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The determinants of local employment dynamics in Western Germany

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Contents

Abstract

This paper studies the impact of the local industrial structure on employment dynamics in Western Germany. Following an 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 specialization, diversity, and competition in a region. The analysis is conducted for 24 sectors in the West German labor market regions from 1993 to 2002. Estimation results emphasize the positive influence of diversity on both internal and external employment growth, whereas there is no clear result on specialization. A high degree of competition fosters external employment, but is detrimental to internal employment. Dynamic panel regressions show that static externalities dominate. Importantly, the impact of the local industrial structure on employment dynamics does not differ between small and larger plants, nor are there fundamental differences between Western Germany and France.

Zusammenfassung

Im Zentrum dieses Artikels steht die Frage, wie sich die Art der regionalen Wirtschaftsstruktur auf die Beschäftigungsentwicklung in einer Region auswirkt und welchen zeitlichen Einflüssen diese Zusammenhänge unterliegen. Aufbauend auf einer Studie für Frankreich von Combes/Magnac/Robin (2004) wird das Wachstum der Gesamtbeschäftigung unterteilt in internes Wachstum, das aus Veränderungen in bestehenden Betrieben herrührt, und in externes Wachstum, das durch neu in die Märkte eintretende Betriebe verursacht wird. Die Dynamik beider Komponenten wird mittels eines panel-vektorautoregressiven Modells spezifiziert und mit dynamischen Panelmethoden geschätzt. Als erklärende Variablen, die die regionale Wirtschaftsstruktur charakterisieren, werden Maße für die Spezialisierung, Diversifizierung und das Ausmaß des Wettbewerbs herangezogen. Die Analyse erfolgt für den Zeitraum von 1993 bis 2002 und für 24 Branchen in den westdeutschen Arbeitsmarktregionen. Die Ergebnisse betonen den Einfluss von Diversifizierung und Wettbewerb, wobei statische Externalitäten dominieren. Der Einfluss der regionalen Wirtschaftsstruktur auf die Beschäftigungsentwicklung greift gleichermaßen bei den kleinen wie auch den größeren Betrieben, die Unterschiede zwischen Westdeutschland und Frankreich sind nur gering.

JEL classification: C33, O18, R11

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

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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 geographic proximity provides an environment in which ideas can be exchanged very easily between individuals or firms, knowledge spillovers should consequently be at work in spatially concentrated areas rather than in dispersed regions (see also Jaffe/Trajtenberg/Henderson, 1993).

Despite a widespread consensus on the benefits of agglomeration, there is a great deal of ambiguity surrounding both the nature and the exact spatial scale of these externalities. The question which economic structure is most conducive for regional employment growth has by now been subject to a large body of empirical literature, with contradictory results (see Combes/Overman, 2004 for an overview).[1] Do externalities that work between individuals and firms become effective in a diversified economic environment (the so-called "Jacobs externalities" according to Jacobs, 1969), or is it rather a specialized economic structure that fosters regional employment growth ("Marshall-Arrow-Romer (MAR) externalities")? What role plays local competition? In line with Schumpeter (1942), the existence of MAR-externalities implies that local monopoly is better for growth than local competition, because the former restricts the flow of ideas to others and so allows externalities to be internalized by the innovating plant. By contrast, Porter (1990) provides an alternative theory of technological externalities in arguing that it is just the intensity of local competition that encourages innovation by forcing firms to innovate or to fail ("Porter externalities"). The seminal paper by Glaeser et al. (1992) argues that a local industry thrives if it faces a diversified surrounding economic structure and if the degree of competition is relatively strong, whereas Henderson (1997) and Henderson/Kuncoro/Turner (1995) conclude that own industry specialization is the major employment growth engine.

The question whether a specialized or 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 or in a closely connected set of activities in order to fully exploit scale economies. However, if an industry is subject to Jacobs externalities, in order to thrive it depends on 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. On the other side, these policies seem less appropriate if job creation is primarily fostered by a diversification of the regional economic structure. An additional aspect that should be taken into account is the influence of history. If only the

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[1] Since external economies are by definition shifters of an establishment’s production function, a straightforward way to understand agglomeration economies is to directly test the production function. But because of the challenges associated with that approach, recent studies have begun to examine the impact of the regional economic structure on employment growth instead. The underlying idea is that agglomeration economies enhance productivity and productive regions grow more rapidly as a result.

current economic structure influences regional growth, then regional policies might become effective immediately. If history matters, the impact might be slower, but also longer lasting.

Providing additional insights into the local employment 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 labor market regions between 1984 and 1993. For each component, they allow for different dynamics and determinants. The econometric framework permits to consider the impact of specialization, diversity, and competition on internal and external employment growth separately, whereas conventional approaches only estimate the aggregate impact on total employment. Hence, based on the simultaneous estimation of the dynamics of firm size and the number of firms more effects can be identified than are usually considered in the literature.

