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

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Abstract

To study how the effects of corporate taxation on local economic activity are impacted by establishment labor market power, I develop a model of the location choice of new establishments incorporating monopsonistic labor markets and corporate taxes. Reduced-form estimates of a model-derived equation using German administrative data indicate that establishments prefer lower taxes, but the degree to which worker outside options matter in the location decision varies between industries. I also quantify the effects of a counterfactual place-based tax incentive and find that a commuting zone's response to the place-based policy depends on the degree of labor market power in that commuting zone. More monopsonistic labor markets derive greater benefit from the place-based policy.

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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 by changing local labor demand (Allen and Arkolakis, 2023; Diamond and Suárez Serrato, 2025). Therefore, how new establishments make this decision is of critical interest to governments, which develop place-based policies in an attempt to revitalize underdeveloped regions.

In this paper, I study the determinants of the location choice of new establishments with a focus on monopsony power, worker outside options, and corporate taxes using a tractable model-derived estimating equation. Using model counterfactuals, I then study the effects of place-based tax incentives designed to attract establishments to particular geographic areas. With these counterfactuals, I demonstrate that the degree of monopsony power in local labor markets determines both the direction and magnitude of the change in the number of the establishments as a result of the policy.

To my knowledge, this is the first paper to examine the interplay between tax policy and monopsony power for establishment location decision. The semi-structural approach allows me to formalize the interaction between the two while remaining sufficiently general to allow heterogeneous valuations of input factors for each industry. It also allows me to estimate the effect of place-based tax incentives over time explicitly accounting for the entry of new establishments due to changing worker outside options and productivity. A purely reduced-form analysis would miss these effects, while my reduced-form estimation using the tractable model equation allows me to estimate effects with a clear theoretical basis.

In my model, I incorporate five key ingredients into the establishment location choice problem: corporate tax rates, market size, monopsony power, worker outside options, and differentiated location productivity. I 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 also show that monopsony power directly interacts with worker outside options and local productivity in the establishment location choice problem. As a result of this, the effect of a change in worker outside options on the location choice of establishments is larger in more competitive labor markets.

I implement this method using establishment-level data from Germany and a Bartik instrument approach - taking advantage of a setting with local determination of corporate taxes and relatively high unionization rates with sectoral bargaining. This enables me to utilize quasi-experimental variation in local corporate taxes, and to construct proxies for worker outside options using union minimum wage rates. Furthermore, rich administrative panel data allows me to control for (using empirical proxies and location fixed effects) other factors, such as agglomeration economies, which could directly influence a location's productivity and potentially bias my results.

My empirical findings point to the conclusion that establishments have a relatively uniform aversion to taxes across industrial sectors, but heterogeneous responses to worker outside options across industrial sectors. 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. 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 responses among the five other sectors (mining, utilities, and construction; manufacturing; trade and transportation; professional services; and other services) where the effect of taxes is negative and statistically significant, as point estimates are similar.

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.

Using the estimated coefficients from my empirical specification, I conduct model counterfactuals to study the effects of a place-based tax incentive designed to attract establishments to particular locations. Such a policy has both primary (tax-induced) and secondary (i.e. subsequent changes to worker outside options) effects. I show theoretically that the overall percent change in establishments due to the tax policy depends directly on the interaction between monopsony power and worker outside options - with more competitive labor markets acting as an amplifier of the secondary effects of the policy. Thus, the degree of monopsony power in a commuting zone is a strong predictor 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. As a result, more monopsonistic areas receive more benefit from the place-based policy, in terms of establishment growth and wages, compared to more competitive areas. A purely reduced-form analysis of taxes on entry would not be able to quantify these effects, as they represent indirect and secondary effects of the policy.

This heterogeneity is relevant, because there is a great deal of variation in response to the tax policy in the counterfactual world. In my counterfactuals, in terms of the wage impacts the effects range from -0.6% to 4.1%, with an average effect of 0.94%. 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), 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 9 years ranges from approximately -30% to 74%, with an average effect of 10.19%.

These results are more heterogeneous than the average in the literature, which typically finds positive employment effects of firm subsidy policies in the European Union (Neumark and Simpson, 2015). This is explained by the interaction between outside options 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, growth in the number of establishments as a result of a tax policy, are consistent with reduced-form findings of positive employment effects. Furthermore, high variance of policy effects has been shown to be a common feature of place-based policies when it has been studied. Effects are heterogeneous across space, and variance of effect size can be larger than the mean (Greenstone et al., 2010; Devereux et al., 2007; Becker et al., 2013). I am able to reproduce this high variance using my counterfactuals, and demonstrate that the degree of labor market power is a strong predictor of the effect size.

This paper relates to a number of other literatures in labor, urban, and public economics. Previous empirical 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 (Allen and Arkolakis, 2023, 2025). 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; Lindenlaub et al., 2024), finding that monopsony power impacts the distribution of establishments across space, but these papers do not study the interplay of monopsony power and corporate taxes. Papers focused on the impact of taxation on the geographic distribution of economic activity also traditionally assume establishments are entering perfectly competitive labor markets (Albouy, 2009; Suárez Serrato and Zidar, 2016; Fajgelbaum et al., 2018). This paper focuses on the effects of tax policy in the context of imperfectly competitive labor markets, and shows that incorporating these monopsonistic labor markets is key to fully understanding the effects of these tax policies.

While this paper does not study agglomeration effects directly, it has been shown in previous literature that accounting for agglomeration economies is essential to accurately estimate the impact of taxes on establishment location as well as the effects of place-based policies (Jofre-Monseny and Solé-Ollé, 2010; Fajgelbaum and Gaubert, 2020). I follow the urban economics literature in constructing empirical proxies for these forces to act as regression controls (Ellison et al., 2010). That my estimation strategy is flexible enough to allow heterogeneous valuations of input factors for each industry is also important, since there is also evidence that the relative contribution of types of spillovers may differ for establishments in different industries (Rosenthal and Strange, 2004; Hanlon and Miscio, 2017; Faggio et al., 2020).

This paper confirms results from previous literature that establishments value low taxes in their location choice, and provides evidence that the heterogeneous valuation of worker outside options and differential degrees of monopsony power impact the long-term effects of spatially targeted tax policies. In particular, the interplay between worker outside options and monopsony power explains why the same place-based policy may have different effects in different locations, as seen empirically in Greenstone et al. (2010), Devereux et al. (2007), and Becker et al. (2013).

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

In this section, I derive a tractable estimating equation relating the share of establishments choosing a particular location in geographic space to taxes, monopsony power, worker outside options, market size, and market-level productivity. I also demonstrate that monopsony power and worker outside options interact directly with one another in the estimating equation, and that as a result the marginal effect of a change in worker outside options on establishment location choice is larger when markets are more competitive. Compared to a purely reduced-form approach, relating the model to a tractable estimating equation allows me to conduct counterfactual analysis in Section 5 to better understand the impacts of public policies attempting to attract establishments to particular geographic locations.

I model new establishments' location choice, where they choose optimal locations and wages, 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 using a differentiated-products framework, where "products" are locations with different characteristics.

For simplicity, I assume that only new establishments choose a location; incumbents do not.[1] I additionally assume the mass of new establishments is fixed with no endogenous entry margin, but in Appendix A.5 I relax this assumption and provide bounds for my main counterfactual results. In addition, I assume that workers search only within their own geographic area for work. 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 sub-

[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 that are not spin-offs of existing establishments.

stantial 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, and face a fixed output price normalized to one.

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. The coefficient μ_c is the elasticity of labor supply to the establishment, which reflects the degree of monopsony power enjoyed by establishments in location c (Card et al., 2018). The term 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 choice equation of workers.[3] Assuming the number of establishments is sufficiently large in each location that firms are not strategically

[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 they 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.

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

interacting in their wage setting, this logit-choice equation may be approximated by an exponential probability p_{icjt}.

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

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 $L_{cjt}(w_{cjt})$ to 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 and corporate taxes for each market are denoted by τ_{ct}. I remain agnostic about the exact form of the productivity β_{ctm}, 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.

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

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

Workers' wages fall somewhere between their marginal product of labor β_{ctm} and their outside option b_{ct}. When $\mu_c = \infty$ workers are paid their marginal product, and markets are perfectly competitive. When $\mu_c = 0$ workers are paid their outside option. Worker wages are increasing in both their productivity and their outside options, but in more competitive (monopsonistic) labor markets the productivity (the outside option) is more important in wage determination.

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 Optimal Location Choice

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 that 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).[5]

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

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 worker outside options in this equation, as was the case in the wage equation. The partial effect of an increase in outside options on the share-ratio makes the importance of this interaction even more clear:

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

When a market is more competitive (μ_c is larger) the effect of an increase in outside options on the location choice of the establishment is larger than in more monopsonistic markets. Intuitively, this is because the degree of adjustment to the change is higher in more competitive markets. Wages rise for the establishments exposed to the outside option change, and worker labor supply also adjusts per equation (3). Because of this, the overall effect for the establishments is larger in more competitive markets.

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

[5] 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.1 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.

2.4 Estimating Equation

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

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

where X_{ctm} is a vector of observable location characteristics, $Spillovers_{ctm}$ are empirical proxies for agglomeration spillover forces which will be described in Section 3, γ_c are location fixed effects, and ζ_t are year fixed effects. 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 Section 4.1. I also estimate monopsony power μ_c separately using the method of Bassier et al. (2022), described in Section 4.1. I demonstrate in a robustness check in Section 4.4 that the coefficients of interest β_1 and β_3 in the regression are not sensitive to these pre-estimations.

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, β_{ctm}, and the outside option available to workers, b_{ct}. For the empirical specification, I construct an empirical proxy for the outside option b_{ct} which will be explained in detail in Section 3.

Since I cannot control for productivity (β_{ctm}) directly, I control for a number of location characteristics X_{ctm} which may be correlated with productivity, such as share of highly educated workers.[6] Remaining features of the location that may be correlated with productivity but are not directly observed, such as natural advantage, are captured by the location fixed effect γ_c.

[6]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.

3 Data, Summary Statistics, and Variable Construction

In this section, I outline the various data sources I use to estimate my coefficients of interest, β_1 and β_3. I first describe my main source of data on individual establishments, second the empirical proxy for worker outside options, third the corporate tax data, and finally the empirical proxies I use to control for three different types of spillovers. After combining these sources of data, the main analysis dataset is a commuting-zone-by-year panel spanning 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.[7] In Online Appendix A.2, I describe adjustments to the structural equations and bounding exercises for my empirical and counterfactual analysis to account for the fact that I cannot link establishments to parent firms. The data cover all establishments with at least one employee eligible for social security. The data consist 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.

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

[7]Establishments cannot be linked across locations to a parent firm, but all establishments of the same firm and 5-digit industry in one municipality are combined. For example, Lidl grocery stores in Berlin are combined into one line in the data, but I cannot link Lidl in Berlin and Lidl in Munich as being associated with the same firm.

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 a similar number 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.

3.2 Outside Options

I construct an empirical proxy for the outside option of workers within a market. I follow the approach of Card et al. (2013) and construct the outside option b_{ct} as a weighted average of sectoral union minimum wage rates, where the weights are the establishment shares.

$$b_{ct} = \sum_{m=1}^{M} \frac{N_{ctm}}{\mathcal{N}_{ct}} b_{ctm} \tag{10}$$

where N_{ctm} is the number of establishments in the sector-year-location cell, and b_{ctm} is the union minimum wage rate in the sector-year-location cell.

Union coverage in Germany is much higher than in the United States; Online Appendix Table B.2.1 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.[8] In addition, the data contains information about whether plants not covered by the sectoral contracts abide by them. Plants that 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% coverage 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.

There is no central repository of union contracts available for Germany, but I obtained

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

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 often 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) that map into a single union contract and have sufficiently large 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 by around 100 Euros per year, so I use this to back out an estimated 2017 minimum wage.

The BHP data have information about the wages of low-qualification workers (high school or less, no vocational qualification) at the establishment. For establishments with 20 or more employees, I plot the wage distribution of these low-qualification employees in Figure 1 along with the estimated minimum wage rates described above. As can be seen in Figure 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.[9,10]

[9]There are a small number of establishments that pay below 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.

[10]Online Appendix Figure B.1.2 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 options compared to former West Germany.

3.3 Corporate Taxes

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 for governments to provide tax breaks for specific establishments or firms without a special exemption from the European Commission (EU2, 2008, 2016). Rates do not vary between industrial sectors with the exception of some exemptions for the agricultural sector - the implications of which I discuss in Section 4.3.[11] I have aggregated these municipal tax rates to the commuting zone level using a weighted average with municipal population as the weight.[12,13]

3.4 Proxies for Agglomerating Forces

I incorporate empirical proxies for each of the three classical Marshallian spillovers in my analysis as these spillovers are important components of commuting-zone productivity. 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

[11] 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.

[12] 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.2.2 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.

[13] Online Appendix Figure B.1.3 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, and are lowest in the south and parts of the east.

improve match quality, allow workers to specialize in more specific tasks, or enable establishments to 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 are 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.

$$\text{Spillover}_{ctm} = \sum_{m'=1}^{M} \frac{N_{ctm'}}{\mathcal{N}_{ct}} \text{Pairwise}_{m,m'} \tag{11}$$

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, so own sector spillovers are taken into account), $\frac{N_{ctm'}}{\mathcal{N}_{ct}}$ 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 pairwise proxies in further detail in Online Appendix A.3.

4 Empirical Strategy and Results

4.1 Pre-estimation

4.1.1 Estimation of Elasticity of Labor Supply (μ_c)

I estimate the elasticity of labor supply μ_c 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:

$$s_{ijt} = \sum_j -(\frac{1}{2}\mu_c)\phi_j f^i_{jt} + X_{it} + v_{ijt} \tag{12}$$

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.

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 workers' wages may be polluted by worker wage differences reflecting worker characteristics, such as skill differences.[14]

4.1.2 Estimation of Market Size Term ($\mathcal{L}_{ct}\lambda_{ct}$)

With the estimate of μ_c in hand, I turn to estimation of the market size term $\mathcal{L}_{ct}\lambda_{ct}$. Recall the labor supply equation faced by establishment:

$$L_{ctj}(w_{ctj}) = \mathcal{L}_{ct}\lambda_{ct} exp(\mu_c ln(w_{ctj} - b_{ct}) + a_m) \tag{13}$$

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

$$ln(L_{ctm}(w_{ctm})) - \hat{\mu}_c ln(w_{ctj} - b_{ct}) = ln(\mathcal{L}_{ct}\lambda_{ct}) + a_m + \epsilon_{cjt} \tag{14}$$

where $ln(\mathcal{L}_{ct}\lambda_{ct})$ are the estimated commuting-zone-by-year fixed effects.

[14]Figure B.1.4 shows the distribution of the elasticity estimates across space, and Table B.2.3 provides the exact values for each commuting zone.

4.2 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:

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

There may be bias in the estimates of β_3 and β_5.[15] 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 outside option measure and spillover proxies. 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 outside options and spillover forces with instruments of the general form:

$$\begin{aligned} \text{Spillover}_{ctm} &= \sum_{m'=1}^{M} \frac{N_{m'ct}}{\mathcal{N}_{ct}} \text{Pairwise}_{m,m'} \\ \text{z}_{ctm} &= \sum_{m'=1}^{M} \frac{N_{m'c,1998}}{\mathcal{N}_{c,1998}} * growth_{m't,-c} \text{Pairwise}_{m,m'} \end{aligned} \tag{15}$$

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.[16] 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

[15] 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.

