DISCUSSION PAPER SERIES

DP17300

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FINANCIAL ECONOMICS, ORGANIZATIONAL ECONOMICS AND PUBLIC ECONOMICS

ISSN 0265-8003

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Discussion Paper DP17300
Published 11 May 2022
Submitted 30 March 2025

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JEL Classification: D22, F36, G32, G38, H11, H81, L33

Keywords: State ownership, Privatization, Corporate debt, State banks

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Acknowledgements
We thank Victoria Marino for excellent research assistance and Erik Berglof, Daniel Berkowitz, Saul Estrin, Nandini Gupta, Beata Javorcik, William Megginson, Jangping Thia and seminar participants at the EBRD, EIB, London Business School, IMF and the 2024 ASSA Annual Meeting (San Antonio) for useful comments and Elias Papaioannou for kindly sharing data on a sample of large listed firms. The views expressed are the authors' and not necessarily those of the institutions they are affiliated with.

State Ownership and Corporate Leverage Around the World*

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1 Introduction

The state's role as an owner of corporate equity has expanded considerably over the past decade (EBRD, 2020; World Bank, 2023). Many governments not only nationalized banks during the global financial crisis, but also took stakes in a variety of nonfinancial corporations. The growing popularity of Chinese-style state capitalism and the increase in wealth concentration in hydrocarbon exporting countries further contributed to this resurgence in state ownership (Megginson, 2018; Estrin and Gregoric, 2022; Megginson and Liu, 2022) as did the Covid-19 pandemic, which led many governments to take equity stakes in financially distressed companies.

This growing state presence in corporate ownership raises important questions about how government control affects firms' ability to attract external funding (Borisova, Fotak, Holland, and Megginson, 2015). On the one hand, state ownership may enhance firms' access to credit markets through implicit bailout guarantees (Faccio, Masulis, and McConnell, 2006; Iannotta, Nocera, and Sironi, 2013). On the other hand, concerns about political interference and weak corporate governance may make creditors reluctant to lend to state-owned enterprises.[1] Lastly, state ownership may affect leverage not only through its impact on private investors' behavior but also through governments' own preferences regarding their firms' capital structure.

Understanding which of these effects dominates, and for which types of firm, can help to explain how the growing state presence in corporate ownership shapes firms' financial constraints and investment capacity. To answer this question, we build a globally comprehensive firm-level data set. We start by splicing multiple historical editions of Bureau van Dijk's Orbis database. This allows us to carefully track the ownership structure of individual companies over time, and to identify the shares of all shareholders classified as public authorities or the state. We then create continuous measures of state ownership as well as dummy variables that indicate whether the state owns more than 20, 50 or 99 percent of a firm's equity, either directly or indirectly. Our final data set spans 89 countries over 20 years (2000–2019) and contains almost 20 million annual observations on 3.9 million firms.

[1]For example, state ownership can entail outright political interference (Shleifer and Vishny, 1994; Ben-Nasr, Boubakri, and Cosset, 2012); increased risk taking (Gropp, Gruendl, and Guettler, 2004); or weaker financial discipline (Qiu and Yu, 2019). Note that a negative relationship between state ownership and leverage emerges only if political distortions harm creditors relatively more than shareholders.

The comprehensive nature of our data allows us to explore heterogeneity in the relationship between state ownership and corporate leverage across several important firm- and country-specific dimensions.

We first conduct a cross-sectional analysis to uncover key patterns and stylized facts about state ownership and firm leverage. Throughout this analysis, we control for standard (time-varying) determinants of leverage as suggested by corporate finance theory: firm size; profitability; asset tangibility; and the size of the non-debt tax shield. Importantly, we also consistently control for country-sector-year fixed effects, thus comparing firms with different levels of state ownership in the same country, sector *and* year. We classify state ownership on a scale of 1 to 100 percent, based on the government's share of a firm's capital. While we examine various ownership thresholds, our baseline approach is to consider a firm to be state-owned when the government holds at least 20 percent of its capital.

The first key result is that state ownership, both at the extensive and intensive margins, is robustly and *negatively* related to firm leverage, defined as total debt normalized by total assets. This implies that on average, the negative impact of state ownership more than offsets any benefits firms may derive (in terms of borrowing capacity) from the state as a shareholder. The magnitude of the effect is substantial: within the same country-sector-year, firms with any state ownership on average have a 5 percentage point lower debt/assets ratio. This is about a quarter of the mean leverage of 18.6 percent in our global sample.

Our second main result is that the negative relationship between state ownership and corporate leverage holds across most of the firm-size distribution—with the important exception of the largest firms. We find that only in the top percentiles of the firm-size distribution—that is, firms owning more than approximately USD 3 billion of assets—state ownership is associated with *higher* corporate leverage. In other words, only the largest firms in a country benefit from (partial) state ownership through implicit bailout guarantees and cheaper credit. This finding is corroborated by analogous results for corporate borrowing costs: for smaller firms, state ownership is associated with more expensive debt, while, for larger ones, the relationship has the opposite sign.

Third, we find that the negative relationship between state ownership and corporate leverage is considerably weaker in richer countries with a stronger rule of law; better control of corruption; stronger insolvency rights; and better investor protection. This indicates that, in better institutional environments, private creditors worry less about distortions due to

state interference so that the negative impact of state ownership on firm leverage is smaller.

We also show that the relationship between state ownership and corporate leverage depends critically on the structure of the banking system, in particular the presence of foreign and state banks (relative to domestic private banks). We find that (smaller) state-owned firms are (even) less levered, relative to privately owned ones, in countries where foreign banks play a bigger role. This indicates that foreign bank ownership reduces the likelihood of the state channeling credit to state-owned enterprises. In line with this interpretation, we find that state-owned firms, especially smaller ones, pay higher interest rates relative to equivalent privately owned firms in countries where foreign banks play a bigger role. Our results on state banks are more nuanced. While, on average, a larger presence of state banks is associated with a stronger negative relationship between state ownership and firm leverage, this effect is reversed for companies that are relatively large at either the national or the sub-national level. This suggests that countries use state banks to allocate credit to favored "regional or national champions" (though we do not find that they do so at subsidized interest rates).

Finally, we complement our cross-firm results with a within-firm analysis based on panel data on privatized firms, as well as with results based on a matching estimator that systematically compares privatized firms with observationally similar (non-privatized) state-owned enterprises. Both of these exercises yield empirical results that are very similar to those from the cross-firm analysis, both qualitatively and quantitatively. We find that firms typically increase their leverage by about 5 percentage points (27 percent of the sample mean) in the five years after privatization and relative to comparable (matched) non-privatized firms.

Analyzing these privatization events enables us to use firm fixed effects in panel-data regressions, allowing us to measure how state ownership affects leverage within individual firms over time. This design therefore mitigates possible concerns about selective government ownership. Oster (2019) tests further confirm our findings: state ownership negatively impacts firm leverage, and any selection bias likely understates this negative effect.

The comprehensive nature of our data set—in terms of its coverage of firms of very different sizes and of countries with very different institutional environments—allows us to bring five new insights to the literature. First, we shed light on how the relationship between state ownership and firm leverage varies across the firm size distribution. Previous papers relied on relatively small samples of large (or very large) listed companies. For example, Dewenter

and Malatesta (2001) analyze state-owned enterprises among the 500 largest non-US firms in 1975, 1985 and 1995. They show that—after controlling for business cycles, firm size, location and industry—state-owned enterprises are leveraged more and perform less well than comparable private firms. They also show that leverage falls after privatization events. Borisova, Fotak, Holland, and Megginson (2015) use bond credit spreads from 226 large publicly traded companies from 43 countries. For these large firms they find that, while in normal times government ownership is associated with a higher cost of debt, the credit spreads of state firms were lower during the global financial crisis (when implicit bailout guarantees were particularly important). Borisova and Megginson (2011) use a sample of publicly traded bonds by 60 large European companies to show how credit spreads initially increase during privatization while fully privatized firms experience a drop in their cost of debt. In a similar vein, Boubakri and Cosset (1998; 79 large companies); D'Souza and Megginson (1999; 85 large companies) and Megginson, Nash, and Van Randenborgh (1994; 61 large companies) also find that, after privatization, companies reduce their debt ratios. Interestingly, Boubakri and Saffar (2019; 453 large companies) find that newly privatized firms may continue to benefit from government support after (partial) privatization as residual state ownership correlates positively with bank borrowing.

Our contribution is to show how the impact of state ownership on the cost of borrowing, and therefore on corporate indebtedness, depends crucially on firm size. For most firms, state ownership and the associated inefficiencies entail higher average borrowing costs.[2] This effect of state ownership changes sign for the largest enterprises. For such "national champions"—large firms of national strategic importance—we find that the downsides of state ownership are typically more than compensated for by the implicit (and sometimes explicit) bailout guarantees of the state. By analyzing the full spectrum of state firms—we use data on 46,039 firms with at least a 20 percent government stake—we thus uncover important heterogeneity that helps to put earlier empirical findings in a broader perspective.

Second, the granular and time-varying nature of our data allows us to explore the intensive and extensive margins of the effect of state ownership. This is important because over the past two decades, many governments have expanded their minority stakes in a variety of

[2]This is in line with recent work showing that losses are especially common among small state firms (Musacchio and Pineda Ayerbe, 2019) and the observation that in China many small (but only very few large) state-owned enterprises have gone bankrupt during recent times.

enterprises (Faccio and Lang, 2002). Little is known about the impact of these stakes on the financial policies and borrowing behaviors of such enterprises. Our data show clearly that the negative effect of state ownership on firm leverage already occurs when the state takes minority stakes of as little as 1 percent, suggesting that even small equity stakes can carry considerable power (such as when the state holds a golden share). Estimates of the marginal effect of state ownership reveal that the impact of state ownership on firm leverage is higher in firms with larger equity stakes owned by the state.

Third, we shed new light on the importance of the structure of the banking system by distinguishing between countries with different levels of foreign and state ownership in their banking sectors. Earlier work shows that lending by state banks is often driven by political motivations, electoral cycles in particular.[3] Such lending can distort the allocation of capital throughout the economy, for example, when state banks prefer to lend to state-owned enterprises, crowding out loans to the private sector (Gordon and Li, 2003; Allen et al., 2005; Li et al., 2009; Molnar and Lu, 2019).[4] Panizza (2023) uses a global data set of state banks to show that both state-owned firms and (large) firms that are part of a conglomerate are more likely to borrow from state banks.

Our contribution is to show how state banks limit access to credit for smaller state firms but ease the borrowing constraints of state companies that are relatively large, either at the local or at the national level. This suggests that state banks help to redistribute financial resources from smaller to larger, strategically more important firms. We also show that foreign banks reduce the leverage of (smaller) state-owned firms compared to similar privately owned ones. This is in line with foreign banks relying on arm's-length techniques when lending to distant borrowers, thus reducing credit access to relatively opaque clients in destination countries (Mian, 2006; Detragiache, Tressel, and Gupta, 2008). Our results imply that such distance constraints bind in particular for firms in which the state holds an ownership stake and can exert influence.

Fourth, we contribute to the rich literature on state ownership of productive assets and the firm-level impacts of privatization. Various papers show that full or partial privatization can boost firms' efficiency and performance, provided the right institutional and regulatory

[3]See, for example, Shleifer and Vishny (1994); Shleifer (1998); La Porta et al. (2002); Sapienza (2004); Dinç (2005); Khwaja and Mian (2005); Carvalho (2014) and Bircan and Saka (2021).

[4]On the other hand, state banks may overcome market failures by financing socially desirable investments that the private sector is unwilling or unable to fund (Jiménez, Peydró, Repullo, and Saurina, 2019).

preconditions are in place (D'Souza, Megginson, and Nash, 2005).[5] Megginson, Nash, and Van Randenborgh (1994) compare the pre- and post-privatization performance of 61 large companies and find that a majority of these large firms decrease their leverage ratios after privatization. They argue that this reflects the combined effect of the state's withdrawal of debt guarantees and the firm's improved access to public equity. Our contribution is to demonstrate how the effect of privatization differs markedly for smaller firms. For these firms, the main financial impact of privatization is improved access to debt as lenders worry less about political interference (these small firms never benefited from implicit bailout guarantees in the first place). Only for larger firms is this effect reversed, as these firms can access global equity markets and may experience an uptick in the cost of debt once implicit government guarantees disappear.

Fifth, we contribute to the literature on how government policies and behavior shape corporate leverage. Previous work shows that firms' financing choices respond to changes in both tax policies and government borrowing. Heider and Ljungqvist (2015) use staggered changes in US state-level corporate tax rates to show how tax changes affect leverage asymmetrically—firms respond to tax increases but not to tax decreases. Government debt issuance can also impact corporate borrowing. Greenwood, Hanson, and Stein (2010) demonstrate that companies adjust their debt maturity in response to government borrowing. When the state increases its short-term debt, firms compensate by issuing more long-term debt, and the opposite occurs when the government favors long-term borrowing. Likewise, Badoer and James (2016) find that reductions in the supply of long-term government debt lead firms to issue more long-term corporate debt. Our contribution is to show how a different government policy—direct state ownership—affects firms' ability to access credit markets. We demonstrate that the impact varies systematically with firm size and institutional quality, helping to explain why government influence on leverage differs across firms and countries.

The paper proceeds as follows. In Section 2, we review the corporate finance literature on optimal capital structures and outline mechanisms through which government ownership can affect firm leverage. Sections 3 and 4 then describe our data and the empirical approach, respectively. We present our results in Section 5, and conclude in Section 6.

[5]For example, La Porta and López de Silanes (1999); Megginson and Netter (2001); Megginson (2005); Bortolotti, Fantini, and Siniscalco (2004); and Estrin et al. (2009). Even partial privatization, where the government remains in control of management, can benefit productivity and profitability (Gupta, 2005).

2 The Drivers of Firm Leverage

2.1 Theories of optimal capital structure

The corporate finance literature has developed several theoretical perspectives to explain firms' capital structure, with no single theory fully accounting for observed financing patterns (Frank and Goyal, 2008; 2024). Two particularly influential theories are trade-off theory and the pecking order hypothesis. Trade-off theory describes the balance between benefits and costs of debt financing. Although Modigliani and Miller (1958) showed that firm value is independent of financial structure without transaction costs, this changes when introducing bankruptcy costs and taxes. Higher leverage increases tax-shield benefits, but also increases expected costs of financial distress. Firms choose their capital structure to optimize this trade-off. In contrast, the pecking order hypothesis posits that firms prefer internal over external financing due to asymmetric information between managers and investors. When external funds are needed, firms prefer debt to equity because debt is less sensitive to information asymmetries (Myers and Majluf, 1984; Myers, 1984).

In addition to these two theories, other approaches have been developed to shed light on firms' capital structure. Agency theory (Jensen and Meckling, 1976) focuses on conflicts between shareholders, managers, and debt holders. These conflicts shape optimal capital structure by trading off agency costs against other financing costs (Jensen, 1986). Other work focuses on market timing and describes firms' attempts to exploit favorable conditions by issuing securities when overvalued and repurchasing them when undervalued (Baker and Wurgler, 2002). Lastly, behavioral perspectives highlight how cognitive limitations can affect managers' financing decisions (Graham, 2022).

Overall, these theoretical perspectives offer complementary insights into how firms determine their target capital structure (Graham and Harvey, 2001; Leary and Roberts, 2005). Empirical evidence suggests that no single theory fully captures observed financing behaviors. In practice, firms appear to consider multiple factors simultaneously, as they weigh the bankruptcy risk and interest burden of (too) high leverage against potential missed growth opportunities and lower tax benefits from (too) low leverage. Specifically, reduced leverage decreases bankruptcy risk by enabling firms to better weather economic downturns and industry shocks, while lower debt burdens reduce interest expenses, potentially enhancing profitability and cash flow—particularly during periods of high interest rates. However, an

overly conservative capital structure with very low leverage can lead firms to miss profitable investment opportunities and forego valuable tax shields.

