Specialization and employment development in Germany: An analysis at the regional level[*]

Julia Kowalewski[1]

[1] Hamburg Institute of International Economics (HWWI), Heimhuder Str. 71, D-20148 Hamburg, Germany
  (e-mail: kowalewski@hwwi.org)

Abstract. This paper analyses the impact of industry specific regional specialization on employment growth in German planning regions between 1998 and 2007. The paper investigates Germany as a whole as well as Western and Eastern Germany separately. By using a shift-share regression approach the paper provides new findings about the existence of industry-specific localization advantages. The results show that inverse localization advantages play a major role in explaining regional disparities in Germany. This involves a process of deconcentration of economic activity. In addition, differences between Eastern and Western Germany can also be identified.

1 Introduction

The number of employees subject to social insurance contribution in Germany declined between 1998 and 2007 by about 1 percent. This average development hides strong regional and sectoral growth differences. While employment in the Ingolstadt region increased by nearly 12 percent, Eastern German regions in particular suffered from job losses of up to 20 percent (Oberlausitz-Lower Silesia). The sectoral disparities are even more pronounced: they reflect the structural change in the economy that is characterized by a broad shift from industry to service sectors. This can be illustrated, for example, by comparing the growth rates of computer and related activities and the manufacture of wearing apparel. The number of employees in the former increased by a remarkable 70 percent whereas the latter showed a decline of 50 percent.

How industries – and the regions in which they are located – develop depends on diverse factors. The theoretical and empirical literature stresses that the development of industries in a region does not depend only on regional conditions – such as infrastructure – or the fact that an industry is generally growing or shrinking. It is also influenced by the degree to which a region is specialized in the respective industry. So, industries might develop differently according to their regional distribution. In this paper, shift-share regression methodology is used to analyse the relationship between regional specialization in individual industries and regional industry-specific employment growth. The regression-analytical analogue of the traditional shift-share analysis allows for the examination of causalities and the inclusion of all kinds of meaningful theoretical variables – in addition to the influence of the economic structure. The most important advantage of this method is the unit of analysis, which is the individual industry within regions. In contrast to panel models with fixed effects, which treat regions as the unit of observation, it is possible to separate the effect of industry development from the effect of location of these industries (Blien and Wolf 2002).

The aim of this paper is twofold. First, sector-specific localization advantages are investigated at the level of 60 industries. If it turns out that industries tend to grow in those regions where they were overrepresented and decline where they were underrepresented in the beginning of the observation period, the results can be taken as evidence for localization advantages and a trend towards increasing specialization. Growing structural disparities between the German regions would be associated with this. The opposite case, that industries tend to decline in regions where they were overrepresented compared to the average, would indicate deconcentration and an adjustment of the regional structures during the observation period. Thinking in the context of growth theory, this would exhibit mean reversion of regional structures.[1] To complement the findings, a subsequent analysis is carried out to test if general specialization of a region affects its capacity to generate employment growth. The result will provide insight into the effect of urbanization, such as benefits from diversified sector structures, on the path of employment development in the observation period, and can be seen as validation for the results of the specialization effects.

The high sectoral disaggregation is one advantage of the empirical analysis in this paper (e.g., the estimates of Möller and Tassinopoulos 2000; Blien and Wolf 2002, were restricted to 11 and 27 sectors, respectively). Mameli et al. (2008) analysed the sensitivity to sectoral aggregation of models, which estimates local employment growth. Their results strongly support the use of highly disaggregated data, especially when sector-specific externalities that do not operate across broader industry groups, such as skilled labour or infrastructure availability, are analysed. The continuative analysis further provides findings about the influence of general regional specialization on a region's quality of location.

The second aim is to analyse not only the regions of Germany as a whole but also the Eastern and Western German parts separately. Regarding the significant differences between Eastern and Western Germany, the question of the convergence of the sectoral structure is of particular interest. Former studies were restricted to one of the mentioned parts.[2] Comparing the different results is always accompanied by uncertainty because of different sectoral and regional dimen-

---

[1] It is important to distinguish between structural convergence and the so called β-convergence. The β-convergence aims to verify the convergence hypothesis by regarding the impact of the base level of the per capita income on the growth rate over the following periods. The concept suggests either mean reversion or some conditional convergence in growth across regions, or both. Conditional convergence suggests 'adjustment' only if the basic parameters are equal across the regions. The relationship between the structural convergence and the β-convergence concepts is vague. The advantage of relative backwardness as a pre-condition for β-convergence may be found in using non-exhausted sector growth potentials as well as in taking advantage of specialization opportunities.

[2] Möller and Tassinopoulos (2000) analysed Western Germany, Blien and Wolf (2002) Eastern Germany and Blien and Südekum (2005) analysed Germany as a whole within a dynamic model specification.

sions as well as different observation periods and model specifications. Given the consistent analysis in the present paper, the findings can be directly compared and differences can be illustrated.

The rest of the paper is structured as follows. Section 2 includes the background of economic theory. The data set used for the econometric model will be described in Section 3. Section 4 follows the specification of the econometric model and in Section 5 the results are presented. Section 6 concludes.

2 Theoretical background and empirical literature

A large body of theoretical and empirical literature indicates that regional disparities and growth differences strongly depend on the regions' sector structures. Traditional neoclassical approaches often disregard the role of individual industries. But works by Krueger and Summers (1988) and Appelbaum and Schettkat (1999) showed that industries play an important role in the structural development of an economy. This is due to the fact that industries are subject to specific business cycles and are characterized by specific supply and demand conditions. However, not only the overall development of a particular industry but also the region's degree of specialization in this industry is important for the regional development.

The observation of regional specialization is strongly connected to the existence of localization advantages, namely, positive agglomeration effects that result from the spatial concentration of one industry, such as advantages from a specialized labour market, specialized intermediate products or services and knowledge spillovers (Marshall 1890). While neoclassical theory neglects the existence of agglomeration advantages and implies economic convergence across regions, the approaches of new economic geography allow for concentration as well as spatial dispersion of production activities. On the basis of his centre-periphery model, Krugman (1991) shows that the level of transportation costs, the high mobility of the labour factor and high returns to scale in production, influence the concentration of economic activity.[3] But the theory provides no hint as to of how industries will become situated geographically, because industry specifics have to be taken into account. Therefore, empirical investigations are necessary to explore whether there is a trend towards increasing specialization or structural convergence.

Möller and Tassinopoulos (2000) observe convergence of regional industrial structures based on 11 major industries for the period 1987 to 1996 in Western Germany. They find positive specialization tendencies only for the food and beverage sector. Similar findings for Eastern German regions are provided by Blien and Wolf (2002) for the period 1993 to 1999. Examining 27 industries, they find that employment decreased to a larger extent if an industry was locally concentrated. They argue that the new communication technologies as well as other technological developments permit a more decentralized organization of production so that the regional monostructures – prominent in Eastern Germany – were no longer functional. Blien and Südekum (2005) analyse the development of the economic structure from 1993 to 2001 on the basis of regional employment data for 28 industries in Germany. The authors find evidence for significant localization advantages in the field of higher value services (e.g., business services, education). Thus, local over-representation in the base year 1993 led to significantly faster growth of service industries.

---

[3] Although the concepts of concentration and specialization do not coincide, Molle (1997, p. 16) writes in this context: "When there is a trend towards lower concentration of branches, the degree to which regions are specialized in certain sectors is likely to show a decreasing trend, too".

The observation of deconcentration tendencies in individual industries is connected with the assumption that economies of scale arise from urbanization advantages. They are external to each industry and arise from the overall level of economic activity. Growth of one industry increases the regional income, which is assumed to increase demand for goods from other industries. The growth rates of different industries are then positively correlated, which explains diversified economic structures (Glaeser et al. 1992). For example, Buenstorf and Geissler (2010) found that urbanization rather than localization economies drove the locational choice of firms in the laser industry in Germany between 1964 and 2003.

Dynamic externalities, namely MAR (Marshall-Arrow-Romer) and Jacobs externalities, have to be distinguished from the static location externalities. While static externalities explain regional economic structures, dynamic externalities are supposed to endogenously generate economic growth processes. They underlie the assumption that knowledge spillovers between industries have a positive effect on productivity and as knowledge spillovers decline with higher distance they occur stronger between spatially concentrated industries (Jaffe et al. 1993; Graham 2009). Concentration and specialization of industries are implied if spillovers are mainly intra-sectoral. This is implied by the theory of MAR externalities, which relates to the theory of static localization effects. If spillovers are mainly inter-sectoral, that is, they occur between firms of different industries (Jacobs externalities), concentration would take place, but industries would prefer a diversified rather than a specialized economic structure. The static urbanization effects can be related to this theory (Glaeser et al. 1992).

