

Factor prices, employment and capital stock in Germany: results of a simulation study

This article examines long-run trends in quantity and price changes in the production factors labour and capital for the period 1970 to 2000. Based on national accounts data, it first describes the growth contributions of the two factors. Next, the different effects of wage cost pressure (including the government levy burden) over time are analysed using a simulation. For the 1970s, in particular, evidence is found that an expansionary wage policy, entailing initially moderate employment losses, may influence the functional distribution of income in the short run in favour of the factor labour. In the longer run, however, the employment situation deteriorated in the wake of slackening capital formation (caused not least by wage policy) and a growing capital intensity, and income distribution was readjusted in favour of the factor capital. A similar (albeit less pronounced) pendulum pattern is evident for Germany as a whole since reunification. The inverse implication of these findings is that the sustained pursuit of a moderate wage policy, as has been initiated in the past few years, can lead to a lasting improvement in employment prospects.

Aim of the study and main findings

The labour market in Germany continues to be characterised by a high level of structural unemployment. A look at the long-run deter-

*High structural
unemployment*

minants of wage and employment developments over the past few decades shows that in western Germany between 1970 and 2000, as also in Germany as a whole from 1991 onwards, unemployment increased step-wise, amid cyclical fluctuations, to an ever-higher plateau. A salient feature is the marked rigidity with which unemployment largely persists even after a recession has been overcome. Various approaches to explaining this "persistence phenomenon" have been developed in the literature. Labour economists place particular emphasis on the so-called "insider-outsider problem" on the labour market. Put simply, this means that people still in jobs following a cyclical fall in employment are usually not prepared to orient their wage demands sufficiently to the employment interests of the unemployed. This insider-outsider dichotomy is further reinforced if a spell of unemployment leads to skill losses which, given unchanged wage structures, hamper the reintegration of the long-term unemployed, in particular, into the employment process.¹

Feedback effects between labour and capital

This article examines the systematic feedback effects between the factors labour and capital as an additional source of persistent unemployment. This requires an analytical framework which distinguishes between short-run and long-run effects of wage policy. It can draw on studies which do not analyse the effects of wage policy solely in relation to the labour market. Instead, these studies take it as read that the two key macroeconomic production factors labour and capital are interrelated. Whereas in the short run an economy's capital stock is largely constant, in

the long run it is the more flexible and more mobile factor which, via the choice of technologies deployed, has a major influence on the employment prospects of labour. Not least for this reason the wage formation in the labour market is of particular importance. In particular, owing to the inherent nature of the interaction between the two production factors, the short-run effects of wage policy may turn out to be different from its long-run effects, with the speed of the adjustment dynamics being determined by technological and economic factors.²

Weak capital formation can be explained to a large extent as a lagged response to phases of strong wage pressure. Such phases can be identified, in particular, for the 1970s and the first half of the 1990s. Owing to the feedback effect between the two factors, however, the resulting employment losses were not confined to those periods. The phase of restrained wage settlements notably in the 1980s shows that an employment-oriented wage policy requires a long-term orientation

Empirical findings

¹ Classical contributions to this problem are, in particular, Blanchard, O. and L. Summers, Hysteresis and the European unemployment problem, NBER Macroeconomics Annual, 15–78, 1986; Pissarides, C., Loss of skills during unemployment and the persistence of unemployment shocks, Quarterly Journal of Economics, 107, 1371–91, 1992.

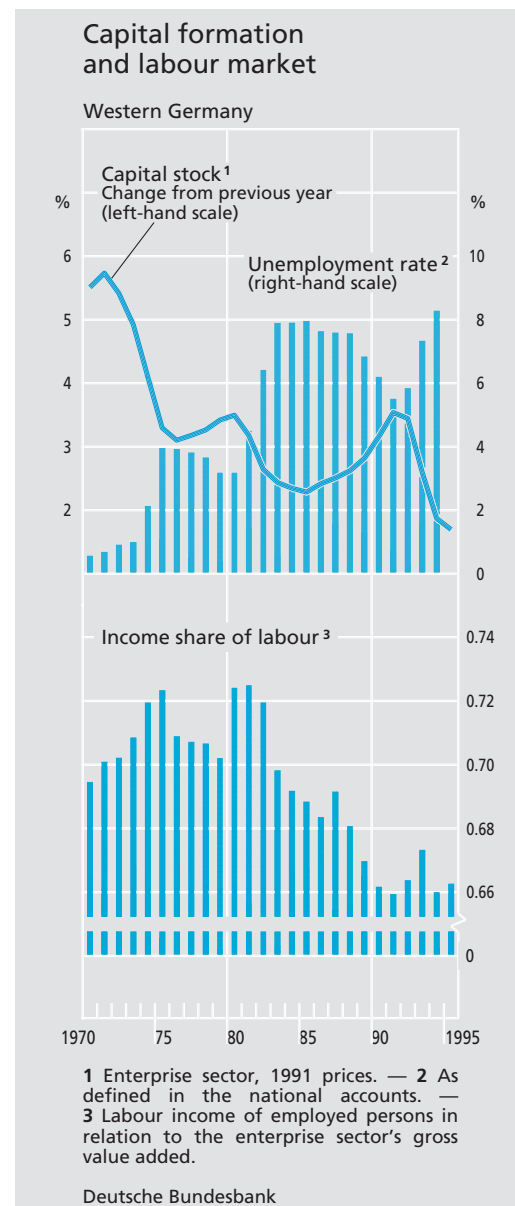
² A dynamic equilibrium analysis in this sense, together with a detailed discussion of the literature, can be found in: Kaas, L. and L.v. Thadden, Unemployment, factor substitution, and capital formation, Economic Research Centre of the Deutsche Bundesbank, Discussion Paper 01/01. Key articles in the literature are, in particular, Blanchard, O., The medium run, Brookings Papers on Economic Activity, 2, 89–158, 1997; Blanchard, O., Revisiting European unemployment: unemployment, capital accumulation and factor prices, NBER Working Paper, 6566, 1998; Caballero, R. and M. Hammour, Jobless growth: appropriability, factor substitution and unemployment, Carnegie-Rochester Conference Series on Public Policy, 48, 51–94, 1998.