[16] 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.

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 cases where the shocks are industry employment growth rates by viewing $growth_{m't,-c}$ as noisy estimates of some latent true demand shifters.[17]

My preferred location definition is the commuting zone, of which there are 141 in Germany. This definition is preferred for several reasons. First, commuting zones are designed to encompass areas where people both live and work. Therefore, these likely represent the most natural local labor market for workers from an outside option perspective, and as discussed previously (in Section 2) I confirm in my data that mobility rates between these markets are low in the empirical context of Germany. Second, in order to conduct empirical analysis of the location choice of new establishments, the market definition must be aggregated enough that there are a meaningful number of entrants in each location cell.[18] In the absence of sufficient sample size, the empirical estimation would become unstable due to sparsity in the outcome variable, leading to substantial bias.[19] Given my chosen aggregate industrial sector definition, the industrial sector with the highest zero-shares when undertaking analysis at the commuting zone level is the agriculture, forestry, and fishing sector with 3.7%, while the next highest is the manufacturing sector with .8%. In terms of the underlying number of establishments, the median number of new establishments in a cell is 26. I discuss effective sample sizes further in robustness checks in Section 4.4.

For all specifications, taxes, outside options, and input-output spillover proxies are log-transformations. The labor market forces spillovers proxy is an inverse hypersine transfor-

[17]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.

[18]By industrial sector, since as discussed in Section 2.4 the analysis is conducted separately by industrial sector.

[19]Although cutting-edge new estimators are being developed in the industrial organization literature to solve this fundamental problem, in order for identification to hold the sample size must be large (Gandhi et al., 2023). Given the relatively small total number of establishments within an industrial sector entering in any particular year, they are unsuitable for this application.

mation. 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.

4.3 Results

Figure 2 shows the results of the main specification. Each panel shows point estimates of a coefficient of interest as well as 95% confidence intervals.[20] Establishments in most economic sectors have a distaste for taxes.[21] 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 nor the education and healthcare sector demonstrate sensitivity to local tax rates. The agriculture, forestry, and fishing sector is, to some extent, exempted from the local corporate taxes, so it is logical that I would not observe such a response in the data.[22] In the case of education and healthcare, given the inelastic demand for these goods, 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 overlap.

The results also indicate that establishments prefer lower worker outside options. As discussed in Section 2, higher outside options force establishments to pay higher wages. Thus, a negative coefficient on the outside option may be interpreted as demonstrating establishments' preference for their ability to markdown wages they pay to their workforce. As in the case of taxes, six sectors display a preference for lower outside options in their choice

[20] Online Appendix Figure $B.1.5$ shows the corresponding OLS results. Online Appendix Table $B.2.4$ shows the exact point estimates, including for the agglomeration proxies, and F statistics for each specification.

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

[22] 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.

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 only the education and health sector does not. With respect to outside options, there is stronger evidence of heterogeneous responses by industrial sector than for taxes. 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 than four times as large.

These differential responses by industrial sectors to outside options are important in explaining the differential impact of similar or identical public policies across geographic space. For example, a policy increasing union minimum wage rates would make a location much less attractive to professional services establishments, but no less attractive to education and health establishments. I explore the implications of these reduced-form results for the design of place-based policies in detail using model counterfactuals in Section 5.

4.4 Extensions and Sensitivity Checks

Extension: Establishment Size One would expect large establishments to behave differently from small establishments for a number of possible reasons. For example, large establishments are likely to be more productive, and may be more exposed to rent-sharing forces than small establishments. To test if there are meaningful differences in behavior between larger and smaller employers, I split the sample into above- and below-median size new establishments, with results shown in Figure 3 (and Online Appendix Table B.2.5). These results do not indicate clear differences between larger and smaller establishments. The point estimates for the coefficients are within overlapping confidence intervals for all sectors. As a caveat, recall from Table 1 that the median establishment is less than five employees; it is possible that very large establishments do behave differently and my sample size is not large enough to detect it.

Extension: Tradability One might expect that there would be differences in how establishments producing tradable goods value a location's characteristics. Table 2 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. 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 thought of as non- or low-tradability (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.

Sensitivity Check: Rental Prices Rental prices are another important factor which may influence establishment location choice, and are a key component in standard spatial equilibrium models (Glaeser and Gottlieb, 2009). The exclusion of rents from the main specification could potentially bias the coefficients of interest if, for example, both new establishment location and union minimum wage rates are influenced by rental prices. In Online Appendix A.4 I show changes to the model equations needed to account for rental prices. The key difference that emerges between the main specification specification and the specification including rental prices is that rents appear in the productivity term of the structural equation. To account for this, I can control for this directly in my reduced form specification with data on rental prices. Data on rental prices for Germany come from the RWI-GEO-REDX dataset maintained by RWI-Essen (Klick and Schaffner, 2021), providing information on relative housing prices within each district.[23] I report the results of the main regression specification controlling for rents in Table 3. As this data are only available from 2008 forward, 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 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.

Sensitivity Check: Definition of Industrial Sector It may be the case that my definition of economic sector is overly broad to capture some nuances of the importance of taxes and outside options within sector. For example, though manufacturing is a single sector in my main specifications, goods manufacturers may face different considerations in their location choice compared to pharmaceutical manufacturers. Table B.2.6 shows the results of the main IV regression for a more disaggregated definition of industrial sector. These results suggest that this may be the case, with heterogeneity in the response to taxes and outside options within the broad industrial sectors used in the main specifications.

However, the results for the finer industry disaggregation have smaller sample sizes and the instrument is often weak. Furthermore, the underlying data are more sparse - i.e., there is a larger proportion of commuting zones with zero or only one establishment in the sector-year pair entering it - which as previously discussed in Section 3 with respect to local market definition can lead to substantial bias in estimates. The weaker instrument combined with the underlying sparsity of the data makes results unstable, and so they should be taken as

[23] Unfortunately, this data are only for residential housing prices rather than commercial real estate prices, but data on commercial prices are not available for Germany to my knowledge. 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 are merged with my main dataset.

suggestive at best.[24]

Sensitivity Check: Pre-Estimation I also test the sensitivity of results to the exclusion of the pre-estimated market size parameter. One should not expect this to make a large difference in the results, given the inclusion of location fixed effects in the main specification. Since the market size parameter moves very slowly over time, most of its effect will be absorbed by the location fixed effect. I confirm this is the case in Appendix Table B.2.7, where results are similar to the main specifications.

5 Counterfactual Analysis: Effects of a Place-Based Policy

The reduced-form results in the previous section provided marginal effects of a change in, for example, corporate taxes on establishment location choice. In this section, I explore aggregate effects of a place-based policy designed to attract establishments to a particular commuting zone using model counterfactuals. Specifically, I simulate a policy where the federal government provides a rebate on local corporate taxes (abstracting from local fiscal effects) for establishments locating in a particular commuting zone, effectively setting the local tax rates to 7% (the lowest legally permitted rate) in treated areas. Such a policy may be thought of as analogous to many types of place-based policies implemented by national governments and supranational organizations, such as the EU. These policies often provide large fiscal incentives for establishments to locate in particular 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. The counterfactual policy is carried out *separately* in each commuting zone rather than in all areas at once, to mimic the most common feature of place-based

[24] The presence of negative coefficients in several sectors for the tax variable also supports that this is a large problem in practice.

policies: that they are geographically targeted.

5.1 The Pivotal Role of Monopsony Power

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 outside options of workers (and agglomeration benefits enjoyed by firms) will have also changed. Figure 4 shows a simplified version of this process. 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 the change in the share ratio due to taxes. Now, in subsequent years the new entrants have moved the level of the outside option, the effects of which are shown in the second graph. In this example, the new establishments have increased workers' outside options, making the location less attractive to firms subsequently, and the dashed line shows an alternative possible path. The overall movement in the share-ratio (which is the linear combination of the movements from taxes and the outside option) as a result of the tax policy is unclear over multiple years. It is possible for there to be negative aggregate effects on entry induced by the tax change as shown in the rightmost panel of Figure 4.

Since the tax policy, after the first year, affects outside options and productivity through the mixture of establishments in a location it is obvious that incorporating worker outside options is key to understanding the impact of these policies. A less obvious - though equally important - implication of the model is that monopsony power - the weight of the outside option in the weighted average in the worker wage equation (5) - also plays a role this process. With slight abuse of notation[25], the partial effect of a change in taxes on the share-ratio of establishments is:

[25] In practice, in the first year, the tax policy has not yet affected the distribution of incumbents.

$$\frac{\partial \ln(\frac{s_{ctm}}{s_{0tm}})}{\partial \tau_{ct}} = -\frac{1}{1-\tau_{ct}} + (1+\mu_c)\frac{\partial[\ln(\beta(\tau_c)_{ctm} - b(\tau_c)_{ct})]}{\partial \tau_{ct}} + (1+\mu_0)\frac{\partial[\ln(\beta(\tau_c)_{0tm} - b(\tau_c)_{0t})]}{\partial \tau_{ct}} \tag{16}$$

The equation shows that the overall effect of a tax policy depends on the interaction of monopsony 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 effect. In more monopsonistic labor markets (where μ_c is closer to 0), the impact of the productivity changes on the overall derivative is smaller than in more competitive labor markets (where μ_c is larger).

Equation (16) 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 (16) will also be negative. This formalizes the intuition from Figure 4 that the overall 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 labor markets act as an amplifier of the secondary effects. 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 Calculating Counterfactual Effects

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

$$ln(\frac{s_{jct}}{s_{j0t}})_{CF} - ln(\frac{s_{jct}}{s_{j0t}})_{actual} = \beta_1[ln(1-\tau_{CF,ct}) - ln(1-\tau_{ct})] \tag{17}$$

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 be one, rearranging implies that:

$$s_{j0t,CF} = \frac{1}{\sum_{ct} \frac{s_{jct,CF}}{s_{j0t,CF}}} \tag{18}$$

Combining equations (17) and (18) 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 calculate the counterfactual numbers of establishments going to each location. Effectively, this assumes that there is no extensive margin and the place-based policy is zero-sum in its effects. The extent to which place-based policies reallocate economic activity across space compared to inducing additional economic activity through fostering of agglomeration economies is a source of debate in the literature (Glaeser and Gottlieb, 2008; Neumark and Simpson, 2015). A lack of extensive margin imposes the former interpretation, but in Appendix A.5 I relax this assumption and provide bounds for my main results.

I use this new distribution of establishments to calculate the counterfactual outside options and agglomeration spillover proxies in all locations.[26] 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 empirical analogue (9), substituting the counterfactual outside options and spillover proxies, and solving for $\beta_{ctm,CF}$.[27]

$$(1+\mu_c)ln[\frac{\beta_{ctm,CF} - b_{ct,CF}}{\beta_{ctm} - b_{ct}}] = \beta_3(b_{ct,CF} - b_{ct}) + \beta_5(Spillovers_{ctm,CF} - Spillovers_{ctm}) \tag{19}$$

Using these counterfactual productivity and outside options I additionally calculate counter-

[26] Recall that these proxies are constructed as weighted averages of union minimum wages and pairwise industry agglomeration measures (see equations (10) and (11)). In the counterfactuals, new entrants change the weights by changing sectoral composition.

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

factual wages using Equation (5). I continue this process iteratively to examine the dynamic secondary effects induced by the tax policy change. A limitation of the partial-equilibrium modeling approach outlined in Section 2 is that a number of model inputs are held constant in counterfactual analysis, most notably the degree of monopsony power μ_c (which I relax in an extension below), and market size $\mathcal{L}_{ct}\lambda_{ct}$.

5.3 Results

5.3.1 Effects of the Place-Based Policy

Figure 5 shows the estimated effects of tax policy if implemented separately in each individual commuting zone beginning in 1999, both after 9 years in 2008 and 18 years in 2017. I.e., each dot represents the effects of the counterfactual place-based policy when implemented (separately) in each commuting zone, while taxes in all other commuting zones remain at their real-world levels. Panel A shows the percent difference in establishments under the counterfactual tax policy compared to the actual tax policy, and Panel B shows the percent difference in wages. In 2008, after 9 years of policy, the mean difference in establishments was 10.19%, while in 2017 after 18 years of policy it was -5.99%. For wages, after 9 years of policy the mean difference was .94%, while after 18 years of policy it was .40%.

The figure also 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. For example, the estimated range for 2008 is from approximately -30% to 74%. Regarding 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 increase being under 5%. Furthermore, in the majority of cases, it seems counterproductive to keep the tax policy in place for a long period. Except for a few winning commuting zones, outcomes are actually worse after 18 years compared to 9 years. This is because the mixture of establishments attracted by the tax policy to the commuting zone is "bad" for the locations, and over longer periods of time the negative secondary effects discussed in Figure 4 begin to dominate the direct positive effects of the tax policy.

High variance of the effects of place-based policies across space has been shown in previous reduced-form literature. For example, the variance of the effects of EU cohesion policy (the EU's main place-based intervention) found in Becker et al. (2013) is higher than the mean of the effect. In Section 5.3.2 below, I explore this heterogeneity further, as understanding factors which produce this heterogeneity is of critical interest to policymakers.

The counterfactual distribution of the wage impacts of the policy is also broadly consistent with results from previous reduced-form studies which study the variance of the effects of place-based policies, although it is 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.[28]

5.3.2 Where are Place-Based Policies Most Effective?

Policymakers may be interested in predicting the effects of a place-based policy in their own location. The correlation in the predicted policy-induced changes in the number of establishments and wages is shown in Online Appendix Figure B.1.6. There is a positive correlation between the two though, as the figure shows, the dispersion is very high. Thus, predicted changes in the number of establishments do not have strong explanatory power for wage effects. This suggests it may be useful to identify predictors of 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 6 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

[28] 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 effects are directly related to one another.

above in Section 5.2, equation (16) 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 6 it must be the case that the second term dominates the first.[29] 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 their goal is to grow 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 policies in areas where they are implemented, which is a highly selected sample of economically depressed areas. These economically depressed areas tend to have more monopsonistic labor markets.[30]

There are no variables which predict the changes in wages as strongly as market power predicts the changes in the number of establishments, though as seen in Panel B, there is a slight correlation between the degree of market power and the wage effects.

[29]Although the third term also plays a role, it will have 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.

[30]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.1.7 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

5.3.3 Extensions

Perfect Competition Taken together, these results suggest that models assuming perfectly competitive labor markets may under-predict possible positive effects of place-based policies in the treated location. To test the assumption, I repeat the counterfactual exercise assuming lesser monopsony power and constant monopsony power across space.[31] The results are shown in Online Appendix Figure 7. Compared to the baseline results, assuming less monopsonistic labor markets leads to much lower predicted benefits of a place-based policy in treated locations, and much more similar results across space in terms of establishment growth.[32]

Incorporating Labor Market Evolution The pre-estimation of monopsony power (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 effects 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 estimate the relationship between the two. I then repeat the counterfactual exercise, also allowing movements in the elasticity of labor supply as establishments enter or leave the market. The results are shown in Figure 8. As seen in Panel A, when movements in μ_c are allowed, the estimated growth in establishments is lower, with a wider gap between the baseline and adjusted 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

[31] I impose $\mu_c = 5$, the maximum estimated value in my data is 4.25.

