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Trade, Technical Change, and Labour Market Adjustment

by **Bernhard Heitger (†)** and **Jürgen Stehn***

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* My colleague and co-author Bernhard Heitger suddenly and unexpectedly died while we were working on the final version of this paper. Since I completed the article, all remaining errors and shortcomings fall into my responsibility. This article is dedicated to the memory of Bernd.

Abstract

The paper empirically examines three possible reasons for the high and rising unemployment of low-skilled employees in Germany: (i) an upsurge in interindustry trade, (ii) a skill-biased technical change, and (iii) a failure of labour market adjustment. The empirical analyses indicate that an exogenous wage-setting process as well as a bundle of factors, including a skill-biased technical and structural change, have contributed to the decline in relative demand for low-skilled employees in Germany. Thus, economic policy in Germany should focus on improving the employability of workers in the lower segment of the labour market and on raising the adjustment flexibility, above all the flexibility of the wage structure, of the German labour market.

JEL classification: F 11; J 31; O 30

Trade, Technical Change, and Labour Market Adjustment

1. The Problem

Starting with the oil price shock in 1974, the unemployment rate in Germany has markedly increased during each recession. In each of the following upswings, the unemployment rate fell slightly, but did not return to its prerecession level. As a result, the unemployment rate had been ratcheting upwards from 0.6 percent in 1970 to an all-time high of 11.4 percent in 1997. Remarkably, since the beginning of the 1980s the unemployment rate among the unskilled has been considerably higher than the unemployment rates for the skilled and high-skilled. What is more, while the three skill-specific unemployment rates moved in a parallel fashion during the 1980s, the unskilled unemployment rate rose much faster than the rates for the skilled and high-skilled after 1990 and tripled from 7 percent in 1991 to 21 percent in 1997.

Looking for the reasons for the relatively high and rising unemployment rate among the unskilled, three more or less parallel trends attract attention. Firstly, the share of imports from developing and newly industrialized countries in total German imports rose from 15.9 percent in 1980 to 22.8 percent in 2001. Thus, with a view to the rigid wage structure in Germany it could be assumed that a fall in relative prices for labour-intensive goods has contributed to the high unemployment rate of unskilled employees. Secondly, the share of unskilled in total workers in Germany has declined by 1.1 percent per year during the period 1984–1997 (Schimmelfennig 2000, p.14). It is remarkable that this trend is not solely the result of structural change in some labour-intensive sectors of the German economy, but holds across all sectors of the German economy, except for energy and transportation. This trend supports the assumption that a skill-biased technical change could at least partially be responsible for the high and rising unemployment rate of the unskilled. Thirdly, the wage differential between

high-skilled and unskilled employees as well as between skilled and unskilled employees have both fallen slightly from 1984 to 1995 (Christensen and Schimmelpfennig 1998). Thus, relative wages of the unskilled have not only not reacted to possible trade and technology shocks but also seem to be determined by factors turning them at least to some extent into exogenous determinants of relative labour demand. The special mechanism of wage bargaining, the unemployment insurance system as well as the social benefits system in Germany could be institutional factors that result in an exogenous wage setting process in Germany and, therefore, could be partly responsible for the declining demand for low-skilled employees.

The objective of this paper is to empirically examine the strength of these hypotheses in explaining the relatively low and falling demand for low-skilled employees in Germany. After some theoretical considerations (section 2), section 3 presents the empirical evidence. Section 4 draws some policy conclusions.

2. Theoretical Considerations

a. Interindustry Trade and Employment

The coincidence between a decreasing demand for low-skilled employees and increasing imports of labour-intensive manufacturing goods from developing countries has raised a lively debate on the economic effects of interindustry trade between industrial and developing countries. This debate centres on the question, if and to what extent the deepening of the interindustrial division of labour between developing and industrial countries is indeed responsible for falling real wages or growing unemployment of low-skilled employees in industrial countries. Authors who are sceptical with regard to the trade hypothesis claim that it is not trade but a skill-biased technical change what drives the skill composition of the labour force in industrial economies. With a view to the empirical results of this debate, the turning

of the scale seems to be – at least with respect to the United States – in favour of the technology hypothesis.¹ However, for Germany the results are not as straight forward as for the United States. Although the few empirical studies on the employment effects of interindustry trade give some hints that trade is not the major culprit of the piece, the empirical picture is still relatively blurred.²

Although there is doubt about the empirical validity of the trade hypothesis, there exists a wide consensus that the causal relationship between the demand for low-skilled employees and the upsurge in interindustry trade is to be analysed in the theoretical framework of a Heckscher-Ohlin-Vanek (HOV) model. In this theoretical framework, the deepening of trade integration between developing and industrialized countries can be modelled as a shift from autarky to free trade. It is assumed that a typical industrial economy can be characterized by two factors of production, low-skilled and high-skilled employees, and two sectors, producing human capital intensive (Q_1) and labour-intensive (Q_2) goods respectively. Moreover, it is realistically assumed that in industrial countries like Germany human capital is the abundant factor, whereas less developed countries are relatively well endowed with low-skilled employees.

In Figure 1, the possible combinations of human capital intensive (Q_1) and labour-intensive goods (Q_2) that can be produced in the industrial country are given by the transformation curve T. In autarky, the equilibrium is established at A, where the indifference curve I_1 is tangent to the transformation curve. The relative prices of the two goods are given by the

¹ See among others, Bound and Johnson (1992), Katz and Murphy (1992), Lawrence and Slaughter (1993), Berman et al. (1994), Leamer (1994; 1996), Wood (1995), Baldwin (1994), Krugman (1995), Sachs and Shatz (1996), Davis (1996), Baldwin and Cain (1997). An overview of the debate is provided in Richardson (1995), OECD (1997), and Stehn (2000).

² For an overview of the German empirical literature see Siebert and Stehn (1999).

slope of the price curve P_1 . A trade integration with labour-intensive economies increases the supply of labour-intensive goods and, therefore, reduces the relative price of these goods in the domestic market. The price curve shifts from P_1 to P_2 . As a consequence of the change in relative prices, the human capital abundant industrial economy specializes in human capital intensive goods; the production point moves from A to B and the new consumption point is given by C.

The welfare gains from trade liberalization go hand in hand with a income redistribution in human capital intensive economies. The relative increase in prices for human capital intensive goods leads to an expansion of the human capital intensive goods producing sector, whereas the labour-intensive sector shrinks. As a consequence, the relative demand for low-skilled employees falls and in the new equilibrium full employment can only be attained if the relative wages of low-skilled employees fall accordingly (Stolper-Samuelson-Theorem). In case of a rigidity of the relative wage structure, i.e. in the German case, unemployment of low-skilled persons is the other side of the coin (Krugman 1995).

This quite simple HOV-model presents a very important message to the empirical researcher: An increase in interindustry trade leads to a falling demand for low-skilled employees, if, and only if it results in a change of relative goods prices. Indeed, as Richardson (1995) has shown in detail, a growth-induced trade expansion that is lifting all boats (a parallel shift of the transformation curve in Figure 1 to the northeast) will not result in any change of relative goods prices (the slope of the price-curve P_1 in Figure 1 stays constant) and, therefore, will have no effects on relative factor demand. Thus, to analyze the effects of a rise in interindustry trade on relative factor demand, one has to examine the trend in relative goods prices.

