ARTICLE IN PRESS

Journal of Urban Economics xxx (xxxx) xxx

Contents lists available at ScienceDirect

Journal of Urban Economics

journal homepage: www.elsevier.com/locate/jue

JUE insight: Expectations about future tax rates and firm entry☆

Dominika Langenmayr [a,b,c,*], Martin Simmler [d,e,c]

[a] KU Eichstätt-Ingolstadt, Ingolstadt, Germany
[b] WU Vienna, Austria
[c] CESifo, Germany
[d] Johann Heinrich von Thünen Institute, Braunschweig, Germany
[e] University of Oxford, UK

ARTICLE INFO

JEL classification:
H25
H71
D84

Keywords:
Corporate taxation
Firm mobility
Commitment

ABSTRACT

Firms should use all available information to anticipate future tax rates. Firm mobility is one source of such information. We first establish theoretically that expected future tax rates are higher in jurisdictions attractive for immobile firms (such as wind power plants or resource extracting firms). Fewer mobile firms enter in such a jurisdiction. Building on previous empirical evidence that German municipalities raise tax rates following the entry of immobile firms, we confirm that firms use this information to anticipate future tax rates. In the jurisdictions with the largest expected future tax rate increases, 10% fewer firms enter.

1. Introduction

Firm location choices, and thus the spatial distribution of firms, are shaped by many factors, encompassing both centripetal and centrifugal forces. A prominent example of a centripetal force are agglomeration economies. They curtail the mobility of the tax base, enabling governments to impose higher tax rates (Koh et al., 2013; Jofre-Monseny, 2013). However, agglomeration economies are susceptible to abrupt changes, as exemplified by the Covid-19 pandemic, when remote work led to an outflow of office workers from urban centers. As firms and tax policies require time to adapt to such shifts, firms' expectations regarding future average firm mobility, and how tax policies will evolve in response, matter.

This paper shows that firms' expectations about future average firm mobility (and, therefore, future tax rates) influence their entry decisions. We first provide a stylized model of how firms can use changes in average firm mobility to foresee tax rate changes. We then empirically show that firms anticipate future tax rates in their location decisions. Our model focuses on a local government whose only policy instrument is the corporate tax rate. This assumption reflects the institutional setting in our empirical testing ground Germany, allowing us to establish the importance of firm expectations in a relatively simple setting. The corporate sector in the model consists of mobile firms (able to relocate to a low-tax jurisdiction) and immobile firms (unable to relocate). The model shows that the local government sets a higher tax rate after an immobile firm entered (i.e. when the tax base share of immobile firms increases). As firms anticipate this behavior in their entry decision, the model's key prediction is that fewer mobile (and immobile) firms enter when the expected tax base share of immobile firms is high.

To test this prediction empirically, we focus on firm entry at the municipality level in Germany and study the rapid emergence of one particular type of immobile firm: wind turbines. This setting provides a perfect testing ground for our study. First, Germany has over 11,000 municipalities, each imposing a local business tax that constitutes about half the tax burden on corporate profits. Second, Germany introduced wind power subsidies in 2000, triggering a rapid increase in wind turbines from roughly 5000 in 2000 to over 23,000 in 2012. Accordingly, the tax base share of wind turbines increased from 0.5% in 2000 to 5% in 2012 on average. Wind conditions, suitable land, and non-wind-turbine firms vary substantially among jurisdictions (even within counties). As predicted by our model and documented in Langenmayr and Simmler (2021), municipalities experiencing an increase in the tax base share of immobile firms from 0 to 100% increased their local

☆ We thank Juan Carlos Suárez Serrato, Steve Bond, Andreas Haufler, Andreas Peichl, and participants at the Royal Economic Society annual conference, the summer symposium of the Oxford Centre for Business Taxation and the CESifo Venice Summer Institute for helpful comments. We gratefully acknowledge financial support from the German Research Foundation (Simmler: SI 2050/1-1). Parts of the analysis in this paper were previously circulated under the title "Why the Current Tax Rate Tells You Little: Competing for Mobile and Immobile Firms".

* Corresponding author at: KU Eichstätt-Ingolstadt, Ingolstadt, Germany.
E-mail addresses: dominika.langenmayr@ku.de (D. Langenmayr), martin.simmler@thuenen.de (M. Simmler).

https://doi.org/10.1016/j.jue.2024.103666
Received 25 November 2022; Received in revised form 8 February 2024

business tax rate by, on average, 3%-points (or around 20%). This paper exploits this setting to study whether firms anticipate future tax rate increases.

We estimate a Poisson model of firm entry at the municipal level. As a proxy for future tax rates, we use the expected tax base share of immobile firms, constructed for each jurisdiction from (1) the simulated potential tax base share of immobile firms and (2) an estimated realization probability.[1] Our estimation strategy accounts for the theoretical model predicting a non-linear relationship between the expected tax base share of immobile firms and future tax rates, which stems from wind turbine entry also depending on future tax rates. Our results suggest that an increase in the expected tax base share of immobile firms deters (non-wind turbine) firms from entering a particular jurisdiction. Quantitatively, the effect is substantial: Jurisdictions with the largest expected future tax rate increases had around 10% fewer firms entering. Wind turbines require almost no labor while running, so this effect is not due to higher local wages.

While existing research has extensively examined how firms react to current tax rates, we expand upon this by demonstrating that firms also take into account their expectations about future tax rates when making location choices. Prior works have shown profit tax rates and depreciation rules influence firms' location preferences (Buettner, 2003; de Mooij and Ederveen, 2008; Feld and Heckemeyer, 2011; Rohlin et al., 2014).[2]

As firms' expectations about future tax rates shape their location choices, these expectations also influence agglomeration dynamics. The role of expectations for the agglomeration process has been studied in the context of labor migration (see e.g. Baldwin, 2001; Ottaviano et al., 2002; Oyama, 2009, for theoretical models). Empirical work on the role of expectations for agglomeration processes has been scarce. Brinkman et al. (2023) show that *expected* highways caused neighborhoods to decline, even when the highway was not built.

More generally, our paper exemplifies that what constitutes a locational advantage changes over time.[3] We thus also contribute to the discussion of the relevance of locational fundamentals versus manmade factors (see Lin and Rauch, 2022) by giving an example how a fundamental characteristic of a location (local wind conditions) can change in importance over time.

In our context, expectations depend on location, and the expectation of higher future tax rates deters firms from entering. Thus, the change in expectations has a negative effect on the municipality's ability to attract firms. It could avoid this negative effect if it was able to commit to keep tax rates low. Our paper thus echoes earlier work that pointed out the time-consistency problem in capital taxation. Kydland and Prescott (1980) show that anticipating future high tax rates imposes an excess burden today. Ex-post optimal taxation implies an excessively high tax rate in the first period. Kehoe (1989), Janeba (2000) and Kato (2015) analyze the commitment problem in a tax competition framework, pointing out that tax competition can be beneficial as it lowers future tax rates. We contribute to this literature by showing that a sufficiently large share of highly mobile firms in a jurisdiction also alleviates the commitment problem. Further, our empirical work confirms that the costs of the commitment problem can be substantial and highlights that governments should consider them when designing optimal taxes or subsidies for location-sensitive industries such as renewable energies.[4]

2. Model

To clarify the expected effects, we set up a firm entry model that incorporates how municipalities react to immobile firm entry, building on Langenmayr and Simmler (2021). We consider a local government choosing a profit tax rate, τ on two types of firms: Mobile firms, which can relocate to a low-tax country (with tax rate τ_{low}) at a cost, and immobile firms, which cannot relocate. Local governments must tax all firms at the same rate.