2.2 Determinants of firms' capital structure

The aforementioned capital structure theories generate several predictions about the relationship between leverage and firm characteristics such as size, tangibility of assets and cash flows. First, as larger firms tend to be more diversified, have stable cash flows (Rajan and Zingales, 1995; Fama and French, 2002) and are therefore less likely to go bankrupt, trade-off theory predicts a positive association between firm size and leverage. In contrast, pecking-order theory highlights that larger firms are more transparent and less subject to information asymmetries, which leads them to prefer equity over debt.

Second, trade-off theory predicts a positive relationship between asset tangibility and leverage because outsiders can easily value tangible assets. This will lower expected distress costs (Frank and Goyal, 2009). That is, when assets are tangible and can serve as collateral, a firm's leverage will be higher, all else equal (Rajan and Zingales, 1995). In contrast, pecking-order theory predicts an inverse relationship between tangibility and leverage because tangibility lowers information asymmetries. This increases the attractiveness of equity relative to debt.

Third, according to trade-off theory, profitable firms have more income to shield from taxation and will therefore have higher leverage. Agency theory predicts that profitable firms are more likely to encounter free cash-flow problems and may therefore use leverage to control their managers (Jensen, 1986). In contrast, pecking-order theory implies that profitable firms will be less leveraged: These firms will prefer to use their internal funds (retained earnings) over external debt and equity financing (Myers and Majluf, 1984).

Fourth, higher non-debt tax shields, such as depreciation, reduce the tax advantage of debt financing. Therefore, trade-off theory implies a negative association between non-debt tax shields and leverage (DeAngelo and Masulis, 1980). Yet, Bradley, Jarrell, and Kim (1984) find a positive correlation between firms' non-debt tax shields and leverage, and suggest this may reflect that high non-debt tax shields also proxy for asset tangibility.

A large empirical literature assesses the empirical relevance of these theoretical predic-

tions regarding the determinants of corporate leverage.[6] Across the board, this body of work concludes that leverage is positively related to the size of the firm; the tangibility of its fixed assets; its non-debt tax shields; and its growth opportunities. In contrast, leverage tends to be negatively correlated with firm-level income volatility and profitability.[7]

2.3 State ownership and firm leverage

How can a firm's ownership—and, in particular, ownership by the state—impact its capital structure? The main effect of state ownership is that it dramatically changes the trade-off between the benefits and risks of taking on debt. On the one hand, the implicit or explicit bailout guarantees that accompany state ownership can reduce the cost of debt because banks and other lenders worry less that a firm will default on its obligations (Faccio, Masulis, and McConnell, 2006; Iannotta, Nocera, and Sironi, 2013). This may particularly apply to large firms that are politically and socially important, and to which the government cannot credibly deny funding (Kornai, 1979). Such soft budget constraints may be particularly common in countries where a large part of the domestic banking system is in state hands (Cull and Xu, 2005; Megginson et al., 2014).

On the other hand, state ownership can increase the cost of debt if the state's non-financial objectives (such as ensuring high levels of employment) clash with those of for-profit lenders. Governments can also extract rents from state firms by paying below-market prices for outputs (Ahroni, 1986) or by implementing price controls to cater to voters. Not only large strategic state firms, but also smaller state-owned enterprises that receive less attention engage in such distorting activities (Musacchio and Pineda Ayerbe, 2019). Finally, state ownership can make borrowing more expensive because the managers of state firms are not adequately incentivized or monitored (Shleifer, 1998; Megginson, 2005 and Firth, Fung, and Rui, 2006). The extent to which state ownership creates such accountability and agency problems in state enterprises then depends on the deeper role that the state sees for itself (e.g., a welfare or a developmental state) as well as the strength and quality of local governance and institutions (Estrin and Gregoric, 2022).

[6] See Harris and Raviv (1991) for an early review.

[7] For example, Rajan and Zingales (1995) provide an empirical assessment of the key correlates of firm leverage in G7 countries, while Booth, Aivazian, Demirgüç-Kunt and Maksimovic (2001) assess the drivers of corporate leverage in ten developing countries.

Beyond affecting private investors' lending decisions, state ownership may also directly influence firms' desired leverage levels. On the one hand, governments might actively encourage lower leverage in their portfolio firms. This could reflect concerns about potential bailout costs if state-owned firms face financial distress, a desire to show higher short-term profits by reducing interest expenses, or recognition that tax shields are less valuable when firms already benefit from various forms of state support. On the other hand, knowing that their firms face softer budget constraints and are less likely to experience bankruptcy, governments might push for higher leverage to expand operations or employment more rapidly. The intensity and direction of such effects depend on the fiscal capacity of governments, their political time horizons, and their broader economic objectives.

Importantly, the conflict between governments' political objectives and private investors' profit motives applies both to private lenders and to private equity holders. If state ownership is expected to undermine private shareholders' payoffs, it should also raise the marginal cost of raising external equity, not just external debt.

3 Data

3.1 Firm-level data

We create a new firm-level data set that splices multiple historical editions of Bureau van Dijk's Orbis database. We focus on firms that report information on total assets and debt structure in any year between 2000 and 2019. As our goal is to identify the relationship between state control and corporate leverage, we exclude companies without valid ownership information, more specifically those with total ownership stakes greater than 104%.[8] Orbis contains information on firm leverage and other characteristics for both fully and partially state-owned firms. Our final data set spans 89 countries, the period 2000–2019 and contains about 20 million annual observations on almost 4 million firms.

A total of 193,700 (equivalent to about 1 percent) of these firm-years have at least a 20 percent government stake. However, our data cover the entire spectrum from no-to-full-state ownership. For example, the dataset also contains 113,727 firm-year observations that

[8]We use a threshold of 104% rather than 100% to allow rounding in a handful of cases. When we instead exclude these observations, our results are virtually unchanged.

pertain to 28,912 unique firms that are fully ($\geq$ 99%) state-owned (Appendix Table A.2). This represents 0.58 percent of the overall firm-year sample (including all fully private firms).

3.1.1 Corporate leverage and covariates

For each firm we have (time-varying) information on ownership, profit-and-loss statements, and its balance sheet—including its leverage, defined as total debt normalized by total assets. Panel A of Table 1 reveals wide variation across firms in their relative indebtedness: leverage ranges between zero and 200 percent and is, on average, 18.6 percent. Figure 1 shows a small decline in the leverage of non-state owned firms over the past 1.5 decades, whereas (partially or fully) state-owned firms experienced a slow but steady increase in leverage.

We create four firm covariates for which corporate finance theory suggests they co-determine leverage (see Section 2.2) and use them as controls throughout our analysis. These are firm size (log total assets); profitability (earnings before interest, taxes, depreciation, and amortization (EBITDA)/total assets); asset tangibility; and the non-debt tax shield. We follow Berkowitz, Lin, and Ma (2015) and Liu, Liu, and Wei (2022) and use fixed assets over total assets as a measure of asset tangibility. A firm's non-debt tax shield is proxied by total depreciation and amortization over total assets. For about half of all observations, we can also create a proxy for the firm's cost of debt by calculating the ratio between total interest expenses and total formal debt (trimmed at the 5th and 95th percentiles). The average implied interest rate is 8.5 percent (Table 1).

3.1.2 Firm-size categories

We allocate each firm to one of five predefined and mutually exclusive size buckets: micro, small, medium-sized, large and super-large firms. In line with official EU definitions[9], micro firms own less then EUR 2 million in total assets; small firms less than EUR 10 million; and medium-sized firms less than EUR 43 million. Large firms are all other firms with the exception of super-large ones, which own more than EUR 1 billion in assets.

Figure 2 presents the share of all enterprises that are state owned, for various firm size categories. The dark gray bars indicate state-owned enterprises' share of total assets owned by all firms in a particular size category. The light gray bars indicate the share of state

[9]https://ec.europa.eu/growth/smes/sme-definition_en.

firms in the total number of firms in each category. The figure shows that state ownership is concentrated among larger firms. For example, among super-large firms, state-owned enterprises account for about 12 percent of total assets and 9 percent of the total number of firms. These numbers are much lower, at 2 percent and 0.4 percent among micro firms.

In Appendix Figure A.1, we show how the number of firms, total employment, and total assets are distributed over the various categories of firm size. Super-large firms make up less than 1 percent of all firms but account for 57 and 74 percent of all employees and assets, respectively. In contrast, micro, small and medium enterprises are numerous and account for about 95 percent of all enterprises. However, they represent only about 15 percent of all employees and 6 percent of all assets.[10]

Lastly, Figure 3 shows a bin scatter plot in which we group all firms with any state ownership into 20 equal bins: 1–5 percent state ownership; 6–10 percent state ownership; etc. Firms with 100 percent state ownership are assigned to a separate bin. The fitted curve shows a clear negative relationship between the intensity of state ownership and firm size. Governments tend to hold minority stakes in (very) large firms and often hold large majority stakes in smaller firms.

3.1.3 State ownership

The Orbis database contains subsidiary-shareholder pair information on direct and total ownership in each year.[11] By splicing various historical editions of Orbis, we carefully track the ownership structure of companies over time and then summarize the shares of all shareholders classified as public authorities, the state or the government. This includes minority stakes by state-owned investment funds and sovereign wealth funds, an increasingly important form of state ownership (Megginson, 2018).

It is important to account not only for direct but also indirect state ownership. Once we have identified all firms where state agencies directly own more than 20 percent of all shares, we next identify the firms in which these directly state-owned firms own more than 20

[10] Appendix Table A.3 provides the complete breakdown of the firm-year observations by level of state-ownership and by size category.

[11] Orbis provides information on voting shares for those firms whose shares are split into voting versus non-voting shares. This makes the database particularly well-suited to identify control (Aminadav and Papaioannou, 2020 and Kalemli-Özcan et al., 2023).

percent.[12] These indirectly state-owned firms are then added to the list of state firms.[13] We proceed with this iteration until we have identified all firms that are linked to state agencies in a way that, at each point in the ownership chain, the state controls at least 20 percent.[14]

Appendix Figure A.4 illustrates our approach to identify both direct and indirect government ownership of firms. This stylized example depicts the ownership structure of Russia's Gazprom, a majority state-owned energy corporation headquartered in St. Petersburg, and its subsidiaries. Gazprom has various subsidiaries, none of which are directly owned by the state. However, following our procedure, we identify all of them as state-owned enterprises with $\geq 20\%$ ownership. More specifically, we use state ownership as a dummy variable that is set to '1' for any firm connected to a government via a path where *all* links have $\geq 20\%$ ownership, which means that the owner can effectively exercise control over the subsidiary.

For instance, in the Orbis database, Gazpromneft-Yaroslavl, which owns and operates gasoline filling stations, is not flagged as a state-owned firm since its direct owner is not the State of Russia. However, we know that Gazprom Neft, which owns 100% of Gazpromneft-Yaroslavl, is itself more than 20% owned by state-owned Gazprom. Due to this indirect ownership, we consider Gazpromneft-Yaroslavl as a state-owned enterprise. Similarly, JSC SibirGazService is identified as a state-owned company through our iterative process, despite not being directly owned by the state. This approach ensures that we capture the full extent of state ownership, even when it is exercised through multiple layers of $\geq 20\%$ ownership. This allows for a comprehensive analysis of the impact of state ownership on firm leverage.

We also create a continuous measure of state ownership that ranges between 0 and 100. It represents the cumulative share directly controlled by the state and/or other state-owned enterprises, as determined by our iterative approach. The average government stake in firms'

[12]International Accounting Standards (IAS 28) consider 20 percent ownership as creating a presumption of "significant influence" over an entity, allowing participation in policy decisions, board representation, and material transactions.

[13]The exact procedure for identifying state ownership involved extracting all valid subsidiary-shareholder links from Orbis, removing entries with missing dates or from unknown information providers, and retaining only the highest reported shareholding percentage when duplicates existed. For each firm-year, we calculated direct and total ownership stakes, excluding observations where these exceeded 104%. We identified state owners using Orbis's "Public authority/State/Government" classification and created a binary indicator for cumulative state ownership of 20% or more. The procedure's accuracy was verified through extensive manual checks against alternative sources using a random sample of firms.

[14]When a firm is owned by a foreign state, we still classify it as a state-owned enterprise provided that there is only one state holding a stake.

equity is very small: 0.8 percent (Table 1, Panel A). The median firm has no state ownership. We then define dummy variables that indicate whether the state owns more than 1, 20, 50 or 99 percent of a firm's equity. Only about 1 percent of all firm-years is at least 20 percent state-owned.[15] Moreover, we create dummies for whether a company falls within one of the following state-ownership intervals: [1%; 20%), [20%; 50%), [50%; 99%) and [99%; 100%].

A final advantage of our Orbis-based sample is that it captures not just listed but also privately held firms. This is important because, unlike most earlier studies, we also cover a broad range of developing countries and emerging markets. Appendix Table A.2 shows that among fully private firms (i.e., firms without any state control) only 2 percent of firm-years refers to firms listed on a stock exchange. This reflects that a large part of our sample are small- and medium-sized enterprises (SMEs), which are typically unlisted. In contrast, among (larger) firms with a minority state ownership of up to 20 percent, listed firm-years make up 76 percent. For firms with a minority state ownership of between 21 and 50 percent, the percentage of listed firm-years is 22 per cent. Finally, for those with a majority (but not full) state ownership, this percentage is 8 percent. These numbers reflect that many governments, especially in lower-income countries, hold minority stakes in firms listed on the local stock exchange.

3.2 Industry-level data

We explore the role of cross-industry variation in firms' dependence on external finance, their liquidity needs and their access to tangible (and therefore pledgeable) assets.[16] Data on external finance dependence come from Rajan and Zingales (1998) and Duygan-Bump et al. (2015). Both measure firms' dependence on external finance as the proportion of capital expenditures not financed with cash flow from operations. Positive values indicate that firms tend to issue debt or equity to finance investments, while negative values mean that firms

[15]The distribution of state versus private ownership is relatively stable over time. When we divide our sample into four time windows (2000–2004, 2005–2009, 2010–2014, and 2015–2019), we find that the percentage of firm-years with at least 20 percent state ownership is 1.2, 1.2, 0.8, and 1.1 percent, respectively, across these four periods.

[16]As our firm-level data use a four-digit NACE 2 sector classification, we first establish concordance between manufacturing industries in ISIC rev. 2 and NACE 2 using concordance tables from UN Stats (see https://unstats.un.org/unsd/classifications/Econ/isic). If one NACE 2 sector matches multiple ISIC rev. 2 sectors, then we use a simple mean of the corresponding ISIC rev. 2 sectors.

in a particular industry typically have cash flows that exceed their investments.[17]

Our second industry-level characteristic is liquidity needs. Firms in industries that require more working capital will typically need more liquid funds to operate. We use the primary measure of four-digit sector-level liquidity needs by Raddatz (2006): the median ratio of inventories over sales for US public companies during 1980–1989.

Third, we measure asset tangibility as the median value of tangible fixed assets over total assets in a four-digit industry. In the vein of Rajan and Zingales (1998), we take all US firms for which we have data on tangible fixed assets in any year between 2000 and 2019. For each of these firms, we then calculate their median asset tangibility over this period. In line with the literature, we expect higher asset tangibility to support firm borrowing and thus to increase leverage, all else equal (Harris and Raviv, 1991; Almeida and Campello, 2007). This implies that any negative effect of state ownership on firm leverage should be attenuated in sectors where firms own relatively more tangible assets.

