POZNAŃ UNIVERSITY
OF ECONOMICS
AND BUSINESS

Piotr Matuszak

State-owned enterprises in European economies in the 21st century

(Collection of thematically cohesive articles)

Supervisor: dr hab. Katarzyna Szarzec, prof. UEP

Auxiliary supervisor: Ákos Dombi, Ph.D.

Dissertation received on: ……..

……..
Supervisor's signature

……..
Auxiliary supervisor's signature

Poznań 2022

Rodzicom

Table of Contents

Part I. Description of the original solution to a scientific problem constituting the subject of a doctoral dissertation in the form of a collection of thematically cohesive articles

I.1. Introduction

The articles that constitute this doctoral dissertation analyse state-owned enterprises (SOEs) in contemporary European economies. The debate on the role of SOEs is a relevant part of the economic literature thanks to the substantial scale of state ownership in enterprises around the world. Despite an abundance of both theoretical and empirical studies on state-owned enterprises – particularly at the microeconomic level – there are important research gaps in the literature. First, the relationship between non-commercial goals of state-owned enterprises and their financial performance (as compared to privately owned enterprises) is a neglected aspect in empirical research. Second, there has been no comprehensive dataset of the scale of state ownership in enterprises for a broad set of countries in the 21st century. Third, as a result of the latter, there have been no recent studies on the impact of SOEs on economic growth. Finally, there have been no studies analysing the determinants of the scale of state ownership in enterprises in contemporary economies.

The candidate's articles are based on empirical research and analyse SOEs both at the micro- and macroeconomic level. Therefore, they complement each other by addressing the questions about state ownership in enterprises in contemporary economies from the various analytical perspectives. The four articles constituting the dissertation aimed to:

- assess the scale of state ownership in enterprises in European economies,
- compare financial performance between state- and privately owned enterprises,
- empirically investigate the relationship between the non-commercial goals and relative financial performance of SOEs,
- estimate the impact of state-owned enterprises on economic growth and investigate its conditioning factors,
- indicate which factors have a significant impact on the scale of state ownership in enterprises.

Based on the literature review, the following research hypotheses are tested in the dissertation:

- *H1*: state-owned enterprises financially underperform when compared to privately owned enterprises.
- *H2*: state-owned enterprises are characterised by a lower financial performance when they fulfil non-commercial objectives.

- *H3*: the impact of state-owned enterprises on economic growth improves with better institutional quality.

The list of the articles and contribution of the doctoral candidate in the co-authored works are as follows:

1. Matuszak, P., & Szarzec, K. (2019). The Scale and Financial Performance of State-Owned Enterprises in the CEE Region. *Acta Oeconomica*, *69*(4), 549-570. DOI: https://doi.org/10.1556/032.2019.69.4.4
   - The candidate is a lead and corresponding author.
   - The candidate had a majority share in preparation of the database, statistical analysis, discussion of the results, formulation of conclusions, preparation and submission of the manuscript to the journal. The candidate had a substantial share in conceptualising and designing the study.
2. Matuszak, P., & Kabaciński, B. (2021). Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries. *Journal of Comparative Economics*, *49*(4), 1068-1087. DOI: https://doi.org/10.1016/j.jce.2021.03.002
   - The candidate is a lead and corresponding author.
   - The candidate had a majority share in every stage of the study - conceptualisation and design of the study, literature review, preparation of input data, econometric analysis, discussion of results, formulation of conclusions, preparation and submission of the manuscript to the journal.
3. Szarzec, K., Dombi Á., & Matuszak, P. (2021). State-owned enterprises and economic growth: Evidence from the post-Lehman period. *Economic Modelling*, *99*, 105490. https://doi.org/10.1016/j.econmod.2021.03.009
   - The candidate had an equal share to other co-authors.
   - The candidate had a majority share in preparation of input data, their aggregation to indicators at the macroeconomic level and literature review. The candidate had a substantial share in preparation of the introduction and summary.
4. Matuszak, P. (2020). What determines the scale of state ownership in enterprises? Some evidence from post-socialist countries. *Economics and Business Review*, *6*(4), 95-117. DOI: https://doi.org/10.18559/ebr.2020.4.6

In the first two articles, the analysis focuses on the microeconomic level, while in the last two – on the macroeconomic level. Matuszak and Kabaciński (2021) complements Matuszak and Szarzec (2019) by, among other things, considering the objectives other than profit maximisation in the analysis of the financial performance in SOEs and POEs. Szarzec, Dombi and Matuszak (2021) extends Matuszak and Szarzec (2019) and Matuszak and Kabaciński (2021) by the analysis of the impact of SOEs at the macroeconomic level, which allows to consider the external effects of the presence of state ownership in enterprises in the economy, which is not possible in the analyses at the microeconomic level. Matuszak (2020) builds on the dataset introduced in Szarzec, Dombi and Matuszak (2021) and complements it by analysing the determinants of the heterogeneity in the scale of SOEs. Firm-level data and their aggregates at the macroeconomic level are employed in the statistical and econometric analyses in the articles. The data cover enterprises in European economies in 2007-2016, which distinguishes the candidate's research from previous literature on large scale privatisations or economic transition in post-socialist countries.

I.2. Description of the research subject and problem

This part first introduces the definition of state-owned enterprises employed in the candidate's published articles. Then, the discussion on the role of SOEs in contemporary economies is briefly summarised. Finally, the classification of the candidate's articles in terms of the scientific disciplines and subdisciplines is considered.

I.2.1. Definition of state-owned enterprises

Although state involvement in the economy through SOEs has been a widely discussed topic in recent years, there is no single commonly used definition of state-owned enterprises. In the articles constituting this dissertation, the ownership and operational criteria are decisive. First, enterprises are classified as either *state-owned enterprises* or *privately owned enterprises* (POEs) according to the 25% and 50% ownership thresholds. Entities in which local and central governments and/or public authorities hold – directly or indirectly (i.e., through another SOE) – more than 50% are considered as *majority SOEs*. If the state or another SOE is the largest shareholder with the share of more than 25% but no more than 50% and the ownership structure is dispersed, the entities are classified as *minority SOEs*. The remaining enterprises are POEs. Second, non-commercial sectors, in which entities usually cannot be privatised, are excluded from the analyses. Thus, in principle, state-owned enterprises

according to this definition should generate revenues from the sale of products and services rather than by receiving state subsidies. Consequently, this definition allows to analyse entities whose main objectives are not limited to providing public services or to pursuing a public mission.

The choice of the 25% and 50% ownership thresholds was dictated by practical reasons. The Amadeus database, which is the main source of data on financial indicators, allows enterprises to be filtered according to the status of their ultimate owners, where ultimate owners might be defined by the thresholds of 25% and 50%. Concerning the exclusion of non-commercial sectors, it was related to entities operating in public administration and defence, compulsory social security (sector O in NACE Rev. 2 classification), education (sector P), human health and social work activities (sector Q).[1]

In terms of the ownership thresholds, 25% and 50% values are also used in, among others, Bałtowski, Kozarzewski and Mickiewicz (2021), Borghi, Del Bo and Florio (2016), Clo, Ferraris and Florio (2017), Okhmatovskiy (2010), Szarzec, Nowara and Totleben (2020), Szarzec, Totleben and Piątek (2022). The importance of considering *minority SOEs* in the empirical analyses is emphasised by their substantial shares in a number of European economies (see Figure I.1 on page 25). Concerning the operational aspect in the definition – that is, selling products and services in the markets as a main source of revenues – a similar approach is used in a number of studies, including Aharoni (1986), Bałtowski and Kwiatkowski (2018), and Kowalski, Buge, Sztajerowska and Egeland (2013). The possibility of shifting ownership to the private sector is emphasised in, for instance, Florio (2014).[2]

The choice of the classification criteria and the distinction between state- and privately owned enterprises are obviously to some extent arbitrary. Concerning the approach in the articles in this dissertation, there are several important limitations to be mentioned. First, there might be some enterprises, in which the state plays a decisive role while holding less than a 25% share. The state control in such enterprises might be fostered by non-ownership tools and regulations (Bałtowski & Kozarzewski, 2016). Second, the ownership criteria might be non-informative in terms of managerial autonomy and political influence on decisions

[1] There are several differences between Matuszak and Szarzec (2019) and the three remaining articles, which are discussed below.
See Eurostat (2008) for details on NACE Rev. 2.

[2] For a broader discussion on the definition of state-owned enterprises, see Chapter 2 in Bałtowski and Kwiatkowski (2018).

(Lazzarini, Mesquita, Monteiro, & Musacchio, 2021). Third, the state might exert significant influence over POEs through sectoral regulations, which might not be captured in empirical analyses focusing on the SOE-POE division. Finally, the ownership structure of the largest enterprises is often strongly dispersed and complex, which makes the calculations of the state shares a demanding task. Therefore, possible misclassifications in large ownership datasets cannot be ruled out.

The latter issue was tackled in the SOE dataset introduced in Szarzec, Dombi and Matuszak (2021) and the dataset in Matuszak and Kabaciński (2021) by manually checking the 50 largest entities in each analysed country (the primary SOE-POE classification was based on information from the Amadeus database) – nevertheless, some misclassifications among smaller enterprises might still be present. On the contrary, in Matuszak and Szarzec (2019), in which the sample size was smaller, the ownership structure of each entity was double-checked manually using in most cases official financial reports of enterprises, which practically allowed ruling out potential misclassifications and recognising additionally non-ownership tools of control in several cases. Moreover, Matuszak and Szarzec (2019) employed slightly different criteria to classify SOEs and POEs. Instead of using the 25% threshold, the combined state and private shares of all shareholders holding at least 5% were calculated, and an entity was classified as state-owned if the sum of shares held by the state was larger than private ownership. A comparison between the SOE indicators from Matuszak and Szarzec (2019) and Szarzec, Dombi and Matuszak (2021) shows that they are highly and statistically significantly (at the 1% level) correlated – the correlation coefficients equalled 0.832 (based on total assets) and 0.930 (based on operating revenues), despite a difference in sample size.[3] This shows that it is very unlikely that the potential misclassifications in large datasets and the choice of the particular ownership threshold could be the factors leading to substantial flaws in the estimates of the SOE shares.[4]

[3] Correlations for the year 2015.
In Matuszak and Szarzec (2019), the sample is limited to entities, which fulfilled at least one of the following conditions: operating revenues ≥ 100 million EUR, total assets ≥ 200 million EUR, employment ≥ 1000. In Szarzec, Dombi and Matuszak (2021): operating revenues > 50 million EUR, total assets > 43 million EUR, employment ≥ 250.

[4] As mentioned above, there is no unified definition of state-owned enterprises in the economic literature. Therefore, the definitions of SOEs in the studies cited in the following sections might be different from that in the candidate's works.

I.2.2.State-owned enterprises in market economies – the current state of the debate

The relevance of the topic of state-owned enterprises in market economies in the economic literature was driven to a large extent by massive privatisation programs that were taking place in both developed and transition economies in the 1980s and 1990s (Bałtowski & Mickiewicz, 2000; Bałtowski & Miszewski, 2007; Boubakri & Cosset, 1998; Estrin, Hanousek, Kočenda, & Svejnar, 2009; Frydman, Gray, Hessel, & Rapaczynski, 1999; Guislain, 1997; Megginson, Nash, & van Randenborgh, 1994; Megginson & Netter, 2001; Millward, 2005; Roland, 2008; Toninelli, 2000). Privatisation was perceived as a means to promote economic efficiency, reduce government intervention in the economy, introduce competition and market discipline in SOEs, and as a source of budget revenues (Megginson & Netter, 2001). In developed countries, privatisation was motivated, on the one hand, by the tightening budget constraints in the aftermath of the crises in the 1970s and 1980s, on the other hand, state ownership was also more and more often perceived as obsolete and incapable of innovation in the context of growing liberalisation and internationalisation of economic systems (Toninelli, 2000). In post-socialist countries, based on the experience of previous decades, state ownership in enterprises was perceived as a failed way to foster economic development and industrialisation in a sustainable way, and privatisation was one of the most important steps towards market economy (Bałtowski & Mickiewicz, 2000; Bałtowski & Miszewski, 2007; Estrin et al., 2009; Roland, 2008). The negative perception of SOEs was dominant at that time and, for instance, the recommendations by the World Bank (1995) – in the spirit of the 'Washington Consensus' – clearly indicated the adverse effects of state ownership in enterprises and the need for their privatisation.

During the 21st century, the characteristics of state ownership in enterprises has noticeably changed (Bruton et al., 2015; Lazzarini et al., 2021; Mussachio & Lazzarini, 2014; Mussachio, Lazzarini, & Aguilera, 2015). Partial privatisations – that is, privatisation of some percentages of ownership without privatising control over the enterprise – were becoming more and more popular (Inoue, Lazzarini, & Musacchio, 2013). This allowed the governments to raise necessary funds and to keep control at the same time. State-owned enterprises were also transformed in terms of their management. A large part of SOEs is now publicly traded and has become more professionally managed and transparent. The largest SOEs operate internationally through their subsidiaries (Cazurra, Inkpen, Musacchio, & Ramaswamy, 2014; Cui & Jiang, 2012; Szarzec et al., 2020). Bruton, Peng, Ahlstrom, Stan and Xu (2015) describe

state-owned enterprises in the 21st century as hybrid organisations, in which private and state ownership is mixed and SOE managers are more independent from politicians than their predecessors in the 20th century. The perception of SOEs by international organisations also changed. Recently, the emphasis is put on good governance, accountability and transparency (Robinett, 2006; Organisation for Economic Co-operation and Development [OECD], 2015).

Despite substantial changes in SOEs in terms of their management, recent empirical studies comparing the financial performance of state- and privately owned enterprises still show that SOEs underperform POEs (for recent survey studies, see Megginson, 2017; Tihanyi et al., 2019; Wang & Shailer, 2018). The reasons of SOE underperformance have been broadly analysed in the economic literature. Two, not mutually exclusive, sets of potential causes of SOE underperformance might be recognised. The first one is associated with some intrinsic characteristics of state ownership in enterprises leading inherently, according to some authors, to SOE inefficiency, such as, dilution of property rights in SOEs (Alchian, 1965; Alchian & Demsetz, 1973), agency problems (Jensen & Meckling, 1976; Lin, Cai, & Li, 1998), soft budget constraints (Kornai, 1979; Kornai, Maskin, & Roland, 2003), and misuse of SOEs for political and private gains (Boycko, Shleifer, & Vishny, 1996; Shleifer, 1998; Shleifer & Vishny, 1994). The second one is related to the role of SOEs as a tool to fulfil social objectives, which in some cases might have a negative impact on the microeconomic performance of the enterprise, but could be desirable from the social welfare perspective (Bai, Li, Tao, & Wang, 2000; Shirley & Nellis, 1991; Stiglitz, 1993).

In recent years, the institutional environment has been highlighted as a crucial factor of SOE efficiency. State-owned enterprises substantially benefit from high-quality institutions thanks to less political interference leading to better corporate governance and higher productivity (Borghi et al., 2016; Castelnovo, Del Bo, & Florio, 2019). Home country institutions also influence internationalisation strategies of SOEs, with SOEs converging to POEs in environments enabling effective control by civil society and minority shareholders (Estrin, Meyer, Nielsen, & Nielsen, 2016).

The role of SOEs as an important tool of the industrial policy and development strategies is also emphasised in the literature (e.g., Musacchio & Lazzarini, 2014). *National champions* can be employed to boost industrialisation and export by supporting relevant industries, especially when start-up costs are substantial and long-term investments are needed. Therefore, they might positively contribute to economic development (Lin & Milhaupt, 2013; Musacchio &

Lazzarini, 2014). There is also a growing body of the literature focusing on the role of state-owned enterprises in supporting innovations and enhancing technological spin-offs (e.g., Antonelli, Amidei, & Fassio, 2014; Zhou, Gao, & Zhao, 2017). Lazzarini, Mesquita, Monteiro and Musacchio (2021) argue that – under sufficient political constraints and/or in high invention productivity sectors – SOEs can be more inventive than POEs because of larger managerial autonomy under looser monitoring, lower resource constraints and the possibility to focus on long-term goals.

Recently, SOEs are often analysed as a crucial instrument of state capitalism (e.g., Bałtowski et al., 2021; Bremmer, 2010; Kurlantzick, 2016; Mussachio & Lazzarini, 2014; Wright et al., 2021). The interest in this field is driven to a large extent by the rise of the Chinese economy with a dominant position of SOEs among the largest enterprises and the growing importance of state-owned enterprises on international markets in the 21st century (The Economist, 2012). State capitalism is a broadly used term in the literature, however, it still lacks a unified definition and refers to a very broad array of actions conducted by the state (for a discussion on the definition of state capitalism, see Alami & Dixon, 2020). The authors from this field emphasise, among other things, the role of SOEs on international markets (Li, Cui, & Lu, 2014), their innovative activities (Lazzarini et al., 2021) and the importance of minority state ownership (Inoue et al., 2013), but also how state ownership in enterprises is used as a source of rents for their political principals (Bałtowski et al., 2021).[5]

I.2.3. Classification of the candidate's articles in terms of scientific disciplines

As regards the classification of the candidate's articles in terms of scientific disciplines, *economics and finance* is a discipline in which this doctoral dissertation should be classified. Concerning the subdisciplines, the candidate's articles are related to the literature on state-owned enterprises, in which most of the abovementioned studies can be classified. As SOEs are employed by the state/politicians as a direct tool of state involvement in the economy, from the broadest perspective, the candidate's articles on state-owned enterprises might be perceived as contributing to the literature on the economic role of the state (e.g., Szarzec, 2013; Bałtowski and Kwiatkowski, 2018, Chapter 1). Using the definition which narrows the

[5] There are several research fields which are sometimes indicated to be closely related and even analysed together with state ownership in enterprises, such as sovereign wealth funds (Dewenter, Han, & Malatesta, 2010), political connections of POEs (Fan, Wong, & Zhang, 2007; Fisman, 2001), or subsidisation of privately owned 'national champions' (Ades & Di Tella, 1997). However, the analysis of these topics is beyond the scope of this dissertation.

focus on state ownership in enterprises (e.g., Musacchio et al., 2015; Aguilera, Capapé, & Santiso, 2016), one can also classify the candidate's articles in the state capitalism literature. In Matuszak and Szarzec (2019) and Matuszak and Kabaciński (2021), the financial indicators at the microeconomic level are compared between state- and privately owned entities. Similar comparisons have been made in a number of studies in the management, international business, economics and finance disciplines (for a recent survey study, see Tihanyi et al., 2019). In Szarzec, Dombi and Matuszak (2021), the focus is on the macroeconomic impact of SOEs. Therefore, this article also refers to the economic growth literature. Finally, Matuszak (2020) analyses the cultural, political and economic factors associated with the scale of state ownership in enterprises and builds on the literature on deeply rooted determinants of economic outcomes (for survey studies, see Nunn, 2009, 2014; Spolaore & Wacziarg, 2013; Cantoni & Yuchtman, 2020).

I.3. Justification of the addressed research problem

The role of state-owned enterprises in contemporary economies – that is, a persistently substantial scale of state ownership in enterprises in many countries around the world and changing characteristics of SOEs – and related literature impose interesting research challenges. In this section, the identified research gaps and the original solutions to research problems in the candidate's articles are discussed.

Research gap 1: The relationship between non-commercial goals of state-owned enterprises and their financial performance (as compared to privately owned enterprises) is a neglected aspect in empirical research.

Although the non-commercial objectives of SOEs and their potential impact on the financial results of state-owned enterprises have been broadly discussed in the literature (see Section I.5), there are very few empirical studies that explicitly considered objectives other than profit maximisation when analysing differences in the performance of SOEs and POEs. More precisely, to the best of the candidate's knowledge, there are only three empirical analyses, in which non-commercial objectives of SOEs are explicitly considered.[6] Non-commercial goals were recognised in Bozec, Breton and Cote (2002) by classifying SOEs as either profit-maximisers or non-profit-maximisers based on qualitative criteria, while Eller, Hartley and

[6] This statement is reinforced by a manual check of the 210 studies included in the meta-analysis by Tihanyi et al. (2019).

Medlock (2011) and Hartley and Medlock (2013) used a proxy based on domestic motor fuel prices to control for the non-commercial objective of providing fuel at affordable prices (a dummy variable that was 1 if the price was below the US level). The substantial research gap on the relationship between the non-commercial goals and financial performance of SOEs is addressed in the article *Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries* (Matuszak & Kabaciński, 2021). This study uses the electricity prices as a conditioning factor of the relative SOE financial performance (as compared to POEs), which allows a comparison across a broad set of enterprises operating in the EU countries. Compared to the articles cited above, Matuszak and Kabaciński (2021) extends also the analysis by employing data of entities operating in countries sharing common supranational regulations and using more comprehensive panel data methods.

Research gap 2: There has been no comprehensive dataset on the scale of state ownership in enterprises for a broad set of countries in the 21st century.

There are some datasets which consider the scale of SOEs based on their shares in the group of the largest enterprises either on a global scale or on a national scale. For instance, the OECD provides the data on the size and sectoral distribution of state-owned enterprises in 34 countries in 2012 (OECD, 2014) and 40 countries in 2015 (OECD, 2017). The SOE shares are also calculated in the literature based on the lists of the largest enterprises such as the 'Forbes Global 2000' in 2011 (Kowalski et al., 2013), the 'Fortune Global 500' in 2005-2014 (Kwiatkowski & Augustynowicz, 2015), the 'Coface – 500 Top Companies in Central-Eastern Europe' in 2008 and 2013 (Szarzec & Nowara, 2017). While being informative about the scale of state ownership in enterprises, these SOE measures cannot be considered as a solid basis for econometric analyses because they mostly refer to some specific years and account only for the largest enterprises. 'The Bureaucrats in Business' dataset of the World Bank is the only dataset offering annual, cross-country data on state-owned enterprises, however, it covers the very distant period - 1978-1991 (World Bank, 1995). The solution to this research problem is the establishment of a brand-new, micro-level-based, annual dataset of the SOE shares in Szarzec, Dombi and Matuszak (2021).

Research gap 3: There have been no recent studies on the impact of SOEs on economic growth.

The impact of state-owned enterprises on economic growth is an important empirical issue concerning the rationale for keeping state ownership in enterprises because such a broader, macroeconomic approach can account for the external effects of SOEs. Nevertheless, despite the widely acknowledged relevance of the topic, the set of studies analysing empirically the SOE impact on economic growth across countries is extremely limited. To the best of the candidate's knowledge, there are only four studies which explicitly analyse the growth impact of SOEs – Doamekpor (2003), Fowler and Richards (1995), Gylfason, Herbertsson and Zoega (2001), Plane (1992). Moreover, all these studies analysed periods before the 21st century. To address this research gap, the analysis of the impact of SOEs on economic growth based on data from 2007-2016 is conducted in Szarzec, Dombi and Matuszak (2021). What is more, this study considers the institutional quality as a conditioning factor of the SOE effect, which had not been done in the literature before.

Research gap 4: There have been no studies analysing the determinants of the scale of state ownership in enterprises in contemporary economies.

The topic of determinants of the scale of SOEs in contemporary economies has been neglected in the literature. To the best of the candidate's knowledge, there were no studies analysing the factors influencing the differences in the scope of state ownership in enterprises based on data from the 21st century. Matuszak (2020) addresses this research gap by analysing the determinants of the scale of SOEs in the group of post-socialist countries.

I.4. Research goals

The following goals are achieved in the studies constituting this dissertation:

- to assess the scale of state ownership in enterprises in European economies (Matuszak & Szarzec, 2019; Matuszak & Kabaciński, 2021; Szarzec, Dombi, & Matuszak, 2021),
- to compare financial performance between state- and privately owned enterprises (Matuszak & Szarzec, 2019; Matuszak & Kabaciński, 2021),
- to empirically investigate the relationship between the non-commercial goals and relative financial performance of SOEs (Matuszak & Kabaciński, 2021),

- to estimate the impact of state-owned enterprises on economic growth and investigate its conditioning factors (Szarzec, Dombi, & Matuszak, 2021),
- to indicate which factors have a significant impact on the scale of state ownership in enterprises (Matuszak, 2020).

I.5. Theoretical and conceptual foundations of the study and research hypotheses

The questions most often researched about state ownership are its implications for enterprise financial performance (Tihanyi et al., 2019). Studies in this field compare financial indicators of SOEs and POEs to assess SOE (in)efficiency. The results of these comparative analyses at the microeconomic level are summarised in the recent literature by Megginson (2017), Tihanyi et al. (2019) and Wang and Shailer (2018).[7] Megginson (2017) examined the results of empirical studies published after 2004. Each of the 17 analysed empirical articles (most of them based on China) documented substantial performance improvements after privatisation. Similarly, all seven studies on the relative efficiency of state-versus-private ownership showed that private ownership is more efficient. Wang and Shailer (2018) conducted a meta-analysis of 54 empirical studies based on data of listed corporations in 17 emerging markets. It showed that state ownership is associated with inferior performance. The most extensive survey study of the relationship between the SOE-POE division and performance was conducted by Tihanyi et al. (2019). The authors used meta-analytical techniques on a sample of 210 studies (most of them published after 2011) spanning 139 countries and concluded that state ownership had a small negative effect on firm financial performance. This negative effect is driven by the state taking large ownership stakes (*majority SOEs* in the terminology of the candidate's articles).

The 'traditional' discussion about inefficiency of state ownership was centred on microeconomic theories, such as, property rights theory (Alchian, 1965; Alchian & Demsetz, 1973), agency theory (Jensen & Meckling, 1976), and soft budget constraints (Kornai, 1979). Property rights theory focuses on the question how ownership of resources and economic goods influences their use, with particular emphasis on how individuals exercise their property rights (Alchian, 1965; Alchian & Demsetz, 1973). State ownership is associated with the

[7] Former survey studies include Djankov and Murrell (2002), Estrin et al. (2009), Havrylyshyn and McGettigan (1999), Megginson and Netter (2001), Shirley and Walsh (2000). Overall, their results indicate that SOEs underperform POEs and privatisation improves the performance of divested enterprises.

dilution of property rights, which leads to the smaller concentration of rewards and costs dependent upon activities of owners in SOEs as compared to POEs. The state and private owners are also more likely to respond in greater degree to, respectively, political and market incentives, which yields differing resource uses. Therefore, private owners are the ones who have the strongest incentives to use their property rights in the most valuable way (Alchian & Demsetz, 1973). The issue of the lack of alignment of goals between agents and principals has been analysed by agency theorists (Jensen & Meckling, 1976) and is of particular relevance for state-owned enterprises. The lack of clearly defined incentives and sufficient monitoring by the multiple principals of the SOE (e.g., government, ministry, state-owned holding company, society), that do not have their wealth at stake in the performance of their monitoring responsibilities, may lead to insufficient motivation of SOE managers to improve performance (Chen, Firth, & Xu, 2009; D'Souza & Nash, 2017; Lin et al., 1998; Sappington & Stiglitz, 1987). Efficiency-oriented behaviour in SOEs can also be limited by soft budget constraints (Kornai, 1979; Kornai et al., 2003). State-owned enterprises may not be liable for their rising costs as excess expenditures may be regularly covered through subsidies or preferential lending by the state or another SOEs (*cross-subsidisation*). This encourages overemployment, excessive salaries, and misallocation of resources, while avoiding the risk of insolvency and bankruptcy of inefficient SOEs (Bałtowski & Kwiatkowski, 2018; Roland, 2000; Song, Storesletten, & Zilibotti, 2011).

State-owned enterprises might also be used to fulfil political and private objectives of their principals (Boycko et al., 1996; Shleifer, 1998; Shleifer & Vishny, 1994). For instance, political principals of SOEs are likely to instruct SOE managers not to lay off employees, to increase lending from state-owned banks or to lower electricity prices in the election years, which clearly has a negative impact on financial performance and might lead to political business cycles (Dinc, 2005; Englmaier, Hinreiner, Roider, & Stowasser, 2017; Nordhaus, 1975; Prabowo, Hooghiemstra, & van Veen-Dirks, 2018). The regular rotations of executives in many enterprises owned by the state in the aftermath of the elections show that politicians use positions in SOEs as political trophies. This misuse of SOEs is associated not only with the executive positions, but also covers a broad set of job positions, which are offered to people allied with the ruling party or politicians' families (Byrka-Kita, Czerwiński, Preś-Perepeczo, & Wiśniewski, 2021; Ennser-Jedenastik, 2014; Liu & Zhang, 2018; Kopecky & Spirova, 2011; Szarzec et al., 2022).

Based on the studies cited above, one can formulate the following research hypothesis:

- *H1*: state-owned enterprises financially underperform when compared to privately owned enterprises.

This research hypothesis is tested in Matuszak and Szarzec (2019) and Matuszak and Kabaciński (2021).

Non-profit-maximisation objectives of state-owned enterprises may be to address market failures, including natural monopolies, incomplete markets and externalities; to stabilise the economy by providing employment; to support the national defence and protect strategic sectors; to supply essential services and products at affordable prices (Bai et al., 2000; Christiansen, 2013; Kowalski et al., 2013; OECD, 2005; Robinett, 2006; Shirley & Nellis, 1991). SOEs were often established because markets were unable to sufficiently meet critical societal needs due to market failures (Bator, 1958; Bognetti, 2020; Millward, 2005, 2011; Stiglitz, 1993; Toninelli, 2000). State-owned enterprises may operate in sectors where competition and market regulation are not considered efficient or feasible, facilitating the collection of monopolistic rents by the state for the good of the whole society. Similarly, SOEs might be established in sectors demanding large capital investments or creating substantial externalities, which might be internalised by entities owned by the state. What is more, there are sectors in the economy that might be considered as vital and strategic for national defence and, therefore, the state can limit private and foreign ownership of them, for example, the network and arms industries (Robinett, 2006; Florio, 2013a). SOEs can be used to fulfil the important social goal of stabilising the economy and supporting vulnerable social groups by keeping employment, especially during economic slowdowns and social unrest (Bai et al., 2000; Prabowo et al., 2018; Wen, 2021). State-owned enterprises are also frequently used to control the fall of sunset industries (e.g., mining) to prevent an accumulation of the negative impacts of long-term unemployment and the deterioration of post-industrial regions. State ownership in enterprises may also be justified by increasing the availability of comprehensive services for society. This means that SOEs not only provide necessary infrastructure, but also increase access to key services and products by setting prices based on affordability, particularly in markets characterised by low levels of competition (Białek-Jaworska, 2021; Hartley & Medlock, 2008; Fiorio & Florio, 2013; Florio, 2013b). Of course, while these non-commercial goals are likely to lower the performance of SOEs as compared to POEs, the presence of state ownership in enterprises might be supported by (at least part of) society

because of, for instance, lower prices of essential services and/or ideological preferences for state/national ownership.

As discussed earlier, there are very few empirical studies on the non-commercial objective of providing crucial services and products at affordable prices and financial performance of SOEs. The main challenge in such an analysis is to find a product or service, which would allow a comparison of the financial performance between SOEs and POEs conditioning on the prices paid by the consumers. The original solution of this problem in Matuszak and Kabaciński (2021) was to use the data on electricity prices from the EU countries. This made available to use the data on the prices of a highly standardised product in a sector in which SOEs and POEs compete on an equal basis across countries that share common supranational sectoral regulations. The approach in Matuszak and Kabaciński (2021) builds not only on the literature discussing the non-commercial goals of state-owned enterprises, but also on empirical research at the country level focusing on the relationship between the presence of SOEs in the electricity markets and price levels (Bacchiocchi, Florio, & Taveggia, 2015; Del-Rio, Fernández-Sainz, & Martinez de Alegria, 2019; Fiorio & Florio, 2013). In short, the results of these studies show that the presence of state-owned enterprises is associated with lower electricity prices. Given the identified structure of the electricity markets in the EU countries, they were considered as mixed oligopoly markets; that is, markets in which state- and privately owned enterprises compete on an equal basis employing market instruments (Clo et al., 2017; De Fraja, 2009; De Fraja & Delbono, 1989; Florio, 2013a). In this setup, POEs aim at maximising their profits, and SOEs at maximising the social welfare while keeping non-negative profits. In the electricity sector, social welfare is associated with prices paid by consumers and, therefore, state-owned enterprises might be used to provide the electricity at lower prices increasing consumers' surplus – this, in turn, has an adverse impact on their financial performance. At the same time, the financial underperformance of SOEs might be caused by inefficiencies such as agency problems, soft budget constraints, corruption, or political interference (as discussed above). In other words, state-owned enterprises might financially underperform privately owned entities due to their inefficiencies or the non-commercial goal of providing electricity at lower prices (or both). If SOEs financially underperform POEs in markets with lower prices but there are no substantial differences with higher price levels, it would suggest that apparent underperformance (as measured with financial indicators) is associated with pursuing a non-commercial goal. However, if SOEs

financially underperform in the markets with both lower and higher prices, it would suggest the presence of their inefficiencies. In Matuszak and Kabaciński (2021), an interaction term between the electricity price levels and ownership status is used to test the following research hypothesis:

- *H2*: state-owned enterprises are characterised by a lower financial performance when they fulfil non-commercial objectives.

The literature on state-owned enterprises remains inconclusive in terms of the net economic effect of SOEs. Based on the discussion above, one could indicate factors related to state ownership in enterprises, which might lead to both negative and positive effects of state-owned enterprises on economic growth. For instance, inefficiencies associated with agency problems, dilution of property rights, political interference, and the misuse of SOEs as political goods might obviously lead to lower levels of output. At the same time, state-owned enterprises could address market failures, promote regional development, support infant industries and technological spin-offs, which might be beneficial for economic growth. Following the discussion on the importance of institutional environment on the performance of SOEs (Borghi et al., 2016; Castelnovo et al., 2019; Estrin et al., 2016), one can expect the quality of institutions to be a decisive factor of the growth impact of state-owned enterprises. Namely, the disadvantages of SOEs are more likely to be present (absent) when the quality of institutions is low (high), while the advantages of state-owned enterprises are more likely to materialise and offset the SOE drawbacks under high-quality institutional environment. Therefore, one could expect that better institutions promote efficiency in SOEs and support their positive external effects leading to more beneficial growth impact.[8] This allows to formulate the following hypothesis:

- *H3*: the impact of state-owned enterprises on economic growth improves with better institutional quality.

This research hypothesis is tested in Szarzec, Dombi and Matuszak (2021).

[8] 'Institutions' is a vague notion in terms of its concrete content and, as pointed out by Acemoglu (2009, p. 782), '"Institutions" mean different things in different contexts'. In Szarzec, Dombi and Matuszak (2021), we focus on governmental institutions because they seem to be decisive when it comes to the economic performance of SOEs. In the empirical part, the Worldwide Governance Indicators are used as a primary measure of institutional quality. Therefore, a low level of institutions should be understood as an environment of low government effectiveness, poor regulatory quality, weak control of corruption, lack of the rule of law, and political instability. A similar approach was also employed in, among others, Borghi et al. (2016) and Estrin et al. (2016).

The state might hold ownership in enterprises for a number of reasons. Following Musacchio and Lazzarini (2014), one can distinguish arguments related to the promotion of coordinated investments and development (the *industrial policy* view), to pursuing social, non-commercial objectives (the *social* view), or the presence of SOEs might be a result of the rent-seeking by politicians who use enterprises to political objectives (the *political* view). Finally, the scale of state ownership in enterprises may be shaped by historical factors and inherited institutional conditions (the *path-dependence* view).[9] The latter is associated with the growing literature on the deep roots of economic outcomes (Nunn, 2009, 2014; Spolaore & Wacziarg, 2013; Cantoni & Yuchtman, 2020). Matuszak (2020) analyses the determinants of the scale of state ownership in enterprises and focuses on post-socialist countries. This group of states is particularly suitable to such an analysis because they started the transition with fairly homogenous economic systems with a sector of large enterprises strongly dominated by SOEs. The latter was a result of the previous socialist ideology favouring state ownership. With the collapse of the socialist system, this imposed ideological bias towards state ownership disappeared, leading to substantial ownership changes and, finally, to different levels of state ownership in enterprises in these countries in the 21st century. In Matuszak (2020), SOE indicators from recent years are used, that is, from the period when the ownership changes in post-socialist countries were already minor as compared to the 1990s. Therefore, the analysed differences in the scale of SOEs might be interpreted as a result of deliberate choices of economic policies, rather than as an effect of selected modes of privatisation processes and the speed of economic reforms. The choice of variables included in the analysis was based on the literature on determinants of institutional performance (e.g., Alesina & Giuliano, 2015; La Porta, Lopez-de-Silanes, & Shleifer, 1999; Piątek, Pilc, & Szarzec, 2019; Piątek, Szarzec, & Pilc, 2013).

I.6. Research methodology and data sources

The candidate's articles are based on empirical research using statistical and econometric methods. The main data source was the Amadeus database (Bureau van Dijk, 2018), which is

[9] Musacchio and Lazzarini (2014) present these views as factors explaining the emergence of state capitalism, which they define as '(…) the widespread influence of the government in the economy, either by owning majority or minority equity positions in companies or by providing subsidized credit and/or other privileges to private companies' (Musacchio and Lazzarini, 2014, p. 2). While this definition covers a broader set of the state instruments than solely SOEs, these explanations might – in the candidate's view – also be used when discussing the prevalence of state ownership in enterprises.

a European subset of the Orbis database and is one of the most widely used sources of data on micro-level financial indicators in the economic literature (Kalemli-Ozcan et al., 2019). In the candidate's articles, this database provided indicators for nonfinancial enterprises from European countries from the years 2007-2016. The classification of enterprises as state- and privately owned was presented in Section I.2.1. In the remainder of this section, applied methods and other data sources are summarised for each candidate's article.[10]

In the article *The Scale and Financial Performance of State-Owned Enterprises in the CEE Region* (Matuszak & Szarzec, 2019), the set of 2140 enterprises from 11 Central-Eastern European countries in 2014-2015 was analysed. In order to measure the scale of state involvement in enterprises, the 'Country SOE Index' and 'Sector SOE Index' were calculated as an equally weighted average of SOE shares in operating revenues and total assets. In the next step, 10 financial indicators were compared between SOEs and POEs to test the *H1* hypothesis. The two-way analysis of variance (the two-way ANOVA) was used to check the differences between group means. The ownership status and the sectoral classification (based on the main section in the NACE Rev. 2) were employed as independent variables in the two-way ANOVA. To check the robustness of the results, the nonparametric Mann-Whitney U test was used in the comparisons within sectors.

In the study *Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries* (Matuszak & Kabaciński, 2021), the dataset included 13,360 enterprises from 22 countries in the European Union, operating in the electricity production sector in 2007-2016. The choice of this set of entities was driven by the fact that they operate in countries sharing common supranational regulations and production is the most competitive subsector of the electricity industry (Del Bo, 2013). Data on wholesale prices from the Agency for the Cooperation of Energy Regulators (ACER, 2018) and the energy and supply price component from Eurostat (2020) were used to reflect the electricity price levels. The random effects model with Driscoll and Kraay heteroskedasticity, autocorrelation and cross-sectional correlation robust standard errors was used in the econometric analysis (Driscoll & Kraay, 1998). In the first step, the model was applied to test the *H1* hypothesis. To test the *H2* hypothesis, the interaction term between the price level and ownership status was added. The dependent variable was the return on assets (ROA)

[10] Note that the description of the data sources and methods is not exhaustive. See the articles for a full presentation.

indicator, measured as the ratio of EBITDA (earnings before interest, taxes, depreciation, and amortisation) to total assets. The set of independent variables included company- and country-level data, which allowed to control for a number of factors which may potentially influence the ROA indicator. Additionally, time and country fixed effects were included in the model to account for, respectively, common shocks across enterprises and time-invariant country characteristics. The robustness check considered issues related to data completeness, the division of prices paid by residential and non-residential consumers, different price component bands, country-by-country exclusion, and the analysis with the fixed effects model. Additional analyses were conducted for other subsectors in the electricity industry – trade, distribution, and transmission.

In the article *State-owned enterprises and economic growth: Evidence from the post-Lehman period* (Szarzec, Dombi, & Matuszak, 2021), the analysis was based on the annual panel data of 30 European countries between 2010 and 2016. The brand-new dataset of economic weight of SOEs at the country level in 2007-2016 was established based on firm-level indicators of 131,068 enterprises. The SOE indicators are aggregated shares of minority and majority state-owned enterprises in terms of total assets, operating revenues, and employment. The classification as state- and privately owned was primarily based on the Amadeus database. As this data source provides the latest available information on the ownership status, Szarzec, Dombi and Matuszak (2021) also constructed the Privatization Dataset which included data on 1160 cases of privatisations and 61 cases of nationalisations based on a broad set of sources. The two-step generalised method of moments (GMM) with heteroskedasticity-robust standard errors and data transformed by forward orthogonal deviation (FOD) were used in the econometric analysis. This estimation method was chosen in order to tackle the issue of endogeneity due to simultaneity and possible measurement errors. To test the *H3* hypothesis, the interaction term between institutional quality and the SOE shares was used. The dependent variable was the growth rate of GDP per capita. The set of independent variables included the SOE indicator, institutional quality measures (*the Worldwide Governance Indicators*, Kaufmann & Kraay, 2008), and conventional growth determinants related to both supply and demand sides of the economy. Time-fixed effects were controlled by year dummies. Country-fixed effects were removed by the FOD-transformation of data prior to the econometric estimation. In the further analysis, the instrumental variables method (2SLS) was used with deep roots of development measures as

instruments, and the growth rate, employment, and total factor productivity as dependent variables. The robustness of the results was checked with respect to the alternative measures of institutional quality, the estimation method, the sample, the construction of the SOE Dataset, and the explanatory variables.

