How do Establishments Choose Their Location? Taxes, Monopsony, and Productivity

Catherine van der List *

University of Essex †

February 2, 2025

Click here for the latest version

Abstract

To study the distribution of economic activity across space and place-based policies, I develop a model of the location choice of new establishments incorporating monopsonistic labor markets, taxes, and spillovers. Estimates using German administrative data indicate that establishments prefer lower taxes and lower worker outside options which enable establishments to pay lower wages. The degree to which various types of productivity spillovers matter in the location decision varies between industries. I also quantify the effects of a counterfactual place-based policy and find that the response of a commuting zone to the place-based policy depends on the degree of labor market power in that commuting zone. More monopsonistic labor markets receive more benefit from the place-based policy.

*I would like to thank my advisors Thomas Lemieux, Florian Hoffmann, and Raffaele Saggio for their guidance, support, and feedback. I would also like to thank Victor Couture, Thomas Cornelissen, Anand Chopra, David Green, Joshua Gottlieb, Jessie Handbury, Torsten Jaccard, Eckhard Janeba, Réka Juhász, Sanghoon Lee, Enrico Moretti, Marit Rehavi, Michel Serafinelli, Sebastian Siegloch, Gregory Verdugo, the VSE labor students workshop, and many seminar participants for their helpful comments. I also thank Mirko Titze and Urban Janisch for their assistance with geocode harmonizations.

†Wivenhoe Park, Colchester CO4 3SQ, United Kingdom. catherine.vanderlist@essex.ac.uk

1 Introduction

Spatial inequality in economic outcomes is large and increasing: wages and wage growth are higher in urban areas, and economic activity is becoming increasingly concentrated in geographic space over time (Moretti, 2012). The location decisions of new establishments may reinforce this. How new establishments make this decision is of critical interest to governments, who develop place-based policies in an attempt to revitalize underdeveloped regions.

There are a number of factors known to influence the spatial distribution of establishments. The effects of taxes on the geographic distribution of economic activity is well established (Albouy, 2009; Suárez Serrato and Zidar, 2016; Fajgelbaum et al., 2018). Manning (2009) and Bamford (2021) argue that monopsony power impacts the location of establishments. Other papers have instead shown that spillovers are an important influence on how establishments sort themselves across geographic space (Rosenthal and Strange, 2003; Ellison et al., 2010; Gaubert, 2018). There is also evidence that the relative contribution of spillovers may differ for establishments in different industries (Hanlon and Miscio, 2017; Faggio et al., 2020).

In this paper, I present evidence on the extent to which monopsony power, corporate taxes, and productivity spillovers influence the location decision of new establishments, and test the effects of placed-based policies (in the form of tax incentives) designed to attract establishments to particular areas. To my knowledge, this is the first paper to examine all of these factors in a unified framework of new establishment location choice, and is sufficiently general to allow heterogeneous valuations of input factors for each industry. Previous literature (Jofre-Monseny and Solé-Ollé, 2010; Fajgelbaum and Gaubert, 2020) has studied the interplay between two of these three factors - demonstrating that accounting for agglomeration economies is essential to understanding the effects of local taxes or place-based policies.

I go further - showing that a unified framework of new establishment location choice allowing for interactions between all three factors is essential to both understanding establishment behavior and designing place-based policies. Starting from a model of imperfect competition in segmented labor markets, I first show that monopsony power directly interacts with local productivity spillovers in the establishment location problem. In subsequent model counterfactuals, I also demonstrate that the effects of a place-based tax incentive implemented over multiple years depend directly on the interaction between the degree of monposony power in a local area and productivity spillovers.

Using my model, I show that there are four key inputs into the establishment location decision problem: corporate tax rates, market size, the degree of monopsony power, and the productivity of each location. I also show that the resulting conditional logit choice problem can be estimated tractably and easily using methods from the differentiated products models of the industrial organization literature and a model-derived estimating equation (Berry, 1994). I implement this method using establishment-level data from Germany combined with data on corporate tax rates, estimates of the degree of monopsony power in each commuting zone, and proxies for Marshallian agglomerating forces.

My empirical findings using a Bartik instrument approach point to the conclusion that establishments have heterogeneous preferences in the location characteristics they consider when they choose where to locate. Taxes present the least heterogeneity where, in line with previous literature (Albouy, 2009; Suárez Serrato and Zidar, 2016; Fajgelbaum et al., 2018), I find that establishments overall have a distaste for taxes. Though, even then, two sectors are not sensitive to local tax rates in their location decision (agriculture, forestry, and fishing; education and healthcare). I see little evidence of heterogeneous response among the five other sectors where the effect of taxes is negative and statistically significant.

I also find that establishments have a preference to pay lower wages, enabled by monopsony power, though the degree of importance varies between sectors. Six sectors (agriculture, forestry, and fishing; mining utilities, and construction; manufacturing; trade and transportation; professional services; and the other services sector, mostly comprised of personal services) prefer to locate in areas where worker outside options are low. This suggests that for these sectors, paying lower wages is a valuable asset to them in a location.

With respect to spillovers, I find that three sectors (mining utilities, and construction; manufacturing; and professional services) are subject to negative congestion forces operating through labor market channels. In empirical extensions, I find that the congestion effects implied by the negative coefficients on the spillover proxies are confined to establishments with below-median productivity levels. This suggests that more productive establishments are either able to better utilize positive spillovers, or they are less negatively affected by congestion effects.

Using the estimated coefficients from my empirical specification, I conduct model counterfactuals to study the effects of a place-based policy designed to attract establishments to particular locations. Such a policy has both primary (tax-induced) and secondary (spillovers-from-new-establishments-induced) effects. I show theoretically that the overall percent change in establishments due to the tax policy depends directly on interaction between the monopsony power and productivity spillovers - with more competitive labor markets acting as a multiplier to the secondary (spillover) effects of the policy. Thus, the degree of monopsony power in a commuting zone is a strong predictive factor in the percent change in establishments from the place-based policy. The model has ambiguous predictions concerning whether these secondary effects are positive or negative - it depends on whether the mixture of establishments attracted by the place-based policy is "good". I show that in-practice, the secondary effects are negative. More monopsonistic areas receive more benefit from the place-based policy, in terms of establishment growth and wages, compared to more competitive areas.

In the counterfactual world, there is a great deal of heterogeneity in the overall response to the place-based policy. In terms of the wage impacts, the effects range from -.6% to 4.1%. This distribution is similar, though more right-skewed, than reduced-form estimates of TFP effects of million dollar plant openings on incumbents from Greenstone et al. (2010) (Figure 2), which range from roughly -3.75 to 2.5 log points. In terms of the difference in the number of establishments compared to the actual policy, the estimated effects of leaving the place-based policy in place for 18 years ranges from -48% to 74%. These results are more heterogeneous than most results in the literature, which typically find positive employment effects of firm subsidy policies in the European Union (Neumark and Simpson, 2015). This is explained by the interaction between productivity spillovers and monopsony power described above. The regional subsidy programs studied in reduced-form papers are targeted to economically depressed areas. My results for less competitive areas of growth in the number of establishments as a result of a tax policy are consistent with reduced-form findings of positive employment effects.

This paper relates to a number of literatures in labor, urban, and public economics. Previous research on the discrete-choice location decision of new establishments has concentrated on identifying its empirical relationship to agglomeration, typically measured as market size (see Neumark and Simpson (2015) for a comprehensive overview). A more structural body of work has attempted to explain the spatial sorting of establishments in equilibrium (Behrens et al., 2014; Gaubert, 2018; Fajgelbaum et al., 2018), which has traditionally assumed establishments are entering perfectly-competitive labor markets. However, economists know from the literature on monopsony power (Berger et al., 2022) that markets are not perfectly competitive in practice.

A smaller literature has examined the impact of imperfectly competitive labor markets on establishment location (Manning, 2009; Bamford, 2021), finding that monopsony power impacts the distribution of establishments across space, but these papers assume homogeneous firms and do not include the impact of corporate taxes. Papers focused on the impact of taxation on the geographic distribution of economic activity also traditionally assumes establishments are entering perfectly competitive labor markets (Albouy, 2009; Fajgelbaum et al., 2018). This paper allows for local tax competition in the context of imperfectly competitive labor markets, and shows that monopsony power is a strong predictive factor of the impacts of place-based tax policies within local areas.

Bilal (2021) uses a search model to study the distribution of heterogeneously productive firms across space, but does not allow productivity spillovers within a location or model the effects of taxes. Gaubert (2018) assumes perfectly competitive labor markets and heterogeneous firms to examine the location choice of firms, but concentrates on whether more productive firms are better able to take advantage of a single generic type of spillover with no structure. In contrast, this paper concentrates on heterogeneous valuation of different types of spillovers and how that contributes to differences in productivity of individual industrial sectors across geographic space.

Existing literature examining spillovers directly has concentrated on empirical measurement of the magnitude of spillovers or the three types of spillovers which may exist theoretically and how to distinguish between the them empirically (see Rosenthal and Strange (2004) for a comprehensive overview). This paper confirms that establishments value spillovers in their location choice, and provides evidence that the heterogeneous valuation and utilization of spillovers has implications for the overall effects of place-based policies. In particular, the interplay between spillovers and monopsony power explain why the same place-based policy may have different effects in different locations, as seen empirically in Greenstone et al. (2010) and Devereux et al. (2007).

The remainder of this paper is organized as follows. Section 2 outlines the model of establishment location choice and the derivation of the estimating equation, Section 3 describes the data, Section 4 discusses the results, Section 5 examines the effects of a counterfactual place-based policy, and Section 6 concludes.

2 Model and Estimating Equation

I model new establishments' location choice where new establishments make optimal location choices and choose wages to maximize their profits, taking as given the labor supply curve. As in Card et al. (2018), I use a static industrial-organization style differentiated products framework to describe how workers value jobs at different establishments. Within this framework, I model the location decision of a new establishment choosing which labor market to enter using a differentiated-products framework, where "products" are locations with different characteristics. Establishments solve their problem by backwards induction. First, they determine their optimal wage subject to the labor supply equation from the workers' utility maximization problem. Second, new establishments choose which location to enter based on which market offers the establishment the highest level of profit. Using the model, I derive a tractable estimating equation relating the share of establishments choosing a particular location to taxes, market size, monopsony power, and market-level productivity. I also demonstrate that monopsony power and productivity interact directly with one another in the estimating equation - and also show that the marginal effect of an increase in productivity on establishment location is larger when markets are more perfectly competitive.

For simplicity, I assume that workers search only within their own commuting zone for work, and that only new establishments choose a location, incumbents do not.[1] Although classical spatial equilibrium models typically assume perfectly mobile labor (Glaeser and Gottlieb, 2009), previous work has shown that labor markets are highly local (Manning and Petrongolo, 2017) and that spatial frictions are substantial in my empirical setting of Germany and lead to sizable labor market distortions (Heise and Porzio, 2022).[2]

2.1 Allocation of Workers to Establishments Within Labor Markets

In a particular labor market c and time t, each establishment indexed by j in industrial sector m posts a wage offer w_{cjt} which is fully and costlessly observed by all workers living in that market. Establishments are willing to hire any worker who will accept the job at the posted wage.

Workers have heterogeneous preferences over establishments, the utility function of worker i at establishment j is given by:

$$u_{icjt} = \mu_c \ln(w_{cjt} - b_{ct}) + a_m + v_{icjt} \tag{1}$$

where b_{ct} is the outside option of workers living in location c, a_m are sector-specific amenities valued equally by all workers, and v_{icjt} is an idiosyncratic preference shock of workers for working at establishment j drawn independently from a type I extreme value distribution. Such preference shocks could be, for example, interactions with co-workers. Workers supply inelastic labor hours normalized to one. By the standard arguments of the McFadden choice model (McFadden, 1973) this leads to the logit

[1] In the data, relocations of establishments are not a reason for a change of establishment identification code (Hethey-Maier and Schmieder, 2013), and in the data only 1.6% of establishments ever change location in their lifetimes. In all analysis I treat relocated establishments as part of the incumbent pool faced by the new establishments. I further follow the methodology of Hethey-Maier and Schmieder (2013) using worker flows to identify new establishments and restrict my sample of new establishments to those which are not spin-offs of existing establishments.

[2] Online Appendix Figure B.1.1 confirms that mobility rates are low in Germany, hovering at an average annual level of approximately 3% throughout my sample period and do not vary strongly between industrial sectors. Furthermore, the vast majority of workers never move between commuting zones in the entire period I observe them in the SIAB. In the sector with the highest mobility, professional services, 74.96% of workers never move, and in the sector with the lowest mobility, mining utilities and construction, 84.97% of workers never move.

choice equation of workers.[3] Assuming the number of establishments is sufficiently large in each location that firms are not strategically interacting in their wage setting, this logit-choice equation may be approximated by the exponential probability.

$$p_{icjt} \approx \lambda_{ct} \exp(\mu_c ln(w_{cjt} - b_{ct}) + a_m) \tag{2}$$

where λ_{ct} is constant for all establishments in market c. Since an establishment's number of employees is the available pool of workers in the location times the probability a worker chooses the establishment, the labor supply equation of the establishment directly follows.

$$L_{cjt}(w_{cjt}) = \mathcal{L}_{ct} \lambda_{ct} \exp(\mu_c ln(w_{cjt} - b_{ct}) + a_m) \tag{3}$$

where $\mathcal{L}_{ct}$ is the size of the labor force in market c.

2.2 Optimal Establishment Behavior Within a Market

Individual establishments maximize their profits conditional on the market they operate within by posting an optimal wage subject to the labor supply behavior of workers outlined above. An individual establishment's profit equation for market c is given by:

$$Y_{jct} = (1 - \tau_{ct})(\beta_{ctm} L_{cjt}(w_{cjt}) - L_{cjt}(w_{cjt}) w_{cjt}) \tag{4}$$

Establishments have a marginal product of labor β_{ctm} which differs by industrial sector, time, and location. I remain agnostic about the exact form of this productivity, but it may be thought of as a function of agglomeration, spillovers, natural advantage, and worker characteristics available to the establishment in a given location. Productivity is allowed to differ by industrial sector m since previous literature has shown that industrial coagglomeration patterns are predicted by heterogeneous types of location characteristics (Hanlon and Miscio, 2017; Faggio et al., 2020), which suggests that locations are not equally productive for all types of establishments. Corporate taxes for each market are denoted by τ_{ct}.

[3] $p_{icjt} = P(\underset{k \epsilon 1,\dots,J}{argmax} = j) = \frac{\exp(\mu_c ln(w_{cjt} - b_{ct}) + a_m)}{\sum_{k=1}^{J} \exp(\mu_c ln(w_{ckt} - b_{ct}) + a_m)}$

Establishments cannot observe workers' idiosyncratic preference shocks v_{icjt}, so they post a single optimal wage by maximizing their profit equation subject to the labor supply equation (3). Using the first order condition of the profit equation and the labor supply equation, the optimal wage posted by the establishment is:

$$w_{cmt} \equiv w_{cjt} = \frac{\mu_c}{1+\mu_c}\beta_{ctm} + \frac{1}{1+\mu_c}b_{ct} \tag{5}$$

This wage equation takes the form of a weighted average of the marginal product of labor and the outside option available to workers in the establishments' location. The form of the equation demonstrates the manner in which monopsony power is exerted by firms, as $\mu_c \to \infty$ markets become perfectly competitive. Furthermore, as worker outside options increase, wage levels must also increase, with the relative importance of productivity and outside option in wage setting determined by the elasticity of labor supply to the establishment μ_c. Of note, since productivity β_{ctm} varies at the sector and commuting-zone level and b_{ct} varies at the commuting-zone level, wages are sector and commuting-zone specific rather than establishment specific.

Furthermore, given that the productivity of workers in a particular location is a function of productivity spillovers (Rosenthal and Strange, 2004), monopsony power interacts directly with productivity spillovers in the wage equation. In perfectly competitive markets, workers are able to capture the entirety of the productivity spillover in their wages, whereas the presence of monopsony allows establishments to mark down the worker wage - decreasing the wage responsiveness to changes in productivity spillovers proportionally to the degree of monopsony power.

Substituting labor supply and wage equations and log-linearizing leads to the log-profit equation.

$$y_{ctj} = \ln(1-\tau_{ct}) + \ln(\mathcal{L}_{ct}\lambda_{ct}) + (1+\mu_c)\ln\left[\frac{1}{1+\mu_c}(\beta_{ctm} - b_{ct})\right] + a_m + \mu_c ln(\mu_c) + u_{ctj} \tag{6}$$

Where u_{ctj} is an idiosyncratic log-profit shock with a type I extreme value distribution.

This log-profit equation has several key terms. The first is taxes $\ln(1-\tau_{ct})$, the second is a market size term $\ln(\mathcal{L}_{ct}\lambda_{ct})$, and the third, $(1+\mu_c)\ln\left[\frac{1}{1+\mu_c}(\beta_{ctm} - b_{ct})\right]$, includes the relative productivity of workers compared to the outside option and monopsony power.

2.3 Modeling Location Choice

Within this framework, I model the location choice of new establishments entering the labor market. Establishments solve their location choice problem by first solving for the optimal wage they would pay in each individual market, then choosing the location where log profit is highest. Since the idiosyncratic shocks to profit in equation (6) are drawn from a type I extreme value distribution, establishments have the standard logit probability of locating in location c. Since establishments in the same industrial sector have the same preferences over locations, this logit probability approximates the share s_{ctm} of establishments of a particular industrial sector which locate in location c - $s_{ctm} \approx p_{ctm}$.[4] Dividing this share equation by the share of establishments choosing a base location s_{0tm} and taking logs leads to the structural share-ratio equation (Berry, 1994).

$$\begin{aligned} ln(\frac{s_{ctm}}{s_{0tm}}) =& ln(1-\tau_{ct}) + ln(\mathcal{L}_{ct}\lambda_{ct}) + (1+\mu_c) ln\left[\frac{1}{1+\mu_c}(\beta_{ctm} - b_{ct})\right] + \mu_c ln(\mu_c) \\ & - ln(1-\tau_{0t}) - ln(\mathcal{L}_{0t}\lambda_{0t}) - (1+\mu_0) ln\left[\frac{1}{1+\mu_0}(\beta_{0tm} - b_{0t})\right] - \mu_0 ln(\mu_0) \end{aligned} \tag{7}$$

The log share of establishments of sector m choosing location c in time t compared to a benchmark location *0* is a function of the taxes in both locations, the market sizes of both locations, and two terms comprising monopsony power and the relative productivity of labor compared to their outside option.

Monopsony power interacts directly with productivity spillovers in this equation, as was the case in the wage equation. The partial effect of a an increase in productivity (due to increased spillovers) on the share-ratio makes the importance of this interaction even more clear:

$$\frac{\partial \ln(\frac{s_{ctm}}{s_{0tm}})}{\partial \beta_{ctm}} = (1+\mu_c)\frac{1}{\beta_{ctm} - b_{ct}} \tag{8}$$

When a market is more perfectly competitive (μ_c is larger) the effect of an increase in productivity due to stronger spillovers on the location choice of the establishment is larger than in more monopsonistic markets. Intuitively, this is because the degree of

[4] $p_{ctm} = \frac{exp\left[ln(1-\tau_{ct}) + ln(\mathcal{L}_{ct}\lambda_{ct}) + (1+\mu_c)ln[\frac{1}{1+\mu_c}(\beta_{ctm}-b_{ct})] + a_m + \mu_c ln(\mu_c)\right]}{\sum_{k=1}^{C} exp\left[ln(1-\tau_{kt}) + ln(\mathcal{L}_{kt}\lambda_{kt}) + (1+\mu_k)ln[\frac{1}{1+\mu_k}(\beta_{ktm}-b_{kt})] + a_m + \mu_k ln(\mu_k)\right]}$

adjustment to the productivity shock is higher in more competitive markets. Wages rise for the establishment(s) exposed to the productivity change, but worker labor supply also adjusts per equation (3). Because of this, the overall effect for the establishments with the productivity increase is larger in more perfectly competitive markets.

2.4 Estimating Equation

I run the following two-way-fixed-effects specification separately for each industrial sector:

$$
\begin{aligned}
ln(\frac{s_{ctm}}{s_{0tm}}) - \mu_c ln(\mu_c) =& \beta_0 + \beta_1 ln(1-\tau_{ct}) + \beta_2 ln(\mathcal{L}_{ct}\lambda_{ct}) + \beta_3 Spillovers_{ctm} + \beta_4 b_{ct} \\
&+ \beta_5 X_{ctm} + \gamma_c + \zeta_t + u_{ctm} \qquad (9)
\end{aligned}
$$

The latter four terms of equation (7), the base-location utilities, are cleanly captured by the time-fixed effect ζ_t. In order to control for the market-size term $ln(\mathcal{L}_{ct}\lambda_{ct})$ directly, I pre-estimate it in a first step, which I outline in Online Appendix A.1. I also estimate μ_c separately using the method of Bassier et al. (2022), also described in Online Appendix A.1.

Given data on corporate tax rates, τ_{ct}, the only remaining term of the structural equation is $(1+\mu_c)ln\left[\frac{1}{1+\mu_c}(\beta_{ctm} - b_{ct})\right]$. This term incorporates two forces which vary across locations and time within sector: the productivity of an establishment in sector m and the outside option available to workers. For the empirical specification, I construct an empirical proxy for outside option b_{ct} which will be explained in detail in Section 3. I also construct empirical proxies for three types of spillovers, which will also be discussed in detail in Section 3.

I additionally control for commuting zone characteristics which may be correlated with productivity, such as share of highly educated workers in the commuting zone.[5] Natural advantage is captured by the location fixed effect γ_c. After estimation, I back out estimated values for the sector-location level productivity using the structural equation.

[5] Specifically, all empirical specifications include controls for share high/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers within the industrial sector.

Guimarães et al. (2003) demonstrate the equivalence of maximum likelihood estimation of the conditional logit and a poisson regression under certain circumstances. Online Appendix A.2 explains this method in more detail and its assumptions. I also show that the distributional assumptions necessary for the equivalence of poisson and conditional logit are not met. As the share-ratio regression does not require these additional assumptions, it is more appropriate for this analysis.

3 Data, Summary Statistics, and Variable Construction

In this section, I outline the various data sources I use to estimate my model. I first describe my main source of data on individual establishments, then the empirical proxies I use for three types of spillovers, and finally additional sources of data necessary for variable construction. Once all of these sources of data are combined, I have a panel spanning the years 1999 to 2017.

3.1 Establishment Data

The core source of data for this project is the Establishment History Panel (BHP) of the Institute for Employment Research (IAB) of the Federal Employment Agency (BA) of Germany. The data are a random 50% sample of all establishments in West Germany from 1975 onward and East Germany from 1992 onward on an annual basis, which I cannot link to parent firms.[6] In Online Appendix A.3 I describe adjustments to the structural equations and bounding exercises to account for the fact that I cannot link establishments to parent firms. The data covers all establishments with at least one employee eligible for social security. The data consists of information about the establishments themselves such as industry as well as information about employee characteristics such as number of highly-qualified workers at the firm and median daily wages. Critically, the data also includes information on establishment location. My preferred location definition is the commuting zone, of which there are 141 in Germany.

[6]Establishments cannot be linked across locations to a parent firm, but all establishments of the same firm in one location are combined. For example, all of the McDonald's in Berlin are combined into one line in the data, but I cannot link McDonald's in Berlin and McDonald's in Munich as being associated with the same firm.

Table 1 shows summary statistics concerning the size of new establishments and industrial sector of new establishments over the sample period. The majority of establishments have fewer than five employees over the entire period, though the average size is growing larger over time. The number of overall entrants has also declined over time, accounting for some of the change in composition. There are fewer small businesses being started, but more similar numbers of very large establishments. The largest industrial sectors are, broadly defined, the trade and service sectors (other comprises mostly personal services), which together account for more than 70% of all new establishments.

There are a number of other data sources merged to the BHP for analysis. An overview of the variables and their sources is shown in Table 2. I will discuss the construction of key variables in detail below.

3.2 Proxies for Agglomerating Forces

I incorporate empirical proxies for each of the three the classical Marshallian spillovers in my analysis. Marshall (1920) emphasized that establishments may locate in clusters in order to take advantage of economies of scale in goods production, labor markets, or ideas. The first reason that establishments might prefer to locate near one another is to be located near to goods suppliers or customers - hereafter referred to as "input-output forces". The second - hereafter referred to as "labor market forces" and "labor correlation forces", is that larger labor markets may improve match quality, allow workers to specialize in more specific tasks, or hire workers who have industry-specific skills. The third - "knowledge forces" - involves geographic proximity facilitating the flow of ideas.

In constructing these empirical proxies, I follow Ellison et al. (2010) (hereafter EGK). EGK develop empirical proxies for the strength of these three forces between two industries. The key difference between my own measures and those in EGK is that their paper develops a set of pairwise-industry-level measures of spillovers which is used to assess how important each factor is to the co-location of industry pairs. However, I require a location-level measure of spillover forces as my analysis concerns locations rather than pairwise industries. To utilize these pairwise-sector-level measures of spillovers in a location-level measure I use a weighted average of the pairwise-sector measures weighted by industrial sector establishment shares in a particular location.

$$\text{Spillover}_{ctm} = \sum_{m'=1}^{M} \frac{N_{ctm'}}{\mathcal{N}_{ct}} \text{Pairwise}_{m,m'} \tag{10}$$

Where Spillover_{ctm} is the spillovers benefits (of a particular type) enjoyed by sector m in location c and year t, m' are industrial sectors (inclusive of m), $\frac{N_{ctm'}}{\mathcal{N}_{ct}}\text{Pairwise}_{m,m'}$ is the share of establishments in location c and year t which are in sector m', and $\text{Pairwise}_{m,m'}$ are the pairwise-industry linkages developed by EGK. I describe the construction of these empirical proxies in detail in Online Appendix A.4.

