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Job Turnover, Risk Sharing, and Regional Wages in Western Germany

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Abstract

We test Krugman's (1991) notion of risk sharing in pooled labor markets as one of the micro-foundations of agglomeration economies, i.e. we examine whether firms share risks from idiosyncratic and sector specific shocks through labor pooling. Estimating wage functions we find that job turnover depresses wages at the regional and the firm level, indicating that firms incur significant adjustment costs when experiencing productivity shocks. On the regional level, industrial specialization and diversification mitigate wage depressing effects of different types of employment shocks. On the firm level, shock intensive firms are found to be more productive when being located in spatial proximity to firms with large but opposite employment shocks. Both findings provide evidence that labor pooling matters as a source of agglomeration economies by allowing firms to share employment risks. However, we find only weak evidence for shock intensive industries to be more concentrated, suggesting that agglomeration costs exceed the benefits from risk sharing.

Keywords: Marshallian Externalities, Labor Pooling, Specialization, Idiosyncratic Shocks
JEL Categories: R12, R30, J31, J63

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I. Introduction: Job Turnover, Risk Sharing, and Regional Wages

> *"A localized industry gains a great advantage from the fact that it offers a constant market for skill. [...] The owner of an isolated factory, even if he has access to a plentiful supply of general labour, is often put to great shifts for want of some special skilled labour. [...] The advantages of variety of employment are combined with those of localized industries in some of our manufacturing towns, and this is a chief cause of their continued growth."*
>
> Alfred Marshall (1890), *Principles of Economics*, IV.X.9-11.

Paul Krugman's (1991, p.2) famous insight that economic activity is remarkably concentrated in space applies to Germany as it does to all other countries investigated yet (see e.g. Holmes/Stevens 2004 for the USA). About 44 percent of all workers are employed in core cities with more than 100.000 inhabitants, which together comprise only 5 percent of the landmass while only about 16 percent work in rural counties, which together make up over 36 percent of the West German territory. Benefits from agglomeration manifest themselves in higher urban profits and wages with the latter usually being referred to as the urban wage premium. Alfred Marshall (1890) provides the earliest categorization of the economic sources of agglomeration, naming labor market interactions, market linkages, and knowledge spillovers as core mechanisms through which proximity in economic exchange unfolds benefits for workers and firms alike. A broad range of studies have investigated the relative importance of either of these sources and found each of them to contribute to the economic benefits rooted in the agglomeration of economic activity (see e.g. Rosenthal/Strange 2001).

As Duranton/Puga (2004) have pointed out, however, this 'Marshallian triplet' is not a particularly useful taxonomy for economists since although it correctly categorizes the sources of agglomeration economies, i.e. spatial proximity between people, goods, or ideas, it does not differentiate adequately between the underlying microeconomic mechanisms. Duranton/Puga therefore propose to classify agglomeration economies along the lines of sharing, matching, and learning as core mechanisms through which economic density unfolds benefits for economic actors. With respect to benefits arising from labor market interactions it is our perception that the majority of existing empirical studies have up to now not adequately differentiated between improved matching opportunities between firms and workers, and improved risk sharing opportunities in the face of idiosyncratic shocks as underlying mechanisms of labor pooling effects (see Rosenthal/Strange 2004). Of the few studies which have differentiated between matching and sharing mechanisms most have investigated the impact of labor market size on matching quality between workers and firms. Helsley/Strange (1990) and Kim (1990) show that increased matching quality and lower training costs increase productivity and wages in larger labor markets. In contrast, the extent to which firms benefit from risk sharing opportunities in a pooled labor market has up to now remained largely unexplored. The concept of risk sharing through labor pooling is based on the idea that larger labor markets allow firms and workers to smoothen employment shocks since it is easier for workers to find a new job when laid off, while firms at the same time face less difficulties in hiring or dismissing workers. As made explicit in Krugman's (1991) labor pooling model, the opportunity of risk sharing through pooled labor markets has an impact on wages because firms can efficiently adjust employment to their optimal level of production and thereby maximize productivity. While some studies have carried the theoretical modeling further (Stahl/Walz 2001, Gerlach/Ronde/Stahl 2005), Overman/Puga (2008) provide to our knowledge the only empirical investigation on the role of risk sharing as a mechanism of agglomeration. Aiming to shed light on the importance of labor pooling as an agglomeration mechanism the present paper is closely related to their study. However, while Overman/Puga approach the question by investigating whether shock intensive industries are more heavily concentrated, we aim to shed light on risk sharing effects by analyzing whether shock intensive industries in pooled labor markets are more productive, i.e. pay higher wages, than shock intensive industries in thin labor markets. In our investigation we borrow from insights and methods developed in two closely related literatures which we briefly introduce here.

The literature on job turnover starting with Dunne/Roberts/Samuelson (1989) and Davis/Haltiwanger (1992) shows that the intensity of job creation and destruction differs remarkably between regions, industries, and over time. Similarly, substantial differences have been found with respect to job turnover of different types of firms (Boeri 1994, Boeri/Cramer 1992). Since the intensity of job turnover can be interpreted as a measure of shock intensity as we do in our analysis below, studies on differences in job creation and destruction provide valuable insight into the spatial, sectoral, and temporal distribution of labor market shocks, as well as on the types of firms most affected.[1] Faberman (2002, 2008) shows for the US that dense regions are characterized by more pronounced labor market shocks arising from a younger distribution of establishments. The only study on regional job turnover in Germany (Cramer/Koller 1988) confirms that shock intensity decreases with firm age. However, contrary to the US, the intensity of labor market shocks is found to be lower in agglomerated regions. Employing measures and indicators from the literature on job turnover we build on these insights by investigating how shock intensities have developed between regions, sectors, and over time, as well as between different types of firms, in order to subsequently analyze whether shock intensive industries are more productive in pooled labor markets.

The second literature which we think is closely related to our analysis is the literature on industrial clustering starting with Henderson (1986). The core question addressed here is whether firms predominantly profit from either regional specialization or regional diversification of economic activity. This question is relevant with respect to labor pooling as a risk sharing device since with different types of risk firms may prefer a specialized or diversified labor market, depending on whether risk is pooled most efficiently within or across industries. Results on whether firms benefit primarily from specialization or from diversification have remained ambiguous in the literature on industrial clustering. We take a fresh look on the issue by investigating the productivity effects from specialization and diversification in the face of idiosyncratic and sector specific shocks.

[1] Interestingly, while the closely related literature on the turnover of workers has repeatedly linked worker turnover to matching quality and matching externalities (see e.g. Burgess/Lane/Stevens 2000 and Finney/Kohlhase 2008), a link between job turnover and risk sharing has up to now not been provided by the literature on the turnover of jobs.

Summing up, the core objective of this paper is to shed light on the extent to which pooled regional and sectoral labor markets increase productivity and wages by serving as a means for firms to share risks from sectoral and idiosyncratic shocks. Our analysis is thus firmly rooted in the tradition of studies investigating the microeconomic foundations of agglomeration economies. We do, however, borrow heavily from methodological developments and general insights made in the literatures on job turnover and on industrial clustering. Section II provides the economic model, derives an empirical specification, and defines the core indicators and variables. Section III investigates the existence of risk sharing through labor pooling on the sectoral and firm level. Focusing on highly qualified workers we find that regional as well as firm specific wages decrease significantly with the intensity of labor market shocks. Firms experiencing the same intensity of idiosyncratic (sector wide) shocks are, however, substantially more productive when locating in diversified (specialized) labor markets, providing evidence for benefits arising from the opportunity to share risk through labor pooling. In Section IV we investigate whether industries experiencing larger shocks tend to agglomerate more heavily. Though we find evidence for clustering intensity being related to shock intensity, the spatial distribution of industries is stable over time suggesting that incentives for further concentration are not strong enough to overcome the cost of movement.

II. Economic Model, Econometric Specification, and Indicators

2.1. The Model

The idea of local risk sharing through labor pooling famously developed by Alfred Marshall has been formalized by Krugman (1991). In line with Overman/Puga (2008) we extend the Krugman model by adding a sectoral and a regional dimension and by, in accordance with Ellison/Fudenberg (2003), treating location and production as a two-stage game. In addition, we introduce adjustment costs incurred by firms when increasing or decreasing employment after a productivity shock. In the first stage, a discrete number of firms i=1,..,i,..,I and a continuous number of workers in sector s choose their location among a discrete number of regions r=1,..,r,..,R with I being strictly larger than R. s is distributed discretely between 1 and S and is strictly smaller than R. In the second stage, firms are hit by a two different types of productivity shock and thereupon determine their optimal level of production. One of these productivity shocks, $\tau_s \in [-\varepsilon, \varepsilon]$, is of the same size ε for all firms in a sector in a region and hits these either positively or negatively. This shock represents constant intra-sectoral competition between firms with some firms pulling ahead in one period and falling back in another. Since τ_s affects all firms with the same intensity $|\varepsilon|$ we term it a homogenous shock. τ_i is, in contrast, an idiosyncratic shock which follows a constant distribution $[\mu, \sigma]$ and is uncorrelated between firms. Since τ_i represents changes in productivity unique to each firm we refer to it as a heterogeneous shock. Both shocks do not only alter productivity, but also impose costs c on firms. These costs can be thought of as adjustment costs incurred by firms when determining their optimal level of employment in reaction to productivity shocks. Adjustment costs are the same for both types of shocks, and the overall level of such costs increases with the level of shock by which a firm has been hit. Firms produce under decreasing returns to scale. Their profit function is thus given by

$$\pi_i = [\beta + \tau_i + \tau_s]l_i - \frac{1}{2}\gamma[l_i]^2 - wl_i - (\tau_i + \tau_s)cl_i \tag{1}$$

Hit by two productivity shocks firms decide on how much labor to hire in order to maximize profits. When adjusting to their optimal level of production firms recruit workers from the intra-sectoral labor market in their region and take wages in this labor market as given. Labor demand in firm i can therefore be expressed as

$$l_i = \frac{\beta - w + \tau_i + \tau_s - (\tau_i + \tau_s)c}{\gamma} \tag{2}$$

Summing over all firms N in a sector in a region and assuming that sectoral labor markets in a region clear, (2) can be rewritten as

$$L = \sum_{i=1}^{N} l_i = \frac{\beta - w + \sum_{i=1}^{N}(1-c)\tau_i + \sum_{i=1}^{N}(1-c)\tau_s}{\gamma} \tag{3}$$

