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Suggested Citation: Quehenberger, Margarethe (2000) : Ten years after: Eastern Germany's convergence at a halt?, EIB Papers, ISSN 0257-7755, European Investment Bank (EIB), Luxembourg, Vol. 5, Iss. 1, pp. 116-136

This Version is available at:

<https://hdl.handle.net/10419/44792>

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Ten years after: Eastern Germany's convergence at a halt?



Margarethe
Quehenberger

1. Introduction

A decade after German unification and the establishment of monetary, fiscal and social union between Western and Eastern Germany (1), it is time to take stock of the economic convergence reached so far, and to assess the prospects for further productivity catch-up. These issues are naturally of keen interest to German taxpayers - who are well aware that high fiscal transfers to the New Länder will not decline as long as their productivity trails behind Western German levels and unemployment stays at about 20%.

For economists the case of Eastern German convergence is of particular interest as a near text book example of the "big bang" reform of a planned economy. Legal and institutional reform, price adjustment and integration into world markets were practically achieved overnight. Privatisation was rapid, and by early 1995, some 95% of Eastern German employees already worked in private enterprises (DIW *et al.*, 1999). Because of the speed of this process, the pre-dominance of transition-related effects can be considered to have come to an end within a few years.

The main features of the regional adjustment process, in particular high wages and the massive subsidisation of investment has put Eastern Germany in a league of its own. It is not atypical for a lagging region that wages increase more rapidly than productivity levels. However, circumstances are rarely as extreme as in Eastern Germany. Already by 1992, gross wages were comparable to those in the US while productivity levels were at Mexican levels (Siebert, 1993). Similarly, lagging regions normally receive fiscal transfers from richer regions. However, the size of German transfers can be seen from the comparison with another well-known case of a depending region, Italy's Mezzogiorno. While net fiscal flows to the Italian South have been estimated to amount to nearly one-fifth of the Mezzogiorno's GDP per year (Boltho *et al.*, 1996), the flows to Eastern Germany were as high as one-third of the former GDR's GDP.

It should be emphasised that the case of Eastern Germany is not comparable to the convergence process for groups of countries that are relatively similar in terms of factor endowments and institutional arrangements. Therefore, the relatively robust prediction from the economic growth literature that economies converge to their long-term growth paths at about 2% per annum, only yields limited insights. Though Barro (1991) predicted that "it will take about 15 years to eliminate one-quarter of the [per capita] income gap", this was achieved in only a few years.

However, for the last five years labour productivity has hovered at a figure that is only a little over one-half the level in Western Germany. Putting this together with the poor employment performance means that real Eastern German GDP growth has dropped below that in Western Germany. This is shown in Table 1. There is no consensus on the reasons for this remaining productivity gap (see DIW *et al.*, 1999, p 83ff). Possible explanations range from firm size (Beer and Ragnitz, 1997), branch

Margarethe Quehenberger is an economist at the Chief Economist's Department. She thanks Chris Hurst and Alfred Steinherr for useful comments, as well as Mireille Fischbach and Thomas Mathä for their collaboration. The usual disclaimer applies.
1) On 3 October 1990 the unification treaty came into effect. Monetary Union was implemented by 1 July 1990.

structure (Rothfels, 1997), utilisation rates (Görzig quoted in Ragnitz *et al.*, 1998), the heterogeneity of factor endowments (Dietrich, 1997), R&D spending (Felder and Spielkamp, 1998), to managerial and organisational deficiencies (Mallok, 1996, Bellmann and Brussig, 1999, Ragnitz *et al.*, 1998, Müller *et al.*, 1998). However, no strong evidence in any direction has been found.

Table 1. Real GDP growth, annual percentage change

	1991	1992	1993	1994	1995	1996	1997	1998
Eastern Germany	-19.2%	7.8%	9.4%	9.6%	4.4%	3.3%	1.7%	2.0%
Western Germany	5.0%	1.8%	-2.1%	2.1%	0.9%	1.1%	2.3%	2.8%

Source: German Federal Statistical Office.

This paper gives an overview of the state of convergence (Section 2) and assesses the prospects for further productivity catch-up. To this end, an econometric analysis of the adjustment process in the manufacturing industry is presented (Section 3). Section 4 concludes with some observations regarding future policy. Throughout the paper Western Germany will serve as the benchmark.

Box 1. East and West compared

1998		Eastern Germany	Western Germany	EU-15
Area	Km ²	108 083 (30%)	248 939 (70%)	3 230 544
Population	1000	15 290 (19%)	66 747 (81%)	374 584
Population density	Population per km ²	141	268	116
Employment	1000	6 544	29 317	126 715
Employment share	% of population	43	44	34
Unemployment	% of work force	19.5	10.5	10.2
GDP	bn DEM	429	3 329	14 936
GDP/capita	DEM	28 064	49 875	39 874
GDP	EU-15=100 bn DEM	70	125	100
Of which:				
Agriculture	%	2	1	3
Industry *	%	34	33	30
Market services	%	45	53	52
Non-market services	%	19	13	15
GDP per employee	DEM	64 370	112 975	108 740
	EU-15=100	59	104	100
Export share	% of GDP	9	28	32
Investment share	% of GDP	43	18	18

* Industry here defined as manufacturing, construction, mining and energy.

Source: German Federal Statistical Office, DIW, Eurostat.

2. Ten years of transition and economic adjustment

2.1 The main features of the Eastern German economy

The main driving forces behind Eastern German convergence have been fiscal transfers and the wage growth that has accompanied them.

Details of the relative sizes of Eastern and Western Germany are given in Box 1. Though regional production per capita in Eastern Germany is still only a little over one-half the Western figure, incomes had already reached almost 90% of the Western German level in 1994. The remaining gap of around DEM 200 billion, equivalent to the regional current account deficit, is financed by transfer payments, private sector capital inflows, and borrowing by the regional governments of the New Länder (2). The largest element comes from the federal government. Over the last few years, these amounted to DEM 140 billion per annum, or 4¹/₂% of Western German GDP. Thus, fiscal transfers have financed about three-quarters of the Eastern German income gap (DIW *et al.*, 1999). Indeed, the main driving forces in the evolution of the Eastern German economy have been these transfers and the wage growth that has accompanied them.

