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Opportunities and Competition in Thick Labor Markets: Evidence from Plant Closures*

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Abstract

Since Marshall (1890), it has been widely held in urban economic theory that cities ensure workers against the risk of unemployment by offering a larger pool of potential jobs. Using a large administrative panel data set on workers affected by firm closures, we examine whether positive effects from a higher urban job density are offset by more intense competition between workers. When controlling for the sorting of workers between regions, we find no evidence that the number of days workers spend in unemployment decreases with local job density. Instead, longer unemployment periods in cities are partly driven by more intense competition for available jobs.

Keywords: agglomeration, thick labor markets, displacement

JEL Codes: J63, J64, R12, R23

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1 Introduction

One key argument for the existence of cities is that denser labor markets insure workers against the risk of unemployment by offering them a larger pool of potential jobs. As a result, workers living in urban areas should benefit from shorter job search periods in case of involuntary job loss (Duranton & Puga, 2004). This way of reasoning stands, however, in stark contrast to the empirical observation that, at least in the US and Germany, the average duration of joblessness rises with the local degree of agglomeration. For the US, a large literature on spatial mismatch documents a higher incidence of unemployment in downtown areas than in less densely populated suburbs (see, e.g., Kain, 1968; Wasmer & Zenou, 2002; Gobillon *et al.*, 2007).¹ For the German case, we have plotted the number of days that displaced workers spend in unemployment against regional population density in the left panel of Figure 1. The figure shows that both variables exhibit a strong positive relation, defying the notion that workers in cities find work more quickly. Consistently, the empirical literature has so far found little evidence in favor of an urban insurance effect. Overall, while access to jobs is of crucial importance for the re-employment process after periods of unemployment (Rogers, 1997), the density of the local labor market does not seem to shorten the time in unemployment (see, e.g., Petrongolo & Pissarides, 2006). This contradiction might be explained by the prevalence of fiercer job competition between workers in cities for available jobs (Raphael, 1998; Détang-Dessendre & Gaigné, 2009). Kroft *et al.* (2013) show for the US labor market that the chances of unemployed to receive a callback for a job interview decrease with the tightness of the local labor market. In the right panel of Figure 1, we relate local unemployment rates to population density in order to examine whether the tightness of the local labor market rises with the degree of agglomeration. The graph shows that the average unemployment rate rises monotonically in size over the range of population densities, indicating that the tightness of the labor market increases with local density. In combination, the

¹ Given the large volume of studies, we refer the reader to the surveys by Ihlanfeldt & Sjoquist (1998) and Gobillon *et al.* (2011).

evidence from both panels suggests that the ‘thickness’ of urban labor markets may turn against workers by reducing individual chances of re-employment due to more intense job competition.

In the present paper, we examine how the degree of agglomeration affects the number of days workers spend in unemployment after having become involuntarily unemployed. In particular, we shed light on the relative importance of job opportunities and job competition for the re-employment prospects of workers. We therefore construct market potential-based indicators for both variables, which explicitly take into account that regions themselves are not closed labor markets. Identifying positive or negative effects of density on individual employment chances is complicated by a potential sorting of individuals and firms between locations. In order to address this issue, we exploit exogenous events of involuntary unemployment from plant closures, which we identify based on detailed information from the German social security records. From this data, we extract the employment biographies of all workers who became unemployed as a result of plant closures between 1999 and 2009. To further reduce the problem of worker selection and unobserved heterogeneity, we impose sample restrictions with regard to tenure and changes in places of residence and make use of the panel structure of the data by employing individual and regional fixed effects. The frequency of the data in quarters allows for a detailed analysis of the effect that job opportunities and job competition have on the re-employment process of displaced workers. By drawing on the most disaggregated administrative level we make use of substantial variation in local densities resulting from the polycentric spatial structure in Germany.

[FIGURE 1]

In line with previous findings, we find evidence for a persistent increase in aggregate unemployment levels over a period of four years after a displacement (see, e.g., Ruhm, 1991; Jacobson *et al.*, 1993; Couch & Placzek, 2010; Schmieder *et al.*, 2010). Regarding the effects of density, there is no indication that the local density of jobs has an effect on the number of days in unemployment once we control for

the sorting of workers across regions. In contrast, we find that the time spent in unemployment rises significantly with the local density of unemployed workers. Overall, it seems that job seekers are effectively worse off in thick labor markets because competition effects dominate the opportunity value of cities. These negative effects are largest for workers who are least likely to resort to self-employment or to leave the labor market altogether.

The paper is organized as follows. In the next section, we review the existing literature. In Section 3, we outline our identification strategy. Section 4 describes the data and provides first descriptive evidence. The results are discussed in Section 5. Section 6 concludes.

2 Related Literature

The idea that a larger number of potential jobs in cities insures workers against the risk of unemployment goes back to Marshall (1890). Formalized by Duranton & Puga (2004), the mechanisms underlying this idea of risk sharing is that the variance of idiosyncratic productivity shocks incurred by firms rises with the degree of agglomeration. Workers who become unemployed are therefore better off in larger cities because of a higher probability that any other firm expands its production in consequence of a positive productivity shock and, hence, is in search of workers to hire.² This type of risk sharing between workers is commonly regarded as one main mechanism through which agglomeration externalities arise.

Despite this long-standing history of thought, the empirical evidence regarding the effect of labor market size on unemployment duration is far from conclusive. This literature, which is surveyed in Petrongolo & Pissarides (2001), reveals mainly constant returns to agglomeration, indicating that workers are not better off in larger labor markets in terms of their job search. Petrongolo & Pissarides (2006) point out that higher reservation wages in cities may offset potentially positive

² On the labor demand side, firms should therefore benefit from lower vacancy times in cities as a result of better access to suitable workers (Rosenthal & Strange, 2001; Moretti, 2011). In line with this notion, Martín-Barroso *et al.* (2015, 2017) and Holl (2012) show that firms in cities are more productive due to an improved access to factor markets.

effects from higher job arrival rates. This argument is supported by Harmon (2013), who shows that while workers in Denmark do not find jobs faster in larger local labor markets, the degree of urbanization positively affects wage levels after a successful match. In contrast, Di Addario (2011) finds that the local degree of agglomeration does indeed raise the hazard rates of unemployed workers in Italy. Similarly, Bleakley & Lin (2012) provide support for positive scale effects from larger labor markets by showing that unemployed workers in densely populated areas are more likely to be re-employed in the same occupation.

