

Dynamic adjustment and long-run equilibria

Panel data estimates for the East German states

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Abstract

The economic development in East Germany after unification shows both, success and failure. In the early nineties, wages and productivity increased fast; later on catching up faded out. A central question from a policy viewpoint is whether this fading out indicates a reduction of the adjustment speed or an equilibrium gap. This points towards a stationarity analysis of differences between East and West Germany. Our paper presents panel data estimates for the German states for wages, productivity, competitiveness and unemployment. The results reveal that the adjustment was fast, but the equilibrium gap is large.

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1 Introduction

In November 1989, the opening of the border between the Federal Republic of Germany and the German Democratic Republic initiated a rapid process of political and economic unification which took place in 1990. The development in East Germany since then is characterized by both, success and failure. Immediately after unification output and employment broke down by about one third of former levels, and unemployment rates increased to about twice those of West Germany. Since then a fast catching-up process began. Investment was far above western levels, and wages, productivity and output increased quickly. However, competitiveness was low and unemployment remained high, despite massive subsidies from the Federal Government. Even more important is the fading out of the catching-up process since the mid-nineties. Rates of change more or less ‘converged’, but large gaps between East and West Germany persisted.

A central question from an economic policy viewpoint is whether this fading out is temporary and indicates only a normalization of the adjustment process after those large growth rates in the early nineties. Another interpretation is that the fading out indicates that the equilibrium is already achieved, albeit at lower levels as compared with West Germany. This would imply conditional convergence with permanent gaps as compared with persistence of differences. Our paper aims at answering this question. From an econometric viewpoint this question points towards a stationarity analysis of the differences of East German variables relative to West Germany. In case of stationarity of those differences the empirical results would yield estimates of both adjustment speed and equilibrium gaps. In case of nonstationarity of those gaps the results would indicate that both parts of Germany are drifting apart.

The data source for the empirical investigation is an annual panel of mostly National Accounts data for the 15 German states (Bundesländer), 1991-2002. Berlin is excluded, because West Berlin was formerly part of West Germany (the FRG) and East Berlin was part of East Germany (the GDR). The empirical analysis is performed for nominal wages, nominal labour productivity, real unit labour costs and unemployment rates. Additionally nominal productivity is divided up into prices and real labour productivity. Concerning empirical specification, a fixed effects panel data estimator is employed. For comparison results are presented for the whole sample and for the East and West German subsamples. In addition, the nineties are splitted into overlapping subperiods, 1991-1997 and 1996-2002, to learn whether adjustment speed and equilibrium gaps were different in the late nineties. The next section discusses the development in East Germany within a broad theoretical framework of the macroeconomic adjustment process. Section 3 presents the data and discusses the empirical specification. In section 4, the estimation results are presented. They reveal a fast adjustment but also large equilibrium gaps of the East German economy. The paper concludes with a short summary and some implications for economic policy.

2 Macroeconomic adjustment in East Germany

Unification began with the opening of the German border November 9, 1989. In terms of the political development, German unification was a great success. In a very short time span, the regulations and institutions of a democratic market economy were introduced to a formerly centrally planned and ruled country. Unification was concluded with the joining of the East German states October 3, 1990, i.e. it took less than one year. [Table A.1](#) in the appendix gives a short time table of the unification process.¹ After the successful political implementation of the unification treaty, East and West German citizens and politicians were very optimistic about the future prospects of the East German economy.

In terms of the economic development the introduction of West German currency and institutions in East Germany imposed many problems.² Central was the currency conversion rate in combination with the state of the East German economy in 1990.³ The currency conversion rate of 1:1 for flows (wages, prices, pensions etc.) implied a wage level in East Germany of about 30 to 40 percent of the West German level. On average East German productivity was not far beyond, but for the export oriented industry sector the currency conversion rate implied an immediate loss of competitiveness. East German consumers switched to western products, East German investors had no interest in outdated technology, former CMEA partners⁴ were not able to pay western currency, and east-west trade was low already before unification. In consequence output broke down by about one third of the former level, employment slowly adjusted downward afterwards, and labour productivity decreased as well (see the upper panels of [figure 1](#)).⁵

After the breakdown a fast catching-up process began. Firstly, wages increased quickly with a doubling of relative wages within 5 years (see the right-hand panel of [figure 1](#)). The central argument in the wage negotiations in the early nineties was wage convergence.⁶ The goals of union leaders and workers were in favour of uniform living conditions in both parts of Germany which should be achieved with fast wage adjustments towards West German levels. The employers' side was less organized and, since it was dominated by West German firms, feared the competition of a low-wage region. Not surprisingly the public opinion was also in favour of fast wage

¹For a detailed discussion of the political economy of German unification, see Sinn and Sinn (1992) and the articles in Lange and Shackelton (1998).

²For a detailed discussion, see Akerlof et al. (1991), Sinn and Sinn (1992), Welfens (1996) and Lange and Pugh (1998).

³The state of the East German economy in 1989 is discussed in detail by Lipschitz and McDonald (1990).

⁴The CMEA (Council for Mutual Economic Assistance) was the economic association of the Eastern bloc countries.

⁵Note that the data for the figures in this section are not directly comparable to those of the empirical analysis in section 3 and 4. The data here refer to the German System of National Accounts and include (East and West) Berlin. See [table A.2](#) in the appendix for details.

⁶See Akerlof et al. (1991), Franz and Steiner (2000) and Hunt (2001) for a detailed discussion.

Figure 1: Macroeconomic adjustment after unification



Source: National accounts (Statistical Office and DIW Berlin), Federal Labour Office

convergence, and the political process with a sequel of elections in the East German states supported the view of the unions. Finally, massive subsidies and transfers from the Federal Government and increasing investment already in 1990 stimulated the expectation of fast productivity increases of which unions and workers wanted to participate.

