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ORIGINAL PAPER

The impact of regional location factors on job creation, job destruction and employment growth in manufacturing

Raimund Krumm · Harald Strotmann

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Abstract Regions are exposed to intensive competition to provide the most attractive location conditions for firms and their employees. Therefore, regional employment development depends to a decisive degree on the attractiveness of regional location factors. Based upon the creation of establishment-level panel data from Official Statistics for manufacturing in Baden-Wuerttemberg, Germany, from 1980 to 1999 this paper gives an empirical analysis of the impact of regional location conditions on regional manufacturing employment growth. In particular, the paper examines whether the impact of regional location conditions on regional net employment growth is driven by the underlying gross components job creation and/or job destruction.

The results indicate that lower regional costs of production and a better regional endowment with skilled labour and R&D promote manufacturing employment growth. Thereby, lower costs of production as measured by a lower wage level stimulate employment growth by decreasing gross job destruction, while a better human capital endowment and a higher regional R&D intensity enhance employment growth by higher rates of gross job creation. Regions characterised by a smaller average firm size in manufacturing experienced higher manufacturing employment growth both by higher rates of job creation and lower rates of job destruction. On the other hand population density stimulates job creation as well as job destruction which lead to a zero effect on the scale of net employment change—indicating a compensation effect "behind the scenes". Otherwise, the analysis reveals the tendency for regional loca-

R. Krumm (✉)
IAW Institute for Applied Economic Research Tübingen, Ob dem Himmelreich 1, 72074 Tuebingen, Germany
e-mail: raimund.krumm@iaw.edu

H. Strotmann
Pforzheim University, Tiefenbronner Str. 65, 75175 Pforzheim, Germany
e-mail: harald.strotmann@hs-pforzheim.de

tion factors to influence either only gross job creation or only gross job destruction, but seldom both sides at the same time.

Keywords Regional development · Employment growth · Job creation · Job destruction · Job flows · Location factors · Manufacturing

JEL Classification R11 · R3 · O18

1 Introduction

For a region's competitiveness as well as for its economic power and employment situation, it is of utmost importance that the firms located within the region are competitive on a national and international scale. Therefore, not only national economies, but also smaller regional units find themselves in an intensive competition to provide attractive location conditions for companies and their employees. Firms' decisions about location and investment as well as their decisions to establish additional workplaces or to diminish employment are influenced by a lot of potential regional conditions. Already traditional economic location theories (see e.g., Launhardt 1882; Weber 1929; and Hotelling 1929) have stressed the special importance of the regional surroundings for firm strategies and performance. Moreover, the importance of regional conditions for the settlement and development of firms has been confirmed in empirical studies for a wide range of countries and time periods.[1]

The aim of this paper is twofold: At first, based on firm-level panel data of manufacturing establishments in Baden-Wuerttemberg, Germany, which are aggregated to regional panel data for forty-four counties, the impact of regional conditions on county-level manufacturing employment growth is empirically analysed. There is a special focus on the relative role of various regional location factors for regional manufacturing employment growth. Second, while the vast majority of existing studies only evaluates the determinants of regional net employment growth, this paper adds to the literature and takes a closer look behind the scenes of aggregate employment change. This is done by investigating employment changes at the establishment-level and thereby allowing for the decomposition of regional net employment change into the gross components of regional job creation and regional job destruction. Thereby, the question is analysed whether the impact of different regional location factors on employment growth is caused by either affecting gross job creation and/or gross job destruction.

[1] For a small selection of the respective empirical papers covering various regional location factors, see Grek et al. (2011), Gauselmann et al. (2011), Arent and Steinbrecher (2010), Arauzo-Carod (2005), Audretsch and Dohse (2007), Devereux and Griffith (1998), or Hoogstra and van Dijk (2004). Referring to a decision-making support for the regional economic policy based on empirical analyses on regional location factors, see Goebel and Hamm (2010) for instance.

Table 1 Regional determinants of employment development

Supply-side factors	Demand-side factors	Industry structure
Cost of production factors	*Regional purchasing power*	*Firm size structure*
• Land prices • Labour costs • Tax burden		• Average firm size
Regional factor endowment		*Export openness*
• Human capital • R & D resources • Traffic infrastructure		• Regional export quota
		Localisation
		• Sectoral concentration
		Role of service sector
		• Tertiarisation degree • Employment development in the services sector
Combined supply-side and demand-side factors		
• Regional unemployment • Urbanisation: population density		

Source: Authors' draft

2 Regional determinants of employment growth—survey and hypotheses

From a theoretical point of view, there is no generally accepted systematisation of possible regional determinants of employment growth. To structure the analysis of location factors, both for the following discussion of possible regional employment determinants suggested by economic theory and for the brief survey of existing empirical evidence, the location factors are divided into supply-side factors, demand-side factors, "combined" supply-and demand-side factors, and further characteristics of the regional industry which are summarised as "industry structure" (see Table 1 for a survey).

At first, important aspects of regional supply-side conditions are the costs of production factors. In particular, wages as the cost for labour and the prices for land may vary to a great extent at a local level, and thus may be considered as important aspects in explaining the spatial distribution of economic activity, and therefore of employment.[2]

All else being equal, the higher the wage level and thus the costs of labour, the more firms will try to substitute labour by capital or to relocate production to low-wage regions. Thus, c.p., a higher regional wage level, can be expected to hamper regional employment growth.[3]

[2]This was currently again confirmed by the empirical analysis of Fukao et al. (2011) who stress the importance of land prices and wage rates for the location choice of firms.

[3]As discussed later, regional wages also have a demand-side aspect, but the net effect of the wage costs on regional manufacturing employment can usually be expected to be negative because the cost impact usually

Already traditional location theory argues that land prices can be of utmost importance for regional employment growth, as land prices for industrial sites are a relevant cost component for firms.[4] Thereby—though higher prices also reflect to a certain extent a high demand for such sites relative to a given supply—higher land prices tend to constrain the expansion of existing firms, as well as the settlement of new firms in a region, and thus have a negative impact on regional employment.

Capital costs can be expected to be less important as a regional determinant of employment growth, because financial capital is a very mobile factor of production, and financial markets are not limited to a decentralised local level.

Another very important source for differences in regional costs of production are regional differences in the tax burden that resident firms are confronted with. Devereux and Griffith (1998), Agostini (2007), and Büttner and Ruf (2005) demonstrate that high tax rates have a negative impact on investment and location decisions, respectively. The higher the rates of profit taxes levied on the regional or local level are, the higher will be the detrimental effect on regional employment.[5]

Besides costs of production, a region's endowment with production factors is also considered as an important supply-side factor that affects regional employment. According to modern economic growth theory (see, e.g., Lucas 1988), a region's endowment with human capital and thus the skill structure of labour supply is one of the most important driving forces for production and employment. This hypothesis has been confirmed by numerous empirical studies. Farhauer and Granato (2006), for instance, show that high qualifications of employees and good human capital endowment, respectively, have a positive impact on the regional employment performance.[6] For positive regional growth effects of high school graduates, see Poelhekke (2009), for instance.

According to theoretical models of economic growth, a good regional endowment with research and development (R&D) resources is a competitive advantage for a region and thus can stimulate regional output and employment.[7] Audretsch and Dohse (2007) for instance illustrate that firms located within R&D intensive regions have a better chance of enlarging employment than firms in other regions. In this context, the importance of inter-firm knowledge spillovers is emphasised. However, the greater

dominates the purchasing power impact. For current papers referring to this topic, see e.g. Suedekum and Blien (2007), Pierluigi and Roma (2008).

[4] See the model of Alonso (1960), for instance, that deals with the relevance of land prices for location choices of firms.

[5] See Kohlhase and Ju (2007) for the impact of property taxes on location decisions of firms. However, one must not neglect the fact that regional or local taxes can be used to finance public goods such as traffic infrastructure. See Gabe and Bell (2004), who show that a high provision of local public goods that goes along with high local tax rates possibly attracts more firms than in the case when both parameters are low.

[6] Cheng (2006) analyses the relative role of human capital and wages and argues that high quality of human capital over-compensates for the significance of high wages.

[7] Therefore, R&D policy may foster regional employment growth. In this context, Koo and Kim (2009) emphasise that such a policy only works if it does not neglect the specific regional environment, such as the regional industry structure. In addition, a R&D policy aimed at regional employment growth should distinguish between different types of subsidised R&D activities, as Koski (2008) points out. A discussion of the connection between location and innovation can also be found in a survey article of Feldmann (2000).

the geographical distance between the firms, the lower will be the spillover intensity (see Funke and Niebuhr 2005). Thus, regional employment is fostered especially by the respective R&D resources within the region.

