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## Abstract

Theory suggests that large firms are more likely to engage in lobbying behaviour and are geographically more mobile than smaller entities. Conditional on jurisdiction size, policy choices are thus predicted to depend on the shape of a jurisdiction's firm size distribution, with more business-oriented policies being enacted if jurisdictions host large firms. The paper empirically tests this prediction using local business taxation in Germany as a testing ground. Exploiting rich and exogenous variation in localities' firm size structures, we find evidence for an inverse relationship between the size of hosted entities and communities' local business tax choices. The effect is statistically significant and quantitatively relevant, suggesting that the rising importance of large businesses may trigger shifts towards a more business-friendly design of (tax) policies.

JEL-Codes: H200, H700.

Keywords: firm size, corporation tax, political economy.

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# 1 Introduction

The importance of large corporations has steadily grown over recent decades (e.g. UNCTAD (2002), Cefis et al. (2009), Poschke (2014)). Many observers eye this development with scepticism and have raised concerns that the increasing fraction of economic activity concentrated in big businesses may foster the corporate sector's influence over government policies (e.g. Crouch (2004), Roach (2007), Barth (2011), Cave and Rowell (2014)). The purpose of our paper is to empirically assess the importance of these concerns. Using tax policy as a testing ground, we investigate whether jurisdictions' firm size structures determine their governments' business tax choices.

The paper starts out with a brief discussion of theoretical mechanisms that establish a link between firm size and jurisdiction policy.[1] Firstly, an increase in the size of hosted entities may, conditional on aggregate jurisdiction size, raise overall corporate lobby spending as free-riding incentives are reduced[2] and more firms take the size threshold to participate in lobbying in the presence of fixed costs. Secondly, theory predicts that large firms are geographically more mobile than smaller entities - among others, because fixed costs of relocating corporate activity can be spread over a larger asset base. For both reasons, jurisdictions may, conditional on their aggregate size, opt for a more business-oriented (tax) policy design if they host large firms.

In the main part of the paper, we empirically test for a link between jurisdictions' firm size structures and their corporate tax rate choices. Our analysis relies on data for the German local business tax, which is set autonomously by German municipalities. The setting is unique and ideal to assess the question of interest. Firstly, tax issues belong to the most pressing policy concerns of the corporate sector (see e.g. the lobbying statistics of the US NGO *Open Secrets*). Secondly, using subnational data offers the advantage that our sample localities, while autonomously choosing the local business tax rate, operate in an otherwise homogenous institutional setting. The business tax furthermore significantly contributes to the tax burden on corporations in Germany, making up around 40% of corporate tax payments on average. The focus on policy choices of subnational government tiers finally allows us to construct consistent measures for the firm size structure of localities based on administrative micro-data for Germany.[3]

[1]Note that we focus on *jurisdictions'* firm size structures, as opposed to firm size distributions within *industries* or *spatial* firm concentration.

[2]Decentralized corporate lobbying for business-friendly common government policies exerts a positive externality on other firms in the jurisdiction which is not internalized by the individual firm.

[3]Consistent data on the firm size structures of countries is to the best of our knowledge not available.

Exploiting rich cross-sectional and longitudinal variation in firm size structures across 4000 sample communities and eight sample years (2000-2007), we find evidence for a statistically significant and economically relevant link between the size of hosted firms and communities' local business tax choices. The empirical models control for socio-economic and budgetary characteristics of communities and include a full set of region and community fixed effects respectively. Remaining endogeneity concerns are addressed by an instrumental variable strategy that exploits industry-level shocks as a source of exogenous variation in the size of individual firms and, in consequence, jurisdictions' firm size structures. Motivated by our theoretical considerations to come, the empirical analysis accounts for effects related to the absolute and relative size of firms (proxied by the average size of businesses and a Herfindahl index in the main analysis), where statistically significant effects, in a horse race, tend to be concentrated around the former measures.[4] Quantitatively, our preferred estimates suggest that doubling the average size of firms lowers the municipalities' local business tax rates by 7.2% on average (or 69.6% of a standard deviation in the local business tax rate).

To assess the relative importance of lobbying and firm mobility in driving this effect, we construct firm-level measures for corporate mobility, namely indicators for firm affiliation with a multinational and national group respectively and a variable capturing the tax sensitivity of business activities.[5] Aggregating these measures to the community-level and adding them to the set of control variables in the main specifications reduces the estimate for the absolute firm-size coefficient by around two thirds. The findings hence suggest that mobility differences are a main driver of the observed link between business size and local business tax choices. Complementary, we assess the 'lobbying channel' by rerunning the baseline regressions with control variables for the fraction of firms per community that engage in lobbying behaviour. Firms are coded as lobby-active if they donate significant funds to German political parties or spend time interacting with politicians and bureaucrats, where the latter is proxied by interactions with policy-makers at the national and supra-national level since according data for the local level is unavailable. Aggregating these measures to the community level and adding them as regressors to our main model reduces the absolute firm size effect of

[4] Including regressors for the absolute (relative) size of hosted firms follows the theoretical notion that only firms above a given absolute size threshold participate in lobbying or relocate corporate investments in space (that free-riding declines and, in consequence, aggregate corporate lobbying increases when jurisdictional economic activity becomes more concentrated at the firm level).

[5] Specifically, we determine the sensitivity of fixed asset investment to changes in the business tax rate based on firm-level data, where the tax effect is allowed to vary across narrowly defined subgroups of firms. Potential reverse causality concerns are addressed in the analysis, cf. Section 5.

interest - suggesting that lobbying contributes to the link between firm size and local business tax choices. Quantitatively, the importance of the channel is indicated to be limited though. Note, however, that mobility and lobbying controls are unlikely to capture all differences in mobility and lobbying behaviour across firms, implying that the sketched strategy yields lower bounds for the importance of firm mobility and lobbying as drivers of the 'firm size-business tax' link. The analysis hence derives bounds for the relative importance of the two mechanisms, with at least two thirds (up to one third) of the effect being assigned to the mobility (lobbying) channel.[6]

To the best of our knowledge, our paper is the first to establish a causal link between jurisdictions' firm size distributions and corporate tax policy choices.[7] It contributes to a flourishing literature on the determinants of tax setting behaviour. In recent years, studies mainly focused on strategic interaction in corporate tax rate choices of neighbouring jurisdictions, presenting evidence in favour of inter-jurisdictional tax competition and a race-to-the-bottom of corporate tax rates (see e.g. Devereux et al. (2008), Overesch and Rincke (2011)). A recent strand of the literature qualifies this race-to-the-bottom prediction, suggesting that corporate tax competition may be mitigated by agglomeration rents, with larger jurisdictions choosing higher corporate tax rates (see e.g. Ludema and Wooton (2000), Baldwin and Krugman (2004), Jofre-Monseny and Solé-Ollé (2012), Koh et al. (2013), Brülhart et al. (2012), Luthi and Schmidheiny (2014), Brülhart and Simpson (2017)).[8] Our paper adds to this literature by highlighting that, beyond effects related to the aggregate size of a jurisdiction's corporate activity, intra-jurisdictional firm size heterogeneity impacts on business tax choices.

As firm size structures vary significantly across countries and sub-national government tiers (see e.g. Garcia-Santana and Ramos (2012)), our findings help to explain observed differences in governments' corporate tax policy choices. The results moreover suggest that recent decades' merger and acquisition waves and the trend towards more concentration of economic activity (particularly in emerging markets and the develop-

[6]The relative importance of firm mobility and lobbying in driving the link between firm size and business tax choices must not necessarily correspond to the relative importance of the two channels in directly affecting local business taxes. See Section 5 for details.

[7]After finalizing the first version of our paper, we became aware of Bischoff and Krabel (2017) who also report a negative correlation between firm size and local business tax choices for the German state of Hesse. Their empirical analysis, however, does not allow for a causal interpretation of the effect and the authors also do not assess potential mechanisms that link firm size and policy choices.

[8]Brülhart and Simpson (2017) study how industry-level agglomeration affects government policy using data on firm subsidies in Great Britain. They find that only the assignment of grants administered by central government agencies conforms with the predictions of economic geography models.

ing world, see e.g. Poschke (2014)) affect governments' tax policies and may trigger shifts towards more favourable tax conditions for the corporate sector. Insights from the analysis may furthermore extend to other policy areas and administrative practices, including the provision of public goods and services, the assignment of grants or product market regulation - suggesting that firm size may play a role in explaining regulatory capture and public fund allocation in these fields.

The remainder of the paper is structured as follows: in Section 2, we present theoretical considerations to motivate our empirical analysis. Section 3 describes the institutional background and data for our empirical analysis. Sections 4 and 5 present the identification strategy and estimation results. Section 6 concludes.

# 2 Theoretical Considerations

While the economic literature provides comprehensive evidence that the *aggregate* size of economic activity affects jurisdictions' corporate (tax) policy choices, it largely ignores the possibility that firm size *heterogeneity* drives governmental (tax) policy setting. As sketched in the Introduction, empirically testing for the latter relationship in the context of the German local business tax is the core aim of our paper. A theoretical link between jurisdictions' firm size structures and corporate (tax) policy may be established by two mechanisms.

*Corporate Lobbying*

The first relates to corporate lobbying activities and thus to the direct attempt of the corporate sector to influence government policy. The effect of lobbying on government behaviour has been analysed extensively in the economic literature (see e.g. Olson (1965) and Grossman and Helpman (2001)) and growing empirical evidence confirms the effectiveness of lobbying activities in influencing policy choices (see, among others, Goldberg and Maggi (1999) for trade protection, Facchini et al. (2011) for immigration policy, Blau et al. (2013) for bank bailouts and Salamon and Siegfried (1977) and Richter et al. (2009) for tax policy choices).

While most papers link aggregate lobby spending to the size of interest groups, Bombardini (2008) emphasizes the role of firm heterogeneity in driving lobby formation and aggregate lobby spending. In particular, she argues that in the presence of a fixed cost of making political contributions, i.e. initial expenses necessary to play an active role in lobbying activities, only the largest firms participate in lobby formation since the initial fixed costs of organising for political activity may be spread over a larger asset base. Firm size, on top, also positively correlates with corporate productivity and profitability, and hence with the size of the corporate tax base, implying that large firms have higher incentives to lobby for low business tax rates than smaller entities. It consequently follows that, conditional on the aggregate size of the jurisdiction[9], corporate lobby spending becomes larger if a jurisdiction hosts large firms.

An analogous prediction derives from the observation that firms benefit from favorable common business policies enforced by the lobbying of other corporates. Lobby involvement is thus affected by free-riding incentives (e.g. Olson (1965)), making aggregate lobby spending inefficiently small from the perspective of the corporate sector. If a jurisdiction's economic activity becomes more concentrated, the positive lobbying externality on other firms is partly internalized, lowering the free-rider problem and enhancing overall corporate lobbying and hence influence over government policy.

In the following, the described lobbying mechanisms will be referred to as *'lobby participation'-effect* and *'lobby free-riding'-effect* respectively.

*Firm Mobility*

On top, a link between firm size structures and corporate (tax) policy choices may be established by differences in the inter-jurisdictional mobility of large and small firms (labeled *'mobility difference'-effect* hereafter). Precisely, if relocating corporate activity involves fixed costs, mobility rates increase in the size of the business, reflecting that big firms can spread the fixed relocation costs over a large asset base (see e.g. Dharmapala (2014) or the literature on selection into outsourcing building on Melitz et al. (2004)). Firm size, moreover, positively correlates with corporate profitability, as described above, implying that large firms have higher incentives to hedge business investments from taxation by relocating to low-tax jurisdictions (see e.g. Baldwin and Okubo (2009)). Optimal (tax) policy choices account for these mobility differences, with governments opting for more business-oriented policies if they host large and mobile businesses and vice versa.

[9]Contrary to lobbying for *private* or *industry-specific* public policies, we are interested in lobbying for policies that affect *all* firms located in a jurisdiction. Note that, if given the choice, firms would prefer to lobby for private benefits (instead of favourable common policies at the industry or jurisdiction level) as this avoids free rider problems (see next paragraph of the main text) and may provide advantages over competitors. Governments, however, can hardly differentiate policy design at the firm or industry level due to administrative and legal constraints (the European non-discrimination law e.g. prohibits state aid for specific firms (Articles 101 and 107, Treaty on the Functioning of the EU)), hence creating a role for aggregate corporate sector lobbying.

