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Factor Allocation and Tax Avoidance

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Abstract

This paper addresses the question of how firms react to tax incentives in a formula apportionment (FA) tax regime. Under FA, profits of all consolidated entities of a business group are summed and then allocated according to a formula based on FA factors. We hypothesize that firms may change the allocation of real production factors and/or manipulate the FA factor through tax avoidance strategies. Analyzing FA tax effects of the German local business tax with payroll expense as the exclusive FA factor, we find empirical evidence consistent with both hypotheses. Regarding the allocation of production factors, we observe significant tax effects on labor input at the intensive margin but not on labor input at the extensive margin. In addition, we find evidence of an indirect FA spillover effect on capital investment. Our findings on tax avoidance proxies are consistent with tax-induced manipulations of payroll expense as FA factor in order to save tax payments.

Keywords: Factor Allocation, Formula Apportionment, Profit Shifting, Tax Avoidance

JEL Classification: H32, H71, H73, J61

1 Introduction

Using firm data at the establishment level, this paper empirically analyzes the impact of a payroll formula apportionment (FA) regime on business activity. Under FA, profits of all consolidated entities of a business group are summed and then allocated according to a formula based on measurable proxies for inputs and/or outputs (e.g., payroll expense, sales revenues, fixed assets). Due to the difficulties in calculating arm's length prices for intra-group transactions and the resulting opportunities for firm tax base erosion and profit shifting (Dharmapala, 2014), FA has been suggested as an alternative for the separate accounting (SA) regime in international taxation (Altshuler & Grubert, 2010, Gresik 2010, Nielson et al., 2010, Clausing 2013). Examples include unitary taxation in the U.S. and Canada and the concept of the Common Consolidated Corporate Tax Base (CCCTB) of the European Union.

While there is a great deal of empirical research on incentive effects of SA tax regimes (see Heckemeyer & Feld, 2011, for tax effects on foreign direct investment and Dharmapala, 2014, for research on tax avoidance using profit shifting strategies), few studies address the impact of FA on business activity (e.g., Gupta & Mills, 2002). Most of these studies analyze the U.S. unitary taxation regime using state-level data (Weiner, 1996, Klassen & Shackelford, 1998, Lightner, 1999, Goolsbee & Maydew, 2000, Gupta & Hofmann, 2003). However, our knowledge of FA effects at the firm and establishment level is limited. As a result, attempts to assess the budgetary and firm-specific consequences of introducing FA instead of SA typically do not account for behavioral responses (Shackelford & Slemrod, 1998, Devereux & Loretz, 2008, Hines, 2010, Clausing & Lahav, 2011).[1]

From a theoretical perspective, an FA-based income tax can be interpreted as a tax upon the FA factors of the apportionment formula (McLure, 1981). It follows that FA factor allocations are distorted by tax rate differences (Gordon & Wilson, 1986). In line with this argumentation, recent research on the German local business tax, where payroll is the exclusive FA factor, interprets correlations between tax rates and payroll costs as evidence for a distortion in real business activity (e.g., Riedel, 2010; Thomsen et al., 2014). FA tax effects are assumed not to be driven by "artificial" tax avoidance

[1] An exception is the simulation of Altshuler and Grubert (2010). However, due to the lack of empirical research on FA, their simulations are not based on empirically-based estimates but on hypothesized tax elasticities.

strategies (Riedel & Runkel, 2007, Martini et al., 2012, Clausing, 2013). Clausing and Lahav (2011) argue: "While accounting manipulations can easily shift profits of low-tax countries under a separate accounting system, that is not the case under a formulary system." By contrast, the German practitioner literature documents a wide range of tax avoidance strategies for the FA system of the German local business tax (Dietrich & Krakowiak, 2009, Urbahns, 2010, Scheffler, 2011). A main target of these strategies lies in manipulation of payroll expense, which is the exclusive FA factor of the German regime (see Section 2).[2]

We address these issues through detailed analysis of the impact of the German local business tax FA regime on (1) allocation of real labor input at the extensive margin and the intensive margin, (2) spillover effects on investment and output, and (3) tax avoidance strategies affecting payroll expense but not real input and/or output. The German local business tax is raised by German municipalities; there is wide variation in tax rates in the cross section and over time. Our analysis is based on a unique firm panel with detailed information on the FA factor (payroll expense), real labor input (number of employees, number of working hours), capital input (investment expense), and output (sales revenues) on the establishment level. Using this data, we are able to perform a much more detailed investigation of FA effects on business activity than existing empirical studies. An additional benefit of our analysis lies in the fact that payroll expense is the only FA factor of the German local business tax. Therefore, we can identify spillover effects on output (measured by sales revenues) and capital input (measured by investment expense).

Confirming existing research using firm-level tax data (Riedel, 2010; Thomsen et al., 2014), we obtain a significant negative correlation of the tax rate differential (difference of the tax rate of establishment *i* and the average tax rate) and payroll expense as the FA factor. However, analyzing real labor input, FA effects are significant only for the number of working hours and not for the number of employees. We also provide evidence for FA spillover effects on related variables. Corresponding to our results for the small-group subsample (firms with less than four establishments per entity), FA distorts not only the allocation of labor input, but also capital input as a complementary

[2] For example, businesses may "lease" employees from low-tax establishments to high-tax establishments, as such leasing contracts will not increase the payroll expense in high-tax municipalities. Further, businesses may "outsource" employees working in high-tax jurisdictions to subsidiaries that are not part of the FA scheme.

production factor.[3] Furthermore, we investigate proxy variables for tax avoidance. Assuming that tax avoidance strategies have a stronger impact on payroll expense than on our measures for real input or output, our results are consistent with FA tax avoidance strategies having an impact on payroll expense at the establishment level.

Our paper enriches the existing literature in several ways. First, extending the scarce literature on firm reactions to FA, we provide evidence not only on the overall FA effect on payroll expense, but on the different transmission channels. While the U.S.-based literature provides evidence for FA tax effects on employment (Lightner, 1999, Goolsbee & Maydew, 2000) and investment (Weiner, 1996, Gupta & Hofmann, 2003), firm-level evidence on the transmission channels is still missing. Complementing existing research using firm-level tax data (Riedel, 2010), this is the first paper to generate evidence on a distortion of real production factors at the firm level. In so doing, we find a significant impact on labor input at the intensive margin (number of working hours), but not on labor input at the extensive margin (number of employees). An explanation for this outcome might be the strong legal protections for German employees (e.g., dismissal protection regulations; see Sá, 2008, Forsyth, 2009), which limit the ability of German employers to engage in tax-driven labor force adjustments. As a result, FA tax effects on payroll expense do not necessarily imply physical reallocation of employees. Taking into account the strong employee protection legislation in most European countries (Sá, 2008), similar effects might be expected for a CCCTB at the European level.

Second, we find evidence for spillover effects of the FA labor input distortion on investment. This result suggests that FA tax regimes may distort not only the corresponding FA factors but also other related variables. This finding should be relevant for the on-going theoretical debate over which factors are optimal for an FA scheme (Anand & Sansing, 2000, Riedel & Runkel, 2007, De Waegenaere & Sansing 2008, Gresik, 2010; Nielson et al., 2010, Runkel & Schjelderup, 2011). For example, if labor and capital are closely correlated as complements, this limits opportunities for FA tax policy to attract capital investment via a low weight on capital as an FA factor.

[3] In unreported regressions for firms with only two establishments (two-establishment subsample), we also find weak evidence for spillover effects of labor input on output (measured by sales revenues). However, this outcome is not robust in our baseline specification and should be interpreted with caution.

Third, we analyze whether firms use more or less "artificial" tax avoidance strategies in an FA regime. Whereas it is challenging to find direct evidence for FA tax avoidance, our results on tax avoidance proxies suggest a tax-induced manipulation of payroll expense as FA factor. While the allocation of income among jurisdictions under SA tax regimes is strongly affected by profit shifting strategies of multinationals (Dharmapala, 2014), FA has been regarded as less vulnerable to tax avoidance practices (Riedel & Runkel, 2007, Altshuler & Grubert, 2010, Clausing & Lahav, 2011, Martini et al., 2012, Clausing, 2013). Taking into account evidence on FA tax avoidance for the sales factor in the U.S. (Klassen & Shackelford, 1998, Gupta & Mills, 2002), payroll expense may appear to be a particularly suitable and tax-planning robust apportionment factor. However, as documented by Buettner et al. (2011), firms may use consolidation rules of an FA regime to optimally rely either on FA or on SA (as FA is only relevant for consolidated firms). Extending these authors' findings, we generate evidence consistent with firms manipulating payroll expenses within the FA scheme to minimize their tax burden. Thus, the introduction of FA will presumably not "stop" tax avoidance strategies but rather change tax avoidance techniques. Hence, our paper also contributes to the broad literature on tax avoidance (Hanlon & Heitzman, 2010) via its focus on avoidance mechanisms in an FA scheme.