The problem is that knowledge spillovers are almost immeasurable. Further, Cingano and Schivardi (2004) emphasize that employment is not a good instrument to measure the impact of knowledge spillovers on economic growth because knowledge spillovers are supposed to induce productivity increases. Using employment data presumes proportional employment gains through shifts in labour demand. But labour market effects from productivity changes can be very different depending on the industry in question. They can either lead to labour displacement or to compensation effects.[4] Their empirical analysis using Italian data shows that productivity and employment regressions lead to conflicting results. While specialization is found to be a growth engine for productivity, employment growth benefits from diversity and specialization becomes less important. This could be the grounds behind contradictory empirical evidence on the effects of regional specialization on employment development. Glaeser et al (1992) argue for the existence of only Jacobs externalities, while Henderson et al. (1995) find that industry-specific specialization is the major employment growth engine. Blien et al. (2006) again find evidence that employment growth in local industries benefits from a diversified surrounding environment.

3 Data

The data for the study has been provided by the German Federal Employment Agency. This official information is based on a complete inventory count and therefore highly reliable and far more accurate than survey data. The data contain all employees subject to social insurance contribution by workplace. Excluded from the observations are the fractionally employed, civil servants and the self-employed. As a result, the analysis covers about 65 percent of the working population. The employment data are available for each year of the period 1998 to 2007, measured annually on the 30th June, which is close to the yearly average (German Federal Employment Agency 2008).

---

[4] The larger the demand elasticity, the larger the production growth, and thus the more employment expands. The reaction is stronger the more elastic labour supply (Combes et al. 2004).

The regional employment data distinguish between 60 industries based on the sector classification of the German Federal Statistical Office WZ 2003 (German Federal Statistical Office 2003), which, in turn, is based on the statistical classification of sectors in the European Community. The choice of this sector classification involves consequences for the length of the investigation period, because comparable data for the WZ 2003 is not available before 1998. Previous analyses of regional specialization processes had to choose a relatively high sectoral aggregation level due to data restrictions.

The employment data are at the district level and are aggregated to the 97 planning regions defined by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2008). The definition of the planning regions is based on the analysis of commuter linkages between districts, namely, districts and towns independent of a district linked by very close commuter movements are combined into one planning region. And so, unlike previous studies, which usually use administrative territorial units like districts, this analysis is based on functionally defined regions, which serve as an approximation for regional labour markets. This seems preferable for two reasons. First, the regional sector structures are significantly influenced by the selection of the territorial units. The differences of sectoral structures are likely to be much greater for small area levels than for the planning regions. For example, differences between a city and its environment disappear to a great extent when applying planning regions. Second, the use of district-level data has a tendency to provide spatial autocorrelation that can arise as an artefact of slicing up homogenous regions (Resende 2010). Therefore, planning regions are appropriate for the study of regional specialization and the effect on labour market performance, as the use of administrative area units might distort the results.[5] The paper uses the classification of seven different region types, based on population density and the size of the regional centre: agglomerated areas with high population density, agglomerated areas with very large centres, urbanized areas of higher density, urbanized areas of medium density with high-level centres, urbanized areas of lower density without high-level centres, rural areas of higher density and rural areas of lower density (BBSR 2008).

The analysis also includes the qualification structure of employees in the planning regions. Because of data protection it was not possible to implement qualification characteristics at the district level and differentiate for the 60 industries without substantial anonymization of parameter-values.

4 Econometric model specification

Dunn (1960) developed the shift-share analysis and it has become a popular instrument in regional economics. The estimation approach implemented in this analysis is an analytical regression analogue of the shift-share analysis. It was developed by Patterson (1991) and augmented by Möller and Tassinopoulos (2000), Blien and Wolf (2002), Blien et al. (2003) and Südekum et al. (2006). As the data has a panel structure, the estimation could also be carried out as a regional panel model with fixed sector effects. But the regression approach provides the opportunity for greater precision because the unit of analysis is a local sector i in region r and, thus, the number of observations is larger than in a panel model by the factor of number of sectors.

The estimation is pooled over the observation period with additional time period fixed effects. The dependent variable is the annual employment growth rate, where i denotes the sector, r the region and t the year under consideration:

---

[5] The problem of the variability of results given different spatial scales refers to the modifiable areal unit problem (MAUP). An evaluation of the MAUP for the case of Brazil is provided by Resende (2010). A similar analysis using the present data set would have to deal with a high degree of anonymization at the district level.

$$g_{irt} = \frac{E_{irt} - E_{ir,t-1}}{E_{ir,t-1}} \tag{1}$$

with E_{irt} the number of employees in sector i and region r at time t. Following the idea of the shift-share method the regional employment growth rate is split into several components. The regional employment growth rate in each sector depends on the time period effect π_t, the sector effect α_i, the specialization or structural adjustment effect γ_i, the region-specific effect β_r, the settlement structure effect δ_j and the effect of regional qualification structure μ_y^Q. Finally, $\tilde{\varepsilon}_{irt}$ denotes a stochastic error term. The regression model, which incorporates these effects, is defined by the following equation:

$$g_{irt} = \pi_t + \alpha_i + \beta_r + \delta_j + \gamma_i \left(a_{ir,98} - a_{i.,98}\right) + \sum_{y=1}^{3} \mu_y^Q Q_{yrt} + \tilde{\varepsilon}_{irt} \tag{2}$$

The impact of the relative importance of an industry in a region on the region's employment growth is reflected by the specialization effects γ_i. More precisely, the effect of industry-specific specialization in the base year on the subsequent industry growth is analysed. Specialization of a region is measured for each industry i and region r in the base year 1998 by the difference between the regional employment share in each industry i ($a_{ir,98}$) and the corresponding national share ($a_{i.,98}$), which is a common definition of industry-specific specialization of regions in the empirical literature (Möller and Tassinopoulos 2000, Blien and Wolf 2002, Mameli et al. 2008). The specialization value describes the extent of a region's specialization in a particular sector. A value of zero indicates that the sector i in region r has an equally large share of employment as in the area as a whole – there is no specialization. If the value becomes greater than zero, there is a specialization of the region. The greater the value, the stronger specialization is found. If a region shows a value less than zero, the sector is represented below average in this region. A positive sign of the parameter γ_i implies that the employment growth of this sector is positive (negative), if the sector has an above (below) average importance in the considered region. This indicates that the specific sector benefits from localization advantages. If the regression provides predominantly positive effects, the German regions are characterized by specialization, that is, structural divergence. On the other hand, predominantly negative effects are an indication for converging structures, which in turn would indicate a lack of localization advantages in large parts of the economy.

In order to correctly measure the effect of specialization, a set of control variables is included in the empirical model. The time period effects π_t, represented by dummy-variables for nine periods, control for business cycle movements that affect employment development in the specific year equally over all units.

The sector effects α_i, represented by dummy-variables for 60 industries, indicate how the employment of each industry has developed. Thus, it captures systematic differences in sector employment growth rates as suggested by standard structural change theories (e.g., Richardson 1969). For example, differences in the competitiveness of industries can be found here insofar as they are constant over the entire observation period. A positive (negative) sign means that the industry has developed better (worse) relative to the overall economy.

By contrast, the region-specific effects β_r, represented by dummy variables for 97 planning regions, allow for inferences on local qualities. They include all factors which affect the employment development in all sectors of a region over the entire period in the same way (Wolf 2002), for example, infrastructure such as the transport connections (Zarth and Crome 1999), the accessibility of suppliers and consumers (Bröcker 1989; Blien et al. 2003), or disadvantages of boundary regions as well as advantages or disadvantages derived from the extent of general specialization of a region.

Restrictions on the region-specific dummy variables – explained below – enable the inclusion of seven dummy-variables for each settlement structure type to capture regional growth differences due to different types of regions. These effects are included because, as Möller and Tassinopoulos (2000) argue, the observed structural convergence of a sector might be due to the fact that the sector is concentrated in a specific region type, which is characterized by lower dynamics.

Finally, the inclusion of the regional qualification structure allows the observation of whether or not the impact of specialization remains robust. Q_{yrt} represents the proportion of a qualification group $y(y =$ low skilled, medium skilled, high skilled), among all workers in region r for time t. The endogenous growth theory starting from Lucas (1988) implemented the connection of human capital and economic growth. Human capital is considered as an alternative and a complement to technical progress in its function as a driving force for growth. Thus, many empirical studies include the qualification structure of employment in their estimation approach and find positive impacts on regional (employment) growth (Green 2002; Farhauer and Granato 2006; Südekum et al. 2006). Qualified labour is a central precondition for the adoption of product or process innovations. They represent an 'innovative potential' which can give an important impulse to the regional development.

Two problems arise with the above model. First, within sectors that are only weakly represented in a region, exorbitant leaps in the growth rate may occur, although the absolute amount of change is small. This results in inherent heteroscedasticity in the model. This problem is often referred to as 'shipbuilding in the midlands'. Furthermore, the average of growth rates is not equal to the value of the superior unit (Blien et al. 2003). Therefore, weakly represented industries in a region are weighted less than strongly represented ones, that is, in the regression, industries are represented according to their overall economic importance.[6] The introduced weighting factor $w_{ir,98}$ is the share of sector i and region r in all employees in the base year 1998:

$$w_{ir,98} = \frac{E_{ir,98}}{E_{..,98}} \tag{5}$$

The whole model equation is multiplied by this factor, while the underlying assumption is that $\varepsilon = \tilde{\varepsilon} w_{ir,98}$ and $\text{cov}(\varepsilon) = \sigma$. In the case of Eastern and Western Germany, the proportions are measured as the share of Eastern and Western overall employment, respectively.