In all three cases, we use US data to capture technological differences across industries. Since the US has highly developed financial markets with relatively few frictions, sectoral patterns from US data likely reflect the underlying technological requirements of different industries rather than constraints from underdeveloped financial markets or institutional weaknesses. This makes the US-based measures a good proxy for the "natural" or "optimal" level of external finance dependence or liquidity needs in each sector.

3.3 Country-level data

We explore country-level heterogeneity in the relationship between state ownership and firm leverage across several key dimensions. We first assess the role of the ownership composition of national banking systems. To do so, we collect data on the share of domestic banking assets held by the government and by foreign investors. We source data on state banks' assets from the World Bank's *Bank Regulation and Supervision Survey* and on assets held by foreign banks from the Global Financial Development Database, also from the World Bank. State (foreign) banks are defined as institutions where the government (foreign investors) holds at

[17] Both measures are based on US data from the 1980s to the early 1990s. However, Duygan-Bump et al (2015) extend the analysis to services whereas Rajan and Zingales (1998) cover only manufacturing sectors. For this reason, the classification by Duygan-Bump et al. (2015) is our preferred measure, while we use the estimates by Rajan and Zingales (1998) for robustness checks.

least 50 percent of all equity. Across our country sample, on average, 15 percent (34 percent) of banking assets are in the hands of state (foreign) banks (Table 1, Panel B).

We also explore variation in domestic income levels and institutional quality. National income levels are measured as log GDP per capita, converted to constant 2017 dollars using purchasing power parity rates. Our main institutional quality measures are the *Rule of law* and *Control of corruption* indices from the World Governance Indicators database; and the *Resolving insolvency* and *Protecting minority investors* scores from the World Bank's *Doing Business* report. Appendix Table A.1 contains all variable definitions.

4 Empirical Methodology

4.1 Cross-sectional analysis

We start our analysis by running cross-sectional regressions in which we explain the leverage (L) of firm i in sector s in country c and year t by one or several time-varying measures of state ownership (S). In all specifications, we control for a matrix Z of standard time-varying determinants of firm leverage as suggested by corporate finance theory: firm size; profitability; asset tangibility; and the size of the non-debt tax shield. Importantly, we saturate all specifications with highly granular sector-country-year fixed effects, ϕ_{sct}, thus comparing firms with different levels of state ownership in the same sector, country and year. Because we systematically compare state-owned enterprises and private firms within the same sector, we exclude by construction any sectors in which state firms have a natural monopoly. We cluster standard errors at the firm level.[18] Our baseline OLS specification is:

$$L_{isct} = \beta_0 + \beta_1 S_{it} + \gamma^{'} Z_{it} + \phi_{sct} + \epsilon_i \tag{1}$$

In some specifications, we replace the dependent variable L_{isct} by I_{isct}: the firm-specific cost of debt. Moreover, to explore cross-country heterogeneity, we also estimate interaction regressions following Equation 2:

[18] Alternatively, we can cluster standard errors by country or ownership. In the latter case, firms with common owners—including all state-controlled firms in the same country—are treated as one cluster. Table A.4 shows that our baseline results are robust to using either of these alternative clustering approaches.

$$L_{isct} = \beta_0 + \beta_1 S_{it} + \beta_2 S_{it} \times M_{ct} + \gamma' Z_{it} + \phi_{sct} + \epsilon_i \quad (2)$$

where M_{ct} indicates time-varying country-level measures of the ownership structure in the banking sector or proxies for the quality of the institutional environment. In some specifications, we replace M_{ct} with M_{st}: time-varying sector characteristics such as industries' external finance dependence, liquidity needs or asset tangibility. In either case, the effect of M_{ct} or M_{st} itself is absorbed by our fixed effects ϕ_{sct}.

4.2 Analysis of privatization events

4.2.1 Panel data analysis of privatized firms

For a deeper insight into the relationship between state ownership and firm leverage, we study changes in corporate debt for privatized firms. To do so, we create a comprehensive global data set of privatization events by extracting all privatizations flagged by Bureau van Dijk's Zephyr database and that are of the "acquisition" deal type. Privatizations are deals where "a government, council, or other state-owned entity disposes of a company or stake in a company that it owns", and acquisitions are those deals "where the acquirer ends up with 50 percent or more of the equity of the target".[19]

Our data set includes detailed information on 2,714 firms privatized during 2000–2019. Most privatizations took place in Russia (1,098 cases), Serbia (267), Poland (192), Ukraine (140) and Bulgaria (118). Our analysis considers firms' debt levels within five-year periods directly before and after privatization. To ensure that our results are not biased by firms disclosing financial information only in one period, we focus on firms for which we have at least three years of data before and after privatization. This reduces the sample to 946 companies. We run regressions following Equation 3 and cluster standard errors at the firm level:

$$L_{isct} = \beta_0 + \beta_1 PP_{it} + \gamma' Z_{it} + \psi_i + \theta_{ct} + \mu_{st} + \epsilon_i \quad (3)$$

[19] Our analysis excludes privatizations through share issuances where governments float shares directly to investors. Moreover, although we cannot distinguish between complete (100%) and partial privatizations due to data limitations, this heterogeneity in stake size would likely attenuate our results. Consequently, our findings represent conservative estimates of the true effect of privatization on leverage.

The variable of interest is a firm-specific pre-privatization dummy (PP_{it}) that takes the value '1' in the years before privatization and '0' in the years afterwards (the privatization year itself is excluded from the analysis). If privatization leads to an increase in firm leverage, we would therefore expect β_1 to be negative.

Importantly, this setup allows us to include firm fixed effects (ψ_i) that absorb all observable and unobservable time-invariant firm characteristics that might otherwise confound estimates of the impact of state ownership on leverage. We thus obtain a clean within-firm estimate of the privatization impact. We also control for country-year (θ_{ct}) and sector-year (μ_{st}) fixed effects. These absorb time trends that affect specific countries (such as their business cycle) and specific sectors (such as industry-level technological change), respectively.

4.2.2 Matching estimator of average treatment effects on privatized firms

To further identify the causal effect of privatization on the debt structure of (previously) state-owned firms, we use a matching estimator (Abadie and Imbens, 2006) to systematically compare privatized firms with similar peers that remained at least 20 percent state-controlled throughout the observed period. We estimate the average treatment effect on the treated (ATT) with treatment being the privatization event.[20]

We condition on several key pre-treatment variables by matching exactly on country, two-digit NACE rev. 2 sector and year. In addition, we match on firm size, tangibility (ratio of fixed assets to total assets), productivity (ratio of operating revenue to total assets), leverage (the outcome variable) and the ratio of total informal debt to total assets. As privatization expectations and preparations may affect these covariates, we use the mean of the years *T-3*, *T-4*, and *T-5* as the reference period for matching (where T is the year of privatization). In order to find the optimal covariate balance, we use a genetic search algorithm as proposed by Diamond and Sekhon (2013) and Sekhon and Grieve (2011).[21] A privatized firm s is matched to a firm z that stayed state-owned throughout the observed period in such a way

[20] See Campello and Giambona (2013); Kahle and Stulz (2013); and Gropp, Mosk, Wix and Ongena (2019) for recent applications of this matching estimator in the financial economics literature. Estimating consecutive cross-sectional ATT's is equivalent to applying a difference-in-differences approach to matched treated and control firms, as long as matching takes into account pre-treatment outcome levels (as we do). See also Athey and Imbens (2006).

[21] We implement this algorithm in R using the *Matching* package of Sekhon (2011).

that the extended Mahalanobis distance m_{sz} is minimized:

$$m_{sz}\left(\mathrm{x}_{is}, \mathrm{x}_{iz}\right) = \left(\mathrm{x}_{is} - \mathrm{x}_{iz}\right)^{\mathrm{T}} \Sigma^{-\frac{1}{2}} \mathrm{W} \Sigma^{-\frac{1}{2}} \left(\mathrm{x}_{is} - \mathrm{x}_{iz}\right)$$

where x_{ic} is a vector of K observable covariates for firm i of type $c = s, z$; $\Sigma^{-\frac{1}{2}}$ is the inverted Cholesky decomposition of the empirical variance-covariance matrix of the covariates, Σ, while W is a matrix of weights obtained via a genetic algorithm that optimizes the covariate balance. Matching is performed with replacement, so a control firm can be linked to multiple treated firms. We match privatized firms s to control firms z one-to-one, conservatively accepting a higher variance for our estimates in exchange for a lower bias.

Our outcome variable is firm leverage at *T-5* to *T+5*: from five years before privatization to five years after. Because Orbis does not always contain data for all years, we run separate analyses for each year. The analysis of the privatization effect in years *T+1* and *T+2* can therefore be based on slightly different treated and control sub-samples because some firms only report outcomes in year *T+1* and others only in year *T+2*. For each year, we estimate the ATT with and without a correction for multiple covariates bias and perform statistical inference by calculating standard errors based on conventional formulas (Abadie and Imbens, 2006). Out of all treated firms selected for this exercise, 656 were matched exactly on country, year and two-digit sector to one or more control firms.[22]

5 Results

5.1 Baseline results

Table 2 presents our baseline results for the full sample. Controlling for country-sector-year fixed effects and for conventional determinants of leverage, we find that state ownership is negatively and significantly correlated with corporate indebtedness. Column (1) shows that even when using a very low minimum ownership threshold of just 1 percent, we find that state ownership decreases leverage by about 5 percentage points. This magnitude is

[22]The number of matched firms is lower in our year-by-year ATT estimates because data for the outcome variable may be missing for specific years (either for the treatment firm or for all control firms in the relevant country-sector-year cell) or because none of the available control firms are similar to the treated firms in terms of the matching covariates.

substantial as the mean leverage in our data is 18.6 percent.

The effect is larger when we use higher thresholds for state ownership. In columns (2)–(4), we present the results for the 20, 50 and 99 percent thresholds, respectively. In column (5), we include dummies for a comprehensive set of ranges of state ownership and find the effect monotonically increases from about 3 percentage points for state ownership below 20 percent to about 7 percentage points for state ownership above 99 percent. In all of the following regressions, we will use the dummy for the state's stake being above 20 percent as our main measure of state ownership. All our results are robust to using alternative thresholds.[23]

Throughout Table 2, we control for firm-level profitability, effectively shutting down the possibility that state ownership not only impacts leverage directly but also indirectly through profitability. For example, state ownership may deter firm entry in the same sector and/or locality (Brandt, Kambourov and Storesletten, 2020). Such a protected position may then allow state firms to charge higher markups and become more profitable (Berkowitz and Nishioka, 2022) which in turn may translate in either higher leverage (in line with trade-off and agency theories) or lower leverage (as pecking-order theory would predict). Yet, when we exclude the profitability measure from our baseline regressions in Table 2, the estimated coefficients for the state-ownership variables turn out to be very stable. This suggests that, on average in our global sample, profitability is not an important mediator in the relationship between state ownership and leverage.

One may worry that governments (un)intentionally target firms with lower leverage, so that the negative correlation we observe would be partly due to selection effect rather than a causal impact of the "government treatment". To assess potential selection bias, we follow Oster (2019). This method quantifies how much of the estimated treatment effect might be due to selection on unobservables rather than a true causal relationship. Oster's beta is calculated by examining how the coefficient of interest changes when control variables are added to the regression, then extrapolating this relationship to account for potential unobserved variables under the proportional selection assumption.

We find that Oster's beta (the bias-adjusted treatment effect) is -0.070 in our base-

[23]Appendix Figure A.2 shows these results are also robust to excluding one industry, region or year at a time. Moreover, we also estimated Poisson Pseudo-Maximum Likelihood (PPML) regressions using three alternative continuous specifications of state control: raw values, log transformation (plus one), and inverse hyperbolic sine transformation. The results of all three specifications confirm the robust negative relationship between state ownership and firm leverage.

line specification, compared to a reported beta coefficient of -0.055. This represents the estimated effect of state ownership on firm leverage under the assumption of proportional selection between observed and unobserved variables, indicating that the effect is indeed negative. Second, Oster's delta is -4.7. Delta measures the relative importance of unobservables compared to observables in explaining firm leverage. The fact that delta is larger than one suggests that unobservables are relatively important. However, the negative sign indicates that any selection bias works in the opposite direction of our estimated effect, meaning our current estimate is likely biased towards zero. These findings suggest we underestimate the negative effect of state ownership on leverage.[24]

Next, in Table 3, we explore the heterogeneity of the effect with respect to firm size. We consider our sub-samples of micro, small, medium-sized, large and super-large firms, as defined in Section 3.1.2. We find that the average negative effect in the full sample is driven by all but the largest firms. The effect is greatest for micro and small firms, lesser for medium-sized firms, even less for large firms and negligible for super-large firms. As we have only around 8,400 super-large firms in our sample (compared to 3.5 million micro and small firms), the average effect is similar in magnitude to that for micro and small firms. In columns (7) and (8), we rerun regressions for the full sample, weighting the observations by size. In column (7), where the weights are proportional to log total assets, the coefficient on state ownership remains significantly negative. In column (8), where we weight observations by linear total assets, the average effect is driven by super-large firms and is essentially zero.

Figure 4 presents the estimated marginal effects of state ownership on leverage at different points of the firm-size distribution (the horizontal axis is logarithmic). These estimates are based on a regression for the full sample where the state ownership dummy is interacted with the log of total assets and with the squared log of total assets. The effect is clearly negative and statistically significant for firms with assets below EUR 1 billion, becomes zero or insignificant among firms with assets from EUR 1 to 10 billion, and is positive for firms with assets of EUR 10 billion or more. The positive effect for the largest firms is in line with previous studies, which mostly focus on listed firms that are usually very large.[25]

[24]Moreover, our privatization event regressions (Section 5.4) further assuage worries about selection bias as they include firm fixed effects, allowing us to estimate the impact of state ownership on leverage by analyzing an ownership change *within the same firm*.

[25]In Appendix Table A.5, we focus on a global sample of the 100, 300 or 500 largest listed firms. For this select sample, we also find a positive relationship between state ownership (of at least 20 percent) and

Importantly, Figure 4 reveals that such findings based on only a subset of the very largest firms cannot be extrapolated to the vast majority of smaller companies. For these firms, the effect of state ownership is actually *negative*, statistically significant, and large in magnitude.

In Appendix Table A.6, we run similar regressions while interacting the state-owned dummy variable with one of three sectoral characteristics: the sector's external finance dependence (EFD), its liquidity needs and the sector's average asset tangibility. The results confirm the strong and robust negative relationship between state ownership and firm leverage. They also show, however, that—in sectors with a high external finance dependence (column 1) or with higher asset tangibility (column 3)—this negative effect is attenuated.[26]

5.2 Cross-country heterogeneity

5.2.1 Institutional quality

Table 4 explores cross-country heterogeneity in the quality of political and legal institutions. Each column includes our main independent variable (state ownership) and its interaction with a country-level measure of institutional quality. In all specifications, the coefficient on state ownership remains negative and statistically significant, while the coefficient on the interaction term is positive and significant. The results indicate that the negative effect of state ownership on leverage is substantially stronger in economically less developed countries (column 1) and in countries with a weaker rule of law (column 2), more corruption (column 3), weaker insolvency regimes (column 4) and worse investor protection (column 5).[27]

The magnitudes are also large: if one country is 2.7 times as poor as another one, then the effect of state ownership on leverage is stronger by an additional 5 percentage points (similar to our average effect in the full sample). Likewise, reducing a country's corruption or strengthening its rule of law by one global standard deviation reduces the effect of state ownership on leverage by almost 3 percentage points or about 40 percent of the average effect.[28] The magnitudes are similar for the indicators of insolvency resolution

leverage, although the coefficient is only precisely estimated for the 100 largest listed firms in the years before the global financial crisis.

