Received: 18 February 2019 | Revised: 7 July 2019 | Accepted: 11 July 2019

DOI: 10.1111/jors.12460

ORIGINAL ARTICLE

JOURNAL OF REGIONAL SCIENCE WILEY

Opportunities and competition in thick labor markets: Evidence from plant closures

Peter Haller[1] | Daniel F. Heuermann[2]

[1]Department for Regional Labour Markets, Institute for Employment Research (IAB), Nürnberg, Germany

[2]Department of Economics and Econometrics, University of Regensburg, Regensburg, Germany

Correspondence
Daniel F. Heuermann, Department of Economics and Econometrics, University of Regensburg, 93040 Regensburg, Germany.
Email: daniel.heuermann@ur.de

Abstract

Since Marshall (1890), it has been widely held in urban economic theory that cities insure workers against the risk of unemployment by offering a larger pool of potential jobs. Using a large administrative panel data set on workers displaced as a result of plant 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 robust evidence that the effect of job competition on unemployment duration exceeds that of job opportunities in absolute value. Our results put the idea of urban risk-sharing into perspective and provide an explanation for observed longer unemployment durations in cities.

KEYWORDS
agglomeration, displacement, thick labor markets

JEL CLASSIFICATION
J63; J64; R12; R23

1 | INTRODUCTION

One key argument for the existence of cities is that denser labor markets insure workers against the risk of unemployment by providing 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 observation that, at least in the United States and in Germany, the average duration of joblessness rises with the local degree of agglomeration. For the United States, a large literature on spatial mismatch documents a higher incidence of unemployment in downtown areas than in the less densely

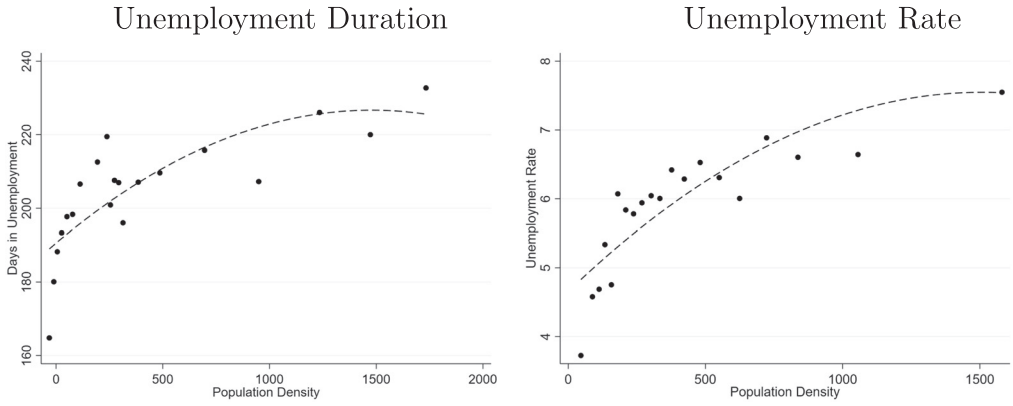

FIGURE 1 Unemployment and regional agglomeration. The left panel relates the average duration of unemployment (based on all noninterrupted episodes of unemployment) to population density (number of inhabitants per square kilometer). The right panel shows the average unemployment rate by population density. Both figures are based on pooled data, which cover the years 1999–2014 and are taken from the Statistics of the Federal Employment Agency and the Sample of Integrated Employment Biographies

populated suburbs (see, e.g., Gobillon, Selod, & Zenou, 2007; Kain, 1968; Wasmer & Zenou, 2002).[1] For the German case, the left panel of Figure 1 shows that the number of days displaced workers spend in unemployment after having lost their job is positively correlated with local population density. Consistently, the empirical literature has so far found little evidence in favor of an urban insurance effect, that is, the density of the local labor market does not seem to shorten the time workers spend 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 (Détang-Dessendre & Gaigné, 2009; Raphael, 1998). Kroft, Lange, and Notowidigdo (2013) show for the U.S. 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 in Germany to population density to examine whether the intensity of job competition rises with the degree of agglomeration. The average unemployment rate increases monotonically over the range of population densities, indicating that labor market tightness increases with local density. As such, the evidence from Figure 1 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 this paper, we disentangle the effect that job opportunities and job competition have on the number of days that workers spend in involuntary unemployment. Since the number of available jobs and the intensity of competition between workers both rise with the local degree of agglomeration, gaining insight into their relative importance for the re-employment prospects of workers provides an important step toward a better understanding of the extent to which urban labor markets insure workers against the risk of unemployment. Identifying the effects of job opportunities and job competition on individual employment chances is, however, complicated by the sorting of workers and firms between locations.

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 region fixed effects. The frequency of the data in quarters allows for a detailed analysis of the effect that

[1]Given the large volume of studies, we refer the reader to the surveys by Ihlanfeldt and Sjoquist (1998) and Gobillon, Magnac, and Selod (2011).

job opportunities and job competition have on the re-employment process of displaced workers. Drawing on municipalities as the most disaggregated administrative level, we exploit the substantial variation in both variables to construct market potential-based indicators, which explicitly take into account spillovers between regions.

In line with the previous literature, we find evidence for a persistent increase in the individual incidence of unemployment over a period of 4 years after displacement (see, e.g., Couch & Placzek, 2010; Jacobson, LaLonde, & Sullivan, 1993; Ruhm, 1991; Schmieder, von Wachter, & Bender, 2010). Regarding the effect of job opportunities, we show that the time spent in unemployment falls significantly with the local density of jobs. This effect is, however, more than offset by the competition between workers for these jobs. When controlling for individual and regional heterogeneity and the sorting of workers across locations, we find the effect of job competition to exceed that of job opportunities by a factor of more than three. Since opportunities and competition both rise with the degree of agglomeration, 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. Section 3 outlines our identification strategy. In Section 4, we describe the data and provide first descriptive evidence. The results are discussed in Section 5. Section 6 concludes.

2 | RELATED LITERATURE AND CONTRIBUTION

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 and Puga (2004), the underlying mechanism of this type of risk-sharing is that the variance of idiosyncratic productivity shocks rises with the degree of agglomeration. Workers who become unemployed are therefore better off in larger cities because of a higher probability that other firms expand their production after having experienced a positive productivity shock and, hence, are in search of workers to hire.[2] Such positive effects from agglomeration on the labor demand side may, however, be offset by a larger number of rivaling job seekers who lost their jobs in cities.[3] Consistent with this theoretical ambiguity, the empirical literature on the effect of labor market size on unemployment, which is surveyed in Petrongolo and Pissarides (2001), reveals mainly constant returns to agglomeration, indicating that workers are not better off in larger labor markets in terms of the duration of their job search. One exception is DiAddario (2011), who finds that the local degree of agglomeration raises the hazard rate of unemployed workers in Italy.[4]

The only two papers which explicitly address the competing roles of labor supply and labor demand within local labor markets are the ones by Détang-Dessendre and Gaigné (2009) and Andersson, Haltiwanger, Kutzbach, Pollakowski, and Weinberg (2018).[5] Both estimate hazard models with a measure of regional job accessibility as the independent variable, where the number of available jobs is discounted by geographical distance or travel time as

[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 (Moretti, 2011; Rosenthal & Strange, 2001). In line with this notion, Martín-Barroso, Núñez-Serrano, and Velázquez (2015, 2017) and Holl (2012) show that firms in cities are more productive due to better access to factor markets.

[3]Although differing in the underlying mechanisms, the literature on neighborhood effects of unemployment is closely related to this paper (Bayer, Ross, & Topa, 2008; Hawranek & Schanne, 2014; Jahn & Neugart, 2017). The general idea 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.

[4]Although not directly focusing on unemployment duration, Bleakley and Lin (2012) also provide support for positive scale effects by showing that unemployed workers in densely populated areas are more likely to be re-employed in the same occupation.

[5]Somewhat more distantly related to our paper is the contribution by Neffke, Otto, and Hidalgo (2018), which examines the effect of local industrial structure on employment probabilities of laid-off workers. The authors find that employment chances rise with the size of a worker's old industry and decline with the presence of different but skill-related industries. As with Détang-Dessendre and Gaigné (2009) and Andersson et al. (2018), one shortcoming of their paper is that the authors do not control for unobserved heterogeneity between workers.

well as the number of competing job seekers. Both papers find evidence that a rise in job accessibility reduces the number of days workers spend in unemployment. Interpreted in light of the spatial mismatch hypothesis, their results suggest that unemployment tends to be higher in urban areas because of a smaller number of accessible jobs in cities relative to the number of job seekers competing for them.

