State Ownership and Firm-level Performance[*]

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Abstract

State-owned enterprises (SOEs) remain widespread in various countries even after decades of privatization and liberalization reforms. In this paper we analyze a large dataset of listed SOEs, both majority- and minority-owned, covering several countries and industries between 1997 and 2012. We compare these SOEs to a sample of private firms using matching methods combined with differences-in-differences estimation to control for the endogenous choice of state ownership. In line with arguments proposing an inherent "liability of stateness," we find that SOEs exhibit significant performance gaps—i.e., they underperform private firms with similar characteristics based on indicators of profitability and efficiency—especially when these firms are subject to external changes that require rapid adjustment or that increase the temptation of the government to intervene (namely, economic recessions and election years). However, these negative effects are relatively less relevant in the case of minority SOEs. Furthermore, adopting novel techniques to gauge heterogeneous treatment effects, we find some evidence of negative selection in the choice of state ownership: firms more likely selected as SOEs tend to have a larger performance gap around recessions, compared to private firms. Although the effect of elections seems to disappear in developed economies, majority-owned SOEs in those economies still exhibit significant performance gaps around events of strong economic downturn.

Key words

State ownership, performance, agency, state capitalism

INTRODUCTION

An impressive body of scholarly work has studied the liabilities of state ownership over the last few decades. The usual conclusion is that state-owned enterprises (SOEs) tend to be less efficient and profitable than privately-owned firms due to several factors. Based on agency logic, scholars have pointed out that managers of SOEs are poorly monitored and lack the high-powered incentives normally found in private firms (Boardman & Vining, 1989; Dharwadkar, George, & Brandes, 2000; La Porta & López-de-Silanes, 1999). SOEs also tend to pursue objectives other than efficiency and profitability (Bai & Xu, 2005; Shirley & Nellis, 1991). For instance, governments may require SOEs to keep prices low or avoid layoffs even in moments of economic downturn. In addition, many SOEs can be used as vehicles of patronage and corruption. For instance, politicians and their allies may be tempted to divert resources from SOEs to support their pet projects or directly benefit their constituencies (Boycko, Shleifer, & Vishny, 1996; Shleifer & Vishny, 1998; Vickers & Yarrow, 1988). Consistent with these predictions, empirical research examining firm-level effects of privatization reforms have, in general, detected performance improvements after the transition from state to private ownership (see for a review Chong & Lopez-de-Silanes, 2005; Megginson, 2005).

Given these potential liabilities of state ownership, it is surprising that in more recent years we still see a pervasive presence of SOEs throughout the world and in a broad range of industries (Wooldridge, 2012). In 2013, among the top-100 *Fortune 500* companies, 25 were state-owned multinational firms, directly owned by the state or indirectly through several state-related investment vehicles. Nine out of the 15 largest IPOs in the world between 2005 and 2012 involved SOEs selling minority positions to private investors (Musacchio & Lazzarini, 2014). And this phenomenon is not simply due to the rise of interventionist emerging economies such as

China or Russia; there is vast evidence that SOEs remain important even in developed countries. A recent survey of OECD countries, for instance, found that SOEs represented a total equity value of US$ 1.4 trillion in 2011, of which 61% involved firms with *minority* stakes—that is, firms with private management and partial state ownership (Christiansen, 2011). In this new scenario, there is also evidence that investors have not shied away from SOEs. A report by Morgan Stanley in May 2012 claimed that several SOEs have outperformed their industry peers in emerging markets, despite the fact that they may be "targeting development objectives rather than shareholder returns" (Morgan Stanley, 2012: 1). All in all, these facts raise an important question: why do SOEs remain resilient as top global corporations and potential investment targets if they have intrinsic sources of performance disadvantage? Are these firms better managed and governed than the old SOEs of the past?

To shed light on these questions, in this paper we examine firm-level performance differences between SOEs and private firms based on a cross-industry, cross-country sample of 482 large listed SOEs observed between 1997 and 2012. Of those firms, 283 have minority state ownership—a form of governmental participation that has been relatively understudied. These SOEs are then compared to a group of 422 listed private firms. We adopt matching techniques (Abadie, Drukker, Herr, & Imbens, 2004; Abadie & Imbens, 2011) to guarantee comparability between the observed SOEs and private firms based on key observable traits such as firm-level "fundamentals" (such as size and capital intensity), industry-level characteristics, and country-level conditions (chiefly, the extent of economic and institutional development). Comparability is crucial in our context because many SOEs operate in particular settings, such as regulated industries, and tend to be relatively more capital intensive than private firms. We also benefit from exogenous changes in the local environment to more precisely identify the effect of state

ownership and remove the effect of fixed, unobservable firm-level factors (Heckman, Ichimura, & Todd, 1997). Namely, we use differences-in-differences estimation to compare changes in performance among SOEs and private firms before and after elections or economic recessions, which require rapid organizational adjustment and tend to increase local governments' temptation to intervene for political gain (Dinç, 2005; Moita & Paiva, 2013).

We also contribute with an assessment of the *selection* process of SOEs—that is, which factors explain why a certain firm is observed with state ownership—and how selection affects the differential performance between SOEs and private firms. Here we have two distinct views. A strand in the literature argues that, over time, SOEs were reformed with improved governance practices and checks-and-balances against governmental intervention (Gupta, 2005; Pargendler, 2012). In this case, we should see a process of *positive* selection: over time, firms more likely to be observed as SOEs will exhibit lower performance gaps when matched to comparable private firms. Yet, there is a second possibility: existing SOEs may have remained under state influence because governments are still tempted to use them as mechanisms to pursue political objectives (Bower, Leonard, & Paine, 2011; Bremmer, 2010). In this case, there will be *negative* selection: firms more likely observed as SOEs will have higher performance gaps when compared to private firms with similar traits. These predictions are examined using novel techniques modeling *heterogeneous treatment effects* (Xie, Brand, & Jann, 2012): how performance differences between SOEs ("treated") and private firms ("non-treated") vary according to their propensity to be observed with majority or minority state ownership.

The remainder of the paper is organized as follows. In the next section, we present our theoretical framework and propose testable hypotheses. We then describe our data and

methodology. Empirical discuss are discussed next, followed by a conclusion section with contributions and suggestions for future research.

STATE OWNERSHIP: BACKGROUND AND THEORY

The evolution of state ownership

Throughout the nineteenth and twentieth centuries, state ownership was adopted on a wide scale. The initial thrust for the expansion of state ownership followed the desire of governments to spur investment in public services such as mail, water, sewage, electricity, telephone, and railways (Millward, 2005; Toninelli, 2000). With the disruptions caused by the Great Depression and the First World War, governments also ended up venturing into a variety new business industries beyond public services. In many cases, government ownership was accidental and temporary, as a way to bail out failing companies; in others, it was the result of an ideological shift towards increased state intervention, exacerbated by the rise of socialism in the Soviet Union, Eastern Europe, Asia, and parts of Latin America. State intervention and nonmarket coordination became widespread (Rajan & Zingales, 2004).

The expansion of state ownership, however, also came with substantial cost. Many SOEs were poorly managed and had to cope with a variety of social or political objectives, while trying to avoid losses or even generate profits (Shirley & Nellis, 1991). With subsequent global macroeconomic crises, notably the two oil shocks of the 1970s, the situation became unsustainable. Higher oil prices fueled inflation and led to a major credit rationing caused by escalating interest rates. Governments using SOEs to impose price controls or preserve employment rapidly eroded the profitability and solvency of the public sector. At the same time, the progressive collapse of command and mixed economies exposed the limits of running various industries with ubiquitous presence of state-controlled firms.

Facing increased debt and realizing the high opportunity cost of allocating state capital to unprofitable SOEs, many governments in the 1980s and 1990s eventually undertook large-scale privatization programs (Megginson, 2005) and experimented with varied reforms in the public sector (Gómez-Ibañez, 2007; Shirley, 1999). Yet, governments had political reasons to not fully privatize SOEs and keep some assets under their control. A number of studies show that governments all around the world kept equity stakes in large SOEs, even after the privatization wave (Bortolotti & Faccio, 2009; Christiansen, 2011; OECD, 2005). Guillén (2005), for instance, describes how Spanish SOEs were consolidated before 1996 and initially only partly privatized. In France, the government held a 18% stake in carmaker Renault and in 2014 acquired another stake in Peugeot, jointly with China's Dongfeng (also an SOE).

In reality, state ownership was not fully replaced by private capital but instead transformed in two important ways. SOEs with majority state control that survived the process of privatization remained relevant players in their sectors and in many cases were listed in stock exchanges, attracting private investors as minority shareholders (Gupta, 2005). In other cases, state ownership was morphed from majority to *minority*, though myriad investment vehicles such as state-owned holding companies, development banks, sovereign wealth funds, pension funds, life insurance investments and many others (Musacchio & Lazzarini, 2014). For instance, Temasek, Singapore's state-owned fund, invests 32% of its portfolio in companies such as Singapore Technologies Telemedia, Singapore Communications, Singapore Power, and Singapore Airlines (Goldstein & Pananond, 2008). Compared to majority SOEs, firms with minority state investment have been relatively understudied.

The firm-level performance implications of state ownership

Given these changes, which differences in performance can we expect between SOEs and private firms? Most theories of state ownership actually predict a "liability of stateness," that is, a *performance gap* between SOEs and private firms. All else constant, several features of SOEs will create intrinsic sources of disadvantage compared to private firms with similar traits.