Dividing by N and solving for the sectoral wage level in a region w yields

$$w = \beta - \gamma\frac{L}{N} + \frac{1-C}{N}\sum_{i=1}^{N}\tau_i + \frac{1-C}{N}\sum_{i=1}^{N}\tau_s \tag{4}$$

Taking expected values leaves us with

$$E(w) = \beta - \gamma\frac{L}{N} + \frac{1-C}{N}\mu \tag{5}$$

The essential insight from the model is that wage levels are a function of firm agglomeration N, the sum of homogenous and heterogeneous shocks, and the size of adjustment costs C. Increasing the number of firms in a region influences wages in two ways. One is the effect arising from decreasing returns to scale, i.e. firms produce on a lower scale and therefore are more productive. In addition, the number of firms mitigates the wage effects from homogenous and heterogeneous shocks inasmuch as it smoothes both the 'pure' productivity effect of unknown direction, and the wage depressing effect of adjustment costs. The impact of shocks on wages depends on their distribution and on the level of adjustment costs. While the expected value for the sum of homogenous shocks takes on a value of zero by assumption, we make no further assumptions on the distribution of heterogeneous shocks here. If the expected value of heterogeneous productivity shocks is positive and with adjustment costs larger than one, the overall impact of productivity shocks turns negative. Expressing the wage consequences of productivity shocks as a function of agglomeration the model captures the core idea of risk sharing through labor pooling. It shows that with sufficiently large adjustment costs or with a sufficiently dispersed distribution of shocks firms benefit from a large number of other firms in the same sector since having access to a large shared labor market allows them to pool risks arising from productivity shocks. With productivity benefits from labor pooling depending on the distribution of homogenous and heterogeneous shocks, on the size of adjustment costs, and on the number of economic actors, the model raises three empirical questions. First, what does the distribution of homogenous and heterogeneous shocks look like, and what inference can we draw on the size of adjustment costs? Secondly, does the number of firms in a sector have an influence on regional productivity by allowing firms to more efficiently adjust to new levels of employment in the face of homogenous and heterogeneous shocks? Thirdly, what is the geographical and sectoral scale of labor market that firms tap in order to smooth shocks and benefit from labor pooling effects?

2.2. Indicators and Econometric Specification

Based on this model we develop an econometric specification enabling us to identify the extent to which regional and firm-specific wages are influenced by risk sharing effects arising from pooled labor markets. Modeling the shock intensity of a sector in a region we resort to the instruments readily provided by the literature on job turnover. The idea that job turnover equals the sum of job creation and job destruction is one of the core concepts employed in that literature. We adopt this notion and interpret job turnover within a sector in a region, i.e. the sum of region-sectoral job creation and destruction, as the overall shock intensity of a sector in a region. Thus, an observed sectoral job destruction rate of ten percent in a region combined with a creation rate of, say, fifteen percent would make us infer an overall shock intensity of twenty-five percent. In accordance with our model we decompose overall shock intensity into aggregate homogenous and heterogeneous shock intensity. We model the aggregate intensity of homogenous shocks in a sector in a region as the overlap between job creation and job destruction rates, i.e. in line with our model aggregate homogenous shocks equal the number of jobs turned over between firms within a sector in a region. Conversely, heterogeneous shocks embody the asymmetric part of job turnover, i.e. that part of job creation which is not mirrored in job destruction. With positive aggregate heterogeneous shocks firms have to resort to other sectors in order to satisfy their employment needs, while with negative aggregate heterogeneous shocks firms contribute to labor pools outside their own sector. The following formal description will clarify the intuition behind our approach.

In line with the methodology proposed by Davis/Haltiwanger/Schuh (1996) we define the job creation rate in region r in sector s at time t as the sum of jobs created by all firms i in sector s in region r at time t as a share of the average employment in sector s in region r between time t and t-1.

$$JC_{r,s,t} = \frac{\sum_i \Delta E^{+}_{i,r,s,t}}{((\sum_i E_{i,r,s,t} + E_{i,r,s,t-1})/2)} \qquad (6)$$

Analogously, we define the region-sectoral job destruction rate as the sum of absolute values of job destroyed in region r in sector s at time t as a share of average past and present region-sectoral employment.[2]

$$JD_{r,s,t} = \frac{\sum_i |\Delta E^-_{i,r,s,t}|}{((\sum_i E_{i,r,s,t} + E_{i,r,s,t-1})/2)} \tag{7}$$

The region-sectoral gross job reallocation rate is equal to the sum of region-sectoral job creation and destruction weighted by average region-sectoral employment (Davis/Haltiwanger 1999). This gross reallocation rate can legitimately be regarded as an indicator for the overall shock intensity of a sector in a region since by adding up employment adjustments across all firms it aggregates firm level employment shocks to the region-sectoral level and thereby indicates the average intensity of adjustment.

$$GJR_{r,s,t} = \frac{\sum_i |\Delta E^-_{i,r,s,t}| + \sum_i \Delta E^+_{i,r,s,t}}{((\sum_i E_{i,r,s,t} + E_{i,r,s,t-1})/2)} \tag{8}$$

We now decompose overall shock intensity, i.e. the GJR, into a homogenous and a heterogeneous part. Homogenous shock intensity is defined as that part of region-sectoral job creation (destruction) which is mirrored in region-sectoral job destruction (creation) and thus expresses the intensity by which jobs are turned over within a sector in a region.

$$HmS_{r,s,t} = min_{r,s,t} \left(\frac{\sum_i \Delta E^+_{i,r,s,t}}{((\sum_i E_{i,r,s,t} + E_{i,r,s,t-1})/2)}, \frac{\sum_i |\Delta E^-_{i,r,s,t}|}{((\sum_i E_{i,r,s,t} + E_{i,r,s,t-1})/2)}\right) \tag{9}$$

Conversely, heterogeneous shock intensity is defined as the difference between job creation and destruction rates. Since these rates can diverge only through net employment growth or through jobs being imported from or exported into other sectors, with relatively small net job growth rates the index of heterogeneous shock intensity approximates the extent to which a sector in a region exchanges jobs with other sectors inside and outside the region.

$$HtS_{r,s,t} = \frac{\sum_i \Delta E^+_{i,r,s,t}}{((\sum_i E_{i,r,s,t} + E_{i,r,s,,t-1})/2)} - \frac{\sum_i |\Delta E^-_{i,r,s,t}|}{((\sum_i E_{i,r,s,t} + E_{i,r,s,t-1})/2)} \tag{10}$$

Given these definitions and recurring to our example provided above, with job creation and job destruction rates amounting to fifteen and ten percent respectively, we would infer a region-sectoral intensity homogenous shocks of ten percent and a heterogeneous shock intensity of five percent. Being based on regional congruence and deviations in gross job creation and destruction rates rather than on net job growth rates alone, our measures of homogenous and heterogeneous shocks fully capture the idea of region-sectoral risk sharing through labor pooling. The fundamental idea of risk sharing is that if two firms experience shocks in opposite directions they both benefit from having access to the same labor market since it allows them to easily adjust their levels of employment and thereby maximize

[2] For reasons of brevity and in order to avoid unnecessary repetition we refer to job creation, destruction, and reallocation in region r in sector s at time t from now on as region-sectoral job creation, destruction, and reallocation.

productivity. It is in this sense that our measure of homogenous shocks captures the potential for intra-sectoral risk sharing, while the intensity of heterogeneous shocks expresses the need of firms to gain access to other labor markets and to benefit from sharing labor markets with firms outside their own sector.

In contrast to indicators of heterogeneous and homogenous shock intensity, measures for region-sectoral composition are readily provided by the literature on sectoral specialization and diversification. We use two indicators for the extent to which an industry shares a labor market with firms of its own sector. A simple measure of intra-sectoral labor pooling is the number of workers employed by firms in one sector relative to the total workforce in a region.

$$Spec^1_{r,s,t} = \frac{\sum_i E_{i,t,s,r}}{\sum_i E_{i,t,r}} \tag{11}$$

Unfortunately, this indicator does not correct for the overall size of an industry. By means of an example, while electrical engineering is characterized by large employment shares in most regions, agriculture is usually much smaller in terms of regional employment. While we will correct for such differences using sector fixed effects in our econometric analysis, for reasons of robustness we employ an additional measure which corrects for overall industry size.

$$Spec^2_{r,s,t} = \frac{\sum_i E_{i,t,s,r} / \sum_i E_{i,t,r}}{\sum_i E_{i,t,s} // \sum_i E_{i,t}} \tag{12}$$

This index measures the degree of intra-sectoral labor pooling in a region by relating the region-sectoral share of employment to the national share of employment in that sector.

We take the regional Hirschman-Herfindahl Index commonly used in the literature as our preferred measure of labor market pooling between industries. The regional HHI reveals the extent to which a regional labor market is equally divided between sectors.

$$HHI_{r,t} = \ln\left(\sum_s \left(\sum_i E_{i,t,s,r}\right)^2\right) \tag{13}$$

Our measures for labor pooling within and between industries are complementary inasmuch as the former represent the availability of workers within a firm's own sector, while the latter indicates a firm's opportunity to tap other labor markets outside its sector. The intuition underlying our empirical investigation is based on the idea that the relative importance of labor pooling opportunities within and between industries depends the relative intensity of homogenous and heterogeneous shocks. If sectors are subject to large homogenous employment shocks firms profit from a large intra-sectoral labor market which allows them to pool risks there, i.e. sectoral specialization is particularly beneficial in the face of sizable intra-sectoral job-turnover. The reverse applies to regional diversification, which allows firms to access labor markets outside their own sector in cases where intra-sectoral job creation diverges from job destruction. Thus, an assessment of risk sharing in pooled labor markets amounts to testing whether firms in the face of homogenous shocks are more productive when having access to large intra-sectoral labor market, while benefitting from labor pooling between sectors when hit by heterogeneous shocks. It is this intuition which underlies our econometric specification.

$$w_{r,s,t} = \beta_1 Spec_{r,s,t} + \beta_2 Div_{r,s,t} + \beta_3 HtS_{r,s,t} + \beta_4 HmS_{r,s,t} + \sum_{l=0}^{m} \gamma_l^1 Spec_{r,s,t-l} \times HmS_{r,s,t-l} + \sum_{k=0}^{m} \gamma_k^2 Div_{r,s,t-k} \times HtS_{r,s,t-k} + \phi_r + \phi_s + \phi_t + \varepsilon_{r,s,t} \quad (14)$$

We regress average wages w in region r in sector s at time t on measures of specialization and diversification, on our indicators for region-sectoral shock intensity, and on interactions between specialization and homogenous shock intensity on the one hand, and diversification and heterogeneous shock intensity on the other hand. In line with the literature on industrial clustering we expect β_1 and β_2 to be positive. Since the distribution of shocks is to be determined empirically, the signs of β_3 and β_4 are ex ante ambiguous. Our coefficients of interest are γ^1 and γ^2, which we expect to be positive if firms benefit from risk sharing through pooled labor markets, i.e. if labor market size positively affects firm productivity in the face of heterogeneous and homogeneous shocks. In line with Combes/Magnac/Robin (2004), who provide evidence for time-lagged effects of industrial structure, we include lags of all interaction terms. As control variables we include region, sector, and time fixed effects.

