# The Dynamics of Local Employment in Western Germany

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**Abstract**

This paper studies the impact of the local industrial structure on employment dynamics in Western Germany. Following the approach of Combes/Magnac/Robin (2004) for France, local employment growth is decomposed into internal growth resulting from employment changes in existing plants and into external growth determined by employment decisions of newly established plants. The dynamics of both components are estimated simultaneously, taking explicitly into account the timing of the impact of diversity and specialisation in a region. The analysis is conducted for 21 sectors in the West German labour market regions from 1993 to 2002. Estimation results emphasize the positive influence of diversity and competition in a region, whereas no clear evidence on the role of specialization emerges. Furthermore, static externalities dominate. Importantly, the impact of the local industrial structure on employment does not differ between small and larger plants, nor are there major differences between Western Germany and France.

Keywords: Regional labour markets, specialization and diversification effects, panel data models, international comparisons

JEL:C33, O18, R12

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# 1 Introduction

The last two decades have witnessed a considerable increase in theoretical and empirical work on economic growth and its determinants. In the framework of the Endogenous Growth Theory, Romer (1986) and Lucas (1988) emphasize the central role of technological externalities created by knowledge spillovers. They act as the driving force of technological innovation and ultimately economic growth. Since the range of these knowledge spillovers is limited geographically (Jaffe/Trajtenberg/Henderson (1993)), they work better in spatially concentrated areas than in dispersed regions. Geographical proximity provides an environment in which ideas can be exchanged very easily between individuals or firms.[1]

Despite a widespread consensus on the benefits of agglomeration, there is a great deal of ambiguity surrounding both the nature and the spatial scale of these externalities. The question which economic structure is most conducive for regional growth has by now been subject to a large body of empirical literature, but with contradictory results (see Combes/Overman (2004) for an overview). Do externalities working between individuals and firms become effective in a diversified economic environment, or does rather a specialized economic structure foster regional growth? The seminal paper by Glaeser et al. (1992) argues that a local industry thrives if it faces a diversified surrounding economic structure, whereas Henderson/Kuncoro/Turner (1995) and Henderson (1997) conclude that own industry specialisation is the major employment growth engine. Studies on France by Combes (2000) and on Germany by Blien/Südekum/Wolf (2006) find supportive evidence for the impact of diversification.

The question whether a specialized or rather a diversified economic structure fosters regional growth is of considerable importance for regional development as well as for regional policy makers. If externalities arise out of specialization, regional actors involved in that industry are likely to specialize in just that one export activity or a closely connected set of activities. Specialization allows for full exploitation of scale economies, while conserving on urban congestion and land rent costs. However, if an industry is subject to diversification externalities, in order to thrive it needs to find a diverse, and hence usually large urban environment. Thus if own industry specialization increases regional growth, policies appear promising that aim at promoting "regional clusters" with the intention of a self-sustained growth take-off due to local concentration. The same policies seem less appropriate if job creation is primarily fostered by a diversification of the regional production composition. Furthermore, if only the current economic structure influences regional growth, then regional policies might become effective immediately. If history matters, the impact might be slower, but also longer

[1] There are other externalities that explain regional specialization and city formation but that do not specifically focus on knowledge spillovers. Marshall (1890) further emphasizes the relevance of common production factors and pooled labour markets. The New Economic Geography focuses on the role of pecuniary externalities in shaping the spatial distribution of economic activities (Krugman (1991a), Krugman (1991b)).

lasting.

Providing additional insights into the local growth factors, Combes/Magnac/Robin (2004) decompose local industry employment into internal and external employment, thereby distinguishing between the growth of existing and the creation of new plants. They simultaneously study the dynamics of both variables as embodied in a panel vector autoregressive setting for 36 different industries in 341 French labour market regions between 1984 and 1993. For each component, they allow for different dynamics and determinants. The econometric framework allows to consider the impact of the local economic structure on internal and external employment growth separately, whereas conventional approaches only estimate the aggregate impact on total employment. Hence, the simultaneous estimation of the dynamics of firm size and the number of firms permits to identify more effects than is usually achieved in the literature.

This paper presents detailed evidence on the determinants of local employment growth in Western Germany by following the methodological framework of Combes/Magnac/Robin (2004). It presents novel results in several respects. First of all, it provides evidence on the influence of the local economic structure on overall employment dynamics in Germany that goes beyond the few studies on Germany by Audretsch/Dohse (2007), Blien/Südekum/Wolf (2006) or Blien/Suedekum (2005). By contrast, the influence of the regional economic structure on the formation and survival of new firms, which in absolute terms contribute the minor share to overall employment dynamics, has been subject to a large body of empirical research (see, for example, Brixy/Grotz (2007) or Fritsch/Falck (2007)). The present analysis combines these two areas of empirical research by covering both employment gains by newly founded as well as by existing plants. Thus, it provides new insights into the sources of employment effects originating from start-ups as opposed to established plants. Second, a comparison with France sheds light on possible country-specific mechanisms that work in creating employment. Are there any differences in the determinants of local inequalities in employment and employment growth between France and Western Germany, or does the influence of specialisation and diversification hold unanimously for both countries? Third, the analysis of Combes/Magnac/Robin (2004) is extended in one important aspect. Since the data for France is available only for plants with more than 20 employees, it does not become clear if the small plants might underly a different pattern than the medium-sized and large plants. Since the present study resorts to an extensive dataset of all plants employing at least one person subject to social security, it is possible to follow the employment record of each individual plant as well as classify plants as entries or as incumbents. Hence, the influence of specialization, diversification and competition can be analyzed separately for the small as well as for the medium-sized and large plants. The analysis is conducted for 24 sectors from manufacturing, trade and services for 112 West German labour market regions from 1992 to 2002.

The remainder of the paper is organized as follows. Section 2 shortly describes the empirical model and its theoretical underpinnings. Section 3 presents the design of the empirical analysis together with the dataset and the specification of the variables. The comparison between France and Western Germany is at the center of section 4. In section 5, results for Western Germany based on the extended data set are presented. Finally, section 6 summarizes the findings and draws conclusions.

# 2 The model

Most of the studies analyzing the relationship between regional economic growth and the industrial composition do not resort to a precisely identified theoretical model, but rather present stylised facts on the sources of local employment growth related to the underlying economic structure. Combes/Magnac/Robin (2004) develop a simple model for a closed economy under which a positive productivity shock leads to an increase in equilibrium employment. They decompose local employment growth into internal growth, which is the growth in size of existing firms, and external growth, which denotes the expansion in the number of firms. It is shown that all variables which have an impact on productivity growth also affect both internal as well as external employment growth. Moreover, the impact of the effects on the two dependent variables can differ in magnitude and even in sign. Under a model of imperfect competition, local externalities that emanate from the productivity shock may simultaneously increase the size of existing plants and drive new firms into the market. Combes/Magnac/Robin (2004) emphasize, however, that this impact is positive only if the demand and labour elasticities are high enough.

The theoretical model can be transferred into the following econometric model (1) which represents a panel vector autoregressive setup:

$$(1)\quad \mathbf{y}_{zst} = A(L)\mathbf{y}_{zs,t-1} + B(L)\mathbf{x}_{zst} + \mathbf{u}_{zs} + \mathbf{v}_{zst},$$

where $\mathbf{y}_{zst} = (\bar{l}_{zst}, n_{zst})'$ is a vector of internal and external employment growth varying over region $z$ ($z$=1,...,$Z$), industry $s$ ($s$=1,...,$S$), and time $t$ (t=1,...,$T$). $\mathbf{x}_{zst}$ comprises the explanatory variables characterizing the economic structure of a region. $A(L)$ and $B(L)$ are matrix polynomials in the lag operator $L$, $\mathbf{u}_{zs} = (u_{1zs}, u_{2zs})'$ captures time-invariant area-and-industry effects, and $\mathbf{v}_{zst}$ is a vector of random shocks. $\mathbf{u}_{zs}$ captures all time-invariant effects that are possibly omitted. This assumption is particularly important for instance because areas are considered as closed economies facing demand and supply decisions that are unaffected of what happens in the neighbouring regions. Time-invariant area-and industry effects control at least for their relative location and hence more generally for physical geography. They can also be regarded as proxies for permanent (industry-specific) spatial disparities in public endowments, technology, or institutions.