Consider first SOEs with majority ownership. Agency theory suggests that the separation of ownership and control will be more problematic in SOEs than in private firms. Given that society essentially delegates the monitoring function to governmental representatives (Dixit, 2002), governments, as owners, tend to appoint politicians and political allies to run and influence SOEs. In China, for instance, SOE managers tend to be closely tied to the government and to the Communist Party (Li & Xia, 2007; Lin & Milhaupt, 2011). By controlling SOEs, governments can also misallocate resources to support projects that will yield political dividends, such as price controls and investments in remote areas to benefit particular constituencies (Boycko *et al.*, 1996; Shleifer & Vishny, 1998; Vickers & Yarrow, 1988). Furthermore, managers of SOEs tend to have low-powered incentives—that is, salaries that are poorly responsive to performance (Boardman & Vining, 1989; Dharwadkar *et al.*, 2000; La Porta & López-de-Silanes, 1999). In reality, the pursuit of multiple objectives beyond profitability complicates the creation of efficient incentive contracts in SOEs (Bai & Xu, 2005; Firth, Fung, & Rui, 2006). SOE managers may not be fully incentivized to pursue profitability if they anticipate that governments will divert resources to support political objectives or veto certain actions that would otherwise cause political damage (e.g. layoffs after economic crises).

In firms with minority state ownership, in contrast, management will be in the control of private shareholders who will likely follow or attempt to follow profit-maximization goals. This feature will not only facilitate the creation of managerial incentive contracts, but also enhance

the monitoring pressure on SOE managers. At the same time, partial state equity can help minority SOEs pursue profitable projects especially when faced with scarce availability of capital and other institutional constraints (Inoue, Lazzarini, & Musacchio, 2013; Vaaler & Schrage, 2009). Yet those minority SOEs may not be completely insulated from governmental interference: governments may collude with other shareholders and even use their distinct regulatory influence to pursue particular actions (Musacchio & Lazzarini, 2014). For instance, Renault, minority-owned by the French government, decided to back off on its intentions to shift production overseas in 2010 after President Nicolas Sarkozy publicly objected to this decision. Consistent with this discussion, studies have confirmed that majority SOEs generally underperform minority SOEs, although the latter do not necessarily fare better than private firms (Boardman & Vining, 1989; Majumdar, 1998; Wu, 2011). Therefore:

Hypothesis 1. There will be a performance gap between SOEs and comparable private firms (that is, SOEs will underperform private firms with similar traits).

Hypothesis 2. The performance gap between SOEs and comparable private firms will be lower in the case of SOEs with minority state ownership.

Environmental changes and the performance of SOEs

SOEs and private firms may also differ in their ability to respond to changes in the external environment. We examine two types of exogenous variation: events of economic downturn (recessions) and cyclical changes in the political market, driven by elections in democratic countries.

Recessions tend to sharply decrease environmental munificence (Wan & Yiu, 2009) and require organizational response in the form of capacity readjustment, downsizing and resource reallocation more generally (Garcia-Sanchez, Mesquita, & Vassolo, 2014). On the one hand,

some argue that state ownership provides firms with more "patient" capital to absorb negative, cyclical shocks (Beuselinck, Cao, Deloof, & Xia, 2013; Borisova, Brockman, Salas, & Zagorchev, 2012). On the other hand, the liabilities of stateness, discussed before, create formidable challenges for the organizational adjustment of SOEs in periods of economic downturn. For instance, SOEs may be constrained by regulatory impediments reducing their ability to fire workers and sell assets to restore profitability and efficiency (Gallagher, 2004). The low-powered incentives of SOE managers may further reduce their willingness of these firms to adjust (Kato & Long, 2006). Complicating matters, governments may directly request SOEs to preserve employment and even pursue unprofitable investment projects (Musacchio & Lazzarini, 2014; Shirley & Nellis, 1991). Given their restricted ability to adjust and the expected escalation in governmental intervention during economic crises, we expect that recession will increase the performance gap of SOEs.

Elections, in turn, will also create extra incentives for governments to intervene. SOEs, in particular, can be used as mechanisms to support governmental pet projects and distort local markets as a way to benefit incumbent politicians (Shleifer & Vishny, 1994). For instance, Dinç (2005) finds that, during election years, state-owned banks generally lend more than private banks in emerging markets. In same vein, Carvalho (2014) finds that governments try to expand employment during elections and use state-owned banks to provide firms with favorable lending conditions. Moita and Paiva (2013) show that prices in regulated industries tend to follow the political cycle. Thus, governments may force SOEs in those industries to keep prices low during elections, as a way to increase the likelihood that the incumbent party will win. All these actions should have negative effects on firm-level profitability and efficiency.

As before, we also expect that such gaps will be lower in the case of SOEs with minority state equity. Although residual interference is still a possibility in those firms, minority SOEs are controlled by private owners who not only have high incentives to adjust but are also less directly influenced by governmental discretion. Because they are not fully controlled by the state, minority SOEs should also be less constrained in their ability to downsize and rearrange their investments. In other words, we hypothesize that the performance gap of minority SOEs will be lower than the gap of majority SOEs as a function of environmental changes that require adjustment or increase the likelihood of governmental intervention. Thus:

Hypothesis 3. After an environmental change that requires organizational adjustment or increases the temptation of governments to intervene, the performance gap between SOEs and comparable private firms will increase.

Hypothesis 4. The effect predicted by Hypothesis 3 will be lower in the case of SOEs with minority state ownership.

Selection and performance

The performance gap of SOEs and private firms may also depend on selection processes that affect the prevalence of state ownership in various industries and countries. Over time, various governments reduced the public burden of inefficient SOEs, privatized state-controlled assets and sought to increase the performance of the remaining firms under their direct influence (Aivazian, Ge, & Qiu, 2005; Lin, Cai, & Li, 1998). For instance, governments listed large SOEs on stock exchanges, professionalized management, created independent boards of directors (often with external members), and gave many of these large SOEs substantial budgetary autonomy in tandem with mechanisms to improve financial transparency (Gupta, 2005; Pargendler, 2012). With those changes, governments managed to attract private investors acting

as minority investors, despite the presence of the state as controlling shareholder. For instance, in Statoil, Norway's national oil company, CEOs are appointed and monitored by boards with a large number of external members, receive stock options, and are subject to an independent regulatory agency that help constrain the ability of governments to directly intervene in the company (Pargendler, Musacchio, & Lazzarini, 2013; Thurber & Istad, 2010). In this scenario, we should expect a process of *positive* selection: over time, firms more likely to become observed as SOEs should have lower performance gaps when compared to private firms with similar traits.

An alternative prediction is that governments selectively kept SOEs to support political allies or intervene in markets to reap electoral dividends. Thus, observing the resilience of SOEs in many countries, Bremmer (2010: 5) defines state capitalism as "a system in which the state functions as the leading economic actor and uses markets primarily for political gain." Absent broader institutional reforms to tie the hands of politicians —such as strong anti-corruption laws and independent regulatory agencies (Bortolotti, Cambini, & Rondi, Forthcoming)—the temptation of governments to intervene may be too high. For instance, after the end of the Brazilian privatization program in the 1990s, Petrobras, a remaining majority SOE in the oil sector, was required to list its shares in the New York Stock exchange and many governance reforms were implemented. Yet, after this period, the firm was progressively used to support investments following political goals, accommodate political allies in its managerial ranks, and directly control market prices (such as the price of gasoline), with negative implications for firm-level profitability. In this case, we should expect a process of *negative* selection: firms more likely to remain as SOEs will exhibit larger performance gaps.

Although we concur that in many cases reforms in the public sector improved management practices and transparency, SOEs are ultimately influenced by governments that will cyclically change and differ in their inclination to intervene. This effect should be particularly critical in the case of SOEs with majority ownership, where governments have direct control rights and, absent institutional checks-and-balances, have a voice in the appointment of managers and firm-level strategies. Thus, we expect that in majority SOEs negative selection will prevail. In contrast, because state capital is under private control in minority SOEs, these firms should be less affected by direct governmental intervention and with an improved capacity to adjust. New vehicles of minority state ownership have also emerged over the years with an independent management and objectives more or less insulated from political influence. For instance, development banks have tried to provide long-term capital to new projects (George & Prabhu, 2000; Inoue *et al.*, 2013), whereas sovereign funds have tried to diversify national savings in a broad range of investment targets (Dewenter, Han, & Malatesta, 2010). In other words, even if intervention in minority SOEs is still a possibility, we expect that these firms will be relatively less affected by the process of negative selection. This logic therefore leads to our final set of hypotheses:

Hypothesis 5. The performance gap between SOEs with majority state ownership and comparable private firms will be higher in the case of firms that, over time, are more likely to be observed with majority state ownership.

Hypothesis 6. Firms observed with minority state ownership will be less subject to the the negative selection effect predicted by Hypothesis 4.

DATA AND METHODS

Data

We built a unique database of listed SOEs and private firms observed between 1997 and 2012. Our sample is comprised of 482 SOEs, of which 199 are majority- and 283 are minority-owned. For the sake of comparison, we also collected data on 422 private firms, although not all of those firms are used in the matching procedure. Our procedure to select our firms was as follows. We started with a set of large publicly listed SOEs described in a recent OECD survey on state ownership (Christiansen, 2011). We then searched in the *Fortune 500* list to find a group of large SOEs in emerging markets. Departing from this preliminary list, we then collected data on the top-ten listed firms, by revenues, in each sector a certain SOE appeared. Whenever available, we also collected data of additional firms of similar size and in the same sector *and* country of each of the SOEs that we selected. We next looked for detailed ownership data to reclassify these newly included firms as SOEs or private firms. Figure 1 presents our final sample of SOEs, separated by country and sector.