Having investigated the importance of risk sharing through labor pooling for aggregate productivity, we wish to corroborate our results on the firm level and shed further light on the geographical and sectoral scale relevant for firms to benefit from sharing a pooled labor market with other firms. More specific, using firm-level wage equations we examine how firms adjust employment in the face of homogeneous and heterogeneous shocks and analyze whether productivity consequences of adjustment depend on the shock intensity experienced by other firms in regional or region-sectoral proximity. In line with Overman/Puga (2008) we define firm specific heterogeneous shocks as the absolute difference between firm employment growth and region-sectoral employment growth. This indicator is consistent with our notion of shock heterogeneity since it measures the deviation of firm employment growth from region-sectoral employment growth, i.e. it increases if firms adjust employment against the region-sectoral trend.

$$HtS_{i,t} = \left| \frac{E_{i,t}}{E_{i,t}+E_{i,t-1}} - \frac{\sum_i E_{i,r,s,t}}{\sum_i E_{i,r,s,t}+\sum_i E_{i,r,s,t-1}} \right| \quad (15)$$

Analogously, our indicator of firm specific homogenous shocks captures the extent to which a firm develops in line with the region-sectoral trend. We define homogenous shock intensity to take a value of zero if a firm's employment develops opposite to the region-sectoral trend.

$$HmS_{i,t} = \begin{cases} \min(\left|\frac{E_{i,t}}{E_{i,t}+E_{i,t-1}}\right|, \left|\frac{\sum_i E_{i,r,s,t}}{\sum_i E_{i,r,s,t}+\sum_i E_{i,r,s,t-1}}\right| \; if\; sign\left(\frac{E_{i,t}}{E_{i,t}+E_{i,t-1}}\right) = sign(\frac{\sum_i E_{i,r,s,t}}{\sum_i E_{i,r,s,t}+\sum_i E_{i,r,s,t-1}}) \\ 0 \; if\; sign\left(\frac{E_{i,t}}{E_{i,t}+E_{i,t-1}}\right) \neq sign(\frac{\sum_i E_{i,r,s,t}}{\sum_i E_{i,r,s,t}+\sum_i E_{i,r,s,t-1}}) \end{cases} \quad (16)$$

In order to investigate the distribution of firm level shocks and the productivity consequences of labor pooling at different spatial scales we regress the average wage in firm i, w_i, on our two types of shocks S_j with j=1,2, on the means of firm specific shocks at the region-sectoral and regional level, and on interactions between firm specific shocks and their respective region-sectoral and regional means, as well as on lags thereof.

$$\begin{aligned} w_i = &\sum_j \delta_j^1 S_{j,i,t} + \sum_{j=1}^{2} \delta_j^3 mean_{r,s,t}(S_{j,i,t}) + \sum_{j=1}^{2} \delta_j^5 mean_{r,t}(S_{j,i,t}) \\ &+ \sum_{j=1}^{2}\sum_{k=0}^{m} \theta_{j,k}^1 S_{i,r,s,t-k} \times mean_{r,s,t}(S_{i,r,s,t-k})) \; + \sum_{j=1}^{2}\sum_{k=0}^{m} \theta_{j,k}^2 S_{i,r,s,t-k} \times mean_{r,t}(S_{i,r,s,t-k})) + \theta^5 Empl_{i,t} + \phi_i \\ &+ \phi_r + \phi_s + \phi_t + \varepsilon_i \end{aligned} \quad (17)$$

δ^1 indicates how firms adjust employment in the face of homogenous and heterogeneous shocks. A positive sign of δ^1 reveals that with positive shocks workers above a firm's mean labor productivity are hired, while with negative employment shocks firms adjust by dismissing workers with below-mean productivity. The reverse applies in case of a negative sign of δ^1. While δ^1 captures the selection effect of labor adjustment, θ^1 and θ^2 give evidence on the productivity enhancing nature of labor pooling in the face of firm shocks. Positive signs of θ^1 and θ^2 suggest that firms facing shocks of any type benefit from increased job turnover intensity in a shared labor market on region-sectoral (θ^1) and on regional level (θ^2). We take positive signs as indication that being located in a dynamic labor market characterized by large turnover intensity allows firms to efficiently adjust to an optimal efficient level of production and thereby be able to pay higher wages. As control variables we include regional job turnover intensities, as well as a battery of region, sector, time, and firm fixed effects. In line with a broad literature showing that wages increase with firm size we also control for employment level per firm (Green/Machin/Manning 1996)[3].

2.3. The Data

All subsequent analyses are based on the Establishment History Panel (BHP) provided by the Institute for Labor and Employment Research (IAB). The panel is generated by aggregating information on all employees in Germany from the individual level to the establishment level. The resulting data set covers the total population of all establishments in Germany between 1975 and 2005 employing at least one employee subject to social security

[3] Controlling for firm size would be unnecessary if it was distributed randomly across firms; however, as Holmes/Stevens (2002) show, firms size increases with industrial concentration, i.e. plants in locations where an industry concentrates are larger than firm outside these areas. Since such patterns might bias our results on specialization and diversification we control for firm scale.

contributions (see Spengler 2007 for a comprehensive overview of the data).[4] The annual number of establishments observed in the data ranges between 1.5 and 2.5 million establishments. An establishment in the data set identifies a location, usually a plant or a place of work.[5] For such establishments the data set contains information on location, industry affiliation, employment structure, and wage structure, with each variable being observed once a year on 30th of June. From the annual waves of observations we have generated a panel data set which allows us to track establishments over time.

Using information on industrial affiliation we have grouped firms into 18 different sectors, a list of which can be found in Table I along with further information on sectoral employment and payment structures. Table II gives an impression of the striking differences in regional industrial composition, listing sectoral shares in Germany's most diversified region, Bielefeld, and its most specialized region, Ludwigshafen. While in Ludwigshafen more than 75 percent of highly qualified workers are employed in the chemical industry, the largest sector on Bielefeld, the public sector, employs a meager 13 percent. It is these striking differences in regional industrial composition which motivate us to investigate the relative importance of specialization and diversification in regional labor markets for firms to benefit from risk sharing effects through labor pooling. We define labor market regions along the lines of the 75 '*Raumordnungsregionen*' defined by the Federal Office for Building and Regional Planning, which are equal to NUTSII regions (BfLR 1996). Unfortunately, these regions are not explicitly defined so as to reflect workers' commuting behavior (Kosfeld/Eckey/Tuerck 2006). However, since by principle of construction they always cover a core city and its surrounding periphery we deem them close enough to representing coherent labor markets and in line with various other studies on regional labor markets adopt them here (see e.g. Brakman/Garretsen/Schramm 2006). Our main dimension of interest throughout most of the analysis will be the region-sectoral level. Since we observe annual job turnover in 18 sectors within each of the 75 labor market areas over a 25-year period between 1977 and 2001 we obtain a maximum number of 43,650 observations in our region-sectoral analyses.

In all our analyses we focus on job turnover and wages of highly qualified workers, defined as those workers holding a degree from either a university or a technical college. A number of reasons have convinced us to do so. First of all, for firms to face the risk of not being able to adapt their employment efficiently in the face of positive productivity shocks there need to be bottlenecks of employment. Such bottlenecks are more pronounced with respect to highly qualified labor while general labor can be regarded as being ubiquitous in basically all regions. Secondly, in the face of negative shocks firms need to be able to adjust employment downwards and thereby contribute to the regional pool of labor. While the German employment protection legislation theoretically covers all workers alike, dismissals are usually easier with respect to highly skilled workers who are more flexible in terms of finding new employment and can be expected to be more willing to leave a firm facing adjustment

[4] Although technically we are dealing with establishments throughout the empirical analysis, in what follows we use the terms establishment and firm interchangeably for reasons of simplicity.
[5] See Fritsch/Brixy (2004) for a detailed discussion of the definition and classification of establishments.

troubles. Finally, wage setting is more flexible for highly qualified workers who are less prone to be bound by wage agreements. Thus, focusing our analysis on highly qualified workers enables us to uncover regional wage differentials which are otherwise prone to be suppressed by wage leveling institutional arrangements.

We differentiate between three different types of establishments the behavior of which we analyze in detail. We define establishments which have employed highly qualified workers in the last period, and continue to do so in this and the next period as 'existing establishments'. Secondly, 'skilled start ups' are those establishments which have not existed in the last period and employ highly qualified workers in this period, while analogously 'skilled closures' are those firms which have employed highly workers in the last period but have ceased to exist in this period. Finally, 'upgrading firms' have existed in the last period without highly qualified workers and continue to exist in this period employing at least one highly qualified worker, while 'downgrading firms' have employed at least one highly qualified worker in the last period but have refrained from doing so in the present period.

III. Results

3.1. Descriptive Evidence on Shock Intensity and Regional Wages

In this subsection we provide evidence on the size and evolution of national, sectoral and region-sectoral shock intensities, as well as on their interplay with spatial wage structures. Graph I maps the dynamics of job turnover on a national level showing that with about twenty-five percent of jobs being created or destroyed annual job turnover within the labor market for highly qualified workers in Western Germany is substantial. Expressed in absolute numbers, more than 350,000 out of about 1.4 million jobs held by highly qualified workers were turned over in 2001. Graph II shows that the bulk of job churning takes place in existing establishments, which create and destruct nearly twenty percent of overall highly qualified employment, i.e. about 280,000 jobs, each year. This number is distinctly smaller for start ups, closing firms and up- and downgrading firms, which together turn over about five percent of national employment, i.e. about 70,000 jobs, annually.[6] Graph III reveals that job turnover not only differs substantially between sectors, but that these differences are stable over time. While most sectors exhibit shock intensities between fifteen and thirty percent, annual job turnover rates in Retail, Consumer Services, and Legal and Economic range well beyond forty percent.

