Does State Ownership Have Limits in Romania?

An Assessment of Firm Performance and Market Outcomes before and during the COVID-19 Crisis

Seidu Dauda
Georgiana Pop
Mariana Iootty

WORLD BANK GROUP

Abstract

This paper assesses the performance of Romanian state-owned enterprises with various degrees of ownership (minority owned with 10 to 24.9 percent stakes, minority owned with 25 to 49.9 percent stakes, and majority owned with at least 50 percent ownership stakes) and control levels (central versus local state-owned enterprises and directly versus indirectly owned state-owned enterprises) relative to privately owned enterprises. The paper uses the Romanian firm-level data from the Ministry of Finance covering enterprises of all sizes from 2011 to 2020, combined with the new World Bank Businesses of the State dataset, which tracks ownership of state business entities with at least 10 percent stake in Romania. The paper analyzes whether various degrees of state ownership and levels of control matter for state-owned enterprises' performance.

The paper also assesses whether Romanian state-owned enterprises were able to act as stabilizers during the early period of the COVID-19 pandemic, and how the presence of state-owned enterprises in markets correlates with market outcomes. The findings show that relative to private firms, Romanian state-owned enterprises, particularly those that are majority owned, directly owned, and local ones, employ more people, pay higher wages, but are less productive. In addition, Romanian state-owned enterprises cushioned the job and wage losses associated with the COVID-19 pandemic better than private firms, especially in competitive sectors. Finally, there is evidence that the presence of state-owned enterprises may limit private firm entry and allocative efficiency.

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Seidu Dauda,[2] Georgiana Pop,[3] and Mariana Iootty[4]

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[2] The World Bank, sdauda@worldbank.org.

[3] The World Bank, gpop@worldbank.org (corresponding author).

[4] The World Bank, miootty@worldbank.org.

1. Introduction

State-owned enterprises (SOEs) play an important role in many economies. In several emerging and developing economies, they are significant or the only market player(s) in some sectors, providing essential public services, such as utilities (e.g., electricity, gas, and water), transportation (by road, air, rail, and water), and telecommunications (fixed line, mobile services, and postal services). In economic crises, they can also serve as buffers, limiting employment layoffs, sustaining workers' wages, and keeping the economies afloat.

Romania is not an exception and has the largest number of SOEs in the European Union (EU), with over 1,400 centrally and locally owned SOEs (Sakha and Jin 2022; World Bank 2020). Of these, about 80 percent are owned by local or municipal governments, with the rest owned by the central government. Together, they generated about 8 percent of the total output of non-financial corporations, employed about 4 percent of the total workforce in 2017,[5] and were beneficiaries of government subsidies and transfers totaling about 0.7 percent of GDP (Sakha and Jin 2022; World Bank 2020). Within the last decade, the state's footprint has increased, with several new SOEs being created: for instance, the Bucharest city government alone set up around 22 new SOEs in several sectors with no clear economic rationale, such as taxi services, travel arrangements, and advertising (World Bank 2020).

Notwithstanding various waves of state divestiture, the significant SOE footprint, combined with a lack of competitively neutral policies, has been obstructing market functioning. The reach of Romanian SOEs goes beyond the typical network sectors and encompasses activities without a clear economic rationale for their presence, such as manufacturing, accommodation, and food service activities. Like in many countries, Romanian SOEs do not always operate under the same rules and conditions as privately-owned enterprises (POEs) (World Bank 2020; Iootty, Pop and Pena, 2021; OECD 2023). The advantages and privileges they enjoy can create an unequal footing with POEs, thus distorting key market outcomes and limiting the efficiency of resource allocation across firms and sectors.

Romanian SOEs tend to perform worse than their private peers. They are less profitable and generate lower revenues per employee than their private peers. Besides, they were found to have high wage premia, which weighs on their financial bottom line (IMF 2019). The prevalence of SOEs in the Romanian economy, their inefficiencies, notably in key sectors like energy and transport that provide essential inputs to other sectors, coupled with their lower profitability and higher wage premium, have been identified as imposing a significant burden on public finances and economic growth (EC 2015; World Bank 2018). Historically, SOEs had higher debt levels, including through overdue payments to suppliers (Marrez 2015). Weak governance of SOEs and state aid support to dwindling industries with significant SOE presence (e.g., railways), among others, have induced resource misallocation towards less productive firms, such as SOEs, thus dampening aggregate productivity gains (World Bank 2018).

This papers sheds additional light on the performance of Romanian SOEs in the recent years (including the early COVID-19 period) and their effects on markets. The paper addresses several questions relating to SOE presence in markets. For that the paper uses the Romanian firm-level data from the Ministry of Finance covering enterprises of all sizes (hereafter referred to as MoF firm-level data) for the period 2011-2020, combined with the new World Bank Businesses of the State (BOS) database that

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[5] According to the World Bank Businesses of the State database, SOEs with at least 10% state ownership accounted for 3.6% of the formal employment as of 2019 in Romania. Section 3, "Data Sources", of this paper describes the World Bank Businesses of the State database.

tracks ownership of state business entities with at least 10 percent stake in over 90 countries, including Romania. The first part of the paper examines whether the degree of ownership and control levels of SOEs matter for differences in performances—in terms of employment, average wages, assets per worker, investment, and (labor) productivity—between SOEs and POEs over the 2011-2019 period. The ownership degrees analyzed are *minority owned SOEs with 10 to 24.9 percent stakes*, *minority owned SOEs with 25 to 49.9 percent stakes* and *majority owned SOEs with at least 50 percent ownership stakes*. Control levels mean (a) whether the SOE is owned by the central government (i.e., *centrally owned SOEs*) or local governments (i.e., *locally owned SOEs*) and (b) whether the SOE reports to directly to a government agency, be it central or local government agency (i.e., *directly owned SOEs*), or indirect because the SOE is a subsidiary of an SOE that reports directly to a central or local government agency (i.e., *indirectly owned SOEs*). The first part also assesses government subsidy allocations to SOEs and POEs. The second part of the paper assesses whether Romanian SOEs acted as buffers during the first year of the COVID-19 pandemic (i.e., 2020) and the potential implications of subsidy receipt on performance during this crisis period. The final part investigates how the presence of SOEs in markets correlates with measures of allocative efficiency and other market outcomes.

The novelty of this work is related to the fact that the paper compares performance differences across varying SOE ownership degrees and control levels relative to POEs, also considering key government interventions through subsidies. Previous studies on Romania only assessed performance differences between SOEs in general and POEs or those between majority owned SOEs and POEs. None have assessed how the performance of SOEs owned by local governments and those owned by the central government, or SOEs that report directly to government agencies and those that do not, compared to that of their private peers. This paper contributes to the debate in Romania, and the literature in general, by shedding light on SOE performance along different ownership degrees and control levels, also considering the role of subsidies for firm performance, including during the early period of COVID-19.

The main findings suggest that, first, Romanian SOEs employed more people, had larger assets per worker, and paid better wages, on average, than their POE peers but were less productive over the 2011-2019 period. They also experienced higher growth in terms of jobs, total assets, and labor productivity than their private peers. SOEs, however, saw slower expansion in average wage. Majority owned, directly, and locally owned SOEs drove these results. The majority owned, directly, and locally owned SOEs also received more government subsidies than POEs. Second, relative to POEs, Romanian SOEs seemed to have weathered better some of the early negative effects that the COVID-19 downturn had on revenues, jobs, and wages. Third, the presence of Romanian SOEs in markets may limit the entry of new private competitors and undermine the efficient allocation of resources across firms within sectors.

The rest of the paper is organized as follows. Section 2 reviews the literature on how SOEs perform relative to POEs along the main research aspects of the study. Section 3 discusses the two main datasets used for the analyses in this study, while Section 4 provides the empirical methodologies underlying the main findings. Section 5 presents the main results and Section 6 concludes.

2. Related Literature

A large strand of literature has examined the performances of SOEs relative to POEs in Romania. The first strand is the literature examining SOEs' financial and productivity performances relative to POEs in Romania. Most of these studies find that SOEs are less productive. For instance, Marrez (2015) highlights that Romanian SOEs generate lower revenue per employee (i.e., are less productive) compared to POEs, suggesting that SOEs seem to be over-staffed compared to POEs. A similar exercise by the European

Commission also suggests that Romanian SOEs have lower labor productivity than their private peers (EC 2015). In a study across the Central, Eastern, and Southeastern European (CESEE) region, IMF (2019) found that SOEs in Romania exhibited lower revenue per worker compared to POEs but had a more than 80 percent wage premium over POEs. These findings align with EC (2015), which indicatesthat despite being less productive, Romanian SOEs paid higher salaries than their POE peers. Further, OECD (2023) found that Romanian SOEs underperformed significantly in terms of sales and profitability when compared to POEs.

Outside Romania, studies find that SOEs grow jobs faster but underperform POEs on several dimensions. In a study across European countries, Szarzec, Dombi, and Matuszak (2021) found that SOEs are positively associated with employment growth, with the effect diminishing with institutional quality. Cerdeiro and Ruane (2022) highlighted that Chinese SOEs exhibit lower revenue productivity than POEs. Harrison et al. (2019) indicated that SOEs had significantly less profitability than POEs and even privatized SOEs exhibited slightly higher profitability than SOEs. The authors also found that SOEs were less innovative when compared to former SOEs and POEs that were never state-owned ones.

The literature on the SOE performance dimension has also focused on the differential performances between SOEs of different ownership degrees and control levels relative to POEs. SOEs are not uniform. Some are majority owned, with 50 percent or more ownership stakes, and others are minority owned with different degrees of ownership stakes less than 50 percent. While some SOEs are directly owned under the direct supervision of government agencies and line ministries, others are indirectly owned because they are subsidiaries of the directly owned SOEs. Yet, others are owned by national or central governments and others by subnational, municipal, or local governments. As such, SOEs under different ownership and control levels may face different governance structures, entrusted with distinct objectives, and may be differentially targeted for government support in ways that could generate differences in their measured performances relative to POEs. Jurzyk and Ruane (2021) assessed whether the productivity differential between listed SOEs and POEs in China varied by SOEs owned by the central government and those owned by local governments. Their results suggest that, despite differences in governance and incentives, central and local SOEs both exhibit a similar productivity gap of about 30 percent relative to POEs.

Other studies have assessed whether SOEs get preferential treatment by receiving more state support through subsidies than POEs. SOEs can benefit disproportionately from government subsidies because they need to compensate for their higher costs of meeting policy mandates. In China, a study by Harrison et al. (2019), using 1998-2013 data on medium and large firms, found that SOEs were 3 times more likely to receive government subsidies and other support, such as low interest rates on loans, than POEs.They also tended to receive larger values of subsidies compared to POEs. Even when SOEs are privatized, they tend to be favored more by government subsidies and support compared to POEs that were never state-owned. Former SOEs were twice more likely to receive subsidies and in larger values, than POEs that were never state-owned.

Regarding the role of SOEs during economic downturns, recent literature analyzed whether SOEs acted as buffers during economic downturns. SOEs and state-owned banks or other financial institutions (SOBs or SOFIs) can act as economic stabilizers in economic crises by attenuating job losses and sustaining workers' wages in ways that POEs cannot do. Even if governments during various crises aspired to stabilize demand, employment, and investment through state support to SOEs, the evidence on the effectiveness of SOEs in fulfilling those objectives is not clear cut (Beuselinck et al., 2017; Vitoria et al., 2020; Lazzarini and Musachio, 2018, IMF, 2019; Vagliasindi, 2022; Kopelman and Rosen, 2014, Jaslowitzer et al, 2018; Jie et al, 2021, Szarzec, Dombi, and Matuszak, 2021). IMF (2019) found mixed evidence across several

countries on the employment buffering role of SOEs during crises. The study found that SOEs in Latvia shed jobs at a slower rate than POEs during the 2008-09 global financial crisis, thus mitigating the negative effect on jobs during the recession. In Serbia, the SOE sector shed jobs faster than the POE sector over the entire 2007-16 period, irrespective of the economic cycles. While governments may not, as a policy goal, be actively using SOE employment to cushion the adverse job effects of economic crises, SOEs may be a passive means of maintaining stable jobs for their citizenry. Szarzec, Dombi, and Matuszak (2021) found that while domestic and foreign-owned firms reacted to the 2008 global financial crisis by decreasing their net job creation, Hungarian SOEs did not reduce their net job creation. During the COVID-19 pandemic, in most countries, SOEs did not furlough or fire employees (IMF 2021). A household survey conducted by the EBRD (2020) in August 2020 revealed that employees of state firms were less likely to lose their jobs or see their income reduced in the early months of the COVID-19 crisis. This is consistent with findings for the global financial crisis. Overall, it is worth noting that data limitations often prevent insights on the buffer effects of SOEs during crises.

Finally, some studies have examined how a greater SOE footprint in markets affects competition and market outcomes, such as business dynamism and allocative efficiency. Business dynamism matters for aggregate productivity improvements and economic growth. In a study on China, Cerdeiro and Ruane (2022) found that in provinces where SOEs account for a larger share of the capital stock, manufacturing sector business dynamism in those provinces tended to be weaker. Other studies have highlighted that the presence of the state in markets is associated with entry barriers and, thus, lower entry rates of new firms. Using 1995, 2004, and 2008 data from the Chinese Industrial Census, Brandt, Kambourov, and Storesletten (2020) indicate that a key factor underlying the dispersion and dynamics of aggregate total factor productivity and wages across Chinese prefectures were entry barriers, which in turn were linked to significant state presence in economic activities. The reduction in SOE employment in prefectures between 1995 and 2004 was systematically linked to the reduction in entry barriers, and prefectures where SOE employment fell over the period saw faster growth in wages and labor productivity, capital per worker, and aggregate total factor productivity. Further, Iootty, Pop and Pena (2020) show that certain firm characteristics in Romania, notably state ownership, matter in explaining differences in markup performance as a proxy for competition (a higher markup indicative of lower competitive pressure). The authors find that both majority and minority owned SOEs tend to demonstrate the highest markup premiums when compared with domestic privately owned companies, especially in the manufacturing sector. The average difference in markup is higher for companies with minority state ownership (28.9 percent) than for fully state-owned companies (20 percent). However, in manufacturing, markups of fully state-owned firms (100% state shareholding) are the highest on average, at 52.7 percent, compared to domestic privately owned firms. Iootty and Dauda (2017) also found that Chinese manufacturing SOEs had higher markups than non-SOEs compared to their POEs peers, even after controlling for firm location and whether they were subsidized.

3. Data Sources

The analysis relies on data from two main sources and a taxonomy of sectors. The data sources are (1) Romania MoF firm-level data for the period 2011-20, and (2) the World Bank Businesses of the State (BOS) database for Romania, and (3) the taxonomy of sectors developed by Dall'Olio et al. (2022b).

3.1 Romanian Firm-Level Data

The data used is the Romanian MoF firm-level data. The data is from the Ministry of Finance, and it has no size threshold restriction as it covers micro, small, medium, and large enterprises in Romania over

the period 2011 to 2020. It is based on financial statements and contains balance sheet information such as firm tax identification number, year of incorporation, operating revenue, average number of employees, number of employees at the end of the year, labor cost, fixed assets, total assets, amount of subsidies received from the government,[6] 4-digit NACE industry code, and the county location of the firm. The data has about 1.2 million unique firms, and over 7 million firm-year observations, across the period 2011-2020. The Romania MoF firm-level data did not include a variable that identifies the ownership status of the firm (whether the firm is an SOE), which is the key explanatory variable of interest. To identify whether the firm is an SOE, the analysis relies on the new WBG BOS database.