Ideally, we would like to perform comparisons between SOEs and private firms in the same country and sector. Unfortunately, however, various SOEs do not have comparable private firms in the same country. Some SOEs represent monopolies or quasi-monopolies in their own sectors; and, in some countries, the widespread presence of minority state equity makes it more difficult to find firms that are completely private-owned. Thus, in our database only 15.6% of majority SOEs have private firms in the same country and sector. For this reason, as we explain below, we compare SOEs to private firms in the same sector and then used country-level traits to find private firms under similar conditions (including in the same country, whenever possible).

<Figure 1 around here>

Dependent variables (firm-level performance)

We adopt a host of measures capturing distinct elements of firm-level performance. We use two accounting-based measures, *ROA* and *EBITDA/Assets*, to measure short-term performance; the later, in particular, is used to assess the comparative operational performance of firms removing the effects of differential taxes or subsidized interest rates. We also adopt two market-based measures, *Tobin's q* (operationalized as the stock market value of the firm plus debt divided by total assets) and *Market-to-book* (market value divided by book value of equity). These measures allow us to examine the effect of ownership on the long-term valuation of firms. Finally, we use two measures of firm-level productivity. *TFP* (total factor productivity) gauges how firm-level output (revenues) varies beyond the existing stock of capital and labor (Syverson, 2011), measured as total fixed assets and number of employees respectively. To avoid endogeneity bias due to firms' simultaneous choice of inputs and outputs, we computed TFP using first-differences, thus removing the effect of firm-level unobserved heterogeneity (Van Beveren, 2012). Namely, we used the following specification:

$$\Delta Ln(Revenues) = \beta_1 \Delta Ln(Fixed\ assets) + \beta_2 \Delta Ln(Employees) + \text{year dummies} + \text{error},$$

where Δ denotes first-differences. TFP is then computed as the residual of this equation; in this sense, our measure can be interpreted as *TFP growth*. Additionally, we also more directly computed *Labor productivity* as the ratio of total revenues to the total number of employees. This measure allows us to specifically examine how SOEs and private firms differ in their use and allocation of labor. Given their wide variation and likely presence of outliers, we winsorized all performance variables at the 1% and 99% percentiles.

Independent (ownership) variables

For each firm and year, we collected data on the extent of total state ownership and the nature of ownership, that is, whether states directly own firms or instead use indirect channels of ownership or "pyramids" (e.g. Inoue *et al.*, 2013). For instance, it is very common for states to hold ownership stakes in certain firms that in turn have stakes in other firms, and so on. Whenever available, we tried to unveil those pyramids and identify state-related owners including the federal government, state-level governments, sovereign wealth funds, development banks, and all sorts of state-related investment vehicles (such as pension and insurance funds). Our primary data sources were the databases *Orbis* and *Capital IQ*, besides Christiansen's (2011) survey in the case of OECD countries. Yet, in various cases we had to search for additional information on multiple sources such as *Nexis-Lexis,* company websites and the shareholder lists available in some of their annual reports.

We then created two dummy variables coding the type of state ownership. We classified firms as *Majority SOEs* when a state-related entity held more than 50% of the controlling shares throughout the whole pyramid. This can occur, for instance, when a state-related owner holds more than 50% of the shares of a given firm, which then holds more than 50% of the shares of another firm, and so successively until the ultimate owner of the firm in the database is found. *Minority SOEs* are then coded as such when there is relevant state ownership (more than 1%) but less than the amount necessary to grant clear control rights. In our database, the median levels of state ownership are 71.1% and 18.9% in majority and minority SOEs respectively.

Control (matching) variables

We use three sets of control variables to more effectively compare SOEs and private firms. The first set involves firm-level traits. *Ln(Assets)* is the logarithm value of total assets and allows us to compare firms with similar size. *Fixed capital* is the ratio of fixed assets to total

assets and is used to control for capital intensity. *Leverage*, a measure of total debt to total assets, is in turn adopted to account for differences in the use of debt across firms. The second set includes fixed industry- and year-specific factors, operationalized as industry and year dummy variables. The third set of variables, in turn, is comprised of country-level indicators of economic and institutional development

We adopted the following country-level indicators. *GDP per capita* is used as a measure of economic development. Drawing from the *Polity IV* database (Marshall, Jaggers, & Gurr, 2002), we also coded the nature of the country's political regime, ranging from -10 (autocracy) to 10 (full democracy). In addition, following previous research (e.g. Chacar, Newburry, & Vissa, 2010; Chan, Isobe, & Makino, 2008; Hermelo & Vassolo, 2010) we employed a host of variables measuring the extent of institutional development based on capital, product, and labor markets. *Market capitalization* represents the total stock market value of companies in each country divided by the country's GDP. We also add a group of measures coming from the *World Competitiveness Yearbook*, a survey published by IMD. *Ease of credit*, *Competition Legislation* and *Skilled labor* measure executive perceptions on the availability of credit, the extent of regulation avoiding unfair competition, and the supply of high-quality workers respectively. Finally, we created a composite measure with three indicators of the *Yearbook* found to be highly correlated: perceptions of protection of property rights, justice and absence of corruption. The final measure, referred to as *Rule of law*, has a high reliability score (Cronbach Alpha = 0.913).

Tables 1 and 2 present summary statistics and correlations of our variables.

<Tables 1 and 2 around here>

Methods

Simple comparisons between SOEs and private firms are plagued with endogeneity concerns: that is, governments do not choose their ownership stakes at random. For instance, governments may decide to privatize high-performance firms or keep under their control certain firms controlling "strategic assets" such as mines and public utilities. To circumvent this problem and guarantee a more effective comparison between SOEs and private firms, we primarily rely on matching methods (see e.g. Imbens, 2004). For each individual firm *i*, let π_i^S denote its performance under state ownership (majority or minority) and π_i^P its performance under private ownership. S_i is a dummy variable indicating whether firm *i* is actually observed with state equity or not. State ownership, in this case, is a "treatment." Our measure of interest is the so-called *average treatment effect of the treated* (ATT), which is the difference in the expected performance of an SOE compared to the counterfactual outcome if the *same* firm were private:

$$\text{ATT} = E[\pi_i^S - \pi_i^P | S_i = 1] = E[\pi_i^S | S_i = 1] - E[\pi_i^P | S_i = 1]. \quad (1)$$

In our theoretical discussion, a *performance gap* between SOE and private firms would be observed if ATT < 0. In practice, however, we only observe whether, in a given moment, a certain firm is an SOE or private firm. That is, instead of $[\pi_i^P | S_i = 1]$, we only observe $[\pi_i^P | S_i = 0]$. Thus, we need to carefully build a "control" group of private firms that more likely resemble our "treated" cases (SOEs). Matching analysis essentially builds on two core assumptions (Rosenbaum & Rubin, 1983). The first assumption is called "selection on observables": conditional on a set of observable traits, being an SOE or private firm (i.e. D_i) is independent of the final outcome (firm-level performance). Let X_i represent a set of observable covariates—in our case, represented by our previously discussed control variables. The assumption of selection on observables guarantees that $E[\pi_i^P | X_i, S_i = 1] = E[\pi_i^P | X_i, S_i = 0]$, i.e., we can take the

performance of comparable private firms as an approximation of what would be the performance of a similar SOE under private ownership. The second assumption is that there is a group of comparable control (private) firms, similar to the set of treated (state-owned) firms that can be used for matching purposes. Under these assumptions, ATT can now be estimated as:

$$\text{ATT} = E[\pi_i^S - \pi_i^P | X_i, S_i = 1] = E[\pi_i^S | X_i, S_i = 1] - E[\pi_i^P | X_i, S_i = 0]. \quad (2)$$

In most of our analyses we adopt the nearest-neighbor matching estimator proposed by Abadie and Imbens (2011) and implemented by Abadie, Drukker, Herr and Imbens (2004). For each SOE, majority or minority, we try to find the closest private firm based on our set of observables. We adopt one match per treated firm, and implement, whenever possible, exact matching by sector and year. In addition, we compute robust standard errors controlling for heteroscedasticity and employ a bias adjustment given that the continuous nature of certain observables does not allow for exact matching. To reduce the effect of a contemporaneous association between our performance indicators and matching variables, all our control covariates are lagged (average of the two previous years).

A clear problem with matching techniques, however, is that they do not remove bias due unobservable factors that are captured by our controls. Fortunately, our strategy of examining how SOEs and private firms respond to exogenous changes allows us to remove the effect of fixed firm-level observables by combining matching analysis with differences-in-differences estimation (Heckman *et al.*, 1997). Following our theoretical discussion, we focus on two distinct changes: recessions and elections. We assume that a recession event at year *t* occurs when a given country exhibits two years of positive GDP growth (at *t*-1 and *t*-2) followed by two years of negative growth (at *t* and *t*+1). For the subsample of countries with democracies, we also observe whether presidential or parliamentary elections occurred at year *t*. Therefore, for a

given exogenous event, we consider *changes* in firm-level performance after and before the event, thus removing the effect of fixed unobservable factors. We compute post-event performance as the average between years *t* and *t*+1 and pre-event performance as the average between years *t*-1 and *t*-2; and then take the difference between the two measures as our final measure of performance change. As matching covariates, we use all our previously discussed controls and, following the suggestion by Cook, Shadish and Wong (2008), also add pre-event performance as an additional covariate. For instance, when computing ATTs for *ROA*, we also include as a matching variable the pre-event level of *ROA*.