In Graph IV we divide gross job turnover up into net job growth and excess turnover. While net job growth refers to the number of jobs newly created, i.e. to the difference between job creation and destruction, excess turnover is defined as the number of existing jobs reallocated between firms. The graph shows that while net job growth has remained roughly constant

[6] Disaggregating gross job turnover into job creation and job destruction by firm type clearly evidences that existing firms are the drivers of employment growth, defying Birch's (1987) notion that small start-ups create the lion's share of jobs (Graph II).

over time with about 50,0000 jobs newly created per year, excess turnover has tripled from about 120,000 jobs being reallocated between firms in 1977 to 350,000 jobs in 2003. Thus, job reallocation between firms is about seven times as large as annual net job growth. Given our theoretical considerations these numbers raise the question of whether larger local labor markets allow firms to more efficiently share risks of employment shocks. With each job being turned over every four years on average in every firm there is clearly room for theoretical arguments stating that firms benefit from having access to large labor markets enabling them to efficiently adjust to optimal levels of employment.

Containing region-sectoral job creation and destruction rates in 2000, Graph V throws a first light on the relative importance of homogenous and heterogeneous shocks at the region-sectoral level. In line with findings in the literature on job turnover (e.g. Baldwin/Dunne/Haltiwanger 1998) job creation and destruction are positively correlated. A general tendency for job creation to be larger than job destruction suggests that job destruction is the predominant binding parameter for homogeneous shocks. We find the average size of homogeneous shocks to amount up to 14 percent, i.e. on average 14 percent of jobs in a region are redistributed between firms belonging to the same sector. Heterogeneous shocks average 16 percent, implying that 16 percent of jobs in each sector in a region are either resulting from net job growth, or are imported from, or exported into other sectors each year.

As Graphs VI and VII show, both types of shocks exhibit a negative, non-linear relationship with region-sectoral wages, suggesting a lower productivity of sectors subject to large employment shocks. However, according to Graph VIII gross job turnover rates, i.e. the intensity of shocks, fall with regional density, suggesting that larger labor markets might provide an environment which allows for the pooling of employment shocks. Such risk sharing effects from labor pooling are mirrored in Map I, which contains regional averages of daily gross wages for highly qualified workers. The extent to which regional wages follow patterns of agglomeration and industrial clustering in Western Germany is striking. Average wages range above 120 Euros in larger cities like Hamburg, Hannover, Bremen, and Munich, as well as in industrial clusters like the Rhein-Ruhr area, the Rhein-Main area, and the automobile cluster around Stuttgart. Compared to an overall average wage of 106 Euros this amounts to a wage premium of more than 13 percent. In what follows we wish to shed light on the extent to which risk sharing effects from labor pooling are a driving force behind regional wage differentials. We therefore disentangle direct productivity effects of shocks from those effects arising from the interrelation of shocks with the sectoral structure of regional labor markets.

3.2. Risk Sharing and Wages: Region-Sectoral Level

In this section we present our results from estimating equation (14) for the pooled sample of all firms, as well as separately by firm type. Our intent here is to examine empirically whether more shock intensive sectors benefit from larger labor markets with respect to productivity. In our analysis we differentiate between homogenous and heterogeneous shock intensity and interact both with measures of regional specialization and diversification. Column I contains our results for all firms using the absolute regional share of sectoral employment as our indicator for relative size of intra-sectoral labor markets, while for reasons of robustness column II employs the relative regional share of employment as a measure of specialization. Columns III to V contain results from regressions differentiated by firm type.

As a first result we find sectoral specialization to be associated with higher sectoral wages with these effects to be larger, in general, for existing plants. An increase of the sectoral share of employment by one percent raises wages by 2.6 percent in existing firms and by about .5 percent in start-ups and upgrading firms. In contrast, we do not find support for general positive effects from regional diversity. While we lack an explanation why effects from diversification turn out negative in some of our specifications, our results are generally in line with Henderson (2003), who also finds strong evidence for economies of scale from specialization, but only limited evidence for the existence of urbanization economies.

Coherent with our descriptive results we find the intensity of both homogenous and heterogeneous shocks to be correlated negatively with sectoral wage levels. With respect to homogeneous shocks this implies that higher job churning intensities between firms within a sector are associated with lower wages in that sector. Point estimates indicate that an increase in the intensity of homogeneous shocks by one percent is accompanied by a decrease in wages between .04 and .6 percent depending on the sample and the type of indicator used. The wage reducing impact of heterogeneous shocks is even greater, ranging between .25 and 2.6 percent. Two potential explanations for a positive relation between job churning and wage levels apply. First, in line with our model, adjustment to new efficient levels of production, i.e. increasing or decreasing employment, might be costly for firms. Given this interpretation, negative signs on the intensity of homogenous and heterogeneous suggest that adjustment costs are substantial, forcing firms to economize on wage expenses. However, negative signs on shock intensity might also be rooted in human capital effects, i.e. higher churning intensities can plausibly be expected to reduce average tenure, which in turn implies that lower endowments of firm specific human capital are the underlying cause of lower wages in shock intensive industries (Becker 1964). While we are not able to differentiate between these two rivaling explanations, our lesson from this exercise is that controlling for time, sector, and region specific fixed effects, region-sectoral wage levels display a distinctly negative correlation with region-sectoral shock intensity.

Results on inter-sectoral labor pooling effects are consistent between all regressions, i.e. we find sectoral wages to increase with the combined influence of sectoral diversification and the intensity of heterogeneous shocks. Two insights emerge from the statistical significance and the positive sign of the interaction term which we comment on in turn. The first one is related to Jane Jacob's (1969) famous hypothesis of benefits from agglomeration being rooted in sectoral diversity. Our findings of an insignificant impact of diversification on wages combined with a positive interaction term support the notion that beneficial impacts of diversity on productivity seem to unfold predominantly through labor pooling effects. This finding comes as a surprise given that the microeconomic foundations of urbanization externalities are frequently assumed to be rooted in inter-sectoral learning activities and knowledge spillovers. Our result indicate, however, that while not generally increasing with regional diversification, regional wages are higher in diversified labor markets conditional on the occurrence of large heterogeneous shocks. Secondly, a significantly positive interaction term reveals that heterogeneous productivity shocks unfold positive effects if they take place in diversified labor markets. Framed differently, while positive productivity gains from shocks are thwarted by costs of adjustment in non-diversified labor markets as indicated by the negative sign on the index of heterogeneous shocks, these costs fall with the size of the labor market outside a firm's own sector. The point estimates suggest that in the theoretical case of complete sectoral isolation, intra-sectoral wages decrease by about .24 percent with an increase of heterogeneous shock intensity by 1 percent. In contrast, in sectors located in regions characterized by average diversification, increasing heterogeneous shock intensity by one percent reduces region-sectoral wages by only .14 percent. Thus, as a bottom line, our results suggest that regional diversification, i.e. access to a larger extra-sectoral labor pool, helps to reduce negative wage consequences arising from heterogeneous shocks.

With respect to the combined effect of sectoral specialization and homogeneous shock intensity our results provide a textbook example of the potential fallacies encountered when not controlling adequately for group membership of entities. While the relationship between regional specialization and homogeneous shock intensity turns out to be significantly positive when estimated separately by firm type, pointing to the existence of labor pooling effects in intra-sectoral labor markets, it turns out to be negative in the full sample. Systematic group differences with respect to shock intensity and wage levels turn out to be the underlying reason for such differences. Since existing establishments display lower shock intensities and higher wages compared to start-ups and closing establishments, the overall relationship turns out to be negative while within each group it is robustly positive.[7] The positive coefficients on the interaction between the relative size of a sector and the intensity of homogeneous shocks within each group of firms reveal two aspects of specialization and its importance for intra-sectoral labor pooling, which we only explain briefly here since they are analogue to the points discussed with respect to diversification and heterogeneous shocks. First, it turns out that regional specialization affects wages in more than one way. While being beneficial in terms of a labor pooling device, sectoral specialization also raises wages through other positive effects frequently mentioned in the literature, like matching or learning effects. With respect to existing establishments labor pooling effects account for nearly one fifth of overall benefits from specialization, while for all other establishments this share rises to about one half. Secondly, the results show that conditional on high intra-sectoral job turnover wages rise with increasing sector size, indicating that risks from intra-sectoral job turnover can be pooled more efficiently among a larger number of firms. Effects are smaller than those found on pooling effects in diversified labor markets in the face of heterogeneous shocks. As for existing establishments, while an increase of heterogeneous shock intensity by one percent

[7] These results are in line with Stiglbauer et al (200) who also find a strongly negative relationship between establishment scale and job turnover.

decreases wages by 2.5 percent for sectors with a specialization close to zero, this negative effect reduces to about 2 percent in sectors characterized by an average level of specialization.

Thus, evidence on the regional-sectoral level supports the idea that risk sharing in pooled labor markets has a role to play as a microeconomic mechanism of agglomeration. With respect to the debate on urbanization and localization economies we show that part of the positive effects arising from sectoral specialization and regional diversification found in the literature can be ascribed to labor pooling effects in the face of homogeneous and heterogeneous shocks. Our results indicate that the negative impact of such shocks on region-sectoral wages can partly be offset through labor pooling effects being rooted in the relative size of sectoral and regional labor markets. In order to scrutinize the robustness of these results and to shed further light on the sectoral and geographical scale of labor pooling effects, in section 3.3 we carry the analysis to the firm level. We therein examine how firms adjust employment levels when experiencing homogenous and heterogeneous shocks, and check whether job turnover intensities of firms in sectoral and spatial proximity influence the productivity consequences of such adjustments.

3.3. Risk Sharing and Wages: Firm Level

In order to provide a consistent analysis of the effect of labor pooling on average firm wages we estimate equation (17) for a subsample consisting of existing establishments only. Table IV contains our results of different specifications of equation (17). Before discussing our findings on aggregate labor market variables, we comment on the evidence on firms' adjustment process, which is consistent across all specifications.

Results contained in the first two rows in Table IV show that both homogenous and heterogeneous shocks are negatively correlated with median firm wages, indicating downward wage adjustment with both types of shocks. More specific, hit by positive productivity shocks firms hire workers with wages below the median, while with negative productivity shocks workers above the median wage leave the firm. Such a process of 'low entry' and 'high exit' is in line with the life cycle of jobs in a system characterized by long tenures, implying that workers stay in companies for a long time, often until they retire, and are then replaced by younger workers. Firms experiencing a homogeneous shock of one percent, i.e. firms adjusting employment into the same direction as the sector they are affiliated to, see their median wages fall by about .15 percent. Firms changing employment by one percent against the trend prevailing within their own sector, i.e. those firms subject to heterogeneous shock, experience a fall in wages of only about .009 percent. The finding of a substantially lower wage elasticity of heterogeneous shocks is plausible because while homogeneous shocks are likely to represent a process of continuous turnover, heterogeneous jobs are prone to be rooted in firm specific events, like expansions, mergers, or measures of restructuring, which in their consequences are more prone to hit all workers alike.