Mobile firms realize a fixed profit of π^M. A mass M of potential entrants can enter the municipality. Firms only decide whether to enter or not ("latent start-up model").[5] They can relocate to the low-tax country at a later stage. To enter, each firm has to pay a firm-specific fixed cost, $f_E\pi^M$, drawn from a uniform distribution in $[0, F_E]$ before deciding about entry. If a firm relocates, it pays $f_R\pi^M$ to build a new plant, with $f_R = \beta f_E, 0 < \beta \leq 1$.

Immobile firms use a different technology, which makes them unable to relocate due to jurisdiction-specific resources (e.g., mining companies) or prohibitively high relocation costs (e.g., wind turbines). An immobile firm's profit is π^I. They have a set-up cost of c, uniformly distributed within $[0, C]$. We assume that only one immobile firm can enter each jurisdiction. This normalization enables us to focus on the share of mobile vs. immobile firms, abstracting from the size of the jurisdiction.

Stages of the game. The model proceeds in three stages. First, firms simultaneously decide whether to enter. Second, the local government chooses its profit tax rate.[6] Third, mobile firms can relocate to the (exogenous) low-tax country. Firms then produce and pay taxes. We solve the model backward.

Stage 3: Relocation decision of mobile firms. Mobile firms relocate if their profit when relocating to the low-tax country, $(1-\tau_{low})\pi^M - f_R\pi^M$, is higher than the after-tax profit in the local jurisdiction, $(1-\tau^j)\pi^M$.[7] $\tau^j \in \{\tau^I; \tau^0\}$ denotes the tax rate that the government chooses in the second stage (τ^I with and τ^0 without an immobile firm). Comparing profits when relocating and not relocating shows that mobile firms with

$$f_R < \tau^j - \tau_{low} \tag{1}$$

relocate in response to the tax differential.

Stage 2: Tax rate choice. The jurisdiction maximizes local welfare, which we model as a weighted sum of tax revenue and an advantage resulting from hosting mobile firms (e.g., employment or local amenities), weighted with $\alpha > 0$.

$$W = \begin{cases} (\tau^0 + \alpha)\left[\mu - \frac{(\tau^0 - \tau_{low})}{F_R}\right] M\pi^M, & \text{if no immobile firm entered,} \\ \tau^I\pi^I + (\tau^I + \alpha)\left[\mu - \frac{(\tau^I - \tau_{low})}{F_R}\right] M\pi^M, & \text{if an immobile firm entered.} \end{cases} \tag{2}$$

[1] The potential tax base share is based on (a) the simulated average tax base of wind turbines (varying due to time-series variation in wind turbines subsidies and cross-sectional variation in wind strength); (b) the potential number of wind turbines (predicted based on the actual turbines in 2011), and (c) mobile firm tax base prior to wind turbine subsidies.

[2] The role of expectations for firm investment decisions has been explored in other contexts, with studies focusing on investor sentiment (Arif and Lee, 2014), analysts' forecasts (Cummins et al., 2006), and Chief Financial Officers' expectations (Gennaioli et al., 2016).

[3] Agglomeration forces change over time, see e.g. Steijn et al. (2022).

[4] Further papers studying the dynamic effects of capital taxes assume that existing and new capital can be taxed at different rates. Doyle and Van Wijnbergen (1994) show that tax holidays may result from sequential bargaining between a multinational firm and a host country government. Bond and Samuelson (1986) point out that host countries may offer tax holidays to signal their productivity to multinational firms.

[5] This implies immobile potential entrepreneurs, aligned with empirical evidence (Figueiredo et al., 2002).

[6] Thus, the government can set the tax rate knowing the mobility of its tax base, similarly to Haupt and Krieger (2020).

[7] We assume the incidence of the tax is (at least partially) born by the firm (as, e.g., Haufler and Wooton, 2010; Haufler and Mittermaier, 2011). This assumption is consistent with prior empirical literature. Although firms can pass on some of the tax burden to employees (Fuest et al., 2018), taxes matter for firms' location choices and investment decisions (de Mooij and Ederveen, 2008; Feld and Heckemeyer, 2011; Zwick and Mahon, 2017).

μM denotes the mass of mobile firms that entered in stage 1, and the last term in the brackets describes the share of mobile firms that relocates in stage 3 according to Eq. (1), using that f_R is uniformly distributed and $F_R = \beta F_E$.

The optimal tax rates are

$$\tau^0 = \frac{\mu F_R + \tau_{low} - \alpha}{2}$$
$$\tau^I = \frac{\pi^I + \mu M \pi^M}{2M\pi^M} F_R + \frac{\tau_{low} - \alpha}{2} = \frac{\eta}{2} F_R + \tau^0. \quad (3)$$

Thus, the municipality sets a higher tax rate when the tax haven is less attractive (τ_{low} ↑) or when it gives less weight to attracting mobile firms (α ↓). Moreover, the tax rate rises in the tax base: τ^0 increases with μ, i.e., the number of active firms; τ^I with both μ and the potential tax base share of immobile firms, $\eta = \frac{\pi^I}{M\pi^M}$.[8] A higher tax rate raises additional revenue from active firms but also implies more firms relocating. If an immobile firm is present, a smaller share of the tax base can relocate. The government can thus set a higher tax rate. The higher the tax base share of the immobile firm, the higher the revenue-maximizing tax rate.

Lemma 1 (*Tax Rates Choice*). *A local jurisdiction sets a higher tax rate if an immobile firm is active.*

Proof. Follows directly from Eq. (3). ■

Stage 1: Firm entry. The immobile firm anticipates that if it enters, the jurisdiction will choose the higher tax rate τ^I. Hence, the immobile firm enters if $\pi^I(1-\tau^I) \geq c\pi^I$.

Mobile firms do not know whether an immobile firm will enter the jurisdiction. They thus base their entry decision on an expected tax rate, $E(\tau) = p\tau^I + (1-p)\tau^0$. With c uniformly distributed, the probability p that an immobile firm enters is

$$p = \frac{1-\tau^I}{C} = \frac{1}{C} - \frac{(\eta+\mu) F_R + \tau_{low} - \alpha}{2C}. \quad (4)$$

Mobile firms compare their expected after-tax profit with the fixed cost of entry, f_i. The mass of firms entering is $\mu M = \frac{1-E(\tau)}{F_E} M$.[9] Using Eq. (3), we find

$$\mu = \frac{1 - \tau^0 - p\frac{\eta}{2} F_R}{F_E}. \quad (5)$$

Thus, mobile firm entry depends on the expected tax base of immobile firms, $p\eta$. Mobile firms anticipate that with a certain probability p, an immobile firm will enter (and then has a tax base share of about η), inducing the government to increase the tax rate to τ^I. Thus, fewer mobile firms enter if the expected tax base of immobile firms is high.