A "high wage strategy" was adopted at unification (Sinn and Sinn, 1991). One logic was that this was only another part of the "big bang" price reform. However, high wage levels in the East were also motivated by concerns over mass migration to the West, and by the fear of West Germans (both employers and employees) of competition from a "low wage" region within the country. Table 2 shows that nominal wages had already reached 60% of the Western German level by 1992. This was far above the productivity differential, and relative unit labour costs stood at almost 140%. Unemployment grew rapidly as a result. In particular, the tradables sector was hit by the wage cost pressure, while at the same time being exposed to international competition. The manufacturing industry virtually broke down, and some 70% of manufacturing jobs had been lost by 1995.

Table 2. Eastern Germany: Labour market indicators

	1991	1992	1993	1994	1995	1996	1997	1998
Gross nominal wages (W. Germany = 100)	46,7	60,7	67,9	70,5	72,5	73,6	74,4	73,7
Unit labour cost (W. Germany = 100)	150,6	139,4	128,0	126,0	126,5	124,0	123,2	124,0
Employment (y/y change in %)	- 17.0	- 12.8	-2.6	1.8	1.0	-2.0	-3.0	-0.3

Source: DIW *et al.* (1999), Spitznagel (1999)

Employment has only fallen slightly in recent years, and has stabilised at around 6 million. However, this figure includes nearly 1 million people that are covered by social policy or active labour market measures (such as training programmes). Together with the about 1.4 million persons registered as unemployed in 1998, this suggests that there is a lack of almost 2¹/₂ million jobs in Eastern Germany (DIW *et al.*, 1999). This job deficiency has remained high even though net migration from the Old Länder has lowered the available work force (3). However, the participation rate (labour supply in relation to work age population) of 74% in 1998 in Eastern Germany -

2) Sinn (2000) draws attention to the enormous increase in public debt in the New Länder, in addition to their transfer-dependency. Per capita debt of the Eastern German municipalities and Länder had surpassed the respective Western German level by 1998, although they had started with practically no debt in 1990 (Seitz, 1999).

3) There was migration from Eastern to Western Germany of about 1.4 million persons in the first years after the fall of the Berlin wall (Sinn, 1995).

although declining - remains higher than the 69% in Western Germany (Pohl, 1999) and employment as a share of population is almost as high in Eastern as in Western Germany (Box 1).

Still, contrary to initial predictions, Eastern Germans are far from reaching wage parity with Western Germans. In 1998, wages were 74% of the Western German level, and in manufacturing the hourly wage rate was only 62% that of Western Germany (DIW, 1999 and 1999a). *De facto* the wage bargaining process in Eastern Germany is deviating progressively from the pattern prevailing in Western Germany. This is associated with "emergency" provisions (*Oeffnungsklauseln*) agreed by unions, concession bargaining at the firm level, and the fact that fewer firms participate in the collective bargaining process or adhere to its agreements. The result is that wages in Eastern Germany have become somewhat more sensitive to firm conditions than in Western Germany (Franz and Steiner, 1999), though unit labour costs have remained relatively stable at about 120% of the Western figure (see Table 2).

Transfers were also used to support an investment boom, either with public investment or through subsidies for private investment.

In-line with the high wage strategy, social entitlements were also aligned with those in the West. In some cases, such as the valuation of pension contributions, this was done in a favourable way for Easterners (4). Most social payments (such as unemployment benefits, pensions and the like) are automatic. Table 3 shows the breakdown of transfers to Eastern Germany in more detail. In 1998, as much as 44% of gross transfers were social transfers. In fact, a large share of the other transfers have also followed more-or-less automatically from existing German legislation. Only one-quarter of net transfer payments have been based on specific provisions for Eastern Germany (DIW *et al.*, 1999).

Transfers were also used to support an investment boom, either with public investment or through subsidies for private investment. In fact, the figures in Table 3 do not include the full range of subsidy instruments. A more comprehensive analysis, which also takes into account tax credits and preferential depreciation for investment in Eastern Germany by Edler *et al.*, (1998), shows that Eastern Germany received total investment subsidies of DEM 68 billion in 1996, rather than the DEM 15 billion of Table 3. Moreover, investment has been promoted by the privatisation policy. When state-owned enterprises were sold, an important criterion in the evaluation of competing bids was the commitment of the purchaser to investment which would raise the capital stock per employee to that typical for similar enterprises in Western Germany (Carlin and Mayer, 1992). Given the enormous capital subsidies, Sinn (1995) has estimated that the cost of capital for industrial investment was even negative.

Table 3. Transfer payments to Eastern Germany in billion DEM

	1991	1992	1993	1994	1995	1996	1997	1998
Gross Transfers	139	151	167	169	185	187	183	189
Social Transfers	56	68	77	74	79	84	81	84
Investment subsidies	8	10	11	17	18	15	14	16
Public investment	22	23	26	26	34	33	32	33
Payments to local authorities	53	50	53	52	54	55	56	56
Revenues	33	37	39	43	45	47	47	48
Net Transfers	106	114	128	126	140	140	136	141

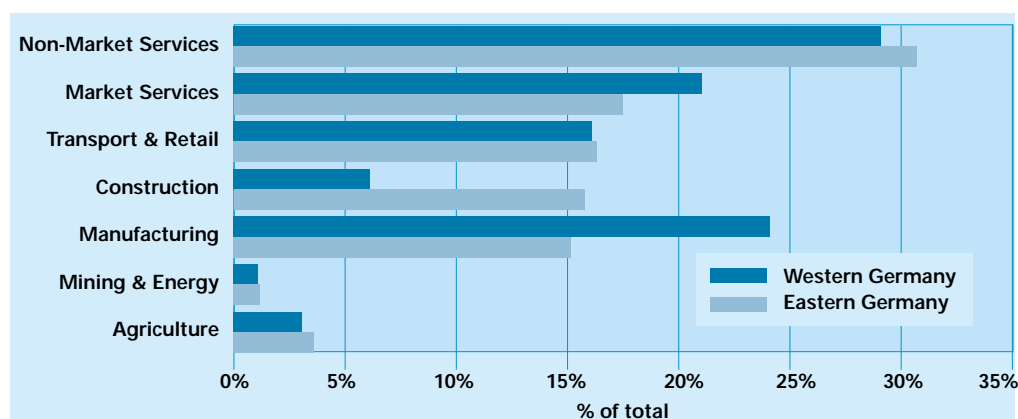
Source: DIW *et al.* (1999)

4) Eastern German household pension income is 11% higher, in nominal terms, and 20% higher, in real terms, than the Western German one, since labour force participation of women is higher and since an overly favourable formula for the translation of GDR claims into the Western German pension system was chosen. (Sinn, 2000).

