Infrastructure State-Owned Enterprises

A Tale of Inefficiency and Fiscal Dependence

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March 2022
Abstract

This paper examines the performance of infrastructure companies owned by the state, using the newly created World Bank Database of Infrastructure State-Owned Enterprises (SOEs). The data cover 19 countries and 135 SOEs between 2000 and 2018. The analysis reveals that infrastructure SOEs are large and have weak financial performance that generates significant fiscal risk. The paper introduces new measures of financial performance net of fiscal transfers and examines previously uncovered patterns of subsidies by sector. It examines the effect of state ownership by comparing the firms in the database with hundreds of comparable private firms, using coarsened exact matching. The findings show that relative to comparable private firms, infrastructure SOEs are less efficient, represent a larger share of gross domestic product, have larger liabilities as a share of gross domestic product and larger employment costs as a share of revenues, and yield lower returns on assets.

This paper is a product of the Infrastructure Chief Economist Office. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The author may be contacted at mdappe@worldbank.org.
Infrastructure State-Owned Enterprises: A Tale of Inefficiency and Fiscal Dependence

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JEL: H2, H54, H81, L9
Keywords: Infrastructure, state-owned enterprises, state ownership, fiscal risk, subsidies, matching

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1 This paper was peer reviewed by Ani Balabanyan, Practice Manager, World Bank, and Siddharth Sharma, Senior Economist, World Bank. It was prepared as a background paper for the Infrastructure Vice-Presidency Flagship Fiscal Costs and Risks from Infrastructure in an Era of High Debt Vulnerabilities and presented at the corresponding authors' workshop, held July 13, 2021, where it benefited from feedback provided by participants. The authors would particularly like to thank Vivien Foster and Teresa Ter-Minassian for their helpful comments and suggestions.
1 Introduction

State-owned enterprises (SOEs) operate in key economic sectors, such as natural resources and infrastructure, and provide basic goods and services to households and firms. As such, they play a crucial role in economic growth and development, especially in low- and middle-income economies.

SOEs are among the largest companies in both developed and developing countries. They are often dominant players in key sectors, especially infrastructure, numbering in the hundreds in various countries, including China, the Russian Federation, and Vietnam (Christiansen 2011; Szamosszegi and Kyle 2011; Wang, Guthrie, and Xiao 2011; OECD 2016, 2018). Total SOE assets in 2018 were estimated to be $45 trillion, about half of global GDP (IMF 2020).

SOEs are particularly prevalent in infrastructure, where they invest more than public entities, such as ministries and agencies, and the private sector combined in emerging and low-income economies.\(^2\) Infrastructure SOEs are arguably the most important SOEs for the overall health and growth of an economy, as they provide access to essential services in areas such as water, sanitation, energy, transportation, and communications, among others. In fact, many developing countries use infrastructure as the main tool for economic development.

Access to basic services is a necessary but not a sufficient condition for industrial development and economic growth. Infrastructure needs to act as a productivity enhancer, removing barriers to investment and improving the overall business climate. In many cases, governments use large infrastructure projects for political objectives—to show progress through physical construction or to inject money into the economy—rather than as an engine of development.\(^3\) Some projects end up being too costly to maintain for the economic benefits they bring, placing a burden on the budget and becoming a major source of fiscal risk (Nellis 2005).

Because of their high fixed costs, and significant economies of scale, many infrastructure SOEs are natural monopolies. For this reason, one would expect them to be smaller in number but much larger in size than the average SOEs in other sectors and to outperform similar private firms in the same sectors.

In practice, they do not. The main obstacle to improvements in the performance of infrastructure SOEs, especially those fully owned by the government, is the fact that they are used for quasi-fiscal operations (QFOs) and are not compensated for them. When they “are directed by their

\(^2\) World Bank (2017) finds that 83 percent of infrastructure projects are funded with public resources, 66 percent of total funding by SOEs.

\(^3\) See https://thediplomat.com/2020/01/the-trouble-with-indonesias-infrastructure-obsession/.
governments to pursue public policy objectives and are not given the resources to do so. . . the repeated use of such uncompensated quasi-fiscal activities leads to loss accumulation, underinvestment, and/or excess borrowing by the affected SOEs” (Ter-Minassian 2019, 51). Moreover, imposing QFOs on SOEs can create dependency, because excessive losses from QFOs lead SOEs to ask for (and receive) subsidies (fiscal transfers to cover operational losses), which can lead to moral hazard.

QFOs are key to explaining the underperformance of SOEs, because the services infrastructure SOEs provide are basic and essential; voters can directly connect their effectiveness to the SOEs and hence to the government. In addition, because SOEs maximize access to infrastructure services to the population, they often have to operate in remote and unprofitable areas. In addition, they are often subject to government interference and compelled to perform QFOs in the form of consumption subsidies to enable basic access for low-income households. As a consequence of these QFOs, SOEs often incur operating losses, which tend to increase over time and generate dependence on government transfers to operate.