To link the model to the empirical test, we re-write μ as a function of η and τ^0 (using Eqs. (4) and (3))

$$\mu = \frac{1}{F_E}\left[1 - \tau^0\left(1 - \frac{\eta F_R}{2C}\right) - \frac{\eta F_R}{2C}\left(1 - \frac{\eta F_R}{2}\right)\right]. \quad (6)$$

Note that τ^0 is endogenous, as it depends on μ. Appendix 1 explicitly solves for the equilibrium. In the empirical part, we interpret τ^0 as a baseline tax rate before immobile firms (wind turbines) became widespread.

Eq. (6) shows that a high baseline tax rate affects the number of mobile firms less if the potential tax base share of immobile firms is high, as it is then less likely an immobile firm enters. Second, the tax base share of immobile firms has a non-linear impact on the number of mobile firms for the same reason: If the tax base share of immobile firms is higher, the tax rate increases more when an immobile firm enters, which in turn decreases the likelihood of immobile firm entry.

We now test this relationship empirically.

3. Empirical strategy and data

3.1. Empirical strategy

In Langenmayr and Simmler (2021), we show municipalities in Germany increased their local business tax rates by up to 3%-points (or around 20%) after the entry of immobile firms (wind turbines).[10] Exploiting this setting for identification, we analyze whether other (non-wind turbine) firms take the potential entry of wind turbines, and thus the potential increase in future tax rates, into account when making their location choice.

The setting in Germany provides ample variation for this empirical analysis. First, each of the over 11,000 municipalities in Germany (~9600 in the eleven federal states we study) decides annually about its local business tax rate (see also Link et al., 2024). In our sample, about 10% of municipalities change their tax rate each year. Besides the local business tax, German municipalities can only choose a property tax rate, which, however, has to be identical on non-agricultural businesses and private property and is thus not suited to attract firms.[11] Therefore, the local business tax rate is municipalities' main instrument to draw firms.

The expansion of wind energy in Germany was salient. First, already in 2000, roughly 5000 (onshore) wind turbines existed; their number had more than quadrupled by 2011. Second, since wind turbine investors reached out to local officials and agricultural land owners to find suitable locations (and to strengthen their bargaining position by having several options), the public knew about potential investors and expected the entry of wind turbines. Newspapers discussed the importance of wind turbines for tax revenues of rural municipalities. Lastly, company owners in Germany undoubtedly know about the link between tax base mobility and tax rates. The local business tax poses a substantial tax burden, and rates differ substantially among jurisdictions (usually between 9% and 15%). Industry associations regularly warn that firms may move away if the local business tax rate increases. Thus, potential entrepreneurs could reasonably foresee the potential shift in the tax base due to the entry of wind turbines and the resulting impact on jurisdictions' tax rate choices.

We analyze firm entry in all municipalities with a positive tax base of mobile firms in 1998. We observe 84,214 municipality-years between 1998 and 2006. Following Brülhart et al. (2012), we estimate a Poisson model at the municipality level. Guimarães et al. (2003) and Becker and Henderson (2000) show that the Poisson model is appropriate to estimate the determinants of the location decision based on the footloose or the latent start-up model.

Our estimation equation reflects the main prediction of the model (see Eq. (6)): a non-linear impact of the expected tax base share of immobile firms on the number of (mobile) firms. We refrain from parameterizing the distribution of entry and relocation costs as no data exists. We also do not model the interaction between the current tax rate and the expected tax base share of wind turbines (which captures the effect of future tax rate increases on the location decision of wind

[8] η is the "potential" tax base share of immobile firms. It corresponds to their tax base share if all firms that can enter the municipality do so.

[9] We assume η is sufficiently small so that not all mobile firms relocate after immobile firm entry. We derive the relevant condition in Appendix 1.

[10] Carlsen et al. (2005), Devereux et al. (2008) and Slemrod (2004) also show a negative relationship between (capital) mobility and tax rates. With wind turbines, the *firm* is immobile; the invested *capital* may be mobile in the long run.

[11] See also Blesse et al. (2019) on the relative importance of the two taxes.

turbines), as we do not have an instrument with sufficient power to instrument both the tax rate and the tax rate interaction.[12]

Thus, our estimation equation is

$$N_{i,t} = exp\left(\alpha_1 \text{LBT}_{i,t} + \alpha_2 \text{E}_C[\text{TBS}_{\text{IF}}] + \beta' X_{i,t} + \delta_i + \rho_t + \epsilon_{i,t}\right). \quad (7)$$

The main dependent variable $N_{i,t}$ is the number of new firms in municipality i in year t.[13] Our two main explanatory variables are the current tax rate $\text{LBT}_{i,t}$—which corresponds to τ^0 in the model—and the corrected expected tax base share of immobile firms $\text{E}_C[\text{TBS}_{\text{IF}}]$—which corresponds to $\frac{\eta F_R}{2C}\left(1 - \frac{\eta F_R}{2}\right)$ from Eq. (6) of the model.[14]

The corrected expected tax base share of immobile firms takes the impact of the expected tax base share of immobile firms $\text{E}[\text{TBS}_{\text{IF}}]$ on the entry decision of immobile firms into account: $\text{E}_C[\text{TBS}_{\text{IF}}] = \text{E}[\text{TBS}_{\text{IF}}] * (1 - \text{E}[\text{TBS}_{\text{IF}}])$. We calculate the expected tax base share by multiplying immobile firms' potential tax base share by its realization probability (see Section 3.2 for details).[15]

As control variables, we include the realized tax base share to rule out that our proxy for the future tax rate simply picks up a delayed increase of the tax rate in municipalities in which wind turbines entered. We also include municipality fixed effects (δ_i) and control for the variables used to calculate the (corrected) expected tax base share, namely the tax base in 1998, agricultural land, and wind strength 10 m above ground. We always include these baseline control variables directly and squared and interacted with year dummies. They control for the expected siting of a wind turbine, which could have negative externalities on other firms in the jurisdiction.

In some specifications, we control for additional municipality characteristics (public good provision via municipality spending and market potential via population) and regional characteristics (average tax rates and public good provision in neighboring jurisdictions, via inverse distance–weighted average tax rate and spending in 20 km-radius municipalities). Additionally, we control for common unobserved shocks by including state-year or county-year fixed effects. To address potential tax rate endogeneity, we employ a control function approach with a state-specific fiscal equalization scheme-based instrument. We report robust standard errors clustered at the county level. We choose this level as counties are the lowest government tier involved in spatial planning, including decisions on wind priority areas (where turbines can be built relatively easily).

[12] We analyze these factors' influence on wind turbine location choice in Table A3. The point estimate for the local business tax rate is positive (albeit insignificant), showing it picks up other factors. It only turns negative (but still insignificant) after instrumenting it, but the instrument in Table 2 for the direct effect of the current local business tax rate is not sufficiently strong to instrument both variables. Further, interpreting interaction effects in non-linear models adds complexity.

[13] Estimation at the municipality-industry level may seem preferable as it allows to control for industry-wide shocks. However, this would result in a large share of zero firm entries (overdispersion). We thus prefer the municipality level.

[14] η in the model refers to the tax base share of immobile firms if all potential firms (mobile and immobile) enter in the municipality. We approximate this in the empirical setting by estimating the potential number of immobile firms (described in Section 3.2) and dividing it by the tax base of mobile firms before the subsidies for wind turbines were introduced. We use the pre-reform tax base of mobile firms so that this measure is unaffected by the expectation of higher tax rates. However, it differs from $M\pi^M$ from the model as some potential firms do not enter even without higher expected tax rates.