To be sure, even the trend in relative goods prices can be misleading if an increase of interindustry trade is (coincidentally) accompanied by a skill-biased technical change leading to

an equal substitution of high-skilled for low-skilled employees in all sectors of an economy (see, among others, Baldwin and Cain 1997). As a result of this substitution, low-skilled employees will become the relative abundant factor and the production of labour-intensive goods will rise relative to the production of human capital intensive goods. If world demand is inelastic with respect to changes in the domestic production structure (small country assumption), a skill-biased technical change will leave relative world market prices unchanged. However, in case of a country that is big enough to influence its terms of trade, a skill-biased technical change will alter relative goods prices in the same direction as an increase of interindustry trade does. As a consequence, an empirical study that takes changes in relative goods prices as a measure will overestimate the trade effects if skill-biased technical change is at work at the same time. Although it seems to be a little bit heroic to assume that a country like Germany is in a position to influence its terms of trade, this potential effect of a skill-biased technical change should be borne in mind when interpreting the empirical results.

b. Technical Change and Employment

Although skill-biased technical change is a term widely used in the literature, it is usually not defined in a precise manner. In general, skill-biased technical change is understood to describe a kind of technical change that leads to an increase in the demand for skilled workers and a decrease in the demand for low-skilled workers. Some authors see the microelectronic revolution at the heart of skill-biased technical change: "... the rapid diffusion of ITC has led – and continues to lead – to a substantial exclusion of large parts of the labour force, either unskilled or wrongly skilled and incapable of training." (Freeman et al. 1995: 600). Johnson (1997) relates skill-biased technical change to different forms of innovations and distinguishes between intensive, extensive and neutral technical change. He defines intensive skill-biased technical change as a technical change that makes skilled workers more productive in the jobs

they already perform; the introduction of computers is an example. Extensive skill-biased technical change is defined as a technical change that leads to the employment of skilled workers in jobs that were formerly performed by unskilled workers; automation in manufacturing is an example. Technical change is skill-neutral, if it raises the productivity of all workers by the same percentage. Also conceivable is the existence of unskilled-biased technical change, e.g., the introduction of the assembly line in production.

Katsoulacos (1986) focuses on two types of innovation: (i) Process innovation decreases employment by mainly eliminating jobs for the unskilled, while (ii) product innovation increases employment by creating new jobs that often require skilled workers. Both types of innovation can appear as skill-biased technical change in the data. However, one should bear in mind that product innovation is better described as sectoral structural change, because it leads to the rise of new markets.

Through product innovation, new goods are introduced and old goods fall into oblivion. Structural change describes the reallocation of economic activity in response to innovations. In particular, structural change describes the reallocation of production factors between different uses or between different sectors. In the case of labour supply, slow adjustment to changes in labour demand can result in an increase in unemployment. Thus, the distinction between skill-biased technical change and sectoral structural change is not as clear-cut as it appears on first sight (Schimmelpfennig 2000). While skill-biased technical change will play some role in explaining the changing skill composition, in empirical research it is nothing more than a residual that could also be interpreted as an indicator of structural change.

In the empirical literature, there is a wide consensus that skill-biased technical change drives the skill composition in industrial economies. The by now almost classic studies were carried out for the United States by Bound and Johnson (1992), Katz and Murphy (1992), Berman et al. (1994), and for a number of OECD countries by Berman et al. (1997). Katz and Murphy

(1992), for example, study the skill composition in the United States from 1963 to 1987. They find that between-industry changes account for 30 percent of the change in the skill composition. Thus, within-industry changes, i.e. skill-biased technical change, explain most of the change.

For Germany, the evidence is not as clear-cut as for the United States. Whereas Falk and Koebel (1997) and Steiner and Moch (1997) identify a skill-biased technical change as the driving force of skill-composition, Kölling (1998) finds no relationship between technical change and relative labour demand. According to the results of Blechinger and Pfeiffer (1998), it is rather a move towards technologically more advanced plants that appears to be hiding behind the residual skill-biased technical change. Schimmelpfennig (2000) explicitly shows that it is a structural change of the production process rather than a skill-biased technical change what determines the unemployment duration of low-skilled workers.

c. Labour Market Adjustment and Employment

As mentioned above, the wage differentials between high-skilled and unskilled employees as well as between skilled and unskilled employees in Germany have both fallen slightly from 1984 to 1995. The labour market consequences of the resulting wage structure can best be illustrated in a Mussa diagram³ (Figure 2). The length of the x-axis equals the stock of the labour force in an economy that is assumed to be constant over time and independent of the wage level (inelastic labour supply). The labour demand functions for low-skilled and high-skilled workers are given by the curves D^L and D^H , respectively, where D^H is drawn to the origin O^* . In the initial period, there is full employment with wage levels of w_0^L and w_0^H for

³ This kind of a diagram was used by Mussa (1974) to explain the impact of tariffs on functional income distribution. It was applied, e.g., to analyse the labour market effects of sectoral structural change by Klodt et al. (1997).

low-skilled and high-skilled employees. The employment of low-skilled workers amounts to $0x_0$ that of high-skilled workers to x_0 .

External shocks like an increase in world wide supply of labour-intensive goods or a skill-biased technical or structural change shifts both demand curves to the left. Given the new demand curves D_1^L and D_1^H as well as a short-term factor immobility, full employment for both groups of factors can only be attained by an adjustment of wages to w_1^L and w_1^H , respectively, resulting in a rising wage differential. However, the German case that is characterized by a constant or even falling rather than rising wage differential does not fit into this standard textbook picture. Moreover, German employees were able to push for higher wages after employment fell in response to negative external shocks (Snower 1997). Thus, despite the possible countervailing effects of external shocks, the wage level of low-skilled employees rises to w_G^L , that of the high-skilled to w_1^H (assuming a constant wage differential). As a consequence, $x_1^L x_0$ less-skilled employees become unemployed due to a wage-setting process that seems to be more or less resistant to market forces.

There are several reasons for this independency that turns relative wages in Germany into exogenous determinants of relative labour demand. Above all, the wage bargaining process in Germany is almost a perfect mirror image of those theories of bargaining postulating that wages are set not by market forces, but in a bilateral bargaining framework between groups of workers with common interests (unions) and individual employers and employers' associations. In Germany, the trade unions and the employers' associations (the so-called "social partner") have been granted the right to negotiate a collective wage contract relating to minimum wages, working time, holidays, fringe benefits, and other aspects of work.⁴ In principle, the contract terms only apply to the contracting parties, although – under a set of

⁴ See Paqué (1999) for an in-depth analysis of wage bargaining in Germany.

exceptional circumstances – the Federal Minister of labour may declare a collective agreement generally binding for any branch of industry. Although this is in fact rarely done, the mere legal possibility may signal enough threat potential to ward off any attempt of outsiders at underbidding. More importantly, however, there are other economic reasons why most employees hold jobs at contractual conditions.