and must be credibly anchored. If, by adopting such a stance, expectations regarding future factor price developments can be stabilised, the long-run employment gains of a restrained wage policy should be far superior to those of a “stop-and-go” policy which runs the risk of never reaping the rewards of its continuously interrupted efforts.

In addition, the study confirms for Germany a finding that has also been ascertained for other continental European countries, namely that since the 1980s a structural shift has been evident regarding the quantity and price ratios of labour and capital which has led to a greater capital intensity of production.³ A key explanation for this finding could be that, as the German economy is becoming more and more embedded within the European and global division of labour, labour-intensive activities have been transferred increasingly to other countries. Wage policy makers should take account of this development by permitting a wider wage spread that is more in line with productivity differences. In the case of unskilled jobs, in particular, they should ensure that a system of wage formation more strongly geared to productivity is harmonised with the level of unemployment benefits in such a way that gives unemployed people an incentive to take up work.

Real product wage

The relevant wage measure in this connection is the real product wage. As far as the employment effects are concerned, it is irrelevant whether the wage pressure results from a heavier burden of government taxes and social security contributions on labour or from higher net wages.⁴ Hence it is not only



wage bargainers but also government levy policy that is responsible for the extent of the wage pressure. “Real” in this context refers to firms’ selling prices net of indirect tax burdens. The consumer price index is not a suit-

³ See especially Blanchard (1997, 1998).

⁴ A detailed discussion of the interaction between levy-induced wage increases, capital formation and economic growth in a cross-country comparison can be found in: Daveri, F. and G. Tabellini, Unemployment and taxes, *Economic Policy*, 30, 49–104, 2000.

able deflator for this purpose since it is based on a different basket of goods and reflects not only domestic, "home-made" price developments but also external influences, especially fluctuations in import prices.

Production factors and factor prices from a long-run perspective

Data basis and sectoral definition

The empirical results for the period 1970 to 2000 discussed below relate to the enterprise sector on the basis of national accounts data. A long-run analysis stretching back beyond 1990 encounters unavoidable methodological problems caused by the unification-related statistical breaks in the time series for 1990 and 1991. Another point to bear in mind is that the figures for Germany as a whole from 1991 onwards are based on the new ESA 95 classification system, whereas a consistent data set for western Germany is available only up to the year 1995 on the conceptual and classificatory basis of ESA 79. These two factors lead to considerable "disruptions" in the time series. This study therefore follows a two-step approach: first, it analyses west German conditions for the period 1970 to 1995 and then widens to a pan-German view for the period 1991 to 2000. In order to constrain the results to market-based processes, the peculiarities of the two sectors "government" and "housing (including owner-occupied housing)" are disregarded as far as possible. The data material therefore comprises the enterprise sector excluding housing.

The role which the production factors play in the creation of value added at the aggregate level and how, in particular, the factor quantity ratio has shifted over time can be shown for the period 1970 to 1995 using a simple growth accounting exercise. Such growth accounting is routinely employed in order to attribute changes in the aggregate value added (output) to changes in the quantities of the two production factors labour and capital or to "explain" them via the so-called total factor productivity. The latter describes economic growth achieved at a constant input level of the production factors labour and capital and is thus a measure of technical progress (for a detailed explanation see the box on page 56).

Decomposition of output growth

The output variable that is to be explained itself shows a marked cyclical movement during the period under review. Starting from high growth rates in the early 1970s, the development of output then reflects the recessions which followed the two oil price crises (with a significant recovery in between), the robust upturn in the second half of the 1980s which, buoyed by the reunification of Germany, extended until 1991, and the subsequent downturn in 1992/93. Over the entire observation period, output grew at an average annual rate of 2.3% amid a declining overall growth trend.

