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**Kiel Working Paper No. 1093**

# Globalization of the Automobile Industry
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# Traditional Locations under Pressure?

**by**

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January 2002

# Globalization of the Automobile Industry – Traditional Locations under Pressure?*

**Abstract:** Even though the automobile industry is technologically advanced, the increasing integration of low-income countries into the global division of labor has put competitive pressure on traditional automobile producing countries. New end-producers emerged in Asia, Latin America as well as Southern and Central Europe. In addition, the automobile industries of Germany, Japan and the United States engaged in outsourcing of relatively labor intensive segments of the value chain, especially on a regional level. Our analysis of the labor market effects of these developments supports the predictions of trade models: Low-skilled workers and labor intensive subsectors of the automobile industry in traditional locations suffered deteriorating wage and employment prospects in the process of globalization. The adjustment to fiercer competition from below differed considerably between Germany, Japan and the United States. Economic restructuring was least pronounced in the US automobile industry, largely due to the resistance of trade unions. As a result, the employment record and the world-market performance of US automobile producers turned out to be poor compared to their German and Japanese counterparts.

**Key Words:** Competitive pressure, outsourcing, specialization profiles, revealed comparative advantages, relative wages, employment restructuring

**JEL classification:** F14, L62

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* This paper has been produced as part of the research project „Ursachen und Implikationen der Globalisierung am Beispiel der Automobilindustrie“. Funding by the Fritz Thyssen Foundation is gratefully acknowledged. We are indebted to Rolf J. Langhammer for many helpful comments and suggestions on an earlier draft of the paper. We would also like to thank Christiane Gebühr and Michaela Rank for excellent research assistance. The usual disclaimer applies.

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# I. Introduction

In contrast to industries producing labor intensive and standardized goods, the automobile industry in high-income countries should be among the winners of globalization. The production of automobiles is relatively human capital intensive and technologically advanced. Nonetheless, globalization is likely to have an impact on wages and employment in this industry, too. Trade models predict that the gains and costs of globalization are unevenly distributed among various employment groups and various subsectors of any industry, including automobile production. Especially low-skilled workers and labor intensive segments of the sectoral value chain should suffer deteriorating wage and employment prospects because of competitive pressure from low-income countries.

We study the automobile industries of three major traditional producer countries, namely Germany, Japan and the United States, in order to test this hypothesis. The analysis covers the period 1978–1998 and proceeds in three steps. In Section II, we discuss several aspects of globalization in the automobile industry. We focus on new competitors which emerged in countries with relatively low per-capita income. This is because trade models predict that increasing trade between countries at different levels of economic development should have relatively pronounced effects on the intrasectoral distribution of income and

employment. In addition to new producers and exporters of finished automobiles, we assess the degree of outsourcing of relatively labor intensive segments of the value chain undertaken by the automobile industry in traditional producer countries.

Section III portrays trends in wages and employment in the automobile industry of Germany, Japan and the United States since the late 1970s. We stress that *inter*sectoral wage premia of the automobile industry, relative to total manufacturing, must not be confused with the *intra*sectoral distributional effects of globalization. The latter are captured by the development of the wage ratio for low-skilled (production) workers versus high-skilled (non-production) workers and the development of the sectoral human capital intensity (proxied by the number of non-production workers per production worker). We then correlate the intrasectoral wage and employment trends with variables reflecting the intensity of international competition. The predictions of trade models are largely supported for Germany and Japan, but rejected for the United States.

Against this background, Section IV inquires more deeply into globalization-induced restructuring processes in the three traditional producer countries. We calculate a measure of revealed comparative advantage, which suggests that the US automobile industry was badly prepared to cope with competitive pressure from below. Next we run simple OLS regressions to evaluate the stability of

production patterns in the automobile industry and its degree of specialization. We find that trade unions resisted economic restructuring in the US automobile industry. In Section V, we conclude that the employment record and the world-market performance of the automobile industry in traditional producer countries critically depends on the intensity and timeliness of economic adjustment to fiercer competition from below.

## II. Competition from Below: Stylized Facts

The question to which extent automobile production has become globalized may be assessed by referring to UNCTAD's transnationality index. This index is calculated as the average of three ratios, namely the share of a company's foreign assets to total assets, its overseas sales to total sales, and its employment abroad to total employment (UNCTAD 1999). It may come as a surprise that, according to the transnationality index, the automobile industry of traditional producer countries is less internationalized than various other industries, including food production, chemicals and electronics (ibid.: 83).

Nevertheless, the automobile industry is typically considered to be at the forefront of globalization. Evidence supporting this view includes:

- the intricate network of alliances and cross-shareholdings among automobile companies, within nations and regions but also between regions (Vickery 1996);

- intensified M&A (mergers and acquisitions) activities in the 1990s, involving both end-producers and automotive input suppliers (PricewaterhouseCoopers 2000; World Trade Agenda 2000);

- the trend towards technologically motivated cooperation agreements, which was caused, inter alia, by end-producers entering into new forms of partnerships for the design of principal components and subsystems (UNCTAD 1998: 25 f.);

- and the significant role of intra-firm trade, e.g. of US-based automobile multinationals (UNCTAD 1999: 443).

All these indicators do not reveal, however, whether new competitors from countries with relatively low per-capita income have become integrated into the international division of labor in the automobile industry. This element of globalization is of utmost importance for analyzing the labor market implications of globalization in traditional producer countries. Labor market effects should be relatively benign as long as international relations remain restricted to intra-industry trade between countries that are similarly advanced economically and

characterized by comparable factor endowments. By contrast, competition from below, i.e., from considerably less advanced countries with an abundant endowment of less qualified labor is expected to cause significant adjustment pressure, especially on less qualified automobile workers in high-income countries.

At first sight, the automobile industry seems badly suited to study the consequences of fiercer competition from below. The industry as a whole is technologically advanced and relatively human capital intensive (Heitger et al. 1999; Vickery 1996).[1] As a consequence, automobile production continues to be dominated by high-income countries, accounting for about 70 percent of world production. However, subsectors of the automobile industry differ considerably in terms of factor intensities. In Germany, for instance, the ratio of workers to sales was 2.5 times as high in the production of autoparts as in the production of automobiles and engines (VDA b, var. issues). Hence, outsourcing, the fragmentation of value chains and the integration of low-income countries into the international division of labor are reasonable options in this industry, too. Put differently, relatively labor intensive segments of this industry and less qualified workers are likely to be negatively affected by the emergence of new

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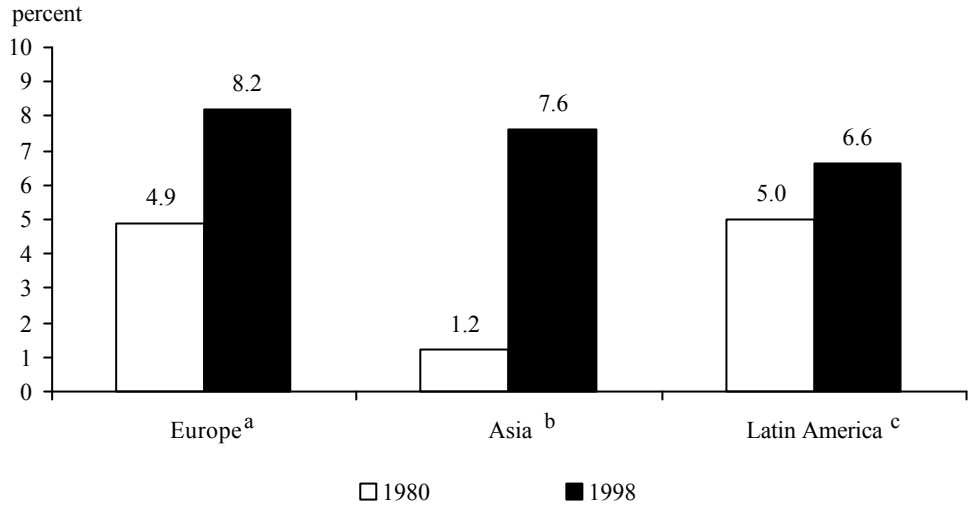
1 For instance, R&D expenditure amounted to 12 percent of value added in the German automobile industry in the mid-1990s, twice as much as in total manufacturing (Weiß 2000).

competitors, even though the automobile industry of high-income countries as a whole should be among the winners of globalization.