Rewriting model (1) by using one of its recursive forms results in

$$(2)\quad \bar{l}_{zst} = A_{11}(L)\bar{l}_{zs,t-1} + A_{12}(L)n_{zst} + B_1(L)\mathbf{x}_{zst} + u_{1zs} + \varepsilon_{1zst},$$

$$(3)\quad n_{zst} = A_{21}(L)\bar{l}_{zs,t-1} + A_{22}(L)n_{zs,t-1} + B_2(L)\mathbf{x}_{zst} + u_{2zs} + \varepsilon_{2zst}.$$

Random shocks $\varepsilon_{1zst}$ and $\varepsilon_{2zst}$ are now uncorrelated and $A_{ij}(L)$ and $B_i(L)$ are scalar polynomials in the lag operator. Note that equation (3) includes only the lagged values of average plant size in the determination of the number of active plants. This is justified by the theoretical argument developed by Combes/Magnac/Robin (2004) that employment decisions are taken conditional on the entry decisions of plants decided beforehand and emphasizes the causality directed from the latter variable to the former one.

Equations (2) and (3) can be estimated separately using the same methodology as for static and dynamic models of panel data. If $A(L)$ and $B(L)$ are of degree 0, the model is static and both employment variables are explained by the current local economic structure only. The more general dynamic model with $A(L)$ and $B(L)$ of higher degrees can be obtained by assuming an autoregressive structure of the error terms. Combes/Magnac/Robin (2003) discuss in detail the statistical properties and the specification search for the best econometric model, and both static as well as dynamic specifications are presented. Since they finally prefer a parsimonious specification of a dynamic model, emphasis is put here on the presentation of the dynamic panel data models as well.[2]

A straightforward way to derive a dynamic model from equations (2) and (3) is to assume that random shocks $\varepsilon_{zst}$ follow an autoregressive process of order 1,

$$(4)\quad \varepsilon_{zst} = \rho\varepsilon_{zs,t-1} + (1-\rho)\eta_{zst},$$

where $\eta_{zst}$ is stationary and possibly autocorrelated. When $\rho < 1$, the process $\eta_{zst}$ is stationary. The general estimation equations representing a dynamic panel setup (see also Blien/Südekum/Wolf (2006)) are then

$$(5)\quad \bar{l}_{zst} = \sum_{l=1}^{m} \rho_l \bar{l}_{zs,t-l} + \sum_{l=0}^{m} \alpha_l n_{zs,t-l} + \sum_{l=0}^{m} \beta_l \mathbf{x}_{zs,t-l} + u_{1zs} + \varepsilon_{1zst}.$$

[2]Results of the static models for Western Germany are displayed in Tables A.3 and A.4 in the appendix. It turns out that the results do not differ dramatically from the dynamic outcomes. Furthermore, the specification tests give preference to the dynamic models.

$$(6) \quad n_{zst} = \sum_{l=1}^{m} \alpha_l \bar{l}_{zs,t-l} + \sum_{l=1}^{m} \rho_l n_{zs,t-l} + \sum_{l=0}^{m} \beta_l \mathbf{x}_{zs,t-l} + u_{2zs} + \varepsilon_{2zst}.$$

$\bar{l}_{zs,t-l}$ and $n_{zs,t-l}$ are the (current or lagged) dependent variables and $\mathbf{x}_{zs,t-l}$ the (current or lagged) explanatory variables characterizing the economic structure of a region. $u_{1zs}$ and $u_{2zs}$ are time-invariant location and industry-specific effects, and $\varepsilon_{1zst}$ and $\varepsilon_{2zst}$ are the respective standard error terms.

When applying the standard within-group estimation technique used for static panel data models to dynamic models, a serious problem arises. Because the transformed endogenous variables $\bar{l}_{zs,t-1} - \overline{\bar{l}_{zs}}$ and $n_{zs,t-1} - \overline{n_{zs}}$ are correlated with the transformed error terms $\varepsilon_{1zst} - \overline{\varepsilon_{zs}}$ and $\varepsilon_{2zst} - \overline{\varepsilon_{zs}}$ the within-group estimate is biased and inconsistent (Nickell (1981). A solution to this problem lies in taking first differences of the original model specified in levels in order to eliminate the time-invariant effects:

$$(7) \quad \Delta\bar{l}_{zst} = \sum_{l=1}^{m} \rho_l \Delta\bar{l}_{zs,t-l} + \sum_{l=0}^{m} \alpha_l \Delta n_{zs,t-l} + \sum_{l=0}^{m} \beta_l \Delta\mathbf{x}_{zst} + \Delta\varepsilon_{1zst},$$

$$(8) \quad \Delta n_{zst} = \sum_{l=1}^{m} \alpha_l \Delta\bar{l}_{zs,t-l} + \sum_{l=1}^{m} \rho_l \Delta n_{zs,t-l} + \sum_{l=0}^{m} \beta_l \Delta\mathbf{x}_{zst} + \Delta\varepsilon_{2zst},$$

where $\Delta\bar{l}_{zs,t-l} = \bar{l}_{zs,t-l} - \bar{l}_{zs,t-l-1}$ and $\Delta n_{zs,t-l} = n_{zs,t-l} - n_{zs,t-l-1}$.[3]

It is now possible to construct instruments for the lagged dependent variables from the second and third lags of $\bar{l}_{zst}$ and $n_{zst}$, either in the form of differences or of lagged levels. One method proposed by Anderson/Hsiao (1981) and Anderson/Hsiao (1982) is to apply the two-stage least squares within estimator to the differenced model. Combes/Magnac/Robin (2004) resort to this technique in their dynamic panel estimations and use lagged values of the right-hand side variables in levels as instruments. In this respect, I do not follow Combes/Magnac/Robin (2004), but rather use an extension of the Anderson/Hsiao approach proposed by Arellano/Bond (1991). They derive a GMM estimator to get consistent estimates for the unknown coefficients by using lagged levels of the dependent and the predetermined variables as well as differences of the strictly exogenous variables. This way, the number of instruments increases considerably, and the information available in the data can be exploited to a larger extent. One important precondition for the validity of the instruments in the case

[3]Since $\bar{l}_{zst}$ and $n_{zst}$ are measured in logs, the left-hand side of equations 7 and 8 are (approximately) the growth rates of average plant size and of the number of plants.

of the Arellano-Bond estimator is that there exists no second-order autocorrelation in the first-differenced error terms. Under the assumption of serially uncorrelated $\varepsilon_{zst}$, the first-differenced error terms $\varepsilon_{zst} - \varepsilon_{zs,t-1}$ follow an MA(1) process, so $\varepsilon_{zs,t-p}(p = 2, 3, ...)$ are valid instruments for $\Delta\varepsilon_{zs,t-1}$. Furthermore, it is assumed that the remaining right-hand side variables embodied in $\mathbf{x}_{zst}$ are weakly exogenous with respect to $\varepsilon_{zst}$, i.e.

$$(9) \quad E(\varepsilon_{1zst}|n_{zst}, \mathbf{x}_{zst}, n_{zs,t-1}, \mathbf{x}_{zs,t-l}, ...) = 0.$$

$$(10) \quad E(\varepsilon_{2zst}|\bar{l}_{zs,t-1}, \mathbf{x}_{zst}, \bar{l}_{zs,t-2}, \mathbf{x}_{zs,t-l}, ...) = 0.$$

# 3 Design of the empirical analysis

## 3.1 Data issues

The data entering the analysis is taken from the Establishment History Panel (EHP) that is provided by the German Federal Employment Agency (Bundesagentur fuer Arbeit) (see Spengler (2008) and Dundler/Stamm/Adler (2006) for further details). This comprehensive dataset contains information on all plants with at least one employee liable to social insurance on the reference day (June 30 of each year).[4] It is derived from counting the notifications given by employers to the social security funds about the number of workers liable to pay social security contributions.[5] All worker employment notifications are compiled under a business number assigned to the plants by the regional labour offices. The data appears as a file listing all participating plants together with the exact number of employees as well as other information related to the plant or the employees on the reference date. This way, the EHP includes between 1.5 and 2.5 million plants each year. It covers the years from 1975 to 2006 and is available for all NUTS3-districts ("Landkreise und kreisfreie Städte") in Germany.