Productivity catching up began about one year after wages increased, delayed by the breakdown of output combined with a sluggish adjustment of employment, but since 1992 huge increases of nominal labour productivity took place. Four channels of productivity catching up can be distinguished.⁷ Firstly, the reduction of labour hoarding through dismissals increased the utilization of labour by about 25 percent. Secondly, relative prices increased by about 20 percent in the first half of the

⁷See Burda and Hunt (2001). Smolny (2003) presents empirical estimates of the sources of productivity catching up in East Germany in the nineties.

nineties through direct adjustments towards West German price levels and through a mark up on increasing wage costs. Thirdly, increasing real wages and massive investment subsidies induced capital-labour substitution. Finally, total factor productivity adjustment through direct investment and technological diffusion could be expected.

This last argument deserves some further attention. The post World War II development has shown that total factor productivity convergence through technological diffusion was very important for the catching-up process of the industrial countries with respect to the productivity leader, the USA.⁸ East Germany provides an excellent example for the proposed working of this mechanism. Before unification the border inhibited the free inflow of modern production methods and capital goods and separated East Germany from best-practice technology. After unification East Germany exhibited a large inflow of technology through direct investment of (mostly) West German firms, and firms got easy access to modern materials, intermediate products and investment goods. Note that investment was highly subsidized and large investment took place. The investment-output ratio was more than twice those of West Germany, and investment per employee was above western standards as well.⁹ In addition East German firms should have faced sufficient incentives to employ best-practice technology in order to survive in a competitive environment.

However, starting from a rather low level immediately after the introduction of the currency union in July 1990 wages increased by far faster as compared with prices and productivity. In addition, unions achieved at least partial compensation for subsequent price and productivity increases. Consequently real unit labour costs increased and competitiveness deteriorated (see the lower left panel of figure 1). Given the low preference for East German products and real unit labour costs far above western standards, it should not be surprising that employment decreased and unemployment increased (see the lower right-hand panel of figure 1). Within 2 years, the East German unemployment rate increased to about twice of the also high West German rate, and persisting unemployment is probably the most severe economic policy problem until today.

Afterwards, the development more or less normalized. Output growth became smaller, employment stabilized, and the utilization of labour increased. The low competitiveness and high unemployment changed the incentives and the power of unions and firms in the wage-setting process, and wage inflation became smaller. Inflation rates which were high in the early nineties converged towards West German rates. Unfortunately, productivity catching up faded out, too. In the late nineties, the convergence process seems to have stopped completely. Growth rates of the East German economy are no longer higher than those in West Germany, and the level differentials of wages, productivity, real unit labour costs and unemployment rates persist.

⁸See Barro and Sala-i-Martin (1997), Coe and Helmann (1995), Temple (1999) and Smolny (1999, 2000).

⁹See DIW, IWH and IfW (1999), AGdwF (2002) and DIW, IfW, IAB, IWH and ZEW (2003).

An important question from an economic policy perspective is whether this fading out of the convergence process indicates only a (temporary) reduction of the adjustment speed due to a normalization of the catching-up process. An alternative hypothesis is that the smaller growth rates indicate that the equilibrium in East Germany is already achieved. This would imply conditional convergence with large permanent differences of income, competitiveness and labour market outcome.

From a theoretical point of view, there are strong reasons to expect a continuation of the convergence process. Firstly, East Germany exhibits the same political and economic institutions and regulations as West Germany. Convergence of the political and economic system took place at an early stage of the unification process.¹⁰ Secondly, the intra-German mobility of workers and firms and the explicit demand of unions for wage convergence strongly hints towards further wage adjustments.¹¹ Thirdly, both neoclassical and endogenous growth models supply strong theoretical reasons for labour productivity convergence via capital-labour substitution and total factor productivity convergence via technological diffusion.¹² In addition, the formal qualification of the work force is high. Finally, East Germany still receives massive help from the Federal Government in terms of active labour market policy programmes, investment subsidies and the financing of modern infrastructure equipment. For the Federal Government, economic convergence is an important objective.

The empirical evidence from previous studies is ambiguous. For instance, Klodt (2000, p. 315) concludes that “Catching-up of East German productivity to West German levels has completely faded out since the mid-1990s.” Barro and de Velde (2000, p. 271), on the other hand, argue “...that labor productivity in East Germany has caught up faster than has happened elsewhere.” Finally, a recent study of German economic research institutes argues that the convergence process has become slower but has not stopped.¹³ The aim of our econometric analysis is to estimate whether East German catching up is continuing or conditional convergence with permanent income, productivity and unemployment gaps has already occurred.

3 Data and empirical specification

The main data source for the empirical investigation are annual National Accounts for the 5 East German and the 10 West German states, 1991-2002. Berlin is excluded, since West Berlin was formerly part of West Germany (the FRG) and East Berlin was part of East Germany (the GDR). The data on unemployment stem from the Federal

¹⁰The importance of social and political factors for catching up is discussed in Temple (1999). Abramovitz (1986) coined the term of the ‘social capability for catching up’.

¹¹For instance, there is a large number of East-West commuters, large migration of East German citizens towards West Germany and still large direct investment of West German firms in East Germany. See Franz and Steiner (2000), Hunt (2001) and DIW, IfW, IAB, IWH and ZEW (2003).

¹²See Dornbusch and Wolf (1992), Barro and Sala-i-Martin (1997) and Temple (1999).

¹³See DIW, IfW, IAB, IWH and ZEW (2003).

Labour Office in Nürnberg.¹⁴ The empirical analysis is performed for nominal wages, nominal labour productivity, real unit labour costs and the unemployment rate. In addition, nominal productivity is divided up into prices and real labour productivity. With the exception of the unemployment rate, a logarithmic specification of state-specific values in relation to the average value of the West German states is chosen,

$$\ln x_{i,t}^d = \ln x_{i,t} - \ln \bar{x}_t^{\text{west}}.$$

x stands for the above mentioned variables. West German averages are calculated as aggregate values for West Germany, excluding Berlin.

The wage rate is nominal gross labour income per dependent employee. The time series development is depicted in the left panel in [figure 2](#). The upper plot depicts the relative rates of change, the bottom plot depicts the relative logarithmic levels. The figure reveals the large rates of wage inflation in East Germany in the early nineties and the reduction in terms of growth rates since the mid nineties. Remarkable is the high correlation within East and West Germany, respectively. The left bottom panel shows the catching-up process, but also the persisting East-West wage gaps. In 2002, average wages in East Germany are about 25 percent below the West German average. Remarkable is the larger regional variance in West Germany as compared with East Germany, but also the still visible gap between ‘poor’ West German states and ‘rich’ East German states.