One argument for why agglomeration may not necessarily reduce unemployment durations in cities is that job opportunities in cities may partly be offset by a larger number of rivaling job seekers.³ The only two papers which empirically address this issue are the ones by Détang-Dessendre & Gaigné (2009) and Andersson *et al.* (2014). Both estimate hazard models with a measure of regional job accessibility as independent variable, where the local number of jobs is discounted by the number of job seekers. Both papers find evidence that a rise in local job accessibility reduces the number of days a worker spends in unemployment, suggesting that the opportunity value of cities supersedes negative effects from fiercer job competition. There are, however, two drawbacks from using one combined measure for opportunities and competition. First, the complexity of the index inhibits a meaningful interpretation of the point estimates beyond their sign and level of significance. Second, the results do not allow for gaining insight into the relative importance of job opportunities and job competition for a successful recovery out of unemployment. A proper design of labor market policies requires, however, an understanding of the role that each of the two sides of the labor market - jobs and competing job seekers - has for the re-employment chances of workers who have become involuntarily unemployed. From the perspective of identification, another

³ Although differing in the underlying mechanisms, the literature on neighborhood effects of unemployment is closely related to this paper (Hawranek & Schanne, 2014; Bayer *et al.*, 2008; Jahn & Neugart, 2017). The general idea of this literature is that higher local levels of unemployment impede access to local job-referrals networks for unemployed workers. The general finding in this literature is that living in a neighborhood with high unemployment rates raises the duration of job search for displaced workers.

difficulty of both papers is that none of them controls for individual heterogeneity by means of individual fixed effects. This is, however, problematic if unobserved worker characteristics are correlated with local labor market conditions (Glaeser, 1996). Also related to our paper is the contribution by Neffke *et al.* (2017), which examines the effect of local industrial structure on employment probabilities of laid-off workers. In a nutshell, the authors find that employment chances rise with the size of a worker's old industry in a region and decline with the presence of different but skill-related industries. As with the contributions by Détang-Dessendre & Gaigné (2009) and Andersson *et al.* (2014), one shortcoming of this paper is that it does not control for unobserved heterogeneity between workers. In the present paper, we build on these latter strands of the literature and add to their insights in two major respects. First, we disentangle the relative magnitude of opportunity and competition effects in thick labor markets. Second, we carefully control for sorting and unobservable heterogeneity between workers by means of a quasi-randomized experiment as well as by imposing different sample restrictions and employing worker and region fixed effects.

3 Measurement and Identification Approach

3.1 Measuring Opportunities and Competition

Any attempt to determine the size and the sources of agglomeration economies crucially depends on the definition of a region and its respective degree of urbanization. In Germany, the smallest administrative units are municipalities. They constitute the fourth administrative layer and, as such, are similar to cities, towns and villages in the US. By the end of 2014, 11,194 of these municipalities existed with an average population of slightly more than 7,000 inhabitants. Out of these, 15 cities contained more than 500,000 residents and another 62 more than 100,000. According to a classification provided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development, which takes into

account the wider economic role of a region, 848 municipalities can be considered as urban while the rest is of rural nature.⁴

While these numbers provide a first glance on the number and the size of big cities in Germany, in the present context they are deficient in three respects. First, they only provide a binary classification of a distribution which by its nature is continuous. Second, they do not take into account the extent to which a local population is sprawled within a region. This is of particular relevance in the present context when taking into account the substantial variation of the size of municipalities, which cover a range between less than one (*Neuheilenbach*) and 890 (*Berlin*) square kilometers. In addition, Glaeser & Resseger (2010) among others argue that the density of workers might be at least of equal importance for agglomeration economies to materialize than absolute population or worker numbers alone. Third, focusing on single municipalities ignores potential labor market interactions between neighboring regions (Combes & Gobillon, 2015). On county level, Haller & Heuermann (2016) show that job search is far from being confined to single regions. In fact, since 38 percent of workers commute across regional borders, the relevant local labor market is effectively larger, in particular if a region is well connected to its surroundings. These problems can be accounted for by means of a continuous measure which takes into account the sprawl of a labor market within the wider region. Relating the number of residents, workers or unemployed in a region r at time t , which we denote as L_{rt} , to the area of a region A_r yields a measure for the density of a local labor market, M_{rt} .

$$\text{Labor Market Density}_{rt} = M_{rt} = \frac{L_{rt}}{A_r} \quad (1)$$

In order to take into account the thickness of the labor market in the wider region, we augment this local density by the distance-discounted density of all

⁴ One peculiarity of the city size distribution in Germany is that according to Zipf's law large cities are underrepresented, which is usually regarded as resulting from a decentralized spatial structure in Germany (Giesen & Südekum, 2011).

neighboring municipalities j (Hansen, 1959; Brakman *et al.*, 2009).

$$M_{rt}^{augm} = \sum_{\substack{j=1 \\ r \in J}}^J \frac{L_{jt}}{A_j} f(d_{rj}), f(d_{rr}) = 1 \quad (2)$$

The impedance function $f(d_{rj})$ is determined by its functional form, the spatial decay parameter θ and the distance d_{rj} between localities (Reggiani *et al.*, 2011). We follow the literature (see, e.g., Andersson *et al.* (2014) and Ahlfeldt & Wendland (2016)) and employ an exponential decay function, $e^{-\theta d_{rj}}$, with $\theta = 0.1$. d_{rj} is measured by the driving time between the centroids of two municipalities in 2005.

Equation (2) provides the foundation for constructing measures of job opportunities and the degree of job competition within local labor markets. The most obvious proxy for job opportunities would be the distance-discounted number of vacancies per area unit. Data on vacancies are, however, not available on the level of municipalities. On county level, they are, in turn, notoriously unreliable because firms are not obliged to report their vacancies to the Federal Employment Agency. As a result, the existing data sets contain only 43 percent of all open positions. We therefore measure local job opportunities by means of the distance-discounted number of available jobs, which we approximate by the number of full-time employed workers within a region.

$$Opp_{rt} = \sum_{\substack{j=1 \\ r \in J}}^J \frac{Workers_{jt}}{km^2_j} f(d_{rj}), f(d_{rr}) = 1 \quad (3)$$

Defined this way, Opp_{rt} is based on the assumption that workers aim to minimize commuting distances and therefore prefer jobs located close to their home. Within regions, the number of jobs is therefore discounted by the size of the area across which they spread. Between regions, the idea that the attractiveness of jobs decreases with distance is captured by the distance decay function $f(d_{rj})$.