3.2 World Bank Global BOS Database

The World Bank BOS database maps the footprint of the state within the corporate sector and across economic activities based on a uniform definition. The BOS dataset tracks all corporations where national or subnational governments have an ownership stake of at least 10%, either directly or indirectly (Dall'Olio et al. (2022a)). In this dataset, corporations are business entities that are (a) capable of generating a profit or other financial gain for their owners, (b) recognized by law as legal entities separate from their owners and with limited liability, and (c) set up for purposes of engaging in market production. The database was built using data from ORBIS and complemented with data from government sources, such as business registries, central depositories, central oversight bodies, and the Ministry of Finance. It tracks several variables on SOEs such as company names, unique company ID, 4-digit NACE code, financial variables such as revenue, employment, profit and loss for 2019, percent of state ownership stake, and different layers of the ownership chain. The latter two variables allow us to partition SOEs into our analytical categories of ownership degrees and control levels, as in Table 1 below. The categories in Table 1 are matched to the Romanian MoF firm-level data using the unique tax ID available in both datasets. Of the 1,416 Romanian SOEs in the BOS database, 1,399 were matched to the MoF firm-level data, with only 17 SOEs not having a match. Of these 17 SOEs, 3 and 11 are central SOEs and local SOEs, respectively, with the other 3 being indirectly owned.

Table 1: SOE Analytical Categories

Types	Analytical categories		Definitions
Ownership degrees	Minority owned	*10-24.9%*	Firms where national or municipal governments hold 10 to 24.9 percent stakes.
		25-49.9%	Firms where national or municipal governments hold 25 to 49.9 percent stakes.
	Majority owned	*50% or more*	Firms where national or municipal governments hold 50 percent or more stakes.
Control levels	National vs. subnational	*Centrally owned SOEs*	Firms where the national government hold 10 percent or more stakes.
		Locally owned SOEs	Firms where municipal governments hold 10 percent or more stakes.

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[6] Subsidies in the dataset are presented as a single continuous variable with the amount granted for any of the following objectives: (i) employment creation; (ii) renewable energy and (iii) fossil fuels. The variable called "subsidies" does not allow to differentiate the types of instruments used (e.g. grants, tax exemptions, tax deferrals, etc).

| Direct vs. indirect supervision | *Directly owned SOEs* | Firms where national or municipal governments hold 10 percent or more stakes and report *directly* to a government agency or ministry, be it central or local. |
| | *Indirectly owned SOEs* | Firms that are subsidiaries of other companies where national or municipal governments hold 10 percent or more stakes. |

Source: World Bank staff analytical categorization based on the World Bank Global Businesses of the State (BOS) database, 2019. See World Bank (2022) for details.

3.3 Sector Taxonomy

The paper also relies on a sector taxonomy that classifies industries based on the economic rationale that justifies an SOE presence. The taxonomy was developed by Dall'Olio et al. (2022b) in conjunction with the BOS database. It classifies 4-digit NACE industries into three broad sectors (competitive, partially contestable, and natural monopoly) based on the economic rationale—the intrinsic features and associated market failures—that justifies SOE presence in an industry (see Table 2). Other NACE codes are excluded from the sector classification of SOEs because firms in those industries provide public goods (e.g., public administration and defense and activities of extraterritorial organizations). In contrast, others are characterized by externalities (e.g., education and human health activities). In these excluded sectors, government interventions are justified because entities in these services are either incapable of generating profits or not set up for market production. Of the 615 4-digit NACE industries, 511 are classified as competitive sectors, 41 as partially contestable sectors, 11 as natural monopoly sectors, and 52 industries are excluded (see Annex Table B1 for the list of partially contestable and natural monopoly sectors).[7]

Table 2: Sector Taxonomy Based on Economic Rationale Justifying SOE Presence

Sector taxonomy	Definitions
Competitive Sectors	Industries that feature little to no entry barriers and are commercially viable for multiple firms to operate (e.g., manufacturing of food and beverages, and taxi operation). See Annex Table B1 for the list of competitive sectors.
Partially contestable sectors	Industries characterized by some form of market failure such as market power resulting from structural barriers (i.e., barriers that relate to industry conditions, such as economies of scale, network economies, fixed costs, and networks), and oligopolistic structures (e.g., aviation, radio broadcasting, and banking). See Annex Table B1 for the list of partially contestable sectors.
Natural monopoly sectors	Industries which feature high entry barriers, scale economies, or sub-additivity cost structures (i.e., when a single firm can produce a product at lower cost than the combined cost of two or more firms producing identical products), thus making them more efficient for just one producer to operate (e.g., water utilities, energy transmission, and postal activities with universal obligation). See Annex Table B1 for the list of natural monopoly sectors.

Source: The taxonomy was developed by Dall'Olio et al. (2022b) to supplement the World Bank BOS database.

4. Empirical Methodology

This section presents the empirical methodologies behind the main results. It presents the econometric approaches used to (a) assess the differential performances between the varied ownership and control levels of SOEs and POEs during the 2011-2019 period, (b) examine whether SOEs acted as buffers during the

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[7] The competitive and excluded sectors are not listed in this paper due to the large number of sectors but for the full list see Dall'Olio et al. (2022b).

early period of the COVID-19 pandemic, and (c) discern the effects of SOE presence in markets on market outcomes.

(a) Performance of SOEs Relative to POEs

The papers assesses the conditional correlation between state ownership status (intensity of ownership) and various outcome variables using the following empirical specification:

$$y_{ijt} = \alpha + SOE_{ij}\beta + X'_{ijt}\theta + \mu_j + \delta_t + \varepsilon_{ijt} \qquad (1)$$

where for each firm i in industry j in year t, y are the outcome variables, SOE are a vector of time-invariant measures identifying SOEs' ownership and control levels s. For the ownership types, an SOE is defined as a dummy variable taking the value one if national or subnational governments have an ownership stake of 10-100% in the firm and then separate SOEs into minority owned (i.e., 10-24.9% stake and 25-49.9% stake) and majority owned (i.e., 50% or more stake) when assessing differences across ownership stakes. For the control levels of SOEs, direct SOEs are defined as a dummy variable taking the value one if the SOE is directly owned by central or local government—i.e., reports directly to a central government agency or ministry or to a subnational/municipal/local government agency—and indirect SOEs are all SOEs that are subsidiaries of SOEs that report directly to government agencies. For the central versus local types of SOEs, central SOEs are defined as those that are owned by the central government and local SOEs are those owned by a municipal or local government. In all cases, the reference group is POEs, defined as firms where national or subnational governments own 0-9.9%. X is a vector of firm-level controls, including age and size groups, and μ, δ, and ε are 2-digit NACE industry fixed effects, year fixed effects, and the error term, respectively. Due to the time-invariant nature of the SOE variables, firm fixed effects cannot be included in all the empirical specifications. The outcome variables are the following: log of employment level, employment growth, log of average wage (defined as total labor cost divided by the number of employees), average wage growth, log of total assets per worker, change in total assets (as a proxy for investment), log of labor productivity (defined as revenue per worker), labor productivity growth, a dummy variable for whether the firm received a subsidy, and log of the subsidy value received. The main coefficients of interest are $\hat{\beta}$s, which capture the differential effects between POEs and the various ownership and control levels of SOEs.

(b) SOEs as Economic Stabilizers (COVID-19 Period)

To assess whether SOEs acted as employment stabilizers in 2020, as is typical with SOEs when an economic crisis occurs, a difference-in-difference framework is applied to compare the average change in revenue, employment, and average wages of SOEs and POEs between 2016-19 (i.e., before period) and the change between 2019-20 (i.e., COVID-19 pandemic immediate period). The below empirical specification is used:

$$y_{ijt} = \alpha + \beta_1 * I(2020)_{ijt} + \beta_2 * I(SOE)_{ijt} + \beta_3 I(2020)_{ijt} \times I(SOE)_{ijt} + X'_{ijt}\theta + \mu_j + \delta_t \\ + \varepsilon_{ijt} \qquad (2)$$

where y is the outcome variable (operating revenue growth, employment growth, wage growth) for firm i in industry j in year t, $I(2020)$ is the indicator function for observations in year 2020, SOE are dummy variables for the various ownership and control levels of SOEs, as defined above, X is a vector of firm-level controls including age groups, size groups, and log of subsidy amount, μ is 2-digit NACE industry fixed effects, δ are other year fixed effects, and ε is the error term. The main coefficients of interest are $\widehat{\beta_3}$s, which capture the differential effects between POEs and the various ownership and control levels of SOEs in the immediate COVID-19 pandemic period of 2020.

(c) SOE Footprint and Market Outcomes

To assess the conditional correlation between SOE footprint and market outcomes, the following equation is estimated:

$$y_{ijt} = \alpha + \beta SOE\_revenue\_share_{ijt} + X'_{ijt}\theta + \mu_j + \delta_t + \varepsilon_{ijt} \qquad (3)$$

where for each 2-digit NACE sector i in year t, y are market outcome variables, $SOE\_revenue\_share$ is the operating revenue share of the SOEs in total revenue of the sector, X is a vector of sector-level controls including lagged values of average age and size of firms and the sector's share in the economy, μ_j are sector fixed effects, δ_t are year fixed effects, and ε_{ijt} is the error term.

The paper considers several measures of market outcomes. They include entry rate, exit rate, gross job creation and destruction rates, net job creation rate, job reallocation rate, employment share of young firms (<5), employment growth dispersion, growth of total assets, Herfindahl-Hirschman Index (HHI) of market concentration, and allocative efficiency. All these measures are at the 2-digit NACE sector level. The entry rate in sector j in year t is the ratio of entrant firms to the average number of firms in t and t-1. Exit rate is the ratio of the number of exiting firms to the average number of firms in t and t-1. The gross job creation rate is the ratio of employment created by firms to the average number of employments in t and t-1. The gross job destruction rate is the ratio of the sum of employment reductions of firms to the average number of employments in t and t-1. Net job creation rate is the ratio of the difference between employment created and reductions by firms to the average number of employments in t and t-1. Job reallocation (churn) rate is the sum of the absolute value of changes in employment divided by the average employment between years t and t-1. The employment share of young firms is the fraction of employees in total employment who are employed by firms aged less than 5 years. Employment growth dispersion is the standard deviation of employment growth of firms in a sector, where employment growth is the change in employment divided by the average employment between years t and t-1. Growth of total assets is the change in total assets divided by the average of total assets between t and t-1. Concentration is the Herfindahl-Hirschman Index, calculated as the sum of each firm's squared market (revenue) operating in a sector.The firm-level measure of allocative efficiency is computed at the 4-digit NACE sector, year, and county level as the cross product between the deviation of a firm's market share from the average market share at the sector-year-county level, and the deviation of a firm's (labor) productivity from the average of firm-level productivity at the sector-year-county level. The firm-level measure of allocative efficiency is aggregated to the 2-digit sector and year level using revenue and employment as weights. To complement the market outcomes analyses, equation (1) above is rerun using as outcome variable a dummy variable for whether the firm exited the market to test if SOEs are less likely to exit a market and a measure of allocative efficiency to assess whether SOEs contribute negatively to allocative efficiency. The main coefficients of interest are $\hat{\beta}$s, which capture the sector presence of SOEs on the main outcome variables.

Summary Statistics

Romanian SOEs tend to be directly owned and mostly by local governments. The footprint of the state cuts across several sectors, but SOEs are mostly concentrated in water supply, sewerage, waste management, and remediation activities (32 percent), administrative and support service activities (11 percent), construction (10 percent), and transportation (8 percent) (Figure 1). These four sectors account for 61 percent of all central and local government SOEs.

The majority of SOEs operate in competitive sectors, where the economic rationale for state involvement in business operations is less clear based on economic efficiency considerations. Figure 2 (a) presents the distribution of SOEs across the three main sector taxonomies developed by Dall'Olio et al.

(2022). About 58 percent of SOEs provides good and services in competitive markets where private sector participation is viable, with 17 percent and 24 percent, respectively, operating in partially contestable and natural monopoly markets where state involvement in markets can be justified (Figure 2 (b)).

Figure 1: Sectoral Distribution of the Number of SOEs in Romania

(a) Degree of Ownership	(b) Central vs. Local SOEs

Source: World Bank Global Businesses of the State (BOS) database, 2019. In the database, SOEs are corporations where national or subnational governments have ownership stake of at least 10%, either directly or indirectly. Corporations are business entities that are (a) capable of generating a profit or other financial gain for their owners, (b) recognized by law as legal entities separate from their owners who enjoy limited liability, and (c) set up for purposes of engaging in market production (See World Bank 2022 for details).

Figure 2: Distribution of SOEs by Sector, Ownership, and Control Levels (Central vs. Local)

(a) Distribution of SOEs by Sector	(b) SOE Ownership and Control Level

Source: World Bank Global Businesses of the State (BOS) database, 2019. In the database, SOEs are corporations where national or subnational governments have ownership stake of at least 10%, either directly or indirectly. Corporations are business entities that are (a) capable of generating a profit or other financial gain for their owners, (b) recognized by law as legal entities separate from their owners who enjoy limited liability, and (c) set up for purposes of engaging in market production (See World Bank 2022 for details). The percentages for majority and minority owned may not add up to 100 because there are "other" SOEs that are neither owned by the central or local government.

Evidence shows that new SOEs have been created across several markets after 2011. About 52 percent of the 1,399 SOEs matched to the MoF firm-level data were incorporated between 2011 and 2019 (Figure 3). The proportion of 2-digit sectors with at least one SOE present increased over the sample period of 2011-2020 by about 3 percentage points from 75 percent to 78 percent.

Figure 3: SOE Creation and Presence Across Sectors

(a) New SOEs Created

(b) Percent of Two-digit Sectors with at Least One SOE Present

Source: World Bank Global Businesses of the State (BOS) database, 2019. In the database, SOEs are corporations where national or subnational governments have ownership stake of at least 10%, either directly or indirectly. Corporations are business entities that are (a) capable of generating a profit or other financial gain for their owners, (b) recognized by law as legal entities separate from their owners who enjoy limited liability, and (c) set up for purposes of engaging in market production (See World Bank 2022 for details).
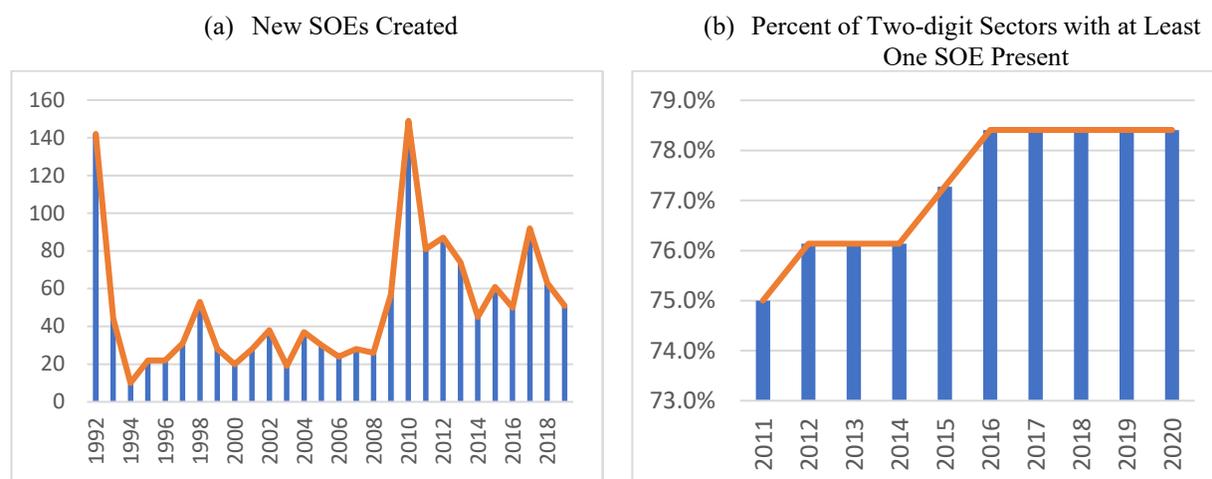
The number of firm observations increased over the sample period, possibly confirming new business creation. Table 3 presents the distribution of firms–private firms and SOE–with revenue and employment data for the period 2011-2019. On average, SOEs represent about 0.24 percent of the sample, with most of the SOEs being directly owned by governments (88 percent) and owned by local or municipal governments (73 percent). Out of a total 613 4-digit NACE industries, SOEs in Romania operate in 192 different 4-digit NACE industries, representing about 31 percent of industries. There is no industry where an SOE is a monopoly. Overall, total sales of SOEs are greater than that of POEs in 24 industries, and in 27 industries, the total employment of SOEs is greater than that of POEs. Table 4 presents the distribution of firms with revenue and employment data for the period 2011-2019 across the sectoral taxonomies developed by Dall'Olio et al. (2022). Approximately 93.5 percent of firm-year observations are in competitive sectors, about 2.1 percent in partially contestable sectors, just 0.5 percent in natural monopoly sectors, and the remainder in sectors that are excluded from the taxonomy. There is a larger proportion of SOEs observations, about 10.3 percent, in natural monopoly sectors relative to competitive sectors, which feature just about 0.15 percent.