New competitors comprise end-producers and input suppliers from countries with relatively low per-capita income; in addition to developing and newly industrializing countries, Eastern and Central European transition countries and the so-called EU-periphery (Greece, Ireland, Portugal and Spain) belong to this income category. Considering the most important producers of automobiles among low-income countries, Figure 1 reveals rising market shares especially for end-producers located in Asia and in Southern and Central Europe. As a corollary, the share of high-income industrial countries declined by almost 10 percentage points since 1980.

This shift in worldwide production of automobiles towards low-income countries only partly reflects increased competitive pressure from below. New suppliers such as China expanded the production of automobiles for serving protected local markets, while lacking international competitiveness. However, several new suppliers, including Mexico, South Korea and Spain were quite successful in penetrating world automobile markets. In the second half of the 1990s, the countries listed in Figure 2 accounted for almost a quarter of world exports of automobiles, thereby nearly doubling their export share within a decade.

Figure 1 — New Competitors: Share in World Production of Automobiles, 1980 and 1998



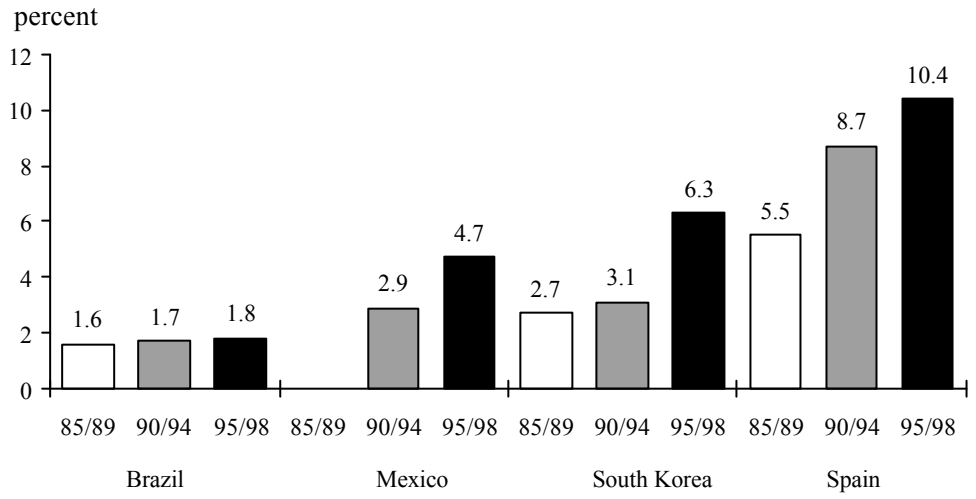

[a]Czech Rep., Hungary, Poland, Spain. – [b]PR China (1983 instead of 1980), India, South Korea. – [c]Argentina, Brazil, Mexico.

Source: VDA (a, var. issues).

Taking recent developments into account, Figure 2 tends to understate the competitive pressure from new automobile production locations. Automobile production in Brazil was traditionally restricted to serving local (or at best regional) markets, but its world-market orientation is likely to become stronger. Investment projects initiated since the mid-1990s indicate that automobile multinationals are changing strategy as a response to liberalized import policies in Brazil (Inter-American Development Bank and Institute for European-Latin American Relations 1996: 41; The Economist 2000: 66). Furthermore, while comparable data are lacking for exports from Central European locations, some

suppliers in this region have clearly emerged as internationally competitive exporters recently. Notably in the Czech Republic, automobile production has become integrated into the value chains of automobile multinationals, as before in Mexico and Spain (Richet and Bourassa 2000).

Figure 2 — Major New Competitors: Share in World Exports of Automobiles, 1985–1998[a]




[a]Period averages; missing values for Mexico: 1985–1991 and 1993; South Korea: 1985. World exports approximated by the sum of exports of relevant exporters as given in VDA.

Source: VDA (b, var. issues); American Automobile Manufacturers Association (1998; for Brazil 1985–1992); Auto & Truck International (var. issues; for Mexico).

The emergence of new producers and exporters of automobiles was frequently due to foreign direct investment (FDI) in low-income countries by multinational companies. For example, low-income countries taken together hosted almost half of total FDI stocks held by the German automobile industry prior to the

DaimlerChrysler merger in 1998 (Table 1). In the early 1980s, Latin America represented the by far most important host region for German automobile companies. In the process of forming the European Single Market, Spain attracted substantial FDI by the German automobile industry. More recently, this industry grasped new investment opportunities in Central and Eastern Europe. In the late 1990s, FDI stocks held in this region were of a similar magnitude as FDI stocks held in the EU-periphery.

Table 1 — Regional Distribution of FDI Stocks of the German Automobile Industry, 1981–1998

| | 1981 | 1985 | 1990 | 1994 | 1997 | 1998 |
|---|---|---|---|---|---|---|
| EU | 25.8[a] | 27.4[a] | 47.5 | 45.7 | 40.6 | 21.9 |
| thereof: | | | | | | |
| – EU-periphery[b] | 10.8 | 7.6 | 24.4 | 14.5 | 11.3 | 7.7 |
| other industrial countries | 21.4[c] | 37.5[c] | 20.0 | 14.9 | 21.2 | 52.7 |
| developing and transition countries | | | | | | |
| – total | 52.8 | 35.0 | 32.5 | 39.4 | 38.2 | 25.5 |
| – Africa | 10.6[d] | 3.6[d] | 5.8 | 3.7 | 2.1 | 1.3 |
| – America | 40.4 | 28.8 | 23.3 | 26.3 | 20.3 | 12.7 |
| – Asia[e] | n.a. | n.a. | 1.0 | 1.1 | 0.7 | 0.4 |
| – transition countries[f] | n.a. | n.a. | 2.5 | 8.4 | 15.1 | 11.1 |
| | | | | | (4.5)[g] | (2.9)[g] |

[a] Excluding Sweden. – [b] Ireland, Portugal and Spain; 1981–1990: only Spain; 1994 and 1997: Portugal and Spain. – [c] Including Sweden. – [d] Rep. of South Africa and Nigeria. – [e] Excluding China. – [f] Including China. – [g] China in brackets.

Source: Deutsche Bundesbank (var. issues).

The crucial role of FDI notwithstanding, the automobile industry of new competitors developed under strikingly different conditions. In China, which opened up to FDI in the process of market-related reforms starting in the late

1970s, automobile production continues to be dominated by national companies (VDAa 1999: 68 pp.). Korea set up an indigenous automobile industry (Daewoo/Ssangyong and Hyundai/Kia) which successfully penetrated world markets. In contrast to Mexico and Spain, Korea's exports of automobiles were not focused on neighboring high-income countries, but regionally diversified.[2] As a consequence, traditional producers were affected by competitive pressure from Korea both in their home markets and in third markets, including in the developing world.

On the other hand, the development of an indigenous automobile industry rendered it more difficult for Korea to become integrated into global sourcing networks of automobile multinationals. Apart from assembling automobiles, locations such as Mexico, Spain and Central European countries increasingly supplied traditional producer countries with automotive parts and components. In other words, competition from below goes beyond world-market oriented assembly operations in low-income countries and extends to imports of automotive inputs.