This paper proceeds as follows. In Section 2, we present the German local business tax and the corresponding FA regulations. Section 3 presents our theoretical considerations and hypotheses. Section 4 introduces the data and the regression model. Regression results are reported in Section 5. Finally, we set forth our conclusions in Section 6.

2 The German local business tax and FA

Domestic business profits of the majority of German firms[4] are subject to a local business tax. While the German parliament and the Federal Council of Germany enact the uniform tax code, each German municipality has the authority to set the local tax rate. The high number of municipalities (12,266 over the sampling period) guarantees strong variation in tax rates used for econometric analysis. The local tax rate is calculated by a uniform basic rate (German: *Messzahl*, 3.5% since 2008) and a variable local business tax multiplier (German: *Hebesatz*). Figure 1 provides an overview of the

[4] Exceptions exist for sole proprietorships and partnerships with earnings from agriculture, forestry and learned academic professions (e.g., self-employed doctors, tax advisers, architects, engineers). These types of businesses are not taxed by the German local business tax.

distribution of local tax rates in Germany in 2008, which is the final year of our data set. There is considerable variation in tax rates in the cross section.

[Figure 1 about here]

In 2004, a minimum local business tax multiplier of 2 (200%, as described by the German Local Business Tax Code) was introduced. The German business tax reform of 2008/2009 slightly reduced the basic rate from 5% to 3.5% and abolished the tax deductibility of the local business tax from taxable profit.[5] Current local business tax rates typically range from 7% (local business tax multiplier of 2) to 17.15% (local business tax multiplier of 4.9). There are very few outliers (current maximum rate of 31.5% in Dierfeld). Accounting for the higher basic rate of 5% and the tax deductibility of the local business tax from its own tax base, historical tax rates before 2008 were slightly higher (9.09% for a tax multiplier of 2 and 19.68% for a local tax multiplier of 4.9). The local business tax base is based on modified profit. The most important modification is the addition of a fraction of interests, leases, and rents paid. To avoid double taxation, there also exist exemptions for distributed profits and dividends.

For our identification strategy, a crucial feature of the local business tax is the payroll FA system. For firms with multiple establishments in different German municipalities (hereafter, multi-establishment firms), the local business tax base is usually apportioned according to the establishments' payroll shares.[6] In consolidated tax groups, subsidiaries are also treated as establishments. The relevant payroll per employee is limited to €50,000 for FA purposes. Trainees' wages, tax-exempt wage payments, and profit-related bonuses are disregarded. The local business tax base must be declared to the central tax authorities, which calculate and allocate the local business tax and perform random tax audits. Usually, tax audits are not conducted by the municipalities but by the German states. Therefore, the German fiscal authorities have no strong incentive to audit the allocation of local business taxes to different municipalities (Becker & Fuest, 2010, Gresik, 2011). Anecdotal evidence (Scheffler 2011) suggests a weak audit system for payroll FA in Germany.

[5] Before 2008, the German local business tax therefore reduced the tax base of the (corporate and/or personal) income tax as well as its own tax base.

[6] Under certain conditions (e.g., wind power stations), there are also special apportionment schemes, which are not based on payroll expense (Scheffler, 2011). Considering their limited scope of application, these special regimes are not relevant for our analysis.

The German practitioner literature discusses a wide range of tax avoidance strategies to manipulate payroll expense as an FA factor (Dietrich & Krakowiak, 1999, Scheffler, 2011). One important tool is the leasing of employees from one (official) entity to work for another (effective) entity. Since leasing fees for employees are not considered by the FA scheme of the German local business tax, this is a powerful strategy to shift payroll expense to a low-tax municipality (via the official entity) for employees working in a high-tax municipality (for the effective entity). In addition, employees may be on the payroll list of one establishment, while effectively working for another one. This should be especially relevant for employees working in more than one establishment (discretion in cost allocation). Such strategies fit well with empirical evidence on tax-motivated cost allocation (Yetman, 2001). Furthermore, employees may be "outsourced" to subsidiaries, which are not part of the FA regime (non-consolidation for FA tax purposes) and can therefore be used for profit shifting in an SA context.

From an empirical perspective, the German local business tax has a number of notable advantages when testing the impact of FA systems on real business activity. First, the German local business tax uses payroll expense as the single FA factor, which simplifies analysis and allows identification of spillover effects on investment and output. Second, the local business tax code is uniform in all German municipalities. Therefore, we may focus simply on the variation in tax rates to identify the impact of payroll FA on the allocation of labor input. Third, we have a wide variation in tax rates over time and in the cross section. Tax rates range from 0% (before 2004) to more than 30% across the period. On average, about 8% of the 12,266 municipalities change their local tax rate each year, providing sufficient variation in tax rates over time. This is documented in Figure 2.

[Figure 2 about here]

3 Theory and hypotheses

As suggested by McLure (1981), income taxes raised by FA can be interpreted as taxes on the corresponding FA factors. In the case of Germany, payroll expense is the only FA factor. Thus, the average local business income tax rate of a multi-establishment firm τ is the weighted sum of tax rates τ_i with the payroll share of an establishment *i* as the weighting factor. Corresponding to the theoretical literature (Gordon & Wilson, 1986, Anand & Sansing, 2000, Nielsen et al., 2010), the tax rate will distort the FA factor cost and consequently the factor input. Therefore, we focus on *Payroll share*$_i$ of

an establishment i $\left(= Payroll\ expense_i \Big/ \sum_{i=1}^{I} Payroll\ expense_i\right.$ with the number of establishments *I*).

We use the tax rate differential $TaxD_i$ as a measure for FA tax incentives. $TaxD_i$ is defined as the difference between the tax rate of establishment *i*, τ_i, and the average tax rate over all other establishments *J* of the same entity $\left(TaxD_i = \tau_i - \overline{\tau}_J\right)$.[7] Since a positive (negative) tax rate differential sets an incentive to shift payroll away from (into) the establishment, we hypothesize:

H1: The Payroll share of an establishment is negatively correlated with the tax rate differential.

While the literature (e.g., Riedel, 2010, Thomsen et al., 2014) interprets the correlation of *Payroll share* and the tax rate differential entirely as evidence for a reallocation of real labor inputs, this is not the only possible response from taxpayers. As documented by Dietrich and Krakowiak (2009), Urbahns (2010), and Scheffler (2011), there is a wide range of FA tax avoidance strategies that affects payroll expense without changing real labor inputs. Further, existing evidence does not provide information on the channels for a reallocation of production factors at the firm level (Lightner, 1999, Goolsbee & Maydew, 2000, Gupta & Hofmann, 2003, Riedel, 2010). To identify the impact of the German FA local business tax rate regime on real labor inputs, we rely on measures of labor input at the extensive margin and the intensive margin.

Similar to *Payroll share*, we use the share of employees of establishment *i* to the total number of employees (*Employee share*) as a measure for labor input at the extensive margin. For labor input at the intensive margin, we use the ratio of working hours per employee of establishment *i* to the sum of working hours per employee over all establishments $\left(Hours\ per\ employee\ ratio_i = \frac{Working\ hours_i / Employees_i}{\sum_{i=1}^{I} Working\ hours_i / Employees_i} \right)$. While this ratio is not a "share" in the true sense, it is a relative measure ranging from zero to 1. Thus, it has similar statistical properties (e.g., mean, standard error; see Table 1) as our "share" measures (*Payroll share*, *Employee share*), which simplifies the comparability of regression coefficients. We assume that both measures for real labor

[7] Riedel (2010) uses a weighted tax rate differential with sales revenues as weighing factor. However, in our study such a measure would not be appropriate as it considers the tax wedge between the tax rate of establishment *i* and the average tax rate on profit but not the shifting incentive resulting from different marginal tax rates in different municipalities.

input are negatively affected by the shifting incentive measured by the tax rate differential.

H2a: The Employee share of an establishment is negatively correlated with the tax rate differential.

H2b: The Hours per employee ratio of an establishment is negatively correlated with the tax rate differential.

As an alternative identification strategy for FA effects on the allocation of real input factors, we analyze spillover effects of labor inputs on output and capital input. Assuming a Cobb-Douglas production function with output (sales revenues) $S_i\left(L_i;K_i\right)$ depending on labor input and capital input and a positive cross-derivative of both input factors $\left(\frac{\partial S_i}{\partial L_i \partial K_i} > 0\right)$, an adjustment of labor input L_i will result in a corresponding adjustment of output S_i and capital input K_i. For example, if German FA tax incentives reduce labor input, we should also observe a reduction in output and capital input. Since the German FA scheme does not consider sales revenues or capital stock as FA factors, both proxies of real business activity should be unaffected by tax avoidance strategies intended to manipulate the FA factor (payroll expense).