For the purposes of the analysis only the West German regions are considered, because the comparatively stable structural and regional characteristics in Western Germany are better suited for a comparison with France than the East German regions, where structural change is still under way. In order to create units of analysis which most closely resemble the delimination

[4] Since 1999 the data also contains all plants with at least one marginally employed person not obliged to pay social security contributions and not earning more than Euro 400 per month. Because of a noticeable break in the time series at that date, these employees are excluded from the analysis.

[5] These figures are essentially based on employers' notification of new employees, out-going employees and end-of-year totals. Because the periods during which an individual holds employment are important for any future payments of benefits by the social security funds, the figures for the number of workers employed at a given point in time are very reliable.

for France, I aggregate the NUTS3-regions according to labour market regions in analogy to Eckey/Kosfeld/Türck (2006). The resulting 112 regions are larger on average (2,260 $km^2$) than their 341 French counterparts (1,570 $km^2$), and in the year 2002 they also contained more employees per region (84,028 versus 70,028). However, like the French *zones d'emploi* used by Combes/Magnac/Robin (2004), the German labour market regions are defined according to the observations of workers' daily migrations. Importantly, this is consistent with the assumption that local growth only depends on local characteristics, because local labour markets and local goods markets should ideally coincide within these regions.[6]

When working with specialization measures, a crucial issue lies in the choice of the appropriate sectoral aggregation level. Because of various inconsistencies and peculiarities regarding the industry classification schemes, it is not possible to use the same sectoral classification as Combes/Magnac/Robin (2004). In contrast to the French analysis, which is based on 36 sectors from manufacturing, trade, and services, the plants here are grouped into 24 sectors belonging to the same industries for a ten-year period from 1993 to 2002.[7] The advantage of this approach is that the results can be additionally compared with the study of Blien/Südekum/Wolf (2006), who run similar regressions for Western Germany and resort to 21 sectors.

For the econometric analysis the information on the level of the individual plants is aggregated by region, industry, and year into cells (z,s,t), thus describing the special features of all plants in a certain region $z$, industry $s$, and year $t$. This aggregation emphasizes that employment growth determinants are area- and industry-specific and that individual, plant-level characteristics play no role in the model. Furthermore, whereas plant size is a variable that is easy to model using individual plant data, modeling the increase in the number of plants increases the level of difficulty. By summing up all entries and exits of plants into cells, the analysis can be There results a total of 24,749 cells for Western Germany. Because it is based on more regions and sectors, but on the same number of years, the analysis on France covers 82,853 cells. The average cell in Western Germany consists of about 160 plants with roughly 14 thousand employees.

One drawback of the French data mentioned by Combes/Magnac/Robin (2004) is that it only includes all French-metropolitan plants employing more than 20 employees. For Germany,

[6] This assumption cannot be supported for an analysis on the level of the NUTS3-regions. Furthermore, they are on average much smaller than the *zones d'emploi* (762 $km^2$ for the districts in Western Germany) and feature a much lower employment density (29,149 employees per district). Hence, a comparison based on the labour market regions is more appropriate.

[7] The data on France is available according to the Nomenclature économique de synthèse (NES), which roughly corresponds to the German WZ93. Data from the EHP is available according to the WZ93 only from 1999 onwards, giving way to observations on seven years only. Hence, I resort to earlier data classified according to the WS73 in order to have the same time span as available as Combes/Magnac/Robin (2004). Because the NES and the W73 are not compatible, it is not possible to exactly reproduce the 36 sectors. However, conducting the analysis with 64 sectors, i.e. using all information on the two-digit level of the WS73, does not significantly change the results.

a complete view of the local employment and plant creation dynamics can be attained, in contrast, because the EHP contains information on all plants in Germany with at least one employee liable to social insurance. About 89 per cent of all plants registered in the EHP have up to 20 employees. However, these smaller plants dispose of only 27 per cent of all employees registered in the EHP. One major extension of the paper is therefore to analyze if the results obtained for the plants with more than 20 employees only hold also for all plants or if the dynamics for small plants with up to 20 employees follow a different pattern. For this reason the following analysis is first conducted for plants with more than 20 employees only. In a second step, these results are compared with those for all plants as well as for the small plants with up to 20 employees.

## 3.2 Dependent variables

The total employment dynamics in a region are defined by the pair of variables $(\overline{L}_{zst}, N_{zst})$. Internal employment is expressed by the average size $\overline{L}_{zst} = L_{zst}/N_{zst}$ of all plants located in region $z$ and operating in industry $s$ at time $t$. $L_{zst}$ is total employment in cell $(z,s,t)$ and $N_{zst}$ the respective number of plants. In the following a logarithmic specification is adopted with $\bar{l}_{zst} = \ln(L_{zst}/N_{zst})$ and $n_{zst} = \ln(N_{zst})$. It has the double advantage of making the distribution of these variables closer to a normal distribution and allowing for the interpretation of first differences as growth rates.

## 3.3 Explanatory variables

The determinants of internal and external employment dynamics can be divided into three groups. First, there are externalities that are linked to the degree of specialization. They are already reflected in the framework of the autoregressive dynamics of system (1). Assume for instance that the process is AR(1). The auto-regressive parameter $\rho$ in the series of average plant size (respectively the number of plants) indicates whether the growth of average plant size is larger if the average plant size has already been larger in the area. Strictly speaking, external effects arising out of specialization are observed only if the autoregressive coefficient is larger than 1. This would imply, however, that employment dynamics are explosive, as some regions end up with no economic activity while others infinitely expand. If the autoregressive parameter is between 0 and 1, some inertia in the dynamics as well as convergence to the long run target are observed. There is mean reversion, i.e. average plant size and the number of plants remain larger where they have already been larger, but spatial disparities in these variables decline.

The usual index of specialization, which is the ratio of employment in area $z$ and industry $s$ over total employment in this area ($L_{zst}/L_{zt}$) is not retained here. In logarithms, the effect of this variable would be non-parametrically identified because of the collinearity between the dependent variables $\ln(L_{zst}/N_{zst})$ and $\ln(N_{zst})$ and the market size indicator $\ln(l_{zt})$. An alternative sometimes adopted in the literature consists in introducing it in levels, but as Combes (2000) shows, this makes the interpretation difficult.

Besides externalities linked to the degree of specialization, two other groups of determinants of employment are included in the explanatory variables. The second group contains variables measuring urbanization externalities:

(1) The logarithm of total employment in area $z$ at time $t$:

$$l_{zt} = \ln \left[ \sum_{s=1}^{S} L_{zst} \right].$$

This frequently used variable captures global urbanization externalities that are related to the local market size, but not to the industrial composition of the area.

(2) The logarithm of the number of industries, $S_{zt}$, in which at least one plant is operating in area $z$ at time $t$:

$$s_{zt} = \ln(S_{zt}).$$

(3) The opposite of the Herfindahl index of local concentration between industries:

$$div_{zt} = -\ln \left[ \sum_{s=1}^{S} \left( \frac{L_{zst}}{L_{zt}} \right)^2 \right].$$

The variable is equal to zero if local employment is concentrated in a single industry and it is equal to the logarithm of the number of industries if the distribution of local employment is uniform across countries.

The last two indicators (2) and (3) measure the industrial diversity of an area. They correspond to Jacobs externalities which constitute the second kind of urbanization externalities.

The third group of determinants measures Porter effects by characterizing the degree of competition between plants within one industry. Contrary to urbanization externalities that are indexed by area and period, but not by industry, local competition indicators vary across area, sector, and time. The following two indicators of local competition are considered:

(1) The dispersion of local employment between plants within a sector as measured by the

opposite of the logarithm of the Herfindahl index of within area-and-industry concentration:

$$comp_{zst} = -\ln\left[\sum_{i\epsilon I_{zst}}\left(\frac{L_{it}}{L_{zst}}\right)^2\right],$$

where $L_{it}$ is the $i$th plant size at period $t$, and $I_{zst}$ denotes the set of all plants operating in area $z$ and industry $s$ at period $t$. If employment is concentrated in a single plant, this variable is equal to zero. It is equal to the logarithm of the number of plants if the distribution of employment is uniform among plants. Given the number of plants, this variable can be interpreted as the intensity of local competition within sectors.