The state of infrastructure in the GDR was much worse than in Western Germany (DIW *et al.*, 1999). In particular the telecommunication network and the quality of roads in the GDR required enormous investments to bring them towards Western German standards. By 1997, some DEM 146 billion of public money has been invested in infrastructure, half of which went to transport, one third to telecommunications and the remainder to energy, water and waste water treatment. While telecoms has caught up with the West, there remains a significant quality gap in road and water treatment (Edler *et al.*, 1998) (5).

Though the tradables sector suffered from competition, high wages increased demand for local services and the retail trade and transport sectors grew to a size comparable to that of Western Germany. These sectoral distortions led to an employment structure that deviates markedly from the Western German benchmark with regard to the relative size of the manufacturing (6) and construction sectors. This is shown in Figure 1. Together these two sectors account for about 30% of total employment in both regions. However, the Eastern German construction sector is 2 1/2 times bigger than that in Western Germany, while the employment share of the manufacturing sector is only 60% of the Western German figure.

Figure 1. Employment in Eastern and Western Germany according to sectors, 1998



Data Source: German Federal Statistical Office

2.2 Labour productivity and capital intensity

Sectoral distortions led to an employment structure that deviates markedly from Western Germany.

During the period from 1991 to 1998 investment in Eastern Germany grew at an annual rate of 7% on average, three times higher than in Western Germany. In 1998, investment as a share of GDP in Eastern Germany amounted to 43% (Müller, 2000). Following this, the stock of capital equipment in Eastern Germany is, in quality terms, as new and modern as in Western Germany. In aggregate terms, the capital intensity, or capital labour-ratio, was about three-quarters the Western level in 1997. However, there has been an ongoing debate regarding the capital-labour ratio that exists (7), and the capital stock data in Eastern manufacturing has recently been revised downward

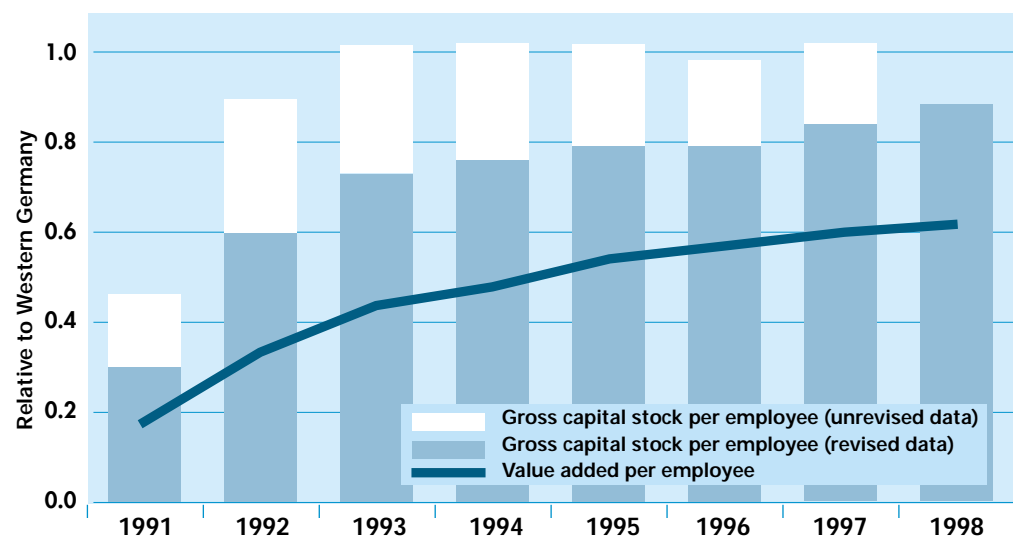
5) A forecast by the DIW with regard to the relative infrastructure intensity, using a composite index, estimates a remaining gap of one-quarter with respect to transport, and a 60% gap with respect to waste water treatment (Edler *et al.*, 1998).

6) Here the manufacturing sector is defined to be the core tradeables sector, also referred to as industry, plus crafts.

7) The main reasons are that the Eastern German capital stock was initially valued at Western German market prices and the low utilisation rate of buildings.

by the DIW. Whereas the old data showed the capital intensity in Eastern German manufacturing had already reached Western German levels in 1993 (DIW *et al.*, 1999), the revised data (DIW, 1999) document a more moderate increase in the relative capital-labour ratio. Figure 2, showing the capital-labour ratio from both the old and the new data series gives an idea of the magnitude of this revision. In any case, the adjustment to manufacturing does not have a significant effect on the aggregate economy-wide ratio due to the relatively small size of manufacturing.

Figure 2. Relative capital to labour ratio and relative labour productivity of Eastern German manufacturing



Data Source: DIW *et al.*, (1999) for unrevised data; DIW (1999)

Table 4 summarises data (from various sources) on Eastern German investment and capital stock relative to the Western German benchmark. The progress in convergence with regard to capital intensity is illustrated for the total regional economy level and for manufacturing.

As a result of the subsidy schemes, building investment accelerated far ahead of equipment investment in Eastern Germany.

Table 4 also shows that building investment, not least as a result of the subsidy schemes (8), accelerated far ahead of equipment investment. Though the building stock per work-aged person already amounts to 89% of the Western German level, the stock of equipment per work-aged person is some 60% (Müller, 2000). Moreover, the combination of high wages and capital subsidies favoured investment in very capital intensive sectors since they gained most from capital subsidies, and could more easily compensate for high wages (Sinn, 1995). Gerling (1998) supports this view with econometric evidence that subsidies resulted in significant substitution between capital and low-skilled labour. For the period 1991 to 1996 she shows that investment in the manufacturing sector in Eastern Germany has been biased towards capital-intensive industries. In 1997, the ten most capital intensive branches of manufacturing accounted for 46% of the Eastern German gross capital stock, whereas their share in Western Germany was only 37% (DIW *et al.*, 1999).

8) In particular the special depreciation allowance fostered building investment.

Table 4. Investment and capital intensity, Western Germany = 100

	1991	1992	1993	1994	1995	1996	1997	1998
Building investment								
Per work-aged person (a)	72	105	132	163	174	178	177	163
Equipment investment								
Per work-aged person (a)	62	76	102	112	110	111	102	90
Gross capital stock								
Per employee (b)	46	n.a.	n.a.	62	n.a.	n.a.	73	n.a.
Gross capital stock in manufacturing								
per employee (c)	30	59	73	76	78	79	84	89

Sources: a) Müller (2000) presenting an ifo-Munich estimate.