In *What determines the scale of state ownership in enterprises? Some evidence from post-socialist countries* (Matuszak, 2020), data were collected for 28 post-socialist countries in 2007-2016. The SOE indicators from Szarzec, Dombi and Matuszak (2021) and the large scale privatisation indicator by the European Bank for Reconstruction and Development (EBRD, 2014) were used as measures of state ownership in enterprises. The latter was chosen as a proxy for the scale of state ownership in enterprises for two reasons. First, it covers all 28 post-socialist countries in the CEE region and the former Soviet Union (as compared to 16 post-socialist countries in Szarzec, Dombi and Matuszak, 2021); second, it strongly correlates with the SOE measures by Szarzec, Dombi and Matuszak (2021). The econometric analysis was conducted with the ordinary least squares (OLS) model with heteroskedasticity robust standard errors. The sets of cultural, political, economic and control variables were included on the right-hand side of the model. The different sets of independent variables were included in the model stepwise, with a particular focus on potentially endogenous political factors.

I.7. Research results and discussion

This section summarises and discusses the results of the candidate's articles. Apart from discussing the results of the statistical and econometric analyses in the context of the research hypotheses, measures of aggregated economic weight of SOEs are also presented.

The 'Country SOE index' introduced in *The Scale and Financial Performance of State-Owned Enterprises in the CEE Region* (Matuszak & Szarzec, 2019) had the highest values in 2015 in Slovenia (53.7%) and Latvia (45.8%), while the lowest in Lithuania (15.7%) and Hungary (17.5%). The index value for the CEE region was 26.4%. Slovenia and Poland were the countries with the largest shares of minority SOEs – 13.4% and 11.7%, respectively. If minority SOEs were not considered, the estimated state share in the CEE region would be 24.4% less (6.4 p.p.). Transportation (77.3%) and energy (67.3%) sectors were characterised by the highest shares of SOEs in the CEE region. Concerning a comparison of financial indicators between SOEs and POEs, on average, state-owned enterprises had significantly lower return on assets, return on equity, and return on capital employed. At the same time, SOEs had higher

employee costs to operating revenue and higher solvency ratio. These indications are generally in line with the literature showing that capital is employed less efficiently in SOEs, state-owned enterprises have higher employee costs and are less leveraged than POEs (Goldeng, Grünfeld, & Benito, 2008; European Commission, 2016; Tihanyi et al., 2019; Szarzec & Nowara, 2017). Interestingly, SOEs were characterised by a higher cash-flow-to-operating-revenue ratio and EBITDA margin – this could suggest that SOEs keep more favourable terms of sales and higher margins. When the nonparametric Mann-Whitney U test was employed, the outcomes were very similar. The results in Matuszak and Szarzec (2019) only partially support the *H1* hypothesis concerning worse financial performance of state-owned enterprises. At the same time, the indications for cash flow and EBITDA margin could even be interpreted as contradicting the *H2* hypothesis. However, the findings based on the analysis with the two-way ANOVA and Mann-Whitney U test should be treated with caution. These methods do not allow to control for a broader set of control variables, which may be a potential source of omitted variable bias. What is more, in this setup, it is not possible to explicitly control for non-commercial goals of SOEs. Matuszak and Kabaciński (2021) aimed at addressing these shortcomings.

According to the data from *Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries* (Matuszak & Kabaciński, 2021), the share of SOEs in the production of electricity sector was above 80% in 2011-2016 in France, Slovenia, Denmark, Austria, and Greece, while below 20% - in Germany, Belgium, Portugal, Slovakia, Spain, and Great Britain. In the first step of the econometric analysis, it was revealed that SOEs were characterised by a substantially lower level of the return-on-assets indicator – on average, return on assets was lower among SOEs than POEs by 0.598 (25% ownership threshold) and by 0.836 (50% ownership threshold) percentage points, while the mean value of this indicator was 9.01%. These results suggest that one cannot reject the *H1* hypothesis. In the second step, it was indicated that SOEs were characterised by significantly (at the 5% level) lower return on assets compared to POEs when prices were sufficiently low. For prices above a certain threshold, there were no substantial differences in the financial performance between state- and privately owned entities. A one standard deviation increase in prices led to an average increase of the ROA indicator of SOEs (as compared to POEs) by 0.42-1.02 percentage points (depending on the ownership thresholds and price indicators). These results unambiguously support the *H2* hypothesis.

These indications were robust when the analysed period was limited to 2011-2016, different price configurations were used, countries were excluded from the analysis one-by-one and fixed effects model was used. What is more, the results were supportive for the *H2* hypothesis when the production and trade sectors were analysed jointly, as well as when the focus was on distribution and transmission. The results in Matuszak and Kabaciński (2021) are in line with former empirical studies on non-commercial goals of state-owned enterprises, which indicated that SOEs do not underperform POEs when they are profit-maximisers (Bozec et al., 2002) and a large part of their worse financial performance might be explained by pursuing objectives other than profit maximisation (Eller et al., 2011; Hartley & Medlock, 2013). The research design in Matuszak and Kabaciński (2021) builds on the extensive SOE literature and empirical studies focusing on the relationship between SOEs and electricity price levels (Bacchiocchi et al., 2015; Del-Rio et al., 2019; Fiorio & Florio, 2013). However, it should be emphasised that this approach is indirect, that is, it is based on the price levels at the country level rather than on prices at the enterprise level. By employing firm-level prices, one could more clearly show how the relative financial performance of SOEs is associated with providing electricity at lower prices. Nevertheless, such an analysis would demand data for a broad set of entities across countries which, to the best of the candidate's knowledge, are not available.

The brand-new indicators of economic weight of state-owned enterprises introduced in *State-owned enterprises and economic growth: Evidence from the post-Lehman period* (Szarzec, Dombi, & Matuszak, 2021) showed that the role of the state as an owner of enterprises in Europe is still the most substantial in post-socialist countries; with Bosnia and Herzegovina, Russia, and Montenegro having the highest SOE shares – exceeding 50% – in terms of total assets of large enterprises. In the group of non-post-socialist countries, Greece, Norway, Italy, and Austria were characterised by relatively large SOE shares. In turn, Great Britain and the Netherlands had the lowest shares of SOEs in total assets (see Figure I.1).

The results of the econometric part revealed that in the growth regression the coefficients of the SOE variables were insignificant when the SOE variable was not interacted with the institutional quality measure. This means that state-owned enterprises were, in the analysed sample, neither positive nor negative for economic growth *per se*. In the next step, the interaction term between the SOE and institutional quality variables was introduced, and the results showed that the marginal effect of SOEs on economic growth significantly (at least at

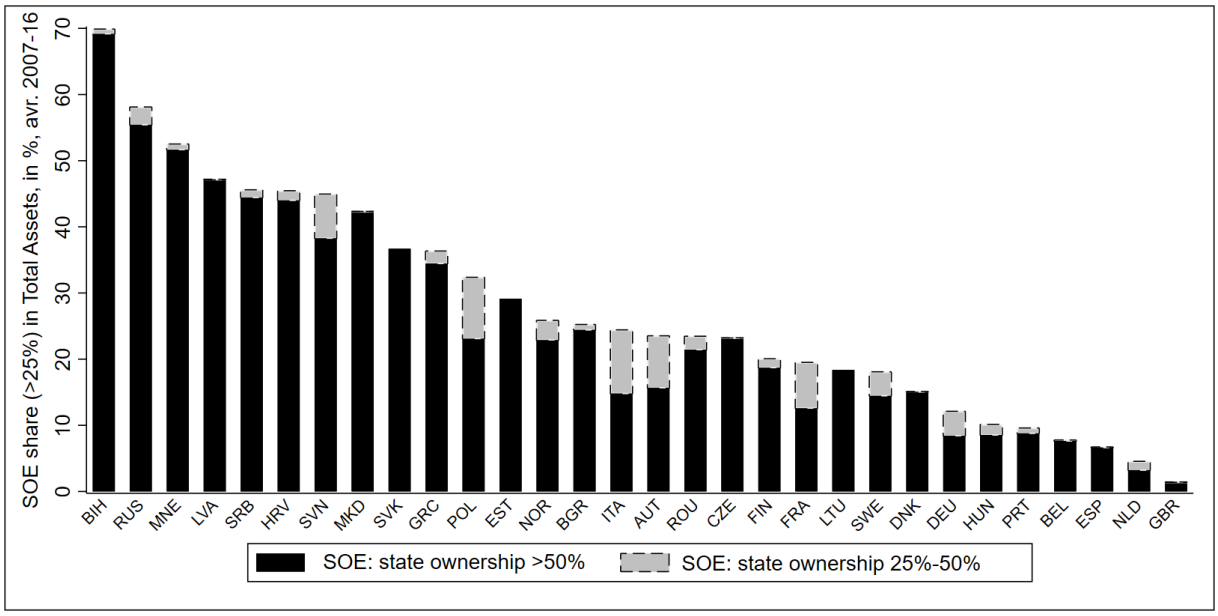

Figure I.1 The scale of state ownership: average share of SOEs in total assets (2007–2016)
Source: own elaboration based on data from Szarzec, Dombi and Matuszak (2021).
Note: *SOE share* is the share of SOEs in the sum of total assets of large nonfinancial enterprises.
SOE >50% presents the share of majority SOEs, that is, enterprises with the state share above 50%.
SOE 25%-50% stands for the share of minority SOEs, that is, enterprises with the state share 25%-50% and a controlling position of the state.

the 10% level) improves with institutional quality. Importantly, the conditionality of the interacted variables proved to be significant when the estimated marginal effect of the SOE variable was plotted along the sample distribution of institutional quality (Brambor, Clark, & Golder, 2006; Kingsley, Noordewier, & Vanden Bergh, 2017). Namely, when the SOE measures based on total assets were employed, the marginal effect of SOEs on growth was significantly (at the 10% level) negative at low levels of institutional quality but insignificantly different from zero at moderate and high levels of institutional quality. When the SOE shares were based on operating revenues, the marginal SOE effect was negative but statistically insignificant in the left tail of the distribution of institutional quality, turning into statistically positive (at the 10% level) in the right tail. To assess the economic importance of these results, the change of the marginal SOE effects due to a one standard deviation (SD) increase in the measure of institutional quality was calculated. This exercise revealed that a one SD increase in institutional quality improves the marginal effect of state-owned enterprises on economic growth by 0.186-0.259 percentage points (depending on the respective SOE measures). The identified conditionality between the SOE growth impact and institutional quality proved to be robust in a battery of robustness checks. This unambiguously supports the *H3* hypothesis about the growth effect of SOEs improving with institutional quality. The results of the additional analyses – employing the 2SLS estimation based on historical instruments – also

provided some evidence in favour of the *H3* hypothesis. The previous (very scarce) empirical literature on the SOE-growth nexus seems to be in line with the main conclusion of Szarzec, Dombi and Matuszak (2021). Specifically, studies based on data from developed countries with better institutions suggest that there were no negative effects of SOEs on growth (Fowler & Richards, 1995; Doamekpor, 2003), while those analysing developing countries indicated negative growth effects of state-owned enterprises (Plane, 1992; Gylfason et al., 2001). However, some relevant caveats should be mentioned when discussing the results in Szarzec, Dombi and Matuszak (2021). First, the positive conditionality of the marginal effect of state-owned enterprises on institutional quality should not be interpreted as an indication to increase state ownership above all limits in countries with good institutions. Second, the analysis covered 30 countries over the period 2010-2016. With such a short period and small sample size, the estimated marginal effects might be imprecise and therefore, should be interpreted cautiously. What is more, growth enhancing/impairing impact of the presence of SOEs might need more years to materialise, and long-run effects of state-owned enterprises might not be captured in the econometric analysis based on a short time span.

The dataset by Szarzec, Dombi and Matuszak (2021) showed substantial heterogeneity in terms of the scale of state ownership in enterprises among European countries. *What determines the scale of state ownership in enterprises? Some evidence from post-socialist countries* (Matuszak, 2020) aimed at discovering which factors could determine these differences. Building on the unique historical setting of post-socialist countries, the study revealed that cultural factors – proxied by the dominant religion – appeared to be the most robust factor explaining the difference in the scale of SOEs among post-socialist countries. More precisely, the role of the state as an owner of enterprises was the most limited in the years 2007-2016 in the group of predominantly Protestant and Catholic countries, followed by predominantly Orthodox states, while predominantly Muslim ones had the highest SOE shares. Such results seem to be in line with the previous literature showing that countries with dominant Protestant and Catholic religions were characterised by a higher pace of institutional changes towards the market economy (Piątek et al., 2019; Schweickert, Melnykovska, Belke, & Bordon, 2011). These results also emphasise the importance of cultural factors in shaping the current socio-economic outcomes (Grigoriadis, 2016; Guiso, Sapienza, & Zingales, 2006). At the same time, the remaining variables representing political (the length of the period under central planning, armed conflict, EU accession, ruling party) and economic

(oil and gas reserves, GNP per capita in 1989) factors turned out to be either insignificant or their coefficients were unstable across model specifications. Concerning the limitations of Matuszak (2020), one should underline that the SOE indicators by Szarzec, Dombi and Matuszak (2021) are available for only 16 out of 28 post-socialist countries of the CEE region and the former Soviet Union. Moreover, micro-level-based indicators were better available in more-developed countries of the CEE region. These factors could have made the estimations in Matuszak (2020) less precise due to smaller heterogeneity in this group of states. Another caveat is that the dominant religion is only a proxy for cultural factors and based on such a variable, one cannot precisely indicate what particular cultural characteristics drive the scale of state ownership in enterprises.

I.8. Conclusions

The articles constituting this doctoral dissertation analyse state-owned enterprises in European countries in the 21st century and contribute to the recent discussion on the role of the state as an owner of enterprises (the articles are summarised in Table I.1). The first contribution of the candidate's studies is the assessment of the scale of state ownership in enterprises according to the explicitly stated criteria distinguishing minority and majority SOEs, as well as direct and indirect ownership. Based on this, Matuszak and Szarzec (2019) provides the 'Country SOE index' and 'Sector SOE index' for 11 countries of the CEE region in 2014-2015, Matuszak and Kabaciński (2021) shows the SOE share in the production of electricity sector in the EU countries and, finally, Szarzec, Dombi and Matuszak (2021) establishes the comprehensive micro-level-based, annual SOE dataset for 30 European countries in 2007-2016. The second contribution is the empirical analysis of the relationship between the non-commercial goal of providing crucial products at affordable prices and financial performance of SOEs, which explicitly considers the price levels as a conditioning factor of the analysed phenomenon (Matuszak & Kabaciński, 2021) – such an exercise had not been done before in the economic literature. The third contribution is the analysis of the impact of state-owned enterprises on economic growth based on data from the 21st century (Szarzec, Dombi, & Matuszak, 2021), which is novel in the literature in terms of its comprehensive country focus. This study also considers the institutional quality as a conditioning factor of the SOE growth effect, which had not been done in previous research.

The fourth contribution is the analysis of the deep determinants of state ownership in enterprises in contemporary economies (Matuszak, 2020), which had been missing until now.

The results presented in the articles constituting this dissertation are not unambiguously in favour or against state ownership in enterprises. Nevertheless, they might be a solid basis for some relevant policy implications. First, the importance of non-commercial goals of state-owned enterprises and their adverse impact on financial performance presented in Matuszak and Kabaciński (2021) emphasise the need of establishing a clear range of SOE objectives in order to keep a balance between financial sustainability and societal benefits. Precise criteria of assessing the performance of state-owned enterprises and their impact on consumers' surplus seem to be essential not only in limiting the possibilities of the discretionary management of entities for private and political gains but could also be an important rationale to keep some enterprises state-owned. Second, the growth impact of SOEs appeared to be substantially negative in countries with bad institutions according to the results in Szarzec, Dombi and Matuszak (2021). As these states usually keep the large state sector and SOEs are used as an important tool of an active development policy, it should be emphasised that these countries should improve their institutions first, that is, they should take action to reduce corruption, strengthen the rule of law and effectiveness of governance. If not, state-owned enterprises are likely to remain an obstacle in catching up to developed economies.

There are several interesting future research avenues related to the candidate's studies. Concerning the presence of SOEs in the electricity sector, future studies should focus on evaluating the social gains and losses by binding the theoretical framework of mixed oligopoly markets with the econometric analyses. Such a broader approach could also consider the potential negative effects of keeping low prices in the electricity sector such as preventing the market entry of competitors, discouraging investments, or reducing incentives for energy efficiency improvements, as well as account for state aid granted to both state- and privately owned enterprises. Moreover, the results in Matuszak and Kabaciński (2021) indicate that researchers comparing the performance of SOEs and POEs at the microeconomic level should consider non-commercial objectives in their empirical analyses. Next, research on the economic growth effect of SOEs should be expanded in terms of the geographical and time coverage. This analysis requires the establishment of an SOE dataset covering a broad set of countries around the world. Empirical studies should also be accompanied by theoretical models, which could indicate the channels through which state-owned enterprises impact

economic growth. Finally, with SOE indicators available for a large group of countries, one could more thoroughly analyse the determinants of the scale of state ownership in enterprises and disentangle the impact of particular cultural factors (e.g., along the individualism-collectivism cultural dimension) shaping the role of the state as an owner.

***

I would like to thank my advisor Dr. hab. Katarzyna Szarzec, prof. UEP, for her insightful guidance and constant encouragement. Research passion of prof. Szarzec has fuelled all research constituting this dissertation. I also owe a debt of gratitude to my auxiliary supervisor and co-author, Dr. Ákos Dombi, for the support and a number of interesting discussions. I am grateful to all employees and PhD students of the Department of Macroeconomics and Development Studies at the Poznan University of Economics and Business for their instructive comments and administrative support. During the doctoral studies, I have received financial support from the Polish National Agency for Academic Exchange under the Iwanowska Programme (2018/1/00065) and the National Science Centre Poland under the ETIUDA 8 Programme (2020/36/T/HS4/00048). During my research stays, I benefited from the hospitality of the Institute for East-European Studies at Freie Universität Berlin and the Department of Economics at Northwestern University.

Most importantly, I thank my wife, Ania, and my parents for their patience, endless support and unconditional love.

Table I.1 Summary of the articles constituting the dissertation

Title, authors, (year), *Journal*	Data (source)	Methods	Results	Contribution
The scale and financial performance of state-owned enterprises in the CEE Region. P. Matuszak (2019), *Acta Oeconomica*	Financial indicators of 2140 nonfinancial enterprises in 11 countries of the CEE region in 2014-2015 (Amadeus database)	Descriptive statistics, two-way ANOVA, Mann-Whitney U test	•Highest 'Country SOE index' in Slovenia and Latvia •Highest 'Sector SOE index' in transportation and energy •Lower ROA, ROE, ROCE and higher employee costs in SOEs	•Analysis of both *minority* and *majority* SOEs •Considering both direct and indirect state shares •Calculating country and sectoral SOE shares
Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries P. Matuszak & B. Kabaciński (2021), *Journal of Comparative Economics*	Financial indicators of 13,360 enterprises operating in the generation of electricity sector in the EU countries in the years 2007-2016 (Amadeus database), country and sectoral level control variables (Eurostat, World Bank, BP)	Random effects model with interactions and Driscoll-Kraay (1998) heteroskedasticity, autocorrelation and cross-sectional correlation robust standard errors	•Lower ROA in SOEs •Lower ROA of SOEs in markets with lower prices, no significant differences in markets with higher prices	•Empirical analysis of the relationship between non-commercial goals of SOEs and their financial performance •Inclusion of prices as a conditioning factor of profitability of SOEs (relative to POEs)
State-owned enterprises and economic growth: Evidence from the post-Lehman period. K. Szarzec, A. Dombi, & P. Matuszak (2021), *Economic Modelling*	Brand-new comprehensive SOE shares at the macroeconomic level based on financial indicators of 131,068 nonfinancial enterprises in 30 European countries in the years 2007-2016 (Amadeus database)	Descriptive statistics, two-step generalised method of moments with heteroskedasticity-robust standard errors and data transformed with forward orthogonal deviation	•Growth impact of SOEs neither negative nor positive *per se* •Growth impact of SOEs improves with institutional quality – negative with bad institutions, turning into positive with good institutions	•Establishment of a unique, micro-level-based SOE dataset •Establishment of a privatisation and nationalisation dataset •Empirical analysis of the impact of SOEs on economic growth •Inclusion of institutional measures as a conditioning factor of the SOE-growth nexus
What determines the scale of state ownership in enterprises? Some evidence from post-socialist countries. P. Matuszak (2020), *Economics and Business Review*	SOE measures (Szarzec, Dombi, & Matuszak, 2021), large scale privatisation indicator for 28 post-socialist countries in 2007-2014 (EBRD)	Descriptive statistics, ordinary least squares	•Cultural factors – represented by a dominant religion – as the most robust predictor of the scale of SOEs	•Empirical analysis of the determinants of the SOE scale based on the unique historical setting of post-socialist countries and data from contemporary economies

Note: the data list focuses on the main data sources and is not exhaustive. *ROA* – return on assets. *ROE* – return on equity. *ROCE* – return on capital employed.

I.9. References

Acemoglu, D., 2009. *Introduction to Economic Growth*. Princeton: Princeton University Press.

ACER (2018). *Estimated Electricity Mark-up 2008-2018 (prices in €/MWh)*. Retrieved January 20, 2020 from https://aegis.acer.europa.eu/chest/category/1/list

Ades, A., & Di Tella, R. (1997). National champions and corruption: Some unpleasant interventionist arithmetic. *Economic Journal*, *107*(443), 1023-1042.

Aguilera, R. V., Capapé, J., & Santiso, J. (2016). Sovereign wealth funds: A strategic governance view. *Academy of Management Perspectives*, 30(1), 5-23.

Aharoni, Y. (1986). *The Evolution and Management of State Owned Enterprises*. Ballinger Publication: Cambridge, MA.

Alami, I., & Dixon, A. (2020). State capitalism(s) redux? Theories, tensions, controversies. *Competition & Change*, *24*(1), 70-94.

Alchian, A. (1965). Some Economics of Property Rights. *Il Politico*, *30*(4), 816-829.

Alchian, A., & Demsetz, H. (1973). The Property Right Paradigm. *The Journal of Economic History*, *33*(1), 16-27.

Alesina, A., & Giuliano, P. (2015). Culture and institutions. *Journal of Economic Literature*, *53*(4), 898–944.

Antonelli, C., Amidei, F.B., & Fassio, C. (2014). The mechanisms of knowledge governance: State owned enterprises and Italian economic growth, 1950-1994. *Structural Change and Economic Dynamics*, *31*, 43-63.

Bacchiocchi, E., Florio, M., & Taveggia, G. (2015). Asymmetric effects of electricity regulatory reforms in the EU15 and in the New Member States: Empirical evidence from residential prices 1990–2011. *Utilities Policy*, *35*, 72-90.

Bai, C., Li, D., Tao, Z., & Wang, Y. (2000). A multitask theory of state enterprise reform. *Journal of Comparative Economics*, *28*(4), 716-738.

Bałtowski, M., & Kozarzewski, P. (2016). Formal and real ownership structure of the Polish economy: state-owned versus state-controlled enterprises. *Post-Communist Economies*, *28*(3), 405-419.

Bałtowski, M., Kozarzewski, P., & Mickiewicz, T. (2021). State Capitalism with Populist Characteristics: Poland and Hungary. In M. Wright et al. (Eds.), *Oxford Handbook on State Capitalism and the Firm*. Oxford, UK: Oxford University Press.

Bałtowski, M., & Kwiatkowski, G. (2018). *Przedsiębiorstwa państwowe we współczesnej gospodarce*. Warszawa: PWN.

Bałtowski, M., & Mickiewicz, T. (2000). Privatisation in Poland: Ten years after. *Post-Communist Economies*, *12*(4), 425–443.

Bałtowski, M., & Miszewski, M. (2007). *Transformacja gospodarcza w Polsce*. Warszawa: WN PWN.

Bator, F. (1958). The anatomy of market failure. *The Quarterly Journal of Economics*, *72*(3), 351-379.

Białek-Jaworska, A. (2021). Revenue diversification and municipally owned companies' role in shaping the debt of municipalities. *Annals of Public and Cooperative Economics*, *online first*.

Bognetti, G. (2020). History of western state-owned enterprises: from the Industrial Revolution to the age of globalization. In L. Bernier, M. Florio, & P. Bance (Eds.), *The Routledge Handbook of State-Owned Enterprises* (pp. 25-44). London & New York: Routledge.

Borghi, E., Del Bo, C., & Florio, M. (2016). Institutions and firms' productivity: evidence from electricity distribution in the EU. *Oxford Bulletin of Economics and Statistics*, *78*(2), 170-196.

Boubakri, N., & Cosset, J. (1998). The financial and operating performance of newly privatized firms: Evidence from developing countries. *Journal of Finance*, *53*(3), 1081-1110.

Boycko, M., Shleifer, A., & Vishny, R. (1996). A Theory of Privatisation. *The Economic Journal*, *106*(435), 309-319.

Bozec, R., Breton, G., & Côté, L. (2002). The Performance of State–Owned Enterprises Revisited. *Financial Accountability & Management*, *18*, 383-407.

Brambor, T., Clark, W., & Golder, M. (2006). Understanding Interaction Models: Improving Empirical Analyses. *Political Analysis*, *14*(1), 63–82.

Bremmer, I. (2010). *The End of the Free Market: Who Wins the War between States and Corporations?*. New York: Penguin Random House.

Bruton, G. D., Peng, M., Ahlstrom, D., Stan, C., & Xu, K. (2015). State-owned Enterprises Around the World as Hybrid Organizations. *Academy of Management Perspectives*, *29*(1), 92-114.

Bureau van Dijk (2018). *Amadeus database*. Retrieved in February 2018 from https://amadeus.bvdinfo.com/

Byrka-Kita, K., Czerwiński, M., Preś-Perepeczo, A., & Wiśniewski, T. (2021). Does CEO Replacement at State-Owned Enterprises Matter? Evidence from the Polish Capital Market. *Eastern European Economics*, *59*(2), 125-147.

Cantoni, D., & Yuchtman, N. (2020). *Historical Natural Experiments: Bridging Economics and Economic History*. NBER Working Paper Series 26754. Cambridge, MA: National Bureau of Economic Research.

Castelnovo, P., Del Bo, C., & Florio, M. (2019). Quality of institutions and productivity of State-Invested Enterprises: International evidence from major telecom companies. *European Journal of Political Economy*, *58*, 102-117.

Cazurra, A., Inkpen, A., Musacchio, A., & Ramaswamy, K. (2014). Governments as owners: State-owned multinational companies. *Journal of International Business Studies*, *45*(8), 919-942.

Chen, G., Firth, M., & Xu, L. (2009). Does the type of ownership control matter? Evidence from China's listed companies. *Journal of Banking and Finance*, *33*, 171–181.

Christiansen, H. (2013). *Balancing commercial and non-commercial priorities of state-owned enterprises*. OECD Corporate Governance Working Papers No. 6. Paris: OECD Publishing.

Clo, S., Ferraris, M., & Florio, M. (2017). Ownership and environmental regulation: Evidence from the European electricity industry. *Energy Economics*, *61*, 298-312.

Cui, L., & Jiang, F. (2012). State ownership effect on firms' FDI ownership decisions under institutional pressure: A study of Chinese outward-investing firms. *Journal of International Business Studies*, *43*(3), 264-284.

D'Souza, J., & Nash, R. (2017). Private benefits of public control: Evidence of political and economic benefits of state ownership. *Journal of Corporate Finance*, *46*, 232–247.

De Fraja, G. (2009). *Mixed Oligopoly: Old and New*. Discussion Papers in Economics 09/20. Leicester, UK: University of Leicester.

De Fraja, G., & Delbono, F. (1989). Alternative Strategies of a Public Firm in Oligopoly. *Oxford Economic Papers*, *41*, 302–11.

Del Bo, C. (2013). Productivity in electricity generation: The role of firm ownership and regional institutional quality. *International Review of Applied Economics*, *27*, 237–264.

Del-Rio, B., Fernández-Sainz, A., & Martinez de Alegria, I. (2019). Industrial electricity prices in the European Union following restructuring: A comparative panel-data analysis. *Utilities Policy*, *60*, 1-9.

Dewenter, K., Han, X., & Malatesta, P. (2010). Firm values and sovereign wealth fund investments. *Journal of Financial Economics*, *98*(2), 256-278.

Dinc, I. (2005). Politicians and banks: Political influences on government-owned banks in emerging markets. *Journal of Financial Economics*, *77*, 453–479.

Djankov, S., & Murrell, P. (2002). Enterprise Restructuring in Transition: A Quantitative Survey. *Journal of Economic Literature*, *40*(3), 739-792.

Doamekpor, F. (2003). A Structural analysis of the value-added effects of enterprises: A re-assessment. *International Journal of Comparative Sociology*, *44*(2), 129-154.

Driscoll, J., & Kraay, A. (1998). Consistent covariance matrix estimation with spatially dependent data. *Review of Economics and Statistics*, *80*, 549–560.

EBRD (2014). *Transition indicators by country*. Retrieved April 15, 2020 from www.ebrd.com/documents/oce/transition-indicators-by-country.xlsx

Eller, S., Hartley, P., & Medlock, K. (2011). Empirical evidence on the operational efficiency of National Oil Companies. *Empirical Economics*, *40*, 623–643.

Englmaier, F., Roider, A., Stowasser, T., & Hinreiner, L. (2017). *Power Politics: Electoral Cycles in German Electricity Prices*. Annual Conference 2017 (Vienna): Alternative Structures for Money and Banking 168267. German Economic Association.

Ennser-Jedenastik, L. (2014). The Politics of Patronage and Coalition: How Parties Allocate Managerial Positions in State-Owned Enterprises. *Political Studies*, *62*(2), 398–417.

Estrin, S., Hanousek, J., Kočenda, E., & Svejnar, J. (2009). The Effects of Privatization and Ownership in Transition Economies. *Journal of Economic Literature*, *47*, 699–728.

Estrin, S., Meyer, K., Nielsen, B., & Nielsen, S. (2016). Home country institutions and the internationalization of state owned enterprises: A cross-country analysis. *Journal of World Business*, *51*(2), 294-307.

European Commission (2016). *State-Owned Enterprises in the EU: Lessons Learnt and Ways Forward in a Post-Crisis Context*. Institutional Paper 031. Luxembourg: Publishing Office of the European Union.

Eurostat (2008). *NACE Rev. 2: Statistical classification of economic activities in the European Community*. Luxembourg: Eurostat.

Eurostat (2020). *Eurostat database*. Retrieved January 20, 2020 from https://ec.europa.eu/eurostat/web/energy/data/database

Fan, J., Wong, T., & Zhang, T. (2007). Politically connected CEOs, corporate governance, and Post-IPO performance of China's newly partially privatized firms. *Journal of Financial Economics*, *84*(2), 330-357.

Fiorio, C., & Florio, M. (2013). Electricity prices and public ownership: Evidence from the EU15 over thirty years. *Energy Economics*, *39*, 222–232.

Fisman, R. (2001). Estimating the value of political connections. *American Economic Review*, *91*(4), 1095-1102.

Florio, M. (2013a). *Network Industries and social welfare: The Experiment that Reshuffled European Utilities*. Oxford, UK: Oxford University Press.

Florio, M. (2013b). Rethinking on public enterprise: Editorial introduction and some personal remarks on the research agenda. *International Review of Applied Economics*, *27*, 135–149.

Florio, M. (2014). *The return of public enterprise*. Centre for Industrial Studies (CSIL) Working Papers. Milano, Italy: CSIL.

Fowler, P., & Richards, D. (1995). Test evidence for the OECD countries, 1965-85: The relationship between the size of the public enterprise sector and economic growth. *International Journal of Social Economics*, *22*(3), 11-23.

Frydman, R., Gray, C., Hessel, M., & Rapaczynski, A. (1999). When does privatization work? The impact of private ownership on corporate performance in the transition economies. *The Quarterly Journal of Economics*, *114*(4), 1153-1191.

Goldeng, E., Grünfeld, L., & Benito, G. (2008). The Performance Differential between Private and State Owned Enterprises: The Roles of Ownership, Management and Market Structure. *Journal of Management Studies*, *45*(7), 1244-1273.

Grigoriadis, T. (2016). Religious origins of democracy & dictatorship. *Journal of Policy Modelling*, *38*(5), 785-809.

Guislain, P. (1997). *The Privatization Challenge. A strategic, legal, and institutional analysis of international experience*. Washington, DC: The World Bank.

Guiso, L., Sapienza, P., & Zingales, L. (2006). Does Culture Affect Economic Outcomes?. *Journal of Economic Perspectives*, *20*(2), 23-48.

Gylfason, T., Herbertsson, T., & Zoega, G. (2001). Ownership and growth. *World Bank Economic Review*, *15*(3), 431–449.

Hartley, P., & Medlock, K. (2008). A model of the operation and development of a National Oil Company. *Energy Economics*, *30*(5), 2459–2485.

Hartley, P., & Medlock, K. (2013). Changes in the operational efficiency of National Oil Companies. *The Energy Journal*, *34*(2), 27–57.

Havrylyshyn, O., & McGettigan, D. (1999). *Privatization in Transition Countries: A Sampling of the Literature*. IMF Working Paper WP/99/6. Washington, DC: International Monetary Fund.

Inoue, C., Lazzarini, S., & Musacchio, A. (2013). Leviathan as a Minority Shareholder: Firm-Level Implications of State Equity Purchases. *Academy of Management Journal*, *56*(6), 1775-1801.

Jensen, M., & Meckling W. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, *3*(4), 305-360.

Kalemli-Ozcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V., & Yesiltas, S. (2019). *How to Construct Nationally Representative Firm Level Data From the Orbis Global Database: New Facts and Aggregate Implications*. NBER Working Paper Series 21558. Cambridge, MA: National Bureau of Economic Research.

Kaufmann, D., & Kraay, A. (2008). Governance indicators: where are we, where should we be going?. *World Bank Research Observer*, *23*, 1–30.

Kingsley, A., Noordewier, T., & Vanden Bergh, R. (2017). Overstating and understating interaction results in international business research. *Journal of World Business*, *52*(2), 286–295.

Kopecký, P., & Spirova, M. (2011). 'Jobs for the boys'? Patterns of party patronage in post-communist Europe. *West European Politics*, *34*(5), 897-921.

Kornai, J. (1979). Resource-constrained versus demand-constrained systems. *Econometrica*, *47*(4), 801-819.

Kornai, J., Maskin, E., & Roland, G. (2003). Understanding the soft budget constraint. *Journal of Economic Literature*, *41*(4), 1095-1136.

Kowalski, P., Buge, M., Sztajerowska, M., & Egeland, M. (2013). *State-Owned Enterprises: Trade Effects and Policy Implications*. OECD Trade Policy Papers No. 147. Paris, France: OECD Publishing.

Kurlantzick, J. (2016). *State Capitalism: How the Return of Statism Is Transforming the World*. New York: Oxford University Press.

Kwiatkowski, G., & Augustynowicz, P. (2015). *State-Owned Enterprises In The Global Economy – Analysis Based On Fortune Global 500 List*. Management, Knowlegde and Learning – Joint International Conference 2015, Bari, Italy.

La Porta, R., Lopez-De-Silanes, F., & Shleifer, A. (2002). Government ownership of banks. *Journal of Finance*, *57*, 265–301.

Lazzarini, S.G., Mesquita, L.F., Monteiro, F., & Musacchio, A. (2021). Leviathan as an inventor: An extended agency model of state-owned versus private firm invention in emerging and developed economies. *Journal of International Business Studies*, *52*, 560-594.

Li, M. H., Cui, L., & Lu, J. 2014. Varieties in state capitalism: Outward FDI strategies of central and local state-owned enterprises from emerging economy countries. *Journal of International Business Studies*, *45*(8), 980–1004.

Lin, J., Cai, F., & Li, Z. (1998). Competition, Policy Burdens, and State-Owned Enterprise Reform. *The American Economic Review*, *88*(2), 422-427.

Lin, L. W., & Milhaupt, C. J. (2013). We are the (national) champions: understanding the mechanisms of state capitalism in China. *Stanford Law Review*, *65*(4), 697-760.

Liu, F., & Zhang, L. (2018). Executive turnover in China's state-owned enterprises: Government-oriented or market-oriented? *China Journal of Accounting Research*, *11*(2), 129–149.

Matuszak, P. (2020). What determines the scale of state ownership in enterprises? Some evidence from post-socialist countries. *Economics and Business Review*, *6*(4), 95-117. DOI: https://doi.org/10.18559/ebr.2020.4.6

Matuszak, P., & Kabaciński, B. (2021). Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries. *Journal of Comparative Economics*, *49*(4), 1068-1087. DOI: https://doi.org/10.1016/j.jce.2021.03.002

Matuszak, P., & Szarzec, K. (2019). The Scale and Financial Performance of State-Owned Enterprises in the CEE Region. *Acta Oeconomica*, *69*(4), 549-570. DOI: https://doi.org/10.1556/032.2019.69.4.4

Megginson, W. (2017). Privatization, State Capitalism, and State Ownership of Business in the 21st Century. *Foundations and Trends in Finance*, *11*(1–2), 1–153.

Megginson, W., Nash, R., & van Randenborgh, M. (1994). The Financial and Operating Performance of Newly Privatized Firms: An International Empirical Analysis. *The Journal of Finance*, *49*(2), 403-452.

Megginson W., & Netter J. (2001). From State to Market: A Survey of Empirical Studies on Privatization. *Journal of Economic Literature*, *39*(2), 321-389.

Millward, R. (2005). *Private and Public Enterprise in Europe: Energy, telecommunications and transport, 1830-1990*. Cambridge, UK: Cambridge University Press.

Millward, R. (2011). Public enterprise in the modern western world: An historical analysis. *Annals of Public and Cooperative Economics*, *82*(4), 375–398.

Musacchio, A., & Lazzarini, S. (2014). *Reinventing State Capitalism: Leviathan in Business, Brazil and Beyond*. Cambridge: Harvard University Press.

Musacchio, A., Lazzarini, S., & Aguilera, R. (2015). New Varieties of State Capitalism: Strategic and Governance Implications. *The Academy of Management Perspectives*, *29*(1), 115-131.

Nordhaus, W. (1975). The Political Business Cycle. *Review of Economic Studies*, *42*(2), 169-190.

Nunn, N. (2009). The Importance of History for Economic Development. *Annual Review of Economics*, *1*(1), 65–92.

Nunn, N. (2014). Historical Development. In P. Aghion & S. Durlauf (Eds.), *Handbook of Economic Growth* (2nd ed., pp. 347-402). Amsterdam: North-Holland.

OECD (2005). *OECD Comparative Report on Corporate Governance of State-Owned Enterprises*. Paris: OECD Publishing.

OECD (2014). *The Size and Sectoral Distribution of SOEs in OECD and Partner Countries*. Paris: OECD Publishing.

OECD (2015). *State-owned enterprises in the development process*. Paris: OECD Publishing.

OECD (2017). *The Size and Sectoral Distribution of State-Owned Enterprises*. Paris: OECD Publishing.

Okhmatovskiy, I. (2010). Performance Implications of Ties to the Government and SOEs: A Political Embeddedness Perspective. *Journal of Management Studies*, *47*(6), 1020-1047.

Piątek, D., Pilc, M., & Szarzec, K. (2019). What determines the institutional change in transition economies?. *Argumenta Oeconomica*, *1*(42), 235-272.

Piątek, D., Szarzec, K., & Pilc, M. (2013). Economic freedom, democracy and economic growth - a casual investigation in transition countries. *Post-Communist Economies*, *25*(3), 267-288.

Plane, P. (1992). Productive efficiency of public enterprises: A macroeconomic analysis based on cross-section estimation of a neoclassical production function. *Applied Economics*, *24*(8), 833-844.

Prabowo, R., Hooghiemstra, R., & Van Veen-Dirks, P. (2018). State Ownership, Socio-political Factors, and Labor Cost Stickiness. *European Accounting Review*, *27*, 771–796.

Robinett, D. (2006). *Held by the visible hand: the challenge of state-owned enterprise corporate governance for emerging markets*. Washington, DC: World Bank.

Roland, G. (2000). *Transition and Economics: Politics, Markets and Firms*. Cambridge, MA: MIT Press.

Roland, G. (2008). *Privatization. Successes and Failures*. New York: Columbia University Press.

