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performance in transition countries.
Evidence from Lithuania

Claudia Curi, Justas Gedvilas,
Ana Lozano-Vivas

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Claudia Curi

Free University of Bozen-Bolzano
claudia.curi@unibz.it

Justas Gedvilas

Independent
j.k.gedvilas@gmail.com

Ana Lozano-Vivas

University of Malaga
avivas@uma.es

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Abstract

This paper investigates whether and to what extent corporate governance mechanisms affect the efficiency of State Owned Enterprises (SOEs) operating in transition economies. Furthermore, it examines the relationship between corporate governance practice and its impact on both wholly state run SOEs and majority state run SOEs. We employed a unique dataset of corporate governance ratings (related to quality of transparency, quality of board, and quality of strategic planning, implementation and control) of commercial Lithuanian SOEs relating to the period following the introduction of the corporate governance reforms in the years 2012-2013. In order to investigate our research hypotheses, we set-up a two stage empirical research strategy that combined a non-parametric efficiency estimator (i.e., Data Envelopment Analysis) with a bootstrapped truncated regression. We built two aggregate indexes of corporate governance ratings to represent one dimension of corporate governance quality. We then ran a battery of regressions using both the aggregated and the single corporate governance indexes as independent variables. First, the paper finds that the wholly state ownership model of SOEs is positively correlated to efficiency (i.e., wholly SOEs are more efficient than majority SOEs). Moreover, overall corporate governance practices are efficiency-enhancing; more specifically, board quality and strategic planning seem to be effective internal governance mechanisms in promoting overall organizational efficiency. Interestingly, we uncovered that there exists a relationship between concentration of ownership and corporate governance practices, but this mitigated efficiency enhancement in wholly state run SOEs compared to majority state run SOEs. This effect was driven by the lower quality of the board. Overall, our findings illustrate that corporate governance

reforms have enhanced efficiency, but wholly SOEs require a better implementation in order to achieve full efficiency gains.

Keywords: SOE, Corporate Governance, transition economy, DEA, Bootstrap

JEL Classification: C14, D24, G34, L32, P31

1. Introduction

Corporate governance has become a mainstream concern in the aftermath of the financial crisis and corporate governance scandals in the United States and Europe that triggered some of the largest insolvencies in history. As a result, numerous studies have documented that the quality of corporate governance plays an important role in achieving management excellence and company goals and exercises a positive impact on a firm's performance, asset allocation, and other efficiency improvements (Claessens and Yurtoglu, 2013). Good governance is a necessary condition for accomplishing economic goals regardless of the ownership structure of the firm. In 2015, the Organization for Economic Cooperation and Development (OECD) updated its Guidelines on Corporate Governance for State-Owned Enterprises (SOEs), wherein the ownership of state property is the dominant shareholding form.

Although SOEs are enterprises where the State is the exclusive or dominant owner that controls or has an influential role on the board of directors, and determines the objectives of the business according to the public interest, the OECD stated that good governance of SOEs is essential, for efficient and open markets at both the domestic and international level. In fact, this type of enterprise has a great importance in many countries, mainly emerging economies, and they have an increasingly prominent presence in international markets. Thus, ensuring that SOEs operate in a sound competitive and regulatory environment through good corporate governance, is crucial to maintaining an open trade and investment environment that underpins domestic and international economic growth. In this regard, the OECD in the "Guidelines on Corporate Governance of State-Owned Enterprises" argues that public ownership does not intrinsically produce inefficiency within an enterprise and that possible inefficiencies can be likely removed through reforming the way the government exercises its ownership and regulatory powers, as well as providing profit incentives.

Overall, despite seeking important social objectives, SOEs are required to work efficiently. Thus, the implementation of corporate governance mechanisms is considered as alternative reform to privatization to enhance the efficiency of the SOEs. Although the existing literature argues that, in general, higher quality corporate governance enhances firm performance, it is not clear whether SOEs with high or wholly state shareholdings can exploit the benefits of corporate governance mechanisms.

The aim of this paper is to provide empirical evidence as to the effectiveness of corporate governance mechanisms adopted by wholly and majority state-owned enterprises in emerging markets. Specifically, the

paper deals with the example of Lithuania for two reasons: (i) the State controls the largest share of commercial assets in the country with a market value of 4.4 billion EUR as of 2013, and (ii) Lithuanian SOEs are the most significant generators of economic value, and promote economic development in the country. In fact, they constitute an important source of budgetary income as well as the implementation of strategic projects.

This study contributes to the literature of corporate governance in emerging markets in several ways. First, it provides empirical evidence as to whether different forms of state ownership lead to different performance outcomes. Second, it contributes to the literature concerning the relationship between the quality of corporate governance practices (such as quality of transparency, board and strategic planning) and SOE efficiency. Lastly, we investigate the link between corporate governance – efficiency and the level of state ownership of the SOE.

The paper is structured as follows. Section 2 presents the literature review, Section 3 describes the Lithuanian setting, Section 4 explains the empirical research strategy, Section 5 discusses the empirical results and Section 6 concludes the paper with findings and recommendations.

2. Literature review of corporate governance, state owned enterprises and performance

During the last couple of decades, a large body of research has documented the importance of the quality of a corporate governance framework on firm performance, through organisational management that is more efficient, has better asset allocation, improved labour policies, and other efficiency improvements (see Claessens and Yurtoglu, 2013 for a complete survey). However, most of this research refers to developed countries such as the US, UK, and Japan in which private enterprises are the predominant economic actors, while less work has been done in emerging markets where SOEs represent a generous part of GDP, employment opportunities and market capitalization.

