Wage adjustment, competitiveness and unemployment – East Germany after unification

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Abstract

Nearly 20 years after unification large differences of the labor market situation in East and West Germany persist. Wages are still considerably lower, the unemployment rate is about twice of the West German level, and the competitiveness of the East German economy seems to be low. This paper analyzes the process of (relative) wage adjustment in East Germany and the resulting development of competitiveness and unemployment differentials. We present estimates of the wage adjustment in East vs. West Germany based on wage convergence and effects of unemployment on wage growth. The central focus of the paper is the empirical analysis of the interaction of the development of competitiveness and the labor market situation. The results reveal large equilibrium gaps for wages and unemployment which are based on the wage-setting process, the behavior of competitiveness and the adjustment of unemployment.

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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. In terms of the political development German unification was a great success. In less than one year the regulations and institutions of a democratic market economy were introduced to a formerly centrally planned and ruled economy. In terms of the economic development the adjustment process took much more time, and until today, nearly 20 years after unification, large East-West differences persist.[1] Despite longer working hours and better formal qualification levels of the employees wages are much lower in the east, and despite lower wages the unemployment rate is about twice of the West German level. The competitiveness of the East German labor market seems to be low.[2]

The central focus of the paper is the interaction of wages, competitiveness and the labor market situation in East Germany. As a starting point we look at the process of wage adjustment in terms of wage convergence and effects of unemployment on wage gaps. In a second step we analyze the adjustment of real unit labor costs which we see as an appropriate indicator of competitiveness for labor market analysis. The final step is the analysis of effects of competitiveness on the adjustment of the unemployment rate. The analysis if focussed on the adjustment process of East Germany towards West Germany after unification. Therefore the discussion is concentrated on those arguments which are seen as mostly relevant for this process, and the empirical analysis is performed for East-West differentials. We employ regional panel data for the East German states and estimate dynamic adjustment models which permit to calculate adjustment speeds and equilibrium gaps. The empirical analysis is carried out for the full sample 1991 to 2007 and for a more recent sample (since 1996) after the normalization of the adjustment process.

Section 2 gives a short introduction into the macroeconomics of German unification with a special emphasis on the early years. Section 3 presents an overview of arguments related to the interaction of (relative) wages, competitiveness and unemployment in the East German transition process. Section 4 discusses the data and the empirical specifications. Section 5 presents the estimation results which reveal significant and fast adjustment processes but large equilibrium gaps. The final section concludes with some implications for economic policy.

[1] See BMVBS (2008).

[2] See Burda (2006) and Snower and Merkl (2006).

2 Macroeconomic adjustment after unification

Unification began with the opening of the German border November 9, 1989. The first cornerstone of the economic development in East Germany was the decision for a fast implementation of Economic, Monetary and Social Union in July 1990, i.e. less than 8 months after the opening of the border. In terms of the political development this decision and its implementation was as a great success. In a very short time span the regulations and institutions of a market economy were introduced to a formerly centrally planned and ruled economy. Unification was concluded with the joining of the East German states October 3, 1990.[3]

In terms of the economic development the introduction of West German currency and institutions in East Germany imposed many problems. Central was the currency conversion rate in combination with the state of the East German economy in 1990.[4] The currency conversion rate of 1:1 for flows (wages, prices, pensions etc.) implied a wage level in East Germany of about 1/3 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 partners[5] were not able to pay western currency, and east-west trade was low already before unification. Consequently output and employment broke down.

Figure 1 depicts the development of some key macroeconomic variables from 1989 to 1998.[6] In 1991 output (real GDP) was about 1/3 lower as compared with 1989, and in 1992 the employment loss amounted to about 1/3, too.[7] Employment adjusted only slowly with respect to output due to several measures of employment policy introduced specifically for the situation in East Germany after unification. Despite massive lay-offs in 1990 and 1991 and the starting investment boom there was still a large overhang of employees not required for production. From 1991 until 1993

[3] For a detailed discussion of the political economy of German unification see Sinn and Sinn (1992) and the articles in Lange and Shackelton (1998). A short time table of the unification process is provided in table A.1 in the appendix.

[4] For a detailed discussion see Akerlof et al. (1991), Dornbusch and Wolf (1992), Sinn and Sinn (1992), Hughes Hallet and Ma (1993), Welfens (1996) and Lange and Pugh (1998).

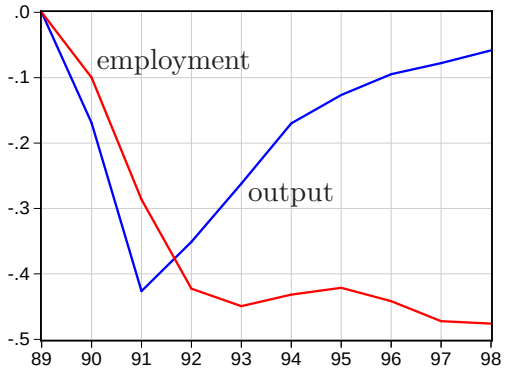
[5] The CMEA (Council for Mutual Economic Assistance) was the economic association of the Eastern bloc countries.

[6] The data for 1989 and 1990 are estimates of the DIW, Berlin. A more detailed description of the data is given in table A.2 in the appendix.