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2 In 1998, Europe absorbed 48 percent of Korean exports of automobiles, 31 percent went to America (two thirds of which were exported to the United States and Canada), and about one fifth were destined to Africa, Asia, Australia and Oceania (VDAa).

Figure 3 shows that low-income countries have become relevant suppliers of automotive inputs for the automobile industries of Germany, Japan and the United States. According to detailed country studies, trade in automotive inputs with low-income countries expanded particularly on the regional level (Diehl 2001):

- In the case of the US automobile industry, a rising share of imports of engines, electrical equipment and other parts and accessories originated from Mexico.

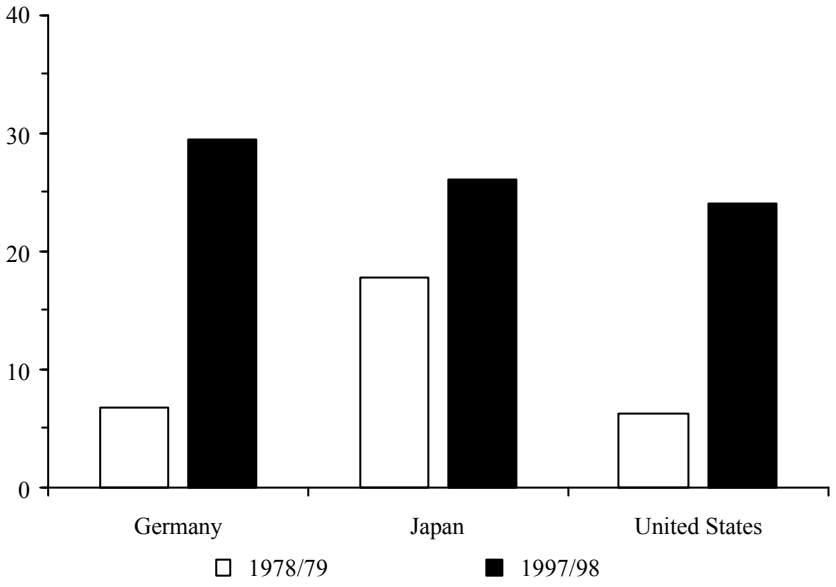
- For the Japanese automobile industry, other Asian countries represented the most important (low-income) suppliers of automotive inputs.

- Apart from high-income European neighbors, the EU-periphery was the most important supplier of electrical equipment to the German automobile industry. Since the mid-1990s, this industry imported a steeply rising share of engines from Central European countries.

Measured by the share of imports from major low-income trading partners in total imports of automotive inputs, competitive pressure from below appears to be similarly advanced in all three traditional producer countries (Figure 3). However, imports from all sources contributed significantly less to domestic

absorption of the automobile industry in Japan than in Germany and the United States (Diehl 2001).

Figure 3 — Imported Inputs of the Automobile Industry in Traditional Producer Countries from Low-income Countries[a], 1978/79 and 1997/98[b] (percent)




[a]Share in total imported inputs; inputs considered here comprise parts and accessories (SITC 784), electrical equipment (SITC 778.3) and motors (SITC 713.2). Low-income trading partners of Germany include the EU-periphery, Turkey, and Central and Eastern Europe; low-income trading partners of Japan and the United States include Asia and Latin America. – [b]Annual averages.

Source: OECD (2000).

All in all, the evidence suggests that traditional automobile producing countries have been subjected to increasing competitive pressure from new locations in low-income countries. Countries such as Mexico, Spain and the Czech Republic emerged as competitive suppliers of both finished automobiles and automotive parts. Other countries, notably Korea, focused on penetrating world markets for finished automobiles. All three traditional producer countries considered here

were affected, even though imports of automotive inputs remained less important for Japan than for Germany and the United States. Hence, the stylized facts let us expect adverse labor market implications of fiercer competition from below for low-skilled workers in all traditional automobile producing countries.

## III. Labor-Market Effects in Traditional Production Locations

### 1. Theoretical Models on Distributional Effects of Globalization

The links between the globalization of the world economy and changes in relative factor prices have long been discussed in the theoretical literature. With regard to the *intra*sectoral dimension of income inequality, i.e., wage differentials between workers of different skill levels in the same sector, there are two basic models. In the Heckscher-Ohlin model, the liberalization of international trade in final goods causes a restructuring towards the relatively human capital intensive sectors in high-income countries. High-skilled workers gain relative to low-skilled workers, both in wages and employment (Stolper, Samuelson 1941). This is because more high-skilled workers per low-skilled worker are required for the expansion of human capital intensive sectors than are released in the contraction of labor intensive sectors. In the Feenstra-Hanson model, the liberalization of foreign direct investment and international trade in intermediate goods enables high-income countries to outsource relatively labor intensive segments of the value

chain to low-income countries (Feenstra, Hanson 2001). Hence, like in the Heckscher-Ohlin model, the labor market situation of low-skilled workers in high-income countries is expected to deteriorate.

With regard to the *inter*sectoral dimension of income inequality, i.e., wage differentials between workers of the same skill level in different sectors, there are also two basic models to explain globalization-induced distributional effects. In *rent-sharing* models[3], firms and unions bargain over sector-specific rents. The greater these rents and the greater the union bargaining power, the higher the sectoral wage level. Opening up to international trade erodes the market power of incumbent firms and, hence, the sector-specific rents in once protected sectors. Furthermore, the exit-option of capital and know-how in liberalized factor markets curtails the bargaining power of unions. Therefore, the rent-sharing models predict a decline in the sectoral wage levels in the course of globalization in those sectors where import penetration rises and where firms can easily move production to low-income countries.

In *efficiency-wage* models, firms do not regard wages as exogenous but use them as a motivation instrument to increase labor productivity. Workers receive a sectoral mark-up on their reservation wage. The size of this mark-up is positively related to the strength of the relationship between wages and labor productivity,

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3 For a comprehensive survey of rent-sharing models see Oswald (1985).

which in turn depends on the capital and technology intensity (according to the *shirking* and the *labor-turnover* approach)[4] and on the average profitability of the firms in the sector (according to the *gift-exchange* approach). The higher these variables, the stronger the wage-productivity relationship. Hence, the efficiency-wage models suggest that high wages can be paid only in those sectors which can maintain their international competitiveness by specializing in human capital intensive segments of the value chain.

## 2. Intersectoral Distributional Effects

The analysis of the intersectoral dimension of globalization-induced distributional effects proceeds in two steps. First, we trace the development of wages and employment in the German, Japanese and US automobile industry relative to the total manufacturing sector of the respective country. Second, we perform the same analysis for important subsectors of the automobile industry.

The automobile industry is characterized by a higher-than-average capital and technology intensity. Furthermore, the development and manufacturing of automobiles requires increasing R&D and involves significant fixed costs (Vickery 1996). Hence, it is not surprising that the average earnings of automobile

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4 The different approaches to explain the positive wage-productivity relationship are presented in Akerlof and Yellen (1986).

workers are significantly higher than those of workers in total manufacturing (Table 2).

Table 2 — Wage and Employment Trends in the German, Japanese and US Automobile Industry

| | Germany | Japan[a] | United States |
|---|---|---|---|
| Average earnings (total manufacturing = 100) | | | |
| 1978–1982[b] | 117 | 124 | 135 |
| 1995–1999[b] | 121 | 129 | 133[c] |
| Employment (percentage share of total manufacturing) | | | |
| 1978–1982[b] | 9.2 | 2.6 | 4.0 |
| 1995–1999[b] | 11.3 | 2.5 | 4.6[c] |

[a] Transport equipment. – [b] Unweighted average. – [c] 1994–1996.