Table 3: Distribution of Firm-Year Observations (with Revenue and Employment Data), 2011-2019

	Observations		State-owned enterprises (SOEs)				
Year	All firms	SOEs	% Of firms	% Directly owned	% Indirectly owned	% Centrally owned	% Locally owned
2011	393,578	841	0.21	84.3	15.7	30.0	66.0
2012	409,253	903	0.22	85.5	14.5	27.6	68.4
2013	419,707	986	0.23	86.3	13.7	26.0	70.3

2014	428,618	1,031	0.24	86.8	13.2	25.2	71.2
2015	440,445	1,092	0.25	87.5	12.5	23.7	72.7
2016	457,273	1,136	0.25	88.1	11.9	22.9	73.7
2017	475,757	1,209	0.25	88.9	11.1	21.4	75.4
2018	491,289	1,277	0.26	89.4	10.6	20.5	76.4
2019	511,863	1,299	0.25	89.5	10.5	20.1	76.9
Total	4,027,783		0.24	87.6	12.4	23.7	72.8

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. For purposes of providing the summary statistics, the sample is restricted to firms with revenue and employment data. SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%, while POEs are firms where national or subnational governments own 0-9.9%. The percentages for centrally owned or locally owned may not add up to 100 because there are "other" SOEs that are neither owned by the central or local government.

Table 4: Distribution of Firm-Year Observations by Sector, 2011-2019

	Observations		SOEs				
Type of sector	All firms	SOEs	% All	% Directly owned	% Indirectly owned	% Centrally owned	% Locally owned
Competitive	3,769,932	5,691	0.15	83.2	16.8	19.3	75.7
Partially Contestable	85,411	1,907	2.23	92.3	7.7	49.7	48.9
Natural Monopoly	20,991	2,167	10.32	94.8	5.2	12.6	86.2
Excluded	151,449	9	0.01	100.0	0.0	0.0	100.0
Total	4,027,783	9,774	0.24	87.6	12.4	23.7	72.8

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%, while POEs are firms where national or subnational governments own 0-9.9%. The percentages for centrally owned or locally owned may not add up to 100 because there are "other" SOEs that are neither owned by the central or local government.

Romanian SOEs are larger relative to POEs. The median employment of SOEs is larger than POEs, regardless of the government's degree of ownership (Figure 4 (a)). Similarly, the median operating revenue of SOEs is larger than POEs (Figure 4 (b)). Similar size differences remain when comparing direct, indirect, central, and local SOEs to POEs (see Annex Figure A1). These size differences between SOEs and POEs and even among SOEs remained during the immediate period of the COVID-19 pandemic (i.e., 2020). While SOEs' revenue and employment share have only declined slightly over the 2011-2020 period, the size of their total assets size ha**s** increased by about 5 percentage points (Figure A2). Annex Figure A3, Figure A4, and Figure A5 also present the evolution of SOE revenue, employment, and total assets share over the 2011-20 period by direct, indirect, central, and local ownership types and by majority and minority ownership types. In addition, Table A1 in the Annex presents the summary statistics of the main variables of interest across the 2011-2019 period for POEs and SOEs, along with a statistical test of the equality of the means of each variable for the two groups. Except for employment growth and the log of labor productivity, the paper finds a statistically significant difference in the means of all the key variables. The means for SOEs are greater than those for POEs in all cases except for wage growth, entry, and exit.

Figure 4: Size Distribution of POEs and SOEs

(a) By Employment	(b) By Operating Revenue

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%, while POEs are firms where national or subnational governments own 0-9.9%.

5. Main Findings

The first part of this section presents the main results regarding whether ownership stakes (i.e., majority and minority) in SOEs and control levels (i.e., directly vs. indirectly owned and centrally vs. locally owned) of SOEs matter for firm performance. It also presents results of whether performance differences between POEs and SOEs depend on the type of sectors they operate, and whether ownership also matters for subsidy allocation. The second part presents the results of whether SOEs could act as buffers in attenuating some of the effects of the COVID-19 crisis. The final part presents how SOEs' presence in sectors affects sector or market outcomes.

(a) Does the Ownership Matter for Firm Performance and Subsidy Allocation?

On average, SOEs in Romania employed more people and paid higher average wages during 2011-2019 than their POE peers. They also had higher assets per worker than the POE. However, on average, they were less productive than their POEs counterparts. These effects are irrespective of the various ownership types of SOEs (Figure 5 (a)). These findings align with other studies, which find that SOEs in Romania generate less revenue per employee but pay higher wages than POEs (EC 2015; Marrez 2015; and IMF 2019).

The average SOE in Romania experienced higher job growth, investment, and labor productivity but slower wage growth during 2011- 2019. However, these growth effects are not uniform across the various ownership types (Figure 5(b)). For instance, the job growth, investment, and productivity effects are driven by majority owned SOEs, which invested more and increased their employment and labor productivity faster than POEs. In contrast, s minority SOEs experienced slower job and productivity growths and invested less than POEs. SOE employees, irrespective of the SOE ownership types, saw slower wage growth than their counterparts employed by POEs.

Figure 5: Performance of SOE Relative to POEs by Ownership Type, 2011-2019

(a) Log of ……

(b) Growth of ……

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019.
Note: The sample includes all firms. Employment is the log of the number of employees. Wage level is the log of average wage bill, where average wage bill is (real) labor cost divided by number of employees. Assets per worker is (real) total assets divided by the number of employees. Labor productivity is (real) revenue per worker. Employment growth is calculated as the difference between the number of employees in year t and t-1 divided by the average number of employees in year t and t-1. Wage growth is the difference between wage level in year t and t-1 divided by the average wage level in year t and t-1. Total asset growth (used as a proxy for investment) is calculated as the difference between (real)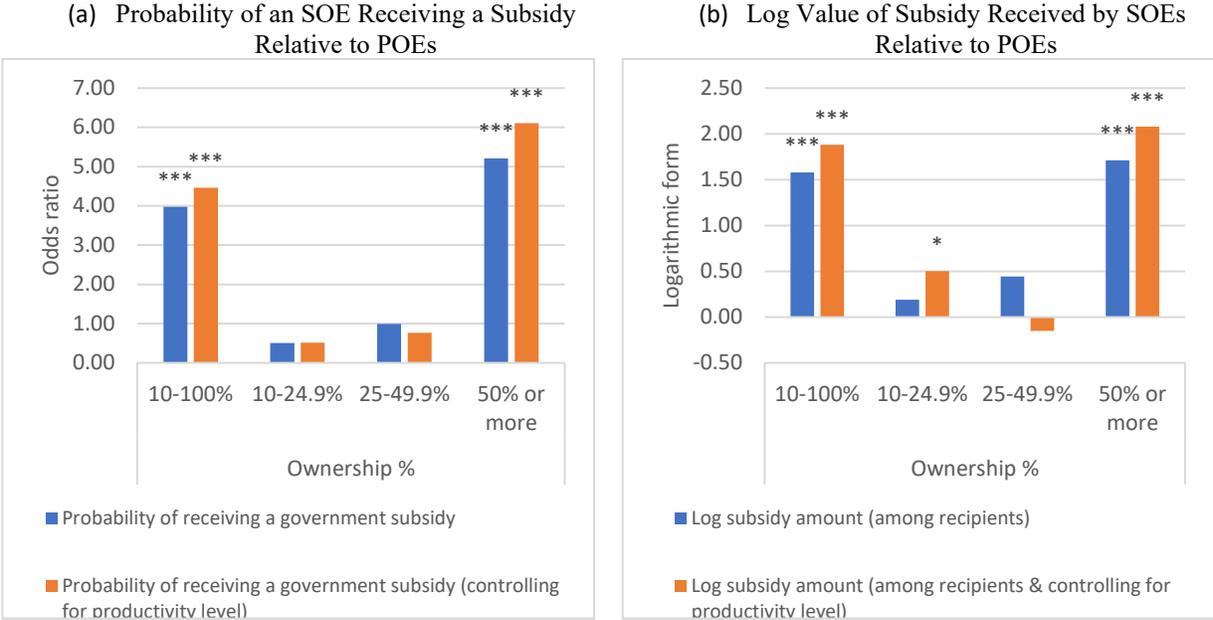 total assets in year t and t-1 divided by the average of total assets in year t and t-1. Labor productivity growth is calculated as the difference between (real) revenue per worker in year t and t-1 divided by the average revenue per worker in year t and t-1. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. Where indicated, the model includes age groups: Young (3-5), Mature (6-10), and Old (>10), with Start-ups (0-2) being the reference category, and size group: Small (10-49), Medium (50-99), Large (100-499), and Very large (500+). with Micro (1-9) being the reference category.

Romanian government support to firms tends to be geared towards majority owned SOEs. Overall, the average SOE was four times more likely to receive government subsidies than the average POE, irrespective of their productivity levels (Figure 6(a)). However, not all ownership types of SOEs were likely to receive subsidies. Majority owned SOEs had a greater likelihood of receiving subsidies from the government than minority owned SOEs, and they were about five times more likely to receive subsidies than POEs. The likelihood of minority owned SOEs receiving subsidies from the government was not statistically significantly different from POEs.

When firms receive subsidies, majority owned SOEs tend to receive far larger amounts than POEs. Among subsidy recipients, the average SOE also tends to receive far larger values of subsidies than the average POE (Figure 6 (b)). However, larger subsidies are provided to majority owned SOEs compared to POEs or even the minority owned ones. Majority owned SOEs benefited more from government subsidies, and they were not more productive. Further, at the same level of (labor) productivity levels of subsidy recipients, majority owned SOEs also received larger values of subsidies. These findings are in line with Harrison et al. (2019) who found that listed SOEs in China were more likely to receive subsidies, and in larger values, than their listed POE counterparts. This may indicate that the majority owned SOEs have easier access to subsidies than the POEs.

Figure 6: Probability of an SOE Receiving a Subsidy, and Value of Subsidies Received, Relative to POEs by Ownership Type, 2011-2019

(a) Probability of an SOE Receiving a Subsidy Relative to POEs

(b) Log Value of Subsidy Received by SOEs Relative to POEs

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019.
Note: The sample includes all firms. Estimates in graph (a) are odds ratios indicating for the probability of receiving a subsidy based on a logit model with a dummy variable taking the value one if the firm reported a positive subsidy amount. The estimates in (b) are in logarithmic terms with the dependent variable being the log of the subsidy amount the firm reported as received. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. Where indicated, the model includes age groups: Young (3-5), Mature (6-10), and Old (>10), with Start-ups (0-2) being the reference category, and size group: Small (10-49), Medium (50-99), Large (100-499), and Very large (500+). with Micro (1-9) being the reference category.

(b) Does the Control Level of SOEs Matter for Performance and Subsidy Allocation?

There are significant differences in performance between direct and indirect SOEs relative to POEs. Given that directly owned and indirectly owned SOEs face different incentives (and constraints) that may induce differences in their performances relative to POEs, the paper replicates the analyses, separating SOEs into directly owned and indirectly owned ones. In general, except for the wage level and growth results, the findings suggest there are indeed performance differences between direct and indirect SOEs compared to POEs (Figure 7 (a)). For instance, while directly owned SOEs saw higher employment and total assets growths relative to POEs, indirectly owned SOEs witnessed a decline in their employment and total assets growths (Figure 7 (b)). Similarly, the finding that Romanian SOEs were less productive but experienced higher (labor) productivity growth over the period than their POEs counterparts did not hold for indirectly owned SOEs. Specifically, the results showed that indirectly owned SOEs experienced higher productivity levels. At the same time, the rate with which they expanded their productivity was not significantly different from POEs.

There are also differential performances between centrally owned and locally owned Romanian SOEs relative to POEs. When assessing whether there are performance differences between central SOEs and local SOEs compared to POEs, results show that, overall, the performance differences between SOEs and POEs are driven by local SOEs. While locally owned SOEs were less productive than POEs, they experienced higher growth in terms of employment, total assets, and labor productivity than their privately

owned peers. Results show that differences between centrally owned SOEs and POEs were not statistically significant (Figure 7(a) and Figure 7 (b)). These findings contrast with Jurzyk and Ruane (2021), who found that central and local SOEs exhibit similar productivity gaps.

In addition, subsidies favored SOEs under direct Romanian government control and in larger values. Government subsidies to firms are channeled mostly to SOEs under the direct supervision of the Romanian government (Figure 7 (c)). Among subsidy recipients, directly owned SOEs received disproportionately larger values than POEs, or even their indirectly owned counterparts (Figure 7 (d)). Direct and local SOEs were favored more for subsidies, but they were not more productive.

Local SOEs were also more likely to receive subsidies and in larger values. Their likelihood of receiving subsidies was between 6.3 to 7.6 times greater than that of POEs, and centrally owned SOEs. The likelihood of centrally owned SOEs receiving subsidies from the government was not statistically significantly different from that of POEs (Figure 7 (c)). Among firms that did receive subsidies, local SOEs received much greater values than POEs and central SOEs (Figure 7 (d)). Controlling for subsidy recipients' (labor) productivity levels, the likelihood and value of subsidies received by local SOEs were even higher.

Figure 7: Performance Differences, Likelihood of Receiving a Subsidy, and Value of Subsidies Received by BOS Relative to POEs by Control Levels, 2011-2019

(a) Log of ……   (b) Growth of ……

(c) Probability of an SOE Receiving a Subsidy Relative to POEs

(d) Log Value of Subsidy Received by SOEs Relative to POEs

Chart (c): Odds ratio. Categories: Direct, Indirect (Direct vs indirect); Central, Local (National or subnational). Series:
- ■ Probability of receiving a government subsidy
- ■ Probability of receiving a government subsidy (controlling for productivity level)

Chart (d): Logarithmic form. Categories: Direct, Indirect (Direct vs indirect); Central, Local (National or subnational). Series:
- ■ Log subsidy amount (among recipients)
- ■ Log subsidy amount (among recipients & controlling for productivity level)

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019.