[26]Because we include sector-country-year fixed effects, the base effects of *External finance dependence*, *Liquidity needs*, and *Tangibility* are absorbed by these fixed effects in columns 1, 2, and 3, respectively.

[27]Because we include sector-country-year fixed effects, the base effects of these institutional variables are again absorbed by these fixed effects.

[28]For example, a one standard deviation increase in the variable *Control of corruption* amounts to 1.023.

and the protection of minority investors. Together, these results reveal how underdeveloped institutional frameworks exacerbate credit-market frictions related to state ownership.

A related question is whether the negative relationship between state ownership and leverage is present across countries with different types of political regimes. To look into this, we re-run our baseline specification (Table 2, column 2) while splitting the firm sample into three parts using the Polity2 democracy score (published by the Center for Systemic Peace). Figure A.3 plots the coefficient estimates for countries with a Polity2 score between -10 and 5 (autocracies and hybrid regimes: left); a score between 6 and 8 (democracies: middle); and a score of 9 or 10 (full democracies: right). We document a negative correlation between state ownership and firm leverage within each type of political regime, with the strongest effect in the middle category. This suggests that rather than a country's political regime, it is the specific quality of the institutional and legal framework that moderates the relationship between state ownership and financial leverage.

5.2.2 Ownership structure of the banking sector

In Table 5, we explore the role of the ownership structure of countries' banking systems. In addition to the state ownership dummy, we include its interactions with the share of state banks and the share of foreign banks in a country's banking system. Column (1) presents the results for the full sample. The coefficient on state ownership remains negative and statistically significant, and so are the coefficients on the interaction terms.

First, we find that the higher the share of state banks in the economy, the stronger the negative effect of state ownership on firm leverage. This result is clearly at odds with the conventional wisdom that state banks are more likely to lend to (all) state-owned firms. To investigate this further, columns (2)–(6) break the sample down into different size categories. We find the effect for the full sample is driven by micro, small and medium-sized firms. That is, a larger presence of state banks further reduces the leverage of small and medium-sized state enterprises. At the same time, the coefficient on the interaction term for larger firms is positive and significant (in the case of large firms) or insignificant (in the case of super-large firms). This suggests that countries may use state banks to channel credit towards larger

With an estimated interaction effect of 0.022, this means that a one standard deviation decline in corruption would reduce the effect of state ownership on leverage by $1.023 \times 0.022 = 2.25$ percentage points. This amounts to 41 percent of the average effect of state ownership on leverage.

state-owned "national champions" and away from smaller state-owned firms.

Second, we find that, in countries with a higher share of foreign banks, the negative effect of state ownership on leverage is also stronger.[29] This indicates that foreign banks are more reluctant to lend to state-owned firms than their (private) domestic competitors. As with state banks, the effect is concentrated in the micro, small and medium-sized firm categories. It is these smaller state firms that foreign banks feel less secure lending to, whereas this is not the case for larger (likely more transparent and publicly more supported) state-owned enterprises. Indeed, the reluctance of foreign banks to lend to state-owned enterprises is strongest for smaller firms, where information asymmetries are highest, and foreign banks' limited ability to prevent political interference matters most. Importantly, Table 5 also shows that, unlike state banks, foreign banks do not preferentially lend to large state-owned "national champions"—a logical pattern since foreign banks neither serve as instruments of domestic industrial policy nor expect protection if major state borrowers default.

These findings reveal how banks' incentives and constraints shape their response to state ownership. State banks channel credit to politically important firms while restricting it to others, whereas foreign banks maintain greater distance across the board, especially from smaller state-owned firms where their informational disadvantages are largest.

Next, we investigate the relationship between a more dominant position of state-owned banks and the leverage of firms that are relatively small at the national level but (very) large at the sub-national (i.e., regional) level. To identify such firms, we first use Orbis information on each firm's address to extract its geo-location from Google API. We then assign firms to sub-national regions, using the GADM classification[30]. We keep all sub-national regions that have at least one year with ten or more firms. We then drop all firms falling into the 90th percentile or above, within country, in terms of their median asset size. For each remaining firm we calculate the size percentile (in terms of total assets) that it falls into within its sub-national GADM region.

With these data in hand, we run regressions similar to those in Table 5 to test whether state banks are more likely to lend to smaller firms (defined as such at the national level) if those firms are among the largest in their region. More specifically, we define firms as

[29]This is confirmed by the sample-split regressions reported in Appendix Table A.7, which show that the relationship between state ownership and firm leverage is systematically more negative in countries where foreign banks own larger segments of the banking sector.

[30]https://gadm.org/.

regionally large if they are at or above the 75th percentile of the regional size distribution, or alternatively if they are at or above the 85th percentile of this distribution.

Table 6 presents these results. In the first four columns, we show regressions using all firms while in the last four columns we focus on MSMEs only. The results are striking and align nicely with those originally obtained at the national level. For regionally small firms, we observe that the higher the share of state banks in the economy, the stronger the negative effect of state ownership on leverage (columns 1 and 3). However, when we focus on firms that are regionally large, we find the opposite: for locally important firms, state banks actually appear to allow for higher leverage (columns 2 and 4).

In columns 5–8, we repeat this analysis, now focusing on the sample of MSMEs only. Table 5 showed that MSMEs are responsible for the stronger negative relationship between state ownership and leverage in the presence of state banks. We confirm this in columns 5 and 7 of Table 6. However, we also find that among the regionally largest SMEs, state banks help these firms to borrow more (columns 6 and 8). Finally, we note that the role of foreign banks is the same regardless of whether firms are locally important or not.

5.3 State ownership and the cost of debt

Table 3 showed that state ownership is associated with significantly lower firm leverage across most of the firm-size distribution. The exceptions are large and super-large firms, where this negative effect is either very small (in the case of large firms) or entirely absent (in the case of super-large firms). These baseline results, and the subsequent additional findings, are consistent with the idea that creditors are concerned about the governance-related risks of lending to (smaller) state-owned enterprises. This should make creditors price in these risks by charging higher interest rates to (relatively small) state-owned firms. The results in Table 7 demonstrate precisely this. We find that, in the sample as a whole, state ownership is associated with, on average, a 0.3 percentage point higher implied interest rate. This amounts to 3.5 percent of the median interest rate. Importantly, this positive effect is entirely concentrated among small and medium-sized state firms (column 2). In contrast, large and super-large firms appear to *benefit* from state ownership in the form of lower borrowing costs.

Figure 5 shows the marginal effects of state ownership on borrowing costs along the firm-

size distribution (the horizontal axis is again logarithmic). These estimations are based on column (1) of Table 7, with the state ownership dummy interacted with the log of total assets and the squared log of total assets. The figure shows clearly how state ownership makes debt more expensive for smaller state-owned enterprises but cheaper for larger ones. The finding that the largest firms benefit financially from the implicit and explicit bailout guarantees associated with state ownership is in line with the existing literature (Faccio, Masulis, and McConnell, 2006; Iannotta, Nocera, and Sironi, 2013). Our contribution here is to demonstrate that the impact of state ownership on funding costs is in fact the opposite for the vast majority of smaller state-owned enterprises that have, as yet, not been studied.

In Table 8, we investigate whether and how the structure of the banking system moderates the relationship between state ownership and corporate debt costs. Interestingly, the data show that there is no special role for state-owned banks (relative to private domestic banks) in determining the interest rates paid by state-owned firms. This indicates that the bailout guarantees associated with state ownership help to reduce the credit risk as perceived by privately owned and state-owned domestic banks alike. In contrast, we find that a greater presence of *foreign* banks results in a higher cost of borrowing for state firms. Yet, in line with Table 5, this holds mainly for smaller state firms and much less so, or not at all, for large and super-large ones.

5.4 Privatization and firm leverage

In this section, we study a sub-sample of firms that were privatized. This allows us to estimate the impact of state ownership on leverage by analyzing an ownership change within the same firm. We focus on privatized firms for which we have at least three years of data before and after the privatization year.[31] There are about 900 such firms. Of these, approximately 700 are micro, small and medium-sized firms, while almost 200 are large and super-large firms.

Figure 6 shows the evolution of leverage before and after privatization separately for micro, small and medium-sized firms (solid line) versus large and super-large firms (dashed line). For the latter, there is no change in leverage in the 10-year window around the privatization event. However, for the smaller firms, privatization is accompanied by a major increase in leverage around the year of privatization. Moreover, this increase is sustained for

[31] Our results are virtually unchanged when we use a two-year data availability rule instead of this three-year rule.

at least five years after the change in ownership.

In Table 9, we report results from panel regressions where we include firm fixed effects, country-year and sector-year fixed effects, and our standard set of time-varying firm-level characteristics. We exclude the year of privatization from the analysis. The results are strikingly similar to our earlier baseline results—in terms of the sign of the effect and its magnitude. In column (1), we present the results for the full sample. Here, state ownership (that is, the pre-privatization dummy) has a negative and significant impact on leverage. The magnitude of the effect is 5 percentage points, exactly as in Table 2 where we compared leverage in state-owned and private firms while controlling for country-sector-year fixed effects. Once we split the sample into size categories, we again find that the average effect is driven by the micro, small and medium-sized firms (column 2). For these, the coefficient is negative and significant and the size of the effect is 6 percentage points. This is again very similar to the results in Table 3. For the large and super-large firms in column (3), there is no effect: the coefficient is close to zero.

In Appendix Figure A.5, we present a robustness check where we re-estimate the baseline privatization regression (Table 9, column 1) multiple times, each time excluding one country from the sample. This shows that our coefficient estimate is highly robust, consistently remaining close to the overall estimate of -0.049 and maintaining statistical significance at the 1 percent level. The only notable deviation occurs when we exclude Russia, which comprises 40 percent of our sample, causing the coefficient to shift to -0.035. This analysis reveals that while the strong negative effect we document is partially driven by (the many) Russian privatizations, it persists consistently across the rest of our country sample.

Next, we use a matching estimator to systematically compare privatized firms with similar firms that remained state-controlled. We condition on several key pre-treatment variables by matching exactly on country, two-digit sector and year. In addition, we match on firm size, tangibility, productivity, leverage (the outcome variable) and the ratio of total informal debt to total assets, using genetic Mahalanobis distance matching. For each year, we then estimate the ATT with and without a correction for multiple covariates bias (Abadie and Imbens, 2006).

The first two columns of Table A.8 present variance-standardized means between the treated and control observations for both the raw and the matched sample. This standardized bias is the mean difference between treatment and control units divided by the pooled

standard deviation. It is encouraging that matching significantly brings down this metric, to below 5 percent (and hence below the often used threshold of 10 percent). This indicates that both groups become substantially more comparable in terms of covariates, reducing concerns about potential confounding. The last two columns of this table show the variance ratio. Matching brings this ratio closer to one, indicating that there is also increased between-group similarity in terms of variability.

Table 10 and Figure 7 present the ATT estimates. The results are qualitatively and quantitatively similar to the cross-sectional regressions and panel data analysis. Relative to the matched control group, privatization increases leverage by about 5 percentage points.[32] There is, however, one nuance: while the main increase in leverage takes place in the year of privatization (and the year after), there is also a clear (albeit not as steep) increase in leverage just beforehand. In the two years before privatization, firm leverage already rises by about 2 percentage points. As the preparation of privatization deals usually takes several years, this likely reflects creditors' ex ante expectations of improved governance after privatization.[33]

6 Conclusions

In this paper, we have studied the relationship between state ownership and leverage in 4 million firms around the world. While previous studies focused mostly on very large and listed companies, our sample includes many micro, small and medium-sized firms. We show that the relationship between state ownership and leverage is indeed heterogeneous across firm sizes. While there is no robust impact of state ownership on leverage for large firms in our sample, we find a strong negative effect of state ownership on leverage among micro, small and medium-sized firms. Controlling for country-sector-year fixed effects and standard firm-level determinants of leverage, state-owned firms have a 5 percentage points lower debt

[32] Although governments could build trust with investors by selecting less levered firms to sell during the early stages of a privatization program, they often select high-leverage firms to transfer financial burdens to private investors, facilitate industrial restructuring, and avoid potential bankruptcies. Importantly, if governments chose high-leverage firms for privatization, this selection mechanism would work against our empirical finding of increased leverage post-privatization, potentially underestimating the true positive effect of privatization. Indeed, this is in line with the negative sign of Oster's delta we discussed earlier.

[33] In unreported regressions, we also find a simultaneous decline in privatized firms' average debt costs of 3 percentage points. Because we only have data on the cost of debt for about half of the privatized firms, this sample is too small to perform sub-sample analyses by firm size.

to assets ratio than their private peers. This is substantial: the average leverage in our data set is 18.6 percent. The effect is increasing in the degree of state ownership, but is significant even if the state only has a small ownership stake. Finally, we find similar effects on firms' costs of debt: while state ownership increases these costs for smaller state firms, it actually reduces external funding costs for large and super-large state-owned enterprises.

In addition to comparing state and private firms within the same countries, sectors and years, we also analyze the effect of state ownership on leverage within the same firms. We study the evolution of leverage in firms that were privatized and find that privatization allows firms to lever up. Similar to our findings from the cross-firm analysis, this effect is again driven by micro, small and medium-sized firms. The magnitude of the effect is also very similar: 5 percentage points.

The strong negative relationship between state ownership and corporate leverage likely reflects the corporate governance risks of state ownership. Creditors may fear the state's intervention in firms' operations, and they may therefore be less willing to lend to such firms. Indeed, we find the negative effects of state ownership on leverage are much stronger in countries with a weaker rule of law, control of corruption, protection of investors, and insolvency procedures. These results reveal how underdeveloped institutional frameworks exacerbate the credit-market frictions stemming from state ownership. Moreover, this pattern may also reflect governments' own preference for lower leverage to minimize potential bailout costs.

Our results can also be seen in light of a recent literature that underlines the substantial misallocation of capital and labor across firms—even within narrowly defined industrial sectors and within the same country (Hsieh and Klenow, 2009; Restuccia and Rogerson, 2017). State ownership can be an important source of such allocative inefficiency and the resulting drag on total factor productivity (Nigmatulina, 2022). Our results highlight one mechanism through which state ownership can introduce distortions and resource misallocation: it interferes with the ability of all but the largest firms to access credit.

Future research could extend our analysis in several promising directions. First, with richer data on transaction details, researchers could explore how different privatization structures and the extent of remaining state ownership affect the post-privatization evolution of firm leverage and other financial outcomes. This would include examining how the specific mechanisms of privatization——such as the size of stake transfers, the identity of private acquirers, and the sequencing of ownership changes——influence firms' financial policies. Sec-

ond, investigating the long-term evolution of leverage in privatized firms beyond our five-year window would provide insights into the permanence of these ownership effects and potential convergence patterns toward industry norms. Third, a comprehensive analysis of how state capital support beyond traditional debt financing—including cash injections, transfers of fixed assets, debt-to-equity conversions, and in-kind contributions of intangible assets—affects firms' capital structure decisions would provide a more complete understanding of government influence on corporate financing.

