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20 years after the fall of the Berlin Wall: Regional unemployment in Eastern Germany

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Twenty years after the fall of the Berlin Wall: Regional unemployment in Eastern Germany

Structure

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Paper for the ERSA 2010 Congress

Abstract: 20 years after the fall of the Berlin Wall there are still considerable differences between the economies and labour markets of eastern and western Germany. In the last few years, however, unemployment has fallen especially in eastern Germany, even in times of economic crisis. Within eastern Germany a strong variation of labour market situations is visible, which has been relatively stable over time. A centre-periphery structure can be understood by those approaches of regional economics which recognise the property of path dependency, such as the New Economic Geography. In the paper the development of unemployment is analysed in a spatial econometrics framework. The results show the relevance of convergence processes (beta- and sigma-convergence), which are not very strong. An industry structure with an emphasis on manufacturing helps to reduce unemployment. In the analysis spatial autocorrelation is found to be significant.

¹ The authors would like to thank W. Dauth and K. Wolf (both at the IAB) for their support with the statistical analyses, and the participants at the IAB/IWH workshop "20 Years of Eastern Germany's Labour Market – Experiences and Prospects" in October 2009 for their suggestions and ideas regarding the contents. The sole responsibility for conducting the analyses, for the results obtained and for their interpretation lies with the authors, however.

1. Introduction

Twenty years after the fall of the Berlin Wall, the regions of eastern Germany still lag strikingly behind those of western Germany: in 2004 the level of incomes from employment subject to social security contributions was 23 % lower than that in the West (source: own calculations using data from the IAB Employment Sample). What stands out even more is that unemployment has now long been twice as high as in western Germany. People living in eastern German regions are therefore disadvantaged in at least two ways. First, they have more difficulty finding work because unemployment is far higher, and second, their incomes are lower.

How can such large differences within a country remain in place for such a long period? Twenty years is a long time. The standard neoclassical approaches of economic theory suggested that labour market disparities would level out even without supporting economic policy measures. Instead, a strong stability in the differences can be observed. These differences also affect the small-scale level. Eastern Germany is not a homogeneous area, but comprises regions that manage to catch up with the West and other regions that lag far behind (see Chart 1).

For these reasons in the following we first look into the overall unemployment differentials between eastern and western Germany. Then in the second part of our paper the regional variations within eastern Germany are examined more closely.

2. The gap between western and eastern Germany

Despite the persistence tendency in many key labour market indicators which was mentioned earlier, it must be emphasised that eastern Germany has caught up with western Germany in certain important fields, albeit generally without fully reaching the level of the western states. There is no information from the employment statistics for the period immediately after the unification of Germany. If the disposable income per capita from the official statistics is used as an indicator instead, then the gap between the eastern German *Länder* (without Berlin) and their western German counterparts has decreased from 42.9 % (1991) to 18.3 % (2008) in the meantime (BMWi 2009). Moreover, the inhabitants of eastern Germany benefit from the fact that many public services have been improved since unification. Towns and villages have been redeveloped and the infrastructure has been strengthened.

One key indicator for which no such catching-up process can be detected over a long period of time is income subject to social security contributions from the employment statistics. This has been stagnating since 1996 when measured against the benchmark of western Germany. The (neo)"classical" approaches of growth theory suggested that East-West differences would balance out via convergence processes. From empirical studies Barro & Sala-i-Martin (1991) deduced that differences in the growth process lead to a balance of productivities, but that this convergence proceeds slowly. It should reduce the disparity by about two percent per year, as Barro also asserted as early as 1991 for the case of eastern Germany. However, the studies used refer to the case of so-called β -convergence and are not conclusive proof that the disparities actually decrease. An intensive debate among the advocates of growth research (see for example Bliss 1999 on this subject) adduced that the reduction in the variance of key economic variables can be linked directly to their standard deviation (Barro, Sala-i-Martin 2004). This reduction in the standard deviation is then called " σ -convergence".

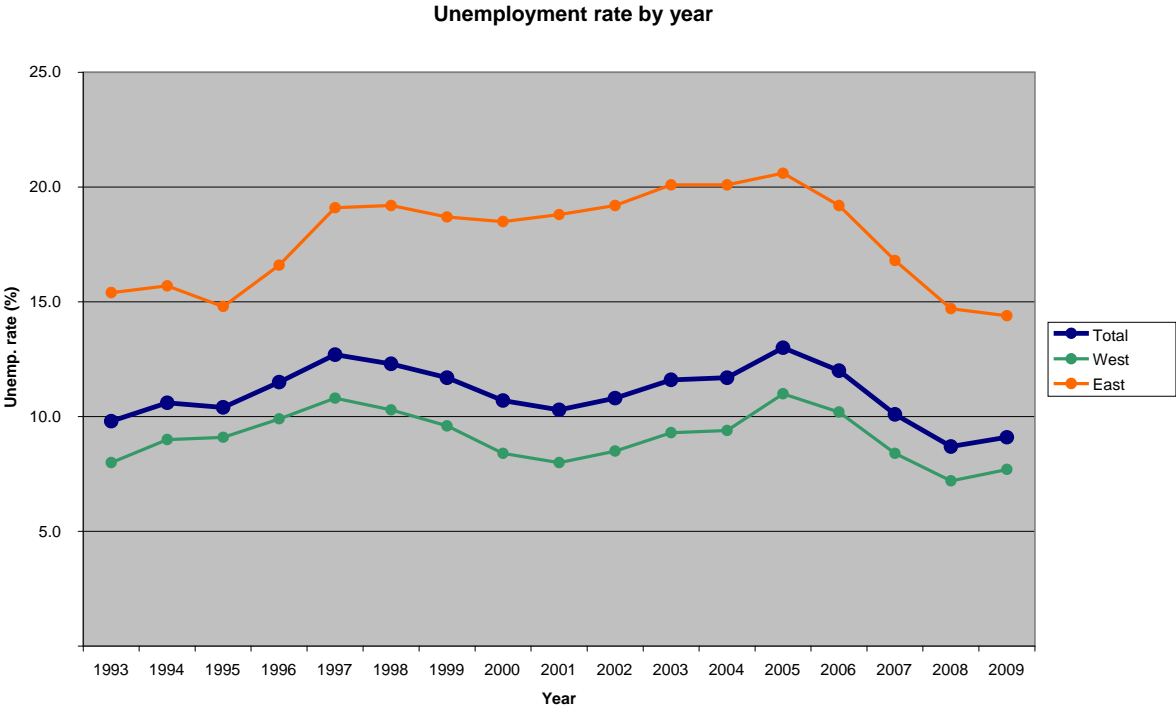
Another important indicator that shows large and stable differences between eastern and western Germany is unemployment. Figure 1 shows the development of the unemployment rate over time (June values) for the two parts of the country. The diagram makes it clear that unemployment in eastern Germany is affected by a structural problem: for most of the period observed it remained at a very high level and was unaffected by business-cycle influences. A high level of hard-core unemployment also remained during boom periods. The "new economy boom" resulted in a phase of economic recovery on the labour market which lasted until approximately 2001. During this time unemployment fell more considerably in western Germany than in eastern Germany.