First, the degree of organization (the ‘density rate’) is high especially on the employers’ side: about 35–40 percent of dependent-status employees are members of unions, about 80 percent of all employers are members of employers’ associations. Second, virtually all of these organized employers offer the same wage and working conditions to union members and non-union members alike, because any unorganised worker employed at subcontractual conditions in an organized firm might join the relevant union and thus secure himself the right to the conditions of the collective agreement. In turn, the employer is not allowed to dismiss the worker on the grounds of his newly acquired union membership, e.g., to enforce an individual contract which obliges the worker not to join a union. Hence the only sensible economic strategy for any organized employer is to simply grant contractual conditions to anybody in the first place. Third, there is a widespread consensus in the public – including the press and political parties – that offering wages or working conditions at subcontractual levels involves some sort of worker exploitation. Thus, at least prestigious domestic firms which have a reputation to lose in public, refrain from openly disregarding collective agreements by hiring workers at wages and working conditions below the common contractual minimum in the respective industry.

Moreover, the so-called *Günstigkeitsprinzip* of the German wage contract law (*Tarifvertragsgesetz*) stipulates that an individual worker who is a union member can deviate from the negotiated union wage contract if this is favourable for him. However, “favourable” is interpreted in a very narrow sense by the labour courts as a wage higher than the union

wage or as less working time. The risk of becoming unemployed or the security of the job can not legally be part of the consideration of whether to deviate from the union contract is favourable; this has been explicitly decided by the highest German labour court. There is no doubt that this limitation of individual choice contributes to the rigidity in the German labour market and thus to the low degree of wage differentiation.

In addition, the unemployment benefit and the social welfare benefit systems are important factors that contribute to the resistance of the German wage structure to market forces. The unemployment benefit system includes two types of unemployment support. Unemployment benefits of type I (*Arbeitslosengeld*) amount to 67 percent of the previous net income for unemployed persons with at least one child (60 percent for singles). The duration of benefits varies with age and goes up to 32 months. Unemployment benefits of type II (*Arbeitslosenhilfe*) are set at 57 percent of the previous net income for unemployed persons with at least one child (53 percent for singles). This type of benefit is paid for an indefinite period of time. Although it is linked to the previous working income, it requires neediness. Social welfare benefits (*Sozialhilfe*) aim at allowing a life in dignity for those who cannot make their living by themselves. This includes the elderly without sufficient income and those in the working age who are unable to work, who do not find a job and for whom the unemployment schemes do not apply. Social welfare benefits are defined by minimum requirements for living and are means-tested. For a married worker with one child, the benefits make up 68.5 percent of the lowest net wage in industry, 75 percent of wages in craft, and 100 percent of wages in low-paid jobs in restaurants and hotels (Boss 2002).

This set of government-provided incomes has a considerable impact on the wage that an unemployed expects from a new job (reservation wage). Empirical studies indicate that the reservation wage of unemployed persons in Germany amounts to 120 percent of the previous income (Christensen 2001). This is unusually high for someone who is striving to find a new

job and it is high in comparison to other countries. What is more, reservation wages in Germany do not decline with the duration of unemployment (Christensen 2002). Given the special institutional characteristics of wage-bargaining in Germany, it is obvious that neither workers nor their unions will accept a wage rate below the reservation wage. As a consequence, welfare benefits of the German type define a floor to the wage structure. In other words, there exists an implicit minimum wage, without a minimum wage being formally defined, that restricts wage differentiation – at least in the lower segment of the labour market – to a considerable extent (Siebert 2003).

3. Empirical Evidence

a. Interindustry Trade and Employment

Since trade theory based on HOV-models identifies changes in relative goods prices as the main transmission mechanism between interindustry trade and relative factor demand, an empirical analysis of this relationship has to start with an estimation of trends in relative goods prices. Official statistics of the German *Statistisches Bundesamt* provide both, price indices for international trade (export and import prices) as well as for production (supplier prices and value-added prices). To secure a comprehensive empirical analysis, we estimated the time trend of all price indices in 33 industries of the manufacturing sector for the period 1970–1995⁵. The estimation coefficients, expressed as percentage points per year, are presented in Table 1. A positive (negative) coefficient indicates an above (below) average price increase in a certain industry compared to the manufacturing industry as a whole. In up

⁵ Our empirical analysis is confined to the period 1970–1995 because – as a consequence of German unification – most data sources on qualification, wages by qualification as well as goods prices provide separate data for the ‘old’ West Germany on the one side and the new Bundesländer on the other side only until 1995.

to 29 of 33 industries a statistically significant positive or negative price trend can be observed.

As HOV trade theory assumes a negative relationship between labour intensity and the relative trend in goods prices, we need an indicator for the skill composition of manufacturing industries. The official statistics of the *Statistisches Bundesamt* on industrial skill composition divide white-collar workers into 4 and blue-collar workers into 3 skill categories ranked from highest to lowest skills. For our empirical analysis, we have re-structured these 7 categories into two skill groups called “low-skilled employees”, including white-collar workers of categories 3 and 4 as well as blue-collar workers of categories 2 and 3, and “high-skilled employees”, including white-collar workers of categories 1 and 2. The re-structuring shows that the share of low-skilled employees in manufacturing as a whole has declined from 56 percent in 1970 to 40 percent in 1995, whereas the structure of skill composition among industries stayed relatively unchanged over time. The latter outcome indicates that the substitution of high-skilled for low-skilled employees in Germany is not a sectoral phenomenon, but can be observed in almost all manufacturing industries.

To examine the relationship between labour-intensity and the price trend in manufacturing industries, we have plotted the share of low-skilled employees in 1985 against the trend in supplier prices (Figure 3). Since the four estimated price trends show a high correlation of up to 0.94, it does not make much of a difference to use the one or other price index. We decided to plot the trend in supplier prices, because this trend reveals the most significant estimation coefficients. In Figure 3, the line DD mirrors the average share of low-skilled employees in manufacturing, the vertical line indicates relative price changes of zero. It is obvious that there seems to exist no strong relationship between the trend in supplier prices and labour-intensity. Although there are some labour-intensive industries like textiles that experienced an above average decline of prices, the high dispersion of results indicates that there has been no

systematic decline of relative prices in labour-intensive industries. In order to back-up this result, we have also estimated the partial correlation between the share of low-skilled employees in different selected years and the trend in import, export, supplier as well as value-added prices (Table 2). As expected, the correlation coefficients are rather low and only one coefficient is statistically significant at the (quite weak) 10-percent level.

Thus, trade integration with developing countries seems to exert no systematic impact on relative wages and/or relative employment of low-skilled employees in Germany. Since – from a theoretical point of view – a skill-biased technical change would also have a negative impact on relative prices of labour-intensive goods, it is impossible that a potential technology shock has led to an underestimation of the trade effect. However, there is some empirical evidence that trade protection of German manufacturing industries has at least mitigated the effect of interindustry trade on skill composition. Cross-section OLS regressions of effective protection in Germany on the share of low-skilled employees indicate that trade barriers in manufacturing industries rise with an increasing share of low-skilled employees (Table 3). Thus, the empirical evidence presented here leads to the conclusion that the existence of a trade shock cannot be ruled out, but that this possible trade shock has had no impact on relative goods prices and, therefore, on relative wages and/or relative employment in Germany.

b. Technical Change, Labour Market Adjustment, and Employment

In contrast to an external trade shock, both a skill-biased technical change as well as an exogenous wage-setting process have a direct impact on relative labour demand. Thus, we will examine the effects of technical change and labour market adjustment on relative labour demand in Germany by estimating a labour demand function that includes indicators for both exogenous variables.