The second problem occurs in the case of an inappropriate use of dummy variables because of perfect multicollinearity of the model. A typical solution is the definition of a reference region or a reference sector, respectively. In this case the results have to be interpreted in relation to the excluded reference category. A more elegant solution is the implementation of restrictions for the estimated coefficients. Then the included fixed effects are measured in relation to their particular mean value and so they can be interpreted in common terms as percentage deviations. Neither the effects nor the significance tests will require a subsequent adaptation. In particular, the sum of the weighted coefficients of the industry fixed effects is set equal to zero:

$$\sum_{r=1}^{97} \sum_{i=1}^{60} w_{ir,98} \alpha_i = 0 \tag{6}$$

and the same applies for the region-specific effects:

---

[6] A weighted estimation approach similar to the one used in this paper was implemented by Möller and Tassinopoulos (2000), and later adapted by Blien and Wolf (2002), Blien et al. (2003) and Südekum et al. (2006).

$$\sum_{r=1}^{97}\sum_{i=1}^{60} w_{ir,98}\beta_r = 0 \tag{7}$$

Thus, the effect of industry i represents the development of this industry compared to the average development. A positive (negative) sign implies that industry i has developed better (worse) than the overall economy. The same applies for the region-specific effects. A positive (negative) sign here awards the region an above (below) average development.

Further, the effects of the settlement structure have to be separated from the region-specific dummies. Therefore the implementation of a condition is necessary, which states that the sum of all region-specific effects of each type of region corresponds to the overall effect for this type:

$$\sum_{r=1}^{97}\sum_{i=1}^{60} \varphi_j w_{ir,98}\beta_r = \delta_j \tag{8}$$

with φ_i as a selection variable, which takes a value of one for a particular type of region j and zero otherwise. In other words: $\varphi_j = 1$ for each region type $RT_r = j$ and $\varphi_j = 0$ otherwise, with $j = 1,2, \ldots , S$ for the $S = 7$ different settlement structures or $S = 6$ in the case of the Eastern German regression.[7] The region-specific effects can then be interpreted as the deviation from the mean growth rate of the specific region type, that is, the region-specific effects represent the regional specifics which are not attributed to settlement structure conditions.

Because of the previously-mentioned problems, the model has to be estimated as constrained weighted least square without an intercept. The regression for Germany as a whole is based on 52,380 observations (60 sectors × 97 regions × 9 periods). The separated Western and Eastern German regressions contain 39,960 and 12,213 observations, respectively. For the latter, the mining industry of thorium and uranium had to be excluded from the analysis, since no values are observed in Eastern regions.

5 Estimation results

5.1 Model fit

The model type presented here neglects the phenomenon of spill-over effects between regions. In order to prove that the estimated effects are reliable, the model was tested for autocorrelation by using the Moran coefficient I. Given the unit of analysis, the test is carried out on the level of the individual industries. Moran's I tests whether the residuals of the estimation are spatially autocorrelated.[8] If the test statistics show spatially autocorrelated residuals in the regression model, the estimation would provide inefficient or even biased estimators (Eckey et al. 2006). However, the test results suggest that sector-specific spatial autocorrelation plays a minor role in this model. Choosing functional regions as the level of analysis might already represent some spill-over effects. The sectors showing tendencies for spatial autocorrelation vary from eight to 17 in the different observation years. Table A1 presents a summary table of the Moran's I tests for the year 2001–2002.

The F-tests of the regression analysis indicate a significant relation between the development of the overall employment and the exogenous variables. A common R^2 is not available for this type of analysis. An estimation without constraints, which reproduces the chosen approach most

---

[7] There are no agglomerated areas with high population density observed in Eastern Germany.
[8] The null hypothesis is no spatial autocorrelation. The weighting matrix is a binary 0/1-matrix, with one if the regions have a border in common and zero otherwise.

precisely, reaches an R^2 of 24 percent. The Eastern German model reaches a coefficient of determination of 60 percent, while the one for Western German regions amounts to 17 percent.

5.2 Specialization and sector effects in Germany

The shift-share technique allowed the separation of the general development trends for each industry – covered by the sector effects – from the effects that are due to spatial concentration or deconcentration tendencies of each industry – covered by the specialization or structural adjustment effect. First, the focus is on the industry-specific results for Germany as a whole. Table A2 presents the estimated coefficients and t-values from the models for Germany and for Eastern and Western Germany.

The actual developments of the individual industries in the observation period are generally reflected by the estimated sector effects, which allow the conclusion of a good model fit. More than half of the sector effects are significant (36 at the 5% level; 38 at the 10% level). The growth rates of 17 industries were above average and 21 sectors showed a below average development between 1998 and 2007. They capture both the structural change from industrial to service sectors and the change from labour-intensive to research and skill-intensive industries. Industries with above-average growth rates are mainly service sectors. The air transport industry achieved an enormous employment growth of 21 percentage points over average. For comparison, the actual growth rate between 1998 and 2007 was 90 percent. Furthermore, the computer and related activities industry, as well as more established industries like education or health and social work, have grown more rapidly than the average. The high growth rates of business-related activities show that the increasing importance of services is not only due to the increasing demand of private households, but is rather driven by an increasing demand of companies for services (DIW Berlin 2009). Two skill-intensive manufacturing sectors also performed very well in the observation period: the manufacture of other transport equipment and the manufacture of electrical motors and apparatus.

A large number of sectors, however, developed significantly below average in the observation period. Although six of them belong to the service sector, their negative effects are comparatively low (electricity, gas, steam and hot water supply: −1.7 percentage points). Strong employment losses are observed in those industries characterized by mainly low-skilled and labour intensive production processes like the wearing apparel (−9 percentage points), textile industries (−7 percentage points), and furniture manufacture (−4 percentage points). They compete with countries that have a large labour force and relatively low labour costs (Peters et al. 2006; Kowalewski and Stiller 2009). But also high-skilled industries like office machinery (−5 percentage points), and chemical production (−2 percentage points), declined between 1998 and 2007. The displacement of employment by outsourcing into other (service) companies could be responsible for this change.

Controlling for the general developments, individual industries evolved differently depending on their distribution across regions. The regression coefficient for specialization γ_i turned out to be significant for one third of the industries. Table 1 presents the estimated coefficients and t-values from the models for Germany and for Eastern and Western Germany. Negative specialization effects are estimated almost exclusively. This means an above (below) average share of a particular industry in a given region in the base year tends to result in a lower (higher) employment growth rate for the same industry in the following years. In general this implies a deconcentration of the industry's economic activity. Sectors with an above average development, namely, positive sector effects, particularly improved in regions where they were underrepresented in the base year. This is true for industries in the manufacturing sector as well as the service sector. Particularly strong negative specialization and concurrently positive sector effects

Table 1. Estimated specialization effects

Endogenous variable: Growth rate of employment	Model of Germany		Model of Western Germany		Model of Eastern Germany	
	coefficients	t-values	coefficients	t-values	coefficients	t-values
conc_Agriculture and hunting	-0.0098	-3.14	-0.0027	-0.2	-0.0232	-0.06
conc_Forestry and logging	-0.0070	-0.02	-0.0500	-0.07	-0.9118	-0.13
conc_Fishing and fish farming	0.0811	0.05	0.0674	0.02	0.0146	1.05
conc_Mining of coal and lignite; extraction of peat	-0.0006	-0.31	0.0003	0.17	0.0742	0.04
conc_Extraction of crude petroleum and natural gas	0.0063	0.05	0.0109	0.07	0.2113	0.12
conc_Mining of uranium and thorium ores	-88.5898	-0.02	-46.2736	-0.01	-4.8531	-0.1
conc_Mining metal ores	-0.6823	-0.7	-0.6321	-0.22	0.0908	0.65
conc_Other mining and quarrying	0.0096	0.54	0.0121	0.65	0.0297	4.06
conc_Manufacture of food products and beverages	0.0021	1.14	0.0019	0.92	-0.3464	-0.16
conc_Manufacture of tobacco products	0.0296	0.17	0.0680	0.27	0.0165	0.55
conc_Manufacture of textiles	0.0005	0.13	0.0020	0.48	0.0267	0.1
conc_Manufacture of wearing apparel	0.0125	1.07	0.0130	1.03	-0.0847	-0.07
conc_Tanning and dressing of leather	-0.0051	-0.28	-0.0063	-0.31	-0.0378	-0.37
conc_Manufacture of wood (except furniture)	-0.0087	-0.73	-0.0047	-0.36	0.1232	0.9
conc_Manufacture of pulp, paper and paper products	0.0025	0.23	0.0027	0.24	-0.0312	-0.97
conc_Publishing, printing and reproduction of record media	0.0002	0.03	0.0057	0.8	-0.0877	-0.89
conc_Manufacture of coke	-0.0140	-0.51	-0.0093	-0.29	0.0108	0.52
conc_Manufacture of chemicals and chemical products	-0.0006	-1.75	-0.0008	-1.53	0.0724	1.83
conc_Manufacture of rubber and plastic products	0.0018	0.49	0.0030	0.73	0.0038	0.21
conc_Manufacture of other non-metallic mineral products	-0.0016	-0.55	-0.0008	-0.26	0.0072	0.27
conc_Manufacture of basic metals	-0.0012	-0.65	-0.0006	-0.28	0.0192	4.02
conc_Manufacture of fabricated metal products	-0.0003	-0.55	0.0000	-0.05	0.0162	2.13
conc_Manufacture of machinery and equipment	0.0003	0.57	0.0009	1.48	0.0052	0
conc_Manufacture of office machinery and computers	0.0062	0.65	0.0085	0.82	-0.0271	-1.83
conc_Manufacture of electrical motors and apparatus	-0.0021	-1.87	-0.0049	-3.92	0.1064	3.38
conc_Manufacture of radio, television and communication equipment and apparatus	-0.0392	-3.55	-0.0387	-3.09	0.0260	0.8
conc_Manufacture of medical, precision and optical instruments	-0.0017	-0.92	-0.0010	-0.49	0.0116	1.13
conc_Manufacture of motor vehicles, trailers and semi-trailers	0.0001	0.45	0.0003	0.84	-0.0233	-0.88
conc_Manufacture of other transport equipment	-0.0141	-5.46	-0.0148	-5.28	-0.0037	-0.14
conc_Manufacture of furniture, manufacturing n.e.c.	-0.0023	-0.9	-0.0021	-0.76	-0.0878	-0.4
conc_Recycling	-0.1241	-0.54	0.0888	0.07	0.0002	0.01
conc_Electricity, gas, steam and hot water supply	-0.0019	-0.12	-0.0020	-0.11		