The right-hand panels depict the corresponding specifications for relative nominal labour productivity, i.e. nominal GDP per employee. The figure shows the large growth rates 1992-1994; productivity growth was even higher as compared with wage inflation (note the different scaling of the right-hand panels). However, wages increased already in 1990/1991, while productivity was low due to the breakdown of output and the delayed adjustment of employment. Once again the fading out of the adjustment process with large persistent gaps of about 35 percent more recently is visible. The picture for real labour productivity looks similar (see [figure A.1](#) in the appendix).¹⁵ In the early nineties the gap was smaller, but growth rates were smaller too; since the late nineties the gap was about 35 percent as well. With respect to price inflation, relative prices in East Germany increased by about 20 percent in the early nineties, but quickly achieved West German levels.¹⁶ Since 1995 price inflation hardly differs between East and West Germany.

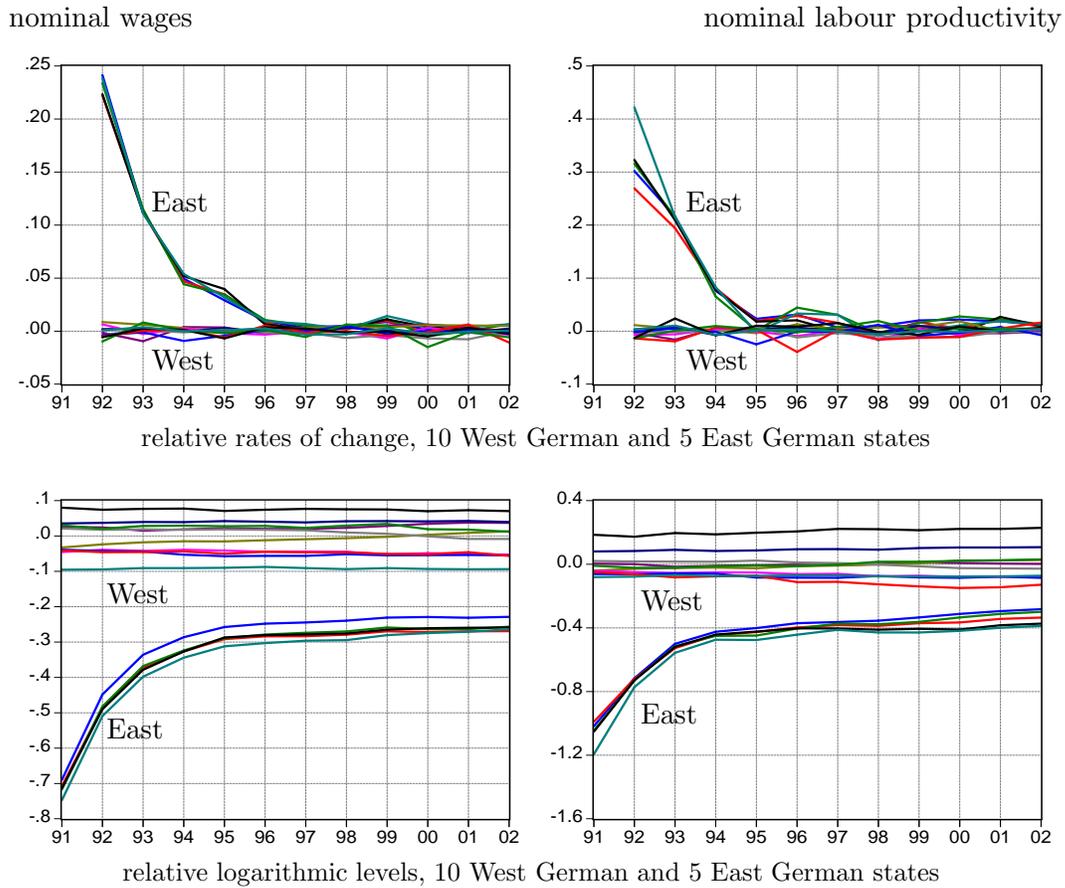
An indicator of East German competitiveness are relative real unit labour costs, i.e. nominal wages in relation to nominal labour productivity (see the left panel of [figure 3](#)). As a consequence of large wage increases as compared with sluggish productivity growth in 1990/1991, real unit labour costs were about 35 percent above West German values in 1991. Since 1992 the gap became smaller, but the

¹⁴The data sources are discussed in table A.2 in the appendix.

¹⁵Real labour productivity is real GDP (prices of 1995) per employee.

¹⁶Prices refer to the GDP deflator.