We identify these indirect effects of the German FA scheme by investigating the correlation between *TaxD* and *Revenue share* (ratio of sales revenues of establishment *i* to total sales revenues of the firm) as well as *TaxD* and *Investment share* (ratio of gross investment in equipment and real estate in establishment *i* to total gross investment of the firm). As profits from foreign operations may be tax-exempt under certain conditions,[8] *Revenue share* is based on sales revenues from domestic operations. However, we also perform a robustness check considering sales revenues from domestic and foreign operations. *Investment share* is based on gross investment, since our data base does not provide information on the capital stock at the establishment level. *Investment share* also accounts for leasing contracts for new equipment and real estate. We assume that these secondary spillover effects of *TaxD* via labor input are delayed by one period. Therefore, we use lagged valued of *TaxD.*

[8] Corresponding to § 2 of the German Local Business Tax Code (German: *Gewerbesteuergesetz)*, the tax is relevant only for ongoing business operations in Germany. In addition, German businesses may credit foreign income taxes against the German local business tax under certain requirements.

H3a: The Revenue share of an establishment is negatively correlated with the once-lagged tax rate differential.

H3b: The Investment share of an establishment is negatively correlated with the once-lagged tax rate differential.

Finally, we also analyze tax avoidance strategies of German businesses manipulating the FA factor payroll expense without changing the real factor allocation. We assume that tax avoidance will affect payroll expense while leaving real labor input or output unchanged. Therefore, we investigate correlations between the tax rate differential and the ratio of payroll expense to real labor input or output. Following the approach of the *Hours per employee ratio*, we use the following two measures:

1) ratio of payroll expense per working hour of establishment *i* to the sum of payroll-expense-per-working-hour values over all establishments

$$\left(Payroll\ \ per\ hour\ ratio_i = \frac{Payroll\ expense_i / Working\ hours_i}{\sum_{i=1}^{I} Payroll\ expense_i / Working\ hours_i} \right),$$

2) ratio of payroll expense per unit of sales revenue of establishment *i* to the sum of payroll expense per unit of sales revenue over all establishments of the firm

$$\left(Payroll\ \ per\ revenue\ ratio_i = \frac{Payroll\ expense_i / Sales\ revenues_i}{\sum_{i=1}^{I} Payroll\ expense_i / Sales\ revenues_i} \right).$$

Since both measures have similar statistical properties as our share measures (*Payroll share*, *Employee share*), corresponding regression coefficients should be comparable in terms of size and distribution. Assuming that tax avoidance takes place and that therefore, in addition to real input changes, we will observe tax avoidance effects, we hypothesize:

H4a: The Payroll per hour ratio of establishment is negatively correlated with the tax rate differential.

H4b: The Payroll per revenue ratio of establishment is negatively correlated with the tax rate differential.

4 Data and empirical strategy

Our analysis is based on the German AFiD panel (German: *Amtliche Firmendaten in Deutschland*) for the manufacturing and mining industries. These industries contribute

about one-quarter of the gross value added of the German economy (Destatis 2015). The AFiD panel comprises several mandatory business surveys conducted by the German Federal Statistical Office (German: *Statistisches Bundesamt*) and can be accessed by remote-data processing (Malchin & Voshage, 2009). The surveys in question, conducted between 1995 and 2008, are the Investment Survey and the Monthly Report for Manufacturing and Mining Enterprises (both raised on the establishment level).[9] We rely on the Monthly Report for payroll expense, number of employees, and number of working hours per establishment; we rely on the Investment Survey for investment in equipment and real estate on the establishment level. Using the German Statistics of Tax Multipliers (German: *Statistik der Hebesätze*) and Regio-Stat information, we complement these data with local tax rate panel data at the municipality level and information on the economic situation at the district level (GDP per capita, population, unemployment rate). This provides us with a unique panel of establishment data covering the period from 1995 to 2008.

Compared to other firm panels like Compustat or AMADEUS, AFiD holds a number of major advantages for our analysis. Unlike public accounting data, the Investment Survey and the Monthly Report provide very detailed information on the volume and composition of payrolls, investments, and sales revenues, and these data are collected at the establishment level. Since we complement the data with information on local tax rates, we are not only able to analyze correlations between payroll expense and tax rates, but also correlations with number of employees, number of working hours per employee, sales revenue, gross investment, and measures for tax avoidance (payroll per number of hours worked, payroll per unit of sales revenue) on the establishment and firm levels. To our knowledge, this is a unique feature, allowing us a more detailed analysis than in previous research. Both surveys are conducted as a mandatory census for all domestic establishments in the manufacturing and mining industries with at least 20 employees; therefore, non-response and sample selection are not issues. An additional advantage stems from the fact that the data are anonymized and available only for political and scientific use. Hence, there should be a smaller incentive for survey participants to "brighten the numbers" as in balance sheet information.

[9] German titles of the surveys are as follows: „Investitionserhebung bei Betrieben des Verarbeitenden Gewerbes sowie der Gewinnung von Steinen und Erden" and „Monatsbericht bei Betrieben des Verarbeitenden Gewerbes sowie der Gewinnung von Steinen und Erden".

A disadvantage of the data set is that it does not provide information on holding structures. Thus, we obtain data for the different establishments of one entity, but not for subsidiaries or parent companies of that entity. While the data should be excellently suited to analyze factor allocations within an entity, they do not enable us to address other forms of tax avoidance between different entities of a consolidated business group (e.g., profit shifting between different legal entities). Further, the data are restricted to the manufacturing industry and the mining sector, and they provide information only on gross investment but not on the capital stock.

The original data include 691,822 observations for business establishments between 1995 and 2008 that participated in the Investment Survey and the Monthly Report, and that provide both firm and establishment IDs. In a first step, we exclude all firms with only a single establishment, as FA is generally not relevant for these observations.[10] Second, we exclude observations with missing ID information on firm and/or establishment. Third, we drop all observations with missing information on variables (including lagged variables). Our final sample comprises 90,678 observations for multi-jurisdictional establishments in the German manufacturing and mining sectors. Table 1 summarizes the price-adjusted establishment data (using the German producer price index for the manufacturing industry; German Council of Economic Experts 2011). Due to confidentiality policies of the German Federal Statistical Office, we are not allowed to report maximum and minimum values.

[Table 1 about here]

Descriptive statistics point to significant variance and a skewed distribution of establishment size. While the average price-adjusted revenue per establishment is €38.9 million, the median is only €6.7 million. On average, establishments spent about 9% of revenues on gross investment and about 22% on payroll expense. The average number of employees (3,826) and the median number of employees (985) underline the considerable size of the establishments in our data. On average, each employee works 135.5 hours per month. Descriptive statistics for the tax rate differential show a relatively uniform distribution of tax incentives over the 90,678 establishments. Average *TaxD* is almost zero and the number of observations with positive *TaxD* is very close to the number of observations with negative *TaxD*. For the various "share" and

[10] FA may be relevant for consolidated subsidiaries using a group taxation regime. However, our data provides neither information on firm ownership and consolidation nor on group taxation regimes. Therefore, we focus on legally distinct entities with more than one establishment.

"ratio" variables of H1 through H4b, we find very similar statistical properties (see H1 through H4b). Mean values range from 32.8% (*Payroll per revenue ratio*) to 35.1% (*Payroll share*) and standard deviations from 20.0% (*Investment share*) to 32.3% (*Payroll per revenue ratio*).

We regress payroll expense at the establishment level on tax rate differentials to test H1. We use the share of payroll expenses of establishment *i* to total payroll at the firm level as the dependent variable (*Payroll share*$_{it}$ = *Payroll expense*$_{it}$ / $\sum_{j=1}^{I}$ *Payroll expense*$_{jt}$). An advantage of this scaled variable is that it should not be affected by general payroll changes at the firm level that are unrelated to allocation of payrolls across establishments. *Payroll share* of establishment *i* in year *t* is regressed on the tax rate differential *TaxD*$_{it}$ and covariates

$$Payroll\ share_{it} = \beta_0 + \beta_1 \cdot TaxD_{it} + \beta_2 \cdot Payroll\ share_{it-2} + \varepsilon \cdot E_{it} + \delta \cdot D_{it} + \lambda_t + \alpha_i + u_{it} \quad (1)$$

with the error term u_{it}.

We use the tax rate differential *TaxD*$_{it}$ as a measure for the tax incentive. *TaxD*$_{it}$ is defined as the difference between the local business the tax rate τ_{it} of establishment *i* and the unweighted average tax rate of the other establishments of the same legally distinct entity ($\overline{\tau}_{Jt} = \sum_{j=1, j\neq i}^{J} \tau_{jt} \Big/ J$ with *J* denoting the number of establishments excluding *i*): $TaxD_{it} = \tau_{it} - \overline{\tau}_{Jt}$. To calculate the tax rate differential, we refer to an unweighted average tax rate.