By building on the methodological framework of Combes/Magnac/Robin (2004), in this paper I provide detailed evidence on the determinants of local employment growth in Western Germany. The paper entails novel results in several respects. First, 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 dynamics between France and Western Germany, or does the influence of specialization, diversification, and competition hold unanimously for both countries, after all two of the economically largest EU members? Second, by explicitly looking at internal as well as external employment growth it complements the few studies on Germany by Blien/Suedekum (2005), Blien/Südekum/Wolf (2006) or Audretsch/Dohse (2007) that consider aggregate employment only. Providing new insights into the sources of employment effects originating from start-ups as opposed to incumbents, it furthermore connects this field of research to the large body of literature focusing on the regional and sectoral determinants of the formation and survival of new firms (see, for example, Armington/Acs, 2002, Brixy/Grotz, 2007 or Fritsch/Falck, 2007 for Germany). Third, I extend the analysis of Combes/Magnac/Robin (2004) 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 with at least one employee 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 larger plants. The analysis is conducted for 24 sectors from manufacturing, trade, and services for 112 West German labor market regions from 1993 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 estimation results for Western Germany and the comparison with France are 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 empirical 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 stylized 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 labor elasticities are high enough.

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

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

where $\mathbf{y}_{zst} = (\bar{l}_{zst}, n_{zst})'$ is a vector of internal and external employment 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 because, for instance, areas are considered as closed economies facing demand and supply decisions that are unaffected of what happens in the neighboring 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

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

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

Random shocks ε_{1zst} and ε_{2zst} are now uncorrelated and $A_{ij}(L)$ and $B_i(L)$ (*i,j* $= 1, 2)$ 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 introduce dynamic elements into equations (2) and (3) is to assume that random shocks ε_{zst} follow an autoregressive process of order 1,

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

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

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

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

$\bar{l}_{zs,t-l}$ 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 υ_{1zst} and υ_{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 $\upsilon_{1zst} - \overline{\upsilon_{1zs}}$ and $\upsilon_{2zst} - \overline{\upsilon_{2zs}}$, the within-group estimate is biased and inconsistent for T fixed (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:

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

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

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

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 (2SLS) 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. Since the direct comparison between Western Germany and France undertaken in Section 4 should not be distorted by the use of different estimation techniques, I also resort to the 2SLS estimator as well as to the same instruments.[4] In addition, I apply 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 of the Arellano-Bond estimator is the absence of second-order autocorrelation in the first-differenced error terms. Under the assumption of serially uncorrelated υ_{zst}, the first-differenced error terms $\upsilon_{zst} - \upsilon_{zs,t-1}$ follow an MA(1) process, so that the right-hand side variables lagged two and more periods are valid instruments for their specification denoted in equations (7) and (8). Furthermore, it is assumed that the right-hand side variables are weakly exogenous with respect to υ_{zst}, i.e.

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

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

The Arellano-Bond estimator is used as a robustness check for the direct comparison of the two regions in Section 4 and exclusively for the extended database in Section 5.

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

[4] The respective estimation equations and the instrumental variables will be discussed in more detail in Sections 7 and 8.

3 Design of the empirical analysis

3.1 Data issues

The data entering the analysis is taken from the Establishment History Panel (*Betriebs-Historik-Panel* or BHP) that is provided by the German Federal Employment Agency (*Bundesagentur für 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 a reference day (June 30 of each year).[5] 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. All worker employment notifications are compiled under a business number assigned to the plants by the regional labor 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. 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 for France, we aggregate the NUTS3-regions according to labor 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 labor market regions are defined according to the observations of workers' daily commuting patterns. Importantly, this is consistent with the assumption that local growth only depends on local characteristics, because local labor 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]

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[5] 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.

[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

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) that describe 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 can become difficult at this fine level of disaggregation where the number of plants per cell might be very small. The aggregation yields a total of 25,869 cells for Western Germany consisting on average of about 42 plants with roughly 4,000 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, in contrast, a complete view of the local employment and plant creation dynamics can be attained, 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 of the 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 to enable the comparison with France. In a second step, these results are compared with those for all plants as well as those for the small plants with up to 20 employees.

3.2 Dependent variables

The total employment dynamics in a region, $\mathbf{y}_{zst}$, 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} is 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.

1999 onwards, giving way to observations on seven years only. Hence, I resort to earlier data classified according to the WZ73 in order to have the same time span as available as Combes/Magnac/Robin (2004). Because the NES and the WZ73 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 WZ73, does not significantly change the results.

3.3 Explanatory variables

Following both the empirical literature on agglomeration economies and regional growth and Combes/Magnac/Robin (2004), 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. In the empirical framework followed in this study they are reflected in the autoregressive dynamics of equations (7) and (8). Assume for instance that the process is AR(1). The auto-regressive parameter ρ in the series of average plant size (the number of plants) indicates whether the growth of average plant size (the number of plants) is larger if its growth rate has already been larger in the area. Strictly speaking, MAR-externalities 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. Average plant size and the number of plants remain larger in those regions where they have already been larger, but spatial disparities in these variables slowly 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, the two other groups covering the determinants of local employment dynamics are included among the explanatory variables. The second group contains three 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 sectors.

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 the size of plant *i* at time *t*, and I_{zst} denotes the set of all plants operating in area *z* and industry *s* at time *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 for average plant size, $\bar{l}_{zst}$.

Table 1 reports summary statistics for all logged 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 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 for Western Germany. This implies that employment is more dispersed between plants in one sector than in France. Accordingly, 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 in a single plant.

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

Table 1: Summary Statistics for Western Germany and France (>20 employees)

	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

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

The correlations between the variables are reported in the Appendix. First of all, the correlation in levels between average plant size and the number of plants is relatively weak (Table A.1). Second, the larger the two dependent variables, 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 along 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 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. To abstract from size effects, Table A.2 reports correlations between growth rates. They are generally weaker than those in levels. A notable exception is the correlation between the number of plants and average plant size, which becomes both stronger as well as negative.