Note: The sample includes all firms. Employment is the log of the number of employees. Wage level is the log of average wage bill, where average wage bill is (real) labor cost divided by number of employees. Assets per worker is (real) total assets divided by the number of employees. Labor productivity is (real) revenue per worker. Employment growth is calculated as the difference between the number of employees in year t and t-1 divided by the average number of employees in year t and t-1. Wage growth is the difference between wage level in year t and t-1 divided by the average wage level in year t and t-1. Total asset growth (used as a proxy for investment) is calculated as the difference between (real) total assets in year t and t-1 divided by the average of total assets in year t and t-1. Labor productivity growth is calculated as the difference between (real) revenue per worker in year t and t-1 divided by the average revenue per worker in year t and t-1. Estimates in graph (c) are odds ratios indicating for the probability of receiving a subsidy based on a logit model with a dummy variable taking the value one if the firm reported a positive subsidy amount. The estimates in (d) are in logarithmic terms with the dependent variable being the log of the subsidy amount the firm reported as received. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. Where indicated, the model includes age groups: Young (3-5), Mature (6-10), and Old (>10), with Start-ups (0-2) being the reference category, and size group: Small (10-49), Medium (50-99), Large (100-499), and Very large (500+). with Micro (1-9) being the reference category. For outcome variables in level form, the age and size dummies are defined using contemporaneous age and size variables, but they are defined using lagged values for outcome variables in growth (or change) form.

(c) Do Performance and Subsidy Allocation between SOEs and POEs Vary across Sector of Operation?

Results suggest that some performance differences between POEs and SOEs depend on the types of sectors in which they operate. Understanding the relative performance of SOEs across sectors which feature different technological and market features may, therefore, be important. Thus, the analysis is peerfomed for three broad sectors—competitive, partially contestable, and natural monopoly,[8] sectors with dissimilar intrinsic market characteristics and failures (see Section 3.3 for an explanation of the sector taxonomy). The results suggest that SOEs employed more people, paid bigger wages, had larger assets per worker ratio, but had lower labor productivity levels across the three types of sectors (Figure 8(a)).

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[8] Although the features of natural monopoly industries suggest that it is more efficient for just one firm to operate in the market, it is still possible to compare the performance of SOEs to POEs in natural monopoly industries within 2-digit NACE sectors because they are multiple firms, both SOEs and POEs, in different geographic markets of the natural monopoly sectors.

However, while the investment and labor productivity growth performance differentials between SOEs and POEs also remained similar across sectors, the same cannot be said about job and wage growths differentials between SOEs and POEs (Figure 8(b)). SOEs drove the overall employment growth differentials in partially contestable and natural monopoly sectors. Similarly, although SOEs in natural monopoly sectors experienced higher wage growth, the overall lower wage growth effect was driven by the lower wage growth experienced by SOEs in competitive sectors.

Figure 8: Performance of BOS Relative to POEs by Sector, 2011-2019

(a) Log) of ……

(b) Growth of ……

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019.
Note: The sample includes all firms. The bars are average marginal effects. Employment is the log of the number of employees. Wage level is the log of average wage bill, where average wage bill is (real) labor cost divided by number of employees. Assets per worker is (real) total assets divided by the number of employees. Labor productivity is (real) revenue per worker. Employment growth is calculated as the difference between the number of employees in year t and t-1 divided by the average number of employees in year t and t-1. Wage growth is the difference between wage level in year t and t-1 divided by the average wage level in year t and t-1. Wage level is (real) labor cost divided by number of employees. Total asset growth (used as a proxy for investment) is calculated as the difference between (real) total assets in year t and t-1 divided by the average of total assets in year t and t-1. Labor productivity growth is calculated as the difference between (real) revenue per worker in year t and t-1 divided by the average revenue per worker in year t and t-1. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. The model includes age groups: Young (3-5), Mature (6-10), and Old (>10), with Start-ups (0-2) being the reference category, and size group (except employment outcomes): Small (10-49), Medium (50-99), Large (100-499), and Very large (500+). With Micro (1-9) being the reference category. For outcome variables in level form, the age and size dummies are defined using contemporaneous age and size variables, but they are defined using lagged values for outcome variables in growth (or change) form.
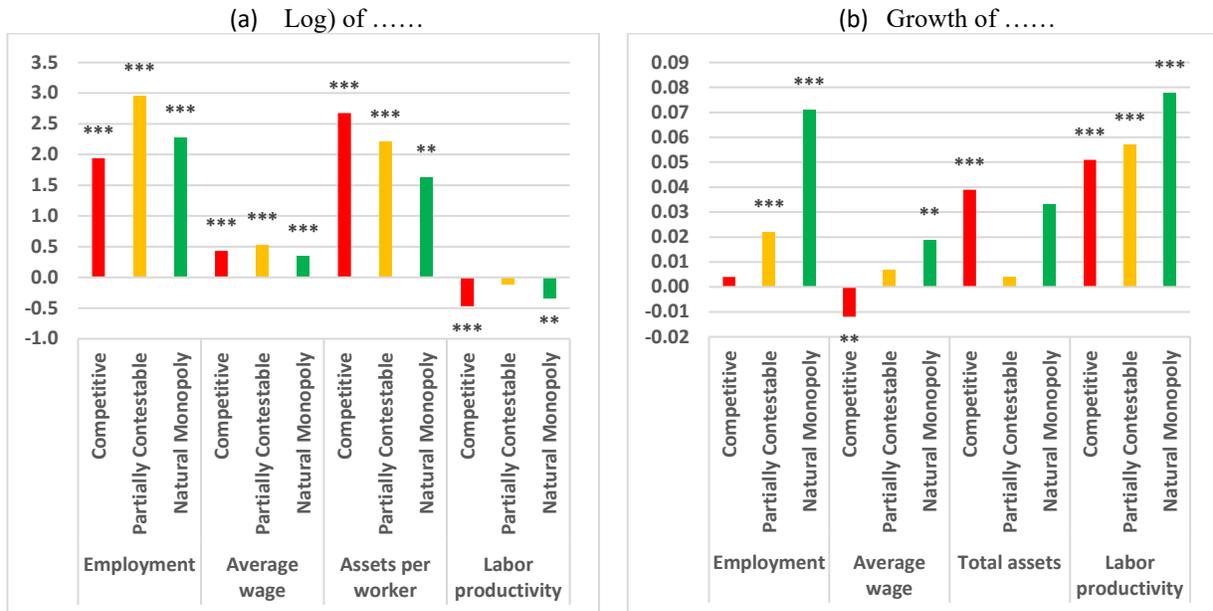
Figure 9: Probability of an SOE Receiving a Subsidy, and Value of Subsidies Received, Relative to POEs by Sector, 2011-2019

(a) Probability of an SOE Receiving a Subsidy Relative to POEs

(b) Log Value of Subsidy Received by SOEs Relative to POEs (among recipients)

(c) Probability of an SOE Receiving a Subsidy Relative to POEs (controlling for productivity level)

(d) Log Value of Subsidy Received by SOEs Relative to POEs (among recipients and controlling for productivity level)

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019.
Note: The sample includes all firms. Estimates in graph (a) are odds ratios indicating for the probability of receiving a subsidy based on a logit model with a dummy variable taking the value one if the firm reported a positive subsidy amount. The estimates in (b) are in logarithmic terms with the dependent variable being the log of the subsidy amount the firm reported as received. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. Where indicated, the model includes age groups: Young (3-5), Mature (6-10), and Old (>10), with Start-ups (0-2) being the reference category, and size group: Small (10-49), Medium (50-99), Large (100-499), and Very large (500+). with Micro (1-9) being the reference category.

In addition, some SOEs in competitive and contestable sectors were more likely to receive government subsidies, but among recipients, SOEs in natural monopolies receive larger values of subsidies. While SOE operating in competitive sectors were also more likely to receive government subsidies relative to POEs, they were targeted less compared to SOEs in partially contestable sectors. (Figure 9(a)). However, in terms of the value of subsidies, although several of the majority and minority owned SOEs in the three types of sectors received larger values relative to POEs, the largest amounts went

to SOEs operating in natural monopoly sectors, possibly explained by their different public policy mandates (Figure 9(b)). The results remained relatively the same when controlling for the productivity levels of subsidy recipients (Figure 9(c) and (Figure 9(d))). That SOEs in contestable sectors were more likely to receive subsidies and those in natural monopoly sectors received larger values is not surprising because SOEs in these sectors tend to provide services—such as water, electricity, and postal services—in the context of their public service obligations. However, unlike in natural monopoly sectors there is a higher risk of subsidies distorting markets in partially contestable and competitive sectors where SOEs operate together with POEs.

All the above results remained robust to the exclusion of micro firms. As a robustness check, the extent to which the main findings are driven by the inclusion of micro firms (i.e., firms with fewer than 10 employees) is assessed. Thus the sample is restricted to firm observations with at least 10 employees between 2011 and 2019. It is expected this restriction to likely have the biggest effects on the correlations with firm employment growth and private entry rates. Figure A6 and Figure A7 in the Annex present the main results—comparing job, average wage, assets per worker, and labor productivity performances of SOEs to those of POEs during the 2011-2019 period—using the sample of 10 or more employees. Except for employment growth—which is impacted by the restriction of the sample to 10 or more employees—of majority owned SOEs, the main findings remained robust to the exclusion of micro firms.

(d) Were SOEs Able to Act as Buffers during the Early Period of the COVID-19 Crisis?

In Romania, there is evidence that, on average, SOEs had a buffering effect during the early period of the COVID-19 pandemic. While all firms shed jobs in 2020, SOEs shed jobs at a slower rate than POEs, thus weathering the negative effects that COVID-19 downturn had on employment. When the employment growth in SOEs between 2019-20 (the initial COVID-19 period) relative to growth between 2016-19 are compared to those of POEs in a difference-in-difference framework, there is evidence that the employment decline of the average SOE in 2020 was significantly lower than that of the average POE (Table 5, column 1, Panel A). However, the average SOE effect was driven by minority owned SOEs with a 25%-49.9% state ownership (Table 5, column 1, Panel B) and directly owned SOEs (Table 5, column 1, Panel C). For majority owned and local SOEs, their employment growth between 2019-2020, relative to the baseline growth between 2016-19, were statistically not significant different from those of POEs (Table 5, column 1, Panels B and C). Specifications using a shorter pre-treatment period of 2018-19, rather than 2016-19, to assess the early crisis effect were also tested. The results showed that, while minority owned SOEs with a 25%-49.9% state ownership shed fewer jobs in 2020, the jobs that the average SOE shed was statistically significantly not different from those of the average POE (see Annex Table A2).

In addition, SOEs acted as buffers by mitigating the COVID-19 effects on revenues and wages. Regarding revenues, the average SOE registered fewer losses than the average POE (Table 5, column 2, Panel A). A similar story emerges regarding wages, with the average SOE registering smaller declines than the average POE (Table 5, column 3, Panel A). These revenue and wage effects were driven by majority owned SOEs, minority owned SOEs with a 25%-49.9% state ownership, direct SOEs, and local SOEs, although central SOEs also experienced smaller wage declines (Table 5, columns 2 and 3, Panels B to D). The robustness check using the shorter pre-treatment period yielded similar results (see Annex Table A3).

Further, SOEs that provided a buffer operate in competitive sectors, which were more likely to be affected by the COVID-19 crisis. In sectors with greater competitive pressure, the job, revenue, and wage losses due to a crisis may be severe, so SOEs may be called upon to provide emergency relief, stabilize and cushion such declines. The analysis using the three sector types suggests that the average SOE in competitive sectors cushioned its employment, revenue, and wage losses during 2020 better than the average POE (Table 6, columns 1 to 3, Panels A). The findings by the different ownership degrees and

control levels provide a more nuanced picture and depend on the sector type. In competitive sectors, majority owned, directly and locally owned SOEs experienced smaller employment, revenue, and wage losses during 2020 than POEs (Table 6, Panels B to D). The robustness check using the relatively shorter pre-treatment period of 2018-19 yielded similar results, except for majority owned SOEs, which showed no statistically significant effects (see Annex Table A3).

Table 5: Early Effect of COVID-19 Pandemic on Growth of Employment, Operating Revenue, and Average Wages of SOEs Relative to POEs in Romania, 2016-2020

	(1) Employment growth		(2) Operating revenue growth		(3) Average wage growth	
Panel A:						
Interaction effect						
10-100% x 2020	0.026**	0.026**	0.077***	0.077***	0.042***	0.041***
	(0.013)	(0.013)	(0.021)	(0.021)	(0.014)	(0.014)
Main effects						
SOE: 10-100%	0.008	0.004	0.030**	0.025*	-0.026***	-0.030***
	(0.009)	(0.009)	(0.014)	(0.014)	(0.007)	(0.007)
In 2020	-0.054***	-0.054***	-0.106***	-0.106***	-0.117***	-0.117***
	(0.007)	(0.007)	(0.018)	(0.018)	(0.006)	(0.006)
Panel B:						
Interaction effect						
10-24.9% x 2020	0.056	0.057	0.123	0.124	0.034	0.035
	(0.071)	(0.071)	(0.140)	(0.140)	(0.048)	(0.048)
25-49.9% x 2020	0.114***	0.115***	0.154**	0.155**	0.095***	0.096***
	(0.035)	(0.035)	(0.074)	(0.074)	(0.036)	(0.036)
50% or more x 2020	0.016	0.016	0.066***	0.066***	0.037**	0.037**
	(0.012)	(0.012)	(0.015)	(0.015)	(0.015)	(0.015)
Main effects						
SOE type	-0.059***	-0.059***	-0.076*	-0.076*	-0.046**	-0.046**
	(0.021)	(0.021)	(0.043)	(0.043)	(0.019)	(0.018)
10-24.9%	-0.024	-0.024	-0.020	-0.019	-0.077***	-0.077***
	(0.020)	(0.020)	(0.026)	(0.026)	(0.015)	(0.015)
25-49.9%	0.017*	0.013	0.044***	0.038***	-0.019**	-0.024***
	(0.009)	(0.009)	(0.013)	(0.013)	(0.008)	(0.007)
50% or more	-0.054***	-0.054***	-0.106***	-0.106***	-0.117***	-0.117***
	(0.007)	(0.007)	(0.018)	(0.018)	(0.006)	(0.006)
In 2020	-0.059***	-0.059***	-0.076*	-0.076*	-0.046**	-0.046**
	(0.021)	(0.021)	(0.043)	(0.043)	(0.019)	(0.018)
Panel C:						
Interaction effect						
Direct x 2020	0.023*	0.023*	0.080***	0.079***	0.044***	0.044***
	(0.013)	(0.013)	(0.018)	(0.018)	(0.015)	(0.015)
Indirect x 2020	0.052	0.052	0.049	0.050	0.022	0.022
	(0.042)	(0.042)	(0.087)	(0.087)	(0.030)	(0.030)
Main effects						
SOE type						
Direct	0.014	0.010	0.039**	0.033**	-0.024***	-0.029***
	(0.011)	(0.010)	(0.015)	(0.015)	(0.008)	(0.008)
Indirect	-0.034***	-0.035***	-0.027	-0.026	-0.040***	-0.039***

	(0.011)	(0.011)	(0.022)	(0.022)	(0.015)	(0.015)
In 2020	-0.054***	-0.054***	-0.106***	-0.106***	-0.117***	-0.117***
	(0.007)	(0.007)	(0.018)	(0.018)	(0.006)	(0.006)

Panel D:

Interaction effect

Central x 2020	0.021	0.021	0.073	0.073	0.052**	0.051**
	(0.020)	(0.020)	(0.048)	(0.048)	(0.022)	(0.022)
Local x 2020	0.022	0.022	0.081***	0.081***	0.037**	0.037**
	(0.015)	(0.015)	(0.020)	(0.020)	(0.016)	(0.016)

Main effects

SOE type

Central	0.003	-0.000	0.015	0.011	-0.029***	-0.032***
	(0.008)	(0.008)	(0.017)	(0.016)	(0.008)	(0.008)
Local	0.013	0.010	0.038**	0.033*	-0.023**	-0.027***
	(0.012)	(0.012)	(0.017)	(0.017)	(0.009)	(0.009)
In 2020	-0.054***	-0.054***	-0.106***	-0.106***	-0.117***	-0.117***
	(0.007)	(0.007)	(0.018)	(0.018)	(0.006)	(0.006)
SOE dummies	Yes	Yes	Yes	Yes	Yes	Yes
Age dummies	Yes	Yes	Yes	Yes	Yes	Yes
Size dummies	No	No	Yes	Yes	Yes	Yes
Subsidies received	No	Yes	No	Yes	No	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations†	2,253,381	2,253,381	2,165,653	2,165,653	2,249,388	2,249,388
Pseudo/Within R†	0.018	0.018	0.049	0.049	0.029	0.029

Source: World Bank staff analysis using Romania MoF firm-level data from 2016-20. The sample includes all firms. Growth is calculated as the difference between the values in year t and t-1 divided by the average of the values in year t and t-1. Wage is labor cost divided by average number of employees. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-24.9%, 25-49.9%, or 50% or more, respectively, in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Observations in the top and bottom 1 percentile of each two-digit NACE sector and year distribution are excluded as outliers in the analyses. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. The reference categories for age and size groups are Start-ups (0-2) and Small (10-49), respectively. † indicates values are for the state ownership model using 10-100% stake. All models include a constant term.