3.3 Construction of Additional Variables for Analysis

In addition to agglomeration, taxes also play a role in establishment location choice (Fajgelbaum et al., 2018). Corporate tax rates in Germany are set at a base level by the federal government, but individual municipalities are permitted to set their own corporate tax rates in the form of a multiplier on the current federal rate of 3.5%. Changes in local multipliers are frequent, and are exogenous to local economic conditions (Fuest et al., 2018). Furthermore, it is illegal under EU competition law governments to provide tax breaks for specific establishments or firms without a special exemption from the European Commission (EU2, 2008, 2016). Rates do not also vary between industrial sectors with the exception of some exemptions for the agricultural sector - the implications of these exemptions I will discuss further in Section 4.2.[7] I have aggregated these municipal tax rates to the commuting zone level using a weighted-average with municipal population as the weight.[8,9]

[7]The public sector is also exempt. I exclude all public sector establishments from my analysis as the location choice problem would be, for obvious reasons, very different from that of private-sector establishments.

[8]Although the tax rates are set at the municipal level, there is significant redistribution of funds at the landkreis, or county-equivalent, level. Hence, there are incentives for individual municipalities within the same landkreis to move their multipliers in tandem with one another. Online Appendix Table B.2.1 shows that more than half of the variation in municipal tax rates is explainable by commuting zone and year fixed effects, suggesting that these co-movements are strong in practice.

[9]Online Appendix Figure B.1.2 shows the average corporate tax rates for the years 2000, 2010, and 2017. Tax rates are generally increasing throughout the time period of my panel, and are highest in northwestern Germany, while the lowest in the south and parts of the east.

I also construct an empirical proxy for the outside option of workers within a commuting zone. I follow the approach of Card et al. (2013) and construct the average outside option as a weighted average of sectoral union minimum wage rates, where the weight is the establishment shares. Union coverage in Germany is much higher than in the United States, Online Appendix Table B.2.2 shows both the actual and effective coverage rates of sectoral bargaining among establishments by industrial sector. Actual coverage is the share of plants subject to either a sectoral contract or a plant-specific contract.[10] In addition, the data contains information about whether plants not covered by the sectoral contracts abide by them. Plants which answer in the affirmative are "effectively" covered by the contracts. The professional services sector has the lowest effective coverage rates overall, with approximately 67% of establishments covered in 1999 and 43% in 2017. Despite declines over time, effective coverage of the union minimums remains high at more than half of establishments in all other sectors in 2017.

Union minimum wages rates are not straightforward to obtain for Germany, so I have developed a data-based method to approximate the union minimum wage rate which I describe in detail Online Appendix A.5. I approximate the union minimum wage rate with the 20th percentile of the establishment-level distribution of low-qualification employees' mean wages, which is close to the minimum wages in a subset of union contracts I was able to analyze.

4 Empirical Strategy and Results

4.1 Empirical Strategy

Revisiting the estimating equation relating the share of new establishments in an industrial sector m entering a particular geographic area c in time t relative to the share entering base location 0 to the characteristics of location c:

$$\begin{aligned} ln(\frac{s_{ctm}}{s_{0tm}}) - \mu_c ln(\mu_c) =& \beta_0 + \beta_1 ln(1-\tau_{ct}) + \beta_2 ln(\mathcal{L}_{ct}\lambda_{ct}) + \beta_3 Spillovers_{ctm} + \beta_4 b_{ct} \\ &+ \beta_5 X_{ctm} + \gamma_c + \zeta_t + u_{ctm} \end{aligned} \tag{9}$$

[10]In the German context, plant-specific contracts are typically used for wages above the sectoral minimums as discussed in Jäger et al. (2022).

There may be bias in the estimates of β_3 and β_4.[11] Specifically, there may be unobserved demand or productivity shocks which impact the distribution of incumbent establishments in the commuting zones used as weights in the spillover proxies and outside option measure. These unobserved demand or productivity shocks may also make the location more attractive to new establishments, affecting the share-ratio.

In order to correct for this, I construct a Bartik instrument. Specifically, I instrument the spillover forces and outside options with instruments of the general form:

$$\begin{aligned} \text{Spillover}_{ctm} &= \sum_{m'=1}^{M} \frac{N_{m'ct}}{\mathcal{N}_{ct}} \text{Pairwise}_{m,m'} \\ \text{z}_{ctm} &= \sum_{m'=1}^{M} \frac{N_{m'c,1998}}{\mathcal{N}_{c,1998}} * growth_{m't,-c} \text{Pairwise}_{m,m'} \end{aligned} \tag{11}$$

where $N_{mc,1998}$ is the number of incumbent establishments in sector m and commuting zone c in the pre-period 1998, and $growth_{mt,-c}$ is the leave-out growth rate in sector m in similarly sized commuting zones between 1998 and t.[12] Each agglomerating force and the worker outside option are instrumented in the same manner.

I follow the identification assumptions of Borusyak et al. (2022), which demonstrates that the pre-period industrial share composition need not be exogenous so long as the shocks (the leave-out growth rates) are exogenous. More specifically, Borusyak et al. (2022) show that identification holds in ees where the shocks are industry employment growth rates by viewing $growth_{m't,-c}$ as noisy estimates of some latent true demand shifters.[13]

[11] Theoretically, there may also be bias in β_1 if there are correlations between local corporate tax rates and local economic conditions. This is examined thoroughly by Fuest et al. (2018), who find no evidence that municipalities set their corporate tax rates in response to local economic conditions.

[12] Specifically, I split the 141 commuting zones into quartiles (35 commuting zones each) and construct the growth rates as the leave-out growth rates within these quartiles.

[13] Intuitively, the key to identification is that there must be sufficient variation in the shocks, and identification should not be coming from a small number of markets. As discussed in Borusyak et al. (2022), my regressions being unweighted assists with this. For example, if they were employment weighted identification may be coming near-exclusively from shifts in a small number of locations if those locations made up the majority of employment within particular sectors.

4.2 Results

Figure 1 shows the results of the main specification. Each panel shows point estimates of a coefficient of interest as well as 95% confidence intervals. Online Appendix Figure B.1.5 shows the corresponding OLS results. Online Appendix Table B.2.3 shows the exact point estimates and F statistics for each specification.[14,15]

Establishments in most economic sectors have a distaste for taxes.[16] Five sectors (mining utilities, and construction; manufacturing; trade and transportation; professional services; and the other services sector, mostly comprised of personal services) display a significant aversion to taxes in their location choice. Neither the agriculture, forestry, and fishing sector or the education and healthcare sector demonstrate sensitivity to local tax rates. The agriculture, forestry, and fishing sector is, to some extent, excepted from the local corporate taxes, so it is logical that I would not observe such a response in the data.[17] In the case of education and healthcare, it is logical that given the inelastic demand for these goods that these establishments may face different motivations and incentives in their location choice. Conditional on responding to taxes, there is little evidence that sectors display heterogeneous sensitivity. Though the point estimates range from 2.53 in the trade and transportation sector to 5.89 in the other services sector, the confidence intervals of the estimates are overlapping.

The results also indicate that establishments in all economic sectors either prefer lower worker outside options or are indifferent. As discussed in Section 2, higher

[14]The number of observations in Appendix Table B.2.3 also shows that the data are not sparse (i.e. very few industry-commuting zone pairs have zero establishments). The number of commuting zones excluding the base location is 140, and with 19 years of data the number of observations with no zero shares is therefore 2660. As can be seen via the observation counts, in all sectors the data has very few cells with zero shares. In terms of the underlying number of establishments, the median number of new establishments in a cell is 26.

[15]For all specifications, taxes, input-output forces, and the outside option are log-transformations and the labor market forces spillovers measure is an inverse hypersine transformation. To account for serial correlation of the error term within a given commuting zone, the standard errors in all regressions are clustered at the commuting zone level.

[16]Estimated coefficients are positive because the independent variable is $ln(1 - \tau_{ct})$

[17]See Federal Constitutional Court of Germany (2008) and Federal Ministry of Justice (2022) for details. Animal husbandry establishments are subject to the tax as are mixed-use establishments under certain conditions. Back of the envelope calculations suggest that at most 70% of establishments in this sector in the BHP would be subject to the taxes.

outside options force establishments to pay higher wages. Thus, a negative coefficient on outside option may be thought of as demonstrating a preference on the part of their ability to markdown wages they would pay to their workforce. As in the case of taxes, six sectors display a preference for lower outside options in their choice of location (agriculture, forestry, and fishing; mining utilities, and construction; manufacturing; trade and transportation; professional services; and the other services sector, mostly comprised of personal services), while the education and health sector does not. With respect to outside option, there is stronger evidence of heterogeneous responses by industrial sector. The strongest response, from the professional services sector with a coefficient of -4.068, and the weakest statistically significant response, from the manufacturing sector of -.91, are statistically distinguishable from one another and the magnitude of the point estimate for professional services is more then four times as large.

Utilization of spillovers differs substantially by economic sector, particularly the valuation by establishments of the labor market forces proxy. Three sectors (mining utilities, and construction; manufacturing; and professional services) prefer to be located away from establishments which use workers in similar occupations to themselves, with the magnitude of the effect ranging from -61.19 in the manufacturing sector to -24.38 in the professional services sector. This is suggestive that for these industrial sectors, there are congestion effects to being located too close to one another. There is also evidence that the other services sector prefers to be located near establishments using workers in similar occupations. Three sectors (agriculture, forestry, and fishing; trade and transportation; and education and health) are unresponsive to the presence of establishments with similar occupational profiles.

This result is surprising, since previous work in on agglomeration economies has found positive spillover effects likely operating through human-capital and/or labor-market channels (Moretti, 2004; Greenstone et al., 2010; Baum-Snow et al., 2021). I explore this result further and discuss potential underlying mechanisms in Section 4.3.

The regression results also indicate that for establishments input-output forces are of lesser importance, consistent with previous literature. The only sector which displays a preference for locating near to or away from establishments providing inputs or buying outputs is the other services sector. Although input-output forces have been emphasized in canonical models such as Krugman (1991), input-output forces are becoming relatively less important in explaining industrial coagglomeration patterns over time (Steijn et al., 2022). Intuitively, transport costs have been declining over time, and in explaining the flows of new establishments input-output linkages are unimportant. Furthermore, studies of large plant openings spillovers to the productivity of other establishments in the area find results consistent with either labor pooling or knowledge spillovers, but not input-output linkages (Ellison et al., 2010; Giroud et al., 2021). So, findings that input-output linkages are not important to spillovers are not unprecedented.

Knowledge spillovers are only statistically significant in the case of the manufacturing sector. It is possible that this is because the measure of knowledge is not sufficiently relevant for non-manufacturing establishments. I cannot match patent technology to a sector in the BHP data, so the measure if only at the commuting-zone level. The measure is also relatively sparse, with more than 15% of patents being filed in Munich each year as is shown in Online Appendix Figure B.1.4. More than 40% of those patents are filed by Siemens, a manufacturing conglomerate. It is likely that the coefficient is significant only for the manufacturing sector because the measure is the most relevant for this sector.

It may be the case that my definition of economic sector is overly broad to capture some nuances of spillover benefits for establishments. For example, though manufacturing is a single sector, but inputs used in auto manufacturing may be very different from those used in pharmaceutical manufacturing. Online Appendix Table B.2.4 shows the results of the main IV regression for a more disaggregated definition of industrial sector. These results are suggestive that this may be the case, with much more heterogeneity in the sign and size of the coefficient on both main spillover measures in comparison to the main results in Online Appendix Table B.2.3. However, the results for the finer industry disaggregation have smaller sample sizes and the instrument is weaker. Furthermore, the underlying data is more sparse, so results should be taken as suggestive.[18]

[18] I.E. there is a larger proportion of commuting zones with only one establishment in the sector-year pair picking it, so results are less stable. The presence of negative coefficients in several sectors

4.3 Heterogeneity by AKM Establishment-Effect and Establishment Size

I perform several extensions of my main results. The first is splitting the sample by above-median and below-median Abowd et al. (1999) (hereafter AKM) effect. Although AKM effects are not a direct measure of establishment productivity, the AKM effect is correlated with direct measures of productivity such as worker value-added (Card et al., 2015). AKM effects are obtained by running a regression of worker wages on individual and establishment fixed effects. The individual fixed effect is the "worker component" of the wage - reflecting constant characteristics of the worker which lead to higher wages such as ability. The establishment effect is the portion of the wage premium which comes from the employer. This is the common level of productivity of workers in the establishment which is passed through to worker wages.[19] Gaubert (2018) has demonstrated that more productive firms are able to better utilize the benefits of agglomeration economies. This leads to sorting of more productive firms to larger cities. In order to test whether establishments with different levels of productivity consider different characteristics of locations when making their location decision, I repeat the specification in equation (9) separately for above- and below-median AKM effect establishments.

Figure 2 (and Online Appendix Table B.2.5) shows the results. Panel A shows the estimated coefficients and 95% confidence intervals for each industrial sector. The coefficients on the tax rates are largely overlapping for both below- and above-median AKM effect establishments, though the coefficient is significant in more sectors (3) for above-median-effect establishments compared to below-median-effect establishments (1).

There do seem to be differences in how the outside option is valued between higher and lower productivity establishments as shown in Panel B, with below-median AKM establishments being more likely to place value on the outside option in their decision making process, and the estimated magnitudes of the effect being much larger. For below-median AKM establishments, the sector with the smallest magnitude statisti-

for the tax variable is also of concern, suggesting that as discussed above the results are unreliable for a more finely disaggregated definition of industrial sector.

[19] In this context, so long as the relative productivity of establishments within the same firm is reflected in the wages paid to workers at that establishment (i.e. headquarters has higher wages than a retail outlet) segmentation of production activities is accounted for in the AKM effects.

cally significant response has an estimated coefficient of -6.7, while for above-median AKM establishments the largest negative magnitude statistically significant response is -1.7.[20] This result makes sense, since less-productive establishments will, by definition, have a productivity closer to the outside option.[21] So, in order to make more profits lower outside options benefit them more than higher productivity establishments.

In the case of spillovers, it seems that negative coefficients for labor market forces seen in Figure 1 Panel D are being driven almost entirely by below-median AKM effect establishments. Only the mining, utilities, and construction sector has a significant response to labor spillovers for above-median AKM effect establishments. This shows that congestion effects within a market either primarily affect low-productivity establishments, or that if there are congestion effects for high-productivity establishments they are counterbalanced by positive spillovers.

This is consistent with the evidence in Gaubert (2018) that high-productivity establishments are able to utilize productivity spillovers more effectively than low-productivity establishments, a result also shown empirically in Baum-Snow et al. (2021). On top of being less able to utilize positive spillovers, new establishments may also be more vulnerable to negative congestion effects. A theoretical analysis by Combes and Duranton (2006) microfounds the tradeoffs faced by establishments clustering locally, showing that advantages of labor pooling compete with the costs of labor poaching (i.e. loss of employees to competitors, higher wage bills to retain employees). Given that this paper studies the behavior of the average new establishment, which is likely to be substantially less productive than highly-productive incumbents, they may be more subject to these negative poaching costs. Empirically, this hypothesis is supported by studies showing that the urban productivity premium

[20] The positive coefficient on outside option for the manufacturing sector is puzzling. It may be due to the sectoral heterogeneity discussed in Section 4.2. Different areas of manufacturing, for example food manufacturing and chemical manufacturing, employ different types of labor and are subject to different union agreements. My imputation of the union minimum wage rates may not capture the strength of the differences in this sector. When the results are split into a more finely disaggregated sector in Online Appendix Table B.2.4 the coefficient on outside option is negative for all manufacturing subsectors.

[21] Recalling one of the terms of the log-profit equation, $(1+\mu_c)ln[\frac{1}{1+\mu_c}(\beta_{ctm}-b_{ct})]$, β_{ctm} will be lower for the below-median AKM effect establishments

is higher among mature firms compared to young firms (Bellofatto et al., 2022).

I also split the sample by establishment size to see if there are meaningful differences in behavior between larger and smaller employers, with results shown in Figure 3 (and Online Appendix Table B.2.6). These results are more consistent between large and small establishments compared to the previous results for productivity. The point estimates for the coefficients are within overlapping confidence intervals for all sectors and inputs, suggesting that smaller and larger establishments do not behave indistinguishably differently from one another. Though, as a caveat, recall from Table 1 that the median establishment is less than five employees, it's possible that very large establishments do behave differently and my sample size is not large enough to detect it.

Taken together, these two results suggest that policies increasing wages in low-wage regions may make the location less attractive to less productive establishments. Analyzing net welfare effects of such a change is beyond the scope of this paper, but would likely depend on whether phasing out such establishments would lead to workers having jobs at higher wages, or if unemployment would increase. It also suggests that tax incentives to attract establishments utilizing a particular type of labor, if they are initially successful in their endeavor, may ultimately attract more productive establishments which aren't as sensitive to congestion effects as low-productivity establishments.

4.4 Tradability

One might expect that there would be differences in how establishments producing tradable goods value a location's characteristics. Table 3 shows the share of establishments classified as tradable using the definition of Dauth et al. (2017), based on the two-digit-industry-level import penetration and export opportunities using UN Comtrade data.

As the table shows, for the purposes of analysis, two sectors may be thought of as tradable (agriculture, forestry and fishing; manufacturing). Both of these sectors have all establishments in the underlying data in industries classified as medium or high tradability in the data. Three sectors may be though of as non- or low-tradable (mining, utilities, and construction; trade and transportation; and the education and health sector), with more than 90% of establishments producing non- or low-tradability goods. Two sectors (professional services and other services) are mostly non- or low-tradability with a sizable minority (roughly 20%) of establishments within-sector producing medium-tradability goods.

Comparing the relationship between the tradability index and estimated regression coefficients, there is no clear pattern. This suggests that individual sectoral needs are more important than a broad definition of tradability in the location-choice problem. However, there are additional differences between establishments producing tradable vs. non-tradable goods warranting further discussion.

In the case of non-tradable goods establishments may be able to pass on higher labor costs to their customers in the form of higher output prices or have more potential customers due to higher market access in some locations. In contrast, establishments in the tradable sector face a constant output price across space and local market access is not a constraint. For example, although restaurants may theoretically dislike the high labor costs in Vancouver compared to Prince Rupert, there are still restaurants in Vancouver. They simply charge higher prices and serve a larger local market.

Although the empirical framework outlined in this paper focuses on taxes, monopsony, and productivity spillovers, it can control for the ability of establishments producing local goods to pass cost increases on to their customers. The parameter β_{ctm} represents, essentially, the marginal revenue of each worker at the establishment. For example, in the case where establishments would be able to fully pass on the burden of the local corporate taxes to customers by charging higher prices for the output produced by their workers, they would not display any aversion to those taxes in the decision making process. This is consistent with the fact that the sectors which do not demonstrate a statistically significant response to the corporate taxes produce non-tradable goods (the education and healthcare sector) or are partially exempt from the taxes (agriculture). The inclusion of the location fixed effects γ_c will also capture the extent to which consumers will tolerate higher prices as establishments will be more likely to enter those commuting zones conditional on other observables.

The strength of agglomeration and spillover forces operating through labor markets and/or knowledge channels are also likely to be weaker or non-existent in less-tradable sectors.[22] This is also a question of to what extent my proxies for agglomeration forces capture classical labor market productivity spillovers compared to other, related, forces. For example Mas and Moretti (2009) and Cornelissen et al. (2017) demonstrate substantial productivity spillovers among peers in the context of low-skill occupations. The authors of these papers attribute these spillovers to the fact that output is observable and workers are compared to one another in the workplace. If, for example, a commuting zone has a high proportion of establishments using low-skill labor, the labor market for that labor is likely more competitive on the worker side. If workers know they are very easily replaced, the peer effects seen in Mas and Moretti (2009) and Cornelissen et al. (2017) may become more salient. In my regressions, these types of forces would be captured, at least in part, by the labor spillovers proxy.

Local market access is another force which may be difficult to distinguish from classical productivity spillovers The framework does control for local market access, at least to some extent, through the market size parameter λ_{ct}. The lack of clear systematic differences between the tradable and non-tradable sector coefficients does suggest a limited role for local market access in producing the observed coefficients.

4.5 Additional Results

Rental prices are another important factor which may influence establishment location choice (Glaeser and Gottlieb, 2009). In Online Appendix A.6 I show changes which would be made to the model equations to account for rental prices, as well as the results of an empirical regression controlling for rental prices. Controlling for rents does not change the point estimates of the coefficients of interest, and though three sectors (mining, utilities, and construction; trade and transportation; education and health) respond to rental prices in their location choice, the significance is marginal at the 10% level for all three.

In Online Appendix Table B.2.7 I test the sensitivity of results to the exclusion of the pre-estimated market size parameter. As shown in the table, results are similar

[22] This remains an open research question, however. Baum-Snow et al. (2021) demonstrate empirically that substantial agglomeration economies through labor market channels exist in the professional services sector, which is semi-tradable according to my own data. In addition, transportation costs for goods inputs remain relevant for establishments producing non-tradable outputs.

to the main specifications.

In Online Appendix Figure B.1.6 I test how well the model fits the data for a parameter not included in the regressions by calculating the estimated commuting-zone-sector-year wage using Equation 5 and the backed out productivity estimates from the structural Equation (7), and comparing this value to the actual average wages within that cell. As shown in the figure, the model predicts actual wages well.

5 Counterfactual Analysis: Effects of a Place-Based Policy

In this section I simulate a place-based policy designed to attract establishments to a commuting zone. I simulate a policy where the federal government provides a rebate for local corporate taxes for establishments locating in a particular commuting zones, effectively setting the local tax rates to 7% (the lowest legally permitted rate) in treated areas. In this section, I first outline the theoretical predictions of my model concerning the effects of a place-based policy. I then show the overall effect of the policy in each commuting zone in Germany, and conclude with a case-study examining within commuting zone sector-level responses to the policy. I provide the technical details of how I carry out the iterative counterfactual process in Online Appendix A.7.

5.1 Effects of Tax Policy - Theory

A change in tax policy, or any place-based policy more generally, will have both immediate and secondary effects. Immediately, the tax policy will attract new establishments, some of which would not have otherwise gone to the treated location - opting for some other location. Subsequently, the composition of establishments in the commuting zone differs, and thus the spillovers available to establishments and the outside options of workers will have also changed. Online Appendix Figure B.1.7 shows a simplified version of this process.[23]

[23] The figure illustrates the effects of a tax change implemented in time t=0. Between time 0 and 1, the taxes have decreased. The effects of this are shown in the leftmost graph, which shows the changes in the portion of share ratio from taxes. Now, in subsequent years the new entrants have moved the level of spillovers, the effects of which are shown in the second graph. In this example, the spillovers have decreased, and the dashed line shows an alternative possible path. As is clear in the

Since the tax policy, after the first year, affects productivity spillovers and outside options through the mixture of establishments in a location it is obvious that including spillovers is key to understanding the impact of these policies. A less obvious - though equally important - implication of the model is that monopsony power also enters this process through its interactions with productivity in the worker wage equation (5). With slight abuse of notation[24], the partial effect of a change in taxes on the share-ratio of establishments is:

$$\frac{\partial \ln(\frac{s_{ctm}}{s_{0tm}})}{\partial \tau_{ct}} = -\frac{1}{1-\tau_{ct}} + (1+\mu_c)\frac{\partial[\ln(\beta(\tau_c)_{ctm} - b(\tau_c)_{ct})]}{\partial \tau_{ct}} + (1+\mu_0)\frac{\partial[\ln(\beta(\tau_c)_{0tm} - b(\tau_c)_{0t})]}{\partial \tau_{ct}} \tag{12}$$

The equation shows that the overall effect of a tax policy depends on the interaction of monposony power with the relative productivity of workers in the location compared to their outside option. The first term reflects that a tax increase always decreases the attractiveness of a location to establishments, and thus the share-ratio. The second term reflects the impact of taxes on the composition of establishments present in the commuting zone - and monopsony power is a direct dampener of this affect. In more monopsonistic labor markets, the impact of the productivity changes on the overall derivative is smaller than in more competitive labor markets where μ_c is larger.

Equation (12) also reveals that the overall effect of a change in taxes on the share ratio depends on whether it brings worker productivity closer to their outside option or not. In the case that an increase in taxes brings worker productivity closer to the outside option then $\ln(\beta(\tau_c)_{ctm} - b(\tau_c)_{ct})$ is decreasing in τ_c and the second term of equation (12) will also be negative. This formalizes the intuition that the total effect of a place-based policy can be positive or negative for a location depending on the mixture of establishments that are attracted by it - and shows that more competitive

figure, the overall movement in the share-ratio (which is the linear combination of the movements from taxes and spillovers) as a result of the tax policy is unclear over multiple years. It is possible for negative spillovers to be induced by the tax change and actually make the location overall less attractive to new establishments as shown in the rightmost panel of Online Appendix Figure B.1.7.

[24]In practice, in the first year of the tax policy has not yet affected the distribution of incumbents, and over multiple effects the effects of previous years' tax policies are persistent through these distributions.

labor markets act as an amplifier of the effect. In more monopsonistic labor markets, the direct effect of the taxes is a larger proportion of the total effect since μ_c is closer to zero.