Output growth

For proxying the relative contribution to output of the factor capital measured over a year, it is assumed for the sake of simplicity that this has a fixed relationship to the capital stock.⁵ On this assumption the production-

Contribution of the factor capital

⁵ See box on page 56.

related growth rate of the capital stock, and hence the assumed growth rate of the services of capital, amounted to an annual average of 3.2 %. The dynamics of capital formation over the observation period show a noticeable decline. Thus despite a temporary recovery in the late 1980s and early 1990s, the rate of capital accumulation tended to decline throughout the period under review.⁶

*Contribution
of the factor
labour*

The labour input into the production process is measured by the total hours worked per year in the enterprise sector. Except for a brief recovery phase from 1988 to 1992, total hours worked declined in absolute terms throughout the observation period. The reduction averaged 0.9 % per year. It should be noted that the number of employed persons remained virtually constant on average during the whole of the observation period. Hence the fall in the total hours worked is attributable more or less entirely to a reduction in the average hours worked by each employed person.

*Results of the
growth decom-
position*

The divergent evolution of the two inputs in the form of a growing capital stock and a declining total of hours worked – in relation to western Germany for reasons of data availability – leads to marked differences in the average annual growth contributions of the two factors in the period 1970 to 1995.⁷ Whereas roughly 1 percentage point of the average annual output change of 2.3 % may be attributed to the factor capital, the contribution of the factor labour was a negative – 0.6 percentage point. The growth analysis implies that the large residual amount of almost 2 percentage points on average was

due to total factor productivity. These high values for the rate of total factor productivity and the negative growth contribution of labour result largely from the explicit definition of the labour input as total hours worked and diverge from studies which instead use the number of employed persons as the measure of labour input. Under that alternative approach, the growth contribution of labour works out at more or less zero, whereas total factor productivity falls to an annual average of 1.3 percentage points. From a theoretical point of view, however, measuring the labour input as total hours worked is a more suitable indicator because a view based only on the number of employed persons does not capture changes in working time and therefore tends to underestimate total factor productivity in phases of reduced working time, which are typical of the observation period.⁸

The fact that the arithmetical growth contribution of labour turns out to be negative throughout the long period under review *per se* does not yield any clear-cut welfare implications. Thus the reduction of working time may lead to desirable gains in leisure time which have to be offset against the market income losses. Furthermore, a negative growth contribution of labour would be unsurprising in connection with a contracting labour force.

*Role of reduced
working time*

⁶ For a detailed account see Deutsche Bundesbank, Trends in and structure of the overall capital stock, Monthly Report, November 1998, pages 25–37.

⁷ For the computation see the box on page 56.

⁸ Qualitative changes in the factor labour are disregarded under this approach. See the box on page 56.

Solow decomposition of output growth

The growth model commented on in the text was based on the following formula where $\Delta X_t/X_{t-1}$ is the rate of change of variable X in year t from the previous year:

$$(1) \quad \frac{\Delta Y_t}{Y_{t-1}} = \alpha_t \cdot \frac{\Delta K_t}{K_{t-1}} + (1 - \alpha_t) \cdot \frac{\Delta H_t}{H_{t-1}} + \frac{\Delta G_t}{G_{t-1}}$$

The calculation relates to data on the enterprise sector excluding housing.¹ The variable Y stands for the real gross value added at constant 1991 prices. The capital stock K is computed as an annual average value of gross fixed capital formation at constant 1991 prices, i. e. it is defined as the total fixed assets used in production, excluding land and inventories. Gross fixed capital formation is calculated according to the perpetual inventory approach, which uses long investment series as well as data on the estimated useful life of fixed assets. Unlike the net concept of measuring the capital stock, the assets' economic wear and tear is not deducted continuously as consumption of fixed capital. Instead, assets are valued as new up to the end of their estimated useful life.

The variable H stands for total hours worked using data from the *Institut für Arbeitsmarkt- und Berufsforschung* (Institute for Employment Research). Using a broad measure of labour costs, the income share of labour $1 - \alpha$ comprises not only employee compensation but also an implied labour income for self-employed persons. This implied figure is cal-

culated on the basis of the employee hourly wage rate. As the capital stock is computed from data on gross fixed capital formation, the income share of labour is related to the gross value added by the enterprise sector and not (as is customary for computing the relative share of wages or employee compensation) to national income. The growth rate of the variable G , which is known as the Solow residual or the change in total factor productivity, denotes the autonomous share of output growth that cannot be attributed to changes in the input volumes.

As the cyclically fluctuating degree of capacity utilisation, especially of the capital stock, is not explicitly modelled, the Solow residual displays a strongly cyclical behaviour. For the values which particularly interest us here – i. e. the average growth contributions of the two inputs and of total factor productivity – this approach is not a great problem, however.² Even when adjusted for cyclical effects, trend estimates of total factor productivity cannot be readily interpreted as a measure of (non-observable) technical progress. Hence the growth accounting according to equation (1) is exact only if constant returns to scale in the aggregate production function and price-taking behaviour are specified.³ Moreover, within the framework of a micro-study it would also be necessary to take account of the qualitative changes in the factor inputs.⁴