Widespread privatization programmes and market liberalization, through several reforms aimed at decentralizing and commercializing SOEs, has generated empirical literature investigating the effectiveness of corporate governance systems in transition economies (Dnes, 2005). Among the various corporate governance mechanisms, ownership structure change (through privatization) has been the most extensively studied (Denis and McConnell, 2003; Megginson, 2005; Estrin et al., 2009). Research questions have been concerned with whether private ownership leads to higher efficiencies for firms. However, the empirical evidence is far from being conclusive. One stream of literature asserts that because governments cannot play an active role in corporate governance, privatization with ownership changes are necessary for any significant performance improvement of SOEs (i.e., Boycko et al., 1996; Shleifer, 1998; Megginson and Netter, 2001; Djankov and Murrell, 2002; Dewenter and Malates, 2001; Su and He, 2012). On the other hand, another stream of literature (i.e., Vickers and Yarrow, 1991; Allen and Gale, 2000; Dahya et al. 2008)

argue that less radical changes such as managerial incentive contracts, market deregulation, and internal and external government reforms can be effective substitutes to outright privatization.

In many countries, the approach used to reform SOEs has been based on the implementation of new corporate governance structures while the government remains the majority shareholder (Gupta, 2005; Tian and Estrin 2008). In this regard, and consistent with the suggestion of Stiglitz (1999), Chen et al. (2009) argue that in a transitional economy with a weak legal environment, certain types of state ownership can play a positive role on firm performance.

Overall, the relation between government shareholding and corporate performance is still a field under investigation. Most of the studies found in the literature are oriented principally to analysing whether the firm-level variation in overall corporate governance predicts a firm's market value (governance-to-value studies). Focusing on emerging markets, Black (2001) (Russia), Black et al. (2006a) (Korea), Black et al. (2006b) (Korea), and Black et al. (2006c) (Russia) find a connection between the measure of firm-level governance and share price in a single country. Corresponding results are those of Durnev and Kim (2005) and Klapper and Love (2004) where the examination setting is on a cross-country basis. Most of those studies used overall corporate governance indexes estimated by rating agencies such as Standard and Poor's, The Institute of Corporate Law and Governance, among others. Some studies develop unique indexes of corporate governance quality when data is not available (e.g., Zheka, 2005; Zheka and Zelenyuk, 2006).¹

Although the implementation of corporate governance mechanisms is considered as an alternative reform to privatization to enhance the efficiency of SOEs, very few studies are available regarding this issue. While the dominant approach used by previous research is to estimate the impact on the market value of a firm, technical efficiency is also a useful measurement in a transitional context as it captures the basis of corporate governance problems, specifically the inefficient use of resources, which is usually not easily observable by outside stakeholders and governments. Thus, technical efficiency represents a good proxy to measure the quality of the management in using incentive mechanisms, such as contract, organizational designs and legislation.²

¹ Other studies focus on the relationship between firm performance and single aspects of corporate governance, e.g., executive compensation and CEO turnover (Gibson, 2003; Bryan et al., 2010), blockholders (Claessens et al., 2000; Holderness, 2003), the takeover market (Allen and Gale, 2000), and investor protection (La Porta et al., 2000, 2002; Durnev and Kim, 2005).

² This problem is seen through Leibenstein's (1966) concept of "X-(in) efficiency", according to which the "X-(in) efficiency" can be understood as the difference between a firm's potential and actually observed (realized) performance caused by (i) intra-plant efficiency; (ii) external motivational efficiency, and (iii) non-market input efficiency.

Among the few studies that analyze the relation between operating efficiency and corporate governance are those developed by Zheka (2005) and Zheka and Zelenyuk (2006). These authors investigate the effects of different ownership structures on the quality of corporate governance and the efficiency of the Ukrainian economy. The authors attempt to create three corporate governance indicators for Ukrainian enterprises. The first indicator proxies the level of transparency of the companies and it measures whether the firm's annual financial statements were published in the press. The second indicator mimics the possible failures in the enterprise's corporate governance system. It measures the presence of complaints (from individuals and organizations) to the Ukrainian State Commission for Securities and Stock Market against the enterprise during a three year period concerning the violations of shareholders' rights, nondisclosure of statements, and violation of proper conduct of register. The third indicator represents whether these complaints were upheld by the Commission for Securities and Stock Market. Overall, they find a negative relationship between the state-ownership and the firm-efficiency. While the number of complaints is found not to be statistically significant, the violation of corporate governance in relation to laws is found to increase inefficiency. Moreover, a lack of significant relationship between the transparency index and efficiency is found. Lastly, they find a scale effect having a positive effect on efficiency.

Chen et al. (2009) find that the operating efficiency of Chinese listed companies varies across the type of controlling shareholders, and that SOEs affiliated to the central government perform better than SOEs controlled by state asset management bureaus or private controlled firms. Drawing on a large data set of Chinese public listed companies, Tian and Estrian (2008) extend previous results by finding that a government shareholding can be beneficial to corporate value when the state ownership is greater than 25%. Lastly, Lin et al. (2009) and Su and He (2012) find that restructuring publicly listed Chinese SOEs via corporate governance reform improved efficiency. Specifically, ownership structure plays a dominant role in determining efficiency and state shareholding reduces greatly that efficiency. Board independence is positively related to firm efficiency while a supervisory committee plays no role in improving firm efficiency.

This paper attempts to contribute to the rather limited literature in this area by analysing the relationship between corporate governance and firms' technical efficiency by extending prior research in several dimensions. Firstly it aims to analyze whether there exists a positive relation between the quality of corporate governance and the efficiency of SOEs. Secondly, it considers the link between corporate governance – efficiency and the degree of the state ownership of an enterprise. In other terms, whether wholly and majority SOEs experience the same corporate governance-efficiency. Thirdly, we investigate these issues by analyzing empirical data collected from Lithuania, thereby, increasing our knowledge of transitional economics.

3. Lithuanian setting

The Lithuanian setting provides a unique opportunity to analyse the impact of corporate governance mechanisms on SOEs’ performance. Firstly, the State of Lithuania controls the largest share of commercial assets in the country and the size of SOE sector relative to the national economy (as measured by employment share) is higher than the OECD average. Secondly, there is a substantial range of business SOEs. As of December 31st 2013, there were 137 state-owned enterprises in Lithuania, ranging from *energy* (the largest and the most strategically important SOE sector by sales, which includes 9 SOEs), *communications* (the second largest SOE sector, which includes 23 enterprises), and the *forestry* sector (which consists of 42 local enterprises). The remaining 57 enterprises were involved in activities varying from minting coins to project evaluation and insurance services (The Property Bank. State-Owned Enterprise Governance Coordination Unit, 2014). Thirdly, Lithuania is an example of a post-Soviet country, which enables it to demonstrate the applicability of corporate governance standards in SOE management, as an alternative to SOE privatization. The Lithuanian Government initiated the SOE reform with the goal of improving the efficiency and transparency of SOEs and to improve interaction amongst SOEs, the State and the public. The four areas of intervention enforced by the SOE management reforms were: (i) the setting of clear objectives; (ii) the separation of commercial and non-commercial functions; (iii) the separation of ownership and regulatory functions; and (iv) the increase in the transparency of SOEs (Table 1. For further details, see OECD (2015)).