(2) An indicator of total absence of competition within an area and industry:

$$mono_{zst} = \left\{\begin{array}{l} 1\ if\ N_{zst} = 1 \\ 0\ if\ not \end{array}\right\}$$

Since it directly depends on the second dependent variable, $n_{zst}$, it is only included among the explanatory variables in the equation describing average plant size, $\bar{l}_{zst}$.

Table 1 reports descriptive statistics for all variables both for the West German as well as for the French regions. The average values of most of the variables are higher in the West German regions than in France, which is mainly due to the larger regions. Concerning average plant size, the standard deviation is higher in France, and it should be noted that the maximum value is also considerably higher than in Western Germany. However, like in France, the local number of plants (in logs) is considerably more variable than average plant size.[8] This is already an indication that a significant fraction of the dynamics of local employment should be explained by plant creation and destruction. Because the German data comprises less sectors, $s_{zt}$ is on average smaller than for France. Interestingly, the competition variable has a higher average in Germany. This implies that in Western Germany employment is more dispersed between plants in one sector than in France. The existence of a monopoly is less relevant than in the French dataset, where in more than 20 per cent of all cases, labor employed in a cell is concentrated on a single plant.

The correlations between the variables in levels and in first differences are reported in the appendix (Tables A.1 and A.2). First of all, the correlation between average plant size and the number of plants is relatively weak. Second, the larger plant size or the larger the number of plants, the larger local market size, the number of active sectors, the degree of diversity between sectors, and the less likely a monopoly situation. Larger plant size goes long with less competition between plants, whereas the larger the number of plants, the larger is local competition within sectors. These correlations seem to reflect mainly the contrast between small and large markets. In general and in line with the French data, the number of plants

[8] As measured by the coefficient of variation: standard deviation divided by arithmetic mean.

Table 1: Descriptive Statistics for Western Germany and France

| | Western Germany[a] | | | | France[b] | | | |
|---|---|---|---|---|---|---|---|---|
| | Av. | Std. | Min. | Max. | Av. | Std. | Min. | Max. |
| $\bar{l}_{zst}$ | 4.42 | 0.69 | 3.04 | 8.99 | 4.18 | 0.76 | 2.99 | 10.12 |
| $n_{zst}$ | 2.82 | 1.28 | 0 | 7.06 | 1.49 | 1.16 | 0 | 7.54 |
| $l_{zt}$ | 10.87 | 0.92 | 8.61 | 13.29 | 9.51 | 1.08 | 6.51 | 13.59 |
| $s_{zt}$ | 3.10 | 0.06 | 2.77 | 3.14 | 3.22 | 0.24 | 1.79 | 3.58 |
| $div_{zt}$ | 2.39 | 0.34 | 0.44 | 2.92 | 2.37 | 0.42 | 0.34 | 3.12 |
| $comp_{zst}$ | 2.10 | 1.09 | 0 | 5.79 | 1.16 | 0.95 | 0 | 6.33 |
| $mono_{zst}$ | 0.04 | 0.20 | 0 | 1 | 0.21 | 0.41 | 0 | 1 |

a: Own results, n=25,869. b: Results of Combes/Magnac/Robin (2004), n=82,853.

is higher correlated with the explanatory variables than average plant size. The only major difference in comparison to France emerges in the negative correlation between the competition variable and average plant size.

From all variables the mean within period and industry cells is subtracted, because the focus here is on characterizing spatial effects and on comparing the performance of the single regions within Western Germany. In working with the demeaned variables, the question is not why the employment growth of an industry in a given region is x %, but rather why it is y % higher (or lower) in this region compared to the national level. Let $Z_{zst}$ be the set of indices $z$ for those regions where there exists a positive number of active plants in sector $s$ at time $t$. Variable $\bar{l}_{zst}$ is then replaced by

$$\bar{l}_{zst} - \frac{1}{\#Z_{st}} \sum_{z' \in Z_{st}} \bar{l}_{z'st}.$$

The same calculation is applied to the other variables varying over region, sector, and time, $n_{zst}$, $comp_{zst}$, and $mono_{zst}$.

The variables capturing only region- and time-specific effects $l_{zt}$, $s_{zt}$, and $div_{zt}$ are simply detrended. For example, if Z is the set of all area indices, $l_{zt}$ is replaced by

$$_{zt} - \frac{1}{\#Z} \sum_{z' \in Z} l_{z't}.$$

# 4 Comparison between Western Germany and France

This section centers on the direct application of the French approach to the West German labour market regions. Only plants with more than 20 employees are included. First, the results of the dynamic panel data models on average plant size are discussed, to be followed by an analysis of the number of plants.[9]

[9] Static model specifications are reported in Tables A.3 and A.4 in the Appendix.

## 4.1 Average plant size

After testing several specifications of equation (7) for Western Germany, the one finally adopted includes two lags of the dependent variable and up to two lags of the right-hand side variables:[10]

$$\text{(11)} \quad \Delta\bar{l}_{zst} = \sum_{l=1}^{2} \rho_l \Delta\bar{l}_{zs,t-l} + \sum_{l=0}^{2} \alpha_l \Delta n_{zs,t-l} + \sum_{l=0}^{2} \beta_l \Delta \mathbf{x}_{zst} + \Delta\varepsilon_{1zst},$$

Table 2 reports the results of the dynamic model specifications for Western Germany, where the Arellano/Bond estimator is used, and for France, with the application of the Anderson/Hsiao estimator. For instrumenting the first difference of the lagged dependent variable the higher order time lags of the dependent variable in levels are used in both cases. The results on Western Germany are quite robust to specification testing. The Sargan test of overidentifying restrictions can not be rejected at the 1 percent level. The other assumption necessary for the validity of instruments, serial uncorrelated error terms $\varepsilon_{zst}$, can not be rejected at conventional significance levels either. [11]

One important finding for Western Germany as well as for France is that the degree of specialization within a sector and region clearly plays a role for internal employment growth. The persistence of shocks measured by the estimate of the autoregressive coefficient $\rho_1$ for the lagged dependent variable $\bar{l}_{zst}$ of 0.804 is highly significant and positive and very close in magnitude to France. Since it is significantly smaller than one, though, it gives no evidence for an explosive growth path. Hence, specialization effects in the strict sense are not observed. There is rather mean reversion in the process, implying that an exogenous growth impulse persists for some time, but with slowly decreasing effects.

The impact of the number of plants, $n_{zst}$, on average plant size is negative and becomes insignificant with a time lag of two or more periods. Obviously, opposing forces are at work than in France, where the effect is positive. In Western Germany, the number of plants in one sector and area grows more quickly than employment, while in France, employment growth outweighs the growth in the number of plants. The differences can be interpreted twofold. First, pure local externalities implying that a larger number of plants favors innovation and then plant size seem not to work in the case of Western Germany. On the contrary, the entry of new plants into the market entails crowding-out effects, and due to a higher degree of competition less profitable plants ultimately shut down. Second, the supply elasticity of labour seems to be

[10]Specifications with more than two lags result in non-significant coefficients for most of the variables lagged three or more times. Also all the estimates for the contemporaneous variables remain stable. Results are available from the author upon request.

[11]Monte Carlo studies have shown that the Sargan test rejects the null hypotheses of valid instruments too easily (see e.g. Hansen/Heaton/Yaron (1982)). In this light, the low p-value of the Sargan test should not be taken too seriously, especially because the other condition necessary for the validity of the instruments is met.