[32] Notably, with respect to wage effects, though the predicted effects are lower in relative terms (as seen in the graph) the absolute wage remains higher in the more competitive world because wages are less marked down in the case of stronger labor market competition.

across commuting zones. As the second term of equation (16) 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 uniform 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.

6 Conclusions

I develop a model of establishment-location choice incorporating corporate taxes, monopsonistic labor markets, and differential worker outside options across labor markets and show it is straightforwardly 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 largely homogeneous responses to taxes, but heterogeneous responses to worker outside options. Establishments in most industrial sectors prefer to pay lower wages as reflected by the coefficient estimates for outside options, but some are indifferent.

Model counterfactuals show that the effects of place-based policies are highly heterogeneous across space due to the types of establishments that are attracted by the place-based policy narrowing the gap between worker outside options and productivity. This is "less bad" in areas with more monopsonistic labor markets, where the positive effects of the tax incentives dominate the negative wage effects for newly entering establishments. As demonstrated by the counterfactuals, small differences in initial conditions can lead to very different effects of the same place-based policy in different locations, making effective policy challenging.

However, the results do demonstrate that more monopsonistic areas benefit more from place-based policies than less monopsonistic areas in practice. This is consistent with recent suggestions from economists about how to design and effectively target place-based policies (Austin et al., 2018). This paper provides evidence that monopsony and worker outside options matter not only for workers living in those areas, but also for the design of public policies targeting establishments or firms - as imperfect local labor markets matter for their decision-making.

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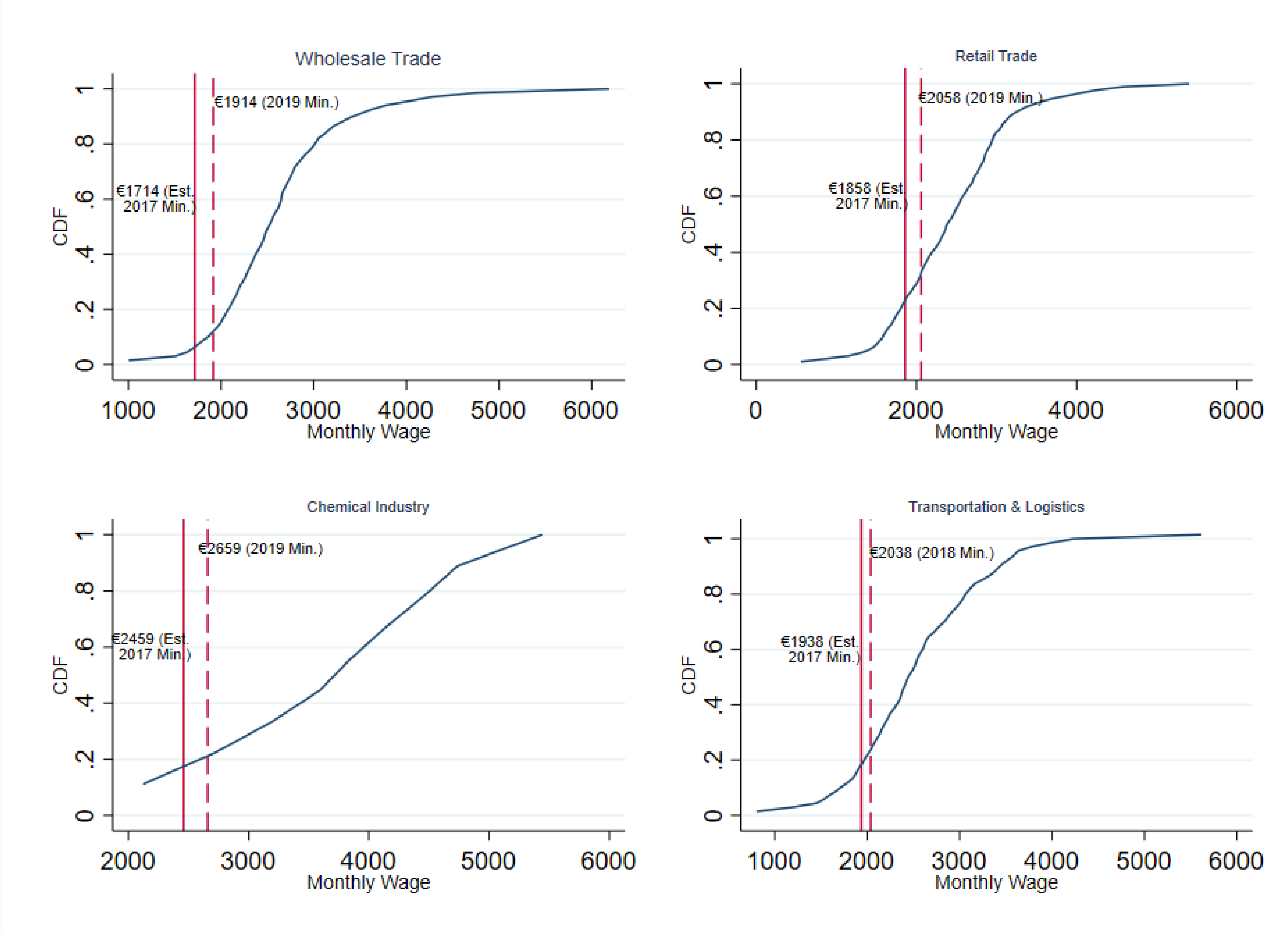
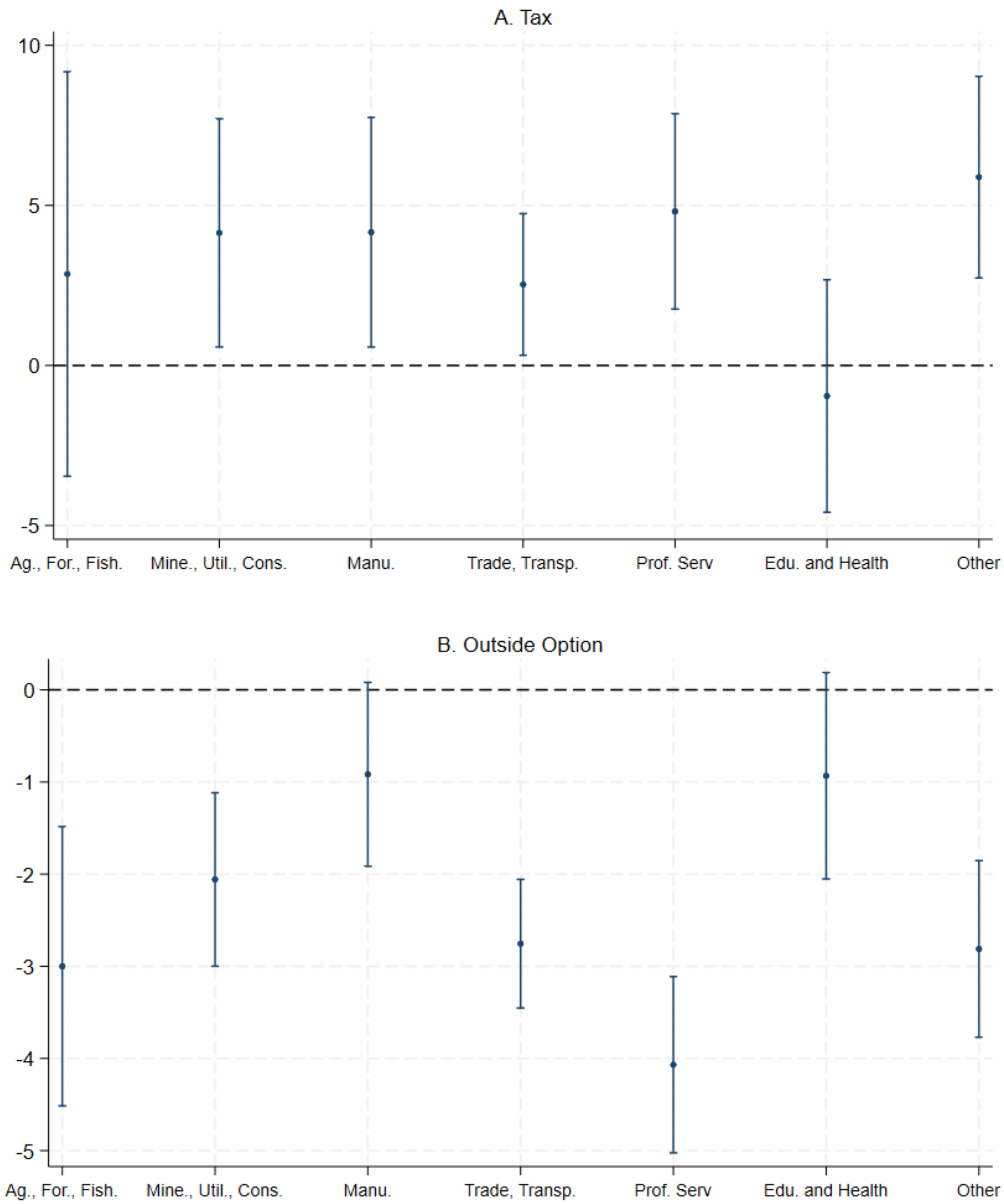
Figures

Figure 1: Imputing Union Minimum Wage Rates



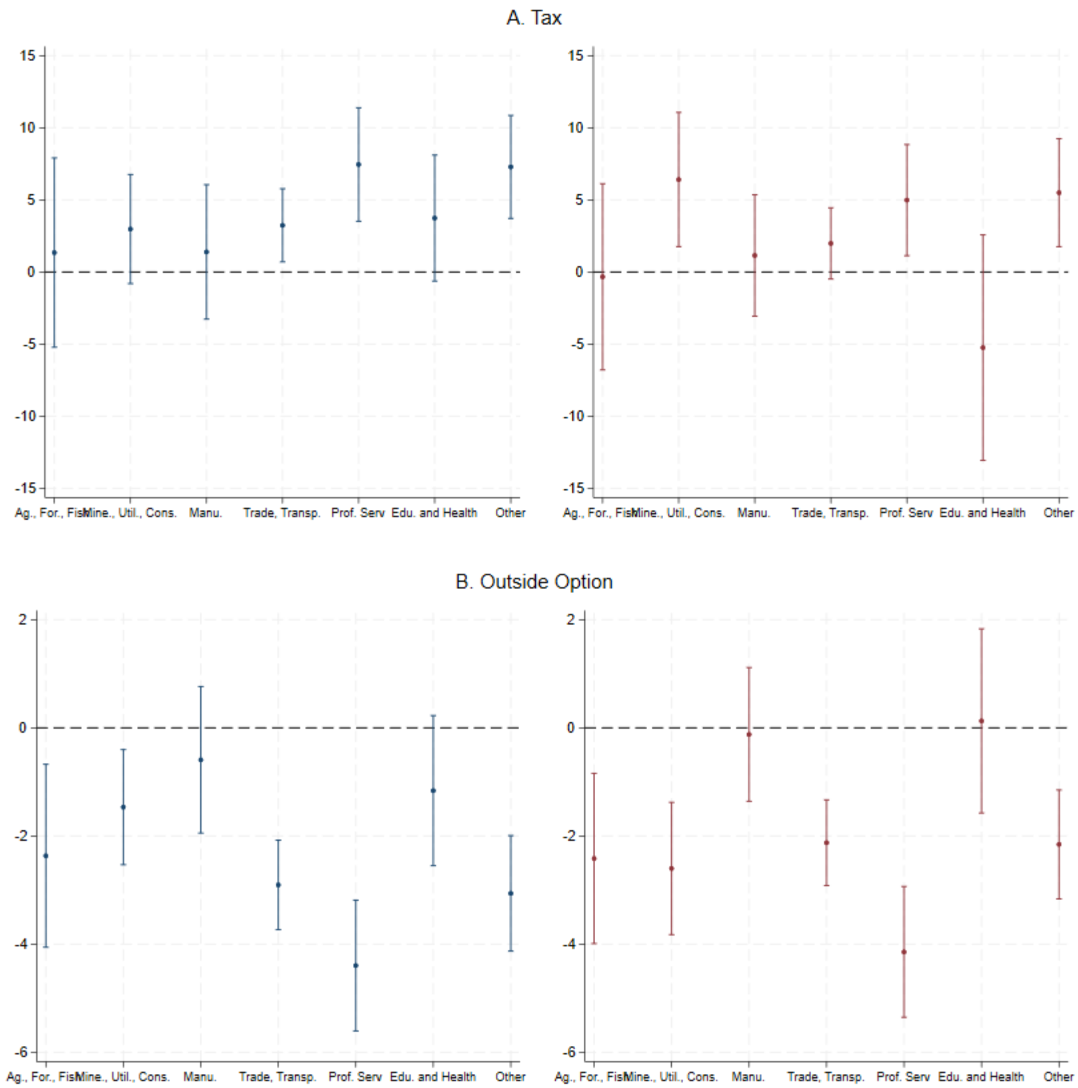
Notes: Figure shows the CDF of the monthly wage levels in the BHP data for low-skill (with a lower secondary, intermediate secondary or upper secondary school leaving certificate but no vocational qualifications) workers at establishments with twenty or more employees in the state of North Rhine-Westphalia 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 3.2 and are shown by the solid red line.

Figure 2: Coefficients by Sector



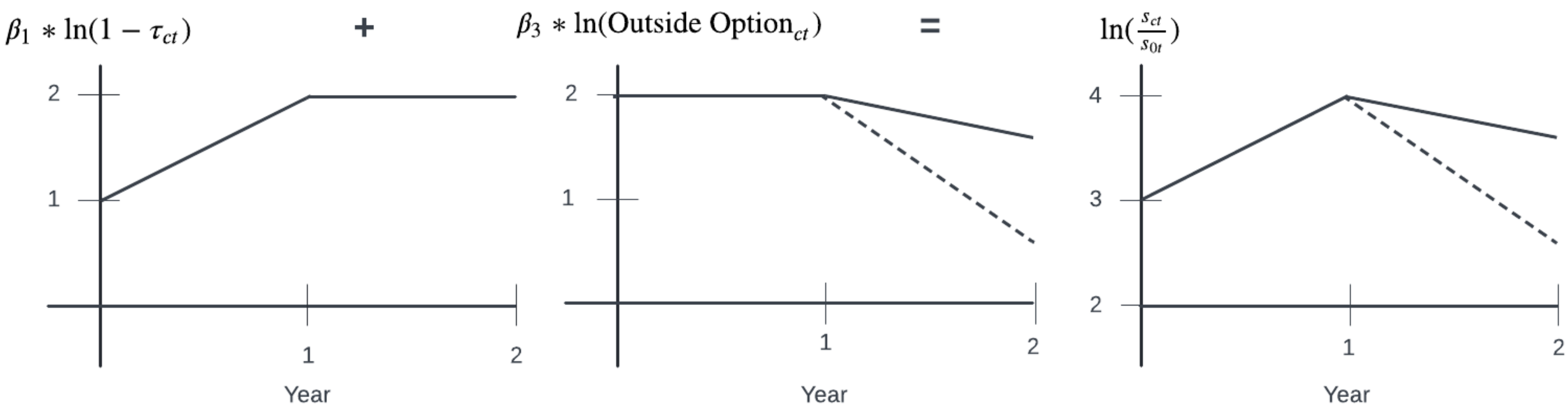
Notes:
These figures show the point estimates of coefficients of the variables of interest for each industrial sector in the instrumental variable regression 9, as well as the 95% confidence intervals. The outcome variable is the log ratio of the share of new establishments locating in a location c compared 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 4.1, 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