Sappington, D., & Stiglitz, J. (1987). Privatization, Information and Incentives. *Journal of Policy Analysis and Management*, *6*(4), 567–582.

Schweickert, R., Melnykovska, I., Belke, A., & Bordon, I. (2011). Prospective NATO or EU membership and institutional change in transition countries. *Economics of Transition*, *19*(4), 667-692.

Shirley, M., & Nellis, J. (1991). *Public Enterprise Reform: The Lessons of Experience*. EDI Development Studies 9800. The World Bank: Washington, DC.

Shirley, M., & Walsh, P. (2000). *Public versus Private Ownership: The Current State of the Debate*. Policy Research Working Paper 2420. Washington, DC: The World Bank.

Shleifer, A. (1998). State versus private ownership. *Journal of Economic Perspectives*, *12*(4), 133-150.

Shleifer, A., & Vishny, R. (1994). Politicians and Firms. *Quarterly Journal of Economics*, *109*(4), 995-1025.

Song, Z., Storesletten, K., & Zilibotti, F. (2011). Growing Like China. *The American Economic Review*, *101*(1), 196-233.

Spolaore, E., & Wacziarg, R. (2013). How Deep Are the Roots of Economic Development? *Journal of Economic Literature*, *51*(2), 325–369.

Stiglitz, J., 1993. *The role of the state in Financial Markets*. Proceedings of the World Bank Annual Conference on Economic Development. Washington, DC: International Bank for Reconstruction and Development/World Bank.

Szarzec, K. (2013). *Państwo w gospodarce: studium teoretyczne - od Adama Smitha do współczesności*. Warszawa: WN PWN.

Szarzec, K., Dombi Á., & Matuszak, P. (2021). State-owned enterprises and economic growth: Evidence from the post-Lehman period. *Economic Modelling*, *99*, 105490. https://doi.org/10.1016/j.econmod.2021.03.009

Szarzec, K., & Nowara, W. (2017). The economic performance of state-owned enterprises in Central and Eastern Europe. *Post-Communist Economies*, *29*(3), 375–391.

Szarzec, K., Nowara, W., & Totleben, B. (2020). State-owned enterprises as foreign direct investors: insights from EU countries. *Post-Communist Economies*, *33*(5), 517-540. doi: 10.1080/14631377.2020.1793603.

Szarzec, K., Totleben, B., & Piątek, D. (2022). How do politicians capture a state? Evidence from state-owned enterprises. *East European Politics and Societies: and Cultures*, *36*(1), 141-172.

The Economist, 2012. *Special report: State capitalism*. The Economist, January 21, 1–18.

Tihanyi, L., Aguilera, R. V., Heugens, P., van Essen, M., Sauerwald, S., Duran, P., & Turturea, R. (2019). State Ownership and Political Connections. *Journal of Management*, *45*(6), 2293-2321.

Toninelli, P. (2000). The rise and fall of public enterprise: the framework. In: P. Toninelli (Ed.), *The rise and fall of public enterprise in the western world* (pp. 3-24). Cambridge, UK: Cambridge University Press.

Wang, K., & Shailer, G. (2018). Does Ownership Identity Matter? A Meta-analysis of Research on Firm Financial Performance in Relation to Government versus Private Ownership. *Abacus*, *5*, 1–35.

Wen, J., 2021. *The Political Economy Of State Employment And Social Unrest In China*. Working Paper, Harvard University.

World Bank (1995). *Bureaucrats in business: The economics and politics of government ownership. A World Bank policy research report*. Washington, DC: The World Bank.

Wright, M., Wood, G., Musacchio, A., Okhmatovskiy, I., Grosman, A., & Doh, J. (2021). State capitalism in international context: Varieties and variations. *Journal of World Business*, *56*(2), 101160.

Zhou, K. Z., Gao, G. Y., & Zhao, H. (2017). State Ownership and Firm Innovation in China: An Integrated View of Institutional and Efficiency Logics. *Administrative Science Quarterly*, *62*(2), 375–404.

I.10. A list of articles

1. Matuszak, P., & Szarzec, K. (2019). The Scale and Financial Performance of State-Owned Enterprises in the CEE Region. *Acta Oeconomica*, *69*(4), 549-570. DOI: https://doi.org/10.1556/032.2019.69.4.4
2. Matuszak, P., & Kabaciński, B. (2021). Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries. *Journal of Comparative Economics*, *49*(4), 1068-1087. DOI: https://doi.org/10.1016/j.jce.2021.03.002
3. Szarzec, K., Dombi Á., & Matuszak, P. (2021). State-owned enterprises and economic growth: Evidence from the post-Lehman period. *Economic Modelling*, *99*, 105490. https://doi.org/10.1016/j.econmod.2021.03.009
4. Matuszak, P. (2020). What determines the scale of state ownership in enterprises? Some evidence from post-socialist countries. *Economics and Business Review*, *6*(4), 95-117. DOI: https://doi.org/10.18559/ebr.2020.4.6

Part II. Articles that constitute a doctoral dissertation

Acta Oeconomica, Vol. 69 (4) pp. 549–570 (2019)
DOI: 10.1556/032.2019.69.4.4

THE SCALE AND FINANCIAL PERFORMANCE OF STATE-OWNED ENTERPRISES IN THE CEE REGION*

Piotr MATUSZAK – Katarzyna SZARZEC

(Received: 11 January 2018; revision received: 4 May 2018; accepted: 14 June 2018)

The paper aims to analyse state-owned enterprises (SOEs) in 11 post-socialist Central-Eastern European (CEE) countries. Based on the individual data of large non-financial companies, we estimated the real state share in the years 2014 and 2015. We consider both direct and indirect state ownership and apply an explicit classification of companies as majority and minority state-owned, which is neglected in a lot of research. The countries with the highest values of the 'Country SOE index' were Slovenia and Latvia, while the lowest were Lithuania and Hungary. State ownership is dominant in transportation and storage and energy supply. The lower return on assets (ROA), return on equity (ROE) and return on capital employed (ROCE) ratios of SOEs imply that capital in this group of companies is used less efficiently. Furthermore, they are characterised by higher wage costs. At the same time, SOEs have higher earnings before interest, taxes, depreciation and amortization (EBITDA) margins and better ability to turn operating revenue into cash than their privately-owned counterparts.

Keywords: state-owned enterprises, Central and Eastern Europe, post-socialist countries, financial performance

JEL classification indices: H82, P31, P43

* This work was supported by the National Science Centre Poland under Grant number 2015/17/B/HS4/00327. We thank the participants of the 3rd Conference "The Role of State in Varieties of Capitalism", held at the Central European University, Budapest, Hungary (30 November – 1 December 2017) for their comments on an earlier version of this paper. We take exclusive responsibility for all the opinions expressed in this study.

Piotr *Matuszak*, corresponding author. PhD student at the Department of Macroeconomics and Development Studies, Poznan University of Economics and Business, Poland.
E-mail: Piotr.Matuszak@ue.poznan.pl

Katarzyna *Szarzec,* Associate Professor at the Department of Macroeconomics and Development Studies, Poznan University of Economics and Business, Poland.
E-mail: katarzyna.szarzec@ue.poznan.pl

INTRODUCTION

The reasons and scale of state ownership in enterprises have been discussed since the 1990s. Despite the waves of privatisation, the state has remained a significant owner of firms in many countries. Moreover, the economic significance of state-owned enterprises (SOEs) on the global and regional markets has increased, too.

This paper aims to explore and compare the phenomenon of state ownership in 11 Central-Eastern European (CEE) countries in 2014 and 2015. We claim that, in spite of the privatisation processes, the state has remained a significant owner of (mainly large) enterprises, most of them being of socialist origins. Moreover, we compare the economic performance of the state enterprises with their private counterparts focusing on a broad set of financial indicators.

We address the following research questions:

- What is the scale of state ownership in the group of largest non-financial enterprises in the CEE countries?
- What is the scale of state ownership in particular sectors in CEE?
- Are there substantial differences in financial performance of SOEs as compared to their privately-owned counterparts?

We contribute to the literature by analysing not only the *majority* SOEs but also those companies with a *minority* but the controlling stake held by the state. Further, we consider both direct and indirect state ownership and apply an explicit classification of companies as majority and minority state-owned. By doing so, the real share of state ownership is estimated based on the firm-level data in the CEE countries. We also introduce two country and sector SOE indices.

This paper consists of the following sections: firstly, we discuss the reasons for the persistence of state ownership. Secondly, we present the scale of state ownership in the non-financial companies in 11 CEE countries. Thirdly, we compare the financial performance of the large companies in the region according to their ownership structure. Finally, we draw conclusions and offer some recommendations for further research.

1. REASONS FOR THE PERSISTENCE OF STATE OWNERSHIP

In the 80s and 90s, the economic debate was dominated by negative thinking about state ownership. This was connected to the waves of privatisation processes happening in the developed and transition countries, justified by the belief that only private ownership guarantees high efficiency (Kozarzewski 2006; Snowdon 2007; Roland 2008). The negative perception of state ownership resulted, to

a large extent, from the experiences of the socialist and developing countries, where state enterprises were treated as vehicles of industrialisation and economic development but were, in reality, highly inefficient due to overemployment, lack of incentives to develop and the fact that they did not produce the goods demanded on the market. State enterprises also faced the soft-budget constraint problem (Kornai 1986), due to which their managers were not motivated towards pro-efficiency behaviours. Moreover, authorities often failed to identify promising sectors of the economy. A key argument for the privatisation of state companies in the post-socialist countries was an improvement in their economic performance. According to the widely accepted recommendation by the EBRD: "Private ownership would ensure profit-oriented corporate governance, while liberalisation of trade and prices would set free the competitive market forces that reward profitable activities. Firms would have therefore both internal and external incentives to restructure" (EBRD 1999).

Due to privatisation processes and the establishment of new private firms, the ownership structure of production and employment in the post-socialist countries was the opposite when compared to the previous decades. Notwithstanding this, the state remained an important owner of enterprises in the CEE region through dominant stake or non-ownership tools (Bałtowski – Kozarzewski 2016; Szarzec – Nowara 2017). Further, in Hungary and Poland one can also observe a change in the ownership policy and a trend of renationalisation through share buyouts in previously privatised companies (the so-called 'reversal in the privatisation logic') and using SOEs by politicians for political and personal rent-seeking (Kozarzewski – Bałtowski 2016; Szanyi 2016).

Discussing the motivation of state ownership in the economy, one can refer to a range of reasons, such as (OECD 2005; Christiansen 2013; Kowalski et al. 2013; Putniņš 2015): the provision of public goods, an increase in access to public services, a source of public funds, improvement of labour relations particularly in 'strategic' sectors, a limitation of private and foreign control in the domestic economy and encouragement of economic development and industrialisation. Nowadays, in the CEE countries the main reason that the state intentionally holds shares in enterprises is its national economic policy concerning national security and economic development. Governments recognise some sectors of the national economy as *strategic* and prevent the privatisation of certain industries and enterprises. They want to hold corporate supervision in them, either by being the majority shareholder, a minority shareholder, or by introducing a system of government authorisations and licenses which controls the economic activities in a given sector **(**Report from… 2013). Typical strategic sectors are those involving natural resources or energy supply. In this case, the argument is no longer about a natural monopoly, but concerns the strategic resources necessary to maintain national security.

Moreover, state companies are also treated as a vehicle of economic development and industrialisation and a potential source of building a new comparative advantage. At the beginning of the 2000s, a significant change in the attitude towards state ownership occurred when large SOEs from China and Russia became important players in the global market. They grew in part from the past socialist development models adapted to the present reality and are regarded as *national champions* that are not to be privatised under any circumstances. The increasing significance of state companies in these countries, and subsequently in some of the CEE countries, was accompanied by a revival of the idea of the so-called 'developmental state' and the development of the New Structuralist Economics (NSE). The 'developmental state' was a subject of reflections in the literature on the structuralist economics in the 70s and 80s.[1] The state was dedicated to identifying and creating 'infant industries' by establishing state enterprises and applying special protection policies (e.g. export subsidies). Later on, however, economists started to doubt if public authorities would really be able to appropriately perform such activities (Irwin 2008), and trade liberalisation in the 90s limited the application of protection policies. NSE sees the state as playing a very important role, but in contrast to the old structuralism, the government here does not replace the market, but merely supports and promotes industrial development and innovation (Lin – Monga 2012). As such, state enterprises should operate in commercial affairs to achieve economic goals and foster competition.

Some researchers claim that state enterprises can be as efficient as their privately-owned counterparts (e.g. Bortolotti et al. 2013; Borghi et al. 2016). Firstly, one important issue is an increase in the quality of political and economic institutions – good institutions promote efficiency in companies controlled by the state. Secondly, the quality of the management of state enterprises has changed significantly due to the propagation of corporate governance rules established by national authorities and international organisations (e.g. OECD). The application of these rules requires more responsible, predictable and profitable activities. Besides, some of these new state enterprises are publicly listed, which demands pro-market behaviour from them.

Almost 30 years after the beginning of the transition in the CEE region, it can be argued that due to competition from foreign-owned companies, granting state aid according to the stricter EU rules and hard budget constraints, state enterprises should not underperform when compared to privately-owned entities. This issue has been recently discussed in literature. Szarzec – Nowara (2017) indicate that the largest state-owned oil and gas enterprises operating in CEE, as well as

[1] For an overview of the theories of economic development with emphasis put on the role of the state, see Boyer (2006).

Slovak SOEs in general, are characterised by a higher profit ratio and at the same time a lower ROE indicator than their privately-owned counterparts. A similar relation in the return on equity was shown in the report by the European Commission (2016) on companies from 8 countries in the CEE region over the period of 2004–2013. Böwer (2017) points out that SOEs in this region had lower returns on equity and capital employed and higher employee costs. Russian SOEs were analysed by Abramov et al. (2017) and the authors suggest that there is an inverse relation between the state's stake and returns on shareholders' funds. Such results lead to the conclusion that capital is employed rather less efficiently in the group of SOEs than among privately-owned entities.

Even though most studies suggest the inefficiency of state ownership, companies controlled by the state remain important economic players in both domestic and international markets (Liao – Zhang 2014; Götz – Jankowska 2017). Therefore, there is still a need to evaluate the real share of state ownership (regarding not only majority owned enterprises but also companies controlled by the state through the minority stake) and to compare the financial performance of SOEs, especially in the group of post-socialist countries of the CEE region that experienced the 'unique historic experience' (Kornai 2006) of rapid institutional changes.

2. DESCRIPTION OF DATASET

In order to indicate to what extent a nation-state operates as an owner in the economies of CEE, a dataset including the largest non-financial enterprises in this region was collected from the Amadeus database (Bureau van Dijk 2017).[2] Data were gathered for the years 2014 and 2015 – this choice was based on the fact that many indicators for 2016 were still unavailable when this research was conducted.

The dataset consists of data on non-financial companies, which were classified as '*very large*' from 11 countries of the CEE region (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia).[3] A very large enterprise is defined when it fulfils at least one of the following conditions: operating revenue higher or equal to 100 million EUR; total assets higher or equal to 200 million EUR; number of employees higher or equal

[2] Amadeus is the European subset of the Orbis database. It contains data on more than 20 million companies. The access to the database was provided by Bureau van Dijk.

[3] This group of countries was chosen in order to obtain a complete and reliable dataset. Moreover, they are all post-socialist countries that joined the European Union.

to 1000; listed.[4] Since for many entities there were no data on the operating revenue and total assets for the analyzed years, two additional conditions were added: operating revenue higher than 50 million EUR in both 2014 and 2015; total assets higher than 50 million EUR in both 2014 and 2015. This procedure allowed for the establishment of a dataset that consisted of 2290 enterprises.

The classification of the enterprises as state-owned is non-trivial due to the different definitions of state ownership and different means that the government uses to influence the companies (Bałtowski – Kozarzewski 2016). Therefore, one needs to precisely define conditions that classify the analysed entities. In this study, the focus is on ownership control of the state.[5] Enterprises were classified manually, considering both direct and indirect state ownership, as majority state-owned, minority state-owned or privately-owned enterprises. Majority SOEs are defined as entities in which the state holds, directly or indirectly, an ownership stake of more than 50%. The minority state-owned group consists of enterprises with a dominant position of state shareholders and dispersed ownership structure.[6] Privately-owned enterprises (POEs) are controlled by private entities. In order to indicate the ownership status of the enterprises, ownership structures were

[4] Moreover, companies with ratios operating revenue (or assets) per employee below 100 EUR are excluded from this category, and enterprises with unknown values of operating revenue, total assets and number of employees that reach a level of capital over 5 million EUR are included.

[5] At the same time, we are aware that governments might also influence some enterprises through additional, non-ownership tools. We think companies such as MOL (Hungary), PGE, PKN Orlen (Poland), INA, and Koncar Distributivni i Specijalni Transformatori (Croatia). Nevertheless, we cannot unambiguously rule out that there were some other companies in which the state had a decisive impact through non-ownership means. A problem of non-ownership tools of control rights in Polish companies is broadly discussed by Bałtowski – Kozarzewski (2016). The authors distinguish between companies that are controlled by ownership and non-ownership means and refer to them as, respectively, SOEs and state-controlled enterprises (SCEs).

[6] For each enterprise the sum of the private and state ownership stakes of the entities holding at least a 5% share was calculated. If a state holds (directly and indirectly) a higher ownership stake than all the private entities jointly, an enterprise is classified as a minority SOE. Therefore, minority SOEs are actually controlled by the state, despite the fact that it does not have majority blocks of shares. A 5% threshold was set due to a fact that disclosure requirements in 10 out of 11 analyzed countries impose an obligation on entities reaching 5% stake (10% in Croatia) to notify the issuer of the proportion of voting rights in publicly quoted companies (Clearstream 2018). The terms 'majority state-owned enterprises' and 'minority state-owned enterprises' are used by OECD (2017) to describe enterprises with a state stake above 50% and between 10–49%, respectively. Henceforth, unless indicated otherwise, we refer to both majority and minority state-owned enterprises as 'state-owned enterprises' or 'SOEs'.

checked using the Amadeus (Bureau van Dijk 2017), EMIS (2017) and EIKON Thomson Reuters (2017) databases and official company reports.[7]

Since we focus on for-profit non-financial enterprises whose ownership can be easily taken over by the private sector (Florio 2014; Szarzec – Nowara 2017), entities from the following sectors were excluded from the dataset: compulsory social security activities, public administration, forestry, public education, defence activities, public health care, urban transport and public research institutes. Additionally, enterprises owned by municipalities were also not included – this choice was based on the fact that the focus in this research is on the ownership by central governments. Due to these criteria, 143 companies from the raw database were not included in the analysis.

Data collected from Amadeus were based on unconsolidated accounts. This choice was driven by the fact that by employing data from unconsolidated accounts, one can avoid double-counting and can consider a wider range of activities by sector within holding companies and conglomerates. Subsidiaries were classified in the same ownership group as their parent companies. Registered and operating abroad subsidiaries of state-owned companies, i.e. in a different country than the parent company is registered, were classified as POEs.[8] When the status of an enterprise changed during the analysed year, i.e. it was either privatised or nationalised, the company was excluded from the dataset for this year.[9]

3. THE SCALE OF STATE OWNERSHIP IN CEE

Using all the selection criteria described above, 198 majority and 41 minority SOEs were identified among 2140 largest non-financial companies in CEE in 2015 (*Table 1*).[10] All entities included in this research recorded a sum of operating revenue of 867 billion EUR and total assets of 852 billion EUR, which is equal to, respectively, 75% and 74% of the GDP[11] of the CEE region. SOEs had a share of 19% in total operating revenue and 35% in total assets.

The number of enterprises in the dataset by country is presented in *Table 2*. The country with the highest number of observations was Poland (721), followed by the Czech Republic (395), Hungary (245) and Romania (232). The countries with

7 In such cases where the data on the ownership structure differed between sources, the official reports were decisive.

8 There were 21 such cases in 2014 and 20 in 2015.

9 Due to changes in the ownership structure, 7 enterprises were excluded from the analysis for the year 2015 and 5 for the year 2014.

10 In this part, data for 2015 are presented. Data for 2014 are available upon request.

11 Data on GDP were collected from the World Bank internet database.

Table 1. Largest enterprises in CEE, 2015

Status		POE	Majority state-owned	Minority state-owned	Total
Number of observations		1900	198	42	2140
Operating revenue	EUR, billion	705.791	110.665	50.950	867.406
	% database	81.37	12.76	5.87	
	% GDP	61.13	9.59	4.41	75.13
Total assets	EUR, billion	557.673	234.424	59.716	851.813
	% database	65.47	27.52	7.01	
	% GDP	48.30	20.30	5.17	73.77

Source: Own elaboration based on data from Amadeus.

Table 2. Number of large enterprises by countries, 2015

Country	Status			Total
	POE	Majority state-owned	Minority state-owned	
Bulgaria	85	12	0	97
Czech Republic	374	21	0	395
Estonia	25	6	0	31
Croatia	76	16	1	93
Hungary	222	17	6	245
Latvia	23	12	0	35
Lithuania	54	5	0	59
Poland	648	47	26	721
Romania	207	19	6	232
Slovakia	131	18	0	149
Slovenia	55	25	3	83
Total CEE	1900	198	42	2140

Source: Own elaboration based on data from Amadeus.

the least enterprises in the dataset were Estonia (31), Latvia (35) and Lithuania (59). More than 20 SOEs were registered in Poland (73), Slovenia (28), Romania (25), Hungary (23) and the Czech Republic (21). In five countries, there was at least one company controlled by the state without a majority stake – most of these were in Poland (26).

Unsurprisingly, the SOEs were larger than the POEs in the analysed dataset in terms of their operating revenue and total assets.[12] A median majority SOE had an operating revenue of 284 million EUR and a median minority SOE had 430

[12] Descriptive statistics of operating revenue, total assets and profit is available upon request.

million EUR, while for POEs this value was equal to 195 million EUR. Similarly, the median values of total assets were substantially higher in the group of SOEs. Despite the fact that the median SOE had higher profit before tax than the median POE, the share of companies which reported losses was higher among the companies controlled by the state – 23% for majority SOEs and 29% for minority SOEs as compared to 12% in the group of POEs.

In the list of the 15 largest enterprises in CEE in terms of operating revenue,[13] one can indicate three minority SOEs (Polski Koncern Naftowy Orlen S.A., MOL Magyar Olaj- és Gázipari Nyrt.[14] and KGHM Polska Miedź) and two majority SOEs (Grupa LOTOS S.A., Polskie Górnictwo Naftowe i Gazownictwo S.A.). All of them were publicly-listed, which suggests that their status is an effect of 'reluctant privatisation' (Bortolotti – Faccio 2004). State ownership dominates among Poland's largest companies – four of the five entities from this country were SOEs. On the other hand, none of the five largest companies registered in the Czech Republic was an SOE (in fact, they were all owned by foreign entities).

To indicate the scale of state ownership in CEE, the data on operating revenue and total assets were summarised (*Table 3*). It should be pointed out that the countries with the highest share of majority SOEs in terms of operating revenue

Table 3. Operating revenue and total assets of SOEs by countries, 2015, %

Country	Operating revenue		Total assets	
	Majority state-owned	Minority state-owned	Majority state-owned	Minority state-owned
Bulgaria	15.61	0	35.14	0
Czech Republic	10.47	0	29.30	0
Estonia	18.77	0	54.76	0
Croatia	19.25	10.53	40.87	7.86
Hungary	8.81	8.74	7.89	9.45
Latvia	27.58	0	63.92	0
Lithuania	3.94	0	27.35	0
Poland	14.35	10.51	26.87	12.88
Romania	8.64	1.90	25.01	3.35
Slovakia	12.96	0	41.35	0
Slovenia	29.49	15.85	51.06	10.90

Source: Own elaboration based on data from Amadeus.

[13] The list is available upon request.

[14] MOL was classified as a minority SOE despite the fact that the Hungarian State held a lower ownership stake than private investors (holding at least a 5% share) jointly at the end of the years 2014 and 2015. This choice was based on a fact that the state holds special rights concerning, among others, election and dismissal of the members of the board of directors, the supervisory board's decision of the profit distribution (MOL 2017: 171).

in 2015 were Slovenia (29%) and Latvia (28%). The same indicator for minority SOEs exceeded a level of 10% for Slovenia (16%), Croatia (11%) and Poland (11%). SOEs had a substantially high share in the sum of total assets in Latvia (64%), Slovenia (62%) and Estonia (55%).

In order to measure the relative importance of SOEs among the largest companies in the CEE region, the 'Country SOE Index' was calculated. The index is an equally weighted average of SOE shares of operating revenues and total assets in the dataset.[15] It ranges from 0% to 100% – the higher the value, the more substantial share of SOEs in the analysed country. Values of the index for 11 countries in the CEE region are presented in *Figure 1*.

The index value for the whole CEE region was equal to 26%. The country with the highest SOE share of operating revenue and total assets was Slovenia – 54%. Another country with an index value higher than 40% was Latvia (46%). Three countries with values between 30% and 40% were Croatia (39%), Estonia (37%) and Poland (32%). Slovakia and Bulgaria had a SOE share close to the value of the whole analysed region – 27% and 25%, respectively. Four countries obtained index values below 20%: the Czech Republic (19.89%), Romania (19.45%), Hungary (17%) and Lithuania (16%). When compared to the year 2014, the most substantial declines in the 'Country SOE Index' in 2015 were for Slovenia (–5.62 percentage points) and Romania (–3.47 p.p.). An increase of the state share among largest enterprises was recorded in one country – Bulgaria (+1.22% p.p).

Countries with the highest share of minority SOEs were Slovenia (13%) and Poland (12%). At the same time, this group of enterprises accounted for almost a half of the value of the index in Hungary (9% out of 17%). If companies controlled by the state without a majority stake were not taken into account, the state share in the CEE region would be 24% less.

Slovenia appears to be the country with the most substantial state share among largest enterprises. Similar conclusions are presented in the report by the EC (2016). Moreover, it is pointed out that the Slovenian SOEs are present in sectors where state involvement is less pronounced in other countries (such as manufacturing and tourism). In the report, Poland, Croatia and Romania were also mentioned as countries with extensive scopes of public ownership. At the country level, a comparison to the study of Bałtowski – Kozarzewski (2016) for Polish enterprises can be made. They pointed out that state-owned and state-controlled enterprises accounted for, respectively, 9.8% and 6.3% in the sum of revenues in the whole non-financial sector in Poland in 2013. Among the 500 largest Polish

[15] A similar approach was employed by Kowalski et al. (2013) that also considered employment in their index. We decided not to include the number of employees due to the problem of missing data.

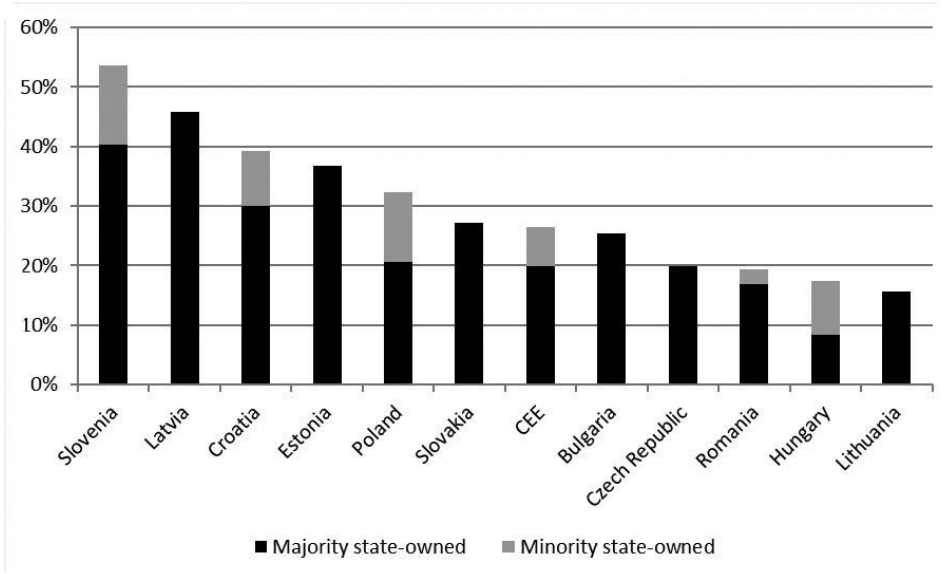

Figure 1. Country SOE Index, 2015

Source: Own elaboration based on Amadeus database.

companies, these values equalled 14.0% and 14.5%. In our study, companies with a state stake above 50% had a share of 14% in operating revenue and minority SOEs – 11%. This shows that both analyses lead to similar conclusions on the scale of state ownership in Poland and by not considering enterprises that are controlled by the state with the minority stake the state share would be substantially less. Szarzec – Nowara (2017) analysed Slovakia's largest companies and show that the SOEs accounted for 13% of turnover in 2013, while the operating revenue value in our study equalled 13% in 2015. Similarly, based on data from the EC (2016), the Romanian SOEs (with at least 50% state stake) had a share of 7.1% in revenues in 2013 as compared to 8.64% in 2015 in our research. Such comparison shows that based on individual-level data and a precisely defined classification as SOEs, one can obtain more precise measures of state involvement as an owner.

The sector structure of the largest enterprises in the CEE region is presented in *Table 4*. The manufacturing section was dominant (996 entities) in the group of largest companies in CEE. Most SOEs were classified as electricity, gas, steam and air conditioning supply (85 SOEs) and transportation and storage (69 SOEs). The share of enterprises controlled by the state was also substantial in mining and quarrying (15 SOEs of 33 entities) and arts, entertainment and recreation (5 SOEs of 13 companies).

Table 4. Number of large enterprises by sectors, 2015

Main section, NACE Rev. 2	Status			Total
	POE	Majority state-owned	Minority state-owned	
B. Mining and quarrying	18	13	2	33
C. Manufacturing	963	18	15	996
D. Electricity, gas, steam and air conditioning supply	82	73	12	167
F. Construction	87	3	4	94
G. Wholesale and retail trade; repair of motor vehicles and motorcycles	506	5	3	514
H. Transportation and storage	47	65	4	116
J. Information and communication	85	7	0	92
L. Real estate activities	6	2	0	8
M. Professional, scientific and technical activities	28	6	1	35
N. Administrative and support activities	21	1	1	23
R. Arts, entertainment and recreation	8	5	0	13

Source: Own elaboration based on data from Amadeus.

The 'Sector SOE Index' was employed to compare the state share in terms of operating revenue and total assets by sector. *Figure 2* shows the index values in 2015. The highest state share was indicated in the transportation and storage sector – 77%. This was driven by the fact that the largest enterprises in this sector operated in rail transportation and pipeline transportation, which were dominated by the state.

Another sector with a substantial state share was electricity, gas, steam and air conditioning supply (67%). 6 of the 10 largest natural gas distribution companies in terms of assets were state-owned in 2015. At the same time, there were seven SOEs among the 10 largest enterprises in electric power generation, transmission and distribution.

The index value was also higher than 50% in mining and quarrying and professional, scientific and technical activities (56% each). In the first sector, the largest SOEs were operating in metal ore mining, coal mining and oil and gas extraction. In the second one, the value was driven by the fact that PGE Polska Grupa Energetyczna S.A., Polskie Koleje Państwowe S.A. and Cesky Aeroholding, a.s. were classified as operating in the management of companies and enterprises. All of them are parent companies of subsidiaries operating mainly in, respectively, energy supply, rail and air transportation. This shows that, by employing consoli-

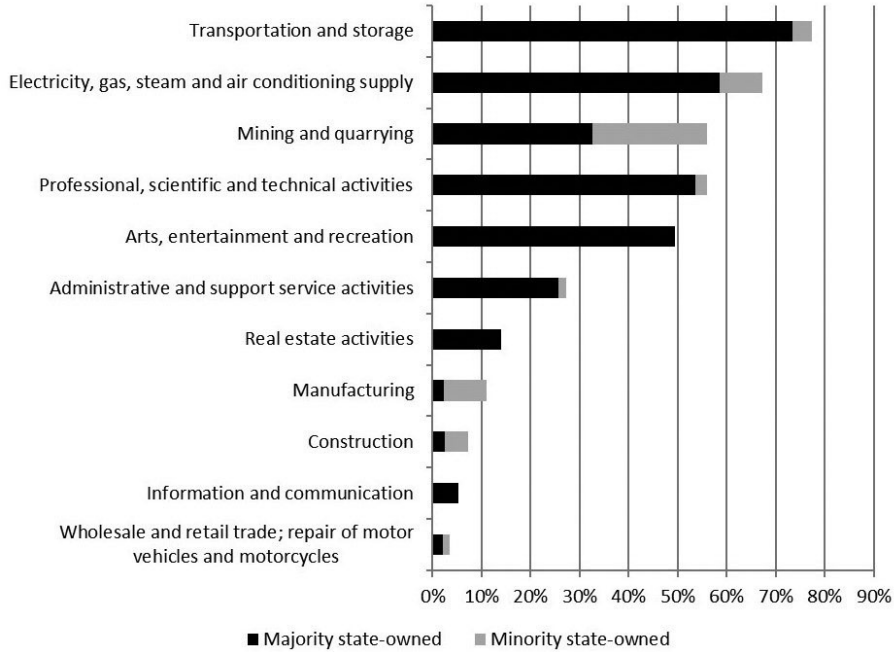

Figure 2. Sector SOE Index, 2015

Source: Own elaboration based on data from Amadeus.

dated accounts, one cannot account for the broad range of activities of the holding companies and conglomerates, and that the share of such enterprises in particular sectors can be either overestimated or underestimated.

Besides all this, 49% of SOEs were recorded in the arts, entertainment and recreation sector. This was due to state control over the largest companies in the gambling industries in Hungary, Poland, Romania, Slovakia and Slovenia.

The index value for the sector with the highest number of observations in the dataset – manufacturing – was equal to 10.5%. The share of minority SOEs was the highest in the mining and quarrying (23%), electricity, gas, steam and air conditioning supply (9%) and manufacturing (8%) sectors.

The dominant role of the state in the energy and transport sectors in the CEE countries was already indicated by the EC (2016). The presence of companies controlled by the state in these sectors is often justified by the need to correct market failures and to provide essential services at lower prices in less competitive markets. Kowalski et al. (2013) pointed out that mining, the extraction of crude petroleum and gas and transport were sectors with the highest state share in the group of the world's largest companies. Szarzec – Nowara (2017) showed

that there was at least one energy supplier controlled by the government among the largest enterprises in each of the 13 analysed countries of CEE. Therefore, it may be said that the results in our study are in line with the conclusions presented in the literature.

4. DETAILED ANALYSIS

State intervention through enterprises is often justified as a means to correct market failures or to provide services to society at subsidized and/or controlled prices and good quality. SOEs might also be used to foster innovativeness, to protect employment in a particular sector or region and as a tool of international expansion (Bałtowski – Kwiatkowski 2017). Bozec et al. (2002) pointed out that the main reason for setting up SOEs is rarely maximisation of profit and this impacts on their financial performance. Nevertheless, profitability and efficiency of state companies might be substantially lower even when they pursue the same set of goals as their privately-owned counterparts. It might be due to soft budget constraints, corruption or rent-seeking behaviours or a combination of all these reasons (Kornai 1986; Estrin – Perotin 1991; Vickers – Yarrow 1991; Shleifer – Vishny 1997; Shleifer 1998; Toninelli 2000).

In this study, the financial performance of SOEs is assessed with a focus on the profitability, the efficiency with which they use their capital and labour and the ability to meet their short-term and long-term obligations. 10 ratios from the Amadeus database[16] are employed to compare the financial performance of SOEs (including both majority and minority SOEs) to the group of POEs.

One of the most commonly used methods of analysing the differences among group means is the analysis of variance (ANOVA) (StatSoft 2006). Its purpose is to test differences in means by partitioning the total variance into components that are due to true random error (within group, SS error) and differences between means caused by analysed factors (treatments, SS effects). The latter variance components are tested for statistical significance with the null hypothesis that there are no differences between means. As it was discussed in the previous part, the numbers of SOEs differ substantially among the different sectors, therefore in the ANOVA analysis one needs to also address the issue that the values of ratios may be different due to operation in various sectors of the economy. For this reason, it was decided to employ the two-way ANOVA with independent variables indicating ownership status and the sector in which a particular enterprise operates (based on the NACE Rev. 2, main section classification (Eurostat 2008)).

[16] The formulae are presented in *Table A1* in the *Appendix*.

ANOVA is a parametric test that assumes that analysed data are normally distributed. This assumption was tested for the values of the employed ratios and it was shown that each of them was not normally distributed. However, in the literature (Harwell et al. 1992), it was indicated that when the number of observations is sufficiently high, due to the central limit theorem the violation of the assumption on normal distribution does not significantly influence the value of the F-test and does not lead to an increase in the false positive rate in ANOVA. Therefore, it can be argued that the two-way ANOVA is an appropriate method for this study. Nevertheless, to avoid the incorrect rejection of a true null hypothesis and to check the robustness of the results, it was decided to conduct an additional analysis with a nonparametric test that does not require the assumption of normal distributions.

The Mann-Whitney U test allows to check if there are significant differences in medians between two groups and the null hypothesis states that there are no statistically significant differences. The test is based on the *U* statistic that is calculated by assigning numeric ranks to all observations from both groups, adding up the ranks for observations from the same group and adjusting by the group sample size (StatSoft 2006).

In the next two parts, the results of the analysis using the two-way ANOVA and the Mann-Whitney test are presented. Tests were conducted for each of the ratios. In the two-way ANOVA, first-order (non-interactive) effects of ownership status and sectors were analysed. Since the Mann-Whitney U test is a nonparametric test that checks differences in medians due to one factor (ownership status), it was decided to also provide results for smaller samples to address the problem of different levels of ratios between sectors.

5. RESULTS AND ROBUSTNESS CHECK

Table 5 shows whether differences between means due to ownership status are statistically significant based on the two-way ANOVA.[17] The results reveal that there are significant differences (at the 1% level) in the means of the EBITDA margin and cash flow to operating revenue ratios in both the analysed years. It shows that SOEs were characterised by higher earnings (before interest taxes, depreciation and amortisation) on operating revenue and a higher ability to generate cash from revenues. However, when depreciation and amortisation were considered, means differed significantly only at the 10% level in 2015. In the case of

[17] Detailed results of the two-way ANOVA and descriptive statistics of the ratios are available from the authors upon request.

Table 5. Two-way ANOVA of financial ratios

Indicator (unit)	Year	POE		ANOVA	SOE	
		N[18]	Weighted means		Weighted means	N
EBITDA margin (%)	2015	1554	10.50	<***	20.06	178
	2014	1549	10.20	<***	19.11	182
Cash flow / Operating revenue (%)	2015	1551	9.07	<***	19.32	177
	2014	1536	8.59	<***	17.85	174
EBIT margin (%)	2015	1895	6.25	<*	6.91	232
	2014	1892	6.09	<	7.76	242
Profit margin (%)	2015	1893	5.68	<	6.91	236
	2014	1893	5.36	<	7.30	241
ROA using P/L before tax (%)	2015	1897	7.07	>***	2.58	238
	2014	1857	6.85	>***	3.51	237
ROE using P/L before tax (%)	2015	1851	17.18	>	6.96	231
	2014	1854	17.60	>***	2.35	233
ROCE using P/L before tax (%)	2015	1458	15.79	>	6.36	147
	2014	1463	16.91	>**	3.11	149
Solvency ratio, asset based (%)	2015	1904	44.24	<***	49.02	237
	2014	1898	43.84	<**	49.61	243
Current ratio (x)	2015	1900	1.75	<	2.02	239
	2014	1897	1.73	<	1.84	244
Costs of employees / Operating revenue (%)	2015	1528	8.39	<***	17.61	165
	2014	1530	8.34	<***	17.45	173

Notes: ***1%, **5%, *10% significance levels. N = number of observations. A SOE group consists of both majority and minority state-owned enterprises.

Source: Own elaboration with Statistica based on data from Amadeus.

the profit margin before tax, it should be pointed out that despite the fact that the weighted means were slightly higher for the SOE group, these differences were statistically insignificant.

In the next step, returns on assets, shareholders' funds and capital employed were compared. Results suggest that POEs recorded higher profits from the capital they used – this may be interpreted as an indicator of their higher efficiency. All differences were significant at least at the 5% level in 2014. The ROA ratio was also substantially higher in the group of POEs in 2015, however, the ROE and ROCE ratios did not differ significantly at the 10% level despite the higher weighted means of the POEs.

[18] The number of observations varies due to missing data for some ratios, from 1612 to 2141 in 2014 and from 1605 to 2139 in 2015.

A substantially higher share of shareholders' funds in total assets was observed in the SOE group in both of the analysed years. This shows that SOEs were significantly less leveraged than privately-owned counterparts. At the same time, there were no significant differences in the means of the current ratio. Therefore, one can point out that the ability to pay its short-term obligations did not differ significantly between the POE and SOE groups.