Figure 2: Wages and productivity

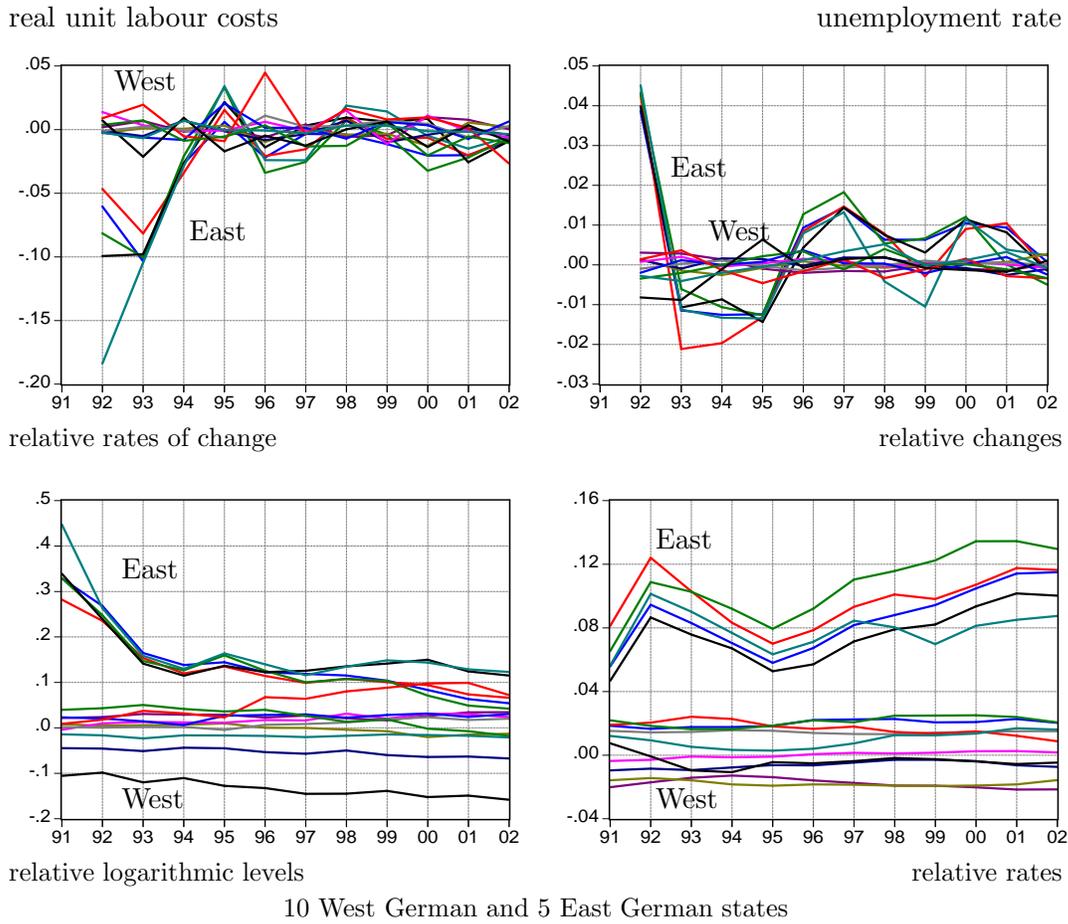


East German average in 2002 is still about 10 percent above the corresponding West German value. Notable are also the large and persisting differences within the East and West German states, respectively.

Finally, the right-hand panel depicts the development of relative unemployment rates. The unemployment rate is the number of unemployed (national definitions) in relation to the dependent labour force. On average, East German unemployment rates are about 10 percentage points above West German rates, i.e. more than twice as high. Convergence is not visible, the figure indicates that differences increase.

The econometric analysis devotes most attention to the estimation of the adjustment speed and the average equilibrium gap of the East German states. The economic concept of convergence corresponds to the econometric concept of cointegration of the levels of economic variables or the stationarity of the differences between East and West Germany. One can distinguish absolute and conditional convergence. The panel data permit the estimation of fixed effects for the states; the fixed effects stand

Figure 3: Competitiveness and unemployment



for state-specific factors conditioning the equilibrium gap.¹⁷ It is well known that the econometric interpretation of the results of panel data analyses with non-stationary data is difficult, especially within small samples.¹⁸ However, the general impression from the literature is that panel data increase the power of stationarity tests. In addition, we have argued above that there are strong theoretical reasons to expect stationarity of the differences, i.e. at least conditional convergence of East and West Germany.

¹⁷The empirical estimates reveal the significance of the fixed effects in most cases.

¹⁸There is an intense discussion of this subject in the econometric literature. See for instance Banerjee (1999) and Levin, Lin and Chu (2002).

4 Estimation results

This section presents empirical evidence for the stationarity of East-West gaps. In a first step, estimates for the complete sample of all 15 states are carried out. The idea of this specification is to achieve parameter stability from the large sample. In a second step, only the East German states are included to learn whether the adjustment in East Germany was different. In a third step, the results are compared with those from the subsample of West German states. This should yield evidence whether the estimated models are an appropriate description of the dynamic adjustment towards the mean in West Germany as well. In order to detect changes of adjustment speed and equilibrium levels, all models are estimated for the whole period, 1992-2002, and for two overlapping subperiods, 1992-1997 and 1996-2002. Since the subperiods capture only 6 or 7 years those estimates should be interpreted with care.

Estimation results for wages and nominal labour productivity are shown in [table 1](#), the corresponding results for real unit labour costs and unemployment are depicted in [table 2](#), and the results for real labour productivity and prices are shown in [table A.3](#) in the appendix. Depicted are the estimated coefficients and the corresponding t -values (in parantheses) of the adjustment coefficient λ and the equilibrium gaps of the East German variables. The estimated equation is

$$\Delta \ln x_{i,t}^d = \lambda \cdot (\ln x_{i,t-1}^d - \text{constant} - D^{\text{east}} - \text{FE}_i) + \varepsilon_{i,t}$$

where x_i^d stands for the value of the corresponding variable of state i in relation to the West German average. The fixed effects FE_i are defined as differences of the dummy of state i and the reference state (East and West Germany, respectively). Therefore, the coefficient of the dummy variable for East Germany D^{east} for the full sample (all states) and the **constant** of the East German subsample can be read directly as estimates of the average equilibrium gap.¹⁹

The estimates of wage convergence for the full sample of all states (left columns of table 1) firstly yield a well determined and quite large adjustment coefficient λ . About 50 percent of the wage gap were closed each year. They also yield a precisely estimated average equilibrium gap of the East German states D^{east} of about 25 percent. The 99 percent confidence intervall of the estimated gap is about ± 0.5 percentage points. Note also the low standard error of the estimated equation SEE; a large part of the variance of relative state-specific wage changes is explained by the model. Nearly the same result, both for the equilibrium gap and the adjustment coefficient, is revealed for the smaller sample of the East German states. For the West German subsample the adjustment coefficient is smaller and less well determined. Note that the standard error of the equation for West Germany is smaller, but the variance of wage changes is smaller, too. Therefore the \overline{R}^2 is smaller.

¹⁹The coefficients of the fixed effects for the individual states are not reported in the tables. The detailed results are available on request from the authors.