5.2 Counterfactual Results for All Commuting Zones

Figure 4 shows the estimated effects of tax policy if implemented in each individual commuting zone beginning in 1999, both after 9 years in 2008 and 18 years in 2017. Panel A shows the percent difference in establishments under the counterfactual tax policy compared to the actual tax policy, and panel B the percent difference in wages. The figure shows that the effects of a place-based policy are extremely heterogeneous, with some locations experiencing large increases in the number of establishments, while others actually experience declines in the number of establishments. For wages, the majority (more than 90%) of locations experience increases, but the magnitude of the increase is larger in some locations than others, with the maximum being under 5%. Online Appendix Figure B.1.9 shows the share of the predicted wage change which is coming from changes in the outside option in the year 2017. The figure shows that in the typical commuting zone less than half of the overall wage change comes from movements in the outside option, with the remainder from productivity changes. Furthermore, it seems counterproductive to keep the tax policy in place for a long period of time in the majority of cases, with the exception of a few winning commuting zones, outcomes are actually worse after 18 years of tax policy compared to 9 years.

The counterfactual distribution of the wage impacts of the policy is broadly consistent with results from previous reduced-form studies, though more right-skewed. Greenstone et al. (2010) estimate the effects of million dollar plant openings on the TFP of incumbent plants in the same U.S. county, and find spillovers ranging between -3.75 and 2.5 log points.[25]

It may be of interest to policymakers to predict the effects of a place-based policy in their own location. The correlation in the predicted policy-induced change in

[25] Recent studies of the pass through of TFP shocks to worker wages such as Chan et al. (2020) and Hornbeck and Moretti (2022) find that TFP shocks pass through to wages at statistically and economically significant levels. This suggests that the TFP spillovers estimated in Greenstone et al. (2010) and my estimated wage spillovers are directly related to one another.

the number of establishments and wages is shown in Online Appendix Figure B.1.8. There is a positive correlation between the two, though as is clear from the figure the dispersion is very high. Thus, predicted changes in the number of establishments do not have strong explanatory power for wage effects. This suggests that attempting to find individual factors predictive of the changes in establishment numbers or wages may be of use, since the goal of a place-based policy may be to increase wages and/or to increase employment.

Figure 5 shows the relationship between the elasticity of labor supply within a commuting zone and the predicted change in establishment counts and wages in Panels A and B, respectively. The level of market power in a location is highly predictive of the response to a place-based policy in terms of the growth in the number of establishments. As discussed above in Section 5.1, equation (12) shows that the overall effect of a decrease in taxes depends on whether the policy attracts a mixture of establishments that bring the worker outside option closer to their productivity or not. Since the direct effect of a tax decrease will be positive (i.e. the first term of the derivative will be positive when taxes decrease), in order to see the downward-sloping relationship in Figure 4 it must be the case that the second term dominates the first.[26] This implies that in practice, the tax policy attracts establishments that decrease the gap between the worker productivity and their outside option. Although this reduces the attractiveness of the location to all establishments, it is relatively less bad for the more monopsonistic locations where the direct effects of the taxes dominate.

This suggests that if policymakers are interested in revitalizing underdeveloped regions, place-based policies are a possible tool in their arsenal if they are interested in growing the number of establishments. Growth in the number of establishments is likely correlated with employment effects, though this paper is not analyzing employment effects directly. This relationship also explains why my results in terms of growth in establishments are more heterogeneous and dispersed than reduced-form results studying subsidy policies in the E.U., which typically find positive employment effects (Neumark and Simpson, 2015). The papers study the effects of subsidy

[26] Although the third term also plays a role, it will be the opposite sign of the second term because establishments which have left the base location have chosen to enter the treated location. Furthermore, the effects on the base location will be smaller in magnitude since the treated location attracts establishments from all locations - not only the base location.

policies in areas where they are implemented, which is a highly selected sample of economically depressed areas. These economically depressed areas are precisely the areas where markets are more monopsonistic.[27]

There are no variables which predict the changes in wages as clearly as market power predicts the changes in the number of establishments, though as seen in Panel B there is a slight correlation. Taken together, these results suggest that models assuming perfectly competitive labor markets may underpredict possible positive effects of place-based policies in the treated location. To test the assumption, I redo the counterfactual exercise assuming an elasticity of labor supply of 5, constant across locations.[28] The results are shown in Online Appendix Figure B.1.10. Compared to the baseline results, assuming more perfectly competitive markets leads to much lower predicted benefits of a place-based policy within a location, and much more similar results across space in terms of establishment growth.[29]

The pre-estimation of μ_c also imposes additional restrictions on the counterfactuals. Because μ_c is not an equilibrium object, it does not move in response to the new establishments choosing the treated location. However, market power has been shown to be related to employer concentration by Azar et al. (2020). Thus, the new establishments attracted by the counterfactual policy should presumably have affects on the level of market power and implied wage markdowns in the area.

To address this, I perform a simple linear projection of the number of incumbent establishments on the estimate of μ_c to obtain an estimate of the relationship between the two. I then repeat the counterfactual exercise, also allowing movements in the elasticity of labor supply when establishments enter or leave the market. The results are shown in Figure 6. As seen in Panel A, when movements in μ_c are allowed, the estimated growth in establishments is lower, with a larger gap between the baseline

[27]The qualification criteria for regional development programs in the E.U. such as the Regional Selective Assistance policy in the UK studied by Criscuolo et al. (2019) typically include unemployment rates. Online Appendix Figure B.1.11 shows the relationship between unemployment rates and model-predicted establishment growth. As is clear in the figure, there is a strong positive relationship between the two

[28]The maximum estimated value in my data is 4.25

[29]Of note with the wage effects, though the predicted effects are lower in relative terms (as seen in the graph) the absolute wage is still higher in the more perfectly competitive world because wages are less marked down in the case of stronger labor market competition.

estimates and the additional estimates at the right tail of the distribution. This suggests that allowing movements in the elasticity flattens the relationship between market power and the growth in establishments, and makes results more uniform across commuting zones. In technical terms, as the second term of equation (12) becomes more similar across commuting zones when μ_c is also permitted to depend on τ_c, the effects of the place-based policy become more similar across space. With respect to wages, Panel B shows that the estimated wage growth is slightly higher if μ_c is allowed to vary, though the effect is small.

5.3 Case Study: Effects Within a Commuting Zone

In order to more deeply examine the sources of the heterogeneity shown in Figure 4, I will now examine the dynamic effects of a the theoretical place-based policy in four locations. Specifically, I examine the commuting zones at roughly the 10th, 40th, 60th, and 90th percentile of the wage and establishment effects distribution.[30] The four commuting zones are Kaiserslautern, Freiburg, Teltow-Fläming, and Leipzig. Online Appendix Figure B.1.12 shows the location of these commuting zones.

Online Appendix Figure B.1.13 shows the time-series change in the number of establishments in these four areas. The overall patterns are fairly smooth between commuting zones, with two of the areas experiencing overall growth in the number of establishments and two experiencing declines. Online Appendix Figure B.1.14 shows the growth in individual sectors within each commuting zone. As is clear from the figures, within-commuting zone changes can be highly heterogeneous by industrial sector. In the case of locations where there are smaller magnitude increases or declines (as in Panels A and B, showing Kaiserslautern and Freiburg respectively), some sectors overall grow (decline) even in the case where the overall number of establishments shrinks (increases). In the cases where there is a large increase or decline in the number of establishments (as in Panels C and D showing Teltow-Fläming and Leipzig respectively), there are clear differences in the degree of the decline between sectors with the gap growing over time. From the perspective of a

[30] The four were chosen this way to minimize the burden of data privacy checks for the IAB while displaying a mixture of effects for both the establishment and wage growth. Though they are roughly at these percentiles of each distribution, they are inexact.

policymaker developing a place-based policy, they should be aware that the overall effects may mask concentrated benefits and costs to the policy.

Online Appendix Figure B.1.15 shows the changes in wages brought about by the tax policy. The figure shows that predicted wage changes are overall noisy. These results reinforce the results seen in the previous Section 5.2 that the overall change in wages is very difficult to predict.

6 Conclusions

I develop a model of establishment-location choice incorporating corporate taxes, monopsonistic labor markets, and differential location-sector productivity and show it is simply and tractably estimated using methods from the differentiated products models of the industrial organization literature and a model-derived estimating equation. Using an instrumental variables approach, I show that establishments in different economic sectors display heterogeneous sensitivities to taxes, and differently value spillovers in their location decision. In particular, the congestion effects of the presence of establishments using similar types of labor are valued differently by each industrial sector in their location decision, while transportation costs seem to be mostly unimportant. Most types of establishments prefer to pay lower wages as measured by the outside option, but some types of establishments are indifferent.

Model counterfactuals show that the effects of place-based policies are highly heterogeneous across space due to the secondary impact of spillovers, particularly with respect to the growth of establishments as seen in previous literature such as Devereux et al. (2007). The distribution of effects in the wage changes induced by a tax policy are largely positive, but the magnitude of changes varies greatly between locations. As demonstrated by the counterfactuals, small differences in initial conditions can leads to very different effects of the same place-based policy in different locations, making effective policy challenging. However, the evidence strongly suggests that less competitive locations derive more benefit from place-based policies than more highly developed ones.

References

Consolidated versions of the treaty on european union and the treaty on the functioning of the european union. *Official Journal of the European Union*, (C 115):1–388, May 2008.

Commission notice on the notion of state aid as referred to in article 107(1) of the treaty on the functioning of the european union. *Official Journal of the European Union*, (C 262):1–50, July 2016.

John M. Abowd, Francis Kramarz, and David N. Margolis. High Wage Workers and High Wage Firms. *Econometrica*, 67(2):251–333, 1999.

David Albouy. The Unequal Geographic Burden of Federal Taxation. *Journal of Political Economy*, 117(4):635–667, 2009.

Manfred Antoni, Philipp vom Berge, Tobias Graf, Stephan Grießemer, Steffen Kaimer, Markus Köhler, Claudia Lehnert, Martina Oertel, Alexandra Schmucker, Stefan Seth, and Christan Seysen. Weakly anonymous Version of the Sample of Integrated Labour Market Biographies (SIAB) – Version 7517 v1, 2019.

José Azar, Ioana Marinescu, Marshall Steinbaum, and Bledi Taska. Concentration in US labor markets: Evidence from online vacancy data. *Labour Economics*, 66:101886, 2020.

Iain Bamford. Monopsony Power, Spatial Equilibrium, and Minimum Wages, November 2021.

Ihsaan Bassier, Arindrajit Dube, and Suresh Naidu. Monopsony in Movers: The Elasticity of Labor Supply to Firm Wage Policies. *Journal of Human Resources*, 57(S):S50–s86, 2022.

Nathaniel Baum-Snow, Nicolas Gendron-Carrier, and Ronni Pavan. Local productivity spillovers, 2021.

Kristian Behrens, Gilles Duranton, and Frédéric Robert-Nicoud. Productive Cities: Sorting, Selection, and Agglomeration. *Journal of Political Economy*, 122(3):507–553, 2014.

Antonio Bellofatto, Begoña Domínguez, and Elyse Dwyer. Uncovering the urban advantage of australian firms: New evidence from blade data. *Available at SSRN 4190920*, 2022.

David Berger, Kyle Herkenhoff, and Simon Mongey. Labor Market Power. *American Economic Review*, 112(4):1147–93, April 2022.

Steven T. Berry. Estimating Discrete-Choice Models of Product Differentiation. *The RAND Journal of Economics*, 25(2):242–262, 1994.

Adrien Bilal. The Geography of Unemployment. Working Paper 29269, National Bureau of Economic Research, September 2021.

Kirill Borusyak, Peter Hull, and Xavier Jaravel. Quasi-experimental shift-share research designs. *The Review of Economic Studies*, 89(1):181–213, 2022.

Lisa; Gensicke Miriam Kohaut Susanne; Möller Iris; Schwengler Barbara; Tschersich Nikolai; Umkehrer Matthias Bächmann, Ann-Christin; Bellmann. IAB-Betriebspanel (IAB-BP) – Version 9322 v1. Forschungsdatenzentrum (FDZ) der Bundesagentur für Arbeit (BA) im Institut für Arbeitsmarkt- und Berufsforschung (IAB), 2023.

David Card, Francesco Devicienti, and Agata Maida. Rent-sharing, Holdup, and Wages: Evidence from Matched Panel Data. *The Review of Economic Studies*, 81(1):84–111, 10 2013.

David Card, Ana Rute Cardoso, and Patrick Kline. Bargaining, Sorting, and the Gender Wage Gap: Quantifying the Impact of Firms on the Relative Pay of Women. *The Quarterly Journal of Economics*, 131(2):633–686, 10 2015.

David Card, Ana Rute Cardoso, Joerg Heining, and Patrick Kline. Firms and Labor Market Inequality: Evidence and Some Theory. *Journal of Labor Economics*, 36(S1):S13–S70, 2018.

Mons Chan, Sergio Salgado, and Ming Xu. Heterogeneous passthrough from tfp to wages. *Available at SSRN 3538503*, 2020.

Pierre-Philippe Combes and Gilles Duranton. Labour pooling, labour poaching, and spatial clustering. *Regional Science and Urban Economics*, 36(1):1–28, 2006.

Thomas Cornelissen, Christian Dustmann, and Uta Schönberg. Peer effects in the workplace. *American Economic Review*, 107(2):425–456, 2017.

Chiara Criscuolo, Ralf Martin, Henry G. Overman, and John Van Reenen. Some Causal Effects of an Industrial Policy. *American Economic Review*, 109(1):48–85, January 2019.

Wolfgang Dauth, Sebastian Findeisen, and Jens Suedekum. Trade and Manufacturing Jobs in Germany. *American Economic Review*, 107(5):337–42, May 2017.

Wolfgang Dauth, Sebastian Findeisen, Enrico Moretti, and Jens Suedekum. Matching in Cities. *Journal of the European Economic Association*, 20(4):1478–1521, 02 2022.

Michael P. Devereux, Rachel Griffith, and Helen Simpson. Firm location decisions, regional grants and agglomeration externalities. *Journal of Public Economics*, 91(3):413–435, 2007.

Glenn Ellison, Edward L. Glaeser, and William R. Kerr. What Causes Industry Agglomeration? Evidence from Coagglomeration Patterns. *American Economic Review*, 100(3): 1195–1213, June 2010.

Giulia Faggio, Olmo Silva, and William C Strange. Tales of the city: what do agglomeration cases tell us about agglomeration in general? *Journal of Economic Geography*, 20(5): 1117–1143, 04 2020.

Pablo D Fajgelbaum and Cecile Gaubert. Optimal Spatial Policies, Geography, and Sorting. *The Quarterly Journal of Economics*, 135(2):959–1036, 01 2020.

Pablo D Fajgelbaum, Eduardo Morales, Juan Carlos Suárez Serrato, and Owen Zidar. State Taxes and Spatial Misallocation. *The Review of Economic Studies*, 86(1):333–376, 09 2018.

Federal Constitutional Court of Germany. Bverfg, decision of the first senate of january 15, 2008 - 1 bvl 2/04 -, rn. 1-139, 2008.

Federal Ministry of Justice. Income tax act (estg) section 13 - income from agriculture and forestry, 2022.

Clemens Fuest, Andreas Peichl, and Sebastian Siegloch. Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany. *American Economic Review*, 108(2):393–418, February 2018.

Masahisa Fujita, Paul R Krugman, and Anthony Venables. *The spatial economy: Cities, regions, and international trade.* MIT press, 1999.

Andreas Ganzer, Schmucker, Alexandra, Jens Stegmaier, and Stefanie Wolter. Establishment History Panel (BHP) – Version 7517 v1, 2018.

Cecile Gaubert. Firm Sorting and Agglomeration. *American Economic Review*, 108(11): 3117–53, November 2018.

Xavier Giroud, Simone Lenzu, Quinn Maingi, and Holger Mueller. Propagation and amplification of local productivity spillovers. Working Paper 29084, National Bureau of Economic Research, July 2021.

Edward L. Glaeser and Joshua D. Gottlieb. The Wealth of Cities: Agglomeration Economies and Spatial Equilibrium in the United States. *Journal of Economic Literature*, 47(4):983–1028, December 2009.

Stephan; Köhler Markus; Lehnert Claudia; Moczall Andreas; Oertel Martina; Schmucker Alexandra; Schneider Andreas; Seth Stefan; Thomsen Ulrich; vom Berge Philipp Graf, Tobias; Grießemer. Weakly anonymous Version of the Sample of Integrated Labour Market Biographies (SIAB) – Version 7521 v1, 2023.

Michael Greenstone, Richard Hornbeck, and Enrico Moretti. Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings. *Journal of Political Economy*, 118(3):536–598, 2010.

Paulo Guimarães, Octávio Figueirdo, and Douglas Woodward. A Tractable Approach to the Firm Location Decision Problem. *The Review of Economics and Statistics*, 85(1): 201–204, 02 2003.

W. Walker Hanlon and Antonio Miscio. Agglomeration: A long-run panel data approach. *Journal of Urban Economics*, 99:1–14, 2017.

Sebastian Heise and Tommaso Porzio. Labor Misallocation Across Firms and Regions. Working Paper 30298, National Bureau of Economic Research, July 2022.

Tanja Hethey-Maier and Johannes F Schmieder. Does the use of worker flows improve the analysis of establishment turnover? evidence from german administrative data. *Journal of Contextual Economics–Schmollers Jahrbuch*, (4):477–510, 2013.

Richard Hornbeck and Enrico Moretti. Estimating who benefits from productivity growth: local and distant effects of city productivity growth on wages, rents, and inequality. *The Review of Economics and Statistics*, pages 1–49, 2022.

Adam B. Jaffe, Manuel Trajtenberg, and Rebecca Henderson. Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations*. *The Quarterly Journal of Economics*, 108(3):577–598, 08 1993.

Simon Jäger, Shakked Noy, and Benjamin Schoefer. The german model of industrial relations: balancing flexibility and collective action. *Journal of Economic Perspectives*, 36 (4):53–80, 2022.

Jordi Jofre-Monseny and Albert Solé-Ollé. Tax Differentials in Intraregional Firm Location: Evidence from New Manufacturing Establishments in Spanish Municipalities. *Regional Studies*, 44(6):663–677, 2010.

Larissa Klick and Sandra Schaffner. Regional real estate price indices for germany, 2008 – 2019: Rwi–geo–redx. *Journal of Economics and Statistics (Jahrbuecher fuer Nationaloekonomie und Statistik)*, 241(1):119–129, 2021.

Paul Krugman. Increasing returns and economic geography. *Journal of Political Economy*, 99(3):483–499, 1991.

Alan Manning. The plant size-place effect: agglomeration and monopsony in labour markets. *Journal of Economic Geography*, 10(5):717–744, 09 2009.

Alan Manning and Barbara Petrongolo. How Local Are Labor Markets? Evidence from a Spatial Job Search Model. *American Economic Review*, 107(10):2877–2907, October 2017.

A. Marshall. *Principles of economics, an introductory volume*. Macmillan and Co., Limited, London, London, 1920.

Alexandre Mas and Enrico Moretti. Peers at work. *American Economic Review*, 99(1): 112–145, 2009.

Daniel McFadden. Conditional logit analysis of qualitative choice behavior. 1973.

Enrico Moretti. Workers' education, spillovers, and productivity: Evidence from plant-level production functions. *American Economic Review*, 94(3):656–690, June 2004.

Enrico Moretti. *The new geography of jobs*. Houghton Mifflin Harcourt, 2012.

Enrico Moretti. The Effect of High-Tech Clusters on the Productivity of Top Inventors. *American Economic Review*, 111(10):3328–75, October 2021.

David Neumark and Helen Simpson. Chapter 18 - Place-Based Policies. In Gilles Duranton, J. Vernon Henderson, and William C. Strange, editors, *Handbook of Regional and Urban Economics*, volume 5 of *Handbook of Regional and Urban Economics*, pages 1197–1287. Elsevier, 2015.

OECD. Citations database, January 2020a.

OECD. REGPAT database, January 2020b.

Stuart S. Rosenthal and William C. Strange. Geography, Industrial Organization, and Agglomeration. *The Review of Economics and Statistics*, 85(2):377–393, 05 2003.

Stuart S. Rosenthal and William C. Strange. Chapter 49 - Evidence on the Nature and Sources of Agglomeration Economies. In J. Vernon Henderson and Jacques-François Thisse, editors, *Cities and Geography*, volume 4 of *Handbook of Regional and Urban Economics*, pages 2119–2171. Elsevier, 2004.

Kurt Schmidheiny and Marius Brülhart. On the equivalence of location choice models:

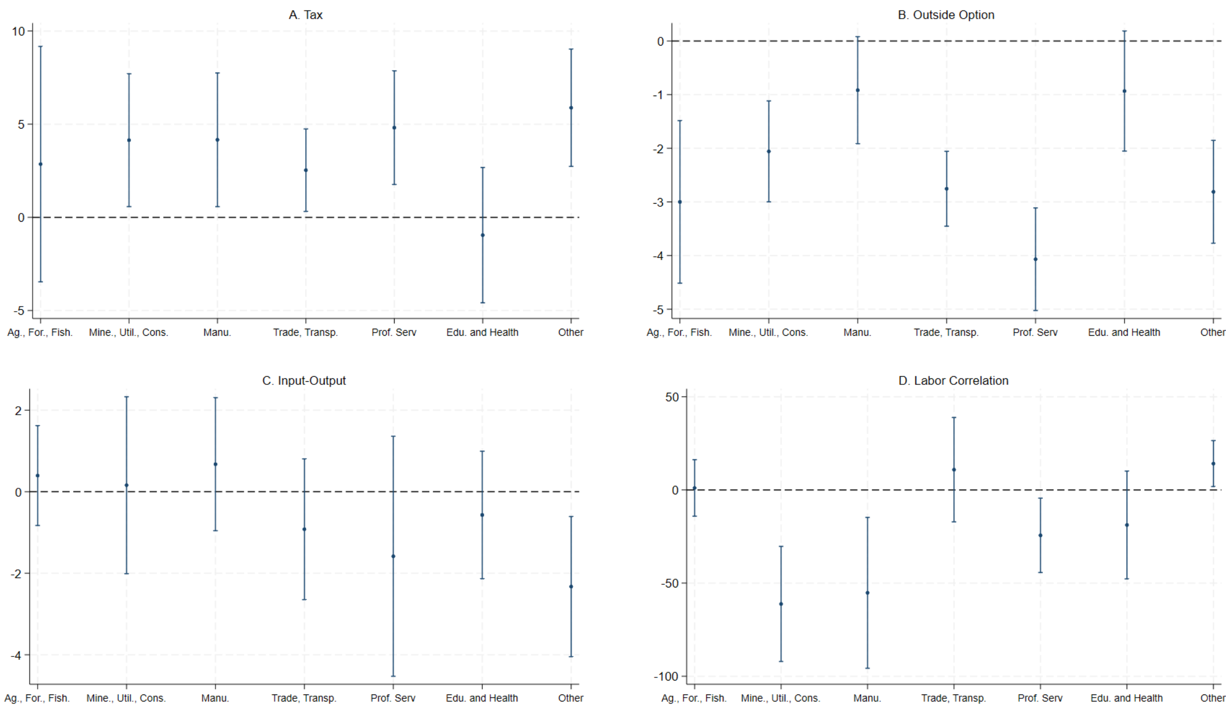
Conditional logit, nested logit and poisson. *Journal of Urban Economics*, 69(2):214–222, 2011.

Mathieu P.A. Steijn, Hans R.A. Koster, and Frank G. Van Oort. The dynamics of industry agglomeration: Evidence from 44 years of coagglomeration patterns. *Journal of Urban Economics*, 130:103456, 2022.

Juan Carlos Suárez Serrato and Owen Zidar. Who Benefits from State Corporate Tax Cuts? A Local Labor Markets Approach with Heterogeneous Firms. *American Economic Review*, 106(9):2582–2624, September 2016.