Table 2: Dynamic estimation results for average plant size

| | | Western Germany | France |
|---|---|---|---|
| Method | | GMM | 2SLS |
| $\bar{l}_{zst}$ | t-1 | 0.804*** (27.34) | 0.878 (16.3) |
| | t-2 | 0.065*** (4.55) | |
| $n_{zst}$ | t | -0.310*** (-11.66) | 0.281 (4.9) |
| | t-1 | 0.251*** (11.27) | -0.257 (11.5) |
| | t-2 | -0.018 (-1.60) | |
| $l_{zt}$ | t | 0.435*** (5.85) | 0.257 (1.6) |
| | t-1 | -0.265*** (-3.76) | -0.237 (-4.2) |
| | t-2 | -0.100* (-1.82) | |
| $s_{zt}$ | t | -0.116* (-1.79) | -0.093 (0.5) |
| | t-1 | 0.174*** (3.01) | 0.239 (4.1) |
| | t-2 | 0.050 (0.73) | |
| $div_{zt}$ | t | 0.225*** (5.61) | 0.166 (2.4) |
| | t-1 | -0.150*** (-3.89) | -0.109 (-4.4) |
| | t-2 | -0.077** (-2.40) | |
| $comp_{zst}$ | t | -0.226*** (-9.23) | -0.497 (-11.9) |
| | t-1 | 0.183*** (8.82) | 0.529 (16.3) |
| | t-2 | 0.031*** (3.07) | |
| $mono_{zst}$ | t | -0.180*** (-3.74) | -0.002 (-0.1) |
| | t-1 | 0.077** (2.15) | 0.072 (4.9) |
| | t-2 | 0.036 (1.52) | |
| Sargan | | 53.604 | |
| | | (0.013) | (-0.579) |
| AC(1) | | -12.247 | -0.579 |
| | | (0.000) | ($< 10^{-5}$) |
| AC(2) | | -0.020 | 0.084 |
| | | (0.984) | ($< 10^{-5}$) |
| AC(3) | | 0.928 | -0.003 |
| | | (0.408) | (0.57) |
| Obs. | | 17,969 | 54,664 |

No inclusion of t-2 in the regressions on France. **: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level. No significance levels reported for France. Student statistics are reported in parentheses.

not large enough, which in the theoretical model is a necessary precondition for productivity shocks to be transferred to employment growth via the economic structure. The direct negative effect the larger number of plants exerts on plant size is higher than the indirect positive effect arising from the productivity gains that decrease prices (via the increase in competition) and then increase demand. If the labour supply elasticity is low, plant size decreases following a positive productivity shock in the long run.

Total market size ($l_{zt}$) has a highly significant and positive influence on average plant size that does not fade quickly away over time. Faster growing areas might give way both to stronger technological spillover effects as well as a faster growth of intermediate and final goods markets, thus promoting agglomeration economies. This finding holds even more for Western Germany than for France. It is also in line with Blien/Südekum/Wolf (2006), who conclude, however, that only the current setting influences employment growth.

Besides global urbanization externalities, the degree of the local industrial diversity described by $s_{zt}$ and $div_{zt}$ also matters for internal employment growth. Plants are larger if the fewer the sectors within a region and if employment tends to be distributed uniformly across these sectors. Clearly, externalities connected to the industrial diversity within one area matter for internal employment growth regardless of the country considered. In terms of agglomeration forces, this finding is consistent with the idea that cost and demand linkages extend similarly to all intermediate inputs in a given industry, even if the number of these inputs is not necessarily large. As regards pure local externalities, technological spillovers might work across some industries, but not all. They would rather be maximized within fairly small but evenly balanced sub-groups of similarly sized sectors.

Regarding the degree of competition between plants within a sector and region, the influence of history is quite pronounced in Western Germany and reaches as far back as four periods. $comp_{zst}$ is found to be negative and significant, implying that average plant size is larger in a sector if employment is concentrated only on few plants. The existence of a monopoly within a cell has a much higher impact than for France in spite of the fact that labour is employed more often by a monopolist there. Evidently, internal employment growth is maximized if employment within one sector is concentrated among only few plants implying a low degree of competition, but definitely not only on one plant.

Like for France, differences between the West German sectors become evident only in terms of magnitude, but neither in sign nor significance. Table A.5 in the Appendix lists the regression results for manufacturing and services. The negative impact of the number of plants is attenuated for the service sector, but still significant. In return, the degree of competition between plants has a stronger influence in absolute terms in services than in manufacturing.

Summing up the comparison of the estimation results between Western Germany and France, the common factors outweigh by far the differences in the impact of the underlying economic structure on internal employment growth. Apart from the differing signs of $n_{zst}$, the influence of history justifies a further remark. In Western Germany, the coefficients are significant up to a time lag of two periods or even more, hinting towards a larger relevance of the historical influence in Western Germany. However, it is not very large, so that these results are basically in line with those of Blien/Südekum/Wolf (2006)).

## 4.2 Number of plants

Like for average plant size, the specification of equation (8) adopted for the comparison with France uses two lags of the dependent variable and up to two lags of the right-hand side variables:

$$(12) \quad \Delta n_{zst} = \sum_{l=1}^{3} \alpha_l \Delta \bar{l}_{zs,t-l} + \sum_{l=1}^{2} \rho_l \Delta n_{zs,t-l} + \sum_{l=0}^{2} \beta_l \Delta \mathbf{x}_{zst} + \Delta \varepsilon_{2zst},$$

Table (3) displays the results of the dynamic model specification for the number of plants in Western Germany, again contrasted by those for France. The results are robust to specification testing as indicated by the absence of second-order autocorrelation.

Like for internal employment growth, specialization effects measured by the coefficient of $n_{zs,t-1}$ are important determinants of the number of plants in a sector and region, although the effect is much smaller in size for Germany than for France. Furthermore, in the case of Western Germany the persistence in the creation and destruction of plants is weaker than in average plant size. Hence, large external growth rates at a given period imply weaker future growth rates than would be the case for internal employment growth.

The effect of the lagged plant size ($\bar{l}_{zs,t-1}$) on the number of plants is positive for Western Germany, but negative for France. Seemingly, large average plant size promotes the number of plants in the following period.

A positive influence can also be asserted towards the total size of the local market that is even stronger for Western Germany than for France. Like for internal employment, global agglomeration economies that go along with increased demand for goods and services are also existent in the case of external employment. In addition, a large regional demand increases the motivation of entrepreneurs to found new firms and raises the new firms' prospects of survival (Brixy/Grotz (2007).

In contrast to average plant size and to the results on France, there is no significant impact of diversification attributed to the number of sectors, whereas the degree of diversification between sectors is again positive. Hence, they would be maximized within evenly balanced sectors, although there is no evidence on the range that technological spillovers could work.

The degree of competition between the plants belonging to the same sector clearly differs in its impact on internal employment on the one hand and external employment on the other,

Table 3: Dynamic estimation results for the number of plants

| | | Western Germany | France |
|---|---|---|---|
| Method | | GMM | 2SLS |
| $n_{zst}$ | t-1 | 0.467*** (9.39 ) | 0.829 (15.6) |
| | t-2 | -0.013 (-0.75) | |
| $\bar{l}_{zst}$ | t-1 | 0.167*** (6.35) | -0.041 (-1.7) |
| | t-2 | -0.013 (-1.12) | 0.036 (5.1) |
| | t-3 | 0.027** (2.27) | |
| $l_{zt}$ | t | 0.585*** (8.46) | 0.191 (1.9) |
| | t-1 | -0.383*** (-5.76) | -0.219 (-6.4) |
| | t-2 | -0.073 (-1.40) | |
| $s_{zt}$ | t | -0.083 (-1.39) | -0.107 (-0.8) |
| | t-1 | -0.033 (-0.58) | 0.092 (2.4) |
| | t-2 | 0.013 (0.21) | |
| $div_{zt}$ | t | 0.268*** (7.12) | 0.082 (1.5) |
| | t-1 | -0.155*** (-3.78) | -0.086 (-4.5) |
| | t-2 | -0.010 (-0.31) | |
| $comp_{zst}$ | t | 0.648*** (25.46) | 0.818 (32.1) |
| | t-1 | -0.281*** (-8.03) | -0.692 (-16.1) |
| | t-2 | 0.023 (1.42) | |
| Sargan | | 54.373 | |
| | | (0.006) | (0.300) |
| AC(1) | | -9.707 | -0.571 |
| | | (0.000) | ($< 10^{-5}$) |
| AC(2) | | 1.566 | 0.062 |
| | | (0.117) | ($< 10^{-5}$) |
| AC(3) | | -0.146 | -0.001 |
| | | (0.884) | (0.91) |
| Obs. | | 15,375 | 54,664 |

No inclusion of t-2 in the regressions on France. **: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level. No significance levels reported for France. Student statistics are reported in parentheses.

because competition fosters the growth in the number of plants rather than being seen as detrimental to market entry. This relationship corroborates the view stated by Porter (1990) that the effects of knowledge spillovers on growth are enhanced by local competition as plants need to be innovative on order to survive.