1 The enterprise sector comprises all economic sectors other than "general government, households, non-profit institutions serving households". — 2 A substantiated method of determining the trend of total factor productivity is contained, for example, in Roeger (1994) who, in a capital vintage approach, uses the average age of the capital stock to determine the trend: Roeger, W., Total factor productivity in West German manufacturing, Is there investment-induced technical progress?, *Allgemeines Statistisches Archiv*, 78, 251–61, 1994. — 3 For further details see Jorgenson, D. and Z. Griliches, The explanation of productivity change, *Review of Economic Studies*, 34, 249–280, 1967; Hall, R., Invariance properties of Solow's productivity residual, in P. Diamond (ed.), *Growth, productivity, unemployment*, MIT Press, 1990; Barro, R., Notes on growth

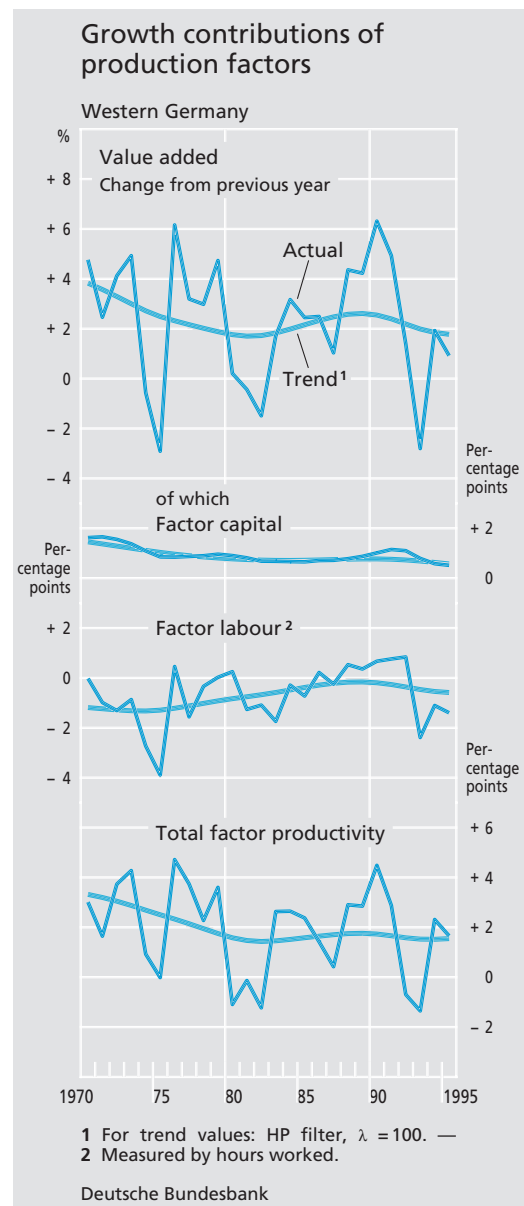
accounting, *Journal of Economic Growth*, 4, 119–37, 1999. — 4 This needs to be borne in mind especially in the case of level comparisons using results from more microbased studies of the US Bureau of Labor Statistics. For a detailed analysis which attempts to take account of the changes in the skills level of the factor labour, see the cross-country study O'Mahony, M., Britain's productivity performance 1950 – 1996, An International perspective, NIESR, 1999. For Germany for the period 1973 to 1995, using conventional growth accounting, O'Mahony initially calculates an average growth rate for total factor productivity of 1.7%. She subsequently shows that this variable turns out to be somewhat smaller if quality adjustments in the factor labour are included.

*Evolution of
unemployment*

In fact, however, the number of employed persons in western Germany rose by around 4 million between 1970 and 1995, with an average annual increase of 0.6%. Unemployment increased over the same period step-wise, with the level rising sharply after each of the two oil price crises. Starting from an unemployment rate (as defined in the national accounts) of 0.6% in 1970, the jobless rate had risen to over 8% by the mid-1990s. This shows that the labour market has been subject to serious disruptions since the early 1970s.⁹

*Interaction
between wage
policy and
capital
formation*

If this result is combined with the finding of a slackening rate of capital formation, it seems likely that the functional disruptions on the labour market had repercussions on the factor capital. In the early 1970s, in particular, wage policy took insufficient account of the decelerating rate of productivity growth. The excessive wage increases compared with the productivity gains were partly to blame for the failure to achieve full employment. This was accompanied by a decline in the real rate of return on capital, which was amplified by the oil price shock. This had a dampening effect on capital accumulation and, via the complementarity of the two factors in the production process, the weaker propensity to invest exacerbated the employment situation. This is a prime illustration of the fact that the capital stock, as an endogenous variable, is a major entrepreneurial adjustment parameter. Thus the correction of the ratio of factor prices following a steep rise in wages normally results in a reduced supply of capital. This reinforces the decline in employment triggered by the original wage shock.