We consider year-fixed effects λ_t to account for economic trends and shocks, and establishment fixed effects α_i to detect unobserved heterogeneity of the establishments. E_{it} describes a vector of additional control variables at the establishment level. Supplementing twice-lagged *Payroll share*$_{it-2}$, we consider twice-lagged *Investment share*$_{it-2}$ and twice-lagged *Revenue share*$_{it-2}$ to obtain a robust set of control variables for establishment size. D_{it} is a vector of control variables at the district level, including *unemployment* (local unemployment rate in percentage points), *GDP per capita* (logarithm of price-adjusted GDP per capita in euro) and *population* (logarithm of the population) in a district. Hypotheses H2a through H4b are tested by a generalized version of equation (1)

$$Y_{it} = \beta_0 + \beta_1 \cdot TaxD_{it} + \beta_2 \cdot Y_{it-2} + \varepsilon \cdot E_{it} + \delta \cdot D_{it} + \lambda_t + \alpha_i + u_{it}. \quad (2)$$

As dependent variables Y_{it}, we use *Employee share*$_{it}$ for H2a, *Hours per employee ratio*$_{it}$ for H2b, *Revenue share*$_{it}$ for H3a, *Investment share*$_{it}$ for H3b, *Payroll per hour ratio*$_{it}$ for H4a and *Payroll per revenue ratio*$_{it}$ for H4b. Since we assume delayed spillover effects, we use a once-lagged $TaxD_{it-1}$ for *Revenue share*$_{it}$ and *Investment share*$_{it}$. A documentation of regression variables is found in Table 2.

[Table 2 about here]

One problem with our estimation strategy stems from the ambiguity of tax avoidance incentives for firms with a high number of establishments. For example, a firm with five establishments, of which one establishment is in a high-tax municipality, has the opportunity to shift payroll expense from the high-tax establishment to four other establishments, as well as among these four other establishments. In a world without non-tax costs, the firm would simply reallocate payroll to the establishment with the lowest local business tax rate. However, reallocation of payroll generates non-tax costs (e.g., the costs of production inefficiency) and tax avoidance costs (e.g., tax adviser fees, tax avoidance risk), which are not observable in our data. In addition, alternative tax avoidance strategies (e.g., from the implicit option between SA and FA as discussed by Buettner et al., 2011) should be more valuable for larger entities with a high number of establishments. Therefore, identification of FA tax effects should be more difficult for firms with a higher number of establishments.

Accordingly, we initially focus on a subsample with a low number of establishments. In order to account for different payroll shifting incentives for firms with many establishments as well as to generate subsamples of sufficient size, we decided on a subsample of entities with up to three establishments (small-group subsample, 52,542 observations). This subsample should be best-suited for a detailed analysis of the various FA effects. Descriptive statistics of the small-group subsample (< four establishments) and the remaining large-group subsample (≥ four establishments, 38,136 observations) are provided in Table 3.

[Table 3 about here]

Establishments in the two subsamples are very similar to each other for such variables as monthly working hours per employee, local tax rate, tax rate differential, and regional economic properties (e.g., unemployment rates). Differences exist for establishment size and allocation of input and output variables among different business units. Establishments of large-group firms are bigger in terms of sales revenue, gross

investment and payroll expense. Further, driven by the higher number of establishments, mean values of our relative "share" and "ratio" variables are smaller. Due to the higher heterogeneity of the large-group subsample, standard deviations of our regression variables (e.g., *Payroll share*) are relatively high compared to mean values.

5 Results

5.1 FA effects on payroll expense

As a first step, we estimate regression model (1) to confirm existing evidence on a negative and significant correlation between the tax rate differential (*TaxD*) and *Payroll share* (Riedel, 2010; Thomsen et al., 2014). In so doing, we address the question of whether the correlation becomes more obvious for the subsample of firms with few establishments (small-group subsample). Therefore, we estimate (1) for a) the full sample, b) the small-group subsample (entities with less than four establishments), and c) the large-group subsample (entities with at least four establishments). We also estimate models for the full sample including an interaction term of *TaxD* and a measure of group size. Hence, we test whether tax effects in the large-group subsample differ significantly from the results of the small-group subsample. As variables for group size, we consider a dummy variable for the small-group subsample (*Small group*), the number of establishments (*Establishments*), and the logarithm of the number of establishments (*LN(Establishments)*). The partial tax effect is identified by the interaction term of group size and *TaxD* (e.g., *TaxD x Small group*). Estimations are performed by ordinary least squares (OLS) in a fixed effect model using robust and clustered standard errors at the establishment level. For the calculation of R^2, we do not account for establishment fixed effects.[11] Results are documented by Table 4.

[Table 4 about here]

Confirming the literature (Riedel, 2010; Thomsen et al., 2014) as well as H1, we obtain a negative and significant correlation of *TaxD* and *Payroll share*. Corresponding to our estimate for the full sample (1), increasing *TaxD* by 1 percentage point reduces *Payroll share* by 0.43 percentage points. While we obtain a somewhat higher coefficient for the small-group subsample (-0.689), *TaxD* is not significant for the large-group subsample.

[11] R^2 is calculated on the basis of "xtreg"-models of our STATA package. This means that the explanatory power of establishment-fixed effects is not considered for the calculation of R^2. Thus, the model provides R^2-measures over time (within-R^2) and for the overall model (overall-R^2) for the variation, which has not already been explained by establishment-fixed effects. Considering the explanatory power of these fixed effects would result in significantly higher (adjusted) R^2-values.

Thus, *TaxD* has less explanatory power for firms with a high number of establishments. In spite of this, the models that include interaction terms do not provide significant evidence for stronger FA effects of the small-group subsample. While the coefficient of *TaxD* remains stable in models (4) to (6) in Table 4, none of the tested interaction terms is significant.

Calculating semi-elasticities, the outcome of models (4) to (6) fits well the coefficients of *TaxD* in models (1) and (2). If we compare the regression coefficients of *TaxD* to the corresponding mean values of *Payroll share* in the subsamples (see Table 1 and Panel A of Table 3), the underlying semi-elasticities for a one-percentage-point tax change range from 1.40% (= 0.689/0.4925) for the small-group subsample to 1.22% (= 0.430/0.3511) for the full sample. Hence, both elasticities seem to be in the same range. Concluding, the results of Table 4 suggest that FA tax effects can be identified more easily for the small-group subsample. However, considering elasticity estimates and insignificant interaction terms of *TaxD* and group size, the models do not generate evidence for a difference of FA tax effects between the small-group subsample and the large-group subsample.

5.2 Factor allocation, spillover effects, and tax avoidance

Let us now turn to our main analysis of FA effects on factor allocation and tax avoidance. As described in Section 3, we use six variables as measures of FA effects on business activity. While FA effects on real labor input at the extensive margin and at the intensive margin are measured by *Employee share* and the *Hours per employee ratio*, FA spillover effects on output and investment (capital input) are considered through *Revenue share* and *Investment share*. Finally, tax avoidance strategies affecting payroll expense without affecting real labor input or output are identified by the *Payroll per hour ratio* and by the *Payroll per revenue ratio*.

Considering Table 4, our main focus is on the subsample with the more robust regression results for *Payroll share* (small-group subsample with less than four establishments). Corresponding results are provided in Table 5. Notwithstanding, we also report results for the full sample (Table 6). Corresponding to Table 4, there is no evidence of a *TaxD* effect for the large-group subsample. Hence, we abstain from reporting results.

[Table 5 about here]

While the coefficient for *Employee share* is insignificant, the coefficient for the *Hours per payroll ratio* has a similar value as the coefficient of *Payroll share* and is significant. Hence, we generate empirical evidence for an impact of FA on real labor inputs at the firm level. However, this effect is mainly caused by an adjustment of average working hours and not by an adjustment of the labor force (as suggested by Lightner, 1999, and Goolsbee & Maydew, 2000). This outcome is robust and remains constant for the full sample (Table 6) and robustness checks (Subsection 5.3).

Therefore, it remains questionable whether German FA effects on business activity have a significant impact on German labor markets. Further, long-run FA effects on real labor input may be smaller than the short-run effects, as the number of working hours per employee should be restricted to a certain limit. An obvious explanation for our finding is the institutional structure of the German labor market. Compared to the U.S., Germany has strong employment protection rules for businesses with at least 10 employees. In addition, unions have a strong position in the German labor market, and worker participation is an important aspect of the German corporate governance system (Sá, 2008, Forsyth, 2009). Thus, it may well be that the German labor force is not flexible enough to be strongly affected by an FA tax incentive.

Regarding FA spillover effects, we use once-lagged *TaxD* as the dependent variable, to account for a delay of the indirect effects. We calculate an insignificant coefficient for *Revenue share* and a negative and significant coefficient for *Investment share*. Hence, while we find evidence for spillover effects of labor input on investment, results for spillover effects on output are generally not significant.[12] Our outcome suggests that labor and capital are, on average, complementary input factors. While the coefficient of *Investment share* is similar to the coefficient of the *Hours per employee ratio* (-0.529 compared to -0.633), the indirect FA effect on capital input is significantly smaller than the direct FA effect on labor input. The reason for this is that *Investment share* measures the share of investments (dynamic variable) and not the share of capital stock (static variable). If, for example, gross investment amounts to 20% of capital stock, a tax-induced change of investment by 1% would result in a change of capital stock by only 0.2%.

