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Abstract

Previous studies suggest that state ownership facilitates access to debt financing because of implicit state guarantees to bondholders. Private co-owners of partially state-owned companies may exploit such guarantees to save taxes and increase profit distributions to private shareholders. We hypothesize that the latter behavior alters the cost-benefit trade-off between debt and equity financing in such a way that debt ratios under shared ownership are set at a maximum level, irrespective of variations in tax rates. Our empirical analysis supports this hypothesis. We find that debt ratios of shared ownership companies are higher but unresponsive to changes in tax rates. Additional results indicate that shared ownership is not exploited for the purpose of international tax planning.

Key words: State-Owned Enterprises, Capital Structure; Corporate Taxes; Multinational Enterprises; Firm-Level Data

JEL classification: G32, G38, H25, F23

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1 Introduction

An extensive literature analyzing state-owned enterprises (SOEs) argues that commercial lenders assume implicit state guarantees when providing credit to enterprises held by the government. Consequently, SOEs should be able to issue more debt. Many empirical studies support this hypothesis. The survey of Megginson and Netter (2001) suggests that the privatization of an SOE usually leads to a significantly lower debt-to-asset ratio. Rizov (2008) provides a more general overview of theoretical and empirical work analyzing the consequences of a soft budget constraint on leverage.[1] Two reports by the OECD (2012, 2014) confirm that the pricing behavior of lenders differs if the borrower is an SOE. A recent paper by Chen et al. (2016) finds that private firms in China have lower leverage than SOEs, suggesting that SOEs have facilitated access to debt financing.

While many SOEs are not wholly state-owned, previous literature has ignored how implicit guarantees change the behavior of private co-owners. Similarly, we know little about how the presence of a state owner, regardless of the ownership share, alters the risk perception of creditors. This is surprising, as mixed ownership is widespread: the OECD (2014b) estimates minority state holdings alone to amount to 860 billion USD across member states. In an international context, it is often the case that domestic SOEs and privately owned multinational enterprises (MNEs) have stakes in the same affiliates (see Norbäck and Persson, 2004, arguing that in about 29% of the privatizations in OECD countries the buyer was a foreign firm; see also Gupta, 2005).

Analyzing the consequences of state guarantees is naturally difficult: they are implicit and therefore unobserved. Although a study by the OECD (2014) confirms that SOEs (from European or OECD countries) obtain debt in the commercial marketplace, just like privately held firms, commercial credit markets seem to be increasingly

[1] Implicit state guarantees are closely related to soft budget constraints (Kornai et al., 2003), which is why numerous studies on the subject are of equal relevance in our context. Theory and empirical work suggest a rise in leverage, the softer the budget constraint, i.e., the stronger the assumed implicit guarantee.

influenced by state-owned banks, and this could facilitate access to credit for SOEs (Sapienza, 2004; Dinc, 2005).[2] Private co-owners of mixed-ownership companies may particularly benefit from the facilitated debt access. From their perspective, implicit guarantees might change the standard trade-off between tax benefit (deductible interest expense) and cost of financial distress. For example, a private co-owner might pressure managers to set a maximum attainable debt level to avoid unilateral distributions (via tax payments) to the government. This suggests two things. First, debt levels of mixed-ownership firms are higher. Second, the debt ratio of mixed-ownership firms should be less responsive to changes in corporate tax rates.

Tax-deductible interest expenses allow firms to avoid tax payments and suggest a positive correlation between business taxes and debt financing. While there is a vast number of studies on the role of taxes for capital structure choice,[3] previous research has not addressed the issue of whether the debt responses of partial SOEs differ with regard to the standard determinants of capital structure. In particular, partial state ownership may alter a firm's debt tax-responsiveness for three reasons. First, the government as a shareholder benefits from both taxes and dividends.[4] However, under shared ownership, it will prefer tax payments to dividends because tax payments are not distributed to all shareholders. Second, private co-owners might take advantage of easier debt access and benefit from maximum tax shields, irrespective of the corporate tax level. Third, agency conflicts could affect the behavior of managers under partial state ownership in a different way compared to private firms, and this might have implications for the decisions about debt financing.

[2]State-owned banks in Europe increased their assets by at least 30 percent from 2008 to 2012 compared to only a 4-percent increase for private banks (Monnet et al., 2014).

[3]Influential contributions to this literature are the ones by Jensen and Meckling (1976), Myers (1977), Harris and Raviv (1991). Empirical contributions finding a positive effect of taxes on debt financing are the ones by MacKie-Mason (1990), Rajan and Zingales (1995), Desai et al. (2004), Huizinga et al. (2008), Buettner et al. (2009); for a meta-study, see Feld et al. (2013); for surveys, see Myers (2001), and Graham (2003).

[4]This assumes that the firm operates in the same country as the government owner, which is the case for a vast majority of SOEs and also in the sample we use for our empirical analysis.

This paper suggests a differential impact of taxes on debt financing, depending on ownership. We particularly provide evidence that mixed-ownership firms use significantly more debt, but are less tax-sensitive than private firms. For the empirical analysis, we use a large micro-level dataset (ORBIS), which allows us to distinguish between affiliates of MNEs in which an SOE is a co-owner and affiliates of MNEs where this is not the case.[5] By comparing affiliates with government participation to similar but privately owned ones, we can identify the differential impact of taxation on capital structure caused by partial state ownership. We thereby show that the well-established effect of taxes on capital structure choice does not hold if the firm is partially state-owned. Instead, leverage levels are higher, irrespective of the tax rate, suggesting significantly higher tax shields for private shareholders. To the best of our knowledge, this is the first paper that makes this distinction when examining the effect of taxes on debt financing.

An unconditional comparison using our data shows that the average debt-to-asset ratio of partially SOE-held affiliates is about 5.8 percentage points higher than the one of affiliates without SOE ownership. Differences in debt financing at the extensive and the intensive margin drive this discrepancy: the unconditional probability of having positive debt is about 15.4 percent higher for affiliates where an SOE is involved; debt-to-asset ratios of partially state-owned affiliates with positive debt exceed the ones of private firms by an average of 2.5 percent. Another interesting observation from the data is that leverage is hardly correlated with taxes in case of partially SOE-held affiliates, while debt ratios of private firms exhibit a clear positive correlation. This may be surprising given numerous anecdotes about the tax planning and tax avoidance of SOEs, and given that SOEs operating in OECD and EU countries are subject to the same tax treatment as private firms (OECD, 2012).[6]

[5]Our data consists of subsidiaries (ownership above 50 percent) and affiliates. In this study, we will usually refer to affiliates. When we use "SOE" in an affiliate context, we always refer to partially state-owned affiliates, that is firms with a mixed MNE-SOE ownership structure.

[6]Within the EU, state aid legislation prohibits differential treatment of SOEs if they are commer-

One of the central issues we need to address in an empirical analysis is that the status of state ownership is not random, and unconditional comparisons (of outcomes) between partially SOE-held and non-SOE-held affiliates will therefore necessarily produce biased estimates. We design our investigation approach in a way that particularly allows us to understand the differential impact of taxes on debt financing, given the non-random assignment of state ownership. To account for the latter, we first match pairs of similar affiliates of MNEs, where each pair involves one partially SOE-held affiliate (treated) and one non-SOE-held affiliate (control). We require these pairs to be active in the same sector and country. The differential impact of taxes is then identified by using time variation in tax incentives, conditional on time-varying determinants of debt financing as well as time- and matched-pair-specific effects. For the basic results, and assuming a tax rate of 25%, our estimates suggest that being (partially) SOE-held is associated with an 8 percentage points higher debt ratio.

A central finding is that treated affiliates do not respond to taxes at all. This indicates that the classic leverage trade-off becomes weaker or even disappears under state ownership. We additionally show that the intensive margin drives the difference between mixed-ownership and private units. Since partial state ownership facilitates access to debt and alters the standard debt trade-off towards higher levels of debt, our findings may also have implications for MNEs and their tax planning activities. In particular, debt as a vehicle to avoid taxes seems to be an attractive tax planning strategy if monitoring by state owners is weak (Megginson and Netter, 2001; Fan et al., 2007). However, our results do not provide evidence that shared ownership is exploited for the purpose of international tax planning. All findings are robust to (i) exact matching within country and sector; (ii) alternative regression specifications; (iii) varying specifications of the propensity score; (iv) placebo tests.

Our empirical results are consistent with theories on capital structure choice and state ownership. First, partial state ownership facilitates access to credit. Second, pri-

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cially active.

vate firms in mixed-ownership relationships aim at exploiting a maximum attainable debt ratio. Third, rate of return targets from governments may give managers of partially state-owned affiliates an incentive to use very high levels of debt, irrespective of the tax rate. Fourth, firms may suffer from a leverage ratchet effect, which biases capital structure decisions towards higher debt levels (Admati et al., 2016). This effect is likely to be particularly strong in SOEs because of restrictions on equity issues imposed by the government.

The rest of this paper is organized as follows. Section 2 provides all definitions of the variables we use in our analysis and reviews the relevant literature. Section 3 explains the econometric approach. Section 4 presents descriptive statistics and the main result. Section 5 summarizes a broad range of sensitivity tests. Section 6 elaborates on implications of our findings. Section 7 concludes.