As the theoretical considerations have shown, the measurement of technical change is a dangerous endeavour. Since this paper does not aim at making this endeavour less dangerous, we decided to move along the easy way that is never right nor wrong, i.e. to measure technical change as the coefficient of the time trend in a neoclassical linear homogeneous production function. To do so, we have expressed labour productivity as a logarithmic function of capital intensity and a time trend and have estimated this function for 33 manufacturing industries in a time-series regression from 1970 to 1995. The estimated coefficient of the time trend is, then, supposed to express the autonomous technical change in an industry. This easy way is never wrong, since it is well-based on traditional growth theories of the Hicks, Harrod and Solow type. It is never right because in empirical research the time trend in a linear homogeneous production function is nothing but a residual that captures a bundle of determinants that goes well beyond what a serious economist would call technical change. However, since we are especially interested in the effects of labour market adjustments on relative labour demand, the inclusion of a broadly defined variable representing a bundle of exogenous influences helps to properly work out the impact of institutional factors on skill composition.

The estimated labour productivity function is statistically significant at the 1-percent level for 31 out of 33 industries and the adjusted R^2 ranges from 0.79 (wood processing) to 0.99 (electronic products).⁶ The estimation coefficient for the time trend variable (“technical change”) is statistically significant at the 1-percent or 5-percent level in 25 industries. It ranges from 12.6 percent a year in dataprocessing and office machines to -4.2 percent a year in shipbuilding. The average technical change in manufacturing as a whole amounts to 1.8 percent a year.

⁶ The regression equations can be obtained on request from the authors.

Official data on wages in different skill categories are again provided by the German *Statistisches Bundesamt*. Figure 4 shows the development of relative wages for low-skilled workers, expressed as a percentage share of the wages for high-skilled employees, as well as the change in relative employment of low-skilled employees, expressed as a percentage share of the employment of high-skilled employees. Whereas the relative employment of the low-skilled declined from about 200 percent in 1970 to about 120 percent in 1995, relative wages for low-skilled employees rose from about 76 percent in 1970 to about 81 percent in 1995 (Figure 4).

We have used the data on relative wages for low-skilled employees and the estimated coefficients of the time trends in the industry-specific production functions (“technical change”) to estimate a labour demand function for the period 1970–1995. Since we are pooling time-series and cross-section data, we have to use panel estimation techniques that allow us to include the industry-specific trend coefficients as cross-section specific effects in the estimation equation. Thus, we have estimated the following demand function:

$$\ln \text{RELE} = \text{fixed effects} \times \text{cross section specific effects (technical change)} \times \ln \text{RWLE},$$

with RELE: relative employment of low-skilled employees, and RWLE: relative wages of low-skilled employees.

The regression results indicate that both, relative wages for low-skilled employees as well as a broadly defined technical change have contributed to the decline in employment of low-skilled workers in Germany (Table 4). The estimation coefficients of the cross-section specific effects (technical change) have a significant negative sign in 23 out of 30 industries; in 5 industries a significant positive impact of technical change on the relative employment of low-skilled employees can be observed. The highly significant negative estimation coefficient for the wage variable indicates that market forces have not played their textbook role in smoothing the impact of external forces on relative labour demand. Obviously, the special

mechanisms of wage bargaining as well as the special characteristics of the unemployment insurance system and the social aid system in Germany have not only hindered relative wages to adjust to external shocks but also turned them into exogenous determinants of relative labour demand.

4. Policy Conclusions

The previous sections have shown that an exogenous wage-setting process as well as a bundle of factors, including a skill-biased technical and structural change, have contributed to the decline in relative demand for low-skilled employees in Germany. What are the policy implications of these results?

If it is indeed a skill-biased technical change or a skill-biased structural change of any kind that is mainly hiding behind the time trend in a neoclassical production function, as traditional growth theories suggest, our results urge upon improving the employability of workers in the lower segment of the labour market as one important task of economic policy. Employability crucially depends on having core skills that are demanded in the labour market. If requirements concerning these core skills change, e.g., due to technical or structural changes, individuals may lose their employability. If they want to regain employability, they have to invest in their human capital. Since there is no credit market for education in Germany, there may be constraints that lead to an under-investment in employability. An alternative way of financing the investment in employability is the reinterpretation of the unemployment insurance system as an employability insurance system.⁷

Under the new system, an individual who is laid off could take his insurance entitlement and use it to finance the investment in human capital necessary to regain his employability. In

⁷ This proposal that is based on the benefits transfer programs suggested by Snower (1994) and Orszag and Snower (1996) has first been made by Schimmelpfennig (2000).

Germany, this approach is already adopted to some extent. The labour office (*Arbeitsamt*) provides different training courses available to some registered unemployed. However, the present system does not rely on market forces. Instead, training schemes are offered as long as there is still room in the fixed budget. Private initiative is only allowed within the narrow borders drawn by the bureaucracy of the labour office.

An employability insurance system that relies on market forces is easy to conceive. To sketch an extreme position, today's mandatory public unemployment insurance could be replaced by a mandatory private employability insurance system. The system should be mandatory to avoid myopic or free-rider behavior. Upon joining the labour force, individuals enter an employability insurance contract with a private insurer. If these individuals become unemployed during their career, two cases may arise. First, the individual is employable. In this case, the insurer pays a specified transfer to provide the unemployed with the means to search for a new position. Second, the individual has lost his employability, for example, due to structural change of the production process. In this case, the insurer pays for the training required to regain employability. The particular type of training will depend on the skills the individual possesses, his ability to acquire new skills, and the particular skills demanded by firms. Determining the type of training can be left to the unemployed and the insurer who could cooperate with temporary staff firms or private job placement firms that have superior information on the current composition of labour demand.

In order to revive the adjustment flexibility, i.e. above all the flexibility of the wage structure, of the German labour market to external shocks, several tasks are on the economic policy agenda. Firstly, with respect to wage bargaining, the main political task is to appraise the conflict between the protection of the employed and the discrimination of the unemployed. The most appropriate solution of this conflict is to allow some decentralized autonomy in the collective labour contract. A legal redefinition of the *Günstigkeitsprinzip*

should provide that individual employees are allowed to deviate from the collective contract, if this deviation makes their jobs more secure, e.g., due to a commitment of the employer not to lay off workers in the near future. Moreover, a reform of the Workers Council Constitution Act (*Betriebsverfassungsgesetz*) should enable the employees of a firm to deviate from the collective contract as a group, if a qualified majority of two thirds of the employees vote in favour of a deviation.