The most recent economic recovery after 2005, however, confirmed the rule of thumb that unemployment in eastern Germany is approximately twice as high as that in western Germany, as the decrease in eastern Germany was roughly proportional to that in the West. This implies a considerably more rapid development than in the West. The trend towards a drop in unemployment is currently being slowed down by the global economic crisis; all the same the rate in eastern Germany is continuing to fall even during a period when the western German regions are already showing clearly increasing values.

Why did convergence tendencies between the two parts of the country not become established sooner and more strongly? According to the standard economic theory approaches, eastern Germany could have been expected to be able to attract comparatively large amounts of capital. The lower wages in eastern Germany meant a cost advantage for investors. Disadvantages associated with the infrastructure were increasingly being levelled out by means of

public investment. As a consequence wages and employment should close up on the western German levels. The unemployment rates should level out even more rapidly: unemployed people from eastern Germany should increasingly find work in western Germany, thereby reducing the stock of labour in eastern Germany. As a result of this mobility the differences in the unemployment rates of the two parts of the country should level out.

Figure 1



Instead, a strange development can be observed: although so many people are migrating from eastern Germany that some regions are gradually emptying, unemployment is hardly falling! Between 1989 and 2002 no fewer than 1.3 million more individuals migrated out of eastern Germany (excluding Berlin) than migrated in (Heiland 2004). From the viewpoint of regional economics, however, there are explanations for this apparent paradox. One such explanation is that out-migration has opposing effects. It reduces the stock of labour in eastern Germany, and by reducing the supply of labour it lowers the unemployment rate directly. There is also an indirect effect, however, because out-migration also weakens effective demand in the regions of eastern Germany. The market potential of the eastern German regions is reduced. As out-migration increases, the incentive for firms to produce in eastern Germany declines, at least when they are also orientated towards the local market. Instead, many goods can be produced in western Germany and then transported eastwards via the now excellent transport connections to the East.

Out-migration therefore has two effects, a direct one which lowers unemployment, and an indirect one which weakens the regions' market potential, thereby raising unemployment in a roundabout way. It is not possible to foresee in abstract terms which of the effects is stronger. In the case of eastern Germany, however, the two effects appear almost to balance one another. The result is that unemployment remains high.

Krugman's New Economic Geography (Krugman 1991, Krugman, Fujita, Venables 1999), in which there can be stable equilibria between a centre and a periphery, is often used for problem analysis. This theory is based on monopolistic competition, increasing returns to scale and mobile production factors. It recognises two types of externality: workers move to where production takes place and production moves to where the effective demand is, i.e. where there are many workers.

On the basis of this theory, Brakman and Garretsen (1993, 1994) argued that in relation to western Germany, eastern Germany could play the role of the disadvantaged periphery which would not be of interest to investors as a production location. Such investors would be more likely to establish their business in the centre, in other words in western Germany, where the market potential, i.e. the effective demand, would be correspondingly larger. The development of the infrastructure, i.e. in particular the transport routes to the East, would then not contribute towards setting up a corresponding productive capacity but on the contrary, would reinforce the relative position of western Germany because it would then be possible to supply goods to eastern Germany more easily without producing them there. Similar divergent processes are described by Uhlig (2006a, b) in a model framework that recognises other causal processes.

The out-migration that can be ascertained for eastern Germany strengthens the role of the East as the periphery of the West because it further weakens the market potential of the regions concerned. In particular Südekum (2005) expanded the New Economic Geography by integrating unemployment into its structure. Migration from a peripheral region has a direct effect on unemployment in the area concerned because it reduces the supply of labour. It also has an opposing indirect effect, however, because it lowers the market potential of the regions concerned.

Suggestions as to how to solve eastern Germany's labour market problems which make the sweeping statement that unemployed people should migrate to prospering regions of Germany thus seem inappropriate. These solutions could further increase the regional differences between the two parts of the country.

A restriction that must be mentioned regarding the presented argumentation is that the New Economic Geography approaches are based on specific assumptions, for example regarding the preferences of the economic subjects, which do not occur in this way in reality. The described feedback mechanisms in the emergence and stabilisation of disparities in the economy and the labour market, however, remain conceivable as a meaningful abstraction beyond the model framework. Here the direction of a development can even change under certain circumstances if a disadvantaged region gradually improves and finally crosses a critical threshold beyond which the situation begins to undergo a cumulative improvement process.

In the context of the so-called ENDOR project (Blien, Maierhofer, Vollkommer, Wolf 2003), an appraisal and comprehensive analysis of the regional development conditions of eastern Germany was conducted at the IAB. At that point in time, at the start of the last decade, eastern Germany's regions were regarded as being likely to have moderately good development prospects. This appears to be proving true now, as unemployment is lower than it has been at any time since 1993. We will return to eastern Germany's prospects later on in the paper.

3. Regional disparities within eastern Germany

Eastern Germany is not a homogeneous area, as can be seen by taking a look at the charts for rural districts (*Landkreise*) and urban districts (*kreisfreie Städte*) with this article. Chart 1 in the appendix shows clearly the current distribution of unemployment by district. Along the former inner German border and south of Berlin there are regions whose unemployment rates would not be out of place in western Germany. In contrast to these regions there are other, especially rural areas, far from good transport connections to the West, which continue to be affected by a serious labour market crisis. What is behind these unemployment differentials are above all differences in the development of employment. Chart 2 accordingly depicts the growth rate of employment subject to social security contributions. All of these charts were based on the framework of the 87 eastern German rural and urban districts which has been valid since the last territorial reforms:

- Chart 3 depicts the historical unemployment status for June 1993.
- Chart 4 shows the absolute change in the unemployment rate (difference between the values for June 1993 and June 2009).