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Tables and Figures

Table 1: Summary Statistics

Panel A: Firm-level Variables

Variable	Observations	Mean	SD	Median	Min.	Max.
State ownership	19,647,273	0.809	8.361	0	0	100
State-owned $\geq 20\%$	19,647,273	0.010	0.099	0	0	1
State-owned $\geq 50\%$	19,647,273	0.008	0.090	0	0	1
State-owned $\geq 99\%$	19,647,273	0.006	0.076	0	0	1
State-owned [1%; 20%)	19,647,273	0.004	0.067	0	0	1
State-owned [20%; 50%)	19,647,273	0.002	0.042	0	0	1
State-owned [50%; 99%)	19,647,273	0.002	0.048	0	0	1
Firm size	19,647,273	13.924	2.195	13.732	2.197	29.131
Profitability	19,647,273	0.091	0.195	0.074	-2	2
Tangibility	19,647,273	0.274	0.289	0.158	0	1
Non-debt tax shield	19,647,273	0.043	0.056	0.027	0	1
Firm leverage	19,647,273	0.186	0.249	0.072	0	2
Cost of debt	9,851,940	0.085	0.101	0.054	0.005	0.768

Panel B: Country-level Variables

Variable	Countries	Mean	SD	Median	Min.	Max.
State banks	87	0.152	0.196	0.056	0	1
Foreign banks	86	0.341	0.323	0.220	0	1
GDP per capita, PPP, log	87	10.049	0.868	10.224	7.729	11.655
Rule of law	86	0.576	0.931	0.590	-1.823	2.100
Control of corruption	86	0.538	1.023	0.356	-1.431	2.470
Resolving insolvency	84	0.564	0.204	0.552	0.000	0.939
Protecting minority investors	84	0.600	0.149	0.600	0.200	0.967

Panel C: Industry-level Variables

Variable	Industries	Mean	SD	Median	Min.	Max.
External finance dependence	73	0.036	0.314	0.010	-0.960	0.670
Liquidity needs	107	0.173	0.042	0.174	0.050	0.290
Tangibility, sector	403	0.257	0.188	0.207	0.000	0.855

Notes: This table provides summary statistics for all variables used in the analysis. Panels A, B and C summarize the main characteristics of firm-, country- and industry-level variables, respectively. Appendix Table A.1 contains all variable definitions and data sources.

Table 2: State Ownership and Firm Leverage

	Firm leverage				
	(1)	(2)	(3)	(4)	(5)
State-owned ≥ 1%	-0.048***				
	(0.001)				
State-owned ≥ 20%		-0.055***			
		(0.001)			
State-owned ≥ 50%			-0.060***		
			(0.001)		
State-owned ≥ 99%				-0.064***	
				(0.002)	
State control 1-20%					-0.030***
					(0.001)
State control 20-50%					-0.031***
					(0.002)
State control 50-99%					-0.047***
					(0.002)
State control >99%					-0.068***
					(0.002)
Total assets	0.011***	0.011***	0.011***	0.011***	0.011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	-0.125***	-0.126***	-0.125***	-0.125***	-0.125***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	0.184***	0.185***	0.185***	0.184***	0.185***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Non-debt tax shield	0.188***	0.187***	0.187***	0.186***	0.187***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Country×Sector×Year FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.214	0.214	0.214	0.214	0.214
N observations	19,647,109	19,647,109	19,647,109	19,647,109	19,647,109
N firms	3,976,424	3,976,424	3,976,424	3,976,424	3,976,424
N countries	89	89	89	89	89

Notes: This table reports OLS regressions where the dependent variable is firm leverage. Column 5 uses bins where the omitted baseline category is all firms with no or less than 1% state ownership. All regressions include interactive fixed effects (FE) at the country × two-digit NACE 2 sector × year level. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table 3: State Ownership and Firm Leverage: Firm-Size Heterogeneity

	Micro	Small	Medium	MSMEs	Large	Super-large	All firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State-owned $\geq$ 20%	-0.063***	-0.062***	-0.040***	-0.062***	-0.018***	-0.005	-0.052***	-0.007
	(0.002)	(0.003)	(0.003)	(0.001)	(0.003)	(0.009)	(0.001)	(0.008)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country×Sector×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.220	0.201	0.227	0.213	0.286	0.380	0.214	0.387
N observations	14M	3.5M	1.3M	18.8M	737,270	75,625	19.7M	19.7M
N firms	3.1M	582,095	198,609	3.9M	96,179	8,433	4.0M	4.0M
N countries	61	76	85	87	89	68	89	89

Notes: This table reports OLS regressions where the dependent variable is firm leverage. In columns 1-6, the sample includes firms of the specified size category only and observations are not weighted. The firm-size categories are: super-large (total assets above EUR 1 billion, large (total assets between EUR 1 billion and EUR 43 million), medium-sized (total assets between EUR 10 and 43 million), small (total assets between EUR 2 and 10 million) and micro (total assets below EUR 2 million). MSMEs is a combination of micro, small and medium-sized firms. A firm is classified by its size only once: in the year it first enters the data set. In columns 7 and 8, the sample includes all firms. In column 7, observations are weighted by log(total assets + 1) and in column 8 by total assets. Firm characteristics include firm size, tangibility, profitability and non-debt tax shield. All regressions include interactive fixed effects (FE) at the country × two-digit NACE 2 sector × year level. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table 4: State Ownership, Institutional Quality and Firm Leverage

	Firm leverage				
	(1)	(2)	(3)	(4)	(5)
State-owned ≥ 20%	-0.521***	-0.074***	-0.071***	-0.139***	-0.113***
	(0.021)	(0.001)	(0.001)	(0.004)	(0.006)
State-owned ≥ 20% × GDP per capita	0.045***				
	(0.002)				
State-owned ≥ 20% × Rule of law		0.023***			
		(0.001)			
State-owned ≥ 20% × Control of corruption			0.022***		
			(0.001)		
State-owned ≥ 20% × Resolving insolvency				0.120***	
				(0.006)	
State-owned ≥ 20% × Protecting investors					0.097***
					(0.010)
Firm characteristics	Yes	Yes	Yes	Yes	Yes
Country × Sector × Year FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.214	0.214	0.214	0.213	0.212
N observations	19.6M	19.5M	19.5M	19.2M	18.5M
N firms	4.0M	3.9M	3.9M	3.8M	3.7M
N countries	87	86	86	84	84

Notes: This table reports OLS regressions where the dependent variable is firm leverage. Firm characteristics include firm size, tangibility, profitability and non-debt tax shield. All regressions include interactive fixed effects (FE) at the country × two-digit NACE 2 sector × year level and these FE absorb the base effects of the institutional variables. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data

Table 5: State Ownership, Structure of the Banking Sector and Firm Leverage

	All firms	MSMEs	Large	Super-large
	(1)	(2)	(3)	(4)
State-owned $\geq$ 20%	-0.030***	-0.032***	-0.029***	0.010
	(0.003)	(0.003)	(0.008)	(0.018)
State-owned $\geq$ 20% $\times$ State banks	-0.022***	-0.088***	0.049***	-0.030
	(0.008)	(0.011)	(0.018)	(0.042)
State-owned $\geq$ 20% $\times$ Foreign banks	-0.087***	-0.084***	0.000	-0.015
	(0.004)	(0.005)	(0.016)	(0.047)
Firm characteristics	Yes	Yes	Yes	Yes
Country $\times$ Sector $\times$ Year FE	Yes	Yes	Yes	Yes
R-squared	0.208	0.207	0.288	0.373
N observations	13.1M	12.6M	517,548	47,825
N firms	3.7M	3.6M	90,533	7,798
N countries	85	84	85	66

Notes: This table reports OLS regressions where the dependent variable is firm leverage. In column 1, the sample includes all firms; in columns 2–4, the sample includes firms of the specified size category. The notes to Table 3 provide the definitions of these size categories. Firm characteristics include firm size, tangibility, profitability and non-debt tax shield. All regressions include interactive fixed effects (FE) at the country $\times$ two-digit NACE 2 sector $\times$ year level and these FE absorb the base effect of *State banks* and *Foreign banks*. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table 6: State ownership, Structure of the banking Sector and Firm Leverage in Regionally Large Firms

	All firms				MSMEs			
Regional size:	<75th percentile	≥75th percentile	<85th percentile	≥85th percentile	<75th percentile	≥75th percentile	<85th percentile	≥85th percentile
State-owned ≥ 20%	-0.031***	-0.049***	-0.034***	-0.039***	-0.030***	-0.050***	-0.034***	-0.041***
	(0.005)	(0.009)	(0.005)	(0.012)	(0.005)	(0.009)	(0.005)	(0.012)
State-owned ≥ 20%	-0.110***	0.122***	-0.089***	0.125***	-0.117***	0.099***	-0.095***	0.095***
× State banks	(0.019)	(0.026)	(0.017)	(0.034)	(0.019)	(0.028)	(0.018)	(0.036)
State-owned ≥ 20%	-0.083***	-0.107***	-0.085***	-0.123***	-0.083***	-0.101***	-0.084***	-0.114***
× Foreign banks	(0.008)	(0.013)	(0.008)	(0.016)	(0.008)	(0.013)	(0.008)	(0.017)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country × Sector × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.201	0.200	0.198	0.207	0.201	0.197	0.198	0.202
N observations	4.4M	1.3M	4.9M	742,267	4.4M	1.2M	4.9M	705,503
N firms	1.3M	301,421	1.5M	173,804	1.3M	293,896	1.4M	167,092
N countries	55	48	55	40	53	32	53	31

Notes: This table reports OLS regressions where the dependent variable is firm leverage. Percentiles refer to regional size distributions. Firm characteristics include firm size, tangibility, profitability and non-debt tax shield. All regressions include interactive fixed effects (FE) at the country × two-digit NACE 2 sector × year level and these FE absorb the base effect of *State banks* and *Foreign banks*. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table 7: State Ownership and the Cost of Debt

	All firms	MSMEs	Large	Super-large
	(1)	(2)	(3)	(4)
State-owned $\geq$ 20%	0.003***	0.003***	-0.008***	-0.007**
	(0.000)	(0.001)	(0.001)	(0.003)
Firm characteristics	Yes	Yes	Yes	Yes
Country $\times$ Sector $\times$ Year FE	Yes	Yes	Yes	Yes
R-squared	0.092	0.094	0.152	0.317
N observations	9.8M	9.3M	507,965	57,601
N firms	2.4M	2.4M	79,691	7,042
N countries	89	85	89	63

Notes: This table reports OLS regressions where the dependent variable is a firm's cost of debt. In column 1, the sample includes all firms while in columns 2–4, the sample includes firms of the specified size category. The notes to Table 3 provide the definitions of these size categories. Firm characteristics include firm size, tangibility, profitability and non-debt tax shield. All regressions include interactive fixed effects (FE) at the country $\times$ two-digit NACE 2 sector $\times$ year level. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table 8: State Ownership, Structure of the Banking Sector and the Cost of Debt

	All firms	MSMEs	Large	Super-large
	(1)	(2)	(3)	(4)
State-owned $\geq$ 20%	-0.005***	-0.004***	-0.014***	-0.009
	(0.001)	(0.001)	(0.002)	(0.007)
State-owned $\geq$ 20% $\times$ State banks	0.003	0.007*	0.009*	0.008
	(0.003)	(0.004)	(0.005)	(0.015)
State-owned $\geq$ 20% $\times$ Foreign banks	0.020***	0.021***	0.010*	0.007
	(0.002)	(0.003)	(0.006)	(0.013)
Firm characteristics	Yes	Yes	Yes	Yes
Country $\times$ Sector $\times$ Year FE	Yes	Yes	Yes	Yes
R-squared	0.079	0.081	0.132	0.288
N observations	7.0M	6.6M	355,887	35,874
N firms	2.2M	2.1M	73,250	6,455
N countries	85	81	85	61

Notes: This table reports OLS regressions where the dependent variable is a firm's cost of debt. In column 1, the sample includes all firms while in columns 2–4, the sample includes firms of the specified size category. The notes to Table 3 provide the definitions of these size categories. Firm characteristics include firm size, tangibility, profitability and non-debt tax shield. All regressions include interactive fixed effects (FE) at the country $\times$ two-digit NACE 2 sector $\times$ year level and these FE absorb the base effect of *State banks* and *Foreign banks*. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table 9: Privatization and Firm Leverage

	All firms (1)	MSMEs (2)	(Super)Large (3)
Pre-Privatization	-0.049***	-0.061***	-0.007
	(0.010)	(0.011)	(0.025)
Firm characteristics	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes
Sector × Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R-squared	0.678	0.640	0.877
N observations	8,020	6,221	1,297
N firms	939	743	166
N countries	29	22	21

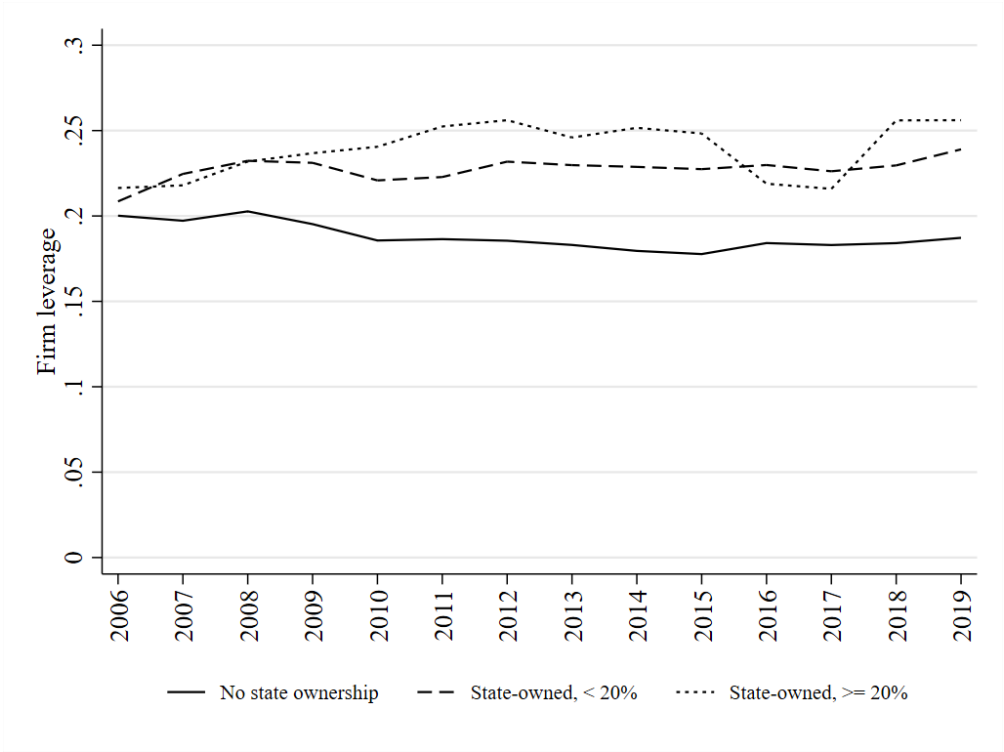
Notes: This table reports fixed effects panel data regressions where the dependent variable is firm leverage. The sample includes only firms that were privatized and for which we have data for at least three years before and three years after privatization. A privatization is a deal that was classified as "Acquisition" by Bureau van Dijk's Orbis Zephyr database (that is, the acquirer ended up with 50 percent or more of the target's equity). The year of privatization is excluded from the analysis. In column 1, the sample includes all eligible firms. In column 2, the sample includes micro, small and medium-sized firms. In column 3, the sample includes large and super-large firms. The notes to Table 3 provide the definitions of these size categories. The explanatory variable of interest—*Pre-privatization*—is a dummy that takes the value '1' in the years before privatization and '0' in the years afterwards. Firm characteristics include firm size, tangibility and productivity. All regressions include firm fixed effects (FE) as well as interactive FE at the country × year level and the two-digit NACE 2 sector × year level. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table 10: Privatization and Firm Leverage: Average Treatment Effect on the Treated (ATT)