Regarding the local degree of job competition, $Comp_{rt}$, it is ex ante an open question whether dismissed workers compete with all persons in the local workforce or only with other unemployed job seekers. In light of the literature inspired

by Snower & Lindbeck (1989), it seems very likely that the latter is the more relevant peer group for unemployed workers when aiming to find a new job. From the perspective of identification, one additional problem that we encounter when using the local population of working age as a measure for competition is that this is highly correlated with the local number of jobs (corr.: 0.91). This results from the fact that a large share of workers are employed in the region they live in. When using regional fixed effects, the multicollinearity between both variables substantially reduces the precision of the estimates. For theoretical and econometric reasons, we therefore resort to the distance-discounted number of unemployed workers per region r normalized by the area of a municipality in square kilometers as our measure for job competition.

$$\text{Comp}_{rt} = \sum_{\substack{j=1 \\ r \in J}}^J \frac{\text{Unemployed}_{jt}}{\text{km}^2_j} f(d_{rj}), f(d_{rr}) = 1 \quad (4)$$

3.2 Identification Approach

Estimating the effect that job opportunities and job competition have on individual labor market outcomes is complicated by the fact that firms and workers are not distributed randomly in space (Combes *et al.*, 2011). This is problematic if the intensity of job search or other individual characteristics that are relevant for finding a job differ systematically between regions. In addition, unobservable regional characteristics are likely to lead to bias in the estimates if they are correlated with the local density of jobs or workers. We address this issue in three ways.

First, we quasi-randomize the place of residence of workers, and thereby the degree of job opportunities and competition, in order to render them orthogonal to individual characteristics. Finding a true randomized experiment where a large number of workers is allocated exogenously to regions is, however, hard to find (see for instance Katz *et al.* (2001) or Kling *et al.* (2007)). Starting with Ruhm (1991) and Jacobson *et al.* (1993), the literature has therefore resorted to incidences of mass layoffs in order to achieve an exogeneity of job search deci-

sion. In these studies, wages or earnings of displaced workers are compared to those of workers who have remained in the firm in order to gain insight into the costs of job loss in terms of earnings and income (see von Wachter (2010) for a survey).⁵ This literature unanimously shows that a period of involuntary unemployment yields substantial income losses for displaced workers due to the loss of firm-specific knowledge (Couch & Placzek, 2010; Schmieder *et al.*, 2010) and occupational mismatch (Nedelkoska *et al.*, 2015; Holm *et al.*, 2016). In this paper, we apply a similar line of reasoning and focus on job displacements as a result of plant closures. We use incidences of plant closures rather than of mass layoffs because the latter are restricted to a small and selective subset of regions. Incidences of plant closures do, in turn, approximate the distribution of workers across locations rather well. In fact, 77 percent of workers who are displaced as a result of plant closures live in urban regions. This is similar to the population distribution in Germany, where 75 percent of individuals live in cities. The key idea of this design is that neither closing establishments nor dismissed workers differ systematically between regions in terms of their characteristics (Andersson *et al.*, 2014). In this setting, the local degree of labor market thickness is as good as randomly assigned to workers and the local number of job opportunities and job competition should therefore be unrelated to the individual intensity of job search. We discuss the plausibility of this assumption in Section 4.

Second, in order to further reduce potential bias from the selection of workers, we restrict the sample in terms of worker mobility and tenure. Specifically, we only include workers who have changed neither their place of residence nor their employer over a period of four years prior to the firm closure (Schmieder *et al.*, 2010). While this restriction may limit the external validity of our results, it reduces the threat of selective moves between firms and regions which would impede a correct identification of the causal effect of job opportunities and competition

⁵ In addition, effects on health (Sullivan & Von Wachter, 2009), fertility decision (Huttunen & Kellokumpu, 2016), divorce probabilities (Eliason, 2012) and the inter-generational transmission of these effects (Oreopoulos *et al.*, 2008) have been examined. Gathmann *et al.* (2017) provide evidence for sizeable negative spillovers of mass layoffs within local labor markets.

on unemployment. In order to shed light on the extent to which our results can be generalized, we compare the characteristics of the workers in our sample to the universe of all employed and unemployed workers in Section 4. Finally, we control for individual fixed effects which at the same time absorb all time-invariant regional characteristics because workers by definition do not change municipalities.⁶ As discussed in Section 2, this provides a novel approach in the literature since in particular the studies by Détang-Dessendre & Gaigné (2009) and Andersson *et al.* (2014) do not control for the unobserved heterogeneity of workers. We compare our results to theirs when discussing our findings in Section 5.

Based on the resulting sample of workers, we examine the effect of job opportunities and job competition on individual employment prospects by means of an event study. Denote the number of days that a displaced worker i spends in unemployment per quarter q as d_{iq} , which is the dependent variable.⁷ Note that since we observe workers for a period of four years after the incidence of involuntary displacement, q runs from $q = 0$ to $q = 16$. In addition, assume that worker i lives in region r , which is characterized among other things by the number of job opportunities, Opp_{rq} , and the intensity of job competition, $Comp_{rq}$. The following equation relates the time that each workers spends in unemployment per quarter to both variables.

$$d_{iq} = \beta_1 Opp_{rq} + \beta_2 Comp_{rq} + \mathbf{X}_{iq} \boldsymbol{\alpha} + \mathbf{R}_{rq} \boldsymbol{\gamma} + \theta_i + \phi_t + \psi_q + \varepsilon_{iq} \quad (5)$$

The matrix \mathbf{X}_{iq} contains covariates on individual level like age, gender, nationality, skill level, and a dummy for East Germany. \mathbf{R}_{rq} , in turn, controls for systematic differences between regions in terms of GDP, amenities, and commuters. θ_i denotes individual fixed effects. ϕ_t represents year-quarter fixed effects, which capture variation in re-employment chances over the business cycle. Since

⁶ Note that we impose a further restriction with regard to non-moving after dismissal in the robustness checks.