Secondly, incentives to decrease the unusual high reservation wages of unemployed persons in Germany and, as a consequence, the implicit minimum wage floor in the German labour market, should be provided by an appropriate reform of the unemployment benefits systems. With respect to unemployment benefits of type I, many observers propose to reduce the maximum duration of benefits from currently 32 months to 12 months as it had been the case until the mid 1980s. This would still be twice as long as the duration in the United Kingdom and the United States. More radical proposals suggest a dual system model of private unemployment insurance that strengthens incentives for both employees as well as employers to react to market forces: employees pay an insurance premium according to their individual risk of becoming unemployed, employers a refundable premium according their firm's individual employment record (Glismann and Schrader 2001).

The most far-reaching proposal with regard to the unemployment benefits of type II is to terminate this benefit system. In this case, those unemployed who do not find a job and whose unemployment benefit of type I has expired would receive (lower) social welfare benefits. However, in a recent reform proposal, the German government advocates to continue transfers of type II, but proposes to define neediness more strictly and to reduce the benefits to a level somewhat above social welfare.

Thirdly, the social welfare benefit system needs to be reformed in a way that increases the disparity between incomes in the lower segment of the labour market and social welfare

payments. A “smooth adjustment” approach would be to apply the existing criteria of eligibility for social welfare more strictly, especially with a view to the reduction of benefits in case of a refusal of a job-offer, or to de-link the annual increases in benefits from changes of the consumer price index. However, measures along these lines might only lead to a psychological rather than a real redefinition of the implicit wage floor in the German welfare system. A more results-oriented approach would be to reduce the level of social welfare for those who are able to work but lack employability (i.e. to leave social welfare for the sick and elderly untouched) and at the same time to strengthen the incentives to accept low-wage jobs in the lower segment of the labour market for those that are able to find a job by gradually phasing out social welfare with increasing earned income as it is the case in the US Earned Income Tax Credit and the UK Family Tax Credit (Siebert 2003). This double-sided approach of reducing social benefits and granting wage subsidies might contribute to correct the false incentives that are being set in the German welfare benefit system.

REFERENCES

- Baldwin, R.E. (1994). The Effects of Trade and Foreign Direct Investment on Employment and Relative Wages. *OECD Economic Studies* (23): 7–54.
- Baldwin, R.E., and G.G. Cain (1997). Shifts in US Relative Wages. The Role of Trade, Technology and Factor Endowments. Working Paper 5934. National Bureau of Economic Research, Cambridge, Mass.
- Berman, E., J. Bound, and Z. Griliches (1994). Changes in the Demand for Skilled Labor within US Manufacturing: Evidence from the Annual Survey of Manufactures. *Quarterly Journal of Economics* 109 (2): 367–397.
- Berman, E., J. Bound, and S.J. Machin (1997). Implications of Skill-Biased Technological Change: International Evidence. Working Paper 6166. National Bureau of Economic Research, Cambridge, Mass.
- Blechinger, D., and F. Pfeiffer (1998). Qualifikation, Beschäftigung und technischer Fortschritt. ZEW Discussion Paper 98–04. Zentrum für Europäische Wirtschaftsforschung, Mannheim.
- Boss, A. (2002). *Sozialhilfe, Lohnabstand und Leistungsanreize: Empirische Analyse für Haushaltstypen und Branchen in West- und Ostdeutschland*. Kieler Studien 318. Berlin: Springer.
- Bound, J., and G. Johnson (1992). Changes in the Structure of Wages in the 1980's: An Evaluation of Alternative Explanations. *American Economic Review* 82 (3): 371–392.
- Christensen, B., and A. Schimmelpfennig (1998). Arbeitslosigkeit, Qualifikation und Lohnstruktur in Westdeutschland. *Die Weltwirtschaft* (2): 177–186.
- Christensen, B. (2001). The Determinants of Reservation Wages: Does a Motivation Gap Exist? Kiel Working Paper 1024. Kiel Institute for World Economics, Kiel.

- Christensen, B. (2002). Reservation Wages, Offered Wages, and Unemployment Duration – New Empirical Evidence. Kiel Working Paper 1095. Kiel Institute for World Economics, Kiel.
- Davis, D.R. (1996). Does European Unemployment Prop up American Wages? Development Discussion Papers 550. Harvard Institute for International Development, Cambridge, Mass.
- DIW (Deutsches Institut für Wirtschaftsforschung) (1995). *Produktionsvolumen und -potential, Produktionsfaktoren des Bergbaus und des Verarbeitenden Gewerbes 1970–94*. Berlin.
- Falk, M., and B. Koebel (1997). The Demand for Heterogeneous Labour in Germany. ZEW Discussion Paper 97–28. Zentrum für Europäische Wirtschaftsforschung, Mannheim.
- Freeman, C., L.L.G. Soete, and U. Efendioglu (1995). Diffusion and the Employment Effects of Information and Communication Technology. *International Labour Review* 134 (4): 587–603.
- Glismann, H.H., and K. Schrader (2001). Ein funktionstüchtiges System privater Arbeitslosenversicherung. Kiel Working Paper 1076. Kiel Institute for World Economics, Kiel.
- Heitger, B., and J. Stehn (1990). Japanese Direct Investments in the EC: Response to the Internal Market 1993? *Journal of Common Market Studies* 29 (1): 1–15.
- Johnson, G.E. (1997). Changes in Earnings Inequality : The Role of Demand Shifts. *Journal of Economic Perspectives* 11 (2): 41–54.
- Katsoulacos, Y.S. (1986). *The Employment Effect of Technical Change: A Theoretical Study of New Technology and the Labour Market*. Brighton, Sussex: Wheatsheaf Books.
- Katz, L.F., and K.M. Murphy (1992). Changes in Realive Wages, 1963–1987: Supply and Demand Factors. *Quarterly Journal of Economics* 107 (1): 35–78.

- Klodt, H., R. Maurer, and A. Schimmelpfennig (1997). *Tertiarisierung in der deutschen Wirtschaft*. Kieler Studien 283. Tübingen: J.C.B. Mohr.
- Kölling, A. (1998). *Anpassungen auf dem Arbeitsmarkt: Eine Analyse der dynamischen Arbeitsnachfrage in der Bundesrepublik Deutschland*. Beiträge zur Arbeitsmarkt- und Berufsforschung 217. Nürnberg: Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbeit.
- Krugman, P.R. (1995). Technology, Trade, and Factor Prices. Working Paper 5355. National Bureau of Economic Research, Cambridge, Mass.
- Lawrence, R.Z., and M.J. Slaughter (1993). International Trade and American Wages in the 1980s: Giant Sucking Sound or Small Hiccup? *Brookings Papers on Economic Activity: Microeconomics* (2): 161–226.
- Leamer, E.E. (1994). Trade, Wages and Revolving Door Ideas. Working Paper 4716. National Bureau of Economic Research, Cambridge, Mass.
- Leamer, E.E. (1996). Wage Inequality from International Competition and Technological Change: Theory and Country Experience. *American Economic Review* 86 (2): 309–314.
- Mussa, M. (1974). Tariffs and the Distribution of Income: The Importance of Factor Specificity, Substitutability, and Intensity in the Short and Long Run. *Journal of Political Economy* 82 (6): 1191–1203.
- OECD (Organisation for Economic Co-operation and Development) (1997). *Employment Outlook*. Vol. 15. Paris.
- Orszag, M., and D. Snower (1996). A Macro Theory of Employment Vouchers. CEPR Discussion Paper 1367. London.
- Paqué, K.-H. (1999). *Structural Unemployment and Real Wage Rigidity in Germany*. Kieler Studien 301. Tübingen: Mohr Siebeck.