[12] In an unreported cross check, we also tested the impact of *TaxD* on *Revenue share* only for firms with two establishments (two-establishment subsample with 38,126 observations). In these regressions we obtain a coefficient of -0.458, which is significant at the 10% level. However, corresponding results are neither robust for the small-group subsample nor for the full sample.

The negative and significant results for the *Payroll per hour ratio* and the *Payroll per revenue ratio* document that the impact of *TaxD* on the FA factor payroll expense is stronger than FA impacts on input and output measures. This constitutes evidence for the existence of more or less artificial tax avoidance strategies that do not result from a reallocation of real labor input (see also Section 2). Our regression results imply that tax avoidance may be an important element of the overall FA effect on payroll. Comparing the range of coefficients of tax avoidance measures (-0.545 to -0.929) with the effect on working hours (-0.633), tax avoidance may be responsible for a significant part of the overall impact of *TaxD* on *Payroll share*.[13] Considering that our tax avoidance measures are probably not appropriate to identify all tax avoidance strategies, tax avoidance may even be responsible for a major part of the FA impact. However, as it is very hard to measure tax avoidance under an FA system directly and consequently our proxies are indirect measures for tax avoidance, the results have to be interpreted with due caution.

An alternative explanation for a tax-driven reduction of payroll expense without a corresponding change in the underlying real input measure (number of working hours) or output measure (sales revenues) might be tax incidence. It has been argued that businesses may impose the local tax burden on their employees by reducing gross wages (Fuest et al., 2013). However, taking into account the binding force of labor market contracts and the tariff commitment of most German industries (especially in the manufacturing sector), this does not seem to be a likely explanation for the strong immediate tax effects on the *Payroll per hour ratio* found in our paper. While employment and incidence effects of taxes should have delayed effects (Fuest et al., 2013, Siegloch, 2014), our regression results rather imply a rapid effect from the tax rate differential on *Payroll share*, the *Payroll per hour ratio* and the *Payroll per revenue ratio*. Therefore, we find stronger effects of current *TaxD* on payroll compared to lagged *TaxD*.[14] Since Fuest et al. (2013) argue that, due to collective rent dividing

[13] Taking into account the tax-induced reduction of workings hours per employee, one might argue that part of the lower *Payroll per hour ratio* might be due to a reduction in overtime hours with corresponding overtime compensation. Taking into account that an increase in the tax rate by one percentage point reduces the *Hours per employee ratio* by 0.633 percentage points and the *Payroll per hour ratio* by almost the same value (0.545 percentage points), the impact of overtime compensation should be almost negligible. An adjustment of working hours by a small fraction (e.g., 0.6%) will not result in a noteworthy change in the average payroll over all working hours. Even for an extremely high overtime compensation of 100%, a change in working hours of 0.6% will result in a change in average payroll per working hour of only 0.006%.

[14] This is documented by a comparison of our baseline regression results in Table 4 (*Payroll share*) and Table 8 (other dependent variables) with the corresponding results for lagged *TaxD* in Table 7 (*Payroll share*) and Table 9 (other dependent variables).

negotiations, the tax burden is shifted particularly to workers under collective wage agreements, we would expect this effect to be stronger for firms with many establishments. However, we do not observe this pattern in our results. Note that Fuest et al. (2013) perform calculations for payroll per employee and not for payroll per working hour. Hence, their calculations might be biased by changes in the number of working hours, as suggested by Table 5 and Table 6.

In Table 6, we document our regression results for the full sample (all firms). In line with our assumption on a more effective identification strategy for our small-group subsample, we find a smaller number of significant tax effects on measures of factor allocation and tax avoidance. Notwithstanding, the general implications of these regressions are largely the same as in Table 5. We obtain negative and significant *TaxD*-coefficients for the *Hours per employee ratio* (as the measure for real labor input) and *Payroll per revenue ratio* (as the measure for tax avoidance). However, we do not find significant spillover effects for *Investment share*. Therefore, our result of an FA spillover effect on capital stock is significant only for the small-group sample (maximum of three establishments).

[Table 6 about here]

5.3 Robustness checks

We estimate several additional models to control for the robustness of our findings. Robustness checks are calculated for *Payroll share* (Table 7) as well as for the variables measuring FA effects for factor allocation and tax avoidance (Table 8 to Table 10). For simplicity, we concentrate on the main variables of interest and do not report control variables. We consider three types of robustness checks.

First, we rerun the regressions without including establishment controls. This is for two reasons: 1) we analyze the robustness of correlations when important control variables are excluded; 2) we test whether including twice-lagged values of the dependent variables in our standard regression models affects regression results. While our R^2-measures are much smaller for the models that exclude establishment controls, we obtain largely the same results for *TaxD*.

Second, we test whether the dynamic structure is estimated correctly. It may be argued that a change in tax rates has a generally delayed effect for all variables (e.g., *Payroll share*). In addition, one may argue that spillover effects are not delayed by one year. Thus, we consider once-lagged values of *TaxD* for *Payroll share* and all other

dependent variables for which current *TaxD* is used in the standard regressions. By contrast, we consider current *TaxD* instead of lagged *TaxD* for *Revenue share* and *Investment share*. Results remain broadly unchanged. However, the estimated effects are generally smaller and less significant compared to our standard models. This holds particularly for *Investment share*. Therefore, our standard regression models appear to consider the temporal dynamics better than the robustness test. We also test (unreported) models for longer time lags and find similar implications.

Third, our baseline models might be biased by the fact that we only account for sales revenues of domestic operations as dependent variables (e.g, *Revenue per hour ratio*) and control variables (e.g., twice-lagged *Revenue share*). Therefore, we perform a robustness check accounting for the aggregate sum of sales revenues from domestic operations and sales revenues from foreign operations. Our results remain broadly unchanged. In fact, the impact of *TaxD* on the dependent variables (e.g., *Payroll per revenue ratio*) seems to be even slightly stronger within these models.

Regression results for the three different types of robustness checks are provided by Table 7 for *Payroll share*. In Tables 8 through 10, we document corresponding robustness checks for our measures on factor allocation and tax avoidance. Within these regressions we account for the small-group subsample (panel A) and the full sample (panel B).

[Table 7 about here]

[Table 8 about here]

[Table 9 about here]

[Table 10 about here]

6 Conclusion

We address the question of how multi-establishment firms react to a payroll apportionment regime. Our analysis is based on a unique panel of establishments in the German manufacturing and mining sector. Confirming previous firm-level evidence, we find that changes in the tax rate differential are significantly and negatively correlated with the allocation of payroll among constituent establishments of a firm. Therefore, firms shift payroll away from high-tax establishments to low-tax establishments to optimize overall tax burden. A one-percentage-point increase in the difference between the local business tax rate of an establishment and the average tax rate of the firm (tax

rate differential) decreases the *Payroll share* of the establishment by 0.43 to 0.69 percentage points, or about 1.2% to 1.4%.

Extending the literature, we analyze the impact of FA on the allocation of real labor input, spillover effects on investment and output, and tax avoidance strategies. Our main focus is on a subsample with a small number of establishments that facilitates identification of FA tax effects due to clear incentives. We find a significant impact of the German FA regime on labor input at the intensive margin (number of working hours per employee), but not on labor input at the extensive margin (number of employees). This outcome may be driven partially by the inflexibility of the German labor market (e.g., strong dismissal protection) and suggests a limited impact of the German FA tax regime on recruitment of employees. For the small-group subsample (< four establishments per firm), we also find evidence for spillover effects of the payroll-based German FA tax regime on gross investment in equipment and real estate. Therefore, by distorting labor input, FA tax regimes may also indirectly distort the capital stock. All in all, our findings suggest that the German FA tax regime has a significant impact on the allocation of real production factors.

Further, our results are consistent with tax avoidance taking place in addition to real payroll shifting. We show that the distortion of the FA factor payroll expense significantly exceeds the distortion of the corresponding measures of real input (number of working hours) and output (sales revenues). Hence, firms may find ways to adjust the payroll FA factor without adjusting real business activity. This outcome challenges the assertions in the literature that FA taxation may be robust to aggressive tax avoidance strategies. Introducing FA instead of SA for international taxation (e.g., in the form of a CCCTB on the European level) may therefore restrict profit shifting, but also provide new tax avoidance opportunities in addition to real factor shifting. From this perspective, “fine-tuning” international tax systems (e.g., by introducing thin-capitalization rules) to narrow tax loopholes may be as relevant as the more general question of SA or FA.