Conditional on this fixed set of pre-event observables and only considering firms subject to the same exogenous change, we can then compute the ATT as the difference between treated (state-owned) and private (control) firms, this time considering observed variations in their performance around the event at *t*, whose occurrence is indicated by the dummy variable D_{it}:

$$\text{ATT} = E[\Delta\pi_{it}^{S} | X_{it}, S_{it} = 1, D_{it} = 1] - E[\Delta\pi_{it}^{P} | X_{it}, S_{it} = 0, D_{it} = 1]. \quad (3)$$

Finally, also following our previous theoretical discussion, we would like to examine heterogeneous treatment effects: how ATTs vary according to particular characteristics of each firm and their environment. We benefit from the techniques described in Xie, Brand and Jann (2012) and implemented by Jann, Brand and Xie (2010). The idea is to model treatment effects as a function of the *propensity score* of a given firm (Rosenbaum & Rubin, 1983), that is, the predicted probability that the firm will be observed as an SOE (i.e. it will be "treated") for a given set of covariates (our control variables). We adopt the smoothing-differencing procedure, which fits nonparametric regressions on how performance varies according to the propensity score, for both treated and control firms. We use logit regression to estimate propensity scores and restrict our analysis to regions of "common support," that is, cases when treated and control

firms have similar propensity scores. Treatment effects are then computed as the difference between those regressions for each level of the propensity score. Negative selection, for instance, occurs when treatment effects are negatively related to the propensity scores: firms more likely to be treated are more likely to underperform firms in the control group.

RESULTS

Comparative performance of SOEs versus private firms

Figure 2 shows a visual, cross-sectional comparison of SOEs and private firms without matching. In general, we see substantial performance heterogeneity, and private firms are not apparently clearly superior to SOEs. Of course, this comparison fails to consider that SOEs may differ from private firms based on important traits that can crucially influence the selection of state or private ownership. Table 3 then presents matching (ATT) estimates following equation 2, corresponding to the difference in performance between SOEs and matched private firms with similar traits. Observing firms with majority state ownership, we see that these SOEs significantly underperform private firms in terms of operational profitability (*EBITDA/Assets*) and efficiency (*TFP* and *Labor productivity*). The estimate of *ROA*, for instance, indicates that the return on assets of minority and majority SOEs is 0.9 and 1.3 percentage point inferior to private firms, respectively. Yet, we fail to uncover any significant difference with respect to *ROA* and *Market-to-book*; and even find that majority SOEs have *superior Tobin's q*. As for minority SOEs, we observe that they also underperform private firms in some accounting (*ROA*, *EBITDA/Assets*) and efficiency indictors (*Labor productivity*). Even if it has a larger magnitude, the performance gap of minority SOEs is also not significantly different from the performance gap of majority SOEs according to Chi-square test of coefficient comparison.

<Figure 2 and Table 3 around here>

However, given that our database has a panel structure, the above analysis ignores within-firm correlation patterns across various years as well as temporal changes in the performance gap between SOEs and private firms. We thus compute ATTs separately for each year. Because a larger incidence of missing observations in the early years of our database makes it more difficult to compute yearly estimates for most firms, we focus our analysis in the period after 2000. Figure 3 shows our yearly estimates with 95% confidence intervals. In general, we see that performance gaps vary greatly year by year. In the case of majority SOEs, negative ATTs are mostly observed in more recent years especially for *ROA*, *EBITDA/Assets*, and *TFP*. The positive ATT for *Tobin's q* has also apparently diminished over the years. A distinct pattern is found for minority SOEs: we observe negative ATTs for *ROA* and *EBITDA/Assets* mostly in early periods, although a significant gap in *Labor productivity* appears in more recent years.

<Figure 3 around here>

Therefore, these results lend mixed support for Hypothesis 1. Although SOEs do not unambiguously underperform comparable private firms, we do find that, in more recent years, the performance gap between majority SOEs and private firms has increased for some performance indicators. We also fail to provide strong support for Hypothesis 2: minority SOEs do not clearly exhibit lower performance gaps when compared to majority SOEs (i.e. less negative ATTs). As mentioned before, however, this comparison does not control for firm-level unobservable factors that might bias the computation of treatment effects. In the next section we rely on differences-in-differences estimation to control for these factors.

The effect of exogenous changes: differences-in-differences estimation

Table 4 shows how the performance of SOEs and private firms change before and after exogenous changes involving recessions and elections (see equation 3). We find that recession events are usually associated with negative ATTs for majority SOEs: after a recession, the performance of those SOEs falls more than that of private firms for virtually all performance indicators except *TFP*. We also find negative ATTs around elections for all indicators except *ROA* and *TFP*. The estimated performance gaps are much larger than what we found in our previous analysis (Table 3). For instance, after recessions, the estimated change in profitability of majority SOEs (as measured by *ROA* and *EBITDA/Assets*) is 4.1 percentage points inferior to the observed change in comparable private firms.

For minority SOEs, in contrast, the only detected effects are on *Labor productivity*. For all other indicators, there is no significant performance gap. However, according to a Chi-square comparison test, the negative ATT for *Labor productivity* around recessions is significantly more pronounced in majority SOEs than minority SOEs, but there is no significant difference around elections for the same performance indicator. Thus, if anything, minority SOEs appear to be less sensitive to exogenous changes that tend to increase the temptation of governments to intervene. These results therefore lend general support for Hypotheses 3 and 4.

<Table 4 around here>

Selection: factors influencing the choice of majority and minority state ownership

Our next task is to examine how ATT vary according to firm-, industry- and country-level traits that increase the likelihood of a given firm to be observed as a majority or minority SOE. In this analysis, modeling the process of selection is crucial. Although we do not offer specific hypotheses on how selection will occur, it is informative to briefly describe which covariates are more important and in which direction. In our implementation of the smoothing-

differencing method, we take variations of performance around the exogenous events discussed before, and then compute the propensity scores for all periods when an event occurs and for each performance variable under consideration. For simplicity, we will next present a more aggregate analysis considering all periods and firms in our database. Our objective is not to claim causality but rather to examine which factors are mostly correlated with state ownership.

Table 5 presents the results of Probit regressions with all our matching covariates plus an additional trend (year count) term. We examine, for instance, the likelihood that a given firm will be observed with majority state versus private ownership. We also add lagged values of each performance variable as regressors as a way to check if past performance affects selection. We see that, compared to private firms, majority SOEs tend to be larger (in terms of total assets), more capital intensive (in terms of fixed assets) and less leveraged. We also observe a higher incidence of majority SOEs in countries that do not have consolidated democracies (as seen by the negative coefficient of *Polity*) and with limited economic progress in terms of *GDP per capita* and capital market development (*Market capitalization*). This finding is consistent with theoretical discussions that state ownership might help solve myriad institutional voids in developing countries, such as capital scarcity to fund new industries (e.g. Gerschenkron, 1962; Yeyati, Micco, & Panizza, 2004). Yet we find that, conditional on these other development indicators, *Rule of law* has a *positive* effect on the likelihood of majority state ownership. Although somewhat counterintuitive, this finding is also consistent with more recent discussions arguing that the existence of large, listed SOEs mandates institutional conditions curbing the risk of expropriation of minority private shareholders (Bortolotti *et al.*, Forthcoming; Pargendler *et al.*, 2013).

As for minority SOEs, we also see that their incidence is also affected by similar factors except for *Leverage*, which appears to mostly influence majority SOEs, and *Skilled labor*, which negatively affects the likelihood of observing minority state ownership. Although the effect of capital intensity also appears to become weaker in magnitude when we compare the coefficients of *Fixed assets* across the regressions for the two types of SOEs, the difference is not significant according to a Chi-square test of coefficient comparison. It is also interesting to note that the trend term is highly significant for minority SOEs: over the years, the incidence of minority state equity has generally increased in various industries and countries. Finally, and fortunately, we do not detect significant effects of past performance variables, which indicates that, conditional on our matching covariates, selection does not appear to be generally influenced by firm-level performance. We only find a negative effect of *Labor productivity* in the choice of minority state equity. This finding may explain why we found negative ATTs for minority SOEs with respect to *Labor productivity* (Tables 3 and 4). An explanation is that governments may be targeting minority state equity to influence or preserve employment in labor-intensive firms, which may also happen to be firms that are relatively less productive.

<Table 5 around here>

Heterogeneous treatment effects

We can now turn to the analysis of heterogeneous treatment effects. Figure 4 shows how ATTs vary according to the propensity score of the firm, i.e., the likelihood that it will be observed as a majority or minority SOE. From our previous discussion, we now that a firm will likely be, say, a majority SOE when it is large, capital-intensive, less leveraged and under less developed country-level conditions (except for *Rule of law*). Figure 4 shows differences-in-differences estimates around recessions. We see that "typical" majority SOEs (i.e. firms with

high propensity scores) tend to have negative ATTs for *ROA* and *EBITDA/Assets*, thus suggesting a process of negative selection: existing or remaining majority SOEs may be more likely selected by governments with high temptation to intervene after recessions. Yet the effect is not significant for the other performance variables. A possible explanation is that interventions around recessions may affect short-term, accounting-based indicators only. As for minority SOEs, the effects are generally less clear: except for *Market-to-book*, firms *less* likely to be observed as a minority SOE tend to have negative ATTs. Thus, if anything, we fail to find any evidence of negative selection for minority SOEs.

The analysis of heterogeneous treatment effects around elections is shown in Figure 5. For majority SOEs, we do not find consistent changes in treatment effects across all performance indicators. However, for minority SOEs we find a pattern of positive selection: ATTs are significantly positive for firms that are more likely observed with minority state equity when *ROA* and *EBITDA/Assets* are used as performance indicators. In other words, the typical minority SOEs tend to benefit more than private firms from election events. A possible explanation is that private capitalists with minority state capital are better connected with local governments and can therefore benefit from transfers, preferential access to credit, or other nonmarket rents that tend to increase around elections (Carvalho, 2014; Sapienza, 2004).