Source: Bartelsman and Gray (1996), Ministry of Finance (var. issues), Statistisches Bundesamt (var. issues).

In Germany and Japan, the intersectoral wage differential increased over the last 20 years, while it slightly decreased (albeit from a very high level) in the United States. According to efficiency-wage models, this development may reflect that the German and Japanese automobile industries were more successful in adapting to globalization by outsourcing labor intensive segments of the value chain to low-income countries.[5] At the same time, the employment share of the automobile industry in total manufacturing increased in Germany and the United

5 As shown below, the high wage premium in the United States does not mean that this country was best prepared to deal with fiercer competition from below.

States but remained fairly stable in Japan. In the case of the United States, the ostensibly favourable employment trend is, however, mainly due to a seriously depressed starting point. The US automobile industry was hit especially hard by the recession of the late 1970s and early 1980s, during which it shed 27 percent of its production workers and 18 percent of its non-production workers.

The overall favorable wage and employment situation in the automobile industries of Germany, Japan and the United States does not rule out that some of their subsectors lost out in the course of globalization. Both Heckscher-Ohlin and Feenstra-Hanson models suggest that labor intensive subsectors should be especially vulnerable to competitive pressure from low-income countries. This hypothesis is corroborated by the development of the wage ratio between the relative human capital intensive automobile assembly and the relatively labor intensive production of automotive parts and components (Table 3).[6]

Table 3 — Wage Ratio between the Automobile Assembly[a] and the Production of Automotive Parts and Components

| | Germany | Japan | United States |
|---|---|---|---|
| 1990 | 1.18 | 1.14 | 1.28 |
| 1995 | 1.16 | 1.15 | 1.42 |
| 2001 | 1.18[b] | 1.23 | n.a. |

6 In the United States, the production of automotive parts and components requires 3.7 times as many workers per revenue unit than the automobile assembly. In Germany, the ratio is 2.5.

[a] Germany: automobiles and motors; Japan: automobiles; US: cars and car bodies. – [b] 1999.

Source: Bartelsman und Gray (1996), Confederation of Japan Automobile Workers' Unions (JAW) (unpublished data), Statistisches Bundesamt (var. issues).

As expected, this wage ratio increased significantly over the last 10 years in Japan and the United States. In the German automobile industry, by contrast, workers in labor intensive subsectors did not incur income losses relative to their peers in human capital intensive subsectors. The different experience of Germany is striking as all three countries were hit by competitive pressure from low-income countries.[7] The fairly stable wage ratio may be explained in two alternative ways: Either the intersectoral wage structure[8] in Germany is less flexible, or German producers of automotive parts and components adapted more successfully to globalization. This issue is taken up again in Section IV.

## 3. Intrasectoral Distributional Effects

In order to assess the impact of globalization on the intrasectoral dimension of income distribution, we compare recent wage and employment trends of low-skilled and high-skilled automobile workers in Germany, Japan and the United

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7 See Section II.

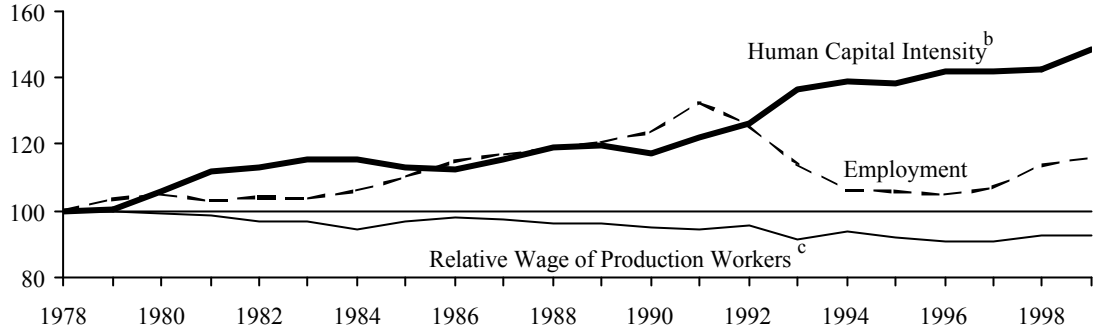
8 As mentioned before, the term *intersectoral* is also used when comparing different subsectors within the automobile industry.

States. Using correlation techniques, we subsequently link the changes in the human capital intensity and the relative wage of low-skilled workers to the changes in import penetration in various subsectors of the automobile industry. Since data on schooling, professional training and work experience are not available at this level of sectoral disaggregation, we use the dichotomy of production versus non-production workers as a rough proxy for the qualification level. As usual in the relevant literature, we assume that non-production workers are more highly qualified than production workers.

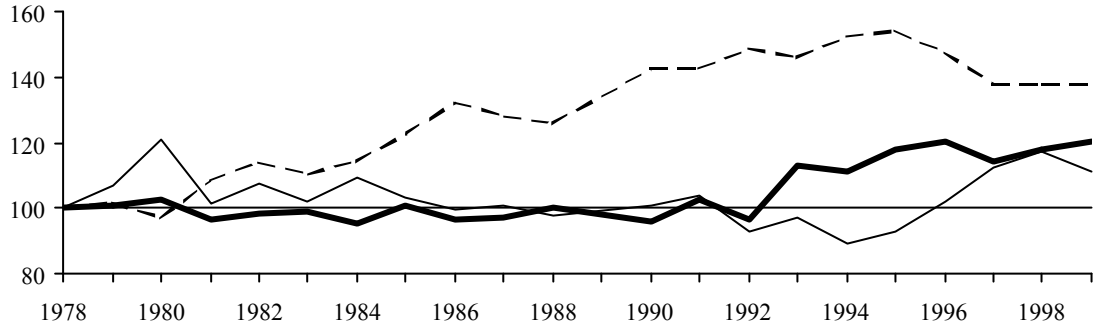
In the German automobile industry, employment increased steadily from 1978 to 1991 (Figure 4). The post-unification recession was a severe blow to this industry, however, almost entirely wiping out the employment gains achieved since 1978. In 1994, the sector stabilized and subsequently returned to its pre-unification employment growth path. Despite the positive overall employment trend, the labor market situation of low-skilled workers deteriorated. First, the sectoral human capital intensity increased strongly throughout the observation

Figure 4 — Wages and Employment in the German, Japanese and US Automobile Industry (1978 = 100)

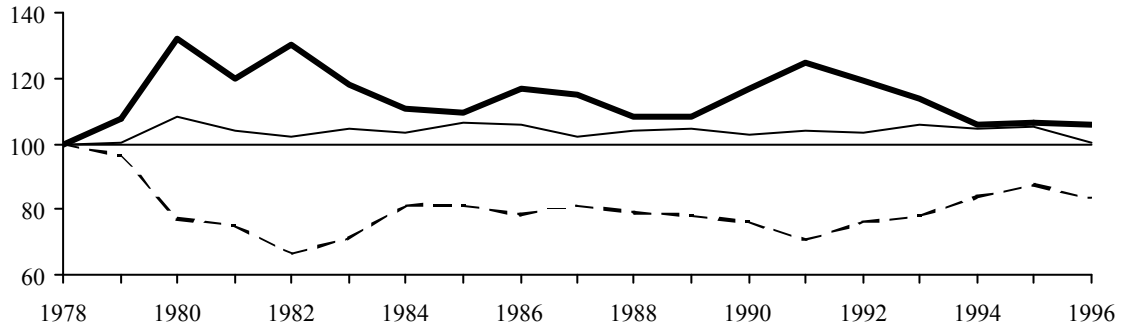
Germany[a]




Japan[d]




United States




[a]West Germany. – [b]Number of non-production workers divided by number of production workers. – [c]Ratio between the average wage of production workers and the average wage of non-production workers. – [d]Transport equipment.