Finally, we point out several limitations of our paper. We provide a detailed analysis of the German local business tax FA regime for the German manufacturing and mining sector. While the manufacturing and mining sector is an important part of the German economy, our findings may not be representative for other FA tax regimes and other industries (e.g., due to different production processes and investment adjustment costs). Nevertheless, we are convinced that our main propositions on FA tax effects on factor

allocation and tax avoidance should also be interesting in a broader context. These primary results hold for the full sample as well as for the small-group subsample. By contrast, we find FA spillover effects only for the small-group subsample. While this lack of significant evidence might result from a more tricky identification of tax effects for large-group entities, we nevertheless cannot rule out that FA spillover effects are relevant only for firms with a limited number of establishments. Hence, more empirical research on these issues (e.g., for other countries or industries) is most welcome.

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Figures and Tables

Figure 1: Local tax rates in Germany, 2008

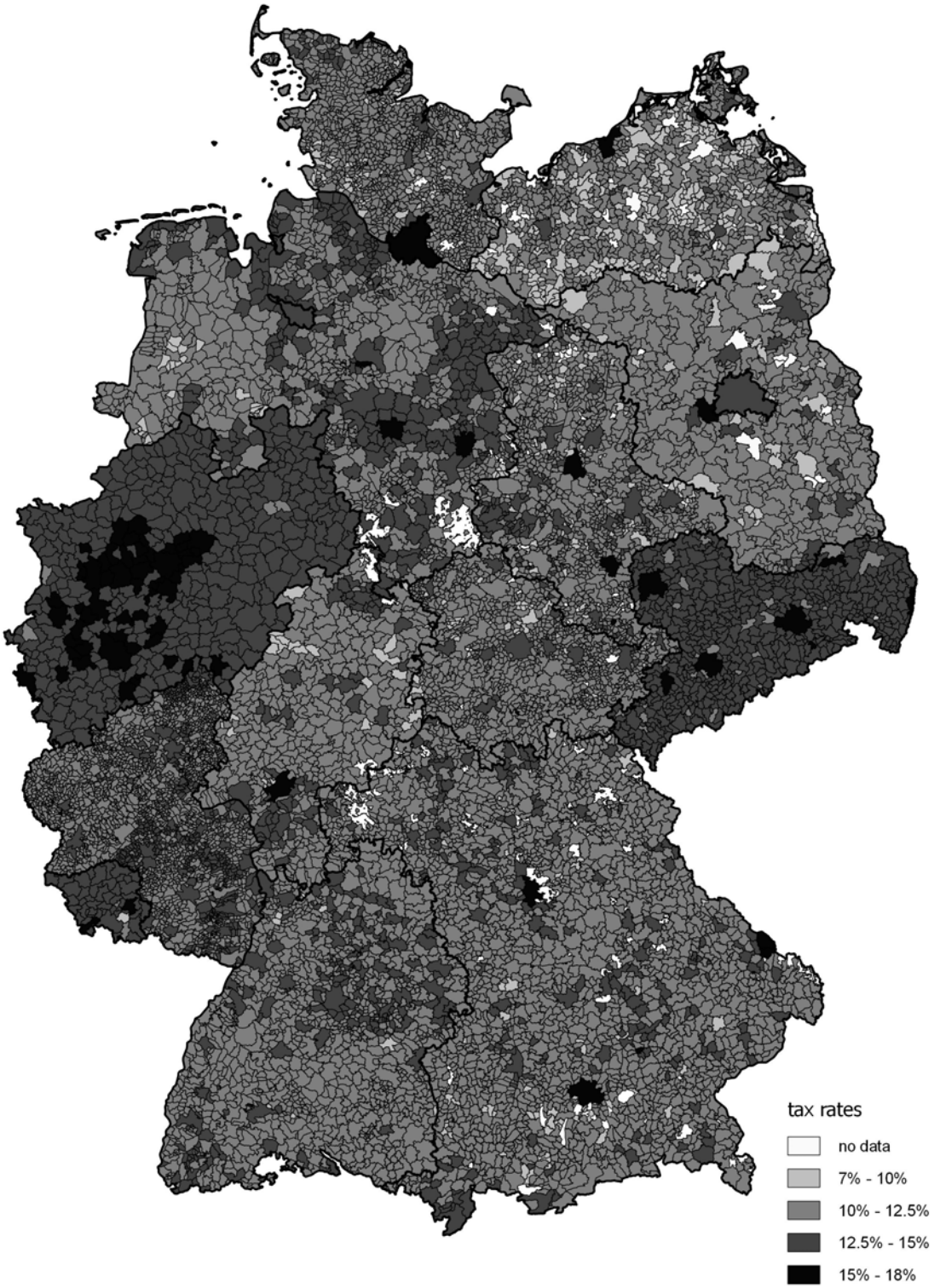

Figure 2: Number of local tax rate changes per German municipality, 1995-2008

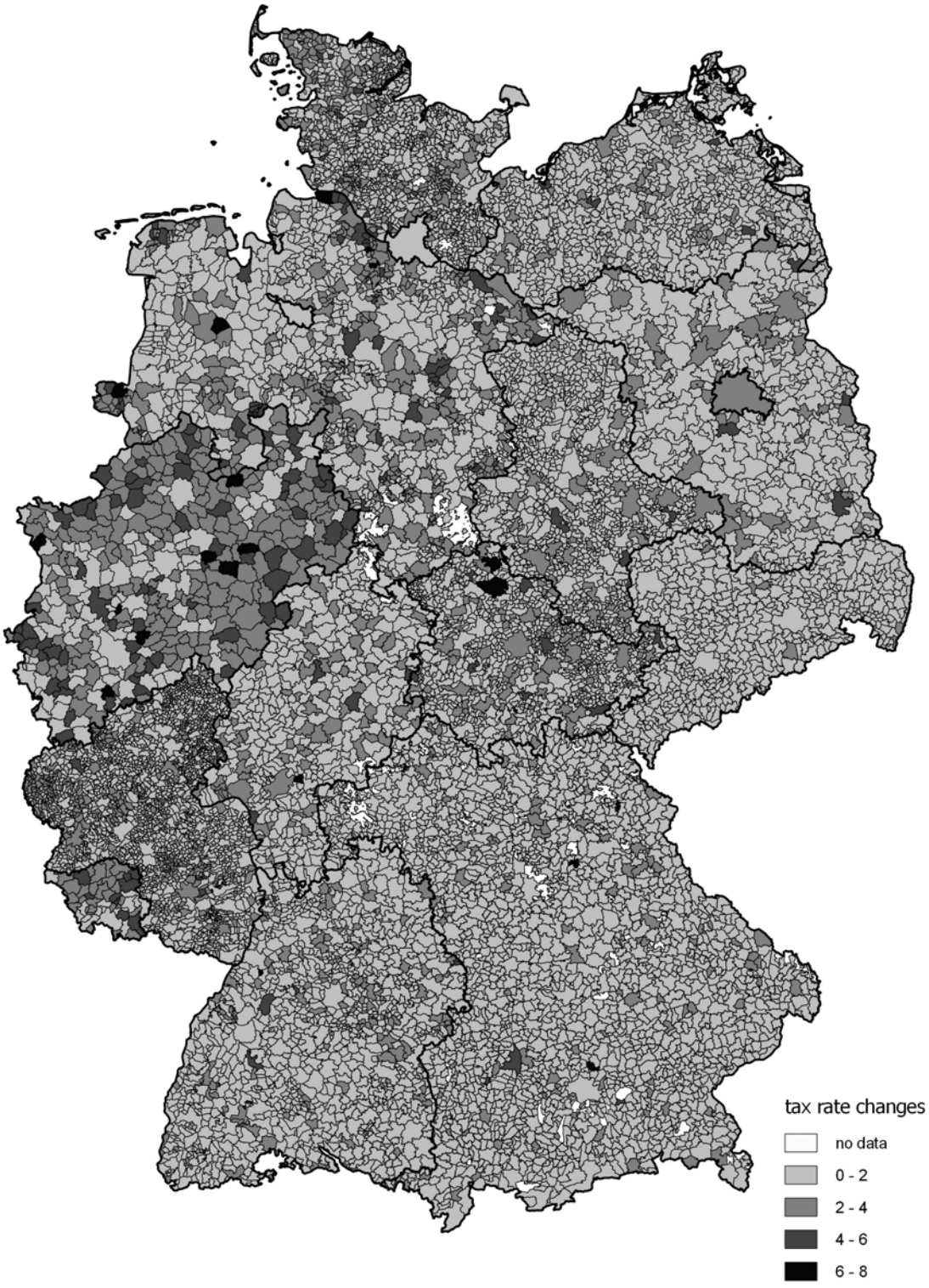

Table 1: Descriptive Statistics

Variable	Mean	Median	Std. Dev.	N
Sales revenue (1,000 euro)	38,892.27	6,736.57	199,851.91	90,678
Gross investment (1,000 euro)	3,542.40	290.40	25,446.08	90,678
Payroll expense (1,000 euro)	8,601.54	1,692.95	46,967.13	90,678
Number of employees	3,826.23	985.00	16,122.54	90,678
Monthly hours per employee	135.49	133.03	27.32	90,678
Local business tax rate	0.1546	0.0191	0.1525	90,678
TaxD (tax rate differential)	-0.0003	0.0000	0.0198	90,678
TaxD ≥ 0	0.0142	0.0109	0.0131	46,433
TaxD < 0	-0.0156	-0.0121	0.0129	44,245
Payroll share	0.3511	0.2658	0.2979	90,678
Employee share	0.3463	0.2598	0.2912	90,678
Hours per employee ratio	0.3440	0.3384	0.2112	90,678
Revenue share	0.3478	0.3374	0.2353	90,678
Investment share	0.3491	0.3580	0.2000	90,678
Payroll per hour ratio	0.3468	0,3388	0.2269	90,678
Payroll per revenue ratio	0.3282	0.2549	0.3225	90,678
Unemployment rate (district level)	0.1054	0.0920	0.0481	90,678
GDP per capita (district level)	26,453	23,726	11,073	90,678
Population (district level)	332,160	198,964	481,340	90,678

Notes: AFiD panel industrial units of the manufacturing industry; price-adjusted data; own calculations.