conc_Collection, purification and distribution of water	−0.3062	−2.4	−0.2934	−1.95	−0.0566	−0.09
conc_Construction	−0.0038	−17.33	−0.0005	−0.72	0.0008	2.25
conc_Sale, maintenance and repair of motor vehicles and motorcycles; retail of automotive fuel	−0.0084	−1.34	−0.0072	−0.73	−0.0004	−0.04
conc_Wholesale trade and commission trade (except motor vehicles)	0.0003	0.55	0.0001	0.15	0.0011	0.15
conc_Retail trade	−0.0020	−2.4	−0.0024	−2.26	0.0000	0
conc_Hotels and restaurants	−0.0012	−0.55	−0.0048	−1.78	0.0104	2.59
conc_Land transport; transport via pipelines	−0.0071	−2.69	−0.0113	−1.16	0.0001	0.01
conc_Water transport	0.0299	0.49	0.0326	0.48	0.0530	0.32
conc_Air transport	−0.2637	−3.14	−0.4498	−4.23	−0.4295	−0.44
conc_Supporting and auxiliary transport activities	−0.0061	−3.86	−0.0064	−3.56	0.0058	0.32
conc_Post and telecommunication	−0.0304	−1.71	−0.0023	−0.08	−0.0505	−2
conc_Financial intermediation	0.0052	5.43	0.0047	4.43	−0.0147	−1.24
conc_Insurance and pension funding	0.0103	1.6	0.0086	1.15	−0.0521	−0.47
conc_Activities auxiliary to financial intermediation	−0.0059	−0.16	−0.0092	−0.21	−0.0171	−0.06
conc_Real estate activities	−0.0098	−1.56	0.0054	0.23	−0.0097	−1.07
conc_Renting of machinery and equipment without operator and of personal and household goods	−0.0452	−0.25	−0.0528	−0.23	−0.2049	−0.45
conc_Computer and related activities	−0.0209	−3.83	−0.0190	−3.09	0.0127	0.13
conc_Research and development	−0.0240	−1.71	−0.0091	−0.5	0.0165	0.17
conc_Other business activities	−0.0008	−1.86	−0.0010	−2.04	−0.0014	−1.73
conc_Public administration and defence; compulsory social security	−0.0051	−14.68	−0.0059	−7.14	−0.0057	−12.63
conc_Education	−0.0056	−5.28	−0.0088	−2.45	−0.0196	−10.96
conc_Health and social work	−0.0010	−2.72	−0.0011	−2.27	−0.0043	−6.33
conc_Sewage and refuse disposal, sanitation and similar activities	−0.0140	−1.03	−0.0658	−1.08	−0.0449	−1.61
conc_Activities of membership organizations	−0.0052	−1.86	−0.0039	−1.27	−0.0396	−4.95
conc_Recreational, cultural and sporting activities	0.0006	0.1	−0.0013	−0.17	0.0062	0.51
conc_Other service activities	−0.0218	−0.77	−0.0597	−1.15	−0.0454	−0.65
conc_Private households with employed persons	−0.2027	−0.26	−0.2271	−0.26	1.0344	0.13
conc_Extra-territorial organizations and bodies	0.0119	0.76	0.0130	0.78	−24.1990	−0.18

emerge for air transport and manufacture of other transport equipment. Accordingly, regions with a relative backwardness in these industries were able to strongly improve the employment shares in these economic sectors. Further enormous negative specialization effects emerge for water collection, purification and distribution (−31 percentage points) and for radio, television and communication equipment manufacture (−4 percentage points).

Only in one sector does the specialization effect turn out positive: financial intermediation. Although the effect of 0.5 percentage points is quite low, the industry seems to benefit from regional specialization and to be dominated by concentration forces. The significant employment losses in this sector especially affect those regions starting with a relatively low sector share, while regions with a large share might compensate for the negative sector effect. Regions where financial intermediation is over-represented include highly agglomerated areas like Frankfurt, Hamburg, Munich or Stuttgart. Following Storper and Venables (2004) financial services are characterized by tacit knowledge typically embodied in highly-skilled workers. The need to communicate this knowledge creates the necessity for face-to-face contact and, therefore, proximity.

The dominance of deconcentration processes, however, can be seen as an indication for reverse localization advantages. Regional specialization, which in general goes along with the concentration of certain production activities, could lead to economic disadvantages. There are for example, higher transportation costs in relation to decentralized supply or higher costs of production factors. Furthermore, new communication technologies like the internet might have reduced the need for proximity in many industries, as it enables certain kinds of complex communication to occur at a distance which was previously constrained by the need for proximity. This holds especially for industries where knowledge is codified (e.g., the car industry) (Storper and Venables 2004).

The fact that two thirds of the industries did not show significant specialization effects is also worth mentioning because this can indicate either that they face a balancing of specialization and structural adjustment forces or that these forces do not exist.

5.3 Sector and specialization effects in Eastern and Western Germany

Turning to the results of the regressions for the formerly divided parts of Germany reveals some peculiarities in Eastern Germany. The sector effects were significant for 30 (19) industries in Western (Eastern) Germany at the 5% level (33 (23) at the 10% level). They show that Eastern regions did not benefit from the enormous growth of the air transport sector, which is indicated by the non significant sector effect. Another noticeable effect concerns the construction industry. In Eastern Germany, where the construction sector accounts for a large share, strong downsizing of excess capacity can be observed, namely, numerous job losses, which are reflected by yearly growth rates of eight percentage points below average. This process is accompanied by concentration tendencies (see Table 1). While this effect is low in the Eastern Germany (0.0008) and non significant for comparison with Western Germany, the effect is negative and relatively strong on the level of Germany as a whole (−0.0034). This indicates an adjustment of Eastern and Western German structures.

The strength of localization advantages differs substantially between Eastern and Western Germany. The Western German regression reveals 14 significant coefficients for the specialization variable and the Eastern German regression 15, while five and six of them are significant at the 10% level, respectively. The estimated effects in Western Germany are, again, similar to the effects for Germany as a whole, but they differ substantially from the observations for the Eastern economy. It is somehow surprising that seven out of 15 significant specialization effects in Eastern Germany are positive. This means the growth rates of those industries were signifi-

cantly higher in regions where they were over-represented in the base year as compared to the Eastern German average. Interestingly, except for the hotel and restaurant industry, all of them belong to the industrial sector. This refers to a concentration process of these industries. Radio and television manufacture is mostly affected by concentration tendencies. The fact that this industry has a negative effect in Western Germany and Germany as a whole points to a process of structural convergence between the two German parts. Moreover, manufacture of rubber and plastic products (7 percentage points), manufacture of food products and beverage (3 percentage points), fabricated metal products (1.9 percentage points), and manufacture of machinery and equipment (1.6 percentage points), showed higher growth rates in regions where they were over-represented in the base year. This is different to findings of other studies, for example, Blien and Wolf (2002) found concentration tendencies, only for the manufacture of food and tobacco products and construction, could be due to different regional and sectoral units of analysis or to changing conditions, like technical progress, that lead to different behaviour patterns at different points in time.

Industries showing a negative specialization effect are predominantly in the service sector and they do not differ substantially from the German regression. Post and telecommunication (−5 percentage points), and activities of membership organizations (−4 percentage points), showed the highest deconcentration tendencies in Eastern Germany, followed by manufacture of electrical motors and apparatus (−3 percentage points). In the agricultural sector, where a slightly negative effect is also observed, the transition from large and highly-specialized agricultural enterprises before reunification to economically oriented firms still seems to support the process of deconcentration.