2 Taxation, state ownership, and debt

2.1 Taxes and debt financing of SOEs

The differential effect of taxes on SOEs has attracted very little attention in the corporate finance literature. Cui (2015) summarizes three different (not mutually exclusive) perspectives on the issue.

First, from the government's point of view, taxes are irrelevant in the context of wholly-owned SOEs: it does not matter whether the government receives taxes or dividends. However, differential tax treatment matters in mixed-ownership companies as governments tax the dividends paid to private investors, whereas distributions to the state are not subject to additional tax. Otherwise, it is reasonable to assume that SOE managers are indifferent between tax and dividend payout, assuming the absence of agency conflicts.

Second, there is a perspective called the "condition of neutrality" which similarly

suggests that there should not be a differential impact of taxes on SOEs. It also argues from the point of view of the government and derives from the observation that most SOEs operate in market environments where preferential taxation would give SOEs a competitive advantage over private firms. Hence, SOE taxation is necessary to ensure fair competition. For this reason, the point is often emphasized by EU policymakers, because preferential tax treatment of SOEs would contradict state aid legislation aimed at providing a level playing field in the single market.[7] We should note, though, that if governments intervene for reasons of market failure, arguments on competitive neutrality do not apply.[8] Within an SOE, it may be unclear which activities stem from public service obligations and which are of commercial interest. Moreover, it is hard to say if public service obligations ultimately benefit or hurt an SOE's market activities. In any case, SOEs and their private shareholders may benefit from other competitive advantages such as implicit debt guarantees.[9]

Third, SOE taxation is a means of forcing distributions under agency conflicts (Cui, 2015). Note that tax payments, in this view, reduce free cash flow in the spirit of Jensen (1986). The latter paper argues that managers may be reluctant to pay dividends due to agency conflicts. For instance, they may prefer to invest in projects that produce private benefits, or they pursue "empire building" and "quiet life" strategies. This effect may be more important in the context of SOEs as weaker monitoring and corporate governance (see Megginson and Netter, 2001; Musacchio and Lazzarini, 2012) increase opportunities for "empire-building" strategies (Cui, 2015). Note that Jensen (1986)

[7]The relevant articles are 107-109 in the Treaty on the Functioning of the European Union (TFEU). Even though exceptions persist on when SOEs may receive state aid (at arm's-length), Article 90 of the Treaty on the European Community explicitly subjects public undertakings of "general economic interest" to EU competition law.

[8]We see in our data that governments often hold a participating interest in network industries, such as energy companies, airlines, railways, postal services, utilities and other sectors of public interest. Many former state monopolies have been partly privatized over the last decades. However, the comprehensive review of ownership structures undertaken for this study reveal continued government participation in these sectors across all countries included in our sample.

[9]We may mention at this point that there is also a literature suggesting that SOEs are less profitable (Dewenter and Malatesta, 2001; Megginson and Netter, 2001) and less well managed (Borisova et al., 2012).

argues that free cash flow can be reduced through interest payments by relying more on debt financing, providing an incentive to use more debt. Thus, with respect to capital structure choice, this implies that SOEs choose, ceteris paribus, lower debt ratios as tax payments are used to substitute for interest payments to reduce free cash flow. This effect is likely to be absent if mixed-ownership firms are considered.[10]

Summing up, mixed-ownership firms face different tax-related capital structure trade-offs compared to private companies. First, implicit state guarantees allow for higher debt ratios. Second, under private co-ownership, debt ratios may be even higher as private owners benefit more from maximum debt shields, monitoring by the government is weak, and agency conflicts are not as important (compared to fully state-owned enterprises).[11]

As a consequence, we expect that the debt ratios of mixed-ownership firms are primarily driven by incentives related to ownership. This is because the standard (cost-benefit) capital structure trade-off theory no longer applies – the implicit state guarantee makes the cost of financial distress irrelevant, and the marginal tax-benefit of using debt financing is absent as the debt ratio is set at a maximum level. This leads us to propose the following hypothesis:

> **Hypothesis:** *Mixed-ownership SOEs exploit the facilitated access to debt financing and use a maximum attainable debt ratio to shield private investors from corporate taxes. The optimal capital structure then primarily depends on the presence of implicit guarantees and less on corporate tax rates.*

Our empirical analysis tests this hypothesis by (i) focusing on the differential im-

[10]Governments in many EU member states use financial gains from their commercially active companies in budgets (European Commission, 2016). Effective tax payments of wholly-owned commercial SOEs reflect this behavior. For a sample of European firms, Jakob (2018) finds significantly higher effective tax rates of SOEs compared to private firms. In our mixed-ownership study, tax payments increase distributions to state shareholders and lower distributions to private owners. Hence, if there is a conflict between the government and private shareholders, governments cannot *force* high tax payments to increase their distributions over those of private shareholders and therefore this point may also be irrelevant under partial state ownership.

[11]The latter may suggest that taxes substitute for debt financing implying lower debt ratios of SOEs, ceteris paribus.

pact of ownership on leverage, (ii) examining whether ownership determines the tax-responsiveness of debt.

2.2 Data and the definition of state ownership

Our analysis focuses on MNEs and their affiliates. We use the commercial ORBIS firm-level panel dataset from Bureau van Dijk. ORBIS records balance sheet and income statement data from many companies across the globe. An essential advantage of ORBIS is the inclusion of non-listed firms and affiliates, which allows us to analyze debt financing at the non-consolidated micro level (the affiliate level). We should mention, though, that the dataset suffers from a large number of missing values in some variables that are important for this study. This reduces the overall sample size to a significant extent.

We first use information provided by Bureau van Dijk to identify affiliates of SOEs. In ORBIS, a company is classified as state-owned if the state owns a substantial share of at least 25 percent of a company's controlling equity. We define an indicator variable $PSOE_i$, which equals 1 if affiliate i is partially-owned (co-owned) by an SOE. If this is not the case and no SOE is involved in the controlling capital of i, we set $PSOE_i = 0$. As mentioned above, we focus on multinational enterprises, i.e., firms that have at least one affiliate abroad in which the parent company holds at least 1 percent. In a next step, we manually verify the ownership structure of each affiliate with $PSOE_i = 1$, using the historical ownership information available in the online ORBIS database. Thus, we ensure that during the years from 2004 to 2013, an affiliate was always partially owned by an SOE.[12] At the same time, we ensure that the affiliate had a mixed ownership structure by identifying at least one private shareholder in each year. We also make sure that the MNEs and their affiliates with $PSOE_i = 0$ are purely private firms by

[12] Around 77 percent of treated firms fulfill our ownership structure requirements for all years in the period considered. We also construct matched pairs for different ownership patterns in the respective years to avoid a survivorship bias in our estimates.

manually checking their historical ownership structure in each year. Affiliates that we find to be partially state-owned (for example, if the owning government holds a share smaller than 25 percent of the parent company) are removed from the dataset in the respective years. We thereby make sure that we compare affiliates of MNEs with state participation to affiliates of MNEs where the state is not involved at all.

The ownership structure of some affiliates cannot be fully determined, as the data include some holding companies for which no ultimate ownership data is available. We assume that such firms are privately owned, which is most likely the case as OECD governments make all their holdings public. Besides, we are ultimately interested in implicit guarantees, for which state ownership has to be publicly known.

Note that our data include small and passive investments by sovereign wealth funds (SWF). In ORBIS, we can easily differentiate between SWF portfolio companies and companies directly owned by the state because SWF companies carry the ownership label "country *via its funds*" compared to "country". SWF portfolio companies tend to be non-substantial and hold less than 10 percent of affiliate equity, which is below our sample threshold for substantial ownership. Cui (2015) argues that SWF portfolio companies differ from traditional SOEs because the SWF stake is mostly not substantial and will alter firm behavior and incentives to a much lesser extent.[13] In any case, we do not consider SWF portfolios as SOEs, and this is consistent with the political view of state ownership (Shleifer, 1998; Shleifer and Vishny, 1994). The latter suggests that SOEs may be vehicles of politicians' private interests (such as forcing distributions or pursuing employment and investment policies). The state primarily acts as an investor rather than as an owner when acquiring non-controlling positions in firms via its SWF. The aim is then to realize a long-term financial return (Fotak and Megginson, 2015).

The definition of an entity being state-owned or private is crucial. Few studies find a negative correlation between state ownership and debt. For example, the study by

[13]Nevertheless, a body of research has shown that SWF participation does affect characteristics of target firms. See Fotak and Megginson (2015) for a survey.

Bortolotti et al. (2015) suggests a decrease in leverage of publicly traded firms after investments of state-owned investors. However, they focus on investments in minority stakes, whereas we use affiliates of substantially state-owned SOEs. Borisova and Megginson (2011) find that the cost of debt increases with a decreasing share of government ownership, which implies lower leverage. Entirely privatized firms, in turn, face lower spreads (used by Borisova and Megginson, 2011, as a proxy for the cost of debt) and hence lower borrowing costs. A study by Borisova et al. (2015) suggests that implicit guarantees have only been relevant during the financial crisis (starting in 2008) and that SOEs face higher bond spreads in normal times. These studies appear to contradict previous findings. The focus on bond spreads may, however, not be the most relevant one given that the medium-sized utility affiliate (of the partially state-owned units) is the typical observation in our sample.