In column VI we test whether firms benefit from being located in a specialized or diversified environment when adjusting employment. With both interaction terms of firm specific shocks and regional industrial structure being insignificant we find no such evidence. While this result may seem surprising in the light of the importance we have ascribed to regional industrial structure as a determinant of wages, it is entirely plausible given the change in the level of analysis. In section 3.2 we found regional specialization and diversification to matter conditional on the existence of substantial region-sectoral shock intensity, i.e. conditional on the sum of firm shocks being large. Recall our take on these results, which said that firms subject to large employment shocks benefit from an improve efficiency of the adjustment process, if being located in a large labor market allows them to pool employment shocks. Thus, a necessary condition beyond the mere existence of a large labor market for the benefits of labor pooling to unfold is the occurrence of large employment shocks across firms. As our results in column VI quite plausibly demonstrate, shock intensity is not necessarily correlated with specialization or diversification, which is in turn the reason for why firms do not benefit from industrial structure alone. Framed differently, we expect firms subject to heterogeneous or homogenous shocks to profit from the extent to which other firms in proximity churn jobs, too, rather than from industrial structure itself.

Indeed, if we substitute variables for overall industrial structure by the region-sectoral and the regional means of either shock in column IX, we find the interaction terms between firm shocks and aggregate shock intensity to unfold a highly significant and positive effect on firm-specific wages. Including mean shock intensities on regional and region-sectoral level into one equation allows us to examine the relative importance of either level of labor pooling by comparing the coefficients of the interaction terms. With respect to the interaction between firm-level heterogeneous shocks and aggregate heterogeneous shocks we find a positive and significant albeit small coefficient on the region-sectoral level while the coefficient on the regional level turns out to be significantly negative. This implies that when experiencing heterogeneous shocks firms predominantly benefit from labor pooling on the region-sectoral level. Given similar requirements with respect to the types and levels worker qualification firms probably find it easier to exchange jobs within their sector and therefore are more likely to benefit from shocks incurred by firms within their own sector. Such positive labor pooling effects are small though, amounting only to about .003 percent in the case of a one percent increase in heterogeneous shocks in region-sectors with average heterogeneous shock intensity, thereby offsetting about one third of the unconditional wage effect arising from heterogeneous shocks.[8] Pooling effects for homogeneous shocks are much larger and matter predominantly on the regional level. The importance of the regional level for homogenous shocks is in line with our idea of risk sharing. If firms are subject to homogenous shocks, i.e. to shocks following the region-sectoral trend, they can be expected to benefit from being close to firms which are not following the same trend in order to exchange jobs with them. Since other sectors are likely to display different shock distributions, firms benefit from inter-sectoral job exchange in the face of homogenous shocks. The conditional pooling effect of a one percent

[8] See Brambor/Clark/Golder (2005) on interpretations of econometric conditionality when using interaction terms.

increase in homogeneous shocks leads to a wage increase of .2 percent in regions characterized by average homogeneous shock intensity.

The results on the interaction terms suggest that firms subject to homogenous and heterogeneous shocks benefit from having access to dynamic labor markets. More specific, our findings indicate that if due to changed productivity firms need to adjust their employment of highly qualified workers, they benefit from being close to firms adjusting employment in the opposite direction. With respect to homogenous shocks this means that if firms adjust employment in line with the region-sectoral trend, they benefit from an increased shock intensity of firms outside their own sector, as expressed by the significantly positive interaction between homogeneous shocks and regional mean homogeneous shock intensity. Conversely, if firm level employment develops over and above, or in contrast to, region-sectoral developments, firms benefit from increased heterogeneous shock intensity within their own sector.

In Column X we use the dispersion of shocks among the population of firms instead of their mean as a robustness check. In general, we expect to obtain similar results since firms benefit from a large variance of shocks as they do from a large mean. In fact, while the regression confirms our results on the region-sectoral level, evidence for pooling effects on the regional level is weaker than in earlier regressions.

Four core insights emerge from firm-level regressions. First, we find that firms in general adjust employment in a mean-decreasing way, a behavior which is consistent with the prevalence of long-term employment relations. Secondly, rather than from industrial structure in general, firms benefit from being located in a dynamic environment characterized by high rates of job turnover among existing firms. Thirdly, in line with our analysis on region-sectoral level, we find that with heterogeneous shocks firms gain advantage if other firms within their own sector also develop differently than the region-sectoral average, while in the face of heterogeneous shock firms benefit from being able to exchange jobs with firms outside their own sector. Therefore, fourthly, we observe that while region-sectoral job turnover matters most for firms facing heterogeneous shocks, regional turnover is more important for firms adjusting employment after homogenous shocks.

IV. Risk Sharing and Industrial Concentration

Do shock intensive industries cluster more intensely in order to benefit from risk sharing through labor pooling effects? We approach this question by, first, investigating whether industrial concentration has become more pronounced over time, and, secondly, by examining whether inter-sectoral differences of industrial concentration can be related to differential sectoral shock intensities. We use the Ellison-Glaeser-Index (Ellison/Glaeser 1997) as our preferred measure of industrial concentration. The EGI measures the extent to which industry s is regionally concentrated at time t and is defined as

$$\gamma_{s,t} = \frac{G_{s,t} - (1 - \sum_r (E_{r,t}/E_t)) H_{s,t}}{(1 - \sum_r (E_{r,t}/E_t))(1 - H_{s,t})} \tag{18}$$

G represents the spatial Gini coefficient of industry s. It is constructed by taking the sum of the differences between relative national employment in region r and relative sectoral employment in region r across all regions. G equals zero if employment in sector s is distributed across regions in exactly the same way as is overall employment, and takes a value close to one if a sector is concentrated exclusively within one region.

$$G_{s,t} = \sum_r \left(\frac{E_{r,t}}{E_t} - \frac{E_{s,r,t}}{E_{s,t}}\right)^2 \tag{19}$$

The Gini coefficient has lost its leading role as the indicator of choice it used to have in basically all studies on spatial concentration because it does not adequately differentiate between true sectoral clustering on the one hand, and the intensity to which employment is clustered due to differences in the size of firms and regions. By means of an example, if all employment within a sector is concentrated within one firm, it is not surprising to find sectoral employment to be concentrated within one region. This concentration is, however, due to employment being concentrated in a firm, and not to unique sectoral agglomeration. The EGI corrects for regional size and employment clustering among firms by including relative region size and the Hirschman-Herfindahl index H_s of employment concentration between plants i within one sector into the index.

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$$H_{s,t} = \sum_i z_{i,t}^2 \tag{20}$$

The EGI increases with the extent to which sectoral clustering deviates from a random distribution of sectors under a given distribution of firms and regions. Though inherently ad hoc, Ellison/Glaeser propose the following classification of sectors with respect to their concentration: a range of γ between .2 and .5 indicates sectoral concentration, with γ exceeding .5 pointing to high sectoral concentration. Sectors with γ below .2 are regarded as not being concentrated at all, with negative values of γ indicating excess dispersion.

Graph IX contains the evolution of sectoral concentration in Western Germany. The two most striking observations emerging from the graph are the low degree of concentration of Western German industries on the one hand, and the relative stability of intra-sectoral concentration, which is in line with the findings by Suedekum (2006). Out of 18 industries only four qualify as being concentrated. If we exclude Agriculture/Fishing/Mining, which is by definition concentrated around natural resources, and Transportation, the concentration of which is to a large extent rooted in the nature of ports and airports as indivisible goods, only the Iron and Steel Industry and the Insurance and Banking Sector display a certain extent of concentration with the former moving towards deconcentration and the latter towards increased concentration. With these caveats in mind we do nevertheless wish to test whether sector-specific shock intensity contributes to the existing albeit little variation in the data. We therefore regress the EGI on logarithms of sectoral means of homogenous and heterogeneous shock intensity and include sector size, as well as time and sector specific fixed effects as further controls.

$$\gamma_{s,t} = \varphi_1 \ln(HmS_{s,t}) + \varphi_2(HtS_{s,t}) + \varphi_3 Empl_{s,t} + \phi_t + \phi_s + \varepsilon_{s,t} \tag{21}$$

It goes without saying that this specification has nothing to say about causality since it is prone to suffer from omitted variable bias, as well as from reverse causality. It does, however, live up to our intent to see whether patterns of industrial clustering are in line with predictions from the labor pooling model. Since sectoral concentration theoretically leads to lower job turnover due to smoothing effects, φ_1 and φ_2 can, if anything, be expected to be underestimated, so overestimating the relation between industrial concentration and shock intensity is highly unlikely. We expect to find industries experiencing more intensive homogeneous shocks to be concentrated in order for them to be able to benefit from pooled labor markets within their sector, while heterogeneous shock intensity should induce firms to deconcentrate so as to benefit from diversification. Table V contains the results.

In line with our expectations φ_2 is significantly negative, implying that sectors subject to an increased intensity of heterogeneous shocks are more dispersed and therefore able to profit from inter-sectoral labor pooling. φ_1 is significant only at the ten percent level and shows an unexpected sign. Hence, we do not find evidence for industries to cluster in order to benefit from pooled labor markets within their sector. In order to scrutinize this finding we employ the index of heterogeneous shocks used by Overman/Puga (2008) in their investigation, which is defined as the sum of absolute deviations of intra-firm employment growth from sectoral employment growth, i.e. it contains sector-time average of heterogeneous shocks as defined in equation (15).

$$HtS^2_{s,t} = \frac{1}{I}\sum_i \left|\left(\frac{E_{i,t}}{E_{i,t}-E_{i,t-1}}\right) - \left(\frac{E_{s,t}}{E_{s,t}-E_{s,t-1}}\right)\right| \tag{22}$$

The results contained in column XII in Table VI corroborate the findings encountered when using our own indicator, i.e. we do not find evidence that firms experiencing larger heterogeneous shocks are more heavily concentrated. It has to be said that in their investigation Overman/Puga obtain similar insignificant results. It is only when averaging HtS over time that they find the intensity of heterogeneous shocks to increase sectoral concentration. Since averaging over time would leave us with 18 observations only we restrict ourselves to conclude that while we find some evidence that benefits from risk sharing in pooled labor exceed the costs of agglomeration for those sectors experiencing pronounced heterogeneous employment shocks, this does not apply to industries subject to large homogenous shocks.