Thus, these results provide partial support for Hypothesis 5: we unveil an apparent process of negative selection for majority SOEs but only for a subset of performance indicators and when recessions are taken as events of exogenous change. Support, however, is found for Hypothesis 6: no negative selection is found for minority SOEs and we even detect a pattern of positive selection for performance changes occurring around elections.

<Figures 4 and 5 around here>

Differences-in-differences analysis for SOEs in developed countries

As a *post-hoc* analysis, we finally examine how our previous results hold when we restrict our analysis to the subset of SOEs belonging to developed countries, according to the IMF's list of advanced economies (Table 6). One could argue that improved economic and institutional conditions in those countries will reduce the ability of governments to intervene in SOEs. As it turns out, however, the negative ATTs around recessions in the case of majority SOEs remain strong, for all performance indicators; and we even find some negative effects in the sample of minority SOEs for *Tobin's q* and *TFP*. However, negative ATTs around elections disappear, except for a negative effect of *Labor productivity* for minority SOEs. This result indicates that country-level development attenuates the effect of political cycle but does not necessarily remove the performance gap of SOEs during recessions. Even in developed countries, which tend to have better institutional checks-and-balances against intervention, SOEs appear to be relatively more constrained in their ability to adjust.

<Table 6 around here>

CONCLUDING REMARKS

In this paper we analyze a large dataset of listed SOEs and private firms covering several countries and industries. We not only examine SOEs with majority state control and private minority owners but also SOEs controlled by private owners with minority state capital. In a nutshell, we find that SOEs exhibit significant important performance gaps—i.e., they tend to underperform private firms with similar characteristics—especially when subject to external changes that require rapid adjustment or that increase the temptation for governments to intervene (namely, economic recessions and election years). However, these negative effects are weaker in the case of minority SOEs. Furthermore, we find some evidence of negative selection

in the choice of state ownership: firms more likely to be selected as SOEs given their characteristics tend to have a larger performance gap around recessions, compared to private firms. Although the effect of elections seems to disappear in developed economies, majority SOEs in those economies still exhibit significant performance gaps around events of strong economic downturn. In light of these results, below we discuss the contributions and implications of our research, followed by suggestions for future research.

Contributions

At a more fundamental level, our paper contributes to the literature on the determinants of heterogeneous firm-level performance by examining the impact of state ownership in its various forms. We examine not only firms with majority state control, but also the effect of minority state equity, which has been relatively understudied despite their prevalence in many countries. In addition, our theorizing explicitly includes the role of environmental changes as factors that will shift the relative performance of SOEs versus private firms. That is, we study in which conditions performance gaps might become relatively more acute after exogenous changes that magnify the liabilities of state ownership. Not less important, we explicitly incorporate in our theorizing and empirical analysis the role of selection: how the processes that make a certain firms more likely to be observed as an SOE might also change their performance gap when compared to similar private firms.

Our empirical analysis also presents some important novel features. Instead of focusing on a single country and industry, our database covers many countries and sectors, which increases the generalizability of our findings and allows us to unveil a host of heterogeneous factors affecting performance and selection. Our matching methods also allow for a more direct comparison between SOEs and private firms, thus helping mitigate biases in the assessment of

performance heterogeneity. Moreover, our use of new methods to measure heterogeneous treatments effects helps us identify factors the influence the selection of state ownership and how selection affects performance gaps. These methods can also be more widely adopted in strategy research as a way to control for endogeneity in a broad range of strategic choices.

Implications for practice and policy

Our sample includes large, listed SOEs that not only compete with private firms—in some cases, even on a global scale—but also attract private owners as relevant investors. From the point of view of managers of SOEs, our study shows that these firms still exhibit important liabilities that potentially create competitive disadvantage. Yet these liabilities appear to be weakened when the state participates as a minority owner—a model of state capitalism that is becoming increasingly frequent. From the point of view of investors, our study does not imply that SOEs should be generally avoided (for instance, many SOEs control unique resources that can yield positive rents) but instead that particular caution is needed when exogenous changes increase the temptation of governments to intervene. Monitoring and responding to these events seems to be critical.

Our study also suggests important policy implications. Over the years, many governments have privatized failing SOEs and reformed the corporate governance of the remaining firms with state capital. Yet our results show that these reforms were only partial. SOEs still appear to be less responsive than private firms to negative shocks, such as recessions, that require rapid adjustment. They also appear to be influenced by the political cycle, as indicated by the negative effect of elections. Even though in developed economies the latter effect seems to disappear, the performance gap during recessions remains significant. Thus, our results suggest the need of new reforms that improve the ability of SOEs to adjust and repel

discretionary intervention. Also, given that gaps appear to be lower in firms with minority state capital, a possibility is to reduce the extent of state ownership as a way to more effectively infuse performance-enhancing private practices even if the state remains a relevant (minority) investor.

Limitations and suggestions for future research

Although we tried to include several covariates that can affect firm-level performance and the process of selection, there is still room to assess sources of unexplained heterogeneity. For instance, there are reasons to believe that particular governance features will help reduce performance gaps. As noted before, heterogeneous governance practices across SOEs may critically influence the ability of governments to intervene. For instance, some SOEs have boards with independent directors. State ownership may also change the way managers are allowed to exert managerial discretion and promote performance-enhancing adjustments (e.g. Li & I., 2010). The analysis of heterogeneous managerial and governance features of SOEs, compared to private firms, can be particularly rewarding.

Furthermore, we restricted our empirical analysis to performance indicators related to profitability and efficiency. Yet SOEs may yield positive externalities not necessarily captured by these indicators. For instance, some argue that state intervention is sometimes necessary to invest in areas with scant private interest or when private investment is inherently risky (Murphy, Shleifer, & Vishny, 1989; Rodrik, 2004). More recently, authors such as Mazzucato (2011) have forcefully argued that states have been instrumental in the development of novel technologies with positive spillovers to the private investment and innovation (such as early computing know-how and green technologies). Following this idea, one could argue that state ownership will reduce its performance gap and even become a source of advantage for performance indicators that are not naturally pursued by the private sector but that have relevant implications for the

economy and society. Examining these other performance indicators in comparative perspective will be an important step to improve our understanding of the pros and cons of state ownership.

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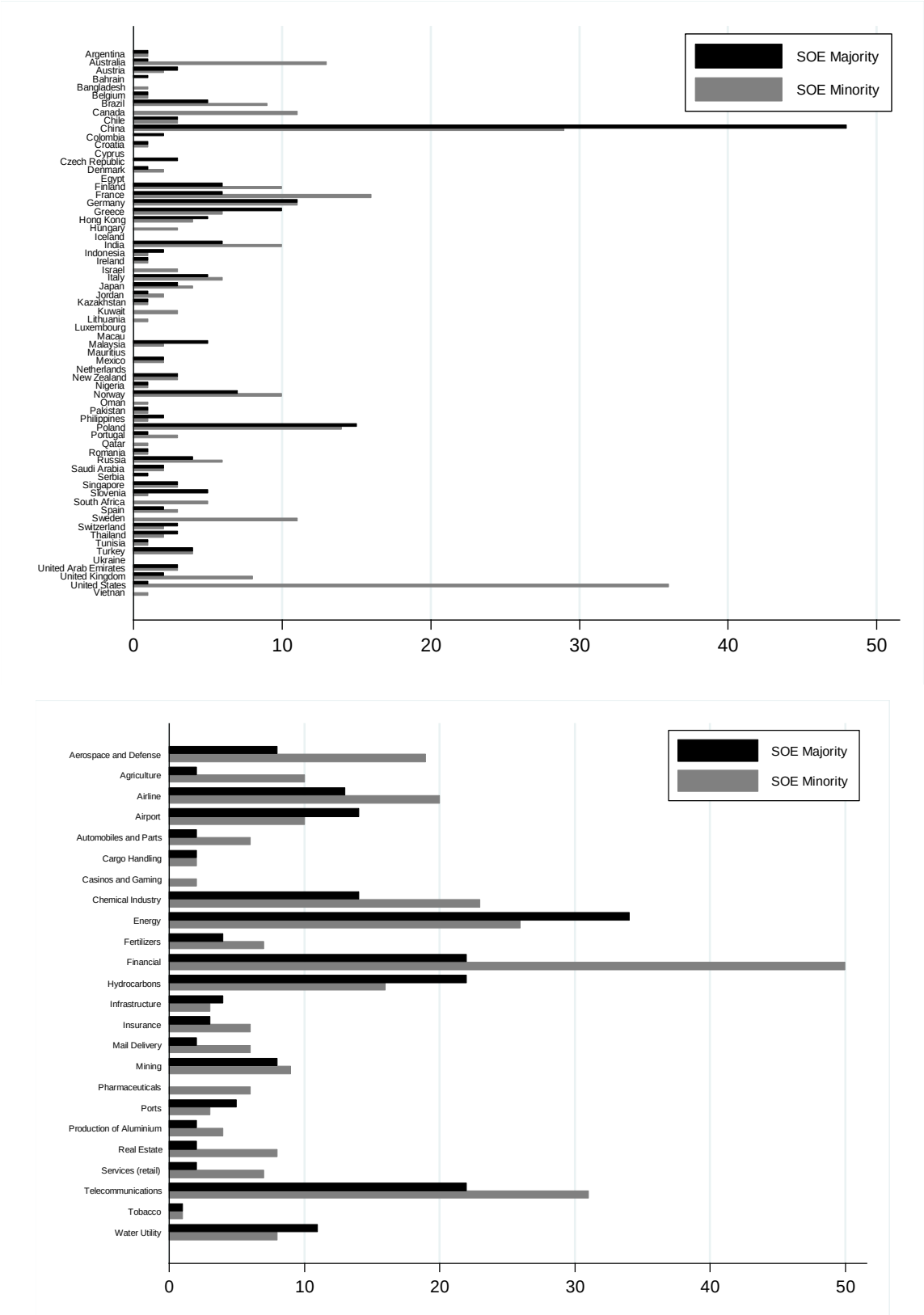