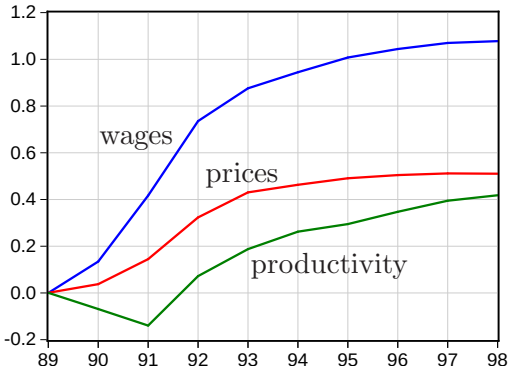
[7] See Akerlof et al. (1991) and Lipschitz and McDonald (1990) for a detailed discussion.

Figure 1: East Germany after unification

output and employment

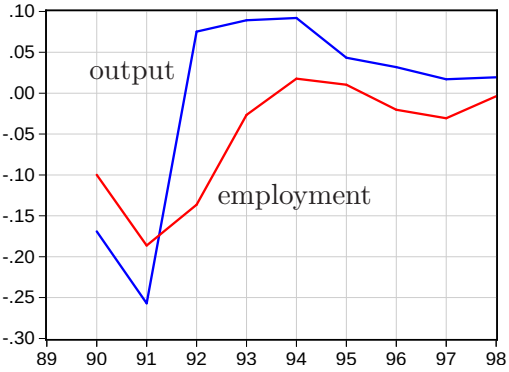


wages, prices and labor productivity

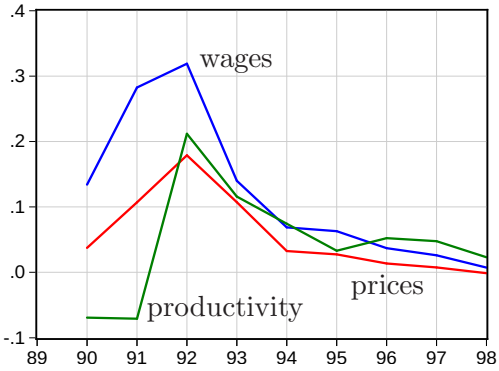


log. index 1989=0

output and employment



wages, prices and labor productivity

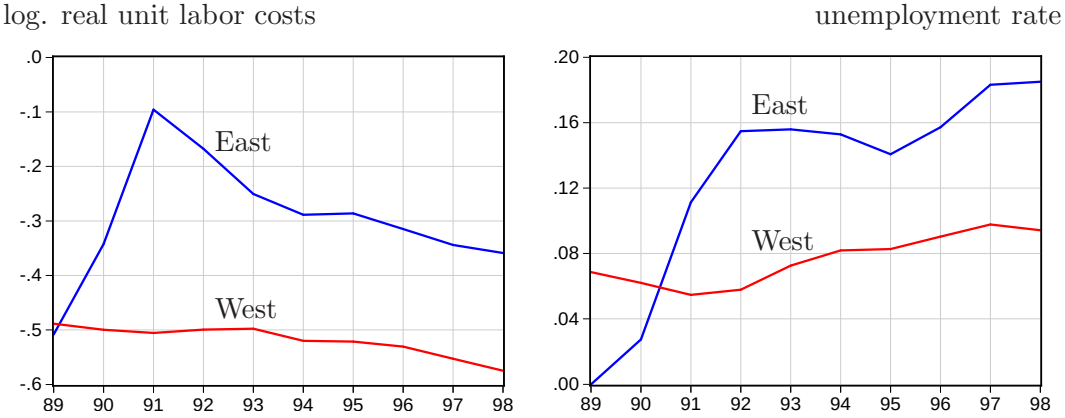


rates of change

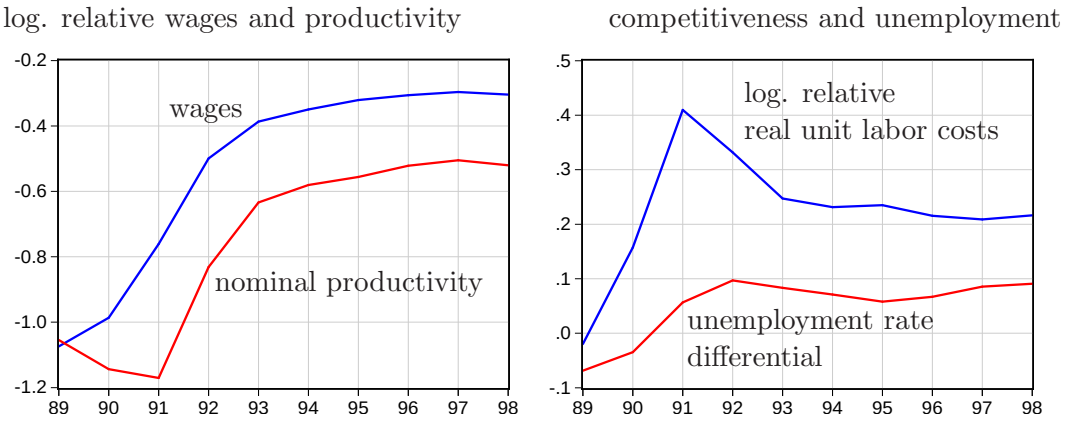
a further reduction of employment by more than 15 percent took place, despite real output increases of nearly 18 percent in the same period. Consequently labor productivity in 1991 was lower as compared with the pre-unification level in 1989. Wages and prices, on the other hand, increased enormously already in 1990 and 1991. This implied a dramatic loss of competitiveness and contributed to the increase of unemployment.