⁷ An alternative approach would be to take the time to the next full-time employment as a measure for labor market success. Since, however, this first employment is often only of short duration, summing up the days in unemployment per quarter is a more informative measure of long-term labor market success after a displacement.

re-employment prospects vary with time spent in unemployment, we include fixed effects for each quarter after the incidence of displacement, ψ_q . Note that we standardize Opp_{iq} and $Comp_{iq}$ by their respective mean and standard deviation. Doing so allows for interpreting the coefficients as changes in days in unemployment per quarter as a result of a change in either Opp_{iq} or $Comp_{iq}$ by one standard deviation. As a result, we can directly compare the coefficients β_1 and β_2 to each other. Throughout all regressions, standard errors are clustered on the level of closed establishments.

4 Data & Descriptive Evidence

4.1 Data

We draw on administrative data from the German Federal Employment Agency, which are provided by the Institute for Employment Research in the IEB (Integrated Employment Biographies). The IEB contain information on a daily basis for all employed persons subject to statutory social security contributions, as well as all on all recipients of unemployment insurance or unemployment assistance (Antoni *et al.*, 2014). For these persons, information on education, age, gender, nationality, full-time vs. part-time, occupation, and wage, as well as on firm characteristics like establishment size and industry classification are provided.

Based on this data, we identify in a first step all plants that were closed between 1999 and 2009 and have employed at least four employees at the time of closure.⁸ The latter restriction accounts for the risk that otherwise the resulting unemployment needs not necessarily be involuntary but might rather be the result of the decision of one person or a small group of persons. We address the issue of changing firm identifiers by means of the method proposed by Hethey-Maier & Schmieder (2013). For the resulting set of firms, we take the employment biographies of all individuals between 25 and 50 years of age who were employed full-time

⁸ See Fackler *et al.* (2013) and Fackler & Schnabel (2015) for an overview of the characteristics of closing firms.

at the firm and have not left earlier than six months before the firm disappears. In addition, we apply the restrictions discussed in Section 3, i.e., we only include workers into the sample who have changed neither their place of residence nor their employer over a period of four years prior to the closure.⁹

One problem we had to address is the one of sample attrition after displacement. In fact, around 12 percent of workers disappear from the data in the quarter after displacement. 27 percent drop out of the sample over the next four years. Potential reasons for such attrition are that workers become part-time or self-employed or leave the labor market altogether. In order to account for such temporary or permanent dropouts from the sample, we generate spells for those periods, mark them as ‘neither full-time employed nor unemployed’ and count the days per quarter that each individual spends in this status. We then convert the spell data into a balanced panel data set. This data set contains quarterly information on 97,743 workers who were employed in 34,946 establishments for a period of four years before and four years after the displacement.

On regional level, we consider all 11,194 municipalities that existed on 31st of December 2014. We exclude 78 uninhabited units, which consist only of woods and lakes, as well as all islands, which due to their isolation are peculiar cases in terms of their labor markets. In 6,417 of these municipalities, we observe at least one worker who was affected by a plant closure. Information on the population of working age within each of these municipalities is provided by the Federal Statistical Office. The monthly number of unemployed per municipality is taken from the Statistics of the Federal Employment Agency (2017), which we aggregate to quarterly averages. The stock of employed individuals per municipality are contained in the Administrative Wage and Labor Market Flow Panel (Stüber & Seth, 2017). These data are based on the full universe of establishments in Germany. Aggregating them to the level of municipalities allows for a very precise measurement of the stock of employed workers. In addition, we are able to exactly match end of period values to quarters, which greatly reduces the problem of aggregation inherent to

⁹ Table A.1 shows how each of these restrictions affects the number of workers in the sample.

other data sources. As regional controls on county level we use the log of GDP, commuter balance and the number of hotel beds as a proxy for local amenities, which are all provided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development.

4.2 Descriptive Evidence

Table 1 summarizes the characteristics of displaced workers, closed establishments and municipalities in Germany. The first two columns show the mean and the standard deviation of the main variables within each dimension. The median displaced worker is 40 years old, male, medium-skilled, of German nationality, lives in West Germany and has worked for six years (2,439 days) in a firm prior to its closure. The median establishment has existed for 15.9 years, was located in West Germany and has employed 17 workers out of which 13 were full-time employed. The average municipality covers an area of 80 square kilometers. The mean number of displaced workers per municipality per quarter in our sample is 3.3. On average, each municipality exhibits 719 jobs and 142 unemployed persons per square kilometer. One assumption of our identification design is that workers who have become involuntarily unemployed do not differ between regions in terms of their characteristics since otherwise we might capture a sorting effect rather than the causal effect of density. The remaining two columns show the mean of the main variables for workers and firms in the upper and the lower quartile of regions with regard to population density. Generally, workers and firms turn out to be relatively similar in regions shaped by high and low degrees of urbanization. Exceptions are the average degree of education and the nationality of the workforce. In denser areas, displaced workers are generally better educated and have a higher probability to be foreign-born. This emphasizes the need to not only control these characteristics in the regression approach but to also include individual fixed effects since workers may also differ in terms of other unobservable characteristics.

[TABLE 1]

To shed light on the issue of external validity, we have summarized the characteristics of all employed and all unemployed workers in Germany in Table A.2 in the Appendix. Overall, the workers in our sample are not very different from the two groups with the exception of the share of foreigners, which is higher in our sample, and the share of women, which is lower. While we condition on these variables, the populations of employed and unemployed workers may still differ from the individuals in our sample with regard to unobservable characteristics. The overall similarity between all groups shows, however, that the restrictions we have imposed with regard to tenure and place of residence have not yielded a sample that is disconnected from the universe of workers and unemployed in Germany.

In Figure 2, we compare the regional distribution of job opportunities, job competition and unemployment duration. Maps (1) and (2) provide evidence for a close spatial correlation of job opportunities and job competition. Both variables closely follow the pattern of urbanization with densely populated regions like the Rhine-Ruhr and the Rhine-Main area and the regions in and around the large cities of Berlin, Hamburg, and Stuttgart exhibiting the highest values. The distribution of unemployment durations is dominated by a sharp divide between East and West Germany. It shows that local labor markets in the East have still not overcome the detrimental labor market effects of the German reunification. Within the West, the geographic distribution of unemployment durations largely follows the pattern of job opportunities and job competition. Overall, the evidence from the figure yields two main insights. First, it confirms the earlier finding that, at least in West Germany, the duration of unemployment rises with the degree of agglomeration. Second, it shows that job opportunities and job competition are two sides of the same coin in the sense that a ‘thick’ local labor market not only yields a large number of jobs, but at the same time also a large number of competitors for these jobs. In the following, we disentangle the influence that these two variables have on the number of days that laid-off workers spend in unemployment per quarter.