5.4 Regional specifics

In the following, the focus is on the regional specifics. The variables are included as control variables – in the case of regional dummies and the qualification structure – but they also reveal some interesting insights. The results of the estimated coefficients and t-tests are presented in Table A3 together with the results of the time period effects.

The settlement structure effects suggest systematic differences between area types from 1998 to 2007. Three of seven coefficients are statistically significant at the 5% and 10% levels in the German regression. Positive employment development was found for rural areas with higher density, as the growth rate was about 0.33 percentage points higher than the average. By contrast, the growth rates in agglomerated areas lagged behind average growth (about −0.2 percentage points). The estimation results show that long-observed tendencies of deconcentration of employment (Bade and Niebuhr 1999) persist. The dynamic development of the rural areas with higher density refers to the observation of a wide-area relocation of employment. However, this observation does not give evidence for a general converging process, as the effect for rural areas with lower density is not significant.

Restricting the model to Western Germany lets the effects of the settlement structure become nearly non significant. Only the agglomerated areas with high population density show negative developments when allowing for a 10% level of significance. In contrast, the agglomerated areas in the Eastern part have had above average growth. At the same time, urbanized areas in Eastern Germany lost employment significantly. Following Südekum et al. (2006) agglomeration externalities seem to be relatively more significant in the catching-up process of the economically backward Eastern regions. The diagnosis of unfavourable development in Eastern German rural areas, which was made by Blien and Hirschenauer (1999) and later confirmed by several studies (Blien and Wolf 2002, Blien et al. 2003), cannot be found in this later period.

The region-specific effects also reflect the east-west disparities in Germany. Up to the 10% level, 42 planning regions showed significantly different developments compared to the national

average, while 21 of them developed above average. The estimation results show that regions with a significant positive effect are, without exception, located in Western Germany, while negative effects are mainly observed in regions of Eastern Germany. More than 15 years after the beginning of the transformation process in the Eastern part of Germany the regional conditions are, on average, much more disadvantageous than in Western Germany. Comparing the group of Western German planning regions, however, shows that the regional preconditions for employment growth are also significantly different. Areas with very favourable local conditions can be found particularly in Bavaria, Baden-Württemberg and in North-West Germany. Conversely, in the centre of Western Germany – in large parts of North Rhine-Westphalia and Hesse and in Southern Lower Saxony – the region-specific conditions often had a negative impact on employment growth. With the separated regression analyses for Eastern and Western regions the basic results hardly change.

The influencing factors on regional preconditions for employment growth are numerous. One factor that is related to the topic of this paper is the overall specialization of a region. There are a lot of empirical investigations dealing with the question of which regional structure is beneficial for employment growth. Is it a specialized or rather a diversified economic environment that spurs employment growth? In a subsequent analysis, the effect of regional specialization in the base year 1998 on the estimated region-specific effects is analysed by implementing the following equation:

$$\beta_r = \alpha + \rho KSI_{r,98} + \varepsilon_r \tag{9}$$

with α being a constant term, $KSI_{r,98}$ the Krugman index in region r in the base year 1998 and ρ the regression coefficient. The Krugman index is defined as:

$$KSI_r = \sum_{i=1}^{60} |(a_{ir} - a_{i.})| \tag{10}$$

with a_{ir} the share of employees in sector i in the overall employment in region r and a_i the respective share in the nation. The index measures the relative specialization of a region compared to the national average. The results will show whether region-specific effects were driven by the degree of regional specialization and whether a specialized or rather a diversified sector structure in the beginning of the observation period positively affect regional conditions for employment growth. Table 2 shows the results.

The estimation is undertaken as a complement to the shift-share analysis. The result for Germany shows that diversified rather than highly-specialized sectoral structures positively affect regional conditions for employment growth. Turning to the separate regressions of Western and Eastern Germany, the direction of the effect stays the same but it becomes non significant. Here, the extent of regional specialization did not affect the quality of location significantly. The findings for Germany add to the widely observed deconcentration tendencies of economic activity in the industry-specific regression. They indicate that not only revised

Table 2. Effect of regional specialization

Endogenous variable: Estimated region specific effect	Model of Germany		Model of Western Germany		Model of Eastern Germany	
	coefficients	t-values	coefficients	t-values	coefficients	t-values
ksi	−0.0307	−2.52	−0.0026	−0.32	−0.0081	−0.47
constant	0.0116	2.47	0.0009	0.32	0.0019	0.45

location advantages cause the regional distribution of firms but also urbanization effects that are due to the benefits from diversified economic surroundings. Whether the observed effect is actually ascribed to static inter-industry externalities that facilitate employment growth or even Jacobs externalities, namely, endogenous growth processes due to inter-industry knowledge spillovers, cannot be answered with this analysis.

In the empirical literature findings on effects of regional specialization on labour market performances are quite contradictory. Evidence for diversity as a stimulus for employment growth comes from such sources as Glaeser et al. (1992), who analysed cities in the US, from Blien et al. (2006), who analysed Western German districts, and from Bishop and Gripaios (2010) for Great Britain. Henderson et al. (1995) found that diversity only matters for newer high-tech industries, while MAR externalities support employment growth in mature industries. In contrast, Robson (2009) argues that employment growth was, in general, stimulated by regional specialized structures in the UK. Fotopoulos et al. (2010) found that regional specialization – especially in growing manufacturing industries – had a positive effect on employment growth in Greece. The different results might raise some doubts about their validity. On the other hand, the relationship between diversity and employment growth may be both area and period-specific (Robson 2009).

Finally, the results for the qualification variables show that a higher share of high-skilled workers in a region is generally connected with higher employment growth. Including the qualification structure in the model does not change the results for the specialization effect and hardly changes the results for the dummy-variables. This is another indication of the robustness of the model.

6 Conclusion

This paper focused on the impact of the regional distribution of individual industries on labour market performance at the level of 97 planning regions during the period 1998 to 2007. The high disaggregation on the sectoral level enabled the analysis of the existence of industry-specific localization advantages. The analysis showed that 19 industries grew significantly stronger in regions with a relative backwardness, namely, in those regions where they were under-represented in the base year. This suggests a deconcentration process of economic activity in the observation period and provides evidence for the existence of reverse localization advantages. In only one sector, namely financial intermediation, do specialization forces seem to outweigh deconcentration forces. The fact that two thirds of the industries did not show significant specialization effects is either an indication that they face a balancing of specialization and structural adjustment forces or that these forces do not exist.

The subsequent analysis further showed that general regional specialization negatively affected a region's capacity to generate employment growth. The result suggests that not only reverse localization effects but also urbanization effects determined the path of employment development in the observation period. Future research is needed to prove this assumption of inter-industry externalities.

Shift-share regressions were carried out not only for Germany as a whole but also for the Eastern and the Western parts of Germany. Hence, this is the first study that allows the analysis of differences between Eastern and Western Germany within a consistent framework. This is because the same analytical method with the same observation period and the same regional and sectoral units are provided for all parts.

The results show considerable differences between Eastern and Western Germany. While the results for Western Germany are fairly in line with the German results, in Eastern German regions localization effects are observed for seven – mainly manufacturing – industries. The fact

that in most cases no specialization effect is observed at the national level indicates a catching-up process of the Eastern regions to the German average.

In this process both parts of Germany are subject to the general structural change, as the results of the sector effects show. It is characterized by the change from the industrial sector to services and, moreover, from the labour-intensive to the skill-intensive industries. The estimated region-specific effects showed that after even more than 15 years after reunification, the spatial preconditions of employment growth are shaped by differences between Eastern and Western Germany. None of the 23 Eastern planning regions are characterized by significant positive region-specific effects. Furthermore, the results suggest that agglomeration externalities are relatively more important in the catching-up process of the economically backward Eastern regions because labour market performance turned out to be positive in agglomerated Eastern German areas. In the national comparison dynamic development of rural areas with higher density and negative development of agglomerated areas refer to an area-wide relocation of employment.