After the breakdown of the East German economy a fast catching-up process began. Real output increased, employment stabilized, and since 1992 enormous increases of labor productivity took place. However, since the mid-nineties the adjustment process slowed down. Output growth became smaller. Low competitiveness and high unemployment changed the incentives and the power of unions and firms in the

Figure 2: Wages, competitiveness and unemployment, 1989-1998



East and West Germany



East Germany relative to West Germany

wage-setting process, and wage inflation became smaller. Inflation rates which were high in the early nineties converged towards low West German rates. Productivity catching up faded out as well, and since the late nineties large wage and productivity gaps persist.[8]

The central theme of the paper is the interaction of the wage adjustment and the development of unemployment. The analysis is concentrated on a small number of key variables, i.e. wages, real unit labor costs (wages relative to labor productivity) and unemployment rates. Figure 2 depicts in the upper panels the development of real unit labor costs and unemployment rates in East and West Germany. The

[8]See Boltho et al. (1997), Burda and Hunt (2001), Sinn (2002), DIW et al. (1999, 2003) and BMF (2003).

figures reveal the sharp increase of real unit labor costs in East Germany in 1990 and 1991 which was related to rapidly increasing wages in combination with the reduction of labor productivity in this period. Correspondingly unemployment rates increased enormously from 1990 until 1992 and persisted far above West German levels since then. Our paper is concerned with the process of adjustment of East Germany relative to West Germany. Therefore our theoretical discussion is concentrated on the relative adjustment of East German variables towards West German levels, and the empirical analysis is performed for East-West differences of the data. The development of those relative variables from 1989 to 1998 is depicted in the bottom panels of figure 2.

3 Wages, competitiveness and unemployment

The central focus of the paper is the analysis of the determinants of the relative wage adjustment in East Germany and the resulting consequences in terms of competitiveness and unemployment. The analysis is based on standard macroeconomic modeling and focusses on those arguments which are seen as mostly relevant in the context of labor market adjustment in East Germany after unification. The starting point of the discussion is the process of wage adjustment which began even before Economic, Monetary and Social Union. The central argument in the wage negotiations in the early nineties was wage convergence. The goals of union leaders and workers were in favor of uniform living conditions in both parts of Germany which should be achieved with fast wage adjustments towards western 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 favor of wage convergence, and the political process with a sequel of elections in the East German states supported the view of the unions.[9]

However, the breakdown of output and productivity in 1990 and 1991 implied real unit labor costs far above West German levels. In addition, the unemployment rate rose to more than 15 percent already in 1992 which strengthened the employers' side and restricted the wage demand of unions. The first aim of the empirical analysis is to quantify the relevance of wage convergence for the relative wage adjustment. Secondly we want to quantify the mitigating effect of unemployment on wage growth. The aim of our analysis is to calculate equilibrium wage gaps and unemployment

[9] See Akerlof et al. (1991), Sinn (1995), Franz and Steiner (2000), Burda and Hunt (2001) and Hunt (2001) for a more detailed discussion.

rates. Therefore the estimated wage equations are specified as error correction models.[10] Since we are interested in the process of adjustment of East Germany relative to West Germany the empirical analysis is performed for the relative variables.

In a second step we proceed with a corresponding analysis for real unit labor costs, i.e. real wages over real labor productivity. Real unit labor costs combine three distinct economic variables, i.e. nominal wages, prices and real labor productivity. In terms of the macroeconomic adjustment those variables are strongly interrelated. Firstly, wage increases above real labor productivity growth induce price increases and thereby deteriorate the cost and demand conditions for firms. Secondly, real wage increases above total factor productivity growth induce capital-labor substitution and thereby reduce the labor demand of firms. Therefore real unit labor costs are seen as an appropriate measure of competitiveness in the context of labor market adjustment. They capture wage growth above price inflation and labor productivity growth.

From theoretical arguments we expect a process of convergence of relative real unit labor costs based on wage convergence, relative price adjustment, capital-labor substitution and total factor productivity convergence. The interrelation of wages, prices and labor productivity should strengthen the convergence process. We also expect an effect of unemployment on the development of real unit labor costs based on the effect of unemployment on wages. The estimated error correction models will enable to calculate equilibrium real unit labor cost gaps and the mitigating effect of unemployment rates on those gaps.

The final step of our analysis is the estimation of the effects of real unit labor costs on the development of unemployment rates. From theoretical arguments we expect a negative effect of real unit labor costs on employment based on capital-labor substitution and the worsening of the competitive disadvantage of the firms. The estimates are again carried out in terms of error correction models in order to take a dynamic adjustment of the labor market situation into account. From those combined estimates we will be able to quantify the speed of adjustment and the resulting equilibrium gaps of those variables in East Germany after unification.