Table 1: Wages and productivity

	nominal wages			nominal labour productivity		
all states	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
D^{east}	-.254 (-148.1)	-.261 (-137.2)	-.236 (-26.4)	-.358 (-62.1)	-.374 (-44.0)	-.328 (-26.5)
λ	-.507 (-107.2)	-.520 (-123.1)	-.177 (-3.5)	-.479 (-50.1)	-.501 (-42.9)	-.248 (-5.7)
SEE	.0047	.0035	.0038	.0147	.0150	.0088
\overline{R}^2	.9888	.9963	.3749	.9519	.9709	.5091
East	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
constant	-.262 (-164.7)	-.267 (-123.9)	-.248 (-33.3)	-.362 (-51.0)	-.377 (-32.4)	-.318 (-12.2)
λ	-.508 (-98.7)	-.520 (-95.9)	-.203 (-3.3)	-.484 (-34.8)	-.502 (-27.8)	-.205 (-2.9)
SEE	.0051	.0045	.0038	.0213	.0231	.0121
\overline{R}^2	.9945	.9969	.2257	.9573	.9639	.2043
West	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
λ	-.150 (-2.4)	-.583 (-6.1)	-.122 (-1.4)	-.147 (-3.1)	-.398 (-3.3)	-.355 (-5.9)
SEE	.0039	.0030	.0038	.0082	.0088	.0065
\overline{R}^2	.1530	.4399	.1676	.1882	.2214	.5579

Notes: t -ratios in parantheses, fixed effects for the states (not reported).

The results for subperiods should be interpreted with some care, since they are based on only 6 or 7 annual time series observations. However, most of the coefficients are well determined. The estimated equilibrium gap in the more recent subperiod is slightly smaller (0.24 vs. 0.26); in addition, the adjustment is slower. Finally, the fixed effects estimates reveal significant differences of the equilibrium gap of about ± 3 percent for the East German states. The differences between the West German states are larger (± 8 percent) and also highly significant. Nevertheless, a significant difference between ‘poor’ West German states and ‘rich’ East German states of about 15 percent remains.

In conclusion, the estimates reveal a well determined and nearly constant average East German equilibrium wage gap of about 1/4. The differences between the East German states are small but significant. In the first half of the nineties the adjustment was fast, and in 1996 the equilibrium was more or less achieved. Afterwards the adjustment towards the mean was slower.

The results for nominal labour productivity are depicted in the right-hand columns of table 1. The estimates of the full sample yield again a highly significant adjustment coefficient of about 0.5 and a well determined average equilibrium productivity gap of about 36 percent. This result is robust for the East German subsample, too. Once again, the estimated equilibrium gap is somewhat smaller and the adjustment seems to be slower in the late nineties. The adjustment towards the mean is confirmed for the West German sample as well, although the coefficients are less well determined. The coefficients of the fixed effects reveal significant but small (± 3 percent) differences of the equilibrium gaps of the East German states.

The results for real labour productivity mirror those for nominal labour productivity (see table A.3 in the appendix). The estimated adjustment coefficient is about 0.40, the estimated equilibrium gap is about 35 percent and well determined. Table A.3 depicts the results for prices, too. The estimates reveal a highly significant and fast adjustment and a small average equilibrium gap of less than 1 percent. In addition, the individual state dummies are hardly significant. In conclusion, the estimates reveal a fast adjustment of East German labour productivity. The equilibrium was more or less achieved in 1996. Afterwards, the adjustment was slower. The estimated average equilibrium productivity gap is about 35 percent.

In table 2, the results for real unit labour costs (left columns) and unemployment rates (right-hand columns) are depicted. Given the results for wages and labour productivity, the estimates for real unit labour costs should not come as a surprise. Since some part of the variance is removed by taking ratios – nominal wages and nominal labour productivity are positively correlated – the estimated t -ratios are smaller. Nevertheless, the coefficients are again well determined. The estimated adjustment speed is about 0.45. The estimated average equilibrium real unit labour cost gap is about 10 percent. Once again, the equilibrium gap was slightly smaller and the adjustment was slower in the second half of the nineties. The adjustment towards the mean is confirmed for the West German states as well. The results of the East German state dummies reveal small and insignificant differences of equilibrium gaps in East Germany, i.e. state-specific wage and productivity gaps in East Germany correspond.²⁰

The right-hand columns in table 2 depict the results for east-west differences of unemployment rates. The model appears to be appropriate for the labour market situation as well. The estimates reveal a significant and very fast adjustment towards state-specific means especially in the first subperiod. Disequilibria are more persistent in the second half of the nineties and in the West German states. The estimated average East German equilibrium gap is about 9 percentage points with significant differences of about ± 2 percentage points for the individual states.²¹ Even more important, from an economic policy perspective, is the estimated increase of the gap. Albeit the sample size for the subperiods is small and the adjustment coefficient in

²⁰The results for West Germany reveal larger and significant differences.

²¹Individual state differences of equilibrium gaps in West Germany are about ± 2 percentage points, too.

Table 2: Competitiveness and unemployment

	real unit labour costs			unemployment rate		
all states	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
D^{east}	.104 (16.2)	.118 (13.5)	.093 (11.1)	.093 (30.2)	.080 (40.4)	.114 (21.4)
λ	-.437 (-17.1)	-.505 (-14.7)	-.317 (-5.2)	-.478 (-7.5)	-.994 (-9.9)	-.228 (-6.5)
SEE	.0147	.0158	.0096	.0082	.0086	.0034
\overline{R}^2	.6998	.7903	.3464	.2506	.5071	.5386
East	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
constant	.101 (12.6)	.114 (9.3)	.074 (3.6)	.096 (22.2)	.083 (30.4)	.118 (13.8)
λ	-.454 (-11.5)	-.505 (-9.2)	-.226 (-2.3)	-.490 (-4.4)	-1.021 (-5.8)	-.224 (-3.8)
SEE	.0220	.0249	.0125	.0139	.0146	.0055
\overline{R}^2	.7037	.7435	.1419	.2159	.4987	.2702
West	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
λ	-.196 (-3.5)	-.468 (-3.4)	-.487 (-6.1)	-.285 (-4.3)	-.588 (-6.4)	-.323 (-3.9)
SEE	.0085	.0086	.0074	.0021	.0020	.0015
\overline{R}^2	.1402	.1961	.4117	.1166	.4050	.2832

Notes: t -ratios in parantheses, fixed effects for the states (not reported).