- Chart 5 portrays the rate of change (difference between the values over the same period, divided by the 1993 level)
- Chart 6 shows the development of unemployment using the latest available data (difference between the values of November 2008 and November 2009).

Huge differences already emerge in the development of employment. Although the actual impact of the "unification shock" on employment is not contained in the data, the figures range from a 38% drop in the Spree-Neiße district, which includes the town of Cottbus, to a gain of 18 % in Bad Doberan, the region around Rostock. Incidentally, Berlin shows a 16 % reduction. This is close to the overall value for eastern Germany (excluding Berlin) of 18.1 %.

If the other charts are also consulted for the diagnosis, then a hint of a spatial structure consisting of concentric rings with Berlin at their centre emerges. In Berlin there is an average rate of employment growth, in the surrounding area the rate is more positive. The regions that adjoin eastern Berlin to the north constitute an exception. Further outwards there is a "ring" comprising rural regions with a predominantly high drop in employment. This ring is followed by regions with heterogeneous situations. An East-West difference overlies this structure: towards western Germany there are many regions with better development, whilst on the border to Poland the picture is dominated by unfavourable conditions. This becomes even clearer if the employment growth does not apply to 1994 as the base year, but to 1998. In this case virtually all of the regions on the border are affected by unfavourable developments. The towns and cities in eastern Germany are developing heterogeneously: whereas Leipzig and Dresden stand out positively, Halle and Frankfurt constitute more negative examples.

If the change in unemployment (Chart 4) is examined instead of the development of employment, it stands out in general that the large cities are experiencing a negative development. This becomes even more evident if Chart 5 with the relative rates of change is consulted. Here the East is coming into line with western Germany, where the cities mainly have higher unemployment rates than their surrounding areas. In Chart 1, showing the current unemployment status of eastern Germany, the same hint of a ring structure as emerged for the development of employment is visible. There it becomes apparent that high unemployment rates occur in eastern Germany in particular in rural, sparsely populated areas. This is entirely in accord with the ideas of the New Economic Geography mentioned above. The large relative growth in the values for the large cities has generally not (yet) led to the rural regions being surpassed. This special development of the large cities is not compatible with the New Economic Geography. It should be investigated elsewhere using microdata.

Measured by means of the standard deviation, the general variation of the unemployment rates in eastern Germany stands at approximately the same level as in western Germany. However, it decreased from 3.5 to 2.8 in the period from 1993 to 2009, though this can be attributed more to the decreasing average level than to a "genuine" convergent development.

The model by Blanchard & Katz (1992) in the extension by Elhorst (2003)

The seminal paper by Blanchard & Katz (1992) contains several model approaches. One of these models is formulated in theoretical terms on the one hand and tested empirically on the other. Paul Elhorst (2003: 720) describes this model as the "most extensive" one currently available for empirical analyses. He extends it slightly, thereby obtaining the version displayed below. The model consists of four basic equations, the first of which describes labour market demand:

$$w_{rt} = -a(L_{rt} - u_{rt}) + z_{rt} \quad (1)'$$

Here w is the log wage, L is log labour supply, u is the unemployment rate, z denotes long-run effects on labour demand, r is the index for the region and i for time. The second equation is a wage curve:

$$w_{rt} = -bu_{rt} + X_r^W \quad (2)'$$

Here X^W are structural influences that affect wage formation (analogous in the following to X^S & X^D). The third equation describes labour supply:

$$L_{r(t+1)} - L_{rt} = cw_{rt} - gu_{rt} + X_r^S + \varepsilon_{rt}^S \quad (3)'$$

Here ε^S stands for exogenous shocks to labour supply.

$$z_{r(t+1)} - z_{rt} = -dw_{rt} - ku_{rt} + X_r^D + \varepsilon_{rt}^D \quad (4)'$$

The model parameters are indicated by a , b , c , d , g , and k , all of which are greater than zero. If an assumption of equilibrium is made which implies that the unemployment rate remains stable during that period and that the effects of external shocks have settled, then the following expression is obtained for the unemployment rate:

$$u_r^* = \frac{aX_r^S + X_r^D + (ac + d)X_r^W}{a(bc + g) + bd - k} \quad (5)'$$

The analysis makes it clear that unemployment differentials can continue to exist for a long time. When testing this empirically, however, high demands are made on the possibility to obtain data. If data are not available, the model can not be identified. Another problem is the concentration on equilibrium conditions, as eastern Germany's high unemployment rates can not be assumed to depict the end of the development. Instead the model is regarded as an instrument of analysis that helps in the recognition of key factors.

4. Spatial econometrics of the development of unemployment

For a further analysis of regional unemployment within eastern Germany it seems appropriate to refer to multivariate econometric models. Elhorst (2003) provides an overview of the modelling approaches and the theory upon which they are based (see the box above; see also Zenou 2009 regarding the theory). As our topic is the development of eastern Germany during the two decades since the fall of the Berlin Wall, we concentrate on analysing rates of change of regional unemployment, as depicted in Chart 5. The correlation between the regional unemployment rates for 1993 and 2009 (June values in each case) amounts to 0.51. There is thus a large degree of persistence in regional unemployment, even in a transition economy over such a long period of time. Nonetheless there is still sufficient scope for a multivariate analysis.

Owing to the considerable lack of employment opportunities, we select a model that starts out from the assumption that the unemployment is primarily shaped by the demand side of the labour market. The following parametrisation applies for the model to be estimated:

$$ga_r = \beta^0 + \beta^a a_r + \beta^v v_r + \beta^w w_r + X_r \beta^x + \varepsilon_r \quad (1)$$

In equation (1) ga_r is the growth rate of unemployment from 1993 to 2009, a_r is the level of regional unemployment in 1993, r is a regional index symbolising the 87 rural and urban districts according to the current territorial structure. The variable v_r indicates the proportion of employees in manufacturing for 1993, w_r denotes employment growth across all sectors. One of the fascinating questions associated with the analysis is whether unemployment grows more strongly in the regions with large shares of manufacturing. Was the de-industrialisation process of the period following unification already over in 1993 or did it continue after that time? Were the industrial sectors that still existed in 1993 able to serve as focal points for new

employment, thus helping to avoid unemployment? These are questions which can be answered by the analysis.