It is important to recall that, at this point, the partially state-owned affiliate i, which we will analyze in the empirical part below, is at the same time an independent entity of a private MNE. The affiliate is located somewhere within the EU/OECD member states, but not necessarily in the same country as the SOE.[14] The goal of the empirical analysis is to match (comparable) affiliates that are fully privately owned with mixed-ownership affiliates (see Section 3).

2.3 Debt financing

The variable we are interested in is long-term debt, which we define as long-term credit (i.e., maturities of more than one year) divided by total assets. We denote this variable for affiliate i as LEV_{it}. We focus on long-term debt as it should be the choice variable when (i) firms decide on optimal tax shields, and when (ii) implicit state guarantees are more important for long-term financing (which is very likely). Similarly, facilitated

[14]We also estimate our model where SOEs and affiliates operate in the same country.

debt access at state banks should, in particular, affect long-term funding.[15] We report results for two alternative outcome variables in the sensitivity analysis in Section 5.

Figure 1 depicts the outcome variable, LEV_{it}, over time. The solid line shows the average debt ratio of mixed-ownership affiliates ($PSOE_i = 1$), the dashed line the average debt ratio for the fully privately-held affiliates ($PSOE_i = 0$). While the level of this ratio stays roughly constant over time for the control group, it plummets and subsequently rises again quite significantly on two occasions in the treatment group. The timing seems to suggest a relation to events at the macroeconomic level: the first peak in 2008 coincides with the global financial crisis, the second peak in 2012 may be related to the sovereign debt crisis in the Eurozone. The cyclical responses of debt financing of the SOEs support the results of Borisova et al. (2015). These show that implicit guarantees of state-owned firms are particularly relevant in times of macroeconomic crisis.

3 Empirical approach

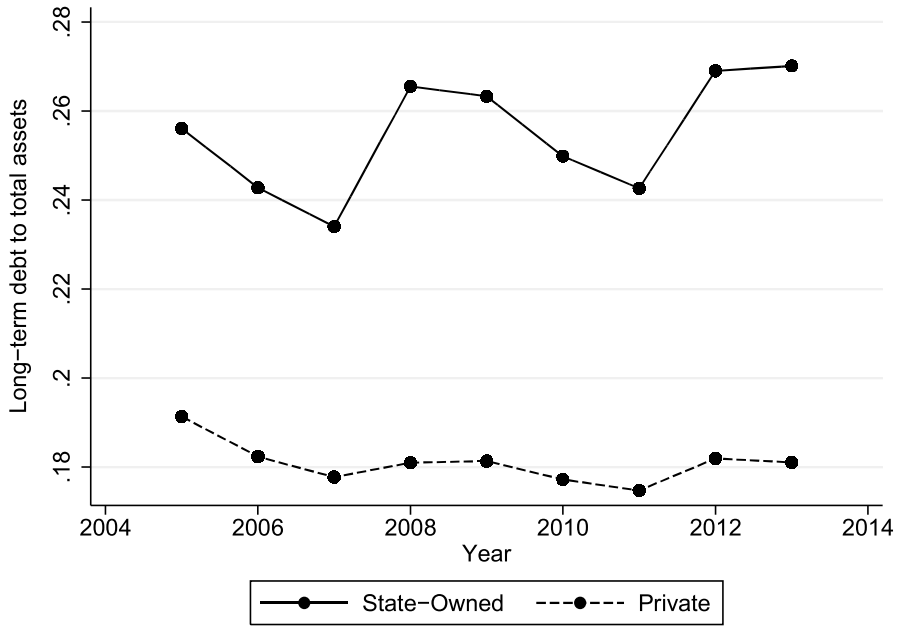
The central goal of our empirical analysis is to learn about a possible differential impact of the corporate tax rate that applies at location k and time t, TAX_{kt}, on debt financing of affiliate i, LEV_{it}. To estimate the differential impact we use interaction terms of TAX_{kt} and $PSOE_i$.

First, however, our empirical approach requires identifying pairs of affiliates, where each pair consists of one affiliate that is co-owned by an SOE ($PSOE_i = 1$) and one that is not ($PSOE_i = 0$). The former unit is called *treated*, and the latter unit is called *control*. Whether affiliate i is assigned to one or the other group depends on vectors of affiliate-i-specific and host-country-k-specific determinants, which we summarize in $\boldsymbol{X}_{0i}$ and $\boldsymbol{Z}_{0k}$, as well as the industry s in which an affiliate operates, ψ_s. We then

[15] For instance, European state-owned banks focus on long-term lending (Monnet et al., 2014).

Figure 1: Yearly average of the outcome variable

Figure 1 plots yearly averages of our outcome variable LEV_{it} for state-owned and privately owned firms with $LEV_{it} > 0$ from 2005 to 2013. LEV_{it} is defined as long-term credit divided by total assets for firm i in year t.



specify the following linear index:

$$PSOE_{it_0} \quad = \quad \boldsymbol{\beta}_1 \boldsymbol{X}_{0it_0} + \boldsymbol{\beta}_2 \boldsymbol{Z}_{0kt_0} + \psi_s + \epsilon_{ikt_0}. \tag{1}$$

We use specification (1) to predict the propensity $\hat{p}_i$ of i being SOE-held, using a binary probability model (probit). Based on this probability model we produce two vectors of propensity scores: one for the SOE-held affiliates $\hat{\boldsymbol{p}}^{\mathbf{1}}$, and one for the ones that are not SOE-held, $\hat{\boldsymbol{p}}^{\mathbf{0}}$. The time index t_0 indicates that we focus on observations in the initial year ($t_0 = 2005$) in our data.[16]

The next step requires identifying the *nearest neighbor* for each treated unit i. Let c_i^m denote the respective control unit m that we match to the treated unit i. The best

[16]We lose $t = 2004$ due to first differencing of some variables. If the ownership verification (described above) reveals relevant changes in ownership during the sample period, we remove the observation from the sample for the respective years.

match is determined by $c_i^m = \min_{\{m\}}(|\hat{p}_i^1 - \hat{p}_m^0|),\ \forall\ m \neq i$. We start by matching across countries and sectors but also provide results based on exact country and industry matching. This produces pairs of affiliates $\{PSOE_i = 1; PSOE_m = 0\}$ where one is SOE-held and one is not. Note that we only use observations as controls which are 100 percent owned by an MNE to ensure they are fully privately owned. Once we have identified c_i^m for each treated unit, we estimate

$$\begin{aligned} LEV_{it} = \alpha_1 PSOE_i &+ \alpha_2 TAX_{kt} + \alpha_3 PSOE_i \times TAX_{kt} \\ &+ \boldsymbol{\alpha}_4 \boldsymbol{X}_{it} + \boldsymbol{\alpha}_5 \boldsymbol{Z}_{kt} + \phi_t + c_i^m + \psi_s + \omega_k + \varepsilon_{iskt}, \end{aligned} \tag{2}$$

where LEV_{it} denotes the debt-to-asset ratio of affiliate i in year t ($t = 2005, ..., 2013$), $PSOE_i$ indicates treatment status, and TAX_{kt} is the statutory tax rate of country k in year t, the host location of affiliate i. We are mainly interested in the coefficient α_1 of the treatment variable $PSOE_i$ and the interaction term $PSOE_i \times TAX_{kt}$. In particular, the coefficient α_3 provides an estimate for the differential impact of TAX_{kt} under partial state ownership. It is identified through variation in tax rates over time as we condition on ϕ_t and c_i^m, which denote time, and pair-specific effects. Similarly, ψ_s and ω_k denote sector and country effects, respectively. Note that the index m in c_i^m indicates that the pair fixed effect is based on the best match as determined above. Thus, conditioning on c_i^m means that we remove all cross-sectional differences between affiliate-pairs and it allows us to identify the differential impact of being SOE-held by time-averaging over all treatment-control units within each pair.

4 Descriptive statistics

For our empirical analysis, we use a mostly balanced panel, in which both treated and control units are observed in almost every year from 2005 to 2013. Our dataset includes affiliates operating in 22 countries, all of which are either OECD or EU member countries. This leads to a total of 1,780 treated and 73,033 control observations over the whole observed time interval. The average SOE parent holds 27 percent of a joint affiliate, and the average non-SOE parent owns 25 percent.[17] The treated units operate only in 12 of the 22 countries, all of which are EU member countries with the exceptions of Norway and South Korea. The countries with the most treated observations are Germany, France, and Belgium. Some countries, like Italy, are not represented in our sample because of missing information in some of the control variables.[18]

Table 1: Sectoral distribution of state ownership

The table presents the sectoral distribution of partially state-owned and fully privately owned firms. The sectoral distribution is based on 1-digit SIC identifier codes.