Figure 1. Number of SOEs by country and sector

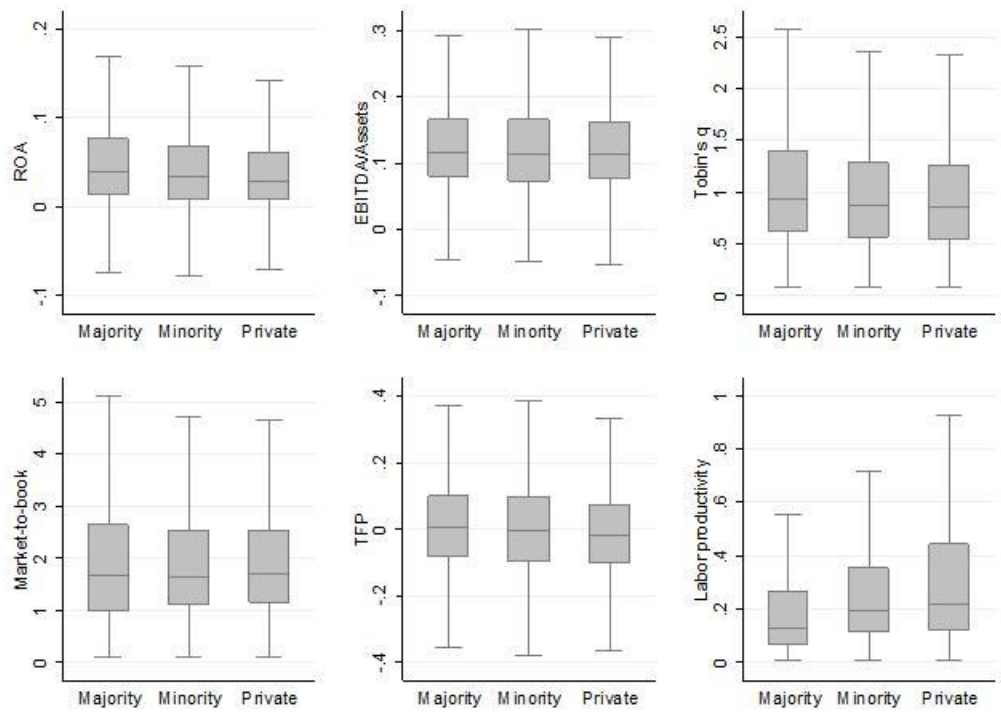

Figure 2. SOEs and private firms: heterogeneity in observed performance

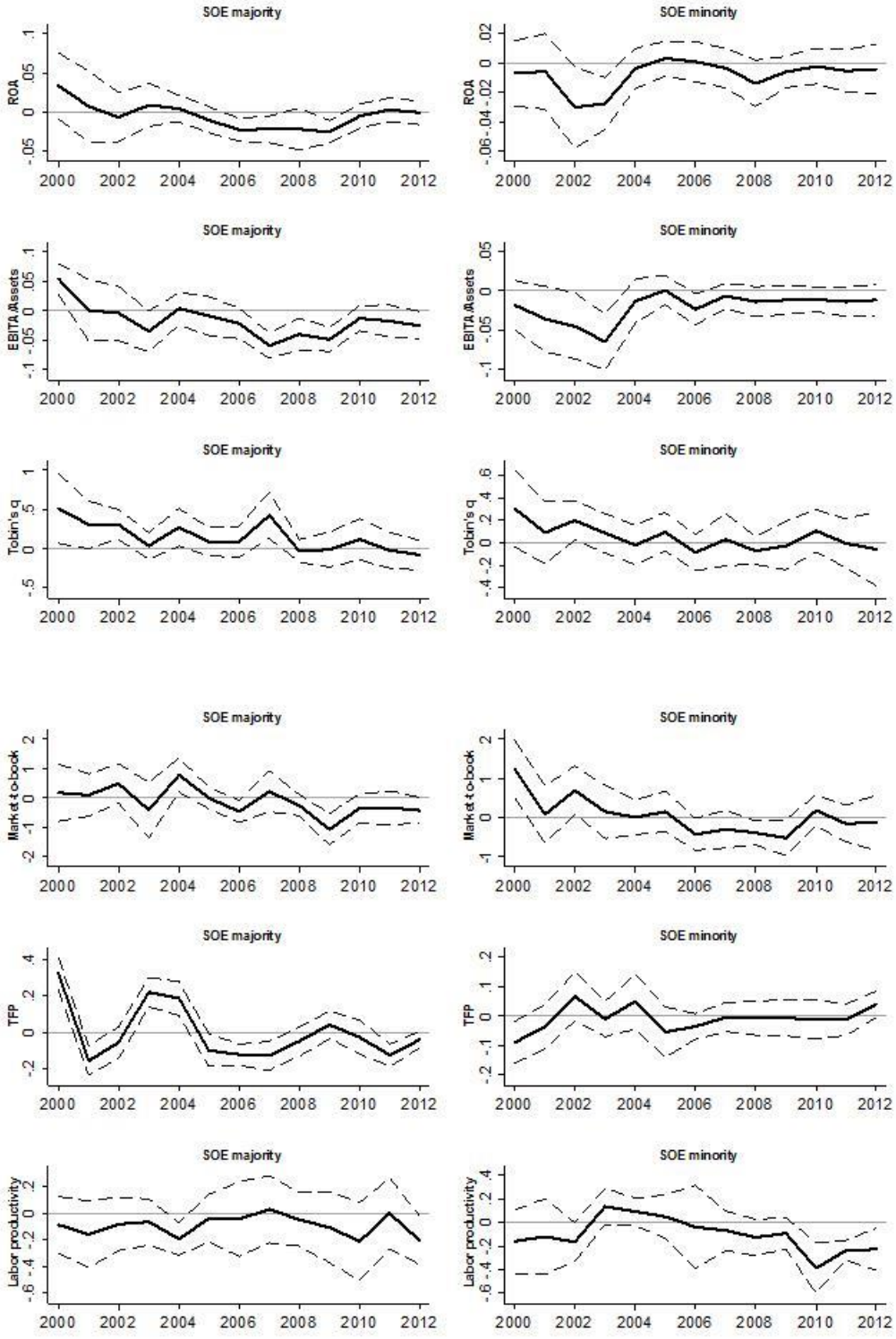

Figure 3. Performance differences between SOEs and matched private firms, by year (ATT matching estimates; dashed lines represent 95% confidence intervals)

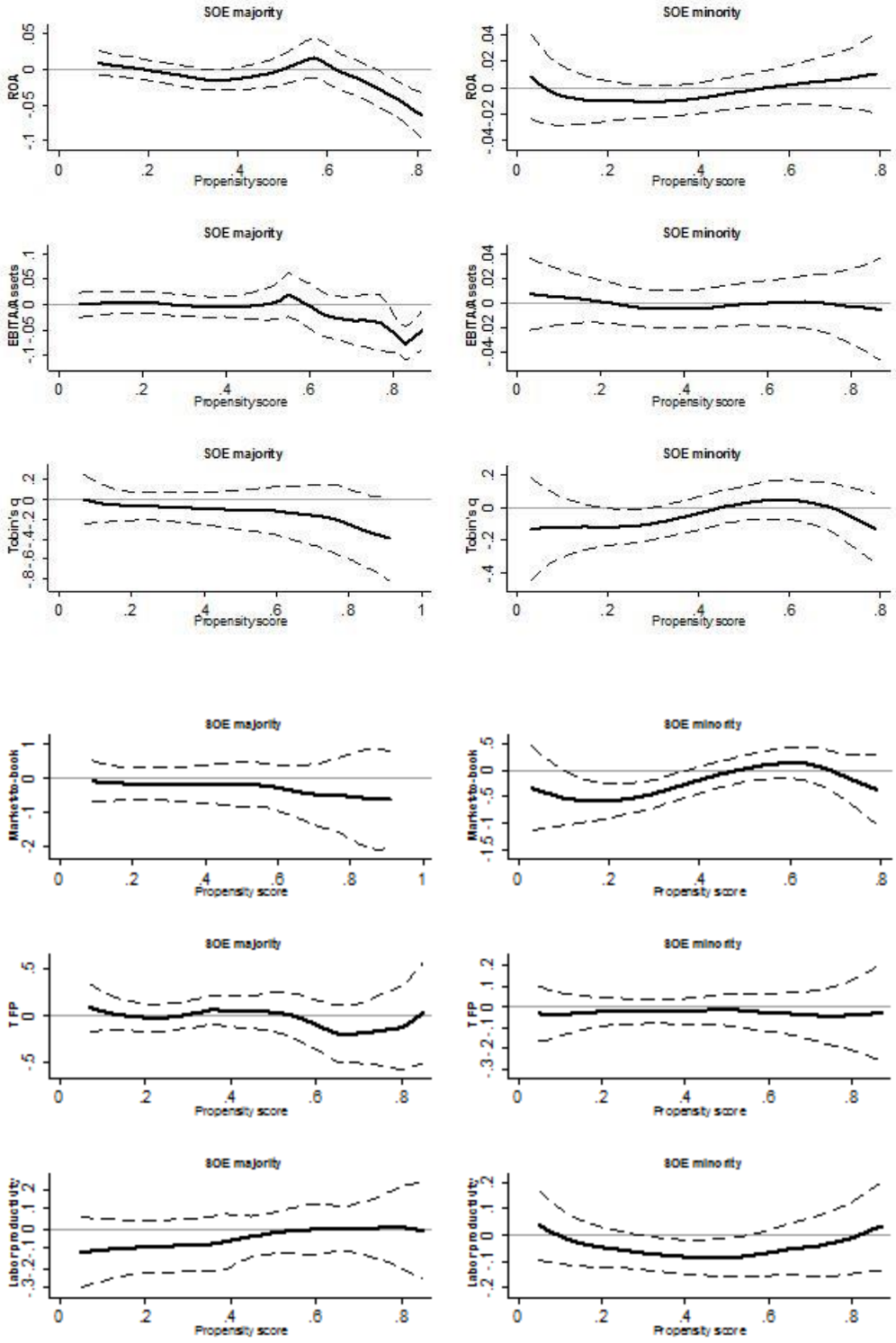

Figure 4. Heterogeneous treatment effects using recessions as an exogenous source of variation

