	472
Brazil	1,471	n. a.	31	1,486	n. a.	n. a.
Austria	1,355	2	213	1,693	45	276
Taiwan	1,334	0	386	1,542	26	24
Korea Rep.	667	22	874	1,304	0	49
Argentina	546	n. a.	n. a.	1,169	n. a.	27
Denmark	500	1	158	547	21	272
Singapore	393	n. a.	40	972	n. a.	69
China PR	378	2	1,287	897	42	28
Czech Rep.	363	99	67	316	44	67
Portugal	354	0	5	1,026	25	54
Australia	302	2	27	1,168	45	55
Hungary	250	2	104	160	3	49
Russian F.	197	n. a.	26	287	n. a.	64
Turkey	182	2	91	768	17	26
Slovenia	145	n. a.	50	356	n. a.	29
Poland	124	55	117	753	144	79

Source: UN, International Trade Statistics Yearbook 1997; OECD, ITCS.

Table 6 (continued) — Major exporters and importers of parts for motor vehicles, 1995

	Exports (mill. US$)			Imports (mill. US$)		
	Engines for motor vehicles	Parts of engines for transp. eq.	Electrical equipment for vehicles	Engines for motor vehicles	Parts of engines for transp. eq.	Electrical equipment for vehicles
SITC Rev.2	713.2	713.9	778.3	713.2	713.9	778.3
World	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
Japan	5,993	4,577	2,615	83	322	189
USA	3,714	3,381	1,453	6,335	3,338	2,020
Germany	2,545	3,581	2,354	2,721	1,243	1,010
Mexico	2,122	462	286	381	666	357
France	2,103	1,283	1,113	1,093	1,123	783
UK	1,752	1,022	477	870	1,323	694
Canada	1,002	707	177	3,732	1,317	1,112
Italy	905	880	634	412	669	507
Spain	887	301	563	2,438	516	645
Sweden	847	336	140	65	654	336
Brazil	n. a.	*923*[a]	n. a.	n. a.	*699*[a]	n. a.
Belgium	12	343	442	1,511	334	330
Netherlands	131	362	109	198	496	240
Austria	239	138	22	108	314	153
Singapore	n. a.	*410*[a]	n. a.	n. a.	*852*[a]	n. a.
Portugal	258	68	30	223	267	98
Australia	239	138	22	108	314	153
Taiwan	150	69	134	174	216	160
Korea Rep.	34	98	70	330	598	100
Russian F.	n. a.	*210*[a]	n. a.	n. a.	*182*[a]	n. a.
China PR	37	91	58	139	360	65
Turkey	1	110	23	190	111	75
Czech Rep.	22	55	38	8	37	25
Hungary	7	13	79	36	23	42
Poland	5	75	16	236	59	61

[a]Total section 713 (‘internal combustion engines and parts’).

Source: UN, International Trade Statistics Yearbook 1997; OECD, ITCS.