SIC-Sector	**MNE**		**PSOE**		**Total**	
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Agriculture, Forestry and Fishing	500	0.68	0	0	500	0.67
Mining	420	0.58	0	0	420	0.56
Construction	3,532	4.84	70	3.93	3,602	4.81
Manufacturing	19,300	26.43	250	14.04	19,550	26.13
Transport, Communications, Electric, Gas	5,600	7.67	700	39.33	6,300	8.42
Wholesale Trade	19,328	26.46	80	4.49	19,408	25.94
Retail Trade	3,070	4.20	20	1.12	3,090	4.13
Finance, Insurance, Real Estate	7,116	9.74	250	14.04	7,366	9.85
Services	13,018	17.82	390	21.91	13,408	17.92
Public Administration	1,149	1.57	20	1.12	1,169	1.56
Total	*73,033*	*100.00*	*1,780*	*100.00*	*74,813*	*100.00*

Descriptive statistics at the sectoral level suggest that governments are involved in many

[17]The mean ownership share in the paper by Beuselinck et al. (2017) is about 22% (cf. Table 1).

[18]This is not representative, as SOEs play a prominent role in many EU and OECD member states, especially in Italy (EU, 2016). Note that the sample composition is not relevant, however, in the sense that cross-country variation is fully taken into account in results where we match treated and control units located in the same country. Moreover, our estimates are robust to a full set of country dummies in the propensity score estimation. To save degrees of freedom in the basic estimate, we follow Borisova et al. (2012) and include only dummies indicating the La Porta et al. (1998) legal origin.

industries. However, there is more government activity in sectors like transport, electricity, and communications, than in others, like wholesale trade. Table 1 depicts the relative shares using a sectoral classification based on the first digit of the US-SIC-code. To ensure that sectoral distributions do not drive our results, we include SIC-1 dummies in the estimates of the propensity scores.[19]

Table 2 presents summary statistics for all variables of interest.[20] We are mainly interested in LEV_{it}, the *long-term debt-to-asset ratio* of affiliate i at time t. We remove affiliates where long-term debt exceeds or equals the total assets as corporations in the OECD and EU require some equity.[21] As we would expect, the unconditional correlation between LEV_{it} and $PSOE_i$ is positive. Note that the mean of LEV_{it} is smaller than in most studies, which may be for the following reasons: First, we focus on long-term borrowing and exclude any debt with a maturity of less than one year.[22] Second, our dataset includes a large share of zero-leverage firms. To be precise, 42 percent of the affiliates report zero long-term debt, which is higher than the 32 percent reported by Strebulaev and Yang (2013) in their study using US data from 1962 and 2009.[23] We account for the fact that many of our observations have zero debt by estimating an extensive and an intensive margin debt choice in Section 5. We additionally use two alternative specifications of outcome as a robustness check in the same section.

The control variables we include in the outcome equation are ones that have been shown to affect the capital structure of firms in previous literature. In particular, we condition on

[19]Our results are also robust to exact matching by sector (see below).

[20]Table A.1 in the Appendix reports a correlation matrix for the variables used in the regressions. Table A.3 provides data sources and a description of all variables.

[21]When including observations in our empirical analysis with $LEV_{it} = 1$, the results are unchanged, though.

[22]We present estimates including short-term debt in Section 5.

[23]The inclusion of short-term debt leads to a zero-leverage share of 35 percent, which is close to Strebulaev and Yang (2013).

the following variables: TAX_{kt} is the statutory tax rate that applies to entity i at location k and year t. In most countries, firms can deduct interest payments from their tax base and therefore have a tax-incentive to use debt financing. The data consistently confirm a positive correlation between TAX_{kt} and LEV_{it} (0.0508; see Table A.1 in the appendix). At the same time, governments may want to force distributions via taxation from their SOEs, which is an alternative way of raising revenue under the assumption of a dividend-averse management.

We use the following firm-level variables: First, Graham and Leary (2011) suggest profitability as an important determinant of leverage. We follow Huizinga et al. (2008) and use the return on total assets (ROA_{it}) as a measure of profitability. The reasoning for its inclusion is straightforward. The more profitable a firm, the more likely it will get credit. From the government's perspective, it is arguably more interesting to participate in profitable ventures, or more lucrative to sell stakes in more profitable SOEs. Second, the variable $ATANG_{it}$ is the ratio of fixed to total assets. Asset tangibility ($ATANG_{it}$) has been found to be an important determinant of capital structure because tangible assets can be used as collateral to obtain credit (Rajan and Zingales, 1995; Graham and Leary, 2011). Key industries with a large propensity to be state-owned are industries with a high share of fixed assets, such as utilities, airlines, and energy companies. The variable is strongly correlated with both LEV_{it} and $PSOE_i$ (see Table A.1).

Graham and Leary (2011) further suggest to include a measure of firm size. Larger firms have better access to credit. The government is also more likely to intervene if a firm is large. This is because political reasons for ownership become more important with increasing firm size. We use total assets ($log(TA)_{it}$) as a proxy for firm size. We also produce results where we use the log of total sales as size proxy ($log(SALES)_{it}$), but as we have many missing values in the sales variable, we prefer $log(TA)_{it}$. Using one or the other does not change our

Table 2: Descriptive statistics

The table presents summary statistics of the dependent variable LEV_{it}, state ownership $PSOE_i$ and the control variables used to estimate equation (2). Table 2 is based on 74,813 observations.

Variable	**Mean**	**Std.Dev.**	**Min.**	**Max.**
LEV_{it}	0.07	0.16	0	0.99
TAX_{kt}	0.30	0.06	0.1	0.40
ROA_{it}	6.81	17.16	-100	99.94
$ATANG_{it}$	0.30	0.29	0	1
$log(TA)_{it}$	9.27	2.03	0	18.03
$log(SALES)_{it}$	9.44	1.90	0	17.59
$CORRF_{kt}$	74.50	14.80	33	97
$INVESTF_{kt}$	72.40	14.21	50	95
$CREDITM_{kt}$	131.35	42.90	30.38	248.94
$GDPG_{kt}$	1.61	2.72	-14.81	11.90
$GDPPC_{kt}$	39,572	10,937	11,623	96,711

findings.

At the country level, beside TAX_{kt}, we include two indicators from the Heritage Foundation, freedom from corruption ($CORRF_{kt}$) and investment freedom ($INVESTF_{kt}$), as well as a proxy for credit market depth ($CREDITM_{kt}$), GDP growth ($GDPG_{kt}$) and GDP per capita ($GDPPC_{kt}$). We take the latter three variables from the World Bank's World Development Indicators database.

4.1 Basic result

Based on a probit model and equation (1), we first estimate propensity scores for being state-owned. We use firm size, firm leverage, sales growth, an investment proxy, return on assets, a proxy for credit market size, GDP per capita, GDP growth and an indicator of legal origin based on La Porta et al. (1998) as control variables. Our specification of the propensity score is very similar to the specification used by Borisova et al. (2012), but we additionally include polynomials of the explanatory variables and some additional regressors such as a proxy for investment growth, $\Delta log(FA)_{it}$, where FA denotes the fixed assets of affiliate i. However, some of the variables used by Borisova et al. (2012) are not available in ORBIS. We

finally include one-digit SIC-sector dummies. The results of the propensity score estimation are presented in Table A.2 in the Appendix.

We then try to find a comparable entirely privately owned affiliate (with $PSOE_i = 0$) for each partially state-owned treated affiliate (with $PSOE_i = 1$) in the base year 2005. We do this by using the procedure described above (nearest-neighbor-matching based on propensity scores obtained from the probit estimates).[24]

Based on the pairs we then run outcome regressions as indicated in equation (2). It is important to note that the estimates include pair fixed effects, which absorb unobserved heterogeneity between the matched pairs but allow us to identify the impact of being partially state-owned. All regressions additionally condition on country-specific effects (by including country dummies), industry-specific effects (by including one-digit SIC-sector dummies), as well as time-varying affiliate and country controls. Table 3 provides the basic results. These results are based on 1,481 observations and 92 treated units matched with 92 nearest neighbor control units observed over time.

Given a tax rate of 20%, our model predicts a 13 percentage points higher debt ratio for mixed-ownership firms. Note that the indicator $PSOE_i$ controls for all remaining unobserved effects within matched pairs. Thus, the effect of TAX_{kt} is identified from changes in the tax over time. For $PSOE_i = 0$, a 1-percentage-point increase in TAX_{kt} is associated with an almost 1 percentage point higher debt-to-asset ratio. This implies that the 13 percentage points mixed-ownership effect from above has a tax-equivalent of about 13 percentage points (the tax-equivalent refers to the tax differential, which has about the same impact). The tax

[24]We match the pairs using the alternative calipers 0.5, 0.1, 0.01, 0.001, as well as 10 and 1 percent of the propensity score standard deviation. Thus, we apply even stricter caliper criteria than suggested by Austin (2011). The results (of the outcome regressions) are very robust and do not change with calipers. We take this as evidence of a good first step model and proceed with a caliper of 0.5 to maximize our sample size.