Firm mobility may, however, also link jurisdictions' firm size structures to their (tax) policy choices in the absence of mobility differences between small and large entities. To see this, consider a scenario where corporate location decisions are a function of governments' policy choices and idiosyncratic location preferences. If firms obtain shocks to their location preferences each period, communities may lose and win firms that relocate across borders. In such a setting, welfare costs of firm turnover are plausibly higher if communities lose relatively large entities as the lost economic activity and jobs may not be compensated in the short run by the attraction or foundation of new firms, causing unemployment and related welfare losses. Even if communities can make up for the lost economic activity, search frictions in the labor market may induce high welfare losses (in the short-run) when large employers relocate. If communities (e.g. for historic reasons) depend on large firms, they may hence be more inclined to implement business-friendly (tax) policies. In the following, this mechanism is labelled as *'dependence on large employers'-effect*.[10]

*Implications for the Empirical Strategy*

The aim of this paper is to empirically assess the proposed link between jurisdictions' firm size structures and government policies using the German local business tax as a testing ground. Following our theoretical considerations, the empirical analysis will account for two characteristics of a jurisdiction's firm size distribution: firstly, the *absolute* size of firms, motivated by the theoretical notion that only entities above a given *absolute* size threshold engage in lobbying or relocate corporate activity in the presence of fixed costs (see the *'lobby participation'-effect* and *'mobility difference'-effect* described above); and, secondly, the *relative* firm-size structure within localities or firm-level concentration of economic activity, motivated by the notion that incentives to free-ride on the lobbying of other corporates and effects related to communities' dependence on large employers are driven by relative firm size patterns (see the *'lobby free-riding'-effect* and the *'dependence on large employers'-effect* described above). As will be shown below, absolute and relative firm size measures are positively correlated in our empirical application, but do not capture identical information (in small communities, economic activity may e.g. be concentrated in a limited number of firms, with businesses nevertheless being small in absolute size).

[10]The importance of this argument as a driver of the link between firm size and (tax) policy choices is, however, reduced if firm investments can be geographically separated at moderate costs and it is investment-tiers within firms that are hit by shocks, not whole companies.

# 3 Institutional Background and Data

We study the link between firm size and local business tax choices using the German local business tax as a testing ground. The following section describes the institutional background and the data used for the empirical analysis.

*Local Business Taxation in Germany: Institutional Background*

German localities autonomously set the local business tax rate, while the definition of the business tax base is determined by federal law and is thus homogenous across municipalities. The tax is levied on business earnings of incorporated and non-incorporated firms located within a community's borders. It significantly contributes to the tax burden on businesses in Germany and is also the most important revenue instrument at German communities' own discretion.[11] Municipalities set a tax multiplier, which is measured in business tax points and is multiplied by a base rate ('Messzahl') chosen at the federal level when calculating a firm's tax levy. In our sample period, a proportional base rate of 5% applied for corporations (and for non-incorporated firms on income above EUR 48,000 (Par. 11 Local Business Tax Act)). To ease interpretation, the empirical analysis to come will approximate the local business tax rate in percentage points as the product of a locality's tax multiplier and the base rate of 5%. In our estimation sample (see below), communities on average set a tax multiplier of 340 business tax points, which corresponds to a tax rate of 17% (cf. Table 1).[12]

Furthermore note that, in all German communities, a change in the local business tax rate is enacted by a simple majority of votes in the local council. German localities moreover have exactly the same fiscal policy tools at hand and also face the same main responsibilities, including the construction and maintenance of roads, sewerage, kindergartens and primary schools as well as the provision of certain social benefits to the unemployed and the poor. Other responsibilities, such as the maintenance of cultural or sport facilities, tourism, and public transport are optional.

[11] Liberal professions and non-profit organisations are exempted from local business taxation. Furthermore note that a major fraction of communities' revenues comes from state grants and redistributed tax revenues. German communities moreover autonomously set the local property tax rate, which, however, is a less important revenue source relative to the local business tax. The majority of local business tax revenues moreover remains directly with the municipalities; only a small share is transferred to the central and regional level as an element of the German federal equalisation scheme, see e.g. Büttner (2003) and Foremny and Riedel (2014).

[12] Note that the results are robust to using an effective local business tax measure, which additionally takes into account that the local business tax was deductible from its own base until 2007.

*Sample Definition and Variable Construction*

The empirical analysis to come draws on a sample of West German localities between 2000 and 2007.[13] The analysis disregards small communities with less than 2000 inhabitants as anecdotal evidence suggest that small jurisdictions lack room for strategic policy-making. In line with that notion, we obtain qualitatively comparable, but quantitatively smaller, results to the ones presented below when this restriction is dropped (cf. an earlier working paper version Böhm et al. (2016)).[14] Our main estimation sample comprises 3982 municipalities and 30,831 municipality-year observations.

The sub-national setting furthermore allows us to construct consistent measures for jurisdictions' firm size patterns. The latter are calculated from the universe of German plants provided by the German Employment Agency (GEA) for 2000 to 2007. The data comprises more than 2 million plants per year and includes information on the host community and the number of employees subject to social security contributions (see also Koh and Riedel (2014)). In the following, we use this information to construct the average size $A_{i,t}$ of firms hosted in jurisdiction $i$ at time $t$ (as a measure for the absolute size of businesses) and a Herfindahl index $H_{i,t}$ (as a measure for the relative size of businesses): $A_{i,t} = \sum_k S_{k,i,t}/K_{i,t}$ and $H_{i,t} = \sum_k \left(S_{k,i,t}/\sum_k S_{k,i,t}\right)^2$, with $S_{k,i,t}$ denoting the size of plant $k$ located in community $i$ at time $t$, measured by plant employment, and $K_{i,t}$ depicting the total number of firms hosted in community $i$ at time $t$.[15] We will moreover assess the sensitivity of our empirical results to the use of alternative firm size measures (see Section 5 for details).

The data is furthermore augmented by rich information on the socio-economic, budgetary and political characteristics of our sample municipalities. We account for the size of economic activity as measured by the jurisdiction's population and number of firms, the economic conditions as measured by the localities' unemployment rate and the net income per capita. We furthermore add information on the level of public good

[13]The sample restriction to West German localities and to the years 2000-2007 is data-driven and reflects that the plant data provided by the German Employment Agency (see below), which we use to calculate the firm concentration indices, is available to us for the indicated time period only. East German localities are moreover omitted from the analysis as East Germany saw major community boundary reforms within our sample frame.

[14] Specifically, it is mostly larger German municipalities which, besides their mandatory spending obligations, provide significant amounts of public goods and services - reflecting prohibitively high per capita provision costs in smaller jurisdictions (see e.g. Alesina and Spolaore (1997)). As localities, moreover, have limited options to take on debt, many small jurisdictions are reported to only adjust their local business tax rate to balance their mandatory spending.

[15]Moreover, $0 < H_{i,t} \leq 1$. The described indices are drawn from previous research, see Koh and Riedel (2014) for further details on the construction.

provision, precisely on the municipality's number of railway stations, airports, seaports and high-way connections. The data is moreover augmented by information on public good preferences and financing needs as indicated by the fraction of the community's population aged below 15 and above 65 respectively as well as indicators for the municipalities' fiscal performance, namely the locality's total outstanding per capita debt as well as its total per capita revenue and local business tax revenue[16]. On top, we include information on the seat shares of the political parties in the municipal council and variables capturing the communities' firm and industry structure, namely the fraction of non-incorporated businesses and a proxy for corporate rents from spatial firm concentration.[17] Table 1 presents information on variable definition, data sources and descriptive statistics.

Finally, we add firm-level data from Bureau van Dijk's AMADEUS database, which comprises rich accounting and ownership information on firms in Europe. The subset of the data on German firms is linked to our sample localities via post code information and is used to construct firm concentration measures (complementary to the GEA data) as well as control variables.[18] For Germany, Bureau van Dijk's main data source is the German registrar of companies. From the mid 2000s onwards, the data covers nearly all companies with limited liability in Germany. As will be described in the

[16]All controls vary at the municipality level with the exception of income per capita and debt per capita, which are obtained at the county level. The latter variable, however, also includes municipality-specific information on the debt of hospitals and other city owned firms. Note, moreover, that information on total per capita revenue and local business tax revenue is obtained from the cashflow statements of localities (and have been used in prior work, see e.g. Buettner (2006)). Total revenue includes own tax revenues, income tax and VAT revenues allocated to the community as well as grants from the state. The information on local business tax revenues captures actual business tax payments received by localities (i.e. pre-payments for the tax are captured at the time when they accrue as are refunds in the case that tax pre-payments exceed firms' actual tax levy). For multi-plant firms, a formula apportionment system applies, implying that the tax base is consolidated at the German federal level and apportioned to localities based on plants' payroll shares. Related tax payments are included in the local business tax revenues of each locality (cf. Riedel (2010)).

[17]Information on the share of non-incorporated firms is drawn from the German local business tax statistics and available at the county level (cf. Table 1). Similar results are, however, obtained when we calculate the share of non-incorporated firms at the municipality level from AMADEUS (as the difference between the total number of firms (drawn from GEA) and the number of incorporated firms (drawn from AMADEUS, which includes the population of incorporated firms in Germany, whereas many non-incorporated entities are missing)). Information on spatial agglomeration rents at the industry level is obtained from prior work (Koh et al. (2013), $Log\ L^{o2}_{i,t}$ defined therein).

[18]On top, we retrieve information from Bureau van Dijk's DAFNE database, which coincides with the AMADEUS sub-data for Germany but includes additional information, most importantly allows us to identify company relocations within our sample period.

next section, we moreover rely on AMADEUS data for Germany and other European countries to construct instrumental variables (cf. Section 4 for details). Finally note that, since accounting information is available for ten historic years per AMADEUS version only, we make use of historic AMADEUS versions to complement accounting information in our early sample years.

# 4 Empirical Strategy

As spelled out in Section 2, the aim of our empirical analysis is to assess the impact of the firm size structure $M_{i,t} \in \{A_{i,t}, H_{i,t}\}$ on the local business tax choice $b_{i,r,t}$ in municipality $i$ of region $r$ at time $t$. We estimate a model of the following form

$$b_{i,r,t} = \alpha_1 + \alpha_2 M_{i,t} + \alpha_3' X_{i,r,t} + \rho_t + \mu_{r/i} + u_{i,r,t}. \tag{1}$$

The theoretical considerations predict that a rise in the average size of firms and a higher firm-level concentration of economic activity are associated with lower local business tax choices and hence $\alpha_2 < 0$. Equation (1) controls for unobserved heterogeneity along two dimensions: In cross-sectional regressions, we include a full set of commuting area fixed effects $\mu_r$ ("*Raumordnungsregionen*", following the definition of the Bundesamt für Bauwesen und Raumordnung), which absorbs unobserved heterogeneity in economic, social, budgetary or institutional characteristics of hosting communities that correlate with geographic location. Complementary, we run specifications that exploit the panel structure of the data and include a full set of municipality fixed effects, thus absorbing time-constant unobserved heterogeneity across sample jurisdictions. On top, a full set of year fixed effects $\rho_t$ is included which captures common shocks to municipalities' local business tax choices over time.

The estimation model moreover controls for the rich set of community characteristics described in the previous section (subsumed in the vector $X_{i,r,t}$), thus acknowledging that firm size changes - irrespective of their source - might correlate with changes in jurisdictions' aggregate economic activity and other socio-economic and budgetary determinants of the local business tax choice. On top of linear models, we run specifications with flexible functional forms of control variables by adding higher order polynomials and interaction terms between regressors.

Next to controlling for observed and unobserved heterogeneity, we moreover pursue an instrumental variable strategy to hedge against results that are driven by potential firm size responses to changes in jurisdictions' tax policies - where the direction of the

OLS-bias is a priori unclear: low business taxes may attract firms of above average size (biasing the $\alpha_2$-estimate upwards in absolute terms) but may simultaneously also foster entrepreneurship and the foundation of new (and, in consequence, small) companies (biasing the $\alpha_2$-estimate downwards in absolute terms). Our instrumental variable strategy will exploit industry-level-shocks as an exogenous driver of individual firm size (see Bertrand et al. (2002) and Dharmapala and Riedel (2013) for similar approaches) and, in consequence, of localities' aggregate firm size structures.[19]

Technically, the instrumental variable approach models individual firm size $\tilde{S}_{k,i,t}$ of entity $k$ located in community $i$ in year $t$ as $\tilde{S}_{k,i,t} = \tilde{S}_{k,i,t-1} \cdot (1 + \tilde{g}_{k,i,t})$, where $\tilde{S}_{k,i,t-1}$ stands for $k$'s predicted size in period $t-1$ and $\tilde{g}_{k,i,t}$ depicts the predicted size growth of firm $k$ calculated from common firm size shocks to all other entities $j$ that are part of the same industry ($k \neq j$). To avoid inflicting the instrument with endogenous variation, we assign a uniform firm size value for all entities in 2000 and refrain from anchoring the simulation in firms' endogenous actual size structure in the first sample year 2000 ($\tilde{S}_{k,i,2000}$).[20] Any cross-sectional and longitudinal difference in predicted firm size values in later sample years hence relates to variation in $\tilde{g}_{k,i,t}$, which is modelled as a function of the average size growth of other firms in the same industry: $\tilde{g}_{k,i,t} = F(\sum_{j \in I_\ell, j \neq k} \frac{g_{j,t}}{(|I_\ell|-1)})$, with $|I_\ell|$ denoting the cardinality of the set of firms $I_\ell$ in industry $\ell$ ($k, j \in I_\ell$) and with the function $F$ being further specified below. Note that $\tilde{g}_{k,i,t}$ captures different sources of common firm size variation within industries, among others, shocks to consumer demand, industry regulation, production technology or cost structures. Aggregation of the predicted firm size values $\tilde{S}_{k,i,t}$ to the jurisdiction level then yields instruments for the localities' absolute and relative firm size measures, namely the average size of entities $\tilde{A}_{i,t} = \sum_k \tilde{S}_{k,i,t}/K_{i,t}$ and the Herfindahl Index $\tilde{H}_{i,t} = \sum_k \left(\tilde{S}_{k,i,t}/\sum_k \tilde{S}_{k,i,t}\right)^2$.