By including employment growth it is possible to examine whether the expectation holds that unemployment really is driven by the demand side. Employment itself has been analysed intensively in previous IAB projects. In the context of the ENDOR project that was mentioned earlier and the later VALA project (see for example Ludsteck 2006) the determinants of the development of employment were examined. In the present context, however, employment growth is an independent variable.

X_r is a vector of controlling (binary) indicator variables, ε_r is the usual error term. The components of X include the region types according to a widely used classification with which, for example, large cities can be distinguished from rural areas. The region types are obtained by cross-tabulating two characteristics, centrality and population density (see Table 1).

The differences between the region types are important for determining agglomeration effects and relating them to the theory. If the expectations of the New Economic Geography are correct, poor labour market conditions should be found in the sparsely populated regions far away from the core cities. The importance of agglomeration effects has been examined intensively recently, in particular since Glaeser, Kallal, Scheinkman & Shleifer (1992) and Ellison & Glaeser (1997). Analyses of western Germany's labour market can be found for example in Blien, Südekum & Wolf (2006).

Table 1
Classification of regions according to BBR (Görmar, Irmen 1991)

Region type 1	Core cities	in regions with large agglomerations
Region type 2	Highly urbanised districts	
Region type 3	Urbanised districts	
Region type 4	Rural districts	
Region type 5	Core cities	in regions with conurbational features
Region type 6	Urbanised districts	
Region type 7	Rural districts	
Region type 8	Urbanised districts	in regions of rural character
Region type 0	Rural districts	

Region type 2 is not present in eastern Germany, region type 0 serves as the base category in the regressions.

One indicator variable shows a location in the vicinity of western Germany. People who live close to western German regions can be expected to take advantage of employment opportunities outside eastern Germany by commuting. In these border regions unemployment should therefore be lower than would otherwise be expected. Another indicator variable shows a location on a border with another country, which leads one to expect higher unemployment.

In addition, test calculations were also conducted using the wage as the exogenous variable. However, the theoretical model shown in the box indicates that the direction of causality is unclear here. Relatively high wages can be the result of low unemployment, but they can also lead to relatively high unemployment rates. Owing to this endogeneity problem, regressions with the development of wages as the independent variable can not be interpreted causally.

Following the pattern of the analyses conducted by Barro & Sala-i-Martin (1991), unemployment growth is also regressed on its level. One must be aware here that a possible convergence ascertained by means of a negative coefficient β^a is a trend that is only of significance in relative terms (" β -convergence"). Ultimately the convergence of regional unemployment is to be linked to the standard deviation of the variables concerned (Barro, Sala-i-Martin 2004). A reduction in the standard deviation is then called " σ -convergence".

When implementing the analyses in an econometric model we are confronted by the problem that the individual regions are presumably not independent of each other. Positive impulses of economic development may spread in the area and thus regions with relatively low unemployment may be located side by side. Commuting also contributes towards the levelling out of unemployment rates in adjacent regions. All this would produce a positive correlation of unemployment in the area. The concentration of unemployment has the opposite effect, for instance when certain places "attract" unemployed people. This can occur, for example, when certain "problem groups" with an above-average risk of unemployment are more likely to be found in certain places. In this case a negative spatial correlation of unemployment would be observed.

As the regions analysed here are comparatively small and effects of the type described may occur, it at least can not be ruled out that the unemployment in location A is connected with that in the neighbouring location B. However, such dependence relationships violate the assumptions of the classical linear model. Of course it would be possible to go over to examining larger more unified regions, but this would waste a great deal of information. This dilemma can be remedied using methods of spatial econometrics, which have been appearing

increasingly in the past few years and for which Cliff & Ord (1973) and Anselin (1988) conducted pioneering work. They developed techniques which make it possible to estimate models with spatial autocorrelation by means of maximum likelihood methods or with GMM (generalised methods of moments). Two different classes of models prove to be useful. The first of the two classes concerns the incorporation of "spatial error", i. e. spatial dependencies in the error term of the regression:

$$ga = \beta^0 + \beta^a a + \beta^v v + \beta^w w + X\beta^x + \tau \quad \text{with:} \quad \tau = \psi W\tau + \varepsilon \quad (2)$$

In equation (2) the variables are no longer indexed with r but are portrayed as vectors or matrices. In the new model the error τ_r of the regression model for a particular region is dependent on the error in neighbouring regions, ψ is the autocorrelation parameter which shows the strength of the spatial dependence. The matrix W takes up the relationships between the regions. In the present case we simply specify a neighbourhood matrix which contains a one for regions which are direct neighbours and a zero for all other regions. To implement the matrix in concrete terms, it is normed, as is customary in the literature, so that the row totals add up to 1. If equation (2) is the decisive model, then the coefficients with the pooled regression from (1) become inefficient and the standard errors are estimated with a bias. A further relevant model contains not a spatial error but a "spatial lag":

$$ga = \beta^0 + \phi Wga + \beta^a a + \beta^v v + \beta^w w + X\beta^x + \varepsilon \quad (3)$$

Here the unemployment growth ga_r of region r influences the growth of the neighbouring regions, again defined via the matrix W . If model (3) applies and if the pooled regression (1) is used instead, all of the coefficients are estimated with a bias. Maximum likelihood methods following Anselin (1988) and Anselin & Hudak (1992) are used to estimate the models in the next sections. Florax & Nijkamp (2003) and Anselin et al. (1996) are of importance for the LM tests also cited in the table of results.

The data used are from the employment and unemployment statistics gathered by the Federal Employment Agency (Bundesagentur für Arbeit). As the regions are used with the current district boundaries, some of the data had to be re-estimated with a procedure based on the RAS method (this is an entropy optimisation procedure, see Blien & Graef 1991).

Tables 2 and 3 as well as A1 in the appendix show results of regression analyses for the development of unemployment. Two different groups of models were calculated: a group with the development of employment as the independent variable (models 4-6) and a group

without it (models 1-3). In each of the groups a pooled regression, a model with a spatial error term and a model with a spatial lag were estimated.