Table 6: Early Effect of COVID-19 Pandemic on Growth of Employment, Operating Revenue, and Average Wages of SOEs Relative to POEs in Romania by Sector, 2016-2020

	(1) Employment growth			(2) Operating revenue growth			(3) Average wage growth		
	Competitive	Partially Contestable	Natural Monopoly	Competitive	Partially Contestable	Natural Monopoly	Competitive	Partially Contestable	Natural Monopoly
Panel A:									
Interaction effect									
10-100% x 2020	0.042***	-0.016	-0.027	0.092***	-0.068	-0.022	0.047***	0.038*	-0.010
	(0.016)	(0.023)	(0.022)	(0.032)	(0.060)	(0.028)	(0.017)	(0.019)	(0.012)

Main effects

SOE: 10-100%

SOE: 10-100%	-0.011	0.032***	0.071***	0.004	0.068***	0.119***	-0.039***	-0.012	0.017
	(0.009)	(0.011)	(0.016)	(0.017)	(0.018)	(0.023)	(0.007)	(0.010)	(0.011)
In 2020	-0.054***	-0.014	-0.043*	-0.105***	0.024	-0.024	-0.117***	-0.081***	-0.070***
	(0.008)	(0.023)	(0.018)	(0.019)	(0.050)	(0.038)	(0.007)	(0.012)	(0.009)

Panel B:

Interaction effect

10-24.9% x 2020	0.049	0.188	0.003	0.141	-0.308***	0.057	0.023	0.075	0.056*
	(0.088)	(0.169)	(0.016)	(0.178)	(0.108)	(0.074)	(0.058)	(0.095)	(0.024)
25-49.9% x 2020	0.135***	-0.098*	0.128	0.161	-0.079	0.113	0.099**	0.065	0.054
	(0.043)	(0.051)	(0.076)	(0.101)	(0.126)	(0.118)	(0.047)	(0.074)	(0.116)
50% or more x 2020	0.030**	-0.016	-0.036*	0.078***	-0.063	-0.032	0.043**	0.036*	-0.016
	(0.015)	(0.023)	(0.018)	(0.024)	(0.060)	(0.025)	(0.020)	(0.020)	(0.011)

Main effects
SOE type

10-24.9%	-0.081***	-0.054	0.068**	-0.115**	0.132**	0.049	-0.051**	0.035	-0.022
	(0.023)	(0.045)	(0.020)	(0.055)	(0.052)	(0.038)	(0.023)	(0.064)	(0.016)
25-49.9%	-0.049***	0.066**	0.062***	-0.050*	0.089**	0.090***	-0.084***	-0.061***	0.001
	(0.017)	(0.031)	(0.016)	(0.028)	(0.033)	(0.017)	(0.019)	(0.020)	(0.010)
50% or more	0.002	0.032***	0.070***	0.023	0.065***	0.124***	-0.032***	-0.010	0.020*
	(0.009)	(0.011)	(0.017)	(0.017)	(0.020)	(0.020)	(0.007)	(0.011)	(0.010)
In 2020	-0.054***	-0.014	-0.043*	-0.105***	0.024	-0.024	-0.117***	-0.081***	-0.070***
	(0.008)	(0.023)	(0.018)	(0.019)	(0.050)	(0.039)	(0.007)	(0.012)	(0.009)

Panel C:

Interaction effect

Direct x 2020	0.041**	-0.018	-0.034	0.102***	-0.066	-0.032	0.052***	0.039*	-0.010
	(0.017)	(0.023)	(0.019)	(0.028)	(0.057)	(0.027)	(0.018)	(0.020)	(0.012)
Indirect x 2020	0.043	0.017	0.109**	0.025	-0.106	0.191	0.019	0.020	-0.014
	(0.049)	(0.085)	(0.043)	(0.107)	(0.129)	(0.198)	(0.039)	(0.052)	(0.043)

Main effects
SOE type

Direct	-0.004	0.034***	0.075***	0.012	0.069***	0.127***	-0.040***	-0.007	0.020*
	(0.011)	(0.010)	(0.015)	(0.018)	(0.021)	(0.018)	(0.007)	(0.011)	(0.010)
Indirect	-0.047***	0.012	0.013	-0.045	0.063	0.008	-0.036**	-0.057*	-0.020
	(0.012)	(0.038)	(0.009)	(0.028)	(0.038)	(0.010)	(0.017)	(0.029)	(0.011)
In 2020	-0.054***	-0.014	-0.043*	-0.105***	0.024	-0.024	-0.117***	-0.081***	-0.070***
	(0.008)	(0.023)	(0.018)	(0.019)	(0.050)	(0.039)	(0.007)	(0.012)	(0.009)

Panel D:

Interaction effect

Central x 2020	0.011	0.002	0.012	0.101	-0.077	0.007	0.031	0.042**	0.040
	(0.035)	(0.022)	(0.016)	(0.094)	(0.074)	(0.026)	(0.036)	(0.019)	(0.034)
Local x 2020	0.042**	-0.033	-0.037*	0.095***	-0.055	-0.028	0.048***	0.028	-0.014
	(0.017)	(0.032)	(0.018)	(0.029)	(0.051)	(0.026)	(0.018)	(0.026)	(0.009)

Main effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SOE type									
Central	-0.018	0.024**	0.025***	-0.029	0.062**	0.013	-0.031**	-0.020*	-0.016
	(0.012)	(0.010)	(0.005)	(0.025)	(0.023)	(0.030)	(0.014)	(0.010)	(0.010)
Local	-0.004	0.038***	0.083***	0.014	0.068***	0.144***	-0.039***	-0.002	0.027***
	(0.011)	(0.012)	(0.014)	(0.019)	(0.018)	(0.015)	(0.007)	(0.010)	(0.006)
In 2020	-0.054***	-0.014	-0.043*	-0.105***	0.024	-0.024	-0.117***	-0.081***	-0.071***
	(0.008)	(0.022)	(0.018)	(0.019)	(0.050)	(0.038)	(0.007)	(0.012)	(0.009)
SOE dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size dummies	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Value of subsidies received	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations[†]	2,098,570	47,698	11,260	2,016,257	45,597	10,878	2,094,821	47,624	11,249
Within R-squared[†]	0.018	0.016	0.013	0.048	0.034	0.042	0.028	0.023	0.030

Source: World Bank staff analysis using Romania MoF firm-level data from 2016 to 2020. The sample includes all firms. Growth is calculated as the difference between the values in year t and t-1 divided by the average of the values in year t and t-1. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-24.9%, 25-49.9%, or 50% or more, respectively, in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. The reference categories for age and size groups are Start-ups (0-2) and Small (10-49), respectively. The classification of the 4-digit NACE sectors into competitive, partially contestable, and natural monopoly sectors are based on the SOE sector taxonomy developed by Dall'Olio, Goodwin, Alonso, Patino Pena, & Sanchez-Navarro (2022). [†] indicates values are for the state ownership model using 10-100% stake. All models include a constant term.

Given the unique position of SOEs across many markets, their presence could limit competition and better market outcomes. This is especially so when no clear rationale for SOE operations based on economic efficiency exists. This section presents the results relating to the contribution of Romanian SOEs to aggregate productivity, determining how their presence in markets correlates with firm- and market-level measures of allocative efficiency. This section also presents the main effects of SOEs in markets on overall and private sector or market outcomes, including business dynamism, competition, and allocative efficiency. Except for the firm-level allocative efficiency analysis, all analyses are performed at the 2-digit NACE level.[9]

SOE Presence, Likelihood of Exiting the Market, and Static Allocative Efficiency

Romanian SOEs were less likely to exit the market than their POEs peers. This is irrespective of whether they are majority-owned or minority-owned, directly owned or indirectly owned, and centrally owned or locally owned (Table 7, column 1). That SOEs are less likely to exit the market is not surprising given the privileges and protections they might enjoy. They are sometimes protected from exposure to market discipline and operate in an environment that may not be competitively neutral (World Bank 2020, OECD 2023).

Table 7: Conditional Correlations Between State Ownership and Firm Exit in Romania, 2011-2019

	Probability of firm exiting a sector	Firm-level measure of allocative efficiency
State ownership		
Panel A:		
10-100%	-0.023***	-0.029**
	(0.003)	(0.013)
Panel B:		
10-24.9%	-0.015***	0.098
	(0.003)	(0.060)
25-49.9%	-0.024***	0.034
	(0.004)	(0.027)
50% or more	-0.024***	-0.048***
	(0.003)	(0.014)
Panel C:		
Direct	-0.024***	-0.044***
	(0.003)	(0.014)
Indirect	-0.015***	0.061*
	(0.002)	(0.037)
Panel D:		
Central	-0.012***	0.011
	(0.003)	(0.025)
Local	-0.027***	-0.046***
	(0.003)	(0.016)
Age dummies	Yes	Yes
Size dummies	Yes	Yes
Industry effects	Yes	Yes
Year effects	Yes	Yes
Observations[†]	4,173,917	4,027,292
Within R-squared[†]	0.004	0.061

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[9] For robustness checks, the analyses will be replicated at the 4-digit NACE level.

Given that Romanian SOEs are less likely to exit the market, they could hold on to scarce resources, hampering allocative efficiency. This is particularly true when they command disproportionate market shares relative to their productivity levels. In an economy with no technological and informational frictions or institutional and policy distortions, market shares must move to the most efficient and high-performing firms at the expense of the least productive ones. When policy and other distortions and frictions are present, allocative inefficiencies prevail in the economy, with less productive firms tending to have larger market shares and harming aggregate productivity. Such suboptimal allocation of resources is a common driver of slow productivity growth.

Given that Romanian SOEs are less productive relative to their private peers, they are more likely to contribute negatively to aggregate productivity. As is common in the literature, the paper uses the static Olley and Pakes (1996) measure of allocative efficiency, defined as the within-industry covariance between firm size and productivity. Since the analysis in this section is performed at the 2-digit NACE level, the paper uses covariance between firm size (i.e., market share) and labor productivity at the 2-digit sector, year, and county level and derive 2-digit level measures from the firm level measures using simple averages and weighted averages of revenue and employment shares as weights. The county dimension is included to account for the geographic features of markets. The paper also uses the covariance between firm size (i.e., market share) and labor productivity at the 4-digit sector, year, and county level and aggregate at the 2-digit level.

The findings suggest that the presence of Romanian SOEs in some markets is undermining allocative efficiency. Romanian SOEs contribute negatively to allocative efficiency: the average SOE is larger but less productive, so they are associated with lower covariance between firm size and productivity than POEs. This is particularly true with majority owned, directly owned, and local SOEs (Table 7, column 2). This implies that these SOE ownership types command a disproportionately larger market share, given their productivity levels. This suboptimal allocation of resources is a key driver of slow aggregate productivity growth. At the market level, their larger presence or market share is also negatively correlated with allocative efficiency (Table 8).

Table 8: Conditional Correlation between SOE Market Share and Market Level Measure of Allocative Efficiency in Romania, 2011-2019

	(1) Two-digit sector aggregation of firms' revenue share and productivity deviations from 2-digit revenue share and productivity averages, respectively		(2) Two-digit sector aggregation of firms' revenue share and productivity deviations from 4-digit revenue share and productivity averages, respectively	
	Revenue-weighted avg.	Employment-weighted avg.	Revenue-weighted	Employment-weighted avg.

			avg.	
SOE revenue share	-0.333***	-0.146**	-0.353*	-0.252
	(0.126)	(0.056)	(0.211)	(0.209)
Constant	0.196*	0.104*	0.364***	0.219**
	(0.103)	(0.054)	(0.122)	(0.084)
Lagged avg. age	Yes	Yes	Yes	Yes
Lagged avg. employment	Yes	Yes	Yes	Yes
Sector size in economy	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Observations	704	704	704	704
Within R-squared	0.021	0.019	0.031	0.032

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. Market-level measure of allocative efficiency is the static Olley and Pakes (1996) measure computed as the within market covariance between firm size (i.e., market share) and (labor) productivity. SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%. All regressions are at the 2-digit NACE industry level and include industry and year fixed effects. Standard errors clustered at the industry level are parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent.

SOE, Business Dynamism and Market Outcomes

On the other hand, SOE presence in Romanian markets has limited effects on business dynamism. Using the revenue share of SOEs in markets as a proxy of SOE footprint , the results suggest that business dynamism has not suffered a significant slowdown. However, on average, the higher market share of SOEs is associated with a low entry rate of firms, including private firms that may want to enter and compete (Table 9, Column 1, Row (a)). This is more true in partially contestable and natural monopolies sectors, where one would expect lower entry rates, but not in competitive markets (Table 9, Column 1, Row (b)).

6. Conclusion

This paper compared the performance of, and subsidy allocation to, Romanian SOEs of various ownership degrees and control levels to POEs. In addition, the paper assessed whether Romanian SOEs could provide a buffer in terms of jobs, revenues, and wages to mitigate the early negative effects of the COVID-19 pandemic. Finally, the paper examined the effects of SOE presence on market outcomes, including business dynamism, competition, and contribution to allocative efficiency. In all cases, the paper uses the Romanian MoF firm-level data from 2011 to 2020 and the World Bank BOS database.

Several key messages emerge. First, SOEs in Romania were larger—employed more people and had larger assets per worker—and paid better wages, on average, than their POE peers from 2011 to 2019. On average, they had lower revenue per worker than POEs over the same period. These results are robust for the various SOE ownership degrees (i.e., minority and majority owned SOEs) and align with other studies. In addition, the average SOE experienced higher job growth, investment, and labor productivity growth but slower wage growth than the average POE over the same period. Nevertheless, these growth effects are not uniform across the various ownership degrees.

Second, performance differences exist between SOEs at various control levels relative to POEs. Directly and indirectly owned SOEs performed differently compared to POEs. On the one hand, directly owned SOEs experienced higher employment and total assets growth, but were less productive than POEs. On the other hand, indirectly owned SOEs saw lower employment and total assets growth than POEs but experienced similar (labor) productivity growth to that of POEs. There are also performance differences between central and local SOEs compared to POEs. The local SOEs mostly drive the overall performance

differences between SOEs and POEs. Overall, the performance of centrally owned SOEs was not statistically significantly different from that of POEs.