[10] Standard analyses of equilibrium unemployment rates are based on Phillips curves and the NAIRU concept. See Franz (2005) and Fitzenberger, Franz and Bode (2007) for a discussion and recent estimates for Germany. The concept here is based on the wage adjustment solely.

4 Data and empirical specification

The empirical analysis is based on regional panel data for the German states, 1991 to 2007.[11] The key variables are relative wages (rw), relative real unit labor costs (rcomp) and unemployment rate differentials (urd). The relative data are defined as differences of the state-specific values for the 5 East German states and the average value of West Germany.[12] The analysis is performed for logarithmic differences for wages and real unit labor costs and for absolute differences of unemployment rates.

Figure 3 depicts the data. The figures firstly reveal the fast and largely parallel increase of relative wages in the early nineties.[13] Since the midst of the nineties a further adjustment is hardly visible, and the relative wage gaps remain at about 20-30 percent. Correspondingly relative real unit labor costs were strongly positive especially in the early nineties. During the nineties the differences became smaller, and in the recent years some of the gaps were negative. Finally the unemployment rate differential is strongly positive during the whole sample period. In the recent years the differential becomes smaller, but it is not clear whether this reduction indicates a long-run trend or a cyclical effect.

The empirical analysis proceeds in 3 steps. The first step is the univariate stationarity analysis for each of the 3 variables. Stationarity of East-West differences of the data would imply at least conditional convergence, while non-stationarity would imply that East and West German variables are drifting apart. Therefore testing for stationarity is an obvious starting point of the analysis. The theoretical analysis supplies strong arguments in favor of convergence, but the empirical analysis strongly depends on the time-series properties of the data. Therefore a rigorous testing is required. Furthermore the analysis of the test-equations will yield first (univariate) estimates of adjustment speeds and equilibrium gaps of the corresponding variables.[14]

The second step is the estimation of the relative wage adjustment in terms of wage convergence and unemployment. The wage equations are specified as error correction

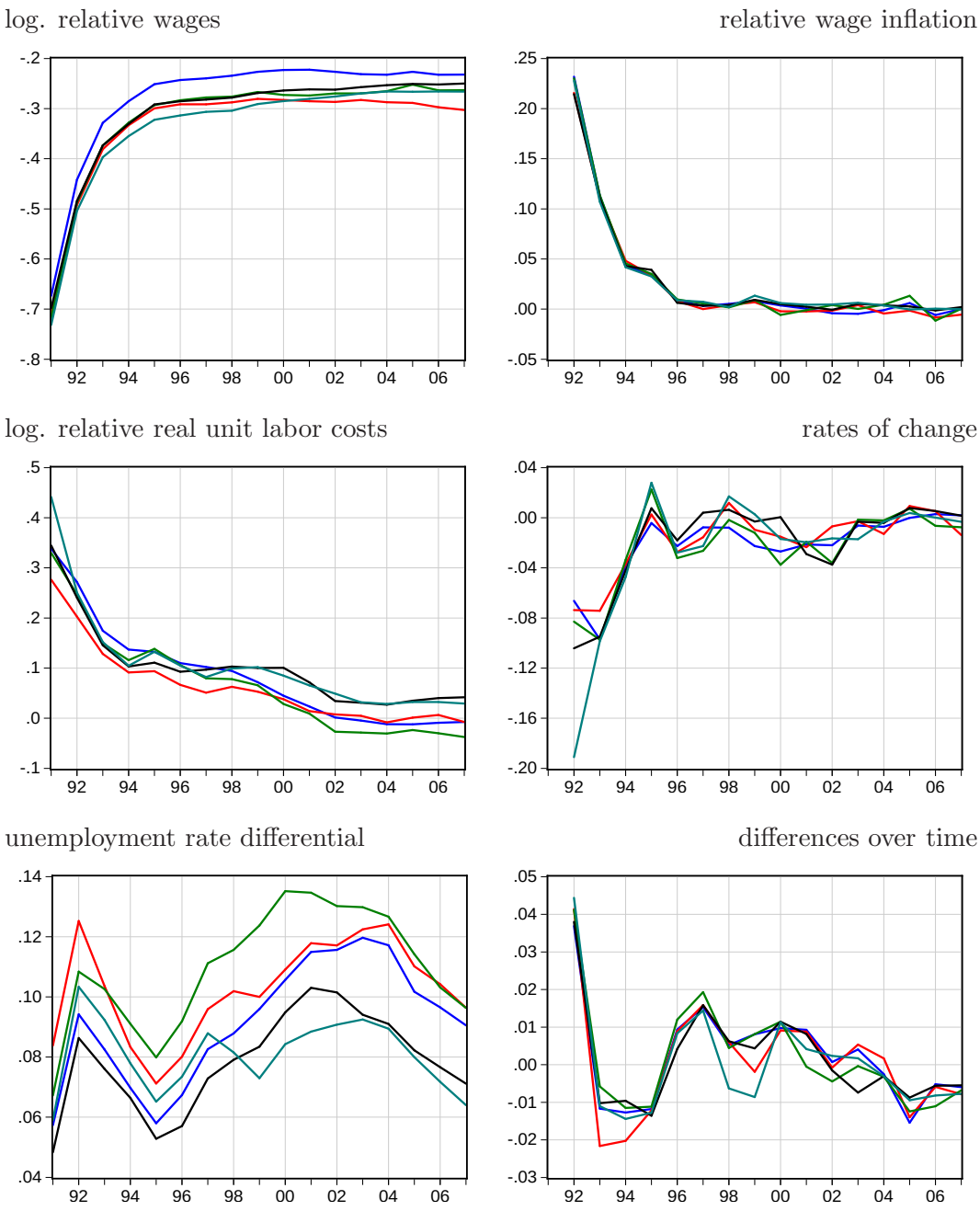
[11] The data stem from the National Accounts of the States (Federal Statistical Office) and from the Federal Labor Agency. Detailed data sources and definitions are given in table A.2 in the appendix.