References

Appelbaum E, Schettkat R (1999) Are prices unimportant? *Journal of Post-Keynesian Economics* 21: 387–398

Bade F-J, Niebuhr A (1999) Zur Stabilität des räumlichen Strukturwandels. *Jahrbuch für Regionalwissenschaften* 19: 131–156

BBSR (2008) Laufende Raumbeobachtung – Raumabgrenzung. *Federal Institute for Building, Urban Affairs and spatial development.* URL: http://www.bbsr.bund.de

Bishop P, Gripaios P (2010) Spatial externalities, relatedness and sector employment growth in Great Britain. *Regional Studies* 44: 443–454

Blien U, Hirschenauer F (1999) Regionale Disparitäten auf ostdeutschen Arbeitsmärkten. In: Wiedemann E (ed) *Die arbeitsmarkt- und beschäftigungspolitische Herausforderung in Ost-Deutschland.* Beiträge zur Arbeitsmarkt- und Berufsforschung 223, Inst. für Arbeitsmarkt- und Berufsforschung, Nürnberg

Blien U, Südekum J (2005) Local economic structure and industry development in Germany. IAB Discussion Paper 1

Blien U, Wolf K (2002) Regional development of employment in Eastern Germany: An analysis with an econometric analogue to shift-share techniques. *Papers in Regional Science* 81: 391–414

Blien U, Blume L, Eickelpasch A, Geppert K, Maierhofer E, Vollkommer D, Wolf K (2003) Die Entwicklung der ostdeutschen Regionen. Beiträge zur Arbeitsmarkt und Berufsforschung 267, Nürnberg

Blien U, Südekum J, Wolf K (2006) Local employment growth in West Germany: A dynamic panel approach. *Labour Economics* 13: 445–458

Bröcker J (1989) Determinanten des regionalen Wachstums im sekundären und tertiären sektor der Bundesrepublik Deutschland 1970 bis 1982. Schriften des Instituts für Regionalforschung der Universität Kiel 10

Buenstorf G, Geissler M (2010) The origins of entrants and the geography of the German laser industry. *Papers in Regional Science*, article published online: 19 October 2010 in Early View. DOI: 10.1111/j.1435-5957.2010.00332.x

Cingano F, Schivardi F (2004) Identifying the sources of local productivity growth. *Journal of the European Economic Association* 2: 720–742

Combes P-P, Magnac T, Robin J-M (2004) The dynamics of local employment in France. *Journal of Urban Economics* 56: 217–243

DIW Berlin (2009) *Studie: Wachstums- und Beschäftigungschancen in wissensintensiven Dienstleistungsmärkten in Ostdeutschland, Schlussbericht.* Bundesministeriums für Verkehr, Bau und Stadtentwicklung, Berlin

Dunn ES (1960) A statistical and analytical technique for regional analysis. *Papers in Regional Science* 6: 97–112

Eckey H-F, Kosfeld R, Türck M (2006) Räumliche Ökonometrie. *Wirtschaftswissenschaftliches Studium* 35: 548–554

Farhauer O, Granato N (2006) Regionale Arbeitsmärkte in Westdeutschland, Standortfaktoren und Branchenmix entscheidend für Beschäftigung. IAB-Kurzbericht 4

Fotopoulos G, Kallioras D, Petrakos G (2010) Spatial variations of Greek manufacturing employment growth: The effects of specialization and international trade. *Papers in Regional Science* 89: 109–133

German Federal Employment Agency (2008) *Beschäftigtenstatistik: 1998–2007.* Statistik der Bundesagentur für Arbeit, Nürnberg

German Federal Statistical Office (2003) *German classification of economic activities,* Edition 2003. Statistisches Bundesamt, Wiesbaden

Glaeser EL, Kallal HD, Scheinkman JA, Shleifer A (1992) Growth in cities. *The Journal of Political Economy* 100: 1126–1152

Graham DJ (2009) Identifying urbanisation and localisation externalities in manufacturing and service industries. *Papers in Regional Science* 88: 63–84

Green AE (2002) The importance of skill in regional development: Evidence from the United Kingdom. *European Spatial Research and Policy* 2: 17–33

Henderson V, Kuncoro A, Turner M (1995) Industrial development in cities. *Journal of Political Economy* 103: 1067–1090

Jaffe A, Trajtenberg M, Henderson R (1993) Geographical localization of knowledge spillovers as evidenced by patent citations. *Quaterly Journal of Economics* 108: 577–598

Kowalewski J, Stiller S (2009) Strukturwandel im deutschen verarbeitenden Gewerbe. *Wirtschaftsdienst* 89: 548–555

Krueger AB, Summers LH (1988) Efficiency wages and the interindustry wage structure. *Econometrica* 56: 259–293

Krugman P (1991) *Geography and trade*. Leuven University Press, Leuven

Lucas REJ (1988) On the mechanics of economic development. *Journal of Monetary Economics* 22: 3–42

Mameli F, Faggian A, McCann P (2008) Employment growth in Italian local labour systems: Issues of model specification and sectoral aggregation. *Spatial Economic Analysis* 3: 343–360

Marshall A (1890) *Principles of economics*. MacMillan, London

Molle W (1997) The regional economic structure of the European Union: An analysis of long-term developments. In Peschel K (ed) *Regional growth and regional policy within the framework of European Integration*. Physica-Verlag, Heidelberg

Möller J, Tassinopoulos A (2000) Zunehmende Spezialisierung oder Strukturkonvergenz? Eine Analyse der sektoralen Beschäftigungsentwicklung auf regionaler Ebene. *Jahrbuch für Regionalwissenschaften* 20: 39–54

Patterson MG (1991) A note on the formulation of a full-analogue regression model of the shift-share method. *Journal of Regional Science* 31: 211–216

Peters S, Reinhardt K, Seidel H (2006) *Wissen verlagern: Risiken und Potentiale von Standortverlagerungen*. Gabler Verlag, Wiesbaden

Resende GM (2010) Multiple dimensions of regional economic growth: The Brazilian case, 1991–2000. *Papers in Regional Science*, article published online: 3. DEC 2010 in Early View. DOI: 10.1111/j.14355957.2010.00336.x

Richardson HW (1969) *Regional economics: Location theory, urban structure and regional change*. Weidenfeld and Nicolson, London

Robson M (2009) Structural change, specialization and regional labour market performance: Evidence for the UK. *Applied Economics* 41: 275–293

Storper M, Venables A (2004) Buzz: Face-to-face contact and the urban economy. *Journal of Economic Geography* 4: 351–370

Südekum J, Blien U, Ludsteck J (2006) What has caused regional employment growth differences in Eastern Germany? *Jahrbuch für Regionalwissenschaften* 26: 51–73

Wolf K (2002) Analyse regionaler Beschäftigungsentwicklung mit einem ökonometrischen Analogon zu Shift-Share-Techniken. In: Kleinhenz G (ed) *IAB-Kompendium Arbeitsmarkt- und Berufsforschung. Beiträge zur Arbeitsmarkt- und Berufsforschung* Inst. für Arbeitsmarkt- und Berufsforschung, Nürnberg

Zarth M, Crome B (1999) Die regionale Infrastrukturausstattung als Indikator für die Auswahl regionalpolitischer Fördergebiete. *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung* 32: 618–630

Appendix

Table A1. Summary table of Moran's *I*, Germany 2001–2002

Sector	I	z	p-value*
Agriculture and hunting	0.24	3.99	0.00
Manufacture of chemicals and chemical products	0.21	4.02	0.00
Construction	0.28	4.69	0.00
Private households with employed persons	0.28	4.68	0.00
Mining of coal and lignite; extraction of peat	−0.16	−2.96	0.00
Extra-territorial organizations and bodies	−0.06	−2.81	0.01
Health and social work	0.15	2.48	0.01
Hotels and restaurants	0.15	2.46	0.01
Manufacture of medical, precision and optical instruments	−0.15	−2.16	0.03
Wholesale trade and commission trade (except motor vehicles)	0.12	1.99	0.05

Table A1. Continued

Sector	I	z	p-value*
Manufacture of food products and beverages	0.11	1.95	0.05
Forestry and logging	−0.12	−1.85	0.07
Water transport	−0.09	−1.83	0.07
Activities of membership organizations	0.09	1.81	0.07
Publishing, printing and reproduction of record media	0.09	1.66	0.10
Manufacture of other non-metallic mineral products	0.09	1.63	0.10
Retail trade	0.08	1.51	0.13
Land transport; transport via pipelines	0.08	1.43	0.15
Research and development	−0.08	−1.42	0.16
Recreational, cultural and sporting activities	−0.10	−1.39	0.16
Tanning and dressing of leather	0.07	1.38	0.17
Recycling	0.08	1.38	0.17
Post and telecommunication	−0.09	−1.32	0.19
Manufacture of rubber and plastic products	−0.08	−1.23	0.22
Manufacture of fabricated metal products	0.07	1.22	0.22
Sewage and refuse disposal, sanitation and similar activities	0.05	1.14	0.26
Air transport	0.06	1.13	0.26
Other mining and quarrying	0.06	1.12	0.26
Other business activities	−0.08	−1.11	0.27
Manufacture of electrical motors and apparatus	−0.07	−1.10	0.27
Manufacture of wood (except furniture)	0.06	1.09	0.27
Collection, purification and distribution of water	0.05	0.95	0.34
Manufacture of basic metals	0.03	0.94	0.35
Activities auxiliary to financial intermediation	0.04	0.93	0.35
Manufacture of wearing apparel	0.05	0.92	0.36
Public administration and defence; compulsory social security	−0.06	−0.81	0.42
Insurance and pension funding	0.03	0.72	0.48
Computer and related activities	0.03	0.66	0.51
Manufacture of coke	0.00	0.65	0.52
Manufacture of machinery and equipment	−0.05	−0.65	0.52
Manufacture of pulp, paper and paper products	0.03	0.64	0.52
Manufacture of office machinery and computers	0.02	0.56	0.58
Manufacture of furniture, manufacturing n.e.c.	0.02	0.56	0.58
Financial intermediation	0.02	0.46	0.64
Fishing and fish farming	−0.04	−0.41	0.68
Mining metal ores	−0.03	−0.39	0.69
Education	−0.03	−0.37	0.71
Manufacture of tobacco products	0.01	0.27	0.79
Supporting and auxiliary transport activities	0.00	0.25	0.80
Extraction of crude petroleum and natural gas	0.00	0.20	0.84
Real estate activities	−0.02	−0.18	0.86
Sale, maintenance and repair of motor vehicles and motorcycles; retail of automotive fuel	−0.02	−0.17	0.86
Electricity, gas, steam and hot water supply	−0.02	−0.16	0.87
Manufacture of other transport equipment	−0.02	−0.15	0.88
Manufacture of radio, television and communication equipment and apparatus	0.00	0.14	0.89
Manufacture of textiles	−0.02	−0.14	0.89
Other service activities	−0.01	0.12	0.91
Manufacture of motor vehicles, trailers and semi-trailers	−0.01	−0.02	0.98
Renting of machinery and equipment without operator and of personal and household goods	0.01	−0.01	0.99
Mining of uranium and thorium ores	.	.	.