The construction of the instruments draws on Bureau van Dijk's AMADEUS data (cf. Section 4). We calculate $\tilde{S}_{k,i,t}$ for the approx. 400,000 German firms in AMADEUS that were active during our sample period 2000-2007 (derived based on firms' year of incorporation and, if applicable, year of company closure). Note that this set of companies includes firms with missing balance sheet information in some or all of

[19]As described above, we control for the aggregate economic development by including control variables for the number of firms in jurisdiction $i$ at time $t$, the unemployment rate and population size. On top, we add a regressor for anticipated industry-shock-driven changes in localities' unemployment rates, see Section 5 and the online appendix for more details.

[20]Specifically, we assign a size value of 100 thsd. US Dollars in 2000, where results are insensitive to the particular choice of this starting value. Furthermore note in this context that we measure firm size by corporate fixed assets when calculating size measures based on AMADEUS as the variable is better covered than alternative measures like firm employment (see below).

our sample years, as the simulation of $\tilde{S}_{k,i,t}$ requires information on firms' industry affiliation but not on balance sheet items.[21] The construction of $\tilde{g}_{k,i,t}$ (as a function of the size growth of other entities in the same industry, $\sum_{j\in I_\ell, j\neq k} \frac{g_{j,t}}{|I_\ell|-1}$), in turn, draws on a pool of German and European firms for which balanced size information is available between 2000 and 2007. The focus on firms with balanced size data avoids that $\tilde{g}_{k,i,t}$ captures variation related to AMADEUS's increasing firm coverage over time. Non-German firms are included in the calculation of $\tilde{g}_{k,i,t}$ as accounting information for firms in Germany is restricted to a set of relatively few rather large entities before the mid 2000s (when German registrar information became available within AMADEUS). Assuming that firms in Europe are subject to similar industry shocks, the calculation of $\tilde{g}_{k,i,t}$ draws on more than one million entities located in Germany, Austria, Belgium, France, Italy, Netherlands or Spain in our baseline analysis[22]; in robustness checks, we show that our results are robust to changes in this country set, including a calculation of $\tilde{g}_{k,i,t}$ based on companies located in Germany only.

Our data also suggests that the described industry-shocks are more strongly correlated with the size development of large firms relative to the size development of smaller entities (see the online appendix for details). This may firstly relate to potential differences in the exposure of small and large firms to industry shocks. On top, the difference may root in the calculation of $\tilde{g}_{k,i,t}$, which draws on firms with balanced firm size data between 2000 and 2007. As these entities have above average size, the pattern may relate to the higher underlying similarity of large firms within the same industry and a higher proneness to be subject to the same shocks. To maximise the relevance of our instrumental variable, we account for this heterogeneity when calculating $\tilde{g}_{k,i,t}$ and estimate a parameter $\gamma_q$ which captures the transmission rate with which industry shocks translate into changes in the size growth of firm $k$ in size class-decile $q \in \{1, ...10\}$ and write $\tilde{g}_{k,i,t} = F(\sum_{j\in I_\ell, j\neq k} \frac{g_{j,t}}{(|I_\ell|-1})) = \sum_q I_{qk} \cdot \gamma_q \cdot \sum_{j\in I_\ell, j\neq k} \frac{g_{j,t}}{|I_\ell|-1}$, with $I_{qk}$ indicating whether firm $k$ belongs to size class $q$. The parameters $\gamma_q$ are estimated with Bureau van Dijk's AMADEUS data for Germany, see the online appendix for details on estimation strategy and results. Based on the sketched information, individual

[21]Note that we cannot draw on the GEA data to calculate $\tilde{S}_{k,i,t}$ as regulations for researchers' access to the GEA data were tightened over the past years, implying that we can exploit firm size structure variables calculated from the GEA data in prior research (cf. our discussion in Section 4) but cannot use the data for the construction of the instrumental variables.

[22]These countries were chosen as they firstly, exhibit a good firm coverage during our sample period and, secondly, are broadly comparable to the German economy in terms of location, economic structures, institutional settings and industry composition; thirdly, our data suggests that the size development of German firms positively correlates with the size development of firms in these countries.

firm size $\tilde{S}_{k,i,t}$ is simulated and localities' average firm size $\tilde{A}_{i,t}$ and the Herfindahl index $\tilde{H}_{i,t}$ are calculated. Finally, note that, for the construction of the instrument, firm size is proxied by corporate fixed assets (as assets are better covered in AMADEUS than other potential size measures like employment) and industry affiliation is defined based on 4-digit NACE industries.

# 5 Results

The results are presented in Tables 2 to 6. Heteroscedasticity robust standard errors that account for clustering at the municipality level are depicted in brackets below the coefficient estimates.

*Baseline OLS Models*

Table 2 presents the baseline OLS estimates. Specification (1) regresses communities' local business tax rates on a measure for their absolute firm size structures, namely the average size of businesses (calculated from the GEA data), as well as full sets of commuting area fixed effects, state fixed effects, year fixed effects and the time-varying control variables described in the previous section. Specification (2) reestimates the model restricting the sample to observations in 2007 - as this subset of the data also serves as one of the main samples for the instrumental variable regressions to come (see below). In line with our theoretical considerations, the coefficient estimates for the firm size variable turn out negative and statistically significant. Quantitatively, Specification (2) suggests that a doubling of the average size of firms is associated with a reduction in the local business tax rate by 0.26 percentage points or 1.5% evaluated at the sample mean. Figure 1 graphically depicts the link in a binned scatter plot.[23]

On top, we run specifications which regress the local business tax on communities' *relative* firm size structures as modelled by a Herfindahl index. This yields results that are qualitatively and quantitatively comparable to our baseline estimates (cf. Specifications (3) and (4) of Table 2). As average firm size and Herfindahl index are positively correlated (coefficient: 0.34, p-value $< 0.00$), we furthermore run models where both variables are included simultaneously in the set of regressors. In this horse race, the estimate for the average firm size variable remains statistically significant and quantitatively largely unchanged, while the coefficient estimate for the Herfindahl index loses in size and statistical significance, providing some evidence that it is mainly

[23]The coefficient estimates for the control variables are presented in Table A1 of the online appendix and show expected signs.

the absolute not the relative size of firms which impacts on local business tax choices (cf. Specifications (5) and (6)). Table A2 in the online appendix furthermore shows that similar results emerge with alternative firm size measures and when we account for clustering of errors at more aggregated levels.

*Instrumental Variable Models*

In Specification (1) of Table 3, we reestimate the baseline model (Specification (2) in Table 2) instrumenting for communities' average firm size with the simulated size variable described in the previous section (where industry shocks are constructed based on firms in Germany, Austria, Belgium, France, Italy, Netherlands and Spain). The sample is restricted to observations in 2007, implying that identifying variation relates to differences in average firm size across localities induced by industry-shock-driven corporate firm size changes between 2000 and 2007. Jurisdiction's aggregate size (as measured by population and firm numbers) is, moreover, treated as endogenous and instrumented with long-lagged information from a population census in 1910, namely the long-lagged population density of communities and their long lagged market potential, where the latter variable is defined as the sum of surrounding localities' long lagged population, normalised by distance (both variables are drawn from prior research, see Koh et al. (2013)).[24] Additionally, per capita revenue is instrumented with its county-year average (where instrumenting other control variables with county-averages does not affect the estimates for the firm size coefficients). The F statistic supports the relevance of the instruments and the results confirm the negative effect of average firm size on local business tax choices. Quantitatively, the estimates gain in absolute size compared to the OLS specification, pointing to a downward bias of the absolute OLS estimate. A doubling of a jurisdiction's average firm size is suggested to lower local business tax choices by 0.86 percentage points or 5.0%.

Similar results are derived with alternative instruments, which model the industry shock $\tilde{g}_{ikt}$ based on firms from different countries (cf. Specifications (2)-(5)). Specification (6), on top, reruns the model in Column (1), augmenting the set of regressors by a Herfindahl Index and the set of instruments by $\tilde{H}_{it}$. The result pattern mirrors the OLS estimates, in the sense that the coefficient estimate for the average firm size variable remains largely unchanged in size and significance when the Herfindahl Index is added to the set of regressors, while the coefficient estimate for the Herfindahl index

[24]The data is obtained from "Kaiserliches Statistisches Amt (1915), Die Volkszählung im Deutschen Reiche am 1. Dezember 1910, Kaiserliches Statistisches Amt, Berlin" and is matched to the communities in our data set based on historic maps (see Koh et al. (2013)).

turns out statistically indistinguishable from zero (and positive).[25] This supports the notion that jurisdictions' local business tax choices are mainly affected by the absolute but not the relative size of hosted firms.

Table 4 moreover reestimates the instrumental variable models with municipality instead of region fixed effects. This controls for time-constant unobserved heterogeneity in tax-setting behaviour and implies that only longitudinal variation in firm size (instruments) is employed for empirical identification. The sample is restricted to the years 2000 and 2007, implying that local business tax changes between the beginning and end of our sample period are related to *accumulated* changes in firm size structures induced by industry-shocks between 2000 and 2007. Analogously to Table 3, the construction of the industry shocks relies on firms operating in the same 4-digit NACE industry in our baseline set of countries (cf. Section 4). Specifications (2)-(5) assess the robustness of the findings to the use of alternative instrumental variables, which construct $\tilde{g}_{ikt}$ based on other country-sets of firms. The coefficient estimates for the average firm size variable are comparable across specifications (and comparable to the cross-sectional estimates in Table 3). Quantitatively, the specifications suggest that a doubling of the average size of businesses reduces the local business tax rate by around 1.23 percentage points (or 7.16%, evaluated at the sample mean and 69.6% of a standard deviation in the local business tax, cf. Specification (1)).

The online appendix furthermore shows that our findings are robust to accounting for clustering of errors at higher geographic units and to changes in the modelling of control variables, namely to adding higher order polynomials and interactions between regressors. We devote particular attention to the modelling of the control variables for the aggregate size of economic activity and localities' budgetary situation. The former acknowledges that changes in firm size structures may correlate with changes in overall corporate activity and unemployment that might equally impact on policy setting. To substantiate that point the online appendix furthermore presents instrumental variable models which control for industry-shock driven changes of expected future unemploy-

[25]Note that Specification (6) relies on an instrument $\tilde{H}_{it}$ which is simulated as described in the previous section but uses firms' actual size (instead of a fixed value of 100,000 US Dollars) as starting point for the simulation exercise in the year 2000 (cf. Section 4). In doing so, we draw on observed firm size in 2009 (when accounting information from the German business tax registry was already available within Bureau van Dijk's databases) as exploiting firm size information from earlier sample years would result in the loss of a large number of observations. The described modification offers the advantage that instrument relevance is increased. Qualitatively and quantitatively similar coefficient estimates for the firm-size effect are, however, obtained from instrumental variable regressions with instruments, where $\tilde{S}_{ikt}$ is constructed with a fixed starting size-value of 100,000 US Dollars in 2000.

ment rates - deriving results similar to our baseline estimates (see Table A3 in the online appendix).[26] The budgetary regressors are moreover included in the model to absorb potential confounding effects related to a possible correlation between firm size and locality revenues (conditional on aggregate jurisdiction size), which might affect local business tax setting if local business tax choices are partly driven by revenue needs. A correlation between firm size and the local budget might root in productivity advantages of large firms, implying that large businesses earn higher income and pay more taxes per activity unit than smaller entities. On top, it is well documented that large firms pay higher wages than their smaller counterparts (see e.g. Oi and Idson (1999) and Fox (2009)), which might also raise local revenues (conditional on jurisdiction size) as German communities receive a fraction of their inhabitants' federal personal income taxes (that are set and administered at the federal level). Our baseline analysis accounts for this point by including a regressor for the log of localities' per capita revenue (which is instrumented by county averages in the instrumental variable models). The online appendix furthermore shows that similar results emerge when we control for the local business tax base[27] or change functional form assumptions regarding the influence of the budgetary control regressors.

*Discussion*

Concluding, the results provide evidence for a negative effect of firm size structures on local business tax choices. The effect is statistically significant and quantitatively relevant, with an increase in average firm size by one standard deviation lowering communities' local business tax choices by around 32% of a standard deviation.[28] German cities like Wolfsburg, Ingolstadt and Ludwigshafen, which host the headquarters of the world leading car and chemical manufacturers Volkswagen, Audi and BASF, are for example predicted to would have chosen significantly higher local business tax rates under the counterfactual that these firms were absent: if average business size dropped to the level of other German cities of similar aggregate size, local business tax rates

[26]If the control variables failed to absorb the described effects, we expect the coefficient estimate for $\alpha_2$ to be biased towards zero - hence establishing a lower bound for the true absolute impact of firm size on tax policy choices (- this relates to the notion that (industry-shock-driven) changes in firm size are, if at all, expected to positively correlate with changes in aggregate economic activity and that tax policy is expected to respond to declines in aggregate economic activity by lowering business tax rates to counterbalance the negative economic trend).