Good regional traffic infrastructure is also essential for the competitiveness of the local industries. For some industries, transport connections or accessibility to motorways, railway transportation, waterways, or air traffic are even of outstanding importance. The hypothesis that a good transport infrastructure favours regional employment is also confirmed by a wide range of empirical studies.[8]

Besides regional supply-side conditions, differences in regional demand conditions may also be relevant in explaining regional employment growth: The higher the purchasing power of the local population is, the higher the demand for goods and services produced by local firms might be. Thus, the firms in the respective region might profit through increased sales which would stimulate additional employment. The extent to which an increasing purchasing power induces more production is controversial. In contrast to neoclassical models, the New Economic Geography "predicts a more than proportionate response in production" (Redding 2010, p. 304).[9] Usually the dependence of regional production, and therefore of regional employment on regional purchasing power, tends to be weaker when we consider the manufacturing sector instead of the service sector. This can be explained by the circumstance that the manufacturing industry often produces investment goods that are not aimed at consumers and private households, respectively. In addition, manufacturing goods are more often exported to other regions or abroad than service goods.

For some regional location factors the demand-side dimension and the supply-side dimension might be of similar importance. They are classified as "combined factors" in Table 1. The regional unemployment rate, for example, can be interpreted as a combined location factor as it could, on the one hand, be negatively linked with regional purchasing power thus measuring a possible effect of regional demand on regional manufacturing employment. However, a higher regional unemployment rate has also a supply dimension: High rates imply a relatively larger labour supply, which induces downward pressure on labour costs for the firms, thereby working as a "worker-discipline device" (see Shapiro and Stiglitz 1984). A special aspect is how the unemployment level influences the foundation of new firms, and therefore the creation of new jobs in a region. Corresponding empirical studies, however, indicate mixed findings in this respect (see Brixy and Grotz 2006, for instance).

A region's employment level can also be influenced by its settlement structure. If there is a spatial concentration of economic activity in a region, so-called agglomeration effects can occur. One of these effects, "urbanisation economies", results from the general spatial concentration of population and economic activity (see, for instance, O'Sullivan 2005). There can be urbanisation advantages, such as the availability of extensive sales markets (demand-side effect) and of labour pooling (supply-

[8] See, e.g., Coughlin and Segev (2000), De Vor and de Groot (2009), or Jiwattanakulpaisarn et al. (2008), each of the latter analyse the significance of highway infrastructure for regional employment growth. The effect of traffic congestion on employment growth is analysed by Hymel (2009).

[9] Redding (2010) gives an overview about the empirics of the New Economic Geography in addition to the broad theoretical literature to this approach.

side effect), but also urbanisation disadvantages, such as overcrowding. Thus, the impact direction of urbanisation effects on regional employment growth is a priori not unique. A common proxy for urbanisation effects is the level of regional population density. Hoogstra and van Dijk (2004) argue that an increasing population density might favour regional employment, since urbanisation benefits still dominate urbanisation costs if a critical threshold is not crossed. After exceeding a certain threshold, however, the net urbanisation effect becomes negative. Consequently, whether a higher population density induces a positive or negative impact on regional employment may depend on the specific case and the concrete situation.[10,11]

Whereas urbanisation economies refer to spatial concentration of population and economic activity in general, "localisation economies", as the second kind of agglomeration effects, result from the spatial clustering of firms in the same industries.[12] This leads to our fourth group of regional determinants of employment growth, namely the characteristics of the regional industry structure. One concept that is used to measure localisation economies and sectoral concentration is the Herfindahl-Index, which is closer to 1 if there is a high concentration of industries within a region and closer to 0 if a large variety of different industries is of similar importance.[13,14]

The interaction of the regional manufacturing and the services sector might also help explain regional manufacturing employment growth. However, from a theoretical point of view, an increase in tertiarisation (defined as the service sector's share of all sectors with regard to employment or value added) can stimulate or hamper regional employment growth in the manufacturing sector, since the relationship between the services and the manufacturing sector may be complementary or substitutionary.[15] An example of the latter would be the case of outsourcing economic activities from the manufacturing to the service sector. The other way round, the employment level in the manufacturing sector might be stimulated by the employment growth in the service sector because of its demand for investment goods from manufacturing.

[10] This is line with an overview of Feldmann (2000) who cites studies both for urbanisation economies and others for urbanisation diseconomies.

[11] Strotmann (2007) analyses the impact of regional agglomeration on new-firm survival in German manufacturing and shows that the risk of failure of start-ups in agglomerated regions is about 30 % higher than the corresponding risk in rural areas.

[12] According to Glaeser et al. (1992) localisation economies are also called Marshall-Arrow-Romer (MAR) externalities (in contrast to Jacobs externalities which stands for urbanisation economies, see Feldmann 2000). For localisation economies, see, among others, the empirical study by Hoogstra and van Dijk (2004). For aspects with regard to localisation economies calculated using direct measures of physical distances between pairs of firms rather than with respect to pre-specified geographical units, see, e.g., Cainelli and Lupi (2011).

[13] See Almeida (2007) for selected aspects referring to economic structure and regional development, and Drucker (2009) for associations between industrial concentration and regional employment growth.

[14] In some studies aspects of the industry structure are included by a shift-share analysis, see for instance Möller and Tassinopoulos (2000) and Suedekum et al. (2006).

[15] Schettkat and Yocarini (2006) provide a review of the literature referring to the employment shift from the manufacturing to the service sector. This includes aspects of outsourcing as well as inter-industry shifts in final demand.

Numerous empirical studies indicate that regional employment growth might also depend on a region's firm size structure. Farhauer and Granato (2006) argue that the highest employment potential can be expected from smaller and medium-sized firms, i.e., regions characterised by small-scale firms might favour regional employment growth. Studies such as Fritsch et al. (2006) referring to start-ups and their employment contribution find that regional economic surroundings dominated by smaller firms produce more employment than a regional economic environment dominated by large-scale firms. On the other hand, it is well-known from the literature on job flows that small firms usually have higher rates of job creation, but also of job destruction and that the persistence of new jobs in small firms is often lower than in larger firms (see e.g. Davis et al. 1996 or for Germany Wagner 2007, 1995 or Strotmann 2002).

Regional employment growth may also be influenced by the export intensity of regional firms. A high regional export quota indicates that the regional firms are realising a considerable part of their sales abroad. Provided that competition in external markets is more intensive than in home markets and an engagement abroad is more costly than at home, respectively, exporting firms are usually more productive and competitive than firms that restrict their sale activities to the internal market (see Helpman et al. 2004). As a consequence, highly competitive firms might have a better employment performance, therefore, a high regional export quota favours regional employment.

3 The data

To empirically analyse the impact of regional supply- and demand-side conditions on manufacturing employment growth in Germany, we create establishment-level panel data for the manufacturing sector in the state of Baden-Wuerttemberg. The use of confidential micro data from German Official Statistics was made possible by cooperation with the Statistical Office of Baden-Wuerttemberg and the Research Data Center of Official Statistics in Germany.[16] To build this establishment-level panel dataset, we combine two sources of Official German industrial statistics. The first contains information on the population of all manufacturing establishments with at least twenty employees and on establishments which are part of an enterprise with at least twenty employees. These data are taken from monthly reports of manufacturing firms. The second data source contains information from annual reports of small manufacturing establishments, covering all establishments with less than twenty employees. From these reports, a longitudinal dataset is created that comprises the total population of

[16]Baden-Wuerttemberg is one of the largest German states (Bundeslaender). In 2010, it accounted for more than 13 % of the German population, 14.5 % of German GDP, and 16.0 % of German exports. In addition, the state is host to the headquarters of a variety of global players like the Daimler AG or Robert Bosch GmbH for instance. Its GDP is larger than that of countries such as Sweden, Denmark, or Austria. The manufacturing sector which is analysed in this paper, is of above-average importance in Baden-Wuerttemberg, accounting for 31.4 % of total employment (Germany: 24.4 %) and 36 % of gross value added (Germany: 27.9 %, see Regional Accounts VGRdL 2011).

manufacturing establishments (with a very good coverage of small establishments)[17] in the period from 1980 to 1999.[18] Although this panel dataset contains relatively few variables, it comprises of more than 21,000 establishments in total, offers a very high quality of data, and allows for the tracking of individual establishments over time. For the purpose of our paper, having an establishment-level panel is important for calculating regional job flows and thus regional rates of gross job creation and gross job destruction.