The costs of employees to operating revenue were significantly higher (at the 1% level) in the SOE group in 2014 and 2015, which could suggest that SOEs were overemployed and/or their employees were overpaid.

The Mann Whitney U test was employed to check the robustness of the results. The test was conducted for all enterprises in the dataset and by particular sectors (electricity, gas, steam and air conditioning supply; manufacturing; transportation and storage; mining and quarrying).[19] The results of the test are summarised in *Table A2* in the *Appendix*.[20]

An analysis of the whole dataset indicates that SOEs had a substantially higher EBITDA margin and cash flow to operating revenue ratios. When division by sector was considered, differences were significant in transportation and storage. As previously, the test values of EBIT and profits margins lead to ambiguous conclusions.

The ROA, ROE and ROCE ratios were higher in the group of POEs in each specification. All differences in the median values were statistically significant in the whole dataset and individually for the transportation and storage and manufacturing sectors.[21] In the energy sector, the ROCE ratio was substantially higher in both the analysed years.

SOEs had a higher median value for the solvency ratio (apart from mining and quarrying in 2015), which shows that they were less leveraged and had a higher ability to meet long-term obligations. Differences were statistically significant in the whole dataset and manufacturing. At the same time, the median of the current ratio, which is a measure of the ability to pay short-term obligations, was substantially higher when all sectors were considered and in transportation and storage.

Costs of employees to operating revenue were higher among SOEs and differences were statistically significant in each specification.

[19] The number of SOEs exceeded a level of 10 in each of the selected sectors. This threshold was set to avoid the problem of a small sample size. SOEs from these four sectors accounted for 84% (2015) and 85% (2014) of the total number of SOEs in the dataset.

[20] Detailed results are available upon request from the authors.

[21] There were no substantial differences indicated in mining and quarrying, however it should be pointed out that one needs to treat results in this sector with caution due to the small sample size (18 POEs and 15 SOEs in 2015).

6. CONCLUSIONS

Our analysis shows that the state is still a significant player in the national economy of the CEE countries, though the scale of state ownership varies. We estimated the real share of state ownership including companies with a minority but controlling stake by the state, which is neglected in a lot of research. Without minority SOEs the scale of state ownership in the region would be lessened by approximately one-quarter. In order to compare the economic weight of SOEs in countries and sectors, we introduced two SOE indices. The 'Country SOE Index' is the highest in Slovenia, Latvia and Croatia, while the lowest in Hungary and Lithuania. The 'Sector SOE Index' values show that the main sections H (transportation and storage) and D (energy supply) were dominated by the state.

Analysis employing two-way ANOVA and its robustness check reveal that the SOEs had a higher EBITDA margin and cash flow to operating revenue ratios, this suggests their stronger market position and a higher ability to generate cash from revenues. When EBIT and profit margins were considered as measures of profitability, no substantial differences were indicated. POEs were characterised by higher returns on assets, shareholders' funds and capital employed ratios. This indicates that the capital in SOEs was employed less efficiently than in POEs. SOEs were less leveraged and did not have a substantially higher ability to cover their short-term obligations. Significantly higher employee costs to operating revenue suggest overemployment and/or the fact that workers were overpaid and may be an indicator of the inefficiency of state-owned companies. These results suggest that SOEs have still the potential to improve their corporate governance and financial results.

Our results are in line with other literature indicating that SOEs are characterised by lower returns on the capital employed and higher employee costs. At the same time, the higher cash flow to operating revenue ratio and EBITDA margin may suggest that SOEs use their market power to keep more favourable terms of sales and to increase margins. This may contradict the hypothesis that the poorer performance of SOEs is an effect of incurring the social burden of providing essential services at lower prices. This issue, along with consumer costs, should be addressed in further research. Furthermore, we believe that for each SOE there is a need to explicitly indicate a set of goals that such an entity fulfils. This will allow assessing more precisely costs and gains of state intervention through enterprises, considering not only financial performance but also other aims, including political and social ones.

REFERENCES

Abramov, A. – Radygin, A. – Entov, R. – Chernova, M. (2017): State Ownership and Efficiency Characteristics. *Russian Journal of Economics,* 3: 1–23.

Bałtowski, M. – Kozarzewski, P. (2016): Formal and Real Ownership Structure of the Polish Economy: State-Owned Versus State-Controlled Enterprises. *Post-Communist Economies*, 28(3): 405–419.

Bałtowski, M. – Kwiatkowski, G. (2017): *Przedsiębiorstwa państwowe we współczesnej gospodarce* (State-Owned Enterprises in the Contemporary Economy). Warszawa: PWN.

Borghi, E. – Del Bo, C. – Florio, M. (2016): Institutions and Firms' Productivity: Evidence from Electricity Distribution in the EU. *Oxford Bulletin of Economics and Statistics,* 78(2): 170–196.

Bortolotti, B. – Cambini, C. – Rondi, L. (2013): Reluctant Regulation. *Journal of Comparative Economics*, 41(3): 804–828.

Bortolotti, B. – Faccio, M. (2004): Reluctant Privatization. *Nota di Lavoro, Fondazione Eni Enrico Mattei*, No. 130.2004. Milano: Fondazione Eni Enrico Mattei.

Boyer, R. (2006): Half a Century of Development Theories. An Institutional Survey. In: Stathakis, G. – Vaggi, G. (eds): *Economic Development and Social Change. Historical Roots and Modern Perspectives.* London – New York: Routledge, pp. 29–73.

Böwer, U. (2017): State-Owned Enterprises in Emerging Europe: The Good, the Bad, and the Ugly. *IMF Working Paper*, No. 17(221), Washington.

Bureau van Dijk (2017): Amadeus Database. https://amadeus.bvdinfo.com/.

Christiansen, H. (2013): Balancing Commercial and Non-Commercial Priorities of State-Owned Enterprises. *OECD Corporate Governance Working Papers*, No. 6. Paris: OECD Publishing.

Clearstream (2018): *Disclosure Requirements*. http://www.clearstream.com/.

EBRD (1999): *Transition Report 1999. Ten Years of Transition*. London.

EMIS (2017): *EMIS Emerging Markets Information Services*. http://www.emis.com/.

Estrin, S. – Perotin, V. (1991): Does Ownership Always Matter? *International Journal of Industrial Organization*, 9(1): 55–72.

European Commission (2016): State-Owned Enterprises in the EU: Lessons Learnt and Ways Forward in a Post-Crisis Context. *Institutional Paper,* No. 031. Luxembourg: Publishing Office of the European Union.

Eurostat (2008): *NACE Rev. 2: Statistical classification of Economic Activities in the European Community*. Luxembourg: European Communities.

Florio, M. (2014): The Return of Public Enterprise. *Centre for Industrial Studies (CSIL) Working Papers*. Milano, Italy.

Goldeng, E. – Grünfeld, L. – Benito, G. (2008): The Performance Differential between Private and State Owned Enterprises: The Roles of Ownership, Management and Market Structure. *Journal of Management Studies,* 45(7): 1244–1273.

Götz, M. – Jankowska, B. (2017): Outward Foreign Direct Investment by Polish State-Owned Multinational Enterprises: Is 'Stateness' an Asset or a Burden? *Post-Communist Economies*, 30(2): 216–237.

Harwell, M. R. – Rubinstein, E. N. – Hayes, W. S. – Olds, C. C. (1992): Summarizing Monte Carlo Results in Methodological Research: The One- and Two-Factor Fixed Effects ANOVA Cases. *Journal of Educational and Behavioral Statistics,* 17(4): 315–339.

Irwin, D. A. (2008): Infant-Industry Protection. In: Durlauf, S.N. – Blume, L. E. (eds): *The New Palgrave Dictionary of Economics.* London: Palgrave Macmillan.

Kornai, J. (1986): The Soft Budget Constraint. *Kyklos,* 39(1): 3–30.

Kornai, J. (2006): The Great Transformation of Central Eastern Europe: Success and Disappointment. *Economic Transition,* 14(2): 207–244.

Kowalski, P. – Buge, M. – Sztajerowska, M. – Egeland, M. (2013): State-Owned Enterprises: Trade Effects and Policy Implications. *OECD Trade Policy Papers*, No. 147. Paris: OECD Publishing.

Kozarzewski, P. (2006): *Prywatyzacja w krajach postkomunistycznych* (Privatisation in Post-Socialist Countries). Warszawa: Instytut Nauk Politycznych PAN.

Kozarzewski, P. – Bałtowski, M. (2016): Change in Economic Policy Paradigm: Privatization and State Capture in Poland. *CASE Working Papers*, No. 3.

Liao, S. – Zhang, Y. (2014): A New Context for Managing Overseas Direct Investment by Chinese State-Owned Enterprises. *China Economic Journal,* 7(1): 126–140.

Lin, J. Y. – Monga, C. (2012): The Growth Report and New Structural Economics. In: Lin, J.Y. (eds): *New Structural Economics. A Framework for Rethinking Development and Policy*. Washington: The World Bank.

MOL (2017): *MOL Group Annual Report 2016*. Budapest, Hungary: MOL. https://molgroupp.info/images/molgroup/pdf/investor_relations/annual_general_meeting/documents/mol_group_annual_report_2016_en_0606.pdf.

OECD (2005): *OECD Comparative Report on Corporate Governance of State-Owned Enterprises*. Paris: OECD Publishing.

OECD (2017): *The Size and Sectoral Distribution of State-Owned Enterprises.* Paris: OECD Publishing.

Privatization – What's Next (2013): Report from the Conference about the Future of the Public Sector (Warsaw 13 May 2013). CASE − Ministry of Treasury of the Republic of Poland – OECD. https://msp.gov.pl/download/3/3737/privatisationwhatsnextenglishreportfinal.

Putniņš, T. J. (2015): Economics of State-Owned Enterprises. *International Journal of Public Administration,* 38(11): 815–832.

Roland, R. (2008): *Privatization. Successes and Failures*. New York: Columbia University Press.

Shleifer, A. (1998): State versus Private Ownership. *Journal of Economic Perspectives*, 12(4): 133–150.

Shleifer, A. – Vishny, R. W. (1997): A Survey of Corporate Governance. *The Journal of Finance*, 52 (2): 737–783.

Snowdon, B. (2007): *Globalisation, Development and Transition*. Cheltenham UK–Northampton USA: Edward Elgar.

StatSoft (2006): *Elektroniczny Podręcznik Statystyki PL* (Electronic Statistical Handbook). Kraków, Poland.

Szanyi, M. (2016): The Reversal of the Privatisation Logic in Central European Transition Economies. *Acta Oeconomica,* 66(1): 33–55.

Szarzec, K. – Nowara, W. (2017): The Economic Performance of State-Owned Enterprises in Central and Eastern Europe. *Post-Communist Economies,* 29(3): 375–391.

Thomson Reuters (2017): EIKON Thomson Reuters, https://financial.thomsonreuters.com/en/products/tools-applications/trading-investment-tools/eikon-trading-software-c.html.

Toninelli, P. A. (ed.) (2000): *The Rise and Fall of Public Enterprise in the Western World*. Cambridge: Cambridge University Press.

Vickers, J. – Yarrow, G. (1991): Economic Perspectives on Privatization. *The Journal of Economic Perspectives*, 5(2): 111–132.

APPENDIX

Table A1. Financial ratios from the Amadeus database

Ratio (unit)	Definition
Profitability ratios, %	
EBITDA margin	$\frac{EBITDA}{Operating\ revenue} * 100$
EBIT margin	$\frac{EBIT}{Operating\ revenue} * 100$
Profit margin	$\frac{Profit\ before\ tax}{Operating\ revenue} * 100$
ROA using P/L before tax	$\frac{Profit\ before\ tax}{Total\ assets} * 100$
ROE using P/L before tax	$\frac{Profit\ before\ tax}{Shareholders'\ funds} * 100$
ROCE using P/L before tax	$\frac{Profit\ before\ tax + Interest\ paid}{Shareholders'\ funds + Noncurrent\ liabilities} * 100$
Structure ratios	
Solvency ratio, asset based	$\frac{Shareholders'\ funds}{Total\ assets} * 100$
Current ratio (x)	$\frac{Current\ assets}{Current\ liabilities}$
Other ratios	
Cash flow/Operating revenue	$\frac{Cash\ flow}{Operating\ revenue} * 100$
Costs of employees/Operating revenue	$\frac{Costs\ of\ employees}{Operating\ revenue} * 100$

Source: Own elaboration based on the Amadeus database, 2017.

Table A2. Robustness check

Indicator (unit)	Year	Two-way ANOVA	Mann Whitney U test	Mann Whitney U test	Mann Whitney U test	Mann Whitney U test	Mann Whitney U test
		All sectors	All sectors	Electricity, gas, steam and air conditioning supply	Transportation and storage	Manufacturing	Mining and quarrying
EBITDA margin (%)	2015	SOE***	SOE***	SOE	SOE*	SOE	SOE
	2014	SOE***	SOE***	SOE	SOE**	SOE	SOE
Cash flow / Operating revenue (%)	2015	SOE***	SOE***	SOE	SOE***	SOE	SOE
	2014	SOE***	SOE***	SOE**	SOE***	POE	SOE
EBIT margin (%)	2015	SOE*	POE	SOE	POE	POE	POE
	2014	SOE	POE	SOE	POE	POE*	POE
Profit margin (%)	2015	SOE	SOE	SOE	POE	POE	POE
	2014	SOE	SOE	SOE*	POE	POE	POE
ROA using P/L before tax (%)	2015	POE***	POE***	POE	POE***	POE**	POE
	2014	POE***	POE***	POE	POE***	POE***	POE
ROE using P/L before tax (%)	2015	POE	POE***	POE*	POE***	POE***	POE
	2014	POE***	POE***	POE	POE***	POE***	POE
ROCE using P/L before tax (%)	2015	POE	POE***	POE**	POE***	POE*	POE
	2014	POE**	POE***	POE**	POE***	POE**	POE
Solvency ratio (Asset based)	2015	SOE***	SOE***	SOE	SOE	SOE**	POE
	2014	SOE**	SOE***	SOE	SOE	SOE**	SOE
Current ratio (x)	2015	SOE	POE*	SOE	POE**	SOE*	POE
	2014	SOE	POE**	SOE	POE**	SOE	POE
Costs of employees / Operating revenue (%)	2015	SOE***	SOE***	SOE***	SOE***	SOE**	SOE*
	2014	SOE***	SOE***	SOE**	SOE***	SOE***	SOE*

Notes: ***1%, **5%, *10% significance levels. *SOE* and *POE* denote that a weighted mean (two-way ANOVA) or a median (Mann Whitney U test) is higher in the group of, respectively, SOEs or POEs. A SOE group consists of both majority and minority SOEs.

Source: Own elaboration.

Journal of Comparative Economics 49 (2021) 1068–1087

Contents lists available at ScienceDirect

Journal of Comparative Economics

journal homepage: www.elsevier.com/locate/jce

Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries

Piotr Matuszak [a,*], Bartosz Kabaciński [b]

[a] Poznań University of Economics and Business, Institute of Economics, 61-875 Poznań, al. Niepodległości 10, Poland
[b] Poznań University of Economics and Business, Institute of Accounting and Finance Management, 61-875 Poznań, al. Niepodległości 10, Poland

ARTICLE INFO

JEL classification:
Q48
Q41
L21
L33

Keywords:
State owned enterprises
SOEs
State ownership

ABSTRACT

This study considers the financial performance of state-owned enterprises (SOEs) in relation to non-commercial goals. We focus on enterprises operating in the production of electricity sector in the EU countries and analyse their profitability conditioning on the level of electricity prices. We reveal that SOEs underperform as compared to their privately owned counterparts when they operate in those markets that have lower prices. This suggests that their profitability is likely to be substantially affected by pursuing goals other than profit-maximisation - providing crucial products and services at affordable prices - and emphasises a need to consider the non-commercial objectives of SOEs in the empirical research.

1. Introduction

The conventional wisdom is that state-owned enterprises (SOEs) financially underperform as compared to their private counterparts. There are many reasons for this possible financial underperformance, including agency problems, lack of well-defined groups of monitoring, soft budget constraints, the employment of SOEs as 'political goods' and cronyism. Nevertheless, in the literature, it is also argued that the financial underperformance of SOEs might be caused by the fact that they fulfil a wider set of goals than privately-owned enterprises (POEs), including goals other than profit-maximisation, which has a negative impact on their profitability but is socially desirable. Despite the broadly discussed importance of the non-commercial aims of enterprises owned by the state, this field is still a neglected aspect in the empirical analyses of state ownership. We contribute to the literature on state ownership by analysing the relationship between the non-commercial goal of providing crucial services at affordable prices and the relative financial performance of SOEs. To the best of our knowledge, this is the first study examining explicitly the price levels as a conditioning factor of SOE profitability (as compared to POEs).

We employ data for enterprises that operate in the production of electricity sector in the EU countries over the period 2007 and 2016. This allows us to use data on the prices of a highly standardised product, that is, electricity, in a sector in which SOEs and POEs compete on an equal basis across countries that share common supranational sectoral regulations. At the same time, the EU policies are explicitly neutral on the ownership structure of enterprises, and the level of state involvement through enterprises in this sector varies substantially between the EU countries (Florio, 2013a; European Commission, 2016).

* Corresponding author.
E-mail address: piotr.matuszak@ue.poznan.pl (P. Matuszak).

https://doi.org/10.1016/j.jce.2021.03.002
Received 16 January 2020; Received in revised form 9 March 2021; Accepted 12 March 2021
Available online 20 April 2021

The econometric analysis with the random effects model employing the Driscoll and Kraay cross-sectional correlation robust standard errors (Driscoll and Kraay, 1998) shows that SOEs had substantially lower profitability than POEs. By introducing the interaction terms between the ownership status and prices, we revealed that SOEs were characterised by lower profitability than POEs in those markets that have lower prices and there were no substantial differences in terms of financial performance between SOEs and POEs at higher price levels. Analysis of these results indicates that the most plausible explanation for this performance difference is the fact that state-owned enterprises fulfil the non-commercial goal of providing crucial services at affordable prices, which strongly emphasises the need to focus on a broader set of objectives than only financial ones in empirical analyses of state ownership in enterprises. This conclusion is not based on a direct test of the proposition, since no company-level electricity price data for such a broad set of countries is available. The test is indirect and, first, builds on the theoretical literature that underlines the role of the non-commercial goals of SOEs and the empirical literature at the macroeconomic level which shows that the presence of state-owned enterprises in the electricity sector is associated with lower prices; second, it checks whether there are substantial differences in financial performance between SOEs and POEs in the production of electricity sector in the EU countries; and finally, it examines whether apparent financial underperformance of SOEs is associated with price levels (collected at the country-level).

Discussion on the role of the state as an owner of enterprises is an important part of the economic discourse as state-owned enterprises still play a substantial role in the world economy—282 out of the 2000 largest publicly listed companies worldwide were state-owned in the years 2012–2013 (Christiansen and Kim, 2014) and SOEs accounted for more than 20% of very large enterprises in terms of total assets over the period 2007–2016 in 19 out of 30 European countries analysed by Szarzec et al. (2021). State ownership seems to be persistent despite the privatisation processes that were started in many developed and post-socialist countries in the 1980s and 1990s (Guislain, 1997; Roland, 2000; Megginson and Netter, 2001; Bortolotti et al., 2004). In the EU countries, state-owned enterprises play a particularly important role in the network industries in which they are often used to support the security of supply, long-term investments and social affordability (Florio, 2013a, 2013b).

The remainder of this article is organised as follows. In Section 2, we describe the related literature. Section 3 presents the research design and the hypotheses to be tested. In Section 4, we describe the data collected and used in the empirical analysis. Section 5 contains the presentation of the econometric approach, and Section 6 shows the results of our research and robustness checks. We discuss the results obtained, our conclusions and policy implications in Section 7.

2. Aims of SOEs and their financial performance—a selected literature overview

The efficiency of SOEs and their performance as compared to POEs have been a broadly discussed topic since the 1980s and 1990s. One of the most cited articles in this field is a survey study that was completed by Megginson and Netter (2001). In this study, the authors analysed the efficiency of state versus private ownership and post-privatisation performance in both developed and transition countries. They concluded that research supports the proposition that SOEs are less efficient and less profitable than POEs and that privatisation improves the performance of divested enterprises. Further survey studies (Shirley and Walsh, 2000; Djankov and Murrell, 2002; Estrin et al., 2009; Megginson, 2017; Wang and Shailer, 2018; Tihanyi et al., 2019) have also provided some evidence for the underperformance of SOEs and the positive effects of privatisation.

State-owned enterprises might underperform POEs for a number of reasons, including agency problems, lack of well-defined groups of monitoring, soft budget constraints, the employment of SOEs as 'political goods' and cronyism (Shleifer, 1998; Megginson and Netter, 2001; La Porta et al., 2002). However, some authors (e.g., Bozec et al., 2002, 2006; Christiansen, 2013; Muhlenkamp, 2015; Bałtowski and Kwiatkowski, 2018; Estrin et al., 2019) have also underlined that the relative financial underperformance of SOEs might be primarily because SOEs fulfil a broader set of goals than POEs, including non-commercial ones which clearly have an adverse impact on their profitability but are socially desirable.

The problem of a lack of alignment of objectives between agents and principals has been analysed by agency theorists (Jensen and Meckling, 1976) and is of particular importance for SOEs. Managers of SOEs might not be motivated to improve financial performance due to a lack of clearly defined incentives and a lack of sufficient monitoring by the multiple principals of the SOE (e.g., government, ministry, state-owned holding company, society) that do not have their wealth at stake in the performance of their monitoring responsibilities (Shleifer and Vishny, 1998; Hartley and Medlock, 2008; Chen et al., 2009; D'Souza and Nash, 2017). Soft budget constraints are another factor that limit efficiency-orientated behaviour in SOEs (Kornai, 1979; Kornai et al., 2003). The state might support these enterprises by public aid, favourable taxing, lending policy and limited competition in the sector, which allow SOEs to operate inefficiently without facing the risk of insolvency and bankruptcy (Bałtowski and Kwiatkowski, 2018). State-owned enterprises might also be used by politicians to seek private gains. Evidence pointing to *trusted colleagues* can be found in the regular rotations of executives in state-owned enterprises, depending on the results of political elections, and partiality in awarding jobs, as well as other advantages (Wang and Wang, 2013; Liu and Zhang, 2018; Szarzec et al., 2020). What is more, SOEs can be employed as political tools to manipulate economic outcomes in the run-up to elections and, therefore, support the re-election of incumbents, leading at the same time to the political business cycles (Nordhaus, 1975; Shleifer and Vishny, 1994; Baskaran et al., 2015; Englmaier et al., 2017).

The objectives of SOEs that are other than profit-maximisation might consist of addressing market failures, including natural monopolies and externalities; enhancing economic growth; supporting the national defence and protecting strategic sectors; stabilising the economy by providing employment; assuring reliable and sustainable service; and supplying essential services at affordable prices (Bai et al., 2000; Robinett, 2006; Kowalski et al., 2013; Bałtowski and Kwiatkowski, 2018). State-owned enterprises have often been created because markets were unable to sufficiently meet critical societal needs because of market failures (Bator, 1958). SOEs might operate in a sector where competition and market regulation are not deemed efficient or feasible, which should allow the takeover of monopolistic rents for the good of the whole society. Similarly, the state keeps control over enterprises that internalise positive

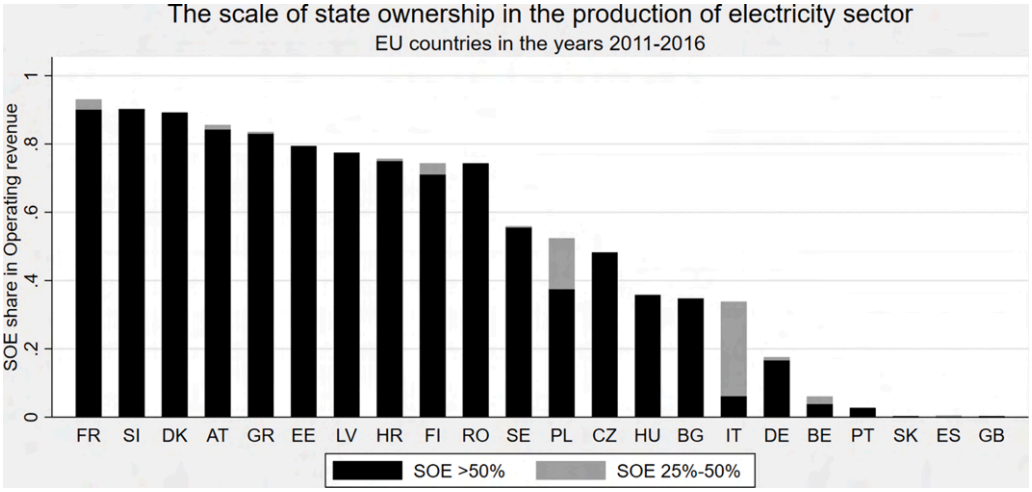

Fig. 1. State ownership in the EU countries. Source: own elaboration based on data from Amadeus. The scale of state ownership calculated as an average yearly share of SOEs in the sum of operating revenues in the period 2011 to 2016.

externalities by providing the necessary infrastructure or mobilising capital for economic development (European Commission, 2016). The role of SOEs as an important tool of the industrial policy and development strategies is broadly emphasised in the literature (e.g., Bremmer, 2009; Lin, 2010; Musacchio and Lazzarini, 2014). *National champions* can be employed to encourage industrialisation and exports by launching new and emerging industries, especially when start-up costs are significant and long-term investments are needed and that positively contribute to economic development (Lin and Milhaupt, 2013; Musacchio and Lazzarini, 2014). Some authors (e.g., Mazzucato, 2013; Tõnurist, 2015) also underline the role of entities owned by the state in supporting innovations and enhancing technological spin-offs. At the same time, there are sectors in the economy that might be considered as strategic and crucial for national defence and, therefore, the state limits private and foreign ownership of them, for example, the arms and network industries (Robinett, 2006; Florio, 2013a). State-owned enterprises can fulfil the important social and political goals of stabilising the economy and supporting vulnerable social groups by preserving employment, especially during economic slowdowns (Bai et al., 2000; Prabowo et al., 2018). SOEs are also often used to control the decline of sunset industries (e.g., mining) in order to avoid an accumulation of the negative effects of long-term unemployment and the deterioration of industrial regions. State ownership in enterprises might also be justified as enhancing the availability of comprehensive services for society. This means that SOEs are used not only to provide necessary infrastructure but also to increase access to crucial products and services by setting prices based on affordability, especially for services characterised by a low level of competition (Hartley and Medlock, 2008; Fiorio and Florio, 2013; Florio, 2013a).

The questions most often researched about state ownership are its implications for enterprise financial performance (Tihanyi et al., 2019). Despite the fact that the non-commercial aims of SOEs have been broadly discussed in the literature, there are very few empirical studies that explicitly account for objectives other than profit maximisation in the empirical analysis of financial performance between state- and privately owned enterprises. One is by Bozec et al. (2002), who analysed the performance of 20 SOEs and 300 POEs in Canada in the period of 1976 to 1996. The authors classified state-owned enterprises as either profit-maximisers or non-profit-maximisers based on qualitative criteria and conducted separate regression analyses for both groups. Their results showed that non-profit-maximising SOEs had relatively lower return on assets, return on sales and asset turnover, while profit-maximising SOEs either outperformed POEs (when monopolies were included in the analysis) or there were no substantial performance differences (when monopolies were excluded). Eller et al. (2011) studied the relative efficiency of state versus private ownership in the petroleum industry with data envelope analysis and stochastic frontier analysis based on a panel of 78 global oil companies in the years 2002–2004. They indicated that national (state-owned) oil companies (NOCs) were less efficient in generating revenues from employment and resource reserves. However, the authors pointed out that much of this inefficiency could be explained by the non-commercial goals of NOCs. They used a proxy based on domestic motor fuel prices to control for possible oil subsidies (a dummy variable that was 1 if the price was below the US level). After including this variable in the analysis, the impact of state ownership was still negative and significant, however of the smaller magnitude. The authors considered also excess employment and showed that increased employment had less of a positive effect on revenue in NOCs than in privately owned entities. The authors concluded that the relative inefficiencies of NOCs, which were indicated when one considered only commercial objectives, were to a large extent the result of redistributing resource rents. The further analysis by Hartley and Medlock (2013), using data on 61 oil companies in 2001–2009, led to very similar conclusions.

The abovementioned studies show that research that did not consider objectives other than profit-maximisation and interpreted the financial underperformance of SOEs as evidence of their technical inefficiencies might be misleading and biased in favour of private ownership—SOEs might aim at, for example, providing some services at prices that maximise social welfare, which leads to lower margins and apparent financial underperformance even though they might manage their resources technically as efficiently as POEs. Compared to Bozec et al. (2002), Eller et al. (2011) and Hartley and Medlock (2013), our study extends the analysis of the

non-commercial goals of SOEs by including price levels as a conditioning factor of the relative financial performance of SOEs; by using data on a broad set of enterprises operating in a sector in which SOEs and POEs compete on an equal basis across countries that share common supranational regulations; and by employing more comprehensive panel data methods.

3. Research design and hypotheses

Based on the literature review presented in Section 2, the analysis of the performance of SOEs should consider more than commercial goals, including social and political objectives that could alter their financial results. In this study, our purpose is to assess the relationship between the fulfilment of the non-commercial objective of providing crucial services at affordable prices and the financial performance of SOEs (relative to POEs). In such an analysis, data from a sector that allows the comparison of the prices of certain products or services across countries needs to be employed. We claim that electricity, which serves both as a substantial input in production and as a final service to households (Florio, 2013a), is a highly standardised product that allows a comparison between countries. We thus decided to focus on the production of electricity sector in the European Union countries. The reason for choosing this set of countries is the fact that they share common supranational regulations on the electricity sector. Production of electricity is chosen as the sector is considered the most competitive segment of the electricity industry (Del Bo, 2013), which allows a comparison between SOEs and POEs in the competitive environment. At the same time, the EU policies remain explicitly neutral on the ownership structure of enterprises and the decision to keep state ownership in companies is up to Member States, which results in heterogenous levels of the scale of state ownership in the analysed sector (see Fig. 1) (European Commission, 2016).

While we do not explicitly address the question of the SOEs' impact on electricity prices, empirical studies support the proposition that the presence of SOEs in the electricity market is associated with lower prices. Fiorio and Florio (2013) analysed the 15 'old-EU' countries for more than a 30-year period starting from 1978 and concluded that residential electricity prices in Western Europe were lower in countries where public ownership had been preserved. Bacchiocchi et al. (2015) focused on the effects of electricity regulatory reforms on residential prices in the 27 EU countries in the period of 1990 to 2011 and showed that prices with privatisation were significantly higher for the New Member States. Del-Río et al. (2019) examined electricity prices in the 15 'old-EU' states in the years 2003–2013 and their results indicated that higher shares of state ownership in the largest company in the sector were linked to lower industrial prices.

The use of state-owned enterprises to fulfil the non-commercial goal of providing electricity at lower prices might clearly have an adverse impact on the financial performance of these enterprises. Therefore, in the first step of our analysis, we see if SOEs financially underperform their privately owned counterparts in the electricity sector in the EU countries. We then ask whether apparent financial underperformance of SOEs is associated with the non-commercial goal of providing products at low prices for consumers. We formulate the following research hypotheses:

- H1: *state-owned enterprises financially underperform when compared to privately owned enterprises;*
- H2: *state-owned enterprises are characterised by a lower financial performance than that of privately owned enterprises when they operate in those markets that have lower prices.*

Despite the EU's efforts to liberalise the electricity market, the member countries substantially differ in terms of the level of implementation of market restructuring, and the electricity markets in many EU countries are still characterised by a high level of concentration (Bacchiocchi et al., 2015). Based on the dataset described in Section 4, the average share of the five largest enterprises in terms of electricity generation was equal to 77.4% in the period of 2007 to 2016. At the same time, SOEs had at least a 20% market share in terms of operating revenues in 16 out of 22 states (see Fig. 1). Therefore, in our analysis, we consider the electricity markets in the EU countries as mixed oligopoly markets; that is, markets in which SOEs and POEs compete on an equal basis employing market instruments (De Fraja and Delbono, 1989; De Fraja, 2009; Florio, 2013a; Clo et al., 2017). In mixed oligopoly markets, privately owned enterprises aim at maximising their profits, while the objective of state-owned enterprises is to maximise the social welfare and to maintain non-negative profits. Social welfare in the electricity sector is associated with the price level paid by consumers, and SOEs might be employed to provide the electricity at prices which increase consumers' surplus. At the same time, following the literature on state ownership in enterprises (see Section 2), other reasons for the financial underperformance of SOEs might be inefficiencies caused by, amongst other things, soft budget constraints, agency problems, political interference or corruption.

In other words, SOEs in the electricity sector might financially underperform POEs because of their inefficiencies or due to the non-commercial goal of providing electricity at lower prices (or both). In the first step of our analysis, we test the *H1* hypothesis on the financial underperformance of SOEs. We then examine whether the financial performance of SOEs is associated with price levels (*H2*). If the relative financial performance of SOEs (compared to POEs) varies with price levels (that is, if financial performance of SOEs is worse in those markets that have lower prices but there are no significant differences in those markets that have higher prices), it would suggest that their financial underperformance is associated with a non-commercial goal, namely affordability. At the same time, if the SOEs are characterised by weak financial indicators in the markets with both lower and higher prices, it would suggest the presence of SOE inefficiencies.

4. Description of dataset

In order to measure state involvement in the electricity markets in the European Union countries and to indicate possible links between the prices and financial performance of SOEs, data from the following sources was collected: Amadeus (Bureau van Dijk,

2018), Eurostat (2020), BP's 'Statistical Review of World Energy' (2020), World Bank (2020), European Environment Agency (EEA, 2018), Agency for the Cooperation of Energy Regulators (ACER, 2018), EC's reports 'Quarterly Report on European Electricity Markets' and Rademaekers et al. (2018). Data was gathered for the years 2007 to 2016 and this choice was based on the availability of the financial indicators from Amadeus.

The dataset includes indicators on 13,360 enterprises from 22[1] countries in the European Union that operate in the production of electricity sector (3511 code based on NACE Rev. 2 classification; enterprises' distribution by country and ownership type is presented in Table A1 in Appendix). As mentioned in Section 3, the focus on EU member states is driven by the fact that they share common supranational regulations, and the scale of state involvement in the sector differs substantially amongst these countries. The production of electricity sector was chosen because it is a competitive activity, contrary to electricity distribution and transmission that are natural monopolies. It was decided not to include the trade of electricity sector in our baseline estimations due to the very limited scope of data from Amadeus for entities operating in this sector—financial indicators for state-owned entities were available for only 15 out of 22 analysed countries, and for only nine states was the number of non-missing observations for SOEs greater than 10.

The analysed set of enterprises consists of medium, large and very large entities based on the average values of total assets and operating revenues in the period under consideration. We follow Eurostat's criteria and classify an enterprises as 'medium' if total assets or operating revenues exceeded EUR 2 and 1 million, respectively. Our motivation in focusing on at least medium-sized enterprises stems from the fact that the data missing problem is more prevalent in the group of small entities, and state ownership is concentrated in the group of large entities. Data based on unconsolidated accounts from Amadeus was employed.[2]

An important issue was to introduce a classification of enterprises as either SOEs or POEs. As shown in, for example, Bałtowski and Kozarzewski (2016), Szarzec and Nowara (2017) and Matuszak and Szarzec (2019), this issue is non-trivial due to the different means that governments use to control the enterprises. For the purpose of assessing a state share, we not only consider enterprises in which the state holds an ownership stake of more than 50% (SOE50) but also entities in which the state is a dominant shareholder and holds more than 25% of the shares (SOE25). This allows us to consider partially privatised enterprises in which the state still exerts control as state-owned (Gupta, 2005; Kočenda and Hanousek, 2012). State ownership in our study incorporates ownership both by public authorities and (local and central) governments. Subsidiaries were classified in the same ownership group as their parent companies. We classify as SOEs only those enterprises that are owned by domestic states. Data on the ownership structure of enterprises was retrieved from Amadeus.[3] In the year 2016, a total of 593 entities were classified as SOEs with a state stake above 50% and a total of 171 with a 25.01–50.00% state share.

Fig. 1 shows the average share of SOEs in terms of operating revenue in the electricity production sector across the EU countries over the period 2011 to 2016.[4] We can indicate that SOEs were dominant in the sector for countries such as France, Slovenia, Denmark, Austria and Greece. At the same, state involvement through enterprises was close to zero in Portugal, Slovakia, Spain and the United Kingdom. If enterprises controlled by the state with an ownership stake between 25.01% and 50.00% were not considered, the state share would be substantially lessened in Poland, Italy and Belgium. Thus we see that the state as an owner of enterprises differs substantially within the European Union despite the common supranational regulations.

Data on wholesale prices from ACER (2018) and the energy and supply price component from Eurostat (2020) were employed to reflect the electricity price levels in this study. The former was chosen because wholesale prices determine the revenues of electricity production enterprises in a liberalised market (Grave et al., 2016). The latter—consisting of wholesale prices and supply costs, including metering, billing and supplier margins—was used because of a substantial limitation in terms of data availability of wholesale prices (see notes on Fig. A1 in Appendix).[5] The levels of the energy and supply price component in the econometric analysis were calculated as an average of prices for the median consumption bands DC (representing annual consumption between 2500 and 5000 kWh) for residential and ID (between 2000 and 20,000 MWh) for non-residential consumers, weighted by the shares of residential and non-residential consumption in the final energy consumption.[6] Price indicators across countries of the European Union are summarised in Fig. A1 in Appendix.

Liberalisation of the electricity sector in the EU countries has, to a large extent, been driven by legislative packages which were adopted in the EU in 1996, 2003 and 2009 (Hyland, 2016; Pollitt, 2019). Restructuring has been aimed at increasing operational

[1] Cyprus, Ireland, Lithuania, Luxembourg, Malta and the Netherlands were excluded from the analysis due to a relatively small number of enterprises in the database and a missing data problem. The empirical part of the study was re-estimated including companies from these countries and the results led to the same conclusions as presented in this article. The results are available upon request.

[2] Unconsolidated accounts were chosen in order to avoid double counting and to more precisely consider a type of activity by sector within holding enterprises and conglomerates.

[3] Data was retrieved in February 2018 and the information on ownership structures of enterprises referred to this period. To account for changes in the ownership status in the analysed period, we used the dataset on privatisations and nationalisations by Szarzec et al. (2021). Based on this data, we found 26 privatisations and 5 nationalisations in the underlying dataset for the period 2007 to 2016. At the same time, we are aware that privatisation and nationalisation data employed in this study can be regarded as approximate only, and we cannot unambiguously exclude a possibility that some changes in the ownership structure were left out and not considered in our research. Nevertheless, we claim that this should not substantially impact the conclusions that were obtained.

[4] Shares were calculated for this time span because of better data completeness in this period.

[5] The final electricity price paid by the consumer consists of three components: energy and supply component, network costs, taxes and levies.

[6] Median consumption bands DC for residential and ID for non-residential prices from Eurostat (2020) were chosen, as they have the largest shares in electricity consumption in most EU countries (Rademaekers et al., 2018). For details, see: https://ec.europa.eu/eurostat/cache/metadata/en/nrg_pc_204_esms.htm

efficiency and lowering costs by fostering competition, introducing market-based pricing, providing market access to third parties, establishing independent regulatory agencies and expanding the internal EU market. The crucial aspect of the EU regulations is unbundling transmission and distribution activities that are natural monopolies from competitive activities, that is, electricity production and trade. This allows the avoidance of discriminatory activities of vertically integrated monopolies that might have incentives to distort competition by, for example, limiting access to the electric grid. Despite the common supranational regulations, the pace of the implementation of reforms aimed at liberalisation of the electricity sector differs amongst the EU countries, and enterprises operating in electricity production might face various competitive environments that influence their financial performance. In order to account for these cross-country differences, we include a set of variables that reflect local market characteristics. Our dataset comprises categorical variables which indicate the level of residential and non-residential price regulation by the national regulator (based on Rademaekers et al. [2018]). In order to account for market concentration, we calculated the Herfindahl-Hirschman index (HHI) for each country-year. Electricity market liberalisation supports integration and cross-border trade in the EU. Within-day imports allow to reduce generating costs, and, in order to account for the level of interconnection as well as the cross-border competition, export and import to total electricity consumption ratios are included in the analysis. Finally, a dummy variable is used reflecting whether or not a member state has developed a functioning wholesale market for electricity (based on the reports of the European Commission 'Quarterly Report on European Electricity Markets').

Electric power may be considered as a highly standardised product; however, generation methods differ substantially amongst countries and this influences price levels and firm financial performance. Different types of generation depend on former investments and are characterised by heterogeneous start-up costs and dependency on the prices of fuels and the natural environment (Stridbaek, 2006). Since there is no data on the generation type in Amadeus, we calculated the energy mix (see Fig. A2 in Appendix) at the country-level based on data from Eurostat, as well as we included data on coal, oil and gas prices that are interacted with the share of the respective fuel in the energy mix in the econometric analysis. As costs associated with the EU Emission Trading Scheme have been substantial for electricity production enterprises in recent years, we also consider CO2 intensity of generation at the country-level and the interaction between this variable and the CO2 European Emission Allowances prices. Electricity demand is measured as final electricity consumption per capita.