[15] We use this proxy approach and do not include the (observed) future tax rate as the explanatory variable (an IV strategy) as the proxy approach requires less challenging assumptions, in particular regarding the link between the expected and the realized tax rate.

3.2. Data

The firm entry data stems from the *Gewerbeanzeigenstatistik*, the registry of firms.[16] It covers all firm entries and exits in a particular municipality and year, discloses whether firms relocated or are newly founded, and includes industry information. The data covers the years 1998–2006 for most German states (all except Saarland, Baden Württemberg, and the city-states Berlin, Hamburg, and Bremen). The coverage only starts in 1998 for Lower Saxony, 1999 for Schleswig-Holstein, and 2001 for Hesse. We focus on the years up to 2006 as the first years after the introduction of wind turbine subsidies in 2000 provide the cleanest set-up, and a major corporate tax reform was announced in 2007 and implemented in 2008.

Our main tests will consider only "real" firm births. We exclude relocating firms, as the impact of municipality characteristics on new and already existing firms' location decisions may differ. We also exclude self-employment.

To calculate the corrected expected tax base share of immobile firms, we first determine the "potential" tax base share, then predict the "expected" share using this potential and a realization probability. Lastly, we derive the corrected expected tax base share by applying the model's predicted quadratic relationship to the expected share.

Calculation of potential tax base share of immobile firms. In the first step, we simulate the tax base of wind turbines using data from the operator database, a private database collected by consultants in the renewable energy industry and the Schleswig-Holstein Chamber of Agriculture. We use the location, technology, and construction date for all wind turbines in Germany and simulate wind turbines' profitability by using information on the average wind strength in a municipality and the feed-in tariff that applied in the respective year (see Haan and Simmler, 2018, for details of this calculation). We then take the average profit over the life cycle of a turbine with the median technology.

In the second step, we predict the number of wind turbines in a jurisdiction. To do so, we use the sample of jurisdictions with turbines in 2011 and regress (ln) number of turbines (in 2011) on the economic and legal factors determining wind turbines' location choice. These factors are wind strength (10 m above ground), agricultural land, tax base in 1998, tax rate in 1998, and state dummies to account for differences in building regulations. We then use the estimated coefficients for wind strength, agricultural land, and state dummies to predict the number of turbines.[17] We then multiply the simulated wind turbine profits (from the first step) with the predicted number of turbines in a particular jurisdiction to calculate the potential wind turbine tax base.

In the third step, we scale this potential wind turbine tax base by the tax base of mobile firms in 1998 plus the simulated potential turbine tax base. This calculation yields the potential tax base share of wind turbines, Pot. TBS_{IF}.

Calculation of expected tax base share of immobile firms. To derive the expected tax base share of immobile firms, we multiply the potential tax base share by the fraction of municipalities within a state with at least one turbine in 2011. We see this as a proxy for the fixed entry costs in the model (c). The underlying idea is that planning regulation—set by the federal states—largely determines how many wind turbines will be built. In a robustness check, we use the share of municipalities with turbines in 2011 by wind strength quintile. The variation in the expected tax base share, $\text{E}[\text{TBS}_{\text{IF}}]$, thus stems from time-series variation in the feed-in tariff and the technological development

[16] The data is proprietary. Appendix 3 provides detailed information on all data, including how to obtain it. The code for data preparation and analysis is available at Simmler and Langenmayr (2024).

[17] We ignore in the prediction the effects of the tax rate and the tax base in 1998 to remove the impact of the expected tax base share on the expected number of turbines.

of wind turbines, and cross-sectional variation in jurisdictions' wind strength, number of potential turbines, and 1998 tax base of mobile firms.

Calculation of corrected expected tax base share of immobile firms. Lastly, we calculate the corrected tax base share of immobile firms, $E_C[TBS_{IF}]$, which is the expected tax base share times one minus the expected tax base share.

As discussed in Section 3.1, we control for several municipality characteristics. Table A1 describes these variables and lists their sources.

In our sample, an average municipality has a local business tax rate of 14%, 6470 inhabitants, and about 14 new firms per year. The realized tax base share of wind turbines is 2%, their potential tax base share is 42%, and the expected tax base share based on state variation in realization is 7%. The sample of municipalities without turbines in 2011 has similar local business tax rates, inhabitants, potential and expected tax base shares. The number of new firms (nine per municipality) is lower, however. Table A2 provides the complete descriptive statistics.

4. Results

4.1. Graphical evidence

The variation in the corrected expected tax base share of immobile firms stems from two sources: The profitability of wind turbines and the tax base of mobile firms. To confirm the former, Fig. 1(a) shows that changes in the expected tax base share have variation for all levels of the mobile firm tax base, although the variation at the lower end of the distribution is largest.

Regarding the latter, Fig. 1(b) plots the evolution of the average expected tax base share for the 5th, 50th, and 95th percentiles of the tax base of mobile firms in 1998. We observe the strongest reaction to the introduction of subsidies for the 5th and 50th percentile of the tax base of mobile firms: In municipalities with many mobile firms, the tax base share of immobile firms will always remain small.

Second, we inspect descriptive evidence of how the corrected expected tax base share relates to the entry of new (mobile) firms. As we cannot control for the realized tax base share (which triggers an increase in tax rates), we include only jurisdictions without wind turbines in 2011.

Fig. 1(c) shows the evolution firm entry relative to 1997, comparing jurisdictions with above- and below-median changes in the corrected expected tax base share (termed "treatment" and "control" groups).[18] Although mapping changes in the corrected expected tax base share into a binary indicator discards some information, it allows us to inspect whether treatment and control groups followed a common trend before the subsidies for wind energy. As expected, fewer firms enter jurisdictions with a larger change in immobile firms' corrected expected tax base share.

In Fig. 1(d), we exploit more variation in the corrected expected tax base share by studying quintiles of its changes between 1998 and 2006, confirming that larger share changes correlate with decreased firm entries.

4.2. Regression evidence

Before reporting our main regression results, we show that the expected tax base share of immobile firms (and the realized tax base share of immobile firms, which we used in Langenmayr and Simmler, 2021) is a reasonable predictor of (expected) future tax rates. Table 1 shows the results using 1998 and 2006 only, i.e., a long difference. In col. (1) (col. 3), we regress the tax rate on the expected tax base share of immobile firms, using state (wind strength quantile) variation for the realization probability. We find positive and statistically significant point estimates, suggesting a higher expected tax base share of immobile firms is associated with higher future tax rates. In cols. (2) and (4), we instrument the realized tax base share of immobile firms with the expected tax base share.

Table 1
Expected and realized tax base share of immobile firms and tax rates.
Source: Authors' calculations based on Statistik Lokal, 1998–2006, data from the operator database, 1990–2006, and the German Weather Service.