[FIGURE 2]

5 Results

Figure 3 contains the estimated days in unemployment per quarter after a displacement conditional on covariates on worker and regional level. It shows that workers are jobless on average for more than 30 days in the first quarter after displacement. This number decreases gradually and converges to a persistent level of around 11 days after four years.

[FIGURE 3]

In Table 2, we examine the effect that local job opportunities and job competition have on the number of days in unemployment per quarter. Column (1) provides the results for the specification contained in equation (5) with individual and regional controls as well as with year-quarter and time fixed effects, but without individual fixed effects. It shows that a rise in job opportunities by one standard deviation is associated with a decrease in the number of days in unemployment by 1.89 days. An increase in job competition by one standard deviation is, in turn, accompanied by 1.84 more days in unemployment per quarter. Both coefficients are highly significant and similar in size. The fact that they are not statistically different from each other indicates that the effects from higher job density and higher unemployment density in cities offset each other. When adding individual fixed effects in column (2), the coefficient on job density decreases to -1.4 and becomes insignificant. The coefficient on unemployment density, in contrast, rises to 3.5 and remains highly significant. In column (3), we account for fact that Figure 1 suggests a non-linear relationship between the local degree of agglomeration and unemployment duration. Based on the specification contained in column (2), we insert quadratic terms of job density and unemployment density. As a result, while both coefficients are insignificant for job opportunities, job competition indeed exhibits decreasing returns but the total effect never turns negative in our sample.

[TABLE 2]

Taken together, these results are informative in at least three major respects. First, finding the effects from opportunities and competition to offset each other in the absence of individual fixed effects is consistent with the literature on matching functions, which has found no evidence for increasing returns to scale (Petrongolo & Pissarides, 2001). This absence of an overall effect of urbanization on the duration of joblessness hides, however, the potential existence of opportunities and competition as two underlying and opposing mechanisms which are both statistically significant as long as worker heterogeneity is not being controlled for.

Second, the results emphasize the need to control for individual and regional heterogeneity by means of fixed effects. While finding a positive effect of job opportunities on unemployment duration in column (1) is in line with the findings by Andersson *et al.* (2014), this effect vanishes with the inclusion of individual fixed effects. This supports the argument by Petrongolo & Pissarides (2006) and Harmon (2013) that higher job arrival rates in cities might be offset by higher reservation wages. One peculiarity of our setting is that workers by construction of the sample do not change their region of residence prior to being laid off. As a result, individual fixed effects effectively also control for all time-invariant regional characteristics before dismissal. In order to disentangle the sources of unobserved heterogeneity, we estimate equation (5) with municipality but without individual fixed effects. Column (4) contains the results with municipality but without individual fixed effects. A comparison of columns (1), (2) and (4) shows that the effect of job competition on unemployment duration is underestimated in the absence of individual and regional fixed effects, but overestimated if only regional fixed effects are included. As such, the results suggest that while more dynamic urban labor markets partly offset negative effects from enhanced job competition in cities, individuals in cities tend to be negatively selected in terms of their probability of finding employment. This latter finding is consistent with a branch of the literature in sociology, which discusses a larger anonymity and less social pressure as main reasons for a higher incidence of long-term unemployment in cities (see, e.g., Siebel (1997)).

Third and most importantly, our findings provide a causal interpretation of the empirical regularity that unemployment rates and unemployment duration are both higher in urban than in rural areas in Germany. In line with the argument by Kroft *et al.* (2013) that job finding probabilities decrease with the tightness of the local labor market, we find that being exposed to a higher degree of job competition significantly raises the number of days that individuals spend in unemployment. At the same time, our results provide no evidence in support of the theoretical argument that workers benefit from sharing the risk of unemployment in thick labor markets. This combination of results is of key importance for the design of urban labor market policies because it emphasizes the key role of the labor supply side when considering additional efforts to fight higher unemployment rates in cities. Reducing the number of job seekers through, e.g., improved placement services, training measures and counseling services is likely to have an external effect on all other job seekers by relieving competitive pressure.

Before conducting a number of robustness checks, we briefly summarize the coefficients of the individual and regional variables in column (1), which are informative in their own right. Generally, living in East Germany is associated with longer unemployment spells compared to West Germany, which is in line with a well-documented higher incidence of long-term unemployment in this part of the country (Bundesagentur für Arbeit, 2017a; Bauer *et al.*, 2016). The number of days that foreigners spend in unemployment per quarter after displacement exceeds those of German nationals by more than five days. Women are about one day longer unemployed per quarter than men. Age exhibits a negative effect in younger years, which turns positive around the age of 48. Low-skilled workers are 7 days longer unemployed than medium skilled workers and 11 days more than high skilled workers. Workers find jobs more quickly in more prosperous regions, while amenities do not significantly affect unemployment duration. The number of in-commuters, in turn, raises the duration of unemployment, which is likely the result of more intense competition for available jobs.

In order to further reduce the threat of bias from worker sorting, we impose another restriction in column (5) with regard to the continuity of a worker's place of residence. So far, we have only required that individuals exhibit a constant place of residence during the four years prior to displacement. We now extend this restriction to the full period of four years before *and* four years after the incidence of unemployment. In consequence, the effect of unemployment falls slightly in size from 3.5 to 3.1. This result provides evidence for a positive selection of stayers in the sense that dismissed workers with lower re-employment prospects in their home region tend to leave the region and look for work elsewhere. Those workers who decide to stay are, in turn, more likely to find a job in their home region.

In a second robustness check, we examine the sensitivity of our findings with regard to the artificial spells we have generated to avoid bias from panel attrition. As described in Section 4, about 27 percent of individuals are neither full-time employed nor registered as unemployed at some point during the four years after dismissal. In these cases, we have imputed unemployment spells of zero days. When we drop these artificial spells in column (6), the coefficient of job opportunities remains insignificant while the effect of job competition rises to 4.0. The direction of this change suggests that persons leaving the sample for part-time or self-employment are positively selected.