Table 1: Lithuanian SOEs - Areas of intervention of corporate governance reform and relative provisions.

Areas of intervention	Provisions
Set clear objectives	SOEs are classified into groups according to the level of commercialization. Performance target (ROE-based) are defined for each group. Largest SOEs are obliged (others encouraged) to develop long-term strategies with clear, ambitious objectives.
Separation of commercial and non-commercial functions	Identification, separation and disclosure of SOEs’ public policy objectives (“special obligations”). Compensation mechanism to cover costs supported for the special obligation.
Separation of the ownership and regulatory function	Establishment of a separate coordinating authority, the Governance Coordination Center (GCC). Criteria for nomination and composition of corporate boards.
Increase the transparency	Aggregated reporting and disclosure established by law. SOEs obliged to prepare and publish yearly and quarterly aggregated reports.

The two cornerstones of SOE reforms were the Government Resolution No. 1052 “On the Approval of the guidelines for ensuring transparency of the activities of the state-owned enterprises and designating a coordinating Authority” (“Transparency Guidelines”), approved on July 2010, and the Government Resolution No. 665 “On the Approval of the guidelines for the Procedure for the Implementation of the State’s Property

and Non-Property Rights at State-owned Enterprises” (“Ownership Guidelines”), approved on June 2012. The Transparency Guidelines apply to all SOEs, irrespective of size and legal form, whether they are statutory SOEs or limited liability companies. It required SOEs to implement minimum information disclosure standards as outlined in the Corporate Governance Code for listed companies, and to keep accounts in accordance with international accounting standards (IFRS), and to publish annual and quarterly sets of financial statements. The Ownership Guidelines consolidate three main aspects of the SOE management. Provisions on the separation of the state’s role as owner and regulator is aimed to separate the state’s ownership rights from their sectorial policy function. In this regard, the Governance Coordination Center (GCC) was established as an authority designed to monitor and analyze the implementation of the ownership guidelines by state ownership entities. The provisions relating to boards were aimed at establishing qualification requirements for the board members along with guidelines regarding the composition of the board. The principle of clear objectives was designed to set ambitious objectives for the companies and ensure that all SOEs create comprehensive strategic plans. The state, as their main shareholder, will set the required rate of return for the enterprises. Thus, the two directives effectively prescribe a common set of corporate governance rules for all SOEs.

Overall, Lithuania is an especially suitable case study laboratory for studying the effect of firm-level variation in corporate governance as all Lithuanian SOEs participated in a radical change promoted by through corporate governance reform during the year 2011 and 2012.

4. Research design and data

The empirical methodology used to investigate the relation between corporate governance and SOEs’ performance is presented in this section, along with the description of corporate governance indicators and the data employed for the implementation of the empirical analysis.

4.1. Empirical methodology

The main goal of the paper is to analyse the relationship between corporate governance and SOEs’ technical efficiency, rather than market-based or accounting-based performance measures.³ As pointed out above, this type of productive efficiency is able to examine the basis of corporate governance problems, specifically, inefficient use of resources, not usually easily observable by outside stakeholders and governments.

The empirical methodology is composed of two steps: (i) **First step**: to measure the efficiency level of the SOE, a Data Envelopment Analysis (DEA) is used. DEA is a popular nonparametric approach well appreciated for its advantages of not imposing prior functional form on the production frontier (less sensitive

³ Market-based measures are excluded, as the majority of Lithuanian SOEs are not listed. Accounting-based measures are inappropriate to compare firms, which use multiple inputs and produce multiple outputs.

to misspecification) and the distribution of the inefficiency term and the simultaneous use of multiple inputs and outputs. (ii) **Second step**: to analyse the relationship between corporate governance and SOE performance, we performed a two-stage efficiency analysis based on an ad-hoc bootstrap procedure proposed by Simar and Wilson (2007), that addresses important statistical issues ignored by standard regression (i.e., OLS and Tobit). In the first step, the efficiency scores were estimated based on a set of inputs and outputs using DEA. In the second step, the efficiency scores were regressed on a set of explanatory variables to ascertain the impact of corporate governance.

At the first step, the DEA was used in order to obtain the SOE's efficiency scores. To briefly outline the DEA estimator, let $x_k = (x_k^1, \dots, x_k^H)' \in \mathfrak{R}_+^N$ be a vector of H inputs that each SOE k ($k = 1, 2, \dots, n$) uses to produce a vector of M outputs, denoted $y_k = (y_k^1, \dots, y_k^M)' \in \mathfrak{R}_+^M$. Then the DEA estimate of the technology set (assuming constant returns to scale and free disposability of inputs and outputs) can be written:

$$\hat{\Psi}_{DEA} = \left\{ (x, y) \in \mathfrak{R}_+^H \times \mathfrak{R}_+^M \mid \sum_{k=1}^n z_k y_k^m \geq y^m, m = 1, \dots, M \right. \\ \left. \sum_{k=1}^n z_k x_k^h \leq x^h, h = 1, \dots, H, z_k \geq 0, k = 1, \dots, n \right\} \quad (1)$$

where $\{z_k \geq 0 : k = 1, \dots, n\}$ are the intensity variables over which the maximization will be made. Under certain regular conditions on the data generating process (DGP), the expression in (1) provides a consistent estimator of the unknown technology.⁴ Once the technology is estimated, we derive the efficiency scores by measuring for each SOE the radial distance to the frontier, according to the Debreu (1951)-Farrell (1957) criterion. In particular, we use the output-oriented measure of technical efficiency defined as:

$$TE(x, y) = \max_{\theta, \bar{z}_1, \dots, \bar{z}_n} \left\{ \theta \mid (x, \theta y) \in \hat{\Psi}_{DEA} \right\}, \quad (2)$$

This is a consistent estimator of the true efficiency score from a point (x, y) to the frontier of the true technology set in (1).