Governments can compensate SOEs for QFOs in ways that avoid losses, but doing so is usually complicated by two problems. First, to budget for QFOs, governments need to estimate their cost ex ante. They can underestimate the cost of the QFOs or the negative effects they may cause because of the moral hazard they create. Second, having the government use SOEs to perform QFOs generates moral hazard because SOEs can overestimate the cost of the QFOs or request additional funds to cover losses generated for QFO–related operations. Hence, state ownership offers advantages and disadvantages for infrastructure SOEs. Because of them, it is not clear how strong or weak their financial performance is and how much they over or underperform similar private firms in the same sectors.

In this paper, we compare the size, cost structure, fiscal support, and financial performance of infrastructure SOEs across countries and relative to private firms, using data from the World Bank Infrastructure SOEs Database, which covers 135 SOEs in 19 countries between 2000 and 2018. We examine the role of state ownership in four sectors: power, airlines and airports, railways, and roads.

The analysis reveals that infrastructure SOEs are large and perform poorly, generating significant fiscal risk. We introduce new measures of performance net of fiscal transfers and examine previously uncovered patterns of subsidies by sector. We show that relative to comparable private firms, infrastructure SOEs are less efficient, represent a larger share of GDP, have larger liabilities as a share of GDP and larger employment costs as a share of revenues, and yield lower returns on assets.
We follow the recent literature on SOE performance and use coarsened exact matching techniques to compare the performance of infrastructure firms in the World Bank database with firms the same size in a newly created database of private firms in the same sector (Lazzarini and Musacchio 2018). We compare firms by size, industry, and region, because finding a good private match for an SOE within the same country is hard, because many SOEs are large and usually have market power.

The paper is organized as follows. Section 2 reviews the literature. Section 3 describes the World Bank Infrastructure SOE Database. Section 4 presents the main patterns that emerge from the data. Section 5 presents the results of a matching exercise that compares the performance of SOEs with similar private firms. Section 6 summarizes the paper’s main conclusions.

2 Literature Review

Financial performance in fully owned SOEs is weak, because of failures in monitoring (Shirley and Nellis 1991; Shirley and Walsh 2000), except when governments adopt corporate governance reforms (World Bank 2014; OECD 2018) and/or create holding structures to monitor their SOEs (OECD 2015; Musacchio and Pineda Ayerbe 2019). In the power sector, unbundling functions and allowing independent power producers to sell back their spare production and SOEs to recover costs can improve performance (Foster and Rana 2019).

Most progress in governance, monitoring, and regulating SOEs has been accompanied by partial privatization. The large body of literature on partial privatization finds significant improvements in monitoring, performance, and efficiency as government ownership falls. Most of this research uses fixed-effects regressions that exploit changes in ownership (Gupta 2005; Megginson 2005; Andrés, Foster, and Guasch 2006). Recent work compares the performance of partially privatized SOEs and private firms using matching techniques.

The results have been mixed. Using propensity score matching on a sample of 477 partially privatized SOEs, Lazzarini and Musacchio (2018) find that SOEs outperformed similar private firms. In their study of dozens of fully owned SOEs in Latin America, Musacchio and Pineda Ayerbe (2019) find the opposite result.

3 The Data

The World Bank Infrastructure SOE Database was compiled as part of a broader research project to analyze the fiscal costs and risks of infrastructure. The data come from financial statements from SOE websites, government websites that include SOE financial statements, annual reports, and other sources, such as the EMIS Intelligence database and stock exchange websites. The database covers all SOEs operating infrastructure assets in the power (generation, transmission, and distribution) and transportation (roads, railroads, and airlines and airports) sectors for 19
countries between 2000 and 2018. The countries were selected based on data availability and to maximize sectoral coverage. They include the following:

- East Asia and Pacific: Indonesia, Solomon Islands
- Europe and Central Asia: Albania, Bulgaria, Croatia, Georgia, Kosovo, Romania, Ukraine
- Latin America and Caribbean: Argentina, Brazil, Peru, Uruguay
- South Asia: Bhutan
- Sub-Saharan Africa: Burundi, Ethiopia, Ghana, Kenya, South Africa.

The database classifies an enterprise as an SOE if the state directly or indirectly owns more than 50 percent of its shares or is the ultimate controlling entity, through majority ownership of common stock or any other mechanisms of control. This definition is in line with the European Union’s definition of public undertakings in Commission Directive 2006/111/EC. It allows SOEs to be separated into two categories: fully owned SOEs (SOEs in which at least 99.5 percent of the shares are owned by the government or government entities) and partially privatized SOEs (all others).