For the subsequent econometric analysis the mean within period and industry cells is subtracted from all variables, 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

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

4 Comparison between Western Germany and France

This section centers on the direct application of the French approach to the West German labor 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] For both models, I resort to the same estimation technique as Combes/Magnac/Robin (2004) in order to reconstruct their procedure as closely as possible. In addition the results obtained with the Arellano-Bond estimator are included. Since this estimator can be seen as an extension of the 2SLS method proposed by Anderson/Hsiao, it serves as a robustness check of the 2SLS results for Western Germany. Furthermore, these results act as a reference base for Section 5, where the GMM estimation results based on the extended dataset are discussed.

4.1 Average plant size

For average plant size, Combes/Magnac/Robin (2004) adopt a parsimonious specification of equation (7). The estimated model explains $\Delta\bar{l}_{zst}$ by the first differences in the number of plants (n_{zst}) and the independent variables ($\mathbf{x}_{zst}$), and by the differences in these variables and average plant size lagged once:

$$\Delta\bar{l}_{zst} = \rho_1 \Delta\bar{l}_{zs,t-1} + \sum_{l=0}^{1} \alpha_l \Delta n_{zs,t-l} + \sum_{l=0}^{1} \beta_l \Delta\mathbf{x}_{zs,t-l} + \Delta v_{1zst}. \tag{11}$$

The parameters are estimated by instrumental variables using the following values of the right-hand side variables in levels as instruments:

$$\bar{l}_{zs,t-3}, n_{zst}, \mathbf{x}_{zst}, n_{zs,t-1}, \mathbf{x}_{zs,t-1}, n_{zs,t-2}, \mathbf{x}_{zs,t-2}.$$

Table 2 reports the results for France and Western Germany based on the Anderson/Hsiao estimator (2SLS). The results of the Arellano/Bond estimator (GMM) for Western Germany are included in the last column. Since the specification finally adopted for the extended dataset includes two lags of the dependent variable and up to two lags of the right-hand side variables, this structure is also chosen for the plants with more than 20 employees only.[10] Basically all of the GMM regression results corroborate the 2SLS findings for Western Germany.

The degree of specialization within a sector and region clearly plays a role for internal employment growth both for France and Western Germany. The persistence of shocks measured by the estimate of the autoregressive coefficient ρ_1 for the lagged dependent variable $\bar{l}_{zst}$ of 0.192 in the 2SLS case and of 0.804 in the GMM regression is highly significant and positive, but smaller in magnitude compared to France. Since it is smaller

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[9] Static specifications are reported in Tables Tables A.3 and A.4 in the Appendix for a comparison with Combes/Magnac/Robin (2003).

[10] Apart from the facilitated comparison, this specification is the preferred one here as well.

Table 2: Dynamic estimation results for average plant size (>20 employees)

		France		Western Germany			
Method		2SLS		2SLS		GMM	
$\bar{l}_{zst}$	t-1	0.878***	(16.3)	0.192***	(2.64)	0.804***	(27.23)
	t-2	.		.		0.066***	(4.56)
n_{zst}	t	0.281***	(4.9)	-0.228***	(-22.34)	-0.310***	(-11.67)
	t-1	-0.257***	(11.5)	0.101***	(5.89)	0.251***	(11.29)
	t-2	.		.		-0.018	(-1.58)
l_{zt}	t	0.257	(1.6)	0.449***	(10.03)	0.429***	(5.76)
	t-1	-0.237***	(-4.2)	-0.040	(-0.68)	-0.266***	(-3.76)
	t-2	.		.		-0.097*	(-1.75)
s_{zt}	t	-0.093	(0.5)	-0.034	(-0.64)	-0.116*	(-1.78)
	t-1	0.239***	(4.1)	0.061	(1.13)	0.173***	(2.98)
	t-2	.		.		0.051	(0.74)
div_{zt}	t	0.166**	(2.4)	0.191***	(7.19)	0.223***	(5.53)
	t-1	-0.109***	(-4.4)	0.017	(0.54)	-0.150***	(-3.87)
	t-2	.		.		-0.075**	(-2.35)
$comp_{zst}$	t	-0.497***	(-11.9)	-0.276***	(-34.99)	-0.226***	(-9.27)
	t-1	0.529***	(16.3)	0.048**	(2.11)	0.183***	(8.84)
	t-2	.		.		0.031***	(3.07)
$mono_{zst}$	t	-0.002	(-0.1)	-0.204***	(-17.21)	-0.180***	(-3.74)
	t-1	0.072***	(4.9)	-0.053***	(-3.22)	0.077**	(2.14)
	t-2	.		.		0.036	(1.51)
Sargan		.	(0.839)	.		53.585	(0.013)
AC(1)		-0.579	$(< 10^{-5})$	.		-12.242	(0.000)
AC(2)		0.084	$(< 10^{-5})$	.		-0.041	(0.968)
AC(3)		-0.003	(0.57)	.		0.928	(0.408)
Obs.		54,664		15,375		17,969	

***: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level. Significance for France added by the author. Student statistics are reported in parentheses. Time dummies for Western Germany included but not reported.

than one, it gives no evidence for an explosive growth path. Hence, specialization effects in the strict sense are not observed. There is 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 highly significant. Obviously, opposing forces are at work than in France, where this effect is positive. In Western Germany, the number of plants in one sector and area grows more quickly than total employment, while in France, employment growth outweighs the growth in the number of plants. This difference can have various reasons. First, knowledge spillovers that are seen as the driving force for close-by plants to gain in productivity and ultimately employment growth might not be visible in Western Germany. Second, the elasticity of demand might not be large enough, which in the theoretical model is a necessary precondition for productivity shocks to be transferred to employment growth via the underlying economic structure. The direct negative effect that 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. This way, average 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. Faster growing areas might give way to stronger technological spillover effects as well as to a faster growth of intermediate and final goods markets, thus promoting global urbanization externalitites. This finding holds even more for Western Germany than for France and is also supported by Blien/Südekum/Wolf (2006).