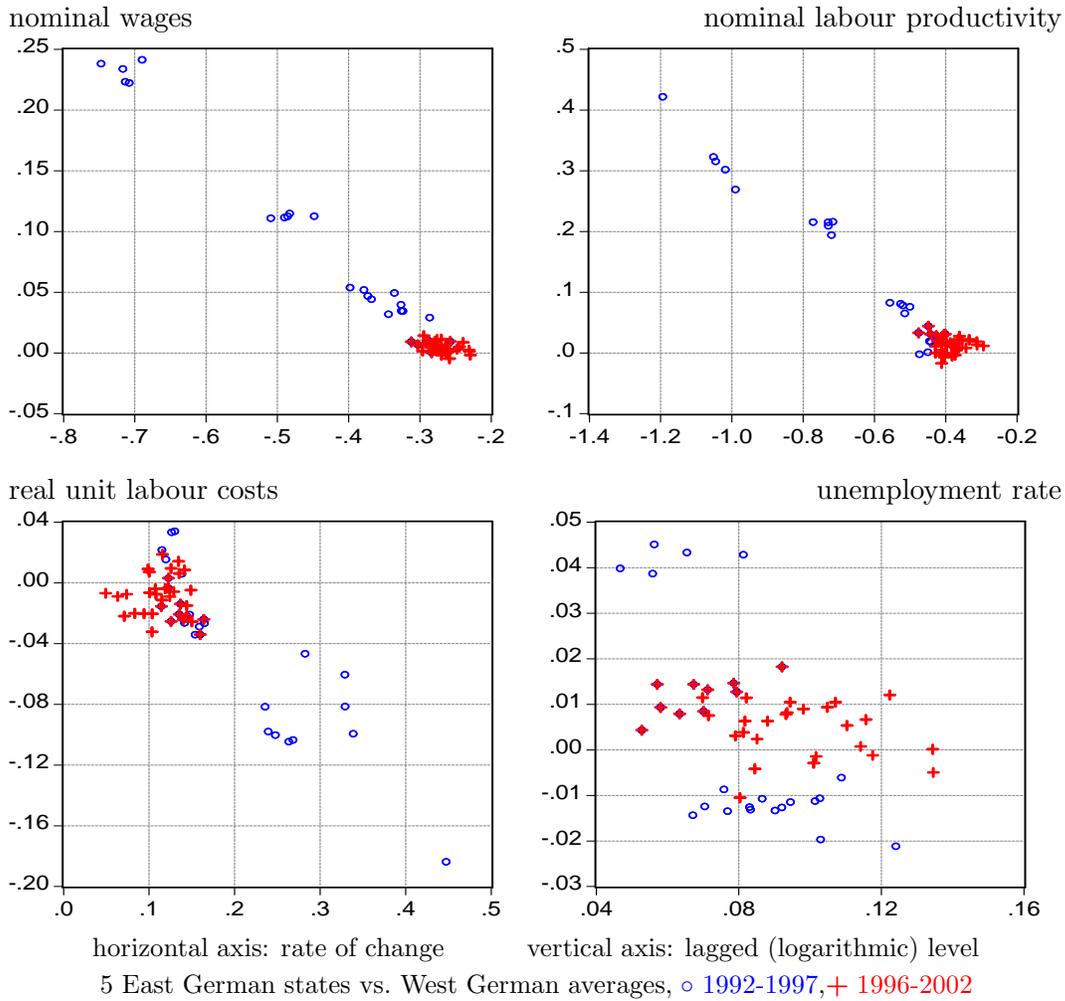
the more recent subsample is less well determined, the estimated coefficients point towards an increase of the gap from about 8 to about 12 percentage points.

Figure 4 presents a visual impression of the success and the failure of the adjustment process in East Germany. For the 4 variables, wages, productivity, real unit labour costs and unemployment, the annual rates of change (vertical axis) are plotted against the lagged (logarithmic) level.²² The figures refer to the East German states only, a circle \circ refers to the years 1992-1997, and a $+$ refers to the observations from 1996-2002.

These figures confirm the impression of the adjustment process of the East German economy, despite of the omission of the fixed effects. Especially for wages and productivity the adjustment path is clearly visible. In the early nineties, wages

²²Corresponding scatter plots for real labour productivity and prices are depicted in figure A.1 in the appendix.

Figure 4: Adjustment in East Germany



and productivity were far below equilibrium values. However, the adjustment was fast, and it took only 4 years until the equilibrium was established. Afterwards rates of change between West and East Germany hardly differed, and the relative positions hardly changed. The average equilibrium wage gap is about 25 percent, and the productivity gap is about 35 percent. Correspondingly, real unit labour costs are about 10 percent above those of West Germany. For the labour market situation, the picture is less clear; for this variable, the fixed effects (± 2 percentage points) are rather important. Nevertheless, the adjustment towards an equilibrium unemployment rate differential of about 8 to 12 percentage points is visible.

In conclusion, the estimates reveal a significant and fast adjustment of East Germany towards West Germany, i.e. East and West Germany are not drifting apart. The estimates also indicate large equilibrium gaps for wages, productivity, competi-

tiveness and unemployment. Conditional convergence had occurred, but equilibrium gaps are large. The coefficients are well determined and robust across subsamples; low standard errors indicate reliability, and the model appears to be appropriate for the West German states as well. A general impression of the estimates is that the adjustment was slower in the second half of the nineties. With respect to income and competitiveness, equilibrium gaps appear to be smaller more recently as compared with the early nineties. The equilibrium unemployment differential seems to be higher today. The fixed effects estimates reveal significant state-specific differences within East Germany. However, differences within the East and West German states are smaller than those between the regions, and differences within the East German states are smaller than those within the West German states.