Work-aged persons are defined as the population aged 15-65 years.

b) DIW *et al.*, (1999) which rely on an estimate by the Institut für Weltwirtschaft, Kiel.

c) DIW (1999)

Tables 5 and 6 show in more detail the effect on sectoral productivity patterns already alluded to before. Table 5 presents the nominal data, and reveals that the most rapid gains in relative productivity were observed in manufacturing. Whereas the other sectors - except for agriculture - increased productivity between 1991 and 1998 by a factor of roughly 1.7 to 1, manufacturing increased by a factor of 3.3. From Table 6 we learn that the latter factor even applies in real terms, which implies that the average gap between Eastern and Western price levels remained rather constant for manufacturing goods over the time span considered. Indeed, relative producer prices in Eastern German manufacturing have only increased by 1.6 percentage points between 1991 and 1998.

For the other sectors, the different convergence patterns presented in the two tables arise because the relative price levels did not remain constant.

Against this backdrop, Müller (1999) found a difference between Eastern and Western German producer price levels of 12% for overall Eastern German output in 1995. In manufacturing the price gap is particularly wide. For rather disaggregated groups of commodities in manufacturing, he reports an average producer price gap between Eastern and Western German products of 28% in 1995.

At least for the tradables sector, which accounts for two-thirds of the manufacturing industry and in which prices can be assumed to be determined on the world market, these price differentials must be interpreted as quality gaps (Paqué, 1998). Surveys confirm that Eastern German firms specialise on lower quality products (DIW *et al.*, 1999). Thus, at least in the tradables sector, a catching-up in relative prices would indicate convergence. For non-tradables, by contrast, prices are determined by local demand and supply conditions and market structure is an important determinant of the price level.

Table 5. Eastern German value added per employee, Western Germany = 100

	1991	1992	1993	1994	1995	1996	1997	1998	1998/ 1991
Non-market services	50	62	72	75	78	80	82	85	1.7
Market services	28	36	42	42	42	43	44	45	1.6
Retail and Transport	30	39	46	48	51	52	52	52	1.7
Construction	49	62	68	76	77	78	77	83	1.7
Manufacturing	19	30	41	48	52	55	59	62	3.3
Agriculture	44	55	64	62	60	59	55	52	1.2
Total	31	43	52	54	56	57	58	59	1.9

Source: German Federal Statistical Office

Table 6. Eastern German real value added per employee, Western Germany = 100

	1991	1992	1993	1994	1995	1996	1997	1998	1998/ 1991
Non-market services	50	49	50	50	51	52	53	55	1.1
Market services	35	40	41	41	41	41	42	39	1.1
Retail and Transport	30	36	41	43	45	46	46	45	1.5
Construction	49	56	58	63	63	63	63	63	1.3
Manufacturing	19	31	42	49	53	56	61	63	3.3
Agriculture	44	54	74	74	71	70	65	64	1.5
Total	31	38	43	45	45	46	47	47	1.5

Source: German Federal Statistical Office

2.3 Eastern Germany's convergence at a halt?

Several features indicate that the convergence process has come to a halt.

Overall, several of the features just described could indicate that the convergence process has come to a halt. To re-cap, there are three main points for concern.

Firstly, since 1997 Eastern GDP growth has dropped below that in Western Germany. This is also confirmed by preliminary figures for 1999, and the joint forecast of Germany's six economic research institutes (published in autumn, 1999) for the year 2000. Only in the first few years after the transition recession did GDP growth, amounting to almost 9% on average between 1992 and 1994, strongly support convergence.

Secondly, the withdrawal of some capital subsidies seems to have severely slowed investment (9). In 1998, equipment investment per work-aged person has been lower in Eastern Germany than in Western Germany (see Table 4). Sinn (2000, p. 20) argues that high wages are the root of the problem: "It explains why the investment in equipment has been so low (and the investment in buildings has been so high) despite the negative cost of capital which the public subsidy programmes implied. The high wage level is a fundamental brake that has been imposed on the

9) By 1997, the special depreciation allowance was abolished and the investment grant reduced.

East German economy right from the beginning. Now that the driving force of the investment subsidy programme is no longer available, it has brought the adjustment process to a halt. The East Germans simply priced themselves out of the market”.

The productivity gap in manufacturing is particularly sobering given the radical selection process that has taken place.

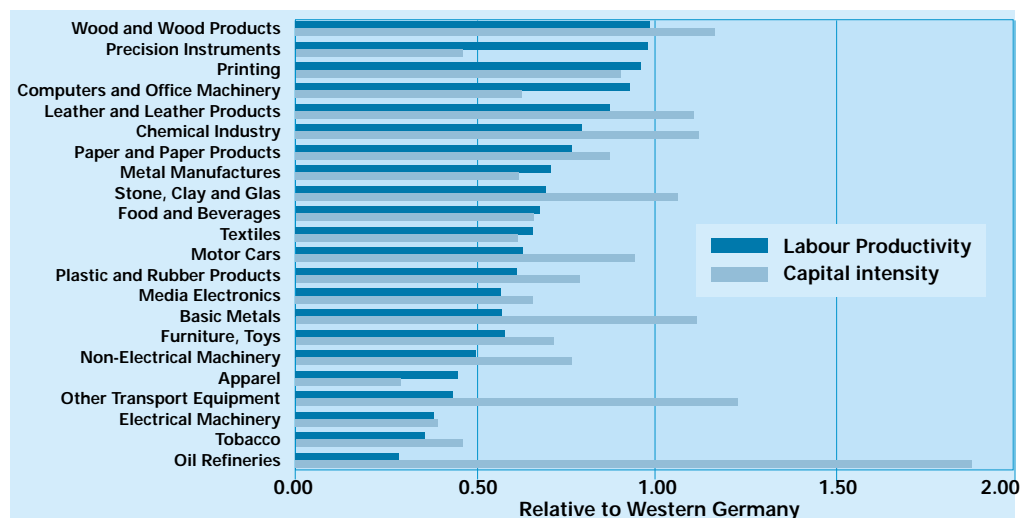
Thirdly, sectoral patterns give rise to concerns about the prospects of further overall convergence. Market services and manufacturing appear to be key sectors for a balanced and sustainable development. As illustrated in Figure 1, these two sectors account for 45% of total employment in Western Germany, but only for 32% in Eastern Germany. The gap in productivity in manufacturing is particularly sobering given the radical selection process that has taken place during the first years of transition, and that this sector has gained most from capital subsidies. With its comparatively small size and high capital-labour ratio, the productivity gap in manufacturing could have been expected to be much below average. Indeed, both Klodt (1999) and Sinn (2000) have concluded from the unrevised (1997) data on relative capital intensity and labour productivity at the manufacturing branch level that the catch up in labour productivity has come to a halt.