[TABLE 3]

In Table 3, we examine the effects of job opportunities and job competition on the unemployment duration of different subgroups of workers with regard to gender, age, nationality, skill-level, region type and firm size in greater detail. All results are based on the specification contained in column (2) of Table 2. Since the effects of job opportunities are insignificant throughout, we only comment on the results obtained with regard to job competition. We begin by splitting the sample by individual characteristics, starting with gender. The first set of results shows that the effect of job competition is larger for men (3.7) than for women (2.8). This difference can be attributed to women being more likely to resort to

part-time employment or to leave the workforce altogether if they become involuntarily unemployed (Bundesagentur für Arbeit, 2017b). When we split the sample by the median age of 40 years, we find the effect of job competition to be larger for younger (4.3) than for older workers (2.8). Despite the upper ceiling of 50 years of age that we have imposed, this result is most likely driven by the drop-out of older workers to early retirement. In particular during the early years of the period of observation, which spans the years between 1999 and 2009, legal regulations still foresaw substantial room for early retirement under certain circumstances (Bellmann & Janik, 2010; Bonin, 2009). The third set of results indicates that the effect is larger for German nationals (3.5) than for foreigners (2.0). This result is counterintuitive at first glance since one would expect foreigners to be particularly disadvantaged in regions shaped by a high intensity of competition for available jobs. It can, however, be explained by a higher propensity of foreigners to resort to self-employment after jobs-loss (Brixy *et al.*, 2011). When differentiating the results by skill level, we find job competition to affect unemployment duration only for medium-skilled workers but not for low-skilled and high-skilled workers.¹⁰ For low-skilled workers, this finding probably results from one peculiarity in the German unemployment statistics, where participants in measures of active labor market policies are not counted as unemployed. If such measures are more prevalent in regions with higher levels of unemployment, job competition will leave the number of days in unemployment unaffected since workers drop out of the unemployment statistics due to their participation in, e.g., training measures and public employment schemes. The insignificance for high-skilled workers might be taken as evidence that these workers compete within their own segment of the labor market and remain unaffected by a higher overall unemployment density.

We continue by shedding light on how the size of the effects varies with the overall degree of urbanization. We therefore categorize municipalities into rural and urban types according to the classification provided by the Federal Institute for

¹⁰ The category *low-skilled* contains all persons who have not undergone or not completed vocational training. Workers who have successfully completed vocational training are classified as *medium-skilled* while workers holding a university degree are defined as *high-skilled*.

Research on Building, Urban Affairs and Spatial Development described in Section 3. About three quarters of the workers in our sample reside in urban municipalities. For these workers, negative effects from competition are about 35 percent smaller than for workers living in rural regions. This finding is in line with the notion that metropolitan areas provide better access to job referral networks (Jahn & Neugart, 2017) and offer a broader diversity of industries (Neffke *et al.*, 2017), which both shorten the periods that workers spend in unemployment. Lastly, we split the data with regard to the median size of closed establishments.¹¹ The negative effects of job competition are slightly larger for workers who were employed in smaller firms. Similar to the differences between rural and urban regions, this finding might be a result better job referral networks prevailing within and between larger firms.

6 Conclusion & Outlook

We have started off from the observation that both unemployment rates and unemployment durations are higher in urban than in rural areas in Germany, which stands in stark contrast to the argument posited by urban economic theory that workers benefit from sharing the risk of unemployment in larger labor markets. In this paper we have therefore examined to which extent the local number of job opportunities and the degree of job competition influence the number of days that workers spend in unemployment after having become involuntarily unemployed. When controlling for regional and individual heterogeneity and for the sorting of workers across locations, we find that the degree of job competition substantially raises the number of days in unemployment while job opportunities have no significant effect. While these findings defy the notion of risk sharing in urban labor markets, they emphasize the detrimental effect of job competition on the re-employment prospects of unemployment workers. As such, they establish a causal link between observed higher unemployment rates and longer unemployment durations in urban areas.

¹¹ Note that the median size is calculated based on the 97,743 individuals and not on the 34,946 different firms contained in the sample.

With regard to the design of labor market policies, these findings emphasize the need for supply side approaches to fighting higher unemployment rates in cities since a decrease in overall unemployment reduces competitive pressures on job seekers and thereby unfolds external effects. It would therefore be desirable to better understand the local segregation of labor markets by skill level and occupation in order to better target active labor market policies to different types of unemployed workers in order to effectively relieve competitive pressures within specific segments of local labor markets. The contribution by Neffke *et al.* (2017), which complements our findings in this direction, provides a valuable starting point for further research.