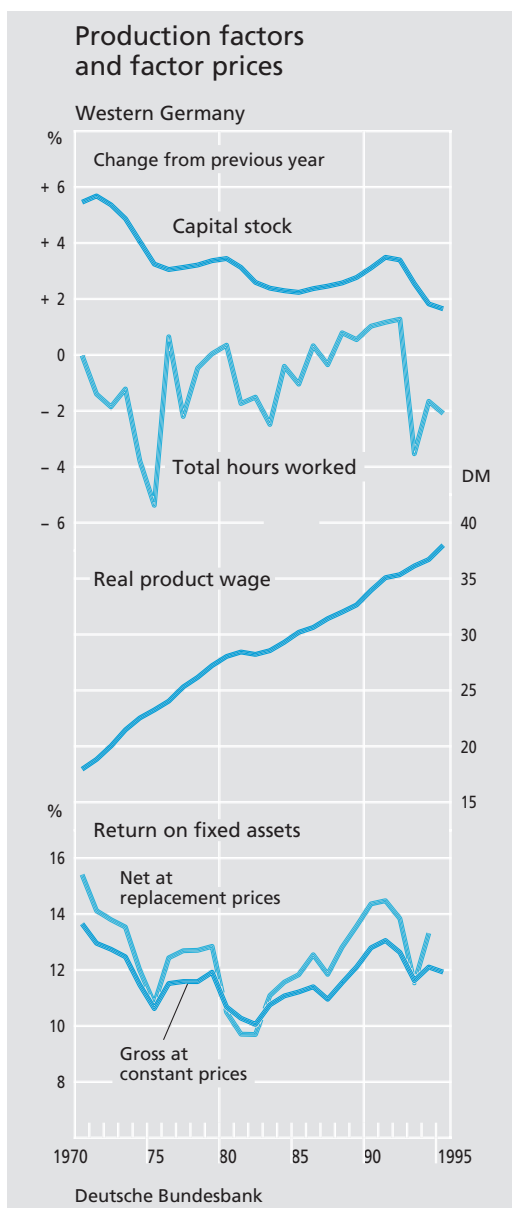


Results of a simulation study

The “induced capital shortage” following a steep increase in wage costs is largely caused by a preceding shift in relative factor prices – this is shown by a simulation study carried out by the Bundesbank (see the box on pages 60–61). The starting point of the study is the

Approach

⁹ See, for example, Franz, W., *Arbeitsmarktökonomik*, 4th edition, 1999, chapter 9.



real product wage (based on total hours worked).¹⁰ As a useful complement to this, a simple return on fixed capital may be computed which calculates the rate of return on the capital stock as that part of income which does not accrue to the factor labour. This return variable displays a conspicuous U shape: in 1990/91, following a low in 1982, it more or less regains its initial level of 1970. This pattern holds regardless of whether, as in this

case, one measures gross fixed capital formation and values the capital stock at constant prices or whether, alternatively, the study is based on replacement prices and a net concept of capital formation in which the returns and the capital stock are adjusted for the consumption of fixed capital.¹¹

Unlike the return on capital, the real wage on a long-run view is typically a growing variable and therefore has no natural reference value. To further explore the interaction between factor prices and factor quantities, therefore, a simple trend adjustment is made – in line with general practice – which takes account of technical progress. In addition, a labour market equilibrium is simulated which provides insights into changes in wage-setting behaviour and in labour demand.

As explained in greater detail in the box on pages 60 and 61, the analysis of relative factor prices in the first half of the observation period 1970 to 1995 reveals clear evidence of a relative increase in the cost of labour caused mainly by a persistent wage shock. In the short run the employment level reacts more quickly than the sluggish capital stock. In the

Western
Germany:
1970 to 1995

¹⁰ For details see Deutsche Bundesbank, Determinants and macroeconomic significance of product wage and consumption wage, Monthly Report, July 2000, pages 15–27.

¹¹ In its calculation of the rate of return on capital, the German Council of Economic Experts (*Sachverständigenrat*) values the net capital stock, including inventories, at purchase or manufacturing prices. The finding of a U-shaped evolution of the rate of return holds for this approach, too. However, attempting to capture entrepreneurs' propensity to invest using aggregated national accounts data has certain limitations. In particular, the *ex post* perspective presented by the national accounts data can only very roughly capture entrepreneurs' expected rate of return, which normally underlies investment decisions.

interaction between the relative factor price effect and the reaction of factor quantities, the income share of labour in the gross value added nevertheless increases initially, i. e. the expansionary real wage effect at first outweighs the negative employment effect. Thus in the early 1980s the income share of labour was around 3 percentage points higher than in 1970.

Owing to capital formation adjustment processes, however, this situation did not persist. In 1990 the factor price ratio was again almost at the same level as in the reference year 1970, and the income share of labour fell distinctly below the level of 1970.¹² The ratio of factor quantities did not fully match the downward movement of the factor price ratio during the 1980s. The labour market simulation implies rather that from the mid-1980s – in the sense of a negative labour demand shock – entrepreneurs resorted systematically to more capital-intensive technologies. As can be seen from the scatter plot on page 61, the previously stable correspondence between the ratios of factor prices and quantities shifted, with the result that a higher capital intensity becomes apparent for a given relative factor price relation.¹³

This move towards increased capital intensity placed greater demands on a successful wage policy measured by an employment target. The fall in the income share of labour during the 1980s shows that wage policy makers were prepared to allow increases in the real product wage which were lower than the average growth of labour productivity (per hour worked by each employed person). But

it was not until the end of the 1980s that this wage restraint led to a certain easing of tension on the labour market. However, at the start of the 1990s a new phase of strong wage pressure began, which again worsened the situation on the labour market.