At the enterprise-level, the control variables describe the size of a company in terms of its total assets and operating revenues, the level of leverage measured by the solvency ratio and the year of establishment; these are broadly used control variables in empirical corporate finance (Wang and Shailer, 2018).

Financial performance of SOEs versus POEs is usually analysed in the literature with accounting-based (return on assets, return on sales, return on equity), financial market-based (Tobin's Q, market-to-book ratio), productivity (labour productivity, total factor productivity) and efficiency (technical, operating and income efficiency) measures (Tihanyi et al., 2019). We decided to include accounting-based measures as dependent variables for two reasons. First, they are the most commonly used indicators in the literature on the financial performance of SOEs, which allows to compare our results with a broad set of other empirical studies in the literature on state ownership. Second, data completeness for these measures is substantially better than for financial market-based measures that are limited to publicly quoted entities only, as well as than for indicators such as the number of employees or material costs which might be employed as inputs in productivity and efficiency measures, and for which data coverage in Amadeus is much worse than for EBITDA, total assets and operating revenues that are used in our study.[7]

The production of electricity sector is a capital-intensive industry and the entrance to the market is associated with large investments. For this reason, an indicator in the analysis of this sector should allow a comparison of the efficiency of an enterprise's management of assets between SOEs and POEs. Therefore, we decided to include return on assets (ROA) as a dependent variable for electricity production enterprises. While the applicability of the return on sales (ROS) indicator in research on the capital-intensive sectors is limited because it does not consider the level of assets that is employed to generate income, we abandoned use of the return on equity (ROE) indicator because there are substantial differences between the levels of liabilities and shareholders' equity amongst SOEs and POEs.[8] The assets of SOEs were, to some extent, built and paid for by the state in the previous years, while POEs often need to take investment loans to set up a new plant or to incur long-term liabilities to finance privatisation activities, which leads to the higher leverage in the group of POEs—this substantially limits the possibility of using the ROE indicator in the analysis on the electricity sector in the EU countries.

For return on assets, we use EBITDA (earnings before interest, taxes, depreciation and amortisation) as a numerator for the following reasons: we compare enterprises operating in many countries that have different tax systems; POEs are more leveraged than SOEs and, therefore, they might be characterised by higher interest expenses; capital-intensive industries, such as the electricity production sector, are marked by a high level of depreciation costs and various depreciation rates amongst enterprises which could make their profits incomparable due to non-cash expenses.

The set of variables employed in this study and their sources are presented in Table 1.

Table A2 in Appendix presents average values of the ROA indicator for SOEs and POEs in the electricity production sector in the period 2011 to 2016 based on the 25% ownership threshold. Average values of ROA vary from 4.61% in Romania to 15.74% in

[7] The shares of non-missing observations for the number of employees and material costs from Amadeus in the set of enterprises included in our analysis were 21.8% and 26%, respectively. Productivity in the context of state ownership is analysed by, among others, Brown et al. (2006), Commander and Svejnar (2011), Eller et al. (2011), Peter et al. (2012).

[8] The mean values of the ratio of shareholders' funds to total assets equal 22.7% for POEs and 31.4% for SOEs, while the median – 13.2% and 29.0%, respectively.

Table 1
List of variables.

Variable	Description	N	Source	Mean	Median	SD
Company-level data						
SOE25	Ownership status of an enterprise (state-owned and privately-owned), according to either 25% or 50% ownership threshold	133,600	Amadeus; Szarzec et al. (2021)	0.057	0	0.233
SOE50				0.045	0	0.206
ROA	Return on assets calculated as EBITDA to Total assets (in%); outside values smaller than the 1st percentile and greater than the 99th percentile dropped	67,715	Amadeus	9.009	8.970	8.624
logTA	Log of Total assets (in th EUR)	90,902	Amadeus	8.797	8.701	1.869
logOR	Log of Operating revenue (in th EUR)	74,110	Amadeus	7.267	7.178	2.103
SR	Solvency ratio calculated as Shareholders' funds to Total assets	92,012	Amadeus	0.232	0.141	0.356
YearInc	Enterprise age group (established before 1997, in 1997–2006, in 2007–2016)	133,600	Amadeus	0.094	0	0.291
				0.248	0	0.432
				0.658	1	0.474
Country-level data						
Wholesale Price	Wholesale market price (in EUR per kWh)	150	ACER (2018)	0.051	0.051	0.013
Energy and supply price component	Energy and supply price component based on DC consumption band (annual consumption between 2500 and 5000 kWh) for residential and ID band (between 2000 and 20,000 MWh) for non-residential consumers and calculated as an average weighted by their shares in the final energy consumption (in EUR per kWh)	205	Eurostat	0.068	0.063	0.024
		208		0.059	0.057	0.016
		205		0.061	0.059	0.017
HHIgroup	Herfindahl-Hirschman Index (HHI) for the production sector, categorical variable based on 0.125, 0.25, 0.5 HHI values thresholds	215	Own calculation based on data from Amadeus	0.246	0	0.432
				0.293	0	0.456
				0.163	0	0.370
				0.298	0	0.458
RegPr_HH	Residential price regulation, categorical variable based on the share of residential consumers under regulated prices, 5% and 50% thresholds	220	K. Rademaekers et al. (2018)	0.409	0	0.493
				0.127	0	0.334
				0.464	0	0.500
RegPr_nHH	Non-residential price regulation, categorical variable based on the share of non-residential consumers under regulated prices, 5% and 50% thresholds	220	K. Rademaekers et al. (2018)	0.677	1	0.469
				0.095	0	0.295
				0.227	0	0.420
Cons_pc	Final electricity consumption per capita (in MWh)	220	Eurostat, World Bank	5.741	5.068	2.995
WholLib	Functioning wholesale electricity market	220	EC reports 'Quarterly Report on European Electricity Markets'	0.818	1	0.387
Exp	Export to total electricity consumption	220	Eurostat	0.265	0.177	0.231
Imp	Import to total electricity consumption	220	Eurostat	0.246	0.157	0.220
CO2int	CO2 emission intensity of electricity generation (in gCO2/kWh)	220	European Environment Agency	358.653	314.455	253.006
CO2price	Average annual CO2 EUA price (in EUR)	10	World Bank	11.586	7.936	9.941
GasPrice	Brent oil price (EUR per barrel)	10	BP 'Statistical Review of World Energy' (2020)	7.109	6.931	1.338
OilPrice	Gas price based on Heren NBP Index (EUR per m Btu)	10	BP 'Statistical Review of World Energy' (2020)	66.677	68.532	17.030
CoalPrice	Northwest Europe coal marker price (EUR per t)	10	BP 'Statistical Review of World Energy' (2020)	70.758	65.901	18.522
SFshare,	Energy mix; Shares in the total electricity production of, respectively, solid fuels, renewable, hydro, nuclear, crude oil and petroleum, natural gas and other sources (in%)	220	Eurostat	34.459	28.723	24.376
REshare,				6.074	3.068	8.197
HYshare,				18.853	12.854	18.929
NUshare,				21.624	18.868	22.088
OIshare,				2.204	0.899	3.202
NGshare,				16.678	13.682	14.152
OTshare				0.108	0.000	0.424

Note: all pecuniary values were deflated by local price deflators (from World Bank) and are presented in constant 2015 EUR.
Source: own elaboration.

Table 2
Econometric analysis—production.

Dependant variable	ROA					
Prices	Not included		Wholesale prices		Energy and supply price component	
SOE	>25%	>50%	>25%	>50%	>25%	>50%
Model	(1)	(2)	(3)	(4)	(5)	(6)
SOE	−0.598**	−0.836*	−2.306***	−2.455***	−3.666***	−3.711***
	(0.26)	(0.44)	(0.38)	(0.46)	(0.69)	(0.75)
Price			19.006	19.580	9.223	9.795
			(17.65)	(18.25)	(14.21)	(13.83)
*SOE*Price*			34.872***	30.822**	50.403***	46.400***
			(8.78)	(11.81)	(12.91)	(12.02)
Firm-level control variables	yes	yes	yes	yes	yes	yes
Country-level control variables	yes	yes	yes	yes	yes	yes
Intercept, country FE, time FE	yes	yes	yes	yes	yes	yes
N	53,716	53,716	49,406	49,406	46,650	46,650
N enterprises	10,855	10,855	10,466	10,466	10,551	10,551
N countries	22	22	20	20	22	22
R^2_o	0.119	0.120	0.125	0.125	0.115	0.115
σ_u	5.011	5.008	5.075	5.074	5.354	5.354
σ_e	5.437	5.436	5.334	5.334	5.233	5.233
ρ	0.459	0.459	0.475	0.475	0.511	0.511

Driscoll and Kraay (1998) standard errors are reported in parentheses. Asterisks denote significance levels: ***−1%, **−5%, *−10%. *SOE* indicates stake thresholds employed to classify an enterprise as state-owned. *N* denotes the number of observations. R^2_o is overall R-square. σ_u is the standard deviation of residuals within groups. σ_e is the standard deviation of residuals (overall error term). ρ is an intraclass correlation that shows how much of the variance is due to differences across panels. The coefficients depict the effect in percentage points. Detailed results presented in Appendix B are available online. A list of variables is described in Table 1.
Source: own elaboration with Stata.

Portugal for POEs, while for SOEs, they vary from 0.48% in Romania to 16.56% in Slovakia. At the same time, average values of the ROA indicator of SOEs were lower than POEs in 13 out of 22 countries, and this difference ranged from −7.18 percentage points (Bulgaria) and −4.65 (Latvia) to 4.13 percentage points (Slovakia) and 4.54 (Hungary). The remaining part of the paper aims to explore how relative performance of SOEs (compared to POEs) is conditioned on the price levels when controlling for a set of variables at the company- and country-level.

5. Empirical strategy

A broad set of the analyses in empirical corporate finance employs panel data techniques. The main motivation to use panel data models is to address the omitted variables problem that is caused by unobserved heterogeneity amongst units. We conducted the Breusch-Pagan Lagrange multiplier test (Breusch and Pagan, 1980) to check for significant differences across units in our dataset and to choose between panel data models and a simple OLS regression. The results show that we can reject the null hypothesis on zero variance across entities at the 1% significance level and, therefore, OLS regression would not be a proper method to employ in our study. In the next step, we tested whether our dependent variable was stationary. We employed the Harris-Tzavalis test (Harris and Tzavalis, 1999) and its results suggest that we can reject (at the 1% level) the null hypothesis on panels containing unit roots. Consequently, in our analysis, we focus on static panel models.

The basic solutions to the problem of unobserved heterogeneity in panel data are methods used in the fixed effects and random effects models (Wooldrigde, 2002). The fixed effects estimator employs time-demeaned data and solves the problem of unobserved heterogeneity by removing the time-invariant individual effect. Therefore, only the time variation within each unit is used and time-invariant variables are ruled out. In our analysis we focus on the state ownership variable (and its interaction with prices), which is characterised by very low within variation—only 31 enterprises included in the dataset changed their ownership status during the analysed period (26 privatisations and 5 nationalisations, comprising 0.23% of all enterprises in the dataset). This makes the use of the fixed effects estimator problematic. As indicated by Beck and Katz (2001) and Bell and Jones (2015), we lose a large amount of important variation by employing the fixed effects estimator with almost time-invariant variables. In our dataset, it would lead to more than 99% of enterprises (that did not change their ownership status) scored at zero in terms of the state ownership variable and, hence, having no impact on the parameter estimates.[9] This is a reason to employ the random effects estimator which is a panel data method

[9] The choice between fixed effects and random effects models is usually based on the results of the Hausman test which checks differences between the coefficients obtained employing both methods and indicates the possible rejection of the orthogonality assumption. However, as indicated by Beck and Katz (2001) and Bell and Jones (2015), the results of the Hausman test, especially based on models including variables characterized by very low (or zero) within variation, are very unlikely to give any reasonable indications whether to use random effects or fixed effects models. Therefore, we perceive the Hausman test in our analysis as unnecessary.

that allows the inclusion of time-invariant variables and exploits the serial correlation in composite errors in a generalised least squares framework.[10]

In order to control for common shocks across enterprises, time dummies are included. Country fixed effects were also employed in order to control for any unobserved time-invariant characteristics at the country-level. Based on the results of the modified Wald test for groupwise heteroskedasticity (Baum, 2001) and the Wooldridge test for autocorrelation in panel data (Wooldridge, 2002), the standard errors to be employed should be heteroskedasticity and autocorrelation robust. We also tested for cross-sectional independence with the Frees test (Frees, 2004; De Hoyos and Sarafidi, 2006). Its results suggest that the null hypothesis on cross-sectional independence should be rejected at the 1% significance level. This shows that residuals of a panel model are correlated not only within units but also between enterprises, which might result in consistent but inefficient estimates and overly optimistic standard errors. We address this issue by calculating Driscoll and Kraay heteroskedasticity, autocorrelation and cross-sectional correlation robust standard errors (Driscoll and Kraay, 1998; Hoechle, 2007[11]).

- H1: *state-owned enterprises financially underperform when compared to privately owned enterprises.*

To test the first research hypothesis, the model of the following form was estimated within the random effects framework:

$$ROA_{it} = \beta_0 + \beta_1 SOE_{it} + x_{it}^{'}\beta_4 + \mu_i + \gamma_t + (u_i + e_{it}),$$

where *ROA* is the dependent variable observed in an enterprise *i* over the period *t, SOE* denotes an ownership status, the parameter of interest is β_1, $x_{it}^{'}$ is a vector of control variables,[12] μ_i is the country fixed effect, γ_t represents time-dummies, u_i denotes an unobserved individual effect, e_{it} is the idiosyncratic error.

- H2: *state-owned enterprises are characterised by a lower financial performance than that of privately owned enterprises when they operate in those markets that have lower prices*.

To test the second research hypothesis, there is a need to measure the relationship between the financial performance of SOEs and the level of electricity prices, that is, the financial performance of SOEs conditional on electricity prices. Therefore, our model includes the interaction term between variables indicating an ownership status and prices.[13] Using the random effects framework, the model of the following form was estimated:

$$ROA_{it} = \beta_0 + \beta_1 SOE_{it} + \beta_2 Price_{it} + \beta_3 SOE_{it}{*}Price_{it} + x_{it}^{'}\beta_4 + \mu_i + \gamma_t + (u_i + e_{it}),$$

where *ROA* is the dependent variable observed in a company *i* over the period *t, SOE* denotes an ownership status, *Price* reflects the level of electricity prices (either wholesale market prices or the energy and supply price component), the parameters of interest are β_1 and β_3, $x_{it}^{'}$ is a vector of control variables, μ_i is the country fixed effect, γ_t are time-dummies, u_i denotes an unobserved individual effect, e_{it} is the idiosyncratic error.

6. Results and robustness checks

6.1. H1: state-owned enterprises financially underperform when compared to privately owned enterprises

Table 2 summarises the results of the econometric analysis.[14] In Models 1 and 2 with no interactions, the coefficients by the variable indicating that a company is state-owned (employing both 25% and 50% stake thresholds) are negative and statistically significant at the 5% and 10% levels. This shows that SOEs were characterised by a substantially lower level of the *ROA* indicator than are POEs. The

[10] At the same time, we are aware that we cannot unambiguously rule out that company performance might affect some variables included in our model, which makes them potentially endogenous and that some covariates might be correlated with unobserved individual effect that can be a cause of possible rejection of the orthogonality assumption, which limits the possibility to draw unequivocal causal inferences in our study. Nevertheless, we believe that, considering the many limitations faced in empirical corporate finance research, the method used in this study allows the indication of a relationship between the financial performance of SOEs and their non-commercial goals. The problem of endogeneity in empirical corporate finance is discussed in Roberts and Whited (2013).

[11] We employ the 1.4 version of the xtscc package in Stata (presented originally in Hoechle (2007)).

[12] Control variables consist of the log of the lagged values of total assets and operating revenues, lagged solvency ratio, an enterprise's age group, HHI, the level of residential and non-residential price regulation, final electricity consumption per capita, functioning wholesale electricity market, export and import to total electricity consumption ratios, CO2 emission intensity of electricity generation, average annual CO2 EUA price (and their interaction), gas, oil and coal prices, shares of different primary sources of electricity (energy mix; shares of natural gas, crude oil and solid fuels are interacted with gas, oil and coal prices, respectively). Lagged values of total assets, operating revenues and solvency ratio were chosen to account for contemporaneous correlation. Since these variables are characterized by low variability, we can consider lags as strong instruments (correlation coefficients between the levels of operating revenue, total assets, solvency ratio and their lag values equal 0.991, 0.996 and 0.810, respectively).

[13] In our analysis we follow the indications presented in Brambor et al. (2006) and Kingsley et al. (2017).

[14] Detailed results are presented in Appendix B available online.

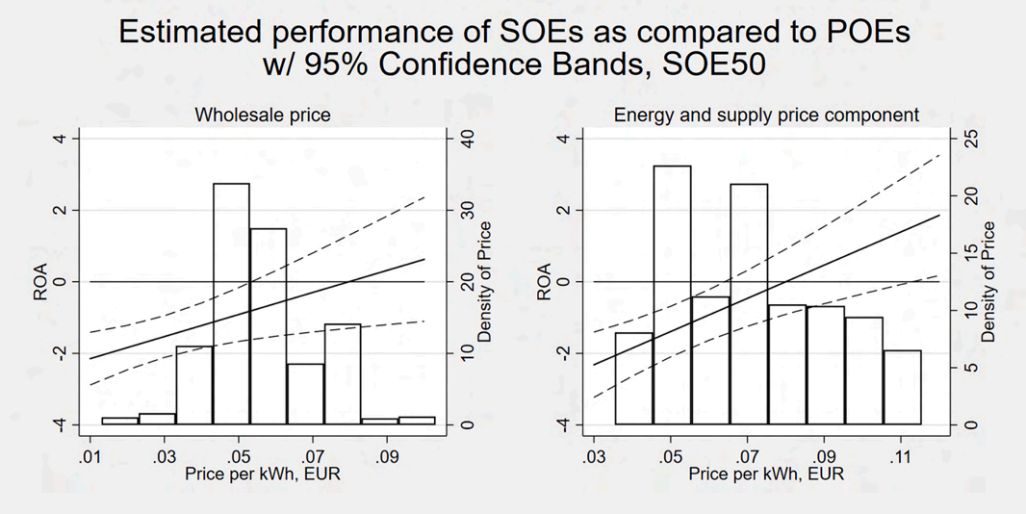

Fig. 2. Estimated performance of SOEs as compared to POEs, within 95% Confidence Bands, SOE50. Source: own elaboration with Stata. Confidence bands were calculated and presented according to formulae presented in Brambor et al. (2006) and Kingsley et al. (2017).

magnitudes of the coefficients (−0.598 and −0.836, respectively) show that this difference is not only statistically significant but also economically significant; keeping all other variables fixed, return on assets of SOEs was lower than POEs by 0.598 and 0.836 percentage points, while the mean value of this indicator in the sample equalled 9.01%. Such results suggest that we cannot reject the first research hypothesis.

6.2. H2: state-owned enterprises are characterised by a lower financial performance than that of privately owned enterprises when they operate in those markets that have lower prices

The results of the econometric analysis which includes interaction terms between the *SOE* and *Price* variables are summarised in Table 2 (Models 3 and 4 for wholesale prices, Models 5 and 6 for the energy and supply price component). This analysis allows us to assess the profitability of SOEs (as compared to POEs) conditioning on the level of prices. The coefficients by the variable indicating that an enterprise is state-owned (using both 25% and 50% stake thresholds) are negative and statistically different from zero. However, as shown in Brambor et al. (2006), this coefficient captures only the effect of the *SOE* variable when the price is zero, which is obviously not the case in our dataset. At the same time, signs of the interaction term and *Price* variables are positive, which shows that higher prices lead to higher returns on assets in both SOEs and POEs, with a stronger relationship for SOEs. To indicate at what price levels there were statistically significant differences between the analysed groups of enterprises, we plot the estimated marginal effects of state ownership (according to the 50% ownership threshold) on the level of prices in Fig. 2.[15]

In Fig. 2, the marginal effect of state ownership is plotted along with the 95% confidence bands over the values of electricity prices. The histogram of price levels is also presented to account for the number of observations within particular price ranges.[16] The first column presents the results of the analysis employing wholesale prices, while the second column shows the results when the energy and supply price component is considered. For wholesale prices and the 50% ownership threshold (Model 4), the results show that enterprises controlled by the state were characterised by comparatively weaker financial performance (measured by the *ROA* indicator) as compared to the POEs and that this relationship is significant at the 5% level when prices were below 0.054EUR per kWh, which accounts for 49% of the observations in our sample. For prices above this threshold, the *SOE* variable did not significantly impact financial performance; that is, there were no substantial differences in the financial performance of SOEs and POEs. When enterprises with a state stake above 25% were considered as state-owned (Model 3), substantial differences were indicated for prices below 0.050EUR per kWh (35% of observations). In order to check if the results were not only statistically significant but also economically significant, we multiplied the coefficients next to the interaction terms and one standard deviation (SD) of prices. This shows that a one SD increase (0.0136EUR per kWh) in wholesale prices leads to an average increase of the *ROA* indicator of SOEs (as compared to POEs) by 0.476 p.p. (>25% state stake, Model 3) and 0.421 p.p. (>50% state stake, Model 4), which can be considered as a substantial economic impact.

When the energy and supply price component was employed as a conditioning variable, state ownership was substantially

[15] As the results for the 50% and 25% ownership thresholds are very similar, the figure for the latter is presented in Appendix (Figure A3).

[16] As shown in Brambor et al. (2006), the percentage of the sample that falls within the region of significance should be shown to avoid drawing conclusions based on values of the conditional variable that are rare in real-world observations.

negatively related to financial performance when prices were below 0.065EUR per kWh, with 42% of the observations falling within this significance region (Model 6; 50% ownership threshold). At the same time, for SOEs with a state stake above 25%, this threshold was equal to 0.059EUR per kWh (34% of observations, Model 5). Considering the magnitudes of the obtained coefficients, an increase by one SD (0.0203EUR per kWh) of the energy and supply price component leads to an average change in the *ROA* variable of SOEs (as compared to POEs) of 0.942 and 1.023 p.p., which illustrates that the relative performance of SOEs improves substantially with increasing prices. Such results show that for a considerable portion of the sample, state ownership was negatively related to financial performance and this relationship was stronger for lower price levels, which supports the second research hypothesis in our study.

6.3. Robustness checks

We conducted a number of robustness checks in order to test the veracity of the conclusions that were obtained in the analysis with the basic specifications. These are briefly discussed below and are summarised in Table A3 in Appendix. The detailed results of the analyses and graphical presentation of interaction terms are provided in Appendix B, which is available online.

6.3.1. Price and enterprise data completeness (2011–2016)

Data on wholesale prices from ACER (2018) were missing for some countries included in the analysis and this issue was most relevant for the period 2008–2010 (see notes on Fig. A1 in Appendix). Similarly, the energy and supply price component from Eurostat was missing for France in 2008–2011, Greece in 2008, the UK in 2010 and Hungary in 2011. The availability of financial indicators from Amadeus was also substantially better in the period 2011 to 2016. Therefore, in order to check the robustness of the baseline results, we conducted an additional analysis including only observations starting from 2011. These results lead to the similar conclusions as were presented in the previous part (see Models 7–10 in Table A3).[17]

6.3.2. Energy and supply component of residential and non-residential consumer prices

The variables indicating the level of the energy and supply price component in the basic analysis were calculated as an average of residential and non-residential price components weighted by their shares in the final energy consumption. In this step of the robustness check, we conducted separate analyses for residential (Models 11 and 12 in Table A3) and non-residential (Models 13 and 14) prices. By separating the energy and supply price components for residential and non-residential consumers, we obtained results that are in line with the conclusions based on the basic model specifications.

6.3.3. Energy and supply price component bands

The energy and supply price components included in the analysis were based on Eurostat data for median consumption bands, that is, bands DC for residential and ID for non-residential consumers (see description in Table 1). In order to check whether the obtained results are robust to switching consumption bands, we re-calculated the model with energy and supply price components for the mean values of DB-DC and IC-IE bands (Models 15 and 16 in Table A3), as well as of DA-DE and IA-IG bands (Models 17 and 18).[18] By doing so, we obtained results that are very similar to those of the basic specification.

6.3.4. Country-by-country exclusion

This robustness check aimed at testing if the exclusion of enterprises from a single country leads to substantially different results. We re-estimated models, omitting enterprises from one country at each step (detailed results in Appendix B). These results lead to the same conclusions as presented previously and, therefore, indicate that they are not driven by entities from a single country.

6.3.5. Fixed effects model

For the reasons discussed in Section 5, we decided to employ the random effects estimator. However, to check whether obtained results are robust when changing to a method that rules out time-invariant unobserved heterogeneity (and its potential correlation with explanatory variables) by time-demeaning, we used the fixed effects estimator as a robustness check. In doing so, we interacted the ownership status variable with the price variable (*SOE*price* and *POE*price*) in order to check whether there were substantial differences in the relationship between increases in prices and profitability amongst SOEs and POEs. In our baseline specification with the random effects estimator, the results suggest that SOEs financially underperform POEs at sufficiently low price levels and that SOE profitability improves more substantially with higher prices than does that of POEs (or, in other words, SOE profitability decreases more substantially with lower prices than does that of POEs).

By employing the fixed effects model (Models 19–22 in Table A3), we obtained positive coefficients by the interaction terms between the ownership status and prices, with a higher magnitude for the SOE variable. We used the Wald test in order to check whether these differences are statistically significant—they are significant at least at the 10% level for Models 19, 21 and 22, while for Model 20, p-value is 0.11. This shows that higher (lower) prices lead to higher (lower) returns on assets in both SOEs and POEs, with this relationship substantially stronger for SOEs. This is in line with the conclusion obtained in the baseline analysis, which suggests that it

[17] By conducting an additional analysis in this time period, we implicitly accounted for the potentially changing role of the state as an owner early in the economic crisis and in the post-crisis period. Baumöhl et al. (2019) show–in the analysis of enterprise survival in the CEE region–that state ownership was a substantial factor affecting firm survival or exit early in the crisis and that its role diminished with time.

[18] See notes to Table A3 for a description of consumption bands DA-DE and AI-IG.

is unlikely that the results with the random effects model in the previous part are driven by the correlation between unobserved heterogeneity and explanatory variables.

6.4. Further analysis - electricity trade, distribution and transmission sectors

For the reasons discussed in Sections 3 and 4, we focus in our analysis on the production of electricity sector. Nevertheless, in this subsection, we conduct a separate analysis for the electricity trade, distribution and transmission sectors in order to check whether the relationship between the price levels and the relative underperformance of SOEs was also present in these sectors. These results are summarised in Table A4 in Appendix. The detailed results of the analyses and graphical presentation of interaction terms are provided in Appendix B, which is available online.

In the electricity trade sector, we employ the mark-up calculated as the difference between the energy and supply component and wholesale price in order to reflect a trading activity as a source of revenues, that is, buying electricity from production enterprises and selling it to consumers or other trading entities (such an approach is similar to Grave et al. [2016] and Rademaekers et al. [2018]). At the same time, trade of electricity is a substantially less capital-intensive activity than electricity production and, therefore, in the analysis of this sector, we employ return on sales (EBITDA to operating revenues) as a dependent variable. The results for the trade of electricity sector are summarised in Table A4, Models 23 and 24. While the coefficient by the interaction term between the SOE and price variables is positive, there are no significant differences (at the 5% level) in the financial performance of SOEs and POEs across all values of calculated mark-ups. However, our approach in the analysis of the trade sector has some substantial limitations. First, the calculated mark-up is only an imperfect proxy for margins of trade entities, especially when we consider that one cannot distinguish between retail suppliers and bulk trading entities based on Amadeus' classification. Second, some enterprises are active in both electricity production and trade, and their classification in only one sector might be misleading.[19] To overcome these limitations, an additional analysis employing the energy and supply price component and including entities from both electricity production and trade sectors was conducted, and its results are in line with the baseline estimations (see Models 25 and 26 in Table A4).

Transmission and distribution of electricity are analysed jointly in Models 27–30 (Table A4). The price variable is based on the network costs price component from Eurostat (2020; based on DC and ID consumption bands, weighted by residential and non-residential shares in the final electricity consumption). The analysis with the random effects model (Models 27 and 28) shows that SOEs financially underperform (at the 5% significance level) as compared to POEs at sufficiently low price levels, and their relative underperformance decreases with higher prices, which is in line with the conclusions from the analysis of the production of electricity sector. As entities in transmission and distribution operate locally and hold a position of natural monopolies, their financial performance is likely to be strongly dependent on local characteristics that are not captured in our dataset; therefore, we also perform the fixed effects estimation in order to check whether the relationship between prices and relative performance of SOEs holds when unobserved heterogeneity and its possible correlation with explanatory variables is ruled out (Models 29 and 30). The coefficients of the interaction terms (*SOE*Price* and *POE*Price*) are positive and larger for SOEs. Based on the Wald test results, we can indicate that these differences are significant at the 10% level. This shows that the relative performance of SOEs (compared to POEs) improves with higher prices, and the opposite also holds, which indicates that the results from Models 27 and 28 which employ the random effects estimator are not likely to be driven by the correlation between unobserved heterogeneity and explanatory variables.

7. Discussion and conclusions

This study is based on three underlying premises. First, objectives of SOEs, which do not centre on profits, are often indicated in the literature as an explanation for the financial underperformance of enterprises controlled by the state; however, empirical research is still a neglected aspect in this field. Second, electricity is a highly standardised product that allows for a cross-country comparison and plays an essential role in the economy. Third, SOEs are still important in many of the economies of European Union countries, especially in the network sectors, and their presence in the electricity sector is associated with lower prices.

We analysed the relationship between the relative financial performance of SOEs (compared to POEs) and price levels, controlling for a broad set of control variables at the country and firm level. We employed the random effects model with the Driscoll and Kraay cross-sectional correlation robust standard errors on a sample of 13,360 enterprises operating in the production of electricity sector in 22 countries of the European Union during 2007–2016. In the first step, we conducted in the analysis a 'typical' comparison of the financial performance between SOEs and POEs, excluding price levels as factors conditioning the researched relationship. The results indicated that state-owned enterprises are characterised by substantially lower profitability than privately owned entities. In the second step, we introduced the interaction terms between the ownership status and price variables and revealed that SOEs are characterised by lower profitability than POEs in those markets that have lower prices, and that there were no substantial differences in

[19] For example, Electricite De France is classified in the electricity generation in Amadeus and is also the largest supplier to end consumers in France. The same is the case for EDF Energy, which is one of the largest generators and suppliers in the UK. Another issue is possible misclassification based on registered primary NACE codes of entities. In order to identify misclassified entities in the electricity trade sector, 95 enterprises with the mean level of return on sales above the 90th percentile were manually checked with the use of Internet sources, and 64 entities, most of them producing electricity from renewable sources, were recognised as misclassified and their sector affiliation was changed to production. Return on sales was used to identify wrongly classified entities because there are substantial differences in the level of ROS between production (mean = 52.7%, median = 63.4%) and trade (9.5% and 2.7%).

terms of financial performance between SOEs and POEs at higher price levels.

As the theoretical literature underlines the importance of SOE objectives other than profit-maximisation and empirical studies at the macroeconomic level show a significant link between state ownership in the electricity sector and lower residential and non-residential prices (Fiorio and Florio, 2013; Bacchiocchi et al., 2015; Del-Rio et al., 2019), we interpret our results as an indication of the significant relationship between the non-commercial objective of providing crucial services at affordable prices and the financial underperformance of SOEs. This shows that the omission of the non-commercial goals of SOEs in empirical analyses might lead to a potential bias in favour of private ownership—apparent financial underperformance of SOEs might be perceived as evidence of their technical inefficiencies rather than as a result of goals other than profit-maximisation—and accentuates the need to include appropriate controls in the research design. In a recent review study, Tihanyi et al. (2019) showed that state ownership has a profound impact on SOE strategies, such as financial leverage, R&D intensity and internationalisation, and that these strategies mediate in the relationship between state ownership and enterprise financial performance. With this study, we emphasise the importance of the non-commercial goal of supporting social affordability as another mediating factor in the state ownership-firm performance relationship, and that this neglected aspect in empirical research should be more broadly explored.

The results of our study also provide some basis for the discussion of the rationale of state intervention in the network industries. Market liberalisation in the electricity sector in (most) EU countries has led to the establishment of mixed oligopoly markets in which SOEs seem to act as an implicit price-cap mechanism and, therefore, provide this crucial service at affordable prices. Nevertheless, one can argue that a similar result can be obtained by a regulatory authority that imposes the price-caps in a market dominated by privately-owned entities. This would yield greater benefits for the customers due to the cost-minimisation behaviour of POEs and the limited scope of SOE inefficiencies. However, the positive impact of the regulation on social welfare can be substantially decreased when the regulator is unable or unwilling to lower prices as closely as possible to marginal costs. The former might be an effect of information asymmetry—privately-owned enterprises might take advantage of the fact that the regulator does not have complete information on cost structure and the dynamics of demand and technology changes. The latter can be caused by regulatory capture; that is, corruption to change the laws in favour of POEs, which is considerably harmful for the whole economy (Del Bo and Florio, 2012). State ownership of enterprises in the electricity sector might be perceived as a tool to circumvent asymmetric information and regulatory capture. However, the impact on the social welfare of such an intervention depends on a broad set of conditions, including the level of SOE inefficiencies, the ability of the regulator to control the privately owned entities and the potential efficiency benefits of privatisation. Therefore, further research in this field should focus on assessing the social benefits and losses of the presence of SOEs in the sector by binding the theoretical framework of mixed oligopoly markets and econometric analysis. This broader approach should also consider the possible negative effects of keeping low electricity prices such as a lack of the right price signals which reduces incentives for energy efficiency improvements by consumers, prevents the market entry of competitors and discourages investments, and might lead to uneven distribution of price policy benefits.

While the results of this study are not decisive in favour or against state ownership in enterprises, they strongly emphasise the necessity of establishing a clear range of SOE objectives in order to provide a balance between financial sustainability and societal gains. These precise criteria will allow to manage SOEs with the benefit of society as well as to limit the possibilities of the discretionary management of enterprises in favour of their political principals.

Formatting of funding sources

This work was supported by the National Science Centre Poland under Grant number 2015/17/B/HS4/00327.

Declarations of Competing Interest

None.

Acknowledgments

We are grateful for constructive comments of the two anonymous referees. All remaining errors are our own.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jce.2021.03.002.

Appendix

See Figs. A1–A3 and Tables A1–A4.

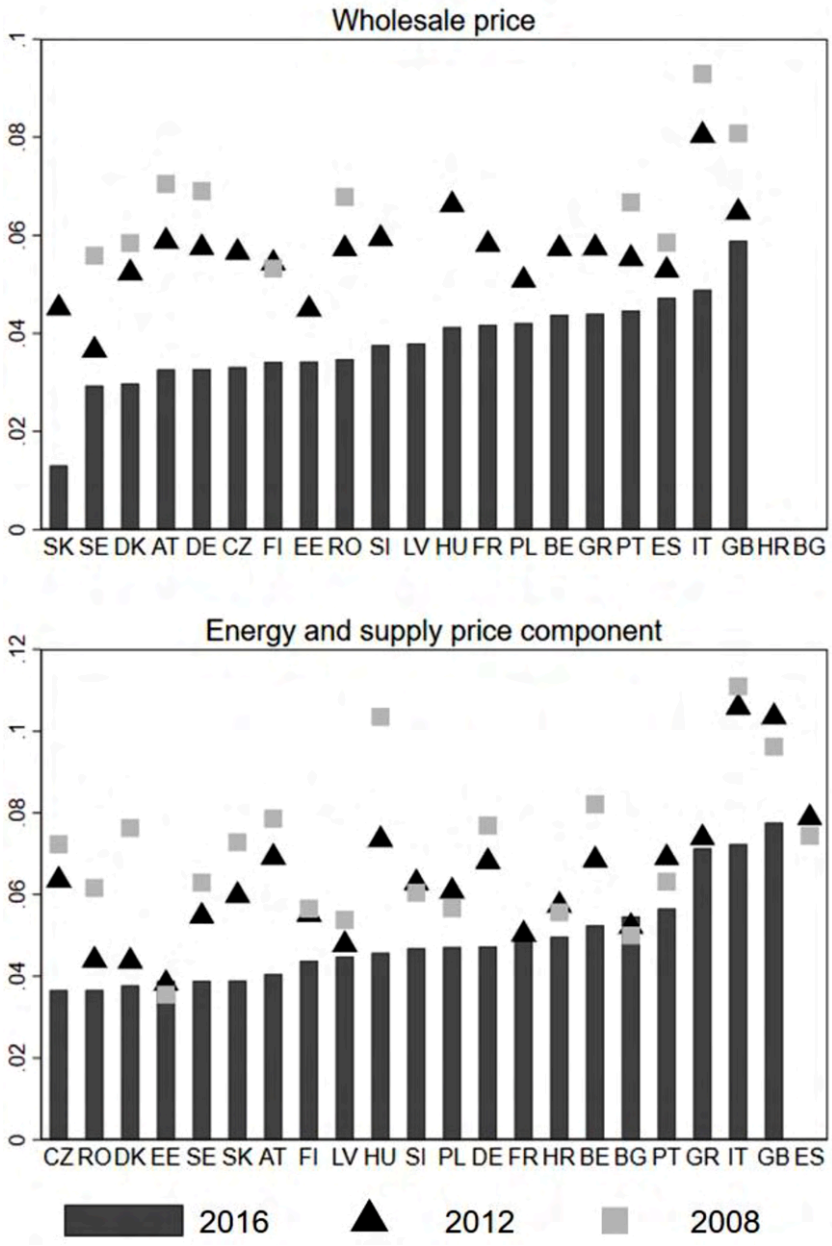

Fig. A1. Price levels, in EUR per kWh. Source: own elaboration based on data from ACER (2018) and Eurostat (2020). Notes: prices deflated by local price deflators (from World Bank) and presented in constant 2015 EUR. Energy and supply price component calculated as an average of prices for the median consumption bands DC (representing annual consumption between 2500 and 5000 kWh) for residential and ID (between 2000 and 20, 000 MWh) for non-residential consumers, weighted by the shares of residential and non-residential consumption in the final energy consumption. Wholesale prices are collected starting from 2008 and missing for Belgium (2008), Bulgaria (2008–2016), Croatia (2008–2016), the Czech Republic (2008–2009), Estonia (2008–2010), France (2008–2011), Greece (2008–2011), Hungary (2008–2011), Latvia (2008–2012), Poland (2008–2010), Slovenia (2008–2009) and Slovakia (2008–2009). Energy and supply price component is missing for Austria (2007), Spain (2007), France (2007–2011), the UK (2007, 2010), Greece (2007–2008), Hungary (2011), Italy (2007), Portugal (2007), Slovenia (2007). Data on the energy and supply component for Spain in years 2013 to 2016 are excluded from the analysis because this component included other cost elements not directly related with energy and supply (such as Policy Support Costs, capacity remuneration mechanisms, market exchange and system operator costs) for this period (K. Rademaekers et al., 2018).

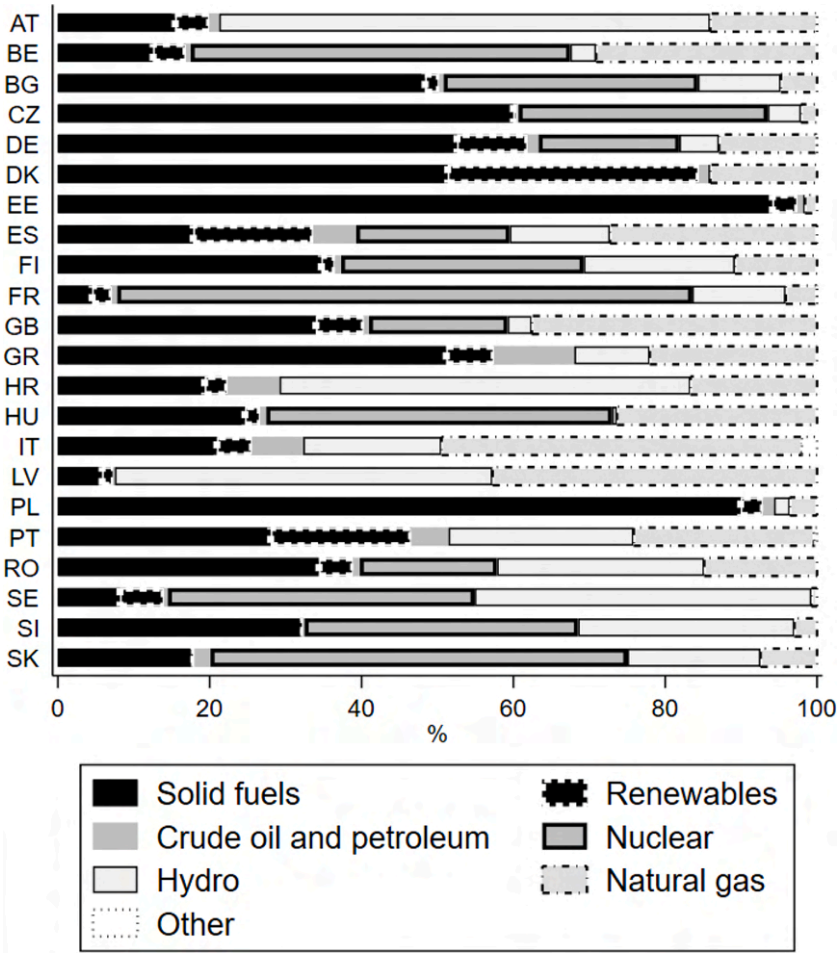

Fig. A2. Energy mix, average share 2007–2016. Source: own elaboration based on data from Eurostat.