- Richardson, J.D. (1995). Income Inequality and Trade: How to Think, What to Conclude. *Journal of Economic Perspectives* 9 (3): 33–55.
- Sachs, J.D., and H.J. Shatz (1996). US Trade with Developing Countries and Wage Inequality. *American Economic Review* 86 (2): 234–239.
- Schimmelpfennig, A. (2000). *Structural Change of the Production Process and Unemployment in Germany*. Kieler Studien 307. Tübingen: Mohr Siebeck.
- Siebert, H. (2003). The Failure of the German Labor Market. Kiel Working Paper 1169. Kiel Institute for World Economics, Kiel.
- Siebert, H., and J. Stehn (1999). Internationaler Handel, dynamischer Wettbewerb und nationale Beschäftigungsstruktur: Eine Bestandsaufnahme für Deutschland. *Ifo Studien* 45 (4): 729–740.
- Snower, D.J. (1994). Converting Unemployment Benefits Into Employment Subsidies. *American Economic Review* 84 (2): 65–70.
- Snower, D.J. (1997). Evaluating Unemployment Policies: What Do the Underlying Theories Tell Us? In D. J. Snower and G. de la Dehesa Romero (eds.), *Unemployment Policy: Government Options for the Labour Market*. Cambridge: Cambridge University Press.
- Statistisches Bundesamt (various issues). *Fachserie 16: Löhne und Gehälter. Reihe 2.3: Arbeitnehmerverdienste im Produzierenden Gewerbe, Handel, Kredit- und Versicherungsgewerbe*. Stuttgart.
- Statistisches Bundesamt (various issues). *Fachserie 17: Preise. Reihe 2: Preise und Preisindizes für gewerbliche Produkte (Erzeugerpreise)*. Stuttgart.
- Statistisches Bundesamt (various issues). *Fachserie 17: Preise. Reihe 8: Preisindizes für die Ein- und Ausfuhr*. Stuttgart.
- Statistisches Bundesamt (various issues). *Fachserie 18: Volkswirtschaftliche Gesamtrechnungen. Reihe 1: Konten und Standardtabellen*. Stuttgart.

- Stehn, Jürgen (2000). Internationaler Handel und Beschäftigung: Eine theoretische und empirische Analyse für Deutschland. *RWI-Mitteilungen* 51 (3/4): 271–288.
- Steiner, V., and D. Moch (1997). Relative Earnings and the Demand for Unskilled Labor in West German Manufacturing. ZEW Discussion Paper 97-17. Zentrum für Europäische Wirtschaftsforschung, Mannheim.
- Wood, A.P. (1995). How Trade Hurt Unskilled Workers. *Journal of Economic Perspectives* 9 (3): 57–80.