[27]The business tax base is defined as business tax revenues (cf. Section 3) over business tax rate.

[28]Cf. Specification (1) of Table 4. An increase in firm size by one standard deviation corresponds to a size increase by 46.0% (cf. Table 1), which lowers the local business tax choice 0.57 percentage points on average or 32% of a standard deviation in the local business tax (cf. Table 1).

are, ceteris paribus, predicted to rise by 22.0%, 12.8% and 15.1% respectively.[29]

Furthermore note that the identified link between firm size and business tax rate choices likely serves as a lower bound for the importance of firm-size-effects on business-related policy choices given that similar effects may emerge in other policy instruments suited to accommodate the corporate sector. In the context of German localities, this may e.g. relate to the provision of local public goods and services; at higher government tiers, it may, among others, affect the setting of the federal corporate tax rate and the tax base definition as well as the assignment of public grants and regulatory provisions.[30] Note that empirically identifying firm-size-effects in other policy instruments may be difficult though - thus underlining the suitability of our testing ground. Firstly, at higher government tiers, the wide and complex set of policy instruments available to accommodate the corporate sector may imply that benefits granted to businesses are spread out across different policy measures, thus making it challenging to identify firm-size-effects for individual instruments. Studying business taxation furthermore offers the benefit that business tax reductions/increases can be directly interpreted as 'business-(un)-friendly' policies, contrary to other policy areas, like government spending, where public information is not available at a sufficiently disaggregated level to identify business-friendly and business-unfriendly shifts in jurisdictions' policy choices.

*Transmission Channel*

Our discussions in Section 2 identified lobbying and firm mobility as potential theoretical drivers of the 'firm size-tax choice' link. The aim of this sub-section is to assess the relative importance of the two transmission channels. This is of particular interest as efficiency consequences starkly differ between the mechanisms.[31] Precisely,

[29]The log-difference in average firm size between the city of Wolfsburg (hosting around 122 thousand inhabitants during our sample period) and other cities of comparable size (with an average population between 100 and 200 thsd. inhabitants during our sample period) is 3.23. A corresponding decrease in average firm size is predicted to raise Wolfsburg's local business tax by 3.97 percentage points or 22%, evaluated at Wolfburg's average business tax during our sample period (=18%). The relative adjustments for Ingolstadt and Ludwigshafen are calculated accordingly. Furthermore note, that in line with our theoretical considerations, all three cities levy local business tax rates that are significantly lower than the ones of other cities of comparable size (18.78% vs. 21.27%). On top note that similar findings emerged in a complementary analysis which exploits community amalgamations in East Germany for empirical identification (cf. Böhm et al. (2016)).

[30]Which instrument is used (and which policy adjustments firms lobby for) thereby depends on the benefit of given policy adjustments for the businesses involved and the welfare costs associated with that change (see e.g. Grossman and Helpman (1994)).

[31]Distributive predictions coincide, with both mechanisms suggesting that increases in firm size go along with a reduction in corporate tax rates (at the expense of other agents in the economy).

if business lobbies spend resources to deviate corporate tax policies in their favour and away from the social optimum, welfare is harmed. On the contrary, corporate tax adjustments in response to differences in the underlying mobility of hosted entities or in response to implicit or explicit relocation threats of large employers are, from the perspective of the individual jurisdiction, in line with welfare maximizing behavior.[32]

As described in Section 2, lobbying activities and firm mobility may theoretically establish a link between *absolute* as well as *relative* firm size and local business tax choices. Since our empirical results provide evidence for the former, but not for the latter link, we discard lobby free-riding incentives or communities' dependence on large employers (cf. Section 2) as significant drivers of our results. The link between absolute firm size and tax policy choices may, in turn, root in corporate fixed costs related to lobbying behaviour (cf. the 'lobby participation' effect described in Section 2) or in mobility differences between large and small firms, related to fixed relocation costs or differences in the underlying productivity of large and small entities (cf. the 'mobility difference'-effect described in Section 2).

To assess the importance of firm mobility as a driver of our results, we make use of Bureau van Dijk's data for Germany to construct three firm-level mobility measures[33]: Firstly, we define an indicator for the affiliation of firms with a multinational and national group respectively. Precisely, firms are coded to be affiliated with a multinational group if one of their majority-owned affiliates or one of their parent firms (owning at least 50% of ownership stakes) is located in a foreign country. Analogously, firms are defined to belong to a national group if one of their majority-owned subsidiaries or a parent (owning at least 50% of ownership stakes) is located in another German community. To further model the mobility of individual firms, we determine the elasticity with which businesses' fixed asset investments expand in response to corporate tax decreases, estimated based on Bureau van Dijk's AMADEUS data for narrowly defined subsets of firms. Specifically, tax elasticities are allowed to vary with observed mobility correlates, namely firm size (cf. Section 2), industry affiliation (capturing differences related to the (in)tangible nature of main production factors) and the size of a firm's host jurisdiction (capturing differences related to mobility-reducing agglomeration rents). On top, we allow for unobserved mobility drivers by letting tax elasticities vary between

[32]From an international perspective, decentralised corporate tax setting behaviour may exert externalities on foreign jurisdictions, which may render decentralised policy choices inefficient.

[33]Specifically, we make use of a version of the so-called DAFNE data, which coincides with the AMADEUS information for Germany, but offers the advantage that ownership changes and firm relocations are accounted for in our data version and information on postal codes allows to identify the host localities of the identified firms.

high, medium and low-tax jurisdictions. This follows the theoretical notion that hosting high-mobility firms (irrespective of the source of the mobility-advantage) goes along with low local business tax choices of municipalities. In total, we derive tax elasticities for 543 subsets of firms (that vary in all four 'heterogeneity dimensions' and are estimated based on around 2.5 million firm-year observations). See the online appendix for further details on the estimation strategy and results.

We furthermore estimate the described tax elasticities based on different sources of identifying variation. In the baseline models, the tax variation stems from a *federal* corporate tax reform in 2008, which, firstly, lowered incorporated firms' federal corporate tax rate by 10 percentage points, while leaving the tax burden of unincorporated entities (taxed on a pass-through basis) unchanged and, secondly, abolished the deductibility of the local business tax from its own tax base and from the corporate tax base and altered the base rate ('Messzahl'), with which the local business tax multipliers set by localities are multiplied when calculating the local business tax levy, see Section 4 and the online appendix for details. All described changes affect the tax burden on businesses in Germany and are exploited for empirical identification. The model is estimated based on Bureau van Dijk's AMADEUS data for Germany between 2004 and 2010. In robustness checks, we additionally estimate tax elasticities based on variation in communities' local business tax multipliers (- where the latter is relegated to a sensitivity analysis to acknowledge reverse causality concerns related to the fact that the local business tax rate also serves as a dependent variable in our main analysis). See the online appendix for details.

Note that, if differences in firm mobility are indeed a significant driver of the 'firm size-tax choice' link, we expect mobile firms - proxied by multinational and national group affiliation and high tax-elasticities - to have above average size and simultaneously face low local business taxes in their host jurisdiction. The online appendix confirms a positive link of firm size with multinational and national firm affiliation as well as with the absolute assigned tax elasticities. Table 5 moreover presents empirical models that rerun our baseline specifications with the descibed mobility controls. Specifications (1) and (3) show coefficient estimates from the baseline OLS models presented in Columns (1) and (2) of Table 2. Specifications (2) and (4) add control variables for the fraction of firms per community that are part of a multinational and domestic group respectively and, on top, augment the set of regressors by the average tax elasticity of hosted entities estimated based on tax variation induced by the federal corporate tax reform in 2008. Furthermore note that the 543 derived elasticities are winsorized at the 5% level before being assigned back to individual firms and before taking community-averages (see the online appendix for details). The results support the notion that communities choose lower local business tax rates when they host mobile firms. Precisely, the coefficient estimate for the MNE-variable turns out negative and statistically significant, while the coefficient estimate for the average corporate tax elasticity is positive and significant as expected (- note that an increase in the *negative* average tax elasticity of firms per jurisdiction corresponds to an absolute decrease in the variable). Adding the mobility controls to the estimation model, moreover, significantly reduces the absolute coefficient estimate for the firm size variable (by 64% and 68% respectively), suggesting that the firm mobility channel is an important driver of the effect of interest.

This finding is confirmed in Specification (5), where we reestimate the model in Column (2) using an average corporate tax elasticity control that draws on tax elasticity estimates obtained based on business tax variation related to the federal corporate tax reform in 2008 as well as to changes in local tax multipliers chosen by localities (see our discussion above). Specification (6) moreover shows that similar results emerge with an average tax elasticity control calculated based on non-winsorized tax elasticities. Finally note that we find comparable result patterns when the mobility controls are added to the instrumental variable models (cf. Specifications (7) and (8)).

The results hence suggest that the link between firm size and communities' local business tax choices is to a significant part driven by mobility differences between large and small firms. Complementary, we assess the importance of lobbying as a driver of our results. Research on corporate sector influence on policy-making faces the challenge that systematic information on firms' lobbying effort is hard to come by. Recent studies for the US draw on entities' direct monetary contributions to candidates running for political office, provided by the Federal Election Commission. Information on indirect lobby efforts, e.g. related to the time spent by firm representatives in meetings with politicians or bureaucrats often remains unacknowledged though. In the following, we account for both means of political influence by coding firms as lobby-active if they either make significant monetary contributions to German political parties or spend time engaging with politicians and bureaucrats.

Precisely, we make use of data on donations to German political parties exceeding the threshold value of 50,000 Euros, which have to be published by German law (Par. 25 Parteiengesetz). The data is available from 2002 onwards and is linked to the AMADEUS database by name matching procedures.[34] This information is com-

[34]Note that we link firm names as well as the names of individual owners of German companies. Firms owned by individuals donating money to political parties are coded as politically active. In

plemented by data on interactions of firms with political representatives. As such data is missing for the local level, we turn to information on corporate interactions with political representatives at the national and supranational level. At the German national level, we rely on a list of entities holding permanent access passes to the premises of the German parliament. The list was published by the German parliament following a decision by the higher administrative court of Berlin-Brandenburg in 2015 ruling that the parliament must disclose holders of access passes to its premises as well as the parliamentary group which granted the access pass. The published list comprises more than 1100 representatives which held such passes between 2013 and 2015. Complementary, we draw on the European Union's Transparency Register, which is jointly operated by the European Parliament and the European Commission, and lists entities that engage in activities designed to influence decision-making in EU institutions. The register was initially founded by the EU Commission in 2008 and was expanded in 2011, when the parliament joined the initiative. Signing up with the registry is voluntary but there are several incentives for entities to register: Among others, registration is required for meetings with EU representatives or participation in expert groups as well as for access to the premises of the European Parliament; registered entities moreover receive automatic information on public consultations or Commission activities and initiatives. In total, around 11,000 entities registered with the registry to date.

In the following, firms are coded as lobby active if they make significant party donations or appear on the access-pass list of the German parliament or in the EU's Transparency Register. Beyond the lobbying entities identified, all affiliated companies (i.e. majority-owned subsidiaries or parent firms holding more than 50% of ownership stakes) are included in the definition of lobbying firms. In total, 4,887 firms are coded as lobby-active. The derived lobbying indicator serves as a proxy for lobbying behaviour at the local level under a number of assumptions. Firstly, the construction presumes an underlying general propensity of firms to engage in lobbying, i.e. a positive correlation between lobbying at higher and lower government tiers. Secondly, we assume time-constant political engagement as firms are coded as lobby-active if they are observed to engage in lobbying in any sample-year or post-sample year. This follows the notion that influence on political decision-making relies on (potentially unobserved) constant relationship building and constant communication with political decision makers.[35]

total, the database comprises 450 donations between 2002 and today.

[35]The EU Transparency Register and the access pass-list of the German parliament comprise information from our post-sample period only, implying that firms that were lobby-active between 2000 and 2007 but closed-down or ceased their lobby-behaviour after 2007 are not captured in our analysis.

To improve upon the definition of the lobbying variable, we also model predicted corporate lobbying propensities based on firms' observed characteristics, namely their industry affiliation, year of incorporation, firm size and legal form. To do so, we run logit regressions that model lobby-activity as a function of the described firm variables and then predict individual firms' propensity to engage in lobbying behaviour. The actual and predicted lobbying variables are then aggregated to the community-level by calculating asset-weighted firm-averages. Specifications (1) and (2) of Table 6 rerun the baseline OLS model in Column (2) of Table 2, including the actual and predicted lobbying controls in the set of regressors. The coefficient estimates for the lobbying variables turn out negative and statistically significant. In line with intuition, the presence of lobby-active firms is hence suggested to lower local business tax choices. The additional regressors moreover reduce the absolute coefficient estimate for the firm size variable of interest, implying that the lobbying channel contributes to the link between firm size and business tax rate choices. The quantitative importance is moderate though, amounting to a reduction in the firm size-effect of interest by around 3.6% (cf. Specification (2)). These findings are confirmed in Specifications (3) and (4), which reestimate the instrumental variable model in Specification (1) of Table 3 with the lobbying controls described above.