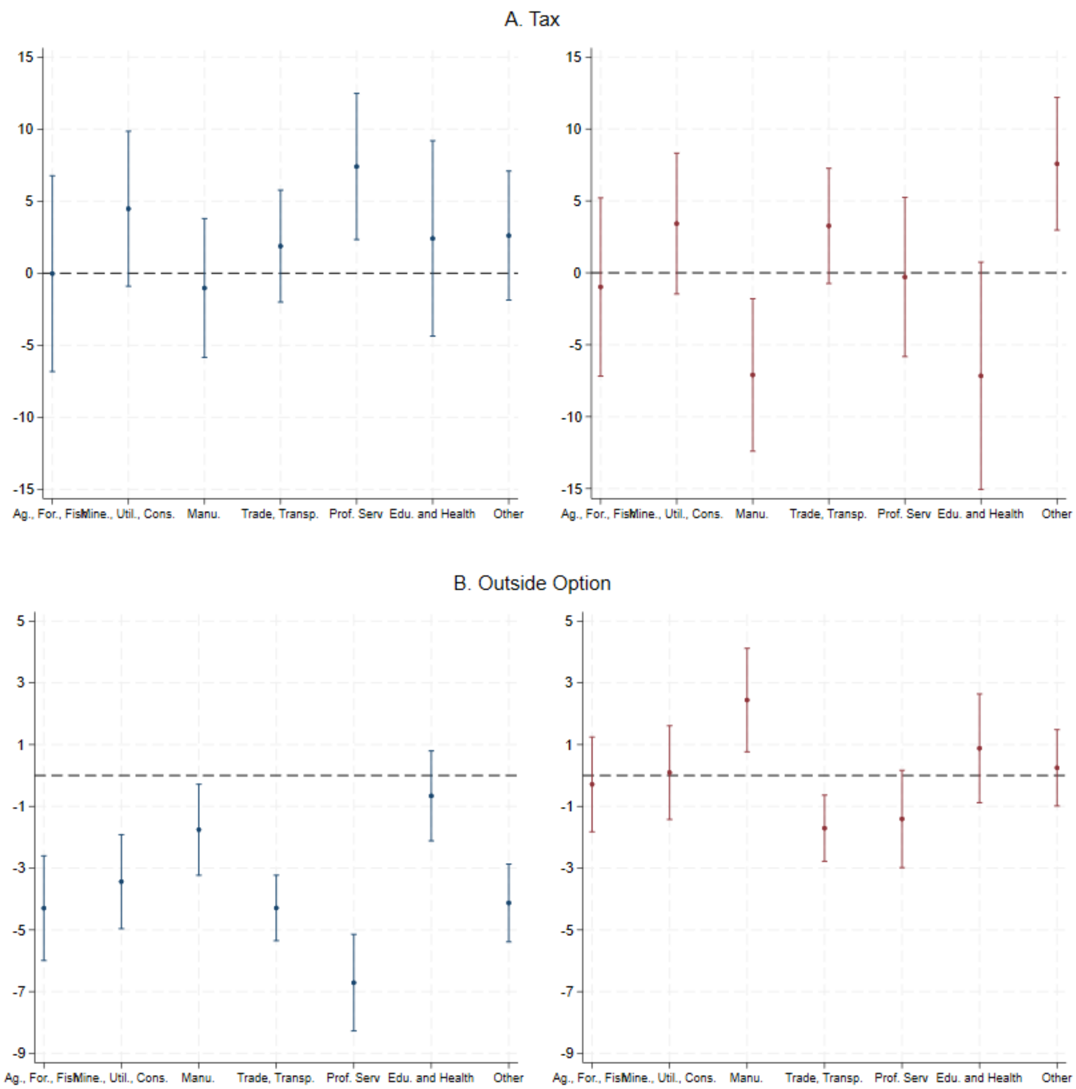
Figures

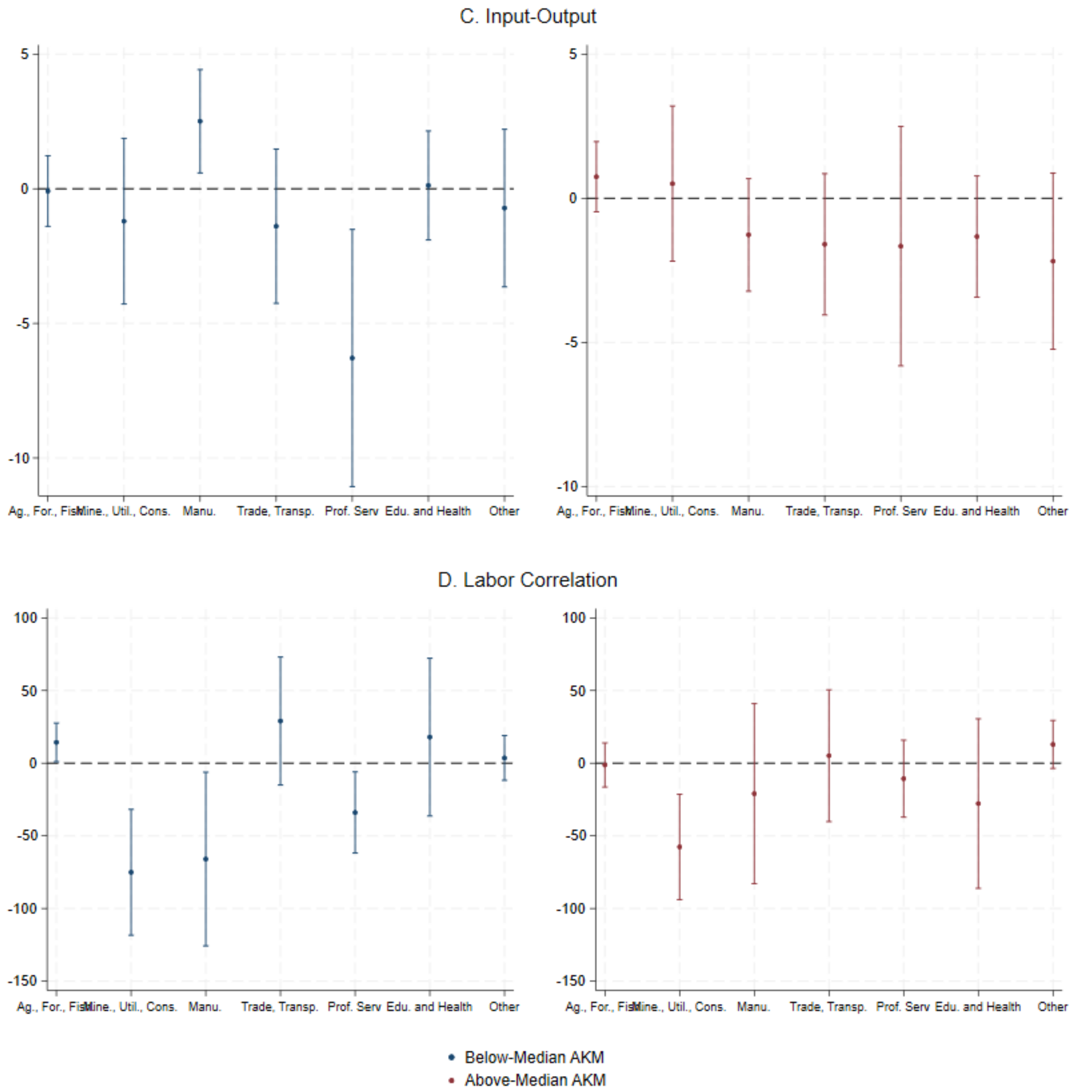
Figure 1: Coefficients by Sector



Notes: These figures show the point estimates of coefficients of the variables of interest for each industrial sector in the instrumental variable regression 9, as well as the 95% confidence intervals. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Online Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level.

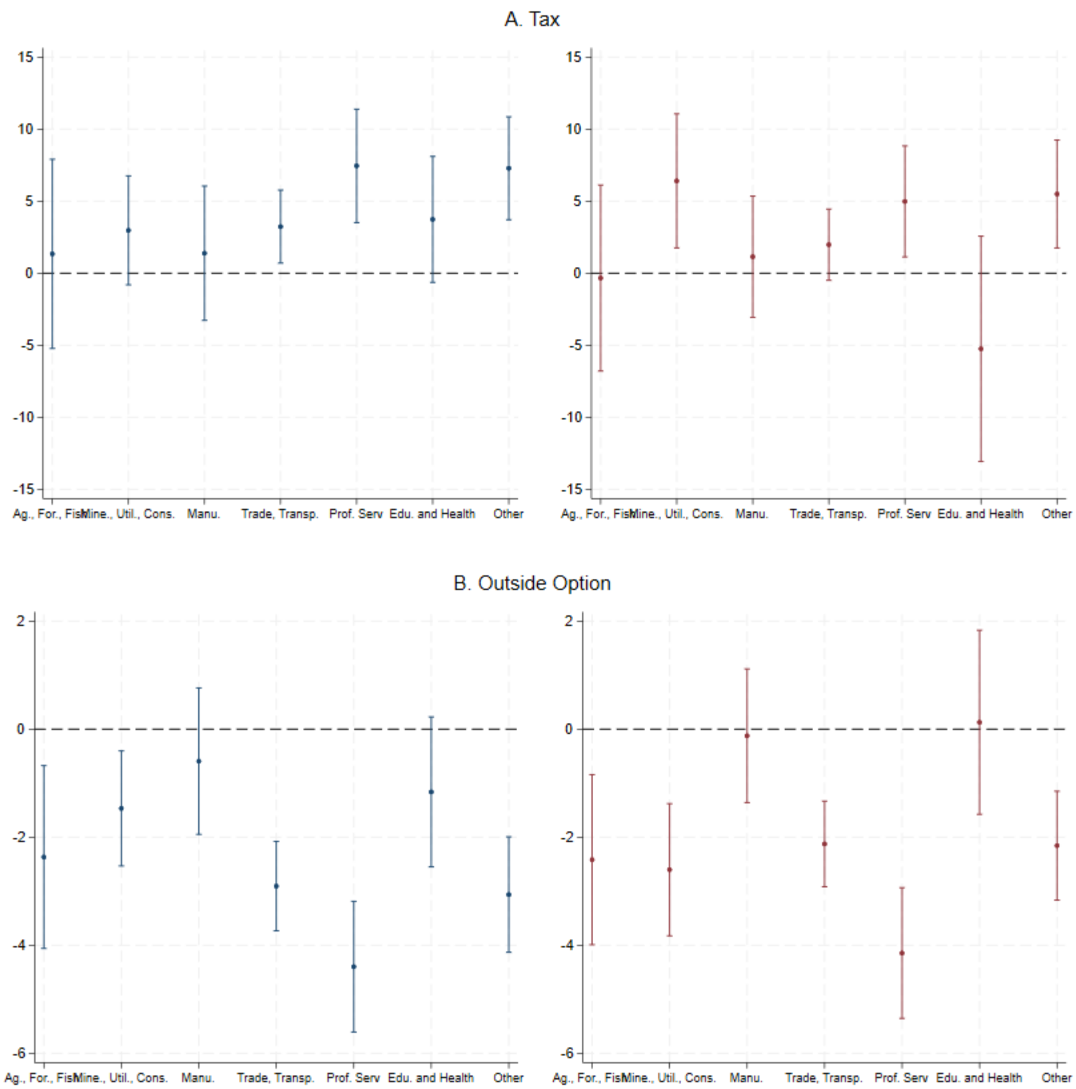
Figure 2: Coefficients: Splitting Sample by AKM Establishment-Effect

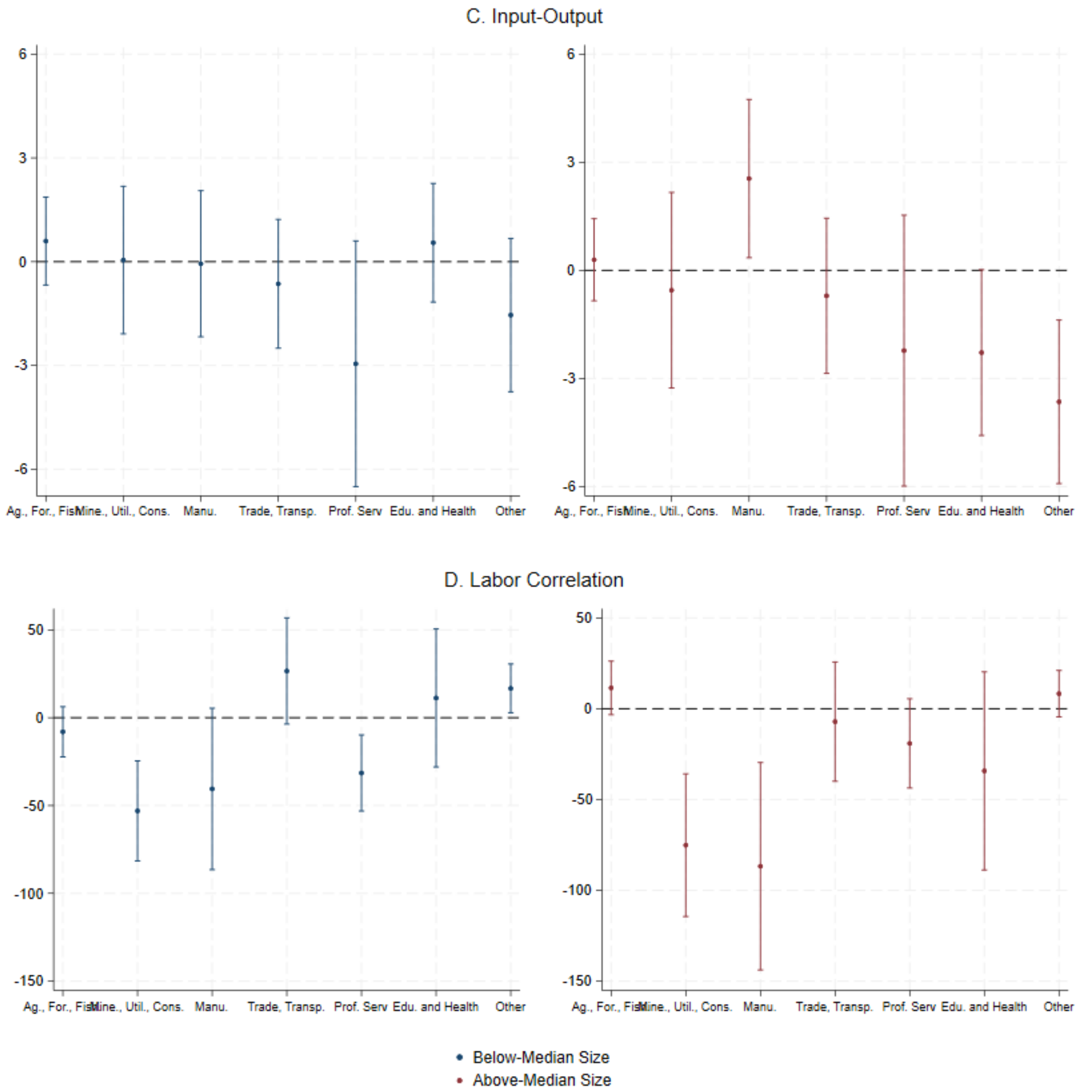




Notes:
These figures show the point estimates of coefficients of the variables of interest for each industrial sector in the instrumental variable regression 9, as well as the 95% confidence intervals. Sample is split by the AKM establishment effect, with below-median AKM effect establishments shown in blue and above-median AKM effect establishments shown in red. Median AKM effect is defined at the sector-year level. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Online Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level.

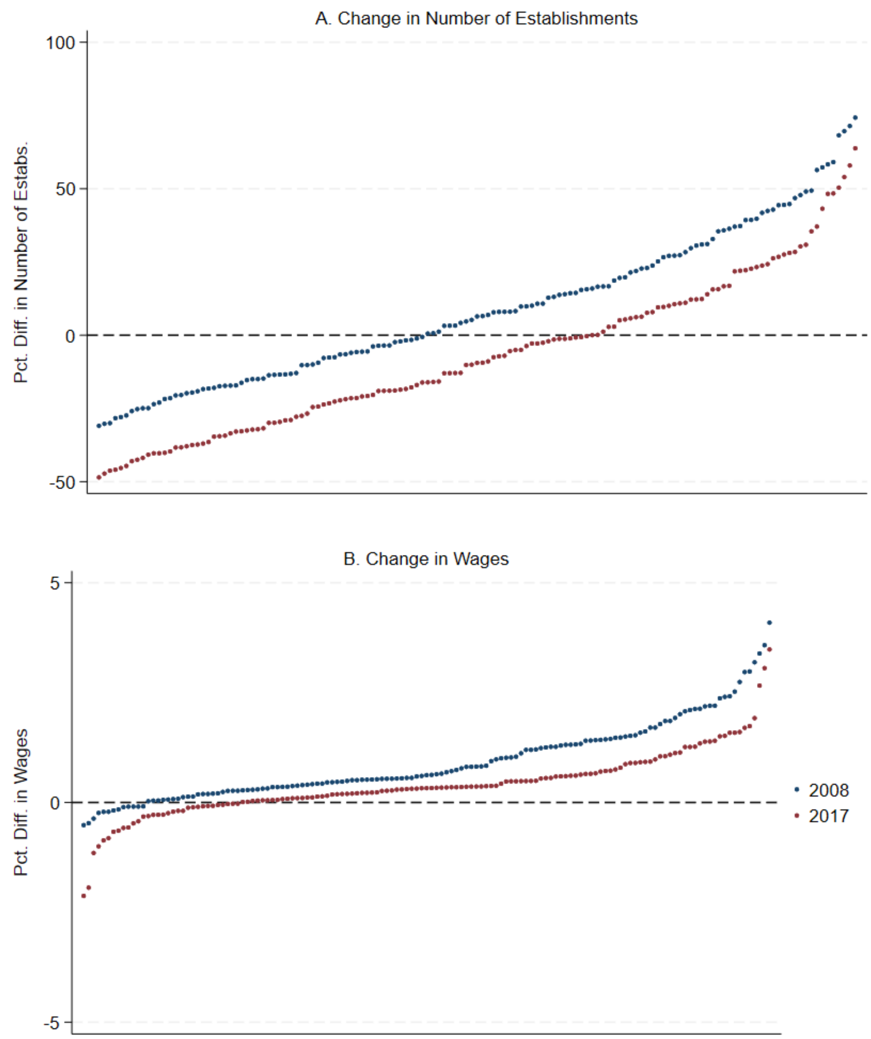
Figure 3: Coefficients: Splitting Sample by Establishment Size





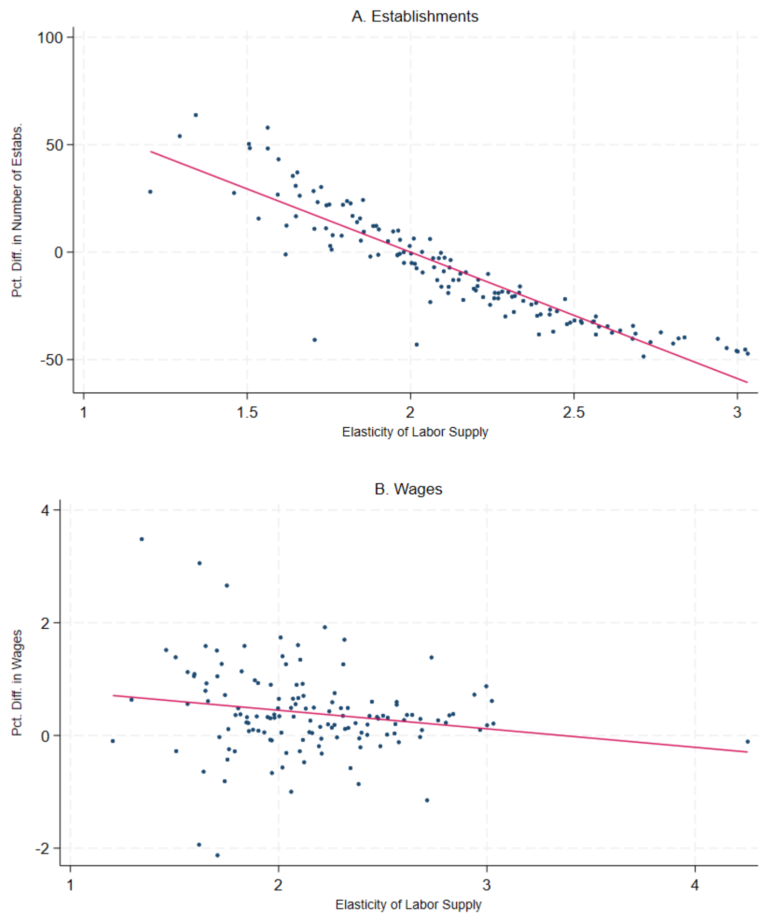
Notes: These figures show the point estimates of coefficients of the variables of interest for each industrial sector in the instrumental variable regression 9, as well as the 95% confidence intervals. Sample is split by establishment size, where size is the total number of employees, with below-median size establishments shown in blue and above-median size establishments shown in red. Median size is defined at the sector-year level. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Online Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level.

Figure 4: Effects of Counterfactual Tax Policy on Commuting Zones



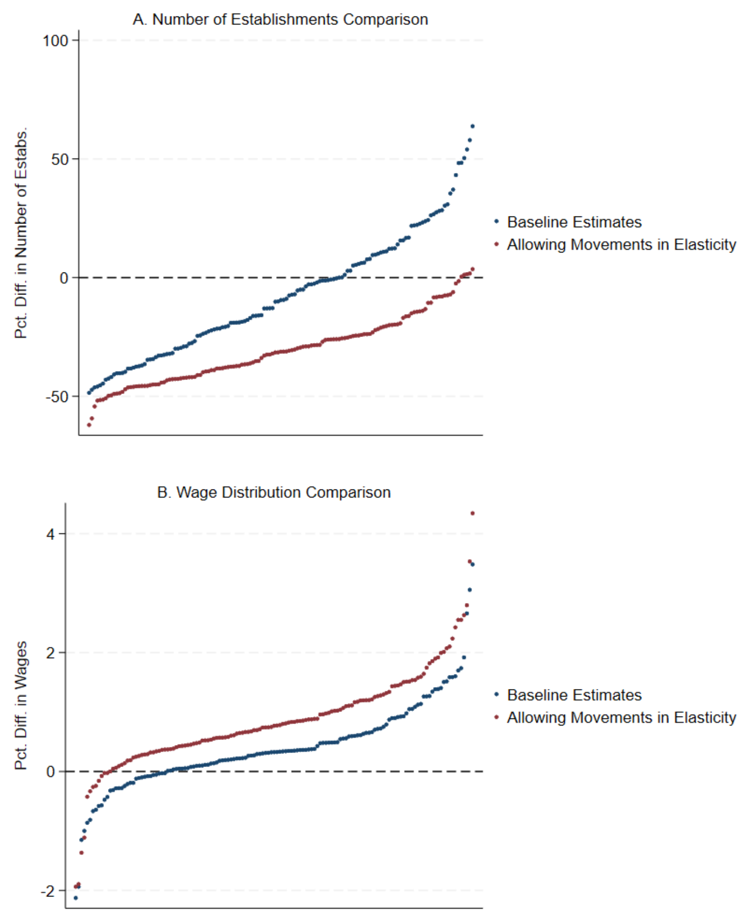
Notes: Each dot is a commuting zone. Panel A shows the percent difference in establishments under the counterfactual tax policy compared to the actual tax policy, and panel B the percent difference in wages. The effect of keeping the policy in place from 1999 to 2008 is shown in blue, while the effect of keeping the policy in place from 1999 until 2017 is shown in red. See Section 5 for details on calculations. The commuting zones with the lowest and highest change in number of establishments and wages were trimmed in the respective panels.

Figure 5: Correlation of Counterfactual Results and Market Power



Notes: Each dot is a commuting zone. Panel A shows the relationship between the percent difference in the number of establishments under the counterfactual tax policy compared to the actual tax policy in the year 2017 and the elasticity of labor supply in the commuting zone μ_c, while Panel B shows the relationship with wages. See Appendix Section A.1 for details on estimation of labor supply elasticities.

Figure 6: Effects of Counterfactual Tax Policy on Commuting Zones Allowing Movements in Market Power



Notes: Each dot is a commuting zone. Panel A (B) shows the percent difference in establishments (wages) under the counterfactual tax policy compared to the actual tax policy in 2017 for both the baseline estimates in Figure 4 and if the elasticity of labor supply were allowed to move in response to the entrance of new establishments. See Section 5 for details on calculations. The commuting zones with the lowest and highest change in number of establishments and wages were trimmed.

Tables

Table 1: BHP Summary Statistics

Sector	1999	2008	2017
Agriculture, Forestry, and Fishing	1.83	1.85	1.8
Mining, Utilities, and Construction	14.44	11.25	14.22
Manufacturing	5.64	5.13	4.15
Trade and Transport	38.03	36.26	34.44
Professional Services	19.46	19.91	19.23
Education and Health	6.56	7.68	8.17
Other	14.05	17.92	17.98
Number of Employees			
1-4	82.15	76.86	69.96
5-9	10.72	13.73	16.84
10-19	4.44	5.75	7.98
20-49	1.96	2.63	3.94
50-99	0.51	0.72	0.94
100-199	0.16	0.22	0.23
200+	0.06	0.09	0.11
Total Entrants	94,537	61,888	37,972

Notes: This table shows summary statistics for new establishments in the BHP.

Table 2: Overview of data

Additional variables merged to the establishment data

Target Variable	**Proxied Using**	**Source**
Spillovers	Follows Ellison, Glaeser, and Kerr (2010)	
Goods	Input-Output Tables	German statistical library
Labor	Vector correlation of occupational shares between two industries	Linked employer-employee data (SIAB)
Knowledge	Measure from Jaffe et al. (1993)	OECD Patent Database
Taxes	Weighted average of municipal corporate tax rates within the commuting zone. A multiplier of the federal tax rate.	German statistical library
Outside Option - Estimated Average Union Contract Minimum	20th percentile of establishment-median low-skill workers wages in an industry-state cell in the BHP	Derived using the BHP, union contracts obtained from Tarifregister Nordrhein-Westfalen

Table 3: Share of Establishments Within Sector by Tradability Group

	Non Tradable	Low Tradability	Medium Tradability	High Tradability
Ag. For. Fish.	0.00	0.00	10.55	89.45
Mine., Util., Constr.	15.06	77.86	7.03	0.05
Manufacturing	0.00	0.00	55.93	44.07
Trade, Transport	86.55	13.45	0.00	0.00
Prof. Serv.	69.07	12.53	18.40	0.00
Edu., Health.	100.00	0.00	0.00	0.00
Other	70.18	7.42	22.39	0.00

Notes: Each row shows the percent of establishments in the industrial sector which in non-, low-, medium-, and high-tradability two-digit industries. Tradability definitions are from Dauth et al. (2017). The tradability index is level of import penetration and export opportunities at the two-digit-industry level. Non-tradable industries are those below the 10th percentile, low tradable those between the 10th and 40th percentile, medium tradable those between the 40th and 70th, and highly tradable those above the 70th percentile.

A Online Appendix

A.1 Pre-estimation of μ_c and $\mathcal{L}_{ct}\lambda_{ct}$

A.1.1 Estimation of μ_c

I estimate the elasticity of labor supply to the establishment using the method of Bassier et al. (2022). The estimating equation is a regression of an indicator for separating from an establishment:

$$s_{ijt} = \sum_j -(\frac{1}{2}\mu_c)\phi_j f^i_{jt} + X_{it} + v_{ijt} \tag{13}$$

Where s_{ijt} is an indicator for separation of individual i from establishment j at time t, ϕ_j is the AKM fixed effect of the establishment, and f^i_{jt} is an indicator variable for individual i working at establishment j in time t. Put simply. the coefficient of interest is on the AKM establishment effect. Figure A.1.1 shows the distribution of the elasticity estimates across space.