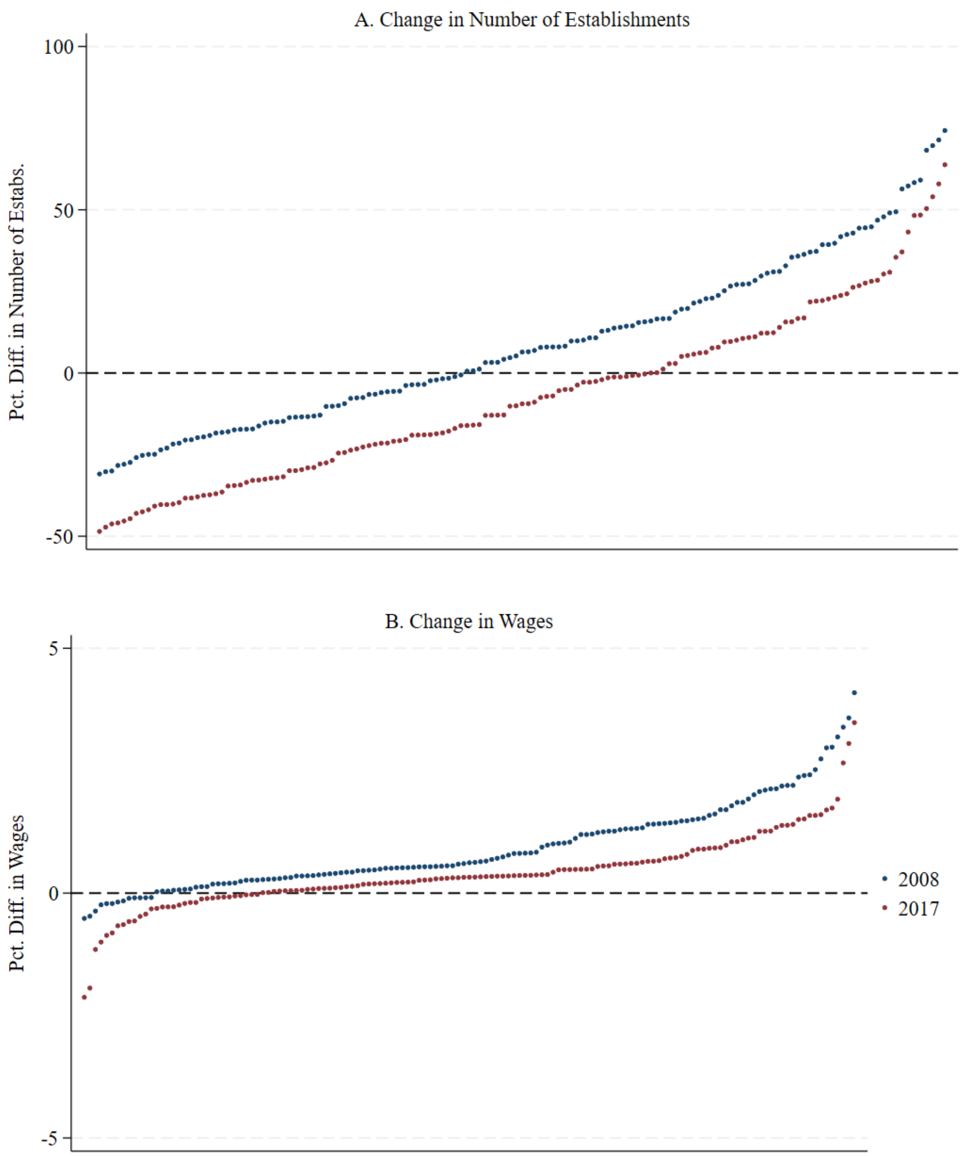
Notes: These figures show the point estimates of coefficients of the variables of interest for each industrial sector in the instrumental variable regression 9, as well as the 95% confidence intervals. Sample is split by establishment size, where size is the total number of employees, with below-median 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 4.1, 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: Illustration of Primary and Secondary Tax Policy Effects



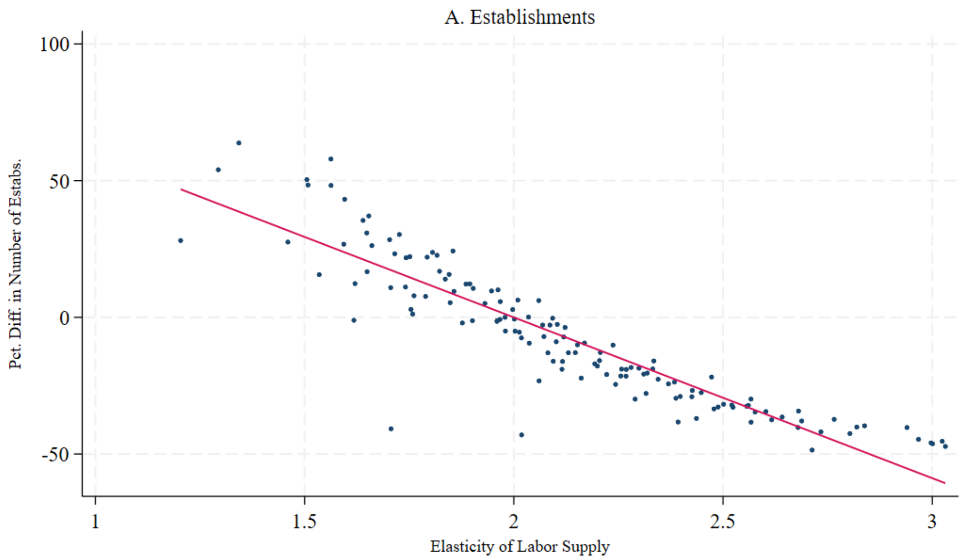
Notes: The leftmost panel shows only the portion of the share ratio from tax effects, and the middle panel the portion of the share ratio from outside option effects. The final panel is the additive combination of both. Time since a tax policy was enacted in t=0. When the tax rate decreases, the share 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 outside options. 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.

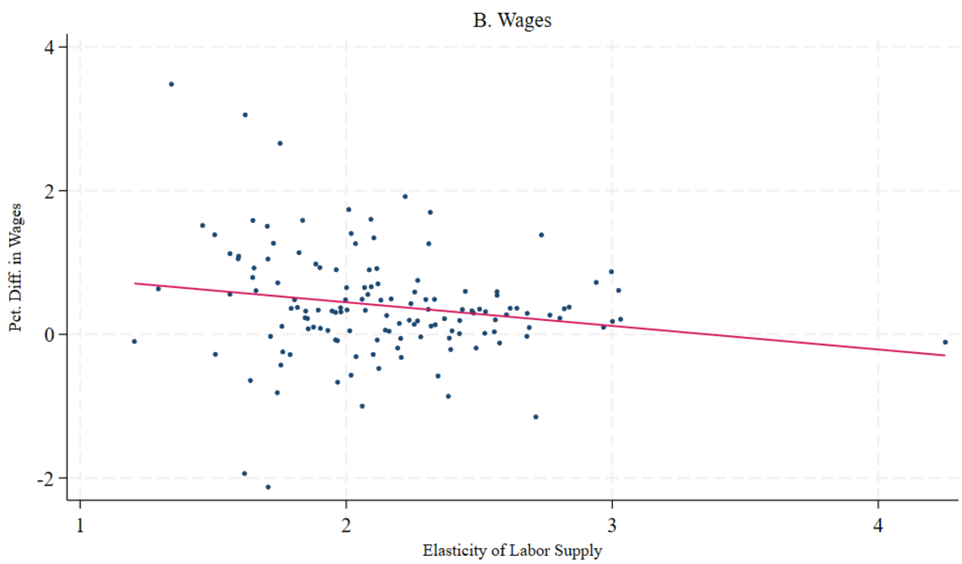
Figure 5: Effects of Counterfactual Tax Policy on Commuting Zones



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 removed in the respective panels, and full results are shown in Appendix Figure B.1.8.

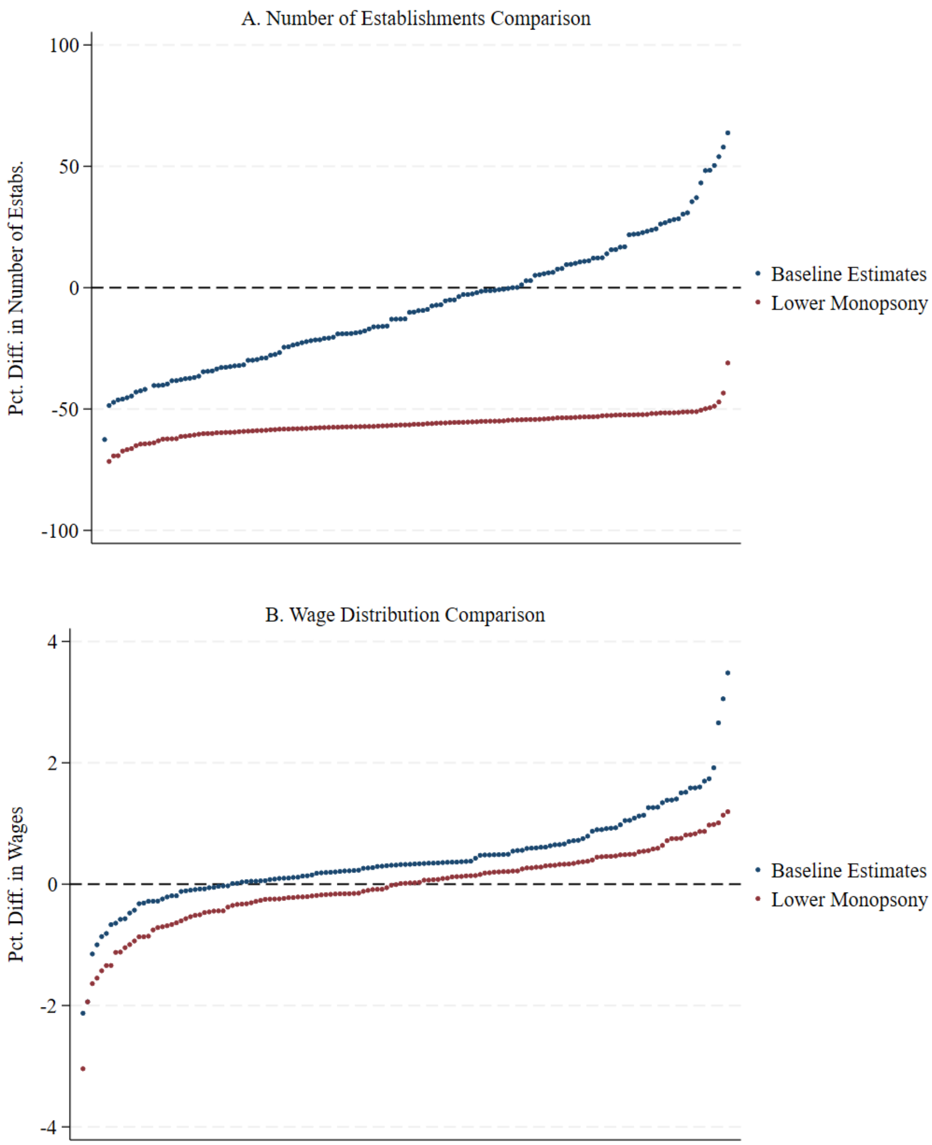
Figure 6: Correlation of Counterfactual Results and Market Power





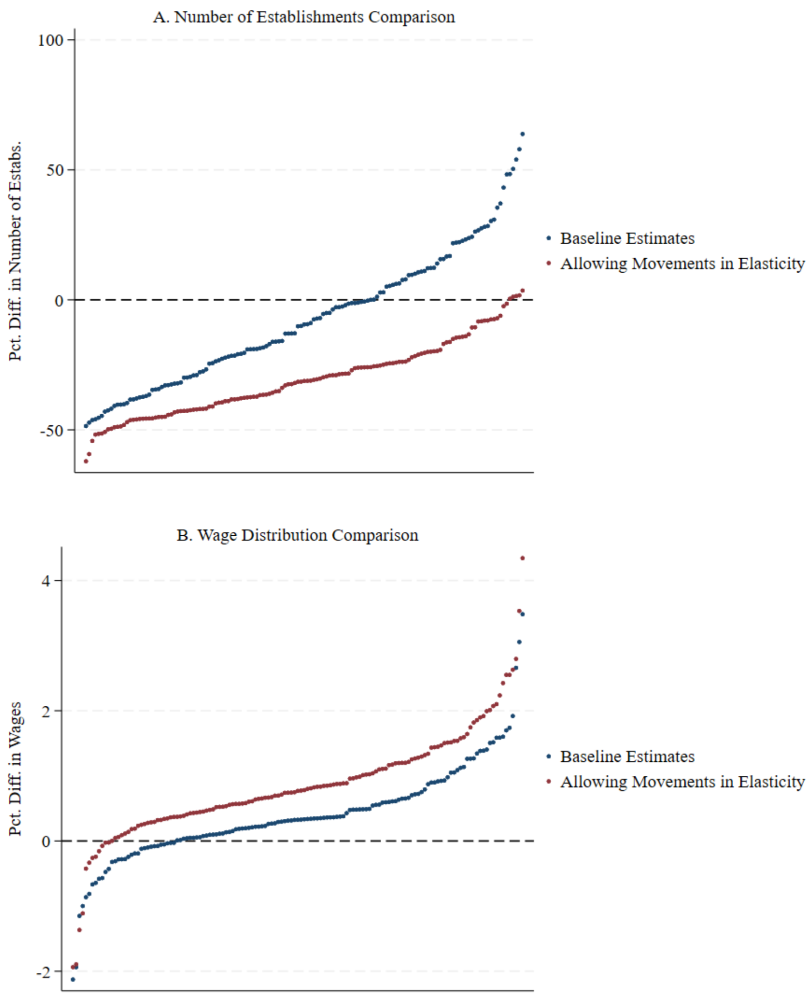
Notes: Each dot is a commuting zone. Panel A shows the relationship between the percent difference in the number of establishments under the counterfactual tax policy compared to the actual tax policy in the year 2017 and the elasticity of labor supply in the commuting zone μ_c, while Panel B shows the relationship with wages. See Appendix Section 4.1 for details on estimation of labor supply elasticities. The commuting zones with the lowest and highest change in number of establishments and wages were removed in the respective panels, and full results are shown in Appendix Figure B.1.9.

Figure 7: Effects of Counterfactual Tax Policy on Commuting Zones Assuming More Competitive Labor Markets



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 5 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 removed, and full results are shown in Appendix Figure B.1.10.

Figure 8: 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 5 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 removed, and full results are shown in Appendix Figure B.1.11.

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: 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.

Table 3: 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 (15) 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 4.1, 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 Online Appendix

A.1 Conditional Equivalence Between Logit and Poisson

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

$$\log(L_{cmt}) = \sum_{c=1}^{C} n_{cmt} \log(p_{cmt}) \tag{20}$$

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

$$E(n_{cmt}) = \lambda_{ctm} = \exp(\alpha + y_{ctm}) \tag{21}$$

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:

$$\log(L_p) = \sum_{c=1}^{C} (-\lambda_{ctm} + n_{cmt} \log(\lambda_{cmt}) - \log(n_{cmt}!)) \tag{22}$$

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

$$\log(L_p) = \sum_{c=1}^{C} n_{cmt} \log(p_{cmt}) - N + N\log(N) - \sum_{c=1}^{C} \log(n_{cmt}!) \tag{23}$$

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.1.1 shows the means and variances of my establishment counts for each industrial sector, as well as the post-estimation goodness-of-fit test p-values for the Deviance and Pearson goodness-of-fit tests.[33] 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.1.1: 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.2 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 observation (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. bserved 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:

$$\text{share}_m(\text{pick c}|\text{observed in data}) \approx \text{pr}_m(\text{pick c}|\text{observed in data}) \tag{24}$$

[33]For these statistical tests, a significant a significant result implies rejection of the null hypothesis that the data are distributed Poisson.