Year	Treated	Control	Raw Diff.	ATT	ATT b.a.	Γ^*
T-5	373	334	-0.059***	0.001	-0.001	1.00
			(0.006)	(0.002)	(0.001)	
T-4	408	371	-0.051***	0.002	-0.002***	1.00
			(0.005)	(0.002)	(0.001)	
T-3	468	428	-0.051***	0.005***	0.002*	1.00
			(0.005)	(0.002)	(0.001)	
T-2	391	357	-0.046***	0.021***	0.018***	1.00
			(0.005)	(0.002)	(0.002)	
T-1	411	385	-0.042***	0.029***	0.026***	1.00
			(0.005)	(0.003)	(0.003)	
T	508	481	-0.015***	0.040***	0.038***	1.20
			(0.006)	(0.004)	(0.004)	
T+1	483	449	0.015**	0.069***	0.066***	1.60
			(0.006)	(0.005)	(0.005)	
T+2	451	417	0.023***	0.066***	0.064***	1.60
			(0.007)	(0.006)	(0.006)	
T+3	369	337	0.016**	0.076***	0.074***	1.75
			(0.007)	(0.006)	(0.006)	
T+4	316	287	0.023***	0.059***	0.058***	1.40
			(0.008)	(0.005)	(0.005)	
T+5	278	255	0.029***	0.064***	0.067***	1.20
			(0.009)	(0.006)	(0.006)	

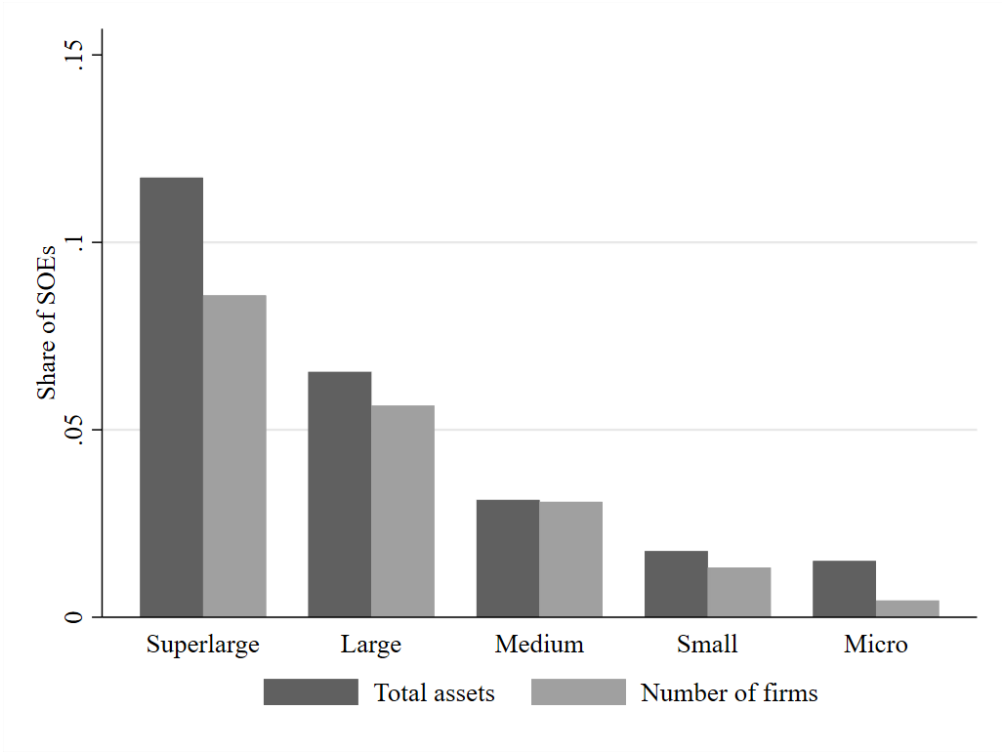
Notes: Standard errors are reported in parentheses. A privatization is a deal that was classified as "Acquisition" by Bureau van Dijk's Orbis Zephyr database (that is, the acquirer ended up with 50 percent or more of the equity of the target). Year T denotes the year of privatization. Years T-5 through T-1 denote the years before privatization while years T+1 through T+5 denote the years after privatization. The matched sample is obtained by genetic Mahalanobis distance matching (with one nearest neighbor) on firm size, tangibility, productivity, the ratio of total formal debt to total assets, and the ratio of total informal debt to total assets, averaged over years T-3, T-4, and T-5. We also force exact matching on country, two-digit NACE Rev. 2 industry and year. In the matched sample, *Treated* is the number of matched treated observations; *Control* is the number of matched controls. The dependent variable is firm leverage. *Raw Diff.* are raw differences based on simple dummy variable regressions on the whole sample. *ATT* and *ATT b.a.* are estimates of the average treatment effect on the treated (ATT) excluding and including a bias-adjustment term, respectively (Abadie and Imbens, 2011). In both cases, standard errors are computed following Abadie and Imbens (2006). Γ^* is the minimum value of parameter $\Gamma \geq 1$, selected from a grid spaced by intervals of 0.05 length, such that in a sensitivity analysis à la Rosenbaum (2002) the Wilcoxon signed-rank tests associated with Γ^* do not simultaneously reject the null hypothesis that the outcome variable is not different across the treated and control samples, for tests with $\alpha = .05$ type I error. Appendix Table A.1 contains all variable definitions and data sources.

Figure 1: State Ownership and Firm Leverage over Time



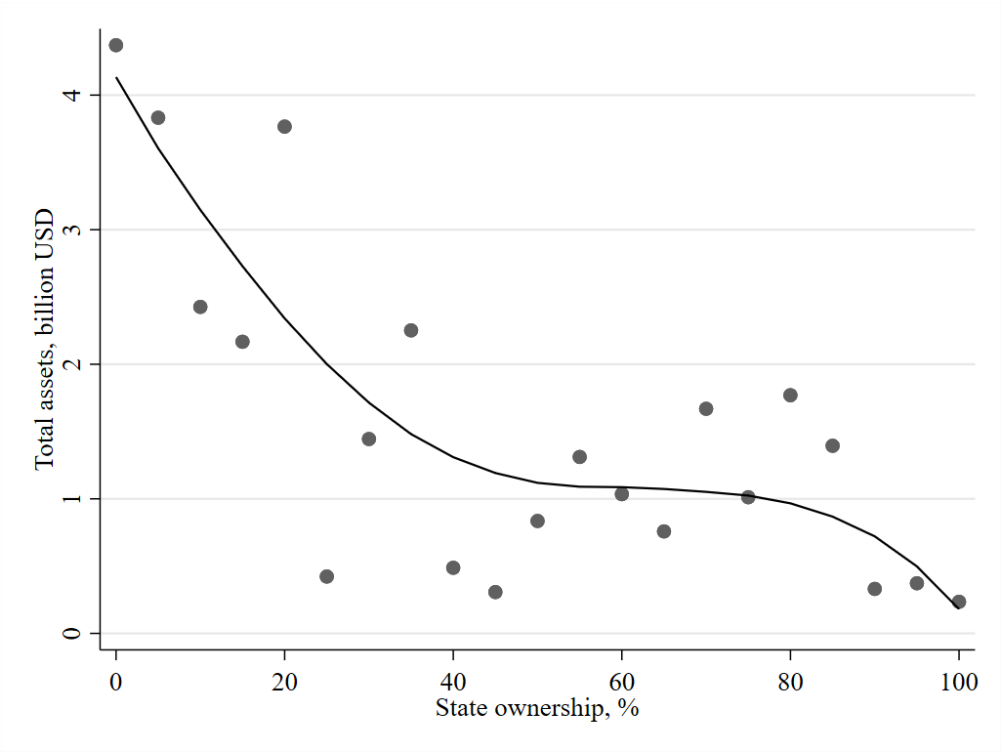
Notes: This figure shows the development of average firm leverage in a balanced sample of approximately 23K firms across 80 countries for which data are available for each year during the period 2006–2019. The solid line indicates firms without any state ownership. The dashed line indicates firms with strictly positive state ownership below 20 percent. The dotted line indicates firms with state ownership of 20 percent or more. Appendix Table A.1 contains all variable definitions and data sources.

Figure 2: Share of State-Owned Enterprises among All Enterprises, by Firm Size



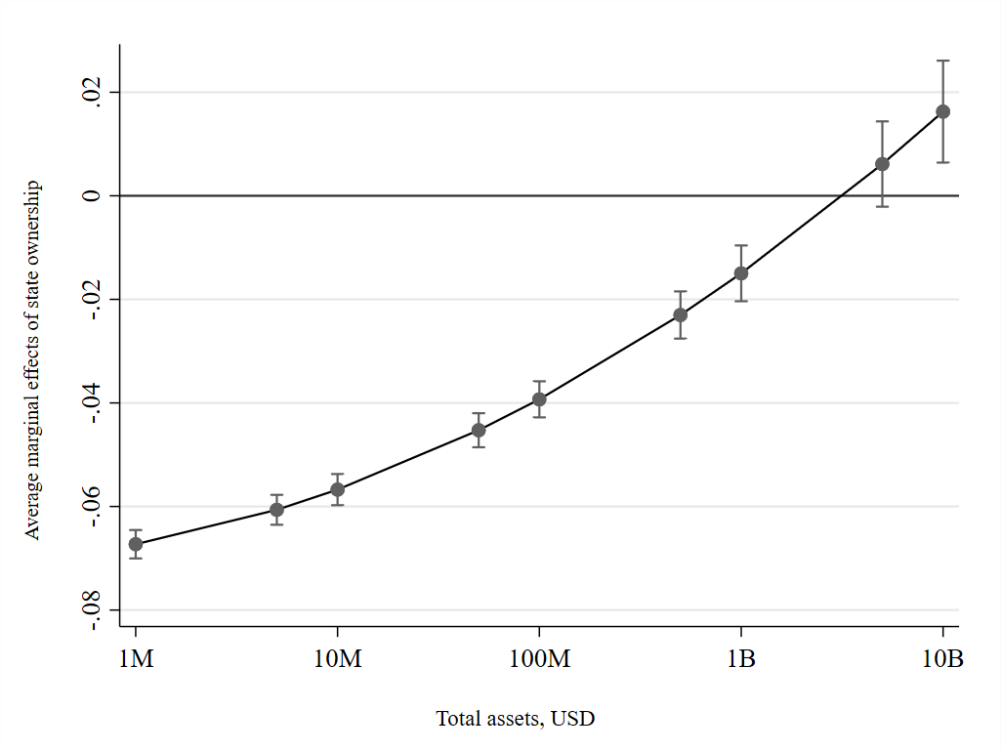
Notes: This figure reports the share of state-owned enterprises (SOEs) within each of five firm size categories: super-large (total assets above EUR 1 billion), large (total assets between EUR 1 billion and EUR 43 million), medium (total assets between EUR 10 and EUR 43 million), small (total assets between EUR 2 and 10 million) and micro (total assets below EUR 2 million). A firm is classified by its size only once: in the year it first enters the dataset. Reported shares are averages over the years 2011–2019. SOEs are defined as firms with at least 20 percent state ownership. Appendix Table A.1 contains all variable definitions and data sources.

Figure 3: Variation in State Ownership and Firm Size



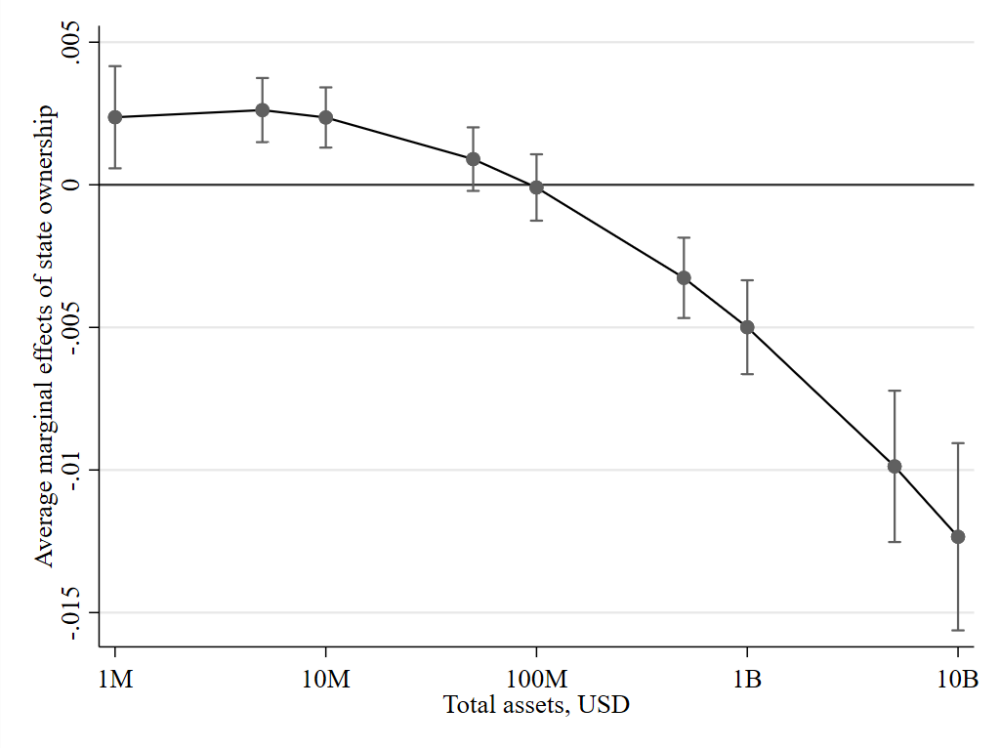
Notes: This figure reports simple means of total firm assets by the level of state ownership. On the horizontal axis, firms are grouped into bins with a 5 percentage point width (e.g. from 0 to 5 percent, from 5 to 10 percent, etc.) in terms of the share of state ownership. Firms without state ownership are excluded from the sample while firms with 100 percent state ownership are assigned to a separate bin. The line is a LOESS curve with 80 percent bandwidth. Appendix Table A.1 contains all variable definitions and data sources.