In the present paper, we extend their analyses in two major respects. First, we disentangle the relative importance of job opportunities and job competition for a successful recovery out of unemployment. To do so, we decompose the combined measures of job accessibility used in Détang-Dessendre and Gaigné (2009) and Andersson et al. (2018) into the distance-discounted number of jobs and of competing job seekers to estimate the effect that changes in either variable have on the time workers spend in unemployment after an involuntary job loss. As such, the results from this analysis further our understanding of the role that each of the two sides of the labor market plays for the re-employment chances of unemployed workers, which is in turn of key importance for a proper design of labor market policies. Second, our setting allows us to control more rigorously for worker sorting and unobservable heterogeneity than it was possible in the two earlier papers. More precisely, the focus on one single unemployment spell per worker has inhibited the use of individual fixed effects in Détang-Dessendre and Gaigné (2009) and Andersson et al. (2018). This is problematic if unobserved worker characteristics are correlated with local labor market conditions (Glaeser, 1996). We address this issue in two different ways. As in Andersson et al. (2018), we restrict the data to cases of involuntary unemployment by drawing on incidences of firm closures. In addition, we control for worker sorting and unobserved heterogeneity by means of individual and regional fixed effects as well as through a number of different sample restrictions, in particular with regard to tenure and worker mobility.

3 | MEASUREMENT AND IDENTIFICATION APPROACH

3.1 | Measuring opportunities and competition

Any attempt to determine the size and the sources of agglomeration economies requires a suitable definition of a "region." 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 United States. By the end of 2014, 11,194 of these municipalities existed with an average population of slightly >7,000 inhabitants. Out of these, 15 cities contained >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, 848 municipalities can be considered as urban while the rest is of rural nature.[6] 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.[7] This is of particular relevance when taking into account the substantial variation in the size of municipalities, which cover a range between less than one (*Neuheilenbach*) and 890 (*Berlin*) square kilometers. In addition, Glaeser and Resseger (2010) among others argue that the density of workers is at least as important for agglomeration economies to materialize as the total number of inhabitants or workers. Third, focusing on single municipalities ignores potential labor market interactions between them (Combes & Gobillon, 2015). On the level of the 402 counties in Germany, Haller and Heuermann (2016) show that job search is far from being confined to single counties. In fact, since 38% of workers commute across county borders, the relevant local labor market is effectively larger, in particular, if a county is well connected to its

[6]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).

[7]Throughout the paper, the term "region" refers to a municipality and its distance-discounted neighbors. M_{rt}^{augm} in Equation (2) denotes the labor market density within a region.

surroundings. This argument applies even more to the municipalities used in the present context, which cover on average only 6.5% of the area of a county. These problems can be accounted for by means of a continuous measure which takes into account the sprawl of a labor market across municipalities. Relating the number of residents, workers, or unemployed in municipality r at time t, denoted as L_{rt}, to the area of a municipality, A_r, yields a measure for the density of a local labor market.

$$\text{Labor market density}_{rt} = M_{rt} = \frac{L_{rt}}{A_r}. \tag{1}$$

To take into account the thickness of the labor market in the wider region, the local density M_{rt} can be augmented by the distance-discounted density of all neighboring municipalities j (Brakman, Garretsen, & VanMarrewijk, 2009; Hansen, 1959).

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

The impedance function $f(d_{rj})$ is determined by its functional form, the spatial decay parameter θ and the distance d_{rj} between two municipalities (Reggiani, Bucci, & Russo, 2011). We follow the literature (see, e.g., Andersson et al., 2018; 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. On the basis of Equation (2), we construct our 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 municipality. Data on vacancies are, however, 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% of all open positions. We, therefore, measure local job opportunities by the number of available jobs, which we approximate by the distance-discounted number of all full-time employed workers within a municipality.

$$Opp_{rt} = \sum_{\substack{j=1 \\ r \in J}}^{J} \frac{\text{Workers}_{jt}}{A_j} f(d_{rj}),\ f(d_{rr}) = 1. \tag{3}$$

Opp_{rt} is based on the assumption that workers aim to minimize commuting distances and therefore prefer jobs located close to their home. Within municipalities, the number of jobs is therefore discounted by the area of a municipality. Between municipalities, 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 displaced workers compete with all persons in the local workforce or only with other unemployed job seekers. In light of the literature inspired by Snower and Lindbeck (1989), it seems likely that the latter is the more relevant peer group for unemployed workers. In addition, since most workers are employed in the region they live in, the local working age population is closely correlated with the number of jobs (correlation: 0.91). With the use of region fixed effects, this poses a problem for identification because the collinearity 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 municipality r normalized by area as a measure for job competition.

$$Comp_{rt} = \sum_{\substack{j=1 \\ r \in J}}^{J} \frac{\text{Unemployed}_{jt}}{A_j} f(d_{rj}),\ f(d_{rr}) = 1. \tag{4}$$

Defined this way, Opp_{rt} and $Comp_{rt}$ are likely to also be correlated. In the upper panel of Figure 2, we shed light on the relation between both variables. The figure shows that the distance-discounted density of jobs is positively related

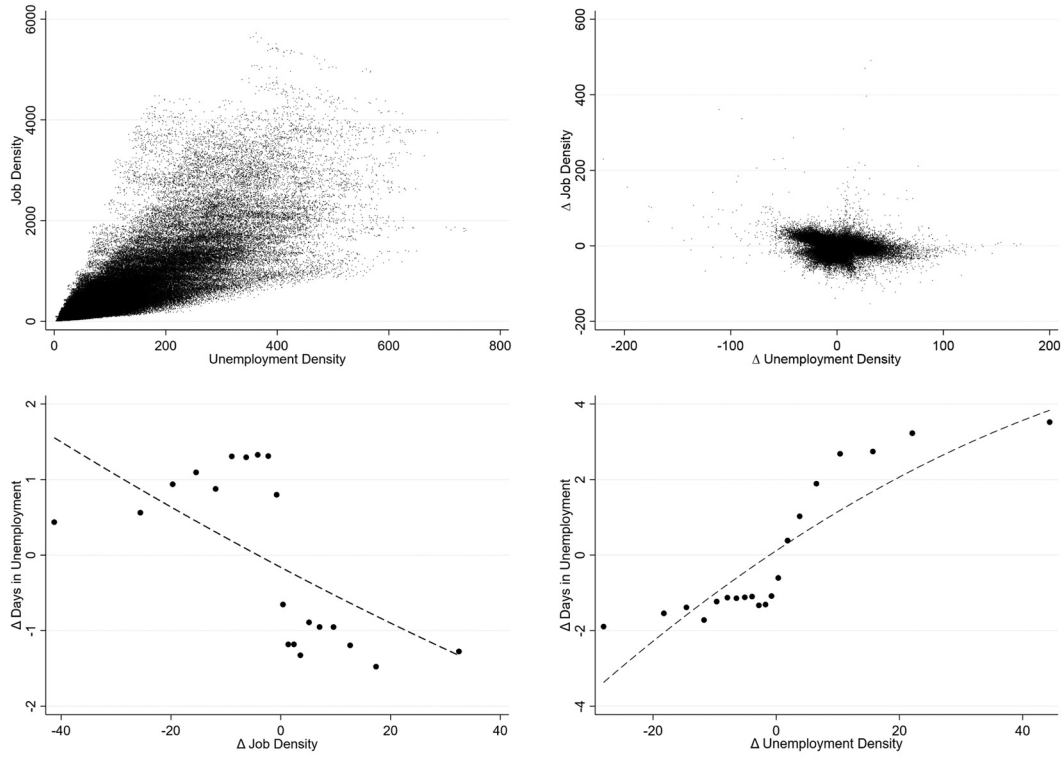

FIGURE 2 Job opportunities, job competition and days in unemployment. The upper two panels show the relation between job opportunities and job competition in levels (left panel) and in first differences (right panel) unconditional on any covariates. Each dot represents one municipality-quarter observation (N = 1,661,631). The lower two panels relate average changes in the individual number of days in unemployment to changes in job opportunities (left panel) and job competition (right panel) in bins of two units

to the distance-discounted density of unemployment (correlation: 0.78), which mirrors the fact that the number of jobs and the number of unemployed both rise with the degree of agglomeration. Since in our identification approach we control for individual and region fixed effects (see Section 3.2), the identifying variation in Opp_{rt} and $Comp_{rt}$ stems, however, from changes in both variables. We have therefore plotted the relation between both variables in first differences in the upper right panel of Figure 2. With a value of −0.28, this correlation is negative, indicating that a rise in the number of jobs is associated with a decrease in unemployment and vice versa. Important for our identification approach, the relation between the two variables in first differences is far less pronounced compared to their relation in levels. In Section 5, we will discuss the issue of multicollinearity in greater detail.