Third, the results suggest that the performance differences between POEs and SOEs with different ownership degrees and control levels depend on the types of sectors in which they operate. Across competitive, partially contestable, and natural monopoly sectors, the employment, average wage, assets per worker, and labor productivity levels differences between SOEs and POEs remained similar. However, the employment growth differential between SOEs and POEs was driven by SOEs in partially contestable and natural monopoly sectors. In contrast, SOEs in competitive sectors explained the lower wage growth experienced by the average SOE.

Fourth, SOEs were more likely to receive government subsidies and in larger values than POEs. SOEs that are majority owned, under direct supervision of government agencies (*directly owned SOEs*), and those owned by local administrations (*locally owned SOEs*) are all more likely to receive subsidies, and in larger values, than POEs. Results also showed that controlling for differences in productivity levels among subsidy recipients, these SOEs received larger subsidies than POEs. Further, when factoring in the sectors of operation, the results showed that SOEs in partially contestable sectors were more likely to get subsidies. Still, among recipients, SOEs in natural monopoly sectors receive larger subsidies. This is not surprising because SOEs in these sectors tend to provide services - such as water, electricity, and postal services -also in the context of their public service obligations. However, unlike in natural monopoly sectors, there is a higher risk of subsidies distorting markets in partially contestable and competitive sectors where SOEs operate together with POEs.

Fifth, the average Romanian SOE acted as a buffer during the early period of the COVID-19 pandemic. Still, there are differences considering SOE types and the nature of the sectors in which they operate. SOEs attenuated some of the early negative effects that the COVID-19 downturn had on jobs, revenues, and wages. While all firms shed jobs, revenues, and wages in 2020, SOEs experienced a slower rate of job, revenue, and wage losses than POEs. In competitive sectors more likely to be impacted by the crisis, the average SOE could cushion its employment, revenue, and wage losses during 2020 better than the average POE. The findings by the different ownership degrees and control levels provide a more nuanced picture and depend on whether they operate in competitive, partially contestable, and natural monopoly sectors.

Sixth, Romanian SOEs were less likely to exit markets, and the less productive ones hampered allocative efficiency. They held on to scarce resources and so their presence undermined the efficient allocation of resources. The average SOE commanded larger market shares, given its lower productivity level, thus contributed negatively to allocative efficiency. The larger their market shares, the lower was the allocative efficiency of the market. This suboptimal allocation of resources is a key driver of slow aggregate productivity level and growth. On the other hand, the results suggested that SOE presence in Romania had not resulted in a significant slowdown of overall business dynamism over the 2011-2019 period, although higher SOE market shares were associated with low entry rate of private firms, on average.

Overall, these findings suggest that continuing SOE reforms and policies that enable productivity growth in Romania is crucial. SOEs continue to be used, although to a much lesser degree than in the past, as buffers and social programs. Despite the role of SOEs in providing essential public services, their presence across many markets where there is no clear economic rationale comes at a cost for public finance, including through subsidization, especially when they are less productive than the POEs. Policies that focus on ensuring a level playing field and competitively neutral policies subjecting SOEs to the same market discipline as the private sector could generate allocative efficiency gains and boost aggregate productivity growth, while also stimulating business dynamism and product market competition.

Table 9: Conditional Correlations Between SOE Revenue Share and Sector or Market Outcomes in Romania, 2011-2019

	(1) Entry rate	(2) Exit rate	(3) Gross job creation rate	(4) Gross job destruction rate	(5) Net job creation rate	(6) Job reallocation rate	(7) Employment share of young firms (<5)	(8) Employment growth dispersion	(9) Growth of total assets	(10) Concentration (HHI)
SOE revenue share										
(a) All sectors										
(i) All firms	-0.061***	0.003	-0.062	0.151*	-0.213*	0.089	0.219***	0.240**	0.238	-0.000
	(0.021)	(0.020)	(0.107)	(0.084)	(0.117)	(0.152)	(0.063)	(0.104)	(0.325)	(0.047)
(ii) Among private firms	-0.046**	0.004	-0.064	-0.040	-0.024	-0.104	0.049	0.240**	1.115**	-0.630***
	(0.019)	(0.021)	(0.107)	(0.089)	(0.154)	(0.122)	(0.078)	(0.104)	(0.512)	(0.131)
(b) Competitive Sectors										
(i) All firms	0.049	-0.012	-0.393	-0.103	-0.290	-0.497	0.069	-0.029	0.406	0.070
	(0.070)	(0.028)	(0.348)	(0.388)	(0.349)	(0.650)	(0.212)	(0.093)	(0.427)	(0.056)
(ii) Among private firms	0.051	-0.012	-0.376	-0.113	-0.263	-0.488	0.162	-0.029	0.380	-0.083**
	(0.071)	(0.029)	(0.349)	(0.390)	(0.341)	(0.656)	(0.153)	(0.093)	(0.401)	(0.038)
Lagged average age	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Lagged avg. employment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector size in economy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations[†]	704	704	704	704	704	704	704	697	704	704
Within R-squared[†]	0.095	0.009	0.039	0.267	0.147	0.193	0.046	0.072	0.045	0.040

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. Entry rate in industry j in year t is the ratio of the number of entrant firms to the average number of firms in t and t-1. Exit rate is the ratio of the number of exiting firms to the average number of firms in t and t-1. Gross job creation is the ratio of the sum of employment created by firms to the average number of employments in t and t-1. Gross job destruction is the ratio of the sum of employment reductions of firms to the average number of employments in t and t-1. Net job creation rate is the ratio of the difference between employment created and reductions by firms to the average number of employments in t and t-1. Job reallocation (churn) rate is the sum of the absolute value of changes in employment divided by the average employment between years t and t-1. Employment share of young firms is the fraction of employees in total employment who are employed by firms aged less than 5 years. Employment growth dispersion is the standard deviation of employment growth of firms in an industry, where employment growth is the change in employment divided by the average employment between years t and t-1. HHI is the Herfindahl-Hirschman Index of sector. Growth of total assets is the change in total assets divided by the average of total assets between t and t-1. Concentration calculated as the sum of squared market (revenue) share of each firm operating in a sector. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. [†] indicates values are for the model using all sectors and all firms. All models include a constant term.
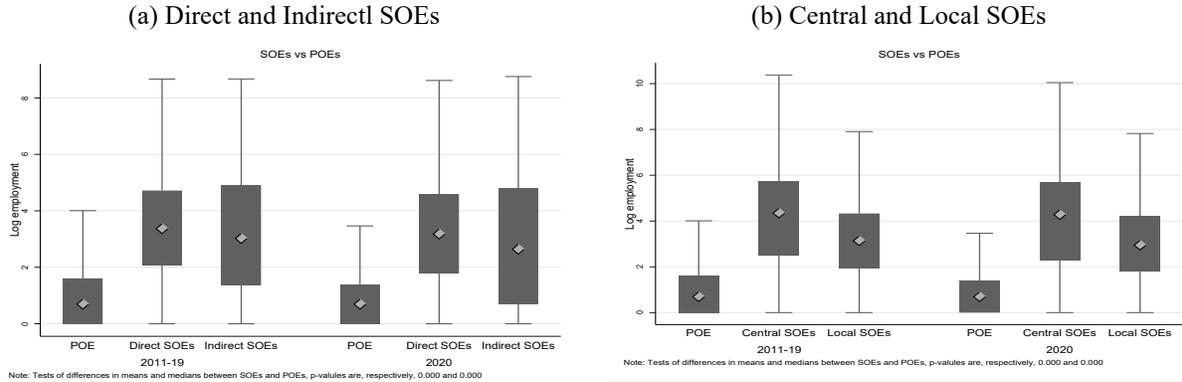
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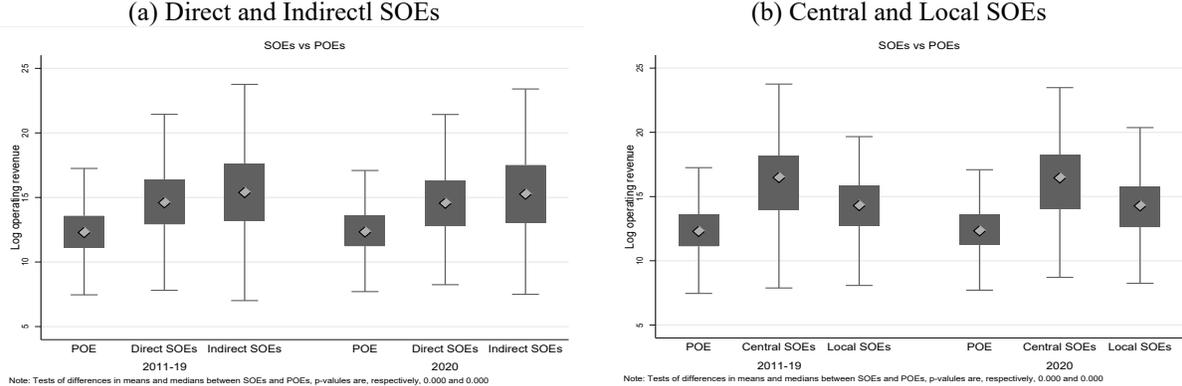
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Figure A1:Size Distribution of POEs and SOEs

(i)   By Employment

(a) Direct and Indirectl SOEs

(b) Central and Local SOEs

(ii)   By Operating Revenue

(a) Direct and Indirectl SOEs

(b) Central and Local SOEs

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%, while POEs are firms where national or subnational governments own 0-9.9%.

Figure A2: SOE Revenue, Employment, and Total Assets Shares

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019 for all firms.
Note: SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%, while POEs are firms where national or subnational governments own 0-9.9%.

Figure A3: SOE Revenue Shares

(a) By Ownership Degrees

(b) By Direct and Indirect Control Levels

(c) By Central and Local Control Levels

(d) By Sector Type

Figure A4: SOE Employment Shares

(a) By Ownership Degrees

(b) By Direct and Indirect Control Levels

(c) By Central and Local Control Levels

(d) By Sector Type

Figure A5: SOE Total Asset Shares

(a) By Ownership Degrees

(b) By Direct and Indirect Control Levels

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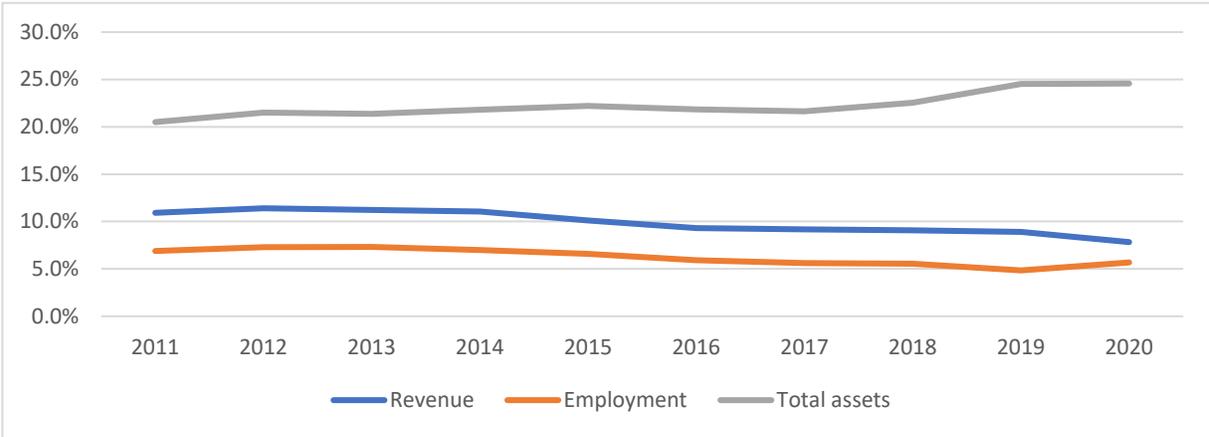| (c) By Central and Local Control Levels	(d) By Sector Type

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019 for all firms. SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%, while POEs are firms where national or subnational governments own 0-9.9%.

Table A1: Summary Statistics of Main Variables of Interest by Ownership, 2011-2019

Main variables	Private-owned enterprises (POEs)						State-owned enterprises (SOEs)						Test of diff. in means
	Obs.	Mean	Median	SD	Q1	Q3	Obs.	Mean	Median	SD	Q1	Q3	
Log employment	4,018,009	0.98	0.69	1.14	0.00	1.61	9,774	3.47	3.30	1.92	2.08	4.74	-2.4907***
Employment growth	3,232,096	0.00	0.00	0.41	0.00	0.00	8,450	0.00	0.00	0.32	-0.06	0.06	-0.0004
Log of total assets	4,004,331	6.43	5.30	2.32	5.30	6.21	9,502	11.90	12.54	4.22	9.21	14.75	-5.4677***
Total assets growth	3,310,586	0.03	0.00	0.23	0.00	0.00	8,259	0.08	0.00	0.38	0.00	0.00	-0.0553***
Log average wage	4,009,013	9.58	9.79	1.00	9.17	10.17	9,774	10.53	10.52	0.68	10.20	10.90	-0.9517***
Average wage growth	3,226,020	0.09	0.04	0.54	-0.08	0.26	8,450	0.07	0.05	0.32	-0.03	0.13	0.0147*
Log of labor productivity	4,018,009	11.34	11.45	1.55	10.57	12.29	9,774	11.37	11.27	1.22	10.72	11.92	-0.0239
Labor productivity growth	3,230,623	0.06	0.02	0.70	-0.27	0.36	8,448	0.08	0.03	0.47	-0.09	0.19	-0.0179*
Subsidy recipients	4,018,009	0.02	0.00	0.13	0.00	0.00	9,774	0.12	0.00	0.32	0.00	0.00	-0.0981***
Log of subsidy amount	72,561	11.01	11.35	2.33	9.20	12.76	1,135	13.91	14.36	2.70	12.22	15.70	-2.9028***