(dashed lines represent 95% confidence intervals)

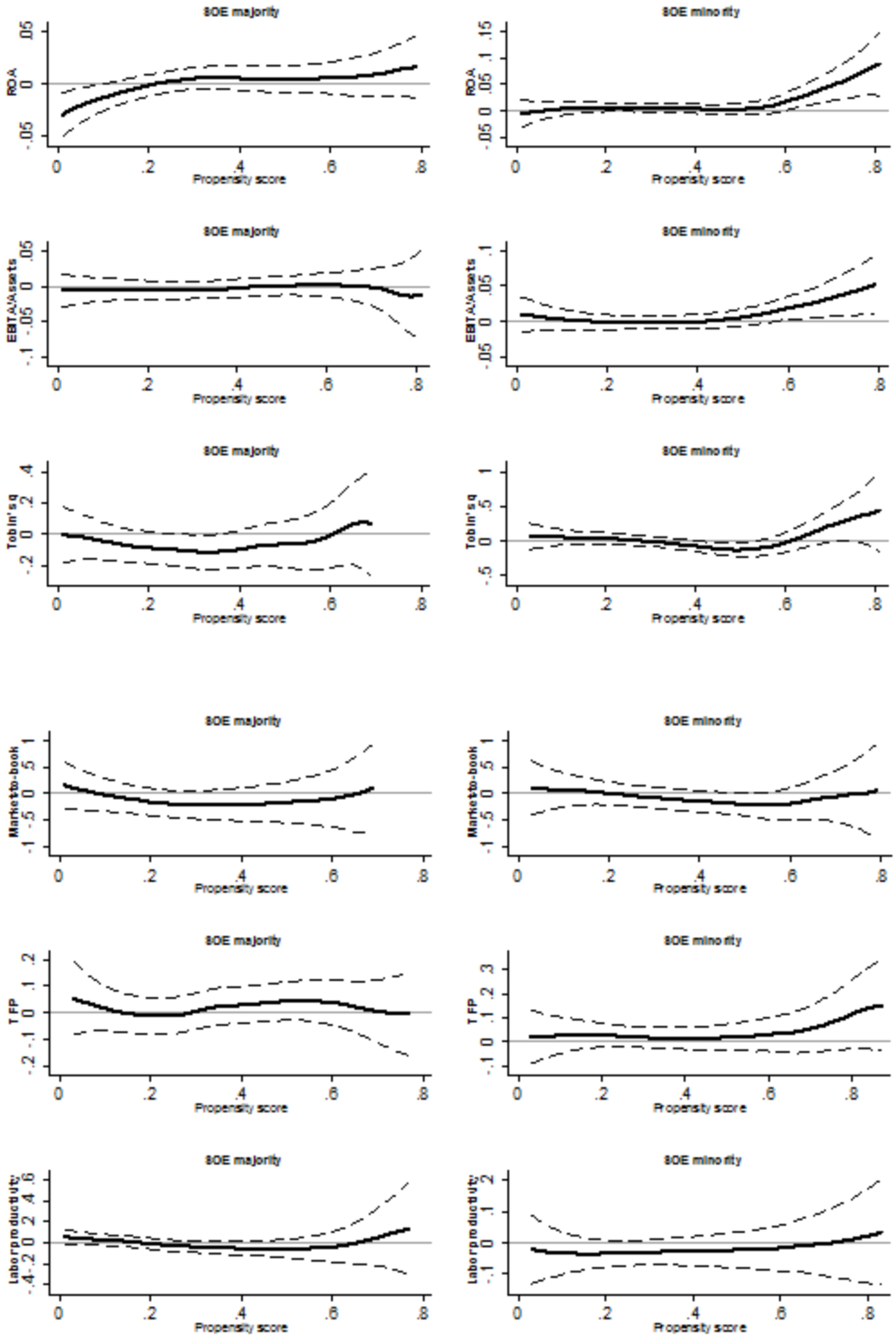

Figure 5. Heterogeneous treatment effects using elections as an exogenous source of variation

(dashed lines represent 95% confidence intervals)

Table 1. Summary statistics and description of variables

Variable	*N*	Mean	Std. dev.	Description	Source of data
ROA	9,814	0.041	0.062	Net profit divided by total assets	Capital IQ
EBITDA/Assets	7,782	0.126	0.081	EBITDA divided by total assets	Capital IQ
Tobin's q	8,246	1.092	0.922	Market value of stock plus debt divided by total assets	Capital IQ
Market-to-book	8,175	2.235	2.060	Market value of stock divided by book value of equity	Capital IQ
TFP	6,577	-0.001	0.199	Estimate of total factor productivity growth as the residual of the regression: ΔLn(Revenues) = $\beta_1\Delta$Ln(Fixed assets) + $\beta_2\Delta$Ln(Employees) + year dummies + error, where Δ denotes first-differences.	Capital IQ/Bloomberg (employees)
Labor productivity	7,524	0.379	0.600	Revenues divided by number of employees	Capital IQ/Bloomberg
Majority SOE	9,816	0.216	0.411	Dummy variable equal to 1 if the firm is an SOE with majority state ownership	Capital IQ, Orbis and own research
Minority SOE	9,816	0.218	0.413	Dummy variable equal to 1 if the firm is an SOE with minority state ownership	Capital IQ, Orbis and own research
Ln(Assets)	9,816	8.243	2.402	Logarithmic value of total assets (deflated 1,000 dollars)	Capital IQ
Fixed capital	9,816	0.374	0.281	Fixed assets divided by total assets	Capital IQ
Leverage	9,816	0.264	0.183	Total debt divided by total assets	Capital IQ
GDP per capita	9,816	18.4	12.0	GDP per capita (deflated 1,000 dollars)	World Bank
Polity	9,792	7.035	5.820	Nature of the political system, from -10 (autocracy) to 10 (full democracy)	Polity IV database
Rule of law	8,973	6.025	1.888	Composite index involving perceptions of protection of intellectual rights, justice and absence of corruption	World Competitiveness Yearbook (WCY)
Ease of credit	8,975	6.026	1.727	Perceptions of availability of credit	WCY
Market capitalization	8,917	90.5	66.3	Country-level stock market capitalization to GDP	World Bank
Competition legislation	8,904	5.850	1.116	Perceptions of regulation avoiding unfair competition	WCY
Skilled labor	8,905	6.154	1.054	Perceptions of availability of skilled labor	WCY

Table 2. Correlation matrix

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.ROA	1.00																	
2.EBITDA/Assets	0.71	1.00																
3.Tobin's q	0.44	0.39	1.00															
4.Market-to-book	0.28	0.31	0.75	1.00														
5.TFP	0.08	0.10	0.07	0.08	1.00													
6.Labor productivity	0.07	0.01	-0.05	-0.07	0.05	1.00												
7.Majority SOE	0.07	0.02	0.05	-0.03	0.03	-0.05	1.00											
8.Minority SOE	0.02	-0.01	-0.01	-0.03	0.01	-0.05	-0.28	1.00										
9.Ln(Assets)	-0.19	-0.09	-0.43	-0.20	-0.05	0.12	-0.04	0.03	1.00									
10.Fixed capital	0.12	0.13	0.15	-0.05	-0.02	0.11	0.21	-0.02	-0.25	1.00								
11.Leverage	-0.26	-0.15	-0.05	-0.03	-0.02	0.03	-0.09	-0.01	0.10	0.31	1.00							
12.GDP per capita	-0.13	-0.12	-0.10	-0.04	-0.11	0.17	-0.32	-0.06	0.18	-0.08	0.15	1.00						
13.Polity	-0.10	0.02	-0.17	-0.09	-0.12	0.15	-0.32	-0.07	0.16	-0.04	0.12	0.49	1.00					
14.Rule of law	-0.12	-0.10	-0.08	-0.02	-0.09	0.10	-0.28	-0.04	0.12	-0.06	0.13	0.79	0.41	1.00				
15.Ease of credit	-0.05	-0.03	-0.03	0.02	-0.05	0.06	-0.26	-0.08	0.01	0.00	0.10	0.56	0.38	0.70	1.00			
16.Market cap.	0.02	-0.04	0.08	0.12	-0.01	0.00	-0.15	-0.07	0.02	-0.01	0.03	0.29	-0.10	0.39	0.45	1.00		
17.Comp.legislation	-0.10	-0.09	-0.07	-0.01	-0.06	0.08	-0.26	-0.01	0.11	-0.05	0.11	0.64	0.42	0.89	0.69	0.27	1.00	
18.Skilled labor	-0.11	-0.09	-0.10	-0.05	-0.08	0.10	-0.21	-0.09	0.06	-0.03	0.09	0.45	0.42	0.55	0.44	0.19	0.48	1.00