In the lower part of Figure 2, we shed first light on the relation between Opp_{rt} and $Comp_{rt}$ as explanatory variables and individual unemployment duration as outcome variable. As before, since with individual fixed effects the identifying variation stems from changes in either variable, we have plotted the two relations in first differences. The figure shows that in line with expectations a rise in job opportunities is associated with a decrease in the number of days in unemployment, while the reverse applies to changes in the intensity of job competition. A comparison of the vertical axes shows that, consistent with our later findings, the variation in individual unemployment duration is more pronounced with regard to changes in job competition as compared to changes in job opportunities.

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, Duranton, & Gobillon, 2011). This is problematic if individual characteristics that are relevant for finding a job differ systematically between regions. In addition, unobservable regional characteristics that are correlated with the local density of jobs or unemployment may lead to bias in the estimates. We address these issues in three ways.

First, we construct a consistent sample of workers that contains only individuals who have become unemployed *involuntarily*. This is important because voluntarily unemployed workers might differ from those who are involuntarily unemployed in terms of their job search behavior and other unobservable characteristics *and* are more likely to be located in regions with better employment prospects, that is, which are shaped by lower unemployment density and higher job density. Addressing this issue, a large number of studies inspired by Ruhm (1991) and Jacobson et al. (1993) have therefore resorted to incidences of mass layoffs to identify workers who have become unemployed involuntarily (see, von Wachter (2010) for a survey).[8] In this paper, we follow a similar line of reasoning and focus on workers who were displaced as a result of plant closures. We use incidences of plant closures rather than mass layoffs because the latter are restricted to a small and selective subset of regions. Plant closures do, in contrast, approximate the distribution of workers across locations fairly well. In fact, 77% 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% of individuals live in cities.

Second, we restrict the sample in terms of worker mobility and tenure. Regarding mobility, we include only workers who have changed neither their place of residence nor their employer over a period of 4 years before the closure of a firm (Schmieder et al., 2010). While this restriction may limit the external validity of our results, it eliminates the possibility of selective moves between regions, which would impede a correct identification of the effect of job opportunities and competition on unemployment. In Section 4, we discuss the extent to which our results can be generalized by comparing the characteristics of the workers in our sample to the population of all employed and unemployed workers in Germany.

Finally, we control for individual fixed effects. Due to the restrictions imposed with regard to moving behavior, these fixed effects also absorb all time-invariant regional characteristics because workers by definition do not change municipalities. As discussed in Section 2, the use of individual fixed effects provides a novel approach in the literature since in particular the studies by Détang-Dessendre and Gaigné (2009) and Andersson et al. (2018) do not control for unobserved worker heterogeneity. We compare our results to theirs in Section 5.

On the basis of the resulting sample of workers, we examine the effect of job opportunities and job competition on individual employment prospects by means of the following regression approach. Denote the number of days that a displaced worker i spends in unemployment per quarter q as d_{iq}, which is the dependent variable. Since we observe workers for a period of 4 years after the incidence of involuntary displacement, q runs from $q = 0$ to $q = 16$. In addition, assume that worker i lives in municipality 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 worker spends in unemployment per quarter to both variables.

$$d_{iq} = \beta_1 \text{Opp}_{rq} + \beta_2 \text{Comp}_{rq} + \boldsymbol{R_{rq}\gamma} + \phi_i + \psi_t + \omega_q + \varepsilon_{iq}. \tag{5}$$

$\boldsymbol{R_{rq}}$ is a matrix of regional covariates that controls for systematic differences between regions in terms of gross domestic product (GDP), amenities, and commuters. ϕ_i denotes individual fixed effects.[9] ψ_t represents year-

[8]This literature shows that a period of involuntary unemployment yields substantial income losses for displaced workers due to a loss of firm-specific knowledge (Couch & Placzek, 2010; Schmieder et al., 2010) and occupational mismatch (Holm, Østergaard, & Olesen, 2016; Nedelkoska, Neffke, & Wiederhold, 2015). In addition, effects on health (Sullivan & von Wachter, 2009), fertility decision (Huttunen & Kellokumpu, 2016), divorce probabilities (Eliason, 2012) and the intergenerational transmission of these effects (Oreopoulos, Page, & Stevens, 2008) have been examined. Gathmann, Helm, and Schönberg (2018) provide evidence for sizeable regional spillovers from mass layoffs.

quarter fixed effects, which capture variation in re-employment chances over the business cycle. Since re-employment prospects vary with time spent in unemployment, we include fixed effects for each quarter after the incidence of displacement, ω_q. With regard to the relative importance of demand and supply side explanations, note that ϕ_i, ψ_t and ω_q effectively also control for variation in reservation wages between workers and over the business and unemployment cycle. Note also that we standardize Opp_{iq} and $Comp_{iq}$ by their respective mean and standard deviation per municipality. 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 β_1 and β_2 in terms of their size. Throughout all regressions, standard errors are clustered on the level of municipalities.

4 | DATA AND DESCRIPTIVE EVIDENCE

4.1 | Data

We draw on administrative data from the German social security records, which are provided by the Institute for Employment Research. The Integrated Employment Biographies (IEB) contain information in daily frequency for all employed persons who are subject to statutory social security contributions, as well as on all recipients of unemployment insurance or unemployment assistance (Antoni & Ganzer, 2014). Important in the present context, the data also contain information on the particular plant a worker is employed at as well as on the municipality a worker lives and works in. On the basis of these linked employer-employee-data, we identify in a first step all plants that were closed between 1999 and 2009 and that have employed at least four workers at the time of closure.[10] The latter restriction accounts for the risk that otherwise the resulting unemployment needs not necessarily be involuntary but might rather be the result of a deliberate decision of one person or a small group of persons. For the resulting set of firms, we draw on the employment biographies of all full-time employed workers between 25 and 50 years of age who have not left a firm earlier than 6 months before its closure. In addition, we apply the restrictions discussed in Section 3, that is, we only include workers who had changed neither their place of residence nor their employer over a period of 4 years before the closure of a firm.[11]

One problem we had to address is the issue of sample attrition after displacement. Around 12% of workers disappear from the data in the quarter after displacement and 27% drop out of the sample over the next 4 years. The main reasons are that workers become employed part-time, are self-employed, or leave the labor market altogether. To account for such temporary or permanent dropouts, we generate spells for these periods which we label "neither full-time employed nor unemployed." We then convert the spell data into a balanced panel data set by counting the days that each individual spends per quarter in each of three possible states (a) full-time employed; (b) registered as unemployed; (c) neither full-time employed nor unemployed. The resulting data set contains quarterly information on 97,743 workers who were employed in 34,946 establishments for a period of 4 years before and 4 years after the displacement.

On regional level, we consider all 11,194 municipalities that existed on December 31, 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. The number of unemployed per municipality at the end of each month is taken from the Statistics of the Federal Employment Agency (2017), which we aggregate to quarterly averages.

[9]Note that Equation (5) does not contain individual-level controls because all variables on individual level are time-invariant (e.g., education, gender, and nationality) and, hence, are absorbed by the individual fixed effects.

[10]We address the issue of changing firm identifiers by means of the approach proposed by Hethey-Maier and Schmieder (2013). Fackler, Schnabel, and Wagner (2013) and Fackler and Schnabel (2015) provide an overview of the characteristics of closing firms.

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

Information on the number of employed individuals per municipality is 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 precisely measuring the stock of employed workers. In addition, we are able to exactly match end-of-quarter values, which reduces the problem of aggregation bias inherent to other data sources. Data on the area of a municipality needed to calculate job and unemployment densities are provided by the Federal Statistical Office. Data on local GDP, commuter balance, and the number of hotel beds as a proxy for local amenities[12] are provided on county level by the Federal Institute for Research on Building, Urban Affairs and Spatial Development, as are information on driving times between municipalities.

4.2 | Descriptive evidence

Table 1 provides summary statistics for displaced workers, closed establishments, and municipalities. 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,[13] of German nationality, lives in West Germany and has worked for about 6 years (2,439 days) in a firm before its closure. The median establishment has existed for 15.9 years, was located in West Germany and has employed 18 workers of which 13 were full-time employed. The average municipality covers an area of 44 km^2. On average, each municipality contains 558 jobs and 108 unemployed persons per square kilometer.[14] The mean number of workers laid off as a result of firm closures per municipality per quarter is 15.2. One assumption of our identification design is that these workers 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 provide the means 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 once again emphasizes the need to include individual fixed effects in the regression approach since workers may also differ in terms of unobservable characteristics.

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. A comparison of these values with the characteristics of the workers in our sample suggests that the restrictions we have imposed, for example, with regard to tenure and place of residence, have not led to a sample that is disconnected from the full population of workers and unemployed in Germany.

Figure 3 visualizes the distribution of job opportunities, job competition and unemployment duration across municipalities. Maps 1 and 2 provide evidence of the spatial correlation between 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 as well as the regions in and around the large cities of Berlin, Hamburg, and Stuttgart exhibiting the highest values. The distribution of unemployment duration is dominated by a sharp divide

[12]Drawing on the quarterly number of firms and of workers active in the hospitality industry (hotels and restaurants) as two alternative proxies for amenities on municipality level leaves our results unaltered.