Figure 4: Marginal Effects of State Ownership on Firm Leverage, by Firm Size



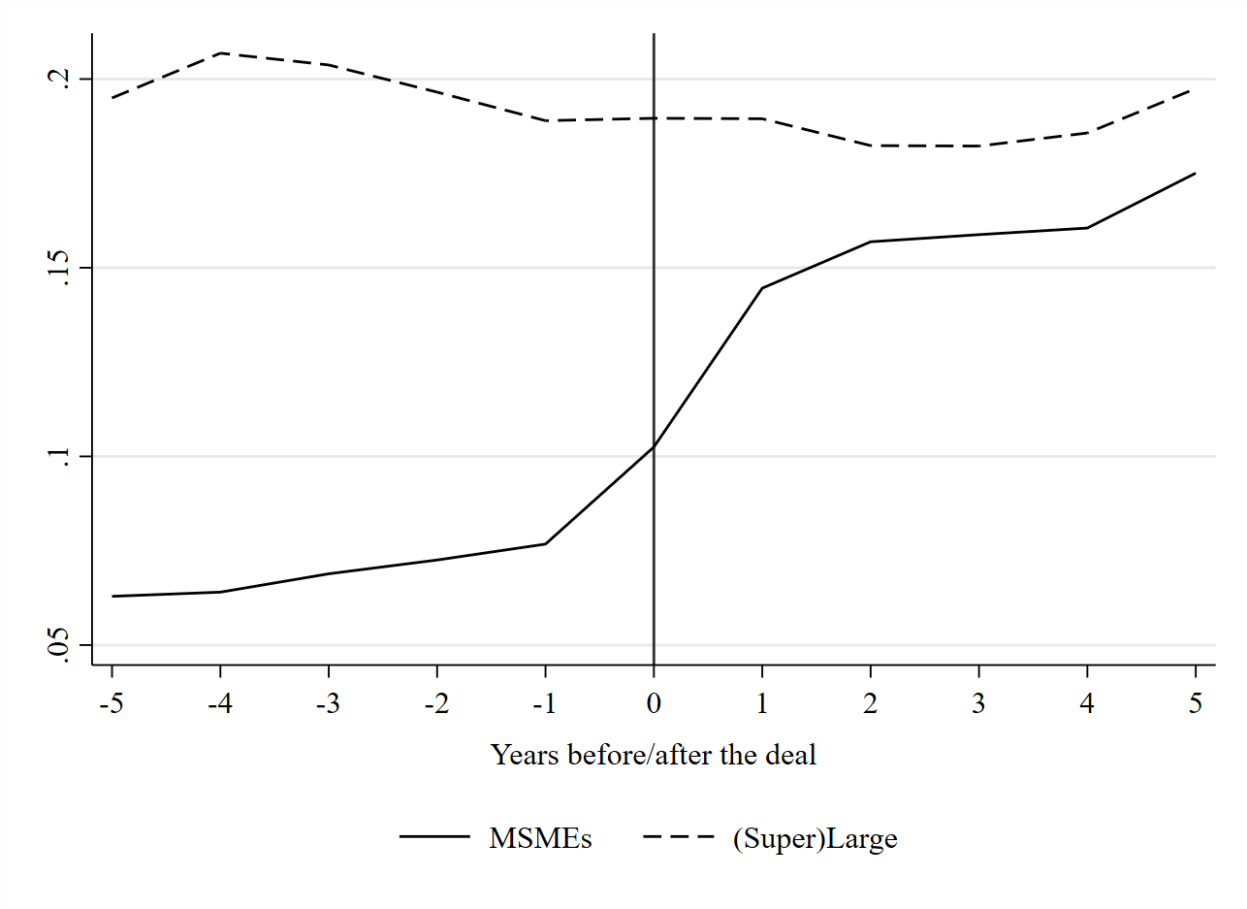
Notes: This figure reports average marginal effects of state ownership on firm leverage with 95 percent confidence intervals. The analysis is based on the regressions reported in Table 2, column 2, with the state-owned dummy interacted with the log of total assets and the squared log of total assets. Appendix Table A.1 contains all variable definitions and data sources.

Figure 5: Marginal Effects of State Ownership on the Cost of Debt, by Firm Size



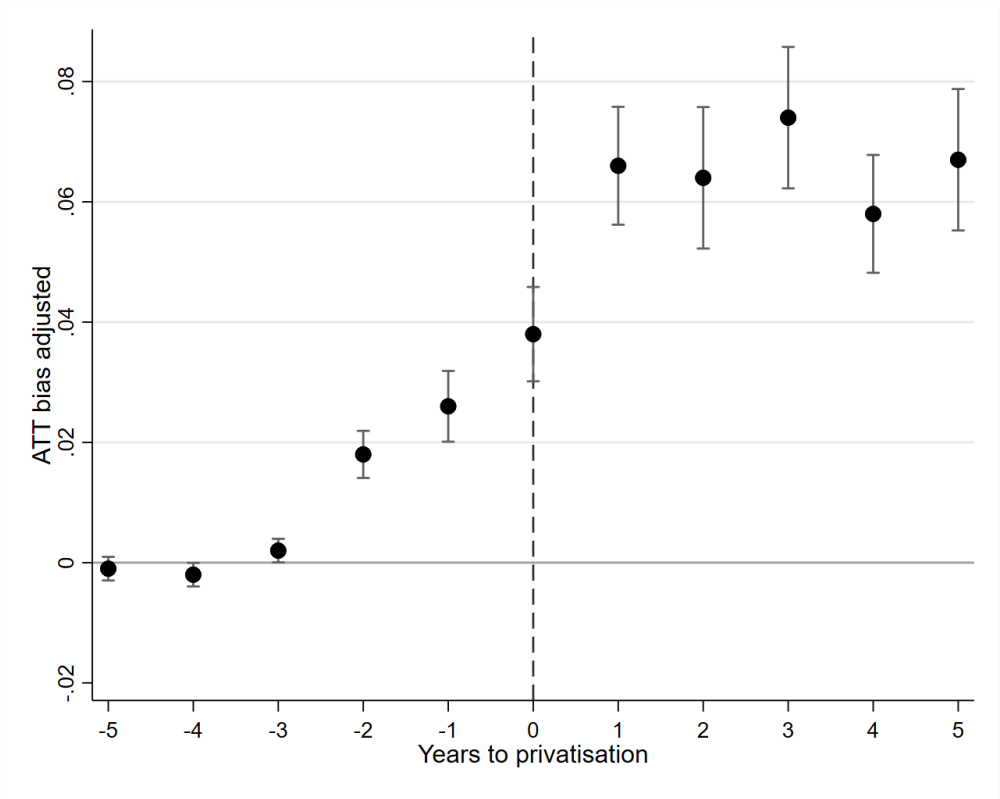
Notes: This figure reports average marginal effects of state ownership on cost of debt with 95 percent confidence intervals. The analysis is based on the regressions reported in column 1 of Table 7 with the state-owned dummy interacted with the log of total assets and the squared log of total assets. Appendix Table A.1 contains all variable definitions and data sources.

Figure 6: Firm Leverage Before and After Privatization



Notes: This figure reports average firm leverage before and after privatization. The sample includes only firms that were privatized and for which data are available for at least three years before and three years after privatization. A privatization is a deal that was classified as "Acquisition" by Bureau van Dijk's Orbis Zephyr database (that is, the acquirer ended up with 50 percent or more of the target's equity). Year 0 denotes the year of privatization. Years -5 through -1 are the years before privatization while the years 1 through 5 are the years after privatization. The solid line shows average firm leverage for micro, small and medium-sized enterprises (MSMEs), and the dashed line shows average firm leverage for large and super-large enterprises. The notes to Table 3 provide the definitions of these size categories. Appendix Table A.1 contains all variable definitions and data sources.

Figure 7: Privatization and Firm leverage: Event Study



Notes: This figure provides a graphic representation of the ATT analysis presented in Table 10. The dots correspond to annual ATT estimates including a bias-adjustment term. The whiskers represent 95 percent confidence intervals.

Appendices

Table A.1: Variable Definitions and Data Sources

Variable	Definition	Source
State ownership	Cumulative percentage of company voting shares (in)directly controlled by the state, governmental agencies, governmental departments, or local authorities.	BvD Orbis
State-owned $\geq$ X%	Dummy that is 1 if state ownership is above or equal to X%, and 0 otherwise.	*Id.*
State-owned [X%; Y%)	Dummy that is 1 if state ownership is above or equal to X% and below Y%, and 0 otherwise.	*Id.*
Firm size	Total assets (log).	*Id.*
Profitability	Earnings before interest, taxes, depreciation, and amortization (EBITDA) to total assets.	*Id.*
Productivity	Operating revenue to total assets.	*Id.*
Tangibility (firm-level)	Tangible fixed assets to total assets.	*Id.*
Non-debt tax shield	Depreciation and amortization to total assets.	*Id.*
Firm leverage	Total formal debt (loans from banks and outstanding bonds) to total assets.	*Id.*
Cost of debt	Total interest expenses to total formal debt (trimmed at the 5th and 95th percentiles).	*Id.*

State banks	Share of bank assets held by domestic state banks (50 percent or more state-owned).	Bank Regulation and Supervision Survey. Chinese data: Berger et al. (2009)
Foreign banks	Share of bank assets held by foreign banks (50 percent or more foreign-owned).	Global Financial Development Database
GDP per capita	Log of GDP per capita based on purchasing power parity (PPP) and constant 2017 dollars.	World Development Indicators
Polity 2 score	Index providing a single regime score that ranges from +10 (full democracy) to -10 (full autocracy). Year coverage is 2000 through 2018.	Polity V database
Rule of law	Index capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police and the courts, as well as the likelihood of crime and violence. The index is expressed in units of a standard normal distribution, with mean zero, standard deviation of one, and runs from approximately -2.5 to 2.5. Higher values indicate a stronger rule of law.	World Governance Indicators

Control of corruption	Index capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture" of the state by elites and private interests. The index is expressed in units of a standard normal distribution, with mean zero, standard deviation of one, and runs from approximately -2.5 to 2.5. Higher values correspond to better control of corruption (i.e. lower corruption).	*Id.*
Resolving insolvency	Index measuring the gap between an economy's performance and the regulatory best practice on the Resolving Insolvency Indicator components. The score ranges from 0 to 100, where 0 represents the worst regulatory performance and 100 the best.	World Bank Doing Business
Protecting minority investors	Index measuring the gap between an economy's performance and the regulatory best practice on the Protecting Minority Investors Indicator components. The score ranges from 0 to 100, where 0 represents the worst regulatory performance and 100 the best.	*Id.*
External finance dependence	Industry-level median proportion of capital expenditures not financed with cash flow from operations. Positive values mean firms must issue debt or equity to finance investments. Negative values mean firms have cash flow exceeding their investments. Calculated using data from companies in Compustat for at least 10 years between 1980 and 1996. Industry is defined at the two-digit level.	Duygan-Bump et al. (2015)

Liquidity needs	Industry-level median ratio of inventories over annual sales. Calculated based on data from all manufacturing companies in Compustat during 1980–1989. Industry is defined at the four-digit level.	Raddatz (2006)
Tangibility (sector-level)	Industry-level median ratio of tangible fixed assets to total assets. Calculated based on data from all available US companies in Bureau van Dijk's Orbis during 2000–2019. Industry is defined at the four-digit level.	BvD Orbis

Table A.2: State Ownership and Share of Listed Firms

	Share of listed firm-years	Number of firm-years
No state control	0.02	19,365,346
State-owned [1%; 20%)	0.76	88,227
State-owned [20%; 50%)	0.21	34,602
State-owned [50%; 99%)	0.08	45,371
State-owned [99%; 100%]	0.00	113,727

Notes: Table showing the share of listed firm years and number of firm-years by ownership category.

Table A.3: Firm-years by State Ownership, Size and Listed

	Share of firm-years	Number of firm-years
Private-owned 100%	0.983	19,315,078
State-owned $\geq$ 1%	0.014	281,927
State-owned $\geq$ 20%	0.010	193,700
State-owned $\geq$ 50%	0.008	159,098
State-owned $\geq$ 99%	0.006	113,727
State-owned [1%; 20%)	0.004	88,227
State-owned [20%; 50%)	0.002	34,602
State-owned [50%; 99%)	0.002	45,371
Micro	0.711	13,966,423
Small	0.178	3,504,938
Medium	0.069	1,348,674
Large	0.038	743,989
Super Large	0.004	83,249
Listed	0.021	406,212

Notes: Table showing the share and number of firm-years by state ownership categories, size categories as defined in Table 3.

Table A.4: State Ownership and Firm Leverage: Alternative clustering

	Country-level clustering					Ownership-level clustering				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
State-owned ≥ 1%	-0.048***					-0.048***				
	(0.008)					(0.006)				
State-owned ≥ 20%		-0.055***					-0.055***			
		(0.010)					(0.010)			
State-owned ≥ 50%			-0.060***					-0.060***		
			(0.011)					(0.010)		
State-owned ≥ 99%				-0.064***					-0.064***	
				(0.012)					(0.011)	
State-owned [1%; 20%)					-0.030**					-0.030***
					(0.013)					(0.001)
State-owned [20%; 50%)					-0.031***					-0.031***
					(0.009)					(0.010)
State-owned [50%; 99%)					-0.047***					-0.047***
					(0.011)					(0.011)
State-owned [99%; 100%]					-0.067***					-0.067***
					(0.012)					(0.011)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country×Sector×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
N observations	19.7M	19.7M	19.7M	19.7M	19.7M	19.7M	19.7M	19.7M	19.7M	19.7M
N firms	4.0M	4.0M	4.0M	4.0M	4.0M	4.0M	4.0M	4.0M	4.0M	4.0M
N countries	89	89	89	89	89	89	89	89	89	89

Notes: Notes: This table reports OLS regressions where the dependent variable is firm leverage. Columns 5 and 10 use bins where the omitted baseline category is all firms with no or less than 1% state ownership. All regressions include interactive fixed effects (FE) at the country × two-digit NACE 2 sector × year level. In columns 1-5, standard errors are clustered at the country level. In columns 6-10, standard errors are clustered at the owner level so that all state-controlled firms in one country belong to one owner while private firms belong to individual owners. Appendix Table A.1 contains all variable definitions and data sources.

Table A.5: State Ownership and Firm Leverage: Largest Public Firms

	All years: 2000–2019			Pre-GFC: 2000–2008			Post-GFC: 2009–2019		
	Top100	Top300	Top500	Top100	Top300	Top500	Top100	Top300	Top500
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State-owned $\geq$ 20%	0.064	0.021	0.011	0.116**	0.043	0.022	0.010	0.016	0.007
	(0.058)	(0.037)	(0.024)	(0.051)	(0.058)	(0.038)	(0.055)	(0.036)	(0.024)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country×Sector×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.710	0.627	0.599	0.750	0.643	0.589	0.733	0.611	0.599
N observations	889	3,690	6,663	391	1,624	3,019	498	2,066	3,644
N firms	219	843	1,619	180	738	1,403	91	314	575
N countries	15	34	39	13	33	37	10	17	25

Notes: This table reports OLS regressions where the dependent variable is firm leverage. In each column, the sample includes the N largest listed firms within the specified period, where N = {100, 300, 500}. Firm characteristics include firm size, tangibility, profitability and the non-debt tax shield. All regressions include interactive fixed effects (FE) at the country × two-digit NACE 2 sector × year level. Columns 1–3 report regressions for the period 2000–2019. Columns 4–6 report regressions for the period 2000–2008 (before the global financial crisis). Columns 7–9 report regressions for the period 2009–2019 (during and after the global financial crisis). Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table A.6: State Ownership and Firm Leverage: Cross-Industry Heterogeneity

	Firm leverage		
	(1)	(2)	(3)
State-owned $\geq$ 20%	-0.060***	-0.071***	-0.059***
	(0.001)	(0.021)	(0.002)
State-owned $\geq$ 20% $\times$ EFD	0.035***		
	(0.005)		
State-owned $\geq$ 20% $\times$ Liquidity needs		0.161	
		(0.119)	
State-owned $\geq$ 20% $\times$ Tangibility			0.037***
			(0.006)
Firm characteristics	Yes	Yes	Yes
Country $\times$ Sector $\times$ Year FE	Yes	Yes	Yes
R-squared	0.214	0.226	0.234
N observations	19.1M	1.6M	16.0M
N firms	3.9M	284,185	3.3M
N countries	89	76	89

Notes: This table reports OLS regressions where the dependent variable is firm leverage. In columns 1 and 3 the sample includes all available firms. In column 2, the sample includes manufacturing firms only. The regressions include interactive fixed effects (FE) at the country $\times$ two-digit NACE 2 sector $\times$ year level in column 1 and country $\times$ four-digit NACE 2 sector $\times$ year level in columns 2 and 3. The levels for *External finance dependence* (column 1), *Liquidity needs* (column 2) and sector-level *Tangibility* (column 3) are absorbed by these fixed effects. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table A.7: State Ownership, Bank Ownership and Firm Leverage: Sample-Split Regressions

			State bank share		
			<= 10%	(10%; 50%]	>50%
Foreign bank share	<= 10%	Coefficient	-0.049***	-0.031***	-0.012*
		SE	(0.003)	(0.004)	(0.007)
		N observations	5.8M	419,985	55,761
		N firms	1.8M	167,669	15,885
		N countries	20	17	6
	(10%; 50%]	Coefficient	-0.037***	-0.067***	-0.109***
		SE	(0.004)	(0.003)	(0.007)
		N observations	2.1M	2.1M	57,356
		N firms	717,005	706,777	27,198
		N countries	24	34	5
	>50%	Coefficient	-0.083***	-0.104***	
		SE	(0.003)	(0.002)	
		N observations	1.9M	679,248	
		N firms	616,062	22,6874	
		N countries	24	11	

Notes: This table summarizes the results of OLS regressions where the dependent variable is firm leverage. Each cell reports the results of a separate regression ran on a different sample of countries. The vertical and horizontal axis legends indicate the percentage of all banking assets owned by state banks (horizontal axis) and by foreign banks (vertical axis) in the countries of that cell. Firm characteristics include the log of total assets, tangibility, profitability and non-debt tax shield. All regressions include interactive fixed effects (FE) at the country × two-digit NACE 2 sector × year level. Standard errors are clustered at the firm level. Appendix Table A.1 contains all variable definitions and data sources.