Baden-Wuerttemberg consists of forty-four different counties ('Kreise'), including nine urban counties ('kreisfreie Städte') and thirty-five counties dominated by rural areas ('Landkreise'). To create our dependent variable "annual manufacturing net employment growth in region i in period t", regional establishment-level employment information is aggregated at the county-level. Additionally, following the concept by Davis et al. (1996), regional gross job creation rates are calculated by dividing the sum of newly created jobs on the establishment-level in $[t-1;t]$ by total employment in t. Thereby, gross job creation at the county level may happen due to the expansion of the number of employees in existing establishments, due to foundation of new establishments and due to firms moving into the county from outside. Correspondingly, regional rates of firm-level gross job destruction are calculated by dividing the sum of jobs lost from $[t-1;t]$ at the establishment level by total employment in t. Gross job destruction at the county level may hence result from existing firms that are shrinking their number of employees, from firm closure or from establishments moving out of the county. By definition, the rate of regional net employment change nec_i in $[t-1;t]$ equals the difference between the rates of regional gross job creation jc_i and regional gross job destruction jd_i:

$$nec_{i,[t-1,t]} = jc_{i,[t-1,t]} - jd_{i,[t-1,t]}.$$

In our empirical analyses in Sect. 4 we will estimate panel regression models to explain regional net employment change and regional gross job flows by regional location factors.[19] For this purpose, the necessary information on regional costs of production, regional factor endowments, regional demand conditions and on characteristics of the regional industry structure[20] can partly be calculated based upon the establishment-level panel. Moreover, we add regional county-level data from other sources of German statistics. Table 2 gives an overview of the regional indicators used and the corresponding data sources.

To account for differences in regional costs of production, different indicators will be included as explanatory variables in our regression models. Regional labour

[17] Handcraft firms with fewer than twenty employees are not included in German official statistics for manufacturing.

[18] Data for small establishments with less than 20 employees are no longer available in Official German Statistics since the beginning of the 2000s. Therefore, the time period for the analyses in this paper has been limited to the time period from 1980 to 1999.

[19] For descriptive statistical analysis referring to net employment changes and the underlying gross job creation and gross job destruction, see Wagner (1995) and Essletzbichler (2004) who analyse the situation in Germany and the United States, respectively.

[20] In contrast to our analysis of location factors on the county-level, i.e., the regional scale, the approach of Arauzo-Carod (2005) is geared to the local scale.

Table 2 Operationalisation of regional determinants of employment development

Determinants of regional employment growth	Operationalisation via …	Data source (see below)
Cost of production factors	Prices for building land [in 100 € per m^2]	(2)
	Average regional monthly salary [in 1.000 € per clerk]	(1)
	Average regional monthly wage [in 1.000 € per worker]	(1)
	Average rate of local tax on profit and real capital [local multiplying factor on general tax rate]	(2)
Regional factor endowments	Share of skilled employees from total employment subject to social security [in %]	(3)
	Share of persons employed in R&D from all employees subject to social security [in %]	(2)
	Driving time to the next motorway slip road, truck-railway terminal and international airport, respectively [in minutes, each]	(4)
Combined supply and demand factors	Population density [in 100 inhabitants per km^2]	(2)
	Unemployment rate [in %]	(3)
Industry structure	Average firm size [in average number of employed persons, in 10 persons]	(1)
	Regional export quota [in share "export turnover/total turnover"]	(1)
	Sectoral concentration [as Herfindahl-Index value, based on sectoral employment]	(1)
	Tertiarisation degree [in % of total employment]	(3)
	Employment development in the service sector [in % growth rate]	(3)

The data for the empirical analyses were collected from the following sources:
(1) *Establishment-level panel data for the manufacturing sector* in the state of Baden-Wuerttemberg. The data were provided by the Statistical Office Baden-Wuerttemberg to the authors, thereby taking into account the rules of confidentiality. For the purpose of this paper, firm-level data have been aggregated to county-level data. (2) *County-level data from German/Baden-Wuerttemberg official statistics.* (www.statistik-bw.de). If not directly available, the data were delivered to the project from the Statistical Office of Baden-Wuerttemberg. (3) *County-level data from the German Federal Employment Agency* (http://statistik.arbeits-agentur.de/Navigation/Startseite/Startseite-Nav.html). The data were delivered to the project from the Statistical Office of Baden-Wuerttemberg. (4) *Public access county-data from the Federal Office for Building and Regional Planning (INKAR data)*: http://www.bbsr.bund.de/cln_032/nn_21272/BBSR/DE/Veroeffentlichungen/INKAR/inkar__node.html?__nnn=true. Source: Authors' composition

costs are measured alternatively by average regional monthly wages for workers (in 1.000 €) or by the average regional monthly salary for clerks (in 1.000 €).[21] The costs for building land are measured by the average price for building land in € per 100 m^2. To analyse a possible impact of the local profit tax level on regional employment growth, we include the average profit tax rate levied at the local level as an additional explanatory variable.

[21] Because unit labour cost data were not available, we could not consider potential interregional differences in labour productivity. With regard to the aspect of labour productivity as a determining factor of unit labour costs and to its impact on employment changes see Suedekum et al. (2006) for instance. There you can find a two-step procedure to overcome the problem of missing productivity data.

Regional human capital endowment is proxied by the share of skilled workers or employees from total employment subject to social security contributions.[22] Regional R&D-intensity is measured by the share of persons employed in R&D from total employment.[23] To account for a possible impact of traffic infrastructure on regional net employment growth, we use regional data on average driving times to the next opportunity to enter a motorway or to the next international airport.

As mentioned in Sect. 2, regional demand should in general be taken into account by information on purchasing power at the county level. However, comparable yearly data on disposable income are not available at the county level for the 1980s. Therefore, we are not able to measure regional purchasing power directly, but only by indirect proxies. As explained in Sect. 2, a negative relation between regional unemployment rates and employment growth could be interpreted as an indicator for an impact of regional demand. Moreover, the population density—see also below—has an indirect demand interpretation, too. Due to the special characteristics of the manufacturing sector mentioned in Sect. 2, there are good arguments to expect that this lack of better data for regional demand at the county-level is less a problem for manufacturing than it would be for the services sector: Manufacturing goods are often sold to other firms rather than to private households and, in addition, the sales are typically not restricted to the region where the manufacturing firm is located. This particularly holds for Baden-Wuerttemberg, where the manufacturing industry is characterised by an outstanding export quota, implying that manufacturing production in Baden-Wuerttemberg strongly depends on foreign demand. A possible impact of the general macroeconomic demand conditions is therefore considered by a set of year dummies.[24] Regional manufacturing export shares measure the relative role of openness for regional employment growth.

Possible urbanisation effects are considered by including the regional population density as a regressor, and localisation effects of regional industry concentration by the Herfindahl index at the two-digit level. As a further control variable for the regional industry structure, we include average firm size. Moreover, to control for possible regional complementarities or substitutional effects between manufacturing and service sector, we use the degree of tertiarisation (measured on employment basis) and employment growth in the service sector as additional regressors.

4 Empirical findings

The following empirical analyses are mainly focused on two questions: First, to what degree is regional employment growth in the manufacturing sector driven by different

[22] The significance of human capital for the economic success and the employment development of firms is also shown by the Human Capital Externalities Theory. According to the HCE approach additional skilled employees can contribute not only directly to their firm's productivity but also indirectly by increasing the productivity of other employees through informal learning. With regard to HCE approach see for instance Heuermann et al. (2010, p. 756).

[23] We would prefer to take R&D investments instead of R&D employment, but such data are not available on a yearly basis.

[24] Referring to business cycle aspects of regional job creation and job destruction, see Böckermann et al. (2004).

regional economic conditions?[25] Second, is the impact of regional conditions on employment growth caused by stimulating either regional job creation and/or regional job destruction? To answer these questions, we first present some descriptive evidence on regional manufacturing employment growth, on gross job creation and gross job destruction in Baden-Wuerttemberg and its counties in Sect. 4.1. In Sect. 4.2, panel regression-based evidence on the link between regional economic conditions and regional manufacturing employment growth will be discussed before having a look behind the scenes of manufacturing net employment growth in Sect. 4.3. There we analyse the impact of regional supply and demand conditions on regional gross job creation and job destruction in manufacturing.

4.1 Descriptive evidence

In the 1980s, the first decade of the period considered in the following empirical analyses, regional manufacturing employment growth was rather heterogeneous in Baden-Wuerttemberg. While half of the forty-four counties suffered from a reduction in manufacturing employment, the other half of the counties experienced rising employment in the manufacturing sector. In the 1990s, however, the development of manufacturing employment was much worse in Baden-Wuerttemberg: Only six out of forty-four counties observed an increase in regional manufacturing employment. While in the 1980s the average annual rates of county-level employment growth ranged from $+1.8$ % to -2.2 %, the corresponding range in the 1990s was from 0.8 to -4.5 %.[26]

Counties with better manufacturing employment performance in the 1980s on average also experienced a better performance in the 1990s. The Bravais-Pearson coefficient of correlation between regional average employment growth in the 1980s and the 1990s is 0.666 (P-value: 0.000). This clearly indicates that structural divergences between the counties are responsible for differences in the regional employment performance.