At the second step, we estimated a multivariate relationship between corporate governance and efficiency, controlling for other SOE characteristics including the legal status. To do so, we followed the

⁴ See Korostelev et al. (1995) and Park et al. (2010) for proof of consistency and rates of convergence of the DEA estimator under constant returns to scale.

truncated regression with the bootstrap approach, suggested by Simar and Wilson (2007), to analyze the following relationship:

$$TE_k = Z_k \beta + u_k, \quad k = 1, \dots, n, \quad (3)$$

where TE_k is the true (in)efficiency score of SOE k , while Z_k is the (row) vector of repressors (corporate governance indices and specific SOEs characteristics) that are believed to influence the (in)efficiency score of SOE k through the (column) vector of parameters β , which we aim to estimate, while u_k is a random error. Obviously, the true inefficiency score, TE_k , is unobserved and so we replaced it with its DEA estimate from the first stage, corrected for the bias via the bootstrap procedure that accounts for the production model in (1) and the hypothesized structure in (3). Importantly, because $TE_k \geq 1$, we also have $u_k \geq 1 - Z_k \beta$, for all $k = 1, \dots, n$ and, to account for this boundary issue, we used the truncated regression approach, by assuming $u_k \sim N(0, \sigma_\varepsilon^2)$ such that $u_k \geq 1 - Z_k \beta$, $k = 1, \dots, n$, where σ_ε^2 is estimated along with β . To improve the accuracy of the inference, we used the parametric bootstrap (reflecting the structure in (3)) to obtain confidence intervals around each element in β . This procedure is described in more detail in Simar and Wilson (2007).

4.2. Sample selection, data and corporate governance measures

The first step of our empirical methodology was to measure the SOE's efficiency scores. To address this issue we defined the SOEs' production model with one output and three inputs, following Su and He (2012). On the output side, we selected total revenues. On the input side, we selected (1) labor, measured by total labor expenses, (2) capital stock, measured by tangible assets, and (3) other costs, measured by total production costs minus depreciation. Accordingly, the efficiency measure reflects the SOE's ability to generate financial returns from the minimum feasible consumption of capital (i.e., fixed assets), the labor and operational costs incurred. Such input and output measurements justify the pooling of data across industries to measure the efficiency of each SOE under one DEA-measured "best-practice frontier" at the first stage. The technology set, as defined in Eq. (1), characterizes a set of possibilities to generate revenues out of investments into major inputs, regardless of specific engineering, managerial and other business features.

Our primary source of data was the dataset provided by the Lithuanian Governance Coordination Center (GCC). The dataset contained information from annual financial statements of all commercial Lithuanian

SOEs and covered the years 2012 and 2013. The initial sample consisted of all commercial SOEs. Of these 101 first selected, five were excluded because of missing information from the annual reports. One additional SOE was excluded because it outsourced its labor force. The final sample, consisted of 190 firm-year observations from wholly and majority SOEs.

The second step of the empirical methodology required the definition of corporate governance measures. In Lithuania, the GCC is the first and sole provider of corporate governance measures of SOEs. By law, it periodically assesses the implementation of good governance practices among Lithuanian SOEs with the aim of monitoring how successfully enterprises follow OECD recommendations and provisions of Ownership Guidelines and Transparency Guidelines (State Property Fund, 2013). Indexes (or ratings) are calculated based on questionnaires responded to either by SOEs themselves or institutions exercising the right of the owner of the SOE.

GCC reports global measures on three corporate governance mechanisms: *quality of transparency, quality of boards and quality of strategic planning, strategic implementation and controls*. Each index is computed as an aggregation of indices measuring corporate governance subcategories. For instance, ***Quality of transparency*** has been derived as a combination of four indices concerning: (1) Comprehensiveness of SOE summary reports; (2) SOE social responsibility; (3) Application of international accounting standards, and (4) Opinion of external auditors. ***Quality of boards*** has been derived as combination of six indices concerning: (1) Board independency; (2) Board competences; (3) Presence of SOE employees on the boards; (4) Board members' participation; (5) Board committees; and (6) Selection of board members. ***Quality of strategic planning, strategic implementation and control*** have been derived as combinations of three indices concerning: (1) Quality of corporate strategies; (2) Supervision of strategy implementation and internal control system; and (3) Implementation of corporate objectives (see Appendix for further details on the assessment criteria).

Each single index has been evaluated on the scale from 1, meaning poor implementation of the appropriate guidance, to 3 meaning full compliance, and then aggregated and standardized over a scale 0-10 (higher numbers indicate better governance) to form a corporate governance global measure.

To mitigate potential measurement error in the individual scores and provide a complete picture of the state of governance, we defined two aggregate measures of corporate governance indexes that take simultaneously into account the three corporate governance mechanisms (i.e. quality of transparency, quality of board, and quality of strategic planning, strategic implementation and control). These indicators provide a more general picture of the overall corporate governance quality, instead of focusing on specific aspects, which could provide only a partial view. More specifically, we obtained the ***Factor Corporate Governance Index*** as the weighted sum of the original variables with weights represented by the value of the first eigenvalue of the corporate governance indexes. The second aggregate measure was obtained by averaging

the individual corporate governance indexes into an aggregate index, the *Average Corporate Governance Index*.

Overall, the Lithuanian setting is unique insofar as it provides for the first time corporate governance measures for a post-Soviet country. Our study exploits this database by explicitly linking the efficiency to these corporate governance measures. The definition of two aggregate indexes allows the performance of an empirical exercise using multiple corporate governance indices, which have significant differences in emphasis. This fact offers us the opportunity to investigate whether corporate governance indices aggregated into a composite index, which provide a more complete picture of the state of governance, have an impact on efficiency.