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. For purposes of providing the summary statistics, the sample is restricted to firms with revenue and employment data. SOEs are defined as firms where national or subnational governments have ownership stake of at least 10%, while POEs are firms w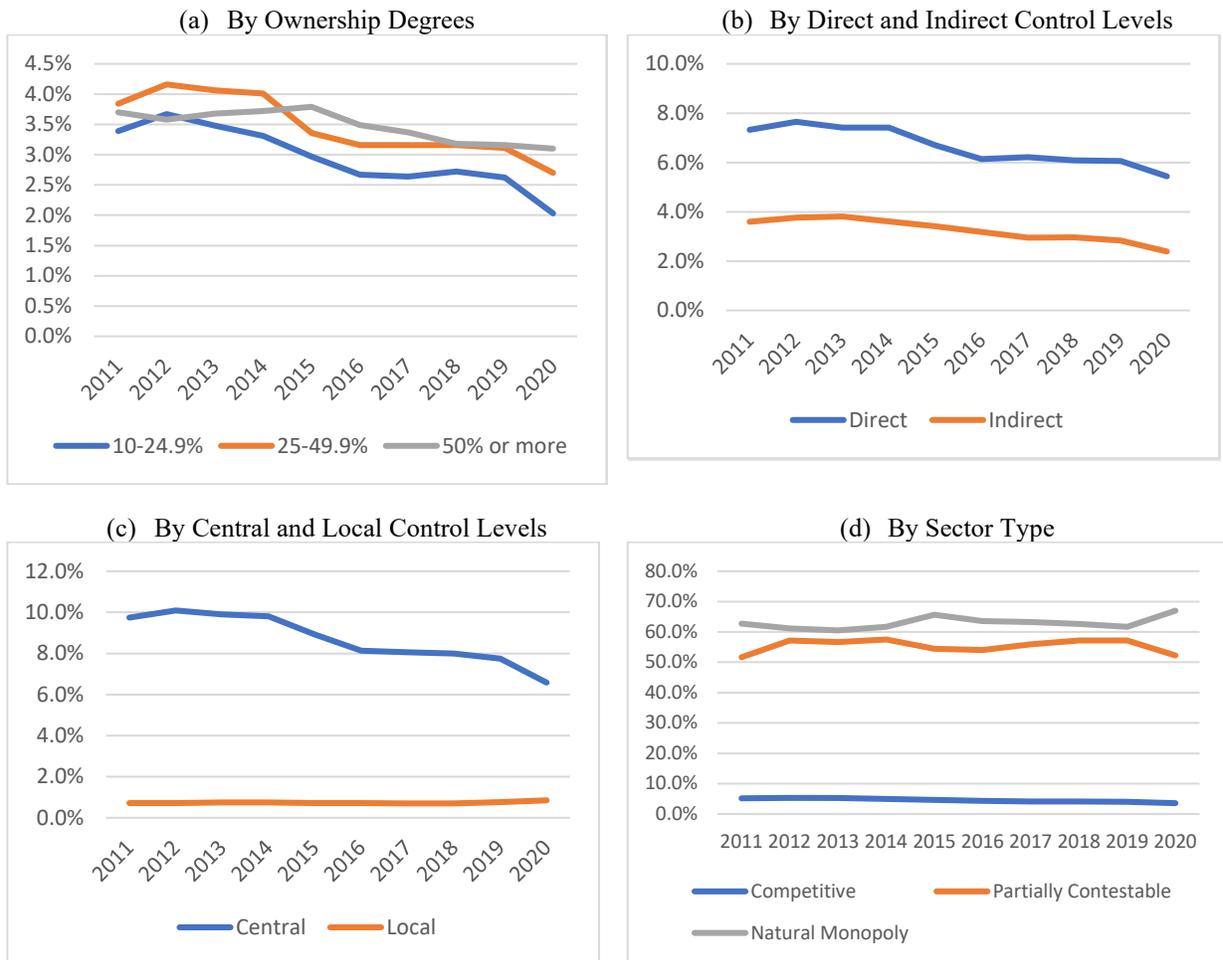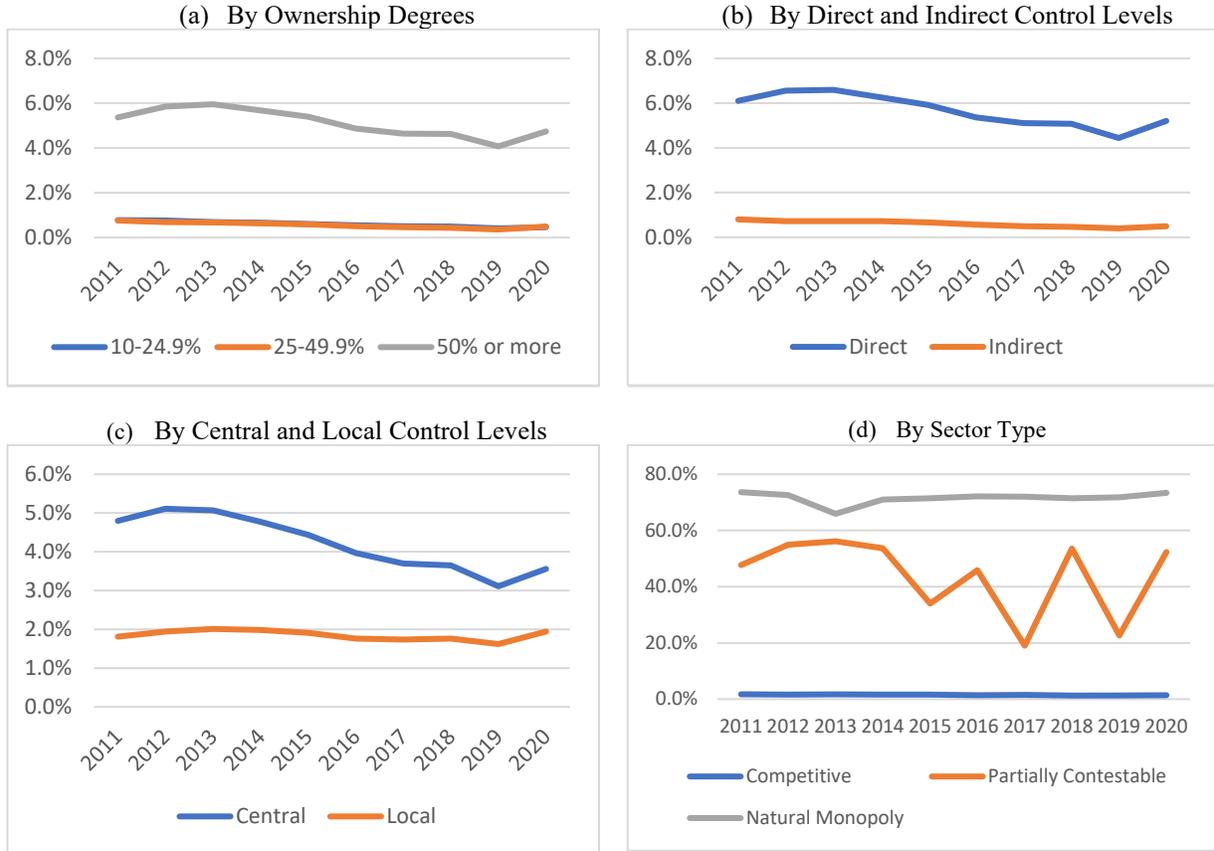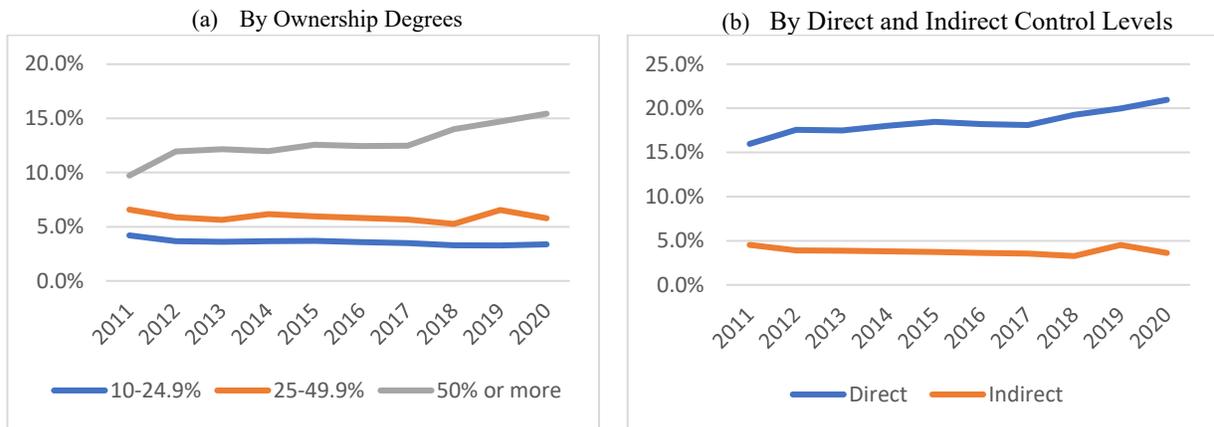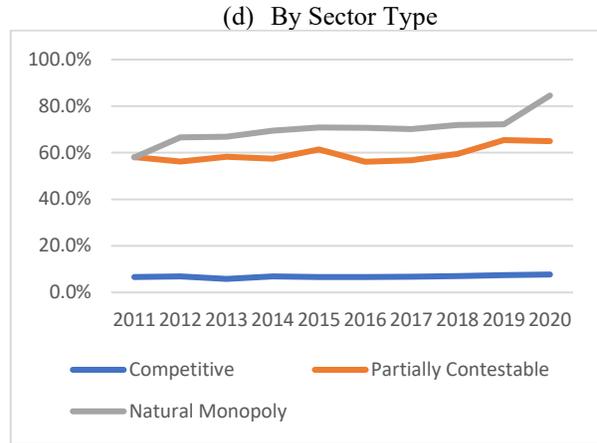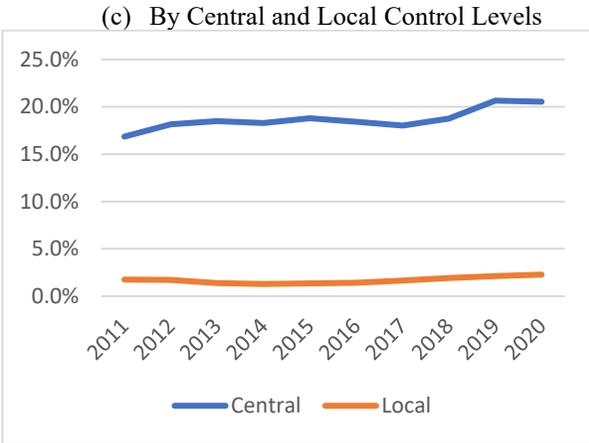here national or subnational governments own 0-9.9%. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent.

Table A2: Early Effect of COVID-19 Pandemic on Growths of Employment, Operating Revenue, and Average Wages of SOEs Relative to POEs in Romania, 2018-2020

	(1) Employment growth		(2) Operating revenue growth		(3) Average wage growth	
Panel A:						
Interaction effect						
10-100% x 2020	0.020	0.020	0.068***	0.067***	0.033**	0.033**
	(0.013)	(0.013)	(0.023)	(0.023)	(0.014)	(0.014)
Main effects						
SOE: 10-100%	0.014	0.010	0.030**	0.023*	-0.025**	-0.031***
	(0.010)	(0.010)	(0.012)	(0.013)	(0.010)	(0.010)
In 2020	-0.052***	-0.052***	-0.145***	-0.145***	-0.065***	-0.066***
	(0.004)	(0.004)	(0.014)	(0.014)	(0.006)	(0.006)
Panel B:						
Interaction effect						
10-24.9% x 2020	0.070	0.070	0.170	0.171	0.019	0.019
	(0.072)	(0.072)	(0.142)	(0.142)	(0.053)	(0.053)

25-49.9% x 2020	0.113***	0.114***	0.118	0.118	0.098**	0.098**
	(0.040)	(0.040)	(0.095)	(0.095)	(0.040)	(0.040)
50% or more x 2020	0.009	0.009	0.056***	0.056***	0.028*	0.028*
	(0.013)	(0.013)	(0.018)	(0.018)	(0.015)	(0.015)
Main effects						
SOE type						
10-24.9%	-0.074**	-0.074**	-0.132**	-0.132**	-0.037	-0.037
	(0.036)	(0.036)	(0.062)	(0.062)	(0.031)	(0.031)
25-49.9%	-0.026	-0.026	0.005	0.005	-0.089***	-0.089***
	(0.025)	(0.025)	(0.043)	(0.043)	(0.026)	(0.027)
50% or more	0.024**	0.020*	0.045***	0.037***	-0.018*	-0.025***
	(0.010)	(0.010)	(0.011)	(0.012)	(0.009)	(0.009)
In 2020	-0.052***	-0.052***	-0.145***	-0.145***	-0.065***	-0.066***
	(0.004)	(0.004)	(0.014)	(0.014)	(0.006)	(0.006)
Panel C:						
Interaction effect						
Direct x 2020	0.018	0.018	0.070***	0.070***	0.035**	0.035**
	(0.013)	(0.013)	(0.021)	(0.021)	(0.015)	(0.015)
Indirect x 2020	0.035	0.036	0.043	0.043	0.012	0.012
	(0.042)	(0.042)	(0.092)	(0.092)	(0.033)	(0.033)
Main effects						
SOE type						
Direct	0.019	0.015	0.038***	0.031**	-0.023**	-0.030***
	(0.011)	(0.011)	(0.012)	(0.013)	(0.010)	(0.010)
Indirect	-0.020	-0.021	-0.031	-0.031	-0.037	-0.037
	(0.018)	(0.018)	(0.037)	(0.037)	(0.025)	(0.026)
In 2020	-0.052***	-0.052***	-0.145***	-0.145***	-0.065***	-0.066***
	(0.004)	(0.004)	(0.014)	(0.014)	(0.006)	(0.006)
Panel D:						
Interaction effect						
Central x 2020	0.013	0.012	0.066	0.065	0.044*	0.043*
	(0.019)	(0.018)	(0.048)	(0.048)	(0.024)	(0.024)
Local x 2020	0.016	0.015	0.071***	0.071***	0.029*	0.029*
	(0.015)	(0.015)	(0.023)	(0.023)	(0.016)	(0.016)
Main effects						
SOE type						
Central	0.008	0.005	0.008	0.003	-0.034**	-0.039**
	(0.010)	(0.010)	(0.021)	(0.021)	(0.015)	(0.015)
Local	0.021	0.017	0.039***	0.032**	-0.021*	-0.028**
	(0.013)	(0.013)	(0.015)	(0.015)	(0.011)	(0.011)
In 2020	-0.052***	-0.052***	-0.145***	-0.145***	-0.065***	-0.066***
	(0.004)	(0.004)	(0.014)	(0.014)	(0.006)	(0.006)

	Competitive	Partially Contestable	Natural Monopoly	Competitive	Partially Contestable	Natural Monopoly
SOE dummies	Yes	Yes	Yes	Yes	Yes	Yes
Age dummies	Yes	Yes	Yes	Yes	Yes	Yes
Size dummies	No	No	Yes	Yes	Yes	Yes
Subsidies received	No	Yes	No	Yes	No	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations†	2,253,381	2,253,381	2,165,653	2,165,653	2,249,388	2,249,388
Pseudo/Within R†	0.018	0.018	0.049	0.049	0.029	0.029

Source: World Bank staff analysis using Romania MoF firm-level data from 2016-20. The sample includes all firms. Growth is calculated as the difference between the values in year t and t-1 divided by the average of the values in year t and t-1. Wage is labor cost divided by average number of employees. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-24.9%, 25-49.9%, or 50% or more, respectively, in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Observations in the top and bottom 1 percentile of each two-digit NACE sector and year distribution are excluded as outliers in the analyses. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. The reference categories for age and size groups are Start-ups (0-2) and Small (10-49), respectively. † indicates values are for the state ownership model using 10-100% stake. All models include a constant term.