Besides global urbanization externalities, Jacobs externalities measured by the degree of the local industrial diversity also matter for internal employment growth in both countries. Among the two indicators, the number of sectors within a region, s_{zt}, is negative and significant only in the GMM results for Western Germany, whereas the concentration of employment between sectors turns out to be highly significant and positive. Obviously, plants are larger the fewer the sectors within a region and the more employment is distributed uniformly across these sectors. In terms of agglomeration forces, this results supports the view that cost and demand linkages extend similarly to all intermediate inputs in one sector, even if the number of these inputs is not necessarily large. As regards pure local externalities, technological spillovers might work across some sectors, but not all. They would rather be maximized within relatively small but evenly balanced sub-groups of similarly sized sectors.

The degree of competition between plants within a sector and region has a pronounced impact on average plant size. $comp_{zst}$ is negative and significant in both regions, indicating that average plant size is larger in a sector if employment is concentrated only in few plants. In spite of the fact that in France labor is employed more often by a monopolist, the existence of a monopoly within a cell ($mono_z st$) has no statistically significant influence, while in Germany this variable is highly significant and negative. Evidently, internal employment growth is maximized if employment within one sector is concentrated among only few plants (but definitely not only on one plant), entailing a low degree of competition.

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 GMM 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 services than in manufacturing. Hence, the impact of specialization, diversity, and competition on average plant size likewise extends in the same way to both the manufacturing and the service sector.

4.2 Number of plants

Like for average plant size, the specification of equation (8) adopted for the comparison with France uses one lag of the dependent variable and up to one lag of the right-hand side variables in differences to explain the growth in the number of plants, Δn_{zst}:

$$\Delta n_{zst} = \sum_{l=1}^{2} \alpha_l \Delta \bar{l}_{zs,t-l} + \rho_1 \Delta n_{zs,t-1} + \sum_{l=0}^{1} \beta_l \Delta \mathbf{x}_{zs,t-l} + \Delta \upsilon_{2zst}, \tag{12}$$

In the results reported in the first two columns of Table 3 the following set of instruments is used:

$$n_{zs,t-3}, \bar{l}_{zs,t-1}, \mathbf{x}_{zst}, \bar{l}_{zs,t-2}, \mathbf{x}_{zs,t-1}, \bar{l}_{zs,t-3}, \mathbf{x}_{zs,t-2}.$$

Like for average plant size, Table 3 displays the results of the 2SLS specification for the number of plants in France and Western Germany and includes the GMM results in the last column. The 2SLS results for Western Germany depart from both the results for France and the GMM results for Western Germany in some respects.[11] Hence, emphasis is put on the GMM results in the following discussion.

Plant growth in period $t-1$ has a positive and significant impact on plant growth in period t. Like for average plant size, this result backs up the importance of specialization effects, but since the coefficient is smaller than one, MAR externalities in the strict sense cannot be observed.

The impact 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, whereas it is detrimental in the case of France. Brixy/Grotz (2007) come to basically the same result in highlighting a negative correlation between the proportion of small firms in a region and new-firm formation in Western Germany.

A positive influence can also be asserted towards the total size of the local market. Like for internal employment, global agglomeration economies that go along with increased demand for goods and services also exist 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, there is no significant impact of diversification emanating from the number of sectors, whereas the degree of diversification between sectors is again positive according to the GMM results. This is consistent with the view that the number of plants would be maximized within evenly balanced sectors, although there is no evidence on the range over which technological spillovers could work.

The degree of competition between plants in one sector clearly differs in its impact on internal and external employment, because now 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 in order to survive.

Sectoral results are reported in Table A.6 in the Appendix. As for average plant size, differences between manufacturing and services arise only with respect to the magnitude of the coefficients, but neither with respect to sign nor to significance. It is worth noting that the

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[11] For the sake of the direct comparison, the 2SLS specification for Western Germany is not altered. Again, the GMM specification reported in Table 3 is the preferred one.