Dependent variable	Local business tax rate			
	OLS	IV	OLS	IV
Realization Prob.:	States		Wind strength	
	(1)	(2)	(3)	(4)
$E[TBS_{IF}]$	0.010***		0.009*	
	(0.004)		(0.005)	
TBS_{IF}		0.034***		0.033*
		(0.012)		(0.017)
Municipality FE	x	x	x	x
State-year FE	x	x	x	x
IV variables	x	x	x	x
Tax base quintile–year FE	x	x	x	x
Observations	16,360	16,360	16,360	16,360
First stage point estimate		0.287***		0.260***
		(0.053)		(0.075)
Sargan-Hansen *p*-value		0.725		0.738
F-statistic		20		9

Notes: Table shows reduced form estimates for the expected tax base share of immobile firms, $E[TBS_{IF}]$, on the local business tax rate and IV estimates where the realized tax base share of immobile firms, TBS_{IF}, is instrumented using the expected tax base share of immobile firms. The realization probability for the expected tax base share in cols. (1) and (2) is based on the share of municipalities with turbines in 2011 on the state level and in cols. (3) and (4) on wind strength quintiles. To assess the validity of the instruments, we use the binary triple DiD estimator as in Langenmayr and Simmler (2021) and report the results of the Sargan-Hansen test of overidentifying restrictions. Robust standard errors, clustered at the county level, in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% levels.

Similarly to Langenmayr and Simmler (2021), we find the local business tax rate increases by 3 %-points if the realized tax base share of immobile firms increases from 0 to 1. In both specifications, the instruments are sufficiently strong, and the exogeneity of one instrument cannot be rejected conditional on the exogeneity of the other instrument.[19] Thus, our expected tax base share of immobile firms captures the variation we want to capture.

In Table 2 Panel A, we present our main results based on Eq. (7). Col. (1) of Panel A shows that the corrected expected tax base share has a negative and significant impact on the number of new firms. In col. (2), we include the additional control variables, which increase the point estimate and its precision. In col. (3), we use a control function approach for the tax rate to assess whether endogeneity in the tax rate (and/or measurement error) is the reason the expected tax base share of immobile firms is significant. The instrument exploits (similarly to Riedel et al., 2020) variation in state-specific fiscal equalization schemes. The point estimate for the tax rate decreases substantially. It suggests a tax elasticity of the number of new firms of around −3 in line with prior literature (e.g., Riedel et al. (2020) or Becker et al. (2012) for Germany, or Suárez Serrato and Zidar (2016) for the US).

[18] We use data from 1997 as it allows a better inspection of the common trend, although we do not observe new firms in 1997 for Schleswig-Holstein, Lower Saxony, and Hesse.

[19] The instrument using realization probabilities based on states is stronger than the one based on wind strength. This could reflect the relative importance of building regulations (differing by state) and wind strength for wind turbines' location choice; or that our wind strength measure (at the municipality level) has measurement error.

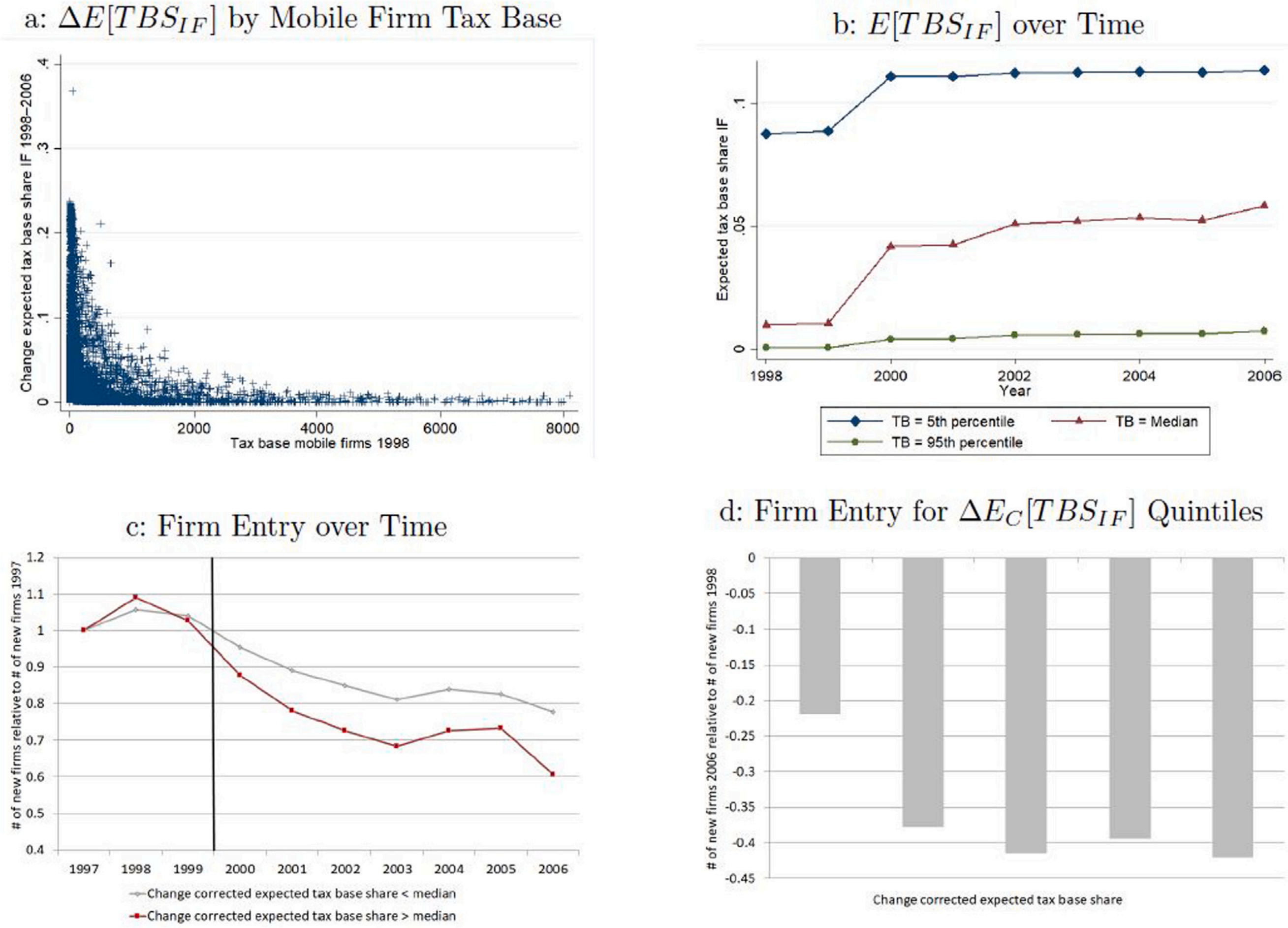

Fig. 1. Graphical evidence for expected $(E[TBS_{IF}])$ and corrected expected tax base share of immobile firms $(E_C[TBS_{IF}])$.
Notes: Fig. 1(a) shows the change in the expected tax base share of immobile firms between 1998 and 2008 for different levels of the 1998 tax base of mobile firms. Fig. 1(b) shows the evolution of the expected tax base share of immobile firms for the 5th, the 50th, and the 95th percentile of the 1998 tax base of mobile firms. Fig. 1(c) shows the evolution of firm entry (relative to new firms in 1997) for treatment and control group based on above/below median change in the corrected expected tax base share $(E_C[TBS_{IF}] = E[TBS_{IF}] * (1 - E[TBS_{IF}]))$ between 1997 and 2006. Fig. 1(d) shows relative changes in the number of new firms between 1998 and 2006 for quintiles of the change in the corrected expected tax base share of immobile firms between 1998 and 2006.
Source: Authors' calculation based on Statistik Lokal, 1997–2011, and data from the operator database, 1990–2011, and the German Weather Service.