Bayes' rule implies

$$\text{pr}_m(\text{pick c}|\text{observed in data}) = \frac{\text{pr}_m(\text{pick c})\text{pr}_m((\text{observed in data}|\text{pick c})}{\text{pr}_m(\text{observed in data})} \tag{25}$$

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

$$\frac{\text{share}_m(\text{pick c}|\text{observed in data})}{\text{share}_m(\text{pick 0}|\text{observed in data})} \approx \frac{\text{pr}_m(\text{pick c})}{\text{pr}_m(\text{pick 0})}\frac{\text{pr}_m((\text{observed in data}|\text{pick c})}{\text{pr}_m(\text{observed in data}|\text{pick 0})} \tag{26}$$

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:

$$ln(\frac{s_{ctm}}{s_{0tm}}) = y_{ctm} - y_{0tm} + ln(\text{pr}_{mt}(\text{observed in data}|\text{pick c})) - ln(\text{pr}_{mt}(\text{observed in data}|\text{pick 0})) \tag{27}$$

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 systematically within commuting zone or year.

More concerning 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.2.1. 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.2.2. In particular, Panel A shows that the distribution of wage effects is slightly more positive in the bounding exercise. Panel B shows that 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.3 Construction of Empirical Proxies for Spillover Forces

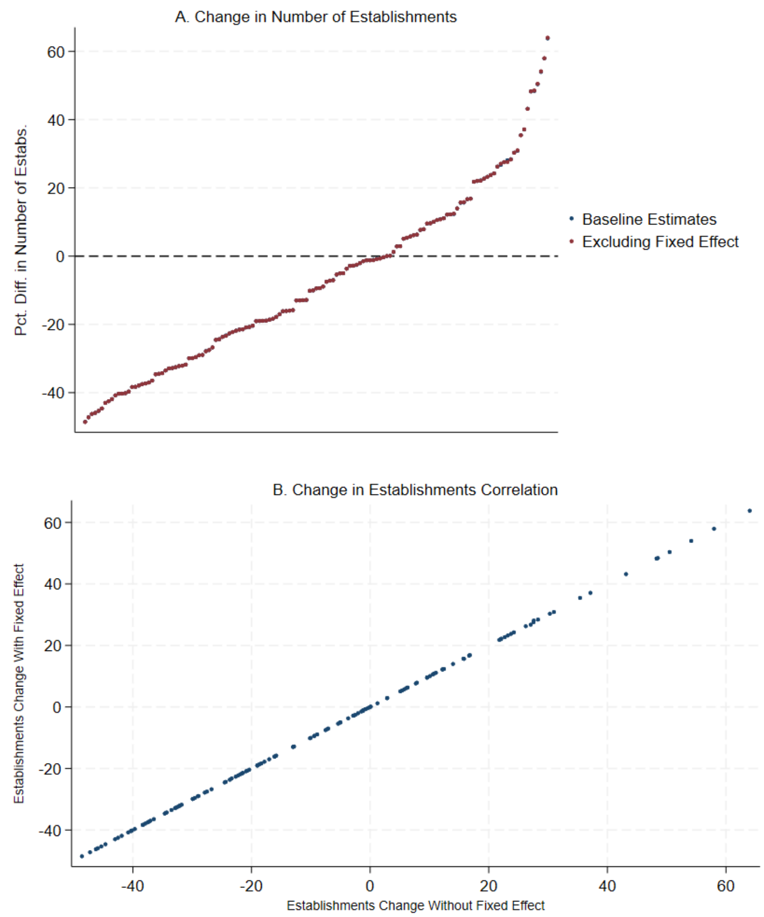
A.3.1 Goods: Distance from Suppliers and Buyers

The first reason that establishments might like to locate near one another is to be located near goods suppliers or customers. Reduced transportation costs are 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'.[34] 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:

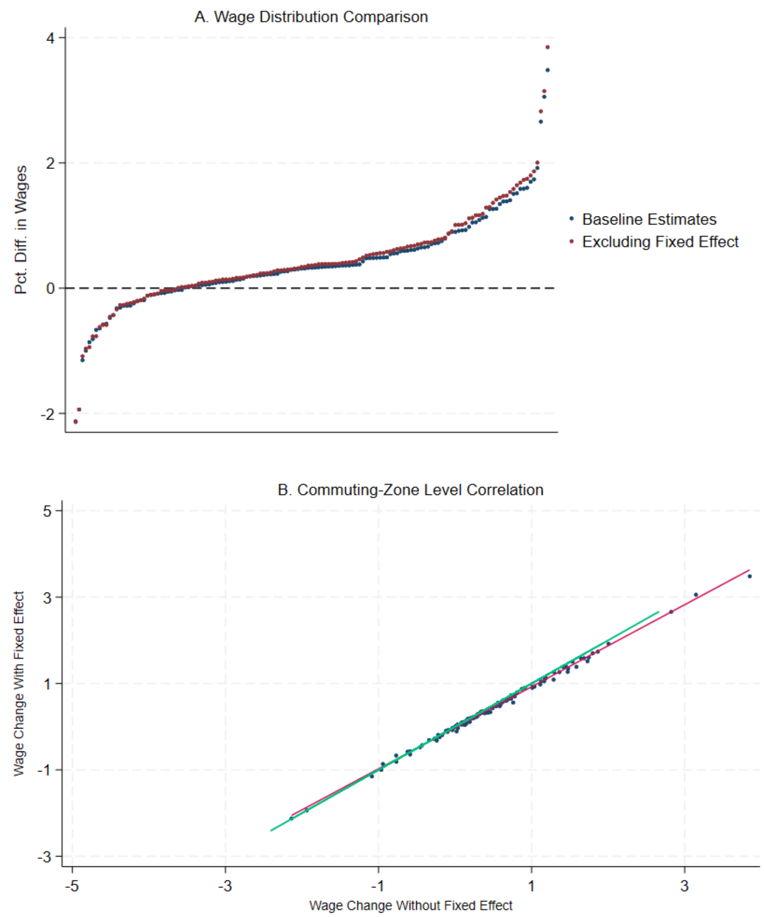
[34] The share of output which is sold to consumers as final goods is included in the output denominator.

Figure A.2.1: 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 removed.

Figure A.2.2: 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 removed.

$$\text{IO Agglom}_{ctm} = \sum_{m'=1}^{M} \frac{N_{ctm'}}{\mathcal{N}_{ct}} max(Input_{m \leftarrow m't}, Output_{m \rightarrow m'}) \tag{28}$$

Thus, the measure of input-output agglomeration benefits is measured for a particular sector, location, and year cell. Figure A.3.1 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.3.2 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 (Dauth et al., 2022). Alternatively, establishments might choose a particular location due to access to workers with particular knowledge or 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 a weighted average is calculated to obtain the labor correlation agglomeration benefits in each possible location. For a firm in sector m in location c and time t, their labor correlation agglomeration benefits are therefore:

$$\text{LC Agglom}_{ctm} = \sum_{m'=1}^{M} \frac{N_{m'ct}}{\mathcal{N}_{ct}} LC_{m,m't} \tag{29}$$

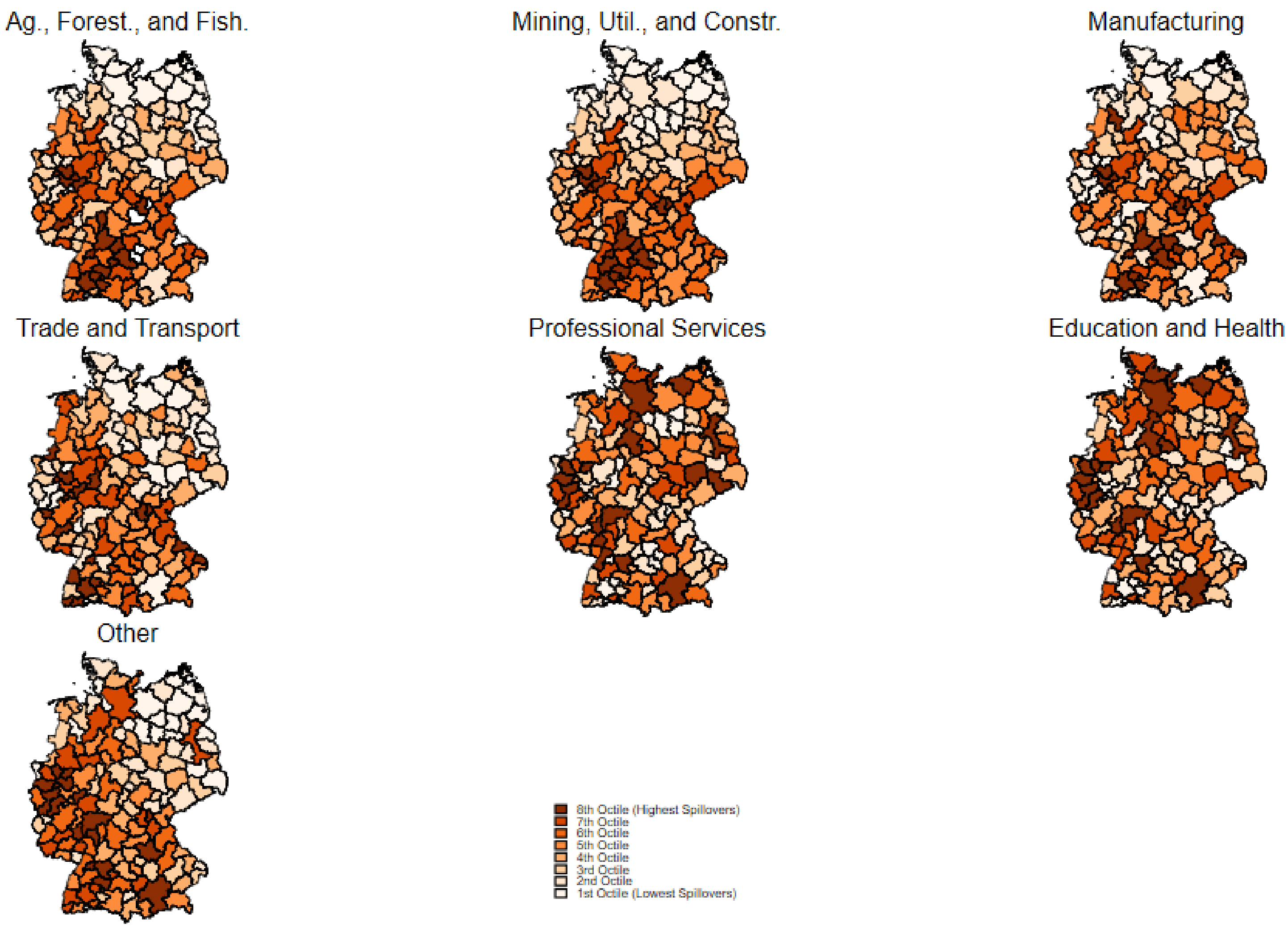
As with input-output agglomeration above, this measure of agglomeration benefits varies by sector, location, and year. Figure A.3.2 shows the strength of labor linkages by industrial sector and commuting zone for the year 1999. The figure shows that the strength of labor linkages varies across space, 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.3.3 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.

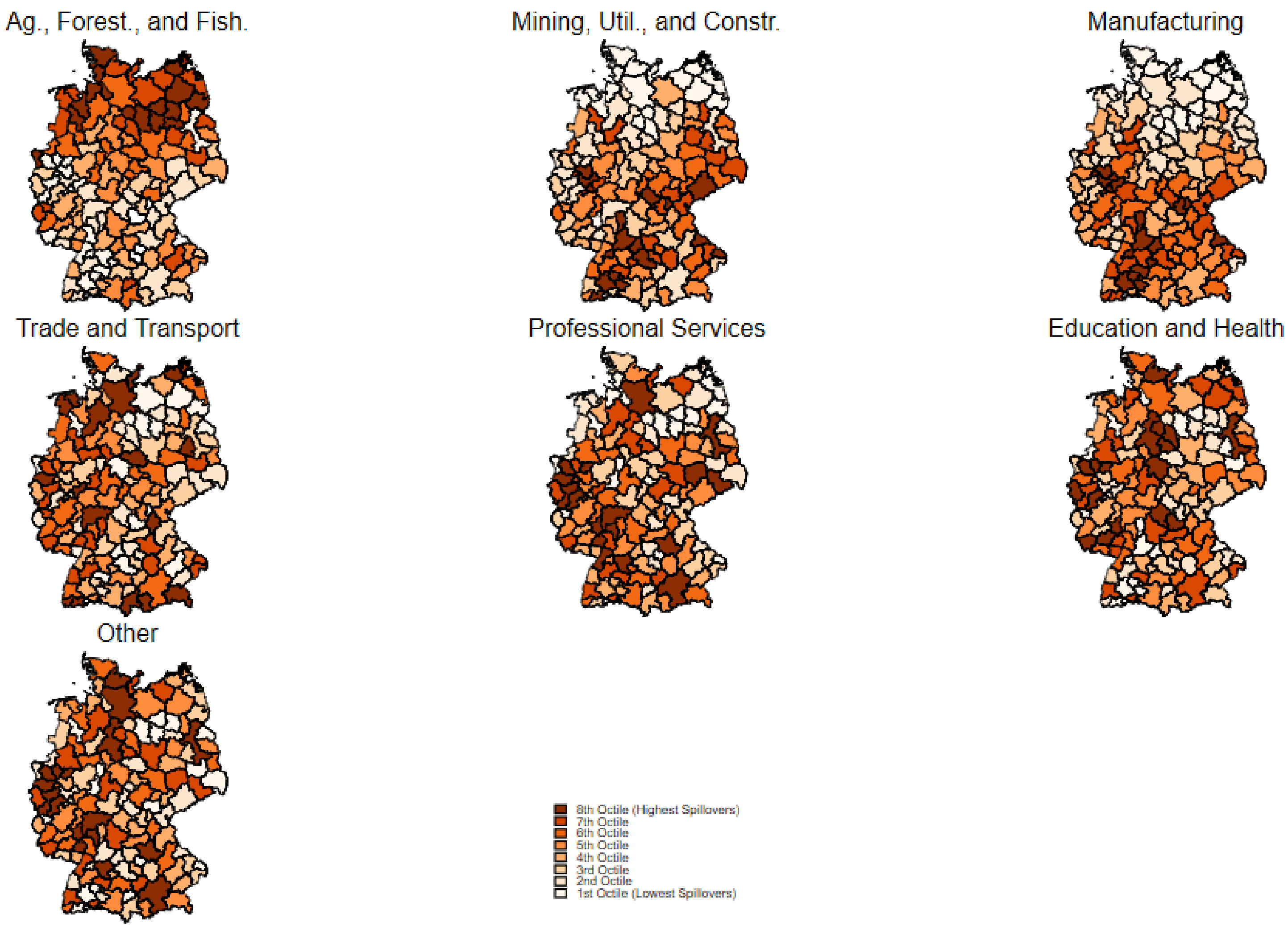
My measure of knowledge spillovers in a location comes from Jaffe et al. (1993). For each patent, I define a control patent as the patent with the closest publication date in the same 3-digit IPC patent class as the main patent. For each patent I also identify the commuting zone where the patent originates, 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 construct a measure of 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 ($pr_{control}$). This proxy measures knowledge spillovers since it measures the percentage of citations in a patent that are from the same location beyond the level that you would expect from the distribution of patents.