Source: Bartelsman and Gray (1996); Ministry of Finance (var. issues); Statistisches Bundesamt (var. issues).

period; essentially all employment gains accrued to high-skilled workers.[9] Second, the relative wage of low-skilled workers fell steadily, i.e., the wages of low-skilled automobile workers developed less favorably than those of their high-skilled peers.

The Japanese automobile industry experienced strong employment growth with an average annual growth rate of 2.7 percent until 1995. In the two consecutive years, employment declined sharply but stabilized afterwards. In contrast to Germany, low-skilled automobile workers in Japan did not lose relative to their high-skilled peers until 1991. Neither did the human capital intensity increase nor did the relative wage of low-skilled workers exhibit a negative trend. Only later did employment prospects of low-skilled workers deteriorate noticeably as evidenced by a rising human capital intensity. All the more surprisingly, their income situation improved with relative wages of low-skilled workers rising steeply since 1994. It points to institutional rigidities in the wage-setting procedure that the Japanese labor-market response to increased competition

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9 While employment of high-skilled workers increased by 50.4 percent, the number of low-skilled jobs rose by merely 1.5 percent.

from low-income countries is only partly in line with the Stolper-Samuelson theorem (see below).[10]

The employment situation in the US automobile industry was dominated by the two recessions at the beginning of the 1980s and the 1990s. During the first recession, employment shrank dramatically and, despite employment growth in the mid 1980s and 1990s, employment has never since recovered its 1978 level. The peaks in human capital intensity during the two recessions show that low-skilled workers were more severely affected by layoffs than high-skilled workers. However, in contrast to Germany, low-skilled workers regained their initial employment share after the recessions. Consequently, there is no upward trend in human capital intensity.

The development of the relative wage of low-skilled workers in the US automobile industry is quite surprising. In contrast to total manufacturing, the relative wage did not fall but remained above its 1978 level throughout the entire observation period. The lack of adjustment according to the Stolper-Samuelson theorem together with the fall in sectoral employment cast considerable doubt on

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10 Another explanation would be that labor supply shifted towards higher qualifications. Data constraints prevent us from evaluating the relative importance of this possibility.

whether the much heralded US labor-market flexibility can be found in the automobile industry.[11]

Germany and the United States offer more disaggregated data, which can be used to analyze globalization-induced adjustment processes in important subsectors of the automobile industry.[12] In the German automobile industry, the most striking difference between the automobile assembly and the production of automotive parts and components concerns the development of human capital intensities (Figure 5). The human capital intensity increased steadily in automobile assembly over the last 20 years, while it remained basically unchanged in the 1980s and increased only afterwards in the production of automotive parts and components. The different timing of adjustment may be attributed to high transportation cost for automotive parts and components and their use in just-in-time production. Shipping these inputs from distant low-income locations seemed too costly and risky for German

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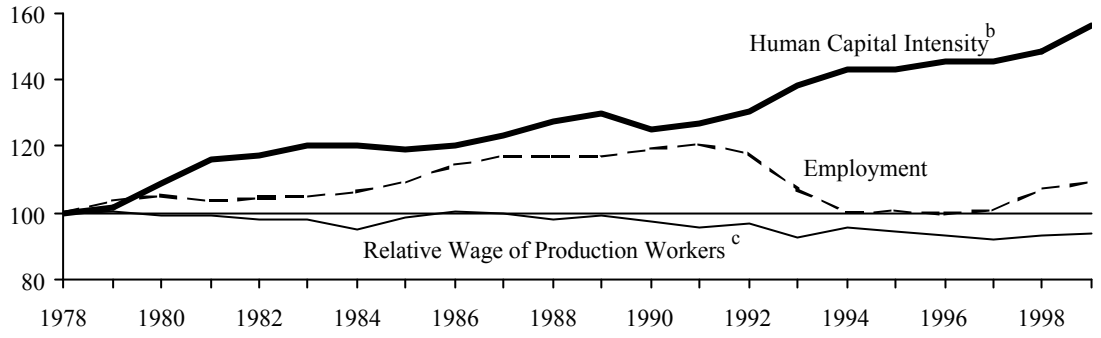
11 According to the Stolper-Samuelson theorem, relative price changes constitute the link between product and labor markets. Data on relative price developments are not available for the US (and Japan) automobile industry; for Germany, see Section IV.2.

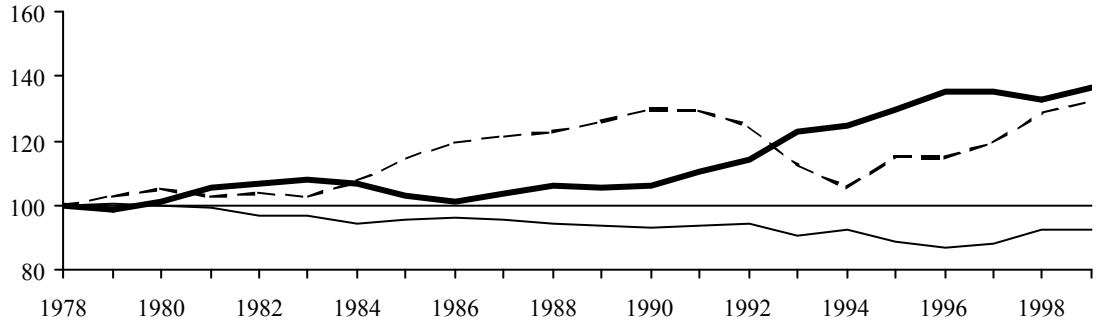
12 In order to keep our discussion within reasonable limits, we confine it to the relatively human capital intensive automobile assembly and the relatively labor intensive production of automotive parts and components.

Figure 5 — Wages and Employment in Two Subsectors of the German Automobile Industry (1978 = 100)

Automobile Assembly[a]




Production of Automotive Parts and Components




[a]Automobiles and motors. – [b]Number of non-production workers divided by number of production workers. – [c]Ratio between the average wage of production workers and the average wage of non-production workers.

Source: Statistisches Bundesamt (var. issues).

automobile manufacturers.[13] Only the opening-up of the geographically closer Central European transition countries in the 1990s triggered a comprehensive restructuring process in this subsector.

The comparison of employment trends in the two subsectors in the 1990s reveals that globalization-induced restructuring does not necessarily imply mass layoffs. Despite the sharp increase in the subsectoral human capital intensity (or perhaps because of it), German producers of automotive parts and components noticeably increased their workforce after the post-unification recession. As discussed further below, the critical question is whether firms are successful in maintaining their international competitiveness by specializing in human capital intensive segments of the value chain.