Concluding, the analysis derived qualitative evidence for a role of both, the lobbying and mobility channel, in driving the link between firm size and local business tax choices. Quantitatively, the estimates assign about two thirds of the effect to the mobility channel. The quantitative importance of the lobbying channel is suggested to be moderate. Note, however, that these estimates yield lower bounds for the true importance of firm mobility and lobbying as drivers of our results since mobility and lobbying controls are unlikely to capture all differences in the mobility characteristics and lobbying behaviour across firms. The analysis hence yields bounds for the relative importance of the two mechanisms, with at least two thirds (up to one third of the effect) being assigned to the mobility (lobbying) channel.[36]

[36]Note that the importance of the mobility and lobbying channel in establishing a link between firm size and local business tax choices must not necessarily correspond to the relative importance of the direct effects of firm mobility and lobbying on local business tax choices. From a theoretical perspective, the importance of the two mechanisms for the 'firm size-tax' link depends on the structure of corporate mobility and lobbying costs. If fixed costs to engage in lobbying at the local level are e.g. small, firms may engage in significant lobbying activities irrespective of their size, which - if effective - result in low local business tax rates. The lobby-driven correlation between firm size and local business tax choices would nevertheless be small in such a scenario. Analogously, moderate fixed relocation costs would imply high mobility rates among small and large firms, potentially resulting in

# 6 Summary and Conclusion

The paper presents evidence for a systematic link between jurisdictions' firm size distribution and government policies. Using the German local business tax as a testing ground, we show evidence for an inverse relationship between the average firm size in German communities and municipalities' local business tax choices. The effect is statistically significant and quantitatively relevant and prevails in various sensitivity checks, including empirical models where identification relies on exogenous firm size variation induced by industry shocks.

The findings suggest that differences in firm size structures across jurisdictions add to explaining observed heterogeneity in governments' tax policy choices. Recent decades' merger and acquisition waves and the trend towards more concentration of economic activity (especially in emerging markets and the developing world) may thus not be neutral in terms of governments' tax policy choices and may lead to more favourable tax conditions for the corporate sector. Finally note that our findings may also extend to other policy areas, including, among others, the provision of public goods and services, the assignment of public grants or product and labor market regulations - suggesting that firm size structures may also play a role in explaining regulatory capture and public fund allocation in these fields.

low local business tax choices, while the mobility-driven correlation between firm size structures and local business tax choices would nevertheless be small.

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# 7 Figures and Tables

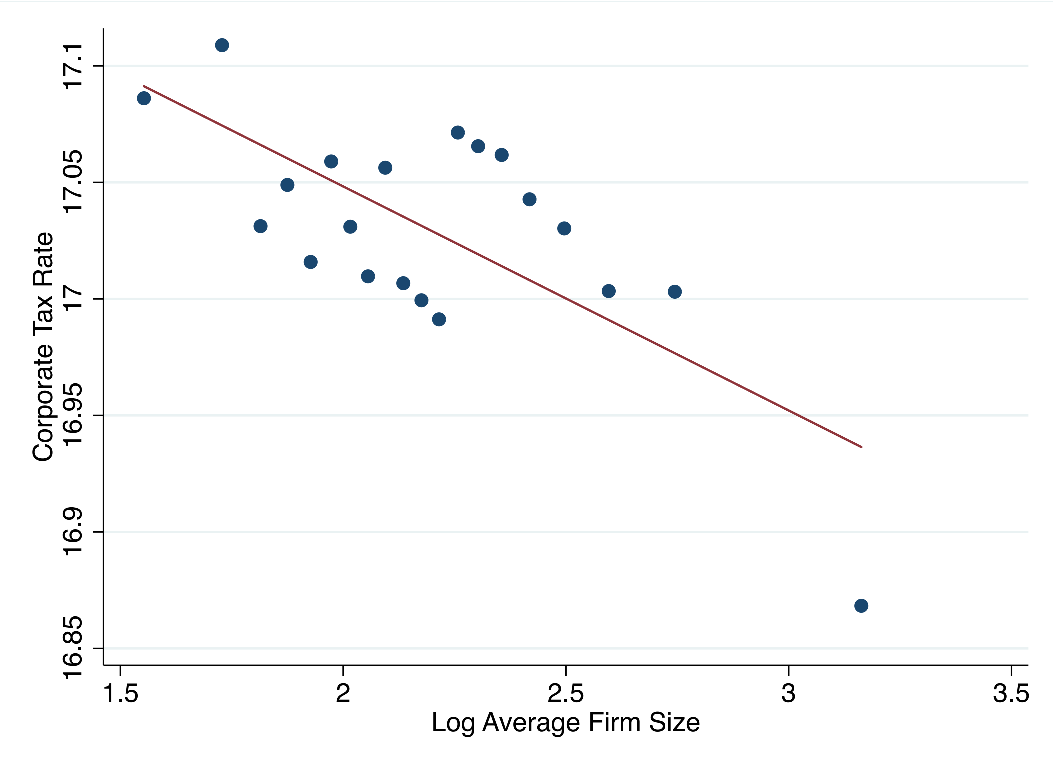


Figure 1: Binned Scatter Plot - Jurisdictions' Local Business Tax Rates and Average Firm Size (Sample: Year 2007, Conditioned on Control Variables)

Table 1: Descriptive Statistics

| Variable | No. of Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Years: 2000-2007** | | | | | |
| Local Business Tax | 30,831 | 17.030 | 1.723 | 10 | 25 |
| Log Average Firm Size (GEA) | 30,831 | 2.195 | .454 | .794 | 4.393 |
| Population | 30,831 | 14,775.3 | 43,313.84 | 2001 | 1,302,067 |
| Firm Number | 30,831 | 372.229 | 1221.792 | 18 | 42,147 |
| Revenue pC (in Euros) | 30,730 | 1490.262 | 614.587 | .955 | 35,323.3 |
| Population Share > 65 | 30,831 | .176 | .031 | .056 | .392 |
| Population Share < 15 | 30,831 | .166 | .021 | .057 | .256 |
| Unemployment Rate | 30,831 | .031 | .012 | 0 | .107 |
| Rural Community | 30,831 | .647 | .478 | 0 | 1 |
| Number of Highway Accesses | 30,831 | .264 | .738 | 0 | 21 |
| Railway Stations | 30,831 | .906 | 1.116 | 0 | 13 |
| Airports | 30,831 | .088 | .297 | 0 | 2 |
| Seaport | 30,831 | .035 | .206 | 0 | 4 |
| Income pC (in thsd. Euros) | 30,831 | 17.776 | 1.889 | 13.222 | 28.872 |
| Share Conservative Party (CDU/CSU) | 30,831 | .367 | .193 | 0 | 1 |
| Share Social Democrats (SPD) | 30,831 | .239 | .165 | 0 | 1 |
| Share Liberals (FDP) | 30,831 | .018 | .037 | 0 | .353 |
| Share Green Party | 30,831 | .026 | .043 | 0 | .375 |
| Share Farleft Parties | 30,831 | .0003 | .003 | 0 | .118 |
| Share Farright Parties | 30,831 | .001 | .007 | 0 | .226 |
| Debt pC (in thsd. Euros) | 30,831 | 2.147 | .812 | .491 | 6.831 |
| Industry Concentration | 30,831 | .244 | .603 | 0 | 6.300 |
| Share Non-Incorporated Firms | 30,831 | .720 | .068 | .419 | .943 |
| **Year: 2007** | | | | | |
| Local Business Tax | 3939 | 17.223 | 1.774 | 11.25 | 24.5 |
| Log Average Firm Size (GEA) | 3939 | 2.198 | .460 | .891 | 4.275 |
| Log Average Firm Size (AMADEUS) | 3877 | 7.225 | .935 | 3.367 | 12.608 |
| Asset Share Largest Quartile Firms (Abs.) | 3877 | .732 | .233 | 0 | 1 |
| Asset Share Largest Firm (Rel.) | 3877 | .309 | .181 | .034 | 1 |
| Herfindahl Index (Firm Concentration) | 3939 | .073 | .081 | .002 | .811 |
| Population | 3939 | 14864.98 | 43873.04 | 2001 | 1,302,067 |
| Firm Number | 3939 | 371.328 | 1210.156 | 20 | 40,923 |
| Revenue pC (in Euros) | 3939 | 1632.037 | 659.216 | 521.756 | 20,970.49 |
| Population Share > 65 | 3939 | .192 | .030 | .090 | .392 |
| Population Share < 15 | 3939 | .154 | .018 | .057 | .234 |
| Unemployment Rate | 3939 | .027 | .011 | .005 | .083 |
| Rural Community | 3939 | .647 | .478,005 | 0 | 1 |
| Number of Highway Accesses | 3939 | .266 | .738 | 0 | 21 |
| Railway Stations | 3939 | .906 | 1.118 | 0 | 13 |
| Airports | 3939 | .089 | .299 | 0 | 2 |
| Seaports | 3939 | .036 | .210 | 0 | 4 |
| Income pC (in thsd. Euros) | 3939 | 19.136 | 1.756 | 15.013 | 28.872 |
| Share Conservative Party (CDU/CSU) | 3939 | .365 | .188 | 0 | 1 |
| Share Social Democrats (SPD) | 3939 | .227 | .157 | 0 | .742 |
| Share Liberals (FDP) | 3939 | .022 | .041 | 0 | .353 |
| Share Green Party | 3939 | .027 | .046 | 0 | .286 |
| Share Farleft Party | 3939 | .0005 | .004 | 0 | .069 |
| Share Farright Party | 3939 | .001 | .006 | 0 | .114 |

| Table 1: Descriptive Statistics, Continued | | | | | |
|---|---|---|---|---|---|
| **Variable** | **No. of Obs.** | **Mean** | **Std. Dev.** | **Min** | **Max** |
| **Year: 2007** | | | | | |
| Debt pC | 3939 | 2.200 | .889 | .491 | 6.091 |
| Industry Concentration | 3939 | .236 | .595 | 0 | 6.300 |
| Share Non-Incorporated Firms | 3939 | .719 | .068 | .419 | .932 |
| Revenue pC | 3939 | 1614.28 | 500.772 | 521.756 | 3531.435 |
| Base Business Tax pC | 3919 | 106.308 | 154.028 | 3.174 | 4262.399 |
| Predicted Avg. Firm Size (base ctry set) | 3869 | 100.1327 | .9452 | 97.4348 | 111.5952 |
| Predicted Avg. Firm Size (DE) | 3869 | 99.9701 | .5253 | 97.7445 | 107.7501 |
| Predicted Avg. Firm Size (base ctry set plus GB+IE) | 3869 | 100.5989 | .7956 | 98.2877 | 107.4452 |
| Predicted Avg. Firm Size (base ctry set plus DK+SE) | 3869 | 100.155 | .9076 | 97.5177 | 111.3943 |
| Predicted Avg. Firm Size (base ctry set w/o IT+ES) | 3869 | 99.9449 | .6938 | 97.5805 | 105.7324 |
| Population 1910 | 3909 | 7241.869 | 29,520.88 | 120 | 633,782 |
| Market Potential | 3939 | 198179.7 | 48886.39 | 92738.41 | 440815.4 |
| Tax Sensitivity (Var-2008, win 5%) | 3,890 | -1.2313 | .1104 | -1.6254 | -.5203 |
| Tax Sensitivity (Var-all, win 5%) | 3,890 | -.9770 | .1069 | -1.3787 | -.3550 |
| Tax Sensitivity (Var-2008, no win) | 3,890 | -1.2305 | .1251 | -1.6253 | 1.6562 |
| Share Multinational Firms | 3,939 | .1938 | .2520 | 0 | 1 |
| Share Domestic Groups | 3,939 | .6319 | .2355 | 0 | 1 |
| Share Lobbying Firms (Actual) | 3,939 | .0161 | .0862 | 0 | .9918 |
| Share Lobbying Firms (Predicted) | 3,939 | .0180 | .0386 | 0 | .6238 |