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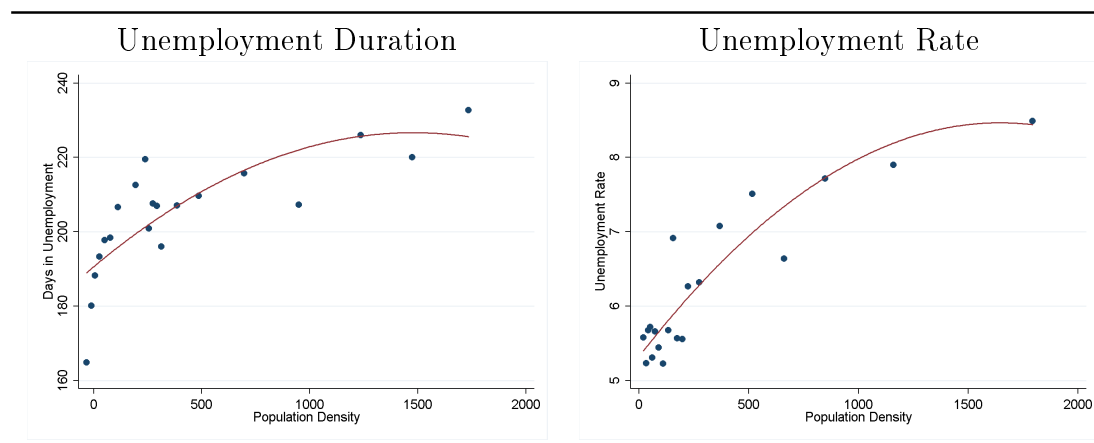
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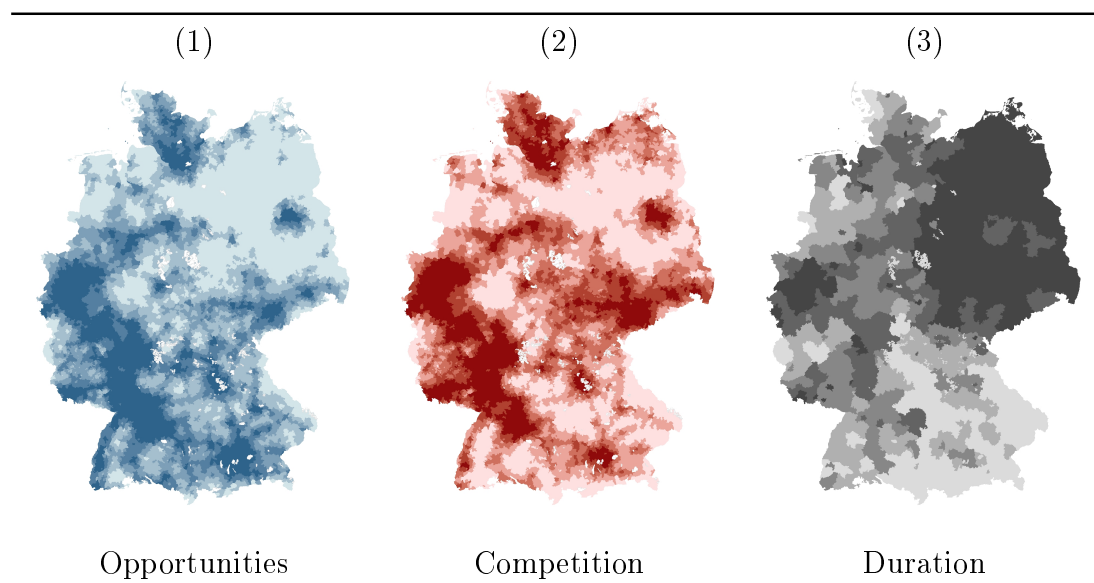
Figures and Tables

Figure 1: Unemployment and Regional Agglomeration



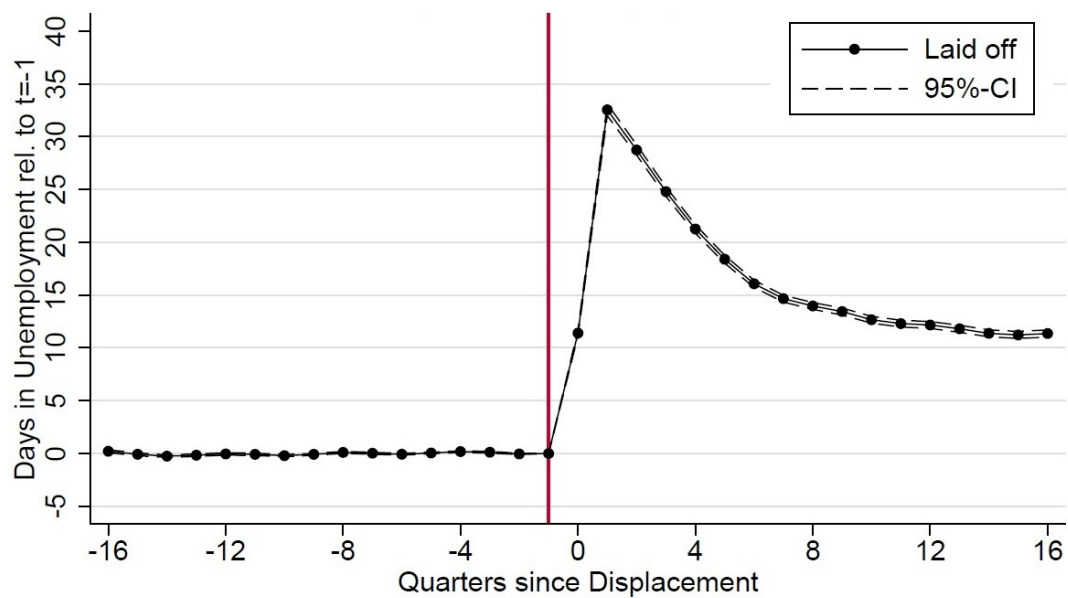
The figure shows the average unemployment rate and unemployment duration per county in density bins (population per square kilometer). The graphs are based on pooled data, which cover the years 1999 to 2014 and are taken from the Statistics of the Federal Employment Agency and the Sample of Integrated Employment Biographies.

Figure 2: Job Opportunities, Job Competition and Duration of Unemployment



The three maps show the regional distribution of job opportunities as defined in equation (3), of job competition as defined in equation (4) and of the average number of days in unemployment. Map (3) is based on a representative sample of unemployed taken from the Sample of Integrated Employment Biographies. Coloring is in quintiles with darker colors indicating higher values.

Figure 3: Days in Unemployment before and after Displacement



The graph shows the estimated days per quarter in unemployment four years before and four years after a displacement conditional on nationality, gender, age, age², skill level, regional GDP, commuter balance, amenities, a dummy for East/West and year-quarter fixed effects.

Table 1: Summary Statistics

Displaced Workers				
	Mean	SD	1 st Quart.	4 th Quart.
N	97,743		24,475	24,435
Age when displaced	39.89	6.49	39.73	39.90
Tenure (in days)	2,439	840	2,336	2,477
Female	0.27	0.44	0.24	0.29
Foreign	0.15	0.36	0.08	0.23
Low skilled	0.12	0.33	0.08	0.17
Medium skilled	0.79	0.40	0.87	0.73
High skilled	0.08	0.26	0.05	0.10
East Germany	0.34	0.47	0.45	0.35
Closed Establishments				
	Mean	SD	1 st Quart.	4 th Quart.
N	34,946		8,499	8,476
Firm age (in years)	15.91	9.12	15.63	16.70
East Germany	0.29	0.46	0.36	0.28
All employed	17.70	35.51	17.86	17.03
Full-time employed	12.94	26.31	13.59	11.97
... of which are female	3.37	8.45	3.05	3.58
... of which are foreign	1.09	4.66	0.66	1.59
Municipalities				
	Mean	SD	1 st Quart.	4 th Quart.
N	6,417		1,602	1,604
Area (in km ²)	44.08	47.31	14.76	57.57
No. of Displaced Workers	4.62	6.69	1	5
Jobs per km ²	557.50	593.44	197.18	690.62
Unemployed per km ²	108.47	86.40	45.19	145.56

The table provides summary statistics for displaced workers, closed establishments and municipalities. Columns '1st Quart.' and '4th Quart.' provide the respective averages for regions in the first and fourth quartile of population density.