The database provides panel data on the finances of SOEs in the power and transport sectors at the SOE/year level that are consistent over time and comparable across SOEs regardless of where they operate. To ensure consistency and reliability, researchers collected the data using a standardized accounting data template that was populated using the information on financial statements. To ensure that quantities like earnings before interest, taxes, depreciation, and amortization (EBITDA) and operations subsidies in the database are comparable across SOEs and years, they identified each item as defined by the template using the notes to the financial statements rather than relying on the way such items are presented in the SOEs’ main financial tables. Data reliability was further ensured through quality assurance checks by alternate analysts and accounting experts.

The database provides a standardized representation of the income statement, the balance sheet, and the cash flow statement of each SOE; it includes a set of selected items from the statements while maintaining consistency across different schedules. It also includes supplementary items, including currency risk, analysis of debt and loans, maturity profiles of assets and liabilities, and SOE ownership structure.

For this paper, we constructed the following variables to measure the size of SOEs: total assets to GDP, total liabilities to GDP, and total SOE expenses to GDP. To measure SOE performance, we created the following variables: employee costs (defined as the share of employment costs to total costs); EBITDA as a share of revenues; and average assets and return on average assets (ROAA), defined as total comprehensive profit or loss over the average of assets in the current
year and the previous year. We also examine a series of variables that adjust financial performance by netting fiscal transfers.

We take advantage of the fact that the database compiles operating and capital subsidies that SOEs receive from the government to adjust financial performance by netting such transfers.\(^4\) We first create a measure of adjusted Total Comprehensive Income (Adj. Income), which subtracts total subsidies from Total Comprehensive Profit (Loss) for the year. We then use that measure of adjusted income to create a ratio that measures the adjusted return on average assets (AdjROAA).

### 4 Descriptive Analysis of Infrastructure State-Owned Enterprises

#### 4.1 Size

Figure 1 depicts three proxies of SOE size for each country in the sample, averaged over the period 2009–18 (the period for which the panel is mostly balanced). It shows that infrastructure SOEs are indeed large. On average, total assets represent almost 18 percent of GDP—an extremely large share given that countries typically have only a handful of infrastructure SOEs, and our study did not cover all of them. This number masks a great deal of heterogeneity. Total assets account for as much as 82 percent of GDP in Bhutan and a mere 1.7 percent in Argentina. This variation likely reflects the sectoral distribution of SOEs in each country. Assets exceed 10 percent of GDP in most countries in the sample.

Panel b shows that the total liabilities of SOEs are also high. Average liabilities are about 8 percent of output and as much as 30 percent (Bhutan). Countries with large infrastructure SOE assets as a percentage of GDP also have large liabilities from infrastructure SOEs as a percentage of GDP. The high level of liabilities may just be an indication that infrastructure SOEs are large, but it can also be a red flag, a symptom of an underperforming SOE sector that, if unattended and persistent, could be a major source of fiscal risk. (We characterize SOE profitability below and discuss the sustainability of these companies.)

Panel c shows that operating expenses of infrastructure SOEs as a share of GDP are high. This finding reflects the fact that most infrastructure projects are financed with public rather than private money and provides further evidence that infrastructure SOEs are large. The distribution of countries is similar in all three measures of size, suggesting some robustness. It also suggests that our panel is well balanced for large firms in the sample. These numbers are extremely large

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\(^4\) Operations subsidies adds up all the subsidies the SOE received for operational expenses. It includes both extraordinary and recurrent subsidies to cover overall losses or quasi-fiscal operations, as disclosed by the SOE, including subsidies reported as revenues by the SOE. Capital Subsidies is the amortized amount of deferred income from capital assets granted to the SOE by the government. If not reported as a separate item in the income statement, the figures were inferred from the deferred income notes.
given that they are for only the infrastructure SOEs in the countries included and there are SOEs in other sectors.\textsuperscript{5}

Figure 1 Average assets, liabilities, and expenses of infrastructure SOEs as percent of GDP, by country

a. Assets

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure1a.png}
\caption{Average assets of infrastructure SOEs as percent of GDP, by country.}
\end{figure}

b. Liabilities

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure1b.png}
\caption{Average liabilities of infrastructure SOEs as percent of GDP, by country.}
\end{figure}

\textsuperscript{5} Total assets and total liabilities presented do not net out the receivables and payables among SOEs because of lack of data availability. They may therefore be overestimated to some degree, especially in countries where the electricity sector has been unbundled and all functions are operated by separate SOEs.
c. Operating Expenses

Source: World Bank Infrastructure SOEs Database.
Note: Data are for 2009–18.

4.2 Performance

SOE underperformance can turn into an important source of fiscal risk and macroeconomic instability, depending on the volatility and size of SOE losses. This section looks at three indicators of profitability to gain a deeper understanding of how infrastructure SOEs perform.