Figure A.3.1: 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 $A.3.1$.

Figure A.3.2: 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 $A.3.2$.

A.4 Including Rental Prices

Rental prices are a key component of classic spatial equilibrium models. Given 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 vary no matter which establishment they work at within 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, which is constant between locations. This leads to the profit equation:

$$Y_{jc} = (1 - \tau_{ct})[\beta_{ctm} L_{ctm}(w_{cjt}) - L_{cjt}(w_{cjt}) w_{cjt} - k r_c L_{ctm}(w_{cjt})] \tag{30}$$

Taking the first-order condition leads to the wage equation:

$$w_{ctm} = \frac{\mu_c}{1 + \mu_c}(\beta_{ctm} - r_c k) + \frac{1}{1 + \mu_c} b_{ct} \tag{31}$$

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. Substituting the functional forms into the wage equation and log-linearizing yields:

$$y_{cjt} = \mu_c ln(\mu_c) + ln(\mathcal{L}_{ct} \lambda_{ct}) + (1 + \mu_c) ln[\frac{1}{1 + \mu_c}(\beta_{ctm} - r_c k - b_{ct})] + ln(1 - \tau_{ct}) + u_{ctj} \tag{32}$$

A.5 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, it is by definition taking possible economic activity away from other locations. In this model, place-based policies can only 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 choose not to under current conditions. 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.1 Poisson analysis is not appropriate for my context, so I need an alternative bounding exercise.

My method estimates the elasticities of substitution using methods from the industrial organization literature. This literature has a standard method of addressing this problem by imputing the potential market size and including a 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 to 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 interpreted 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.

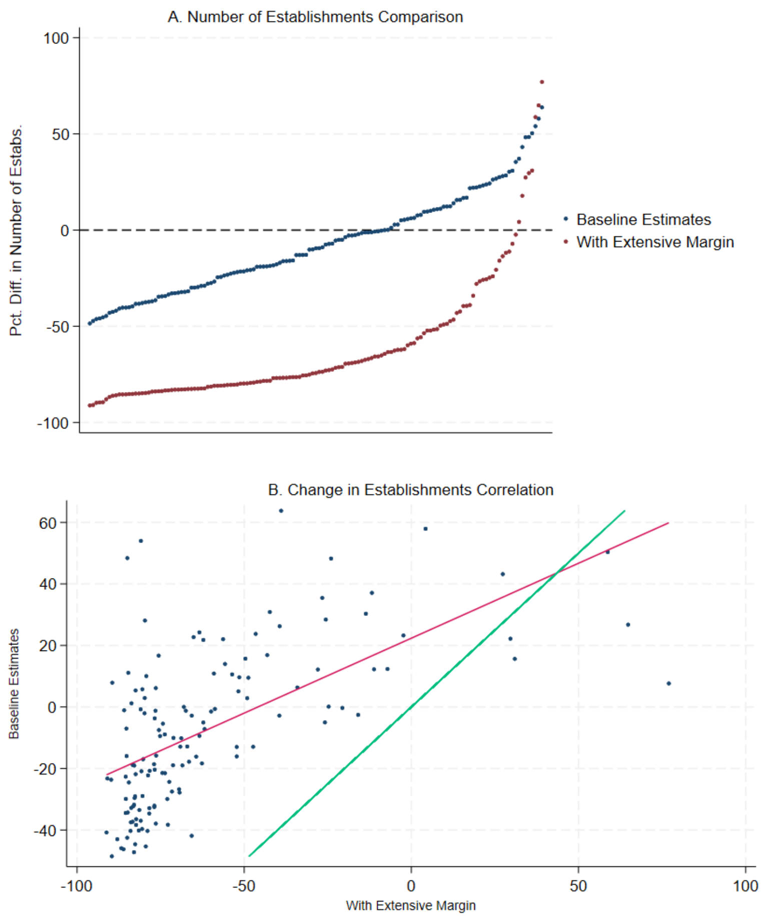
Second, an individual location may exceed the maximum ratio in the counterfactual analysis since the potential market size is necessarily defined at the national level. Imposing bounds at the commuting-zone level is conceptually difficult. Since the number of residents is a parameter in the model it 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.5.1 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 in establishments is much more negative when extensive margin effects are incorporated, with the effect widening at 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 surprising. What is taking place is that the initial mixture of establishments attracted, on average, increases the outside option of workers, consistent with the much more positive average wage effects shown in Figure A.5.2. 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.5.1, but much higher wages as seen in Figure A.5.2.

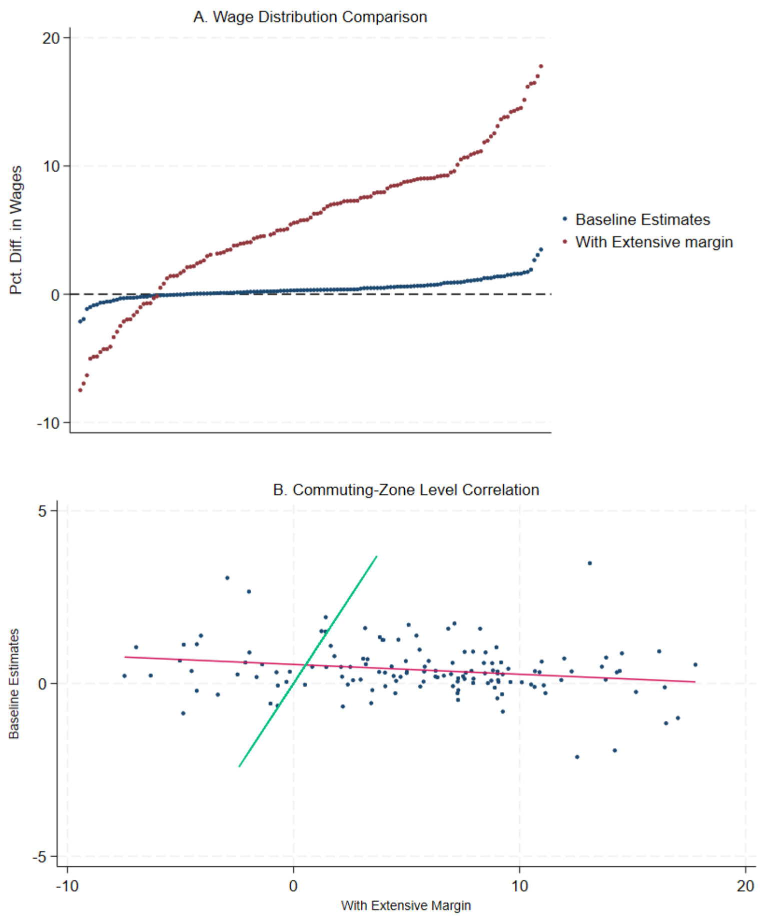
Overall, the extensive margin effects probably mean that my baseline estimates of the effects of place-based policies are likely more positive than they would be in reality in terms of the number of establishments, particularly for already competitive areas, though how much more positive is dependent 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.5.1: 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.5. 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 removed.

Figure A.5.2: Bounding Exercise: Incorporating Extensive Margin Effects

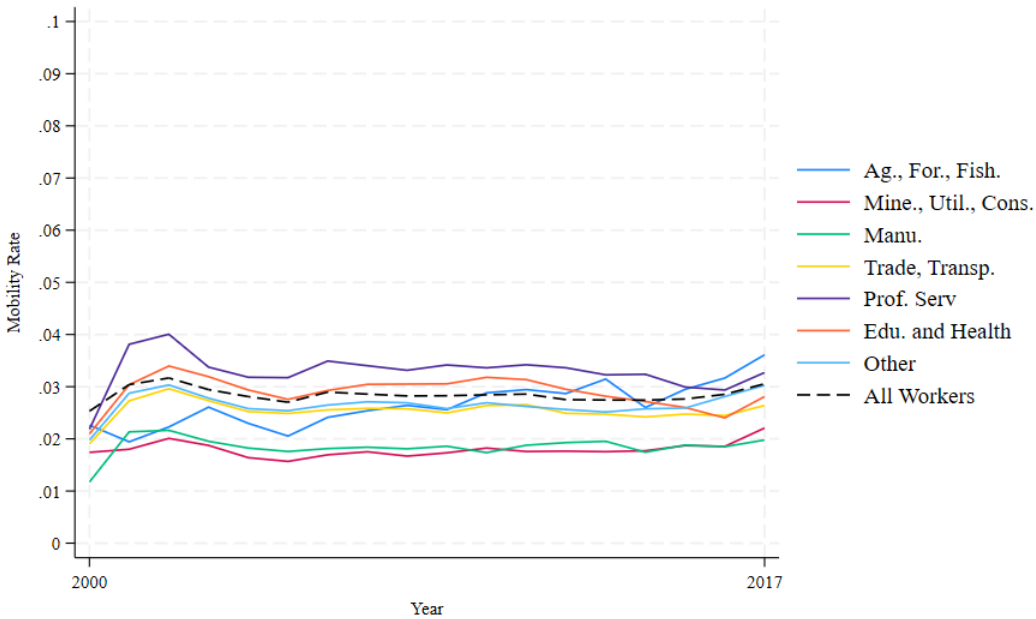


Notes: Each dot is a commuting zone. Panel A shows the percent difference in wages in the year 2017 between the actual and counterfactual policy for both the baseline estimates and when the choice set includes the numeraire as described in Appendix Section A.5. Panel B shows the commuting-zone level 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 removed.

B Additional Figures and Tables

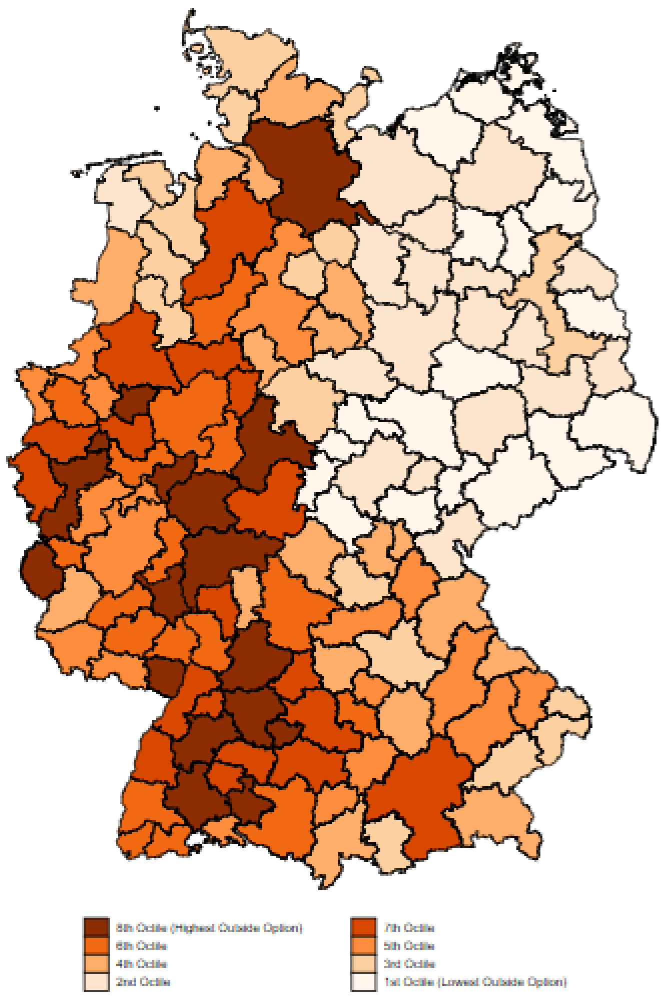
B.1 Additional Figures

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



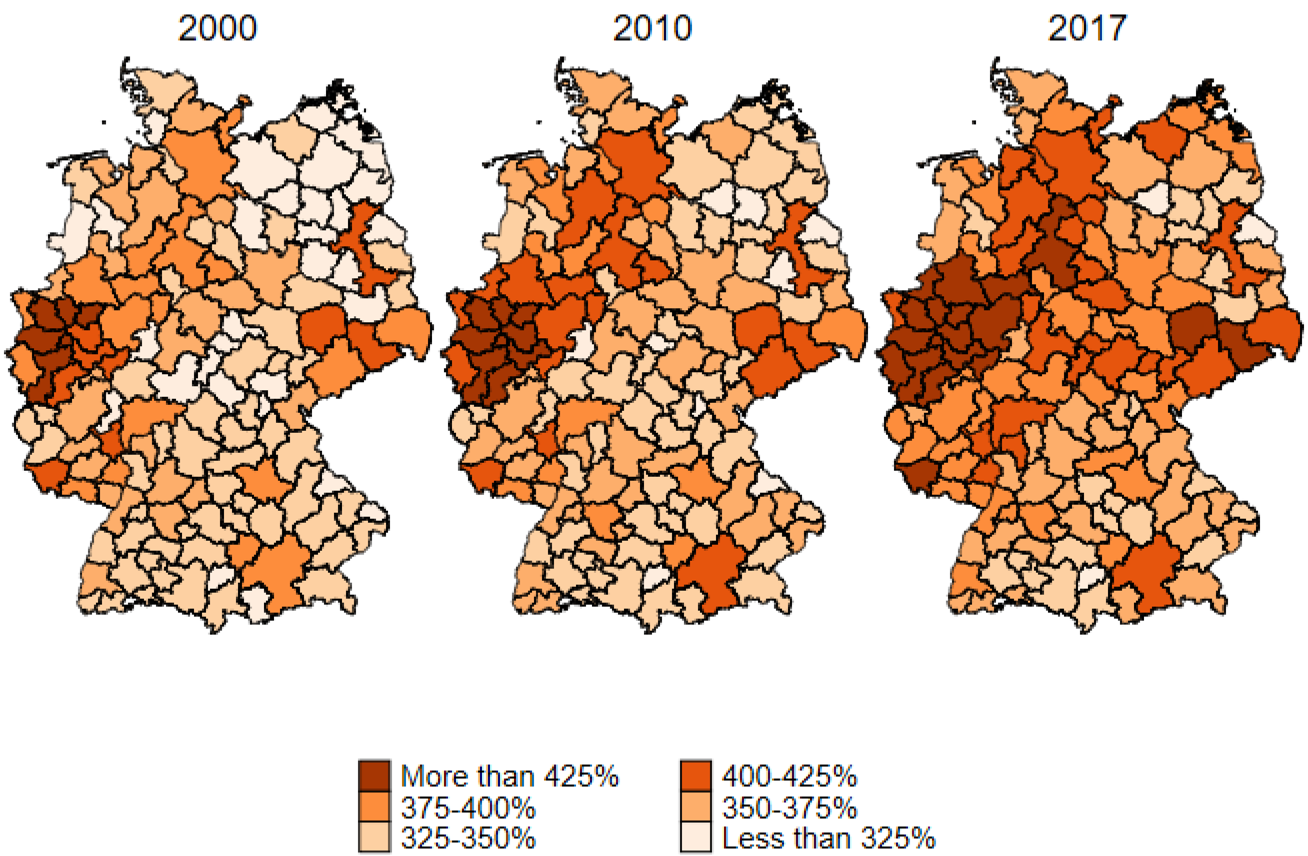
Notes: Figure shows year-over-year mobility rates of workers between commuting zones. Movement is defined as experiencing a labor market spell within the specified industrial sector in a different commuting zone than the previous labor market spell, regardless of whether the individual returns to the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