Conclusion

Our empirical investigation supports Marshall's (1890) and Krugman's (1991) notion that risk sharing through labor pooling matters as one of the microeconomic mechanism of agglomeration. Estimating wage equations on the level of sectors within regions we find the intensity of firm specific and sector-wide employment shocks to significantly depress wages, which we take as indirect evidence of firms incurring adjustment costs when altering their levels of employment. However, negative wage effects from aggregate employment shocks are mitigated by regional industrial structure. On the one hand, we find specialization of labor markets, i.e. the size of the intra-sectoral labor market, to reduce the negative effects from homogeneous shocks, defined as the aggregate intensity of job turnover between existing firms. On the other hand, regional diversification can be shown to alleviate negative effects from heterogeneous shocks, which we construct as the extent to which firms exchange jobs with other sectors. In line with these findings of significantly positive interaction effects between aggregate shock intensity and the size of intra- and extra-sectoral labor markets, results from firm level wage regressions indicate that industrial structure alone does not suffice for risk sharing benefits from labor pooling to emerge. For firms to be able to share risks from employment shocks they need to be close to firms experiencing large but opposite shocks, allowing for shock smoothing through efficient job exchange. Thus, in line with our results from the region-sectoral level, firms pay higher wages if a large shock intensity of firms within their own sector allows them to pool heterogeneous shocks. Conversely, in the face of homogenous shocks firms benefit from labor pooling on the regional level. Such benefits from risk sharing through labor pooling express themselves as regional wage differentials in Germany, with higher wages being paid in agglomerated areas, and in industrial clusters.

In addition to providing evidence on the existence of risk sharing as a micro-mechanism of agglomeration, our results contribute to the literature on urbanization vs. localization economies. The core reason for why debates on the relative importance of specialization and diversification have still not settled is rooted in the prevailing inconclusiveness on the relative importance of the micro-mechanisms through which different types of industrial structure influence wages, profits, and employment. We contribute to the quest for identification showing that while only a modest share of about one fifth of the benefits from industrial specialization unfolds through intra-sectoral risk sharing, the relative importance of risk sharing mechanisms within urbanization economies is much larger. Given the relevance of both sectoral specialization and regional diversification for the occurrence of risk sharing as a wage increasing mechanism, it is not surprising to see that specialization and diversification coexist without regions getting more specialized or diversified, as indicated by our findings on the long-term stability of industrial concentration (see also Duranton/Puga 2000).

This study is to our knowledge the first to investigate the relevance of risk sharing through labor pooling as a driving force behind regional wages differentials. Much remains to be done. In our perception, the most interesting way of continuing the analysis of risk sharing effects would be a thorough examination the importance of risk sharing for interregional industrial evolution. The most influential models on this issue have up to now focused on learning processes and knowledge spillovers as core mechanisms through which industries concentrate or disperse spatially conditional on firm or industry age (see e.g. Desmet/Rossi-Hansberg 2008 and Duranton/Puga 2001). The basic message conveyed in these models is that firms or industries benefit from concentration when young, since being close to other firms allows them to benefit from knowledge spillovers, while getting more dispersed with age in order to economize on transaction costs. Since the empirical literature on job turnover provides ample evidence that job turnover decreases with age (see Davis/Haltiwanger 1992 for the US, and Fuchs/Weyh 2008 for Germany), industry structure may also be influenced through risk sharing getting less important in the life cycle of firms or industries. However, as Mamede (2006) points out in his literature review, although some authors have integrated matching mechanisms into theoretical models on industrial evolution in order to emphasize their changing importance for the spatial distribution of firms over time, no such model has been written with respect to risk sharing as a rationale for the evolution of industry structure over time. In the vein of Dumais/Ellison/Glaeser (2002), who find that new firms play a deagglomerating role while closing firms tend to reinforce agglomeration, empirical analyses would ideally shed light on differences in the propensity of firms of different age to benefit from risk sharing mechanisms and to therefore seek industrial concentration, or dispersion. In general, any such attempt of linking the importance of risk sharing by firm age to the spatial evolution of industry would do a service to our understanding of the geography of industrial clustering, and to the power of our explanations for regional economic success and decline.

Bibliography

Baldwin, John, Timothy Dunne, and John Haltiwanger. 1998. "A Comparison of Job Creation and Job Destruction in Canada and the United States". Review of Economics and Statistics 80: 347-56.

Becker, Gary. 1964. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. Chicago University Press.

BfLR. 1996. "Neuabgrenzung der Raumordnungsregionen". Mitteilungen und Informationen der BfLR: 4-5.

Birch, David. 1987. *Job Creation in America: How Our Smallest Companies Put The Most People to Work*. New York: Macmillan, Free Press; London: Collier Macmillan.

Boeri, Tito and Ulrich Cramer. 1992. "Employment Growth, Incumbents and Entrants". International Journal of Industrial Organization 10: 545-65.

Boeri, Tito. 1996. "Why are Establishments so Heterogeneous?". Small Business Economics 6: 409-20.

Brakman, Steven, Harry Garretsen and Marc Schramm. 2006. "Putting New Economic Geography to the Test: Free-ness of Trade and Agglomeration in the EU Regions". Regional Science and Urban Economics 36: 613-35.

Brambor, Thomas, William Roberts Clark, and Matt Golder. 2005. "Understanding Interaction Models: Improving Empirical Analysis". Political Analysis 14: 63-82.

Burgess, Simon, Julia Lane and David Stevens. 2000. "Job Flows, Worker Flows, and Churning". Journal of Labor Economics 18: 473-502.

Combes, Pierre-Philippe, Thierry Magnac and Jean-Marc Robin. 2004. "The Dynamics of Local Employment Growth in France". Journal of Urban Economics 56: 217-43.

Cramer, Ulrich and Martin Koller. 1988. "Gewinne und Verluste von Arbeitsplätzen in Betrieben – der ‚Job Turnover'-Ansatz". Mitteilungen aus der Arbeitsmarkt- und Berufsforschung 21: 361-77.

Davis, Steven and John Haltiwanger. 1992. "Gross Job Creation, Gross Job Destruction, and Employment Reallocation". Quarterly Journal of Economics 107: 819-63.

Davis, Steven, John Haltiwanger, and Scott Schuh. 1996. *Job Creation and Destruction*. MIT Press. Cambridge, MA.

Davis, Steven and John Haltiwanger. 1999. "Gross Job Flows"; in: Ashenfelter, Orley and David Card (Eds.). *Handbook of Labor Economics*. Elsevier: New York.

Desmet, Klaus and Esteban Rossi-Hansberg. 2008. "Spatial Growth and Industry Age". NBER Working Paper 13302.

Dumais, Guy, Glenn Ellison, and Edward L. Glaeser. 2002. "Geographic Concentration as a Dynamic Process". The Review of Economics and Statistics 84: 193-204.

Dunne, Timothy, Mark J. Roberts, and Larry Samuelson. 1989. "Plant Turnover and Gross Employment Flows in the U.S. Manufacturing Sector". Journal of Labor Economics 7: 48-71.

Duranton, Gilles and Diego Puga. 2000. "Diversity and Specialization in Cities: Why, Where and When Does it Matter?. Urban Studies 37: 533-56.

Duranton, Gilles and Diego Puga. 2001. "Nursery Cities: Urban Diversity, Process Innovation, and the Life Cycle of Products". American Economic Review 91: 1454-77.

Duranton, Gilles and Diego Puga. 2004. "Micro-Foundations of Urban Agglomeration Economies"; in: Henderson, J. Vernon and Jacques-Francois Thisse (Eds.) *Handbook of Urban and Regional Economics*. Elsevier-North Holland Amsterdam.

Ellison, Glenn and Drew Fudenberg. 2003. "Knife-Edge or Plateau: When do Market Models Tip?". Quarterly Journal of Economics 118: 1249-1278.

Ellison, Glenn and Edward L. Glaeser. 1997. "Geographic Concentration in US Manufacturing Industries: A Dartboard Approach". Journal of Political Economy 105: 889-927.

Faberman, Jason R. 2002. "Job Flows and Labor Dynamics in the U.S. Rust Belt". Bureau of Labor Statistics, Washington. Monthly Labor Review September 2002: 3-10.

Faberman, Jason R. 2008. "The Relationship Between the Establishment Age Distribution and Urban Growth". Urban Economics and Regional Studies (forthcoming).

Finney, Miles M. and Janet E. Kohlhase. 2008. "The Effect of Urbanization on Labor Turnover". Journal of Regional Science 48: 311-28.

Fritsch, Michael and Udo Brixy. 2004. "The Establishment File of the German Social Insurance Statistics". Schmollers Jahrbuch 124: 184-90.

Fuchs, Michaela and Antje Weyh. 2008. "The Determinants of Job Creation and Destruction: Plant-Level Evidence for Eastern and Western Germany". Dresden Discussion Paper Series in Economics No 02/2008.

Green, Francis, Stephen Machin, and Alan Manning. 1996. "The Employer-Size Wage Effect: Can Dynamic Monopsony Provide an Explanation?". Oxford Economic Papers 48: 433-55.

Helsley, Robert and William C. Strange. 1990. "Matching and Agglomeration Economies in a System of Cities". Regional Science and Urban Economics 20: 189-212.

Henderson, J. Vernon. 1986. "Efficiency of Resource Usage and City Size". Journal of Urban Economics 19: 47-70.

Henderson, J. Vernon 2003. "Marshall's Scale Economies". Journal of Urban Economics 53: 1-28.

Holmes, Thomas J. and John J. Stevens. 2002. "Geographic Concentration and Establishment Scale". The Review of Economic and Statistics 84: 682-90.

Holmes, Thomas J. and John J. Stevens. 2004. "Spatial Distribution of Economic Activities in North America"; in: Henderson, J. Vernon and Jacques-Francois Thisse (Eds.) *Handbook of Urban and Regional Economics*. Elsevier-North Holland Amsterdam.

Jacobs, Jane. 1969. *The Economy of Cities*. Random House. New York.

Kim, Sunwoong. 1990. "Labor Heterogeneity, Wage Bargaining, and Agglomeration Economies". Journal of Urban Economics 28: 160-177.