Employment in the two subsectors of the US automobile industry evolved virtually identically until 1984 (Figure 6). Subsequently, the two subsectors took different paths. In automobile assembly, a downward trending human capital intensity was accompanied by falling employment. The opposite holds true in the production of automotive parts and components. Lacking adjustment

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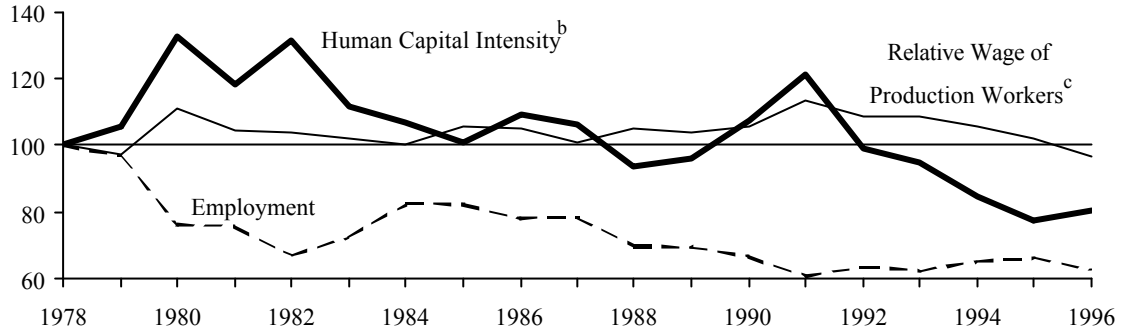
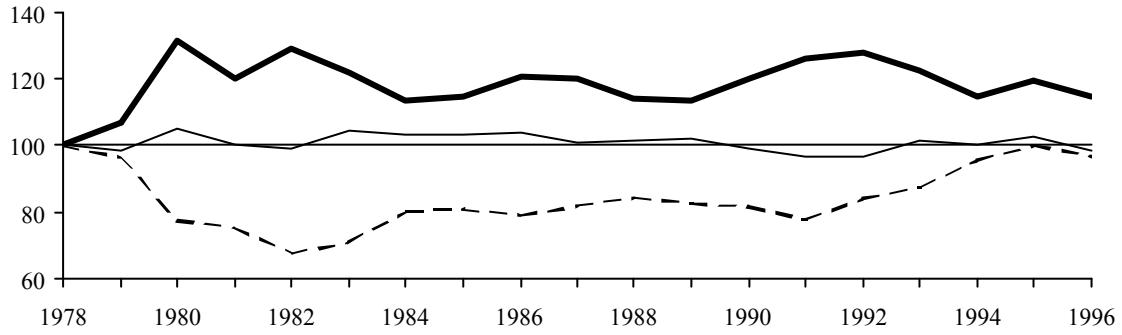
13 Nunnenkamp (1998: Table 5) has shown that imports of automotive parts by the German automobile industry from distant locations such as Brazil, Mexico, China and South Korea remained low compared to imports from closer trading partners such as Spain and the Czech Republic.

Figure 6 — Wages and Employment in Two Subsectors of the US Automobile Industry (1978 = 100)

Automobile Assembly[a]




Production of Automotive Parts and Components




[a]Cars and car bodies. – [b]Number of non-production workers divided by number of production workers. – [c]Ratio between the average wage of production workers and the average wage of non-production workers.

Source: Bartelsman and Gray (1996).

to increased international competition offers an explanation for the poor employment performance of the first subsector. Due to high unionization and militant labor disputes, no restructuring towards human capital intensive products took place and the relative wage of production workers was prevented from

declining.[14] All this eroded the international competitiveness of the US automobile manufacturers.

In order to assess more systematically the impact of international competition on the labor market situation of low-skilled automobile workers, we correlate the intrasectoral wage and employment ratios with some indicators reflecting the intensity of international competition. As a first indicator, we use the share of imports in overall production (MP).[15] However, the labor market outcome of increasing international trade should depend on the relative income level of the trading partners. Trade models predict that increasing trade between similarly advanced countries with similar relative factor endowments should have smaller intrasectoral distributional effects than increasing trade between countries with different relative factor endowments. Hence, we also run correlations with the share of imports from low-income countries in overall imports (MLC). According to the Stolper-Samuelson theorem, MP and MLC should be related positively with the human capital intensity (HN) and negatively with the relative wage of low-skilled workers (RW).

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14 For instance, the dispute between Caterpillar and the UAW on the introduction of more flexible labor contracts began in 1991 and was not resolved till march 1998 (The Economist 1998).

15 Subsectoral terms of trade were not available at this level of sectoral disaggregation; calculating unit values from the ITCS Database (OECD 2000) rendered meaningless results.

As concerns the German automobile industry, all correlation coefficients have the expected sign and are highly significant (Table 4).[16] Similarly strong results are achieved when running the correlations for the two above mentioned subsectors. These results imply that the entire sector adjusted to globalization by specializing in human capital intensive products and by outsourcing labor intensive segments of the value chain to low-income countries. Even though the trends in human capital intensities portrayed above suggested that adjustment in the production of automotive parts and components gathered momentum only in the 1990s, most correlation coefficients turn out to be stronger in this subsector. This indicates that the intensity of adjustment was particularly pronounced.

Japan resembles Germany with respect to the globalization-induced effects on the human capital intensity. Rising imports and a rising import share from low-income countries went along with deteriorating employment prospects of low-skilled workers. By contrast, the correlation coefficients between the proxies for international competition and the relative wage of low-skilled workers are not significant. This suggests that the intrasectoral wage effects were blurred by other factors. In the Japanese automobile industry, the increase in human capital intensity was achieved mainly by reducing the intake of new low-skilled workers

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16 The period of observation differs between the three countries under consideration due to availability of consistent time-series data.

rather than by laying off those employed.[17] As a consequence, the average job tenure of low-skilled workers increased disproportionately. In combination with the principle of seniority in wage setting, this modus operandi counteracted a rise in the skill premium.

Table 4 — Import Pressure and Labor market Developments in the Automobile Industry: Correlation Results[a]

| Correlations | Germany | Japan[b] | United States |
|---|---|---|---|
| Automobile Industry | | | |
| MP ~ HN | 0.82** | 0.52** | 0.14 |
| MP ~ RW | -0.82** | -0.25 | 0.39 |
| MLC ~ HN | 0.91** | 0.74** | -0.32 |
| MLC ~ RW | -0.84** | 0.20 | -0.07 |
| Automobile Assembly | | | |
| MP ~ HN | 0.75** | n.a. | -0.13 |
| MP ~ RW | -0.74** | n.a. | 0.48* |
| MLC ~ HN | 0.88** | n.a. | -0.73** |
| MLC ~ RW | -0.85** | n.a. | -0.07 |
| Production of Automotive Parts and Components | | | |
| MP ~ HN | 0.91** | n.a. | 0.08 |
| MP ~ RW | -0.88** | n.a. | -0.20 |
| MLC ~ HN | 0.94** | n.a. | 0.27 |
| MLC ~ RW | -0.81** | n.a. | -0.34 |

[a] *(**) significant at 5 percent level (1 percent); number of observations: Germany=22, Japan=28, United States=17. – [b]Transport equipment.

Source: Bartelsman and Gray (1996); Feenstra (1996); Ministry of Finance (var. issues); Ministry of Labor (var. issues); Statistisches Bundesamt (var. issues).

17 By contrast, German automobile producers mainly resorted to early retirement of redundant low-skilled workers.

In the United States, the two subsectors of the automobile industry responded differently to globalization. In the production of automotive parts and components, the signs of the correlation coefficients, though insignificant, suggest that some Stolper-Samuelson-type adjustment may have occurred. This appears to have helped the subsector to recover from the severe crisis in the beginning of the 1980s. By contrast, growing international competition went along with a falling human capital intensity and a rising relative wage of low-skilled workers in automobile assembly. At the same time, overall employment declined rapidly, which appears to be the cost of the subsector's failure to adjust. Low labor-market flexibility in this highly unionized subsector is most likely to blame.