Figure B.1.2: Geographic Distribution of Outside Option



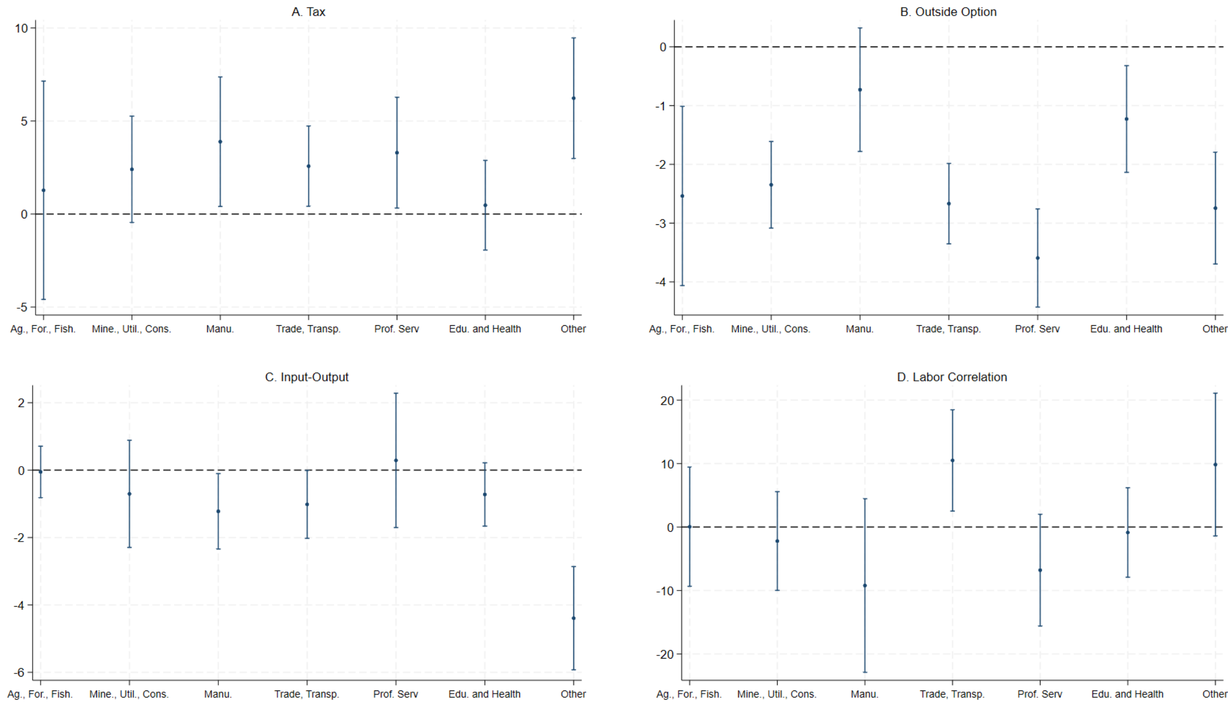
Notes: Figure shows octiles of outside option within a commuting zone for the year 1999. Outside option is calculated as a weighted average of state-level imputed union minimum wage rates using incumbent establishment industrial sector shares in the year 1999 as weights to measure at the commuting zone level. The imputed union minimum wage rates were calculated using the method described in Section 3.2.

Figure B.1.3: Average Corporate Tax Rates - Percent of Base Rate



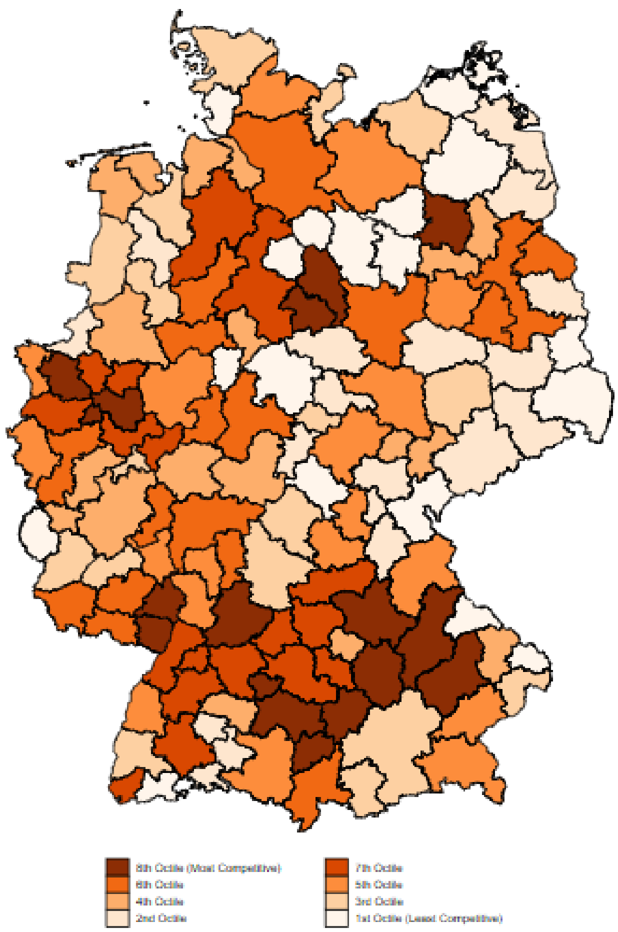
Notes: Figure shows the average corporate tax rate multiplier within a commuting zone. Average values are weighted average of municipal corporate tax rate multipliers, with weights given by the number of residents in each municipality. Multipliers indicate the local corporate tax rate relative to the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

Figure B.1.5: Coefficients by Sector - OLS



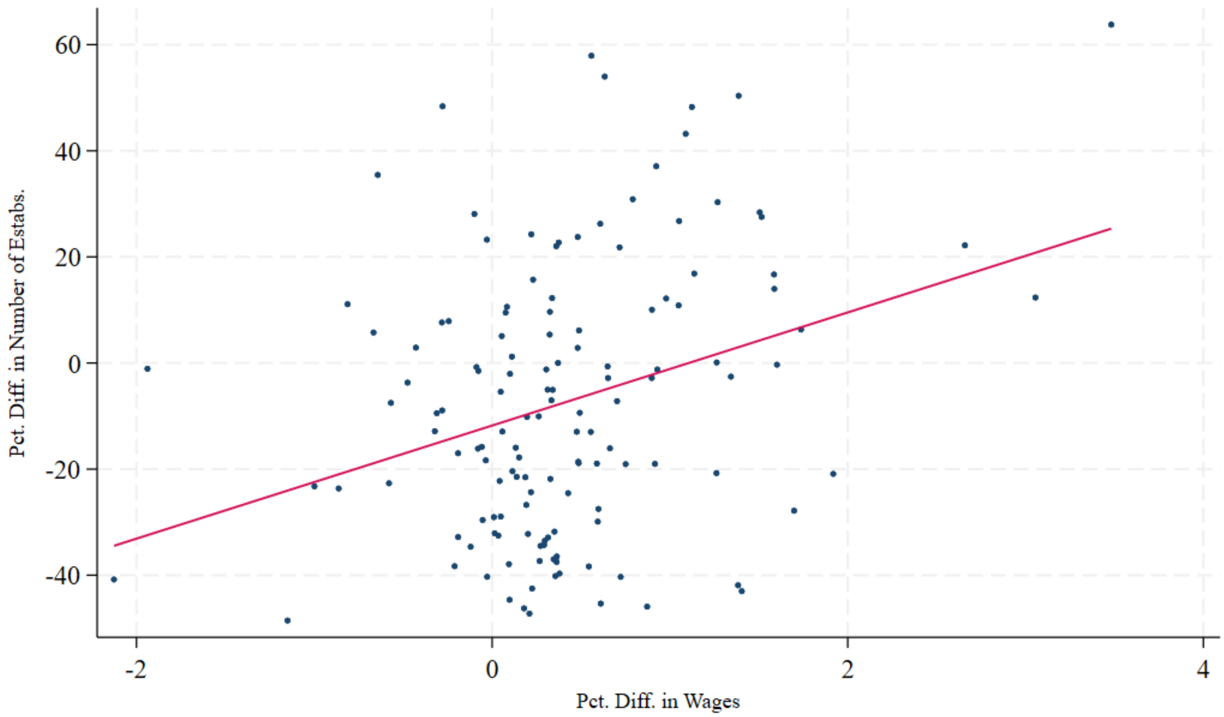
Notes: Results of the OLS empirical specification equation (9). Each column is an industrial sector. The outcome variable is the log ratio of the share of new establishments locating in a location c compared to a base location 0 (Hamburg) - $\mu_c \ln(\mu_c)$. Tax, outside option, and input-output spillovers 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 4.1, 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.1.4: Elasticity of Labor Supply Across Space



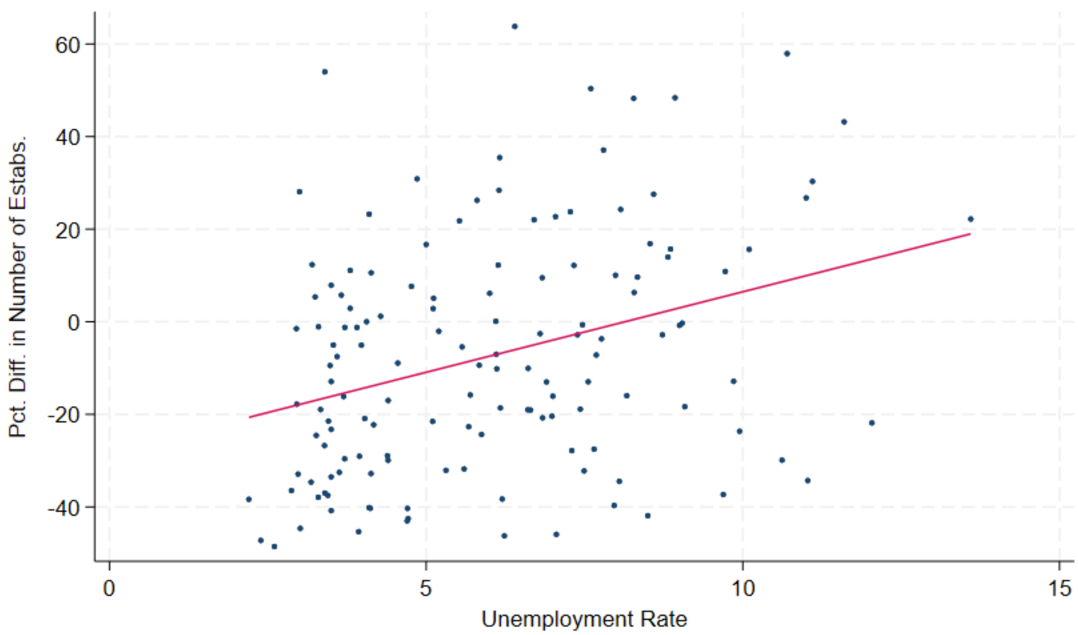
Notes: These figures show the octiles of point estimates of coefficients of the elasticity of labor supply for each commuting zone in Germany calculated using the method from Bassier et al. (2022).

Figure B.1.6: Correlation of Counterfactual Establishment and Wage Effects



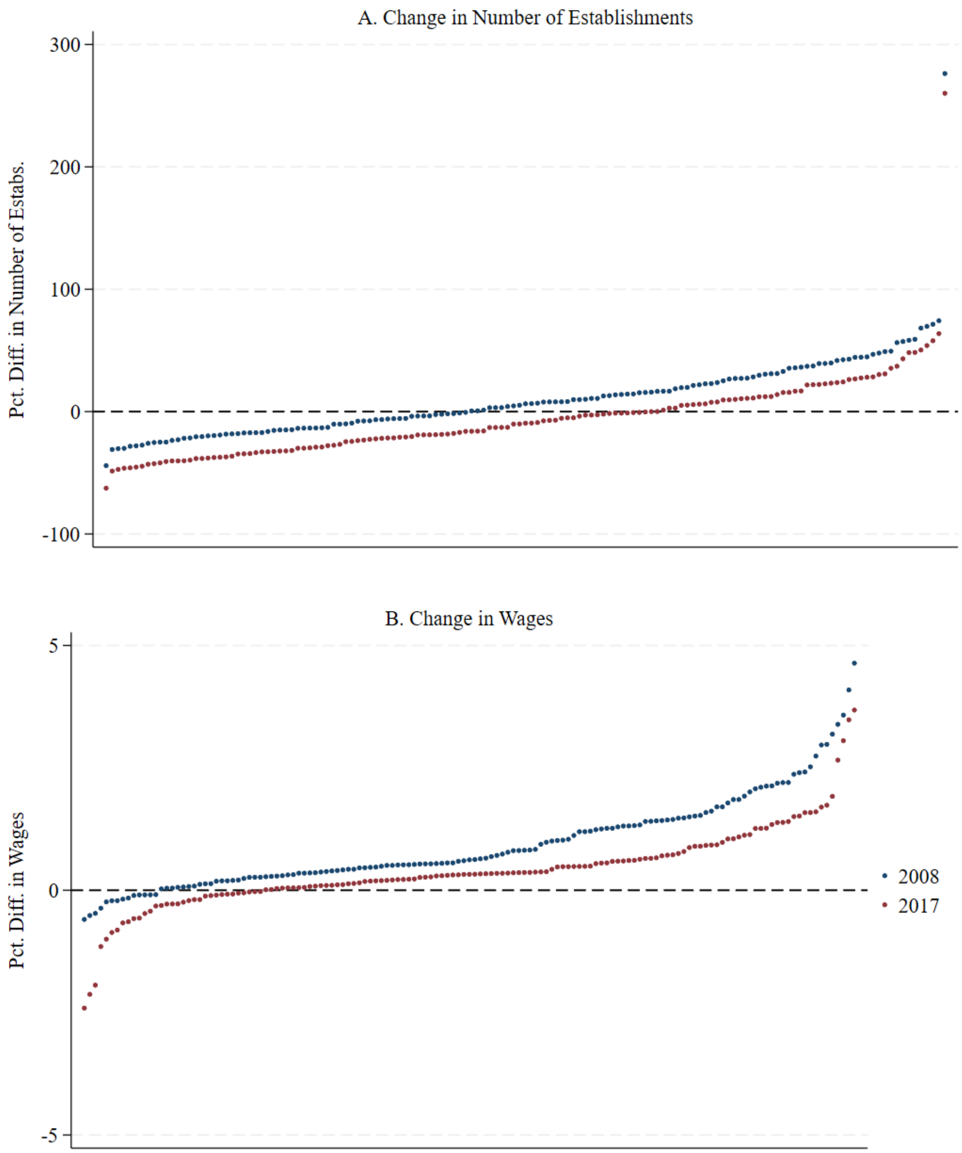
Notes: Each dot is a commuting zone. On the x-axis is the percent difference in wages under the counterfactual tax policy compared to the actual tax policy in the year 2017, while on the y-axis is the difference in the number of establishments under the counterfactual tax policy compared ot he actual 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 removed.