Figure 3 (using the revised data), in which branches are ordered according to their relative labour productivity, reveals the large diversity with regard to capital intensity and labour productivity in the manufacturing industry. Real value added per employee ranges from 28% to nearly 100% of the Western German level. Note that there are already four industries that approach Western German productivity levels, namely wood and wood products, precision instruments, printing, and computer and office machinery - but none is above the Western German benchmark (at least at this level of disaggregation). Capital intensity in the precision instruments industry, however, does not even reach half the capital-labour ratio of its Western German counterpart. At the same time, there are industries (such as oil refineries, other transport equipment and basic metals) whose capital intensity is well above the Western German level, but whose labour productivity is far below - in two cases it does even not reach half of the productivity of the Western German counterpart.

Klodt (1999) found that the correlation coefficient between the relative labour productivity and the relative capital intensity between Eastern and Western German manufacturing industries was negative, albeit insignificant, in 1997. He criticises the allocative distortions created by high capital subsidisation, which led to excessively capital intensive structures accompanied by low utilisation rates. Sinn (2000) takes the same (unrevised) data used by Klodt as empirical evidence for Eastern Germany moving to a long run equilibrium in which, contrary to the standard neo-classical predictions, Eastern German labour productivity remains below the Western German level. This “perverse” adjustment pattern, where higher capital intensity is accompanied by lower labour productivity, follows from the assumption of negative real cost of capital for industrial investment.

Though the data revision was principally a general downward revision of the capital stock level in all branches, the question remains as to whether the new adjusted data still supports these conclusions. Likewise, does a time series approach give the same results? In order to untangle the relationship between output and investment in more detail, we turn in the next section to a growth accounting exercise.

Figure 3. Relative capital intensity and labour productivity in Eastern German manufacturing industries in 1998



Data Source: DIW (1999)

3. Productivity growth and the return on capital in the manufacturing sector

The issue, therefore, is whether the adjustment process has been efficient in that capital accumulation has increased labour productivity and that technical efficiency has systematically improved. Following the observations above, we restrict the analysis to the manufacturing sector. It is also the sector where data availability is by far the best.

Adopting the standard approach, it is assumed that the manufacturing industry can be adequately represented by a Cobb-Douglas production function,

$$(1) \quad Y_t = A_t K_t^\alpha L_t^{1-\alpha}$$

where Y_t , K_t and L_t are output, the capital stock and labour at time t . The term A_t reflects the level of technology and is also referred to as total factor productivity (TFP). After taking logarithms and differentiating with respect to time it follows that:

$$(2) \quad \frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \alpha_t \frac{\dot{K}}{K} + (1-\alpha_t) \frac{\dot{L}}{L}$$

in which a dot above a variable indicates a time derivative. Thus, output growth is equal to the growth rate of total factor productivity plus a weighted average of the growth rates of capital and labour. If perfect competition prevails, then the marginal product of each input equals its factor price. In this case:

$$(3) \quad \alpha = \frac{rK}{Y}, \quad \text{the capital share of output; and,}$$

$$(4) \quad 1-\alpha = \frac{wL}{Y}, \quad \text{the labour share of output; and,}$$

where r is the rate of return to capital and w is the wage rate. Of course, the assumptions of perfect competition r and constant returns to scale are strong ones, particularly in a transition context (see EBRD, 1997, and Stephan, 1998). Any figures emerging from the use of this framework must therefore be interpreted with caution.

We start with a standard growth accounting exercise for the manufacturing sector in total. This takes the observed capital share in output as an estimate for the coefficient α . We then use more disaggregated data to estimate the model parameters.

3.1 Total factor productivity growth

Using the latest data (DIW, 1999), the wage share of manufacturing output in Eastern Germany is 80% for the period from 1991 to 1998 (thus implying the capital share, or α , equals 0.2). For the period from 1995 to 1998, when growth can be considered more market driven, the wage share falls to 69%. This value is in line with the traditional observation for a wide range of market economies that the wage share is 70% (or that α equals 0.3).

Table 7. Capital shares and rates of return to capital in Eastern and Western German manufacturing

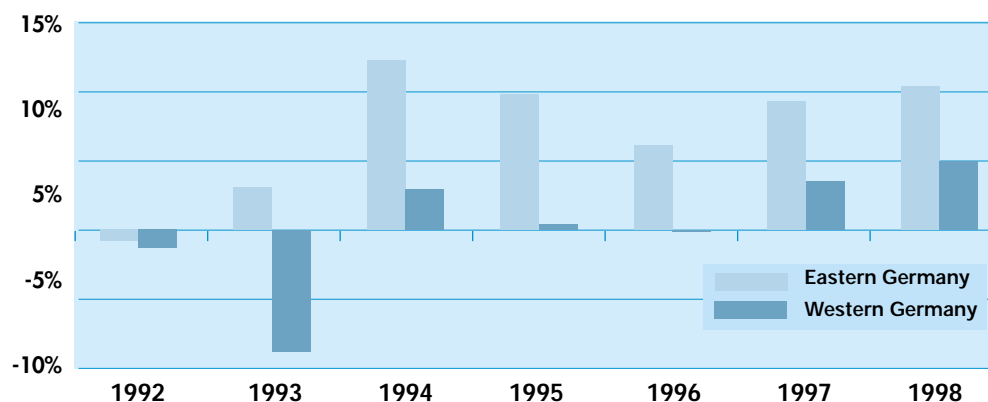
	Eastern Germany		Western Germany	
	1991-98	1995-98	1991-98	1995-98
Capital share (α)	0.20	0.31	0.38	0.40
Rate of return (r)	5%	8%	15%	16%

Source: Author's calculation from data in DIW (1999)

Even if the cost of capital was negative it appears that projects with positive rates of return have been chosen on average.