This method is well suited to identifying the monopsonist wage markdown since it estimates the separations elasticity using only the component of wages that is specifically due to systematic differences in wages between employers. Estimation with individual worker's wages may be polluted by worker wage differences reflecting worker characteristics, such as skill differences.

A.1.2 Estimation of $\mathcal{L}_{ct}\lambda_{ct}$

With the estimate of μ_c in hand, I turn to estimation of the market size. Recall the labor supply equation of an establishment:

$$L_{ctj}(w_{ctj}) = \mathcal{L}_{ct}\lambda_{ct}exp(\mu_c ln(w_{ctj} - b_{ct}) + a_m) \tag{14}$$

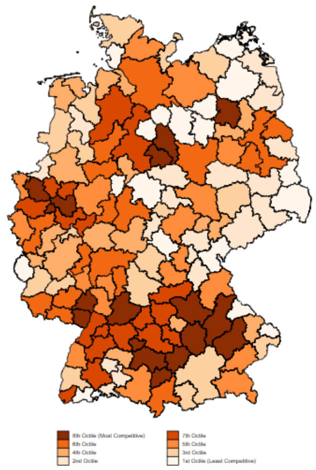
In a log regression, with the pre-estimate of μ_c, the market size may be estimated using a simple fixed-effects regression:

$$ln(L_{ctm}(w_{ctm})) - \hat{\mu}_c ln(w_{ctj} - b_{ct}) = ln(\mathcal{L}_{ct}\lambda_{ct}) + a_m + \epsilon_{cjt} \tag{15}$$

A.2 Conditional Equivalence Between Logit and Poisson

Guimarães et al. (2003) propose an alternative computationally tractable approach to estimating a establishment location decision problem. Starting from the log-likelihood of the traditional maximum likelihood estimation of the logit choice problem:

Figure A.1.1: Elasticity of Labor Supply Across Space



Notes: These figures show the octiles of point estimates of coefficients of the elasticity of labor supply for each commuting zone in Germany calculated using the method from Bassier et al. (2022).

$$\log(L_{cmt}) = \sum_{c=1}^{C} n_{cmt} \log(p_{cmt}) \tag{16}$$

With the assumption that the distribution of counts of establishments picking a certain location is distributed poisson:

$$E(n_{cmt}) = \lambda_{ctm} = \exp(\alpha + y_{ctm}) \tag{17}$$

where y_{ctm} is is the log-profit offered by a location as in Equation (6). Given the probability mass function of the poisson distribution $Pr(n = n_{cmt}) = \frac{\lambda^{n_{cmt}} \exp(-\lambda_{ctm})}{n_{ctm}!}$, the poisson log-likelihood is:

$$\log(L_p) = \sum_{c=1}^{C} (-\lambda_{ctm} + n_{cmt} \log(\lambda_{cmt}) - \log(n_{cmt}!)) \tag{18}$$

After taking the first order condition with respect to α and rearranging Guimarães et al. (2003) shows that the poisson log likelihood is:

$$\log(L_p) = \sum_{c=1}^{C} n_{cmt} \log(p_{cmt}) - N + N\log(N) - \sum_{c=1}^{C} \log(n_{cmt}!) \tag{19}$$

The first term of this equation is the log-likelihood of the logit problem, and the other terms are constants. Thus, if the distributional assumptions are met maximizing the poisson log-likelihood is equivalent to maximizing the conditional logit log-likelihood.

However, this model is unsuited for my data. Table A.2.1 shows the means and variances of my establishment counts for each industrial sector, as well as the post-estimation goodness-of-fit test p-balues for the Deviance and Pearson goodness-of-fit tests.[31] As is plain from the table, the count data are not distributed poisson. Since the distributional assumptions are not met, poisson and conditional logit are not equivalent in this case.

Table A.2.1: Poisson Goodness of Fit Tests

	Mean	Variance	Deviance GOF	Pearson GOF
Agri., Fores., and Fish.	7.79	46.46	0.00	0.00
Mining, Util., and Constr.	55.88	4914.79	0.00	0.00
Manufacturing	21.23	499.57	0.00	0.00
Trade and Transport	156.40	42666.01	0.00	0.00
Professional Services	78.45	18783.35	0.00	0.00
Education and Health	31.33	1698.82	0.00	0.00
Other	70.36	10775.22	0.00	0.00

Notes: Table shows sample means and variances of the number of establishments picking each commuting zone by industrial sector. Columns 3 and 4 show p-values of the Deviance and Pearson Goodness-of-fit tests, respectively, for the Poisson distribution. A significant p-value indicates that the null hypothesis of the data being distributed Poisson should be rejected.

A.3 Adjustment for Establishment Observation

As discussed in Section 3, my unit of observation is an establishment rather than a firm. More precisely, I observe all of the branch offices in a particular municipality as a single line of data (hereafter "establishment"), and I cannot link establishments across municipalities. A simple application of Bayes rule shows how this could potentially bias my empirical result. In my data, a unit of observation is a new establishment that is observed in my dataset, where observed means that a new establishment that is not located in a municipality where the expanding firm is already operating. Therefore, my expression for the share of establishments in sector m picking a particular location c may be more precisely written as:

$$\text{share}_m(\text{pick c}|\text{observed in data}) \approx \text{pr}_m(\text{pick c}|\text{observed in data}) \tag{20}$$

[31]For these statistical tests, a significant coefficient means to reject the null hypothesis that the data are distributed Poisson.

Bayes' rule implies

$$\text{pr}_m(\text{pick c}|\text{observed in data}) = \frac{\text{pr}_m(\text{pick c})\text{pr}_m((\text{observed in data}|\text{pick c})}{\text{pr}_m(\text{observed in data})} \tag{21}$$

Combining the two expressions and taking the ratio of shares for a base location 0 as in the main analysis

$$\frac{\text{share}_m(\text{pick c}|\text{observed in data})}{\text{share}_m(\text{pick 0}|\text{observed in data})} \approx \frac{\text{pr}_m(\text{pick c})}{\text{pr}_m(\text{pick 0})} \frac{\text{pr}_m((\text{observed in data}|\text{pick c})}{\text{pr}_m(\text{observed in data}|\text{pick 0})} \tag{22}$$

The first term $\frac{\text{pr}_m(\text{pick c})}{\text{pr}_m(\text{pick 0})}$ leads to the same unconditional logit share ratio equation as in the main specification. The second term is what could potentially bias my results. After substituting my functional forms of the logit into the share ratio equation and taking logs, I obtain the following structural equation:

$$ln(\frac{s_{ctm}}{s_{0tm}}) = y_{ctm} - y_{0tm} + ln(\text{pr}_{mt}(\text{observed in data}|\text{pick c})) - ln(\text{pr}_{mt}(\text{observed in data}|\text{pick 0})) \tag{23}$$

In my reduced-form analysis, the term $ln(\text{pr}_{mt}(\text{observed in data}|\text{pick 0}))$ is cleanly captured by the time fixed effect, and the term $ln(\text{pr}_{mt}(\text{observed in data}|\text{pick c}))$ is likely at least partially absorbed by the location fixed effect. To bias the coefficients of interest spillovers or taxes would need to be correlated with $ln(\text{pr}_{mt}(\text{observed in data}|\text{pick c}))$, but not in a way correlated within commuting zone or year.

Of greater concern is the fact that I am using the location fixed effect in order to back out the sector-location productivity for my counterfactual exercises, the inability to observe the location choices of the universe of new establishments could affect these estimates. I cannot directly control for this since, as discussed, there is no way to calculate the probability of observing a new establishment in the data conditionally or unconditionally. In order to test whether this is a problem in practice, I repeat my main counterfactual exercises without including the location fixed effect when I back out my measure of productivity.

The results of this bounding exercise for the number of establishments are shown in Figure A.3.1. As is clear from the figure, the main results are nearly identical whether or not I include the location fixed effect in my measure of productivity, with the distribution being nearly identical with the exception of the right tail being shifted up slightly. As for within commuting zone, Panel B shows that for the majority of the commuting zones the predictions are strongly correlated.

For wages, things are only slightly different, which can be seen in A.3.2. In particular, Panel A show that the distribution of wage effects is the tiniest bit more positive in the bounding exercise. Furthermore, as seen in Panel B, the individual commuting zone predictions of wage effects are strongly correlated whether or not the location fixed effect is included. I choose to include the fixed effect because it includes factors other than the adjustment for establishment observation, such as natural advantage.

A.4 Construction of Empirical Proxies for Spillover Forces

A.4.1 Goods: Distance from Suppliers and Buyers

The first reason that establishments might like to locate near one another is to be located near to goods suppliers or customers. Reduced transportation costs is the cornerstone of some of the canonical models of the distribution of activity across space in economics, such as Krugman (1991) and has been emphasized as the key factor driving agglomeration (Fujita et al., 1999).

To proxy efficient moving of goods, I first construct a measure of the strength of buyer-supplier linkages between sectors using data from input-output tables. $Input_{m \leftarrow m'}$ is the share of sector m's inputs which come from sector m', and $Output_{m \rightarrow m'}$ is the share of sector m's output which goes to sector m'.[32] For an establishment in sector m, their input-output relationship with sector m' is defined as the maximum of these two values. Then the weighted average is calculated as described above to obtain the input-output agglomeration benefits for locating in each possible location. For an establishment in sector m in location c and time t their input-output agglomeration benefits are therefore:

$$\text{IO Agglom}_{ctm} = \sum_{m'=1}^{M} \frac{N_{ctm'}}{\mathcal{N}_{ct}} max(Input_{m \leftarrow m't}, Output_{m \rightarrow m'}) \tag{24}$$

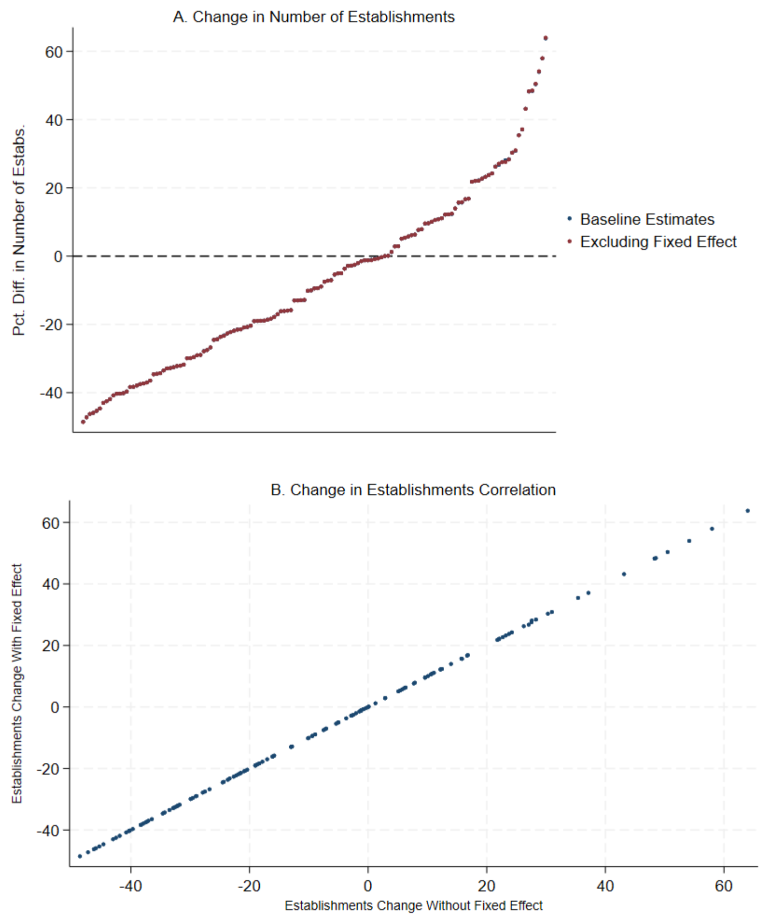
Thus, the measure of input-output agglomeration benefits is measured for a particular sector, location and year cell. Figure A.4.1 shows the strength of input-output linkages by industrial sector and commuting zone for the year 1999. The figure shows that the strength of input-output linkages varies across space, with different areas providing stronger potential input-output linkages for different sectors. For example, in the mining, utilities, and construction sector the strongest linkages are present in southern Germany, while for the professional services sector the strongest linkages are in large cities.

A.4.2 Labor: Reducing Hiring Costs or Improving Match Quality

The second reason that establishments may locate close to one another is to take advantage of a large labor market. These advantages take various possible forms. For example, larger labor markets may improve match quality and allow workers to specialize in more specific tasks

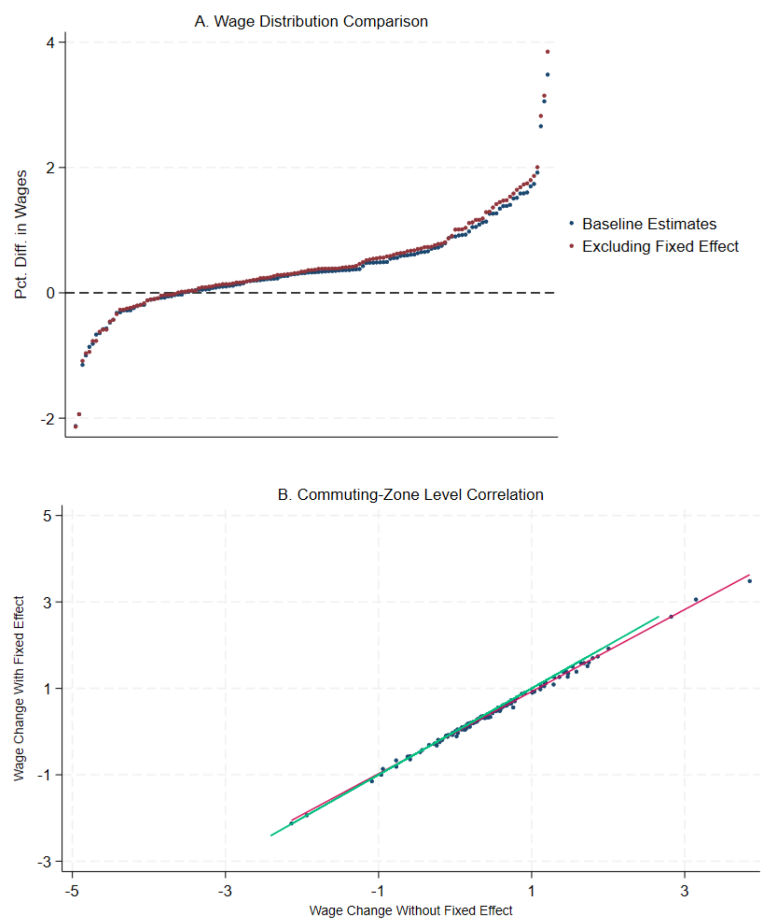
[32] The share of output which is sold to consumers as final goods is included in the output denominator.

Figure A.3.1: Bounding Exercise: Adjustment for Establishment Observation and Establishment Counts



Notes: Each dot is a commuting zone. Panel A shows the percent difference in establishments in the year 2017 between the actual and counterfactual policy for both the baseline estimates and when the location fixed effect is excluded from the measure of β_{ctm}. Panel B shows the commuting-zone level correlation in the percent difference in establishments. See Section 5 for details on calculations on calculations of the counterfactual effects. The commuting zones with the lowest and highest change in number of establishments were trimmed.

Figure A.3.2: Bounding Exercise: Adjustment for Establishment Observation and Wages



Notes: Each dot is a commuting zone. Panel A shows the percent difference in wages in the year 2017 between the actual and counterfactual policy for both the baseline estimates and when the location fixed effect is excluded from the measure of β_{ctm}. Panel B shows the commuting-zone level correlation in the percent difference in wages. See Section 5 for details on calculations on calculations of the counterfactual effects. The commuting zones with the lowest and highest change in number of establishments were trimmed.

(Dauth et al., 2022). Or, establishments might choose a particular location due to access to workers with particular knowledge of skills gained at other firms in the agglomeration (Combes and Duranton, 2006).

To proxy efficient pooling of labor, I first construct a measure of the similarity of labor used by a sector pair. For each sector, I construct a vector of the shares of industrial employment of each three-digit occupation. Then, for sector m and m' the vector correlation is the labor correlation of industry pair, $LC_{m,m'}$. Then the weighted average is calculated to obtain the labor correlation agglomeration benefits for locating in each possible location. For a firm in sector m in location c and time t their labor correlation agglomeration benefits are therefore:

$$\text{LC Agglom}_{ctm} = \sum_{m'=1}^{M} \frac{N_{m'ct}}{\mathcal{N}_{ct}} LC_{m,m't} \tag{25}$$

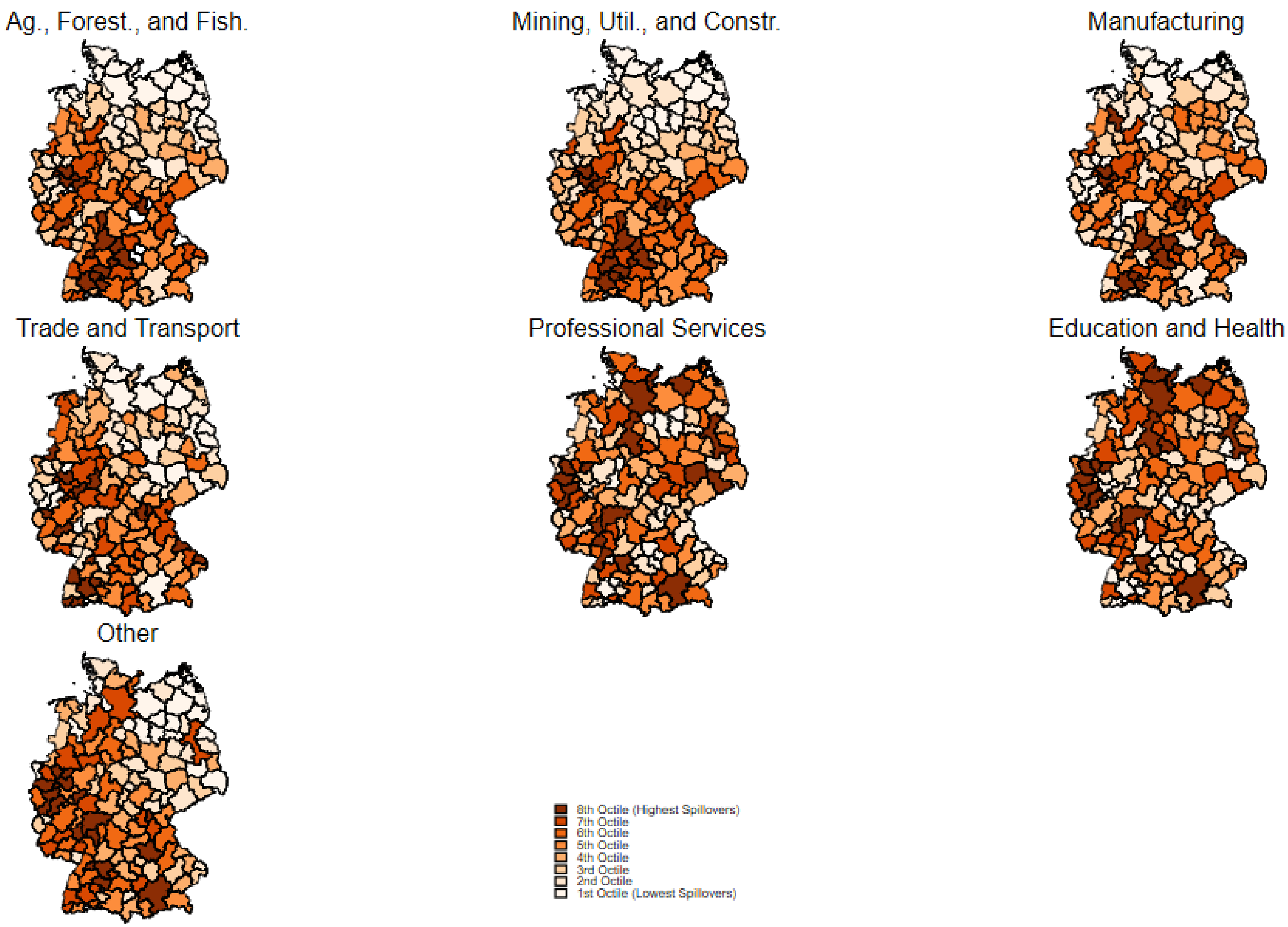
As with input-output agglomeration above, this measure of agglomeration benefits varies by sector, location and year. Figure A.4.2 shows the strength of labor linkages by industrial sector and commuting zone for the year 1999. The figure shows that the strength of labor linkages varies across space, with different areas providing stronger potential labor linkages for different sectors. For example, the agriculture, forestry, and fishing sector has strong labor linkages in the north of the country, while in the manufacturing sector they are more strongly represented in the south.

A.4.3 Knowledge

The final reason emphasized by Marshall (1920) for establishments to locate near one another is to facilitate the exchange of ideas. Workers learn from one another. Moretti (2004) finds that workers in industries that are more closely related to one another as measured by the strength of patent citation relationships have stronger reduced-form estimates of spillovers, suggesting that one of the channels spillovers operate through is knowledge. Moretti (2021) finds that inventors are more productive in high-tech clusters, showing that innovation spreads through knowledge networks.

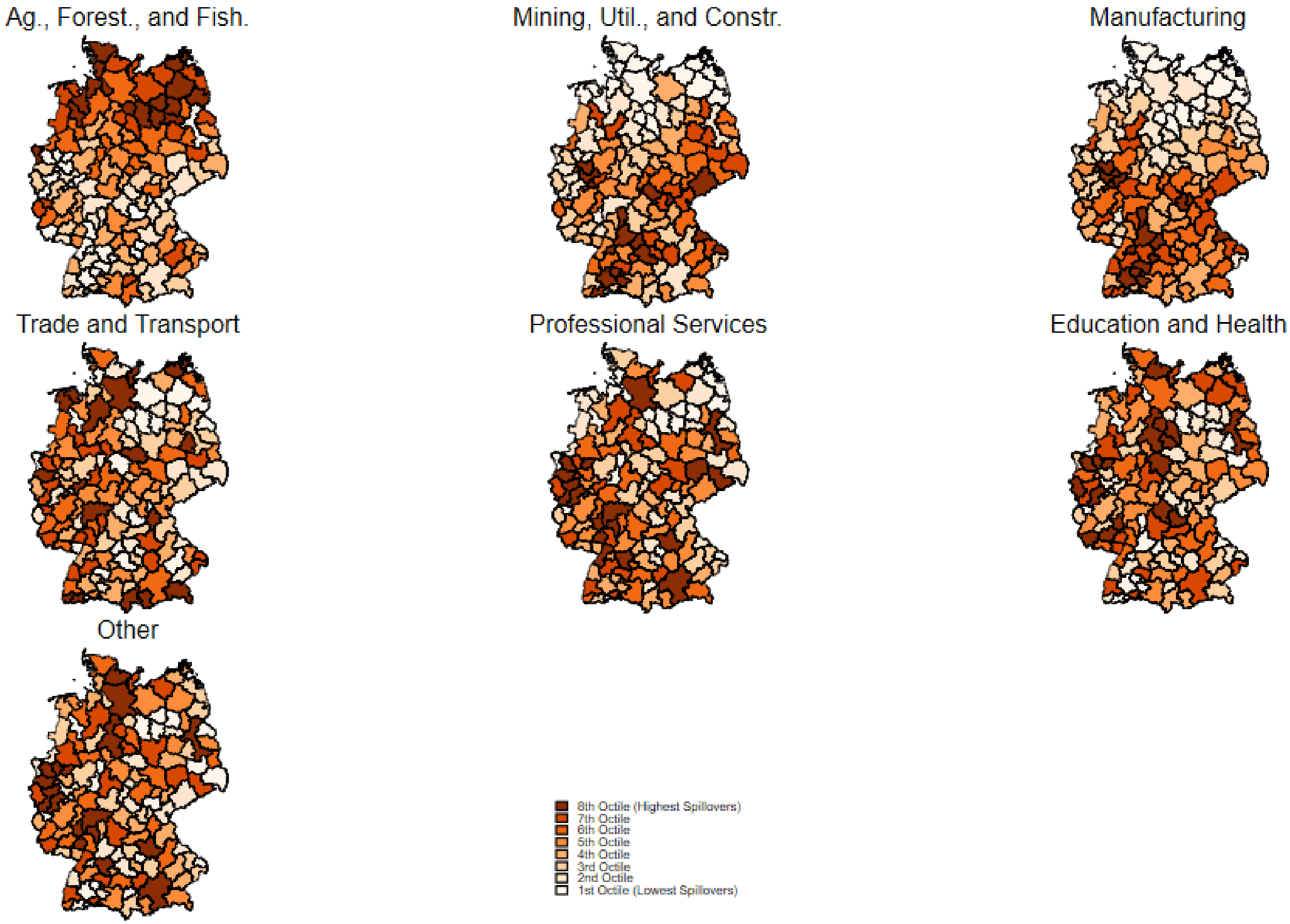
My measure of knowledge spillovers in a location comes from Jaffe et al. (1993). For each patent, I define a control patent as the patent with the closest publication date in the same 3-digit IPC patent class as the main patent. For each patent I also identify the commuting zone where the patent originates, as well as the region where each cited patent introduced by the applicant originates, both excluding and including self-citations. Then, for each location I define the knowledge agglomeration as the probability a cited patent comes from the same region (pr_{cite}) minus the probability that the control patent comes from the same region (pr_{cntrl}). This proxy measures knowledge spillovers since it measures the percentage of citations in a patent that are from the same location over-and-above the level that you would expect from the distribution of patents.