Notes: The upper part of the table presents descriptive statistics for the sample years 2000-2007, the lower part for the subset of observations in 2007. 'Local Business Tax' depicts communities' local business tax in percentage points. 'Log Average Firm Size (GEA)' ('Log Average Firm Size (AMADEUS)') is the natural logarithm of the average size of firms hosted in a community in a given year (uniformly weighted), calculated based on data from the German Employment Agency (AMADEUS). 'Asset Share Largest Quartile Firms (Abs.)' is a firm size measure which identifies whether firms are large in the sense that they belong to the largest 25% of entities in Germany (calculated from the fixed asset distribution of firms in AMADEUS, located in Germany) and then calculates the fraction of a community's corporate activity, as measured by fixed assets, that relates to these firms. 'Asset Share Largest Firm (Rel.)' is the share of a localities' assets in the largest firm hosted by the community. Note that the former is an absolute, the latter a relative firm size measure - to see this, consider a small community where a large fraction of economic activity is concentrated in one firm. Then this locality will observe a high value for 'Asset Share Largest Firm (Rel.)', while 'Asset Share Largest Quartile Firms (Abs.)' is zero as the considered firm is not large in absolute terms. 'Herfindahl Index (Firm Concentration)' stands for the Herfindahl concentration measure defined in Section 3. 'Population' depicts a community's number of inhabitants (obtained from German Federal Statistical Offices and their publication "Statistik Lokal"), 'Firm Number' is the number of firms operating in the considered community, with at least one employee which is subject to social security payments (obtained from the German Employment Agency). 'Population Share > 65' and 'Population Share < 15' indicate the share of a locality's inhabitants older than 65 and younger than 15. 'Income pC' indicates average income at the level of German counties. 'Revenue pC' and 'Base Business Tax pC' stand for total per capita revenue and the per capita local business tax respectively. 'Share Conservative Party (CDU/CSU)', 'Share Social Democrats (SPD)', 'Share Liberals (FDP)', 'Share Farleft Parties', 'Share Farright Parties' indicate the seat shares in the local councils for the respective parties and party groups. Note that the shares do not sum up to one as a significant fraction of local council seats is held by civil parties that are difficult to classify in the traditional left-right-spectrum. The described control variables were obtained from the Federal Statistical Offices in Germany. The 'Number of Highway Accesses' moreover indicates a community's number of highway accesses; 'Number of Railway Stations', 'Number of Airports' and 'Number of Seaports' depict the number of stations, airports and seaports respectively. The latter information was drawn from the INKAR data provided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development. We moreover define 'Rural Communities' following the classification of the Federal Institute for Research on Building, Urban Affairs and Spatial Development. The 'Share (of) Non-Incorporated Firms' was drawn from the population of local business tax returns in 2004 aggregated at the county level for confidentiality reasons. 'Predicted Avg. Firm Size' depicts the instrumental variables as constructed in Section 4, where 'base ctry set' indicates that firms from the baseline countries Austria, Belgium, France, Italy, Spain and the Netherlands were employed for the construction of $\tilde{g}_{i,k,t}$ and 'DE', 'base ctry set plus GB+IE', 'base ctry set plus DK+SE' and 'base ctry set w/o IT+ES' indicate adjustments in this country set in the sense that only firms from Germany are used for the construction, the baseline set of countries is extended by Great Britain+Ireland and Denmark+Sweden respectively and that the baseline set of countries is diminished by Italy and Spain. 'Population 1910' and 'Market Potential' moreover stand for the log of the communities' population in 1910 and its market potential, calculated as the sum of neighbouring localities' population, normalised on distance (see Koh et al. (2013) for details). 'Share Multinational Firms' is the asset-weighted fraction of firms in a given jurisdiction that operate internationally, defined by ownership links to parent firms (owning at least 50% of ownership shares) and majority-owned subsidiaries. Analogously, 'Share Domestic Groups' depicts the share of firms that are affiliated with domestic groups in the sense that they have parent firms (owning at least 50% of ownership shares) or majority-owned subsidiaries that operate in another German community. 'Tax Sensitivity' is the average semi-elasticity of fixed asset investment w.r.t. the changes in business taxation for firms in a given host jurisdiction. These semi-elasticities are determined for different sub-sets of firms, defined based on firm size, industry affiliation and the host jurisdiction's population size and business tax rate (see Section 5 and the online appendix for details). 'Tax Sensitivity (Var-2008/win 5%)' furthermore indicates that only variation in the business tax rate related to the federal corporate tax reform in 2008 is exploited for empirical identification and that the obtained tax elasticities are winsorized at the 5%-level before taking community-averages. 'Tax Sensitivity (Var-2008/no win)' (Tax Sensitivity (Var-all/win 5%)) depicts the same variable but without the winsorizing (without the restriction of the identifying tax variation to the federal corporate tax reform in 2008). 'Share Lobby Firms (Actual)' depicts the asset-weighted share of firms within a community that are identified as lobbiers (cf. Section 5 for details). 'Share Lobby Firms (Predicted)' depicts the asset-weighted predicted propensity of firms within a community to engage in lobbying as determined from a logit model that regresses the lobbying indicator on firm characteristics (namely industry affiliation, year of incorporation, firm size and legal form, cf. Section 5 for details).

| Table 2: Baseline Analysis - OLS Specifications (Region Fixed Effects) | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Average Firm Size (GEA) | -0.1642*** | -0.2596*** | | | -0.1120* | -0.2078*** |
| | (0.0444) | (0.0493) | | | (0.0587) | (0.0645) |
| Herfindahl Index | | | -0.7303*** | -1.0609*** | -0.3692 | -0.3823 |
| (Firm Concentration) | | | (0.2246) | (0.2539) | (0.2974) | (0.3297) |
| Observations | 30,831 | 3,939 | 30,831 | 3,939 | 30,831 | 3,939 |
| R-squared | 0.7018 | 0.7171 | 0.7017 | 0.7164 | 0.7019 | 0.7173 |
| region FE | yes | yes | yes | yes | yes | yes |
| year FE | yes | yes | yes | yes | yes | yes |
| controls | yes | yes | yes | yes | yes | yes |
| sample years | all | 2007 | all | 2007 | all | 2007 |

Notes: Robust standard errors that account for clustering at the community level in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. See the notes to Table 1 for a definition of variables. The coefficient estimates for the control variables are presented in Table A1 in the online appendix.

**Table 3: Instrumental Variable Specifications (Region Fixed Effects)**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Average Size (GEA) | -0.8639*** | -0.9116*** | -0.8359*** | -0.8581*** | -0.8524*** | -1.0493*** |
| | (0.2091) | (0.2154) | (0.2060) | (0.2093) | (0.2018) | (0.3469) |
| Herfindahl Index | | | | | | 2.6822 |
| (Firm Concentration) | | | | | | (2.6625) |
| Observations | 3,841 | 3,841 | 3,841 | 3,841 | 3,841 | 3,841 |
| R-squared | 0.6577 | 0.6569 | 0.6580 | 0.6577 | 0.6578 | 0.6529 |
| region FE | yes | yes | yes | yes | yes | yes |
| year FE | yes | yes | yes | yes | yes | yes |
| controls | yes | yes | yes | yes | yes | yes |
| sample years | 2007 | 2007 | 2007 | 2007 | 2007 | 2007 |
| IV (country-sets) | base | only DE | base plus GB+IE | base plus DK+SE | base w/o IT+ES | base |
| Cragg-Donald | | | | | | |
| F-Statistic | 16.677 | 17.250 | 16.596 | 16.703 | 16.992 | 10.891 |

Notes: Robust standard errors that account for clustering at the community level in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. See the notes to Table 1 for a definition of variables. In all specifications, we include a full set of region fixed effects and instrument for the firm size measures using the 'industry-shock'-instruments constructed in Section 4. 'IV (country-sets)' indicates country-sets of firms used to construct $\tilde{g}_{k,i,t}$. Specification (6) also includes a Herfindahl index, which is instrumented with $\tilde{H}_{i,t}$ as described in Sections 4 and 5. In all specifications, we furthermore treat communities' aggregate size (as measured by Log Firm Number and Log Population) and localities' revenue per capita as endogenous. The former are instrumented with the long-lagged population data described in the main text, the latter with county-year averages.

Table 4: **Instrumental Variable Specifications (Community Fixed Effects)**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Average Firm Size | -1.2339** | -1.6785** | -1.1816* | -1.3000** | -1.2443** |
| | (0.6194) | (0.7236) | (0.6386) | (0.6276) | (0.6232) |
| Observations | 7,052 | 7,052 | 7,052 | 7,052 | 7,052 |
| R-squared | 0.2596 | 0.2233 | 0.2629 | 0.2551 | 0.2589 |
| community FE | yes | yes | yes | yes | yes |
| year FE | yes | yes | yes | yes | yes |
| controls | yes | yes | yes | yes | yes |
| sample years | 2000+2007 | 2000+2007 | 2000+2007 | 2000+2007 | 2000+2007 |
| IV (country-sets) | base | DE only | base plus GB+IE | base w/o IT+ES | base plus scan |
| Cragg-Donald | | | | | |
| F-Statistic | 13.047 | 9.740 | 12.511 | 13.169 | 12.887 |

Notes: Robust standard errors that account for clustering at the community level in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. See the notes to Table 1 for a definition of variables. In all specifications, we include a full set of community fixed effects and instrument for the firm size measures using the 'industry-shock'-instruments constructed in Section 4. 'IV (country-sets)' indicates country-sets of firms used to construct $\tilde{g}_{k,i,t}$.

**Table 5: Channel Analysis - 'Mobility Channel'**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Average Firm Size | -0.2693*** | -0.0934* | -0.1697*** | -0.0526 | -0.0979** | -0.1211** | -0.8639*** | -0.2928 |
| | (0.0496) | (0.0488) | (0.0447) | (0.0430) | (0.0491) | (0.0492) | (0.2091) | (0.2255) |
| Share Multinational Firms | | -0.2365*** | | -0.2771*** | -0.2358*** | -0.2294*** | | -0.4125*** |
| | | (0.0653) | | (0.0515) | (0.0656) | (0.0652) | | (0.1130) |
| Share Domestic Groups | | 0.0507 | | 0.0277 | 0.0521 | 0.0597 | | 0.1312* |
| | | (0.0670) | | (0.0611) | (0.0675) | (0.0668) | | (0.0787) |
| Tax Sensitivity (Var-2008/win 5%) | | 3.6832*** | | 3.0786*** | | | | 3.6750*** |
| | | (0.2423) | | (0.1829) | | | | (0.2735) |
| Tax Sensitivity (Var-all/win 5%) | | | | | 3.4940*** | | | |
| | | | | | (0.2514) | | | |
| Tax Sensitivity (Var-2008/no win) | | | | | | 3.0102*** | | |
| | | | | | | (0.2544) | | |
| Observations | 3,890 | 3,890 | 30,456 | 30,456 | 3,890 | 3,890 | 3,841 | 3,841 |
| R-squared | 0.7167 | 0.7474 | 0.7003 | 0.7229 | 0.7433 | 0.7476 | 0.6577 | 0.6800 |
| region FE | yes | yes | yes | yes | yes | yes | yes | yes |
| year FE | yes | yes | yes | yes | yes | yes | yes | yes |
| controls | yes | yes | yes | yes | yes | yes | yes | yes |
| sample years | 2007 | 2007 | all | all | 2007 | 2007 | 2007 | 2007 |
| IV | no | no | no | no | no | no | yes (base) | yes (base) |

Note: Robust standard errors that account for clustering at the community level in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. See the notes to Tables 1 and 3 for a definition of the (instrumental) variables. 'IV' indicates instrumental variable regressions (where the 'baseline' set of countries is used to construct $\tilde{g}_{k,i,t}$, cf. Section 4).

**Table 6: Channel Analysis - Control 'Lobbying Channel'**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Average Firm Size | -0.2523*** | -0.2503*** | -0.8554*** | -0.8306*** |
| | (0.0492) | (0.0495) | (0.2105) | (0.2152) |
| Share Lobby Firms (Actual) | -0.4427* | | -0.5980** | |
| | (0.2310) | | (0.3011) | |
| Share Lobby Firms (Predicted) | | -0.9517* | | -1.7563** |
| | | (0.5695) | | (0.7921) |
| Observations | 3,939 | 3,939 | 3,841 | 3,841 |
| R-squared | 0.7175 | 0.7174 | 0.6577 | 0.6548 |
| region FE | yes | yes | yes | yes |
| year FE | yes | yes | yes | yes |
| controls | yes | yes | yes | yes |
| sample years | 2007 | 2007 | 2007 | 2007 |
| IV | no | no | yes (base) | yes (base) |

Note: Robust standard errors that account for clustering at the community level in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. See the notes to Tables 1 and 3 for a definition of the (instrumental) variables. 'IV' indicates instrumental variable regressions (where the 'baseline' set of countries is used to construct $\tilde{g}_{k,i,t}$, cf. Section 4).

# A Online Appendix

## A.1 Control Variables & Robustness Checks

Table A1 depicts the coefficient estimates for the control variables in Specifications (1) and (2) of Table 2, which show expected signs. The local business tax is found to rise in the aggregate size of a jurisdiction and with localities' financing needs (with the latter being captured by the local unemployment rate and per capita debt, among others). In line with Jofre-Monseny and Solé-Ollé (2012) and Koh et al. (2013), the results moreover suggest that jurisdictions tax industry-related agglomeration rents. On top, we find that municipalities set higher local business tax rates if they host a large fraction of non-incorporated firms. The latter reflects that local business tax payments by non-incorporated firms can to a large extent be credited against owners' personal income tax liability, implying that effective tax burdens remain largely unaffected when local business taxes rise, but revenue is redistributed from the federal personal income tax to the local business tax. The results moreover point to significant partisan effects and show a positive correlation between communities' overall revenues and local business tax choices. The latter might reflect complementarities in the budgeting process or in localities' ability to raise revenues through different sources.