[13]Note that "skills" are defined with reference to formal schooling. *Low-skilled* workers are those 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*.

[14]At first glance, these figures imply an unemployment rate of 16.2%, which stands in contrast to the average official unemployment rate of 9.5% for the years 1999–2009. This deviation results from the facts that, first, we consider only full-time employed workers and, second, self-employed workers are by definition also part of the labor force. Accounting for both groups in a back-of-the-envelope calculation yields: 108 unemployed/(558 full-time workers + 108 unemployed + 140 part-time workers + 360 self-employed) = 9.0%, which is reasonably close to the official average unemployment rate.

TABLE 1 Summary statistics

	Mean	*SD*	1st Quart.	4th Quart.
Displaced workers				
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				
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				
N	6,417		1,602	1,604
Area (in km^2)	44.08	47.31	14.76	57.57
Jobs per km^2	558.38	594.16	197.44	693.19
Unemployed per km^2	108.30	86.07	45.14	145.00
No. of displaced workers	15.23	136.79	1	6
Vacancies per km^2	8.55	10.97	2.06	10.38
Hires per km^2	39.62	43.24	13.23	48.85

Note: 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.

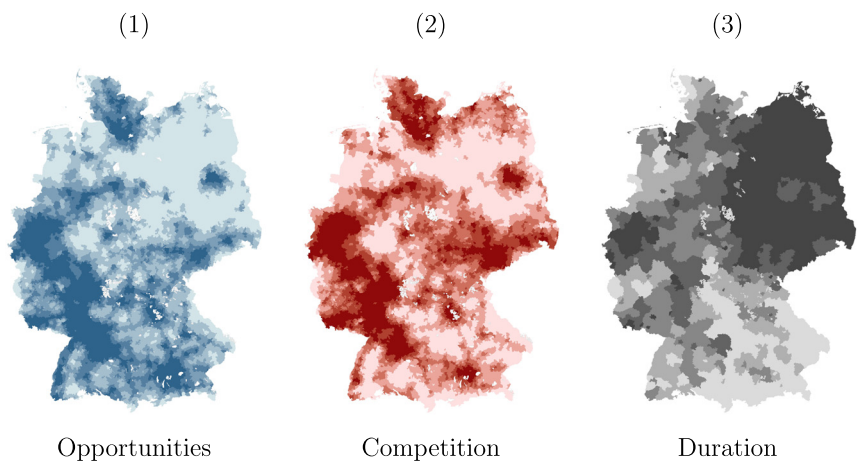

FIGURE 3 Job opportunities, job competition, and duration of unemployment. The maps show the regional distribution of job opportunities as defined in Equation (3), of job competition as defined in Equation (4) and of the average number of days in unemployment. Map (3) is based on a representative sample of unemployed taken from the Sample of Integrated Employment Biographies. Coloring is in quintiles with darker colors indicating higher values [Color figure can be viewed at wileyonlinelibrary.com]

between East and West Germany with average duration being generally higher in the East. Similar to job opportunities and job competition, average unemployment durations in the West are closely correlated with the degree of agglomeration.

Overall, Figure 3 yields two main insights. First, it reproduces the finding from Figure 1 that the average duration of unemployment rises with the degree of agglomeration. Second, it suggests that job opportunities and job competition are two sides of the same coin in the sense that "thick" labor markets not only provide a larger number of jobs, but at the same time are also home to more unemployed workers competing for these jobs. In the next section, we disentangle the relative importance of job opportunities and job competition for the number of days that displaced workers spend in unemployment per quarter.

5 | RESULTS

Figure 4 shows the average number of days that workers spend in unemployment per quarter after a displacement. Amounting to >30 days in the first quarter, this number gradually decreases and converges to a persistent level of around 11 days after 4 years.

In Table 2, we examine the effect that local job opportunities and job competition have on the number of days in unemployment per quarter. Columns (4–6) provide the results for the specification in Equation (5) with job opportunities and job competition being measured locally, that is, ignoring the distance-discounted values of neighboring regions. When introduced separately, Opp_{rt} and $Comp_{rt}$ are highly significant with the effect of job competition (1.59) exceeding that of job opportunities (−0.53) by a factor of three in absolute value. In column (3), we insert both variables simultaneously. While the effect of job competition remains unaltered, the coefficient of job opportunities falls to −0.21 and is only marginally significant. In columns (4) to (6), we replace the local values of Opp_{rt} and $Comp_{rt}$ by the augmented versions defined in Equations (3) and (4). In all three columns, both coefficients are highly significant and rise in absolute magnitude compared with the local values, emphasizing the importance of job competition and opportunities in neighboring regions for local unemployment duration (Manning & Petrongolo, 2017). When we insert both variables jointly in column (6), the results show that an increase in job competition by one standard deviation raises the number of days in unemployment by about 1.77 days per quarter while a rise in job opportunities by one standard deviation is accompanied by a reduction of 0.42 days.

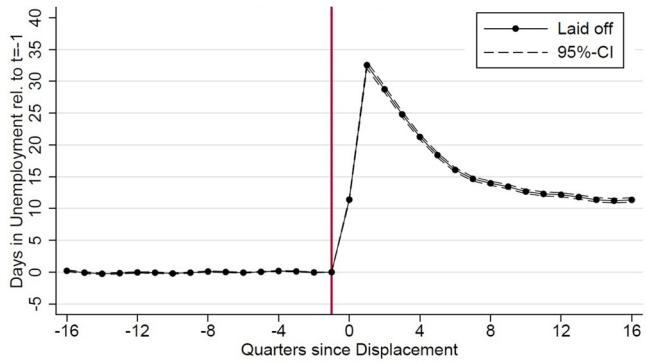

FIGURE 4 Days in unemployment before and after displacement. The figure shows the estimated days per quarter in unemployment 4 years before and 4 years after a displacement conditional on nationality, gender, age, age^2 skill level, regional gross domestic product (GDP), commuter balance, amenities, a dummy for East/West and year-quarter fixed effects [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 2 Regression results

Days unemployed per quarter								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job competition	1.597 (0.095)***		1.557 (0.102)***	1.890 (0.116)***		1.767 (0.125)***	2.535 (0.161)***	2.796 (0.187)***
Job opportunities		−0.530 (0.117)***	−0.211 (0.111)*		−1.121 (0.173)***	−0.422 (0.167)***	−0.288 (0.160)*	0.170 (0.240)
Job competition^2							−0.444 (0.056)***	
Job opportunities^2							−0.160 (0.063)**	
Ln(GDP)	−2.060 (2.471)	−2.963 (2.915)	−1.644 (2.574)	−2.395 (2.409)	−2.293 (2.838)	−1.851 (2.492)	−1.405 (2.360)	−0.947 (2.965)
Comm. balance	0.047 (0.038)	0.079 (0.044)*	0.055 (0.039)	0.058 (0.037)	0.089 (0.044)	0.067 (0.038)*	0.066 (0.037)*	0.045 (0.041)
Amenities	−0.015 (0.016)	−0.017 (0.019)	−0.015 (0.016)	−0.012 (0.016)	−0.015 (0.019)	−0.011 (0.016)	−0.010 (0.016)	−0.039 (0.021)*
Year Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Layoff Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	N
Municipality FE	N	N	N	N	N	N	N	Y
Definition M_{rt}	Local	Local	Local	Total	Total	Total	Total	Total
N	1,661,631	1,661,631	1,661,631	1,661,631	1,661,631	1,661,631	1,661,631	1,661,631

Note: Clustered standard errors in parentheses; cluster correction on municipality level; "*Definition* M_{rt} " indicates whether job opportunities and competition are measured within municipalities ("*local*") or are augmented by the distance-discounted density of all neighboring municipalities ("*total*"); coefficients can be interpreted as the average change in days per quarter in unemployment as a result of a change in job opportunities or job competition by 1 standard deviation.
*$p < .1$.
**$p < .05$.
***$p < .01$.

In column (7), we account for potential nonlinear effects of job competition and job opportunities by inserting quadratic terms of both variables. Regarding job opportunities, the results suggest that unemployment duration decreases more than proportionally with the number of jobs, which is consistent with the idea that increasing the choice that workers have between different jobs raises the probability of a successful match. The effect of competition is, in contrast, subject to decreasing returns (but never turns negative in our sample), suggesting that while the density of unemployed always reduces the chances of re-employment, adding more unemployed workers has less of an effect if competition is already intense.