Eckey, Hans-Friedrich, Reinhold Kosfeld and Matthias Tuerck. 2006. "Abgrenzung deutscher Arbeitsmarktregionen". Raumforschung und Raumordnung 64: 299-309.

Krugman, Paul. 1991. *Geography and Trade*. MIT Press. Cambridge, MA.

Mamede, Ricardo. 2006. "Towards an Integrated Approach to Industry Dynamics and Labour Mobility". MPRA Paper 3994. University Library Munich.

Marshall, Alfred. 1890. *Principles of Economics*. MacMillan & Co. London.

Overman, Henry G. and Diego Puga. 2008. "Labour Pooling as a Source of Agglomeration: An Empirical Investigation". Working Paper 2008-05. IMDEA, University of Madrid.

Rosenthal, Stuart S. and William C. Strange. 2001. "The Determinants of Agglomeration". Journal of Urban Economics 50: 191-229.

Rosenthal, Stuart S. and William C. Strange. 2004. "Evidence on the Nature and Sources of Agglomeration Economies"; in: Henderson, J. Vernon and Jacques-Francois Thisse (Eds.) *Handbook of Urban and Regional Economics*. Elsevier-North Holland Amsterdam.

Spengler, Anja. 2007. "The Establishment History Panel". FDZ Methodenreport. Institute for Labor and Employment Research. Nuremberg.

Stahl, Konrad and Uwe Walz. 2001. "Will There Be a Concentration of Alikes? The Impact of Labor Market Structure on Industry Mix in the Presence of Product Market Shocks". HWWA Discussion Paper 140. Hamburg.

Stiglbauer, Alfred M. et al. 2003. "Job Creation and Job Destruction in a Regulated Economy: The Case of Austria". Empirica 30: 127-48.

Suedekum, Jens. 2006. "Concentration and Specialization Trends in Germany since Re-Unification". Regional Studies 40: 861-73.

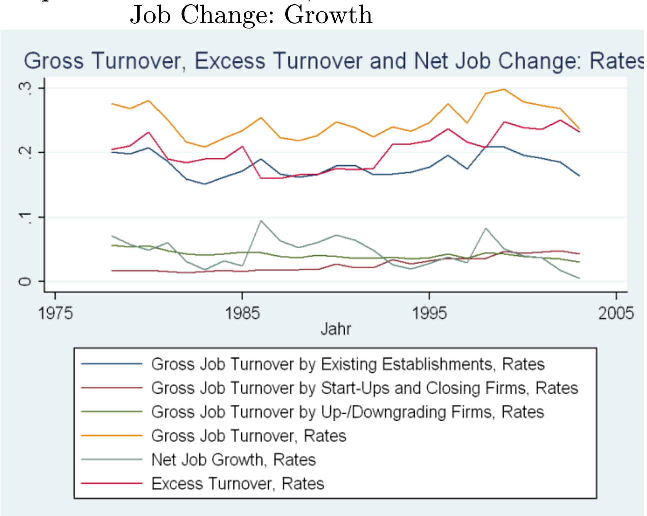
Appendix

Table I – Sectoral Classification and Employment Characteristics

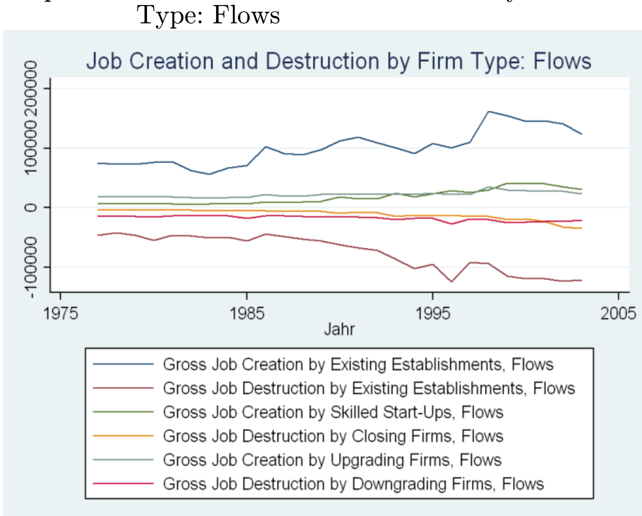
	Employment of Highly Qualified	Average Wages of Highly Qualified
Agriculture, Fishing, Mining	32,526	100.47
Chemical Industry	87,912	121.79
Iron and Steel Industry	17,022	116.87
Mechanical Engineering	162,813	117.02
Electrical Engineering	167,236	116.48
Furniture and Textiles	22,130	101.70
Food Production and Processing	11,952	105.66
Construction	32,872	102.91
Retail	99,395	97.36
Transportation	24,583	96.44
Insurance and Banking	81,000	119.46
Hotels and Catering	19,395	91.10
Consumer Services	26,415	90.66
Education	121,714	101.80
Media, Art, Photography	42,528	97.68
Legal and Economic Consulting	109,802	95.64
Real Estate	146,263	101.40
Public Sector	160,236	103.42
Sum/Weighted Average	1,365,794	106.70

Notes: Employment of Highly Qualified covers all employees holding a degree from a university or a technical college and being subject to social security contributions. This definition excludes self-employed and public servants. Average Wages of Highly Qualified are defined as average daily gross wages in 2000.

Graph I – Gross Turnover, Excess Turnover and Net Job Change: Growth

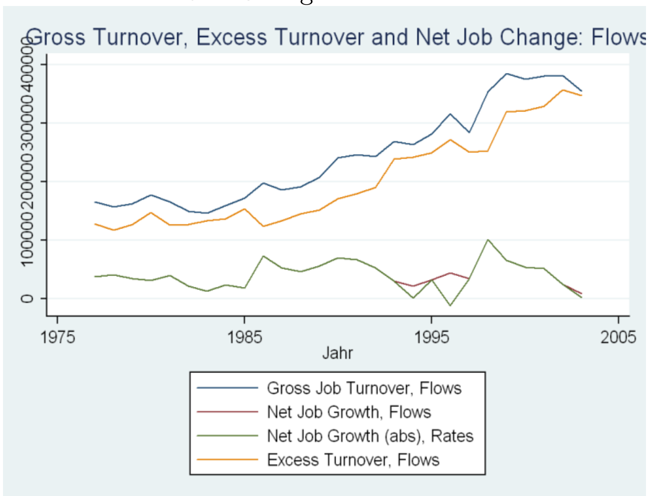


Graph II – Job Creation and Destruction by Firm Type: Flows

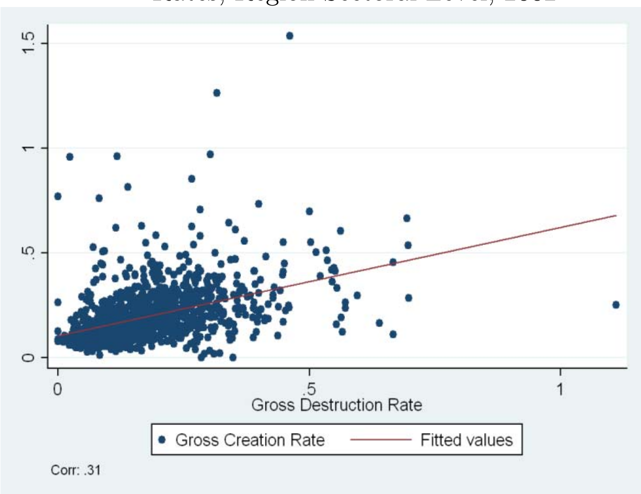


Graph III – Sectoral Gross Reallocation Rates

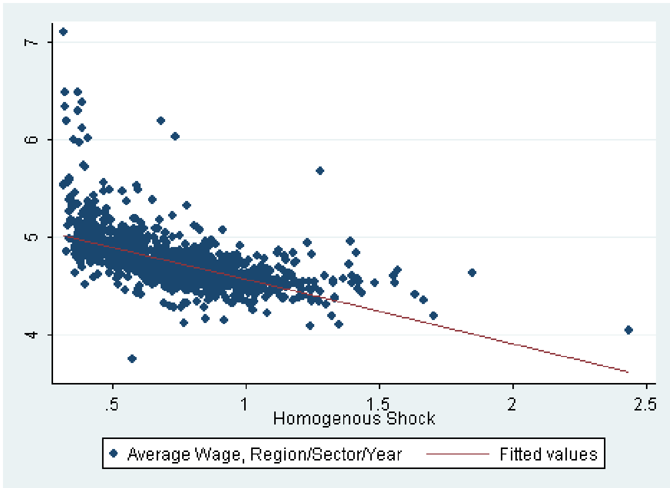
Graph IV – Gross Turnover, Excess Turnover and Net Job Change: Flows



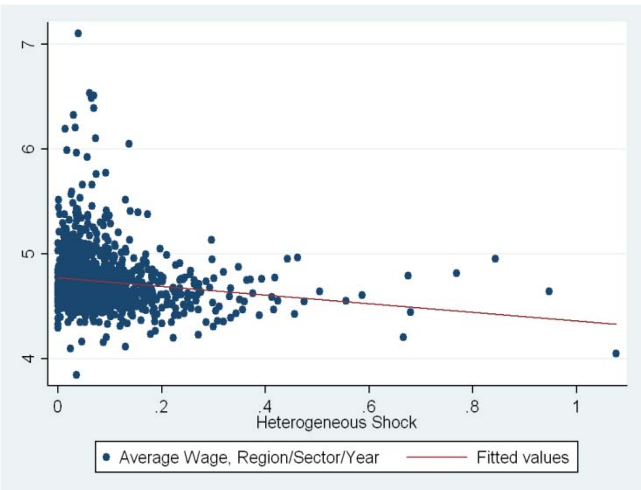
Graph V – Annual Gross Creation and Destruction Rates, Region-Sectoral Level, 2002



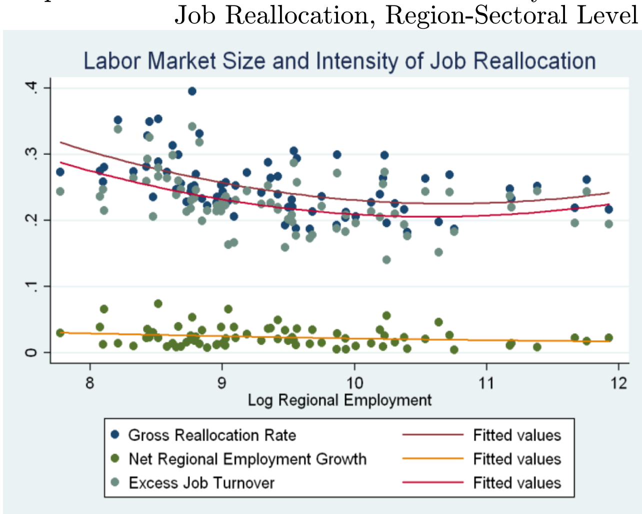
Graph VI – Homogenous Shocks and Wages, Region-Sectoral Level