Figure 2 shows the return on average assets (ROAA) for all the SOEs in the sample, with and without adjusting for the operating subsidies they receive. This figure, and the following ones, reveals the high level of subsidies in infrastructure SOEs. The power sector is the least subsidized and the best-performing sector, with and without subsidies, followed by airlines and airports (without subsidies). Railways is by far both the most heavily subsidized sector and the worst-performing one, with negative ROAA even after accounting for subsidies. This performance raises concerns about the sustainability and fiscal risk of railway SOEs. The figures also show that when the net income of the SOEs in our sample is adjusted for operating subsidies, ROAA becomes very negative.

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6 In Sub-Saharan Africa, for instance, only Umeme, Uganda’s private utility company, has remained profitable. Trimble and others (2016) find that only 2 of 39 African countries they study—the electric utilities of Uganda and the Seychelles—were fully recovering their costs of supply (before taking system expansion into account).
Figure 2 Return on average assets of infrastructure SOEs with and without adjustment for operating subsidies, by sector

Source: Authors, based on data from the World Bank Infrastructure SOEs Database.
Note: Data are for 2009–18.

Figure 3 Return on average assets for partially privatized and fully owned infrastructure SOEs, with and without adjusting for operating subsidies, by sector

a. Partially privatized infrastructure SOEs
b. Fully owned infrastructure SOEs

![Graph showing differences between fully owned and partially privatized infrastructure SOEs.](image)

**Source:** Authors, based on data from the World Bank Infrastructure SOEs Database.

**Note:** Data are for 2009–18. Partially privatized SOEs refer to firms that are majority-owned or controlled but not fully owned by the state.

Figure 3 highlights the differences between fully owned and partially privatized infrastructure SOEs. Among partially privatized SOEs, ROAA is highest in the road and power sectors (figure 3, panel a). In fact, the performance of roads is much better for partially privatized SOEs than for fully owned ones (figure 3, panel b). Power SOEs exhibit no major differences between the two groups. Overall, performance is worse for fully owned SOEs, especially after adjusting for subsidies.

**4.3 Subsidies**

Subsidies of infrastructure SOEs average about 12 percent of operating income (figure 4). They are highest for the worst-performing sectors. Power companies receive only 4 percent of their income in subsidies; in contrast, the roads sector receives about 47 percent. In the airlines and airports sector, about 10 percent of the sample receives transfers, which are used mostly to finance improvements and repairs at airports, especially small regional airports in Eastern Europe, which are expensive to maintain and upgrade.

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7 Partially privatized SOEs are firms that are majority owned or controlled but not fully owned by the state. Full ownership is defined as state control of at least 99.5 percent of the share capital.
Figure 4 Subsidies as a share of infrastructure SOEs’ operating income, by sector

![Bar chart showing subsidies as a share of operating income by sector.]

Source: Authors, based on data from the World Bank Infrastructure SOEs Database.
Note: Data are for 2009–18.

The roads sector is the most heavily subsidized, but there are large differences in magnitude within the sector, with subsidies averaging less than 35 percent of income for partially privatized road SOEs and more than 50 percent of income for fully owned road SOEs. The subsidy differential is even larger in the airlines and airports sector (1 percent versus 13 percent) and in the power sector (1.6 versus 4.8 percent). Fully owned and partially privatized SOEs in the power sector are similar in terms of both profitability and the magnitude of the subsidies received.

To reveal how sustainable the operations of infrastructure SOEs are, figure 5 shows operating subsidies as a share of operating expenses. It focuses on operating expenses because unlike investments, they cannot be postponed or cancelled in bad times. It is particularly hard to cut employment costs. Operating subsidies pay for a large part of total operating expenses in the roads (44 percent) and railways (25 percent) sectors; they cover smaller shares in the power (closer to 5 percent) and airports and airlines (10 percent) sectors. The average across sectors is almost 11 percent. The bulk of the operating subsidies disclosed in SOE financials are in upper-middle-income and high-income countries.
Figure 5 Operating subsidies of infrastructure SOEs as a percent of operating expenses, by sector

Source: Authors, based on data from the World Bank Infrastructure SOEs Database.
Note: Data are for 2009–18.

4.4 Costs

Employment costs represent a very large share of revenues (figure 6). They exceed revenues in the railways sector, and they represent about 91 percent and 70 percent of revenues in the airlines and airports and roads sectors, respectively. Employment costs are lower in the power sector, where they account for 23 percent of revenues. Maintenance costs are high for roads and low for the other sectors. Fuel is the main expense item for the power sector. The government take (taxes plus dividends) is low across all sectors.