The tests reveal a relatively consistent picture: the model with the spatial lag is favoured over the pooled regression and the model with the spatial error term. However, the spatial autocorrelation coefficient is also significant in model 5. Interestingly, this coefficient is negative. The same holds for the coefficient of the spatially lagged variables. This is a relatively rare result, as it means that the development of unemployment is negatively correlated with the development in neighbouring locations. This effect could be presumed to be attributable to suburbanisation phenomena and such like. Developments of this kind should be picked up by the region types, however. Another possible interpretation is the spatial concentration of unemployed people, as was already mentioned earlier. Besides the technical problem that spatial autocorrelation represents, a content-related question also arises which must be investigated in future studies. This study finds evidence of the importance of regional effects; the pooled regression has to be understood as a case of mis-specification.

Table 2:
Results for the relative change in unemployment 1993-2009

Model No.	1	2	3	4	5	6
	Pooled regr.	Spatial error	Spatial lag	Pooled regr.	Spatial error	Spatial lag
Constant	0.443*** (3.31)	0.418*** (3.04)	0.382** (2.99)	0.289** (2.73)	0.233** (2.80)	0.226* (2.34)
Unemp. rate 93	-0.024*** (-3.69)	-0.023*** (-3.91)	-0.023*** (-4.17)	-0.028*** (-5.47)	-0.024*** (-5.82)	-0.027*** (-5.74)
Manufacturing 93	-0.781** (-2.73)	-0.759** (-2.77)	-0.737** (-2.70)	-0.342 (-1.49)	-0.433* (-2.64)	-0.299 (-1.43)
Emp. growth				-0.008*** (-7.2)	-0.008*** (-9.91)	-0.008*** (-9.13)
Neighbour	-0.072 (-1.61)	-0.071 (-1.97)	-0.085* (-2.37)	-0.027 (-0.77)	-0.018 (-0.77)	-0.041 (-1.74)
Reg. type 1	0.224* (2.37)	0.226** (1.94)	0.251** (2.22)	0.241*** (3.30)	0.248*** (2.39)	0.272*** (2.66)
Reg. type 3	0.028 (0.29)	0.045 (0.85)	0.061 (1.31)	-0.027 (-0.35)	0.044 (0.75)	0.010 (0.22)
Reg. type 4	-0.039 (-0.64)	-0.026 (-0.44)	-0.006 (-0.11)	0.020 (0.42)	0.038 (1.20)	0.055 (1.47)
Reg. type 5	0.129 (1.84)	0.123 (2.23)	0.112 (1.94)	0.057 (1.03)	0.067 (1.71)	0.039 (0.80)
Reg. type 6	0.017 (0.26)	0.019 (0.37)	0.016 (0.31)	0.002 (0.03)	0.014 (0.46)	0.001 (0.02)
Reg. type 7	0.008 (0.16)	0.007 (0.15)	0.010 (0.23)	-0.015 (-0.37)	-0.024 (-0.86)	-0.013 (-0.40)
Reg. type 8	0.059 (1.10)	0.057 (1.38)	0.053 (1.36)	0.02 (0.47)	0.023 (0.66)	0.013 (0.37)
R ² / ψ / ϕ	0.52	-0.134 (-0.63)	-0.285* (-1.75)	0.71	-0.467** (-1.99)	-0.307** (-1.95)
LM test		3.245	4.197*		1.620	3.762*

*** 0.001 ** 0.01 * 0.05 % level of significance (t-values in parentheses)

Data: unemployment statistics of the Federal Employment Agency, employment statistics of the Federal Employment Agency, some of the data with updated territorial allocations

Table 3
Results for the relative change in unemployment 1993-2009 (II)

Model No.	7	8	9	10	11	12
Variable	Pooled regr.	Spatial error	Spatial lag	Pooled regr.	Spatial error	Spatial lag
Constant	0.55*** (5.22)	0.494*** (3.77)	0.474*** (4.07)	0.546*** (5.19)	0.476*** (3.43)	0.460*** (3.19)
Unemp. rate 1993	-0.029*** (-5.22)	-0.027*** (-4.92)	-0.028*** (-5.38)	-0.029*** (-5.18)	-0.027*** (-4.88)	-0.028*** (-5.60)
Share of manufacturing 1993	-0.842*** (-3.51)	-0.733** (-2.79)	-0.747*** (-3.19)	-0.842*** (-3.49)	-0.704** (-2.57)	-0.736** (-3.09)
Neighbour in West	-0.065 (-1.62)	-0.07* (-2.16)	-0.091** (-2.94)	-0.064 (-1.58)	-0.065* (-1.99)	-0.088** (-2.88)
Foreign neighbour				0.005 (0.11)	0.03 (0.79)	-0.046 (1.21)
Region type 1	0.175* (2.11)	0.17 (1.45)	0.205 (1.79)	0.176* (2.10)	0.174 (1.49)	0.217* (1.88)
R ² / ψ / ϕ	0.47	-0.23 (-1.09)	-0.357* (4.07)	0.47	0.287 (-1.11)	-0.411** (-2.58)

*** 0.001 ** 0.01 * 0.05 % level of significance

Table 3 again compiles some results and eliminates the variables that are not significant. The result for region type 1 (core city) is now to be interpreted as relative to all other region types. As far as content is concerned, models 7-9 show hardly any changes compared with the results found in Table 2. In models 10-12 the variable "foreign neighbour" was included in addition.

In all of the models portrayed, the 1993 level of unemployment lowers the growth rate of unemployment. It has already been pointed out that this so-called β -convergence does not constitute evidence of the existence of σ -convergence. However, we have already seen that the standard deviation of unemployment in the period under observation also shows a decreasing tendency – so σ -convergence is present. The regions of eastern Germany are growing slightly more equal with regard to the level of unemployment.

Larger shares of manufacturing tend to reduce unemployment. This supports the hypothesis that a more positive labour market development occurs in places where there are focal points for manufacturing. There it is apparently easier to set up further establishments which create employment and reduce unemployment. This constitutes evidence of the occurrence of agglomeration effects. In models 1-3 a location close to the former border with western Germany has a positive effect. Descriptive analyses already show that the unemployment rates in such regions tend to be lower.

Models 4-6 show that employment growth has a very strong impact on the development of unemployment; the additional inclusion of this variable raises the R² of the pooled regression

from 52 % to 71 %. As expected, the development of employment therefore has an influence on the development of unemployment. The influences of other variables may cease to be significant when the development of employment is included. One example is the variable which indicates that a region is located close to western Germany. The effect of the border position is then already contained in that of the development of employment.