FIGURE 1
Interindustry Trade and Relative Goods Prices

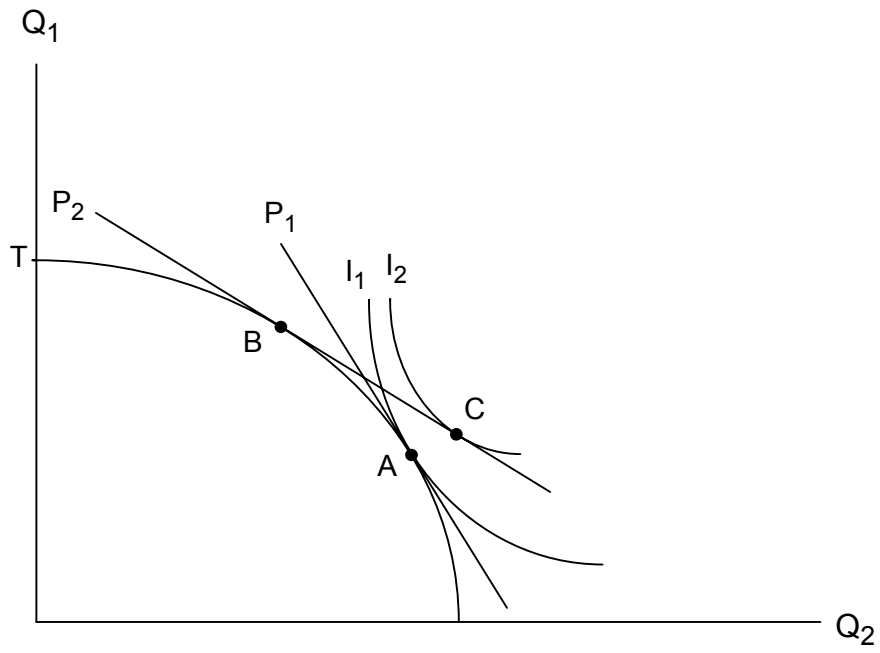


FIGURE 2
External Shocks, Labour Market Adjustment, and Employment

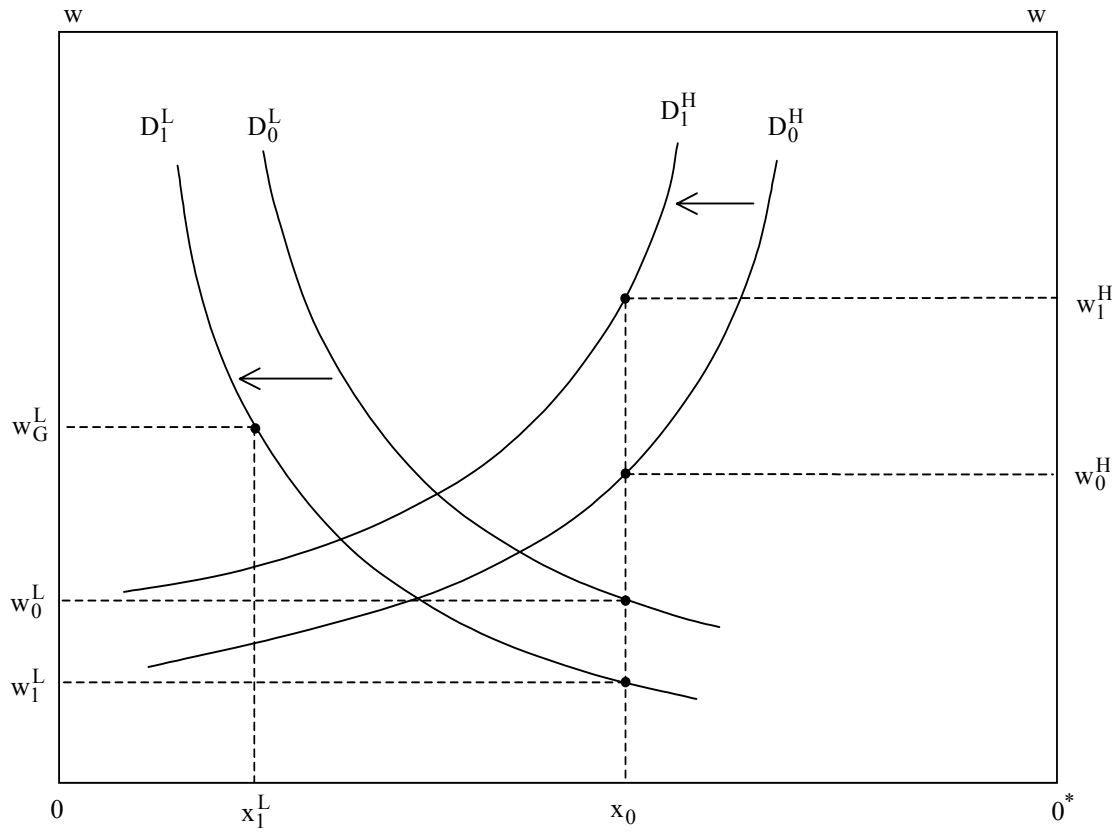
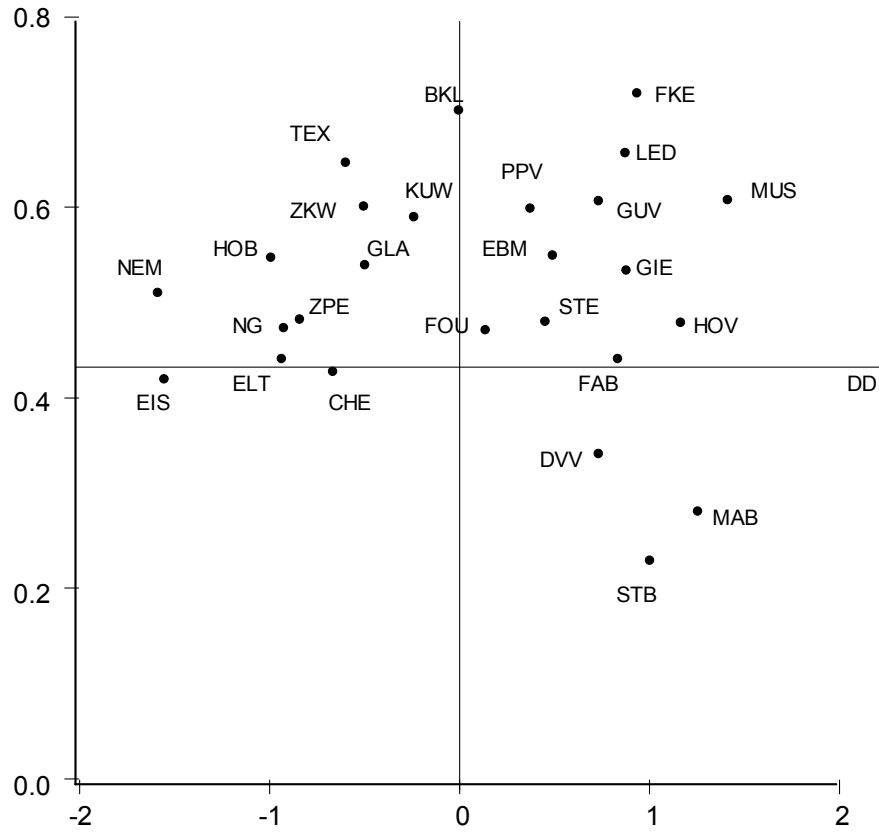


FIGURE 3

Share of low-skilled Employees and Changes in Supplier Prices in German Manufacturing Industries 1970–1995



Source: See Table 1. Statistisches Bundesamt, Fachserie 16, Reihe 2 (various issues). Authors' calculations.

FIGURE 4

Relative Employment and Relative Wage of low-skilled Employees in German Manufacturing Industries 1970–1995



^a compared to high-skilled employees

Source: Statistisches Bundesamt, Fachserie 16, Reihe 2 (various issues). Authors' calculations.

TABLE 1
Trend in Relative Prices in German Manufacturing Industries 1970–1995^a

<i>Industry</i>	<i>Import Prices</i>	<i>Supplier Prices</i>	<i>Value-added Prices</i>	<i>Export Prices</i>
Intermediate Goods	−0.07 (−0.20)	−0.23 (−1.27)	−0.12 (−1.95 ⁺)	−0.70 (−3.57 ^{**})
Petroleum Refining	0.49 (0.28)	1.02 (1.58)	2.88 (7.00 ^{**})	0.51 (0.31)
Stone Goods	1.31 (9.46 ^{**})	0.46 (2.89 ^{**})	−0.26 (−0.84)	0.34 (6.47 ^{**})
Iron and Steel	−0.76 (−5.66 ^{**})	−1.55 (−10.16 ^{**})	−2.51 (−5.15 ^{**})	−1.38 (−6.11 ^{**})
Non-metallic Mineral Products	−0.41 (−1.04)	−1.59 (−4.47 ^{**})	−1.27 (−2.19 [*])	−1.39 (−4.60 ^{**})
Foundries	−0.68 (−1.91 ⁺)	0.88 (13.48 ^{**})	0.71 (5.76 ^{**})	−0.54 (−3.32 ^{**})
Drawing Mills, Cold rolling Mills	−0.65 (−6.62 ^{**})	−0.50 (−4.18 ^{**})	−0.37 (−6.23 ^{**})	−1.30 (−8.90 ^{**})
Chemical Goods	−0.17 (−1.28)	−0.66 (−4.20 ^{**})	−1.38 (−9.15 ^{**})	−0.60 (−4.88 ^{**})
Wood	0.27 (1.86 ⁺)	−0.99 (−6.00 ^{**})	−1.23 (−4.16 ^{**})	0.44 (0.99)
Pulp, Paper, Paperboard	−0.02 (−0.07)	−0.92 (−2.74 ^{**})	−1.36 (−3.25 ^{**})	−0.66 (−2.39 ^{**})
Foundries	−0.30 (−1.36)	0.74 (4.23 ^{**})	0.18 (1.07)	−0.68 (−6.41 ^{**})
Investment Goods	−0.13 (−0.42)	0.30 (3.65 ^{**})	0.06 (0.96)	0.41 (5.01 ^{**})
Metal Products	1.18 (5.22 ^{**})	1.01 (10.22 ^{**})	0.89 (6.41 ^{**})	1.00 (9.97 ^{**})
Machinery	1.13 (4.57 ^{**})	1.26 (19.41 ^{**})	1.30 (27.08 ^{**})	1.17 (10.41 ^{**})
Road Vehicles	0.62 (1.82 ⁺)	0.84 (9.54 ^{**})	0.29 (3.89 ^{**})	0.81 (11.94 ^{**})
Shipbuilding	.	.	0.43 (2.07 ^{**})	.
Aircraft, Aerospace	.	.	0.61 (1.46)	.
Electrical Engineering	−1.13 (−3.19 ^{**})	−0.93 (−6.55 ^{**})	−1.45 (−22.34 ^{**})	−0.74 (−4.36 ^{**})