Looking behind the aggregate net development of manufacturing employment illustrates that average regional gross job creation rates remained rather stable from the 1980s to the 1990s; the median is 4.2 in both periods. The decline in regional net employment growth from the 1980s to the 1990s has therefore been caused by a large increase in regional job destruction rates: While in the 1980s the median regional job destruction rate has been 4.0 %, it rose to 6.1 % in the 1990s (see Fig. 1).

4.2 Regional determinants of net employment growth

In this section, regional differences in manufacturing employment growth shall be explained by differences in regional costs of production, in regional factor endowments and in regional demand and industry structure. Thus, our empirical model is

[25] The effects of various local supply- and demand-side conditions on employment growth in the producer service sector rather than in the manufacturing sector are analysed by Di Giacinto and Micucci (2007).

[26] In 1989 a substantial number of firms have been added to the data due to corrections of the basic population and there were substantial changes in the basic population from 1994 to 1995 due to changes in the classification of industries. We therefore exclude the net employment change and the corresponding gross job flows for periods 1998/89 and 1994/95 from our analyses.

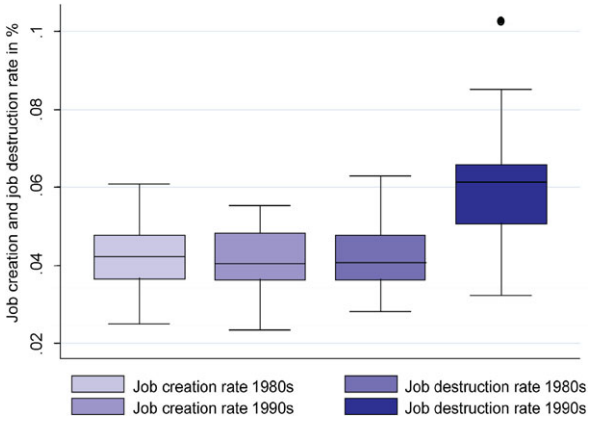

Fig. 1 Distribution of average regional job creation and job destruction rates in forty-four counties of Baden-Wuerttemberg in the 1980s and the 1990s. Source: Author's calculations. The boxes range from the 1st quartile Q_1 to the 3rd quartile Q_3, the line within the box informs about the median. The whiskers are generally informing about the total range of values. However, extreme values are characterised as outliers if they are more than 1.5 times the interquartile range $(Q_3 - Q_1)$ away from the third quartile (outliers in the upper direction) or more than 1.5 times the interquartile range $(Q_3 - Q_1)$ away from the first quartile (outliers in the upper direction)

based on (1).

$$y_{it} = \beta' X + \mu_i + \gamma_t + v_{it} \tag{1}$$

This equation specifies the effect of time-varying regional supply- and demand-side conditions and industry structure (X) on manufacturing employment growth y_{it}, controlling for county-level fixed effects μ_i and time fixed effects γ_t. While the county-level fixed effects capture time-constant unobserved heterogeneity, time fixed-effects control for macroeconomic developments that are identical across regions. v_{it} is the error term and has to satisfy the assumptions of the error term in a classical regression model (see, e.g., Wooldridge 2010). Descriptive statistics for all variables included in the analyses are given in Table 3.[27]

Simple tests of joint significance of the county-specific and year-specific effects confirm that panel estimation with individual effects is preferred to pooled OLS estimation. A Hausman (1978) test shows that the individual effects and the explanatory variables are correlated and thus indicates that a fixed effects model should be used since a random effects model would be biased (see Wooldridge 2010: 328–334.). Furthermore, also considerations with respect to the content support our preference for a fixed effects model: while random effects models are considered appropriate in particular for small samples of panel data, in this study the total population of forty-four counties is analysed (see Baltagi 2008).

To test for the relevance of spatial autocorrelation between the counties, both tests on global and local spatial autocorrelation were undertaken. Thereby, both Moran's I

[27] As for some of the variables data are not available for the early 1980s the number of total observations partly varies between variables considered.

Table 3 Descriptive statistics at the county-level, 1980 to 1999

	N	Mean	Median	Standard deviation	Minimum	Maximum
Regional net employment change	792	−0.0077	−0.0047	0.0345	−0.1656	0.1249
Regional job creation rate	792	0.0429	0.0403	0.0204	0.0069	0.1727
Regional job destruction rate	792	0.0506	0.0462	0.0232	0.0087	0.1833
Price for building land [in 100 EUR / m^2]	836	0.7888	0.5360	0.7748	0.0694	5.8362
Average salary per clerk [in 1.000 € per clerk]	836	5.4424	5.4581	1.3096	3.0749	8.9868
Average of multiplying factor on local tax rate	836	3.3072	3.2306	0.2648	2.9714	4.4500
Share of skilled employees	704	0.6940	0.7045	0.0628	0.4718	0.8110
Share of R&D employees	792	0.0183	0.0114	0.0203	0.0022	0.1168
Unemployment rate	836	6.2049	6.2000	1.9009	1.3250	13.9000
Population density [in 100 inhabitants per km^2]	836	4.8877	2.5219	5.6717	0.9240	28.9112
Sectoral concentration (Herfindahl index)	836	0.0968	0.0702	0.0782	0.0276	0.5593
Tertiarisation degree (Employment basis)	836	0.4454	0.4279	0.1145	0.2307	0.7762
Employment growth in the service sector	836	0.0230	0.0213	0.0230	−0.0419	0.1795
Average firm size (in 10 employees)	836	8.3441	7.3460	3.7096	3.6041	21.8647
Export quota manufacturing sector	836	0.2894	0.2845	0.0797	0.0953	0.6323

Source: Authors' own calculations

and Geary's c indicate that over time and on an annual basis there is no significant evidence for systematic global autocorrelation, only in the 1990s there is some evidence for positive spatial autocorrelation (see Fig. 2). Corresponding tests for local autocorrelation confirm even for the 1990s that there is no significant spatial autocorrelation in the vast majority of counties.[28]

We thus estimate (1) using fixed effects panel regressions. Thereby, we follow Arellano (1987) and compute robust standard errors that allow for both heteroskedasticity and autocorrelation of arbitrary form. Endogeneity might be a problem for a variety of explanatory variables. For example, the growth in the services sector, the level of unemployment or the share of skilled workers might be endogenous regressors for manufacturing growth. To account for the possible problem of endogeneity, we lag all explanatory variables by one period, thus always explaining growth in $[t; t+1]$ by the level of the explanatory variables in $t-1$. To check the sensitivity

[28] Results for the tests are available upon request.

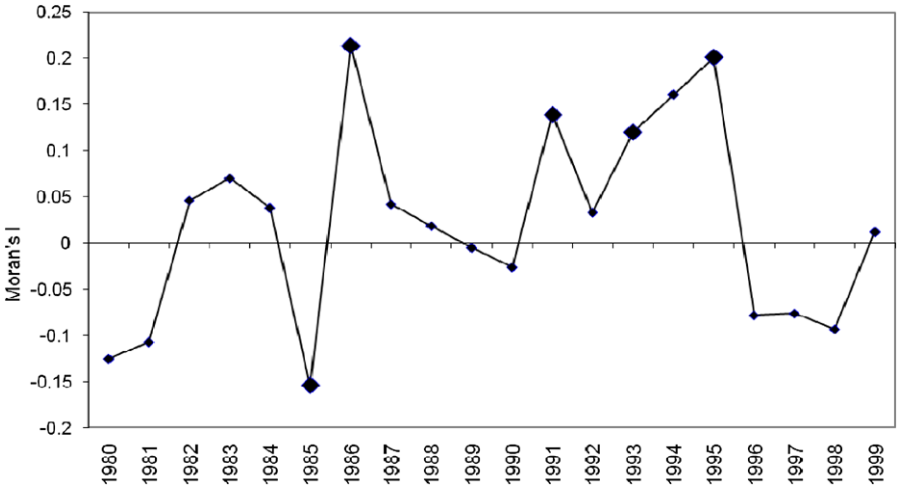

Fig. 2 Moran's I for annual county-level employment change, 1980–1999. Source: Author's calculations. Large symbols indicate statistical significance at a 95 % level of significance. Values for 1988 and 1994 were interpolated because of changes in the classification of industries. Corresponding data for Geary's C are available upon request

of the results e.g. with respect to possible problems due to collinearity, we estimate a variety of different model specifications. As, in general, the estimation results prove to be rather stable, we present the following three models in Table 4: Column 1 is the model in which all explanatory variables, that have been chosen based upon the theoretical considerations in Chap. 2, are included. Because in particular collinearities between export shares and sectoral concentration are rather high, columns 2 and 3 list the estimation results of model specifications that check the sensitivity of conclusions by dropping one of the two variables. Moreover, squared population density is dropped in models 2 and 3 because we never found evidence for non-linearities (see also below).