The point estimate for the expected tax base share of immobile firms is unchanged.[20] To address concerns that the (realized) entry of wind turbines drives the expected tax base share, or that we count some wind turbines as new firms, we restrict the sample to jurisdictions that had not attracted any turbines by 2011. Both worries are unjustified as the point estimate for the expected tax base share in col. (4) is almost unchanged. When we include county-year fixed effects (col. 5), precision decreases, but the point estimate remains unchanged.

Sensitivity. We assess the sensitivity of our results in eight robustness checks.[21] First, since the marginal effect in a Poisson model depends on all variables included, we also estimate the baseline specification and the specification with county-year fixed effects using a log-linear model (col. (1) and (2) of Panel B). The point estimates are larger but still reasonably comparable. Second, we use firms that relocated from another jurisdiction as the dependent variable. The results (col. 3) are similar to our baseline results, although not precisely estimated. Third, we change the definition of the expected tax base share of immobile firms. In col. (4) we use the corrected potential tax base share of immobile firms. The point estimate is reasonable as, on average, around 25% of the jurisdictions had turbines in 2011. Fourth, col. (5) uses the realization probability for wind strength quintiles based on the 2011 share of municipalities with turbines. Results are similar to the baseline results. Fifth, we account for a potential non-monotonic relationship by re-running the regression with dummies for each quintile of immobile firms' corrected expected tax base share. Fig. 2(a) shows the results, using an otherwise identical specification as in cols. (2) and (4) of Table 2, Panel A. The results are similar to the more restrictive specification for both samples. Sixth, to assess the timing of the impact, we calculate how the corrected expected tax base share changed 1998–2006 and interact this change with year dummies. Fig. 2(b) suggests that before introducing the subsidies for renewable energy, the change in the expected tax base share has no predictive power for the location decision of mobile firms. Seventh, we explore a less constrained specification for both the log-linear and Poisson models and replace the *corrected* expected tax base share with

[20] The elasticity of −2.9 follows from the point estimate for the local business tax rate in col. (3), and our sample's average tax rate of 14% (0.14% ∗ (−20.7) = 2.9).

[21] We use the sample excluding jurisdictions with turbines in 2011. Results are similar in the full sample.

Table 2
Estimation of firms' location choice.
Source: Authors' calculations based on Statistik Lokal, 1998–2006, data from the operator database, 1990–2006, and the German Weather Service.

Panel A: Main results					
Dependent variable	Number of new firms				
Sample	All jurisdictions			Jurisdictions w/o turbines 2011	
			CF		
	(1)	(2)	(3)	(4)	(5)
LBT	−2.030**	−0.823	−20.670***	−0.540	−1.359
	(1.012)	(1.033)	(6.818)	(1.075)	(1.069)
$E_C[TBS_{IF}]$	−0.665**	−0.759**	−0.558*	−0.873**	−0.702
	(0.315)	(0.298)	(0.331)	(0.379)	(0.431)
TBS_{IF}	−0.068	−0.076	−0.061		
	(0.075)	(0.075)	(0.077)		
Municipality FE + baseline controls	x	x	x	x	x
State-year FE	x	x	x	x	
County-year FE					x
Additional controls		x	x	x	x
Observations	84,214	84,214	84,214	69,807	69,807

Panel B: Sensitivity analysis					
Model	OLS		Poisson		
Dependent variable	IHS(# of new firms)		Relocated firms	# of new firms	
Realization probability	States				Wind
	(1)	(2)	(3)	(4)	(5)
LBT	−0.510	−0.497	−1.324	−0.551	−0.541
	(0.750)	(0.752)	(2.198)	(1.066)	(1.074)
$E_C[TBS_{IF}]$	−1.328***	−1.320***	−0.776		−0.884**
	(0.341)	(0.358)	(0.982)		(0.381)
$E_C[\text{Pot. } TBS_{IF}]$				−0.184**	
				(0.089)	
Municipality FE + controls	x	x	x	x	x
State-year FE	x		x	x	x
County-year FE		x			
Observations	69,807	69,807	69,807	69,807	69,807

Notes: Panel A shows results of the Poisson model (Eq. (7)) for the corrected expected tax base share (TBS) of immobile firms (IF), $E_C[TBS_{IF}] = E[TBS_{IF}] \cdot (1 - E[TBS_{IF}])$, on the number of total firm entries per municipality and year. The sample in cols. (1) to (3) includes jurisdictions with positive tax base of mobile firms in 1998, in cols. (4) and (5) only those without turbines in 2011. From col. (2) onward we include add. control variables. In col. (3) we use a control function approach to counter the potential endogeneity of the local business tax rate. The excluded instrument is the difference between the reference multiplier and the tax rate in 1998 (if positive; otherwise 0). In col. (5) we include county-year fixed effects. Panel B shows sensitivity analyses based on OLS (cols. 1–2, dependent variable: inverse hyperbolic sine (IHS) of the number of new firms) and Poisson estimations (cols. 3–5). The sample includes jurisdictions with a positive tax base of mobile firms in 1998, but without turbines in 2011. Main explanatory variables are $E_C[TBS_{IF}]$ (cols. 1–3, 5) or the corrected potential tax base share of immobile firms, $E_C[\text{Pot. } TBS_{IF}] = \text{Pot. } TBS_{IF} \cdot (1 - \text{Pot. } TBS_{IF})$ in col. (4). The realization probabilities for the expected tax base share of immobile firms are based on the share of municipalities with turbines in 2011 on the state level, except in col. (5) where they are based on the wind strength quintiles. Robust standard errors, clustered at the county level, in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% levels.

linear and squared terms of the expected tax base share in Table A4. The results support the previous conclusions.[22]

Lastly, since we have only two years of pre-reform data for most jurisdictions, we use an alternative dependent variable: (ln) number of employees, based on data by the Federal Employment Agency (available from 1996 for West Germany). Using a log-linear specification and controlling for state-year or county-year fixed effects and the baseline control variables, we find qualitatively similar results (Fig. 2(c)).

Effect size. How large is the estimated effect? Fig. 2(a) suggests that in the most affected jurisdictions (top quintile), the number of new firms decreased by around 10%. This effect is substantial, particularly as it is based purely on expectations and independent of wind turbines actually entering at some point.

We estimate that municipalities in which the tax base share of immobile firms changed from 0 to 0.3 increased the tax rate by about 1%-point ($0.3 \cdot 0.033$, see cols. 2&4, Table 1). Based on the control function specification (col. 3 of Table 2, Panel A), a tax rate change of this size implies about 21% fewer entering firms ($-20.7 \cdot 0.01$). This is consistent with the impact of the corrected expected tax base share on firm entry: If the expected tax base share of immobile firms increases from 0 to 0.3, the corrected expected tax base share increases from 0 to 0.21 (around 13% fewer new firms, $-0.6 \cdot 0.21$).[23]

As a second plausibility check, we compare the estimated employment effects (see Fig. 2(c)) with prior literature. We estimate employment decreases by around 30% when the corrected expected tax base share increases from 0 to 1. Assuming again that the expected tax base share of immobile firms changes from 0 to 0.3, and thus the corrected expected tax base of immobile firms from 0 to 0.21, this suggests a reduction in employment by 6.3% ($0.21 \cdot 0.3$). This effect is comparable to prior literature: Misra (2019) estimates a long-run tax semi-elasticity of employment of about 4.5 for Germany, i.e., an increase in the tax rate by 1% (upon realization) predicts a decrease in employment by 4.5%. Again, our estimated effect is plausible.