Table A2. Estimated sector effects

Endogenous variable: Growth rate of employment	Model of Germany		Model of Western Germany		Model of Eastern Germany	
	coefficients	t-values	coefficients	t-values	coefficients	t-values
Agriculture and hunting	−0.0060	−0.86	0.0090	0.84	−0.0418	−8.35
Forestry and logging	−0.0344	−0.47	−0.0268	−0.19	−0.0406	−0.43
Fishing and fish farming	−0.0931	−0.17	−0.0779	−0.07	−0.0291	−0.04
Mining of coal and lignite; extraction of peat	−0.0856	−7.47	−0.0923	−7.18	−0.0923	−2.04
Extraction of crude petroleum and natural gas	−0.0409	−0.22	−0.0420	−0.21	−0.0977	−0.14
Mining of uranium and thorium ores	0.2409	0.39	0.0577	0.04		
Mining metal ores	−0.0130	−0.25	−0.0275	−0.03	0.2809	0.09
Other mining and quarrying	−0.0416	−1.52	−0.0456	−1.31	−0.0723	−1.15
Manufacture of food products and beverages	−0.0155	−5.64	−0.0127	−3.92	−0.0270	−5.71
Manufacture of tobacco products	−0.0218	−0.41	−0.0319	−0.23	0.0066	0.02
Manufacture of textiles	−0.0704	−6.06	−0.0757	−5.75	−0.0695	−1.45
Manufacture of wearing apparel	−0.0880	−4.32	−0.0849	−3.85	−0.1107	−1.48
Tanning and dressing of leather	−0.0613	−1.55	−0.0553	−1.24	−0.0414	−0.18
Manufacture of wood (except furniture)	−0.0367	−2.69	−0.0389	−2.64	−0.0093	−0.25
Manufacture of pulp, paper and paper products	−0.0254	−1.98	−0.0231	−1.68	−0.0567	−1.39
Publishing, printing and reproduction of record media	−0.0236	−4.37	−0.0256	−4.66	−0.0021	−0.09
Manufacture of coke	−0.0018	−0.05	−0.0072	−0.18	0.1359	0.88
Manufacture of chemicals and chemical products	−0.0210	−6.97	−0.0189	−5.24	−0.0063	−0.46
Manufacture of rubber and plastic products	−0.0097	−1.87	−0.0077	−1.45	−0.0178	−1.04
Manufacture of other non-metallic mineral products	−0.0344	−4.49	−0.0337	−3.73	−0.0422	−3.1
Manufacture of basic metals	−0.0119	−1.93	−0.0112	−1.71	−0.0125	−0.64
Manufacture of fabricated metal products	−0.0092	−3.53	−0.0084	−2.81	−0.0136	−2.63
Manufacture of machinery and equipment	−0.0107	−5.04	−0.0091	−4.05	−0.0121	−1.82
Manufacture of office machinery and computers	−0.0481	−2.41	−0.0514	−2.39	−0.0126	−0.09
Manufacture of electrical motors and apparatus	0.0315	7.62	0.0497	10.38	−0.0168	−0.91
Manufacture of radio, television and communication equipment and apparatus	0.0084	0.86	0.0033	0.3	−0.0413	−1.83
Manufacture of medical, precision and optical instruments	−0.0014	−0.32	−0.0012	−0.24	−0.0069	−0.47
Manufacture of motor vehicles, trailers and semi-trailers	0.0027	0.92	0.0047	1.49	0.0212	1.02
Manufacture of other transport equipment	0.0330	3.31	0.0396	3.57	−0.0129	−0.42
Manufacture of furniture, manufacturing n.e.c.	−0.0387	−4.91	−0.0359	−4.12	−0.0544	−2.94
Recycling	0.0223	0.38	0.0232	0.24	−0.0163	−0.32
Electricity, gas, steam and hot water supply	−0.0173	−2.37	−0.0071	−0.8	−0.0612	−5.79

Table A2. Continued

Endogenous variable: Growth rate of employment	Model of Germany		Model of Western Germany		Model of Eastern Germany	
	coefficients	t-values	coefficients	t-values	coefficients	t-values
Collection, purification and distribution of water	0.0427	1.1	0.0237	0.31	−0.0365	−0.37
Construction	−0.0453	−44.11	−0.0301	−21.57	−0.0871	−81.02
Sale, maintenance and repair of motor vehicles and motorcycles; retail of automotive fuel	0.0061	2.07	0.0097	2.71	−0.0120	−2.52
Wholesale trade and commission trade (except motor vehicles)	−0.0080	−4.92	−0.0046	−2.45	−0.0272	−8.51
Retail trade	−0.0041	−3.78	−0.0017	−1.22	−0.0206	−11.97
Hotels and restaurants	0.0214	8.05	0.0210	6.4	0.0112	2.93
Land transport; transport via pipelines	0.0044	1.17	0.0119	2.32	−0.0285	−6.47
Water transport	−0.0051	−0.08	−0.0052	−0.07	−0.0509	−0.32
Air transport	0.2144	5.15	0.3075	5.9	0.1173	0.65
Supporting and auxiliary transport activities	0.0182	5.26	0.0204	5.26	0.0024	0.34
Post and telecommunication	0.0201	3.1	0.0240	2.71	−0.0140	−2.01
Financial intermediation	−0.0142	−5.47	−0.0087	−3.02	−0.0341	−4.11
Insurance and pension funding	−0.0149	−1.61	−0.0086	−0.83	−0.0216	−0.42
Activities auxiliary to financial intermediation	0.0374	1.81	0.0414	1.68	0.0129	0.22
Real estate activities	0.0388	4.81	0.0382	2.85	0.0106	1.03
Renting of machinery and equipment without operator and of personal and household goods	0.0232	0.71	0.0282	0.66	0.0008	0.02
Computer and related activities	0.0833	10.33	0.0803	9.11	0.0767	1.91
Research and development	0.0355	2.74	0.0199	1.08	0.0151	0.4
Other business activities	0.0496	35.82	0.0538	31.17	0.0284	13.39
Public administration and defence; compulsory social security	−0.0049	−4.04	0.0014	0.82	−0.0364	−25.17
Education	0.0180	8.27	0.0183	6.18	−0.0050	−2.45
Health and social work	0.0162	17.34	0.0175	14.69	0.0077	5.27
Sewage and refuse disposal, sanitation and similar activities	−0.0144	−1.42	0.0046	0.27	−0.0402	−3.66
Activities of membership organizations	0.0076	2.04	0.0066	1.41	0.0062	1.22
Recreational, cultural and sporting activities	0.0195	2.51	0.0241	2.56	−0.0058	−0.47
Other service activities	0.0147	2.17	0.0143	1.64	0.0002	0.02
Private households with employed persons	0.0019	0.04	−0.0033	−0.07	−0.0534	−0.15
Extra-territorial organizations and bodies	−0.0391	−0.9	−0.0400	−0.86	0.7566	0.23