One peculiarity of our setting is that workers by the construction of the sample do not change their region of residence before being laid off. As a result, individual fixed effects effectively also control for all time-invariant regional characteristics before displacement. To examine the role of worker selection between regions, we estimate Equation (5) with municipality but without individual fixed effects. A comparison of the results in columns (8) and (6) shows that the effect of job opportunities is underestimated in the absence of individual fixed effects while the effect of job competition is overestimated, suggesting that individuals in cities are negatively selected in terms of their probability of finding employment. This 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).

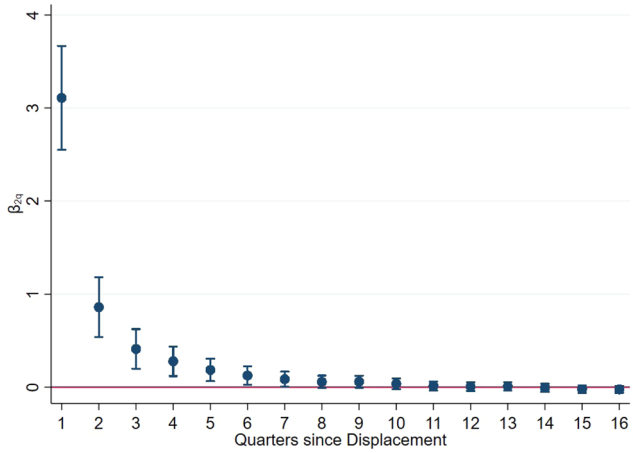

FIGURE 5 Scarring effects of unemployment. The figure shows the point estimates and 95% confidence intervals of the effect that job competition at the time of job loss has on the number of days in unemployment per quarter over a period of four years after displacement. Control variables are those in column (6) of Table 2 [Color figure can be viewed at wileyonlinelibrary.com]

One issue discussed in the literature pertains to the question of whether the particular economic conditions at the time of displacement affect subsequent employment prospects over and above the negative effect of a job loss itself. Studies in this field have shown that the level of unemployment, in particular in times of recessions, yield long-lasting "scarring effects" on later wages and employment chances (see, e.g., Davis & von Wachter, 2011; Oreopoulos, von Wachter, & Heisz, 2012). In the spirit of this literature, we exploit our setting to examine how persistently the intensity of job competition at the time of displacement affects individual unemployment over the course of 4 years after a job loss. To do so, we estimate an alternative variant of our main specification in column (6), where we interact job competition at the time of displacement with a dummy variable for each of the 16 quarters after plant closure. Figure 5 provides point estimates and corresponding confidence intervals. The estimates show that the effect of job competition is most pronounced in the quarter of displacement, raising the number of days in unemployment by more than three. This effect decreases monotonically over time but remains significant until about 2 years after displacement.

Before continuing with a number of robustness checks and extending the analysis in several ways, we briefly summarize the results obtained so far. These are informative in at least three major respects. First, finding the effect of job competition to be larger in absolute value by a factor of between three and four suggests that job competition is a more important determinant of unemployment duration than job opportunities. Since both variables rise with the degree of agglomeration, it seems that positive effects from a larger availability of jobs in cities are more than offset by more intense competition between job seekers. Second, in line with the descriptive evidence discussed in Section 3.1, it is unlikely that this finding is driven by a purely mechanical relationship between both variables since the effect of job opportunities is always smaller in absolute value, regardless of whether both variables are included separately or jointly or whether they are measured locally or are augmented by neighboring values. Third, the results emphasize the need to control for unobserved worker heterogeneity. In particular, a comparison of the estimates with and without individual fixed effects suggests that workers in cities are negatively selected in terms of their job-finding probabilities Table 3

Tables 3 and 4 provide the results from different robustness checks and extensions of the analysis. In column (1) of Table 3, we impose an additional restriction with regard to a worker's place of residence. So far, we have only required that workers exhibit a constant place of residence during the 4 years before displacement. To further reduce the potential of bias from worker sorting, we now extend this restriction to 4 years before *and* 4 years after the incidence of unemployment. A comparison of the results with those in column (6) of Table 2 shows that the

TABLE 3 Regression results—robustness (1)

	Days unemployed per quarter						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Job competition	1.567 (0.148)***	1.959 (0.143)***	1.760 (0.129)***	1.737 (0.125)***	1.746 (0.127)***	1.676 (0.124)***	1.808 (0.124)***
Job opportunities	0.048 (0.218)	−0.628 (0.188)***	−0.411 (0.168)***	−0.511 (0.174)***	−0.389 (0.165)***	−0.384 (0.184)**	
Displaced workers			0.108 (0.239)				
Number of firms				0.353 (0.066)***			
Job opportunities							−0.419
(=vacancies)							(0.124)***
Type of robustness	No moves	No Art. spell	Displ. contr.	Control for LM size		LM regions	Alter. meas.
N	1,147,500	1,380,207	1,661,631	1,661,631	1,661,631	1,661,631	1,661,631

Note: clustered standard errors in parentheses; cluster correction on municipality level; all columns contain individual, regional, year-quarter and layoff-quarter fixed effects as well as regional controls; all measures of job opportunities and competition are augmented by the distance-discounted density of all neighboring municipalities ("*total*"); in column (1), workers changing their region of residence after displacement are excluded; in column (2), all "artificial spells" are dropped; column (3) controls for the number of workers displaced as a result of firm closures perper municipality; the number of firms in column (4) is measured in 1,000 s; column (5) additionally contains *urban*quarter* fixed effects; in column (6), Opp_{iq} and $Comp_{iq}$ are defined on the level of labor market regions; in column (7), the distance-discounted density of vacancies is used as an alternative measure for job opportunities.

*$p < .1$.

**$p < .05$.

***$p < .01$.

effect of job competition falls slightly in size while the effect of job opportunities turns insignificant. This result suggests that "stayers" are positively selected in the sense that mostly those displaced workers who exhibit lower re-employment prospects leave their home region and look for work elsewhere.

In column (2), 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% of individuals are neither full-time employed nor registered as unemployed at some point during the 4 years after displacement. In these cases, we have imputed unemployment spells of zero days. Reassuringly, dropping these artificial spells leaves the results unaltered.

As a third robustness check, we address the concern that plant closures unfold indirect general equilibrium effects, which might drive up local unemployment durations through other channels than increased job competition (see, e.g., Gathmann et al. (2018) on spillover effects from mass layoffs in local labor markets). To control for such confounding effects, we add the number of workers who are laid off as a result of plant closures within a municipality in each quarter as an additional control variable. As shown in column (3), this has no effect on the estimates for job competition and job opportunities.

In columns (4) and (5), we explicitly control for time variation in labor market size. So far, we have accounted for time-invariant differences between regions by means of region fixed effects, which in the absence of movers are a subset of individual fixed effects. Regions may, however, grow at different rates, which might lead to systematic differences in the duration of unemployment. We address this issue in two ways. First, we add the quarterly number of firms as an additional control variable. Second, we insert *urban*quarter* fixed effects, where *urban* is a binary variable that is equal to one for the 848 urban municipalities in Germany and zero for municipalities classified as rural (see Section 3.1). Overall, controlling for labor market size in either way leaves our findings unaltered.

TABLE 4 Regression results—robustness (2)

	Daysunempl. p.Q.		Empl .p.Q.	Unempl. duration		D.Unempl.p.Q.	Unempl. duration	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job competition	3.654	3.891	−0.017	7.233	24.577			
	(0.949)***	(1.135)***	(0.002)***	(6.702)	(11.252)**			
Job opportunities	1.412	1.115	0.003	−0.268	2.377			
	(2.267)	(2.644)	(0.002)	(4.072)	(5.248)			
Accessibility index						−5.697	−13.998	−5.576
						(0.622)***	(3.285)***	(4.588)
Type of robustness	IV		Alternative Dep. Vars.			Accessibility index		
N	1,661,631	1,661,631	1,661,631	65,328	65,328	1,661,631	65,328	65,328

Note: Clustered standard errors in parentheses; cluster correction on municipality level; columns (1), (2), (3) and (6) contain individual, regional, year-quarter and layoff-quarter fixed effects as well as regional controls; columns (4), (5) and (8) contain closing-firm fixed effects; all measures of job opportunities and competition are augmented by the distance-discounted density of all neighboring municipalities ("*total*"); in column (1), the distance-discounted density of displaced workers and the distance-discounted density of hires are used as instruments; in column (2), the distance-discounted density of vacancies is used as an additional instrument; in column (3), *Empl.p.Q.* is a binary variable that is equal to one if a worker is employed for at least one day within a quarter; in columns (4), (5), (7) and (8), *Unempl.Dur.* measures the number of days a worker is unemployed between a displacement and the next full-time employment; in columns (6) to (8), a variant of the accessibility index used in Andersson et al. (2018) is used as an alternative explanatory variable.

*$p < .1$.