## IV. The Role of Structural Adjustment

### 1. Specialization Patterns in the German, Japanese and US Automobile Industry

Despite being exposed to a similarly strong competitive pressure from low-income countries, the wage and employment trends in the German, Japanese and US automobile industry in the 1980s and 1990s differed considerably. This suggests that the labor market implications of globalization in traditional producer countries depend to a large extent on how these countries adjusted to

globalization. The challenge for the traditional producer countries consists of specializing in human capital intensive and technologically advanced segments of the value chain. Such an adjustment strategy can help maintain high wages and high employment. In this section, we inquire more deeply into the nature of globalization-induced adjustment processes in the German, Japanese and US automobile industry. We first track the evolution of international competitiveness by calculating *revealed comparative advantage* (RCA) index values for the automobile industries since 1978. Based on subsectoral RCA-index values, we then use a simple OLS-regression model to estimate the direction and strength of the changes in their specialization patterns.[18]

We consider the widely used RCA-index

$$(1) \quad RCA_i = \frac{X_i - M_i}{X_i + M_i},$$

which relates the net exports of sector $i$, $X_i - M_i$, to the sectoral trade volume, $X_i + M_i$. In order to estimate the international competitiveness of sector $i$

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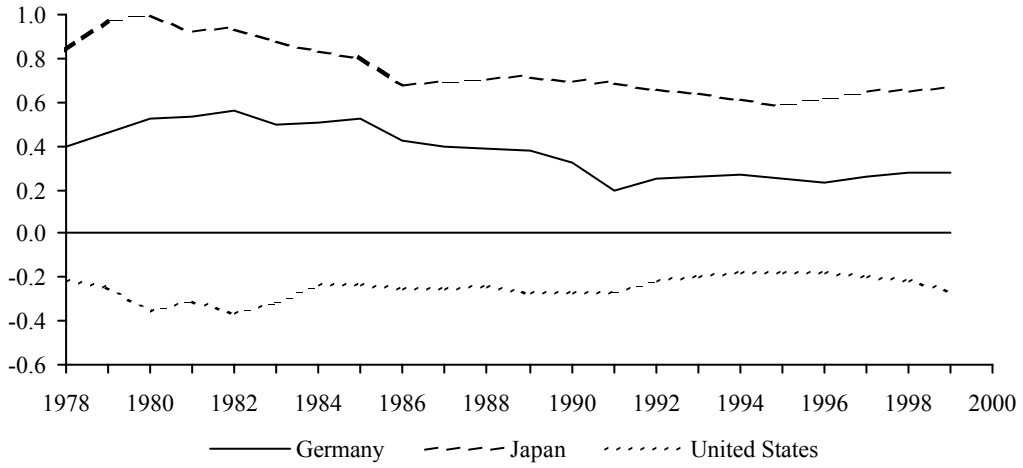
18 According to Ballance et al. (1987), RCA indices can be classified into two categories: *trade-cum-production* indices and *trade-only* indices. As the name suggests, the former are based on both trade and production data and the latter on trade data only. Since compatible trade and production data are not available at a subsectoral level of disaggregation, we had to confine our analysis to trade-only indices.

relative to the total manufacturing sector, we calculate the *relative revealed comparative advantage* (RRCA) index by adjusting $RCA_i$ according to

$$(2) \quad RRCA_i = RCA_i - \frac{X - M}{X + M},$$

where $X$ and $M$ denote the exports and imports of the total manufacturing sector.[19]

Figure 7 — RRCA-Index Values of the German, Japanese and US Automobile Industry




Source: OECD (2000).

Judging by their relative factor endowments, advanced countries should have a comparative advantage in the relatively human capital intensive and technologically advanced automobile industry. This notion is corroborated for

19 For an alternative adjustment see Neven (1995).

Germany and Japan (Figure 7). In both countries the RRCA-index values of the automobile industry were positive throughout the entire observation period, i.e., this sector was internationally more competitive than the total manufacturing sector. Yet, the decline in the RRCA-index values in the 1980s reveals that these countries were not left unscathed by the growing competition from low-income countries. By contrast, RRCA-index values were persistently negative for the US automobile industry. The substantial wage premium of this industry, reported in Table 2, was thus not backed by high international competitiveness. We suspect these differences in international competitiveness are because the US automobile industry failed to adjust to globalization by shifting towards its "natural" specialization profile.[20] In order to validate this hypothesis, we use the simple OLS-regression model

$$(3) \quad RRCA_{j,t_1} = \alpha + \beta \cdot RRCA_{j,t_0} + \varepsilon_{ij},$$

which regresses the RRCA-index of subsector $j$

$$(4) \quad RRCA_j = \frac{X_j - M_j}{X_j + M_j} - RCA_i$$

[20] By „natural" specialization profile, we mean the profile that is consistent with the relative factor endowment of the country.

at time $t_1$ on the RRCA-index of the same subsector at time $t_0$.[21]

Estimates of the correlation coefficient $b$ allow us to derive assertions on the *stability* of the specialization profile within the automobile industry.[22] For $\hat{b} \geq 1$, the initial specialization profile strengthened over time, i.e., subsectors with a high international competitiveness at time $t_0$ became even more competitive while the other subsectors lost further ground in world markets. If $\hat{b}$ lies within the range (0,1), the initial specialization pattern weakened, and for $\hat{b} < 0$, it even turned around. Additionally, we can analyze changes in the *degree* of specialization. Under the standard assumptions of the OLS-regression model, the following relation between the variances of the RRCA indices at time $t_0$ and $t_1$, $s^2_{t_1}$ und $s^2_{t_0}$, the correlation coefficient $b$, and the coefficient of determination $R^2$ holds:

$$(5) \quad \frac{s^2_{t_1}}{s^2_{t_0}} = \frac{b^2}{R^2}.$$

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21 $RCA_i$ stands for the automobile industry as a whole. Here, we are interested in globalization-induced changes in the specialization profile *within* the automobile industry. Hence, we calculate the RRCA index relative to the automobile industry, rather than the manufacturing sector.

22 For a detailed exposition of the methodology see Cantwell (1989) and Dalum et al. (1998).

The degree of specialization increases from $t_0$ to $t_1$ if $\left|\hat{b}\right| > \left|\hat{R}\right|$, and decreases if $\left|\hat{b}\right| < \left|\hat{R}\right|$.

From an economic point of view, a stable specialization profile and a high degree of specialization are positive if (and only if) the sector was already structured in line with its "natural" specialization profile at time $t_0$. In this case, workers can accumulate firm-specific human capital and firms benefit from cumulative innovations and economies of scale, thereby sharpening the competitive edge of the whole sector. However, a stable specialization profile may also be outcome of lacking labor market flexibility or protectionist measures in international trade. In this case, the overall competitiveness of the sector suffers, eventually resulting in a decline in wages and employment.

The regression analysis is carried out separately for the German, Japanese and US automobile industry. We use three-year averages of the RRCA-index values around 1979, 1988 and 1997 in order to reduce the influence of the business cycle on the estimation results. The estimates of $\hat{b}$, and $\hat{b} / \hat{R}$ over the entire observation period ("long-run") and the two subperiods 1978-1989 and 1987-1998 ("medium-run") are presented in Table 5.

Table 5 — Specialization Profiles: Regression Results for the German, Japanese and US Automobile Industry

| | 1978–1998 | | 1978–1989 | | 1987–1998 | |
|---|---|---|---|---|---|---|
| | $\hat{b}$ | $\hat{b} / \hat{R}$ | $\hat{b}$ | $\hat{b} / \hat{R}$ | $\hat{b}$ | $\hat{b} / \hat{R}$ |
| Germany | 0.66* | 1.40 | 0.72** | 0.99 | 1.04** | 1.41 |
| Japan | 3.81* | 7.24 | 0.50 | 1.92 | 1.25 | 3.77 |
| United States | 0.38*†† | 0.68 | 0.72**†† | 0.77 | 0.66**†† | 0.89 |
| *(**) significant at 10 percent level (5 percent). – † (††) significantly different from one at 10 percent (5 percent). Number of observations: Germany: 13, Japan: 12, United States: 10 | | | | | | |

Quelle: OECD (2000).