The simulation results for the west German enterprise sector and labour market from 1970 to 1995 cannot simply be expanded to reunified Germany between 1991 and 2000. Despite the unification-related exceptional developments and statistical-methodological problems¹⁴, however, an attempt is made in the following to qualitatively augment the above analysis by some tendencies for Germany as a whole.¹⁵

In contrast to the strong upturn in the second half of the 1980s, which was robustly extended for a time by unification, the period 1991 to 2000 as a whole is characterised by a ra-

*Germany as a whole:
1991 to 2000*

Output growth and capital formation

¹² This finding holds even if, as an alternative measure of income distribution, one considers the labour income ratio computed by the German Council of Economic Experts. Corresponding calculations are contained in its 1998/99 Annual Report, page 289 (German version).

¹³ This shifts remains, albeit in a weaker form, if the factor quantity ratio of the current period is captured as a function of lagged factor prices of previous periods.

¹⁴ For example, according to the revised figures from autumn 2000, the number of employed persons in Germany in 1991 was over 5% higher than originally suggested, amid a largely constant aggregate value added. This effect, which ensues mainly from the greater inclusion of low-paid part-time workers, should be distinguished from the unification-induced change in the number of employed persons. Owing to a reduction in the number of hours worked per employed person, the increase in the total hours worked is smaller, at just over 3%. See also Deutsche Bundesbank, Revision of employment figures, Monthly Report, November 2000, page 36; Der Arbeitsmarkt im Jahr 2001, IAB Kurzbericht, No. 1, 2001.

¹⁵ This pan-German analysis is based on macroeconomic data which, in the definition of the new standard industrial classification system, exclude the contributions of "Community, social and personal services" and "Real estate services".

Labour market and neo-classical growth equilibrium – analytical framework and simulation results –

Assume that the aggregate output Y in a representative period t may be described as follows:

$$(1) \quad Y_t = F(K_t, A_t H_t), \quad \text{with: } A_{t+1}/A_t = 1+g = \text{const.}$$

In equation (1) K denotes the aggregate capital stock and H the labour input (measured as the total hours worked). It is assumed that technical progress occurs exogenously at a constant rate g and is labour-augmenting. The expression AH accordingly measures total hours worked in efficiency units. The production function $F(\cdot, \cdot)$ is subject to constant returns to scale. To be able to describe the long-run growth equilibrium using stationary variables, the capital stock and output are related to labour in efficiency units, with: $k = K/AH$ and $y = Y/AH = F(K/AH, 1) = f(k)$. The individual firm is assumed to act as a price-taker and for a given real wage w (on an hourly basis) chooses the desired labour input in line with its labour demand curve. Assume wages are formed through collective bargaining between trade unions and employer federations but are taken by the individual producers as given. The assumption of constant returns to scale implies that the following holds for the real wage w^{EU} (in efficiency units) and the gross rate of return on capital r :

$$(2) \quad w_t^{EU} = w_t/A_t = f(k_t) - r_t k_t = w_t^{EU}(k_t), \quad r_t = f'(k_t)$$

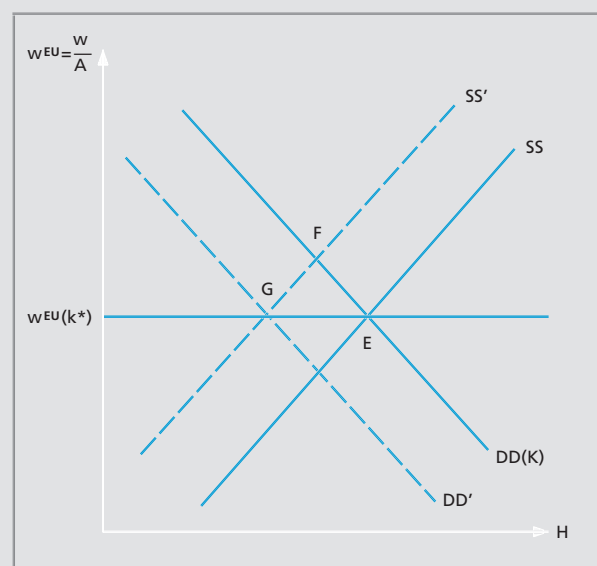
Equation (2) says that the factor prices cannot be chosen independently of one another and that the ratio of factor quantities (k) is rather a rising function of the ratio of factor prices (w^{EU}/r) at an initially undetermined level of inputs.

In the *short* run let the capital stock K be fixed, i.e. the capital stock is a shift parameter of the labour demand curve. The short-run labour market equilibrium is described graphically by the intersection of the labour demand curve (DD) and the wage-setting curve (SS), which mirrors the overall bargaining constellation on the labour market.