**$p < .05$.

***$p < .01$.

Next, we address the concern that municipalities might be inappropriately small as geographic units for our analysis. In this case, job opportunities and job competition in neighboring regions are likely to be discounted too heavily and, consequently, Opp_{rt} and $Comp_{rt}$ would be measured with error. We examine this issue by calculating the spatially discounted number of job opportunities and the intensity of job competition on the level of the 141 labor market regions proposed by Kosfeld and Werner (2012) and replacing the values on municipality level used so far by these new measures. As shown in column (6), altering the definition of regions in this way leaves the results unchanged.

In column (7), we insert the distance-discounted density of vacancies as an alternative measure for job opportunities to once again address the concern that our results might be driven by the correlation between jobs and unemployment. The advantage of the density of vacancies as an alternative measure for job opportunities is that it is closely aligned with the density of jobs and at the same time exhibits less of a correlation with the density of unemployment. The major drawback of this variable is that it is measured with substantially less precision than the number of jobs. The correlation between the density of vacancies and the density of jobs amounts to 0.88. With a value of 0.62, the correlation between vacancies and unemployment is smaller than the one between jobs and unemployment (0.78). However, as discussed in Section 3.1, of more importance for our identification approach is the correlation of the variables in first differences. With a correlation between vacancies and unemployment of only −0.06 in first differences, there is no indication of a purely mechanical relation between the two variables. When inserting the density of vacancies as an alternative measure, the effect of job competition (1.8) still exceeds the one of job competition (−0.42) by a factor of four in absolute value, which further defies the notion that the findings obtained so far were driven by the collinearity between job and unemployment density.

In columns (1) and (2) of Table 4, we apply an instrumental variable approach to address the issue of reverse causality, that is, the notion that individual unemployment duration may itself affect the density of jobs or unemployment. The concern here is that longer individual periods of unemployment, which are caused by unobservable worker characteristics

that vary over time and between regions (motivation, ambition, etc.), lead to higher levels of unemployment and less positions being filled within a region. Arguably, the most plausible instruments in the present context are flow variables which directly translate into changes in job or unemployment density but are themselves unaffected by unemployment duration. On the basis of this idea, we draw on the distance-discounted density of displaced workers from plant closures as an instrument for job competition and the distance-discounted density of hires as an instruments for job opportunities.[15] Columns (1) and (2) in Table A.3 provide the results from the first stage regressions. The significance of the estimates and the corresponding F-statistics strongly support the relevance of both instruments. Column (1) in Table 4 contains the results from the second stage. While the estimates are less precise, they once again support the notion that job competition is a more important determinant of unemployment duration than job opportunities. In columns (3) and (4) of Table A.3, we augment the first stage regression by the density of vacancies as an additional instrument. As shown in column (2) of Table 4, overidentifying the first stage in this way leaves the estimates from the second stage unaltered.

So far, we have focused on the average effect that job opportunities and job competition have on the number of days that dismissed workers spend in unemployment per quarter. In light of the many challenges associated with long-term unemployment, it is also of interest to understand the effect that job opportunities and job competition have on the probability that a worker finds a job *at all* within a quarter as compared with remaining in unemployment throughout the whole period. To examine whether job opportunities and job competition also work through the external margin of employment, we construct a binary variable that is equal to one if a worker is employed at least 1 day within a quarter and zero otherwise. We then estimate Equation (5) with this newly defined dependent variable. The results, which are contained in column (3), show that a rise in job competition by 1 standard deviation reduces the probability of finding a job by nearly two percent. There is, in contrast, no evidence for a significant effect of job opportunities. These results suggest that while job competition also reduces the chances for workers to find employment at all, a rise in the density job opportunities works mainly through adjustments on the internal margin. This latter finding is consistent with the idea that a rise in the number of potential jobs allows workers to find better job matches, which in turn leads to longer periods of employment.

Closely related to the previous point is the question whether job competition and job opportunities have an effect on the time that workers spend in unemployment between a firm closure and the next full-time employment. Addressing this issue, we now treat a job loss as the unit of observation with unemployment duration until the first job after a displacement as the dependent variable. The regressors of interest are initial job competition and initial job opportunities at the time of displacement. Adjusting the analysis in this way reduces the number of observations from about 1.6 million to 65,328. Note that in this setting individual fixed effects cannot be applied since workers usually have not undergone more than one plant closure. To still address the problem of unobserved heterogeneity, albeit in an imperfect way, we instead include worker characteristics (age, age^2, gender, national/foreign, skill level [low, medium, and high], and East/West) as well as firm fixed effects. Column (4) contains the results. Although the estimates are not significant due to the substantial loss in statistical power, they still yield a familiar picture. Again, the effect of job competition (7.2 days) on initial unemployment duration is larger in absolute value by an order of magnitude compared to the effect of job opportunities (0.2 days), suggesting that an increase in competition for jobs at the time of displacement raises the bar for workers to find employment after having become involuntarily unemployed. At the same time, there is no evidence that a rise in job opportunities has an effect on initial job search durations but, as suggested by the results in Table 2, a larger availability of suitable jobs instead seems to promote longer-lasting employment relations by allowing for better job matches. Since the effects of job competition and job opportunities at the time of displacement may wear out over time, we replace both variables by their average values between a job displacement and the take-up of a new job. As shown in column (5), the coefficient of job competition rises in size and becomes

[15]As an alternative approach, we have tested the Rosen-Robak notion that the local level of amenities should raise labor supply and thereby intensify job competition. The number of firms and of workers active in the hospitality industry as two alternative instruments for amenities on municipality level turned out, however, as insignificant in the first stage.

significant while there is still no measurable effect of job opportunities on the time that workers initially spend in unemployment after a firm closure.

In the last three columns of Table 4, we translate the approach from Andersson et al. (2018) to our setting and compare the results we obtain to theirs. As outlined in Section 2, Andersson et al. (2018) examine the effect that the local accessibility of jobs has on the time that workers spend in unemployment after having involuntarily lost their job. To do so, they regress the number of quarters a worker is unemployed after a mass layoff on a combined measure of job accessibility, which discounts the number of available jobs by the driving time and the number of competing job seekers. The setting we make use of in this paper deviates from the one in Andersson et al. (2018) inasmuch as they calculate a worker-specific measure of the jobs that are accessible within a metropolitan area, whereas we draw on region-specific variables which also take into account neighboring municipalities. Applying their idea of job accessibility to our context yields the following indicator.

$$\text{Acc}_{rt} = \sum_{\substack{j=1 \\ r \in J}}^{J} \frac{\text{Employed}_j \, f(d_{rj})}{\sum_{k=1}^{K} \underset{j \in K}{Pop_k^{15-65}} \, f(d_{jk})}. \tag{6}$$

In this definition, the numerator contains the number of available jobs in municipality r augmented by the distance-discounted jobs in all other municipalities j. The denominator corrects the number of jobs in j (with $r \in J$) for all potential job seekers in municipality j and in the municipalities k that surround j (with $k \in J$). As in Andersson et al. (2018), we measure the number of job seekers by the working-age population in r, j, and k.

In a first step, we estimate our main specification from column (6) in Table 2 with this combined indicator. As shown in column (6) of Table 4, a rise in job accessibility by one unit reduces the days in unemployment per quarter by around 5.7, which is qualitatively in line with the findings by Andersson et al. (2018). To compare the effect of job accessibility on unemployment also in a quantitative sense, we then replace the dependent variable by the number of days a worker spends in unemployment between a firm closure and the first full-time employment. When estimating this specification without fixed effects, the results in column (7) suggest that raising job accessibility by one unit reduces the number of days in unemployment after a job loss by 14. With an average of 171 days in unemployment after a firm closure, this is equal to a reduction of 8.2%. Notably, this result lies in the range of 5% and 9% that Andersson et al. (2018) obtain in their main specification. When inserting closing firm fixed effects in column (8), the coefficient becomes insignificant as a result of the loss in statistical power. Numerically, the effect amounts to 5.6 days, which is equal to a reduction of 3.3% in the duration of unemployment with an increase in job accessibility by one unit.

In Table 5, we differentiate the effects that job opportunities and job competition have on the number of days in unemployment by gender, age, nationality, skill-level, region type, and firm size. All results are based on the specification contained in column (6) of Table 2, which we estimate for 16 different groups of workers. The findings from the table can be summarized as follows. Job competition exerts a significantly positive effect on the number of days in unemployment for all groups except for high-skilled workers. Ranging between 1.3 and 2.7, the point estimates show relatively little variation. Job opportunities, in turn, have a significantly negative effect on unemployment duration for six out of the 16 groups. Significant coefficients vary in size between − 0.4 and − 0.7. In terms of their relative magnitude, these estimates once again support the overall finding that the effect of job competition exceeds that of job opportunities by a factor of between three and four in absolute value, which provides the first insight from the table.