5 Conclusion

The economic development in East Germany after unification shows both, success and failure. Central for the understanding of the development in the first years after unification is the breakdown of the East German economy nearly instantaneously after the introduction of economic, monetary and political union. Afterwards, a fast catching-up process began. Wages increased quickly with a doubling of relative wages within 5 years. Productivity catching up began about 1 year later; correspondingly competitiveness deteriorated, and unemployment increased. Since the mid-nineties the catching-up process faded out.

A central question from an economic policy viewpoint is whether this fading-out indicates a (temporary) reduction of the adjustment speed or an equilibrium gap. From a theoretical point of view there are strong reasons to expect a continuation of the adjustment process. Firstly, East Germany exhibits the same economic institutions and regulations as West Germany. Secondly, labour unions and the public opinion strongly demand wage convergence. Thirdly, growth models point towards productivity convergence via capital-labour substitution and technological diffusion. Finally, for the Federal Government economic convergence is an important objective.

This paper presents empirical estimates about the speed of the adjustment and the equilibrium outcome. The economic concept of convergence corresponds to the econometric concept of stationarity of differences between East and West Germany. Based on regional panel data for 15 German states 1991-2002, an augmented stationarity analysis for East-West differences of wages, productivity, competitiveness and unemployment was carried out. The estimates yield well determined coefficients for the adjustment speed and the equilibrium gap.

The results reveal that the adjustment was fast, but equilibrium gaps are large. Starting from low levels in 1991, it took only 5 years until the equilibrium was established. The estimates imply that East German equilibrium wages are about 1/4 below West German wages; the labour productivity gap amounts to about 35 percent. Correspondingly, real unit labour costs are about 10 percent above those

of West Germany. Consequently, equilibrium unemployment rates are about 10 percentage points above West German rates, i.e. more than twice as high. The results fit together.

From the perspective of economic policy, this outcome of low income in combination with high unemployment poses the strongest problem. Especially the significant difference between East and West Germany not only for actual unemployment rates but for equilibrium unemployment is mostly devastating. Concerning income and competitiveness, a glimmer of hope might be that the estimated equilibrium gaps are slightly smaller for the more recent time period, as compared with the early nineties. Concerning labour market outcome, the equilibrium unemployment differential seems to be higher today than in the early nineties.

From the perspective of economic theory, the labour market outcome should not come as a surprise. Wages increased faster and more as compared with productivity; therefore real unit labour costs were high, and unemployment increased. From a theoretical point of view, the disappointing development of productivity poses the strongest problem. In East Germany, labour productivity is low despite high wages, large investment subsidies and huge amounts of capital investment. In addition, the prerequisites for total factor productivity catching up were quickly established via policy decisions at an early stage of the unification process. So one is tempted to ask what distinguishes the East German states?

A convenient (and often used) argument might be that the unfavourable starting position with the history of a repressive and inefficiently organized centrally planned economy provides an explanation for the productivity gap. However, an unfavourable starting position can explain a temporary disequilibrium situation, but not long-run equilibrium gaps which were established in 1996, with hardly any adjustment afterwards. Our estimates reveal that the adjustment was fast; the equilibrium gaps are the central problem.

A more promising line of argument is related to the inheritance of the unification process. The political decisions at the beginning of the unification process – 1:1 currency conversion rate, adoption of the West German social security system, massive investment subsidies – had left the East German economy with distorted incentives which might have impeded the continuation of the catching up.²³ The social security system with extra weight on labour market policy resulted in distorted incentives for unions and workers and led to large nominal wage increases years before productivity increased. The combination of high wages and massive investment subsidies resulted in a distorted capital structure with capital-intensive production methods, capital waste and only a few jobs. This was not so much a problem at the early stage of the unification process when these subsidies were given, but became a problem when those subsidies were reduced. Therefore, East Germany has to recover not only from a poor starting position, but from the distorted incentives installed in the

²³See Sinn (1995, 2002), Boltho, Carlin and Scaramozzino (1997) and Riphahn, Snower and Zimmermann (2001).

early nineties. Given the recent discussion on economic policy reform in Germany, this kind of adjustment had hardly begun.

A final set of arguments is directly related to the underlying factors of the long-run equilibrium and refers to the locational disadvantages of East Germany. Those factors can also be linked to the failures of the unification process until today and might even lead to a diverging development. Firstly, the specific allocation of transfers resulted in a distorted sectoral structure with above average weights of low productivity sectors such as construction and social services and below average weights of high productivity (growth) sectors such as industry and financial services. Secondly, the accumulation of human capital is impeded by the bad employment opportunities on the East German labour market. In addition, qualified workers migrate to West Germany, where wages are higher and employment opportunities are better. Finally, why should (West German) firms open a dependence in East Germany? Given the location at the eastern border of western Europe and the less developed infrastructure equipment, it is still easier to supply East Germany from the West as the other way round. Until today the empirical relevance of those arguments is hardly understood, and the puzzle of the poor development of East German productivity is not yet solved.

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Appendix

Table A.1: The time table of German unification

May 1989	Removal of border controls in Hungary
August 1989	Mass migration of GDR-citizens via Hungary
September 1989	“Monday demonstrations” in Leipzig
November 9, 1989	<i>Opening of the German border</i>
January 12, 1990	Privat ownership of production facilities and joint ventures with foreigners permitted
May 5, 1990	Begin of 2+4 negotiations
May 18, 1990	Signing of the treaty about formation of an economic, monetary and social union
July 1, 1990	The treaty came into force
August 31, 1990	Signing of the unification treaty
September 12, 1990	Closing of the 2+4 treaty
October 3, 1990	<i>German unification</i>
October 14, 1990	Elections of East German state parliaments
December 2, 1990	Elections of the Federal Government

Table A.2: Data sources

The data employed for the figures in Section 2 are not directly comparable with those in the empirical analysis in section 3 and 4. Up to 1998, the Federal Statistical Office calculated aggregate National Account data based on national definitions for East Germany (including East Berlin) and West Germany (including West Berlin), respectively. The data for East Germany 1989 and 1990 are estimates of the DIW, Berlin. The data are available from

http://www.diw-berlin.de/deutsch/service/datenservice/statfinder/vgr_alt/

The National Accounts data for the empirical analysis stem from the ‘Arbeitskreis Volkswirtschaftliche Gesamtrechnung’ of the state agencies of the Federal Statistical Office in Germany. Those data conform to the European System of National Accounts and are available for 1991 to 2002 for the 16 German states from