**Table A1: Coefficient Estimates for Control Variables (Table 2, Spec. (1) and (2))**

| | (1) | (2) |
|---|---|---|
| Log Population | 0.3624*** | 0.3392*** |
| | (0.0796) | (0.0861) |
| Log Firm Number | 0.0265 | 0.0293 |
| | (0.0724) | (0.0791) |
| Log Revenue pC | 0.1814*** | 0.1741** |
| | (0.0547) | (0.0850) |
| Population Share > 65 | -0.9541 | -0.9591 |
| | (0.7825) | (0.8513) |
| Population Share < 15 | -4.3907*** | -5.3597*** |
| | (1.0757) | (1.3847) |
| Unemployment Rate | 5.6425*** | 7.8903*** |
| | (1.9297) | (2.5940) |
| Rural Community | -0.0584 | -0.0833* |
| | (0.0429) | (0.0458) |
| Number of Highway Accesses | 0.0248 | 0.0095 |
| | (0.0507) | (0.0507) |
| Railway Stations | -0.0256 | -0.0306* |
| | (0.0175) | (0.0185) |
| Airports | 0.0742 | 0.0894 |
| | (0.0558) | (0.0601) |

Note: The table is continued on the next page.

| Table A1: Coefficient Estimates for Control Variables (Table 2, Spec. (1) and (2)), Continued | | |
|---|---|---|
| | (1) | (2) |
| Seaports | 0.2389** | 0.2719** |
| | (0.1038) | (0.1080) |
| Income pC | -0.0613*** | -0.0615*** |
| | (0.0157) | (0.0164) |
| Seat Share Conservative Party | -0.4282*** | -0.3795*** |
| (CDU/CSU) | (0.0798) | (0.0957) |
| Seat Share Social Democrats | 0.3333*** | 0.5854*** |
| (SPD) | (0.1198) | (0.1595) |
| Seat Share Liberal Party | -0.2957 | -0.3647 |
| (FDP) | (0.4187) | (0.4453) |
| Seat Share Green Party | 1.6963*** | 1.6018*** |
| | (0.4186) | (0.4742) |
| Seat Share Farleft Parties | 8.7237 | 8.4052 |
| | (7.0547) | (6.7239) |
| Seat Share Farright Parties | 3.7028 | 3.0726 |
| | (2.4383) | (3.1556) |
| Debt pC | 0.1830*** | 0.1467*** |
| | (0.0329) | (0.0344) |
| Industrial Concentration | 0.2278*** | 0.1939*** |
| | (0.0532) | (0.0593) |
| Share Non-Incorporated Firms | 0.4405 | 0.7578*** |
| | (0.2693) | (0.2893) |
| Observations | 30,831 | 3,939 |

Notes: The table presents the coefficient estimates for the control variables in Specifications (1) and (2) of Table 2. Robust standard errors that account for clustering at the community level in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. Please see the notes to Table 1 for a definition of the variables.

Table A2 moreover presents robustness checks for the OLS specifications in Table 2 of the main text. Firstly, we assess the sensitivity of results to using alternative measures to approximate the *absolute* size of firms hosted by a locality. Explicitly, we recalculate the average size of firms per community drawing on Bureau van Dijk's AMADEUS/DAFNE data (cf. Specification (1)) and, complementary, use a firm size measure which identifies the largest quartile of firms in West Germany (with assets larger than 1.7 million US dollars) and then calculate the asset share per community and year related to these firms (cf. Specification (2)). Quantitatively, the coefficient estimates for these alternative firm size measures turn out smaller than the coefficient estimates in our baseline specification, potentially reflecting measurement error in the AMADEUS/DAFNE data. Specification (1) suggests that doubling the average size of firms is associated with a reduction in the local business tax rate by 0.14 percentage points or 0.8% evaluated at the sample mean. Specification (2) estimates that increasing the asset share of the largest quartile of firms by one standard deviation (0.23) lowers the local business tax rate by 0.10 percentage points or 0.6% evaluated at the sample mean. Results similar to our baseline specifications are obtained when the *relative* size of firms is modelled by the asset share of the largest firm in a locality (cf. Specifications (3) and (4)). Finally, Specification (5) shows that our results are robust to accounting for clustering of errors at higher geographic units (namely at the level of German commuting areas).

**Table A2: Robustness Checks - OLS Specifications**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Average Firm Size (DAFNE) | -0.1372*** | | | | |
| | (0.0209) | | | | |
| Asset Share Largest | | -0.4373*** | | | |
| Quartile of Firms (Abs.) | | (0.0808) | | | |
| Asset Share Largest | | | -0.2541*** | -0.1591 | |
| Firm (Rel.) | | | (0.0972) | (0.0970) | |
| Average Firm Size (GEA) | | | | -0.2544*** | -0.2596*** |
| | | | | (0.0499) | (0.0590) |
| Observations | 3,877 | 3,877 | 3,877 | 3,877 | 3,939 |
| R-squared | 0.7178 | 0.7168 | 0.7151 | 0.7174 | 0.7171 |
| region FE | yes | yes | yes | yes | yes |
| year FE | yes | yes | yes | yes | yes |
| controls | yes | yes | yes | yes | yes |
| sample years | 2007 | 2007 | 2007 | 2007 | 2007 |

Notes: The table presents OLS estimations analogous to the ones presented in Table 2 of the main text, with region and year fixed effects and the control variables defined in Section 4. Robust standard errors that account for clustering at the community level are reported in parentheses (apart from Specification (5) which accounts for clustering of errors at the level of commuting areas). ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. Please see the notes to Table 1 for a definition of the variables.

Table A3 depicts robustness checks for the instrumental variable regressions presented in Table 4 of the main text. All models include community and year fixed effects and the other control regressors described in the main text. Specification (1) reestimates the baseline model in Column (1) of Table 4 without the community controls, while Specification (2) adds higher order polynomials and interactions between locality size and the set of municipality regressors. Both modifications leave the coefficient estimate for the average firm size variable qualitatively and quantitatively largely unaffected. Specifications (3) to (5) furthermore modify the budgetary control regressors. The baseline specifications control for the logarithm of overall per capita community revenues to account for potential effects related to the fact that the firm size structure may directly impact the revenue base of the locality and therefore affect optimal local business tax choices (as the main revenue instrument at the localities' discretion). Specification (3) shows that the instrumental variable regressions yield similar results when we control for the logarithm of the per capita local business tax base. Specifications (4) and (5) furthermore indicate the robustness of our results to skipping the log-transformation of the control regressors but dropping outliers instead (at the 1%-level). Finally, we show in Specification (6) that the significance of results is insensitive to accounting for clustering of errors at higher geographic units (namely at the level of German commuting areas).

**Table A3: Robustness Checks - Instrumental Variable Regressions**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Average Firm Size (GEA) | -1.1740* | -1.4117** | -1.2639* | -1.2825** | -1.4376** | -1.2339* | -1.2519** |
| | (0.6708) | (0.6319) | (0.6831) | (0.6315) | (0.6893) | (0.6531) | (0.6176) |
| Log Revenue pC | | 0.4050*** | | | | 0.3786* | |
| | | (0.1393) | | | | (0.2081) | |
| Log Business Tax Base pC | | | -0.0504*** | | | | |
| | | | (0.0093) | | | | |
| Revenue pC, win | | | | 0.2294*** | | | |
| | | | | (0.0881) | | | |
| Business Tax Base pC, win | | | | | -0.0122*** | | |
| | | | | | (0.0025) | | |
| Unemployment Rate | | | | | | | -1.7553 |
| (Industry Shock), Forward | | | | | | | (3.1216) |
| Observations | 7,580 | 7,052 | 7,336 | 7,052 | 7,392 | 7,052 | 7050 |
| R-squared | 0.2329 | 0.2665 | 0.2799 | 0.2550 | 0.2661 | 0.2596 | 0.2584 |
| Number of communities | 3,790 | 3,526 | 3,668 | 3,526 | 3,696 | 3,526 | 3525 |
| community FE | yes | yes | yes | yes | yes | yes | yes |
| year FE | yes | yes | yes | yes | yes | yes | yes |
| controls | no | yes-squ | yes | yes | yes | yes | yes |
| sample years | 2000+2007 | 2000+2007 | 2000+2007 | 2000+2007 | 2000+2007 | 2000+2007 | 2000+2007 |
| iv | base | base | base | base | base | base | base |

Notes: The table presents instrumental variable models analogous to the ones presented in Table 4 of the main text, with community and year fixed effects and the control variables defined in Section 4. Robust standard errors that account for clustering at the community level in parentheses (apart from Specification (6) which accounts for clustering of errors at the level of commuting areas). ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. 'Log Revenue pC' depicts the log of the overall per capita revenue in a locality, 'Log Business Tax Base pC' the log of the local business tax base per capita. 'Revenue pC, win' and 'Business Tax Base pC, win' are the overall locality revenue per capita and the business tax base per capita (in 1000 Euros), winsorized at the 1%-level.

Finally, we account for the fact that communities might adjust their local business tax choice in response to industry-shock-driven changes in (expected) unemployment rates. As described in the main text, all specifications include a comprehensive set of control variables for the aggregate economic development of our sample communities (comprising information on unemployment rates, firm numbers, population size and local business tax revenues). We hence expect related effects to be largely absorbed by the control variable strategy. If this fails to be the case, the sketched positive correlation between industry shocks and local business tax choices (see main text) biases the estimates for the firm size effect of interest towards zero, suggesting that they are a lower bound to the true effect, in absolute terms. To further account for the possibility that local business tax choices may respond to expected future industry-shock-driven changes in local unemployment rates, we rerun our instrumental variable model in Specification (1) of Table 4 with an additional regressor for the industry-shock driven expected future unemployment rate of municipality $i$ in year $t+1$. Industry-shock-driven local unemployment rates are thereby constructed in two steps: Firstly, we use data on aggregate employment numbers at the 2-digit industry level in Germany drawn from EUROSTAT for the years 2000 to 2008 to determine unemployment rates per two-digit-industry and sample year.[37] The industry-shock-driven unemployment rate in our sample localities is then calculated as a weighted average, using municipalities' firm numbers per industry in 2000 as weights (for all sample years). Specification (7) of Table A3 includes the forward of this variable as an additional regressor, yielding average firm size effects comparable to our baseline specifications.

## A.2 Construction of the Instrumental Variable

Table A4 presents results for the estimation of $\gamma_q$. As described in the main text, $\gamma_q$ captures how corporate fixed assets of German firms in size decile $q$ respond to 'industry shocks', i.e. to fixed asset changes of other firms in the same industry. $\gamma_q$ is then used to construct the instrumental variables for our sample frame: namely, industry-shock-driven changes in individual firm size are modelled as $\tilde{S}_{k,i,t} = \tilde{S}_{k,i,t-1}(1 + \tilde{g}_{k,i,t})$, with $\tilde{g}_{k,i,t} = \sum_q I_{qk} \cdot \gamma_q \cdot \sum_{j \in I_\ell, j \neq k} \frac{g_{j,t}}{|I_\ell|-1}$. See Section 4 for further details.

$\gamma_q$ hence needs to be estimated for firms located in Germany and being assigned to different size deciles $q$. Since accounting information for German entities is often missing before the mid 2000s (when registrar information became available within AMADEUS/DAFNE), cf. Section 4, we determine $\gamma_q$ drawing on data for German firms between 2006 and 2010 and estimate a model of the following form:

$$\text{Log } FA_{k,t} = a_k + \rho_t + \sum_{q=1}^{10} I_{qk} \cdot \gamma_q \cdot \text{Log } \overline{FA_{k,t}} + \mu_{k,t} \qquad (2)$$

where Log $FA_{k,t}$ describes the natural logarithm of the fixed assets of firm $k$ at time $t$ and Log $\overline{FA_{k,t}}$ describes the natural logarithm of the average fixed assets of other firms in the same 4-digit industry as firm $k$ at time $t$. $I_{qk}$ is a dummy variable indicating

[37] As our data includes employment but no unemployment numbers per 2-digit industry, we assume that unemployment rates in all 2-digit industries correspond to the average unemployment rate in Germany in 2000 (7.9%). Based on this, unemployment numbers per industry in 2000 are determined. This stock of unemployed individuals is then transferred to later sample years and any reduction/increase in the observed number of employees per 2-digit industry is assumed to increase/reduce the number of unemployed persons in that 2-digit industry on a 1:1 basis.

if firm $k$ belongs to size decile $q$. All specifications furthermore include a full set of firm fixed effects and year fixed effects. The sample comprises German firms with balanced fixed asset information between 2006 and 2010. Analogously, Log $\overline{FA_{k,t}}$ is calculated based on firms with balanced asset information (to avoid that Log $\overline{FA_{k,t}}$ captures variation related to changing firm coverage in AMADEUS over time, see also our argumentation in the main text).