Table 3: Basic result

The table presents pair-FE regressions based on $N = 1,481$ observations; The base year for pair matching is 2005; The dependent variable is the long-term debt-to-asset ratio; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	Coeff. *(s.e.)*
$PSOE_i$	0.3351**
	(0.1348)
TAX_{kt}	0.9706**
	(0.3718)
$TAX_{kt} \times PSOE_i$	-1.0168**
	(0.4185)
ROA_{it}	0.0003
	(0.0004)
$ATANG_{it}$	0.2437***
	(0.0644)
$CORRF_{kt}$	-0.0027**
	(0.0013)
$INVESTF_{kt}$	0.0001
	(0.0010)
$CREDITM_{kt}$	0.0003
	(0.0003)
$GDPG_{kt}$	-0.0002
	(0.0027)
$log(TA)_{it}$	0.0065
	(0.0088)
Country effects	Yes
Sector effects	Yes

effect is larger than the typical tax responsiveness found in the previous literature (see Feld et al., 2013, for a meta-study). The additional interaction term $TAX_{kt} \times PSOE_i$ suggests that one of the reasons for the finding of a relatively moderate tax elasticity in previous literature may be related to the heterogeneity in tax responses depending on ownership. The negative interaction term implies that the effect of taxes when firms are partially state-owned is virtually zero. This finding appears to contradict empirical studies using Chinese data referred to in Cui (2016). These studies find a positive relationship between state ownership and tax sensitivity. Instead, our results support the argument that mixed-ownership firms use

more debt irrespective of the tax rate, and thus the classical cost-benefit trade-off in capital structure choice becomes less relevant. A large part of the following sections will examine how robust our finding of a reduced tax sensitivity of partial SOEs is.

What we can conclude from Table 3 is that there is a differential impact of taxes on debt financing, depending on ownership. One explanation is that private shareholders (in mixed relationships) make use of a maximum attainable debt ratio, which they do not exceed, and no longer respond to marginal changes in taxes.

The effects of other controls are generally in line with what previous studies have found. An increase in the tangible asset share leads to a rise in leverage because fixed assets make better collateral, which firms can pledge against bank loans. The only country-level control that is significant is corruption freedom. The negative relation supports the argument made by Kesternich and Schnitzer (2010), who show that higher levels of corruption discourage the use of equity financing. The other country controls and the firm size proxy are not significant. This may well be due to the country and pair fixed effects included. In addition to the sensitivity analysis presented in the next section, our basic estimates are very robust, and we confirm the estimated effects at very similar significance levels when excluding financial firms (SIC-identifiers starting with "7"), and when using the (log of) sales as an alternative firm size proxy.

5 Sensitivity analyses

5.1 Exact matching

We first assess the robustness of our main result by providing estimates from exact (country and sector) matching. Table 4 presents the findings for both models. Exact matching by coun-

try yields a similar magnitude and significance level for the coefficient on $PSOE_i$ (Column A) compared to the baseline result. This is not very surprising given that the basic estimates condition on country effects in the outcome equation. Perhaps surprisingly, $ATANG_{it}$ is no longer significant.

Table 4: Exact matching

The table presents pair-FE regressions based on $N_A = 1,195$, and $N_B = 1,024$ observations, respectively; The base year for pair matching is 2005; Sector matches are within three-digit SICs; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	A: Country *Coeff.* *(s.e.)*	B: Sector *Coeff.* *(s.e.)*
$PSOE_i$	0.3068**	0.2783**
	(0.1363)	(0.1351)
TAX_{kt}	1.1504**	1.2910***
	(0.4601)	(0.3971)
$TAX_{kt} \times PSOE_i$	-0.8184*	-0.8222*
	(0.4168)	(0.4503)
ROA_{it}	-0.0010*	-0.0008
	(0.0005)	(0.0007)
$ATANG_{it}$	-0.0142	0.2627***
	(0.0600)	(0.0812)
$CORRF_{kt}$	-0.0022	-0.0020*
	(0.0015)	(0.0012)
$INVESTF_{kt}$	0.0002	-0.0010
	(0.0011)	(0.0010)
$CREDITM_{kt}$	0.0003	0.0003
	(0.0004)	(0.0005)
$GDPG_{kt}$	-0.0008	-0.0020
	(0.0033)	(0.0025)
$log(TA)_{it}$	0.0106	0.0008
	(0.0152)	(0.0087)
Country effects	No	Yes
Sector effects	Yes	No

The right-hand side (Column B) of the table provides the results when utilizing exact matching at the level of three-digit SIC-sectors. The effect of $PSOE_i$ remains robust at the five percent level but is now weaker in magnitude (0.2783 compared to 0.3351). The tax

sensitivity is confirmed to be substantially smaller for the SOEs, but its total effect remains positive. $ATANG_{it}$ and $CORRF_{kt}$ are estimated with the same sign as in Table 3, though the coefficients of both variables are smaller now. A potential problem we are facing is that the number of matches becomes relatively small. The results in Column A are based on 78 pairs compared to the 92 from our main result. When matching within the three-digit SIC-sectors, we only find 67 pairs due to the additional restriction of matching exactly on an affiliate's industry (note, though, that both regressions still use more than 1,000 observations). However, we conclude from Table 4 that our benchmark results are not biased by possible spurious correlations arising from comparisons across countries or sectors.

5.2 Extensive vs. intensive margin

From the descriptive statistics, it is unclear whether the extensive margin (i.e., the determinants of zero vs. positive leverage) drives differential responses or the intensive margin (that is, marginal changes in leverage conditional on non-zero debt). To look at this, we estimate equation (2) for both margins separately. Table 5 presents the results.

Apart from $ATANG_{it}$, which seems to be an important determinant of having positive debt, none of the other variables has a significant impact on the extensive margin. Of course, this does not mean that there are no cross-sectional differences in the use of debt at the extensive margin. However, it appears that all of these differences are captured by the fixed effects approach. The estimates at the intensive margin (right-hand side in Table 5) confirm all the findings from Table 3. Only the magnitudes of the effects, as well as the statistical significance, increase compared to the basic findings. This suggests that most of the differential variation in the data happens at the intensive margin.

Given that the OECD finds that SOEs in its member countries access debt almost exclu-

Table 5: Extensive and intensive margin of debt financing

The table presents pair-FE regressions based on $N_A = 1,481$ and $N_B = 847$ observations, respectively; The base year for pair matching is 2005; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	A: Extensive margin *Coeff.* *(s.e.)*	B: Intensive margin *Coeff.* *(s.e.)*
$PSOE_i$	-0.2945	0.4025***
	(0.3335)	(0.1212)
TAX_{kt}	-0.5330	1.4530***
	(0.8406)	(0.4941)
$TAX_{kt} \times PSOE_i$	1.3291	-1.3277***
	(1.0350)	(0.3916)
ROA_{it}	-0.0010	0.0003
	(0.0011)	(0.0013)
$ATANG_{it}$	0.3475***	0.2033***
	(0.1197)	(0.0723)
$CORRF_{kt}$	-0.0031	-0.0062***
	(0.0047)	(0.0021)
$INVESTF_{kt}$	0.0009	-0.0000
	(0.0029)	(0.0013)
$CREDITM_{kt}$	-0.0005	0.0003
	(0.0011)	(0.0004)
$GDPG_{kt}$	-0.0059	0.0027
	(0.0080)	(0.0039)
$log(TA)_{it}$	0.0217	0.0019
	(0.0080)	(0.0131)
Country effects	Yes	Yes
Sector effects	Yes	Yes

sively in the commercial marketplace (OECD, 2014), we are not surprised to see descriptive differences in the extensive margin disappear in the panel regressions. The large effects found for the intensive margin point to lower borrowing costs (for the partially state owned), which is in line with an altered cost-benefit trade-off under mixed ownership.

5.3 Alternative outcome measures

The very low long-term leverage ratio in our data is a possible source of concern. To address this issue, we estimate our model using two alternative specifications of the debt ratio. First,

we include all debt with a maturity of less than one year. The mean leverage is now 17 percent for state-owned and 13 percent for privately owned firms. A total of 35 percent has no short- or long-term debt at all. This zero share is still higher than in most studies, but fairly close to Strebulaev and Yang (2013). Column A of Table 6 provides the results. While the impact of TAX_{kt} remains almost unchanged, the effect of $PSOE_i$ on the outcome is weaker and less robust, but still significant at the 10% level. The same holds for the interaction term TAX_{kt} $\times$ $PSOE_i$. We conclude that partial state ownership primarily facilitates access to long-term debt rather than to short-term debt, a finding that could point to better relationships with long-term lenders, such as state-owned development banks. Second, we define an alternative dependent variable as the total non-current liabilities divided by total assets. The mean of this variable is 0.27 for $PSOE_i = 1$, and 0.2 for $PSOE_i = 0$.[25] The share of zeros decreases to 9 and 17 percent, respectively. This is because the definition of debt is now broader. For example, the non-current liabilities include all deferred tax liabilities of more than twelve months. While we believe that the debt definition from above is more appropriate, this alternative measure has certainly the advantage that it includes any form of long-term financial obligations an affiliate has. It is also plausible to argue that total non-current liabilities may be less likely to suffer from reporting errors or missing values since they are a major balance sheet item. Moreover, the alternative leverage ratio is a useful indicator in its own right because the impact of taxation may depend on the level and timing of deferred taxes. For example, a government may allow an SOE to defer tax payments into the long-term future out of political considerations (despite EU competitive neutrality regulation). In doing so, it softens a firm's budget constraint (Schaffer, 1998) – which of course is in the interest of private co-owners. If partial state ownership helps to defer tax payments more easily, the tax

[25]For data from five sectors in six countries, Vause (2009) reports an average value of this variable of about 0.28.

sensitivity should further decrease.