It is important to test for differentiating effects of the individual region types. It has already been explained that descriptive analyses show unemployment to be particularly high in the rural regions far from the former border to the West and from Berlin. This is, however, obviously an effect that has been "inherited" from the early period of unification (and can be understood by referring to New Economic Geography approaches). It is currently not possible to ascertain any variation between the region types as regards the development of unemployment. There is one important exception, however: the core cities of region type 1 are recording a clear increase in unemployment. This is a process of alignment with the labour market situation in western Germany, where above-average unemployment rates also tend to occur in the cities.

The indicator variable for a location on a border with another country is, surprisingly, not significant. This may be because unemployment in these regions was already above average in the starting year of 1993.

Some test calculations were conducted with other variables, although the results contained in Table A1 can only be interpreted descriptively. This applies to the development of wages, for which an influence on unemployment is accompanied by a dependence on unemployment ("wage curve effect", see equation (2') in the box). It also applies to the population development. As is made clear by the model presented in the box, out-migration from a region would be expected to reduce the potential labour force, thereby lowering the unemployment rate. However, as the out-migration will take place in particular from regions in which unemployment is higher than average, the model registers an opposing effect. In order to avoid such endogeneity problems, these models are not interpreted causally here. Incidentally, our brief discussions of the New Economic Geography have already shown that out-migration from regions for labour-market-related reasons can also further increase unemployment.

5. The current situation and development prospects

The current severe economic crisis is also having an adverse effect on eastern Germany, albeit so far to a lesser extent than on western Germany. Eastern Germany's unemployment rate is still falling – from 14.4 % in November 2008 to 14.7% in November 2009 – whilst that in western Germany is rising. Considering the intensity of the crisis this is an amazing result. If the regional distribution of the absolute changes within eastern Germany is examined, then an East-West difference emerges (see Chart 6) which was even more pronounced some months earlier. Surprisingly, the regions with falling unemployment tend to be in eastern Germany whilst in western Germany unemployment is more frequently on the increase. The reason for this is that the crisis is affecting above all the successful, export-oriented regions, most of which are in western Germany. The inter-regional connections within the German economy are so strong, however, that none of the regions will remain entirely unaffected by the crisis. On the whole the charts illustrate clearly the significance of spatial interdependence.

If we move from the current economic situation to a longer-term examination of eastern Germany, then there are some positive prospects despite the situation to date, which generally continues to be unsatisfactory. Productivity has increased far more rapidly in the more recent past than it has in western Germany. From 1999 to 2008 gross domestic product per worker grew by 8 % in western Germany, but by 20 % in eastern Germany (BMW 2009). This is a development borne mainly by manufacturing. The share of gross value added resulting from manufacturing has increased disproportionately and has reached almost 20 % in the meantime, though this is still lower than the corresponding share of 25 % in western Germany. Yet eastern Germany's export rates are still considerably lower than those in western Germany. This can be put down, for example, to the fact that eastern German firms are younger and smaller than their western German counterparts. The comparatively high productivity growth implies, however, that such deficits will tend to balance out in the future.

What is striking is that the development in eastern Germany received few impulses from the neighbouring countries. Due to their spatial location, Berlin and other cities such as Frankfurt an der Oder appear to be predestined to trade with Poland and other East European countries. However, it has already been shown that this potential locational advantage proves in practice to be a disadvantage. Among other things this could be associated with the fact that the cities' histories have not led firms to establish their headquarters there. With the further integration especially of Poland and the Czech Republic into the EU one may hope that the

eastern part of Germany will receive additional positive impulses for growth and employment.

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Appendix table A1
 Results for the rate of change in unemployment 1993-
 2009 with additional analyses (pooled regression only)

Model No.	A1	A2	A3
Constant	0.414*** (3.19)	0.307 (1.40)	0.440** (3.27)
Unemployment 1993	-0.030*** (-5.75)	-0.024*** (-3.35)	-0.024*** (-3.70)
Manufacturing 1993	-0.551* (-2.42)	-0.828** (-2.79)	-0.773** (-2.69)
Wage growth		-0.493 (-0.76)	
Population growth	-0.757*** (-6.91)		
Neighbour in West	-0.039 (-1.08)	-0.067 (-1.47)	-0.069 (-1.53)
Foreign neighbour	0.009 (0.27)	0.034 (0.76)	0.027 (0.62)
Region type 1	0.289*** (3.83)	0.216** (2.23)	0.229* (2.40)
R ²		0.52	0.52

*** 0.001 ** 0.01 * 0.05 % level of significance

Region types 3-9 included but not shown (not significant)