[12] The average value for West Germany is defined as the aggregate value of the 10 West German states. Berlin is excluded.

[13] Note that a considerable part of the wage adjustment has taken place already before 1991 and is not depicted in the figures. The state-specific data are available from 1991 onwards only.

[14] The estimated equation is $\Delta x_{i,t} = \lambda(x_{i,t-1} - \text{gap}) + \text{dummies} + \varepsilon_{i,t}$ for x: ln rw, ln rcomp, urd.

Figure 3: Wages, competitiveness and unemployment, 1991 to 2007



5 East German states relative to West German averages

models, where the relative wage change is regressed on the lagged unemployment rate differential and the lagged level of relative wages,

$$\Delta \ln \mathrm{rw}_{i,t} = \text{constant} + \alpha_1 \mathrm{urd}_{i,t-1} + \alpha_2 \ln \mathrm{rw}_{i,t-1} + \text{dummies} + \varepsilon_{i,t} \qquad (1)$$

This proceeding can be interpreted as an augmented version of the convergence analysis, where the adjustment process and/or the equilibrium outcome are conditioned by the labor market situation. It yields an estimate of the equilibrium unemployment rate based on the wage setting process, i.e. the unemployment rate differential which is compatible with an unchanging relative wage gap. This differential might depend on the level of the relative wage gap as well.

The final step is the analysis of the dynamic interaction of competitiveness and the labor market situation. Firstly, the change of the relative real unit labor cost gap is regressed on its lagged level and on the lagged unemployment rate differential.

$$\Delta \ln \mathrm{rcomp}_{i,t} = \text{constant} + \beta_1 \mathrm{urd}_{i,t-1} + \beta_2 \ln \mathrm{rcomp}_{i,t-1} + \text{dummies} + \varepsilon_{i,t} \qquad (2)$$

Secondly, the change of the unemployment rate differential is regressed on its lagged level and the lagged relative real unit labor cost gap.

$$\Delta \mathrm{urd}_{i,t} = \text{constant} + \gamma_1 \mathrm{urd}_{i,t-1} + \gamma_2 \ln \mathrm{rcomp}_{i,t-1} + \text{dummies} + \varepsilon_{i,t} \qquad (3)$$

The first equation captures the determinants of the relevant cost component of the labor market adjustment, the second equation captures the quantity adjustment. Both equations together permit a characterization of the labor market equilibrium based on the adjustment of competitiveness and unemployment.

The empirical analysis firstly employs the full sample, 1991 to 2007. This proceeding puts a lot of weight on to the early nineties, since differences and rates of change are much larger for this period. The rather special development during those years might dominate the estimates for the full sample. Therefore the analysis is replicated for a more recent sub-sample, i.e. 1996 to 2007. This proceeding should give some information whether the adjustment process in East Germany was different after the turmoil of the unification shock. The shorter sample might also give a better picture of the more recent adjustments.

Finally, the empirical analysis always includes dummy variables for the individual states. Those dummies are defined as differences between the dummies for state i and the references state. Therefore the reported constants can be read directly as referring to the East German average. The detailed estimates of the adjustment models contain a complete set of time dummies as well. For ease of comparison the average of the estimation sample is chosen as the reference period.

5 Estimation results

The presentation starts with discussing the results of stationarity analyses. We firstly comment on the results of Levin, Lin and Chu (LLC) and Im, Pesaran and Shin (IPS) panel unit root tests which are depicted in table A.3 in the appendix.[15] The results for wages and real unit labor costs strongly indicate convergence. Both the LLC test and the IPS test reject the unit roots hypothesis for both variables for the full sample period 1991 to 2007 clearly.[16] For the shorter sub-sample 1996 to 2007 the LLC test reveals highly significant results as well. The IPS test is significant for relative wages, but the result for real unit labor costs is inconclusive. Since unit root tests in general exhibit less power for shorter sample periods, we interpret those results as sufficient evidence in favor of stationarity of gaps. Finally, the results for the unemployment rate indicate the presence of a structural break. The tests for the full sample do not permit to reject non-stationarity, but the results for the shorter sub-period strongly point towards stationarity.[17]

Table 1 reports some detailed results on the adjustment processes of wages, competitiveness and unemployment. Those results are based on univariate adjustment models, where the relative change of the variable is regressed on the one-year lagged gap. The results for wages reveal an adjustment coefficient of about 0.5 for the full sample, the adjustment in the more recent sample was considerably slower. The estimated equilibrium gap is about 0.26 both for the full and the shorter sample. A corresponding result of a slower adjustment for the more recent sample is revealed for real unit labor costs (competitiveness) and unemployment as well.[18] The estimated equilibrium gap for real unit labor costs is positive for the full sample and negative for 1996 to 2007, but the estimated coefficient for the recent sample is not significantly different from 0.[19] Finally, the univariate estimate of the equilibrium

[15] The Levin, Lin and Chu (2002) test refers to a common unit root, the Im, Pesaran and Shin (2003) test allows for state-specific unit roots. The tests are carried out with cross section specific constants and without trends.