Table 3: Dynamic estimation results for the number of plants (>20 employees)

		France		Western Germany			
Method		2SLS		2SLS		GMM	
n_{zst}	t-1	0.829***	(15.6)	0.715***	(8.09)	0.467***	(9.39)
	t-2	.		.		-0.013	(-0.76)
$\bar{l}_{zst}$	t-1	-0.041*	(-1.7)	5.870***	(11.99)	0.167***	(6.35)
	t-2	0.036***	(5.1)	0.736***	(7.48)	-0.013	(-1.12)
	t-3	.		.		0.027**	(2.29)
l_{zt}	t	0.191*	(1.9)	0.348	(1.34)	0.584***	(8.43)
	t-1	-0.219***	(-6.4)	-2.811***	(-8.00)	-0.378***	(-5.68)
	t-2	.		.		-0.076	(-1.44)
s_{zt}	t	-0.107	(-0.8)	0.200	(0.64)	-0.083	(-1.39)
	t-1	0.092**	(2.4)	0.288	(0.91)	-0.034	(-0.59)
	t-2	.		.		0.014	(0.23)
div_{zt}	t	0.082***	(1.5)	-0.038	(-0.24)	0.268***	(7.09)
	t-1	-0.086***	(-4.5)	-1.294***	(-6.78)	-0.152***	(-3.72)
	t-2	.		.		-0.010	(-0.34)
$comp_{zst}$	t	0.818***	(32.1)	0.438***	(11.85)	0.648***	(25.48)
	t-1	-0.692***	(-16.1)	1.743***	(11.71)	-0.281***	(-8.03)
	t-2	.		.		0.024	(1.43)
Sargan		.	(0.300)	.		54.373	(0.006)
AC(1)		-0.571	$(< 10^{-5})$	.		-9.706	(0.000)
AC(2)		0.062	$(< 10^{-5})$	.		1.573	(0.116)
AC(3)		-0.001	(0.91)	.		-0.146	(0.884)
Obs.		54,664		12,793		15,375	

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. Significance levels for France added by the author. Student statistics are reported in parentheses. Time dummies included but not reported.

impact of the local market size is considerably higher for the service sector than for manufacturing. Global agglomeration externalities seem to foster in a special way the number of service plants. Similar to the findings presented here, Fritsch/Falck (2007) emphasize 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.

5 Extending the dataset

This section goes one step beyond the direct comparison that Section 4 focused on and extends the data sample for Western Germany over all plants employing at least one person subject to social security contributions. 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 low increase in the number of sectors per region. Hence, the greatest changes occur for those variables where the number of plants plays a major role, i.e. $\bar{l}_{zst}$ and n_{zst}. Summary statistics for all plants in Table 4 show that the average value of plant size (in logs) decreases distinctly from 4.42 to 2.78, whereas the log of 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 sectors are occupied, resulting in almost no variation of s_{zt}.

Table 4: Summary Statistics for Western Germany (all plants)

	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

All values are in logs. n=26,839.

5.1 Average plant size

After testing several GMM specifications of equation (7) for average plant size in Western Germany, the one finally adopted includes two lags of the dependent variable and up to two lags of the right-hand side variables:[12]

$$\Delta\bar{l}_{zst} = \sum_{l=1}^{2}\rho_l\Delta\bar{l}_{zs,t-l} + \sum_{l=0}^{2}\alpha_l\Delta n_{zs,t-l} + \sum_{l=0}^{2}\beta_l\Delta\mathbf{x}_{zs,t-1} + \Delta\upsilon_{1zst}, \tag{13}$$

The dynamic regression results of specification (13) for average plant size are reported in Table 5. In order to facilitate the comparison with the restricted data, the GMM results from Table 2 are listed in the last column. First of all, specification statistics as reported by the Sargan test improve dramatically compared to the consideration of only the larger plants. Second, although the two dependent variables undergo 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, s_{zt}, becomes nonsignificant for explaining average plant size. Otherwise, the estimates remain stable with respect to sign and significance. The impact of most of the explanatory variables becomes even stronger in absolute terms, as is the case for the number of plants, local market size, diversity, and the existence of a monopoly.

Last, the impact of the variables remains nonsignificant with a time lag of two or more periods. This finding supports the view that is is rather the current than some historical economic environment that influences the dynamics in average plant size. This remarkably robust relationship between the underlying economic structure and internal employment is backed by separate regressions on the small plants with up to 20 employees only. Apart from the existence of a monopoly turning to insignificance as well, there are only minor changes with respect to the magnitude of the coefficients.[13]

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[12] 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.

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

Table 5: Dynamic estimation results for average plant size

		Western Germany			
		all plants		> 20 employees	
$\bar{l}_{zst}$	t-1	0.638***	(12.28)	0.804***	(27.23)
	t-2	0.045***	(3.45)	0.066***	(4.56)
n_{zst}	t	-0.579***	(-19.83)	-0.310***	(-11.67)
	t-1	0.427***	(11.18)	0.251***	(11.29)
	t-2	0.001	(0.02)	-0.018	(-1.58)
l_{zt}	t	0.674***	(7.87)	0.429***	(5.76)
	t-1	-0.396***	(-5.12)	-0.266***	(-3.76)
	t-2	-0.034	(-0.55)	-0.097*	(-1.75)
s_{zt}	t	0.346	(1.63)	-0.116*	(-1.78)
	t-1	0.109	(0.48)	0.173***	(2.98)
	t-2	0.130	(0.55)	0.051	(0.74)
div_{zt}	t	0.333***	(6.17)	0.223***	(5.53)
	t-1	-0.217***	(-4.52)	-0.150***	(-3.87)
	t-2	-0.025	(-0.68)	-0.075**	(-2.35)
$comp_{zst}$	t	-0.218***	(-12.45)	-0.226***	(-9.27)
	t-1	0.140***	(8.02)	0.183***	(8.84)
	t-2	0.002	(0.37)	0.031***	(3.07)
$mono_{zst}$	t	-0.257**	(-2.15)	-0.180*	(-3.74)
	t-1	0.202***	(3.03)	0.077**	(2.14)
	t-2	0.121	(1.69)	0.036	(1.51)
Sargan		33.004	(0.467)	53.585	(0.013)
AC(1)		-5.314	(0.000)	-12.242	(0.000)
AC(2)		0.927	(0.354)	-0.041	(0.968)
AC(3)		-1.045	(0.296)	0.928	(0.408)
Obs.		18,772		17,969	

***: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level. Student statistics are reported in parentheses. Time dummies included but not reported.