Equation 3 immediately provides an estimate for the rate of return to capital. With the new capital stock estimates, the rate of return in Eastern German manufacturing averaged 5% over the period. It has increased to 8% over the last few years, still only one-half the estimate for Western German manufacturing. However, it is interesting to note that, even if the cost of capital was negative (as argued by Sinn, 1995 and 2000), projects with a positive rate of return appear to have been chosen on average (Table 7).

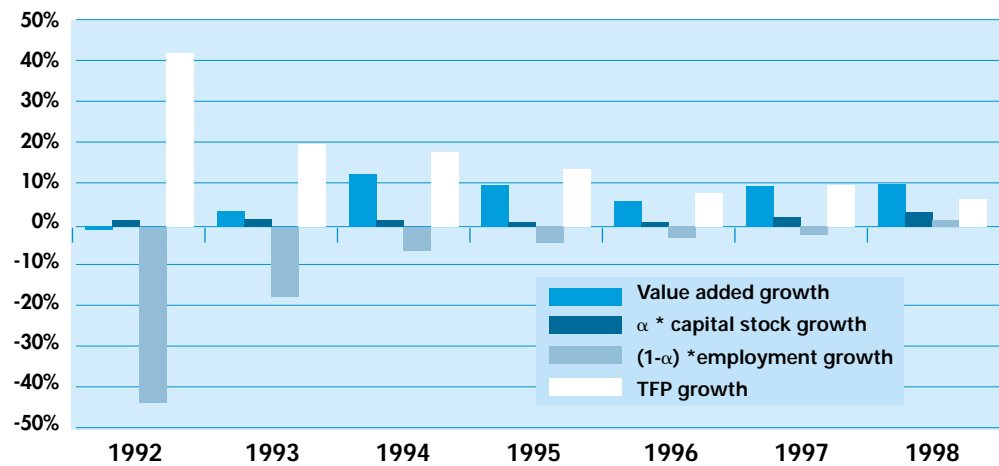
Figure 4. Value added growth in Eastern and Western German manufacturing



Data Source: DIW (1999)

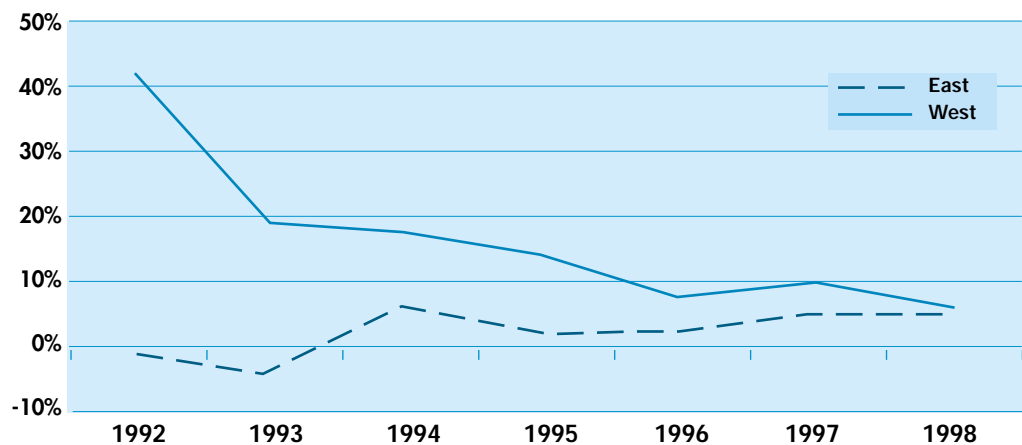
Value-added in manufacturing in Eastern Germany has grown faster than in Western Germany, including the last few years when overall GDP growth was lower in Eastern Germany (Figure 4). Taking the observed average value of α , we can also estimate the contribution to this growth from capital accumulation and TFP using equation 2. This is summarised in Figure 5. This shows that TFP growth in Eastern German manufacturing has been high, though decreasing. The tremendous increase in the total factor productivity in Eastern Germany in the early 1990s is not surprising. This coincides with massive layoffs and the closure of the least profitable businesses. Here, TFP change is capturing a change in average performance rather than technology improvement. In fact, employment growth has made a positive contribution only for the first time in 1998. Capital accumulation, which contributed positively over the whole period, explains about one-quarter of value added growth in 1998. In this last year, the major determinant of growth in manufacturing still remains total factor productivity which accounted for almost two-thirds of output growth.

Figure 5. Growth of value added in Eastern German manufacturing and the respective contribution of capital, labour and TFP growth



Source: Author's calculation from data in DIW (1999).

Figure 6. TFP growth in Eastern and Western German manufacturing



Source: Author's calculation from data in DIW (1999)

The decline of TFP growth means that it is now approaching the Western German figure. This is shown in Figure 6. Indeed, the margin between East and West has fallen to only one percentage point in 1998. If sustained, the future catch-up in the manufacturing sector will depend increasingly on relatively faster capital accumulation.

3.2 An econometric exercise

To take the analysis a bit further, we use panel data on industrial branches to estimate the production function given above. By reformulating equation (1), labour productivity, expressed in logarithmic terms, is given by:

$$(5) \quad \ln y = \ln A + \alpha \ln k, \text{ where } y = Y/L \text{ and } k = K/L$$

Panel data (10) that cover 8 years (1991 to 1998) and 22 manufacturing branches (2-digit level of the NACE classification) have been used. Equation (5) was estimated by taking into account fixed effects, which removes the restriction that different industries must have the same technology. The coefficient, α , is assumed to be stable over the entire period, and a dummy variable for each year was used to estimate the change in TFP from year to year. The results are shown in Table 8 (11).

Table 8. The determinants of labour productivity

Dependent variable	α	1992	1993	1994	1995	1996	1997	1998	R^2
$\ln y_{\text{east}}$	0.46 (0.16)	0.29 (0.11)	0.46 (0.15)	0.66 (0.17)	0.78 (0.18)	0.85 (0.18)	0.93 (0.21)	1.01 (0.22)	0.90
Implied TFP growth			19%	22%	13%	7%	8%	8%	

Notes: Least squares, fixed effect estimate of equation 5, standard errors in brackets. All coefficients are significant at the 1% level.

The value of α emerging from this regression, at 0.46, is above capital share of output given in Table 8. This would also imply a higher rate of return for capital (12). However, this estimation may be flawed. There are almost three times as many sectors as time series observations, posing a problem for the reliable estimation of fixed effects. As a check, the model was also estimated without fixed effects. This resulted in an α that is much smaller, at about 0.12. The true size of the coefficient is likely to lie somewhere between this range, but we cannot say more about its specific value. As in the growth accounting exercise, TFP explains a significant part of labour productivity growth, although the increases in technical efficiency become smaller over time. In order to test the robustness of results, equation (5) has also been estimated with labour productivity defined as the ratio between East and West Germany and in first differences. Box 2 provides details.