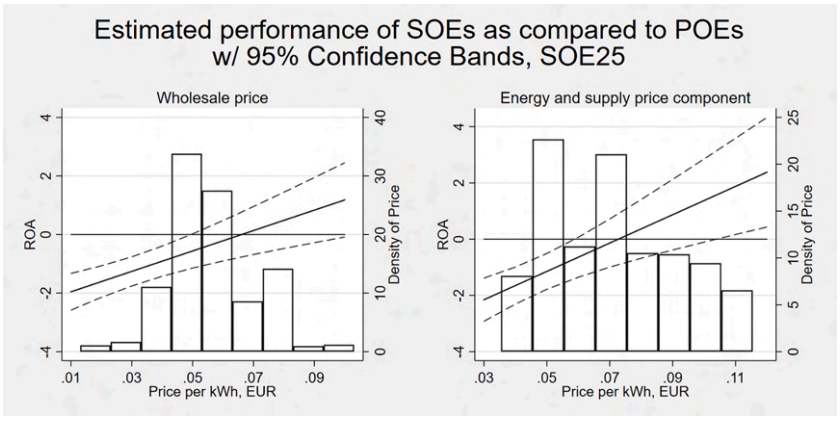

Fig. A3. Estimated performance of SOEs as compared to POEs, within 95% Confidence Bands, SOE25. Source: own elaboration with Stata. Confidence bands were calculated and presented according to formulae presented in Brambor et al. (2006) and Kingsley et al. (2017).

Table A.1
Enterprises' distribution by country and ownership type.

Country	POE	SOE >50% share	SOE 25%−50% share
Austria	70	29	2
Belgium	246	9	2
Bulgaria	346	4	0
Croatia	46	1	1
Czech Republic	545	7	0
Denmark	111	26	0
Estonia	22	1	0
Finland	88	37	7
France	1734	144	115
Germany	1362	177	17
Great Britain	1457	6	0
Greece	242	2	1
Hungary	77	4	1
Italy	2918	40	14
Latvia	70	4	0
Poland	307	15	6
Portugal	344	2	0
Romania	369	13	0
Slovakia	128	1	0
Slovenia	70	13	0
Spain	1706	10	1
Sweden	338	48	4
Total	12,596	593	171

Note: Distribution based on data for ownership type in 2016.
Source: own elaboration.

Table A.2
Average ROA of SOEs and POEs in the production of electricity sector, 2011–2016.

	SOEs		POEs		Difference in ROA
Country	Average ROA	No. of obs.	Average ROA	No. of obs.	(=SOEs – POEs)
Austria	9.12	104	10.83	79	−1.71
Belgium	8.00	53	10.48	1179	−2.48
Bulgaria	4.41	22	11.59	1750	−7.18
Croatia	6.59	12	6.86	167	−0.27
Czech Republic	10.84	31	12.30	2572	−1.46
Denmark	9.56	102	8.26	395	1.30
Estonia	9.46	6	9.53	17	−0.07
Finland	7.38	222	6.82	358	0.56
France	10.23	1042	9.78	6649	0.45
Germany	11.40	707	10.36	1764	1.04
Great Britain	5.52	21	8.89	3525	−3.37
Greece	7.02	14	9.78	974	−2.76
Hungary	11.84	21	7.30	383	4.54
Italy	11.17	303	8.93	15,223	2.24
Latvia	5.46	6	10.11	7	−4.65
Poland	8.90	39	6.73	818	2.17
Portugal	11.29	12	15.74	1569	−4.45
Romania	0.48	56	4.61	1552	−4.13
Slovakia	16.56	6	12.43	714	4.13
Slovenia	8.48	68	9.31	311	−0.83
Spain	8.28	55	8.52	7931	−0.24
Sweden	7.27	239	5.96	1360	1.31

Note: Table presents average values of the ROA indicator and number of observations included in calculation over the period 2011 to 2016. ROA calculated as EBITDA to TA, in%. Enterprises were classified as either SOEs or POEs based on the 25% ownership threshold.
Source: own elaboration based on data from Amadeus.

Table A.3
Econometric analysis—production, robustness check.

Dependant variable	ROA															
Specification	2011–2016				Residential prices		Non-residential prices		Bands DB-DD, IC-IE		Bands DA-DE, IA-IG		Fixed effects			
Price	Wholesale prices		Energy and supply price component		Energy and supply price component (residential, band DC)		Energy and supply price component (non-residential, band ID)		Energy and supply price component (bands DB-DD, IC-IE)		Energy and supply price component (bands DA-DE, IA-IG)		Wholesale prices		Energy and supply price component	
SOE	>25%	>50%	>25%	>50%	>25%	>50%	>25%	>50%	>25%	>50%	>25%	>50%	>25%	>50%	>25%	>50%
Model	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
SOE	−3.070***	−3.724***	−4.047**	−4.179**	−3.556***	−3.069***	−3.518***	−3.720***	−3.593***	−3.660***	−3.816***	−3.772***				
	(0.54)	(0.39)	(1.07)	(1.04)	(0.71)	(0.64)	(0.70)	(0.81)	(0.65)	(0.69)	(0.54)	(0.54)				
Price	4.331	3.839	25.471	26.046	12.587	13.445	4.536	4.955	7.307	7.839	1.557	2.266				
	(29.63)	(29.16)	(19.82)	(19.34)	(14.03)	(13.71)	(13.33)	(12.96)	(14.21)	(13.79)	(13.88)	(13.48)				
*SOE*Price*	55.532**	63.829***	61.471**	58.422**	40.279***	29.639***	52.168***	50.281***	48.572***	45.027***	48.737***	43.824***	56.124***	57.493***	53.172**	59.540**
	(14.94)	(11.22)	(22.65)	(18.19)	(8.94)	(6.23)	(14.90)	(14.67)	(12.02)	(11.22)	(8.82)	(8.18)	(15.52)	(11.56)	(22.95)	(21.83)
*POE*Price*													29.256	29.165	11.516	11.711
													(17.40)	(17.88)	(12.46)	(12.24)
Firm-level control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country-level control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NA	NA	NA	NA
Intercept, time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	42,433	42,433	39,106	39,106	46,650	46,650	46,825	46,825	46,650	46,650	46,650	46,650	49,406	49,406	46,650	46,650
N enterprises	10,350	10,350	10,387	10,387	10,551	10,551	10,552	10,552	10,551	10,551	10,551	10,551	10,466	10,466	10,551	10,551
N countries	20	20	22	22	22	22	22	22	22	22	22	22	20	20	22	22
R^2_o, R^2_w	0.127	0.127	0.117	0.116	0.115	0.114	0.115	0.115	0.115	0.115	0.115	0.115	0.054	0.054	0.054	0.054
σ_u	5.285	5.285	5.705	5.704	5.353	5.353	5.333	5.333	5.354	5.354	5.355	5.354	9.219	9.218	9.145	9.115
σ_e	4.869	4.868	4.646	4.646	5.234	5.234	5.253	5.253	5.233	5.233	5.234	5.233	5.334	5.334	5.233	5.233
ρ	0.541	0.541	0.601	0.601	0.511	0.511	0.508	0.508	0.511	0.511	0.511	0.511	0.749	0.749	0.753	0.752

Driscoll and Kraay (1998) standard errors are reported in parentheses. Asterisks denote significance levels: ***−1%, **−5%, *−10%. *SOE* indicates stake thresholds employed to classify an enterprise as state-owned. *N* denotes the number of observations. σ_u is the standard deviation of residuals within groups. σ_e is the standard deviation of residuals (overall error term). ρ is an intraclass correlation that shows how much of the variance is due to differences across panels. R^2_o is overall R-square (random effects models), R^2_w is within R-square (fixed effects models). *ROA, Wholesale prices* and *Energy and supply price component* as described in Table 1. *Band DC* represents the price for residential consumers with annual consumption between 2500 and 5000 kWh, *DA* for below 1000 kWh, *DB* for 1000–2500 kWh, *DD* for 5000–15,000 kWh, *DE* for above 15,000 kWh. *Band ID* represents the price for non-residential consumers with annual consumption between 2000 and 20,000 MWh, *IA* for below 20 MWh, *IB* for 20–500 MWh, *IC* for 500–2000 MWh, *IE* for 20,000–70,000 MWh, *IF* for 70,000–150,000 MWh, *IG* for above 150,000 MWh. *Bands DB-DD, IC-IE* and *Bands DA-DE, IA-AG* are calculated as averages of prices for respective consumption bands and weighted by residential and non-residential shares in the final electricity consumption. The coefficients depict the effect in percentage points. Detailed results presented in Appendix B are available online. A list of control variables is presented in Table 1.
Source: own elaboration with Stata.

Table A.4
Econometric analysis—trade, transmission and distribution sectors.

Dependant variable	ROS		ROA		ROA		ROA	
Sector, specification	Trade		Trade & Production		Transmission and Distribution		Transmission and Distribution, fixed effects	
Price	Mark-up		Energy and supply price component		Network costs price component		Network costs price component	
SOE	>25%	>50%	>25%	>50%	>25%	>50%	>25%	>50%
Model	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
SOE	0.303	1.004	−2.334**	−2.796***	−2.094***	−2.451***		
	(1.22)	(1.28)	(0.76)	(0.80)	(0.60)	(0.49)		
Price	62.582*	61.180*	−0.719	−1.015	71.781	70.681	4.536	4.955
	(32.01)	(31.20)	(14.11)	(13.95)	(48.60)	(49.02)	(13.33)	(12.96)
*SOE*Price*	22.892	32.147	27.259*	31.953**	63.392**	75.040***	136.237*	139.320*
	(69.69)	(77.23)	(12.02)	(10.52)	(24.18)	(21.83)	(70.36)	(71.37)
*POE*Price*							80.473	80.484
							(47.31)	(47.20)
Firm-level control variables	yes	yes	yes	yes	yes	yes	yes	yes
Country-level control variables	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes	yes	NA	NA
Intercept, time FE	yes	yes	yes	yes	yes	yes	yes	yes
N	3401	3401	50,500	50,500	8203	8203	8203	8203
N enterprises	720	720	11,335	11,335	1463	1463	1463	1463
N countries	19	19	22	22	22	22	22	22
R^2_o, R^2_w	0.151	0.153	0.079	0.079	0.112	0.113	0.029	0.029
σ_u	8.005	8.001	5.774	5.774	6.929	6.929	8.583	8.590
σ_e	8.717	8.718	5.487	5.486	5.852	5.852	5.852	5.851
ρ	0.457	0.457	0.526	0.526	0.584	0.584	0.683	0.683

Driscoll and Kraay (1998) standard errors are reported in parentheses. Asterisks denote significance levels: ***−1%, **−5%, *−10%. *ROS* is return on sales calculated with EBITDA. *SOE* indicates stake thresholds employed to classify an enterprise as state-owned. *N* denotes the number of observations. σ_u is the standard deviation of residuals within groups. σ_e is the standard deviation of residuals (overall error term). ρ is an intraclass correlation that shows how much of the variance is due to differences across panels. R^2_o is overall R-square (random effects models), R^2_w is within R-square (fixed effects models). *ROA, Wholesale prices* and *Energy and supply price component* as described in Table 1. *Mark-up* calculated as the difference between *the energy and supply price component* and *wholesale prices. ROS* calculated as EBITDA to operating revenue. *Network costs price component* based on DC and ID consumption bands, weighted by residential and non-residential shares in the final electricity consumption. The coefficients depict the effect in percentage points. Detailed results presented in Appendix B are available online. A list of control variables in Models 23–26 and 27–30 at the firm-level is presented in Table 1. Country-level control variables in Models 27–30 consist of electricity distribution losses, final electricity consumption per capita, export and import to total electricity consumption ratios and energy mix.
Source: own elaboration with Stata.

References

Agency for the Cooperation of Energy Regulators, 2018. Estimated Electricity Mark-up 2008-2018 (prices in €/MWh). https://aegis.acer.europa.eu/chest/category/1/list.

Bacchiocchi, E., Florio, M., Taveggia, G., 2015. Asymmetric effects of electricity regulatory reforms in the EU15 and in the New Member States: empirical evidence from residential prices 1990–2011. Utilities Policy 35, 72–90.

Bai, Ch., Li, D., Tao, Z., Wang, Y., 2000. A multitask theory of state enterprise reform. J Comp Econ 28 (4), 716–738. https://doi.org/10.1006/jcec.2000.1681.

Bałtowski, M., Kozarzewski, P., 2016. Formal and real ownership structure of the Polish economy: state-owned versus state-controlled enterprises. Post-Communist Economies 28 (3), 405–419. https://doi.org/10.1080/14631377.2016.1196885.

Bałtowski, M., Kwiatkowski, G., 2018. Przedsiębiorstwa Państwowe We Współczesnej Gospodarce [State-owned Enterprises in the Contemporary Economy], 1st ed. PWN, Warszawa.

Baskaran, T., Min, B., Uppal, Y., 2015. Election cycles and electricity provision: evidence from a quasi-experiment with Indian special elections. J Public Econ 126, 64–73. https://doi.org/10.1016/j.jpubeco.2015.03.011.

Baum, Ch., 2001. Residual diagnostics for cross-section time series regression models. Stata J 1 (1), 101–104.

Baumöhl, E., Iwasaki, I., Kočenda, E., 2019. Institutions and determinants of firm survival in European emerging markets. J. Corporate Finance 58, 431–453. https://doi.org/10.1016/j.jcorpfin.2019.05.008.

Bator, F., 1958. The anatomy of market failure. Q J Econ 72 (3), 351–379.

Beck, N., Katz, J.N., 2001. Throwing out the baby with the bath water: a comment on Green, Kim, and Yoon. Int Organ 55 (2), 487–495.

Bell, A., Jones, K., 2015. Explaining fixed effects: random effects modeling of time-series cross-sectional and panel data. Pol. Sci. Res. Methods 3 (1), 133–153. https://doi.org/10.1017/psrm.2014.7.

Bortolotti, B., Fantini, M., Siniscalco, D., 2004. Privatisation around the world: evidence from panel data. J Public Econ 88 (1–2), 305–332.

Bozec, R., Breton, G., Côté, L., 2002. The performance of state–owned enterprises revisited. Financial Accountability Manage. 18, 383–407.

Bozec, R., Dia, M., Breton, G., 2006. Ownership-efficiency relationship and the measurement selection bias. Accounting Finance 46, 733–754. https://doi.org/10.1111/j.1467-629x.2006.00194.x.

BP, 2020. BP Statistical Review of World Energy 2020. https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html. Dataset.

Brambor, T., Clark, W.R., Golder, M., 2006. Understanding interaction models: improving empirical analyses. Pol. Anal. 14 (1), 63–82. https://doi.org/10.1093/pan/mpi014.

Bremmer, I., 2009. State capitalism comes of age: the end of the free market? Foreign Affairs 88 (3), 40–55.

Breusch, T.S., Pagan, A.R., 1980. The lagrange multiplier test and its applications to model specification in econometrics. Rev Econ Stud 47 (1), 239–253.

Brown, J.D., Earle, J.S., Telegdy, Á., 2006. The productivity effects of privatization: longitudinal estimates from Hungary, Romania, Russia, and Ukraine. J. Pol. Econ. 114, 61–99. https://doi.org/10.1086/499547.
Bureau van Dijk, 2018. Amadeus Database. Retrieved in February 2018 from. https://amadeus.bvdinfo.com/. dataset.
Chen, G., Firth, M., Xu, L., 2009. Does the type of ownership control matter? Evidence from China's listed companies. J. Banking Finance 33, 171–181. https://doi.org/10.1016/j.jbankfin.2007.12.023.
Christiansen, H., 2013. Balancing Commercial and Non-Commercial Priorities of State-Owned Enterprises. OECD Corporate Governance Working Papers 6. OECD Publishing, Paris.
Christiansen, H., Kim, Y., 2014. State-Invested Enterprises in the Global Marketplace: Implications for a Level Playing Field. OECD Corporate Governance Working Papers 14. OECD Publishing, Paris. https://doi.org/10.1787/5jz0xvfvl6nw-en.
Clò, S., Ferraris, M., Florio, M., 2017. Ownership and environmental regulation: evidence from the European electricity industry. Energy Economics 61, 298–312.
Commander, S., Svejnar, J., 2011. Business environment, exports, ownership, and firm performance. Rev Econ Stat 93 (1), 309–337.
De Fraja, G., 2009. Mixed Oligopoly: Old and New. Discussion Papers in Economics 09/20. University of Leicester.
De Fraja, G., Delbono, F., 1989. Alternative strategies of a public firm in oligopoly. Oxf Econ Pap 41, 302–311.
De Hoyos, R.E., Sarafidi, V., 2006. Testing for cross-sectional dependence in panel-data models Rafael. Stata J 6, 482–496.
Del Bo, Ch., Florio, M., 2012. Public enterprises, planning and policy adoption: three welfare propositions. J. Econ. Policy Reform 15 (4), 263–279. https://doi.org/10.1080/17487870.2012.722846.
Del Bo, C.F., 2013. Productivity in electricity generation: the role of firm ownership and regional institutional quality. Int. Rev. Appl. Econ. 27, 237–264. https://doi.org/10.1080/02692171.2012.734792.
Del-Río, B., Fernández-Sainz, A., Martinez de Alegria, I., 2019. Industrial electricity prices in the European Union following restructuring: a comparative panel-data analysis. Utilities Policy 60, 1–9. https://doi.org/10.1016/j.jup.2019.100956.
Djankov, S., Murrell, P., 2002. Enterprise restructuring in transition: a quantitative survey. J Econ Lit 40 (3), 739–792.
Driscoll, J., Kraay, A.C., 1998. Consistent covariance matrix estimation with spatially dependent data. Rev. Econ. Stat. 80, 549–560.
D'Souza, J., Nash, R., 2017. Private benefits of public control: evidence of political and economic benefits of state ownership. J. Corporate Finance 46, 232–247. https://doi.org/10.1016/j.jcorpfin.2017.07.001.
Eller, S.L., Hartley, P.R., Medlock, K.B., 2011. Empirical evidence on the operational efficiency of National Oil Companies. Empir Econ 40, 623–643. https://doi.org/10.1007/s00181-010-0349-8.
Englmaier, F., Roider, A., Stowasser, T., Hinreiner, L., 2017. Power politics: electoral cycles in german electricity prices. In: Annual Conference 2017 (Vienna): Alternative Structures for Money and Banking 168267. German Economic Association.
Estrin, S., Hanousek, J., Kočenda, E., Svejnar, J., 2009. The effects of privatization and ownership in transition economies. J Econ Lit 47, 699–728. https://doi.org/10.1257/jel.47.3.699.
Estrin, S., Liang, Z., Shapiro, D., Carney, M., 2019. State capitalism, economic systems and the performance of state owned firms. Acta Oeconomica 69, 175–193. https://doi.org/10.1556/032.2019.69.S1.11.
European Commission, 2016. State-Owned Enterprises in the EU: Lessons Learnt and Ways Forward in a Post-Crisis Context. Institutional Paper 031. Luxembourg: Publications Office of the European Union. https://doi.org/10.2765/99224.
European Environment Agency, 2018. CO2 - emission intensity. https://www.eea.europa.eu/data-and-maps/daviz/co2-emission-intensity dataset.
Eurostat, 2020. Eurostat Database. https://ec.europa.eu/eurostat/web/energy/data/database dataset.
Fiorio, C.V., Florio, M., 2013. Electricity prices and public ownership: evidence from the EU15 over thirty years. Energy Econ. 39, 222–232. https://doi.org/10.1016/j.eneco.2013.05.005.
Florio, 2013a. Network Industries and Social welfare: The Experiment That Reshuffled European Utilities, 1st ed. Oxford University Press, United Kingdom, Oxford.
Florio, M., 2013b. Rethinking on public enterprise: editorial introduction and some personal remarks on the research agenda. Int. Rev. Appl. Econ. 27, 135–149. https://doi.org/10.1080/02692171.2013.785664.
Frees, E.W., 2004. Longitudinal and Panel Data: Analysis and Applications in the Social Sciences. Cambridge University Press, Cambridge.
Grave, K., Breitschopf, B., Ordonez, J., Wachsmuth, J., Boeve, S., Smith, M., Schubert, T., Friedrichsen, N., Herbst, A., Eckartz, K., Pudlik, M., Bons, M., Ragwitz, M., Schleich, J., 2016. Prices and Costs of EU Energy. European Commission. https://doi.org/10.1007/978-1-349-13402-1_6.
Guislain, P., 1997. The Privatization challenge: a strategic, Legal and Institutional Analysis of International Experience. The World Bank, Washington, D.C.. World Bank Regional and Sectoral Studies.
Gupta, N., 2005. Partial privatization and firm performance. J. Finance 60, 987–1015.
Harris, R., Tzavalis, E., 1999. Inference for unit roots in dynamic panels where the time dimension is fixed. J Econom 91 (2), 201–226.
Hartley, P., Medlock, K.B., 2008. A model of the operation and development of a National Oil Company. Energy Econ. 30, 2459–2485. https://doi.org/10.1016/j.eneco.2007.12.017.
Hartley, P.R., Medlock, K.B., 2013. Changes in the operational efficiency of National Oil Companies. Energy J. 34 (2), 27–57. https://doi.org/10.5547/01956574.34.2.2.
Hoechle, D., 2007. Robust standard errors for panel regressions with cross-sectional dependence. Stata J 7, 281–312. https://doi.org/10.1177/1536867x0700700301.
Hyland, M., 2016. Restructuring European electricity markets - A panel data analysis. Utilities Policy 38, 33–42. https://doi.org/10.1016/j.jup.2015.11.004.
Jensen, M.C., Meckling, W.H., 1976. Theory of the Firm: managerial Behavior, Agency Costs and Ownership Structure. J financ econ 3 (4), 305–306.
Kingsley, A.F., Noordewier, T.G., Vanden Bergh, R.G., 2017. Overstating and understating interaction results in international business research. Journal of World Business 52 (2), 286–295. https://doi.org/10.1016/j.jwb.2016.12.010.
Kočenda, E., Hanousek, J., 2012. State ownership and control in the Czech Republic. Econ. Change Restructuring 45, 157–191. https://doi.org/10.1007/s10644-011-9114-z.
Kornai, J., 1979. Resource-constrained versus demand-constrained systems. Econometrica 47 (4), 801–819.
Kornai, J., Maskin, E., Roland, G., 2003. Understanding the soft budget constraint. J Econ Lit 41 (4), 1095–1136.
Kowalski, P., Buge, M., Sztajerowska, M., Egeland, M., 2013. State-owned enterprises: trade effects and policy implications. OECD Trade Policy Paper 147, 1–33. https://doi.org/10.1787/5k4869ckqk7l-en, 2013.
La Porta, R., Lopez-De-Silanes, F., Shleifer, A., 2002. Government ownership of banks. J. Finance 57, 265–301. https://doi.org/10.1111/1540-6261.00422.
Lin, J., 2010. New Structural Economics: A Framework for Rethinking Development. World Bank, Washington DC. Policy Research Working Paper 5197.
Lin, L.W., Milhaupt, C.J., 2013. We are the (national) champions: understanding the mechanisms of state capitalism in China. Stanford Law Rev 65 (4), 697–760.
Liu, F., Zhang, L., 2018. Executive turnover in China's state-owned enterprises: government-oriented or market-oriented? China J. Accounting Res. 11 (2), 129–149. https://doi.org/10.1016/j.cjar.2016.12.003.
Matuszak, P., Szarzec, K., 2019. The scale and financial performance of state-owned enterprises in the CEE region. Acta Oeconomica 69 (4), 549–570.
Mazzucato, M., 2013. The Entrepreneurial State: Debunking Public vs. Private Sector Myths. Anthem Press, London.
Megginson, W., Netter, J., 2001. From state to market: a survey of empirical studies on privatization. J Econ Lit 39 (2), 321–389.
Megginson, W.L., 2017. Privatization, state capitalism, and state ownership of business in the 21st century. Foundations Trends Finance 11 (1–2), 1–153. https://doi.org/10.1561/0500000053.
Muhlenkamp, H., 2015. From to state market revisited: a reassesment of the empirical evidence on the efficiency of public (and Privately-Owned) Enterprises. Annals Public Cooperative Econ. 86 (4), 535–557.
Musacchio, A., Lazzarini, S.G., 2014. Reinventing State Capitalism: Leviathan in Business, Brazil and Beyond, 1st ed. Harvard University Press, Cambridge.
Nordhaus, W., 1975. The political business cycle. Rev. Econ. Stud. 42 (2), 169–190.
Peter, K.S., Svejnar, J., Terrell, K., 2012. Foreign Investment, Corporate Ownership, and Development: are firms in emerging markets catching up to the world standard? Rev Econ Stat 94 (4), 981–999.

Pollitt, M.G., 2019. The european single market in electricity: an economic assessment. Rev. Ind. Organ. 55, 63–87. https://doi.org/10.1007/s11151-019-09682-w.
Prabowo, R., Hooghiemstra, R., Van Veen-Dirks, P., 2018. State ownership, socio-political factors, and labor cost stickiness. Eur. Accounting Rev. 27, 771–796. https://doi.org/10.1080/09638180.2017.1329659.
Rademaekers, K., Smith, M., Yearwood, J., Saheb, Y., Moerenhout, J., Pollier, K., Debrosses, N., Badouard, T., Peffen, A., Pollitt, H., Heald, S., Altman, M., 2018. Study On Energy Prices, Costs and Subsidies and Their Impact on Industry and Households: Final Report. European Commission – DG Energy.
Roberts, M.R., Whited, T.M., 2013. Endogeneity in empirical corporate finance. Handbook Econ.Finance, 493–572. doi:10.1016/B978-0-44-453594-8.00007-0.
Robinett, D., 2006. Held By the Visible hand: the Challenge of State-Owned Enterprise Corporate Governance For Emerging Markets. World Bank, Washington, DC.
Roland, G., 2000. Transition and Economics: Politics, Markets and Firms. MIT Press, Cambridge, MA.
Shirley, M., Walsh, P., 2000. Public Versus Private Ownership: The Current State of the Debate. Policy Research Working Paper 2420. World Bank, Washington, DC.
Shleifer, A., 1998. State vs. private ownership. J. Econ. Perspect. 12, 133–150.
Shleifer, A., Vishny, R., 1994. Politicians and Firms. Q. J. Econ. 109 (4), 995–1025.
Shleifer, A., Vishny, R., 1998. The Grabbing Hand: Government Pathologies and Their Cures. Harvard University Press, Cambridge, MA.
Stridbaek, U., 2006. Lessons from Liberalised Electricity Markets. https://doi.org/10.1787/9789264109605-en. CESifo DICE Report.
Szarzec, K., Dombi, Á., Matuszak, P., 2021. State-owned enterprises and economic growth: evidence from the post-Lehman period. Econ Model. doi:10.1016/j.econmod.2021.03.009.
Szarzec, K., Nowara, W., 2017. The economic performance of state-owned enterprises in Central and Eastern Europe. Post-Communist Econ. 29 (3), 375–391. https://doi.org/10.1080/14631377.2017.1316546.
Szarzec, K., Totleben, B., Piątek, D., 2020. How do politicians capture a state? Evidence from State-Owned Enterprises. East European Politics and Societies: and Cultures. doi:10.1177/0888325420953485.
Tihanyi, L., Aguilera, R.V., Heugens, P., van Essen, M., Sauerwald, S., Duran, P., Turturea, R., 2019. State Ownership and Political Connections. J Manage 45 (6), 2293–2321. https://doi.org/10.1177/0149206318822113.
Tõnurist, P., 2015. Framework for analysing the role of state owned enterprises in innovation policy management: the case of energy technologies and Eesti Energia. Technovation 38, 1–14. https://doi.org/10.1016/j.technovation.2014.08.001.
Wang, K.T., Shailer, G., 2018. Does Ownership identity matter? A meta-analysis of research on firm financial performance in relation to government versus private ownership. Abacus 54, 1–35. https://doi.org/10.1111/abac.12103.
Wang, X., Wang, S., 2013. Chairman's government background, excess employment and government subsidies: evidence from Chinese local state-owned enterprises. China J. Accounting Res. 6 (1), 51–74.
Wooldridge, J.M., 2002. Econometric Analysis of Cross Section and Panel Data. The MIT Press, Cambridge.
World Bank, 2020. World Development Indicators. https://databank.worldbank.org/source/world-development-indicators.

Economic Modelling 99 (2021) 105490

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.journals.elsevier.com/economic-modelling

State-owned enterprises and economic growth: Evidence from the post-Lehman period

Katarzyna Szarzec [a], Ákos Dombi [b,*], Piotr Matuszak [a]

[a] Poznan University of Economics and Business, Institute of Economics, Department of Macroeconomics and Development Studies, Poznan, Poland
[b] Eötvös Loránd University, Institute of Business Economics, Department of Comparative Economics, Budapest, Hungary

ARTICLE INFO

JEL classification:
O11
O43
L32
L38

Keywords:
State-owned enterprises
Institutions
Economic growth

ABSTRACT

This paper investigates the effect of state-owned enterprises (SOEs) on economic growth in 30 European countries in the period between 2010 and 2016. We build a unique dataset on the economic weight of SOEs based on the data of more than 130,000 large nonfinancial companies. In our regression analysis, we condition the growth effect of SOEs on different measures of institutional quality. According to our results, SOEs are not positive or negative for growth per se. Their impact hinges crucially upon the country's institutions: with good (bad) institutions the effect of SOEs is more beneficial (detrimental), turning into significantly positive (negative) in the right-tail (left-tail) of the sample distribution of institutional quality. This result holds through a wide array of robustness checks. The policy conclusion is that with good institutions the positive external effects of SOEs may outweigh the loss in economic growth caused by SOEs' possible inefficiencies.

1. Introduction

This study aims to address a substantial research gap on the impact of state-owned enterprises (SOEs) on economic growth and its conditioning factors. In doing so, we construct a brand-new dataset on the scale of state ownership in 30 European countries over the period of 2007–2016 using financial indicators for more than 130,000 nonfinancial companies. In order to account for the changes in the ownership of enterprises, we also compile a *Privatization Dataset* including 1160 privatizations and 61 nationalizations. The econometric analyses for the years 2010–2016 reveal that the impact of companies owned by the state on economic growth is not good or bad per se, but is conditioned on the level of institutional quality. State-owned enterprises positively contribute to growth in countries with good institutions, while their presence impairs the economy when institutional quality is low.

In the last three decades, there has been a substantial increase in research on state-owned enterprises driven by two key factors. First, massive privatization programs took place both in developed and in transition countries from the 1980s until the early 2000s (Megginson and Netter, 2001; Bortolotti et al., 2004; Roland, 2008; Mickiewicz, 2010). These large-scale privatizations were motivated by the belief that only private ownership could guarantee efficient corporate governance. Second, in the so called BRICS countries (Brazil, Russia, India, China, South Africa), SOEs have been a significant part of the economy and explicitly regarded as vehicles of national development strategies (Lin and Milhaupt, 2013; Musacchio and Lazzarini, 2014; OECD, 2015). Moreover, in recent years, Chinese and Russian SOEs have been appearing on the international capital markets in more and more hawkish manner. They have been nurtured on the basis of past socialist development models adapted to the present reality and are regarded as national champions that must remain in state ownership. In their foreign investments, Chinese and Russian SOEs have followed not just economic objectives but political objectives—shaped by the priorities of foreign policy—too (Ramaswamy et al., 2012; Cahen, 2015; Estrin et al., 2016).

The theoretical literature remains fairly inconclusive concerning the net effect of SOEs on economic growth, and emphasizes that SOEs might exert both negative and positive effects on growth (see Section 2). Therefore, by necessity, the question addressing the balance of SOEs' growth impact is of empirical nature. However, despite the widely acknowledged relevance of the topic, empirical studies on the growth impact of SOEs have been scarce to date and those existing ones focus on remote periods (Plane, 1992; Fowler and Richards, 1995; Gylfason et al., 2001; Doamekpor, 2003). The underlying reason for the latter is the lack of comprehensive cross-country data on the scale of state ownership in the 2000s.

This study contributes to the literature on state-owned enterprises

* Corresponding author.
E-mail addresses: katarzyna.szarzec@ue.poznan.pl (K. Szarzec), dombi@gti.elte.hu (Á. Dombi), piotr.matuszak@ue.poznan.pl (P. Matuszak).

https://doi.org/10.1016/j.econmod.2021.03.009
Received 10 September 2020; Received in revised form 8 March 2021; Accepted 8 March 2021
Available online 12 March 2021

and, more broadly, on state capitalism by constructing a novel micro-level-based dataset on the aggregate economic weight of SOEs in European countries according to leading business indicators. We also compile a dataset on privatizations and nationalizations in the same countries. The SOE Dataset allows us to extend the literature on economic growth by analyzing the growth effect of SOEs under recent economic conditions. Finally, to the best of our knowledge, we are the first to explore the conditionality of the *SOEs–growth* nexus on (governmental) institutional quality.

According to our results, the impact of SOEs on economic growth hinges crucially upon the level of institutional quality: the better the institutional environment, the more beneficial (less detrimental) the overall effect of state-owned enterprises is. This conclusion is robust to the estimation methodology, the sample, the independent variables and other sensitivity checks.

The paper is structured as follows. Section 2 reviews the literature on the economic impact of SOEs. Section 3 introduces our brand-new dataset—in conjunction with the main stylized facts—on the economic weight of SOEs in 30 European countries between 2007 and 2016. Section 4 presents the data and the methodology of our regression analysis. Section 5 discusses the results on the conditional growth impact of SOEs. Section 6 reconsiders the results with alternative measures of institutional quality. Section 7 extends the baseline results with some further analyses. Section 8 performs the sensitivity analyses. Section 9 concludes.

2. The economic impact of state-owned enterprises: literature review

As already mentioned, the literature is not conclusive concerning the overall economic impact of SOEs. While the theory marshals both benefits and drawbacks of state intervention into the economy via owning enterprises, the bulk of empirical evidence suggests that SOEs are less efficient than their private counterparts. In this section, we present the pros and cons of state-owned enterprises. We also highlight the importance of the institutional environment in terms of SOEs' operation and potential growth impact.

There are several economic arguments promoting state ownership. First, SOEs might address market failures by providing public goods and funding for key infrastructure projects (Bator, 1958; Vickers and Yarrow, 1991). Second, SOEs might contribute to the smoothing of business cycles via counter-cyclical investment expenditures and employment (Bai et al., 2000; Telegdy, 2016). They also might support vulnerable social groups by maintaining employment in sunset industries (Robinett, 2006; Christiansen, 2013). Moreover, SOEs can enhance the access to public utilities at affordable prices (Fiorio and Florio, 2013; Florio, 2013; Matuszak and Kabaciński, 2021). They also support national security by limiting private and foreign ownership in sectors of particular national interests, such as the arms and network industries (Robinett, 2006). SOEs are frequently used to promote industrialization, particularly by launching new industries with significant start-up costs and long-term investments needed (Lin and Milhaupt, 2013; Musacchio and Lazzarini, 2014). Last but not least, SOEs can be vehicles of innovation, knowledge dissemination, and technological spin-offs (Mazzucato, 2013; Antonelli et al., 2014; Tõnurist, 2015; Castelnovo and Florio, 2020).

The above positive perceptions of state ownership explain the considerable role played by SOEs in developed economies in historical perspective. In the 19th century, state-owned enterprises in Western countries were heavily involved in setting up the energy, communication and transportation infrastructures (Millward, 2005). Later, in the 20th century, the role of SOEs increased further in two waves until the 1970s: first, in the interwar period due to the crisis of liberal capitalism; second, after—and during—the Second World War (WWII) (Bognetti, 2020). Throughout these periods, the growth in state intervention manifested itself in the creation of large state-owned enterprises through SOEs' diversification and acquisition of private companies (Vernon and Aharoni, 1981; Toninelli, 2000). The governments' objectives were to support promising infant industries, strengthen the public sector against the private one, improve the bargaining power of the state against foreign companies, enhance stability and increase employment (Vernon and Aharoni, 1981). The Western 'mixed economies'—with a substantial weight of SOEs—performed well, experiencing high growth rates in the first part of the post-WWII era. Several country studies found SOEs to play a leading role in this economic success.[1] However, economic slowdowns in the 1970s led to a revaluation of the role of the state and a reduction in state ownership in most Western economies in the successive years.

Most empirical studies support the proposition that SOEs underperform privately owned enterprises (POEs).[2] Agency problems (Jensen and Meckling, 1976; Megginson and Netter, 2001; Musacchio and Lazzarini, 2014), soft budget constraints (Kornai, 1979; Kornai et al., 2003), clientelism and the misuse of SOEs as political goods (Shleifer and Vishny, 1994; Kopecký and Spirova, 2011; Wang and Wang, 2013; Liu and Zhang, 2018; Jian et al., 2020; Szarzec et al., 2020) are often revealed in the background of SOEs' weak performance. Moreover, the use of SOEs as a vehicle of industrialization might do more harm than good due to the frequent failure of policymakers to identify correctly promising industries.

These negative perceptions dominated the debate on SOEs throughout the 1980s and 1990s resulting in large-scale privatizations in developed countries (Guislain, 1997; Megginson and Netter, 2001; Bortolotti et al., 2004) and transition economies (Roland, 2000; Estrin et al., 2009; Mickiewicz, 2010). Privatization was justified by the belief that only private ownership can guarantee high efficiency. In developing and socialist countries, the lack of the profit motive at SOEs resulted in inefficiencies and products which were out of sync with market demand. As a result, state ownership failed to foster economic development and industrialization in a sustainable way. In developed countries, the retreat of state ownership was driven by multiple factors such as the tightening budgetary constraints in the aftermath of the crises in the 1970s, achievements in economic development and restructuring, and the inadequate capabilities of SOEs to innovate (Toninelli, 2000; Bognetti, 2020).

Any inefficiencies in the operation of SOEs would certainly impact economic growth adversely. Plane (1992) shows that the lower productivity of SOEs—which can be a result of agency problems, soft budget constraints or clientelism—leads to static inefficiency and, thereby, lower steady-state output within the neoclassical growth framework. Building on Romer's (1990) model, Gylfason et al. (2001) demonstrate that the different forms of static inefficiency in SOEs' operations would result in a lower steady-state output in endogenous growth theory too. These approaches are mainly inspired by the common finding of micro-level studies that SOEs tend to be less efficient than POEs.

However, focusing exclusively on firm-level evidence and omitting the potential externalities stemming from state ownership might lead us to false conclusions concerning the *SOEs–growth* nexus. Huang et al. (2010) expand the microeconomic multi-task SOE model of Bai et al. (2000) and consider the positive externalities possibly conveyed by SOEs to other sectors in the neoclassical growth model. In their model, the private sector benefits from social stability, a public good supplied by SOEs. Therefore, state-owned enterprises might be conducive to economic growth should their positive externalities outweigh their inefficiencies. Furthermore, SOEs might be used to boost technological development by accelerating research and development (R&D) investments, a decisive determinant of long-run growth in endogenous growth theory (Aghion and Howitt, 1997). The peculiar characteristics of knowledge production and spillovers imply that private firms tend to

[1] See Antonelli et al. (2014) for the case of Italy, Stiefel (2000) for the case of Austria, and Davids and van Zanden (2000) for the case of the Netherlands.

[2] For survey studies, see Shirley and Walsh (2000), Megginson and Netter (2001), Djankov and Murrell (2002), Estrin et al. (2009), Megginson (2017), Wang and Shailer (2018), and Tihanyi et al. (2019).

under invest in research activities (Arrow, 1962; Romer, 1990; Griliches, 1992). Economic policy has several tools to address this problem including the promotion of R&D at SOEs. Similarly, when auxiliary efforts are necessary to use existing knowledge in the generation of new knowledge, public-oriented SOEs aid in coordinating the dissemination of knowledge within national innovation systems (Nelson, 1993). SOEs are often large entities operating in upstream industries and, in their research strategies, focus typically on basic research and the long time-horizon projects. These features point to the key role played by SOEs in knowledge governance mechanisms (Antonelli et al., 2014; Antonelli, 2015).