Sectoral results are reported in Table A.6 in the Appendix. Like for average plant size, differences between manufacturing and services arise only with respect to the magnitude of the coefficients, but neither sign nor significance. It is worth noting that the impact of the local market size is considerably higher for the service sector. Global agglomeration externalities seem to foster in a special way the number of service plants. In a similar vein, Fritsch/Falck (2007) highlight that the process of new firm formation in the manufacturing and the service sector nearly follows the same principles, although the strength of some determinants might be more or less pronounced in certain industries.

Like for average plant size, a comparison of the estimation results on France with those on Western Germany reveals major differences only with respect to the lagged value of average plant size. It is remarkable, though, that the coefficients vary more in their magnitude between the two countries than is the case for internal employment. Additionally, the regression results according to sectors show a very similar influence of the explanatory variables.

# 5 Extending the database

This section goes one step beyond the direct comparison that Section 4 focused on and extends the data sample over all plants employing at least one person subject to social security contributions. First of all, as already mentioned in section 3.1, the number of plants increases much more than the number of employees. The number of cells, however, expands only slightly from 25,869 to 26,839 because of the relatively low increase in the number of sectors per region. Hence, the greatest changes in the variables occur for those variables where the number of plants plays a major role, i.e. $\bar{l}_{zst}$ and $n_{zst}$. Descriptive statistics for all plants in Table 4 show that the average value of plant size decreases distinctly from 4.42 to 2.78, whereas the average number of plants per cell rises steeply from 2.82 to 4.81. The explanatory variables, in contrast, remain relatively stable. $comp_{zst}$ changes the most because of the high increase in the number of plants. Last, now in almost all cells all the sectors are occupied, resulting in almost no variation of $s_{zt}$.

Dynamic regression results of specification (11) for average plant size are reported in Table 5. First of all, specification statistics as indicated by the Sargan test improve dramatically as compared to the consideration of only the larger plants. Interestingly, although the two dependent variables experience such large changes the findings differ only in one respect from those for plants with more than 20 employees only. Not surprisingly, the number of sectors,

Table 4: Descriptive Statistics for Western Germany, all plants included

| | Av. | Std. | Min. | Max. |
|---|---|---|---|---|
| $\bar{l}_{zst}$ | 2.78 | 1.00 | 0 | 8.37 |
| $n_{zst}$ | 4.81 | 1.65 | 0 | 9.98 |
| $l_{zt}$ | 11.33 | 0.89 | 9.22 | 13.66 |
| $s_{zt}$ | 3.18 | 0.01 | 3.14 | 3.18 |
| $div_{zt}$ | 2.52 | 0.24 | 0.84 | 2.81 |
| $comp_{zst}$ | 2.95 | 1.42 | 0 | 6.89 |
| $mono_{zst}$ | 0.01 | 0.07 | 0 | 1 |

$s_{zt}$, turns out to be insignificant for explaining average plant size. Otherwise, the estimates may somewhat differ in magnitude, but remain stable with respect to sign and significance. Moreover, the role of history does not change. This finding is backed up by separate regressions on the small plants with less than 21 employees only. Apart from the existence of a monopoly becoming non significant as well, there are only minor changes with respect to the magnitude of the coefficients, but not with respect to sign or the impact of history.[12]

Results for the number of plants based on the extended database are displayed in Table 6. Again, the model is better specified when including all plants. Since the vast majority of the newly founded plants is small,[13] it might well be the case that the overall results would change due to a different impact of the underlying economic structure. On the other side, it could be argued that because of the low survival rates of new firms their inclusion does not influence the overall results in any significant way but rather constitutes "white noise".

Like for average plant size, there is basically not much change with regard to the restricted data set except for the magnitude of the estimates. Notably market size, the diversity index and the competition variable exert a weaker influence on the number of all plants. Like for internal employment, separate regressions only on the small plants indicate slight differences in the magnitude, but neither in significance nor in size of the estimates as compared to the larger plants.

To sum up, the impact of specialization, diversification and competition holds not only for large plants, but also for the smaller plants with up to 20 employees. The estimated coefficients are comparable in their explanatory power and also in the influence of their past realizations. Hence, this section has provided strong evidence that internal and external employment growth among the smaller plants is subject to the same determinants considered in the approach followed here as the larger plants.

[12] Regression results on the small plants only are available from the author upon request.

[13] **?** show in a cohort analysis for Western Germany that only one half of the start-ups of a given year survives more than five years. The majority of the surviving plants stays small.

Table 5: Dynamic estimation results for average plant size - all plants

| | | Western Germany |
|---|---|---|
| $\bar{l}_{zst}$ | t-1 | 0.640*** (12.30) |
| | t-2 | 0.045*** (3.47) |
| $n_{zst}$ | t | -0.578*** (-19.83) |
| | t-1 | 0.247*** (11.19) |
| | t-2 | 0.001 (0.03) |
| $l_{zt}$ | t | 0.681*** (7.99) |
| | t-1 | -0.401*** (-5.17) |
| | t-2 | -0.038 (-0.62) |
| $s_{zt}$ | t | 0.346 (1.63) |
| | t-1 | 0.108 (0.48) |
| | t-2 | 0.131 (0.55) |
| $div_{zt}$ | t | 0.337*** (6.24) |
| | t-1 | -0.219*** (-4.57) |
| | t-2 | -0.027 (-0.73) |
| $comp_{zst}$ | t | -0.218*** (-12.45) |
| | t-1 | 0.141*** (8.03) |
| | t-2 | 0.002 (0.37) |
| $mono_{zst}$ | t | -0.256** (-2.15) |
| | t-1 | 0.201*** (3.02) |
| | t-2 | 0.122 (1.71) |
| Sargan | | 33.0548 |
| | | (0.4646) |
| AC(1) | | -5.3156 |
| | | (0.0000) |
| AC(2) | | 0.92558 |
| | | (0.3547) |
| AC(3) | | -1.0448 |
| | | (0.2961) |
| Obs. | | 18,722 |

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level.Student statistics are reported in parentheses.

Table 6: Dynamic estimation results for the number of plants - all plants

| | | Western Germany |
|---|---|---|
| $n_{zst}$ | t-1 | 0.579*** (8.08) |
| | t-2 | 0.002 (0.11) |
| $\bar{l}_{zst}$ | t-1 | 0.173*** (7.07) |
| | t-2 | 0.022** (2.31) |
| | t-3 | -0.012 (-1.03) |
| $l_{zt}$ | t | 0.210*** (4.07) |
| | t-1 | -0.165*** (-2.67) |
| | t-2 | -0.036 (-0.66) |
| $s_{zt}$ | t | -0.106 (-0.69) |
| | t-1 | 0.073 (0.54) |
| | t-2 | 0.037 (0.25) |
| $div_{zt}$ | t | 0.076** (2.23) |
| | t-1 | -0.087** (-2.40) |
| | t-2 | 0.013 (0.37) |
| $comp_{zst}$ | t | 0.097*** (8.82) |
| | t-1 | -0.012 (-1.15) |
| | t-2 | 0.003 (0.49) |
| Sargan (p-value) | | 28.3345 |
| | | (0.6039) |
| AC(1) | | -8.3096 |
| | | (0.0000) |
| AC(2) | | 0.28378 |
| | | (0.7766) |
| AC(3) | | -0.1279 |
| | | (0.8982) |
| Obs. | | 18,722 |

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level. Student statistics are reported in parentheses.