10) From DIW (1999). Values are expressed in DEM and 1995 prices.

11) The regressions have also been run without the outlier of oil refineries. However, the size and significance of the coefficients hardly changes when this is omitted. Similar results are also found using the unrevised capital stock data for the period 1991-1997.

12) The rate of return would be of the order of 12% - still below the Western German level.

Increased capital intensity had a significant and positive impact on labour market productivity.

One cannot make too much of the magnitudes of the estimated coefficients given the large number of assumptions involved. However, the regression results and their robustness do indicate that the increased capital intensity had a significant and positive impact on labour productivity, though it is likely that the rate of return on investment was lower than in Western Germany. The regression results also confirm the findings of the growth accounting exercise with regard to the important (though rapidly decreasing) role of technological change as a determinant of labour productivity.

Box 2. The determinants of relative labour productivity

Adapting equation 5 in the main text, the relative labour productivity of the Eastern German manufacturing industry in relation to that in Western Germany is given by:

$$\ln y_e - \ln y_w = \ln (A_e/A_w) + \alpha_e \ln k_e - \alpha_w \ln k_w$$

where $\ln (A_e/A_w)$ represents the technological gap between the Eastern and the Western German manufacturing industry. If $\alpha_e = \alpha_w = \alpha$, then the above equation can be reformulated: $\ln y_e - \ln y_w = \ln (A_e/A_w) + \alpha \ln (k_e/k_w)$. Before implementing this restriction, the null-hypothesis of equality of the coefficients α_e and α_w has been tested in the unrestricted estimate and could not be rejected. The results of this restricted regression are as follows:

Least squares, fixed effects estimate

Dependent variable	α	1992	1993	1994	1995	1996	1997	1998	R ²
$\ln (y_e/y_w)$	0.58 (0.14)	0.23 (0.09)	0.41 (0.12)	0.56 (0.13)	0.66 (0.13)	0.72 (0.14)	0.75 (0.15)	0.76 (0.15)	0.91
Implied rate of closing of the technological gap between East and West			20%	16%	11%	6%	3%	1%	

Standard errors in brackets. All coefficients are significant at the 1 per cent level.

And in first differences:

GLS (cross-section weights)

Dependent variable	α	Constant	1993	1994	1995	1996	1997	1998	R ²
$\ln (y_e/y_w)_t - \ln (y_e/y_w)_{t-1}$	0.49 (0.07)	0.30 (0.05)	-0.11 (0.04)	-0.16 (0.05)	-0.19 (0.05)	-0.26 (0.05)	-0.27 (0.05)	-0.29 (0.15)	0.90
Implied rate of closing of the technological gap between East and West			19%	14%	11%	6%	3%	1%	

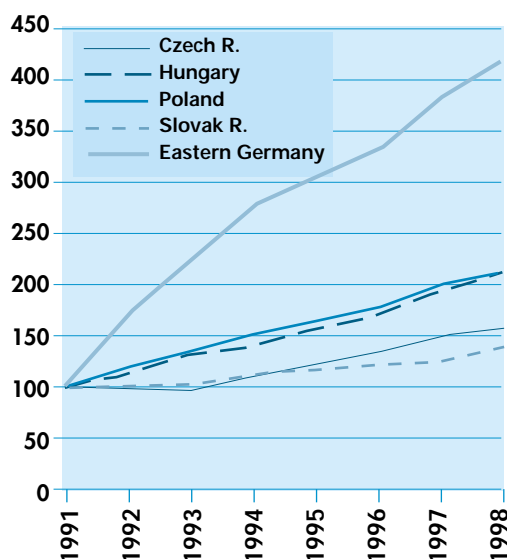
Standard errors in brackets. All coefficients are significant at the 1% level.

As can be seen from the coefficients of the time dummies, the rate of technology catch up has declined rapidly. This again confirms the important, but diminishing role of technical change as a determinant of labour productivity.

4. Conclusions

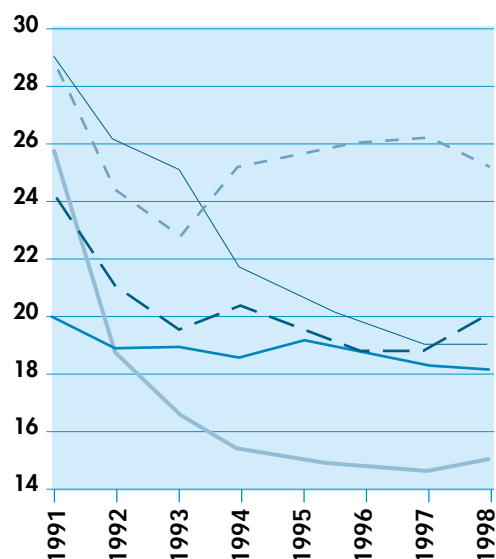
A decade after unification, a mixed picture emerges regarding Eastern German convergence. On the one hand, the main driving forces of the Eastern German economy, high wages, high capital subsidisation and fiscal transfers, pushed up labour productivity to levels far above of those in other transition economies. These differences are even more striking in manufacturing, where German policies have had the strongest impact. In this sector, labour productivity has quadrupled in Eastern Germany since 1991, compared with a doubling in the best performing transition economies (Poland and Hungary). This is illustrated in Figure 7. However, Eastern German productivity growth has been accompanied by massive labour-shedding. The extraordinary productivity growth of manufacturing has been associated with a radical selection process and at the cost of the size of the sector (see Figure 8)

Figure 7. Productivity growth in manufacturing (1991=100)