Table 6: Alternative outcome measures

The table presents pair-FE regressions based on $N_A = 1,481$ and $N_B = 1,264$ observations, respectively; The base year for pair matching is 2005; Outcome in Column A is total short- and long-term debt divided by total assets; Outcome in Column B is total long-term liabilities divided by total assets. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	A: Including short-term debt *Coeff.* *(s.e.)*	B: Total long-term liabilities *Coeff.* *(s.e.)*
$PSOE_i$	0.2495*	0.4033***
	(0.1393)	(0.1440)
TAX_{kt}	0.9306**	0.9625**
	(0.3715)	(0.4239)
$TAX_{kt} \times PSOE_i$	-0.8033*	-1.1678**
	(0.4337)	(0.4643)
ROA_{it}	-0.0030***	-0.0015**
	(0.0006)	(0.0006)
$ATANG_{it}$	0.2010***	0.1234**
	(0.0502)	(0.0527)
$CORRF_{kt}$	-0.0010	-0.0014
	(0.0018)	(0.0017)
$INVESTF_{kt}$	-0.0015*	0.0001
	(0.0008)	(0.0011)
$CREDITM_{kt}$	-0.0001	0.0003
	(0.0004)	(0.0004)
$GDPG_{kt}$	-0.0008	-0.0056*
	(0.0029)	(0.0030)
$log(TA)_{it}$	0.0117	0.0278**
	(0.0093)	(0.0120)
Country effects	Yes	Yes
Sector effects	Yes	Yes

Table 6 reports the estimates with total non-current liabilities divided by total assets as the dependent variable (Column B). The effect of $PSOE_i$ is stronger and statistically more significant. While the impact of TAX_{kt} is very similar compared to the magnitude in our baseline model, the negative coefficient of the interaction term becomes larger. This is consistent with the argument made above that deferring taxes becomes easier under state ownership. The coefficient of $ATANG_{it}$ becomes smaller. This is plausible as well, as collateral

is essential when raising debt, but it does not influence other items now included in the outcome variable. In contrast to our findings from above, the effects of ROA_{it}, $GDPG_{kt}$, and $log(TA)_{it}$ are now estimated to be statistically significant.

5.4 Placebo treatments

In this section, we present further robustness results showing that "placebo treatments" do not affect our outcome variable. In particular, the aim is to assess whether the predictions reported in earlier sections can clearly be attributed to treatment status. To obtain placebo treatment effects, we first randomly select 178 observations as "treated" in our base year 2005. The 178 observations correspond to the actual number of treated affiliates in the dataset. We then run our Pair-FE regression from above and repeat the random assignment procedure 1,000 times. Table 7 presents the averaged regression statistics, and Figure 2 in the Appendix depicts the empirical cumulative distribution functions (CDF) of the three variables of interest. The vertical lines correspond to the benchmark results from Table 3.

Table 7: Placebo effects

The table presents the average of 1,000 Pair-FE regressions based on $n = 178$ randomly assigned treatment observations; The base year for pair matching is 2005; The dependent variable is the long-term debt-to-asset ratio; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	Coeff.
	(s.e.)
$PSOE_i$	-0.0021
	(0.0741)
TAX_{kt}	0.3195
	(0.2530)
$TAX_{kt} \times PSOE_i$	0.0071
	(0.2457)

As can be seen in Table 7, the average from the 1,000 random treatments is very close

to zero, suggesting no treatment effect at all. The distribution of the pseudo-$PSOE_i$ coefficients in Figure 2 reveals that all estimates are below the estimate of 0.3351 from Table 3. The 5 percent confidence intervals given in the right panel of Figure 2 show that only a tiny number of random assignments produce a significantly positive coefficient. The average of 1,000 placebo coefficients for TAX_{kt} in Table 7 has, as expected, a positive sign, but is not statistically significant. The empirical CDF of TAX_{kt} coefficients in Figure 2 is skewed towards positive values and indicates that firms respond to increases in TAX_{kt} with higher debt levels. To a lesser extent, this also holds for 5 percent confidence intervals in the right panel. The averaged coefficient of the interaction term $TAX_{kt} \times PSOE_i$ in Table 7 is not significant either. A closer look at the empirical CDF in Figure 2 reveals a fairly even distribution around 0 for the coefficient, and a slightly positively skewed CDF for the 5 percent confidence intervals. Summing up, regressions with pseudo-SOEs do not produce significant outcomes for the ownership indicator $PSOE_i$ or the interaction term $TAX_{kt} \times PSOE_i$, but do imply a significant impact of TAX_{kt} on LEV_{it} as the conventional debt-tax trade-off suggests. We conclude that the effects of $PSOE_i$ and $TAX_{kt} \times PSOE_i$ from our main result indeed derive from state ownership.

5.5 Location of the mixed-ownership affiliate

An important issue in our context might be the location of affiliates. More specifically, the differential impact of taxes on capital structure choice should be stronger if an affiliate operates in the same country as the SOE. A tax planning MNE will try to minimize overall tax payments independently of location, but facilitated access to debt could depend on the affiliate operating in the same country as the owning state. Besides, a government owner cares more about tax payments within its jurisdiction than abroad. This may be even more

the case if taxes act as a "forcing-distributions" tool as argued by Cui (2015).

Table 8: Local SOEs

The table presents pair-FE regressions based on $N = 1,416$ observations; The base year for pair matching is 2005; The dependent variable is the long-term debt-to-asset ratio; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	Coeff. *(s.e.)*
$PSOE_i$	0.4616***
	(0.1393)
TAX_{kt}	1.3169**
	(0.5038)
$TAX_{kt} \times PSOE_i$	-1.4357***
	(0.4452)
ROA_{it}	-0.0004
	(0.0005)
$ATANG_{it}$	0.1827***
	(0.0479)
$CORRF_{kt}$	-0.0002
	(0.0017)
$INVESTF_{kt}$	-0.0009
	(0.0011)
$CREDITM_{kt}$	0.0001
	(0.0005)
$GDPG_{kt}$	-0.0012
	(0.0039)
$log(TA)_{it}$	0.0055
	(0.0092)
Country effects	Yes
Sector effects	Yes

Table 8 presents our estimates of equation (2) when only affiliates are considered that operate in the same jurisdiction as the SOE parent.[26] All variables of interest show a significant increase in magnitude and significance level. However, we confirm that mixed ownership significantly impacts leverage, irrespective of the tax rate. This evidence is consistent with the arguments from above: the facilitated access induced by partial state ownership should

[26]In most but not all cases the location of the SOE parent coincides with the location of the owning government. A few firms in our sample have various owning governments (mostly France and Belgium) or are firms registered in the OECD by non-OECD governments.

lead to a stronger effect of $PSOE_i$ (the coefficient is now 0.4545). The tax rate does not matter for mixed-ownership firms, as the cost-benefit trade-off becomes less relevant.

6 SOEs and international tax planning

So far, our results have shown that partial state ownership helps MNEs to expand the tax shields of mixed-ownership affiliates. Let us now address the question of whether partially state-owned affiliates are important vehicles for debt shifting within tax-planning MNEs.

It seems that partial state involvement does not discourage firms from making use of preferential tax regimes and tax planning. For example, the European Commission argues that tax rulings granted by Luxembourg to Engie, a French energy giant in partial state ownership (33%), amount to illegal state aid.[27] According to news reports, Engie, as well as other partially-state-owned MNEs such as Eni, Thales, or EDF, have established holdings in the Netherlands to cut their tax bills.[28] A prominent case from Germany is WestLB, a bank that was split up in 2012 and is assumed to have dodged an estimated amount of 600 million euros in taxes between 2006 and 2011.[29]

Previous literature has argued that MNEs often use internal debt to save taxes. This strategy involves lending from firm entities located in tax haven (or low-tax) countries to affiliates located in high-tax countries, where interest payments reduce taxable income. Buettner and Wamser (2013) suggest that optimizing MNEs operate a tax haven affiliate and all lending is provided from that location.[30] The empirical implication is that the minimum

[27] "EU probes French gas firm's Luxembourg tax dealings" (Maurice, 2016).

[28] "French companies set up in Netherlands to cut tax bill" (Reuters, 2013).

[29] "Dividend-Stripping Probe Targets WestLB" (Iwersen and Votsmeier, 2015).

[30] The theoretical argument has been introduced by Mintz and Smart (2004). See also Møen et al. (2018).

tax rate within the firm should negatively correlate with borrowing at other locations. This is because a higher tax in the country in which the MNE operates a lending affiliate reduces the incentives to use internal debt at other locations as the tax savings from providing debt across borders decrease. While, in our data, we cannot distinguish between internal and external debt financing, we would expect that the debt ratio at i increases if the tax at the location of the "lowest-tax affiliate" is cut. For this purpose, we define the variable $MINTAX_{ft} = min(TAX_{kt}) \; \forall \; i \in N^f$, where N^f denotes the total number of affiliates that belong to MNE f.