5.2 Number of plants

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

$$\Delta n_{zst} = \sum_{l=1}^{3} \alpha_l \Delta \bar{l}_{zs,t-l} + \sum_{l=1}^{2} \rho_l \Delta n_{zs,t-l} + \sum_{l=0}^{2} \beta_l \Delta \mathbf{x}_{zs,t-1} + \Delta \upsilon_{2zst}, \qquad (14)$$

Results for the number of plants based on the extended database are displayed in Table 6, with a comparison of the results based on the restricted database in the last column. Again, the model yields better specification statistics when all plants are included. Since the vast majority of the newly founded plants is small and remains small in the case of survival,[14] it might well be the case that the overall results would change due to a differing impact of the underlying economic structure. On the other side, it could be argued that because of

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[14] Schindele/Weyh (2009) 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, accordingly giving way to high exit rates. The majority of the surviving plants stays small.

the low survival rates of new firms their inclusion does not influence the overall results in any significant way but rather constitutes "white noise". Indeed, like for average plant size, there is not much change with regard to the restricted dataset except for the magnitude of the estimates. Notably market size, diversity and competition exert a weaker influence on the change in the number of all plants. As for internal employment, separate regressions on the small plants only indicate slight differences in the magnitude, but neither in significance nor in size of the estimates as compared to the larger plants.

Table 6: Dynamic estimation results for the number of plants

		Western Germany			
		all plants		> 20 employees	
n_{zst}	t-1	0.579***	(8.05)	0.467***	(9.39)
	t-2	0.003	(0.13)	-0.013	(-0.76)
$\bar{l}_{zst}$	t-1	0.173***	(7.06)	0.167***	(6.35)
	t-2	0.022**	(2.32)	-0.013	(-1.12)
	t-3	-0.012	(-1.03)	0.027**	(2.29)
l_{zt}	t	0.206***	(3.98)	0.584***	(8.43)
	t-1	-0.163***	(-2.64)	-0.378***	(-5.68)
	t-2	-0.033	(-0.62)	-0.076	(-1.44)
s_{zt}	t	-0.106	(-0.69)	-0.083	(-1.39)
	t-1	0.074	(0.54)	-0.034	(-0.59)
	t-2	0.036	(0.24)	0.014	(0.23)
div_{zt}	t	0.073**	(2.16)	0.268***	(7.09)
	t-1	-0.086**	(-2.37)	-0.152***	(-3.72)
	t-2	0.014	(0.40)	-0.010	(-0.34)
$comp_{zst}$	t	0.097***	(8.82)	0.648***	(25.48)
	t-1	-0.012	(-1.15)	-0.281***	(-8.03)
	t-2	0.003	(0.50)	0.024	(1.43)
Sargan (p-value)		28.259	(0.608)	54.373	(0.006)
AC(1)		-8.281	(0.000)	-9.706	(0.000)
AC(2)		0.272	(0.786)	1.573	(0.116)
AC(3)		-0.128	(0.898)	-0.146	(0.884)
Obs.		16,086		15,375	

***: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level. Student statistics are reported in parentheses. Time dummies included but not reported.

5.3 Long-run effects

The results on Western Germany based both on the restricted data as well as on all plants support the view that the impact of specialization, diversity, and competition seems to be of a contemporaneous nature rather than rooted in history. However, I also check if there is a long-run impact. Given the specifications (13) and (14), the long-run effects on employment growth can be determined by computing for each independent variable the following coefficient $\delta*$ (see also Blien/Südekum/Wolf, 2006):

$$\delta* = \frac{\sum_{l=0}^{3} \delta_l}{1 - \sum_{\rho=1}^{2} \rho_p}, \tag{15}$$

where δ_l are the coefficients for the lagged right-hand side variables n_{zst} ($\bar{l}_{zst}$) and $\mathbf{x}_{zst}$ and ρ_p for the lagged dependent variable $\bar{l}_{zst}$ (n_{zst}). The long-run results are reported in Table 7, with p-values for the significance of the coefficients in parentheses.

Table 7: Long-run effects

	average plant size ($\bar{l}_{zst}$)	number of plants (n_{zst})
$\bar{l}_{zst}$	.	0.438***
	.	(0.001)
n_{zst}	-0.478***	.
	(0.000)	.
l_{zt}	0.769***	0.022
	(0.000)	(0.879)
s_{zt}	1.846	0.010
	(0.144)	(0.988)
div_{zt}	0.287*	0.002
	(0.057)	(0.985)
$comp_{zst}$	-0.238***	0.208***
	(0.000)	(0.000)
$mono_{zst}$	-0.207	.
	(0.644	.