Table A3: Early Effect of COVID-19 Pandemic on Growths of Employment, Operating Revenue, and Average Wages of SOEs Relative to POEs in Romania by Sector, 2018-2020

	Employment growth			Operating revenue growth			Average wage growth		
	Competitive	Partially Contestable	Natural Monopoly	Competitive	Partially Contestable	Natural Monopoly	Competitive	Partially Contestable	Natural Monopoly
Panel A:									
Interaction effect									
10-100% x 2020	0.029	-0.019	-0.025	0.073**	-0.048	-0.016	0.038**	0.028	-0.012
	(0.019)	(0.026)	(0.022)	(0.036)	(0.067)	(0.029)	(0.018)	(0.017)	(0.015)
Main effects									
SOE type									
10-100%	-0.002	0.047***	0.065***	0.016	0.064**	0.095***	-0.039***	-0.006	0.020
	(0.012)	(0.012)	(0.011)	(0.016)	(0.024)	(0.014)	(0.009)	(0.015)	(0.015)
In 2020	-0.052***	-0.032***	-0.019	-0.144***	-0.048	-0.065	-0.066***	-0.033***	-0.053***
	(0.004)	(0.010)	(0.021)	(0.015)	(0.059)	(0.036)	(0.007)	(0.007)	(0.014)
Panel B:									
Interaction effect									
10-24.9% x 2020	0.067	0.146	0.008	0.224	-0.505**	0.038	0.008	0.032	0.055
	(0.090)	(0.170)	(0.021)	(0.183)	(0.186)	(0.058)	(0.064)	(0.114)	(0.029)
25-49.9% x 2020	0.140***	-0.124**	0.110	0.119	-0.071	0.095	0.106*	0.025	0.068
	(0.047)	(0.054)	(0.070)	(0.130)	(0.135)	(0.121)	(0.055)	(0.106)	(0.109)
50% or more x 2020	0.013	-0.016	-0.032	0.052*	-0.037	-0.023	0.033	0.028	-0.019
	(0.019)	(0.024)	(0.020)	(0.029)	(0.066)	(0.028)	(0.021)	(0.018)	(0.015)
Main effects									
SOE type									

10-24.9%	-0.099**	-0.023	0.060*	-0.198**	0.319**	0.069	-0.039	0.071	-0.022
	(0.045)	(0.021)	(0.029)	(0.078)	(0.152)	(0.043)	(0.037)	(0.093)	(0.017)
25-49.9%	-0.055**	0.091**	0.077***	-0.007	0.083**	0.103***	-0.098***	-0.023	-0.018
	(0.024)	(0.042)	(0.017)	(0.054)	(0.036)	(0.012)	(0.033)	(0.037)	(0.024)
50% or more	0.014	0.047***	0.062***	0.041***	0.056**	0.095***	-0.032***	-0.007	0.024
	(0.013)	(0.013)	(0.012)	(0.015)	(0.024)	(0.015)	(0.008)	(0.016)	(0.013)
In 2020	-0.052***	-0.032***	-0.019	-0.144***	-0.048	-0.065	-0.066***	-0.033***	-0.053***
	(0.004)	(0.010)	(0.021)	(0.015)	(0.059)	(0.036)	(0.007)	(0.007)	(0.014)

Panel C:

Interaction effect

Direct x 2020	0.029	-0.018	-0.030	0.079**	-0.039	-0.024	0.042**	0.033	-0.013
	(0.020)	(0.025)	(0.021)	(0.034)	(0.062)	(0.029)	(0.018)	(0.019)	(0.015)
Indirect x 2020	0.029	-0.023	0.095*	0.033	-0.171	0.163	0.014	-0.034	-0.005
	(0.048)	(0.091)	(0.042)	(0.114)	(0.149)	(0.183)	(0.043)	(0.073)	(0.032)

Main effects

SOE type

Direct	0.004	0.047***	0.066***	0.029*	0.058**	0.097***	-0.039***	-0.005	0.024
	(0.014)	(0.011)	(0.010)	(0.017)	(0.024)	(0.012)	(0.007)	(0.016)	(0.013)
Indirect	-0.033	0.049	0.025	-0.057	0.132*	0.042*	-0.035	-0.007	-0.030***
	(0.024)	(0.050)	(0.014)	(0.047)	(0.064)	(0.018)	(0.028)	(0.042)	(0.005)
In 2020	-0.052***	-0.032***	-0.019	-0.144***	-0.048	-0.065	-0.066***	-0.033***	-0.053***
	(0.004)	(0.010)	(0.021)	(0.015)	(0.059)	(0.036)	(0.007)	(0.007)	(0.014)

Panel D:

Interaction effect

Central x 2020	0.002	-0.004	0.005	0.090	-0.074	0.025	0.024	0.033	0.033
	(0.031)	(0.020)	(0.018)	(0.093)	(0.082)	(0.042)	(0.038)	(0.019)	(0.048)
Local x 2020	0.026	-0.034	-0.032	0.074**	-0.019	-0.021	0.039**	0.018	-0.016
	(0.022)	(0.038)	(0.021)	(0.035)	(0.056)	(0.027)	(0.019)	(0.025)	(0.013)

Main effects

SOE type

Central	-0.010	0.030**	0.021	-0.022	0.066	-0.009	-0.030	-0.028*	-0.008
	(0.019)	(0.011)	(0.013)	(0.034)	(0.044)	(0.017)	(0.024)	(0.015)	(0.015)
Local	0.007	0.061***	0.075***	0.027	0.056***	0.118***	-0.040***	0.016	0.029**
	(0.015)	(0.015)	(0.010)	(0.018)	(0.015)	(0.011)	(0.008)	(0.013)	(0.011)
In 2020	-0.052***	-0.032***	-0.018	-0.144***	-0.048	-0.065	-0.066***	-0.033***	-0.054***
	(0.004)	(0.010)	(0.021)	(0.015)	(0.059)	(0.036)	(0.007)	(0.007)	(0.014)
SOE dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size dummies	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Value of subsidies received	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations†	1,301,155	28,836	6,854	1,253,384	27,611	6,641	1,298,916	28,791	6,847
Within R-squared†	0.022	0.020	0.012	0.055	0.038	0.048	0.030	0.023	0.027

Source: World Bank staff analysis using Romania MoF firm-level data from 2018 to 2020. The sample includes all firms. Growth is calculated as the difference between the values in year t and t-1 divided by the average of the values in year t and t-1. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-24.9%, 25-49.9%, or 50% or more, respectively, in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. The reference categories for age and size groups are Start-ups (0-2) and Small (10-49), respectively. The classification of the 4-digit NACE sectors into competitive, partially contestable, and natural monopoly sectors are based on the SOE sector taxonomy developed by Dall'Olio, Goodwin, Alonso, Patino Pena, & Sanchez-Navarro (2022). [†] indicates values are for the state ownership model using 10-100% stake. All models include a constant term.
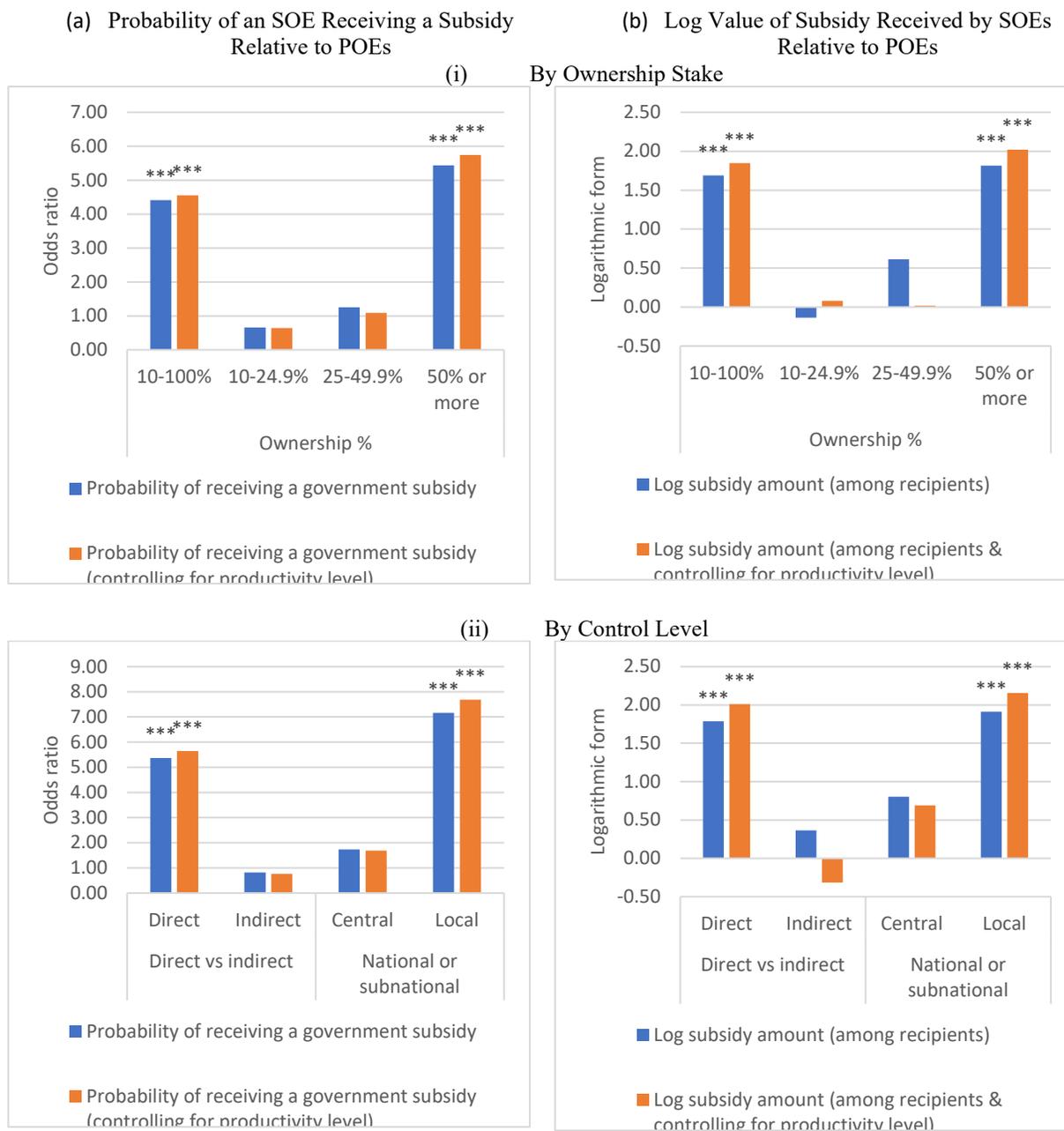
Figure A6: Performance of SOE Relative to POEs by Ownership Type, 2011-2019 (Firms with 10 or More Employees)

(a) Log of ……   (b) Growth of ……

(i)   By Ownership Stake

(ii)   By Control Level

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. The sample includes firms with 10 or more employees. Employment is the log of the number of employees. Wage level is the log of average wage bill, where average wage bill is (real) labor cost divided by number of employees. Assets per worker is (real) total assets divided by the number of employees. Labor productivity is (real) revenue per worker. Employment growth is calculated as the difference between the number of employees in year t and t-1 divided by the average number of employees in year t and t-1. Wage growth is the difference between wage level in year t and t-1 divided by the average wage level in year t and t-1. Total asset growth (used as a proxy for investment) is calculated as the difference between (real) total assets in year t and t-1 divided by the average of total assets in year t and t-1. Labor productivity growth is calculated as the difference between (real) revenue per worker in year t and t-1 divided by the average revenue per worker in year t and t-1. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects.

Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. Where indicated, the model includes age groups: Young (3-5), Mature (6-10), and Old (>10), with Start-ups (0-2) being the reference category, and size group: Medium (50-99), Large (100-499), and Very large (500+). with Small (10-49) being the reference category.

Figure A7: Probability of an SOE Receiving a Subsidy, and Value of Subsidies Received, Relative to POEs by Ownership Type, 2011-2019 (Firms with 10 or More Employees)

(a) Probability of an SOE Receiving a Subsidy Relative to POEs

(b) Log Value of Subsidy Received by SOEs Relative to POEs

(i) By Ownership Stake

(a)(i) — Odds ratio, by Ownership %: categories 10-100%, 10-24.9%, 25-49.9%, 50% or more.
- Probability of receiving a government subsidy
- Probability of receiving a government subsidy (controlling for productivity level)

(b)(i) — Logarithmic form, by Ownership %: categories 10-100%, 10-24.9%, 25-49.9%, 50% or more.
- Log subsidy amount (among recipients)
- Log subsidy amount (among recipients & controlling for productivity level)

(ii) By Control Level

(a)(ii) — Odds ratio, by Direct vs indirect (Direct, Indirect) and National or subnational (Central, Local).
- Probability of receiving a government subsidy
- Probability of receiving a government subsidy (controlling for productivity level)

(b)(ii) — Logarithmic form, by Direct vs indirect (Direct, Indirect) and National or subnational (Central, Local).
- Log subsidy amount (among recipients)
- Log subsidy amount (among recipients & controlling for productivity level)

Source: World Bank staff analysis using Romania MoF firm-level data, 2011-2019. The sample includes firms with 10 or more employees. Estimates in graph (a) are odds ratios indicating for the probability of receiving a subsidy based on a logit model with a dummy variable taking the value one if the firm reported a positive subsidy amount. The estimates in (b) are in logarithmic terms with the dependent variable being the log of the subsidy amount the firm reported as received. SOE variables are dummy variables taking the value one if national or subnational governments have ownership stake of 10-100% in the firm. The reference group is private-owned enterprises (POEs), defined as firms where national or subnational governments own 0-9.9%. All models include 2-digit NACE industry and year-fixed effects. Standard errors clustered at the industry level are in parentheses. ***, **, and * indicate significance at 1 percent, 5 percent, and 10 percent. Where indicated, the model includes age groups: Young (3-5), Mature (6-10), and Old (>10), with Start-ups (0-2) being the reference category, and size group: Small (10-49), Medium (50-99), Large (100-499), and Very large (500+). with Micro (1-9) being the reference category.

Table B1: List of Nace 4-digit Codes Classified as Partially Contestable Sectors and Natural Monopoly Sectors

NACE 1-Digit Description	Nace 4-digit code	Nace 4-Digit Description
A. *Partially contestable sectors*		
Agriculture	161	Support activities for crop production
	164	Seed processing for propagation
	210	Silviculture and other forestry activities
	240	Support services to forestry
Mining and quarrying	510	Mining of hard coal
	520	Mining of lignite
	610	Extraction of crude petroleum
	620	Extraction of natural gas
	710	Mining of iron ores
	721	Mining of uranium and thorium ores
	729	Mining of other non-ferrous metal ores
	891	Mining of chemical and fertiliser minerals
	910	Support activities for petroleum and natural gas extraction
	990	Support activities for other mining and quarrying
Manufacturing	1910	Manufacture of coke oven products
	1920	Manufacture of refined petroleum products
	2051	Manufacture of explosives
	2365	Manufacture of fibre cement
	2446	Processing of nuclear fuel
	2540	Manufacture of weapons and ammunition
	3040	Manufacture of military fighting vehicles
Electricity, Gas, Steam and Air Conditioning Supply	3511	Production of electricity
Water Supply, Sewerage, Waste Management and Remediation Activities	3812	Collection of hazardous waste
	3821	Treatment and disposal of non-hazardous waste
	3822	Treatment and disposal of hazardous waste
Transportation and Storage	4910	Passenger rail transport, interurban
	4920	Freight rail transport
	4931	Urban and suburban passenger land transport
	5110	Passenger air transport
	5121	Freight air transport
	5122	Space transport
Information and Communication	6010	Radio broadcasting
	6020	Television programming and broadcasting activities
	6120	Wireless telecommunications activities
	6130	Satellite telecommunications activities

Financial and Insurance Activities	6419	Other monetary intermediation
Professional, Scientific and Technical Activities	7120	Technical testing and analysis
	7211	Research and experimental development on biotechnology
	7219	Other research and experimental development on natural sciences and engineering
	7220	Research and experimental development on social sciences and humanities
	7500	Veterinary activities

B.   Natural monopoly sectors

Electricity, Gas, Steam and Air Conditioning Supply	3512	Transmission of electricity
	3513	Distribution of electricity
	3522	Distribution of gaseous fuels through mains
Water Supply, Sewerage, Waste Management and Remediation Activities	3600	Water collection, treatment and supply
	3700	Sewerage
Transportation and Storage	4950	Transport via pipeline
	5221	Service activities incidental to land transportation
	5222	Service activities incidental to water transportation
	5223	Service activities incidental to air transportation
	5310	Postal activities under universal service obligation
Information and Communication	6110	Wired telecommunications activities

Source: The taxonomy was developed by Dall'Olio et al. (2022b) to supplement the World Bank BOS database.