Table A.8: Privatization and Firm Leverage: Covariate Balance

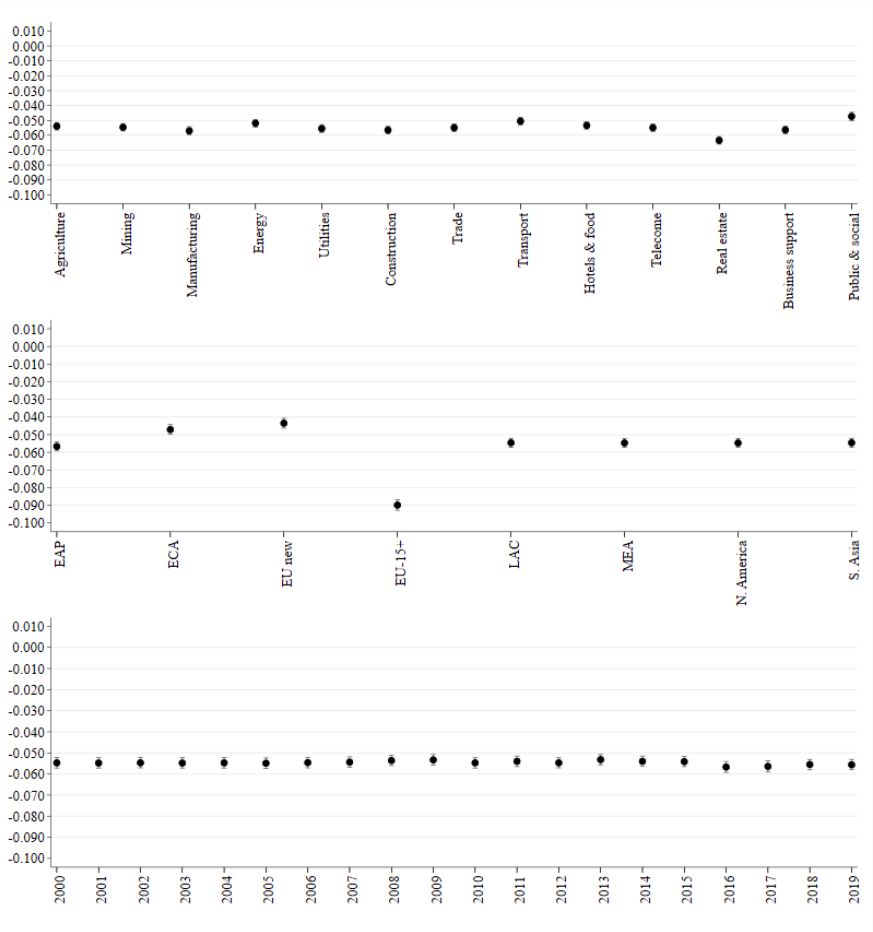
	Standardized bias		Variance ratio	
	Raw	Matched	Raw	Matched
Firm size	-6.189	-0.752	1.163	1.204
Productivity	7.580	2.060	0.575	1.044
Tangibility	-20.705	-0.442	0.674	1.086
Total formal debt / Total assets	-29.716	2.466	0.578	1.144
Total informal debt / Total assets	-14.957	2.937	0.721	1.119

Notes: For each variable in the first column, this table reports the difference in the variance-standardized mean (the standardized bias in percentage points) and the variance ratio between treated and control observations, for both the raw and the matched sample. The matched sample is obtained by genetic Mahalanobis matching on the variables reported above, forcing exact matching on the three categorical variables included in our list of covariates (see the notes to Table 10).

Figure A.1: Contribution of Firm Size Categories

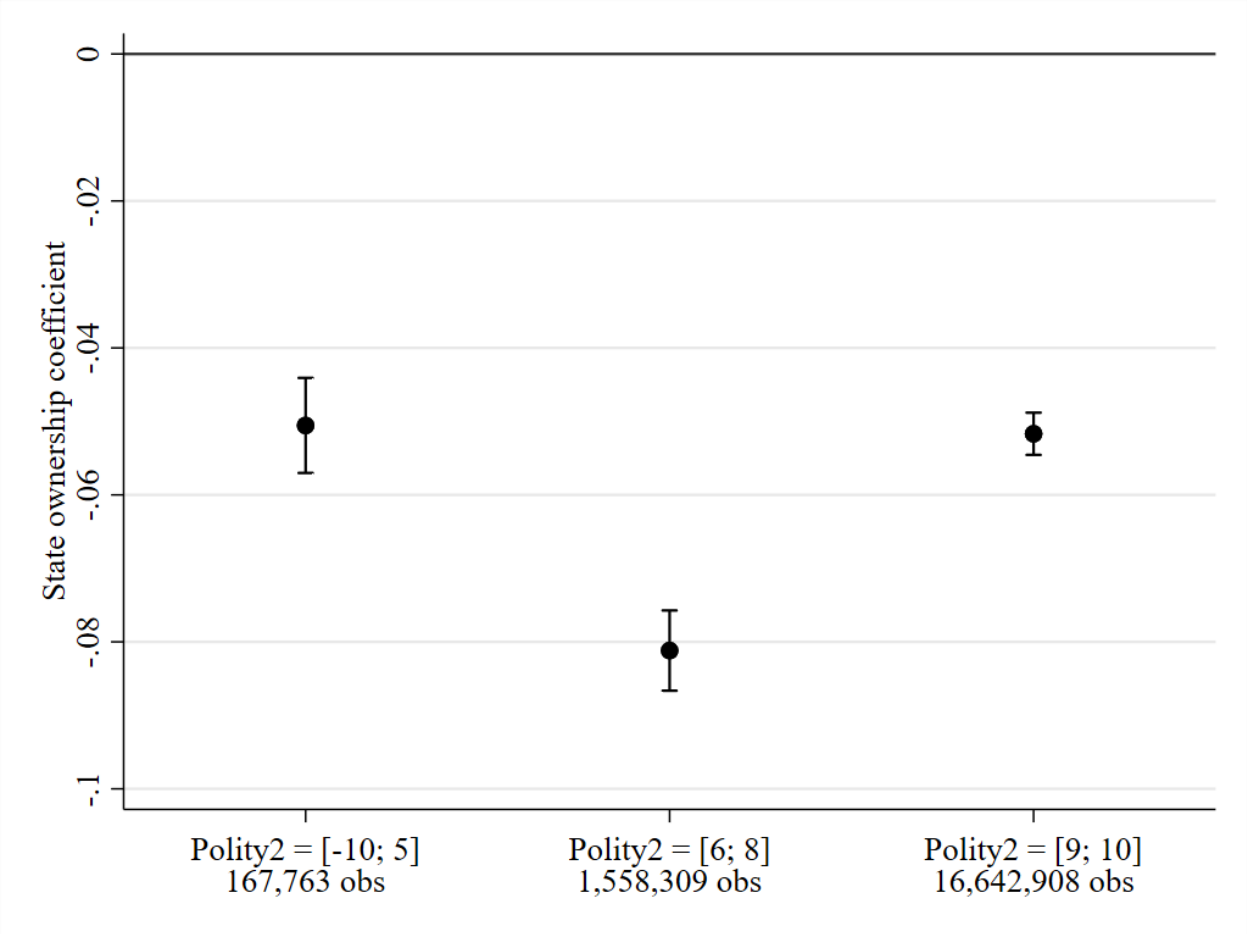
Notes: This figure reports the relative shares that each firm size category accounts for in the distribution of firms, employment, and total assets. Categories are given by super-large (total assets above EUR 1 billion), large (total assets between EUR 1 billion and EUR 43 million), medium (total assets between EUR 10 and EUR 43 million), small (total assets between EUR 2 and 10 million) and micro (total assets below EUR 2 million). A firm is classified by its size only once: in the year it first enters the dataset. Reported shares are averages over the years 2000–2017. Appendix Table A.1 contains all variable definitions and data sources.

Figure A.2: State Ownership and Firm Leverage: Excluding One Industry/Region/Year at a Time



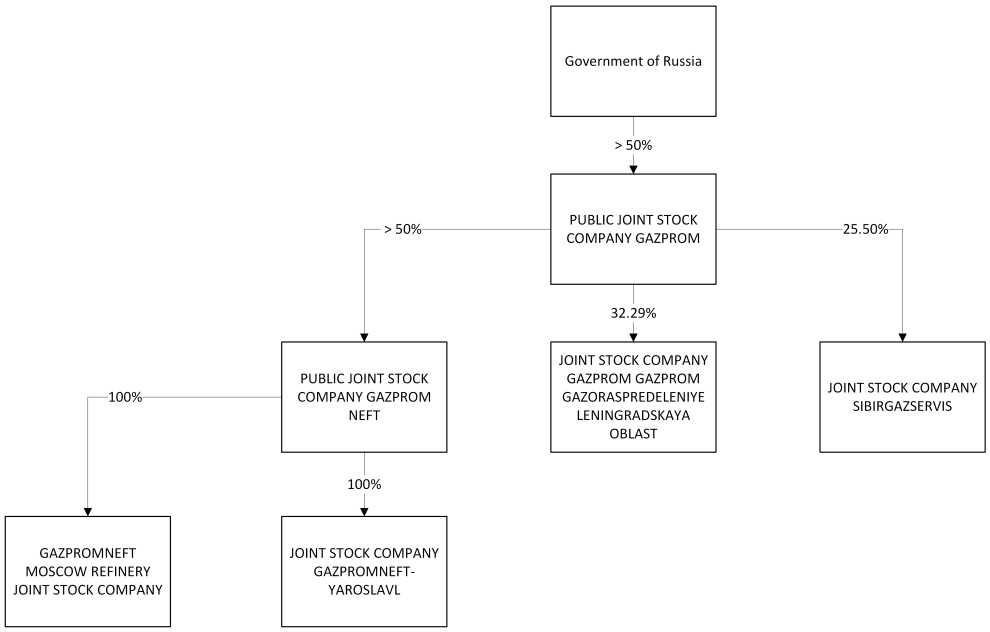
Notes: This figure reports coefficients for the variable "State-owned $\geq$ 20%" when re-running the regression reported in Table 2, column 2, while excluding one NACE Rev. 2 industry, geographic region or year at a time, with the 95 percent confidence interval. The industries 'Agriculture', 'Mining', 'Manufacturing', 'Energy', 'Utilities', 'Construction', 'Trade', 'Transport', 'Hotels & food', 'Telecom', 'Real estate', and 'Business support' correspond to NACE Rev. 2 sections A, B, C, D, E, F, G, H, I, J, L, and M, respectively. Industry 'Public & social' corresponds to aggregated NACE Rev. 2 sections N to U. Regions 'EAP', 'EAC', 'LAC', 'N. America' and 'S. Asia' correspond, respectively, to East Asia and Pacific, Europe and Central Asia (excluding countries grouped in 'EU15+' and 'EU new'), Latin America & the Caribbean, North America, and South Asia as defined by the World Bank country classification by region. The region 'MEA' is a combination of Middle East & North Africa and Sub-Saharan Africa. Region 'EU15+' includes the 15 member countries of the European Union prior to the accession of 10 candidate countries on 1 May 2004 as well as Gibraltar, Iceland, Liechtenstein, Norway and Switzerland. The region 'EU new' includes the 13 countries that have joined the EU since 1 May 2004.

Figure A.3: State Ownership, Democracy and Firm Leverage



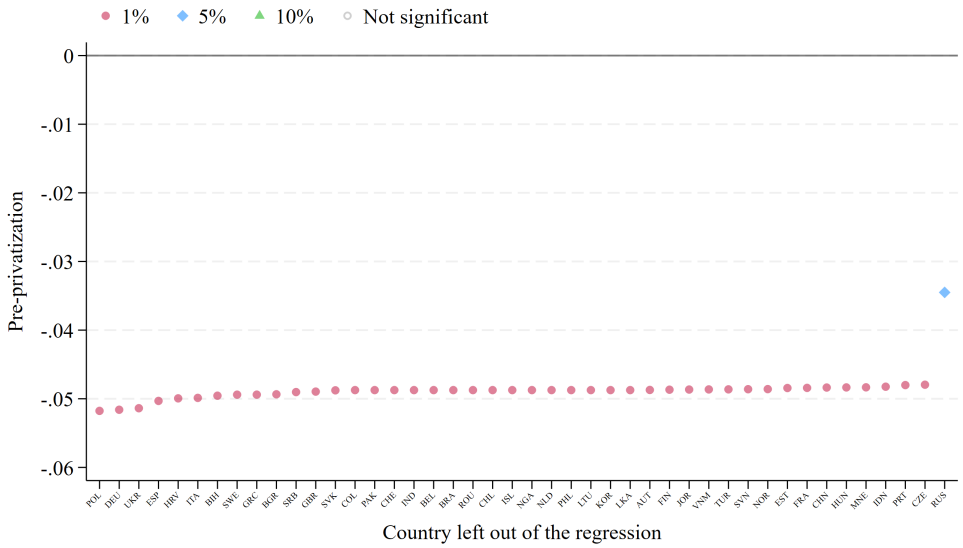
Notes: This figure plots coefficients for the variable "State-owned $\geq$ 20%" when we re-run our basic specification reported in Table 2, column 2, while splitting the sample into three parts by Polity 2 score. The first sub-sample includes all observations from countries where the Polity 2 score is between -10 and 5 in a given year. The second sub-sample includes all observations from countries where the Polity 2 score is between 6 and 8 in a given year. The third sub-sample includes all observations from countries where the Polity 2 score is between 9 and 10 in a given year. The second line of the horizontal axis labels reports the number of observations in these three sub-samples. Vertical bars denote the 95 percent confidence interval. Appendix Table A.1 contains all variable definitions and data sources.

Figure A.4: Stylized ownership example – Russia's Gazprom



Notes: This figure shows the iterative process through which we consistently identify government ownership in firms with several ownership layers.

Figure A.5: Privatization and firm leverage: Leave-one-country-out regressions



Notes: Plot shows *Pre-privatization* coefficients from fixed effects panel regressions of firm leverage, using leave-one-country-out analysis. Sample includes only firms with ≥3 years of data pre/post privatization (defined as acquisitions resulting in ≥50% equity ownership per Orbis Zephyr). Each marker represents the coefficient when excluding the country shown on the x-axis. Controls include firm size, tangibility, productivity, firm FE, country×year FE, and NACE-2-sector×year FE. Privatization year excluded. Standard errors clustered by firm.