Overall, average plant size appears to be influenced by the long-run impact of the underlying economic structure to a larger extent than the number of plants. Interestingly, global urbanization externalities that are linked to the size of the local market are conducive for internal employment growth only. The positive and significant influence of total market size on the number of plants obviously holds only in the short run. Diversity measured by the distribution of local employment across sectors (div_{zt}) is weakly significant and positive for average plant size, suggesting that internal employment growth is enhanced by a diversified economic structure also in the longer run.

A high growth rate of the number of plants as well as a high degree of competition between plants in a sector and region have a significantly negative long-run impact on average plant size. Clearly, internal employment prospers in an economic environment that is characterized by low net plant creation and by a low degree of competition. On the other hand, external employment modeled by the number of plants is positively influenced by competition also in the long run, which again can be taken as evidence for the existence of Porter externalities. In addition, it is fostered by large average plant size.

6 Conclusions

The way the economic structure in a region is set up has a decisive influence on local employment dynamics. A comparison of the results on Western Germany with those on France makes clear that regarding the impact of specialization, diversity, and competition the same fundamental relationship holds between the economic structure and internal and external employment growth. Importantly, in spite of many differences regarding labor market policies and historical developments in the respective economies, opposing forces are at work only with respect to the influence of the number of plants on average plant size and vice versa.

By looking in depth at internal and external employment growth in Western Germany, the results contributes to a refined understanding of the way the local industrial composition is connected with the ability of a region to generate employment. Table 8 provides a condensed summary of the results for Western Germany. The evidence presented allows no clear-cut conclusion as to the existence of positive spillover effects that result from the degree of specialization. MAR-externalities in the strict sense cannot be observed, but there is a positive path-dependency, i.e. the growth in internal and external employment remains larger if it has already been larger in the past. Results are clear, on the contrary, to the impact of diversity on $\bar{l}_{zst}$ and n_{zst}. First, global agglomeration externalities that are captured by the size of the local market are at work for both sources of employment generation. Second, a diversified economic structure with evenly-sized sectors enhances the inter-sectoral exchange of ideas between individuals or plants, thus giving way to productivity and employment gains. A fundamental difference regarding the promotion of internal and external employment can be ascribed to the degree of competition. A high degree of competition is detrimental for the growth of average plant size, but it is beneficial for the growth in the number of plants. All these results hold also separately for manufacturing and services. Additionally, the long-run effects emphasize that static externalities are prevalent compared to dynamic ones. Hence, interventions that influence the local economic structure will rather have a fast impact on employment growth, but might not be long-lasting.

Table 8: Summary of the results for Western Germany (all plants)^a

		GMM results		long-run effects	
		$\bar{l}_{zst}$	n_{zst}	$\bar{l}_{zst}$	n_{zst}
specialization	$\bar{l}_{zs,t-1}$	+	+		+
	n_{zst}	-		-	
	$n_{zs,t-1}$		+		
diversity	l_{zt}	+	+	+	
	s_{zt}				
	div_{zt}	+	+	+	
competition	$comp_{zst}$	-	+	-	+
	$mono_{zst}$	-			

a: Only significant results are reported.

A third important conclusion emerges from extending the dataset for Western Germany. Including the smaller plants with less than 21 employees that after all constitute almost 90 percent of all plants does not change the results in any major way. This provides strong evidence that internal and external employment dynamics among the smaller plants are subject to the same determinants considered in the approach followed here than the employment growth among the larger plants.

Based on the results on Western Germany, important policy-recommendations can be derived. The local economic structure most conducive to employment growth would first of all be embedded in a large market. Furthermore, it would be diversified, with sectors of roughly the same size. Since the regression results show no difference in the impact of these determinants on average plant size and the number of plants, firm consolidation policies and firm creation policies would coincide in these respects. However, they would diverge diametrically when it comes to the role of competition. If internal employment is to be supported, then the role of economic policy should consist in restricting competition within a sector, whereas economic policy should support a high degree of competition if external employment dynamics are to be fostered. This potential conflict of interest is aggravated by the equally diverging and highly significant long-run results on the effect of competition.

With respect to the theoretical basis of the empirical approach undertaken in this paper, some words of caution are advisable. 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. In this spirit, further research could consist in explicitly evaluating the spatial extent to which agglomeration forces operate. In fact, Schanne/Weyh (2009) detect significant spatial correlation in firm formation rates across the German NUTS3-regions.

An additional line of research could lie in considering 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. Further research on these issues could contribute to an even more refined understanding of the linkages between the underlying economic structure and regional employment growth.

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A Appendix

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

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		Δ	L	Δ	Δ
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		Δ	L	Δ	Δ
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.