The second major finding is that negative effects from job competition are largest for workers who are least likely to resort to self-employment or to leave the labor market altogether. This becomes most apparent when comparing the estimates obtained by gender and by age group. Regarding the former, the effect of job competition is larger for men (1.9) than for women (1.3). This difference can be attributed to women being more likely to resort to part-time employment or to leave the workforce if they become involuntarily unemployed (Bundesagentur, 2017). Similarly, when we split the sample by the median age of 40 years, the effect of job competition is larger for younger (1.9) than for older workers (1.6). 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

TABLE 5 Heterogeneity of effects

Dependent variable: Days in unemployment per quarter					
		Gender		Age	
	Benchmark	Male	Female	<40 years	≥40 years
Job competition	1.767 (0.125)***	1.928 (0.157)***	1.332 (0.248)***	1.919 (0.166)***	1.632 (0.160)***
Job opportunities	−0.422 (0.167)**	−0.609 (0.193)***	0.057 (0.250)	−0.254 (0.188)	−0.594 (0.228)***
N	1,661,631	1,214,973	446,658	762,212	899,419
	Nationality		Skill level		
	German	Foreign	Low	Medium	High
Job competition	1.731 (0.119)***	1.619 (0.428)***	1.595 (0.381)***	1.858 (0.136)***	0.295 (0.388)
Job opportunities	−0.479 (0.158)***	−0.042 (0.467)	−0.502 (0.613)	−0.459 (0.160)***	0.329 (0.455)
N	1,406,682	254,949	201,178	1,335,911	124,542
	Region type		East/West		
	Urban	Rural	West	East	
Job competition	1.640 (0.146)**	2.101 (0.246)***	1.606 (0.169)***	2.715 (0.476)***	
Job opportunities	−0.071 (0.216)	−0.540 (0.203)***	0.066 (0.174)	−0.475 (0.398)	
N	1,276,751	384,880	1,104,541	557,090	
	Firm size				
	<10 Emp.	10–49 Emp.	>49 Emp.		
Job competition	1.641 (0.234)***	1.767 (0.187)***	2.008 (0.418)***		
Job opportunities	−0.129 (0.184)	−0.715 (0.247)***	−0.082 (0.413)		
N	633,862	739,585	288,184		

Note: Clustered standard errors in parentheses; cluster correction on municipality level; all regressions are based on the specification contained in column (6) of Table 2 and contain individual, regional, year-quarter and layoff-quarter fixed effects as well as regional controls; coefficients can be interpreted as the average change in days perper quarter in unemployment as a result of a change in job opportunities or job competition by one standard deviation.

*$p < .1$.

**$p < .05$.

***$p < .01$.

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 finding relates to the importance of skill level for the effects from job competition. When differentiating the results by skills, we find job competition to affect unemployment duration only for low- and medium-skilled workers but not for high-skilled workers. 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 higher overall levels of unemployment.

Fourth, when we categorize municipalities into rural and urban types according to the classification provided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development, negative effects from

competition turn out to be about 20% smaller for workers residing in cities.[16] 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., 2018), which are both likely to alleviate the negative effects from job competition. The effect of job opportunities is, in turn, significant only in rural regions, reflecting the relative scarcity of suitable jobs in the countryside. Differentiating the results between East and West Germany yields almost the same picture, which is likely due to the rural nature of most regions in East Germany.

6 | CONCLUSION AND OUTLOOK

This paper started off with 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. One explanation for this seeming contradiction is that a higher number of job opportunities in cities might be overcompensated by more intense competition between workers for these jobs. To examine this idea, we have disentangled the effects that the local number of job opportunities and the degree of job competition have on the number of days that workers spend in unemployment after having become involuntarily unemployed.

In a nutshell, our results strongly support the notion that the intensity of job competition is a more relevant determinant of individual unemployment duration than the regional density of jobs. When controlling for individual and regional heterogeneity and the sorting of workers across locations, we find that the effect of job competition on the number of days workers spend in unemployment exceeds that of job opportunities by a factor of between three and four in absolute value. Given that the density of both jobs and unemployment rises with the degree of agglomeration, these findings put the notion of risk-sharing in urban labor markets into perspective by emphasizing the detrimental effect that job competition in cities has on the re-employment prospects of workers. In addition, this combination of result provides an explanation for empirical regularity that the duration of unemployment is higher in urban than in rural areas in Germany.

With regard to the design of labor market policies, these findings emphasize the pivotal role of labor supply side policies when considering additional efforts to fight higher unemployment rates in cities. Reducing competitive pressure on job seekers, for example, through improved job placement, training measures, and counseling services is likely to also unfold positive external effects on other job seekers. In terms of future research, it would therefore be desirable to better understand the local segregation of labor markets by skill level and occupation so as to be able to more effectively target active labor market policies to different groups of unemployed workers. The contribution by Neffke et al. (2018), which complements our findings in this direction, provides a valuable starting point for further research.

ACKNOWLEDGMENTS

We thank Wolfgang Dauth, Johann Eppelsheimer, Georg Hirte, Thierry Mayer, Joachim Möller, Christoph Rust, Jos van Ommeren, Edward Coulson as corresponding editor, three anonymous referees as well as seminar participants at the Annual Meeting of the German Economic Association, the ERSA in Groningen, the NECTAR in Madrid and at the University of Regensburg, VU Amsterdam and TU Dresden for many helpful comments on this project. All errors are our own.

[16]Note that about three-quarters of the workers in our sample live in urban municipalities.

ORCID

Daniel F. Heuermann http://orcid.org/0000-0001-5849-198X

REFERENCES

Ahlfeldt, G. M, & Wendland, N. (2016). The spatial decay in commuting probabilities: Employment potential vs. commuting gravity. *Economics Letters*, *143*, 125–129.

Andersson, F., Haltiwanger, J. C., Kutzbach, M. J., Pollakowski, H. O., & Weinberg, D. H. (2018). Job displacement and the duration of joblessness: The role of spatial mismatch. *Review of Economics and Statistics*, *100*(2), 203–218.

Antoni, M., Ganzer, A., & vom Berge, P. (2014). Sample of integrated labour market biographies (SIAB) 1975–2014. FDZ Daten Report 4/2014.

Bayer, P., Ross, S. L., & Topa, G. (2008). Place of work and place of residence: Informal hiring networks and labor market outcomes. *Journal of Political Economy*, *116*(6), 1150–1196.

Bellmann, L., & Janik, F. (2010). Betriebe und Frühverrentung: Angebote, die man nicht ablehnt. *Zeitschrift für Arbeitsmarkt Forschung*, *42*(4), 311–324.

Bleakley, H., & Lin, J. (2012). Thick-market effects and churning in the labor market: Evidence from US cities. *Journal of Urban Economics*, *72*(2), 87–103.

Bonin, H. (2009). 15 Years of pension reform in germany: Old successes and new threats. *The Geneva Papers on Risk and Insurance-Issues and Practice*, *34*(4), 548–560.

Brakman, S., Garretsen, H., & Van Marrewijk, C. (2009). *The new introduction to geographical economics*. Cambridge, UK: Cambridge University Press.

Bundesagentur, F. A. (2017). Die Arbeitsmarktsituation von Frauen und Männern 2016. Berichte: Blickpunkt Arbeitsmarkt. Bundesagentur für Arbeit.

Combes, P.-P., & Gobillon, L. (2015). The empirics of agglomeration economies. In G. Duranton, J. V. Henderson, & W. C. Strange (Eds.), *Handbook of regional and urban economics* (Vol. 5, pp. 247–348). Amsterdam: Elsevier.

Combes, P.-P., Duranton, G., & Gobillon, L. (2011). The identification of agglomeration economies. *Journal of Economic Geography*, *11*(2), 253–266.

Couch, K. A., & Placzek, D. W. (2010). Earnings losses of displaced workers revisited. *The American Economic Review*, *100*(1), 572–589.

Davis, S. J., & von Wachter, T. (2011). Recessions and the costs of job loss. *Brookings Papers on Economic Activity*, *42*(2), 1–72.

Détang-Dessendre, C., & Gaigné, C. (2009). Unemployment duration, city size and the tightness of the labor market. *Regional Science and Urban Economics*, *39*(3), 266–276.

DiAddario, S. (2011). Job search in thick markets. *Journal of Urban Economics*, *69*(3), 303–318.

Duranton, G., & Puga, D. (2004). Micro-foundations of urban agglomeration economies. In G. Duranton, J. V. Henderson, & W. C. Strange (Eds.), *Handbook of regional and urban economics* (Vol. 4, pp. 2063–2117). Amsterdam: Elsevier.

Eliason, M. (2012). Lost jobs, broken marriages. *Journal of Population Economics*, *25*(4), 1365–1397.

Fackler, D., & Schnabel, C. (2015). What do we know about company shutdowns? Findings for West and East Germany. *Wirtschaftsdienst*, *95*(2), 143–147.