In the *long* run the capital stock is determined endogenously. Various approaches to fixing the long-run equilibrium are possible. Blanchard (1997, 1998) considers a small open economy model with an exogenously given rate of return on capital r^* . Owing to factor adjustment costs, the short and long-run equilibria may differ temporarily. Over time, how-

ever, capital formation adjusts ("shift of the DD curve") until the short and long-run equilibria coincide at E , so that the following holds:

$$(3) \quad f'(k^*) = r^* \quad \text{and: } w^{EU} = w^{EU}(k^*)$$



An alternative approach is taken by Kaas/v.Thadden (2001) who consider the case of a closed economy. Using a growth model augmented by wage bargaining, they show that, under certain assumptions, the ratios of factor prices and quantities coincide in the long run with those of the completely competitive benchmark economy, whereas in the short run they may differ because of shocks. For example, assume that a permanent shift occurs in the wage-setting curve caused by an increase in insider power. In the short run (move from E to F) the following shifts occur along the short-run labour demand curve: wages rise, employment and the rate of return on capital fall and - assuming the elasticity of substitution between labour and capital σ is smaller than 1 - the income share of labour increases. However, the smaller expected return on capital leads (temporarily) to weaker capital formation. This weakness of capital formation is accompanied by further employment losses. In the new long-run equilibrium (G) the ratio of factor quantities, the ratio of factor prices and the income distribution coincide with those of the initial equilibrium E , albeit at a permanently lower level of the cap-

ital stock and employment than in the initial situation.

In the following simulation 1970 is the reference year. For computing the index values of the labour-saving technical progress from the Solow decomposition of output growth, the residual was first divided by the income share of labour. Next the degree of freedom for fixing the level of the index was used to set the ratio of factor prices w^{EU}/r in 1970 equal to unity. Persistent deviations of the capital intensity (in efficiency units) k and of the ratio of factor prices w^{EU}/r from the reference values for 1970 are interpreted as indications of changes in the relationship between the factors. The functional forms in Blanchard (1997, 1998) are assumed when calculating the labour demand and supply shocks. The following holds for the wage-setting curve (with β as the elasticity of w^{EU} in relation to the employment rate N_t/\bar{N} and Θ as a shift parameter of the curve):

$$(4) \quad w_t^{EU} = \Theta_t \left(\frac{N_t}{\bar{N}} \right)^\beta$$

With 1970 assumed as the reference value for the steady state and $u_t = 1 - N_t/\bar{N}$ as the level of unemployment in period t , the labour supply shock z_t in period t can be approximated via:

$$(5) \quad z_t = \ln(w_t^{EU}) + \beta u_t - \ln(\Theta_{1970})$$

To facilitate comparability with Blanchard (1997, 1998), β was set at 1 in the simulation. Assuming a CES production function, the following equation holds via the first-order condition for labour demand, where $(1-\alpha)$ is defined as the annual average income share of labour and c is a shift parameter of the curve:

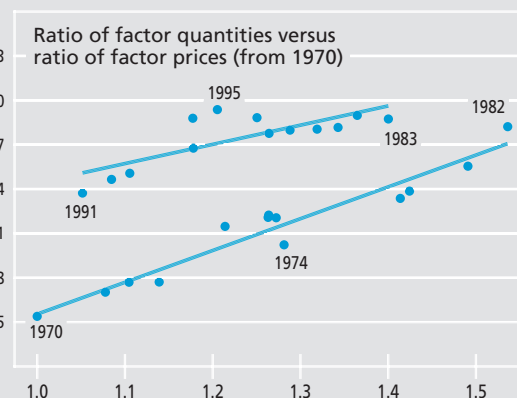
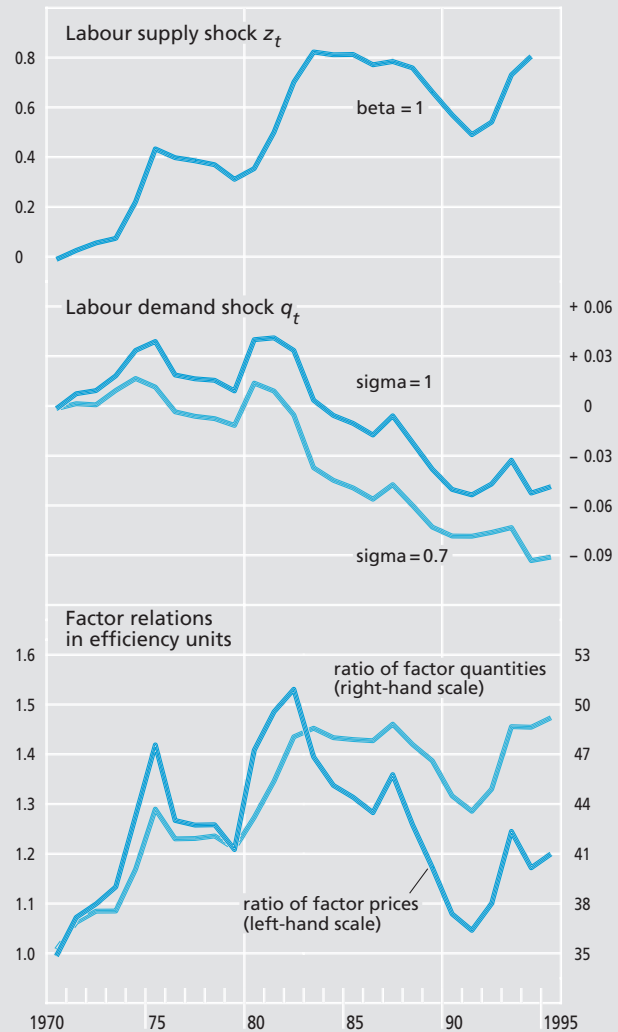
$$(6) \quad w_t^{EU} = c_t (1-\alpha) y_t^{1/\sigma}, \quad \text{with: } y_t = c_t [\alpha k_t^{(\sigma-1)/\sigma} + 1 - \alpha]^\sigma / (\sigma-1)$$