Figure 6 Costs of infrastructure SOE as a share of revenues, by sector
As a share of revenues, employment costs are higher at fully owned SOEs than at partially privatized companies (figure 7). In all four sectors, employment costs at partially privatized firms represent less than 22 percent of revenues, a figure that is in line with that of private firms around the world. A plausible explanation of the large differences between fully owned and partially privatized SOEs is that fully owned SOEs in the infrastructure sector are heavily unionized and have less flexibility to reduce their labor force during downturns. Employment costs thus increase during good times and remain high during bad times. Politicians also use some SOEs as employment vehicles, creating massive companies whose financial performance deteriorates over time.
5 Comparison with Private Companies

This section presents the results of a matching exercise that compares the performance and fiscal risk of SOEs with that of private firms.

5.1 Data and Methodology for Matching Comparisons

To compare the SOEs with private firms, we follow a multistep process. First, we use the tools in Standard & Poor’s Capital IQ to create a comparison set. We search for firms in the same sector and same region, restricting the search to firms that have similar total assets in US dollars. In particular, we compile financials for firms that are within +/–20 percent of the assets of the firms in our sample as well as in the same industry and region. We end up with a comparison set of 10–20 firms for each of the SOEs in our database.

Second, we eliminate companies that are easily identifiable as SOEs in the comparison set, leaving a sample of over 600 firms to use in the matching exercise. We focus on the period 2009–18, for which the World Bank Infrastructure SOEs Database has better coverage.

One concern we had was whether our database of private firms included state-owned firms, despite our efforts to try to eliminate them. Because Capital IQ does not provide information on the ultimate ownership of firms, in a first iteration we use their “public ownership” indicator to remove some obvious SOEs from the comparison set. We used the database of Lazzarini and
Musacchio (2018) to eliminate another 30 firms that have minority state ownership (any firm with more than 5 percent state ownership) in the roads, airports and airlines, power, and railway sectors.  

Having some partially privatized firms in our set of private firms would be a problem only if we find that SOEs outperform private firms. In this case, the partially privatized firms could be reducing the mean performance of private firms, biasing our matching results to indicate better performance for SOEs. If, however, we find that SOEs underperform a sample of private firms and partially privatized SOEs, it is likely that our estimates represent lower bounds on the “treatment effect” of being state owned and that the effect would actually be larger if all partially privatized firms were eliminated from the comparison group. As we explain below, our results show that SOEs perform worse, are larger, accumulate more liabilities, and have higher employment costs than private firms. We are therefore confident that our results present either a lower-bound estimate of the effect of state ownership or at best a good reflection of the average effect of being an SOE.

### 5.2 Matching

In order to estimate the effect of state ownership on several indicators of performance, we first perform a matching exercise in which we treat our SOE sample as the treatment group and a dataset of private firms as the control group. We use matching techniques, because our database is observational rather than randomly selected; there can therefore be systematic differences in characteristics between the treated group (SOEs) and the untreated subjects (private firms) that can cause significant imbalances between these groups.

We use the coarsened exact matching (CEM) algorithm described in Iacus, King, and Porro (2012). This technique minimizes imbalances between groups and provides a larger comparison group for each of our SOEs than we would get with exact matching techniques, which tend to produce only a few matches. The underlying idea of the CEM algorithm is to yield coarsened groups, or strata, to match the treated and the control subjects, which bounds the imbalance between the two groups. The CEM has several benefits, as Blackwell et al. (2009) note. First, it meets the congruence principle, which states that the data space and analysis space should be the same, thereby reducing the possibility of obtaining strange or counterintuitive results. Second, the CEM bounds the matched data to areas of common empirical support, thereby reducing the possibility

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8 There is still the slim possibility that we may have left firms in the sample that are owned by entities that are ultimately controlled by governments. A more specialized database that tracks ultimate ownership, such as Bureau van Dyk’s Orbis, can be used to resolve this issue in future work.

9 We run the same matching exercise but with partially privatized firms, using the sample of Lazzarini, and Musacchio (2018), and find no significant differences with fully owned SOEs.
of difficult-to-justify extrapolations of the causal effect, which are heavily model dependent. Third, the CEM is a computationally efficient method, even for large datasets.

To run the CEM algorithm, we use the natural logarithm of total assets as the pivot variable to construct the strata or coarsened groups. Rather than also restricting the matching by sector and region in which the firms’ headquarters are located according to Capital IQ, we control for those variables in the regression. The CEM procedure yields 574 private firms (with 4,543 panel observations) matched with 85 SOEs (with 686 panel observations). The matching method also yields nine strata and sampling weights to account for the remaining imbalance between groups.