Table 3. Performance differences between SOEs and matched private firms (full sample)

	Performance variable					
	ROA	EBITDA/Assets	Tobin's q	Market-to-book	TFP	Labor productivity
Majority SOEs						
Matching estimate (ATT)	-0.003	-0.009***	0.119***	0.117	-0.027**	-0.073***
	(0.002)	(0.003)	(0.032)	(0.079)	(0.011)	(0.028)
N	5,677	4,656	5,124	5,069	4,300	4,598
Minority SOEs						
Matching estimate (ATT)	-0.004**	-0.013***	0.014	-0.102	0.005	-0.110***
	(0.002)	(0.003)	(0.030)	(0.070)	(0.009)	(0.027)
N	5,958	4,797	5,530	5,469	4,520	4,814

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parenthesis. ATT is computed using the bias-corrected nearest-neighbor matching estimator proposed by Abadie and colleagues (2004, 2011). We allow one matching observation per SOE, imposing exact matching by year and industry. Besides industry and year, other observable matching variables include Ln(Assets), Fixed capital, Leverage, GDP per capita, Polity, Rule of law, Ease of credit, Market capitalization, Competition legislation and Skilled labor (see Table 1). All these matching variables are lagged (average, two previous years).

Table 4. Differences-in-differences estimation of the effect of exogenous changes on the performance differences between SOEs and matched private firms

	Performance variable					
	ROA	EBITDA/ Assets	Tobin's q	Market-to-book	TFP	Labor productivity
Recessions						
Majority SOEs						
Matching estimate (ATT)	-0.041***	-0.041***	-0.368***	-0.693***	-0.025	-0.663***
	(0.006)	(0.007)	(0.089)	(0.217)	(0.045)	(0.064)
N	417	355	387	382	327	348
Minority SOEs						
Matching estimate (ATT)	-0.004	0.001	0.026	-0.112	-0.026	-0.074**
	(0.005)	(0.006)	(0.033)	(0.129)	(0.023)	(0.029)
N	493	414	458	453	379	407
Elections						
Majority SOEs						
Matching estimate (ATT)	0.000	-0.012**	-0.120**	-0.387**	0.015	-0.107**
	(0.004)	(0.005)	(0.050)	(0.152)	(0.028)	(0.049)
N	850	680	681	668	531	594
Minority SOEs						
Matching estimate (ATT)	0.004	-0.002	-0.037	-0.024	0.035	-0.140***
	(0.004)	(0.005)	(0.060)	(0.165)	(0.021)	(0.048)
N	933	741	785	773	596	655

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parenthesis. ATT is computed using the bias-corrected estimator proposed by Abadie and colleagues (2004, 2011); see the note on Table 3. For a given change event at year *t*, we compute differences between post- (average between *t* and *t*+1) and pre-event observed performance (average between *t*-1 and *t*-2).

Table 5. Selection: factors affecting the probability that a given firm will be observed as a majority or minority SOE

	Majority SOEs						Minority SOEs					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Past performance	-0.817	-1.392	-0.096	-0.057	-0.340	-0.020	0.411	-1.097	-0.055	-0.021	-0.096	-0.284**
	(1.130)	(1.005)	(0.094)	(0.038)	(0.258)	(0.169)	(0.731)	(0.699)	(0.076)	(0.025)	(0.210)	(0.136)
Ln(Assets)	0.184***	0.229***	0.153***	0.154***	0.187***	0.189***	0.158***	0.178***	0.153***	0.153***	0.138***	0.140***
	(0.048)	(0.057)	(0.055)	(0.054)	(0.058)	(0.056)	(0.033)	(0.039)	(0.038)	(0.038)	(0.039)	(0.038)
Fixed capital	1.405***	1.581***	1.203***	1.186***	1.368***	1.552***	0.752**	0.769**	0.668**	0.666**	0.493	0.509
	(0.351)	(0.370)	(0.370)	(0.374)	(0.408)	(0.382)	(0.302)	(0.306)	(0.328)	(0.332)	(0.354)	(0.342)
Leverage	-1.909***	-2.381***	-1.813***	-1.789***	-1.835***	-1.794***	-0.573	-0.860**	-0.527	-0.460	-0.322	-0.345
	(0.438)	(0.479)	(0.467)	(0.477)	(0.483)	(0.445)	(0.370)	(0.356)	(0.365)	(0.383)	(0.413)	(0.399)
GDP per capita	-0.043***	-0.046***	-0.044***	-0.044***	-0.044***	-0.044***	-0.035***	-0.041***	-0.038***	-0.038***	-0.027***	-0.027***
	(0.014)	(0.015)	(0.015)	(0.016)	(0.016)	(0.015)	(0.009)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)
Rule of law	0.273***	0.280***	0.276***	0.282***	0.337***	0.316***	0.267***	0.235***	0.290***	0.298***	0.247**	0.268***
	(0.093)	(0.100)	(0.106)	(0.107)	(0.112)	(0.106)	(0.075)	(0.083)	(0.078)	(0.078)	(0.096)	(0.089)
Polity	-0.103***	-0.118***	-0.112***	-0.112***	-0.134***	-0.119***	-0.041**	-0.025	-0.045**	-0.043**	-0.060***	-0.055***
	(0.020)	(0.023)	(0.023)	(0.023)	(0.026)	(0.024)	(0.017)	(0.019)	(0.018)	(0.018)	(0.021)	(0.020)
Market capitalization	-0.006***	-0.007***	-0.006***	-0.006***	-0.008***	-0.008***	-0.005***	-0.005***	-0.004***	-0.005***	-0.006***	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ease of credit	0.006	-0.010	-0.036	-0.037	0.020	0.010	0.019	0.002	0.028	0.027	-0.03	-0.008
	(0.059)	(0.066)	(0.061)	(0.061)	(0.069)	(0.066)	(0.037)	(0.043)	(0.040)	(0.040)	(0.042)	(0.040)
Skilled labor	-0.102	-0.027	-0.093	-0.099	-0.086	-0.072	-0.222***	-0.189***	-0.220***	-0.226***	-0.249***	-0.245***
	(0.070)	(0.076)	(0.078)	(0.078)	(0.085)	(0.079)	(0.058)	(0.061)	(0.062)	(0.062)	(0.070)	(0.067)
Comp. legislation	-0.205	-0.115	-0.161	-0.162	-0.226	-0.225	-0.074	0.035	-0.125	-0.131	0.036	-0.019
	(0.128)	(0.130)	(0.137)	(0.138)	(0.163)	(0.148)	(0.106)	(0.116)	(0.111)	(0.111)	(0.128)	(0.119)
Trend	0.011	0.004	0.022**	0.021**	0.017	0.015	0.059***	0.061***	0.062***	0.061***	0.053***	0.058***
	(0.009)	(0.010)	(0.010)	(0.010)	(0.013)	(0.012)	(0.008)	(0.010)	(0.010)	(0.009)	(0.011)	(0.010)
Performance variable	ROA	EBITDA/ Assets	Tobin's q	Market-to-book	TFP	Labor productivity	ROA	EBITDA/ Assets	Tobin's q	Market-to-book	TFP	Labor productivity
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	5,309	4,206	4,346	4,288	3,498	3,923	5,908	4,693	5,145	5,071	4,020	4,464
Pseudo R^2	0.367	0.363	0.375	0.375	0.405	0.391	0.160	0.175	0.173	0.175	0.187	0.183

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Probit regressions with robust errors clustered on each firm. Standard errors are in parenthesis. All independent variables are lagged (average, two previous years). When assessing the choice of majority ownership, for instance, we consider only the subset of majority SOEs and private firms.

Table 6. Differences-in-differences estimation of the effect of exogenous changes on the performance differences between SOEs and matched private firms: subsample of firms in developed countries

	Performance variable					
	ROA	EBITDA/ Assets	Tobin's q	Market-to-book	TFP	Labor productivity
Recessions						
Majority SOEs						
Matching estimate (ATT)	-0.056***	-0.054***	-0.665***	-1.535***	-0.125***	-0.199***
	(0.005)	(0.007)	(0.080)	(0.175)	(0.036)	(0.071)
N	387	330	368	363	320	339
Minority SOEs						
Matching estimate (ATT)	-0.007	0.003	0.004	-0.347***	-0.053**	-0.007
	(0.005)	(0.006)	(0.034)	(0.117)	(0.024)	(0.026)
N	461	386	438	433	372	398
Elections						
Majority SOEs						
Matching estimate (ATT)	0.000	-0.004	-0.089	-0.238	0.039	-0.034
	(0.005)	(0.006)	(0.065)	(0.225)	(0.032)	(0.047)
N	706	573	571	559	488	541
Minority SOEs						
Matching estimate (ATT)	0.009**	0.005	0.018	0.178	0.029	-0.156***
	(0.004)	(0.006)	(0.063)	(0.176)	(0.025)	(0.047)
N	774	620	660	649	547	597

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parenthesis. ATT is computed using the bias-corrected estimator proposed by Abadie and colleagues (2004, 2011); see explanation in Tables 3 and 4. Developed countries include Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovenia, South Korea, Spain, Sweden, Switzerland, United Kingdom, United States.