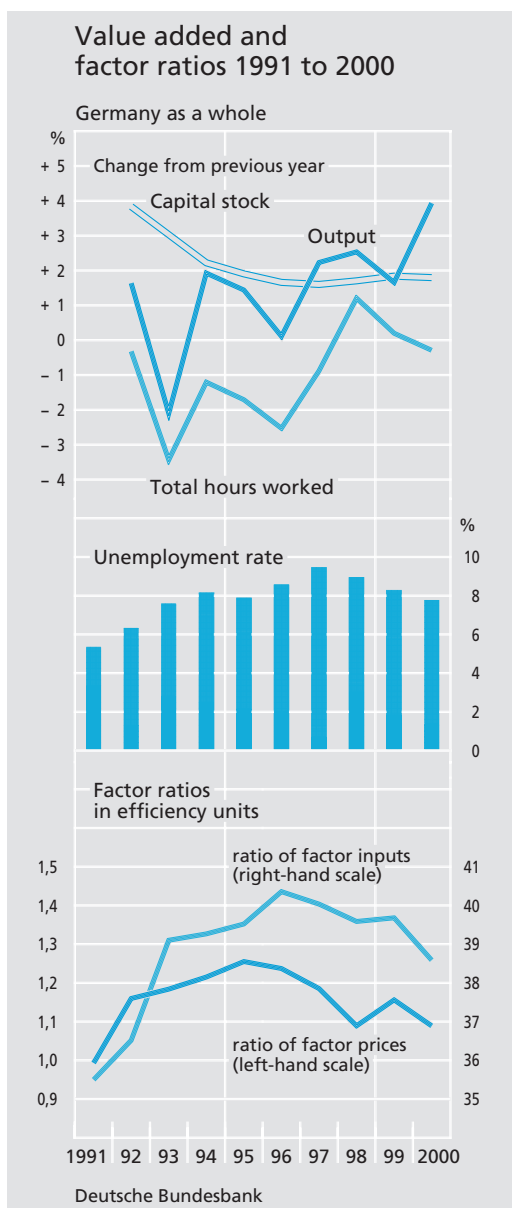
Shifts in the demand for labour ("labour demand shocks") are computed using the formula:

$$(7) \quad q_t = \ln(w_t^{EU}) - \frac{1}{\sigma} \ln(y_t) - \ln(c_{1970} \cdot (1-\alpha))$$

As no uniform estimate for the elasticity of substitution σ exists in the econometric literature, two scenarios are used for computing the labour demand shock, namely $\sigma=1$ (Cobb-Douglas) and $\sigma=0.7$; they lead to qualitatively similar results.

Simulation results for western Germany 1970 to 1995





ther flat growth path and weak capital formation. The average annual increase in value added amounted to only 1.6 %, although this figure was exceeded in the years since 1997. At the same time, the rate of expansion of the capital stock, at barely 2 % in the past couple of years, remains distinctly lower than in the 1980s.

For the whole of the period 1991 to 2000, the labour market was relatively weak. In 2000 both the number of employed persons and the total hours worked were down on the corresponding level in 1991. However, the labour market situation – following sharp setbacks in the first half of the 1990s – has brightened perceptibly in the past few years in line with the general cyclical recovery. Thus the number of employed persons has risen continuously since 1998.¹⁶ This is partly borne out by the fact that the overall unemployment rate in 2000 of just under 8 % was distinctly below the peak figure of 9.5 % reached in 1997. Despite this significant improvement, however, it was still well above the 1991 level of not quite 5.5 %.

*Tendencies on
the labour
market*

In the context of a growing labour supply and a high level of (initially masked) unemployment in eastern Germany, a massive devaluation of productive assets, in the form of fixed and human capital, occurred in the first half of the 1990s. This was accompanied by high wage pressure during this period, leading for a time to a pronounced shift in the factor price ratio towards a relative increase in labour costs. Since the mid-1990s the factor price ratio has manifested a marked countercyclical swing, not least on account of the subdued investment activity during the 1990s. While the starting level of 1991 has not quite been reached, signs of an improvement are apparent, recalling west German developments in the 1980s. In particular, the factor

¹⁶ This effect is smaller when measured by total hours worked owing to a significant structural shift towards more part-time working. It should also be pointed out that the latest figures on total hours worked are provisional.

price ratio has largely returned to its steady-state level during the past few years, principally thanks to the moderate wage policy.

However, our simulation model shows that persistent employment successes cannot be expected from short-run or temporary adjustments on the factor markets – that requires

long-term efforts. Furthermore, sustained employment gains require more than an appropriate overall factor price ratio, which has been the focus of this article. Such a policy must rather be complemented and reinforced by ongoing structural reforms on the product and factor markets.