Figure A.4.1: Input-Output Linkages Across Space, 1999



Notes: Figure shows octiles of the goods spillovers proxy within a commuting zone as calculated as a weighted average of national-level pairwise industrial input-output linkages using incumbent establishment industrial sector shares in the year 1999 as weights to aggregate to the commuting zone level. The pairwise sectoral values were calculated using the method described in Section $A.4.1$.

Figure A.4.2: Labor Linkages Across Space, 1999



Notes: Figure shows octiles of the labor spillovers proxy within a commuting zone as calculated as a weighted average of national-level pairwise industrial correlations using incumbent establishment industrial sector shares in the year 1999 as weights to aggregate to the commuting zone level. The pairwise sectoral values were calculated using the method described in Section $A.4.2$.

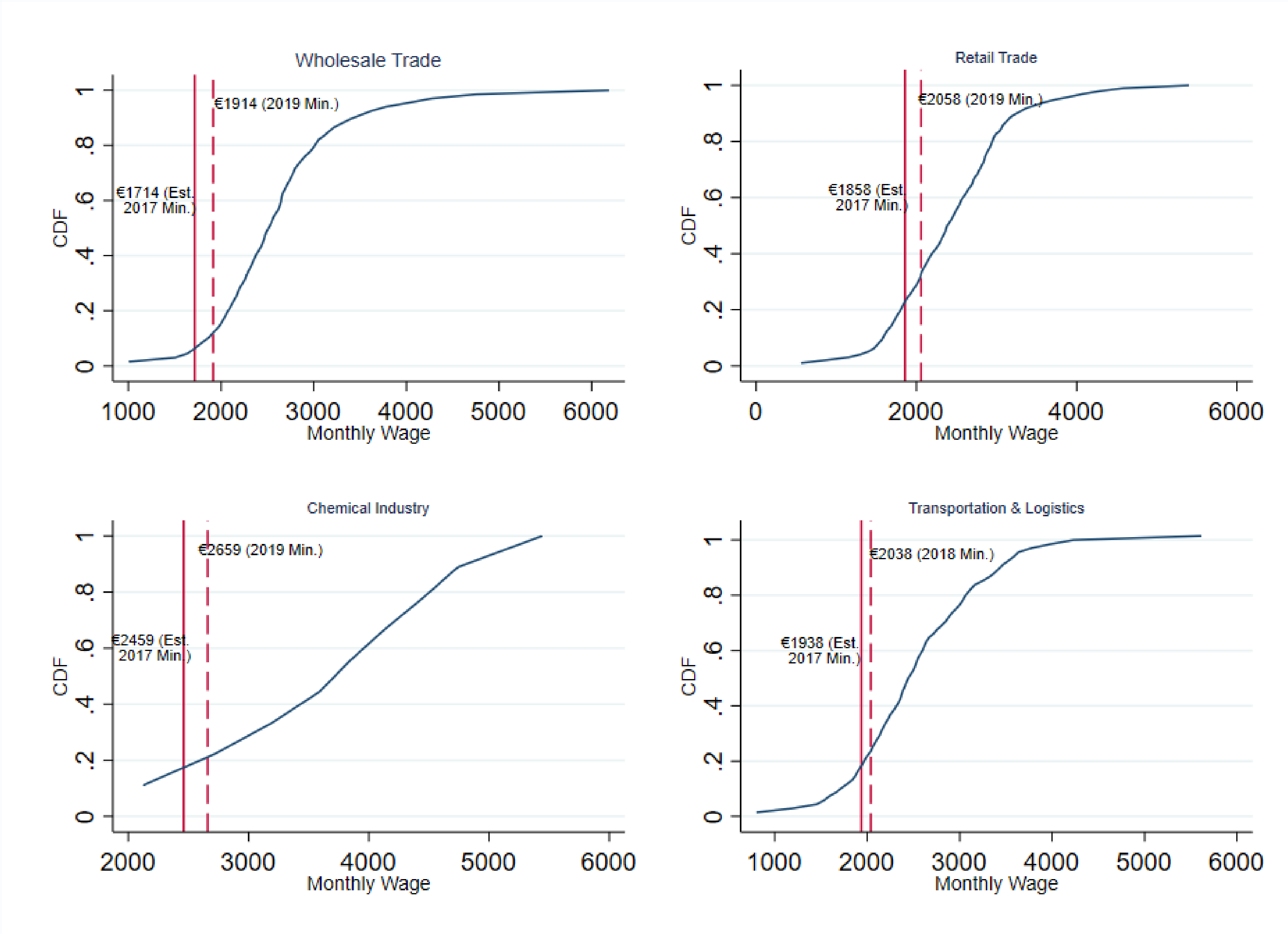
A.5 Imputing Union Minimum Wage Rates

There is no central repository of union contracts available for Germany, but I obtained the 2019 union contracts for the state of North-Rhine Westfalia. In the contracts, the minimum wage rate and the effective date is specified, typically as a monthly rate. There are different rates for different skill levels, I concentrate on the low-skill level for my analysis. Union contracts oftentimes do not map cleanly into a single industry code in the BHP data. I chose four two-digit industry codes (retail trade, wholesale trade, chemical industry, and transportation/logistics) which map into a single union contract, and have large enough employment in 2019 in North-Rhine Westfalia to analyze wage distributions. I have union contracts for 2019, but my main analysis data is only available through 2017. To approximate the union rates in 2017, I average the minimum wage growth rates for 2020 and 2021 to approximate the average wage increases year-over-year. On average, the minimum wage grows around 100 Euros per year, so I use this to back out an estimated 2017 minimum wage.

The BHP data has information about the wages of low-qualification workers (high school or less, no vocational qualification) at the establishment. For establishments with twenty or more employees, I plot the wage distribution of these low-qualification employees in Figure A.5.1 along with the estimated minimum wage rates described above. As can be seen in Figure A.5.1, with the exception of wholesale trade the union minimum wage rate falls at approximately the 20th percentile of the low-qualification wage distribution. Thus, I proxy the union minimum wage rate as the 20th percentile of the low-qualification wage distribution in a particular two-digit industry-state-year cell. These union minimum wage rates are aggregated to the location-level using establishment-sector-share weights as with the agglomerating forces described above.[33] Online Appendix Figure B.1.3 shows the geographic distribution of the outside option proxy across space. There is a clear delineation between former East- and West-Germany, with former East Germany having persistently lower outside option compared to former West Germany.

[33] There are a small number of establishments which pay under this imputed outside option. This is to be expected as there are exceptions to the bargained union contracts. In these cases, I include the establishments in the first-stage regression to calculate $ln(\mathcal{L}_{ct}\lambda_{ct})$ by replacing their actual wage rate with one just above the outside option. Both my empirical and counterfactual results are near-identical whether or not this is done.

Figure A.5.1: Imputing Union Minimum Wage Rates



Notes: Figure shows the CDF of the monthly wage levels in the BHP data for low-skill (with a lower secondary, intermediate secondary or upper secondary school leaving certificate but no vocational qualifications) workers at establishments with twenty or more employees in the state of North Rhine-Westphalia in the year 2017. Union minimum wage rates obtained from Tarifregister North Rhine-Westphalia on May 5, 2021, and are shown on the dashed red line, estimated 2017 union minimum wage rates estimated using the procedure described in Sector 3.3 and are shown by the solid red line.

A.6 Including Rental Prices

Rental prices are a key component of classic spatial equilibrium models. Since I make the assumption that workers are immobile, the inclusion of rental prices does not change the workers' labor supply decision since rental prices they pay do not differ no matter which establishment they choose to work at in their commuting zone. However, rental prices will enter the establishment's profit equation. Assume that establishments pay a fixed price r_c per square meter of space they rent. Each worker requires a fixed amount of space k that does not differ between locations. This leads to the profit equation:

$$Y_{jc} = (1 - \tau_{ct})[\beta_{ctm} L_{ctm}(w_{cjt}) - L_{cjt}(w_{cjt})w_{cjt} - kr_c L_{ctm}(w_{cjt})] \tag{26}$$

Taking first order conditions leads to the wage equation:

$$w_{ctm} = \frac{\mu_c}{1 + \mu_c}(\beta_{ctm} - r_c k) + \frac{1}{1 + \mu_c} b_{ct} \tag{27}$$

This wage equation is very similar to the wage in the main specification, but the productivity portion of the wage is marked down by the price that the establishment needs to pay in rental prices. When functional forms are substituted back into the wage equation and I log-linearize, the log-profits are:

$$y_{cjt} = \mu_c ln(\mu_c) + ln(\mathcal{L}_{ct}\lambda_{ct}) + (1 + \mu_c) ln[\frac{1}{1 + \mu_c}(\beta_{ctm} - r_c k - b_{ct})] + ln(1 - \tau_{ct}) + u_{ctj} \tag{28}$$

The difference between this specification is that now rents appear in the productivity term of the equation. I can control for this directly in my reduced form with data on rental prices. I obtained data on rental prices for Germany from the RWI-GEO-REDX dataset maintained by RWI-Essen. Unfortunately, this data is only for residential housing prices rather than commercial real estate prices, but data on commercial prices is not available for Germany.

The dataset provides information on relative housing prices within each district (Klick and Schaffner, 2021). I combine the reported fixed effects from the first cross-sectional regression 2 and the housing price growth rates from regression 3 of their paper to create a panel dataset of relative housing prices over time which is merged with my main dataset. I report the results of the main regression specification controlling for rents in Appendix Table A.6.1. As this data is only available from 2008 forward, so including it as a control necessitates cutting my panel in half. Therefore, I additionally report the results of the main specification without controlling for rents for the same set of years 2008 to 2017.

The coefficient estimates of interest are not significantly different when controlling for rental prices compared to not, and the only sectors with a significant coefficient on rental prices (mining utilities, and construction; trade and transportation; and education and health) are only weakly significant at the 10% level. This indicates that I should not be concerned about rental prices biasing my main results.

Table A.6.1: Affect of Rental Prices

Panel A: Rental Price Controls

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	8.698	7.431**	9.961**	0.593	4.302*	-0.394	7.662***
	(6.461)	(3.010)	(4.533)	(2.266)	(2.585)	(6.760)	(2.881)
Outside Option	-0.565	-0.244	-0.852	-1.184***	-0.500	0.162	-1.496***
	(0.948)	(0.489)	(0.671)	(0.328)	(0.476)	(0.921)	(0.442)
Input-Output	-1.970	-0.572	2.734	0.737	7.559**	-2.118	-0.201
	(1.989)	(1.270)	(2.151)	(0.815)	(3.472)	(2.258)	(1.849)
Labor Correlation	0.754	-45.38***	-16.80	27.73**	-2.841	-71.24**	11.99
	(8.176)	(10.85)	(26.62)	(13.09)	(10.41)	(34.65)	(9.381)
Knowledge	-0.00148	0.0527	0.0920*	-0.000959	0.0233	-0.0242	-0.0115
	(0.0902)	(0.0375)	(0.0479)	(0.0268)	(0.0318)	(0.0589)	(0.0383)
Rental Prices	0.00139	0.00363*	0.00442	0.00231*	0.00224	-0.00828*	0.00243
	(0.00371)	(0.00204)	(0.00338)	(0.00136)	(0.00204)	(0.00500)	(0.00184)
N	1345	1400	1380	1400	1397	1396	1400
F	6.599	53.54	35.73	86.57	80.81	13.92	56.98

Panel B: No Rental Price Controls

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	9.254	8.513***	11.36**	1.251	5.065**	-2.045	8.583***
	(6.173)	(2.944)	(4.492)	(2.332)	(2.583)	(6.819)	(2.813)
Outside Option	-0.616	-0.280	-0.898	-1.250***	-0.537	0.300	-1.575***
	(0.980)	(0.498)	(0.667)	(0.332)	(0.498)	(0.911)	(0.442)
Input-Output	-1.899	-0.240	2.177	0.916	7.976**	-1.911	-0.548
	(2.007)	(1.254)	(1.991)	(0.832)	(3.270)	(2.134)	(1.876)
Labor Correlation	0.412	-46.24***	-16.40	27.86**	-3.481	-64.91**	12.18
	(8.000)	(11.02)	(26.23)	(13.20)	(10.65)	(31.02)	(9.431)
Knowledge	-0.00148	0.0522	0.0906*	-0.00141	0.0225	-0.0189	-0.0123
	(0.0903)	(0.0379)	(0.0472)	(0.0268)	(0.0319)	(0.0572)	(0.0384)
N	1345	1400	1380	1400	1397	1396	1400
F	7.640	68.61	41.19	96.83	78.63	18.88	70.70

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Results of the reduced-form specification in equation 9, also controlling for rental prices.

Notes: Results of the IV empirical specification equation (9) with spillover and outside option instruments constructed as shown in equation (11) with additional controls for residential rental prices within the commuting zone described in Klick and Schaffner (2021). Each column is an industrial sector. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level.

A.7 Counterfactual Equations

The counterfactual movement in the share ratio due to the tax rate between t=0 and 1 is:

$$ln(\frac{s_{jct}}{s_{j0t}})_{CF} - ln(\frac{s_{jct}}{s_{j0t}})_{actual} = \beta_1[ln(1-\tau_{CF,ct}) - ln(1-\tau_{ct})] \tag{29}$$

Where $\tau_{CF,ct}$ is the counterfactual tax rate of 7%. Subsequently, the number of counterfactual entrants attracted by the tax policy may be calculated with a few additional steps. Since the sum of shares for each location-year must sum to one, rearranging implies that:

$$s_{j0t,CF} = \frac{1}{\sum_{ct} \frac{s_{jct,CF}}{s_{j0t,CF}}} \tag{30}$$

Combining equations (29) and (30) leads directly to the expression for the counterfactual share of establishments choosing the treated location. I impose the additional assumption that the pool of establishments entering the entire German market each year is fixed in order to be able to calculate the counterfactual numbers of establishments going to each location. Effectively, this imposes that there is no extensive margin and the place-based policy is zero-sum in its effects. In Appendix A.8 I relax this assumption and provide bounds for my main results.

I use this new distribution of establishments to calculate the counterfactual spillovers and outside options in all locations. I then calculate the counterfactual productivity of each location by equating the difference in the structural equation (7) between the two time periods and that of the the empirical analogue (9) and substituting the counterfactual spillovers and outside options and solving for $\beta_{ctm,CF}$.[34]

$$(1+\mu_c)ln[\frac{\beta_{ctm,CF} - b_{ct,CF}}{\beta_{ctm} - b_{ct}}] = \beta_3(Spillovers_{ctm,CF} - Spillovers_{ctm}) + \beta_4(b_{ct,CF} - b_{ct}) \tag{31}$$

Using these counterfactual productivity and outside options I additionally calculate counterfactual wages using model Equation (5). I continue this process iteratively to examine the dynamic secondary effects induced by the tax policy change.

A.8 Incorporating Extensive Margin Effects

In the base specifications, there is no extensive margin. There is a pool of establishments that have decided to enter the market, and they are only choosing a location. Thus, the logit model is zero-sum. If an establishment chooses one location they are by definition taking possible economic activity away from other locations. In this model, place-based policies

[34] In the case where the estimated empirical coefficient is not statistically significant, I use zero.

cannot do anything other than redistribute economic activity across space. This is a strong assumption, in reality there are likely establishments that could potentially enter the market given the right circumstances, but have chosen not to. Schmidheiny and Brülhart (2011) discuss the effects of the lack of extensive margin on predicted counterfactual effects, and show that elasticities of substitution between locations implied by the poisson and conditional logit model are boundary conditions for applied research. As discussed in Appendix A.2 poisson analysis is not appropriate for my context, so I need an alternative bounding exercise.

My method estimates the elasticities of substitution directly using methods from the industrial organization literature, which has a standard method of addressing this problem by imputing the potential market size and including the numeraire in the choice set of alternatives. In this section, I follow this approach and estimate the effects of incorporating the extensive margin by estimating the market share of the numeraire. To estimate potential market size, I calculate the ratio of establishments:residents for each commuting zone-sector-year cell. I then define the potential market size as the number of establishments that would exist if every commuting zone-sector-year cell had the number of establishments that would exist with the maximum ratio.

This should be thought of as an absolute upper bound of the potential magnitude of extensive margin effects for two reasons. First, it is unlikely that every location could support the maximum ratio of establishments, particularly for every sector. As a simple example, it is highly unlikely that every location would be able to support the same ratio of mining establishments to population due to minerals not being evenly distributed across space.

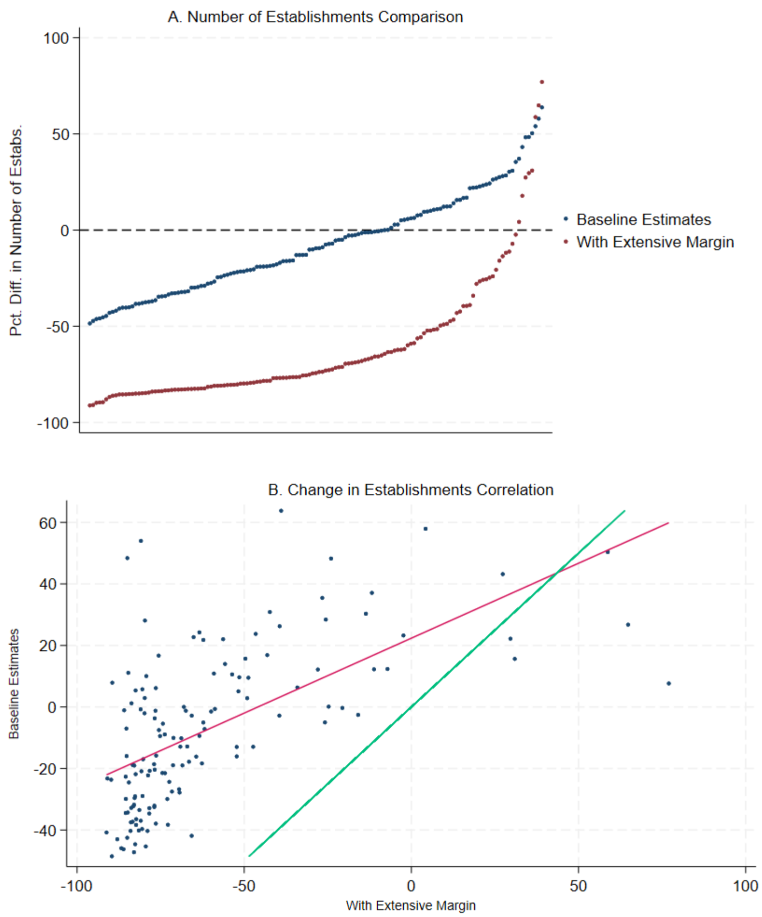
Second, an individual location may exceed the maximum ratio in the counterfactual analysis since the potential market size is necessarily defined at the national level. Imposing bounds at the commuting-zone level is conceptually difficult. Since the number of residents is a parameter in the model it remains fixed in the model counterfactuals, but if a lot of economic activity was being attracted to a location it would probably attract some new residents as well. Estimating the scope of these effects is beyond the scope of this paper, but for these reasons the results shown below should be thought of as the upper bound of the magnitude of the effects.

Figure A.8.1 shows the estimated bounds on the percentage change in the number of establishments when extensive margin effects are incorporated. Panel A shows the distribution of the effects. As is clear from the figure, the prediction of the change is establishments is much more negative when extensive margin effects are incorporated, with the effect widening a the left tail of the distribution. Panel B shows the correlation between the individual commuting zone predictions with and without the extensive margin. The individual commuting zone predictions are highly correlated, though not perfectly. In sum, the predicted changes in the number of establishments is lower when extensive margin effects are incorporated, with fairly uniform predictions for all commuting zones.

On first look these negative results are a surprise. What is taking place is that the initial mixture of establishments attracted, on average, increases the outside option of workers, consistent with the on average much more positive wage effects shown in Figure A.8.2. In subsequent years, the location is then less attractive to new establishments due to having to pay increased wages, and the establishments enter other locations instead. These effects compound upon one another, leading to a lower number of establishments under the counterfactual policy as seen in Figure A.8.1, but much higher wages as seen in Figure A.8.2.

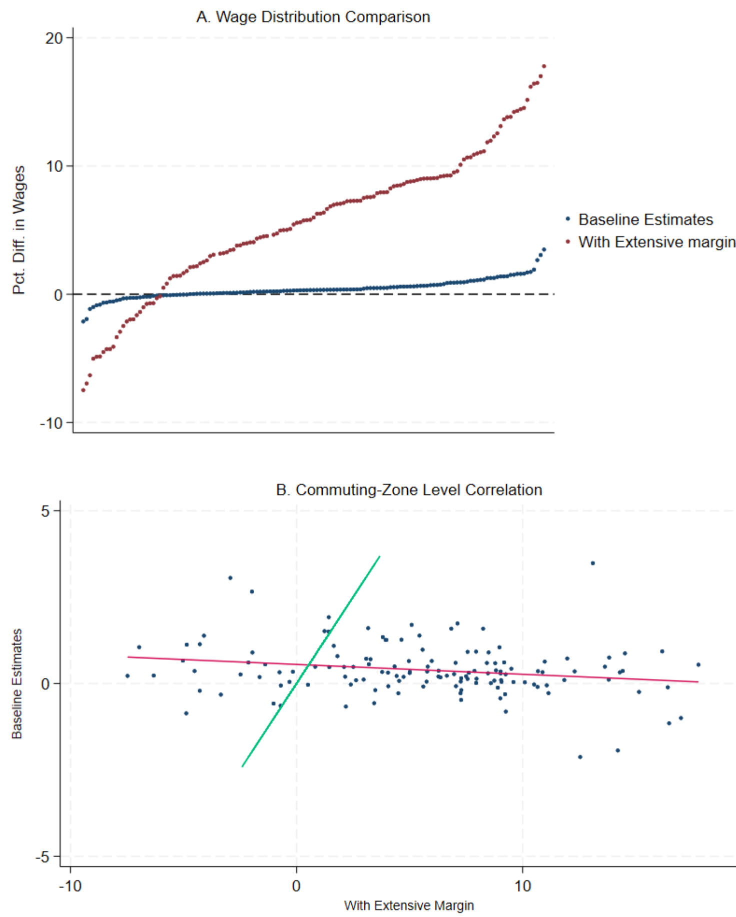
Overall, the extensive margin effects probably mean that my baseline estimates of the effects of place-based policies likely more positive than they would be in reality in terms of the number of establishments, particularly for already competitive areas, though how much more positive is dependent on how large the extensive margin is. I leave the question of the exact size of the extensive margin effects to future work.

Figure A.8.1: Bounding Exercise: Incorporating Extensive Margin Effects



Notes: Each dot is a commuting zone. Panel A shows the percent difference in establishments in the year 2017 between the actual and counterfactual policy for both the baseline estimates and when the choice set includes the numeraire as described in Appendix Section A.8. Panel B shows the commuting-zone level correlation in the percent difference in establishments. See Section 5 for details on calculations of the counterfactual effects. The commuting zones with the lowest and highest change in number of establishments were trimmed.

Figure A.8.2: Bounding Exercise: Incorporating Extensive Margin Effects

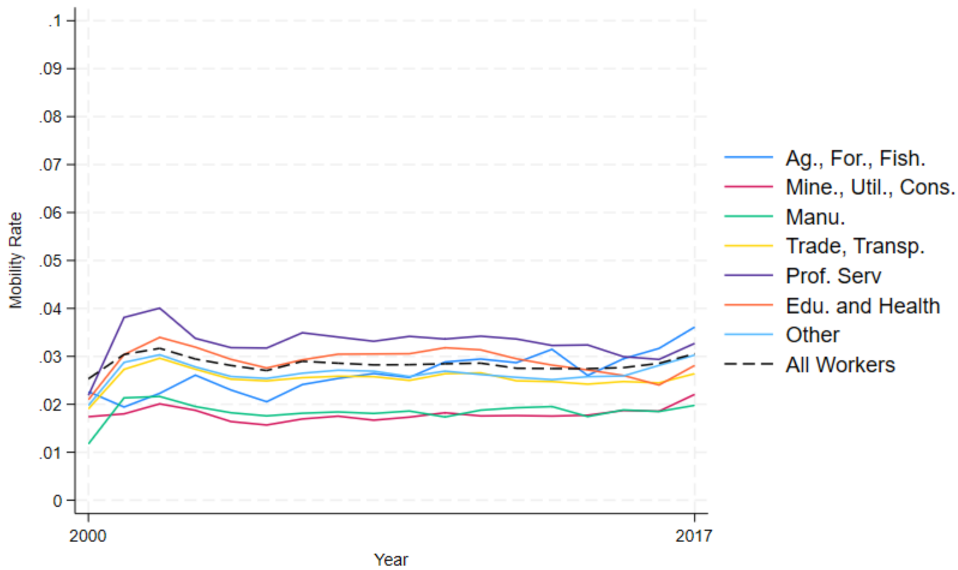


Notes: Each dot is a commuting zone. Panel A shows the percent difference in wages in the year 2017 between the actual and counterfactual policy for both the baseline estimates and when the choice set includes the numeraire as described in Appendix Section A.8. Panel B shows the commuting-zone level correlation in the percent difference in wages. See Section 5 for details on calculations of the counterfactual effects. The commuting zones with the lowest and highest change in number of establishments were trimmed.