Despite the well-known drawbacks and benefits of SOEs, there are some studies that emphasize that SOEs are not bad or good per se. Their performance hinges crucially upon the institutional environment in which they operate. Borghi et al. (2016) show that SOEs benefit much from high-quality institutions because of less political interference in their operations and, thereby, better corporate governance. Castelnovo et al. (2019) show that public ownership in major telecom companies has a negative effect on firm-level total factor productivity, which can be mitigated or even reversed by a favorable institutional environment. Shaheer et al. (2017) consider SOEs as potential bribe payers and suggest that, in these companies, managerial rent-seeking increases disproportionately relative to POEs in a weak institutional environment. Estrin et al. (2016) discuss the influence of home country institutions on the internationalization of listed private- and state-owned companies. According to their results, when home country institutions enable effective control of the decision-makers of SOEs, the internationalization strategies of private and state enterprises converge. Huat (2016) demonstrates that in Singapore, the good financial performance of SOEs is rooted in the disciplining force of market competition, the competence of management and the independence from bureaucrats. Bartel and Harrison (2005) indicate that Indonesian state-owned enterprises underperform when they operate under soft budget constraints and propose enhancing market competition and limiting government financing in order to improve the performance of these SOEs. Bozec et al. (2002) and Bozec et al. (2006) emphasize the crucial importance of whether SOEs' business goals are set by their political principals or not. Both studies come to the conclusion that state-owned enterprises financially underperform their privately owned counterparts when they do not pursue profit-maximizing objectives, while they perform equally to POEs when profit-maximization rules.

Based on the literature presented above, we do not consider state-owned enterprises as having an unambiguous (either negative or positive) effect on growth. We regard the institutional environment as a decisive conditioning factor of SOEs' economic impact: the disadvantages of state-owned enterprises—such as agency problems, soft budget constraints, etc.—are more likely to be present (absent) when government institutions are bad (good), while the potential advantages of SOEs in the economy—such as the support of industrialization, innovations and knowledge spillovers—are more likely to materialize and offset the disadvantages under good government institutions. Consequently, we assume that better (worse) institutions promote (distort) SOEs' efficiency and support (limit) their positive external effects leading to more (less) beneficial growth impact.

Contrary to most of the previous studies, we do not focus on the financial performance of SOEs at the microeconomic level, but we consider the role of state-owned companies in supporting (impairing) economic growth. This wider perspective allows us to account for the externalities related to SOEs in the economy. To date, there have only been few studies addressing the empirical relationship between SOEs and economic growth for a broad set of countries. Based on the sample of developing countries between 1970 and 1985, Plane (1992) shows that the higher share of SOEs in total value added is associated with lower economic growth. Gylfason et al. (2001) corroborate the negative effect of SOEs on growth in developing countries by investigating the period of 1978–1992. However, when advanced countries are also considered the empirical results become less conclusive against SOEs. Fowler and Richards (1995) investigate the sample of OECD countries between 1965 and 1985 and find no evidence on the negative growth impact of SOEs. Based on a mix of advanced and developing economies in the period of 1980–1998, Doamekpor (2003) concludes that SOEs do not have any significant effect on growth.

However, these papers focus on remote periods and do not consider the conditioning effect of institutional quality. The main reason for the absence of new results has been the lack of comprehensive data on the scale of state ownership in the economy in the last two decades. Our important contribution is to fill these gaps by the construction of a brand new dataset on the economic weight of SOEs in 30 European countries in the period of 2007–2016 and, based on this dataset, by the empirical analysis of the impact of SOEs on economic growth conditioned on institutional quality. The next section introduces our *SOE Dataset*.

3. The SOE dataset: data construction and stylized facts

Our new SOE Dataset presents data on the economic weight of state-owned enterprises in 30 Western and post-socialist European countries spanning over the period of 2007–2016.[3] For each country-year datapoint, we present the following measures of SOEs' economic weight: the share of SOEs' total assets (TA), operating revenue (OR) and employment (NoE) in the total sum of large nonfinancial companies.

The contribution of the dataset is threefold. First, to the best of our knowledge, this is the first comprehensive dataset on SOEs embracing a broad set of European countries on both sides of the former Iron Curtain. Although the OECD publishes data on SOEs—covering their size, sectoral distribution and corporate form—only member and partner countries are included, thus a large part of East-Central Europe is neglected. Moreover, data are published on an irregular basis, not annually (OECD, 2017). All in all, these OECD data provide some factual information on the scale and main features of SOEs, but are not appropriate for empirical analysis.

There are some datasets which consider the prevalence of SOEs based on their shares in the largest companies either on a global scale or on a national scale. These data are derived according to standard lists of the largest companies such as the 'Forbes Global 2000' in 2011 (Kowalski et al., 2013), the 'Fortune Global 500' in 2005–2012 (Augustynowicz and Kwiatkowski, 2015), the 'Coface – 500 Top Companies in Central-Eastern Europe' in 2008 and 2013 (Szarzec and Nowara, 2017). However, the calculated shares on SOEs, similarly to the OECD data, are not appropriate to provide a sound basis for econometric analyses for at least two reasons: first, they consider only the largest companies, and second, they mostly refer to some specific years.

The second novelty of our data is its up-to-dateness. Namely, the latest dataset that offers cross-country data on SOEs on an annual basis, the Bureaucrats in Business dataset of the World Bank covering the period of 1978–1991, is almost 30 years old (World Bank, 1995). In contrast to the latter, we consider a recent decade and thereby facilitate the empirical investigation of the effect of SOEs on economic growth under current economic conditions. It has to be also emphasized that the recent time interval of our dataset allows the analysis of the economic effects of SOEs in a period when market transitions—incl. large-scale privatizations—are already over in East-Central Europe (Sonin, 2013). There is a number of studies investigating the effect of privatization on either the performance of the underlying firms (e.g., Frydman et al., 1999; Djankov and Murrell, 2002; Brown et al., 2006) or the national economy (e.g., Berkowitz and DeJong, 2003; Godoy and Stiglitz, 2007;

[3] Of the 30 countries, 16 are post-socialist (Bosnia-Hercegovina, Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, North Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia) and 14 are non-post-socialist Western (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom) countries.

Gouret, 2007) in the transition to a market economy. Contrary to them, we consider a time period when the economic weight of SOEs has already been settled in post-socialist countries. Therefore, this paper is primarily a contribution to the standard SOEs−growth literature.

The third novelty of our data is that they comprise not just majority state-owned enterprises (with state ownership exceeding 50 percent) but also minority state-owned enterprises with a controlling share of the state (i.e. state ownership between 25 and 50 percent). We are aware of only a few studies which—beyond the former—also consider the latter category in their data collection (Bałtowski and Kozarzewski, 2016; Szarzec and Nowara, 2017; Matuszak and Szarzec, 2019). However, the time span and country-coverage of these studies are much more limited. A final peculiarity of our dataset is that it takes both direct and indirect state ownerships into account.[4]

In the following, we introduce the main details of our data construction.[5] Our dataset is a macroeconomic dataset that is based on firm-level data retrieved from the Amadeus database of Bureau van Dijk. Amadeus contains the major business data of companies in European countries for the last ten years. The construction of the SOE Dataset started in November 2017. This explains the time span: 2007–16. The inclusion of countries was conditioned on data availability in Amadeus and data availability concerning privatizations in the studied period (see below).

In our SOE Dataset, we present aggregate shares of SOEs' economic weight according to three major business indicators (total assets, operating revenue, number of employees) based on the unconsolidated accounts of 131,068 large nonfinancial companies.[6] Our motivation in focusing on large companies is twofold. First, from the technical point of view, data are more available for large companies than for small and medium ones in Amadeus. Second, from the economic point of view, state ownership is concentrated in the group of large companies. At the same time, Amadeus contains data only on nonfinancial companies. So, the financial sector is, by necessity, not included in our dataset.[7] We also exclude three noncommercial sectors (education, health care, and public administration) in which companies—usually—cannot be privatized.

After retrieving the data on large companies, the next step was to distinguish state-owned enterprises from privately owned enterprises. However, the definition of SOEs is not straightforward; it hinges crucially upon two issues. First, what kind of ownerships are considered to accord with 'state ownership'? Second, from the economic point of view, above which ownership share should the company be considered as being 'state-owned'—that is, dominated by the state? With regard to the first issue, in our dataset, state ownership incorporates ownerships both by local and central governments and public authorities. As regards the second issue, we work with two minimum thresholds of state ownership when classifying companies either as POE or as SOE. The first is set at 50 percent, implying that state-owned enterprises are defined as entities in which the state holds—directly or indirectly—an ownership stake of more than 50 percent. The second is set at 25 percent, with the condition that only those companies that have the state or another SOE as the largest shareholder are classified as a SOE. According to the 50 percent and 25 percent thresholds, there are, respectively, 6,330 and 7,353 SOEs in our dataset in the year 2016.

Amadeus publishes the ownership structure of companies based on the latest available information, implying that its ownership data reflect the current state.[8] Since our dataset encompasses the period of 2007–2016, we have to take into account the changes in the companies' ownership structure due to privatizations and nationalizations in the considered years. Therefore, based on a broad set of data sources, we also compile a Privatization Dataset for the 30 countries and 10 years under consideration. In this dataset, we identify 1160 cases of privatizations and 61 cases of nationalizations.[9]

In the aggregation, we adhere to two major rules in the case of each indicator. First, in order to retain consistency in the cross-time and cross-country variations of our SOE measures, only those companies are included in the aggregation that have complete observations for the given business indicator in the considered period.[10,11] Second, we are determined to assure the representativity of the aggregate ratios. For this purpose, we adjust the time span at each country-series so that the companies—obeying the first rule and thereby—included in the aggregation would amount at least to 70 percent of the total number of large companies in the respective country.[12] Note, however, that missing data are prevalent in Amadeus, which reduces significantly the time span of the individual country-series that obeys both the rule of consistency and representativity. Therefore, we interpolate and extrapolate the companies' missing data when possible (see the online Data Appendix). Missing data treatment always raises the concern of whether its payoff exceeds its cost. In our case, the payoff turns out to dominate. Namely, as a result of the missing data treatment, the number of company-year slots available for aggregation improves crucially at each indicator, whilst, according to our simulations, the implied noise in the aggregate series is marginal at worst (see the online Data Appendix).[13]

The aggregate shares of SOEs according to total assets, operating revenue and number of employees are calculated both for the national economy and three specific industries (manufacturing, energy, transportation & storage). The remaining part of the section presents some stylized facts on the economic weight of SOEs according to their total assets—compared to the total assets of all large nonfinancial companies—in the national economy.[14]

Fig. 1 summarizes the average share of state ownership between 2007

[4] Indirect state ownership refers to the case when the state has a stake in a company through another SOE.

[5] For a more detailed discussion, see the online Data Appendix.

[6] A company is considered to be 'large'—and thereby included in our data—if either criterion of the related Eurostat classification is met according to the company's respective mean value in 2007–2016:1. (mean 2007–16) Employment $\geq$ 250.2. (mean 2007–16) Balance sheet total (total assets in our context) $>$ 43 million Euro.3. (mean 2007–16) Turnover (operating revenue in our context) $>$ 50 million Euro.

[7] Beyond data unavailability, the omission of the financial sector is reasonable from a methodological point of view too. The financial indicators of these companies are less comparable with those of nonfinancial companies.

[8] Since the Amadeus data underlying our dataset were downloaded in November 2017, the term 'current state' refers to the latter date in our case.

[9] The Privatization Dataset is available in the online appendix. In fact, the Privatization Dataset contains 1591 privatizations, in total. However, 431 privatizations concern companies which are not included in the Amadeus database and, therefore, not taken into account in our SOE Dataset.

[10] This rule ensures the avoidance of any artificial jumps in the aggregate series due to missing data. However, we have to emphasize that this rule is considered for the individual business indicators separately. The reason for this is, that applying the rule in its strictest form—that is, including only those companies in the aggregation which have complete observations for each of the three indicators—would decrease the share of available companies considerably.

[11] The companies established in the period between 2008 and 2016 (i.e. after the start of the SOE Dataset, 2007) are included in the aggregation for the respective years provided that they have complete observations on the given financial indicator starting with the year of establishment. On the other hand, the companies being inactive at the time of data retrieval (November 2017 in our case) are neglected in the dataset by necessity as Amadeus mostly contains data on active companies.

[12] The choice of this required representativity threshold is arbitrary to some extent. Therefore, in the dataset, we also provide the aggregate SOE measures in case of the 60 percent and 80 percent representativity thresholds.

[13] In our dataset, we also publish the aggregate shares of SOEs without any missing data treatment and without imposing either the consistency or the representativity rules.

[14] The stylized facts of SOEs' share in operating revenue are similar (see the appendix). We do not present the stylized facts on SOEs' employment share since company employment data are noisy and irregularly available in Amadeus. However, one can produce them according to our dataset.

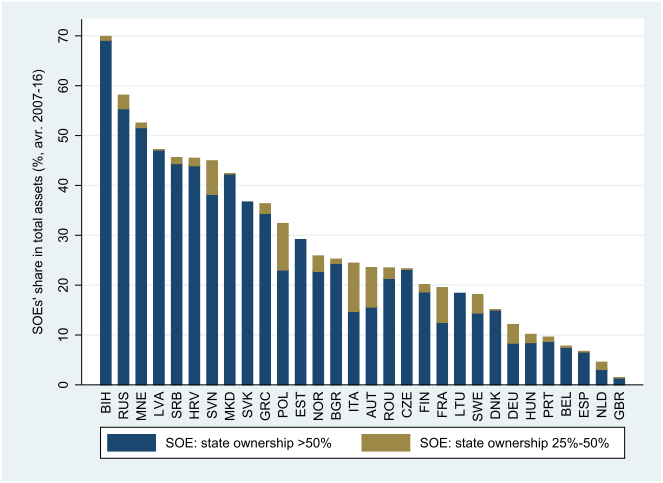

Fig. 1. The scale of state ownership: average share of SOEs in total assets (2007–2016).

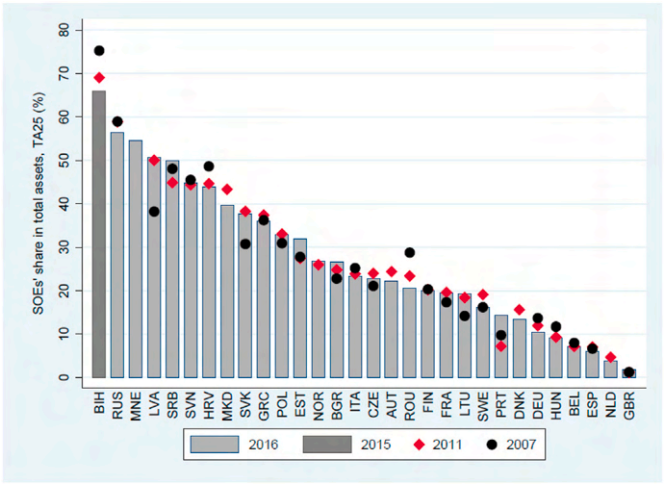

Fig. 2. Changes in the scale of state ownership: share of SOEs in total assets (threshold for state ownership: 25%). *Notes*: Data for 2007 are missing for AUT, DNK, MNE, MKD, NLD, and NOR. Data for 2011 is missing for MNE.

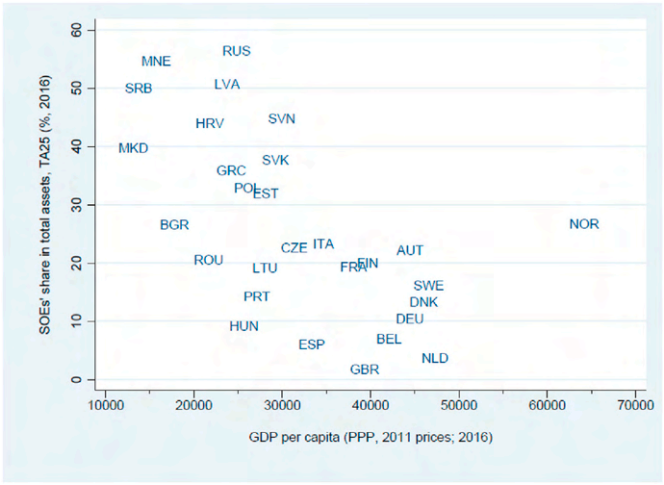

Fig. 3. State ownership and income level, 2016. *Notes*: For the source of GDP per capita, see Table A1.

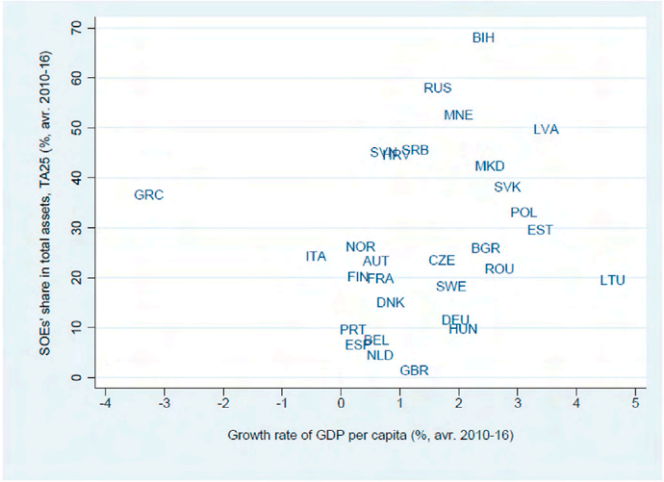

Fig. 4. State ownership and economic growth, 2010–2016. *Notes*: For the source of the growth rate of GDP per capita, see Table A1.

and 2016. Russia and non-EU Balkan countries stand out in terms of total assets of SOEs. They are followed by EU Balkan countries, the Baltics and Central Europe (with the exception of Hungary). In the group of non-post-socialist countries, Greece has the highest SOE share, followed by Norway, Italy and Austria. Great Britain and the Netherlands are characterized by the lowest shares of SOEs in total assets.[15] The patterns suggest two conclusions. First, in post-socialist countries, SOEs tend to make-up a remarkably larger fraction of the national economies. Since large-scale privatizations are mostly concluded in these countries, the latter predicts the preservation of the substantial role of state ownership in the region. Second, in Western countries, the SOE shares partly reflect the different perceptions about the desired scope of state interventions shaped by historical and cultural legacies—such as the laissez-faire orientation in Great Britain and the Netherlands, the self-regulated capitalism in Germany, dirigisme in France, and the welfare state in Scandinavia (Toninelli, 2000). These general patterns underline the importance of path dependence in state ownership, an important topic for future research.

As regards the within-country dynamics, Fig. 2 shows that in most cases SOEs' economic weight was quite persistent between 2007 and 2016. There are only few notable exceptions: the share of SOEs in total assets decreased considerably in Bosnia-Hercegovina, Romania and Croatia, while it increased significantly in Slovakia, Latvia, Lithuania and Portugal in the considered period.

The above ranking of the main country groups in terms of SOEs' total assets predicts that the share of SOEs decreases with the level of economic development. Indeed, Fig. 3 demonstrates that this is the case: there is a strong negative correlation between GDP per capita and the total assets of SOEs in 2016 (−0.59). In this respect, Norway is clearly an outlier by being very developed and considerably state-dominated at the same time.

As we discussed in the previous section, SOEs might be used as an engine for economic catch-up. Fig. 4 presents the scatterplot of SOEs' average share in total assets and the average GDP growth rate in the post-crisis period. There is a strong positive correlation between state ownership and economic growth. However, this relationship can be spurious for two reasons. First, as a legacy of socialism, SOEs are more prevalent in post-socialist countries. Second, these countries are in the

[15] Fig. 1 underpins the importance of also taking minority state ownership into consideration. Namely, if companies controlled by the state only through the 25–50 percent of shares were classified as privately owned companies, the overall share of SOEs would decrease significantly in some countries (e.g. Poland, Italy).

phase of conditional convergence, which explains partly their growth advantage over Western Europe. Therefore, it is possible that the co-movement of the growth rate and SOEs' share is just the legacy of the past. The remaining part of the paper aims to explore the genuine relationship between state ownership and economic growth in the post-Lehman period.

4. Data and methodology

The empirical analysis builds on the tradition of Barro-type growth regressions explaining economic growth by the initial income and a set of growth determinants (Barro, 1991). In our regressions we differentiate among conventional control variables (Controls), institutional quality (IQ) and the economic weight of SOEs (soe). The empirical analysis focuses on the latter, in particular the conditioning factors of the growth effect of SOEs. In this paper, we conjecture that the major prerequisite for SOEs to positively contribute to economic growth is good institutions. Therefore, we condition the growth effect of SOEs on institutional quality by interacting the latter with the respective measure of SOEs' economic weight:

$$gy_{i,t} = \beta_0 \ln y_{i,t-1} + \beta_1 soe_{i,t} + \beta_2 IQ_{i,t} + \beta_3 \left(soe_{i,t} \cdot IQ_{i,t}\right) + \boldsymbol{\alpha}^T \mathbf{Controls}_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

where y is GDP per capita, $gy = (100 \cdot \Delta \ln y)$ is the growth rate of GDP per capita, μ is country-fixed effect, η is time-fixed effect, ϵ is the error term, whilst i and t are country and time indexes. The analysis focuses on the marginal effect of soe on economic growth: $ME_{i,t} = \beta_1 + \beta_3 IQ_{i,t}$. We propose the following hypothesis:

H1. The marginal effect of SOEs' economic weight on economic growth increases with institutional quality, that is $\partial ME/\partial IQ = \beta_3 > 0$.

Measuring institutional quality is not straightforward for two reasons. First, 'institutions' is a vague notion in terms of its concrete content. Second, the measurement of institutional quality is also fraught with ambiguities. In this paper, we focus on governmental institutions as they are assumed to be decisive—surpassing any other institutional elements in terms of importance—when it comes to the economic performance of SOEs. In measuring the quality of governmental institutions, we resort to the most well-known and cited dataset in this field, the Worldwide Governance Indicators (WGIs) of the World Bank (see Table A1). In the baseline case, we use the arithmetic average of the six governance indicators included in this dataset (WGI).[16] However, in a later section we also test our hypothesis on other institutional quality measures—including the individual WGIs too.

The baseline sample is the annual panel of the 30 countries in our SOE Dataset between 2010 and 2016. The sample is strongly balanced having missing observations only in terms of the soe measures. Although three more years (2007–2009) are available on the economic weight of state-owned enterprises, they are dropped due to the distortion of the global financial crisis. Unfortunately, the short time span of the SOE Dataset does not allow the consideration of a multiple-years (e.g. 5-years) panel so as to smooth business cycles in the data. To counterbalance this deficiency of the sample, we also include such explanatory variables in equation (1), which control for the stance of the business cycle (see below). Although, there is only moderate variation in the individual soe measures in most countries over the sample period (Fig. 2), it is reasonable to work with panel data in order to be able to treat endogeneity accurately.

We use forward orthogonal deviation (FOD) to remove any (observed or unobserved) country fixed-effect from equation (1) (Arellano and Bover, 1995).[17,18] As a result, the last year of the sample, 2016, is lost and any observed time-invariant control variable also drops out. Thereafter, the regression is run on the transformed data by two-step generalized method of moments (GMM) with heteroskedasticity-robust standard errors.[19]

In our estimations, all right-hand-side variables are considered to be endogenous for different reasons. First, in the case of contemporary growth determinants simultaneity is usually a legitimate source of concern. Second, in the absence of strict exogeneity, FOD-transformation renders the lagged explanatory variables endogenous. Third, measurement errors make strictly exogenous variables also endogenous. Consequently, all explanatory variables in equation (1) must be instrumented by appropriate instrumental variables (IVs). The lags of the FOD-transformed variables are not valid instruments due to the fact that they involve the contemporary value of the respective untransformed variable. Therefore, in our baseline estimations, we use the first- and second-order lags of the untransformed and unlagged explanatory variables as internal instruments.[20] In order to improve the relevance of the instrument set, we also include geographic region dummies as external IVs so as to control for any common regional differences in the evolution of explanatory variables.[21] GMM is able to tackle endogeneity and measurement errors provided that the applied instruments are valid. In our case, the absence of residual autocorrelation is a substantial prerequisite to instrument validity. Accordingly, serial autocorrelation is always tested by fitting a second order autoregressive (AR(2)) model on the empirical residuum by ordinary least squares (OLS). We also check the relevance of our instruments by Shea's partial R2 and adjusted partial R2 (Shea, 1997).

From the viewpoint of the study, the endogeneity of soe measures is of enhanced importance. The identification of the SOEs−growth nexus is hampered both by potential simultaneity and measurement errors. Regarding the former, one may argue that economic growth can influence the weight of SOEs in the economy. For example, governments may accelerate privatization in times of recession in order to raise additional revenues. It is also possible that in the boom cycle, with increasing financial resources of entrepreneurs, there is a growing demand for the privatization of SOEs. However, theoretical reasoning suggests that simultaneity may be less of a concern as the economic weight of SOEs is rather determined by long-run tendencies (e.g., historical legacies) than

[16] The six WGIs are the followings: voice & accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.

[17] The FOD-transformation of a variable x is $x_{it}^{*} = \sqrt{(T-t)/(T-t+1)}[x_{it} - (x_{i(t+1)} + \ldots + x_{iT})/(T-t)]$, where T is the time span of the sample. That is to say, the FOD produces the scaled difference of the observation and the mean of all leads. FOD is preferred to first-differencing because it preserves the non-autocorrelatedness of the error term and—although irrelevant in our case—does not magnify the gaps in unbalanced panels.

[18] By the removal of any permanent effect from the regression, the potential for omitted variable bias mitigates considerably.

[19] We do not consider system GMM (Blundell and Bond, 1998) and first-differenced GMM (Arellano and Bond, 1991) since with such a small number of cross-sectional units these estimations deliver biased results by overfitting the model due to instrument proliferation (Roodman, 2009).

[20] This implies that for transformed contemporary control variables, the first- and second-order lags of the untransformed counterparts are used as IVs. However, for transformed lagged control variables the contemporary value and the first-order lag of the untransformed lagged counterparts are used as IVs.

[21] We include dummies for the Baltics, Scandinavia, Central Europe, EU Balkan countries, non-EU Balkan countries, Mediterranean countries (without Greece), Russia, and Greece. Western European countries constitute the control group. The validity of these region dummies as instruments requires that all the growth determinants through which common region-specific shocks would exert their effect on the growth rate are included in the control variables. Owing to the extensive specification procedure of the final growth model (see below), we are confident that this requirement is fulfilled. This belief is further reinforced by the absence of any residual autocorrelation in the baseline estimates indicating that the dynamics of our models are correctly specified (Wooldridge, 2010).

by the short-run fluctuation of business cycles. As an empirical justification of the latter, we examine whether economic growth explains the number of privatizations in our Privatization Dataset. The results show that neither the contemporary nor the lagged values of the growth rate have an explanatory power concerning the evolution of privatization transactions in the period between 2010 and 2016 (see Table OA3 in the online appendix). Nevertheless, simultaneity may still emerge if economic growth impacts the performance of SOEs disproportionally changing thereby their economic share.

As far as the second source of endogeneity is concerned, naturally, the shares of SOEs in total assets, operating revenue and employment are measured with some error. Measurement errors are deemed to be classical (i.e. uncorrelated) in our SOE Dataset as the aggregation of firm-level data average them out to a large extent. To conclude, due to measurement errors and some sources of simultaneity, the contemporary soe measure is considered to be correlated with the error term in equation (1). To cope with this issue, the FOD-transformed soe measure—like the other explanatory variables—is instrumented by the first- and second-order lags of its untransformed variant. According to the residual autocorrelation tests and the Hansen J-tests, this instrumentation strategy appears to be valid in our estimations (see below).

We follow a two-step strategy in our model specification. First, we specify the basic growth model that is equation (1) without the variables related to state-owned enterprises and institutional quality (soe, IQ, and soe·IQ). Second, we augment this model by the direct and interaction effects of SOEs. In the specification of the basic growth model, one has to take into account both the short time period of the sample and the special conditions of the years under consideration, that is the balance sheet recession triggered by the global financial crisis (Koo, 2014). Consequently, beyond the supply-side factors conventionally advocated in growth econometrics, the growth model also has to account for the demand side of the economy.

In our initial model specification, we construct four groups of control variables (with the considered variables in parentheses): production factors (gross fixed capital formation – GFCF); policy variables (inflation – Infl, domestic credit – DC, government debt – GD, government budget balance – GB, current account balance – CA); structural factors (hydrocarbon rents – HC, personal remittances received from abroad – Remit, foreign trade – Trade, the inflow of foreign direct investments – FDIin); and business cycle-related factors.[22] Concerning the latter, three measures are considered: the growth rate of government consumption (gGC), the average growth rate of export markets (gEM), and the difference (gap) of the unemployment rate compared to the minimum of 2005–2008 (URgap). The URgap is a proxy for the underutilization of capacities in the economy compared to the pre-Lehman period. The description of the data can be found in Table A1 in the appendix. The descriptive statistics are presented in Tables OA1 and OA2 in the online appendix.

In searching for the final growth model, the main goal is to find that model which fits the data the best in the considered six years (i.e. 2010–2015). Therefore, we start with a general model including all control variables presented above. In the case of the stock variables (GD, DC), the first-order lags are considered. The same holds for the growth of export markets due to the assumed time lag of demand spillover effects. The gap in the unemployment rate is also lagged by one order. Finally, we consider the logged values whenever it is possible without losing observations (i.e. when the underlying data series contain only positive values).

Starting from the initial growth model, the final growth model is derived by the sequential elimination of control variables with p-value higher than 10 percent.[23] By the end of this selection procedure lnRemit, HC, CA, lnTrade, FDIin, and GB are dropped.[24] The final growth model (Model 1) is presented in Table 1. The coefficients have the expected signs. First, the positive coefficient of URgap signals the natural recovery of the economy after a recession. Second, higher demand (gGC, gEM) and investments (GFCF) imply higher economic growth. Third, as expected, after controlling for the demand side, inflation proves to be negative for growth even in times of a balance-sheet recession. Finally, government debt (GD) has a positive effect while the amount of domestic credit (DC) has a negative effect on growth, which runs counter to conventional wisdom at first sight. However, in the post-Lehman years these results are reasonable for Europe. The negative effect of domestic credit can be related to the exaggerated financial fragility of countries with a highly indebted private sector in times of financial turmoil. On the other hand, the increase of government debt—if signaling the more lax stance of fiscal policy—can easily prove to be growth promoting in times of a balance sheet recession when the demand of the private sector is subdued.

The final growth model fits the data remarkably well: the correlation between the observed (FOD-transformed) growth rate and the estimated (FOD-transformed) growth rate is 73 percent, leading to an R2 of 53.4 percent.[25] Consequently, Model 1 is an appropriate base for the inclusion of the effect of state-owned enterprises. The next section performs this exercise.

5. Results and discussion

This section presents the results of the baseline estimations of equation (1). The benchmark cases are Model 1 (the basic growth model) and models 2#, which contain only the unconditioned direct effect of SOEs and institutional quality. Models 3# interact the respective soe measure with the average of the six WGIs (IQ = WGI). Four measures of the economic weight of SOEs are considered: the shares of SOEs in total assets and in operating revenue, both for the cases of a 25 percent and a 50 percent state ownership threshold. In models #A, the share in total assets is used when SOEs are determined according to the 50 percent state ownership threshold (soe = TA50). In models (#C), the share in operating revenue is used with the same—i.e. 50 percent—state ownership threshold (soe = OR50). Models (#B) and (#D) are the counterparts of models (#A) and (#C) when SOEs are determined according to the 25 percent state ownership threshold.

The results are presented in Table 1. Our main interest is in the β_1 and β_3 coefficients. According to models 2#, the unconditioned share of SOEs is not a significant growth determinant in either case. To put it differently, in our sample, SOEs are neither positive nor negative for growth per se. However, the picture changes crucially when the effect of SOEs is conditioned on institutional quality. As can be observed in models 3#, the interaction term remains consistently positive and significant at the 10 percent level for each soe measure. On the other hand, in these models, the direct effect of the respective soe measure is negative although insignificant at standard levels. This result suggests that the marginal effect of SOEs on economic growth improves with the level of (governmental) institutional quality.

[22] Human capital measures are ignored because of the large number of missing observations in their cases. Institutional quality is not considered since it enters the regression only in the second stage.

[23] Year dummies and lagged GDP per capita are always kept to control for time fixed-effects and conditional convergence.

[24] The final growth model is double-checked in two ways. First, we include the previously eliminated variables one by one. They prove to be mostly highly insignificant, with the highest p-value among the Controls. Second, we also include the contemporary values of the lagged variables one by one. In each case, they prove to be insignificant at standard levels, and mostly highly so. Moreover, the respective lagged variable always beats its contemporary counterpart substantially in terms of p-value.

[25] Note, that the R2 is calculated as the squared correlation of the observed and the predicted dependent variables.

Table 1
Baseline results (dependent variable: gy).

soe		TA50		TA25		OR50		OR25	
Model	(1)	(2A)	(3A)	(2B)	(3B)	(2C)	(3C)	(2D)	(3D)
L.lny	−6.7339	4.0731	3.4375	3.5985	0.3211	2.2653	−3.9601	1.7216	−4.0665
	(0.400)	(0.619)	(0.701)	(0.658)	(0.972)	(0.799)	(0.699)	(0.856)	(0.695)
L.URgap	0.3540**	0.5024***	0.6038***	0.4872***	0.5478***	0.4888**	0.4298**	0.4858**	0.4302*
	(0.036)	(0.004)	(0.001)	(0.005)	(0.003)	(0.012)	(0.035)	(0.024)	(0.052)
L.gEM	0.3609*	0.4412**	0.2511	0.4300**	0.2302	0.5714***	0.4873***	0.5371***	0.4278**
	(0.072)	(0.025)	(0.252)	(0.032)	(0.314)	(0.001)	(0.006)	(0.003)	(0.028)
gGC	0.5868***	0.5868***	0.6200***	0.5819***	0.6125***	0.6733***	0.6624***	0.6411***	0.6092***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
lnGFCF	5.3674*	2.4456	5.8166**	2.8610	6.6424**	2.0072	4.6140*	2.8438	5.5324*
	(0.075)	(0.350)	(0.043)	(0.281)	(0.027)	(0.440)	(0.100)	(0.293)	(0.054)
lnInfl	−70.070***	−48.391***	−61.911***	−51.595***	−66.852***	−36.492**	−47.663**	−42.803**	−52.450***
	(0.000)	(0.003)	(0.000)	(0.001)	(0.000)	(0.042)	(0.012)	(0.024)	(0.005)
L.lnDC	−2.5936**	−3.996***	−3.3132**	−4.0762***	−3.1844**	−2.9409**	−2.3317*	−3.2407**	−3.1351**
	(0.042)	(0.005)	(0.037)	(0.004)	(0.045)	(0.037)	(0.088)	(0.018)	(0.020)
L.lnGD	2.5628*	2.1187	1.6718	2.2300*	1.7281	0.8536	1.0358	1.1138	1.3228
	(0.052)	(0.110)	(0.211)	(0.098)	(0.200)	(0.459)	(0.367)	(0.354)	(0.276)
soe		0.0061	−0.2242	−0.0031	−0.2691	0.1202	−0.1731	0.0840	−0.2622
		(0.968)	(0.147)	(0.984)	(0.106)	(0.414)	(0.470)	(0.560)	(0.262)
WGI		−3.8937	−6.8892	−4.3474	−8.1258	−2.1631	−3.2346	−2.5866	−5.3050
		(0.200)	(0.136)	(0.174)	(0.104)	(0.447)	(0.309)	(0.399)	(0.146)
soe·WGI			0.2769*		0.3165**		0.3300**		0.3857**
			(0.054)		(0.030)		(0.045)		(0.020)
Hansen J-test (pv)	0.751	0.731	0.808	0.747	0.799	0.888	0.933	0.892	0.943
resid F-test (pv)	0.899	0.849	0.973	0.858	0.941	0.379	0.727	0.398	0.882
n	180	165	165	165	165	140	140	140	140
no. of countries	30	30	30	30	30	27	27	27	27
no. of IVs	30	34	36	34	36	34	36	34	36
R2	0.534	0.539	0.539	0.539	0.539	0.570	0.560	0.572	0.560

Notes: Two-step GMM estimation of equation (1) on FOD-transformed data. WGI is the arithmetic average of the six WGIs. Year dummies are included but not presented. Sample: annual panel from 2010 to 2016. The IV matrix includes region dummies and the first- and second-order lags of the untransformed and unlagged explanatory variables. Heteroskedasticity-robust p-values are in parentheses. Asterisks denote the significance level (* 10%, ** 5%, *** 1%). At the tests, only the p-value (pv) is presented. The resid F-test is the ANOVA Wald F-test of the AR(2) model fitted on the residuum by OLS. The H0 of the test is that the first- and second-order residual autocorrelations are zero. R2 is the squared correlation of the observed (FOD-transformed) growth rate with the predicted (FOD-transformed) growth rate. L is the lag operator, whilst n is the sample size. Shea's partial R2 and adjusted partial R2 on instrument relevance are presented for models 3A, 3B, 3C, and 3D in Table OA4 in the online appendix (Shea, 1997).

Interaction effects, however, must be interpreted cautiously since a significant interaction term can only be indicative but by no means decisive when it comes to the true conditionality of the interacted variables (Brambor et al., 2006). Namely, it can easily happen that despite a significant $\widehat{\beta}_3$ coefficient, the marginal effect of soe remains zero at standard levels of significance throughout the whole distribution of institutional quality. The opposite cannot be ruled out either: despite a nonsignificant interaction term, the calculated marginal effect of soe can become significant over a certain range of the distribution of institutional quality. In order to avoid the overstatement or understatement of the estimated interaction effect, typical pitfalls of the former cases, we also investigate the evolution of the estimated marginal effect of soe over the sample distribution of institutional quality (Kingsley et al., 2017). Fig. 5 presents these results in conjunction with the 90 percent confidence intervals.

According to Fig. 5, in each case, the estimated marginal effect of SOEs is negative in the bottom range of the distribution of institutional quality, while it becomes positive in the upper range. Moreover, the conditionality of the SOEs−growth nexus proves to be significant too since, according to the confidence intervals, the marginal effect of SOEs has both significant and nonsignificant ranges over the sample distribution of institutional quality. When the economic weight of SOEs is measured by total assets (models 3A and 3B), SOEs are negative for growth at the 10 percent level in the left tail of the distribution of institutional quality while they lose significance for the successive range—although in the right tail they are only marginally insignificant with a positive sign. On the other hand, when the SOEs' share in the operating revenue is used, the effect of SOEs is insignificant for the major part of the distribution of institutional quality, but it becomes significant with a positive sign at the 10 percent level in the right tail.

These results confirm our hypothesis: the growth effect of SOEs improves with institutional quality, that is $\partial ME/\partial IQ = \beta_3 > 0$. Although the previous papers do not consider the conditionality of the SOEs−growth nexus on institutional quality, their results resonate with this fundamental conclusion. Namely, when the sample consists of developing countries, a significant negative growth effect of SOEs is revealed in these studies (Plane, 1992; Gylfason et al., 2001). However, when developed countries with much better institutions are also involved in the analysis, the negative effect of SOEs disappears (Fowler and Richards, 1995; Doamekpor, 2003).