Table 2: Definitions of regression variables

Variable	Definition
Payroll share$_{it}$	Payroll of establishment *i* and year *t* divided by sum of payrolls of all establishments *i* = 0 to *I*
Employee share$_{it}$	Number of employees of establishment *i* and year *t* divided by sum of employees of all establishments *i* = 0 to *I*
Hours per employee ratio$_{it}$	Average working hours per employee in establishment *i* and year *t* divided by sum of average working hours per employee over all establishments *i* = 0 to *I*
Revenue share$_{it}$	Sales revenue of establishment *i* and year *t* divided by total sales revenue of all establishments *i* = 0 to *I*
Investment share$_{it}$	Investment in fixed assets in establishment *i* and year *t* divided by sum of investments in fixed assets over all establishments *i* = 0 to *I*
Payroll per hour ratio$_{it}$	Average payroll per number of working hours in establishment *i* and year *t* divided by sum of average payroll per number of working hours over all establishments *i* = 0 to *I*
Payroll per revenue ratio$_{it}$	Average payroll per sales revenue in establishment *i* and year *t* divided by the sum of average payroll per sales revenue over all establishments *i* = 0 to *I*
TaxD$_{it}$	Difference between tax rate of establishment *i* in year *t* and the unweighted average tax rate of all other establishments.
Unemployment$_{it}$	Unemployment rate of district of establishment *i* in year *t* in percentage points
GDP per capita$_{it}$	Natural logarithm of gross domestic product per capita of district of establishment *i* in year *t*
Population$_{it}$	Natural logarithm of population of district of establishment *i* in year *t*

Table 3: Descriptive statistics for subsamples

Panel A: Small groups (< four establishments)	Mean	Median	Std. Dev.	N
Sales revenues (1,000 euro)	31,651.72	7,349.57	157,414.96	52,542
Gross investments (1,000 euro)	2,735.99	346.06	19,660.29	52,542
Payroll expense (1,000 euro)	6,478.32	1,834.66	31,614.51	52,542
Number of employees	3,028,62	1,079,00	11,538,28	52,542
Monthly hours per employee	134.35	131.76	24.76	52,542
Local business tax rate	0.1528	0.0185	0.1489	52,542
TaxD (tax rate differential)	-0.0005	0.0000	0.0215	52,542
TaxD ≥ 0	0.0145	0.0107	0.0144	28,011
TaxD < 0	-0.0176	-0.0139	0.0143	24,531
Payroll share	0.4925	0.4775	0.2893	52,542
Employee share	0.4868	0.4741	0.2791	52,542
Hours per employee ratio	0.4843	0.4905	0.1462	52,542
Revenue share	0.4892	0.3495	0.4727	52,542
Investment share	0.4901	0.3696	0.4730	52,542
Payroll per hour ratio	0.4886	0.4846	0.1760	52,542
Payroll per revenue ratio	0.4629	0.4536	0.3183	52,542
Unemployment rate (percent, district level)	0.1018	0.0880	0.0476	52,542
GDP per capita (district level)	25,799	23,619	10,203	52,542
Population (district level)	315,657	194,169	455,311	52,542
Panel B: Large groups (≥ four establishments)	Mean	Median	Std. Dev.	N
Sales revenues (1,000 euro)	48,867.97	5,609.63	246,290.04	38,136
Gross investments (1,000 euro)	4,653.43	211.53	31,700.99	38,136
Payroll expense (1,000 euro)	11,526.82	1,384.55	62,075.61	38,136
Number of employees	4,925	797	20.798	38,136
Monthly hours per employee	137.06	134.65	30.43	38,136
Local business tax rate	0.1570	0.0196	0.1561	38,136
TaxD (tax rate differential)	-0.0002	-0.0009	0.0172	38.136
TaxD ≥ 0	0.0138	0.0115	0.0108	18,422
TaxD < 0	-0.0132	-0.0108	0.0105	19,714
Payroll share	0.1562	0.0963	0.1738	38,136
Employee share	0.1527	0.0912	0.1719	38,136
Hours per employee ratio	0.1507	0.1423	0.1100	38,136
Revenue share	0.1530	0.0849	0.1924	38,136
Investment share	0.1548	0.0508	0.2268	38,136
Payroll per hour ratio	0.1516	0.1378	0.1183	38,136
Payroll per revenue ratio	0,1426	0.0617	0.2199	38,136
Unemployment rate (district level)	0.1104	0.0980	0.0484	38,136
GDP per capita (district level)	27,352	23,858	12,113	38,136
Population (district level)	354,896	202,658	514,190	38,136

Notes: AFiD panel industrial units of the manufacturing industry; price-adjusted data; own calculations.

Table 4: Results: Payroll share

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Payroll share	Payroll share	Payroll share	Payroll share	Payroll share	Payroll share
Sample	Full sample	Small groups	Large groups	Full sample	Full sample	Full sample
$TaxD_t$	-0.430***	-0.689***	0.0381	-0.406**	-0.489***	-0.481**
	(0.164)	(0.195)	(0.189)	(0.176)	(0.170)	(0.235)
$TaxD_t$ x Small $group_t$				-0.108		
				(0.194)		
$TaxD_t$ x $Establishments_t$					-0.00354	
					(0.539)	
TaxD x $LN(Establishments_t)$						-0.105
						(0.126)
Investment $share_{t-2}$	0.0105***	0.00977***	0.000217	0.00860***	0.00977***	0.00598***
	(0.00247)	(0.00276)	(0.00448)	(0.00239)	(0.00245)	(0.00234)
Revenue $share_{t-2}$	-0.0419***	-0.0404***	-0.0680***	-0.0494***	-0.0435***	-0.0539***
	(0.00812)	(0.00937)	(0.0145)	(0.00793)	(0.00802)	(0.00773)
Payroll $share_{t-2}$	0.240***	0.203***	0.160***	0.220***	0.236***	0.210***
	(0.00935)	(0.0112)	(0.0154)	(0.00893)	(0.00925)	(0.00881)
Unemployment	0.00288***	0.00456***	0.00150**	0.00268***	0.00310***	0.00304**
	(0.000654)	(0.000915)	(0.000733)	(0.000625)	(0.000646)	(0.000612)
GDP per capita	-0.0194*	-0.0295*	-0.0109	-0.0194*	-0.0194*	-0.0179*
	(0.0104)	(0.0172)	(0.0100)	(0.0102)	(0.0103)	(0.00970)
Population	-0.00315	-0.00549	-0.00305	-0.000996	-0.00240	0.000201
	(0.00810)	(0.0104)	(0.0117)	(0.00782)	(0.00775)	(0.00750)
Small $group_t$				0.144***		
				(0.00486)		
$Establishments_t$					-0.00224***	
					(0.000131)	
$LN(Establishments_t)$						-0.139***
						(0.00356)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,678	52,542	38,136	90,678	90,678	90,678
Overall R^2	0.688	0.502	0.393	0.616	0.494	0.505
Within R^2	0.0863	0.0607	0.0439	0.161	0.106	0.212

Notes: Regressions are calculated by OLS with establishment fixed effects and year fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. A detailed description of the dependent and independent variables is provided by Table 2.