Effect heterogeneity. Last, we assess effect heterogeneity using the same criteria as in Langenmayr and Simmler (2021) (see Table A5). We

[22] In the Poisson model, coefficients become less significant when including the baseline controls since these variables are highly correlated with the expected tax base share and thus absorb part of the non-linear impact of the expected tax base share on firm entry.

[23] The effect of the expected tax base share on firm entry is non-linear. For an average jurisdiction (expected tax base share: 7%), the difference between the impact of expected and current tax rates is much smaller.

ARTICLE IN PRESS

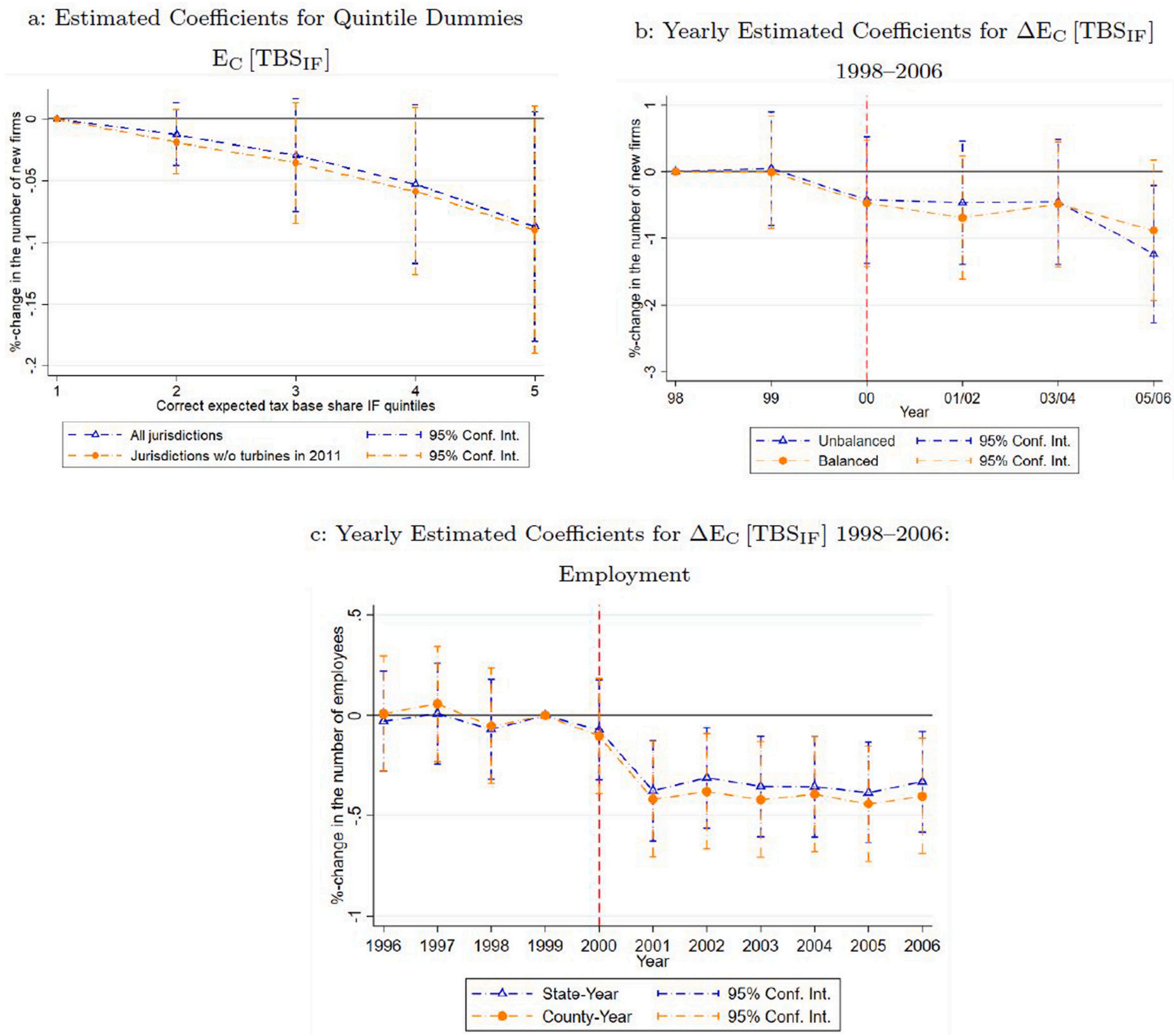

Fig. 2. Sensitivity tests.

Notes: Fig. 2(a) shows estimated coefficients for the corrected expected tax base share $(E_C[TBS_{IF}] = E[TBS_{IF}] \cdot (1 - E[TBS_{IF}]))$ quintile dummies based on an otherwise identical specification as in col. (2) (blue) and col. (4) (orange) of Table 2, Panel A. Fig. 2(b) shows estimated coefficients for the change in expected tax base share deciles between 1998 and 2006 interacted with year dummies based on an otherwise identical specification as in col. (5) of Table 2, Panel A. The sample includes only jurisdictions with no turbines in 2011. Fig. 2(c) shows estimated coefficients for the change in corrected expected tax base share between 1998 and 2006 interacted with year dummies using (ln) number of employees as dependent variable and OLS estimations for 1996–2006. The sample includes 7125 West German jurisdictions with no turbines in 2011 that are observed for all years (total number of jurisdiction-year observations: 78,375). All graphs include 95% confidence intervals.

Source: Authors' calculation based on Statistik Lokal, 1997–2011, and data from the operator database, 1990–2011, and the German Weather Service.

find little heterogeneity, consistent with the results in Langenmayr and Simmler (2021).

5. Conclusion

Our paper highlights the relevance of firms' expectations about future firm mobility and future tax rates for their market entry decisions. We document a reduction in the number of new firms in jurisdictions in which firms expected average tax base mobility to decline, implying higher tax rates in the future. This effect is independent of whether the increase is realized in the future or not.

Our findings have policy implications for municipalities, especially those with favorable location factors of increasing importance, such as good conditions for renewable energy. These municipalities cannot fully capitalize on their geographical advantages, as they cannot commit to maintaining low tax rates. Our paper shows that firms anticipate rate hikes and are thus less likely to enter such municipalities. This insight suggests a need for municipalities to explore alternative strategies that balance attracting firms with realistic tax policy.

Our empirical approach exploits the emergence of a new immobile firm type, wind turbines. An important avenue for future research is to validate our finding using other dimensions that affect average firm mobility, such as expected changes in spending needs due to the aging of societies or changes in agglomeration benefits. A particularly relevant question is whether the effect is symmetric, i.e., whether lower tax rates in the future stimulate entry already today.