**Table A4: Estimation of $\gamma_q$**

| | (1) | (2) |
|---|---|---|
| Log Avg. Fixed Assets | -0.0435*** | -0.0382*** |
| | (0.0026) | (0.0026) |
| Log Avg. Fixed Assets X Decile 2 | 0.0081*** | 0.0086*** |
| | (0.0019) | (0.0019) |
| Log Avg. Fixed Assets X Decile 3 | 0.0068*** | 0.0074*** |
| | (0.0019) | (0.0019) |
| Log Avg. Fixed Assets X Decile 4 | 0.0190*** | 0.0191*** |
| | (0.0019) | (0.0019) |
| Log Avg. Fixed Assets X Decile 5 | 0.0177*** | 0.0175*** |
| | (0.0019) | (0.0020) |
| Log Avg. Fixed Assets X Decile 6 | 0.0298*** | 0.0293*** |
| | (0.0020) | (0.0020) |
| Log Avg. Fixed Assets X Decile 7 | 0.0555*** | 0.0542*** |
| | (0.0022) | (0.0022) |
| Log Avg. Fixed Assets X Decile 8 | 0.0903*** | 0.0876*** |
| | (0.0024) | (0.0025) |
| Log Avg. Fixed Assets X Decile 9 | 0.1410*** | 0.1358*** |
| | (0.0031) | (0.0032) |
| Log Avg. Fixed Assets X Decile 10 | 0.2116*** | 0.2012*** |
| | (0.0055) | (0.0057) |
| Observations | 2,537,194 | 2,537,194 |
| R-squared | 0.8529 | 0.8536 |
| community FE | yes | yes |
| year FE | year | year+size |

Note: Robust standard errors that account for clustering at the community level in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level respectively. The definition of the 10 groups corresponds to the deciles of the fixed asset distribution, namely Decile 1: firms with fixed assets of less than 4 thsd. US Dollars, Decile 2: firms with fixed assets of more than 4 thsd. US Dollars and less than 13 thsd. US Dollars, Decile 3: firms with fixed assets of more than 13 thsd. US Dollars and less than 26 thsd. US Dollars, Decile 4: firms with fixed assets of more than 26 thsd. US Dollars and less than 43 thsd. US Dollars, Decile 5: firms with fixed assets of more than 43 thsd. US dollars and less than 75 thsd. US dollars, Decile 6: firms with fixed assets of more than 75 thsd. US Dollars and less than 138 thsd. US Dollars, Decile 7: firms with fixed assets of more than 138 thsd. US Dollars and less than 289 thsd. US Dollars, Decile 8: firms with fixed assets of more than 289 thsd. US dollars and less than 724 thsd. US dollars, Decile 9: firms with fixed assets of more than 724 thsd. US Dollars and less than 2713 thsd. US Dollars, Decile 10: firms with fixed assets of more than 2713 thsd. US dollars. Specification (1) includes community plus year fixed effects, Specification (2) furthermore allows year effects to vary across size classes.

Note moreover that the construction of Log $\overline{FA_{k,t}}$ corresponds to the construction of $\sum_{j \in I_\ell, j \neq k} \frac{g_{j,t}}{|I_\ell|-1}$ in the sense that the same country-set of firms is used to model the industry shock. If, e.g., firms from the baseline set of countries (Austria, Belgium, France, Italy, Spain and the Netherlands) are used to construct $\sum_{j\in I_\ell, j\neq k} \frac{g_{j,t}}{|I_\ell|-1}$, then the same country-set of firms is used to construct Log $\overline{FA_{k,t}}$ for the estimation of $\gamma_q$. On top, when calculating Log $\overline{FA_{k,t}}$, firms are reweighted such that their size distribution corresponds to the size distribution of firms used to calculate $\sum_{j\in I_\ell, j\neq k} \frac{g_{j,t}}{|I_\ell|-1}$.[38]

The results are presented in Table A4 and show that the firm size development of small firms is not or even moderately negatively correlated with the size development of others firms in the same industry. For large firms, especially firms in the top size decile, this correlation turns positive and is quantitatively relevant. As described in the main text, the observed response-heterogeneity may, firstly, reflect different exposure of large and small firms to industry shocks and, secondly, root in the fact that large firms are overrepresented in the calculation of the industry shocks as described above. From the estimated $\gamma_q$ and the calculated industry shocks ($\tilde{g}_{i,k,t}$), we simulate the average firm size $\tilde{A}_{it}$ and $\tilde{H}_{it}$, as described above and in the main text.

**Table A5: First-Stage Results, Dep. Var.: Log Average Firm Size**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Predicted Avg. Firm Size (base ctry, 4-digit Ind.) | 1.9973*** | | | | |
| | (0.3728) | | | | |
| Predicted Avg. Firm Size (Germany, 4-digit Ind.) | | 3.1747*** | | | |
| | | (0.7183) | | | |
| Predicted Avg. Firm Size (base plus GB+IE, 4-digit Ind.) | | | 2.3612*** | | |
| | | | (0.4344) | | |
| Predicted Avg. Firm Size (base w/o IT+ES, 4-digit Ind.) | | | | 2.7584** | |
| | | | | (0.5074) | |
| Predicted Avg. Firm Size (base plus SK+SE, 4-digit Ind.) | | | | | 2.0632** |
| | | | | | (0.3906) |

Note: The table depicts the first stage results for the Avg. Firm Size equation in the instrumental variable models presented in Specifications (1)-(5) of Table 4. All control variables depicted in the second stage equations of Table 4 are also included in the first stage regressions.

Finally, Table A5 depicts the results of the first stage regressions of the instrumental variable models presented in Table 4 of the main text. Namely, the link between the simulated average firm size and communities' actual average firm size is presented. In line with intuition, the coefficient estimate for the simulated firm size variable turns out positive and statistically significant at the first stage. In addition, Table 4 furthermore presents the Cragg-Donald Wald F-Statistic, which also confirms the relevance of the

[38] As described in the main text, $\sum_{j\in I_\ell, j\neq k} \frac{g_{j,t}}{|I_\ell|-1}$ is calculated based on firms with balanced asset information between 2000-2007. Depending on the country-set used, this implies that the industry-shocks are calculated from firms with above average size. Reweighting firms when calculating Log $\overline{FA_{k,t}}$ to match this size distribution ensures that $\gamma_q$ analogously captures transmission rates for shocks calculated based on firms with above average size.

instrumental variables.

## A.3 Construction of the Tax Elasticities

As described in the main text, we, among others, approximate firm mobility by estimating the elasticity of corporate activity to changes in the business tax rate for narrowly defined subsets of firms. These estimates are then assigned back to individual entities and aggregated to the community level, serving as control variables for the 'mobility channel' in our main analysis.

The following section describes the empirical approach to retrieve these tax elasticities. The estimation relies on the AMADEUS/ DAFNE accounting data described in the main text. Firms are linked to localities via address information. Firms with unlimited liability (e.g. sole proprietor or partnerships) and firms that relocate across locality borders are excluded from the sample. The estimation equation reads:

$$\text{Log } FA_{k,t} = a_k + \rho_t + \beta_{fs,ms,ia,mt} \cdot \tau_{k,t} \cdot \sum_{fs=1}^{fs=4} D_{fs} \cdot \sum_{ms=1}^{ms=4} D_{ms} \cdot \sum_{ia=1}^{ia=10} D_{ia} \cdot \sum_{mt=1}^{mt=4} D_{mt} + \epsilon_{k,t} \quad (3)$$

The dependent variable is the natural logarithm of fixed assets of firm $k$ at time $t$.[39] It is regressed on a full set of firm-specific effects ($a_k$) and a full set of year fixed effects ($\rho_t$) as well as the firm-specific corporate tax rate ($\tau_{k,t}$). The tax rate is firm-specific as it depends on the legal form and the ownership structure of the firm as well as on the tax rate in the firm's host jurisdiction.[40] The construction of the corporate tax variable is explained in more detail below. To allow the tax effect to vary across firm groups, we furthermore interact the tax rate with dummy variables for firm size quartiles (fs), host jurisdiction size quartiles (ms), indicators for 1-digit industry affiliation (ia) and size quartiles for the host municipalities' local business tax (mt). This sub-sample-definition follows the notion that firm mobility may differ between large and small firms (see our discussion in Section 2) and between industries (e.g. related to the (in)tangible nature of main production factors). Accounting for the host community's population, moreover, captures effects related to mobility-reducing agglomeration rents. Finally, we allow the tax elasticities to vary between localities with different local business tax levels to capture potential remaining mobility differences between firms rooted in unobserved mobility drivers. This presumes an inverse relationship between the

[39] Note that the approach relies on corporate fixed assets as the information is significantly better covered than alternative size measures like employment.

[40] In principle, it depends on the location of the establishments and not only of the headquarters. Since we do not observe establishments in our data, we use the location of the headquarter.

hosting of mobile entities and local business tax choices (irrespective of the source of these mobility differences), implying that we expect to see higher mobility rates in lower-tax jurisdictions. As described in Equation 3, the tax elasticities are allowed to flexibly vary in the four dimensions, resulting in 543 firm-cell-estimates.[41]

To avoid reverse causality problems, identification of the corporate tax effect on firm activity, in the main specifications, relies on tax variation induced by a federal corporate tax reform in 2008 (instead of variation in local business tax rates). The reform firstly reduced the federal corporate income tax rate from 25 to 15%, which provides identifying variation as the tax rate reduction affected only incorporated firms and unincorporated firms with corporate shareholders. Unincorporated firms with limited liability (GmbH & Co.KG) owned by individuals, in turn, remained unaffected by the reform and can hence be used as a control group.[42]

On top the reform changed firms' local business tax burden. Precisely, before the federal corporate tax reform 2008, the local business tax was deductible from its own tax base and from the corporate tax base. The reform abolished this deductibility and furthermore changed the base rate ('Messzahl'), with which the local tax multipliers chosen by municipalities is multiplied from 5% to 3.5% (see also Section 3 of the main text). The local business tax rate in a municipality with a multiplier of 400, for example, was 17.3% before 2008, and 14% after the reform.[43] The described changes in the 'Messzahl' and the deductibility of the local business tax are additionally used as identifying business tax variation when estimating Equation 3.

As described above, the empirical model is estimated drawing on AMADEUS/DAFNE data. The sample is restricted to the time period 2004 to 2010 and comprises more than 2.5 million firm-year observations. $\tau_{k,t}$ is calculated as firms' 'comprehensive' business tax rate, accounting for both federal corporate taxation as well as local business taxation. To isolate variation induced by the federal tax reform in 2008, we set the municipality multiplier to 380 for all firms and all sample years when calculating $\tau_{k,t}$.

[41] Allowing tax elasticities to vary across four firm-size groups, ten industries, four host population size groups and four tax level groups would result in 640 firm-cell-estimates. Note, however, that some of these cells lack a sufficient number of firm observations, implying that tax elasticities are eventually estimated for 543 subgroups of firms.

[42] The latter firms are similar to S-corporations in the US. Their income is taxed on a flow-trough basis. If their shares are held by individuals, the business income is subject to personal income tax. Since we do not observe the overall income of the shareholders, we assume a marginal tax rate of 42%, which is the highest income bracket of the personal income tax scheme.

[43] The local business tax rate before 2008 is calculated as $\frac{0.05*m}{1+0.05*m}$ with m as the multiplier set by the municipality. After the 2008 reform it is simply $0.035 * m$.

In robustness checks, we relax this assumption and assess the sensitivity of our results to estimating elasticities based on both, variation induced by the federal tax reform in 2008 as well as by changes in local business tax multipliers.

**Table A6: Distribution of Estimated Tax Elasticities**

| | Mean | P5 | P25 | P50 | P75 | P95 |
|---|---|---|---|---|---|---|
| Coefficients (Var-2008) | -1.1399 | -1.8834 | -1.4611 | -1.2012 | -.9200 | -0.2435 |
| Coefficients (Var-all) | -0.8914 | -1.6550 | -1.2163 | -0.9552 | -0.6676 | 0.0003 |

Notes: The table depicts the distribution of the estimated tax elasticities for 543 sub-groups, defined according to firm size quartiles, industry affiliation and the population and local business tax quartiles of firms' host localities. 'Coefficients (Var-2008)' depicts the distribution of the tax coefficients from a specification where only tax variation related to the federal tax reform in 2008 is exploited for empirical identification. 'Coefficients (Var-all)' are tax sensitivities derived from a specification which exploits tax variation related to the 2008-reform as well variation in local tax multipliers for empirical identification. P5 to P95 indicates the respective percentiles of the distribution of estimated tax elasticities.

The distribution of the 543 estimated semi-elasticities is depicted in Table A6 (for both tax elasticities obtained based on using only variation related to the federal tax reform in 2008 ('Coefficients (Var-2008)') as well as tax elasticities obtained from additionally accounting for variation in local tax multipliers ('Coefficients (Var-all)')). The average estimated elasticities are in line with the existing literature but show significant variation in tax elasticities across sub-groups of firms. Furthermore note that our estimations confirm the notion that firm activity is more responsive to corporate taxation in large firms. Reestimating Equation (2), allowing the tax coefficient to vary across firm size classes only, yields tax sensitivities that, in absolute terms, increase in the size of the firm ($-0.96$ for the smallest size class and $-1.40$ for the largest size class). Analogously, reestimating Equation (2), allowing the tax coefficient to only vary across population size classes, yields tax sensitivities that decline, in absolute terms, with growing population size of the host locality, which is in line with the notion of mobility-reducing agglomeration rents (with a tax elasticity of $-1.33$ in the smallest population size class and $-0.98$ in the largest population size class). Finally, we redo the same exercise, allowing the tax coefficients to vary across local business tax classes. In line with the notion spelled out above, we find a negative correlation between the level of the local business tax and the estimated absolute tax elasticities ($-1.28$ for firms in localities with the smallest level of the local business tax and $-0.93$ for firms in the localities with the largest local business tax).