Table A3. Estimated regional and time period effects

Endogenous variable: Growth rate of employment	Model of Germany		Model of Western Germany		Model of Eastern Germany	
	coefficients	t-values	coefficients	t-values	coefficients	t-values
Aachen	0.0052	1.74	0.0024	0.79		
Allgaeu	0.0006	0.1	−0.0020	−0.29		
Altmark	−0.0021	−0.22			0.0056	0.95
Arnsberg	−0.0075	−1.56	−0.0099	−1.97		
Augsburg	0.0068	1.82	0.0034	0.86		
Bayerischer Untermain	0.0009	0.11	−0.0035	−0.41		
Berlin	−0.0125	−9.29			0.0024	1.41
Bielefeld	0.0027	1.51	0.0022	1.15		
Black Forest North	0.0032	0.61	0.0006	0.11		
Bochum/Hagen	−0.0055	−2.72	−0.0058	−2.67		
Bodensee-Oberschwaben	0.0100	2.13	0.0063	1.29		
Bonn	0.0044	1.3	0.0055	1.45		
Braunschweig	−0.0052	−1.85	−0.0084	−2.75		
Bremen	−0.0045	−1.11	−0.0076	−1.83		
Bremerhaven	0.0021	0.27	−0.0031	−0.39		
Central Hesse	−0.0034	−1.1	−0.0055	−1.64		
Central Mecklenburg/ Rostock	−0.0178	−3.3			−0.0002	−0.05
Central Thuringia	−0.0119	−3.54			0.0041	1.94
Central Upper Rhine	0.0070	2.42	0.0063	2.08		
Chemnitz-Erzgebirge	−0.0084	−3.12			−0.0028	−1.43
Cologne	−0.0010	−0.69	−0.0013	−0.84		
Danube-Iller (BY)	0.0116	1.99	0.0056	0.91		
Danube-Wald	0.0106	2.23	0.0049	0.95		
Dessau	−0.0208	−4.3			−0.0042	−1.45
Donau-Iller (BW)	0.0089	1.65	0.0036	0.64		
Dortmund	−0.0039	−1.44	−0.0044	−1.53		
Duisburg/Essen	−0.0018	−1.25	−0.0032	−2.06		
Dusseldorf	−0.0046	−4.15	−0.0044	−3.6		
East Friesland	0.0070	1.42	0.0053	0.99		
East Thuringia	−0.0151	−4.39			0.0001	0.06
Easthesse	0.0057	0.59	0.0012	0.14		
Emscher-Lippe	−0.0002	−0.05	−0.0003	−0.08		
Emsland	0.0179	2.43	0.0101	1.3		
Environs of Bremen	0.0087	1.34	0.0041	0.62		
Franconia	0.0103	2.96	0.0053	1.41		
Goettingen	0.0009	0.18	−0.0102	−1.92		
Halle/S.	−0.0198	−6.77			−0.0001	−0.06
Hamburg	−0.0026	−1.5	−0.0053	−2.82		
Hanover	−0.0024	−1.12	−0.0055	−2.43		
Havelland-Flaeming	−0.0010	−0.28			0.0095	3.92
Hildesheim	−0.0073	−1.11	−0.0103	−1.47		
Hochrhein-Bodensee	0.0066	1.29	0.0044	0.82		
Industrial region Central Franconia	−0.0021	−0.97	−0.0049	−2.11		
Ingolstadt	0.0160	2.71	0.0094	1.52		
Landshut	0.0065	1.06	0.0025	0.38		
Luneburg	0.0028	0.29	−0.0051	−0.55		
Lusatia-Spreewald	−0.0161	−4.44			−0.0035	−1.53
Magdeburg	−0.0131	−4.83			0.0010	0.55
Main-Rhön	−0.0058	−0.97	−0.0122	−1.93		
Mecklenburgische Seenplatte	−0.0147	−2.07			−0.0032	−0.71
Mittelrhein-Westerwald	0.0044	1.58	−0.0008	−0.27		
North Thuringia	−0.0109	−1.78			0.0055	1.58

Table A3. Continued

Endogenous variable: Growth rate of employment	Model of Germany		Model of Western Germany		Model of Eastern Germany	
	coefficients	t-values	coefficients	t-values	coefficients	t-values
Muenster	0.0082	3.58	0.0054	2.18		
Munich	0.0097	6.18	0.0066	3.74		
Neckar-Alb	0.0030	0.67	0.0006	0.12		
Northhesse	−0.0024	−0.71	−0.0065	−1.8		
Oberes Elbtal/Osterzgebirge	−0.0099	−4.1			0.0011	0.58
Oberland	0.0013	0.17	−0.0003	−0.04		
Oberpfalz North	0.0122	1.96	0.0035	0.54		
Oderland-Spree	0.0038	0.7			0.0008	0.21
Oldenburg	0.0126	2.29	0.0052	0.89		
Osnabrück	0.0078	1.77	0.0045	0.95		
Ostwuerttemberg	0.0004	0.07	−0.0042	−0.64		
Paderborn	0.0034	0.47	−0.0014	−0.19		
Prignitz-Oberhavel	0.0054	0.79			0.0028	0.61
Regensburg	0.0128	2.99	0.0048	1.05		
Rheinhessen-Nahe	0.0047	1.21	0.0028	0.69		
Rhein-Main	−0.0049	−4.03	−0.0048	−3.57		
Rheinpfalz	0.0061	1.67	0.0069	1.65		
Saar	0.0022	0.83	0.0022	0.79		
Schleswig-Holstein Central	0.0002	0.04	−0.0025	−0.59		
Schleswig-Holstein East	−0.0001	−0.02	−0.0016	−0.24		
Schleswig-Holstein North	0.0029	0.46	0.0020	0.29		
Schleswig-Holstein South	0.0057	1.56	0.0015	0.4		
Schleswig-Holstein South-West	0.0022	0.18	−0.0025	−0.18		
Schwarzwald-Baar-Heuberg	0.0100	1.81	0.0065	1.12		
Siegen	0.0072	1.22	0.0039	0.63		
South environs of Hamburg	0.0156	2.5	0.0068	1.06		
South Thuringia	−0.0166	−3.16			−0.0006	−0.19
South-East Upper Bavaria	0.0070	1.71	0.0036	0.81		
Southern Upper Rhine	0.0072	2.41	0.0049	1.54		
South-West Saxony	−0.0228	−5.76			−0.0037	−1.89
Starkenburg	−0.0033	−1.07	−0.0037	−1.13		
Stuttgart	0.0008	0.71	0.0002	0.18		
Suedheide	0.0093	1.02	0.0016	0.18		
Trier	0.0070	1.12	0.0031	0.47		
Uckermark-Barnim	0.0004	0.05			−0.0023	−0.41
Unterer Neckar	0.0004	0.15	0.0003	0.11		
Upper Franconia East	−0.0046	−0.81	−0.0082	−1.35		
Upper Franconia West	−0.0026	−0.55	−0.0068	−1.36		
Upper Lusatia-Lower Silesia	−0.0231	−5.93			−0.0052	−4.06
West Saxony	−0.0132	−5.73			−0.0069	−3.93
West-Central Franconia	0.0106	1.41	0.0011	0.15		
Western-Pomerania	−0.0194	−3.94			−0.0066	−1.95
Westmecklenburg	−0.0010	−0.21			0.0066	2
Westpfalz	0.0003	0.04	−0.0038	−0.57		
Wuerzburg	0.0042	0.8	−0.0012	−0.22		
Agglomerated areas with high population density	−0.0014	−1.67	−0.0041	−3.81		
Agglomerated areas with huge centres	−0.0021	−1.97	−0.0020	−1.46	0.0044	4.01
Urbanized areas of higher density	0.0008	0.7	0.0001	0.07	−0.0038	−3.51
Urbanized areas of medium density with high level centres	−0.0003	−0.26	0.0011	0.75	0.0015	1.49

Table A3. Continued

Endogenous variable: Growth rate of employment	Model of Germany		Model of Western Germany		Model of Eastern Germany	
	coefficients	*t*-values	coefficients	*t*-values	coefficients	*t*-values
Urbanized areas of lower density without high level centres	0.0020	1.38	0.0015	0.9	−0.0052	−4.06
Rural areas of higher density	0.0033	2.08	0.0022	1.1	0.0007	0.46
Rural areas of lower density	−0.0022	−1	0.0011	0.34	0.0024	1.33
Employees without qualification	−0.0003	−1.84	−0.0008	−2.12	0.0011	0.4
Qualified employees	0.0001	1.64	0.0002	1.88	0.0002	1.04
Highly qualified employees	0.0003	1.75	0.0006	2.1	−0.0013	−0.48
Year 1998	0.0162	21.39	0.0186	20.33	0.0082	7.51
Year 1999	0.0196	26.43	0.0254	28.16	0.0011	1.01
Year 2000	−0.0003	−0.4	0.0052	5.75	−0.0182	−16.81
Year 2001	−0.0079	−10.57	−0.0044	−4.89	−0.0190	−17.61
Year 2002	−0.0201	−26.92	−0.0233	−25.75	−0.0099	−9.16
Year 2003	−0.0154	−20.6	−0.0174	−19.25	−0.0088	−8.19
Year 2004	−0.0114	−15.24	−0.0100	−10.99	−0.0161	−14.92
Year 2005	0.0072	9.55	−0.0001	−0.12	0.0307	28.35
Year 2006	0.0122	16.25	0.0060	6.61	−0.0055	−1.88

Resumen. Este artículo analiza el impacto de la especialización regional específica por industrias sobre el crecimiento del empleo en las regiones de planificación alemanas entre 1998 y 2007. El artículo estudia Alemania en su totalidad, así como Alemania Occidental y Oriental por separado. Mediante la utilización de un enfoque de regresión shift-share, el artículo aporta nuevos resultados acerca de la existencia de ventajas de localización específicas por industria Los resultados muestran que las ventajas de localización inversa tienen un papel clave a la hora de explicar las disparidades regionales en Alemania. Esto implica un proceso de desconcentración de la actividad económica. Además, también se pueden identificar diferencias entra Alemania Occidental y Alemania Oriental.

要約 本稿は、1998年から2007年にかけてのドイツの計画地域において、産業特有の地域特化が雇用増加に与えた影響を分析する。本稿では、全ドイツに加え西ドイツと東ドイツを個別に分析する。本稿は、シフト・シェア回帰分析により、産業特有の地域化に利点があることについて新たな知見を得ることができた。分析結果は、ドイツの地域間格差を説明する上で、反地域化の利点が重要な役割を果たすことを示す。これには経済活動の分散のプロセスが関係している。さらに、ドイツ東西間の格差も確認することができる。