Precision Mechanics, Optics	-0.89 (-2.97**)	0.14 (1.14)	0.03 (0.44)	0.30 (1.85 ⁺)
Mechanical Engineering	0.33 (1.25)	0.50 (13.39**)	0.34 (8.08**)	0.84 (14.55**)
Office Machines, Data Processing Equipment	-2.79 (-4.04**)	-4.43 (-19.21**)	-8.23 (-22.03**)	-5.09 (-36.03**)
Consumer Goods	0.29 (2.63**)	0.25 (4.65**)	0.11 (2.58*)	0.01 (0.10)
Musical Instruments, Toys	2.56 (9.66**)	1.42 (7.53**)	1.17 (3.99**)	0.52 (1.64)
Precision Ceramics	1.13 (3.48**)	0.94 (10.24**)	0.97 (16.75**)	1.59 (14.33**)
Glass Products	0.06 (0.28)	-0.50 (-8.75**)	-1.52 (-26.53**)	-0.04 (-0.25)
Wood Products	1.03 (7.57**)	1.17 (7.24**)	1.58 (10.58**)	1.14 (4.78**)
Paper and Paperboard Products	-0.25 (-2.42*)	0.38 (3.83**)	0.39 (5.32**)	-0.10 (-1.40)
Printing Products	0.21 (1.00)	0.74 (15.96**)	0.56 (11.80**)	0.88 (15.85**)
Plastic Products	-0.61 (-3.33**)	-0.24 (-3.45**)	-0.78 (-4.93**)	-0.61 (-9.58**)
Leather Products, Footwear	1.08 (6.12**)	0.88 (12.46**)	0.66 (4.83**)	0.66 (7.16**)
Textiles	-0.25 (-1.81 ⁺)	-0.60 (-6.86**)	-1.32 (-19.96**)	-0.94 (-5.43**)
Wearing Apparel	0.04 (0.28)	0.11 (0.95)	-0.25 (-13.84**)	0.53 (3.41**)
Food, Beverages, Tobacco	-1.27 (-7.59**)	-0.84 (-13.59**)	0.30 (2.10*)	-1.21 (-10.94**)

Note:

^a Estimation coefficients expressed as percentage points a year. The entire regression equations can be obtained on request from the authors. Autocorrelation consistent t-values according to Newey-West are given in brackets. ⁺, *, ** indicates the significance of the coefficients at the 10-, 5-, 1-percent level, respectively.

Source: Statistisches Bundesamt, Fachserie 17, Reihe 2 and Reihe 8 (various issues). Statistisches Bundesamt, Fachserie 18, Reihe 1 (various issues). Authors' calculations.

TABLE 2
Skill Composition^a and Price Trends^b in German Manufacturing Industries 1970–1995 (Partial Correlation Coefficients)

	<i>IMP</i>	<i>SP</i>	<i>VAP</i>	<i>EXP</i>
SHLE70	−0.232	−0.288	−0.303	−0.342 ⁺
SHLE75	−0.096	−0.132	−0.136	−0.209
SHLE80	−0.064	−0.078	−0.087	−0.137
SHLE85	−0.007	−0.034	−0.045	−0.102
SHLE90	0.013	0.037	0.042	−0.080
SHLE95	0.036	0.039	0.073	−0.054

Notes:

^a Measured as share of low-skilled employees (SHLE) in total employment.

^b IMP: trend in import prices; SP: trend in supplier prices; VAP: trend in value-added prices; EXP: trend in export prices.

⁺ indicates that the coefficient is statistically significant at the 10-percent level.

Source: See Table 1 and Figure 2. Authors' calculations.

TABLE 3
Skill Composition and Effective Protection in German Manufacturing Industries 1985
(Regression Results)^a

<i>Endogenous Variable^b</i>	<i>Constant</i>	<i>Exogenous Variables^c</i>			\bar{R}^2	<i>F-Test</i>	<i>Jarque-Bera-Test</i>	<i>White-Test</i>	
EFFPRO85	2,14 (0,69) [0,53]	13,81 (2,25*) [1,67]	SHLE85		0,13	5,07*	3,71 ^d	7,64 ^e	
EFFPRO85	−1,55 (−0,49) [−0,54]	20,53 (3,30**) [3,13**]	SHLE85	13,07 (2,49*) [6,34**]	DUMLRB	0,28	6,14*	2,42 ^d	8,66 ^e

Notes:

^a cross section analysis; t-values are given in () brackets, heteroskedasticity consistent t-values according to White in [] brackets; *, ** indicates the 5- and 1-percent significance level, respectively.

^b EFFPRO: effective protection rate.

^c SHLE: share of low-skilled employees in total employment. DUMLRB: dummy variable (aircraft and aerospace = 1).

^d The residuals of the estimation function are normally distributed.

^e The residuals of the estimation function are heteroskedastic.

Source: Statistisches Bundesamt, Fachserie 16, Reihe 2 (various issues). Heitger and Stehn (1990). Authors' calculations.

TABLE 4
Determinants of Relative Demand for low-skilled Employees in German Manufacturing
Industries 1970–1995^a

<i>Exogenous Variables</i>	<i>Estimation Coefficient</i>	<i>t-Test</i>
Relative Wage of low-skilled Workers ^b	-1,4052	(-6,46**)
Fixed Effects		
Cross-section Specific Effects ('Technical Change')		
Petroleum Refining	-0,0415	(-20,30**)
Stone Goods	-0,0112	(-5,65**)
Iron and Steel	-0,0445	(-22,36**)
Non-metallic Mineral Products	-0,0168	(-8,40**)
Foundries	-0,0163	(-8,16**)
Drawing Mills, Cold rolling Mills	-0,0191	(-9,31**)
Chemical Goods	-0,0257	(-12,93**)
Wood	-0,0074	(-3,71**)
Pulp, Paper, Paperboard	-0,0194	(-8,92**)
Rubber Goods	0,0141	(6,80**)
Metal Products	-0,0219	(-10,78**)
Machinery	-0,0238	(-11,55**)
Road Vehicles	0,0084	(4,01**)
Shipbuilding	-0,0383	(-18,12**)
Aircraft, Aerospace	-0,0449	(-20,15**)
Electronical Engineering	-0,0151	(-7,16**)
Precision Mechanics, Optics	-0,0123	(-5,71**)
Mechanical Engineering	-0,0137	(-6,57**)
Office Machines, Data Processing Equipment	-0,0184	(-7,12**)
Musical Instruments, Toys	-0,0006	(-0,25)
Precision Ceramics	0,0085	(4,08**)
Glass Products	-0,0191	(-9,50**)
Wood Products	0,0118	(5,43**)
Paper and Paperboard Products	-0,0174	(-7,93**)
Printing Products	0,0030	(1,38)
Plastic Products	-0,0134	(-6,45**)
Leather Products, Footwear	0,0074	(3,66**)
Textiles	-0,0055	(-2,65**)
Wearing Apparel	-0,0007	(-0,31)
Food, Beverages, Tobacco	-0,0064	(-3,16**)
N	776	
\bar{R}^2	0,99	
F-Test	2477,25**	

Notes:

^a Panel analysis including cross-section specific effects ('technological change'). Endogenous Variable: relative employment of low-skilled employees compared to high-skilled employees; ** indicates the 1-percent significance level.

^b Measured as share of wages of low-skilled employees in wages of high-skilled employees.

Source: Statistisches Bundesamt, Fachserie 16, Reihe 2 (various issues). DIW (1995). Authors' calculations.