B Additional Figures and Tables

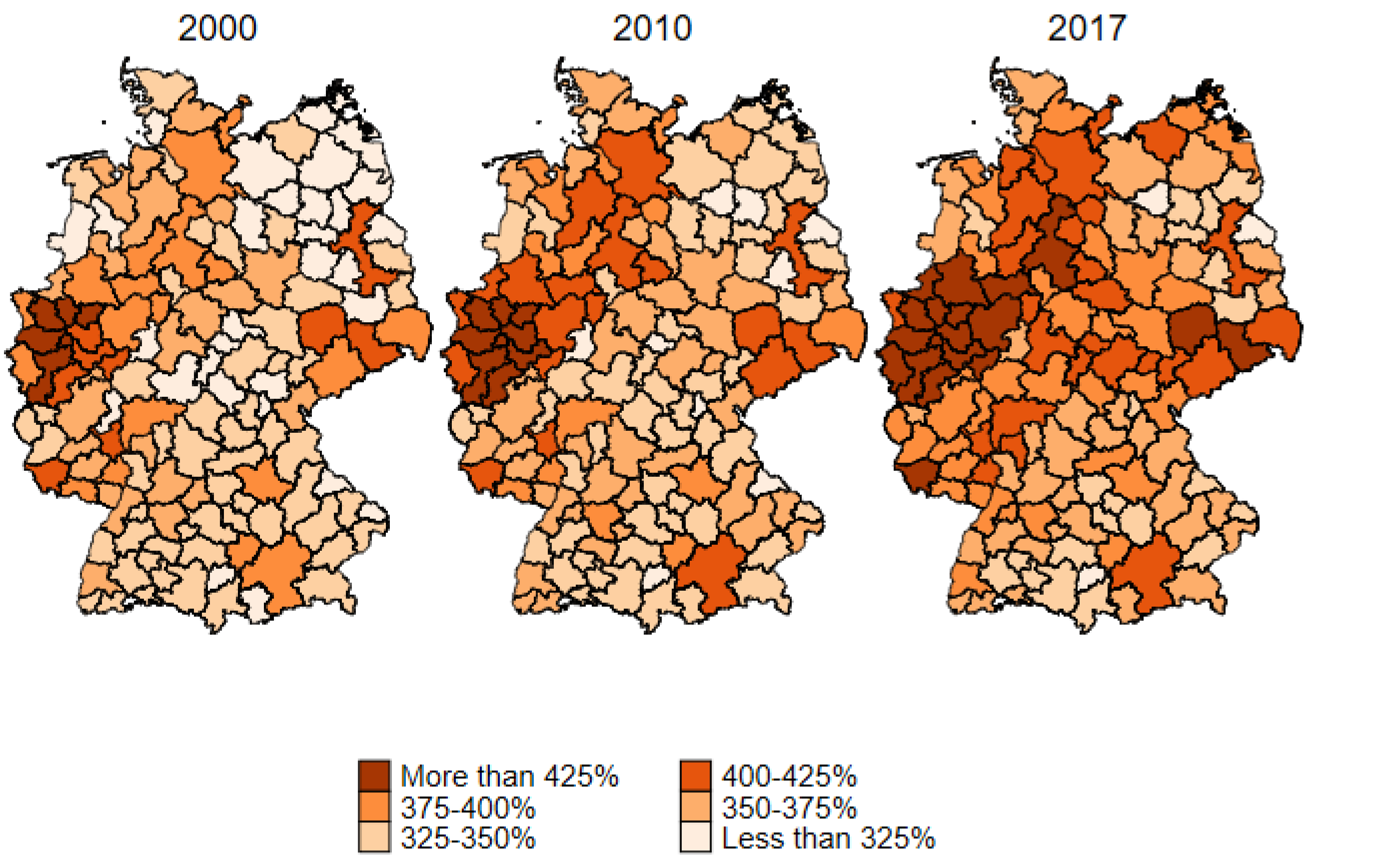
B.1 Additional Figures

Figure B.1.1: Prime-Age Worker Mobility Rates by Industrial Sector



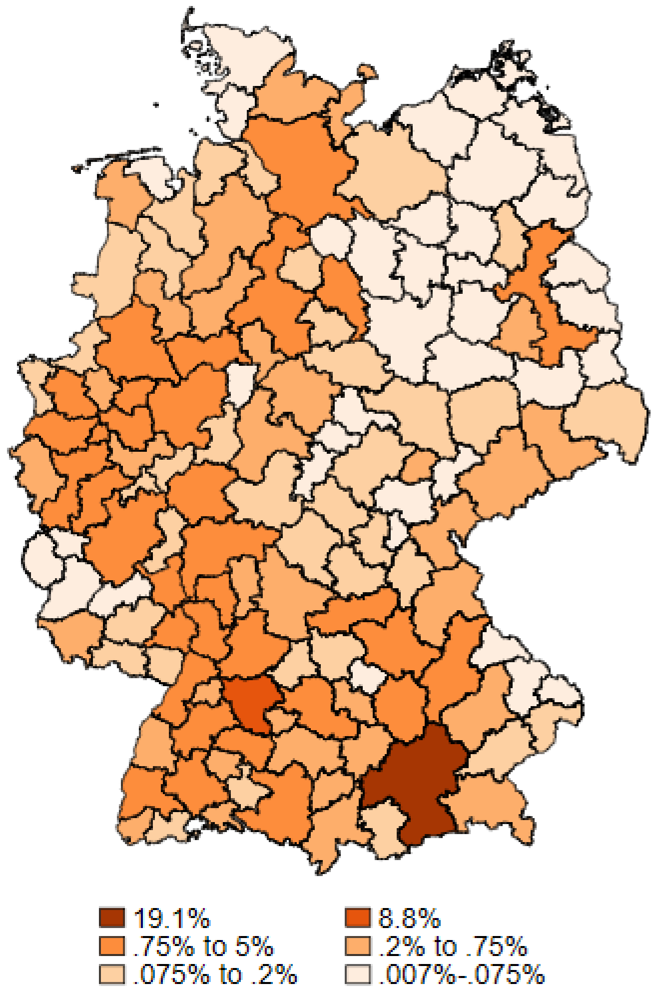
Notes: Figure shows year-over-year mobility rates of workers between commuting zones. Movement is defined as experiencing a labor market spell within the specified industrial sector in a different commuting zone than the previous labor market spell, regardless of whether the individual returns to the previous location before the end of the year.

Figure B.1.2: Average Corporate Tax Rates - Percent of Base Rate



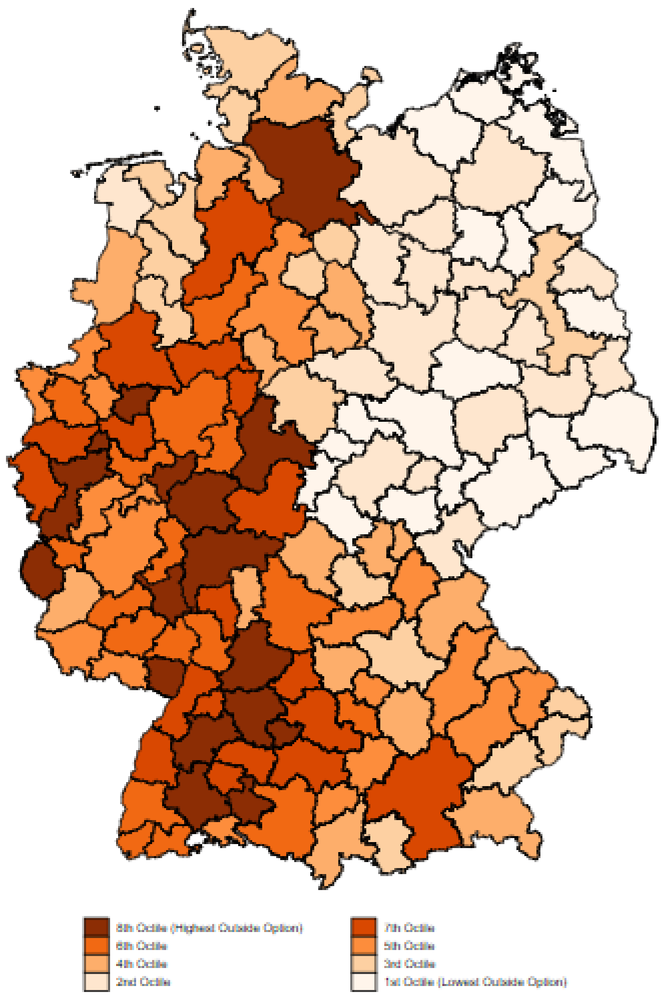
Notes: Figure shows the average corporate tax rate multiplier within a commuting zone. Average values are weighted average of municipal corporate tax rate multipliers, with weights given by the number of residents in each municipality. Multipliers indicate the local corporate tax rate relative to the base tax rate (currently 3.5%). For example, a multiplier of 400% indicates that the local rate is 3.5%*4 = 14%.

Figure B.1.4: Share of Filed Patents, 2015



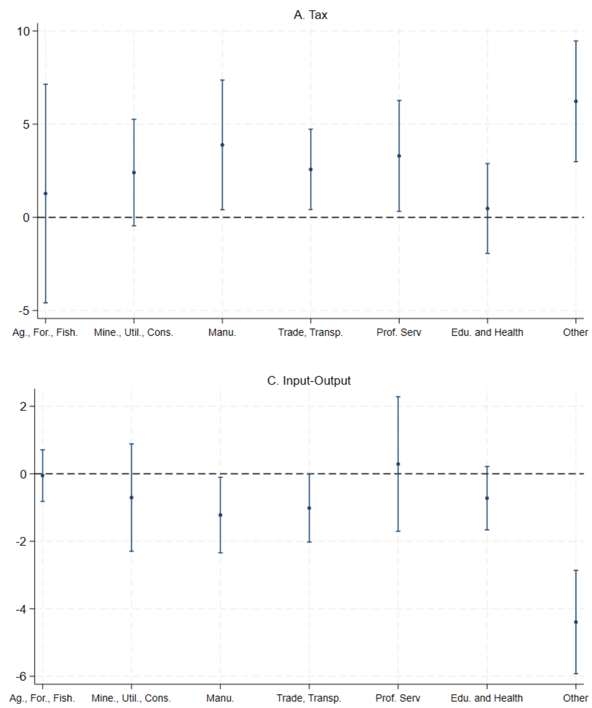
Notes: Figure shows the share of patents in the OECD patent database filed from Germany originating in each commuting zone in the year 2015.

Figure B.1.3: Geographic Distribution of Outside Option



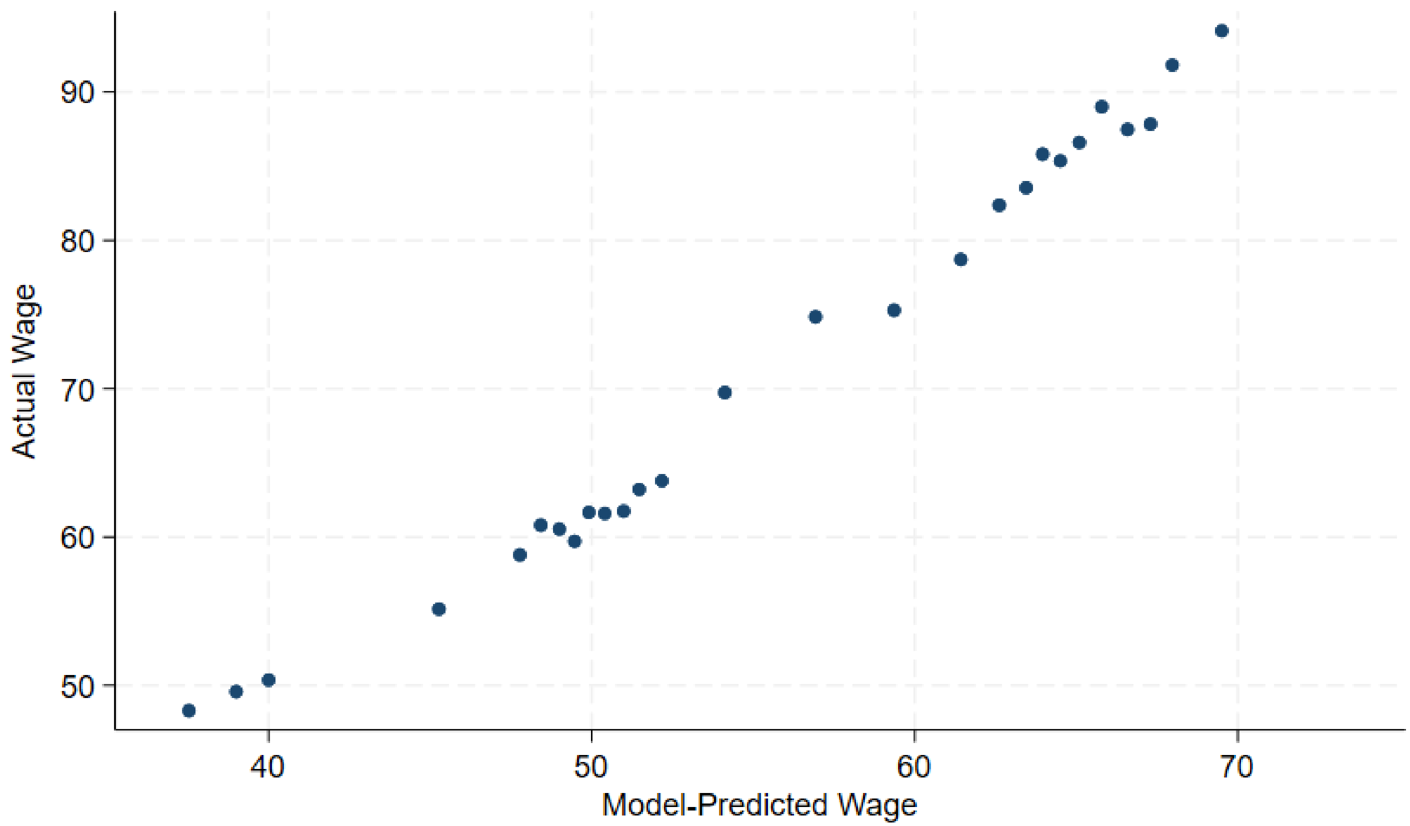
Notes: Figure shows octiles of outside option within a commuting zone for the year 1999. Outside option is calculated as a weighted average of state-level imputed union minimum wage rates using incumbent establishment industrial sector shares in the year 1999 as weights to measure at the commuting zone level. The imputed union minimum wage rates were calculated using the method described in Section 3.3.

Figure B.1.5: Coefficients by Sector - OLS



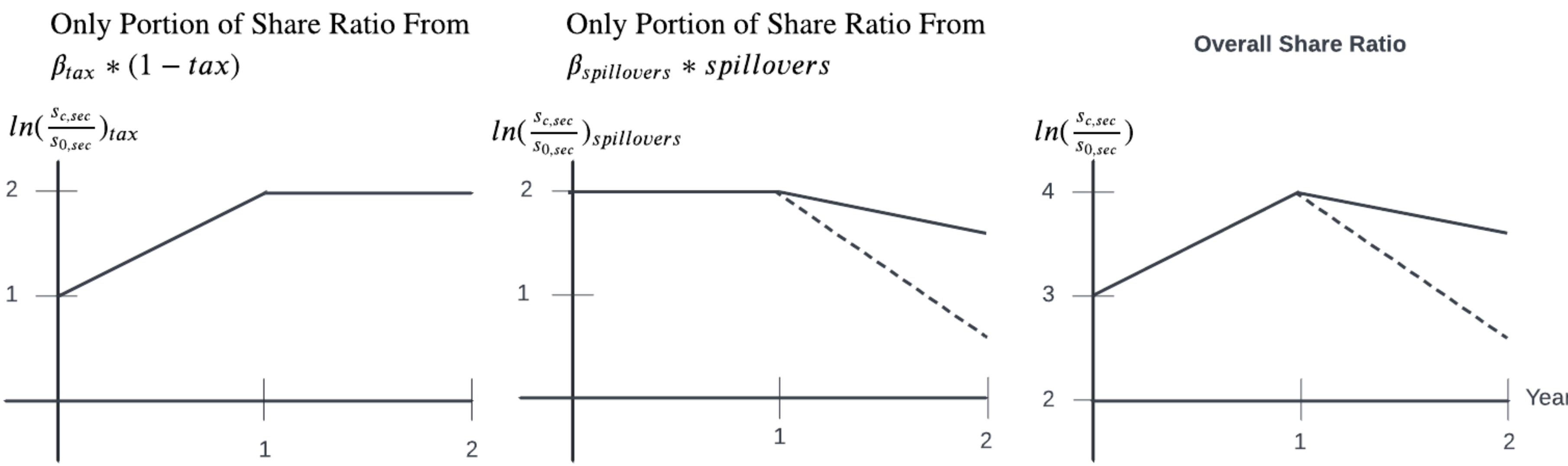
Notes: Results of the OLS empirical specification equation (9). Each column is an industrial sector. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level. See section 3 for details on the construction of the variables of interest.

Figure B.1.6: Model Fit



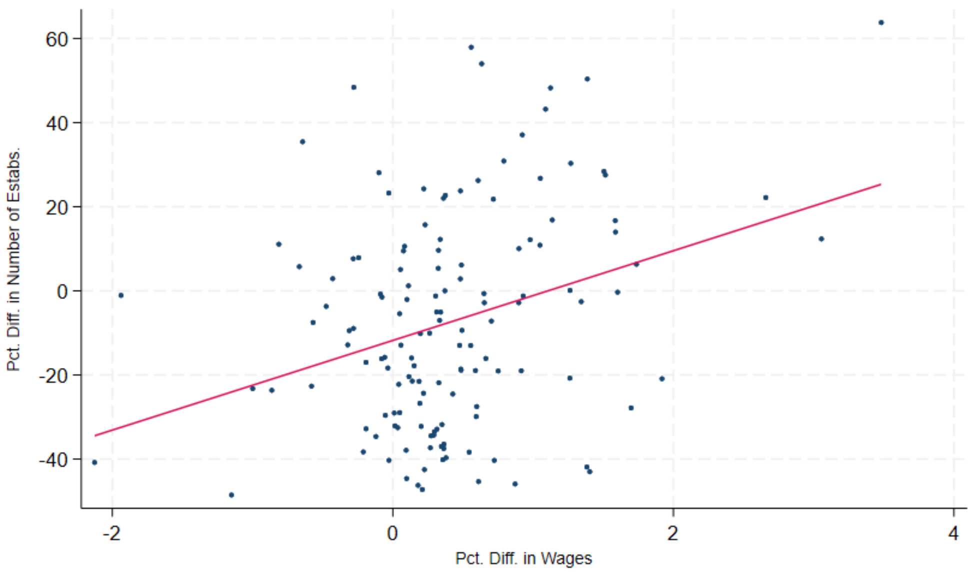
Notes: Figure shows the relationship between the model-predicted average wage within a commuting zone-industrial sector-year cell and the actual average wage within that cell using the binsreg command.

Figure B.1.7: Illustration of Primary and Secondary Tax Policy Effects



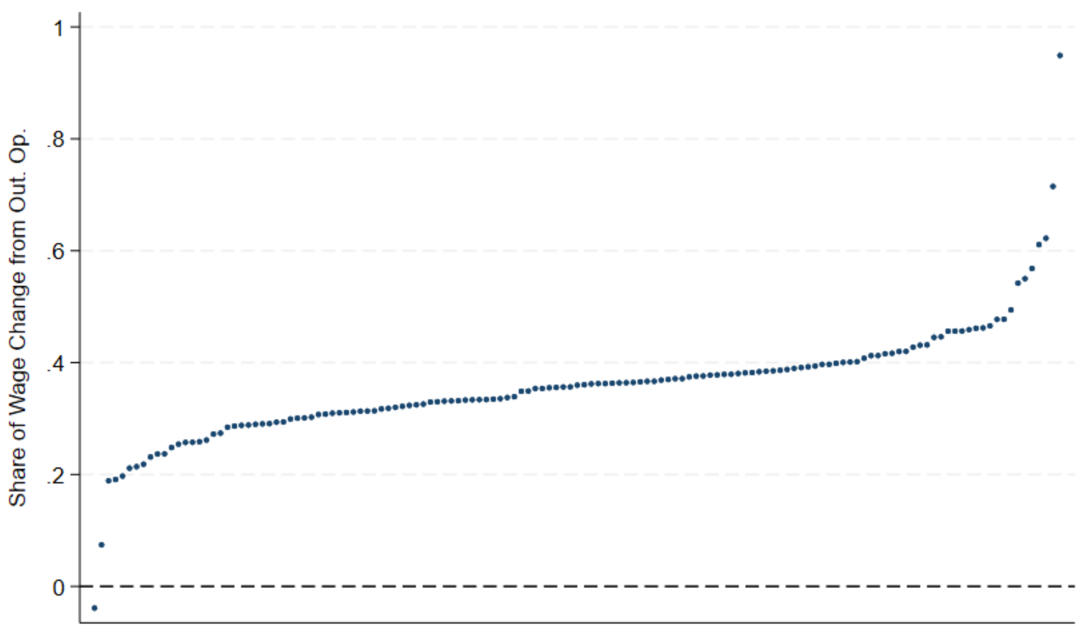
Notes: The leftmost panel shows only the portion of the share ratio from tax effects, and the middle panel the portion of the share ratio from spillover effects. The final panel is the additive combination of both. Time since a tax policy was enacted in t=0. When the tax rate decreases, the share ratio increases directly between time 0 and 1. Between time 1 and 2 the subsequent composition of establishments has changed, which leads to changes in the spillovers. The solid and dashed lines show two possible paths, one of which leads to an overall decline in the share ratio despite the tax policy remaining in place.

Figure B.1.8: Correlation of Counterfactual Establishment and Wage Effects



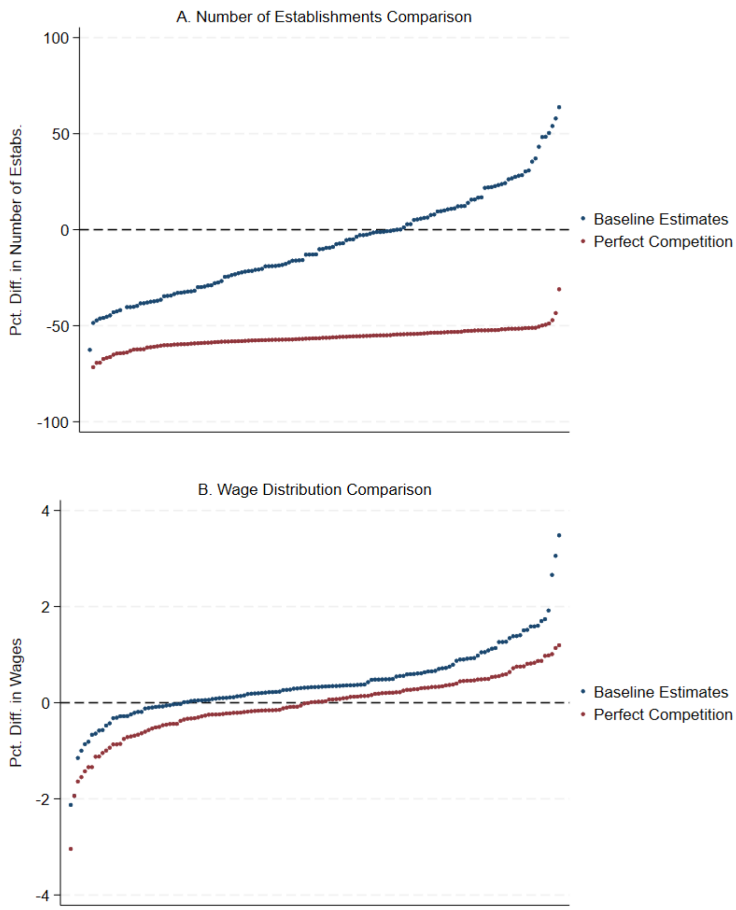
Notes: Each dot is a commuting zone. On the x-axis is the percent difference in wages under the counterfactual tax policy compared to the actual tax policy in the year 2017, while on the y-axis is the difference in the number of establishments under the counterfactual tax policy compared ot he actual tax policy in 2017. The red line is the linear fit. The commuting zones with the lowest and highest change in number of establishments and wages were trimmed.

Figure B.1.9: Share of Counterfactual Wage Changes from Outside Option Changes



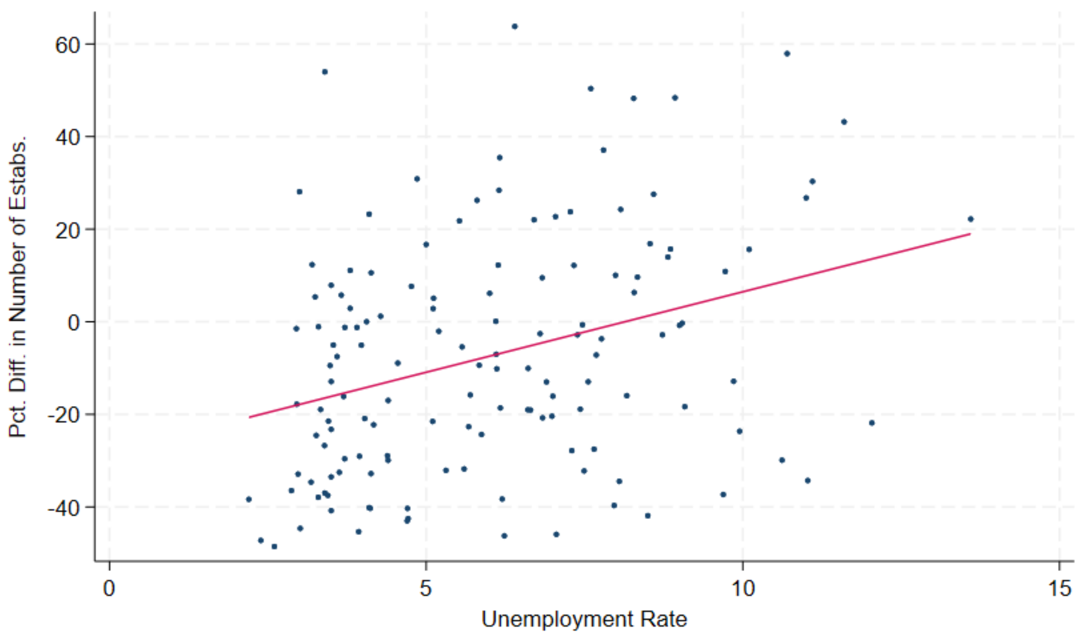
Notes: Each dot is a commuting zone. The figure shows the share of model-predicted changes in wages under the counterfactual tax policy which results from changes in the outside option in the year 2017. The commuting zones with the lowest and highest change in wages were trimmed.