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***	0.623***	0.736***	0.678***
		(23.49)	(11.71)	(20.10)	(11.60)
	t-2	0.034**	0.048***	0.118***	-0.005
		(2.39)	(3.49)	(6.71)	(-0.30)
n_{zst}	t	-0.423***	-0.568***	-0.115***	-0.507***
		(-13.25)	(-16.86)	(-3.77)	(-15.82)
	t-1	0.363***	0.413***	0.083***	0.369***
		(12.97)	(10.53)	(3.26)	(9.13)
	t-2	-0.029**	-0.001	-0.009	-0.003
		(-2.05)	(-0.03)	(-0.58)	(-0.12)
l_{zt}	t	0.371***	0.684***	0.387***	0.640***
		(3.67)	(5.74)	(5.26)	(9.42)
	t-1	-0.175*	-0.381***	-0.385***	-0.349***
		(-1.82)	(-3.80)	(-5.13)	(-4.45)
	t-2	-0.154**	-0.032	0.039	-0.048
		(-2.16)	(-0.36)	(0.58)	(-0.87)
s_{zt}	t	-0.113	0.558*	-0.083	0.071
		(-1.34)	(1.81)	(-1.00)	(0.44)
	t-1	0.183**	0.091	0.115	0.028
		(2.49)	(0.27)	(1.49)	(0.19)
	t-2	0.076	0.209	-0.040	0.213
		(0.84)	(0.62)	(-0.46)	(-1.01)
div_{zt}	t	0.190***	0.337***	0.191***	0.300***
		(3.76)	(4.50)	(4.41)	(7.24)
	t-1	-0.108**	-0.199***	-0.206***	-0.177***
		(-2.14)	(-3.08)	(-4.98)	(-3.87)
	t-2	-0.110**	-0.003	0.003	-0.061*
		(-2.57)	(-0.07)	(0.09)	(-1.88)
$comp_{zst}$	t	-0.162***	-0.269***	-0.325***	-0.158***
		(-4.92)	(-9.19)	(-13.69)	(-16.47)
	t-1	0.131***	0.170***	0.248***	0.102***
		(4.57)	(6.71)	(11.56)	(8.59)
	t-2	0.017	0.009	0.055***	-0.001*
		(1.23)	(0.95)	(4.25)	(-1.90)
$mono_{zst}$	t	-0.281***	-0.250**	-0.145**	.
		(-5.35)	(-2.12)	(-2.45)	
	t-1	0.175***	0.192***	-0.016	.
		(4.17)	(3.03)	(-0.39)	
	t-2	0.002	0.124*	0.120***	.
		(0.08)	(1.75)	(3.29)	
Sargan		41.475	33.019	53.013	58.745
		(0.148)	(0.466)	(0.015)	(0.004)
AC(1)		-10.055	-5.167	-7.268	-4.416
		(0.000)	(0.000)	(0.000)	(0.000)
AC(2)		-0.012	0.924	-0.072	0.547
		(0.991)	(0.356)	(0.943)	(0.584)
Obs.		11,757	12,500	6,212	6,272

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level. Time dummies included but not reported. $mono_{zst}$ dropped in the last column because of collinearity.

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

		manufacturing		services	
		l>20	all plants	l>20	all plants
n_{zst}	t-1	0.437^{***}	0.565^{***}	0.501^{***}	0.208^{**}
		(8.02)	(8.11)	(6.92)	(2.03)
	t-2	0.008	0.007	-0.023	$-.0.044^{**}$
		(0.55)	(0.33)	(-0.74)	(-2.46)
$\bar{l}_{zst}$	t-1	0.146^{***}	0.166^{***}	0.158^{***}	0.116^{***}
		(5.23)	(6.87)	(3.17)	(4.72)
	t-2	-0.005	0.028^{***}	-0.032	-0.009
		(-0.45)	(2.78)	(-1.37)	(-0.73)
	t-3	0.035^{***}	-0.012	0.016	0.026^{***}
		(2.91)	(-0.98)	(0.76)	(2.74)
l_{zt}	t	0.356^{***}	0.150^{**}	0.974^{***}	0.293^{***}
		(5.72)	(2.03)	(7.52)	(6.07)
	t-1	-0.223^{***}	-0.093	-0.578^{***}	-0.138^{**}
		(-3.25)	(-1.14)	(-4.58)	(-1.97)
	t-2	-0.064	-0.051	-0.125	0.003
		(-1.09)	(-0.69)	(-1.40)	(0.08)
s_{zt}	t	-0.069	0.009	-0.026	-0.117
		(-1.06)	(0.04)	(-0.24)	(-0.96)
	t-1	-0.027	0.083	-0.071	0.015
		(-0.45)	(0.45)	(-0.68)	(0.12)
	t-2	-0.028	0.112	0.040	0.125
		(-0.40)	(0.54)	(0.41)	(1.00)
div_{zt}	t	0.133^{***}	0.028	0.500^{***}	0.148^{***}
		(3.22)	(0.70)	(7.86)	(4.87)
	t-1	-0.092^{**}	-0.059	-0.228^{***}	-0.089^{**}
		(-2.05)	(-1.25)	(-3.14)	(-2.49)
	t-2	-0.015	-0.004	-0.033	0.015
		(-0.42)	(-0.09)	(-0.66)	(0.64)
$comp_{zst}$	t	0.758^{***}	0.167^{***}	0.524^{***}	0.028^{***}
		(30.06)	(9.61)	(14.43)	(5.71)
	t-1	-0.305^{***}	-0.046^{***}	-0.259^{***}	0.017^{***}
		(-8.05)	(-2.61)	(-5.04)	(3.79)
	t-2	-0.006	-0.001	0.034	0.001
		(-0.42)	(-0.06)	(1.34)	(0.43)
Sargan		52.499	25.418	33.787	46.521
		(0.009)	(0.748)	(0.334)	(0.036)
AC(1)		-8.874	-8.010	-6.029	-3.113
		(0.000)	(0.000)	(0.000)	(0.002)
AC(2)		0.124	0.308	1.283	-0.574
		(0.901)	(0.758)	(0.200)	(0.566)
Obs.		10,058	10,710	5,317	5,376

**: significant at the 1 percent level, **: significant at the 5 percent level, *: significant at the 10 percent level.
Time dummies included but not reported.

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