Table 1 presents descriptive statistics of the key variables of the treated (SOEs) and control (private firms) groups. It shows that on average, SOEs are larger, more indebted, less efficient, and less profitable than private firms, with all differences statistically significant. However, many of the profitability outcomes may be correlated with both size and leverage, which is why we control for these variables in the regressions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>State-owned enterprises</th>
<th>Private firms</th>
<th>T-test (difference of means)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm average size (log assets)</td>
<td>Observations: 787</td>
<td>Mean: 7.55</td>
<td>Standard deviation: 2.03</td>
</tr>
<tr>
<td>Liabilities to GDP (%)</td>
<td>Observations: 686</td>
<td>Mean: 2.20</td>
<td>Standard deviation: 0.13</td>
</tr>
<tr>
<td>Gross margin to average assets (%)</td>
<td>Observations: 603</td>
<td>Mean: 5.06</td>
<td>Standard deviation: 26.29</td>
</tr>
<tr>
<td>ROA (%)</td>
<td>Observations: 603</td>
<td>Mean: –0.91</td>
<td>Standard deviation: 10.97</td>
</tr>
<tr>
<td>Leverage (debt-to-assets ratio, %)</td>
<td>Observations: 495</td>
<td>Mean: 13.52</td>
<td>Standard deviation: 17.07</td>
</tr>
</tbody>
</table>

Note: EBITDA: Earnings before interest, taxes, depreciation, and amortization. ROAA: Return on average assets.
* p < 0.1, ** p < 0.05, *** p < 0.01.

Once we construct the matched sample, we obtain the sample average treatment of the treated (SATT) by estimating the variable of interest against the dummy of matched SOE—if we assume that the treatment assignment is independent of the potential outcomes—using the sample weights generated from the CEM procedure. Under this approach some degree of imbalance remains, linked with the level of coarsening of the data. A reasonable approach to adjust this imbalance is to specify a statistical model, as the CEM algorithm bounds the level of model dependence, as Blackwell et al. (2009) suggest. One way to do so is by adding controls to the
equation. For this reason, we estimate a panel model of the outcomes of interest, including the dummy of SOE and controls, in equation 1:

\[ Y_{t,ijk} = \beta_0 + \beta_1 SOE_{t,ijk} + \beta_2 Leverage_{t,ijk} + \beta_3 Size_{t,ijk} + \gamma_i + \theta_j + \phi_k + \tau_t + \varepsilon_{t,ijk}, \]  

where \( Y_{t,ijk} \) is the outcome variable observed for the matched firm in the \( i \) region, the \( j \) country-level income group, and the \( k \) sector, at year \( t \), and \( SOE_{t,ijk} \) is a dichotomous variable equal to 1 if the matched firm is a state-owned firm and 0 otherwise. Most specifications control for the log of total assets of the firm (\( Size_{t,ijk} \)); the debt to assets ratio (\( Leverage_{t,ijk} \)); time, sector, country-income, and region effects, represented by \( \tau_t \), \( \phi_k \), \( \theta_j \), and \( \gamma_i \), respectively. Finally, \( \varepsilon_{t,ijk} \) is a normally and independently distributed error term with mean 0, and variance \( \sigma^2 \). To exploit the properties of the weighted estimation, we run the model using a random effect maximum likelihood estimation (random effects at the firm level). The outcomes of interest are assets to GDP, liabilities to GDP, ROAA, our measure of adjusted ROAA (AdjROAA), EBITDA to revenues, EBITDA to average assets, and employment costs as a share of operation expenses. Errors are clustered at the strata level, using the strata produced by the CEM matching procedure.

5.3 Findings and Implications

Table 2 reports the outcomes of the matching regressions. Columns 1 and 2 reveal that SOEs tend to be larger (by almost 2 percentage points of assets to GDP) and highly more indebted (by almost 1 percentage point of GDP) than their private counterparts. In both cases, the effect is economically large (about three times the mean of these variables) and statistically significant.

These results are not surprising, for several reasons. First, it has been well documented in the literature that SOEs tend to be much larger than private companies (OECD 2016; Musacchio and Pineda Ayerbe 2019); we would not expect infrastructure SOEs to behave any differently, especially given that they are the largest SOEs (Christiansen 2011). Second, recent evidence shows that the borrowing behavior of public and private firms differs, because private firms face more obstacles in accessing long-term financing (Dinlersoz et al. 2018). There is also evidence that fully owned SOEs have access to cheaper financing than similar private firms (Wagner, Musacchio, and Jara-Bertin 2016). Regardless of ownership, larger firms in our sample are more indebted, which is consistent with the literature that shows that size matters for access to finance.