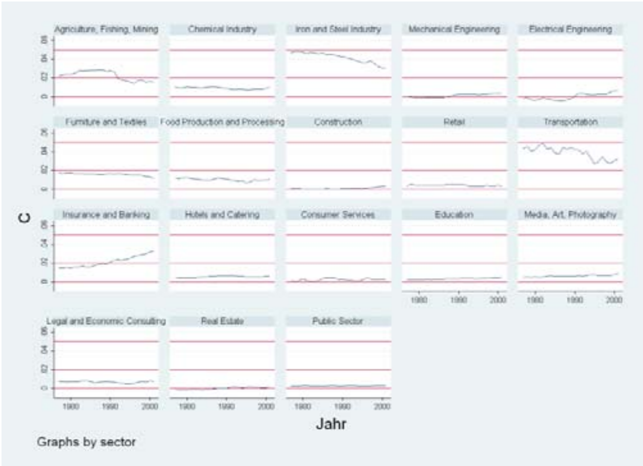
Graph VII – Heterogeneous Shocks and Wages, Region-Sectoral Level



Graph VIII – Labor Market Size and Intensity of Job Reallocation, Region-Sectoral Level



Graph IX – Industrial Concentration by Sector



Map I – Daily Gross Wages of HQ by Region, Average 1995-2001

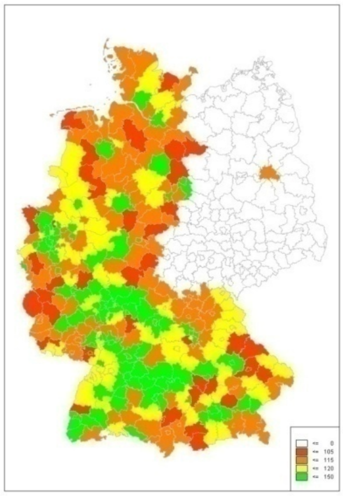


Table II – Industrial Structure, 2001

Ludwigshafen		Bielefeld	
Chemical Industry	76.0%	Public Sector	12.7%
Real Estate	4.6%	Mechanical Engineering	12.6%
Public Sector	4.3%	Consumer Services	11.5%
Education	3.5%	Legal and Economic Consulting	10.8%
Retail	2.7%	Electrical Engineering	9.6%
Mechanical Engineering	1.4%	Real Estate	6.5%
Legal and Economic Consulting	1.4%	Education	6.3%
Electrical Engineering	1.3%	Retail	6.0%
Agriculture, Fishing, Mining	.9%	Chemical Industry	5.1%
Hotels and Catering	.8%	Furniture and Textiles	4.4%
Insurance and Banking	.6%	Iron and Steel Industry	3.2%
Construction	.5%	Insurance and Banking	2.7%
Media, Art, Photography	.4%	Food Production and Processing	1.8%
Transportation	.4%	Media, Art, Photography	1.8%
Consumer Services	.4%	Transportation	1.6%
Furniture and Textiles	.3%	Agriculture, Fishing, Mining	1.4%
Iron and Steel Industry	.3%	Construction	1.2%
Food Production and Processing	.3%	Hotels and Catering	.8%

Notes: The regions of Ludwigshafen (Bielefeld) were chosen because they display the highest (lowest) Hirschman-Herfindahl index of industrial concentration among all 97 LMAs in 2001 (Ludwigshafen: 2.57 from a theoretical maximum of 2.89; Bielefeld: 1.002 from a theoretical minimum of 1.0)

Table III – Shocks and Industrial Structure, Region-Sectoral Level

	Dependent Variable: ln(Mean Wage per Region per Sector per Year)				
	(I)	(II)	(III)	(IV)	(V)
Specialization	3.59 (.032)***	.221 (.002)***	2.63 (.086)***	.497 (.067)***	.525 (.155)***
Diversification	.016 (.015)	-.054 (.016)***	-.068 (.049)	-.075 (.039)**	-.477 (.088)***
Homogenous Shock Intensity	-.241 (.015)***	-.039 (.018)**	-.674 (.049)***	.415 (.038)***	-.158 (.086)*
Heterogeneous Shock Intensity	-.249 (.052)***	-.397 (.054)***	-2.62 (.059)***	-.315 (.129)***	-.017 (.278)
Div*HetShock	.070 (.026)***	.166 (.027)***	.994 (.083)***	.268 (.064)***	.076 (.137)
Div*HetShock(t-1)	-.025 (.004)***	-.015 (.004)***	-.140 (.012)***	-.034 (.009)***	.079 (.021)***
Div*HetShock(t-2)	-.019 (.003)***	-.009 (.003)*	-.139 (.011)***	-.029 (.008)***	.069 (.019)***
Spec*HomShock	-4.06 (.324)***	-.344 (.021)***	.565 (.054)***	.526 (.042)**	.317 (.098)***
Spec*HomShock(t-1)	-5.66 (.314)***	-.316 (.017)***	.033 (.049)	.014 (.039)	.152 (.091)*
Spec*HomShock(t-2)	-5.67 (.306)***	-.298 (.017)***	-.088 (.048)*	-.016 (.038)	.212 (.087)
Year Dummies	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes	Yes
Region Dummies	Yes	Yes	Yes	Yes	Yes
Indicator for Specialization	Abs. Reg. Share	Rel.Reg.Share	Abs. Reg. Share	Abs. Reg. Share	Abs. Reg. Share
Firm Type	All Firms	All Firms	Existing	Start Up/Close	Up- /Downgrade
Adj. R^2	.69	.67	.33	.14	.19
No. of Observations	29,290	29,290	27,748	27,259	27,880

Notes: Standard errors in parentheses; ***, ** and * indicate significance at the 1% level, the 5% level and the 10% level respectively; coefficients for constants are not reported here.

Table IV – Shocks and Industrial Structure, Firm Level

		Dependent Variable: ln(Median Wage per Firm per Year)				
		(VI)	(VII)	(VIII)	(IX)	(X)
	HmS (Firm Level)	-.113	-.136	-.170	-.170	-.127
		(.009)***	(.007)***	(.011)***	(.011)***	(.006)***
	HtS (Firm Level)	-.009	-.105	-.011	-.009	-.008
		(.003)***	(.0005)***	(.0005)***	(.0005)***	(.0004)***
Spec./Div.	Specialization	-.002	-	-	-	-
		(.001)				
	Specialization*HtS	-.001	-	-	-	-
		(.007)				
	Diversification	.029	-	-	-	-
		(.004)***				
	Diversification*HmS	.002	-	-	-	-
		(.001)				
Mean of Shocks	Mean(HtS), RS	-	-.011	-	-.011	-
			(.001)***		(.001)***	
	HtS*Mean(HtS), RS	-	.003	-	.008	-
			(.0002)***		(.0007)***	
	Mean(HmS), RS	-	.013	-	.016	-
			(.005)***		(.005)***	
	HmS*Mean(HmS), RS	-	.161	-	.123	-
			(.026)***		(.029)***	
	Mean(HtS), R	-	-	-.002	.0003	-
				(.0003)***	(.0003)	
	HtS*Mean(HtS), R	-	-	.003	-.005	-
				(.0002)***	(.0007)***	
	Mean(HmS), R	-	-	-.044	-.045	-
				(.014)***	(.014)***	
	HmS*Mean(HmS), R	-	-	.862	.576	-
				(.136)***	(.149)***	
Variance of Shocks	Var(HtS), RS	-	-	-	-	$-.46*10^{-6}$
						$(9.8*10^{-7})$***
	HtS*Var(HtS), RS	-	-	-	-	.00001
						$(1.43*10^{-6})$***
	Var(HmS), RS	-	-	-	-	.611
						(.106)***
	HmS*Var(HmS), RS	-	-	-	-	.206
						(.096)**
	Var(HtS), R	-	-	-	-	-.3.3*10-6
						(4.8*10-6)
	HtS*Var(HtS), R	-	-	-	-	-.00002
						(.00001)**
	Var(HmS), R	-	-	-	-	-.069
						(.021)***
	HmS*Var(HmS), R	-	-	-	-	.467
						(.286)
Controls	No. of Employees, All	.0001	.0001	.0001	.0001	.0001
		$(1.8*10^{-6})$***	$(1.8*10^{-6})$***	$(1.8*10^{-6})$***	$(1.8*10^{-6})$***	$(1.8*10^{-6})$***
	No. of Employees, HQ	.0001	.0001	.0001	.0001	.0001
		(.00001)***	(.00001)***	(.00001)***	(.00001)***	(.00001)***
	Year Dummies	Yes	Yes	Yes	Yes	Yes
	Sector Dummies	Yes	Yes	Yes	Yes	Yes
	Region Dummies	Yes	Yes	Yes	Yes	Yes
	Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
	Lags for Interaction Terms	2	2	2	2	2
	Indicator for Specialization	Rel. Reg. Share	-	-	-	-
	Firm Type	Existing	Existing	Existing	Existing	Existing
	Adj. R^2	.07	.07	.07	.07	.07
	No. of Observations	1,962,913	1,962,913	1,962,913	1,962,913	1,962,811

Notes: Standard errors in parentheses; ***, ** and * indicate significance at the 1% level, the 5% level and the 10% level respectively; coefficients for constants are not reported here; two lags for all interaction terms were included in the regression but are not displayed here.

Table V – Industrial Concentration and Shock Intensity, Sectoral Level

Dependent Variable:	Ellison-Glaeser Index of Industrial Concentration	
	(XI)	(XII)
Ln(Homogenous Shock Intensity)	-.002 (.001)*	-
Ln(Heterogeneous Shock Intensity)	-.007 (.0006)***	-
O/P Index of Labor Pooling	-	-.006 (.003)*
Sectoral Employment	1.15*10 ($1.1*10^{-7}$)***	1.17 ($1.2*10^{-7}$)***
Year Dummies	Yes	Yes
Sector Dummies	Yes	Yes
Region Dummies	Yes	Yes
Adj. R^2	.95	.95
No. of Observations	432	432

Notes: Standard errors in parentheses; ***, ** and * indicate significance at the 1% level, the 5% level and the 10% level respectively; coefficients for constants are not reported here.

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