In general, the estimation results illustrate that higher county-level costs of production hampered county-level manufacturing net employment growth in Baden-Wuerttemberg from 1980 to 1999: To be more concrete, a higher regional wage level tends to significantly slow down a county's manufacturing employment growth. The estimated coefficients for a possible impact of higher tax rates on profit and real capital ("Gewerbesteuer")[29] are also negative across all model specifications, but in no case statistically significant. With respect to a possible influence of prices of building land on regional manufacturing net employment change, no significant impact can be found when controlling for other explanatory variables.

Differences in the regional endowment with production factors however play a significant role in explaining interregional differences in manufacturing employment growth. The estimation results confirm that both a good regional endowment with human capital and a high regional R&D intensity coincide with a better development

[29] Referring to this local tax on profit and real capital, see Zimmermann (1999: 183).

Table 4 Determinants of regional manufacturing net employment growth from 1980 until 1999 in counties in Baden-Wuerttemberg; results from panel estimates with fixed effects, clustered standard errors robust against autocorrelation of unknown form

	(1)	(2)	(3)
Cost of production factors			
Price for building land (100 EUR / m^2), $t-1$	0.005	0.006	0.005
	[0.210]	[0.147]	[0.237]
Average salary per clerk ($t-1$)	-0.019^{**}	-0.019^{**}	-0.018^{**}
	[0.041]	[0.035]	[0.048]
Average of multiplying factor on local tax rate ($t-1$)	−0.022	−0.024	−0.026
	[0.395]	[0.274]	[0.238]
Regional factor endowment			
Share of R&D employees ($t-1$)	0.445^{**}	0.417^{*}	0.415^{*}
	[0.032]	[0.063]	[0.058]
Share of skilled employees ($t-1$)	0.240^{*}	0.239^{*}	0.239^{*}
	[0.081]	[0.080]	[0.065]
Combined supply- and demand-side factors			
Unemployment rate ($t-1$)	0.001	0.001	0.001
	[0.334]	[0.322]	[0.305]
Population density ($t-1$)	−0.001	−0.003	−0.004
	[0.922]	[0.645]	[0.565]
Population density squared ($t-1$)	−0.000		
	[0.785]		
Regional industry structure			
Sectoral concentration ($t-1$)	0.030		0.052
	[0.480]		[0.144]
Tertiarisation degree ($t-1$)	0.038	0.036	0.063
	[0.759]	[0.741]	[0.565]
Employment growth in service sector ($t-1$)	−0.105	−0.107	−0.102
	[0.164]	[0.155]	[0.177]
Average firm size (in 10 employees) ($t-1$)	-0.009^{***}	-0.008^{***}	-0.008^{***}
	[0.000]	[0.000]	[0.000]
Export quota manufacturing sector ($t-1$)	0.061	0.073^{*}	
	[0.215]	[0.068]	
Constant	0.053	0.066	0.077
	[0.729]	[0.580]	[0.481]
Test on joint significance of year effects	80.7^{***}	83.7^{***}	92.9^{***}
	[0.000]	[0.000]	[0.000]

of manufacturing employment. The higher the share of skilled workers or employees in a region in $t-1$ is, the better will be regional manufacturing growth in the following period. The estimated coefficients are positive and significant at the 10 %-level of

Table 4 (*Continued*)

	(1)	(2)	(3)
R^2 (within)	0.787	0.786	0.785
R^2 (between)	0.131	0.162	0.162
R^2 (overall)	0.319	0.337	0.319
Number of observations	616	616	616
Number of counties	44	44	44
F-test for the model	323.2^{***}	225.8^{***}	384.6^{***}
	[0.000]	[0.000]	[0.000]
Share of residual variance explained by individual effects	86.6 %	85.8 %	87.0 %

Robust p-values in parentheses, adjusted for clustering
*, **, *** significant at a 10 %/5 %/1 % level of significance
Source: Authors' own calculations

significance across all estimated models. Moreover, the estimation results show that counties with a higher R&D intensity indicate a significantly better net employment manufacturing growth in the following year.

As explained in Sect. 2 within the context of so-called "combined" location factors, the effects of a higher regional unemployment rate and a higher population density on employment growth can be positive or negative from a theoretical point of view. In both cases, our estimation results neither confirm a positive nor a negative effect as the estimated coefficients are not significantly different from zero. Missing urbanisation effects are no exception in the empirical literature because findings referring to the employment relevance of population density and related indicators are ambiguous.[30] In model 1 we also test for the existence of possible non-linearities in the effect of urbanisation on regional net employment growth, but the estimation results do not confirm any linear or non-linear impact of population density on regional manufacturing employment.

To summarise, our estimation results do not give hints for a significant impact of a county's demand-side conditions on its manufacturing employment growth. Macroeconomic demand-conditions, however, can be shown to matter substantially for manufacturing net employment growth as the set of year dummy variables is jointly highly significant.

In terms of the characteristics of regional industry structures, the estimation results for Baden-Wuerttemberg illustrate that regional differences in firm size structure are important for explaining interregional growth differences in manufacturing: The smaller the average regional firm size is, the higher is the growth rate of manufacturing employment, all else being equal. This can be interpreted as a hint that small firms play an important role in regional employment development. To additionally

[30]This can even hold within a single study. Brixy and Fuchs (2010) for instance find that population density does not influence labour demand in Western Germany. On the other side there is a significant impact in Eastern Germany—but with different signs depending on whether there is a short- or a long-run framework.

analyse whether regions that are characterised by firms highly integrated into foreign trade (measured by export share from turnover) c.p. experience higher or lower manufacturing employment growth than regions with a lower export quota, the regional export quotas in manufacturing are included as a regressor. Looking at model 1 first in which all explanatory variables are included, the estimated coefficients are positive, but not statistically significant. However, as export shares are highly collinear with regional sectoral concentration, model 2 only includes regional export shares as explanatory variables, thereby dropping the Herfindahl index for sectoral concentration. In this case, the estimation results point to a positive impact of integration into trade on manufacturing net employment growth that is at least weakly significant at a 10 %-level of significance. This indicates that a high openness to trade of the firms located within the region tends to stimulate regional manufacturing employment growth.

The results do not confirm the existence of relevant localisation effects, since the estimated coefficients for sectoral concentration variables are never significantly different from zero. This also holds for model 3 in which correspondingly the export share variable has been excluded. In this respect, our results are in line with those empirical studies which cannot find evidence for localisation economies. However, the conclusion of Feldmann (2000) still holds that empirical findings in this respect are not definite.[31]

Considering a possible impact of regional development growth in the service sector on regional manufacturing employment growth, the estimation results lead to the conclusion that there is no significant relationship between the regional degree of tertiarisation and regional employment growth. Similarly, there is no significant relationship between regional employment growth in manufacturing and in the service sector. The fact that the respective coefficients are negative across all estimations might at best be interpreted as a hint to possible substitution effects between these sectors, but the corresponding P-values of the estimated coefficients are 15 % to 18 % and thus above the levels which are typically accepted for statistical significance.

The rather high level of within-R^2 of 0.79 observed for all different estimations can be expected to be based to a substantial degree upon the year dummies that control for changes in macroeconomic conditions. The values for the between-R^2 (which is the correlation squared between county-level average net employment growth and predicted county-level average net employment growth) are about 0.13 to 0.16 and thus substantially lower. Overall-R^2 ranges between 0.32 and 0.34. Thus, the regional conditions explicitly considered in our models are, on the one hand, relevant when explaining observed differences in regional employment performance. On the other hand, however, substantial parts of differences between counties still cannot be explained within our models; they can have plenty of different unobserved causes within, but also outside of the counties considered.

Indicators for traffic infrastructure could not explicitly be included into our fixed effects panel regressions above, since there was no time-varying information available and including information for a single year would lead to estimation problems

[31] Referring to newer studies especially to Germany testing localisation economies as determinants of regional or local employment changes, see Fuchs (2011), Illy et al. (2011) and Blien et al. (2006) for instance.