Table 5: Results: Factor allocation and tax avoidance (small-group subsample)

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable Y_t	Employee share	Hours per employee ratio	Revenue share	Investment share	Payroll per hour ratio	Payroll per revenue ratio
$TaxD_t$	-0.118	-0.633***			-0.545***	-0.929***
	(0.176)	(0.178)			(0.204)	(0.265)
$TaxD_{t-1}$			-0.0962	-0.529**		
			(0.189)	(0.251)		
Investment share$_{t-2}$	0.0114***	0.00912***	0.00264	-0.0271***	0.0112***	-0.00520
	(0.00220)	(0.00263)	(0.00330)	(0.00639)	(0.00304)	(0.00440)
Revenue share$_{t-2}$	0.00908	-0.000416	0.229***	0.0734***	0.0461***	-0.145***
	(0.00734)	(0.00654)	(0.0105)	(0.0105)	(0.00718)	(0.00954)
Y_{t-2}	0.144***	0.0390***			-0.00348	
	(0.0102)	(0.00856)			(0.006909	
Unemployment	-0.00190***	0.000214	-0.00239**	-0.00260	0.00339***	0.00663***
	(0.000664)	(0.000973)	(0.000999)	(0.00177)	(0.00118)	(0.00145)
GDP per capita	0.0247	0.000246	0.0509***	0.00953	0.0126	-0.0568**
	(0.0155)	(0.0156)	(0.0194)	(0.0321)	(0.0178)	(0.0225)
Population	-0.0174*	-0.000825	-0.0163	-0.00733	-0.00679	0.0117
	(0.00905)	(0.0112)	(0.0105)	(0.0187)	(0.0132)	(0.0121)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,542	52,542	52,542	52,542	52,542	52,542
Overall R^2	0.720	0.139	0.744	0.0952	0.0910	0.402
Within R^2	0.0787	0.178	0.0935	0.00346	0.106	0.0528

Notes: Regressions are calculated by OLS with establishment fixed effects and year fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. A detailed description of the dependent and independent variables is provided by Table 2.

Table 6: Results: Factor allocation and tax avoidance (full sample)

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Employee share	Hours per employee ratio	Revenue share	Investment share	Payroll per hour ratio	Payroll per revenue ratio
$TaxD_t$	0.0757	-0.314**			-0.250	-0.527***
	(0.153)	(0.151)			(0.163)	(0.199)
$TaxD_{t-1}$			0.155	-0.0913		
			(0.144)	(0.189)		
Investment share$_{t-2}$	0.0124***	0.0126***	0.00206	-0.0112***	0.0142***	-0.000159
	(0.00203)	(0.00232)	(0.00294)	(0.00532)	(0.00259)	(0.00373)
Revenue share$_{t-2}$	0.00845	0.0190***	0.244***	0.121***	0.0584***	-0.111***
	(0.00671)	(0.00131)	(0.00803)	(0.00835)	(0.00625)	(0.00742)
Y_{t-2}	0.183***	0.0771***			0.0363***	0.194***
	(0.00919)	(0.00740)			(0.00634)	(0.00670)
Unemployment	-0.00140***	-0.000347	-0.00177**	-0.00135	0.00173**	0.00378***
	(0.000523)	(0.000652)	(0.000711)	(0.00110)	(0.000747)	(0.000980)
GDP per capita	0.0147	0.00790	0.0244**	0.000258	0.0100	-0.0346**
	(0.00940)	(0.00910)	(0.0114)	(0.0179)	(0.0102)	(0.0133)
Population	-0.0105	-0.00653	-0.0105	0.00219	-0.0130	0.00378
	(0.00732)	(0.00738	(0.00761)	(0.0132)	(0.00841)	(0.0903)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,678	90,678	90,678	90,678	90,678	90,678
Overall R^2	0.800	0.331	0.784	0.368	0.270	0.438
Within R^2	0.107	0.134	0.108	0.00901	0.0879	0.0570

Notes: Regressions are calculated by OLS with establishment fixed effects and year fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. A detailed description of the dependent and independent variables is provided by Table 2.

Table 7: Robustness checks: Payroll share

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Payroll share	Payroll share	Payroll share	Payroll share	Payroll share	Payroll share
Robustness check	Controls	Controls	Timing	Timing	FRevenue	FRevenue
$TaxD_t$	-0.381***	-0.657***			-0.428***	-0.684***
	(0.185)	(0.212)			(0.164)	(0.195)
$TaxD_{t-1}$			-0.251**	-0.449***		
			(0.128)	(0.155)		
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment controls	No	No	Yes	Yes	Yes	Yes
Regional controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,678	52,542	90,678	52,542	90,678	52,542
Within R^2	0.00550	0.00619	0.692	0.516	0.686	0.496
Overall R^2	0.00446	0.00468	0.0859	0.0599	0.0863	0.0609

Notes: Regressions are calculated by OLS with establishment fixed effects and year fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. A detailed description of the dependent and independent variables is provided by Table 2.

Table 8: Robustness checks: Factor allocation and tax avoidance – establishment controls

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Employee share	Hours per employee ratio	Revenue share	Investment share	Payroll per hour ratio	Payroll per revenue ratio
Panel A: Small-group subsample						
$TaxD_t$	-0.0830	-0.630***			-0.533***	-0.975***
	(0.195)	(0.180)			(0.206)	(0.295)
$TaxD_{t-1}$			-0.0657	-0.515**		
			(0.225)	(0.253)		
Observations	52,542	52,542	52,542	52,542	52,542	52,542
Overall R^2	0.00411	0.0942	0.00509	0.0952	0.0473	0.00240
Within R^2	0.00204	0.175	0.00153	0.00346	0.102	0.00523
Panel B: Full sample						
$TaxD_t$	0.130	-0.300*			-0.208	-0.560**
	(0.455)	(0.157)			(0.170)	(0.219)
$TaxD_{t-1}$			0.237	-0.0498		
			(0.176)	(0.198)		
Observations	90,678	90,678	90,678	90,678	90,678	90,678
Overall R^2	0.00499	0.0432	0.00405	0.00186	0.0249	4.06e-07
Within R^2	0.00367	0.118	0.00255	0.00210	0.0751	0.00417
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment controls	No	No	No	No	No	No
Regional controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regressions are calculated by OLS with establishment fixed effects and year fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. A detailed description of the dependent and independent variables is provided by Table 2. Panel A refers to the small-group sample (firms with less than 4 establishments) and Panel B refers to the full sample.

Table 9: Robustness checks: Factor allocation and tax avoidance – timing effects

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Employee share	Hours per employee ratio	Revenue share	Investment share	Payroll per hour ratio	Payroll per revenue ratio
Panel A: Small-group subsample						
$TaxD_t$			-0.182	-0.448		
			(0.229)	(0.285)		
$TaxD_{t-1}$	0.0745	-0.229			-0.400**	-0.470**
	(0.139)	(0.144)			(0.168)	(0.218)
Observations	52,542	52,542	52,542	52,542	52,542	52,542
Overall R^2	0.725	0.142	0.743	0.102	0.0900	0.409
Within R^2	0.0786	0.177	0.0935	0.00339	0.106	0.0521
Panel B: Full sample						
$TaxD_t$			0.116	-0.099		
			(0.181)	(0.217)		
$TaxD_{t-1}$	0.192	-0.0592			-0.152	-0.258
	(0.117)	(0.119)			(0.132)	(0.164)
Observations	90,678	90,678	90,678	90,678	90,678	90,678
Overall R^2	0.798	0.336	0.785	0.368	0.270	0.442
Within R^2	0.107	0.134	0.107	0.00901	0.0879	0.0568
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment controls	No	No	No	No	No	No
Regional controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regressions are calculated by OLS with establishment fixed effects and year fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. A detailed description of the dependent and independent variables is provided by Table 2. Panel A refers to the small-group sample (firms with less than 4 establishments) and Panel B refers to the full sample.

Table 10: Robustness checks: Factor allocation and tax avoidance – foreign sales revenue

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Employee share	Hours per employee ratio	Revenue share	Investment share	Payroll per hour ratio	Payroll per revenue ratio
Panel A: Small-group subsample						
$TaxD_t$	-0.120	-0.634***			-0.550***	-1.240***
	(0.176)	(0.178)			(0.204)	(0.256)
$TaxD_{t-1}$			0.0115	-0.538**		
			(0.176)	(0.251)		
Observations	52,542	52,542	52,542	52,542	52,542	52,542
Overall R^2	0.720	0.140	0.769	0.120	0.0927	0.417
Within R^2	0.0789	0.178	0.0984	0.00384	0.106	0.0529
Panel B: Full sample						
$TaxD_t$	0.0743	-0.316**			-0.253	-0.748***
	(0.153)	(0.151)			(0.163)	(0.194)
$TaxD_{t-1}$			0.218	-0.101		
			(0.137)	(0.189)		
Observations	90,678	90,678	90,678	90,678	90,678	90,678
Overall R^2	0.800	0.332	0.798	0.379	0.271	0.436
Within R^2	0.107	0.134	0.114	0.00974	0.0883	0.0579
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Establishment controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regressions are calculated by OLS with establishment fixed effects and year fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. A detailed description of the dependent and independent variables is provided by Table 2. Panel A refers to the small-group sample (firms with less than 4 establishments) and Panel B refers to the full sample.

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