[16] A corresponding result is revealed for productivity gaps and relative prices. Those variables together with relative wages define real unit labor cost gaps.

[17] Corresponding results for the West German states do not indicate stationarity of wage, price and productivity gaps. The results for real unit labor costs and unemployment point towards stationarity of differences.

[18] A corresponding result of a smaller adjustment coefficient for the period 1996 to 2007 is revealed for productivity and prices as well (see table A.4 in the appendix).

[19] Those results are consistent with those for relative labor productivity and relative prices. The estimated productivity gap is about 1/4 for the recent sub-sample and slightly larger for the full sample, the relative price gap is hardly different from 0.

Table 1: Adjustment speed and equilibrium gaps

	wages		competitiveness		unemployment	
	1992-2007	1996-2007	1992-2007	1996-2007	1992-2007	1996-2007
adjustment speed	-0.503	-0.200	-0.311	-0.149	-0.426	-0.297
	(0.006)	(0.045)	(0.024)	(0.035)	(0.080)	(0.061)
equilibrium gap	-0.265	-0.258	0.022	-0.016	0.096	0.101
	(0.002)	(0.004)	(0.009)	(0.019)	(0.003)	(0.003)
$\overline{R}^2$	0.989	0.292	0.681	0.227	0.229	0.249
SEE	0.006	0.004	0.020	0.012	0.012	0.007

Annual data. 5 East German states relative to West German averages. State dummies included (not reported), coefficients of state dummies add up to 1. The reference of the equilibrium gap is the average of the East German States during the sample. Standard errors in parentheses are based on non-linear least squares estimation.

unemployment rate differential yields a value of about 10 percentage points both for the full and for the recent sample.[20]

In conclusion, those results point towards significant convergence processes of East vs. West German labor market variables, i.e. East and West Germany are not drifting apart. The estimated coefficients indicate a slower adjustment in the more recent sample period, i.e. after the normalization of the unification process. The estimated equilibrium gaps for wages and unemployment are large, although it should be hold in mind that those estimates are based on univariate analyses only.

The estimates in table 2 explore the interaction of the wage adjustment and unemployment. The rate of change of relative wages is regressed on the lagged unemployment rate differential and the lagged relative wage gap. The estimates are carried out with a complete set of state and time dummies, the constant refers to the relative average of East Germany over the estimation period.[21] The estimates of wage inflation with the unemployment rate as the sole explanatory variable yield

[20] In interpreting those result one should hold in mind that the stationarity analysis for this variable for the full sample was inconclusive.

[21] The introduction of time dummies implies time-varying equilibria. For recent estimates of time-varying NAIRU equilibria see Fitzenberger, Franz and Bode (2007). The introduction of time dummies might also lessen the problem of a possible non-stationarity of the data.

Table 2: Wage adjustment

endogenous variable: relative wage inflation

	1992-2007	1996-2007	1992-2007	1996-2007
constant	0.044	0.016	0.007	-0.015
	(0.006)	(0.007)	(0.019)	(0.017)
lagged unemployment rate diff.	-0.173	-0.143	-0.223	-0.256
	(0.062)	(0.077)	(0.065)	(0.092)
lagged log. relative wages			-0.130	-0.155
			(0.063)	(0.075)
$\overline{R}^2$	0.996	0.579	0.996	0.609
SEE	0.004	0.003	0.004	0.003

Standard errors in parentheses. State and time dummies included (not reported). Reference for the constant: Average East Germany for the sample period.

meaningful results. Taken the estimates at face value would imply that a 1 percentage point higher unemployment rate differential is associated with an about 0.15 percent lower rate of wage inflation. The unemployment rate differential compatible with unchanging relative wage gaps is about 11 percent for the sample 1996 to 2007. The estimate for the full sample 1992 to 2007 is larger which stems from very large values for the early years.

However, the estimates with the lagged relative wage gap as an additional explanatory variable indicate that the equilibrium unemployment rate differential depends on the wage gap. The coefficients of the relative wage gap are significant and indicate that those arguments of wage convergence, which were highly important for the wage adjustment at the early stage of the unification process, were relevant for the wage adjustment later on as well. The estimates for the wage setting equilibrium imply that a smaller relative wage gap would be associated with a smaller unemployment rate differential. The estimates also imply that the univariate estimates of the outcome of the convergence process, i.e. a 26 percent wage gap and a 10 percentage points unemployment rate differential, are roughly compatible with the relative wage equilibrium for the sample 1996 to 2007.[22]

[22]The reported constant for the full sample hides large differences between the wage adjustment in the early years and the more recent years.

Those considerations are still based on estimates of the wage adjustment solely. However, wages affect real unit labor costs which in turn affect unemployment rates, and the adjustment of competitiveness and unemployment has to be taken into account. We firstly comment the results for real unit labor costs, which are depicted in table 3. The endogenous variable is the rate of change of relative real unit labor costs; the explanatory variables are the lagged logarithmic level of this variable and the lagged unemployment rate differential.