Columns 3–6 highlight that ownership matters for financial performance even after controlling for size and leverage. SOEs earn lower returns than private companies, with ROAA almost 2.5 percentage points lower than at similar private firms (5 percentage points lower after adjusting for subsidies). The coefficients for the adjusted ROAA are very large, considering that the mean is 1.5. SOEs are thus significantly (statistically and economically) less profitable than similar private ones, even when they are subsidized.
Table 2 Random effects matching regressions for performance and size variables of SOEs versus private firms

<table>
<thead>
<tr>
<th>Variable</th>
<th>Assets to GDP</th>
<th>Liabilities to GDP</th>
<th>ROAA</th>
<th>Adjusted ROAA</th>
<th>EBITDA to revenues</th>
<th>EBITDA to average assets</th>
<th>Employee costs (share)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.262)</td>
<td>(0.112)</td>
<td>(0.874)</td>
<td>(0.955)</td>
<td>(4.446)</td>
<td>(1.102)</td>
<td>(2.075)</td>
</tr>
<tr>
<td>Leverage</td>
<td>–0.00582***</td>
<td>–0.0491***</td>
<td>–0.0666***</td>
<td>0.0603*</td>
<td>–0.0145*</td>
<td>–0.00102</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00154)</td>
<td>(0.00790)</td>
<td>(0.00843)</td>
<td>(0.0324)</td>
<td>(0.0084)</td>
<td>(0.0151)</td>
<td></td>
</tr>
<tr>
<td>Size (ln(assets))</td>
<td>0.0791***</td>
<td>–0.0176</td>
<td>0.120</td>
<td>3.586***</td>
<td>0.673***</td>
<td>–0.733***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00777)</td>
<td>(0.109)</td>
<td>(0.118)</td>
<td>(0.521)</td>
<td>(0.115)</td>
<td>(0.237)</td>
<td></td>
</tr>
<tr>
<td>World Bank region dummies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Year dummies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Sector dummies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>World Bank income level dummies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constant</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Observations</td>
<td>3,798</td>
<td>3,800</td>
<td>3,383</td>
<td>3,381</td>
<td>3,728</td>
<td>3,371</td>
<td>2,505</td>
</tr>
<tr>
<td>Number of firms</td>
<td>596</td>
<td>597</td>
<td>570</td>
<td>570</td>
<td>590</td>
<td>567</td>
<td>386</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.619</td>
<td>0.329</td>
<td>2.098</td>
<td>1.469</td>
<td>18.84</td>
<td>6.526</td>
<td>14.63</td>
</tr>
</tbody>
</table>

Note: EBITDA: Earnings before interest, taxes, depreciation, and amortization. ROAA: Return on average assets. Standard errors in parentheses. Errors are clustered by strata derived from the coarsened exact matching procedure.

* p < 0.1, ** p < 0.05, *** p < 0.01.

In line with this finding, EBITDA to revenue is 16 percentage points lower and EBITDA to average assets 4.5 percentage points lower at SOEs than at the average private firm. These magnitudes are large considering that the average EBITDA to revenues is 18.8 percent and the average EBITDA to assets 6.5 percent, meaning that being an SOE almost implies a zero margin.

Ownership plays a big role in explaining the weak results of SOEs, as similar private companies perform much better. These abnormal losses may also explain SOEs’ propensity to borrow more and their fiscal dependence.

Column 7 reveals that the share of employee costs to total costs is much larger in SOEs (35 percent) than in private firms (20 percentage points higher), suggesting that governments hire inefficiently or that one of the QFOs these SOEs perform is related to creating employment. Their inability to shed labor in hard times suggests that their financial performance is likely to deteriorate over time and to be highly affected by negative shocks.

Do subsidies distort SOE behavior, by encouraging them to remain or become unprofitable? To investigate the question, we split the SOE firm-year observations into those that receive subsidies (the sum of operation and capital subsidies) and those that do not (table 3).
Table 3 Random effects matching regressions for performance, size, and subsidies variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1) ROAA</th>
<th>(2) Adjusted ROAA</th>
<th>(3) EBITDA to revenues</th>
<th>(4) EBITDA to average assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOEs that do not receive subsidies</td>
<td>$-2.101^{**}$</td>
<td>$-7.268^{***}$</td>
<td>$-34.87^{***}$</td>
<td>$-7.062^{***}$</td>
</tr>
<tr>
<td></td>
<td>(1.015)</td>
<td>(1.084)</td>
<td>(4.806)</td>
<td>(1.211)</td>
</tr>
<tr>
<td>SOEs that receive subsidies</td>
<td>0.416</td>
<td>$-3.844^{***}$</td>
<td>$-25.84^{***}$</td>
<td>$-3.476^{***}$</td>
</tr>
<tr>
<td></td>
<td>(0.753)</td>
<td>(0.790)</td>
<td>(2.927)</td>
<td>(0.758)</td>
</tr>
<tr>
<td>Leverage</td>
<td>$-0.0491^{***}$</td>
<td>$-0.0576^{***}$</td>
<td>0.0588*</td>
<td>0.0146*</td>
</tr>
<tr>
<td></td>
<td>(0.00790)</td>
<td>(0.00833)</td>
<td>(0.0321)</td>
<td>(0.00837)</td>
</tr>
<tr>
<td>Size (ln(assets))</td>
<td>$-0.0174$</td>
<td>0.0366</td>
<td>3.660^{***}</td>
<td>0.675^{***}</td>
</tr>
<tr>
<td></td>
<td>(0.109)</td>
<td>(0.116)</td>
<td>(0.513)</td>
<td>(0.115)</td>
</tr>
<tr>
<td>World Bank region dummies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Year dummies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>World Bank income level dummies</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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Note: EBITDA: Earnings before interest, taxes, depreciation, and amortization. ROAA: Return on average assets. Standard errors in parentheses. Errors are clustered by strata derived from the Coarsened Exact Matching procedure.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3 reveals two interesting findings. First, it shows that SOEs that receive subsidies perform better than firms that do not. Firms that receive subsidies have no significant difference in ROAA relative to private firms. Netting out the subsidies and comparing private ROAA with SOEs’ adjusted ROAA, however, shows that SOEs that receive subsidies perform 3.8 percent worse than private firms—a large difference relative to the sample mean of comparable ROAA of 1.5 percent. This finding means that subsidies are covering up the unprofitability of SOEs by making up for their losses. Similar results are evident when looking at EBITDA to revenues and EBITDA to assets (columns 3 and 4). If we view EBITDA to revenues and EBITDA to assets as a measure of efficiency, then it is clear that SOEs that receive subsidies perform worse than private firms. EBITDA to revenues is 25.8 percentage points lower and EBITDA to assets is 3.4 percentage points less for SOEs than for private firms.