Table 5 Correlation between unobserved county-specific fixed effects and different indicators for traffic infrastructure, example for fixed effects of model 2 in Table 4

Driving time to the next motorway slip road		Driving time to the next truck-railway terminal		Driving time to the next international airport	
Bravais-P.	Spearman	Bravais-P.	Spearman	Bravais-P.	Spearman
−0.25	−0.20***	−0.40***	−0.30**	−0.27*	−0.13
(0.105)	(0,000)	(0.008)	(0.049)	(0.082)	(0.417)

*, **, *** significant at a 10 %/5 %/1 % level of significance

Source: Federal Office for Building and Regional Planning, Authors' calculations

because of perfect collinearity with the county-fixed effects. Simple correlation analysis of the estimated county-specific fixed effects from our panel regressions with our variables on traffic infrastructure, however, might give some indications whether a better quality of regional traffic infrastructure also stimulates regional employment growth. Based on three different measures of traffic infrastructure (driving times to the next motorway slip road, truck-railway terminal, and international airport, respectively), the Bravais-Pearson coefficient of correlation and the Spearman rank coefficient were calculated. The correlation coefficients thereby are without any exception negative and in many cases also statistically significant (see Table 5 for the example of model 2 in Table 4). This can at least be interpreted as a hint that a better regional traffic infrastructure coincides with a higher regional manufacturing net employment growth.

4.3 Are the impacts of regional conditions on net employment growth driven by affecting job creation or job destruction?

In Sect. 4.2 the impact of regional conditions on regional manufacturing net employment growth has been analysed. In the following, the availability of establishment-level panel data is used to additionally examine whether the impact of different regional location factors on net manufacturing employment growth is caused by affecting gross job creation and/or gross job destruction. Thereby, job creation comprises, as mentioned, the job expansion in existing firms, the foundation of new firms and the moving in of firms from other regions while job destruction may consist of job reductions in existing firms, the closure of firms or the moving out of firms into other regions (see Davis et al. 1996 for details on the concept of job creation and job destruction).

Table 6 presents the results for the estimations with regard to regional job creation in the first three columns, the corresponding results for regional job destruction are shown in column 4 to 6. The models estimated follow the proceedings for net manufacturing employment growth in Sect. 4.2.[32]

[32] As the indicators of job creation and job destruction are defined such that they cannot be negative we alternatively estimated regression models with the natural logarithm of job creation and job destruction rates as the dependent variables. As the results are stable we only present estimations for original job creation and job destruction rates.

Table 6 Determinants of regional manufacturing gross job creation and job destruction from 1980 until 1999 in counties in Baden-Wuerttemberg; results from panel estimates with fixed effects, clustered standard errors robust against autocorrelation of unknown form

	Job creation			Job destruction		
	(1)	(2)	(3)	(1)	(2)	(3)
Cost of production factors						
Price for building land	0.002	0.002	0.002	−0.004	−0.003	−0.003
(100 EUR/m^2, $t-1$)	[0.561]	[0.404]	[0.512]	[0.320]	[0.330]	[0.426]
Average salary per clerk ($t-1$)	−0.003	−0.004	−0.004	0.015**	0.014**	0.014**
	[0.625]	[0.529]	[0.529]	[0.019]	[0.021]	[0.027]
Average of multiplying factor on local tax rate ($t-1$)	0.008	0.002	0.002	0.030	0.026	0.028
	[0.671]	[0.916]	[0.918]	[0.157]	[0.170]	[0.124]
Regional factor endowment						
Share of R&D employees ($t-1$)	0.419**	0.406**	0.417**	−0.027	−0.011	0.002
	[0.017]	[0.028]	[0.019]	[0.814]	[0.929]	[0.985]
Share of skilled employees ($t-1$)	0.187*	0.169*	0.168*	−0.053	−0.070	−0.071
	[0.058]	[0.065]	[0.068]	[0.622]	[0.497]	[0.476]
Combined supply- and demand-side factors						
Unemployment rate ($t-1$)	0.000	0.000	0.000	−0.001	−0.001	−0.001
	[0.822]	[0.908]	[0.913]	[0.261]	[0.180]	[0.164]
Population density ($t-1$)	0.022*	0.011*	0.011*	0.024**	0.015***	0.015***
	[0.093]	[0.055]	[0.083]	[0.028]	[0.002]	[0.001]
Population density squared ($t-1$)	−0.000			−0.000		
	[0.232]			[0.305]		
Regional industry structure						
Sectoral concentration ($t-1$)	0.018		0.033	−0.013		−0.019
	[0.543]		[0.185]	[0.600]		[0.248]
Tertiarisation degree ($t-1$)	0.076	0.101	0.117	0.037	0.066	0.053
	[0.475]	[0.276]	[0.219]	[0.618]	[0.369]	[0.459]
Employment growth in service sector ($t-1$)	−0.122**	−0.127**	−0.125**	−0.017	−0.021	−0.024
	[0.028]	[0.020]	[0.024]	[0.701]	[0.637]	[0.594]
Average firm size (in 10 employees) ($t-1$)	−0.004***	−0.004***	−0.004***	0.004***	0.005***	0.004**
	[0.002]	[0.006]	[0.007]	[0.005]	[0.007]	[0.012]
Export quota manufacturing sector ($t-1$)	0.025	0.033		−0.036	−0.040	
	[0.511]	[0.344]		[0.268]	[0.132]	
Constant	−0.182	−0.125	−0.120	−0.235	−0.191	−0.197
	[0.179]	[0.212]	[0.215]	[0.138]	[0.131]	[0.105]
Test on joint significance of year effects	21.1***	21.5***	21.8***	30.8***	32.2***	42.1***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Table 6 (*Continued*)

	Job creation			Job destruction		
	(1)	(2)	(3)	(1)	(2)	(3)
R^2 (within)	0.515	0.512	0.512	0.694	0.693	0.692
R^2 (between)	0.0932	0.0871	0.0776	0.142	0.115	0.112
R^2 (overall)	0.000097	0.000302	0.000674	0.0669	0.0690	0.0685
Number of observations	616	616	616	616	616	616
Number of counties	44	44	44	44	44	44
F-test for the model	92.9^{***}	87.5^{***}	98.4^{***}	88.9^{***}	79.6^{***}	73.8^{***}
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Share of residual variance explained by individual effects	97.8 %	98.0 %	97.9 %	98.7 %	98.6 %	98.7 %

Robust p-values in parentheses, adjusted for clustering
*, **, *** significant at a 10 %/5 %/1 % level of significance
Source: Authors' own calculations

The estimations for regional gross job creation (see Table 6) show that differences in the counties' factor endowments help to explain differences in regional job creation rates: both a better endowment of a county with human capital and a higher R&D intensity stimulate regional job creation in a significant manner. Across all models estimated, the impact of a high share of skilled workers on job creation is positive and significant at a significance level of 10 % (P-values are approximately 5 % to 7 %). The impact of R&D intensity on regional gross job creation is highly significant independent from the model specification at a 5 %-level of significance.

Higher costs of production factors, in contrast, cannot be shown to hamper regional gross job creation in manufacturing: neither the regional wage level nor the price of building land or for the regional tax burden has a significant impact on regional gross job creation.

A higher degree of urbanisation as measured by a higher regional population density tends to stimulate regional job creation: the estimated coefficients for regional population density are positive and always significant at a 10 % level of significance. Possible non-linearities in the effect of the degree of urbanisation on regional gross job creation in manufacturing, however, cannot be confirmed. The estimated coefficients for regional sectoral concentration are also not significantly different from zero. This holds for model 1, but also for model 3 in which regional export shares are eliminated. Therefore, our results do not give evidence for significant regional localisation economies on the job creation side.

With respect to further industry variables, regional firm size structure can be shown to have a significant effect on job creation: The more the local firm structure is characterised by small firms, the higher is the regional rate of job creation. A higher regional export quota of the county's manufacturing establishments does not significantly correlate with higher rates of job creation. Regions with better employment development in the service sector have significantly smaller rates of job creation in manufacturing. One explanation for this phenomenon might be that manufacturing

firms abstain from hiring employees for the internal production of services, because they want to commission specialised service companies with respective tasks, so that job creation in the service sector substitutes job creation in the manufacturing industry. This includes the scenario in which the two sectors compete for qualified employees for service functions in which service companies act more successful than manufacturing firms. Additionally, the analysis also examined the potential impact of the tertiarisation degree on manufacturing job flows. With regard to this aspect, however, no significances could be found.

Turning towards corresponding estimations for gross job destruction, the results show that neither a region's endowment with human capital nor a region's R&D intensity affect regional gross job destruction in a significant manner. The positive impact of a region's endowment with human capital and R&D on manufacturing net employment growth found in Sect. 4.2 is thus in both cases mainly driven by stimulating gross job creation, not by a decrease of gross job destruction.