The estimates firstly reveal a significant convergence process for the real unit labor cost gap. The coefficients indicate a slower adjustment since 1996 which is consistent with the estimates from the univariate analysis. The estimates secondly reveal a significant adjustment of the gap with respect to the unemployment rate differential. The corresponding coefficients are smaller for the more recent sample which confirms a slower adjustment from 1996 onwards. The estimates thirdly reveal a strong significance of the time dummies, indicating time-varying equilibria for the real unit labor cost gap and the unemployment rate differential.[23] However, the estimated coefficients with and without time dummies hardly differ. Finally, the combinations of both variables which are compatible with a constant real unit labor cost gap imply positive gaps for unemployment rate differentials smaller than 10 percentage points.

Table 4 reports the corresponding results for the adjustment of the unemployment rate. The estimates firstly reveal a positive effect of the real unit labor cost gap on the adjustment of the unemployment rate differential. The estimated effect is larger and more significant for the sample starting in 1996, i.e. after the early years. The estimates also indicate time-varying equilibria, the coefficients of the time dummies are highly significant. The state dummies are significant as well, indicating state-specific equilibria. Finally, the equilibrium relation based on the adjustment of the unemployment rate differential 1996 to 2007 (incl. time dummies) implies negative real unit labor cost gaps for unemployment rate differentials smaller than 8 percentage points.

From those combined estimates we are able to calculate the implied equilibrium outcome for the real unit labor cost gap, the unemployment rate differential and the relative wage gap. Given the significance of the time dummies and the differences of the adjustment processes after 1996, the calculations are based on the estimates with time dummies and the sample 1996 to 2007 (see the right-hand columns of table 2, table 3 and table 4). They refer to the averages for East Germany for 1996 to

[23] The coefficients of the state dummies are small and not significantly different from 0.

Table 3: Competitiveness

endogenous variable: rate of change of relative real unit labor costs

	1992-2007		1996-2007	
constant	0.086	0.092	0.029	0.031
	(0.014)	(0.024)	(0.014)	(0.019)
lagged unemployment rate diff.	-0.771	-0.724	-0.289	-0.282
	(0.131)	(0.220)	(0.133)	(0.179)
lagged relative competitiveness	-0.390	-0.505	-0.222	-0.273
	(0.024)	(0.080)	(0.048)	(0.072)
time dummies	no	yes	no	yes
$\overline{R}^2$	0.781	0.879	0.277	0.695
SEE	0.016	0.012	0.011	0.007

State dummies included (not reported). Standard errors in parentheses.

Table 4: Unemployment

endogenous variable: change of unemployment rate differential

	1992-2007		1996-2007	
constant	0.024	0.006	-0.006	0.014
	(0.010)	(0.007)	(0.007)	(0.008)
lagged unemployment rate diff.	-0.288	-0.102	0.002	-0.169
	(0.094)	(0.063)	(0.065)	(0.078)
lagged relative competitiveness	0.044	0.054	0.152	0.085
	(0.017)	(0.023)	(0.023)	(0.031)
time dummies	no	yes	no	yes
$\overline{R}^2$	0.285	0.937	0.579	0.858
SEE	0.012	0.003	0.005	0.003

State dummies included (not reported). Standard errors in parentheses.

2007. The implied unemployment rate differential is about 9 percentage points, the corresponding real unit labor cost gap is about 2 percent. The implied relative wage gap based on the wage adjustment process and the unemployment rate differential of 9 percentage points is about 25 percent. Comparing those values with the actual numbers for East Germany in 2007 – a relative wage gap of about 26 percent, a real unit labor cost gap of about 1 percent and an unemployment rate differential of about 8 percentage points – shows only small differences. The recent economic situation is roughly within the range of our calculated equilibrium.

6 Conclusions

The transformation process in East Germany after unification shows both, success and failure. The fast implementation of Economic, Monetary and Social Union and the Unification Treaty within less than one year after the opening of the border can be considered as a great political success. The remarkable increase of wage income and productivity in the early nineties might also be interpreted as a success in economic terms. The slowdown of the adjustment process since the mid-nineties and the persistence of large differences since then indicates a failure, and especially the steep increase and persistence of unemployment is probably the most important economic policy problem in East Germany until today.[24]

This paper presents estimates of the adjustment of key labor market variables based on standard macroeconomic modeling and panel data for the German states. The focus is on the interaction of the wage adjustment and the development of competitiveness and unemployment. The analysis is concentrated on the relative adjustment and the resulting equilibrium gaps. The results reveal fast adjustment processes which slowed down in the mid-nineties. Based on relative wage adjustments wages increased sharply in the early nineties which deteriorated competitiveness and led to an increase of unemployment. High unemployment, in turn, changed the incentives and the power of firms and unions in the wage-setting process, and wage inflation became smaller. The resulting smaller real unit labor cost gap contributed to the reduction of unemployment rate in the recent years. The estimates also yield large wage gaps and unemployment differentials as the implied outcome of the adjustment processes. The calculated gaps are roughly within the range of the recent economic situation in East Germany, i.e. the equilibrium is more or less achieved.