The second finding of table 3 is puzzling. SOEs that do not receive subsidies perform worse than private firms and therefore also worse than SOEs that receive subsidies. SOEs that do not receive subsidies have an ROAA that is 2.1 percent lower than private firms and an adjusted ROAA that
is 7.2 percentage points lower. In terms of EBITDA to revenues and EBITDA to assets, SOEs that do not receive subsidies have 34.9 and 7.1 percentage points worse ratios, respectively. These ratios are significantly different from both private firms and SOEs that receive subsidies. In terms of economic significance, the coefficients are extremely large relative to the means of these variables—SOEs with a coefficient that is two times the mean of the sample for EBITDA to revenues and one time the mean for EBITDA to assets. If we view these coefficients as basic measures of efficiency, SOEs are in a different league of inefficiency from private infrastructure firms.

These results are surprising, because one would expect that receiving subsidies would generate moral hazard and thus incentives to perform worse than SOEs that do not receive subsidies. Receiving subsidies, usually tied to QFOs, opens the door for SOE managers to request support for losses from other aspects of their operation. What our findings suggest is that SOEs that receive subsidies are probably subject to more attention and perhaps monitoring. As the Ministry of Finance must compensate those firms for losses related to QFOs, its technocrats may pay closer attention to the rest of the operation. As a result, these SOEs may end up performing better than SOEs that do not receive subsidies.

6 Conclusions

This paper uses the World Bank Infrastructure SOEs Database to document the underperformance of SOEs in the database vis-à-vis similar private ones. It highlights some of the factors that may be driving underperformance, such as overstaffing. It also provides evidence that ownership matters by comparing SOEs that are entirely owned by the state with SOEs that are partially privatized and with private firms.

The analysis reveals that SOEs are large and accumulate significant liabilities, which, together with their weak performance, creates significant fiscal risk. We document that subsidies often mask the underperformance of infrastructure SOEs. Netting out those fiscal transfers reveals even weaker performance. The data on subsidies also show a dangerous pattern of fiscal dependence. The soft budget constraint of these SOEs may be generating their underperformance, which translates into fiscal risk. How much of the need for these fiscal transfers is expected or unexpected is an empirical question that requires further exploration.

The paper also examined how much of SOEs’ underperformance, leverage, size, and large employee costs is sector specific and how much is related to state ownership. The results of a matching exercise that compares infrastructure SOEs with similar private firms confirm that state ownership is indeed associated with larger firms, larger liabilities relative to GDP, worse financial performance, and larger employee costs. On average, SOEs that receive subsidies actually perform better net of subsidies than SOEs that do not receive subsidies, although still worse than
private firms. This finding suggests that subsidies are masking some of the profitability issues in SOEs but not generating moral hazard or complacency.

Infrastructure SOEs tend to exhibit weaker operational performance than comparable private firms (Andrés et al. 2008; Gassner, Popov, and Pushak 2009). But little is known about how large the contingent liabilities that SOEs generate are or how costly it is to operate infrastructure assets under state ownership relative to operating them under PPPs or privately (Engel, Fischer, and Galetovic 2010, 2014).

Our results contribute to the debate about who should operate infrastructure assets by bringing systematic evidence of the fiscal cost and financial inefficiency of infrastructure SOEs. We document the fiscal dependence of these SOEs, showing systematic performance differences with private firms. Our evidence highlights that state ownership has significant costs and incentive schemes that perpetuate inefficiency and fiscal dependence.

References