# 6 Conclusions

The way the economic structure in a region is set up shows a strong interaction with the employment dynamics in this region. The degree of diversification between the single sectors as well as the degree of competition within a sector are found to exert a strong influence on employment. Whereas a diversified economic structure enhances the inter-sectoral exchange of ideas between individuals or plants, a high degree of competition is detrimental for plant size, but beneficial for the number of plants. Furthermore, global agglomeration externalities are at work for both sources of employment generation. The evidence presented allows no clear-cut conclusion as to the existence of positive spillover effects that result from the degree of specialization. The dynamic panel results suggest that static externalities are prevalent compared to dynamic ones, which is in line with Blien/Südekum/Wolf (2006). Hence, interventions that influence the local economic structure will have an immediate impact on employment growth, but will not be long-lasting. All these results hold not only for all the sectors considered together, but also separately for manufacturing and services.

A comparison of the results on Western Germany with those on France makes clear that regarding the explanatory variables the same relationships between the economic structure and internal and external employment growth exist. opposing forces are at work only with respect to the influence of the number of plants on average plant size and vice versa.

A third important conclusion emerges from extending the dataset for Western Germany. Additionally considering the smaller plants with less than 21 employees does change the results in any major way. Hence, the internal and external employment growth among the smaller plants is subject to the same determinants considered in the approach followed here than the growth among the larger plants.

Some words of caution are appropriate. Underlying the analysis is the implicit assumption that each region is a closed economy, which means that local growth is related to the economic structure of the considered region only. But since spillover effects are not necessarily confined by administrative borders, one has to be careful interpreting the results on diversity and specialization as evidence for or against a particular theory of knowledge spillovers.

Based on the results presented in this paper, further lines of research can be delineated. First of all, the model could be extended by including further explanatory variables, e.g. information on the educational level attained by the employees. Blien/Südekum/Wolf (2006) include the employment share of college educated workers in order to measure the human capital intensity of a local industry which is not related to local economic spillovers and find a significantly positive impact on overall employment growth. Additionally, since the assumption of the working of localized knowledge externalities is at the heart of the present study, a straightforward extension would be to consider the high-technology or innovative sectors separately. In this line, Audretsch/Dohse (2007) conclude that being located in an agglomeration rich in knowledge resources is more conducive to firm growth than being located in a region that is less endowed with knowledge resources.

An additional line of further research would consist in evaluating the spatial extent to which the local structure acts on growth. Underlying the analyses is the assumption that each labour market region is a closed economy, which means that local growth is related to the economic structure of the considered region only. But spillover effects are not necessarily confined by administrative borders. Starting from the level of the NUTS3-regions, it would be well worthwile to explicitly evaluate the distance at which agglomeration forces operate. In fact, Schanne/Weyh (2009) detect significant spatial correlation in firm formation rates across the German NUTS3-regions. Further research on the mentioned issues could contribute to a more refined understanding of the linkages between the underlying economic structure and regional employment growth.

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# A Appendix

## A.1 Correlations between variables

Table A.1: Correlations between variables in levels

| | $\bar{l}_{zst}$ | $n_{zst}$ | $l_{zt}$ | $s_{zt}$ | $div_{zt}$ | $comp_{zst}$ | $mono_{zst}$ |
|---|---|---|---|---|---|---|---|
| $\bar{l}_{zst}$ | 1 | | | | | | |
| $n_{zst}$ | 0.026 | 1 | | | | | |
| $l_{zt}$ | 0.176 | 0.606 | 1 | | | | |
| $s_{zt}$ | 0.126 | 0.356 | 0.610 | 1 | | | |
| $div_{zt}$ | 0.075 | 0.239 | 0.248 | 0.394 | 1 | | |
| $comp_{zst}$ | -0.252 | 0.919 | 0.496 | 0.291 | 0.201 | 1 | |
| $mono_{zst}$ | -0.109 | -0.451 | -0.135 | -0.118 | -0.084 | -0.35 | 1 |

Table A.2: Correlations between first-differenced variables

| | $\bar{l}_{zst}$ | $n_{zst}$ | $l_{zt}$ | $s_{zt}$ | $div_{zt}$ | $comp_{zst}$ | $mono_{zst}$ |
|---|---|---|---|---|---|---|---|
| $\bar{l}_{zst}$ | 1 | | | | | | |
| $n_{zst}$ | -0.379 | 1 | | | | | |
| $l_{zt}$ | 0.081 | 0.133 | 1 | | | | |
| $s_{zt}$ | -0.001 | 0.003 | 0.024 | 1 | | | |
| $div_{zt}$ | -0.006 | 0.042 | -0.448 | 0.055 | 1 | | |
| $comp_{zst}$ | -0.446 | 0.697 | 0.059 | 0.002 | 0.035 | 1 | |
| $mono_{zst}$ | 0.105 | -0.467 | -0.016 | 0.002 | -0.008 | -0.336 | 1 |

## A.2 Static regression results

Table A.3: Static regression results for average plant size

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Method | OLS | Within | OLS | 2SLS | 2SLS | 2SLS |
| $\bar{l}_{zst}$ | L | | $\Delta$ | L | $\Delta$ | $\Delta$ |
| Instruments | - | - | - | $(\Delta x_{zs,t-j})_{j=1,2,3}$ | $(x_{zs,t-j})_{j=2,3,4}$ | $(x_{zs,t-j})_{j=1,2,3}$ |
| $n_{zst}$ | 0.724*** | -0.060*** | -0.238*** | -0.050 | -0.460*** | -0.395*** |
| | (108.60) | (-7.29) | (-32.82) | (-1.50) | (-2.72) | (-5.23) |
| $l_{zt}$ | -0.063*** | 0.457*** | 0.504*** | 0.433*** | 0.467* | 0.858*** |
| | (-12.53) | (17.24) | (14.26) | (3.53) | (1.70) | (5.39) |
| $s_{zt}$ | 0.241*** | -0.021 | -0.064 | -0.412 | -1.245** | -0.364* |
| | (3.88) | (-0.42) | (-1.57) | (-1.36) | (-2.33) | (-1.86) |
| $div_{zt}$ | -0.023*** | 0.255*** | 0.218*** | 0.401*** | 0.028 | 0.359*** |
| | (-2.72) | (12.64) | (10.21) | (2.65) | (0.12) | (3.91) |
| $comp_{zst}$ | -0.754*** | -0.326*** | -0.275*** | -0.276*** | -0.318* | -0.392*** |
| | (-115.17) | (-52.78) | (-44.24) | (-13.68) | (-1.73) | (-3.49) |
| $mono_{zst}$ | -0.241*** | -0.239*** | -0.191*** | -0.067 | -0.178 | 0.055 |
| | (-15.80) | (-21.63) | (-21.99) | (-1.36) | (-1.22) | (1.25) |
| $R^2$ | 0.41 | 0.08 | 0.27 | - | - | - |
| Sargan | - | - | - | 34.899 | 29.148 | 56.747 |
| | | | | (0.0005) | (0.0037) | (0.0000) |
| Obs. | 25,869 | 25,869 | 23,210 | 15,375 | 12,793 | 15,375 |

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level.

Table A.4: Static regression results for the number of plants

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Method | OLS | Within | OLS | 2SLS | 2SLS | 2SLS |
| $n_{zst}$ | L | | $\Delta$ | L | $\Delta$ | $\Delta$ |
| Instruments | - | - | - | $(\Delta x_{zs,t-j})_{j=1,2,3}$ | $(x_{zs,t-j})_{j=2,3,4}$ | $(x_{zs,t-j})_{j=1,2,3}$ |
| $\bar{l}_{zs,t-1}$ | 0.462*** | 0.075*** | 0.090*** | 0.022 | -0.037 | 0.025 |
| | (110.88) | (13.30) | (15.53) | (0.82 ) | (-0.51) | (0.82 ) |
| $l_{zt}$ | 0.295*** | 0.458*** | 0.544*** | 0.334*** | 0.084 | -0.194 |
| | (81.71) | (18.22) | (14.89) | (3.65) | (0.32) | (-1.09) |
| $s_{zt}$ | -0.319*** | -0.013 | -0.066 | 0.318 | 0.053 | -0.074 |
| | (-6.20) | (-0.29) | (-1.56) | (1.15) | (0.10) | (-0.35) |
| $div_{zt}$ | 0.134*** | 0.229*** | 0.247*** | 0.025*** | 0.076 | -0.166* |
| | (19.17) | (12.06) | (11.29) | (0.32) | (0.36) | (1.67) |
| $comp_{zst}$ | 0.850*** | 0.542*** | 0.617*** | 0.501*** | 0.922*** | 0.969*** |
| | (235.03) | (119.02) | (129.90) | (16.15) | (5.17) | (9.72) |
| $R^2$ | 0.91 | 0.86 | 0.47 | - | - | - |
| Sargan | - | - | - | 15.302 | 21.069 | 15.590 |
| | | | | (0.1214) | (0.0206) | (0.1120) |
| Obs. | 23,210 | 23,210 | 20,579 | 12,793 | 10,217 | 12,793 |

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level.