Figure B.1.7: Relationship Between Unemployment Rates and Counterfactual Establishment Growth



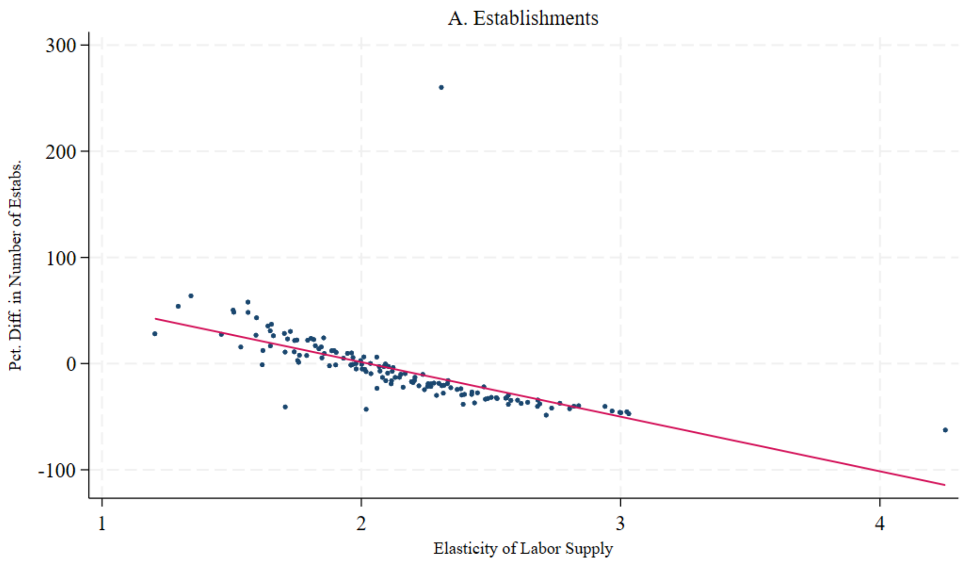
Notes: Each dot is a commuting zone. On the y-axis is the percent difference in number of establishments under the counterfactual tax policy compared to the actual tax policy in the year 2017, while on the y-axis is the commuting-zone level unemployment rate in 2017. The red line is the linear fit. The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

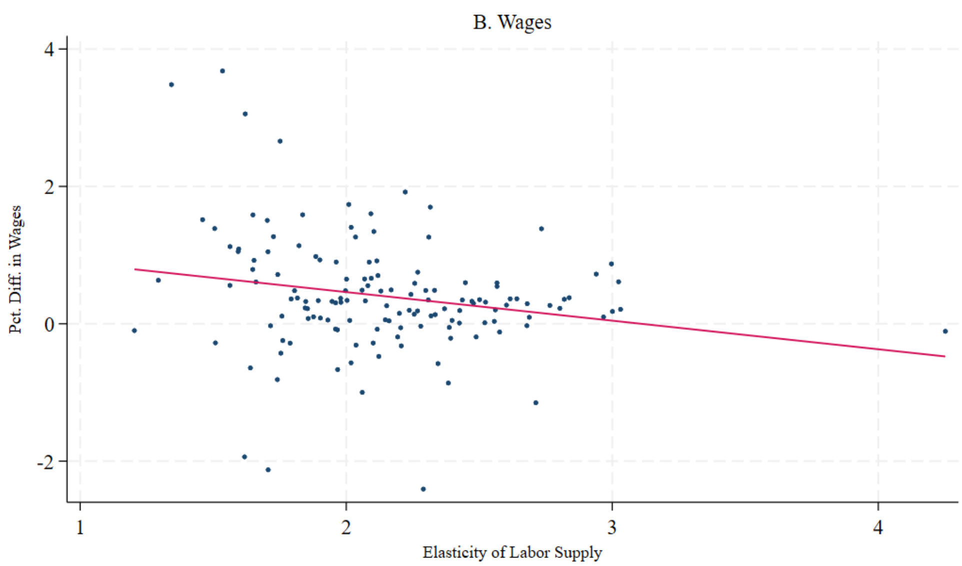
Figure B.1.8: Effects of Counterfactual Tax Policy on Commuting Zones - Full Results



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.

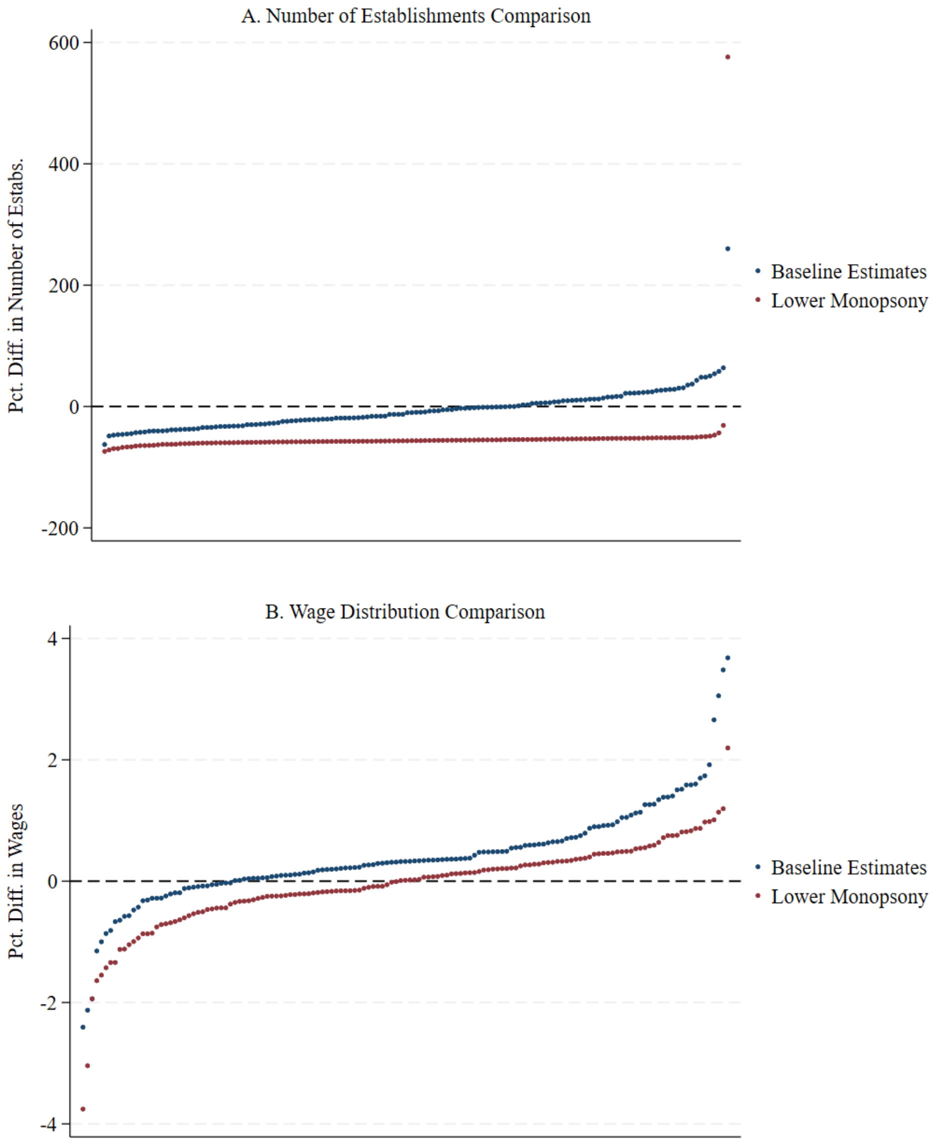
Figure B.1.9: Correlation of Counterfactual Results and Market Power - Full Results





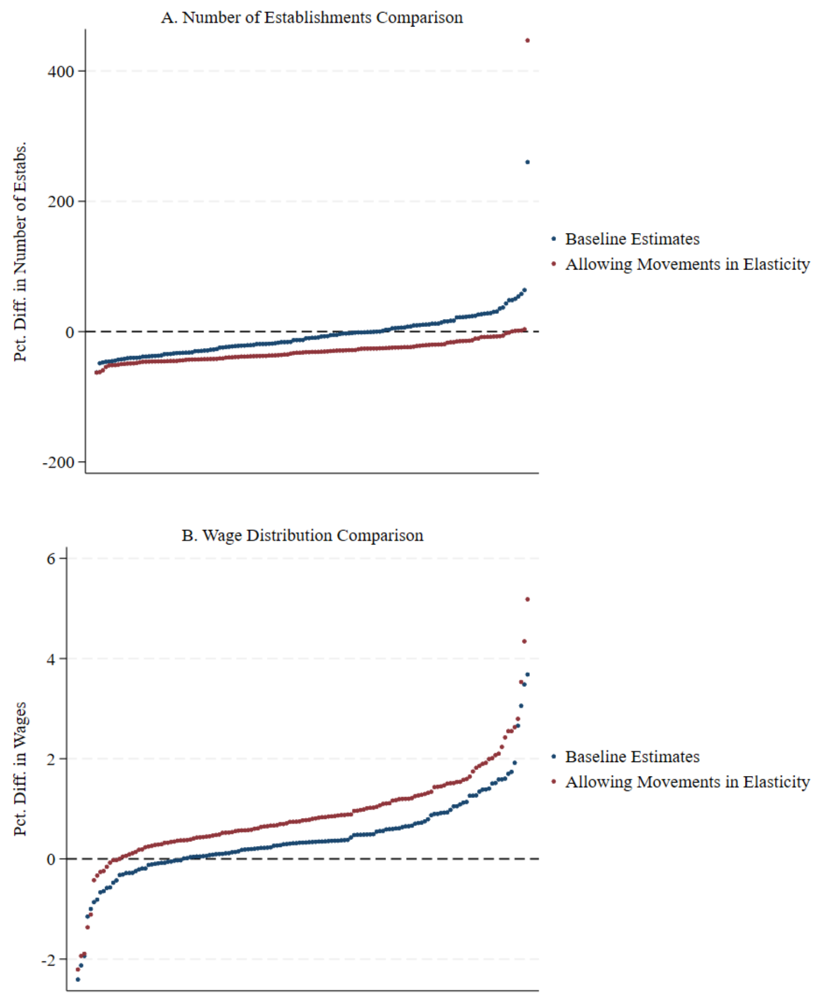
Notes: Each dot is a commuting zone. Panel A shows the relationship between the percent difference in the number of establishments under the counterfactual tax policy compared to the actual tax policy in the year 2017 and the elasticity of labor supply in the commuting zone μ_c, while Panel B shows the relationship with wages. See Appendix Section 4.1 for details on estimation of labor supply elasticities.

Figure B.1.10: Effects of Counterfactual Tax Policy on Commuting Zones Assuming More Competitive Labor Markets - Full Results



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 5 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.

Figure B.1.11: Effects of Counterfactual Tax Policy on Commuting Zones Allowing Movements in Market Power - Full Results



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 5 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.

B.2 Additional Tables

Table B.2.1: 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.2.2: 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.2.3: Elasticities of Labor Supply – Exact Values

	Elasticity of Labor Supply (μ_c)
Commuting Zone	
Aachen	2.122502
Altenkirchen	1.877009
Altötting	2.116489
Amberg	2.161118
Ansbach	2.426551
Aschaffenburg	2.387322
Augsburg	2.679218
Bad Kreuznach	1.857028
Bamberg	2.243161
Bautzen	1.563134
Bayreuth	1.758224
Berlin	2.383892
Bielefeld	2.318933
Bitburg	1.620412
Bochum	2.47251
Bonn	2.059607
Borken	1.715464
Braunschweig	2.997035
Bremen	2.447881
Bremerhaven	2.092734
Böblingen	2.616208
Celle	1.653401
Cham	1.203713
Chemnitz	1.792876
Coburg	2.221949
Cottbus	1.508217
Darmstadt	2.204802
Deggendorf	2.036906
Dessau-Roßlau	1.845402
Dithmarschen	1.505426
Donau-Ries	2.566923
Dortmund	2.56672
Dresden	1.816476
Düsseldorf	2.602434
Eisenach	1.742536
Elbe-Elster	1.705809
Emden	2.068999
Emsland	1.979911
Erfurt	2.152095
Erlangen	2.523771
Essen	2.680387
Flensburg	1.885731
Frankfurt (Oder)	1.8225
Frankfurt am Main	2.344873
Freiburg	1.979056
Freyung-Grafenau	1.617801
Fulda	2.003119
Gera	2.086346
Gießen	2.013182
Goslar	1.805717

Göppingen	2.819619
Göttingen	1.639684
Hagen	2.838156
Halle	2.206804
Hamburg	2.30848
Hameln	2.001212
Hannover	2.56047
Havelland	2.09416
Heidelberg	2.193464
Heidenheim	2.556676
Heilbronn	3.023808
Hof	1.660767
Höxter	1.649333
Ingolstadt	3.031323
Jena	2.07189
Kaiserslautern	2.310487
Karlsruhe	2.425411
Kassel	2.299003
Kempten	2.257599
Kiel	2.119265
Kleve	2.103884
Koblenz	2.101432
Konstanz	1.741129
Kronach	1.706559
Köln	2.334539
Landau	2.939674
Landshut	2.688042
Leipzig	1.854543
Limburg-Weilburg	2.268145
Ludwigshafen	3.000734
Lörrach	2.478353
Lübeck	1.962213
Lüchow-Dannenberg	1.460024
Magdeburg	2.280203
Mainz	2.23707
Mecklenburgische Seenplatte	1.595795
Memmingen	2.712825
Minden	2.369419
Märkisch-Oderland	2.315978
München	1.967723
Münster	1.99725
Nordhausen	1.836138
Nordvorpommern	1.562817
Nürnberg	2.803163
Oberhavel	2.081408
Oldenburg	1.894868
Olpe	2.520855
Ortenaukreis	2.147052
Osnabrück	1.930962
Ostprignitz-Ruppin	2.733892
Passau	1.960159
Pforzheim	2.39779
Pirmasens	2.268798
Potsdam-Mittelmark	2.115054

Prignitz	1.535021
Ravensburg	2.199616
Regensburg	2.641284
Reutlingen	2.018176
Rostock	1.94665
Rottweil	2.57665
Saalfeld-Rudolstadt	1.70319
Saarbrücken	2.331994
Schweinfurt	1.901031
Schwerin	2.130374
Schwäbisch Hall	2.436469
Siegen	2.501301
Sigmaringen	1.761423
Soest	2.168893
Stade	2.035053
Stendal	1.593581
Stuttgart	2.488265
Suhl	1.648569
Südvorpommern	1.726414
Teltow-Fläming	2.392579
Traunstein	2.255575
Trier	1.902962
Uckermark	1.751507
Uelzen	1.342912
Ulm	2.967076
Unstrut-Hainich	1.96688
Vechta	1.789088
Vulkaneifel	2.018632
Waldeck-Frankenberg	2.289877
Waldshut	1.29372
Weilheim-Schongau	1.847809
Weißenburg-Gunzenhausen	2.060274
Wilhelmshaven	2.009682
Wolfsburg	4.25226
Wuppertal	2.765552
Würzburg	1.959723
Zollernalbkreis	1.754191

Notes: Author's calculation using the SIAB data using the method from Bassier et al. (2022) as discussed in Section 4.1

Table B.2.4: 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 (15). 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 4.1, 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 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 (15). 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 4.1, 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: 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 (15). 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 4.1, 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 (15). 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 4.1. Standard errors are clustered at the commuting-zone level. See section 3 for details on the construction of the variables of interest.