Fackler, D., Schnabel, C., & Wagner, J. (2013). Establishment exits in Germany: The role of size and age. *Small Business Economics*, *41*(3), 683–700.

Gathmann, C., Helm, I., & Schönberg, U. (2018). Spillover effects of mass layoffs. *Journal of the European Economic Association*, https://academic.oup.com/jeea/advance-article-abstract/doi/10.1093/jeea/jvy045/5247011

Giesen, K., & Südekum, J. (2011). Zipf's law for cities in the regions and the country. *Journal of Economic Geography*, *11*(4), 667–686.

Glaeser, E. L. (1996). Discussion of O'Regan and Quigley's spatial effects upon employment outcomes. *New England Economic Review*, 58–64.

Glaeser, E. L., & Resseger, M. G. (2010). The complementarity between cities and skills. *Journal of Regional Science*, *50*(1), 221–244.

Gobillon, L., Selod, H., & Zenou, Y. (2007). The mechanisms of spatial mismatch. *Urban Studies*, *44*(12), 2401–2427.

Gobillon, L., Magnac, T., & Selod, H. (2011). The effect of location on finding a job in the Paris region. *Journal of Applied Econometrics*, *26*(7), 1079–1112.

Haller, P., & Heuermann, D. F. (2016). Job search and hiring in local labor markets: Spillovers in regional matching functions. *Regional Science and Urban Economics*, *60*, 125–138.

Hansen, W. G. (1959). How accessibility shapes land use. *Journal of the American Institute of Planners*, *25*(2), 73–76.

Hawranek, F., & Schanne, N. (2014). Your very private job agency—Job referrals based on residential location networks. IAB Discussion Paper 1/2014.

Hethey-Maier, T., & Schmieder, J. F. (2013). Does the use of worker flows improve the analysis of establishment turnover? Evidence from German administrative data. *Schmollers Jahrbuch*, *133*(4), 477–510.

Holl, A. (2012). Market potential and firm-level productivity in Spain. *Journal of Economic Geography*, *12*(6), 1191–1215.

Holm, J. R., Østergaard, C. R., & Olesen, T. R. (2016). Destruction and reallocation of skills following large company closures. *Journal of Regional Science*, *57*(2), 245–265.

Huttunen, K., & Kellokumpu, J. (2016). The effect of job displacement on couples' fertility decisions. *Journal of Labor Economics*, *34*(2), 403–442.

Ihlanfeldt, K. R., & Sjoquist, D. L. (1998). The spatial mismatch hypothesis: A review of recent studies and their implications for welfare reform. *Housing Policy Debate*, *9*(4), 849–892.

Jacobson, L. S., LaLonde, R. J., & Sullivan, D. G. (1993). Earnings losses of displaced workers. *The American Economic Review*, *83*(4), 685–709.

Jahn, E. J., & Neugart, M. (2017). Do neighbors help finding a job? Social networks and labor market outcomes after plant closures. IZA Discussion Paper No. 10480.

Kain, J. F. (1968). Housing segregation, negro employment, and metropolitan decentralization. *The Quarterly Journal of Economics*, *82*(2), 175–197.

Kosfeld, R., & Werner, A. (2012). Deutsche Arbeitsmarktregionen—Neuabgrenzung nach den Kreisgebietsreformen 2007–2011. *Raumforschung und Raumordnung*, *70*(1), 49–64.

Kroft, K., Lange, F., & Notowidigdo, M. J. (2013). Duration dependence and labor market conditions: Evidence from a field experiment. *The Quarterly Journal of Economics*, *128*(3), 1123–1167.

Manning, A., & Petrongolo, B. (2017). How local are labor markets? Evidence from a spatial job search model. *American Economic Review*, *107*(10), 2877–2907.

Martín-Barroso, D., Núñez-Serrano, J. A., & Velázquez, F. J. (2015). The effect of accessibility on productivity in Spanish manufacturing firms. *Journal of Regional Science*, *55*(5), 708–735.

Martín-Barroso, D., Núñez-Serrano, J. A., & Velázquez, F. J. (2017). Firm heterogeneity and the accessibility of manufacturing firms to labour markets. *Journal of Transport Geography*, *60*, 243–256.

Moretti, E. (2011). Local labor markets. In A. Orley & C. David (Eds.), *Handbook of labor economics* (Vol. 4, pp. 1237–1313). Amsterdam: Elsevier.

Marshall, A. (1890). Principles of Economics, London: Macmillan.

Nedelkoska, L., Neffke, F., & Wiederhold, S. (2015). Skill mismatch and the costs of job displacement. *Mimeo*.

Neffke, F. M. H., Otto, A., & Hidalgo, C. (2018). The mobility of displaced workers: How the local industry mix affects job search. *Journal of Urban Economics*, *108*, 124–140.

Oreopoulos, P., Page, M., & Stevens, A. H. (2008). The intergenerational effects of worker displacement. *Journal of Labor Economics*, *26*(3), 455–483.

Oreopoulos, P., von Wachter, T., & Heisz, A. (2012). The short- and long-term career effects of graduating in a recession. *American Economic Journal: Applied Economics*, *4*(1), 1–29.

Petrongolo, B., & Pissarides, C. A. (2001). Looking into the black box: A survey of the matching function. *Journal of Economic Literature*, *39*(2), 390–431.

Petrongolo, B., & Pissarides, C. (2006). Scale effects in markets with search. *The Economic Journal*, *116*(508), 21–44.

Raphael, S. (1998). Intervening opportunities, competing searchers, and the intrametropolitan flow of male youth labor. *Journal of Regional Science*, *38*(1), 43–59.

Reggiani, A., Bucci, P., & Russo, G. (2011). Accessibility and impedance forms: Empirical applications to the German commuting network. *International Regional Science Review*, *34*(2), 230–252.

Rosenthal, S. S., & Strange, W. C. (2001). The determinants of agglomeration. *Journal of Urban Economics*, *50*(2), 191–229.

Ruhm, C. J. (1991). Are workers permanently scarred by job displacements? *The American Economic Review*, *81*(1), 319–324.

Schmieder, J. F., vonWachter, T., & Bender, S. (2010). The long-term impact of job displacement in Germany during the 1982 recession on earnings, income, and employment. IAB Discussion Paper 1/2010.

Siebel, W. (1997). Die Stadt und die Fremden. In B. Joachim & V. Laura (Eds.), *Migration—Stadt im Wandel* (pp. 33–40). Verlag für wissenschaftliche Publikationen.

Snower, D. J., & Lindbeck, A. (1989). *The insider-outsider theory of employment and unemployment*. Cambridge, MA: MIT Press.

Stüber, H., & Seth, S. (2017). The public release data of the administrative wage and labor market flow panel. Jahrbücher für Nationalökonomie und Statistik (online first).

Sullivan, D., & Von Wachter, T. (2009). Job displacement and mortality: An analysis using administrative data. *The Quarterly Journal of Economics*, *124*(3), 1265–1306.

von Wachter, T. (2010). Summary of the literature on job displacement in the US and EU: What we know and what we would like to know. In M. David & R. Francois (Eds.), *Wage structures, employment adjustments and globalization* (pp. 64–121). Basingstoke, UK: Palgrave MacMillan.

Wasmer, E., & Zenou, Y. (2002). Does city structure affect job search and welfare? *Journal of Urban Economics*, *51*(3), 515–541.

How to cite this article: Haller P, Heuermann DF. Opportunities and competition in thick labor markets: Evidence from plant closures. *J Regional Sci*. 2020;60:273–295. https://doi.org/10.1111/jors.12460

APPENDIX A

TABLE A.1 Summary of sample restrictions

	All	Leave <6 m	Tenure >4 y	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 Employed and unemployed workers in Germany

	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

Calculations based on the Sample of Integrated Employment Biographies (SIAB) provided by the Institute for Employment Research (IAB).

TABLE A.3 IV-regressions, first stages

	Job opportunities (1)	Job competition (2)	Job opportunities (3)	Job competition (4)
Density of displaced workers	−0.221 (0.028)***	0.383 (0.062)***	−0.223 (0.029)***	0.391 (0.058)***
Density of hires	−0.052 (0.015)***	0.217 (0.015)***	−0.057 (0.015)***	0.209 (0.013)***
Density of vacancies			0.042 (0.012)***	−0.085 (0.020)***
Year-Quarter FE	Y	Y	Y	Y
Layoff-Quarter FE	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y
Definition M_{rt} total	Total	Total	Total	
F-statistic	48.1	533.1	40.8	362.9
N	1,661,631	1,661,631	1,661,631	1,661,631

Note: Clustered standard errors in parentheses; cluster correction on municipality level; the table provides the results from two sets of first stage regressions; the respective second stages are contained in columns (1) and (2) of Table 4.

*$p < .1$.

**$p < .05$.

***$p < .01$.