Table 2: Regression Results

Dependent Variable: <i>Days Unemployed per Quarter</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
Job Opportunities	-1.898*** (0.165)	-1.424 (2.010)	-3.653 (3.198)	0.886 (2.093)	0.263 (2.351)	-2.438 (2.078)
Job Competition	1.844*** (0.175)	3.493*** (0.513)	7.450*** (0.688)	6.031*** (0.546)	3.093*** (0.598)	4.042*** (0.554)
Job Opportunities ²			0.596 (0.488)			
Job Competition ²			-1.297*** (0.167)			
East	5.224*** (0.283)					
Female	1.080*** (0.195)			0.992*** (0.187)		
Foreign	5.357*** (0.262)			5.190*** (0.260)		
Age	-0.644*** (0.113)	-3.861*** (0.312)	-3.860*** (0.312)	-0.655*** (0.115)	-1.809*** (0.345)	-20.359*** (0.373)
Age ²	0.013*** (0.001)	-0.019*** (0.002)	-0.019*** (0.002)	0.013*** (0.001)	-0.024*** (0.003)	0.002 (0.003)
Low Skilled	6.940*** (0.408)			6.887*** (0.397)		
High Skilled	-4.112*** (0.227)			-4.148*** (0.226)		
log(GDP)	-0.239** (0.112)	-2.901* (1.712)	-2.834* (1.713)	-1.659 (2.018)	-4.402** (2.138)	-4.311** (1.829)
Commuter Balance	0.024*** (0.004)	0.043 (0.037)	0.039 (0.037)	0.046 (0.038)	0.023 (0.050)	0.068* (0.039)
Amenities	-0.004 (0.004)	-0.015 (0.015)	-0.013 (0.015)	-0.050*** (0.015)	0.001 (0.025)	-0.034** (0.016)
Year-Quarter FE	Y	Y	Y	Y	Y	Y
Layoff-Quarter FE	Y	Y	Y	Y	Y	Y
Individual FE	N	Y	Y	N	Y	Y
Municipality FE	N	N	N	Y	N	N
R ²	0.077	0.471	0.471	0.103	0.481	0.549
N	1,661,631	1,661,631	1,661,631	1,661,631	1,147,500	1,380,207

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; clustered standard errors in parentheses; cluster correction on establishment level; coefficients can be interpreted as change in days per quarter in unemployment as a result of a change in job and workforce density by one standard deviation.

Table 3: Heterogeneity of Effects

Dependent Variable: <i>Days in Unemployment per Quarter</i>					
	Benchmark	<i>Gender</i>		<i>Age</i>	
		Male	Female	< 40 years	≥ 40 years
Job Opportunities	-1.424 (2.010)	-1.264 (2.324)	-2.862 (3.270)	1.484 (2.266)	-4.175 (2.782)
Job Competition	3.493*** (0.513)	3.753*** (0.592)	2.841*** (0.851)	4.311*** (0.601)	2.808*** (0.666)
N	1,661,631	1,214,973	446,658	762,212	899,419
	<i>Nationality</i>			<i>Skill Level</i>	
	German	Foreign	Low	Medium	High
Job Opportunities	-2.973 (2.166)	4.617 (4.157)	5.394 (5.086)	-3.512 (2.138)	3.858 (5.137)
Job Competition	3.541*** (0.532)	2.009* (1.173)	1.298 (1.473)	3.809*** (0.523)	1.660 (1.369)
N	1,406,682	254,949	201,178	1,335,911	124,542
	<i>Region Type</i>		<i>Firm Size</i>		
	Urban	Rural	< 18 Emp.	≥ 18 Emp.	
Job Opportunities	0.419 (2.287)	1.593 (5.032)	-0.888 (2.405)	-1.865 (3.166)	
Job Competition	3.504*** (0.581)	5.269*** (1.141)	3.564*** (0.585)	3.397*** (0.834)	
N	1,276,751	384,880	817,666	843,965	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; clustered standard errors in parentheses; cluster correction on establishment level; results are based on the specification contained in column (2) of Table 2; coefficients can be interpreted as change in days per quarter in unemployment as a result of a change in job opportunities or job competition by one standard deviation.

Appendix

Table A.1: Summary of Sample Restrictions

	All	Leave<6m.	Tenure>4y.	Aged 25-50	County ^{const}	Munic ^{const}
1999	131,557	89,701	18,740	13,061	10,864	10,604
2000	184,104	129,352	31,249	22,185	15,563	14,908
2001	204,003	144,544	35,499	24,902	14,640	13,397
2002	195,753	139,985	35,988	25,281	13,422	11,767
2003	156,324	117,698	33,275	23,086	11,963	10,081
2004	143,285	103,510	27,820	19,215	9,789	8,265
2005	130,165	96,072	25,737	17,421	8,785	7,378
2006	92,388	67,430	16,745	11,520	5,933	4,984
2007	95,609	68,728	16,561	11,051	5,724	4,753
2008	127,353	87,174	18,570	12,142	6,193	5,130
2009	128,049	97,144	23,179	14,872	7,701	6,476
Total	1,588,596	1,141,338	283,363	194,736	110,577	97,743

Table A.2: Summary Statistics - Employed and Unemployed

	Employed		Unemployed	
	Mean	SD	Mean	SD
N	19,274,600		2,251,352	
Age	40.17	10.70	41.23	13.06
Tenure (in days)	2,732.43	2,663.02	1,884.27	2,088.97
Female	0.35	0.48	0.40	0.49
Foreign	0.07	0.26	0.09	0.29
Low Skilled	0.08	0.27	0.10	0.29
Medium Skilled	0.77	0.42	0.80	0.40
High Skilled	0.14	0.35	0.10	0.30
East Germany	0.21	0.41	0.30	0.45