This is different for the costs of production factors as measured by the regional wage level: the negative impact of high regional labour costs on manufacturing net employment growth is not the result of significantly lower regional gross job creation, but of higher job destruction. The estimated coefficients of the wage level are positive and highly significant across all models estimated for job destruction. The estimated coefficients for local tax rates on profit and real capital are also positive in all models, but significance would only be given at significance-levels of 12 % to 17 %.[33] The prices of building land can also not be shown to influence gross job destruction in manufacturing in a significant manner.

Urbanisation effects as measured by the regional population density can also be observed for regional gross job destruction: a higher regional population density coincides with a significantly higher rate of gross job destruction. Non-linearities, however, do again not play a role. Our estimation results thus show that in the counties considered, a higher degree of urbanisation led both to higher rates of gross job creation and gross job destruction—this kind of "compensation" reveals why we could not observe a significant impact on net employment change in Sect. 4.2. As a further result, we get that there is no significant effect of regional sectoral concentration on job destruction.

While regions with better employment development in the service sector do have significantly smaller rates of job creation in manufacturing, they do not differ significantly with respect to manufacturing job destruction. This fits at least to the tendency of the regressions for net employment growth in Sect. 4.2, even if the results are not significant there.

The more a region is characterised by a larger average firm size, the higher are the regional rates of gross job destruction. The negative impact of average firm size on manufacturing employment growth derived in Sect. 4.2 is thus driven both by lower rates of gross job creation and higher rates of gross job destruction. Regional

[33] From a theoretical point of view one would expect that high tax rates correlate with high job destruction. This is why the respective tax base included (until 1996) not only profits but also real capital. Therefore, firms had to pay taxes even in times they suffered losses, periods which often coincide with times of job destruction. But in the analysis at hand the impact of the tax rates on job destruction does not reach a significant level.

export shares in manufacturing cannot be shown to significantly influence regional gross job destruction in manufacturing. However, as the estimated coefficients are negative across all estimations and as the estimated P-values are not too far away from the 10 %-level, the estimation results at least give a hint that the positive effect of international integration on manufacturing net employment change seems to be driven more by lower job destruction rates than by higher regional gross job creation.

Summarising these results with respect to the initial question of whether the effects of regional conditions on manufacturing net employment growth are driven by their impact on job creation and/or job destruction, the results illustrate that the negative impact of the regional costs of production as measured by a country's wage level on employment growth is driven by higher rates of job destruction, while there is no significant impact on job creation rates. In contrast, however, the positive impact of human capital and regional R&D intensity on manufacturing net employment growth is mainly caused by significantly larger job creation, while job destruction is not significantly different. With the exception of average firm size and population density, the estimation results indicate the tendency that a regional location factor (or industry structure aspect) that influences job creation does not simultaneously affect job destruction, and vice versa.

5 Concluding remarks

It is the aim of this paper to conduct an empirical analysis of the regional determinants of regional manufacturing employment development in Baden-Wuerttemberg, Germany, from 1980 to 1999. In particular, based upon the calculation of establishment-level flows of gross job creation and destruction, it is examined whether the impact of different regional location factors on net manufacturing employment growth is caused by affecting gross job creation and/or gross job destruction.

Summarising the main results of the paper, the preceding analyses indicate that lower costs of production at the county level as measured by a higher regional wage level and a better regional endowment with skilled labour and R&D are significant drivers of county-level manufacturing employment. By additionally looking behind the scenes of aggregate regional employment growth, the empirical analyses show that some location factors are affecting regional growth positively by stimulating county-level job creation while other factors are contributing to a better development of net employment growth by lowering regional job destruction.

Low regional labour costs contribute to manufacturing net employment growth as they decrease job destruction, while they do not significantly influence the job creation side. The opposite is true for a region's endowment with human capital and regional innovation, which both intensify manufacturing employment growth by affecting job creation.

Regions characterised by a smaller average firm size in manufacturing experienced higher manufacturing employment growth both by higher rates of job creation and lower rates of job destruction. Positive or negative urbanisation effects cannot be significantly confirmed for regional net employment growth. However, the models for the gross job flows illustrate that job creation as well as job destruction are—other things being equal—higher in regions with higher population density and thus

a higher degree of urbanisation. Evidence for localisation effects is neither found on the net employment growth nor on the job flows side.

Excluding the cases of average firm size and population density, the empirical findings indicate that regional location factor or industry structure aspects tend to influence only either job creation or job destruction. General macroeconomic conditions, however, are affecting regional job creation, regional job destruction and regional net employment change in manufacturing significantly.

From the perspective of regional labour market policy the results are on the one hand side underlining that regional actors may contribute to a better regional labour market performance: competitive regional costs of production, the attractiveness of a county based on skilled workers and a broad R&D endowment and—though in this paper only considered by simple correlation analysis—a good traffic infrastructure are key success factors for the county-level employment development in manufacturing. Even if not all relevant decisions are made at or below the county-level—e.g. with respect to traffic infrastructure—it is important for regional policy to derive measures that are suitable to stimulate regional employment.

When interpreting our results, however, we must also take into account the following aspect: Although a variety of regional location factors plays a significant role, unobserved heterogeneity is still of particular importance for the explanation of county-level employment changes. This will partly be the consequence of the fact that further possible location factors—such as information about traffic infrastructure or regional purchasing power—could not explicitly be included into our annual panel data analyses because adequate annual county-level data was not available. But it is also the consequence of the fact that many further regional impact factors, which are relevant in reality, are very difficult to measure. Examples could be the role of a more or less talented District Administrator or the possible impact of so-called "soft" location factors such as closeness to nature or to cultural activities.[34] In our fixed effects panel regression estimations we were at least able to control for these unobserved factors when analysing the impact of our explicit variables, but there is scope for additional research to better understand the regional drivers of employment growth. Moreover, as our estimation results on the dummies for the macroeconomic environment for instance indicate, important reasons for a better or worse development of regional manufacturing employment have their origin not within, but outside of the county-level or even of Baden-Wuerttemberg. Therefore, general economic policy at the German level and the world-wide economic development also play a very important role for the development of regional manufacturing employment growth, but cannot easily be influenced by regional policymakers. These brief remarks help to put our estimation results into perspective. But it should not be underestimated that our findings also indicate opportunities for regional policy to stimulate regional employment growth.

[34]This is in line with the concept of Florida (2002) who points out the importance of the so-called "creative class" for the economic success of firms. According to Florida the firms do not only consider traditional location factors but also "soft" environmental conditions that are preferred by creative class members. This implies that local and regional economic policy should try to supply such soft location conditions in order to attract people of the creative class, and therefore firms. The significance of the creative class for regional productivity and per capita income in German regions is shown in Gottschalk et al. (2011).

Obviously, there is need and opportunity for additional research in several respects. Whereas this paper is focused on manufacturing in general and takes into account industry characteristics as explanatory variables, it might be interesting to do corresponding analyses with respect to different types of industries, too, because the impact of location factors on growth and job flow might vary between industries. In particular, it would also be of interest to know whether these results have to be modified for employment growth and job flows in the service sector. A respective analysis of the determinants of net employment change, job creation, and job destruction for the services sector of Baden-Wuerttemberg or Germany, however, would require the availability of similarly comprehensive long-term establishment-level employment data for the service sector, which is not given so far. Extending the analyses to Germany as a whole might give insights into regional differences in the role of regional location factors. While this paper focuses on an examination of regional differences in manufacturing growth and in particular on an investigation of aggregate regional job flows and uses the establishment-level information for the calculation of regional job flows, a corresponding establishment-level analysis could focus on the analysis of regional determinants of firm-level growth and thereby profit from the larger data set that can be analysed. Also with respect to the estimation methods used, additional robustness checks could be done e.g. by the additional estimation of dynamic panel models or by focusing on possible problems due to spatially autocorrelated explanatory variables. This, however, is left for future research.