The descriptive statistics of inputs and outputs included on the production model, and the corporate governance measures are shown in Tables 2 and 3, respectively. Table 2 provides information about the inputs used and outputs produced by wholly and majority SOEs and the entire sample. Data in nominal values are converted to real terms using the GDP deflator (euro) with base year 2013. Descriptive statistics suggest that, in terms of sample composition, the number of observations from wholly SOEs exceeds the number of observations from majority SOEs. Moreover, majority SOEs use, on average, more input resources and produce a larger amount of revenues. However, when we compare the median values, this pattern changes in favor of wholly SOEs. In terms of size, the majority of SOEs are larger than wholly owned SOEs.

Overall, Table 2 shows that wholly and majority SOEs differ in the input usage and output production, and may be portraying different behavior in approaching the “best-practices frontier”. Table 3 presents descriptive statistics for the three corporate governance measures along with the two aggregate corporate governance indexes, broken down into wholly and majority SOEs. The table shows that wholly SOEs experience higher quality of corporate governance than majority SOEs. When we look at each corporate governance index, it seems that wholly SOEs have better governance in transparency and strategic planning and internal control. The opposite is true with regard to board quality.

The information given by the descriptive statistics guides us to formulate two research questions: (i) whether (or not) there exists efficiency inequality between wholly and majority SOEs and if so, which form of ownership, wholly *vs.* majority, leads to higher efficiency; and (ii) given the differences in terms of corporate governance quality between wholly and majority SOEs, it seems reasonable to investigate whether heterogeneous behavior might play a role in Lithuanian SOE’s performance.

Table 2: Descriptive statistics of firm inputs and outputs.

This table shows the state-owned enterprises (SOEs) sample characteristics in terms of size, inputs and outputs defining the selected production frontier. The sample is constructed by selecting commercial SOEs excluding five SOEs with missing financial data and one SOE that uses labor outsourcing. The table details data for the whole sample, wholly SOEs, and majority SOEs during the year 2012, 2013. Financial variables are expressed in thousand Euros and are converted to real terms using the GDP deflator with base year 2013.

Variable	2012 Mean (Median)			2013 Mean (Median)			2012-2013 Mean (Median)		
	Whole Sample	Wholly State-Owned Enterprise	Majority State-Owned Enterprise	Whole Sample	Wholly State-Owned Enterprise	Majority State-Owned Enterprise	Whole Sample	Wholly State-Owned Enterprise	Majority State-Owned Enterprise
<i>Size</i>									
Total Assets	67,232 (3,799)	16,695 (3,909)	139,799 (2,765)	67,865 (3,882)	17,232 (4,035)	140,570 (2,801)	67,549 (3,816)	16,963 (3,959)	140,184 (2,783)
<i>Inputs</i>									
Labor	4,179 (916)	1,430 (1,033)	8,127 (615)	4,308 (973)	1,456 (1,061)	8,403 (676)	4,244 (960)	1,443 (1,045)	8,265 (638)
Capital	58,003 (2,010)	13,460 (2,212)	121,961 (1,465)	58,985 (2,054)	14,712 (2,371)	122,557 (1,677)	58,494 (2,044)	14,086 (2,301)	122,259 (2,783)
Costs	18,239 (1,854)	2,961 (1,959)	40,177 (954)	17,414 (1,982)	3,040 (2,125)	38,053 (1,184)	17,827 (1,924)	3,001 (2,091)	39,115 (1,060)
<i>Outputs</i>									
Revenues	23,440 (3,060)	5,040 (3,253)	49,861 (1,905)	22,989 (3,140)	5,146 (3,413)	48,610 (1,838)	23,215 (3,087)	5,093 (3,355)	49,236 (1,851)
N. obs	95	56	39	95	56	39	190	112	78

Table 3: Descriptive statistics of the Corporate Governance Indexes

	Wholly State-Owned Enterprise					Majority State-Owned Enterprise				
	mean	median	min	max	std	mean	median	min	max	std
Factor Corporate Governance Index	5.63	6.24	0.90	7.16	1.41	4.54	4.25	0.00	10.00	2.17
Average Corporate Governance Index	5.71	6.04	2.48	6.57	0.88	5.28	5.04	2.69	9.26	1.51
Transparency Index	6.35	6.80	2.98	7.67	1.02	5.86	6.06	3.33	8.89	1.48
Board Index	2.95	2.75	0.00	4.83	0.94	4.04	4.36	0.00	8.89	2.44
Strategic Planning and Internal Control Index	7.82	8.75	3.13	10.00	1.64	5.95	5.94	0.00	10.00	2.45

5. Results

Following our research methodology and the research questions that emerged from the descriptive analysis, we first present the estimates from the efficiency analysis relating to the performance of SOEs, considered as a whole and across the two groups, wholly vs. majority SOEs. Estimates from testing whether there existed significant efficiency inequality between wholly and majority SOEs were also reported. The second step was to examine, the relationship between corporate governance and the SOEs' efficiency. This was analyzed in a multivariate setting by using the second-stage truncated regression with bootstrap.

5.1. Univariate efficiency analysis

Results from the first stage of our research methodology provide insights into whether wholly and major SOEs were equally efficient. Table 4 provides efficiency estimates (biased and bias-corrected respectively) across the two groups of SOEs and the entire sample. As the aim of the analysis was to explain the inefficiency, efficiency scores are reported à la Farrell (1957): the closer the score to unity, the more efficient the SOE. However, to easily interpret the results, we report the efficiency score à la Shephard (1970), which are the reciprocal of the Farrell efficiency scores and represent the relative %-level of efficiency, in the discussion.

We report the average of the (bias-corrected) efficiency of the whole sample and by group (wholly state-owned enterprises vs. majority state-owned enterprises). The first and the second columns report, respectively, the biased efficiency (Eff.) and the bias-corrected efficiency (BC-Eff.). The third and fourth columns report the bias term (Est. Bias) and the estimated standard deviation (Est-Std.).