Chart 1

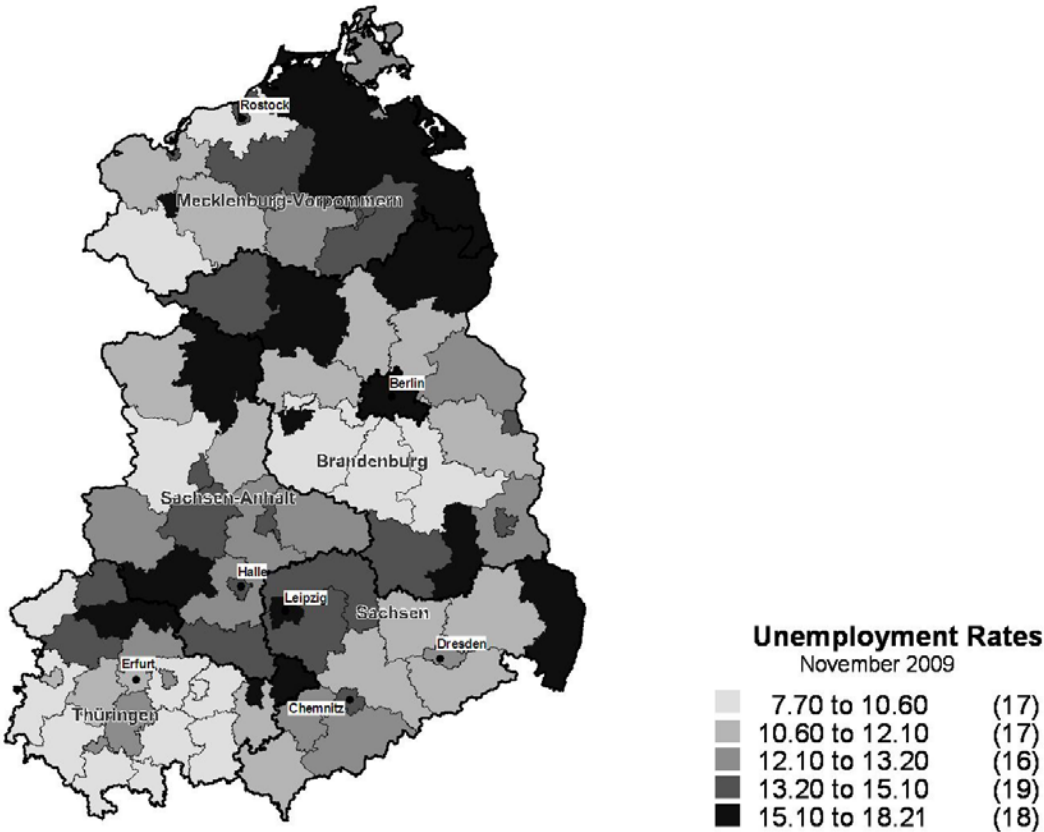


Chart 2

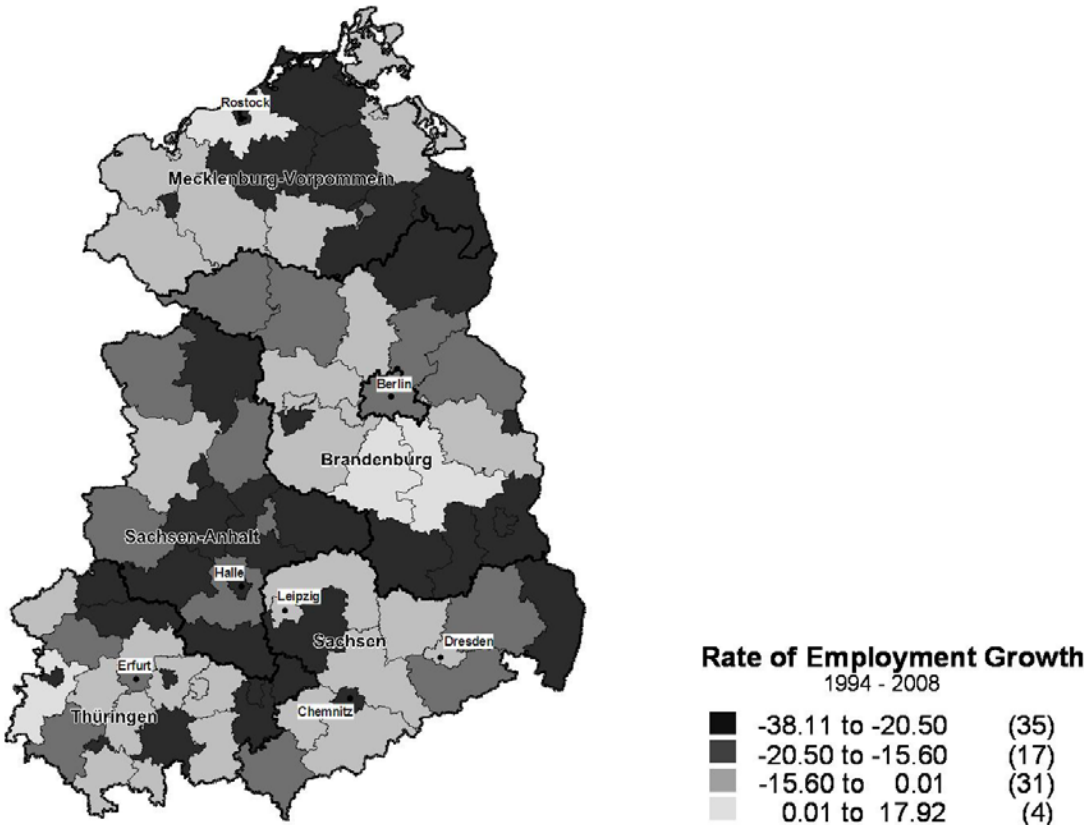


Chart 3

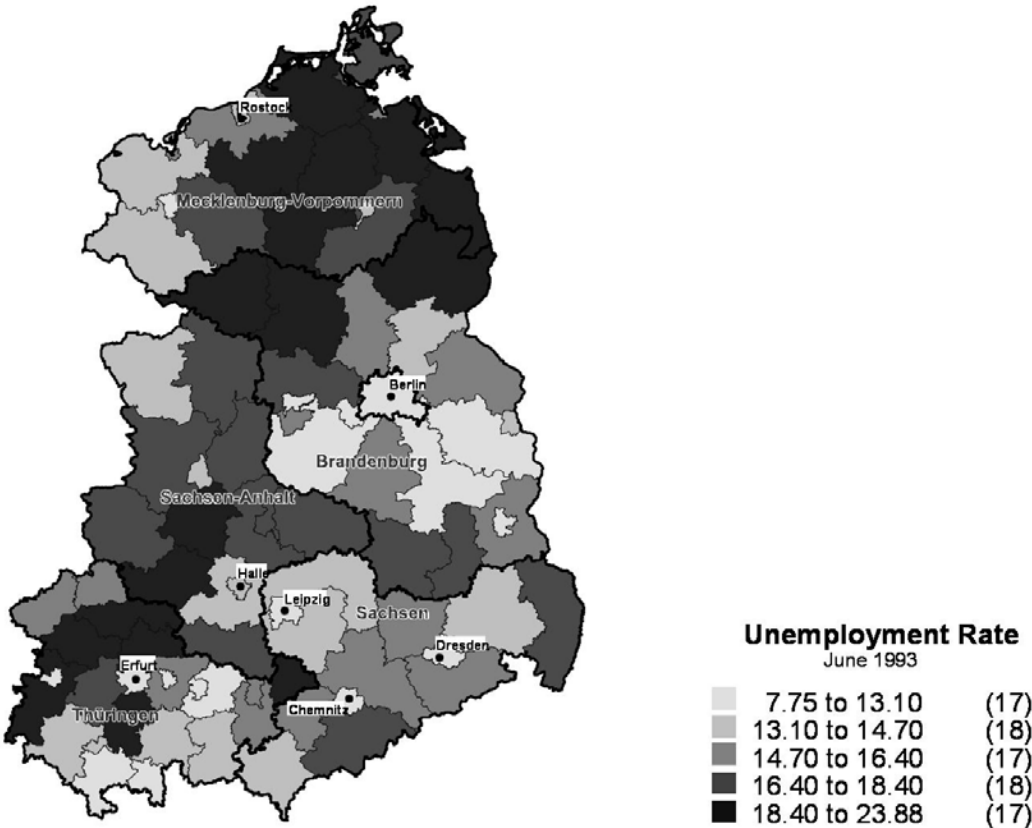