Figure B.1.10: Effects of Counterfactual Tax Policy on Commuting Zones in a More Perfectly Competitive World



Notes: Each dot is a commuting zone. Panel A (B) shows the percent difference in establishments (wages) under the counterfactual tax policy compared to the actual tax policy in 2017 for both the baseline estimates in Figure 4 and if the elasticity of labor supply was constant across space and markets were more competitive, setting μ_c=5 in all commuting zones. See Section 5 for details on calculations. The commuting zones with the lowest and highest change in number of establishments and wages were trimmed.

Figure B.1.11: Relationship Between Unemployment Rates and Counterfactual Establishment Growth



Notes: Each dot is a commuting zone. On the y-axis is the percent difference in number of establishments under the counterfactual tax policy compared to the actual tax policy in the year 2017, while on the y-axis is the commuting-zone level unemployment rate in 2017. The red line is the linear fit. The commuting zones with the lowest and highest change in number of establishments and wages were trimmed.

Figure B.1.12: Commuting Zones in Case Study

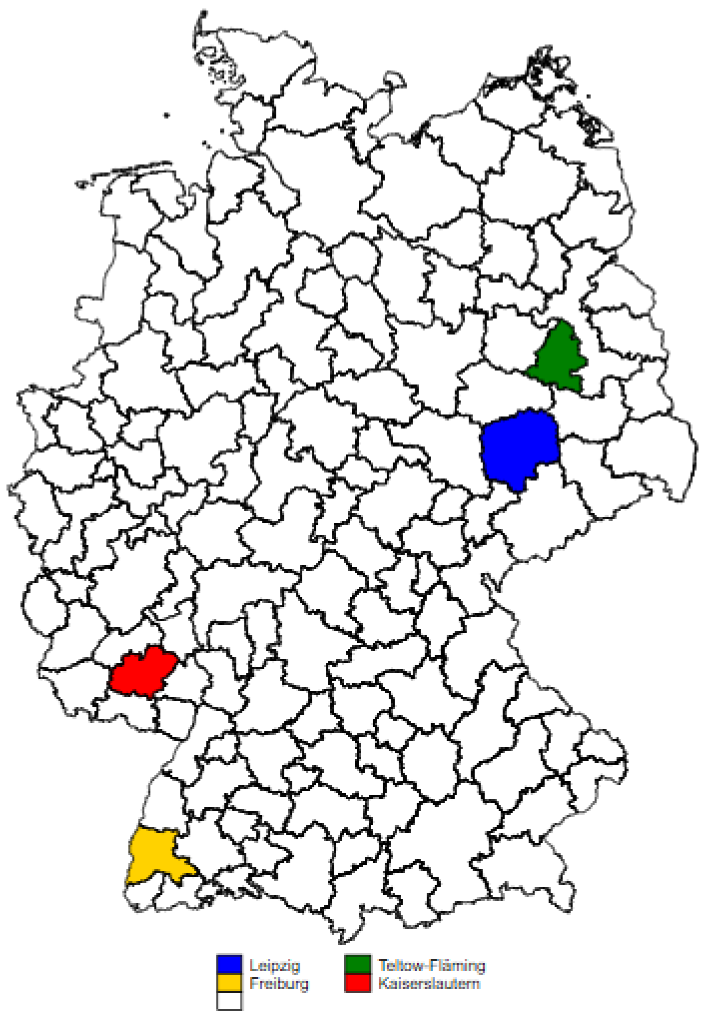
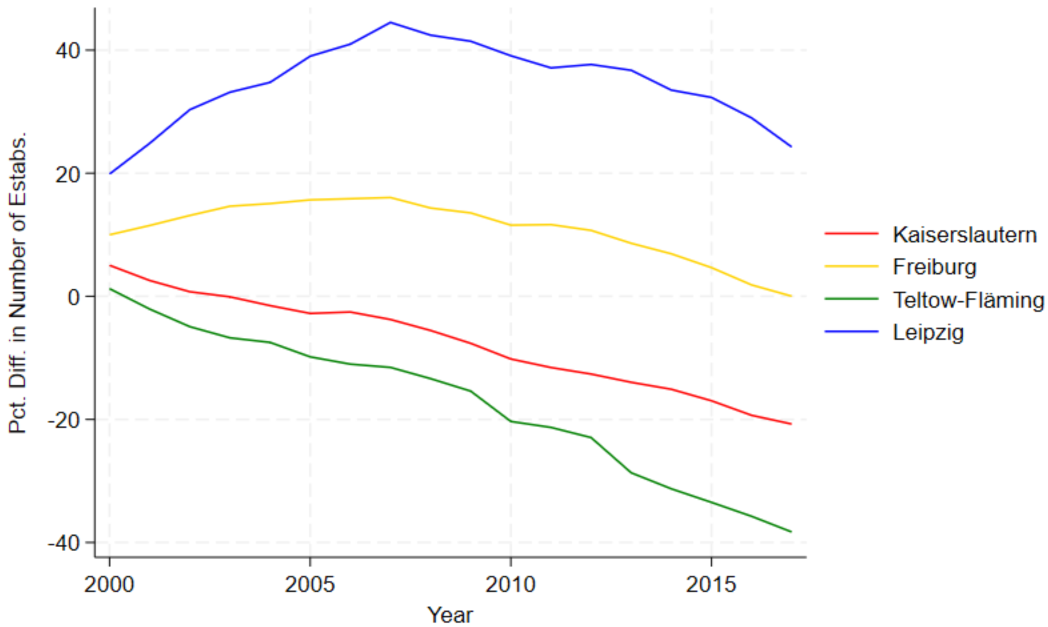
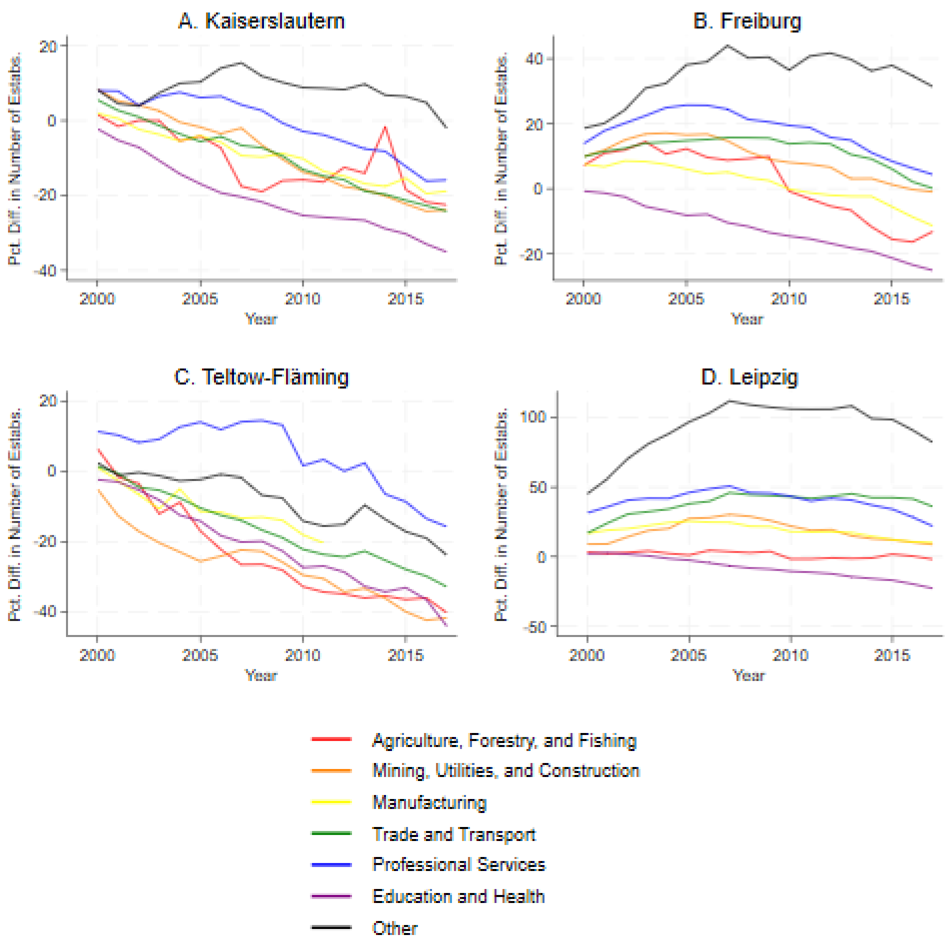


Figure B.1.13: Case Study: Change in Establishment Counts



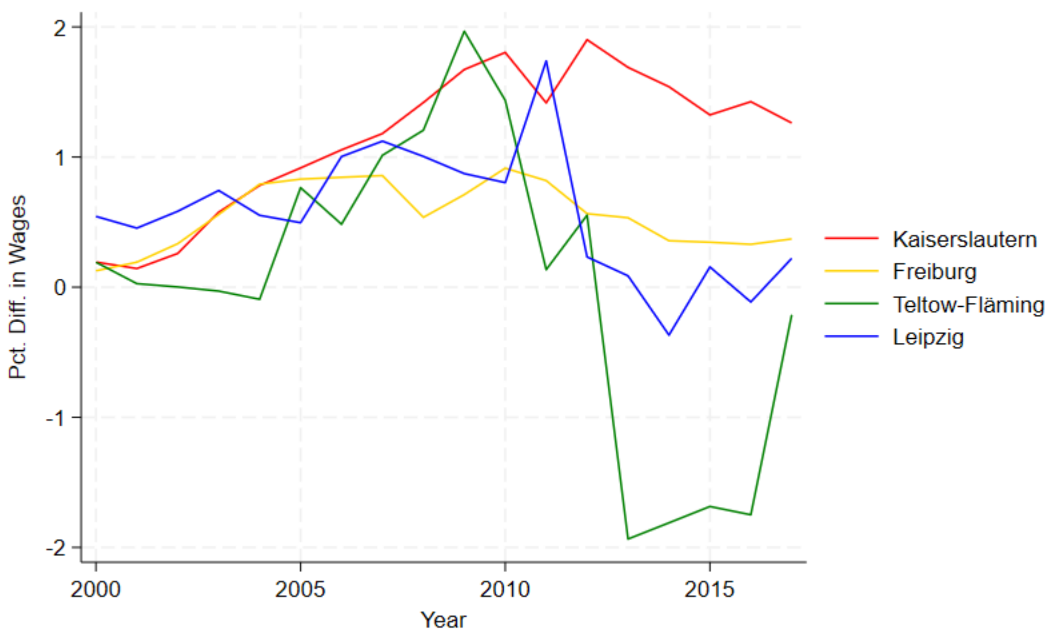
Notes: Each line is the percent difference in the number of establishments under the counterfactual tax policy compared to the actual tax policy in an individual commuting zone. See Section 5 for details on calculations.

Figure B.1.14: Case Study: Change in Establishment Counts by Industrial Sector



Notes: Each line is the percent difference in the number of establishments under the counterfactual tax policy compared to the actual tax policy in an individual commuting zone and industrial sector. See Section 5 for details on calculations.

Figure B.1.15: Case Study: Change in Wages



Notes: Each line is the percent difference in the wages under the counterfactual tax policy compared to the actual tax policy in an individual commuting zone. See Section 5 for details on calculations.

B.2 Additional Tables

Table B.2.1: Correlation of Taxes Within Commuting Zone

	(1) CZ FE	(2) Year FE	(3) Interacted	(4) Leave-out average
R^2	0.417	0.116	0.550	0.541

Notes: Table shows the share of variance in municipal tax rates attributable to to commuting zone and time effects. The dependent variable in the regression is the municipal corporate tax rate multiplier in all specifications. Column 1 includes only commuting zone fixed effects, column 2 year fixed effects, and column 3 commuting zone x year fixed effects. In column 4, the independent variable is the leave-out average of the corporate tax rate multipliers of other municipalities in the same commuting zone.

Table B.2.2: Union Coverage Rates by Industrial Sector

	Year					
	1999		2008		2017	
	Union Coverage Rates		Union Coverage Rates		Union Coverage Rates	
	Actual	Effective	Actual	Effective	Actual	Effective
Industrial Sector						
Ag., For., Fish.	.2938144	.5876288	.3246269	.5858209	.255102	.5238096
Mine., Util., Cons.	.6240115	.8562186	.6048995	.8090453	.5212299	.7701318
Manu.	.589545	.803001	.4448469	.7293382	.3114391	.6243542
Trade, Transp.	.5534247	.7380822	.3917842	.6594114	.2529448	.5424675
Prof. Serv	.5010526	.6705263	.3507507	.5459459	.2083847	.4266338
Edu. and Health	.6467348	.8623132	.5222458	.7897246	.4421801	.7464455
Other	.7411624	.873577	.6845582	.821635	.5912818	.7345706

Notes: Author's calculation using the IAB establishment panel. Actual coverage defined as a plant subject to a sectoral or a plant-specific union contract. Effective coverage includes plants not subject to the agreements but abide by the contractual minimums.

Table B.2.3: Response of the Share Ratio to Taxes, Spillovers, and Outside Option

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	2.856	4.141**	4.162**	2.530**	4.813***	-0.955	5.882***
	(3.223)	(1.819)	(1.830)	(1.129)	(1.557)	(1.853)	(1.607)
Outside Option	-3.000***	-2.058***	-0.917*	-2.755***	-4.068***	-0.933	-2.812***
	(0.773)	(0.480)	(0.509)	(0.356)	(0.488)	(0.571)	(0.489)
Input-Output	0.396	0.160	0.675	-0.920	-1.583	-0.570	-2.327***
	(0.625)	(1.107)	(0.833)	(0.881)	(1.502)	(0.798)	(0.877)
Labor Correlation	1.067	-61.19***	-55.22***	10.87	-24.38**	-18.81	14.13**
	(7.746)	(15.76)	(20.65)	(14.29)	(10.18)	(14.76)	(6.290)
Knowledge	-0.0119	0.0301	0.0778**	0.00474	0.0139	0.00588	0.0209
	(0.0609)	(0.0270)	(0.0313)	(0.0191)	(0.0245)	(0.0309)	(0.0219)
N	2561	2660	2637	2660	2657	2654	2660
F	10.97	74.54	64.89	183.2	94.10	46.63	89.34

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Results of the IV empirical specification equation (9) with spillover and outside option instruments constructed as shown in equation (11). Each column is an industrial sector. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level. See section 3 for details on the construction of the variables of interest.

Table B.2.4: Response of the Share Ratio to Taxes, Spillovers, and Outside Option: Alternative Sector Definition

	Ag. For. Fish.	Mine., Util., Constr.	Goods Manu.	Chem., Pharm. Manu.	Metal. Manu.	Elec. Manu.	Mach. Manu.	Other Manu.
Tax	-2.556	-0.327	-5.017**	-3.175	-8.554***	-3.759	-4.289	-8.144***
	(2.717)	(1.783)	(2.520)	(2.747)	(3.102)	(3.608)	(3.032)	(2.322)
Outside Option	-4.479***	-4.720***	0.192	-3.013***	-3.053***	-1.774	-1.655	0.237
	(1.421)	(0.776)	(1.337)	(1.027)	(0.944)	(1.326)	(1.312)	(1.134)
Input-Output	-1.118***	-1.710	-2.222**	0.110	-0.453	0.762	-0.342	0.582**
	(0.245)	(1.386)	(0.968)	(0.907)	(0.365)	(1.398)	(0.754)	(0.241)
Labor Correlation	33.62***	-7.226	-15.04	-63.02**	-19.48	26.39**	-2.125	-79.90***
	(10.48)	(5.783)	(24.74)	(27.44)	(30.06)	(11.64)	(19.25)	(20.46)
Knowledge	-0.0187	0.0275	-0.00278	0.0264	0.113**	0.0815	0.0252	0.0240
	(0.0618)	(0.0265)	(0.0452)	(0.0662)	(0.0444)	(0.0684)	(0.0576)	(0.0602)
N	2561	2660	2381	1978	2390	1624	2001	2004
F	7.382	81.77	22.94	17.69	22.32	14.55	24.21	17.51

	Trade	Trans., Logis.	Arts, Rec.	Media, Comm.	Tech. Serv.	Bus. Serv.	Edu., Health	Other
Tax	2.011	1.051	0.888	-1.659	1.263	0.184	-0.591	2.880**
	(1.450)	(1.943)	(2.801)	(3.191)	(2.034)	(1.898)	(1.300)	(1.464)
Outside Option	-5.976***	-4.055***	-9.214***	-1.879	-5.333***	-4.423***	-1.602**	-2.673***
	(0.670)	(0.862)	(1.207)	(1.171)	(0.921)	(0.709)	(0.816)	(0.620)
Input-Output	1.411***	0.516	1.041***	4.964**	1.225	-0.786	0.129***	-1.490***
	(0.346)	(0.470)	(0.254)	(2.106)	(0.748)	(0.808)	(0.0415)	(0.458)
Labor Correlation	-12.49	-7.913	-30.95***	-56.55***	-57.86**	-40.86***	-5.515	-13.76**
	(8.124)	(15.53)	(10.29)	(20.70)	(28.87)	(12.20)	(15.01)	(6.877)
Knowledge	0.00649	-0.0602*	0.0932*	-0.0130	0.00663	-0.00323	0.00915	0.00305
	(0.0186)	(0.0333)	(0.0553)	(0.0607)	(0.0344)	(0.0385)	(0.0297)	(0.0230)
N	2660	2615	2423	2098	2636	2645	2654	2659
F	84.48	45.67	228.3	18.61	59.27	65.53	48.51	82.29

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Results of the IV empirical specification equation (9) with spillover and outside option instruments constructed as shown in equation (11). Each column is an industrial sector. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level. See section 3 for details on the construction of the variables of interest.

Table B.2.5: Heterogeneity of Results by AKM Establishment Effect

Panel A: Above-Median AKM Effect

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	-0.985	3.428	-7.101***	3.263	-0.288	-7.159*	7.582***
	(3.162)	(2.496)	(2.705)	(2.043)	(2.823)	(4.030)	(2.353)
Outside Option	-0.288	0.0937	2.443***	-1.708***	-1.409*	0.880	0.250
	(0.783)	(0.774)	(0.855)	(0.547)	(0.804)	(0.898)	(0.630)
Input-Output	0.749	0.509	-1.269	-1.596	-1.659	-1.327	-2.181
	(0.621)	(1.373)	(0.996)	(1.250)	(2.118)	(1.072)	(1.559)
Labor Correlation	-1.234	-57.60***	-20.96	5.152	-10.65	-27.78	12.92
	(7.747)	(18.50)	(31.61)	(23.14)	(13.53)	(29.76)	(8.421)
Knowledge	0.0105	0.0128	-0.0502	-0.0501*	0.0406	-0.0377	0.00946
	(0.0624)	(0.0342)	(0.0609)	(0.0303)	(0.0403)	(0.0535)	(0.0569)
N	1426	2590	2179	2641	2456	2302	2551
F	17.32	26.34	28.47	48.04	28.80	17.26	29.53

Panel B: Below-Median AKM Effect

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	-0.0279	4.477	-1.025	1.883	7.408***	2.417	2.617
	(3.467)	(2.744)	(2.459)	(1.982)	(2.587)	(3.458)	(2.283)
Outside Option	-4.297***	-3.439***	-1.758**	-4.290***	-6.709***	-0.660	-4.128***
	(0.865)	(0.777)	(0.752)	(0.541)	(0.798)	(0.743)	(0.642)
Input-Output	-0.0875	-1.205	2.507**	-1.390	-6.287***	0.122	-0.718
	(0.668)	(1.570)	(0.979)	(1.462)	(2.437)	(1.033)	(1.493)
Labor Correlation	14.33**	-75.07***	-65.96**	29.02	-33.90**	17.94	3.621
	(6.778)	(22.10)	(30.49)	(22.47)	(14.25)	(27.68)	(7.845)
Knowledge	-0.0550	0.0311	0.0875*	0.0323	-0.0366	0.0909*	-0.00213
	(0.0627)	(0.0597)	(0.0468)	(0.0334)	(0.0483)	(0.0477)	(0.0400)
N	1479	2547	2332	2656	2569	2424	2550
F	35.49	19.74	23.36	49.76	33.49	24.75	17.75

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Results of the IV empirical specification equation (9) with spillover and outside option instruments constructed as shown in equation (11). Each column is an industrial sector. The sample is split by AKM establishment effect, with the median value defined at the sector-year level. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level. See section 3 for details on the construction of the variables of interest.

Table B.2.6: Heterogeneity of Results by Establishment Size

Panel A: Above-Median Size

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	-0.333	6.412***	1.145	1.981	4.984**	-5.244	5.498***
	(3.293)	(2.374)	(2.146)	(1.261)	(1.966)	(3.987)	(1.909)
Outside Option	-2.415***	-2.601***	-0.122	-2.124***	-4.143***	0.128	-2.156***
	(0.803)	(0.624)	(0.631)	(0.404)	(0.617)	(0.869)	(0.514)
Input-Output	0.296	-0.550	2.547**	-0.706	-2.226	-2.281*	-3.647***
	(0.581)	(1.384)	(1.120)	(1.098)	(1.918)	(1.173)	(1.157)
Labor Correlation	11.44	-75.14***	-86.73***	-7.134	-19.09	-34.25	8.275
	(7.518)	(20.04)	(29.13)	(16.75)	(12.54)	(27.82)	(6.515)
Knowledge	-0.110*	0.00504	0.0672	0.00936	0.0106	-0.0241	0.0279
	(0.0631)	(0.0378)	(0.0462)	(0.0268)	(0.0372)	(0.0455)	(0.0355)
N	2143	2634	2535	2659	2619	2586	2634
F	17.92	43.31	31.88	108.4	52.61	30.55	63.38

Panel B: Below-Median Size

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	1.344	2.978	1.391	3.236**	7.450***	3.738*	7.284***
	(3.350)	(1.929)	(2.378)	(1.293)	(2.008)	(2.230)	(1.822)
Outside Option	-2.366***	-1.467***	-0.591	-2.905***	-4.395***	-1.161	-3.061***
	(0.863)	(0.543)	(0.691)	(0.422)	(0.617)	(0.708)	(0.545)
Input-Output	0.596	0.0464	-0.0591	-0.641	-2.952	0.546	-1.545
	(0.649)	(1.088)	(1.077)	(0.950)	(1.812)	(0.875)	(1.131)
Labor Correlation	-8.029	-53.05***	-40.53*	26.62*	-31.47***	11.24	16.72**
	(7.297)	(14.53)	(23.45)	(15.42)	(11.05)	(20.05)	(7.085)
Knowledge	0.0410	0.0420	0.0412	0.0157	0.0206	0.00614	0.0336
	(0.0659)	(0.0277)	(0.0385)	(0.0225)	(0.0310)	(0.0382)	(0.0309)
N	2385	2659	2575	2658	2653	2631	2653
F	6.034	57.93	35.11	159.0	63.28	33.38	57.01

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Results of the IV empirical specification equation (9) with spillover and outside option instruments constructed as shown in equation (11). Each column is an industrial sector. The sample is split by establishment size (number of employees) with the median value defined at the sector-year level. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects as well as controls for the market size parameter pre-estimated as outlined in Appendix Section A.1, share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers. Standard errors are clustered at the commuting-zone level. See section 3 for details on the construction of the variables of interest.

Table B.2.7: Results Excluding Market Size Control

	Ag. For. Fish.	Mine., Util., Constr.	Manu.	Trade, Transport	Prof. Serv.	Edu., Health.	Other
Tax	2.962	5.317***	4.521**	4.348***	8.277***	0.418	7.434***
	(3.174)	(1.856)	(1.832)	(1.151)	(1.820)	(2.133)	(1.489)
Outside Option	-2.915***	-1.217***	-0.701**	-1.438***	-2.059***	-0.111	-1.828***
	(0.532)	(0.252)	(0.336)	(0.236)	(0.258)	(0.378)	(0.352)
Input-Output	0.399	0.143	0.729	-1.249	-1.635	-0.402	-2.582***
	(0.626)	(1.097)	(0.853)	(0.897)	(1.492)	(0.857)	(0.881)
Labor Correlation	0.902	-61.81***	-56.23***	9.184	-33.70***	-18.28	10.72*
	(7.531)	(15.61)	(20.69)	(14.40)	(11.51)	(15.07)	(6.475)
Knowledge	-0.0119	0.0308	0.0780**	0.00523	0.0176	0.00609	0.0210
	(0.0609)	(0.0271)	(0.0312)	(0.0192)	(0.0253)	(0.0306)	(0.0219)
N	2561	2660	2637	2660	2657	2654	2660
F	3.472	4.407	6.855	5.799	4.295	1.542	4.087

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Results of the IV empirical specification equation (9) with spillover and outside option instruments constructed as shown in equation (11). Each column is an industrial sector. The sample is split by establishment size (number of employees) with the median value defined at the sector-year level. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers are log transformations, while the labor correlation spillovers are an inverse hyperbolic since transformation. All regressions include commuting zone and year fixed effects, and controls for the share highly/medium qualified workers, share women, share full-time workers, share prime aged workers, and share German workers but not the market size parameter pre-estimated as outlined in Appendix Section A.1. Standard errors are clustered at the commuting-zone level. See section 3 for details on the construction of the variables of interest.