Since the results presented in Table 4 show that the estimated bias is negative, suggesting that our original efficiency is overestimated, and the standard deviation indicates that the estimated bias is statistically different from zero in nearly all cases, we discuss the results in terms of the bias corrected efficiency (BC-Eff). A key result is that SOEs exhibit inefficiency greater than 10% since they register an average efficiency value of 81.25% (Farrell measure is equal to 1.231) and a median efficiency equal to 88.78% (Farrell measures is equal to 1.126). This result indicates that, despite the implementation of the corporate governance measures, Lithuanian SOEs have not fully eliminated all inefficiencies.

Considering the breakdown in wholly and majority SOEs, we find that wholly SOEs have an efficiency score of 83.95% (Farrell measure is equal to 1.192) which seems higher with respect to the efficiency of majority SOEs that is equal to 77.72% (Farrell measure is equal to 1.287). Thus, it seems that there exists inequality between the efficiency of the two groups of SOEs, wholly vs. majority. To confirm this assertion, we test if the difference of the average efficiency scores of the two groups is statistically significant by applying the bootstrap-based procedure. We use the bootstrap to estimate the p-value of a null hypothesis

H_0 , i.e. wholly SOEs and majority SOEs have the same average efficiency score. With 2000 bootstrap replications, we obtain a p-value of 0.9895. As a result, the null hypothesis of equality of mean efficiency between wholly and majority SOEs cannot be rejected. Overall, we find that average wholly SOEs perform better than average majority SOEs, nevertheless, this difference is not statistically meaningful. Thus, the results show that there does not exist efficiency inequality between wholly and majority SOE as was suspected from the descriptive statistic analysis.

Having obtained the efficiency scores of Lithuanian SOEs and compared the performance of the two SOEs' groups, the second step of our methodology was aimed at investigating the role of corporate governance on the SOEs efficiency. We were able to investigate whether there existed a difference between the efficiency of both groups of SOEs, once we accounted for corporate governance and other tangible specific variables.

Table 4: Efficiency estimations.

This table shows the statistics (average, median and standard deviation) of the original efficiency estimates (Eff.), the corresponding estimated bias (Est-bias), and the estimated standard deviation across bootstrap replication (Est-std). The second column show the bias-corrected efficiency estimates (BC-Eff.). Results are reported for the whole sample as well as for the two groups of SOEs, Wholly State-Owned Enterprises and Majority State-Owned Enterprises.

	Whole Sample				Wholly State-Owned Enterprises				Majority State-Owned Enterprises			
	Eff	BC-Eff	Est-bias	Est-std	Eff	BC-Eff	Est-bias	Est-std	Eff	BC-Eff	Est-bias	Est-std
<i>Average</i>	1.189	1.231	-0.042	0.025	1.160	1.192	-0.032	0.019	1.230	1.287	-0.057	0.035
<i>Median</i>	1.100	1.126	-0.030	0.015	1.099	1.121	-0.019	0.010	1.145	1.181	-0.041	0.022
<i>Std</i>	0.285	0.302	0.035	0.027	0.241	0.254	0.030	0.022	0.338	0.355	0.036	0.030

5.2 Multivariate test of the corporate governance hypothesis

To examine the role of corporate governance mechanisms in improving the efficiency of Lithuanian SOEs, we estimated a battery of regressions based on the econometric model described in Eq. (3), adopting the SOE bias-corrected inefficiency score as the dependent variable and corporate governance indexes, both at aggregate and disaggregated level, as independent variables. Additional to the corporate governance indexes, the regressions contain a set of individual SOE characteristics. Specifically, we introduced a binary indicator variable into our models to analyse whether the relationship between efficiency and corporate governance did in fact differ across wholly and majority SOEs, once we controlled for other variables, i.e. to test whether there existed an inequality in efficiency between the groups of SOEs. Furthermore, to investigate whether heterogeneous behavior in the quality of corporate governance plays, to some degree, a role in the Lithuanian SOEs performance, given differences in terms of corporate governance quality between wholly and majority SOEs, the cross product between corporate governance and the binary indicator variable for wholly SOE was introduced. Lastly, we introduced controls for size (measured as the logarithm of total assets) and financial leverage, measured as the ratio of equity to total assets. These variables are intended to control for heterogeneity in firms' business processes. Lastly, we introduce a binary indicator to control for the effects of listing status.

The parameters of second-stage regression described above (Eq. 3) are estimated according to Simar and Wilson's (2007) algorithm 2 with 1000 bootstrap replications to obtain the bias correction and 1000 bootstrap replications to obtain the parameters' confidence intervals. For each parameter, we estimated the relative 99, 95, and 90 % confidence intervals. The effect of the independent variable would not be significant at the 0.01, 0.05, and 0.10 level if the relative confidence interval contained zero (that is the parameter value specified in the null hypothesis). Recall that the parameters with a negative sign indicate sources of efficiency, as DEA bias-corrected estimates are measures of inefficiency (i.e., measured à la Farrell).

Table 5 shows the results obtained from the Model 1 and 2. Both models contain the corporate governance indexes as independent variables. However, while in Model 1 the aggregate corporate governance index is constructed as a linear combination of the corporate governance indexes (Factor Corporate Governance Index), using the first eigenvector of the greater eigenvalue of the corporate governance indexes matrix as the weight coefficient, in Model 2 the aggregate corporate governance index was constructed as the average of the corporate governance indexes (Average Corporate Governance Index). The results contained in Table 5 show that the coefficient of the Factor Corporate Governance Index in Model 1 and the coefficient of the Average Corporate Governance Index in

Model 2 are both statistically negative, meaning that better quality of corporate governance reduces inefficiency. This finding is consistent with our hypothesis that higher quality of corporate governance in SOEs enables an increase of relative efficiency.