Table 9 presents the test of the profit shifting hypothesis. Column A adds only the $MINTAX_{ft}$ variable, whereas Column B also controls for a differential impact depending on ownership. The results suggest the following: In Column A, the effect of $MINTAX_{ft}$ alone does not affect firm leverage significantly. However, once we take the differential impact of $MINTAX_{ft} \times PSOE_i$ into account (Column B), the minimum tax rate is estimated with a negative sign. As expected, MNE affiliates with $PSOE_i = 0$ adjust their capital structure if the tax rate at the minimum affiliate increases. This does not hold for firms with $PSOE_i = 1$, as the interaction between $MINTAX_{ft}$ and TAX_{kt} has a positive sign. While the overall effect of $MINTAX_{ft}$ is still negative, the effect of the minimum tax is less important. This is indirect evidence that tax planning and tax avoidance using internal lending play a less important role under mixed ownership.

The finding is consistent with the other results from above: affiliates that are partially state-owned exploit maximum debt levels under state guarantees. Beyond that, however, the affiliates do not respond to tax incentives comparable to entirely privately held affiliates.[31]

[31]We should note that the results presented in Table 9 are sensitive to the caliper choice in the matching procedure. In particular, the estimates are more robust when smaller calipers are chosen.

Table 9: Minimum tax affiliates

The table presents pair-FE regressions based on $N_A = 935$ and $N_B = 935$ observations, respectively; The base year for pair matching is 2005; Column A does not differentiate the effect of a change in the minimum tax rate of the group with respect to ownership; Column B controls for a differential impact. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	A: Minimum tax rate *Coeff.* *(s.e.)*	B: Differential impact *Coeff.* *(s.e.)*
$PSOE_i$	0.3929**	0.3496*
	(0.1877)	(0.1874)
TAX_{kt}	1.6464***	1.8851***
	(0.4609)	(0.4927)
$TAX_{kt} \times PSOE_i$	-1.2540**	-1.6394**
	(0.5772)	(0.6404)
ROA_{it}	0.0004	0.0005
	(0.0005)	(0.0005)
$ATANG_{it}$	0.2724***	0.2943***
	(0.0644)	(0.0661)
$CORRF_{kt}$	-0.0038**	-0.0038**
	(0.0016)	(0.0016)
$INVESTF_{kt}$	0.0007	0.0006
	(0.0008)	(0.0008)
$CREDITM_{kt}$	0.0002	0.0002
	(0.0004)	(0.0004)
$GDPG_{kt}$	0.0004	0.0005
	(0.0012)	(0.0012)
$log(TA)_{it}$	-0.0038	-0.0073
	(0.0110)	(0.0111)
$MINTAX_{ft}$	-0.3003	-0.6797*
	(0.2518)	(0.3738)
$MINTAX_{ft} \times PSOE_i$		0.6524*
		(0.3675)
Country effects	Yes	Yes
Sector effects	Yes	Yes

7 Conclusion

We examine the impact of partial state ownership on the debt financing of MNE affiliates with state participation. We find that the well-established impact of profit taxation on capital structure does not hold for mixed-ownership firms, using balance sheet data of affiliates from 22 OECD and EU member countries. Thus, a general finding of our study is that the impact of taxes on debt financing depends on ownership. The partially state-owned affiliates are found to use substantially more debt, which is evidence that these firms operate under implicit state guarantees. We argue that privately owned MNEs make use of facilitated access to debt to maximize interest tax shields in such affiliates. The effect of being partially state-owned is identified by first finding comparable control units of privately held affiliates. The requirements for being accepted as a comparable control unit are relatively strict, as matched pairs (of partially state-owned and private affiliates) must operate in the same country and the same sector (in some specifications). Moreover, our estimation approach accounts for time- and pair-fixed effects, as well as a number of time-varying control variables, which are standard in the literature analyzing debt ratios.

We confirm our central finding in many robustness tests, including checks where we randomly assign treatment status. We additionally provide evidence that partial state ownership does not relate to other tax planning strategies involving debt financing for reasons of international tax planning. The main finding of our study is that partially state-owned firms neglect the cost of debt and employ a maximum attainable debt ratio. This suggests that government participation may enable MNEs to reduce tax payments, which ultimately leads to a loss of revenue for the public owner.

8 Literature

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9 Appendix

9.1 Additional Tables

Table A.1: Correlation Matrix

The table presents correlations of the dependent variable LEV_{it}, state ownership $PSOE_i$ and the control variables used in the regression models.

	LEV_{it}	$PSOE_i$	TAX_{kt}	ROA_{it}	$ATANG_{it}$	$log(TA)_{it}$	$log(SALES)_{it}$	$CORRF_{kt}$	$INVESTF_{kt}$	$CREDITM_{kt}$	$GDPG_{kt}$	$GDPPC_{it}$
LEV_{it}	1.00											
$PSOE_i$	0.08	1.00										
TAX_{kt}	0.05	0.05	1.00									
ROA_{it}	-0.12	-0.01	-0.04	1.00								
$ATANG_{it}$	0.36	0.14	-0.03	-0.13	1.00							
$log(TA)_{it}$	0.10	0.11	0.15	-0.00	0.30	1.00						
$log(SALES)_{it}$	-0.05	0.04	0.10	0.08	-0.02	0.79	1.00					
$CORRF_{kt}$	0.02	-0.02	0.25	0.04	-0.10	-0.09	-0.07	1.00				
$INVESTF_{kt}$	0.10	0.03	-0.20	0.02	0.02	-0.02	-0.01	0.38	1.00			
$CREDITM_{kt}$	0.09	0.03	0.50	-0.06	0.01	0.20	0.16	0.43	0.13	1.00		
$GDPG_{kt}$	-0.02	-0.00	-0.16	0.08	-0.00	-0.09	-0.06	-0.14	0.01	-0.40	1.00	
$GDPPC_{kt}$	-0.02	-0.00	0.32	0.05	-0.11	-0.09	-0.07	0.78	0.10	0.26	-0.06	1.00

Table A.2: Propensity score estimation

The table presents the propensity score estimation of (1) based on $N = 5,827$ observations in $t = 2005$; The dependent variable is the propensity score to be partially state-owned; The CI is the 5 percent confidence interval; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	Coeff. *(s.e.)*
LEV_{it}	4.0600***
	(1.3066)
LEV_{it}^2	-11.6170**
	(4.5815)
LEV_{it}^3	8.8499**
	(3.9179)
ROA_{it}	0.0044
	(0.0047)
ROA_{it}^2	-0.0001
	(0.0001)
ROA_{it}^3	-0.0000*
	(0.0000)
$log(TA)_{it}$	-2.2833***
	(0.6355)
$log(TA)_{it}^2$	0.2576***
	(0.0669)
$log(TA)_{it}^3$	-0.0089***
	(0.0023)
$\Delta log(FA)_{it}$	-0.1605
	(0.1208)
$\Delta log(FA)_{it}^2$	-0.0434
	(0.0527)
$\Delta log(FA)_{it}^3$	0.0040
	(0.0172)
$\Delta log(SALES)_{it}$	0.1806*
	(0.1076)
$\Delta log(SALES)_{it}^2$	0.0098
	(0.0368)
$\Delta log(SALES)_{it}^3$	-0.0089
	(0.0072)
$CREDITM_{kt}$	-0.1718
	(0.2363)
$CREDITM_{kt}^2$	0.0021
	(0.0029)
$CREDITM_{kt}^3$	-0.0000
	(0.0000)
$GDPG_{kt}$	-8.1592***
	(2.5743)
$GDPG_{kt}^2$	2.8761***
	(0.8926)
$GDPG_{kt}^3$	-0.2616***
	(0.0803)
$GDPPC_{kt}$	-0.0017***
	(0.0005)
$GDPPC_{kt}^2$	0.0000***
	(0.0000)
$GDPPC_{kt}^3$	-0.0000***
	(0.0000)
Legal origin: French	4.8292*
	(2.7608)
Legal origin: German	3.8950
	(2.8984)
Legal origin: Scandinavian	2.8027
	(3.2151)
Construction	-0.1805
	(0.5264)
Manufacturing	-0.4067
	(0.4964)
Transport, Communications, Electric, Gas	0.8478*
	(0.4917)
Wholesale Trade	-0.7406
	(0.5119)
Retail Trade	-0.6088
	(0.5976)
Finance, Insurance, Real Estate	0.1393
	(0.5077)
Services	0.1672
	(0.4918)
Constant	30.3277***
	(9.3289)