Source: EBRD, German Federal Statistical Office

Figure 8. Employment in manufacturing as a percentage of total employment



Source: WIIW, German Federal Statistical Office

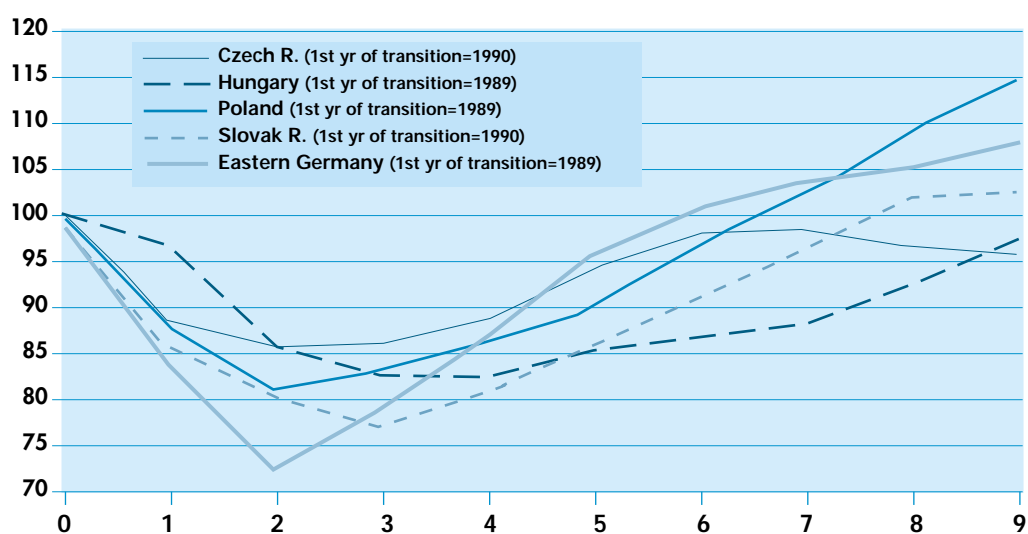
Eastern Germany has by far outperformed its Eastern European peers in terms of labour productivity growth. It has, however not done better in terms of welfare creation.

Although Eastern Germany has by far outperformed its Eastern European peers in terms of labour productivity growth, it has not done better with regard to welfare creation. This is shown in Figure 9. There was a massive real currency appreciation in Eastern Germany when the DEM was adopted at the time of unification. Output denominated in DEM also jumped, but this does not imply an increase in purchasing power parity terms. If the currency appreciation is eliminated by looking at the development of real GDP as an index based on the first year of transition, then Eastern Germany does not look so different from the Visegrad countries. Notwithstanding the massive fiscal transfers flowing in from Western Germany and substantial net-emigration, Poland outperforms Eastern Germany, and Hungary the Czech Republic and Slovakia follow only slightly behind. Obviously the massive policy intervention did not succeed in pushing Eastern Germany on a sustainably higher growth trajectory.

Moreover, the prospects for unemployment in Eastern Germany are bleak. Employment in the construction industry is going to decline as investment finds a more normal level, and it can only be hoped that those laid-off will be absorbed by the manufacturing and the market services sectors, rather than adding further to unemployment. The development of these sectors will be decisive for further productivity catch up in the overall Eastern German economy.

Regarding manufacturing, it is remarkable that the enormous productivity increase in Eastern Germany was hardly supported by any price increases. Surveys (Müller *et al.*, 1998, DIW *et al.*, 1999, and Bellmann and Brussig, 1999) have revealed several possible explanations for the limited success of Eastern German firms in improving their relative price position. These include difficulties in accessing distribution channels and markets, and in building reputation and establishing brand names. These problems are particularly relevant for the large number of newly created firms which account for 50% of employment in industry (Brenke and Schmidt, 1999). Therefore, a major challenge for the Eastern German manufacturing industry is to venture into higher quality markets. This implies that investment into product innovation and marketing, and hence into human capital, is essential. Specialisation in niche products could be helpful, since it offers the opportunity to relax price competition.

Figure 9. Real GDP per capita, year before transition = 100



Source: IIF, own calculations

There is a similar specialisation in the low quality/price segment in market services (DIW *et al.*, 1998). Beside the firm-related issues that have been described above, geographic factors may also play a relatively more important role. High value-added services are strongly concentrated in Western Germany (for example, publishing firms in Hamburg, media in Munich, and banking in Frankfurt). This suggests that agglomeration and localisation effects are at play. In those sectors in which Western German companies have been heavily engaged in Eastern Germany, such as banking and insurance, the Eastern German branches typically focus on low value-added retail activities (DIW *et al.*, 1998). However, there are still many other services that are based on modern communication technologies and where localisation effects do not play a significant role. Call

Overall, the main challenge in the market services sector, like in manufacturing, is to climb up the quality ladder and to define market niches.

centres are one much quoted example. For these types of activity, the cost advantages that Eastern Germany can offer, in combination with the modern telecommunications network, should be sufficient to attract investment and to motivate specialisation.

Overall, the main challenge in the market services sector, as in manufacturing, is to climb up the quality ladder and to define market niches. It is difficult to design policy to effectively support this process, and the quality of local institutions will be key. Already, the dynamics of employment patterns indicate that the southern New Länder may be gaining relative to the northern ones. Employment in manufacturing per 1000 inhabitants is 50% higher in Saxony and Thuringia than in Mecklenburg-Vorpommern, and is significantly higher than in Saxony-Anhalt and Brandenburg (Gornig and Häussermann, 1999). If continued, the resulting South-North gap would imply a return to development patterns prevailing before World War II.

Policy did create an investment boom in Eastern Germany, and, at least for manufacturing, there is evidence that the increased capital-labour ratio has led to higher labour productivity. However, the analysis of the adjustment process suggests that the rate of return to capital in Eastern German manufacturing has been below that in Western Germany (though positive). This is counter to the prediction of neo-classical convergence that the marginal product of capital should be higher in the region where there is relative capital scarcity. In line with this, there is evidence that the German system of general capital subsidies has distorted investment towards buildings and the most capital-intensive industries. Against this backdrop, the German government's intention to discontinue subsidies specific to Eastern Germany by 2004 appears appropriate. In any case, policies from the past - even to the extent that they have been successful - can not deal with the challenges of the future. With a greatly improved capital stock, the starting point today is different. Indeed, the need for a broadly-based quality upgrading in manufacturing and the services sector suggests that human capital with marketing experience may become the binding constraint for convergence to progress.

The problems of Eastern Germany only mirror the structural problems of Western Germany.

Some of the problems of Eastern Germany only mirror the structural problems of Western Germany in achieving employment intensive growth. It is now widely recognised that *"employment creation will need to derive predominantly from the private service sector, taking advantage of new opportunities for individual initiative"* (OECD, 1998, p. 128). Thus, looking at the more gradual adjustment in Central and Eastern Europe, it is far from clear that the wholesale adoption of the Western German institutional system offers the optimal framework for the structural adjustment of former planned economies.

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