Turning to the ownership hypothesis, i.e. whether inequality in efficiency exists between the two groups of SOEs, the coefficient on Wholly SOEs has a negative sign and is significant in both models (Model 1 and Model 2), indicating that wholly SOEs are more efficient than majority SOEs. This implies that there is a positive link between participation of full state capital in SOE ownership and higher technical efficiency. This result is in line with Tian and Estrin (2008), who find a U-shaped relationship between corporate value and government ownership for Chinese firms: as ownership concentration approaches 100%, the relation between ownership concentration and firm efficiency is positive. Moreover, it confirms the existence of a possible conflict of interests between the State (as the largest shareholder) and private entities (as minority shareholders) that reduces firm efficiency. Turning to the hypothesis on the interaction between ownership structure and effectiveness of corporate governance mechanisms, the interaction between wholly SOE and the aggregate corporate governance measure (Model 1 and Model 2), exhibits a positive and statistically significant sign, suggesting that wholly SOEs mitigate the positive effects of corporate governance mechanisms on efficiency compared to the benefits obtained by majority SOEs.

Overall, the results suggest that corporate governance mechanisms are more effective for majority SOEs than for wholly SOEs. However, the ownership structure of Wholly SOEs *per se* improves efficiency.

Table 5: Truncated regression results with Aggregate Corporate Governance Index as the independent variable.

This table reports estimates from the truncated regressions of the inefficiency on aggregate corporate governance index and control variables. In Model 1, the aggregate corporate governance index is constructed as a linear combination of the corporate governance indexes, using the first eigenvector of the greater eigenvalue of the corporate governance indexes' matrix as the weight coefficient (Factor Corporate Governance Index). In Model 2, the aggregate corporate governance index is constructed as the average of the corporate governance indexes (Average Corporate Governance Index). We include the following independent variables: Size measured as log (total assets), Leverage and two dummies (Wholly SOE and Listed SOE). *Significant at 10%; **significant at 5%; ***significant at 1%.

Variables	Model 1	Model 2
Intercept	1.235	3.230**
Corporate Governance Index	-0.469**	-0.763**
Wholly SOE	-3.071**	-5.586**
Corporate Governance Index x Wholly SOE	0.563**	0.970**
Size	0.338**	0.339**
Listed SOE	-0.494	-0.199
Leverage	-3.701**	-3.831**
σ_u^2	0.435**	0.428*

An interesting observation from the results obtained in Table 5 is the fact that the positive effect of the corporate governance mechanism on efficiency for wholly SOEs is diminished to a lower extent when the Factor Corporate Governance Index is used. This result seems to suggest that there may be some categories of corporate governance that are dominating the effect on efficiency.

In our next tests, hence, we analyze the impact of each of the components of the corporate governance indexes over the efficiency of the SOEs (Model 3 through Model 5). Table 6 shows that results in Model 3, 4 and 5 for each of the corporate governance measures, confirming the results in Table 5. Board Index and Strategic Planning Index show a significantly negative coefficient. In Model 6, we estimate the combined model that simultaneously includes Transparency Index, Board Index, and Strategic Planning Index. We found consistent results with Model 3, 4, 5. Specifically, Board Index and Strategic Planning Index are negative and statistically significant, indicating their positive contribution to enhance the SOEs' efficiency. Although the Transparency Index has expected sign in all models, it is statistically insignificant from zero, suggesting a neutral impact on efficiency. This

result is in line with Zheka and Zelenzuk (2006), who, though using a different proxy for transparency, found this corporate governance quality indicator did not affect the efficiency. Turning to the ownership hypothesis, Model 4 through Model 6 confirms previous results, namely Wholly SOEs have a negative and statistically significant sign, indicating that wholly SOEs are more efficient than majority SOEs.

The interaction between wholly SOEs and corporate governance indexes is interesting and needs to be extensively analyzed in order to test which of the three main components is contributing more to mitigate the positive effect of corporate governance on efficiency in the case of wholly SOEs. Although both Board Index and the Strategic Planning Index show a statistically positive coefficient, the transparency mechanism seems to have no impact on wholly SOE efficiency, however, the Board Index is the component which contributes the most to lowering the positive impact of corporate governance on wholly SOE efficiency. The contribution of Board Index (Strategic Planning Index) to the decrease of efficiency for Wholly SOEs is 0.938 (0.5) in Model 4 (Model 5). The results of the interaction between wholly SOEs and each other corporate governance component, when the three corporate governance indexes are simultaneously included in the combined model (Model 6). The only component that affects negatively the efficiency of Wholly SOEs is the Board Index (0.849). Thus, it seems that the quality that the Board corporate governance component is a key variable influencing positively the efficiency of the SOEs in Lithuania. Recalling the descriptive statistics in Table 3, we found that wholly SOEs have better governance in transparency and strategic planning and internal control than majority SOEs, however, the opposite is true with regard to the board. Thus, it seems that the worse board governance (that is lower board quality given, for instance, by a lack of board independence or lack of specific competences among board members) in wholly SOEs, is the main reason that causes their deterioration on efficiency in terms of corporate governance.⁵ In other terms, in wholly SOEs the quality of board has a limited role in mitigating the agency problems, while ownership concentration plays a dominant role. This might lead to the assumption that the lower impact of the board quality in wholly SOEs compared to majority SOEs may possibly stem from potential governance decisions being highly politicized in the wholly SOEs, as pointed out by the OECD Guidelines (2005). Lastly, this confirms the existence of interactions between ownership structure and board quality.

⁵ The marginal effect of the contribution of average corporate governance index on the efficiency of wholly SOEs calculated from Model 2 is 0.207 which is consistent with the sum of the marginal effects of the three components of the corporate governance index on the efficiency of the wholly SOEs, 0.218, calculated from Model 6.

As far as the controlling variables are concerned, in all specification models (Model 1 through Model 6) the estimated coefficient of the scale effect has been found to be positively associated with inefficiency for all specifications: the larger the SOEs the higher the losses in efficiency. Secondly, the listed status is not always statistically significant, although with the right sign. Third, financial leverage is positively associated to efficiency, in all specifications.

Table 6: Truncated regression results with Corporate Governance Index as the independent variable.

This table reports estimates from truncated regressions of the inefficiency on specific corporate governance index and control variables. In Model 3, the corporate governance index is the Transparency Index, In Model 4 the Board Index, and in Model 5 the Strategic Planning Index. Model 6 includes the three indexes simultaneously. We include the following independent variables: Size measured as log (total assets), Leverage and two dummies (Wholly SOE and Listed SOE). *Significant at 10%; **significant at 5%; ***significant at 1%.