Table A.3: Variable definitions

Firm level	(Source: Orbis)
LEV_{it}	Long-term debt / total assets of firm i in year t.
$PSOE_i$	Binary indicator of partial state ownership.
$TAX_{kt} \times PSOE_i$	Interaction term of $PSOE_i$ and TAX_{kt}.
ROA_{it}	Return on assets of firm i in year t.
$ATANG_{it}$	Asset tangibility: fixed assets / total assets of firm i in year t.
$log(TA)_{it}$	Log(total assets) of firm i in year t.
$\Delta log(FA)_{it}$	Investment proxy: log(fixed assets)$_{it} - log$(fixed assets)$_{i,t-1}$.
$\Delta log(SALES)_{it}$	Sales growth: log(turnover)$_{it} - log$(turnover)$_{i,t-1}$.
Country level	
TAX_{kt}	Statutory tax rate of country k in year t.
$CORRF_{kt}$	Corruption freedom in country k and year t (Source: Heritage Foundation).
$INVESTF_{kt}$	Investment freedom in country k and year t (Source: Heritage Foundation).
$CREDITM_{kt}$	Domestic credit provided by banking sector in country k and year t as percentage of GDP (Source: Worldbank).
$GDPG_{kt}$	Annual GDP growth in percent in country k and year t (Source: Worldbank).
$GDPPC_{kt}$	GDP per capita in country k and year t, PPP at constant 2011 international USD (Source: Worldbank) .
Legal origin	Legal origin dummy variables of country k based on La Porta et al. (1998).
Sector level	
Sector dummies	Sector dummies are based on 1-digit SIC identifiers.
$GROP_{skt}$	Growth opportunities are defined as in Huizinga et al. (2008): the growth rate median of affiliate sales in an affiliate's industry s, country k and year t.

9.2 Data

- BvD definition of SOE:
  - Minimum percentage that must characterize the path from a subject company up to its ultimate owner: 25.01 percent. Hence, a company is considered an SOE if the government has at least 25 percent direct or indirect control.
- BvD definition of affiliate:
  - Foreign affiliates: affiliates located in a specific region not ultimately owned but owned by at least 1 percent; may have other shareholders in the foreign country. Extracted for all world regions.
- Only unconsolidated balance sheet information is used (BvD conscode "U1").
- $LEV_{it} \in [0; 1[$. We assume that a fully leveraged firm should be a reporting error since every incorporation form we know requires some equity. The result does not depend on this assumption.
- Only observations with no missing values in LEV_{it} from 2004-2013 are considered.
- Shared SOE-MNE affiliates with a sum of SOE-MNE ownership exceeding 100 percent are dropped as reporting errors.
- Joint affiliates of two SOEs are excluded because we want to focus on joint SOE-MNE affiliates.
- Only wholly-owned MNE subsidiaries are allowed as controls. This ensures that we can unambiguously verify ownership structures.

10 Additional tests

10.1 Additional controls

We additionally include two controls, which have been used in the literature as determinants of leverage (see Graham and Leary, 2011, for a survey).[32] In Table A.4 we include the investment proxy $\Delta log(FA)_{it}$ already used in the propensity score estimation. Investment levels of a firm can affect the leverage level through several channels. First, credit may have been used to finance investment. Hence, a higher investment level should coincide with higher leverage. Second, many credit contracts restrict investments of a firm through financial covenants. Low investment levels could thus be an indicator for an already highly leveraged firm. Roberts and Sufi (2009) present evidence that one-fourth of U.S. public companies violate such covenants at some point. The ensuing technical default allows lenders to decrease the size of a credit facility or even terminate the contract early, with adverse consequences on firm leverage. But also if no technical default is present, i.e., a covenant has not been breached, lenders may be more cautious in disbursing revolving credit facilities if a firm has very high investment levels due to increased cash flow risk. Column A of Table A.4 presents estimates with investment as an additional control. The results are very similar in magnitude and significance to our basic results for all variables. Hence, our results do not support the idea that investment levels affect affiliate leverage.

Another control is a firm's growth opportunities, denoted by $GROP_{skt}$, which can be an indicator of future profits and should positively affect leverage (Harris and Raviv, 1991). We use the Huizinga et al. (2008) definition as the annual growth rate median of affiliate sales in an affiliate's country and industry. However, the inclusion of growth opportunities does

[32]Note that we prefer the more parsimonious specifications from above to have as many observations as possible.

Table A.4: Investment and growth opportunities

The table presents pair-FE regressions based on $N_A = 1,481$ and $N_B = 847$ observations, respectively; The base year for pair matching is 2005; Sector matches are within three-digit SICs; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	A: Investment	B: Growth opportunities
	Coeff.	*Coeff.*
	(s.e.)	*(s.e.)*
$PSOE_i$	0.3362**	0.3356**
	(0.1354)	(0.1347)
TAX_{kt}	0.9789**	0.9720**
	(0.3759)	(0.3706)
$TAX_{kt} \times PSOE_i$	-1.0221**	-1.0186**
	(0.4206)	(0.4180)
ROA_{it}	0.0003	0.0003
	(0.0004)	(0.0004)
$ATANG_{it}$	0.2469***	0.2440***
	(0.0650)	(0.0644)
$CORRF_{kt}$	-0.0026**	-0.0027**
	(0.0013)	(0.0013)
$INVESTF_{kt}$	0.0001	0.0001
	(0.0010)	(0.0010)
$CREDITM_{kt}$	0.0003	0.0003
	(0.0003)	(0.0003)
$GDPG_{kt}$	-0.0000	-0.0001
	(0.0028)	(0.0027)
$log(TA)_{it}$	0.0064	0.0066
	(0.0088)	(0.0090)
$\Delta log(FA)_{it}$	-0.0077	
	(0.0095)	
$GROP_{skt}$		-0.0039
		(0.0133)
Country effects	Yes	Yes
Sector effects	Yes	Yes

not significantly alter our results. We also conduct robustness checks for inflation, the cost of enforcing formal contracts and financial freedom (not separately reported). None of these additional controls alters the findings in any significant way, but the number of observations becomes substantially smaller because of missing values in these controls.

10.2 Variations in the propensity score estimation

The specification of our propensity score model is very similar to the one in Borisova et al. (2012). Although we believe this specification is very plausible on economic grounds, we re-estimate our model with different propensity scores. As a first step, we include asset tangibility $ATANG_{it}$ as an additional predictor of treatment status and then re-estimate our outcome equation (2). Column A of Table A.5 presents the results. The inclusion of asset tangibility increases the magnitude of coefficients and robustness of all variables of interest. The impact of the treatment variable $PSOE_i$ is now 0.41. An increase in the tax rate TAX_{kt} of one percentage point, ceteris paribus, increases leverage by 1.18 percentage points, an increase in magnitude of roughly 20 percent. Similarly, the effect of the interaction term $TAX_{kt} \times PSOE_i$ has increased to the same extent, suggesting that the tax rate does not influence the capital structure of partially state-owned MNE at all. Firm profitability, asset tangibility, and corruption freedom are significant and remain in line with prior estimation results.

We finally use a specification to estimate equation (1) without the sales growth control $\Delta log(SALES)_{it}$. Unfortunately, the ORBIS dataset suffers from many missing values in the total sales variable which we use to compute $\Delta log(SALES)_{it}$. Hence, by excluding the variable at both estimation stages, we can base our model on $N_B = 1,798$ observations, an increase of about 21 percent. Column B of Table A.5 presents the estimates without sales growth in the first stage. The results look very similar to our baseline estimates.

Table A.5: Variations in propensity score estimation

The table presents pair-FE regressions based on $N_A = 1,481$ and $N_B = 847$ observations, respectively; The base year for pair matching is 2005; Sector matches are within three-digit SICs; *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

	A: Including $ATANG_{it}$	B: Excluding $\Delta log(SALES)_{it}$
	Coeff.	*Coeff.*
	(s.e.)	*(s.e.)*
$PSOE_i$	0.4143***	0.3138**
	(0.1124)	(0.1247)
TAX_{kt}	1.1860***	1.1463***
	(0.3120)	(0.3758)
$TAX_{kt} \times PSOE_i$	-1.1936***	-0.9823**
	(0.3498)	(0.3977)
ROA_{it}	-0.0012*	-0.0008*
	(0.0007)	(0.0005)
$ATANG_{it}$	0.1391**	0.1802***
	(0.0609)	(0.0525)
$CORRF_{kt}$	-0.0024*	-0.0010
	(0.0014)	(0.0014)
$INVESTF_{kt}$	0.0010	0.0009
	(0.0011)	(0.0010)
$CREDITM_{kt}$	0.0006	0.0002
	(0.0004)	(0.0003)
$GDPG_{kt}$	-0.0032	-0.0040
	(0.0038)	(0.0028)
$log(TA)_{it}$	0.0116	-0.0057
	(0.0086)	(0.0098)
Country effects	Yes	Yes
Sector effects	Yes	Yes

10.3 Placebo treatments

Figure 2: Distribution of placebo estimates

Figure 2 depicts empirical cumulative distribution functions for 1,000 coefficient estimates of our variables of interest. Treatment was assigned to 178 randomly selected cross-sectional units in each iteration. The first row contains the coefficient estimates and 5 percent confidence intervals (CIs) for $PSOE_i$. The second and third row follow analogously for TAX_{kt} and $TAX_{kt} \times PSOE_i$. Vertical lines represent the estimates from Table 3.