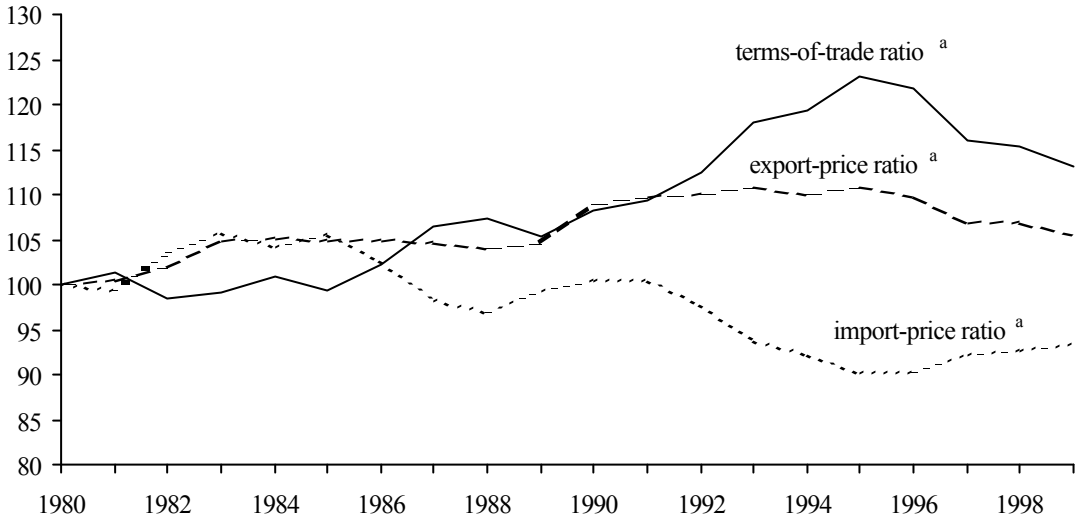
In the long run, the null $b = 0$ can be rejected for all three countries. The specialization pattern of the German, Japanese and US automobile industry was not reversed during the last 20 years. In the case of the United States, however, $\hat{b}$ was significantly different from one, which implies that the initial specialization pattern weakened considerably. This confirms our view that in comparison to its German and Japanese counterparts, the US automobile industry was initially to a lesser extent structured according to its "natural" specialization profile and was, hence, only ill-prepared to manage the growing competitive pressure from low-income countries. The US automobile industry is also different with respect to the long-run changes in the degree of specialization. The estimates of $b / R$ are above one in Germany and Japan, but below one in the United States. In other

words, the degree of specialization rose in the German and Japanese automobile industry and declined in the US automobile industry. Hence, a lower potential to realize economies of scale could have contributed to the loss in international competitiveness of the US automobile industry.

## 2. Relative Price Developments in the German Automobile Industry

As we have shown before, the traditional producer countries can only avoid adverse labor market effects in the automobile industry if they adjust to growing competitive pressure from low-income countries by specializing in human capital intensive segments of the value chain. It, thus, appears rather surprising that, as concerns Germany during the 1990s, wages and employment developed more favorably in the relatively labor intensive production of automotive parts and components than in the relative human capital intensive automobile assembly (Table 3 and Figure 5). Relative price developments reveal that these seemingly contradictory results are due to an extraordinary restructuring process in the former subsector.

Figure 8 — Price Ratios between Automobile Assembly and the Production of Automotive Parts and Components in the German Automobile Industry (1980 = 100)




[a]Production of automotive parts and components relative to automobile assembly.

Source: VDA (b, var. issues)

Figure 8 shows that import prices in the production of automotive parts and components declined more sharply and its export prices rose more steeply after the opening-up of Central European reform countries. This indicates that the subsector adjusted intensively to globalization in the 1990s. Imports increased mainly in the low-end market of automotive parts and components while export demand fuelled a restructuring towards human capital and technology intensive products. The successful specialization strategy enabled the German producers

of automotive parts and components to reap substantial benefits from globalization.

## V. Conclusions

The increasing integration of developing countries into the global division of labor has put severe competitive pressure on various sectors in high-income countries and triggered far-reaching restructuring processes. Textiles, steel and ship-building are prominent cases in point. Despite persistent protection against imports and high production subsidies, these sectors suffered declining wages and dramatic losses of employment. By contrast, the automobile industry is more likely to be on the "sunny" side of globalization since, taken as a whole, it is technologically advanced and relatively human capital intensive. At first sight, choosing this industry to assess the impact of increased competition from below on the labor market situation in high-income countries seems hardly promising.

However, trade models predict that the gains and costs of globalization should be unevenly distributed among the various employment groups and the various subsectors of the automobile industry. Especially low-skilled workers and labor intensive segments of the sectoral value chain should be vulnerable to competitive pressure from low-income countries and face declining wages and employment.

We proceeded in three steps, in order to unveil these more subtle labor market effects of globalization.

We started by analyzing the intensity of competition from below in the automobile industry. At the end of the 1990s, Germany, Japan and the United States, i.e., the major traditional producer countries, still accounted for more than half of global production and two fifth of global exports of automobiles and their parts and components. Nevertheless, the automobile industry was affected by globalization. Since the 1980s countries in Southern and Central Europe, South East Asia and Latin America have significantly increased their share in world production and world exports of automobiles. The emergence of new competitors was frequently initiated and supported by foreign direct investment of multinational companies. In the case of South Korea, however, it was mainly due to industrial targeting by the government. On top of that, low-income countries have become relevant suppliers of automotive inputs. Especially on a regional level, outsourcing of relatively labor intensive segments of the value chain has become a viable option for the automobile industries in Germany, Japan and the United States.

In the second step, we traced the wage and employment trends in the German, Japanese and US automobile industry since the late 1970s and linked these trends to the globalization-induced competitive pressure. Compared to total

manufacturing, automobile workers received a significant wage premium and enjoyed a rising or at least stable employment level in all three countries. They were, thus, among the winners of globalization. But the favorable wage and employment trends mask substantial differences between the various subsectors of the automobile industry. In the case of Japan and the United States, the average wage level rose far more steeply in the relatively human capital intensive automobile assembly than in the relatively labor intensive production of automotive parts and components.

Furthermore, we found evidence that the labor market situation of low-skilled automobile workers deteriorated in the traditional producer countries in the last 20 years. In Germany, the sectoral human capital intensity rose and the sectoral relative wage of low-skilled workers fell. In the Japanese automobile industry, the employment prospects of low-skilled workers deteriorated while their relative wages remained fairly stable. Only in the United States the sectoral human capital intensity did not reveal a clear trend. Even more surprisingly, the relative wage of low-skilled automobile workers in the United States remained above its 1978 level throughout the entire observation period. We then correlated the intrasectoral wage and employment ratios with a number of indicators reflecting the intensity of international competition. Apart from the US automobile industry, we found Stolper-Samuelson-type adjustment to growing competitive pressure from low-income countries.

Finally, we analyzed the evolution of the subsectoral revealed comparative advantages of the automobile industries in Germany, Japan and the United States to inquire more deeply into the nature of globalization-induced restructuring processes. Simple OLS regressions suggest that the relatively poor performance of the US automobile industry in world markets vis-à-vis its German and Japanese counterparts in the last 20 years can be explained by two factors: First, the powerful United Automobile Workers' Union (UAW) obstructed the industry's efforts to restructure towards its "natural" specialization profile. Second, the degree of specialization declined in the US automobile industry, which was in contrast to Germany and Japan. For these reasons, this industry was ill-prepared to cope with competitive pressure from below and lost international competitiveness.

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