### A.3 Dynamic regression results by sector

Table A.5: Dynamic regression results for average plant size

| | | manufacturing | | services | |
|---|---|---|---|---|---|
| | | l>20 | all plants | l>20 | all plants |
| $\bar{l}_{zst}$ | t-1 | 0.826*** | 0.625*** | 0.736*** | 0.640*** |
| | | (23.63) | (11.73) | (20.12) | (12.30) |
| | t-2 | 0.035** | 0.049*** | 0.118*** | 0.045*** |
| | | (2.41) | (3.52) | (6.70) | (3.47) |
| $n_{zst}$ | t | -0.423*** | -0.566*** | -0.116*** | -0.578*** |
| | | (-13.22) | (-16.58) | (-3.80) | (-19.83) |
| | t-1 | 0.363*** | 0.414*** | 0.083*** | 0.427*** |
| | | (12.96) | (10.53) | (3.28) | (11.19) |
| | t-2 | -0.030** | -0.001 | -0.009 | 0.001 |
| | | (-2.11) | (-0.02) | (-0.57) | (0.03) |
| $l_{zt}$ | t | 0.384*** | 0.695*** | 0.383*** | 0.681*** |
| | | (3.81) | (5.86) | (5.22) | (7.99) |
| | t-1 | -0.176* | -0.390*** | -0.385*** | -0.401*** |
| | | (-1.82) | (-3.87) | (-5.18) | (-5.17) |
| | t-2 | -0.164** | -0.038 | 0.044 | -0.038 |
| | | (-2.28) | (-0.44) | (0.64) | (-0.62) |
| $s_{zt}$ | t | -0.114 | 0.557* | -0.083 | 0.346 |
| | | (-1.36) | (1.81) | (-1.01) | (1.63) |
| | t-1 | 0.187** | 0.089 | 0.113 | 0.108 |
| | | (2.55) | (0.26) | (1.47) | (0.48) |
| | t-2 | 0.075 | 0.212 | -0.041 | 0.131 |
| | | (0.83) | (0.62) | (-0.47) | (0.55) |
| $div_{zt}$ | t | 0.196*** | 0.343*** | 0.189*** | 0.337*** |
| | | (3.88) | (4.58) | (4.38) | (6.24) |
| | t-1 | -0.108** | -0.203*** | -0.206*** | -0.219*** |
| | | (-2.16) | (-3.14) | (-5.02) | (-4.57) |
| | t-2 | -0.115*** | -0.006 | 0.005 | -0.027 |
| | | (-2.67) | (-0.12) | (0.13) | (-0.73) |
| $comp_{zst}$ | t | -0.162*** | -0.269*** | -0.325*** | -0.218*** |
| | | (-4.90) | (-9.19) | (-13.66) | (-12.45) |
| | t-1 | 0.131*** | 0.171*** | 0.248*** | 0.141*** |
| | | (4.55) | (6.73) | (11.55) | (8.03) |
| | t-2 | 0.017 | 0.008 | 0.055*** | 0.002 |
| | | (1.26) | (0.94) | (4.23) | (0.37) |
| $mono_{zst}$ | t | -0.282*** | -0.249** | -0.146** | -0.256** |
| | | (-5.38) | (-2.11) | (-2.48) | (-2.15) |
| | t-1 | 0.175*** | 0.191*** | -0.016 | 0.201*** |
| | | (4.20) | (3.00) | (-0.39) | (3.02) |
| | t-2 | 0.002 | 0.127* | 0.120*** | 0.122* |
| | | (0.07) | (1.78) | (3.30) | (1.71) |
| Sargan | | 41.2466 | 33.1056 | 52.8678 | 33.0548 |
| | | (0.1535) | (0.4621) | (0.0155) | (0.4646) |
| AC(1) | | -10.66 | -5.1659 | -7.2719 | -5.3156 |
| | | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| AC(2) | | -0.0036 | 0.9219 | -0.0883 | 0.9256 |
| | | (0.9972) | (0.3566) | (0.9297) | (0.3547) |
| Obs. | | 11,757 | 12,500 | 6,212 | 18,772 |

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level.

Table A.6: Dynamic regression results for the number of plants

| | | manufacturing | | services | |
|---|---|---|---|---|---|
| | | l>20 | all plants | l>20 | all plants |
| $n_{zst}$ | t-1 | 0.437*** | 0.566*** | 0.501*** | 0.579*** |
| | | (8.03) | (8.15) | (6.93) | (8.08) |
| | t-2 | 0.008 | 0.007 | -0.022 | 0.002 |
| | | (0.52) | (0.30) | (-0.71) | (0.11) |
| $\bar{l}_{zst}$ | t-1 | 0.145*** | 0.166*** | 0.157*** | 0.173*** |
| | | (5.22) | (6.89) | (3.13) | (7.07) |
| | t-2 | -0.005 | 0.028*** | -0.033 | 0.022** |
| | | (-0.45) | (2.77 ) | (-1.41) | (2.31) |
| | t-3 | 0.035*** | -0.012 | 0.015 | -0.012 |
| | | (2.91) | (-1.01) | (0.75) | (-1.03) |
| $l_{zt}$ | t | 0.362*** | 0.157** | 0.967*** | 0.210*** |
| | | (5.83) | (2.12) | (7.48) | (4.07) |
| | t-1 | -0.227*** | -0.097 | -0.584*** | -0.165*** |
| | | (-3.31) | (-1.18) | (-4.63) | (-2.67) |
| | t-2 | -0.065 | -0.054 | -0.118 | -0.036 |
| | | (-1.10) | (-0.73) | (-1.32) | (-0.66) |
| $s_{zt}$ | t | -0.069 | 0.006 | -0.027 | -0.106 |
| | | (-1.07) | (0.03) | (-0.25) | (-0.69) |
| | t-1 | -0.027 | 0.083 | -0.071 | 0.073 |
| | | (-0.45 | (0.45) | (-0.69) | (0.54) |
| | t-2 | -0.029 | 0.112 | 0.039 | 0.037 |
| | | (-0.42) | (0.55) | (0.40) | (0.25) |
| $div_{zt}$ | t | 0.136*** | 0.013 | 0.496*** | 0.076** |
| | | (3.30) | (0.70) | (7.80) | (2.23) |
| | t-1 | -0.094** | -0.061 | -0.231*** | -0.087** |
| | | (-2.10) | (-1.29) | (-3.18) | (-2.40) |
| | t-2 | -0.016 | -0.006 | -0.030 | 0.013 |
| | | (-0.43) | (-0.12) | (-0.60) | (0.37) |
| $comp_{zst}$ | t | 0.759*** | 0.168*** | 0.523*** | 0.097*** |
| | | (30.15) | (9.63) | (14.41) | (8.82) |
| | t-1 | -0.305*** | -0.046*** | -0.258*** | -0.012 |
| | | (-8.06) | (-2.62) | (-5.02) | (-1.15) |
| | t-2 | -0.006 | -0.001 | 0.033 | 0.003 |
| | | (-0.41) | (-0.07) | (1.30) | (0.49) |
| Sargan | | 52.8703 | 25.4586 | 33.8676 | 28.3345 |
| | | (0.0085) | (0.7468) | (0.3308) | (0.6039) |
| AC(1) | | -8.8652 | -8.0444 | -6.0674 | -8.3096 |
| | | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| AC(2) | | 0.1328 | 0.3216 | 1.2631 | 0.2838 |
| | | (0.8943) | (0.7477) | (0.2066) | (0.7766) |
| Obs. | | 10,058 | 10,710 | 5,317 | 16,086 |

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level.