[24] See BMVBS (2008).

Looking at the estimates in more detail shows that both the adjustment of competitiveness and the adjustment of unemployment are responsible for this outcome. A complete adjustment, i.e. vanishing real unit labor cost gaps and unemployment differentials, is simply not within the range of the implied adjustment processes: Unemployment would increase, and competitiveness would deteriorate. The wage-setting process helps to maintain the gaps. In terms of the wage adjustment, the wage setting in East Germany is still not in accordance with labor productivity, implying real unit labor costs above those in West Germany for lower unemployment rate differentials. In terms of the adjustment of labor demand and unemployment, a vanishing real unit labor cost gap would not promote labor demand sufficiently to solve the unemployment problem. A way out of this situation should be sought beyond the bounds of the model, i.e. the parameters of the adjustment processes must change.

When looking at the sources of those differences, specific economic policy measures may have contributed to this outcome.[25] Firstly, the wage setting in East Germany was distorted by a rather generous social security system. Secondly, the persistence of unemployment might be related to enormous investment subsidies which provide strong incentives for capital-intensive and labor-saving technologies. One way out might therefor be changes of the wage-setting process which lead to wage moderation. However, the relative wage gap amounts to about 25 percent despite longer working hours and better formal qualification levels of the East German employees. Given those differences combined with high unemployment rate differentials, it is not surprising that large migration outflows can be observed. Therefore it is comprehensible that the current wage setting process tends to an equilibrium which balances arguments of wage equalization and labor market adjustment.

Another promising candidate within the framework of the macroeconomic analysis would be a stimulation of productivity growth. From theoretical arguments closing the labor productivity gap via total factor productivity adjustments would increase competitiveness, shift the labor demand schedule and contribute to a reduction of unemployment rate differentials. East Germany experienced a fast process of productivity catching up in the early years after unification. Later on the catching-up process faded out. Seeking the causes of the slowdown of the productivity adjustment and finding remedies should remain on the agenda of future research.

[25] See Snower and Merkl (2006) and Burda (2006) for a more detailed discussion.

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Appendix

Table A.1: Time table of the unification process

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	*Opening of the German border*
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	*German unification*
October 14, 1990	Elections of East German state parliarments
December 2, 1990	Elections of the Federal Government

Table A.2: Data sources and definitions

Figure 1 and 2:

The data stem from National Accounts, 1989 to 1998, West and East Germany (Federal Statistical Office, the data for 1989 and 1990 are estimates of DIW) and from the Federal Labor Office. West and East Germany include West and East Berlin.
Output is real GDP (prices of 1991). Employment is total employment. The wage rate is total labor costs per employee. Prices refer to the GDP deflator (base 1991). Labor productivity is real GDP per worker. Real unit labor costs (competitiveness) are real wages in relation to real labor productivity. The unemployment rate refers to the data and definitions of the Federal Labor Office.

Figure 3 and empirical analysis:

The data stem from the National Accounts for the states (Volkswirtschaftliche Gesamtrechnung der Länder) and from the Federal Labor Agency.
The East German states are Brandenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt and Thüringen. The reference 'West Germany' refers to the aggregate values for the 10 West German states. Berlin is excluded.
The wage rate is gross wage costs per employee (Arbeitnehmerentgelt je Arbeitnehmer). Real unit labor cost are gross wage costs per employee divided by GDP per total employment. Real values are normalized at prices of 2007. The unemployment rate refers to the definition of the Federal Labor Agency.

Table A.3: Stationarity Analysis

East, 1991-2007	wages	comp.	unemployment	productivity	prices
Levin, Lin and Chu	0	0	0.702	0	0
Im, Pesaran and Shin	0	0	0.363	0	0
West, 1991-2007					
Levin, Lin and Chu	0.555	0.040	0.026	0.220	0.757
Im, Pesaran and Shin	0.995	0.413	0.032	0.819	0.977
East, 1996-2007					
Levin, Lin and Chu	0	0	0	0	0.428
Im, Pesaran and Shin	0.047	0.208	0.001	0.040	0.605

Specification: logs. of relative values (individual state East vs. average West) with the exception of the unemployment rate differential. The tests are carried out with state-specific constants and without trends. Reported are the significance levels of the LLC and IPS tests. 0 means rejection of unit root at 0.000 level.

LLC: Levin, Lin and Chu panel unit root test (common unit root)
IPS: Im, Pesaran and Shin panel unit root test (individual unit roots)

Table A.4: Adjustment speed and equilibrium gaps

	log. relative productivity		log. relative prices	
East Germany	1992-2007	1996-2007	1992-2007	1996-2007
adjustment speed	-0.382	-0.161	-0.562	-0.221
	(0.013)	(0.032)	(0.015)	(0.087)
equilibrium gap	-0.286	-0.244	-0.005	-0.002
	(0.006)	(0.016)	(0.001)	(0.003)
$\overline{R}^2$	0.917	0.285	0.946	0.131
SEE	0.019	0.012	0.006	0.004

Annual data. 5 East German states relative to West German averages. State dummies included (not reported), coefficients of state dummies add up to 1. The reference of the equilibrium gap is the average of the East German states during the sample. Standard errors in parentheses are based on non-linear least squares estimation.