<http://www.vgrdl.de/>

The data on unemployment stem from the Federal Labour Office in Nürnberg

http://www.arbeitsamt.de/hst/services/anba/jg_2003/jahreszahlen2002/index.html

Figure A.1: Prices and real labour productivity

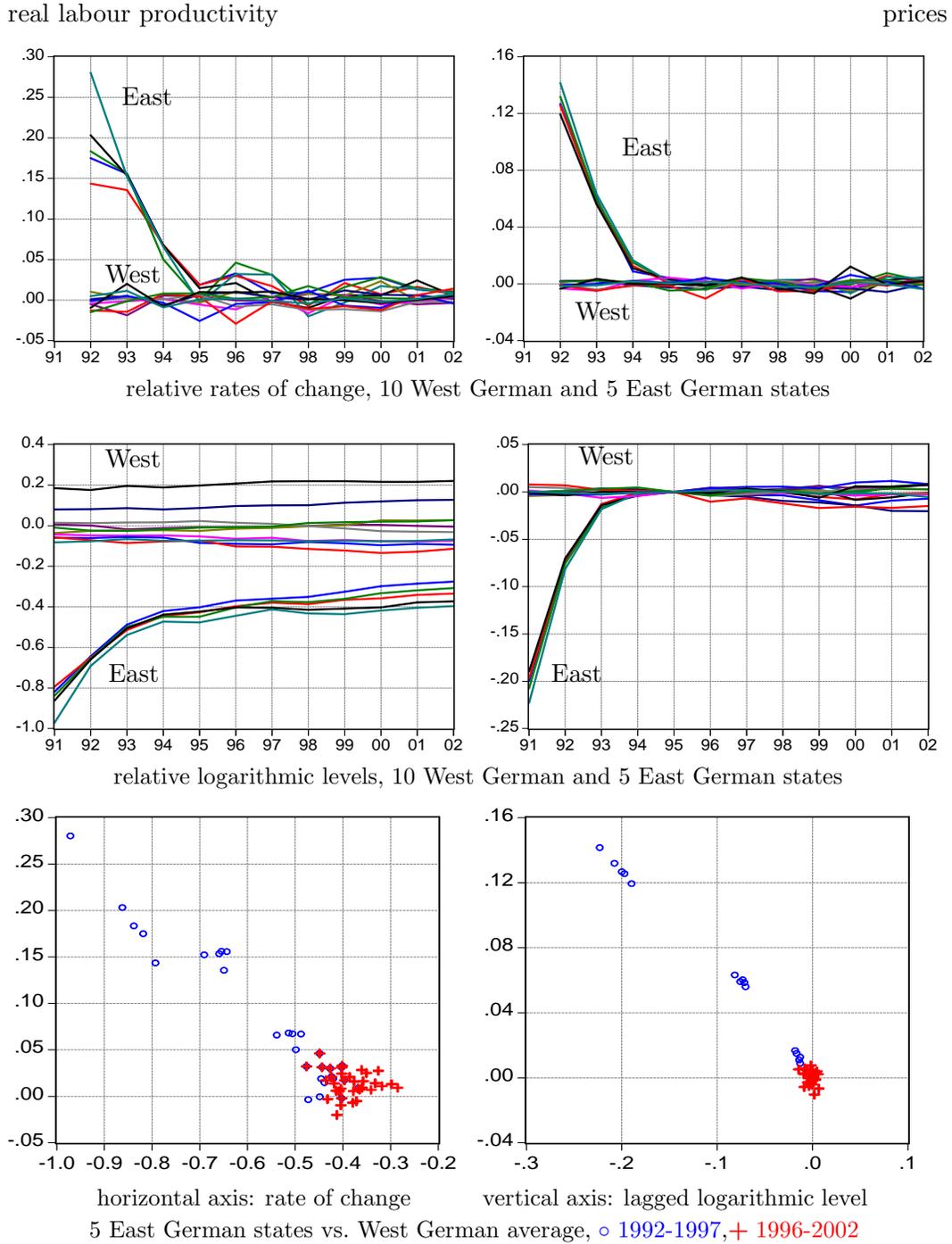


Table A.3: Real labour productivity and prices

	real labour productivity			prices		
all states	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
D^{east}	-.353 (-54.2)	-.370 (-38.3)	-.330 (-28.4)	.002 (1.8)	.003 (2.2)	.000 (.3)
λ	-.408 (-33.5)	-.439 (-27.7)	-.249 (-5.9)	-.645 (-70.7)	-.641 (-69.6)	-.478 (-5.6)
SEE	.0137	.0140	.0086	.0040	.0037	.0030
\bar{R}^2	.9045	.9401	.5149	.9725	.9865	.2383
East	1992-2002	1992-1992	1996-2002	1992-2002	1992-1997	1996-2002
constant	-.356 (-43.9)	-.373 (-27.7)	-.327 (-16.9)	.001 (0.7)	.003 (1.7)	-.001 (-1.1)
λ	-.415 (-23.1)	-.439 (-17.8)	-.237 (-3.4)	-.650 (-58.6)	-.642 (-49.2)	-.527 (-3.0)
SEE	.0199	.0217	.0122	.0049	.0053	.0034
\bar{R}^2	.9078	.9163	.2575	.9845	.9882	.1591
West	1992-2002	1992-1997	1996-2002	1992-2002	1992-1997	1996-2002
λ	-.114 (-2.4)	-.353 (-2.9)	-.282 (-4.8)	-.189 (-3.1)	-.396 (-3.5)	-.456 (-4.7)
SEE	.0078	.0081	.0062	.0028	.0026	.0029
\bar{R}^2	.1575	.1812	.4457	.1087	.1749	.2816

Notes: t -ratios in parantheses, fixed effects for the states (not reported).