Variables	Model 3	Model 4	Model 5	Model 6
Intercept	2.366*	2.040*	0.651	3.083***
Transparency Index	-0.292			-0.141
Board Index		-0.321**		-0.306**
Strategic Planning Index			-0.473***	-0.325***
Wholly SOE	-2.552	-3.605**	-3.662***	-5.302***
Transparency Index x Wholly SOE	0.338			0.125
Board Index x Wholly SOE		0.938***		0.849**
Strategic Planning Index x Wholly SOE			0.500***	0.248
Size	0.146	0.225*	0.480***	0.391***
Listed SOE	-0.506	-0.464	-1.496	-0.260
Leverage	-3.425**	-5.069***	-4.324***	-4.578**
σ_u^2	0.453*	0.524**	0.545***	0.479**

6. Conclusions

In this paper, we analyzed whether, and to what extent, corporate governance mechanisms affect the efficiency of SOEs operating in transition economies and whether the link between corporate governance–efficiency varies with the degree of state ownership (wholly SOEs vs. majority SOEs). Such analysis is potentially relevant for independent research interests along with policy formation and implementation given the importance that good corporate governance has for the progress and prosperity of any enterprise, and its essential importance for the efficiency and growth of the domestic and international economies. This issue achieves more importance when it is analyzed within the context of transition countries, as in this study, which analyses the case of Lithuania, where SOEs play an important role, controlling the largest share of commercial assets in the country. In particular, we exploited a unique dataset of corporate governance ratings of commercial Lithuanian SOEs over the period after the introduction of reforms in the years of 2012 and 2013. We focused first on a composite index of corporate governance ratings as one dimension of corporate governance quality and subsequently we focus on each single corporate governance index. We set-up a two stage empirical research strategy that combined a non-parametric efficiency estimator (i.e., DEA) with bootstrapped truncated regression. At the first step, we estimate technical efficiency for SOEs in Lithuania and explored potential efficiency differences between the two SOE’s ownership structure: wholly vs. majority SOEs. Then, we estimated a battery of regressions, which linked individual SOEs’ technical efficiency scores to the corporate governance aggregate and individual ratings, respectively.

In contrast with previous empirical works, this paper strives to capture the interplay between the two types of ownership structure of SOEs and the quality of corporate governance practices implemented in the recent reforms of SOEs in Lithuania.

The results reveal that wholly state controlled SOEs are associated with greater efficiency when compared with a mixed form of State and minority interest ownership. However, this superiority in efficiency is explained in terms of ownership structure and not in terms of corporate governance. This is confirmed firstly by our regression results where the composite corporate indexes are used, as wholly state governed SOEs seem to benefit less from the overall corporate governance practices. Results from regressions where each corporate governance index is used, highlight that board quality and strategic planning show less efficiency when compared with majority SOEs. Although, the key result obtained in the paper is that it seems that the most important effect on improving efficiency of the SOEs comes from quality of the board and strategic planning, taken together they have a larger impact only in the case of majority SOEs.

Overall, our findings confirm that restructuring SOEs via corporate governance reform plays a crucial role in enhancing efficiencies, however, wholly SOEs are not able to exploit the beneficial effects of corporate governance practices due to their lower levels of board quality and strategic planning, the key driver being low board quality. Several policy implications might be identified for continuing corporate governance reform in Lithuanian. First, there is further room for improving the quality of corporate governance practices among wholly run SOEs, and in particular the state should strive to continue to reduce aggressively, undue political interference or passive state ownership. Because of the efficiency losses incurred by wholly state run SOEs due to weak corporate governance, the state needs to develop unique competencies and should employ professionals with legal, financial, economic and management skills. Second, given the inefficiencies found in the majority SOEs, efforts should be made to mitigate potential conflicts of interests between state and private ownership.

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Appendix: Lithuanian SOE Corporate Governance Index assessment criteria

Category	Assessment Criteria	Description
Transparency	Comprehensiveness of the SOE summary reports	Level of comprehensiveness and publicity of annual reports of each SOE, as stated in the requirements of Transparency guidelines.
	SOE social responsibility	SOE social reasonability, assessed on the basis of two criteria: comprehensiveness of information on implemented social and environmental initiatives provided in the enterprises' activity reports or annual reports, and whether enterprises have separate CSR reports in place.
	International accounting standards (IAS)	Application of IAS, allowing greater comparability on international level and decreasing differences in accounting practices, by each enterprise.
	Opinion of external auditors	Evaluated on the basis of two criteria: opinion of external auditors on the SOE financial statements, and how often each enterprise changed their independent auditor in the last seven years.
Boards	Board independency	Two criteria: the number of independent members on company boards (independent members should comprise one third or more of the total number of board members) and the number of board members not taking part in sector policy making.
	Board competences	As indicated in Ownership guidelines, each company board should include members with competences in the fields of finance, strategic planning and the relevant sector, in ideal case, acquired in the private sector.
	Sitting of SOE employees on the boards	Presence of SOE employees on the boards. Disadvantageous, as it reduces board's independence from company's management.
	Board members' participation	Assessed on two criteria: whether SOE board members sit on boards of more than three other companies (consider disadvantageous, as such board member is unlikely to devote sufficient time and attention to company's problems), and the frequency of board meetings.
	Board committees	Evaluates if Audit and Remuneration committees are formed at each enterprise.

	Selection of board members	Assessment of board member selection criteria. Presence of Selection committee and utilization of open selection procedures for appointing board members evaluated as good practices.
Strategic planning, strategic implementation and control	Quality of corporate strategies	Evaluation of SOE corporate strategies carried out by Governance Coordination Center
	Supervision of strategy implementation and internal control system	Assessment criteria: presence of strategy implementation procedure in internal documents of SOE; fully or partially operation internal control system and control procedures, especially related to risk factor management; internal periodic audits.
	Implementation of corporate objectives	Assessment of fulfillment of SOE objectives, according to the goals set by the State: 1) • Annual ROE at least 5% for Group 1A and 1B enterprises (except forestry companies which have individual profit targets); 2) Positive ROE for Group 2 enterprises