In our setting, jurisdictions have only one relevant tax instrument. Since different types of firms are affected differently by the same tax instrument (e.g., sales vs. corporate income tax, see, for example, Rohlin et al., 2014), our insights may not carry over to richer environments.

CRediT authorship contribution statement

Dominika Langenmayr: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Martin Simmler:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jue.2024.103666.

References

Arif, S., Lee, C.M.C., 2014. Aggregate investment and investor sentiment. Rev. Financ. Stud. 27, 3241–3279.

Baldwin, R.E., 2001. Core–periphery model with forward-looking expectations. Reg. Sci. Urban Econ. 31, 21–49.

Becker, S., Egger, P., Merlo, V., 2012. How low business tax rates attract MNE activity: Municipality-level evidence from Germany. J. Public Econ. 96, 698–711.

Becker, R., Henderson, J.V., 2000. Effects of air quality regulations on polluting industries. J. Polit. Econ. 108, 379–421.

Blesse, S., Doerrenberg, P., Rauch, A., 2019. Higher taxes on less elastic goods? Evidence from german municipalities. Reg. Sci. Urban Econ. 75, 165–186.

Bond, E.W., Samuelson, L., 1986. Tax holidays as signals. Amer. Econ. Rev. 76, 820–826.

Brinkman, J., Lin, J., Mangum, K., 2023. Expecting an expressway. Slides available at https://jlin.org/talk/BLM-EE-talk.pdf.

Brülhart, M., Jametti, M., Schmidheiny, K., 2012. Do agglomeration economies reduce the sensitivity of firm location to tax differentials? Econ. J. 122, 1069–1093.

Buettner, T., 2003. Tax base effects and fiscal externalities of local capital taxation: evidence from a panel of german jurisdictions. J. Urban Econ. 54, 110–128.

Carlsen, F., Langset, B., Rattsø, J., 2005. The relationship between firm mobility and tax level: Empirical evidence of fiscal competition between local governments. J. Urban Econ. 58, 273–288.

Cummins, J.G., Hassett, K.A., Oliner, S.D., 2006. Investment behavior, observable expectations, and internal funds. Amer. Econ. Rev. 96, 796–810.

de Mooij, R.A., Ederveen, S., 2008. Corporate tax elasticities: a reader's guide to empirical findings. Oxf. Rev. Econ. Policy 24, 680–697.

Devereux, M.P., Lockwood, B., Redoano, M., 2008. Do countries compete over corporate tax rates? J. Public Econ. 92, 1210–1235.

Doyle, C., Van Wijnbergen, S., 1994. Taxation of foreign multinationals: A sequential bargaining approach to tax holidays. Int. Tax Public Finance 1, 211–225.

Feld, L.P., Heckemeyer, J.H., 2011. FDI and taxation: A meta-study. J. Econ. Surv. 25, 233–272.

Figueiredo, O., Guimarães, P., Woodward, D., 2002. Home-field advantage: location decisions of portuguese entrepreneurs. J. Urban Econ. 52, 341–361.

Fuest, C., Peichl, A., Siegloch, S., 2018. Do higher corporate taxes reduce wages? Micro evidence from Germany. Amer. Econ. Rev. 108, 393–418.

Gennaioli, N., Ma, Y., Shleifer, A., 2016. Expectations and investment. In: Eichenbaum, M., Parker, J. (Eds.), NBER Macroeconomics Annual 2015. Vol. 30, pp. 379–442.

Guimarães, P., Figueiredo, O., Woodward, D., 2003. A tractable approach to the firm location decision problem. Rev. Econ. Stat. 85, 201–204.

Haan, P., Simmler, M., 2018. Wind electricity subsidies—A windfall for landowners? Evidence from a feed-in tariff in Germany. J. Public Econ. 159, 16–32.

Haufler, A., Mittermaier, F., 2011. Unionisation triggers tax incentives to attract foreign direct investment. Econ. J. 121, 793–818.

Haufler, A., Wooton, I., 2010. Competition for firms in an oligopolistic industry: The impact of economic integration. J. Int. Econ. 80, 239–248.

Haupt, A., Krieger, T., 2020. The role of relocation mobility in tax and subsidy competition. J. Urban Econ. 113, 103196.

Janeba, E., 2000. Tax competition when governments lack commitment: Excess capacity as a countervailing threat. Amer. Econ. Rev. 90, 1508–1519.

Jofre-Monseny, J., 2013. Is agglomeration taxable? J. Econ. Geogr. 13, 177–201.

Kato, H., 2015. The importance of government commitment in attracting firms: A dynamic analysis of tax competition in an agglomeration economy. Eur. Econ. Rev. 74, 57–78.

Kehoe, P.J., 1989. Policy cooperation among benevolent governments may be undesirable. Rev. Econom. Stud. 56, 289–296.

Koh, H.-J., Riedel, N., Böhm, T., 2013. Do governments tax agglomeration rents? J. Urban Econ. 75, 92–106.

Kydland, F.E., Prescott, E.C., 1980. Dynamic optimal taxation, rational expectations and optimal control. J. Econom. Dynam. Control 2, 79–91.

Langenmayr, D., Simmler, M., 2021. Firm mobility and jurisdictions' tax rate choices: Evidence from immobile firm entry. J. Public Econ. 204, 104530.

Lin, J., Rauch, F., 2022. What future for history dependence in spatial economics? Reg. Sci. Urban Econ. 94, 103628.

Link, S., Menkhoff, M., Peichl, A., Schüle, P., 2024. Downward revision of investment decisions after corporate tax hikes. Am. Econ. J.: Econ. Policy forthcoming.

Misra, S., 2019. The labor market effects of corporate taxation: Evidence from Germany. Available at https://scholar.harvard.edu/files/smisra/files/misra_sanjay_jmp.pdf.

Ottaviano, G., Tabuchi, T., Thisse, J.-F., 2002. Agglomeration and trade revisited. Internat. Econom. Rev. 43, 409–435.

Oyama, D., 2009. Agglomeration under forward-looking expectations: Potentials and global stability. Reg. Sci. Urban Econ. 39, 696–713.

Riedel, N., Simmler, M., Wittrock, C., 2020. Local fiscal policies and their impact on the number and spatial distribution of new firms. Reg. Sci. Urban Econ. 83, 103525.

Rohlin, S., Rosenthal, S.S., Ross, A., 2014. Tax avoidance and business location in a state border model. J. Urban Econ. 83, 34–49.

Simmler, M., Langenmayr, D., 2024. "Stata Code for Expectations About Future Tax Rates and Firm Entry" (Version V1). Zenodo, http://dx.doi.org/10.5281/zenodo.10568663.

Slemrod, J., 2004. Are corporate tax rates, or countries, converging? J. Public Econ. 88, 1169–1186.

Steijn, M.P., Koster, H.R., Van Oort, F.G., 2022. The dynamics of industry agglomeration: Evidence from 44 years of coagglomeration patterns. J. Urban Econ. 130, 103456.

Suárez Serrato, J.C., Zidar, O., 2016. Who benefits from state corporate tax cuts? A local labor markets approach with heterogeneous firms. Amer. Econ. Rev. 106, 2582–2624.

Zwick, E., Mahon, J., 2017. Tax policy and heterogeneous investment behavior. Amer. Econ. Rev. 107, 217–248.