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References

Agostini C (2007) The impact of state corporate taxes on FDI location. Public Finance Rev 35:335–360
Almeida R (2007) Local economic structure and growth. Spatial Econ Anal 2:65–90
Alonso W (1960) A theory of the urban land market. Pap Proc - Reg Sci Assoc, Meet 6:149–157
Arauzo-Carod JM (2005) Determinants of industrial location: an application for Catalan municipalities. Pap Reg Sci 84:105–119
Arellano M (1987) Computing robust standard errors for within-groups estimators. Oxf Bull Econ Stat 49:431–443
Arent S, Steinbrecher J (2010) Bedeutung regionaler Standortfaktoren für das Wachstum am Beispiel Sachsen-Anhalts. ifo Dresden berichtet, pp 21–27
Audretsch D, Dohse D (2007) Location: a neglected determinant of firm growth. Rev World Econ 143:79–107
Baltagi BH (2008) Econometric analysis of panel data, 4th edn. Wiley, Chichester
Blien U, Suedekum J, Wolf K (2006) Local employment growth in West Germany: a dynamic panel approach. Labour Econ 13:445–458
Böckermann P, Hämäläinen K, Maliranta M (2004) Sources of job and worker flows: evidence from a panel of regions. Labour 105–129
Brixy U, Fuchs M (2010) How important are plant and regional characteristics for labour demand? Plant-level evidence for Germany. Paper
Brixy U, Grotz R (2006) Regional patterns and determinants of new firm formation and survival in Western Germany. IAB discussion paper No 5, Nürnberg
Büttner T, Ruf M (2005) Tax incentives and the location of FDI: evidence from a panel of German multinationals. Deutsche Bundesbank discussion paper 17, Frankfurt/M

Cainelli G, Lupi C (2011) Does spatial proximity matter? Micro-evidence from Italy. In: De Lisio and Leoncini R (eds) Internationalization, technological chance and the theory of the firm. London, pp 163–186
Cheng S (2006) The role of labour cost in the location choices of Japanese investors in China. Pap Reg Sci 85:121–138
Coughlin C, Segev E (2000) Location determinants of new foreign-owned manufacturing plants. Journal of Regional Sciences, 323–351
Davis SJ, Haltiwanger JC, Schuh S (1996) Job creation and destruction. MIT Press, Cambridge
De Vor F, de Groot HLF (2009) Agglomeration externalities and localized employment growth: the performance of industrial sites in Amsterdam. The Annals of Regional Science (forthcoming)
Devereux MP, Griffith R (1998) Taxes and the location of production: evidence from a panel of US multinationals. J Public Econ 68:335–367
Di Giacinto V, Micucci G (2007) The producer service sector in Italy: long-term growth and its local determinants. Bank of Italy temi di Discussione working paper No 643
Drucker J (2009) Trends in regional industrial concentration in the United States. CES 09-06, Center for Economic Studies
Essletzbichler J (2004) The geography of job creation and destruction in the US manufacturing sector, 1967–1997. Ann Assoc Am Geogr 94:602–919
Farhauer O, Granato N (2006) Regionale Arbeitsmärkte in Westdeutschland. Standortfaktoren und Branchenmix entscheidend für Beschäftigung. IAB-Kurzbericht Ausgabe Nr 4 vom 24.3.2006
Feldmann MP (2000) Location and innovation: the new economic geography of innovation, spillovers, and agglomeration. In: The Oxford handbook of economic geography, pp 373–394
Florida R (2002) The rise of the creative class—and how its transforming work, leisure, community and everyday life. Basic Books, Cambridge
Fritsch M, Brixy U, Falck O (2006) The effect of industry, region and time on new business survival—a multi-dimensional analysis. Rev Ind Organ 28:285–306
Fukao K, Ikeuchi K, Kim Y, Kwon H (2011) Do more productive firms locate new factories in more productive locations? An empirical analysis based on panel data from Japan's census of manufactures (Paper)
Funke M, Niebuhr A (2005) Regional geographic research and development spillovers and economic growth: evidence from West Germany. Reg Stud 39:143–153
Fuchs M (2011) The determinants of local employment dynamics in Western Germany. Empir Econ 40:177–203
Gabe TM, Bell KP (2004) Tradeoffs between local taxes and government spending as determinants of business location. J Reg Sci 44:21–41
Gauselmann A, Marek P, Angenendt JP (2011) MNEs regional location choice: a comparative perspective on East Germany, the Czech Republic and Poland. IWH-Diskussionspapiere 2011, 8, Halle
Glaeser E, Kallal H, Scheinkman J, Shleifer A (1992) Growth in cities. Eur J Polit Econ 100:1126–1152
Goebel C, Hamm R (2010) Zur Bedeutung regionaler Standortfaktoren: empirische Analysen als Entscheidungshilfe der regionalen und kommunalen Wirtschaftspolitik. List-Forum Wirtsch- Finanzpolit 36:187–215
Gottschalk C, Hamm R, Imöhl I (2011) Kreative Klasse und regionalwirtschaftliche Entwicklung – Ansätze zur empirischen Überprüfung der Hypothesen von Richard Florida. List-Forum Wirtsch- Finanzpolit 37:2–26
Grek J, Karlsson C, Klaesson J (2011) Determinants of entry and exit: the significance of demand and supply conditions at the regional level. In: Kourtit K, et al (eds) Drivers of innovation, entrepreneurship and regional dynamics. Springer, Berlin, pp 121–141
Helpman E, Melitz M, Yeaple S (2004) Export versus FDI with heterogeneous firms. Am Econ Rev 94:300–317
Heuermann D, Halfdanarson B, Suedekum J (2010) Human capital externalities and the urban wage premium: two literatures and their interrelations. Urban Stud 47:749–767
Hoogstra GJ, van Dijk J (2004) Explaining firm employment growth: does location matter? Small Bus Econ 22:179–192
Hotelling H (1929) Stability in competition. Economic Journal 39:41–57
Hymel K (2009) Does traffic congestion reduce employment growth? J Urban Econ 65:127–135
Illy A, Schwartz M, Hornych C, Rosenfeld MTW (2011) Local economic structure and sectoral employment growth in German cities. Tijdschr Econ. Soc Geogr 102:582–593
Jiwattanakulpaisarn P, Noland RB, Graham DJ, Polak JW (2008) Highway infrastructure and state-level employment: a causal spatial analysis. Pap Reg Sci 88:133–159

Kohlhase JE, Ju X (2007) Firm location in a polycentric city: the effects of taxes and agglomeration economies on the location decisions. Environ Plann, C Gov Policy 25:671–691
Koo J, Kim TE (2009) When R&D matters for regional growth: a tripod approach. Pap Reg Sci 88:825–840
Koski H (2008) Public R&D subsidies and employment growth—microeconomic evidence from Finnish firms. The Research Institute of the Finnish Economy, Elinkeinoelämän Tutkimuslaitos, Discussion papers No 1143
Launhardt W (1882) Die Bestimmung des zweckmäßigen Standorts einer gewerblichen Anlage. Z Ver Dtsch Ing 26:105–116
Lucas RE (1988) On the mechanics of economic development. J Monet Econ 22:3–42
Möller J, Tassinopoulos A (2000) Zunehmende Spezialisierung oder Strukturkonvergenz? Eine Analyse der sektoralen Beschäftigungsentwicklung auf regionaler Ebene. Jahrb Reg wiss 20:1–38
O'Sullivan A (2005) Urban economics. McGraw-Hill/Irwin, Boston
Pierluigi B, Roma M (2008) Labour cost and employment across euro area countries and sectors. ECB working paper No 912, Frankfurt/M
Poelhekke S (2009) Human capital and employment growth in German metropolitan areas: new evidence. DNB working paper No 209
Redding SJ (2010) The empirics of new economic geography. J Reg Sci 50:297–311
Regional Accounts VGRdL (Volkswirtschaftliche Gesamtrechnungen der Länder) (2011) Online-data, http://www.vgrdl.de/Arbeitskreis_VGR/
Schettkat R, Yocarini L (2006) The shift to services employment: a review of the literature. Struct Chang Econ Dyn 17:127–147
Shapiro C, Stiglitz JE (1984) Equilibrium unemployment as a worker discipline device. Am Econ Rev 74:433–444
Strotmann H (2002) Arbeitsplatzdynamik in der baden-württembergischen Industrie. Eine Analyse mit amtlichen Betriebsdaten. Frankfurt/M. u.a.
Strotmann H (2007) Entrepreneurial survival. Small Bus Econ 28:87–104
Suedekum J, Blien U, Ludsteck J (2006) What has caused regional employment growth differences in Eastern Germany? Jahrb Reg wiss 26:51–73
Suedekum J, Blien U (2007) Stimulating employment growth with higher wages? A new approach to addressing an old controversy. Kyklos (Basel) 60:441–464
Wagner J (1995) Firm size and job creation in Germany. In: Small business economics, vol 7, pp 469–474
Wagner J (2007) Jobmotor Mittelstand? Arbeitsplatzdynamik und Betriebsgröße in der westdeutschen Industrie. Q J Econ Res 76:76–87
Weber A (1929) Theory of the location of industries. University of Chicago Press, Chicago
Wooldridge JM (2010) In: Econometric analysis of cross section and panel data, 2nd edn. MIT Press, Cambridge
Zimmermann H (1999) Kommunalfinanzen. Eine Einführung in die finanzwissenschaftliche Analyse der kommunalen Finanzwirtschaft. BWV, Baden-Baden