Chart 4

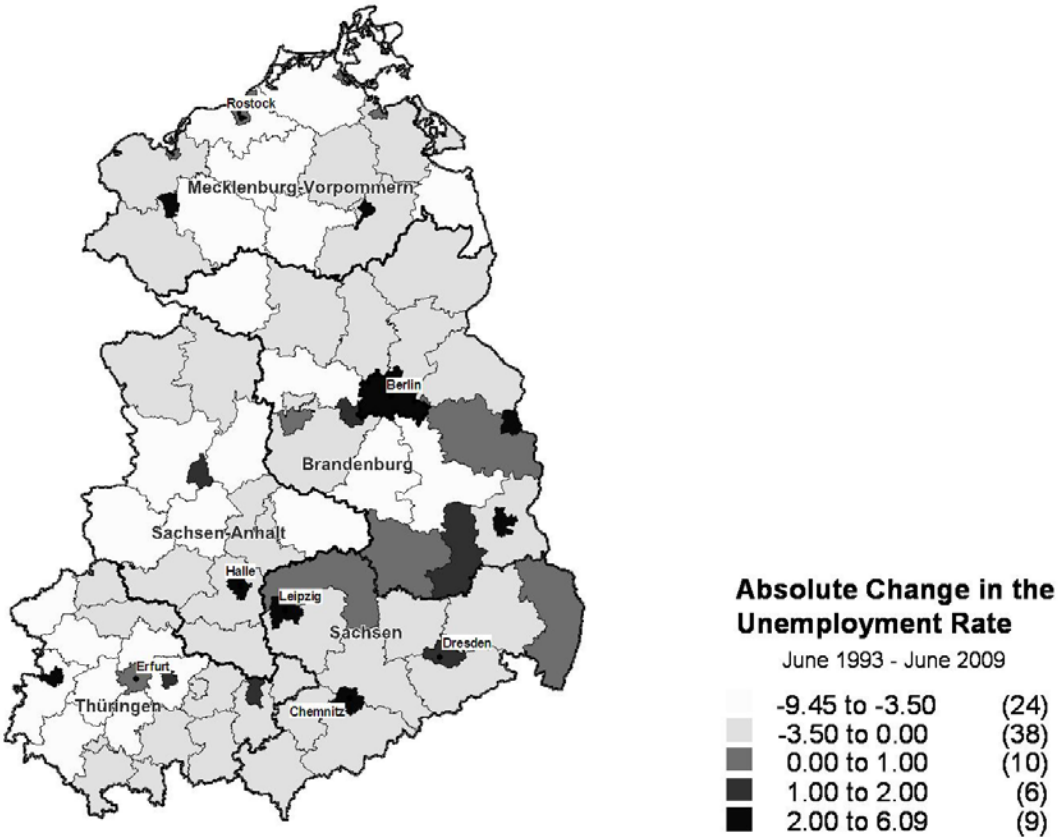


Chart 5

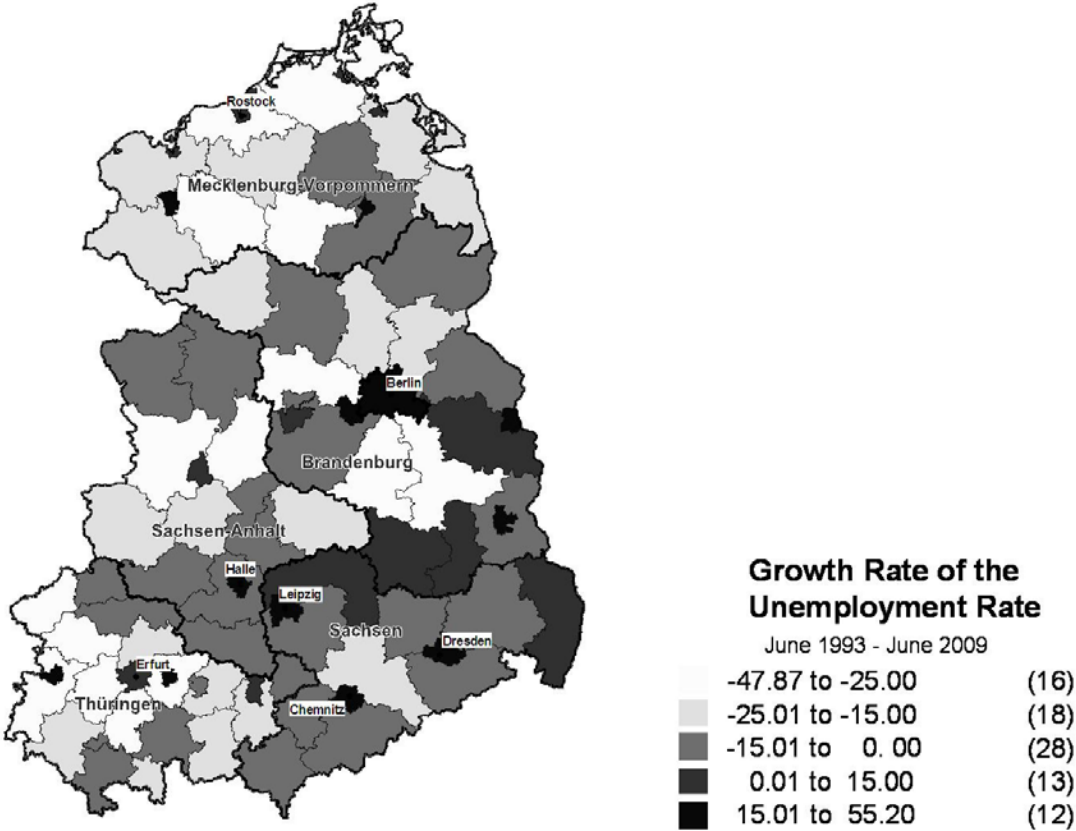


Chart 6