According to the coefficient estimates in Table 1, the conditioning effect of institutional quality is economically important. For example, a one-standard deviation (0.671) increase in WGI improves the marginal effect of SOEs on economic growth by between 0.186 and 0.259 percentage points, depending on the respective soe measure. As a result, considerable differences can emerge in the marginal growth effect of SOEs between countries. For example, in Russia, the country with the worst governmental institutions in the sample, the average of the WGIs was −0.73 in 2016 implying that—according to model 3A (3C)—a 1 percentage point increase in the share of SOEs in majority state ownership in total assets (operating revenue) in the same year would have decreased the rate of economic growth by 0.43 (0.41) percentage point. On the other hand, in Norway, the country with the best institutions in 2016 (WGI = 1.76) the same increase in the share of SOEs in majority state ownership in total assets (operating revenue) would have increased

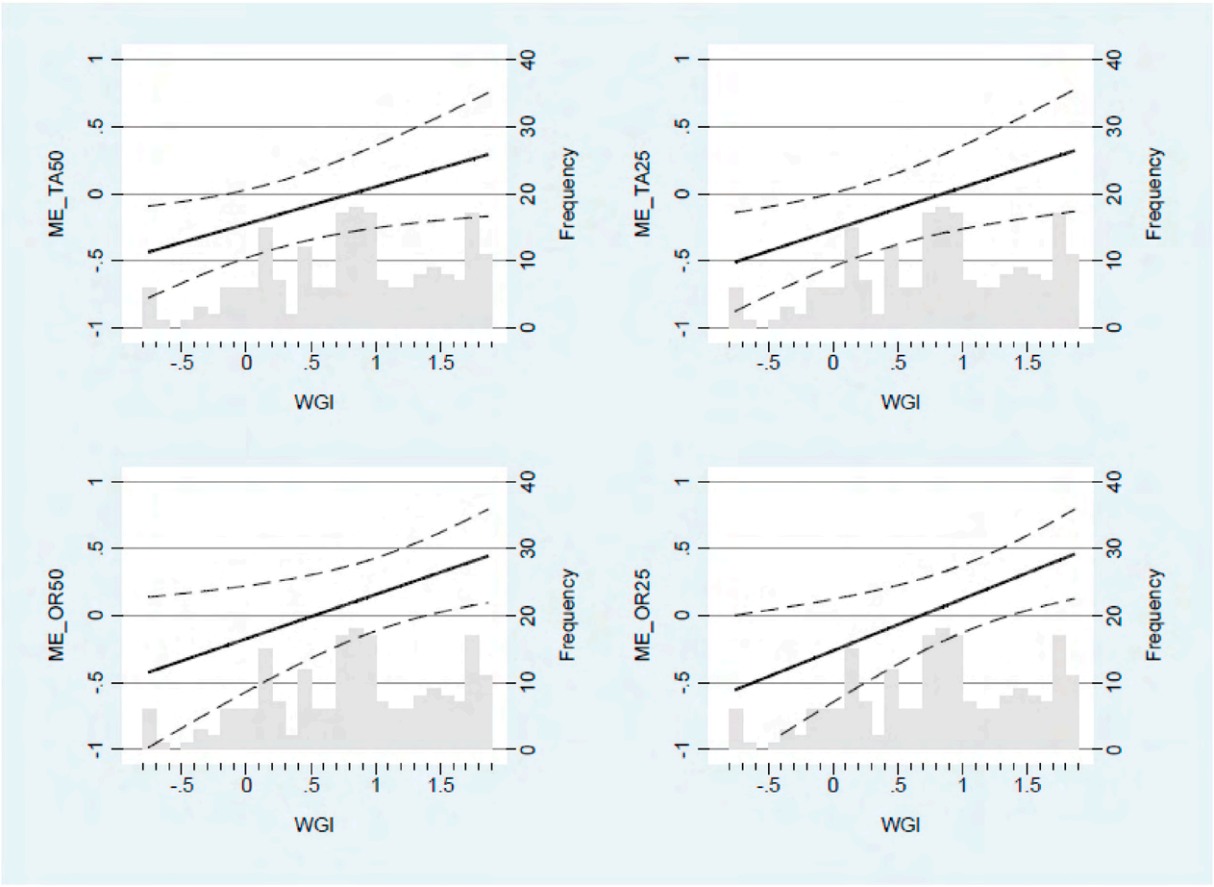

Fig. 5. The marginal effect of *soe* as a function of institutional quality. *Notes*: The 90 percent confidence interval is depicted by dashed lines. In each case, the calculation is performed based on the observations on *WGI* in all the 30 countries between 2010 and 2016. The grey columns represent the frequency distribution of *WGI*.

the rate of economic growth by 0.26 (0.41) percentage point.[26]

These results do not suggest that with good institutions state ownership should be increased above all limits. The positive marginal effect of SOEs in the right tail of the distribution of institutional quality is certainly made to happen by the relatively moderate share of SOEs in countries with relatively good institutions. Conversely, the overwhelming share of SOEs in large companies in countries with some of the worst institutions could contribute to the negative sign of the marginal effect in the left-hand tail of the distribution of institutional quality.

A further caveat to the interpretation of the results is that the coefficient estimates might be imprecise due to the short time period of the analysis and the small number of countries in the sample. Therefore, the calculated marginal effects of SOEs must also be taken with a grain of salt. By the same token, it is not really instructive to calculate the tipping point in the SOEs−growth nexus that is the level of institutional quality at which SOEs' marginal effect on economic growth turns from negative to positive. Nevertheless, despite the uncertainty concerning the numerical effects, the results unambiguously deliver a substantial policy conclusion: With bad institutions it is better to forget about maintaining a considerable state-owned sector, while with good institutions policymakers can be more enthusiastic about SOEs. So the message for any middle-income country considering pursuing an active development policy, is that SOEs might be conducive for economic growth but only after the institutional environment is developed enough to render these enterprises national champions instead of national disasters.[27]

6. Alternative measures of institutional quality

This section performs further analyses by estimating equation (1) with alternative measures of institutional quality. The main goal is to demonstrate the robustness of baseline results to the elusive notion of 'institutions'. First, we consider an alternative to the arithmetic average of the six WGIs. One might argue that our baseline indicator, WGI, is an incomplete measure of overall governmental institutional quality since averaging is not the best way to reflect the joint variation of the underlying components. Theoretically, principal component analysis is a more adequate approach to data compression. According to this analysis, the first principal component (pcWGI) explains 89.9 percent of the sample variation of the six WGIs in the post-Lehman period (2010–16).[28] We take pcWGI as an alternative measure for overall institutional quality.

Second, we turn to three other common sources of institutional quality: the International Country Risk Guide dataset (ICRG) of the PRS Group, the Index of Economic Freedom (IEF) of the Heritage Foundation

[26] Doing the same math for Spain, the median country in terms of WGI (0.86) in 2016 results in a marginal effect of SOEs' share in total assets (operating revenue) on economic growth of 0.01 (0.11) percentage point.

[27] Before proceeding to the next section, it is worth interpreting the effect of institutional quality on economic growth in models 3#: the estimated direct effect of institutional quality is insignificant at standard levels, but the interaction term is significantly positive. As a result, institutional quality is irrelevant for growth in the bottom part of the soe distribution, but it becomes significantly positive for growth above a certain quantile of the soe measure (see Fig. OA1 in the online appendix).

[28] The first principal component disposes of positive factor loading for each Worldwide Governance Indicator.

Table 2
Estimation results with alternative institutional quality measures: soe = TA25 or OR25 (dependent variable: gy).

soe	TA25				OR25			
IQ	pcWGI	IEF	PRI	CPI	pcWGI	IEF	PRI	CPI
Model	(4B)	(5B)	(6B)	(7B)	(4D)	(5D)	(6D)	(7D)
Control variables: L.lny, L.URgap, L.gEM, gGC, lnGFCF, lnInfl, L.lnDC, L.lnGD, year dummies								
soe	−0.030	−1.090**	−0.722*	−0.204	0.062	−1.003	−0.537	−0.134
	(0.865)	(0.040)	(0.065)	(0.337)	(0.696)	(0.169)	(0.173)	(0.681)
IQ	−2.104	−0.613*	0.014	−0.336**	−1.478	−0.092	−0.015	−0.075
	(0.140)	(0.091)	(0.925)	(0.013)	(0.147)	(0.715)	(0.906)	(0.514)
soe·IQ	0.087**	0.021**	0.006	0.008**	0.113**	0.020*	0.009*	0.007*
	(0.041)	(0.017)	(0.183)	(0.010)	(0.021)	(0.074)	(0.074)	(0.069)
Hansen J-test (pv)	0.759	0.536	0.124	0.996	0.935	0.986	0.455	0.986
resid F-test (pv)	0.931	0.834	0.491	0.979	0.878	0.838	0.470	0.873
n	165	164	156	165	140	139	131	140
no. of countries	30	30	27	30	27	27	24	27
no. of IVs	36	36	36	36	36	36	36	36
R2	0.542	0.477	0.641	0.472	0.560	0.536	0.655	0.546

Notes: pcWGI: first principal component of the six WGIs, IEF: Index of Economic Freedom, PRI: Political Risk Index, CPI: Corruption Perceptions Index (For the description of these data, see Table A1 in the appendix). Heteroskedasticity-robust p-values are in parentheses. Asterisks denote the significance level (* 10%, ** 5%, *** 1%). The ICRG dataset does not have data on Bosnia & Hercegovina, Montenegro and North Macedonia. The CPI is rescaled for the years preceding 2012 (see Table A1). For further notes, see Table 1.

and the Corruption Perceptions Index (CPI) of Transparency International. These datasets follow different focus—and methodology—in their data construction. The ICRG aims to judge the political, economic and financial risks faced by private investors in the individual countries. From this dataset, we take the Political Risk Index (PRI), which is related to governmental institutional quality most of all.

The IEF scores the economic freedom of countries by focusing on four main aspects of business environment: rule of law, government size, regulatory efficiency, and market openness. Finally, the CPI assesses the perceptions of the business sector concerning the extent of corruption in the public sector.

These alternative measures of institutional quality are highly and positively correlated both with each other and with our baseline measure, WGI (see Table OA1 in the online appendix). At this point, two observations are worth emphasizing. First, although the PRI and the IEF do not specifically measure the quality of governmental institutions, they strongly co-move with the WGIs. Second, the first principal component and the average of the six WGIs are correlated almost 100 percent.

Table 2 presents the results for the different measures of institutional quality when SOEs are defined according to the 25 percent state ownership threshold. As can be observed, in each case the interaction term is positive and mostly significant at the 10 percent level.[29] Moreover, according to Fig. 6, each measure of institutional quality proves to be a positive significant factor of SOEs' growth effect. Consequently, the general conclusion is that our baseline result holds for alternative measures of institutional quality too: better (governmental) institutions entail a better growth effect of SOEs.

According to Fig. 6, the estimated marginal effect of SOEs varies across the particular measures of institutional quality. This underscores the varied importance of institutions in terms of SOEs' growth impact. However, since the measures of institutional quality are highly correlated with each other, it is a major challenge to assess the relative importance of the different aspects of institutional quality in terms of the SOEs–-growth nexus. Nevertheless, as a trial, we run the estimations when the individual WGIs are considered separately as different measures of institutional quality. The results are presented in the online appendix (Tables OA6 and OA7 and Figs. OA3 and OA4). In accordance with the prior expectations, the positive conditioning effect of institutional quality on SOEs' growth impact is more evident in case of those WGIs which are related to state capacity and bureaucratic quality (i.e. government effectiveness, regulatory quality, rule of law, and control of corruption). However, one of the two WGIs related to the political establishment, voice & accountability, also proves to be a significant positive conditioning factor of the SOEs−growth nexus. This can partly be the result of the strong correlation between the individual WGIs which renders it virtually impossible to disentangle accurately their separate conditioning effects. A deeper investigation of the issue is left open for future research.

7. Further analyses

This section performs some further analyses of the effects of SOEs on economic activity. First, we re-estimate the SOEs−growth nexus conditioned on institutional quality on a cross-sectional sample by 2SLS using some appropriate deep-roots of development (DRD) measures as instruments. In the second analysis, building on the previous 2SLS framework, we explore the effect of SOEs on employment growth and TFP growth, two crucial aspects of overall economic performance. Finally, we shift the focus to the industry level and investigate how the share of SOEs in three specific industries affect economic growth.[30]

7.1. The deep roots of the SOEs−growth nexus

The deep historical roots of contemporary institutions and economic development have been extensively researched recently (Spolaore and Wacziarg, 2013). For example, focusing on the last two millennia, Bockstette et al. (2002) demonstrate that a longer history of organized statehood on the current territories of countries (henceforth state history) results in more developed contemporary institutions and higher GDP per capita. The authors argue that longer state history leads to enhanced state capacity and institutional quality. Borcan et al. (2018) extend the state history index of Bockstette et al. (2002) for the age before the common era, embracing the last six millennia, in order to truly differentiate societies with ancient roots. They explore an inverted U-shaped relationship between contemporary development and the length of established statehood. Their novel insight is that in societies with ancient roots

[29] The results are similar when SOEs are defined according to the 50 percent state ownership threshold and are available in the online appendix (Table OA5, Fig. OA2).

[30] The Authors are thankful for three anonymous referees for suggesting the analyses composing this section.

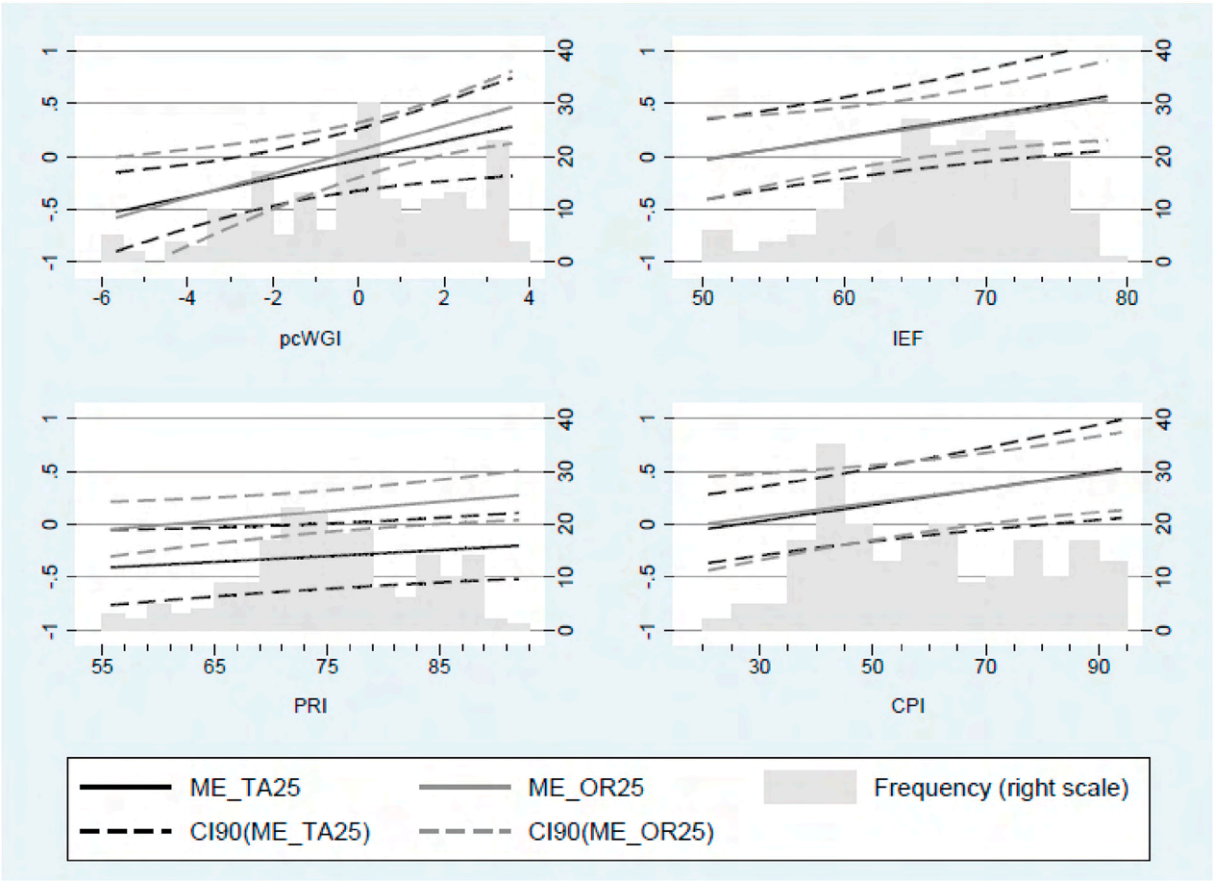

Fig. 6. The marginal effect of *soe* as a function of alternative institutional quality measures.(soe = TA25 or OR25). *Notes:* The 90 percent confidence interval is depicted by dashed lines. In each case, the calculations are performed based on the observations on the underlying institutional quality measure in all the 30 countries between 2010 and 2016. The grey columns represent the frequency distribution of the underlying institutional quality measure.

rent-seeking interest groups are more entrenched and able to capture the state leading to extractive institutions. An interesting result of Borcan et al. (2018) is that the pre-Columbian experience with organized statehood weighs more in terms of contemporary development than the post-Columbian one. The latter coincides with the common finding that pre-modern history is a crucial driver of persistence in comparative development (e.g., Comin et al., 2010).

However, pre-Columbian development does not always yield present-day benefits. Acemoglu et al. (2002) unveil the reversal of fortune in former European colonies in the post-Columbian era by demonstrating the significant negative correlation of the 1500AD level of development (measured by the urbanization rate and population density) with contemporary development. They explain this finding by the different colonization strategies of European colonizers depending on the initial level of development of the later colonies.[31] Acemoglu et al. (2002) borrow the urbanization rate in 1500 AD from Bairoch (1988) and augment it with the estimates of Eggimann (1999) after converting the latter into Bairoch-equivalent estimates.

Another strand of the DRD literature investigates the persistent effect of diversity on contemporary socio-economic outcomes. In their seminal paper, Easterly and Levine (1997) show that ethnic diversity negatively impacts the quality of public policies resulting in significantly reduced growth in more fractionalized societies. Their results lend support to the notion that ethnically fragmented societies are more polarized which might cause a lack of consensus in public policy and the emergence of rent-seeking behavior.

The brief overview of the above papers convincingly illustrates that the DRD literature provides a plethora of potentially valid and relevant instruments both for institutional quality and GDP per capita. Motivated by the latter, we conduct the cross-sectional 2*SLS* estimation of the SOEs−growth nexus based on the following reduced model:

$$avrgy_i = \beta_0 \ln y_{0,i} + \beta_1 avrsoe_i + \beta_2 avrWGI_i + \beta_3 (avrsoe_i \cdot avrWGI_i) + \varepsilon_i \quad (2)$$

where avrgy, avrsoe and avrWGI are the averages of the annual growth rate of GDP per capita (gy), the economic weight of SOEs (soe) and the baseline institutional quality measure (i.e. WGI, the average of the six WGIs) between 2012 and 2016, respectively. Since in 2011, GDP per capita was still heavily impacted by the fallback of the global financial crisis, the initial level of development ($\ln y_0$) is measured by the average logged GDP per capita of 2005–2007.[32]

We use ethnic fractionalization (Fract), the urbanization rate in 1500 AD (Urb1500) and the accumulated experience with organized statehood until 1500 AD (SH1500) as instruments for institutional quality and GDP per capita.[33] We conjecture that ethnic fractionalization has a negative effect on contemporary institutional quality and economic development. Since in Europe no reversal of fortune happened in the post-Columbian era, we hypothesize that the urbanization rate in 1500 AD positively affects contemporary development. Concerning state history, we propose

[31] Acemoglu et al. (2002) argue that European colonizers tended to introduce (or maintain the already existing) extractive institutions in colonies which were urbanized and densely populated in 1500 AD. On the other hand, they established inclusive institutions in less urbanized and populated areas.

[32] The averages appearing in equation (2) are calculated based on the original—that is non-FOD-transformed—data.

[33] For the sources and description of these data, see Table A1 in the appendix.

Table 3
2SLS estimation of the SOEs−growth nexus.

Model		(14A) avrTA50 First-stage estimates					(14C) avrOR50 First-stage estimates			
avrsoe										
Dependent variable	avrgy	lny_0	avrTA50	avrWGI	avrTA50 ·avrWGI	avrgy	lny_0	avrOR50	avrWGI	avrOR50 ·avrWGI
lny_0	−3.935***					−4.438***				
	(0.001)					(0.000)				
avrsoe	−0.007					0.003				
	(0.855)					(0.956)				
avrWGI	1.249*					2.256***				
	(0.058)					(0.000)				
avrsoe·avrWGI	0.039*					0.007				
	(0.091)					(0.847)				
SH1500		−1.930	−105.7**	2.167	30.94		−2.036	−68.80**	2.324	45.97**
		(0.243)	(0.049)	(0.199)	(0.641)		(0.221)	(0.016)	(0.123)	(0.033)
sqSH1500		2.612	253.7**	−11.10**	−24.11		1.782	148.3***	−10.47***	−22.83
		(0.371)	(0.021)	(0.002)	(0.845)		(0.535)	(0.007)	(0.002)	(0.593)
YUCP		−0.008**	0.194	−0.019***	0.104		−0.011**	0.114*	−0.017***	0.133*
		(0.038)	(0.168)	(0.000)	(0.523)		(0.018)	(0.067)	(0.000)	(0.051)
EU		−0.110	−14.14***	0.199*	−1.670		0.051	−14.59***	0.357***	−1.435
		(0.379)	(0.000)	(0.074)	(0.695)		(0.750)	(0.000)	(0.003)	(0.427)
Urb1500		0.028***	−0.889***	0.013	0.375		0.021*	−0.063	0.003	0.182
		(0.004)	(0.004)	(0.158)	(0.306)		(0.055)	(0.655)	(0.719)	(0.220)
Fract		−1.070***	25.41**	−0.175	−2.594		−0.896**	−1.259	0.097	2.709
		(0.004)	(0.049)	(0.624)	(0.862)		(0.025)	(0.834)	(0.752)	(0.610)
		0.012*	−0.110	0.014**	1.369***		0.008	0.107	0.029***	1.841***
pred(avrsoe)·pred(avrWGI)		(0.072)	(0.467)	(0.024)	(0.000)		(0.556)	(0.491)	(0.000)	(0.000)
R2	0.469	0.843	0.802	0.889	0.735	0.471	0.817	0.743	0.903	0.895
First-stage F-stat.		20.74	21.14	57.9	24.69		13.25	14.41	118	609
(p-value)		(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
Overid. test[1]	3.975					7.641				
(p-value)	(0.264)					(0.054)				
n	30	30	30	30	30	29	29	29	29	29

Notes: [1] Overidentification test: Wooldridge's (1995) robust score test. A constant is included in each model, but not reported. avrgy, avrTA50, avrOR50, avrWGI stand for the averages of gy, TA50, OR50 and WGI between 2012 and 2016, respectively. lny_0 is the average lny between 2005 and 2007. These averages are calculated based on the original (i.e. non-FOD-transformed) data. sqSH1500 stands for squared SH1500. EU is 1 for European Union members and 0 otherwise. For the description of the other data, see Table A1. Heteroskedasticity-robust p-values are in parentheses. Asterisks denote significance levels (*10%, **5%, ***1%). Shea's partial R2 and adjusted partial R2 on instrument relevance are presented in Table OA9 in the online appendix (Shea, 1997).

the hump-shaped relationship between SH1500 and contemporary development revealed in Borcan et al. (2018).

These first stage relationships are commonly assumed in the literature. However, to date, the DRD literature has not considered SOEs explicitly, although some of its basic results are applicable for them too. Specifically, our intuition is that the economic weight of SOEs is crucially related to the prevalence and historical roots of rent-seeking. Based on Borcan et al. (2018), we conjecture a U-shaped relationship between rent-seeking and state history. The underlying argument is that rent-seeking is more characteristic to relatively old and young societies for different reasons: in societies with ancient roots interest groups are more entrenched, while in young societies—with less established institutions and state capacity—the state might be too weak to withstand rent-seekers. Furthermore, contemporary state capacity is assumed to be positively correlated with pre-modern economic development in Europe. Consequently, we presuppose a negative relationship between SOEs' share and the urbanization rate in 1500 AD. Finally, we assume that ethnic fractionalization affects the soe measure positively since in deeply divided societies rent-seeking behavior is more pervasive (Easterly and Levine, 1997).

Beyond these DRD instruments, the years under central planning (YUCP) taken from De Melo et al. (2001) and a European Union member dummy (EU) are also included in the instrument set to control for the legacy of socialism and the convergence of institutions within the European Union. Years under central planning is assumed to affect institutional quality and economic development negatively, and the economic weight of SOEs positively.

A final obstacle to cope with before estimating equation (2) is to find an appropriate instrument for the interaction term. In doing so, we follow Ashraf and Galor (2013) and Wooldridge (2010) by introducing a zeroth stage to the analysis where avrsoe and avrWGI are first regressed on their instruments (i.e. SH1500, sqSH1500, Urb1500, Fract, YUCP, EU) to obtain predicted values of average SOEs' share and institutional quality. The product of these predicted averages (pred(avrsoe)·pred(avrWGI)) is used in the first stage as an instrument for the interaction avrsoe·avrWGI.

Table 3 presents the results when the ownership threshold for SOEs is set at 50 percent.[34] The first-stage results suggest the relevance of our instruments: the R2 coefficients reflect the considerable explanatory power of each first-stage regression. Moreover, Shea's partial R2 and adjusted partial R2 are also fairly high for the individual first-stage regressions (see Table OA9 in the online appendix). Regarding the validity of instruments, the overidentification test is supportive at the 10 percent level in model (14A) and at the 5 percent level in model (14C). Furthermore, the individual first-stage regressions confirm our prior hypotheses. Concerning institutional quality and GDP per capita, the coefficients when significant have the proposed signs. Regarding the soe measures, the intuition that deeply rooted historical and cultural factors might partly explain the prevalence of SOEs is corroborated: the U-shaped relationship with state history, the positive relationship with ethnic fractionalization, and the negative relationship with pre-Columbian urbanization rate are empirically validated—although, in their completeness only in Model (14A).

[34] The results are similar when the state ownership threshold is 25 percent. See Table OA8 and Fig. OA5 in the online appendix.

The second-stage results accord with the conventional wisdom of growth regressions: the initial level of development negatively affects the successive growth rate due to conditional convergence, while institutional quality is a positive growth determinant. As expected, these results appear more forcefully in the cross-sectional estimation than in the baseline annual panel estimations. Concerning the main focus of the paper, in model 14(A), the growth effect of SOEs improves significantly with institutional quality—although its magnitude remains moderate compared to baseline estimates. On the other hand, when soe is measured according to operating revenue (model 14C), state-owned enterprises do not prove to be a significant growth determinant at any level of institutional quality (Fig. 7). Nonetheless, with such a small number of cross-sections, a partial underpinning of the baseline conclusion is already a great achievement. Consequently, we find the 2SLS cross-sectional results rather supportive lifting any remaining concerns about endogeneity bias in our GMM panel results. A further contribution of this section is the novel evidence on the deep historical roots of state capitalism.

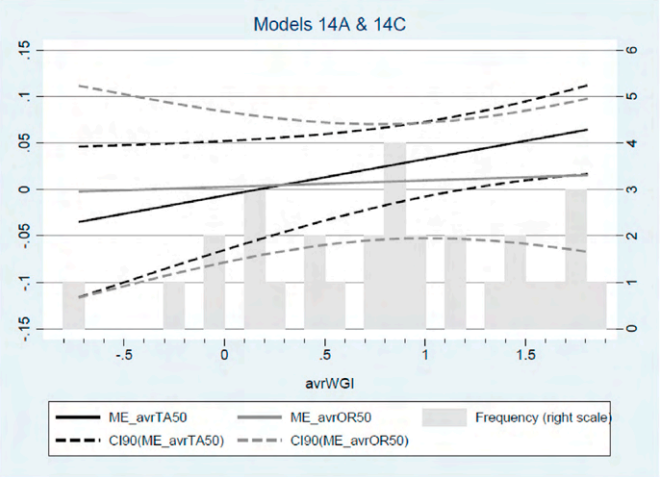

Fig. 7. The marginal effect of *soe*: cross-sectional 2SLS results (avrsoe = avrTA50 or avrOR50). *Notes:* The 90 percent confidence interval is depicted by dashed lines. In case of each *soe* measure, the calculations are performed for all the 30 countries in the sample. The grey columns represent the frequency distribution of *avrWGI*.

7.2. The effect of SOEs on total factor productivity and employment

Beyond economic growth, employment and total factor productivity (TFP) are two other main aspects of economic development. State-owned enterprises might have an effect—conditional on institutional quality—on these performance measures too. First, SOEs are commonly considered as shock absorbers due to their positive effect on employment in economic downfalls. In normal times, however, SOEs are frequently degraded to an instrument of social policy and used to combat unemployment. This labor hoarding is assumed to be more pervasive under bad government institutions. The effect of SOEs on total factor productivity is more ambiguous. Although, innovations tend to concentrate in the private sector, it does not preclude that SOEs contribute substantially to overall technological development by enhancing basic research and knowledge spillovers (Antonelli et al., 2014). On the other hand, if SOEs lag considerably behind private companies in terms of productivity growth, they can become the bottleneck for TFP growth.

To explore the empirical evidence, we resort to the estimation framework of the previous part: after replacing the dependent variable for the average growth rate of employment (or TFP) between 2012 and 2016 (avrEMPgr, avrTFPgr), equation (2) is estimated by 2SLS using the same set of instruments.[35] Fig. 8 and Table OA10 in the online appendix present the results in case of the 25 percent state ownership threshold.[36] According to models (15B) and (15D), SOEs positively affected employment growth in the sample period, with a margin decreasing with institutional quality. Since the years of 2012–2016 did not experience any overall economic downfall in Europe, the latter is suggestive evidence of labor hoarding by SOEs rather than their shock absorbing capacity. This conclusion is further corroborated by the significant negative conditionality of SOEs' employment effect on institutional quality in Model (15D)—resonating with the conventional wisdom that SOEs are less engaged in labor hoarding under better governmental institutions.

On the other hand, models (16B) and (16D) do not unveil any significant effect of SOEs on TFP growth. Concerning the ambiguous effect of SOEs on TFP and the short time period, this result should not come with a surprise.

7.3. The SOEs–growth nexus in the industry-level perspective

As a final analysis, we re-estimate the baseline models by moving from the national economy aggregates to the industry aggregates of SOEs' share. More specifically, we use the share of SOEs in three particular industries where state ownership traditionally concentrates: manufacturing, energy (more precisely: electricity, gas, steam and air conditioning supply), and transportation & storage. The industry-level soe measures are calculated in the same way as the national aggregates with the sole difference that the total assets (operating revenue) of SOEs in an industry are compared to the total assets (operating revenue) of all large companies in the same industry. These estimates will speak to the possibility of SOE growth effect heterogeneity between industries.

The results of estimating equation (1) with these alternative industry-level soe measures one-by-one are presented in the online appendix (Tables OA12 and OA13, Figs. OA7 and OA8). In line with the baseline results, we found some evidence on the positive conditionality of the SOEs–growth nexus on institutional quality in the manufacturing and the energy sectors. However, SOEs in the transportation & storage sector prove to be insignificant for growth. To conclude, the industry-level results support the idea that SOEs might affect GDP growth differently depending on their industry affiliation. However, this conclusion must be treated with some caveat, since industry-level soe data are more noisy than national aggregates.

8. Sensitivity analyses

This section presents the sensitivity analyses of the baseline results. We check the robustness to the estimation method, the sample, the construction of the SOE Dataset, and the explanatory variables of the regression model. In order to spare space, only the results on the 25 percent state ownership threshold are discussed.[37] Furthermore, for the sake of brevity, we only present the figures on the conditional marginal effect of SOEs—the detailed model results are available in the online

[35] We opt for cross-sectional (2SLS) estimation for two reasons. First, employment and TFP are more noisy than GDP raising crucial caveats against an annual panel model. Second, as opposed to the growth regression, it is less clear in what way would the control variables of the baseline model be important for TFP and employment. For the sources of TFP and employment data, see Table A1 in the appendix.

[36] The results are similar when the state ownership threshold is 50 percent (see Table OA11 and Fig. OA6 in the online appendix). The first-stage results of the individual models are the same as (or very similar to) their counterparts in Table 3 and Table OA8.

[37] The results are similar when SOEs are defined according to the 50 percent state ownership threshold and are available in the online appendix (see Tables OA15, OA18, OA19, OA21, OA24, OA25; and Figs. OA9, OA10, OA12, OA14).

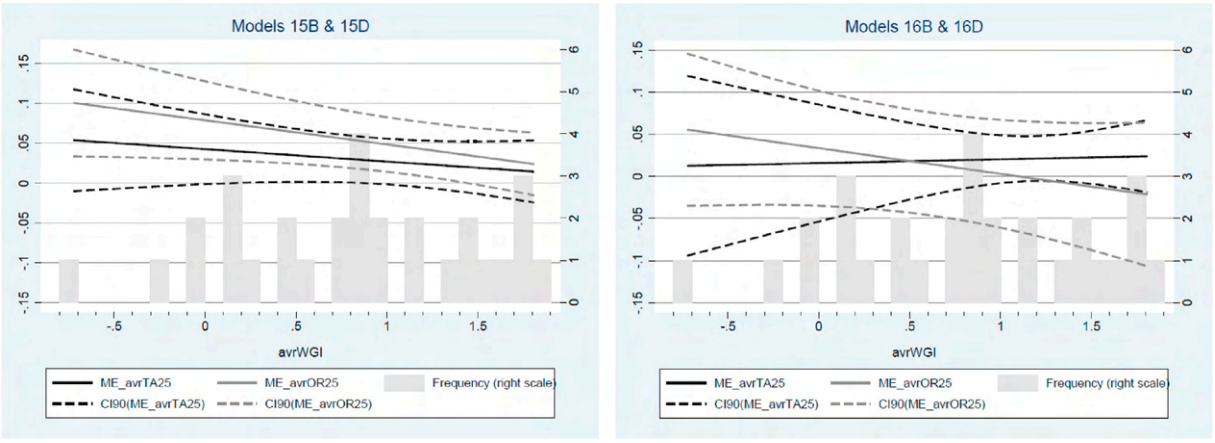

Fig. 8. The marginal effect of soe on employment growth (15B-D) and TFP growth (16B-D)(avrsoe = avrTA25 or avrOR25). *Notes*: See, Fig. 7.

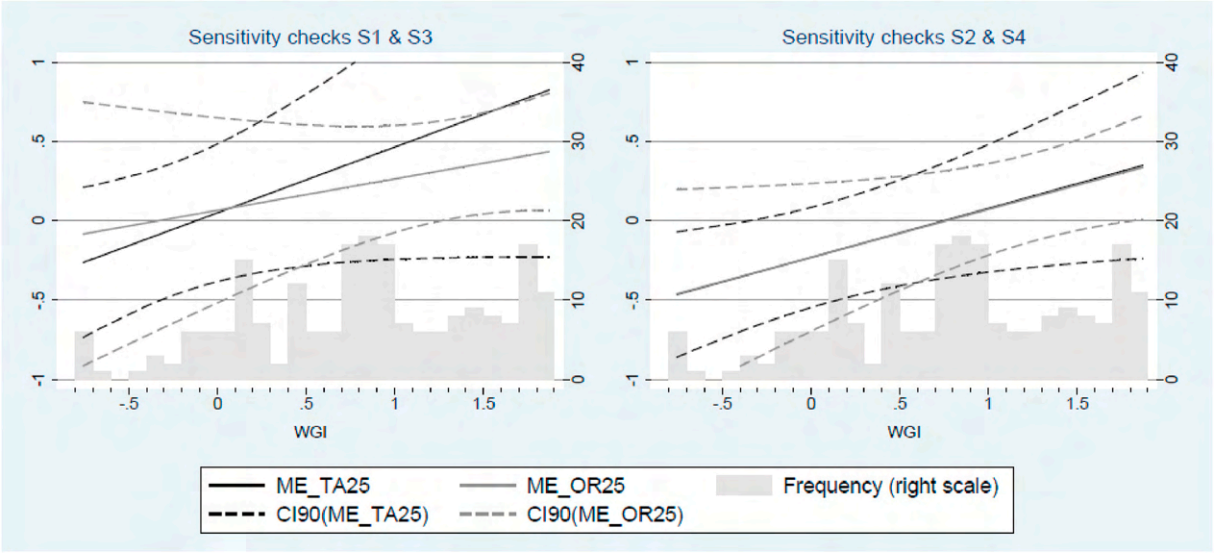

Fig. 9. The marginal effect of *soe*: Sensitivity to the estimation method (soe = TA25 or OR25). *Notes*: See Fig. 5.

appendix. In advance, the sensitivity analyses corroborate the robustness of the revealed conditionality of SOEs' growth effect on institutional quality.

Regarding the estimation method, we investigate the sensitivity to the instrument set and the underlying methodology. In sensitivity checks S1 & S3, the external instruments (i.e. geographic area dummies) are omitted. As it can be observed in Table OA14 in the online appendix, the interaction coefficient remains positive but loses significance in each case—although in S1 only to a marginal extent. In sensitivity checks S2 & S4, two-stage least squares (TSLS) is used instead of two-step GMM with the same set of instruments as in the baseline case. The results concerning the signs and the significances of the underlying soe measure and the interaction term are unchanged (see Table OA14).

The above results are corroborated by the evolution of the estimated marginal effects of SOEs (Fig. 9). First, in case of TSLS estimations, institutional quality continues to condition the growth effect of SOEs in a positive and significant way. Second, when geographic area dummies are dropped from the IVs set, the conditioning effect of WGI remains positive and significant at the 10 percent level in case of S3—although it becomes insignificant in case of S1. Consequently, the insignificant interaction term seems to understate the true conditionality of SOEs' growth effect on institutional quality in sensitivity check S3.

In the second step, the sensitivity to the sample is considered. In doing so, we check the robustness of the baseline results to the countries included.[38] We drop the major regions and two outlier countries—Russia and Greece—one by one from the sample and rerun the estimation of equation (1). The results are presented in Tables OA16 and OA17 in the online appendix. As can be observed, at each subsample, the interaction term has a positive coefficient and is significant at least for one soe measure. The only exceptions are the sensitivity checks when non-EU Balkan countries are left out (S11 & S20). However, according to Fig. 10, the conditionality of SOEs' growth effect on institutional quality is significant in these cases too. Moreover, Fig. 10 conveys a very similar picture to that of Fig. 5 in terms of the changing significance of the marginal effect of SOEs' shares in total assets and operating revenue. We conclude that the baseline results do not seem to be driven by the

[38] We also check the sensitivity to the years included in the sample in two ways. First, we increase the time span of the sample by the inclusion of 2009. Second, we decrease the time span of the sample by the exclusion of 2010. The results are similar to the baseline ones and are available upon request.

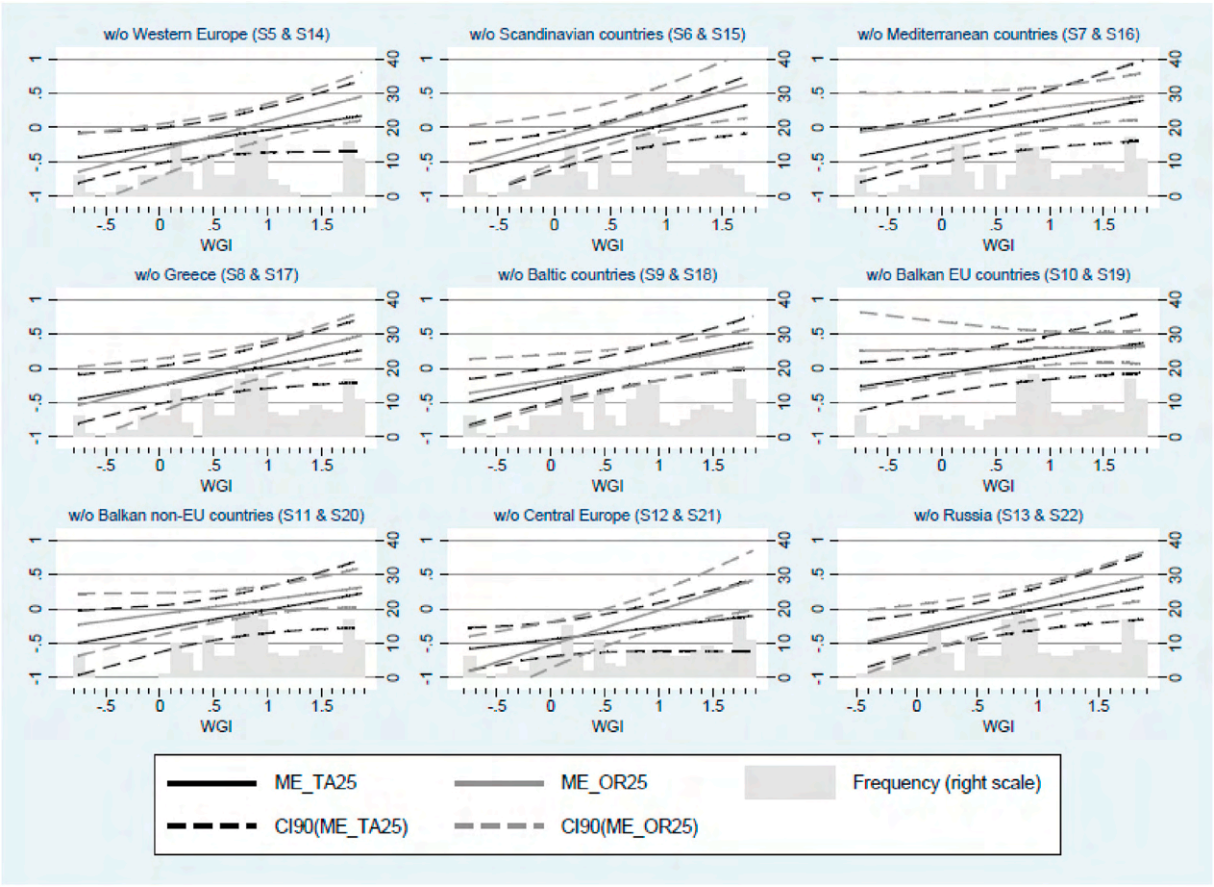

Fig. 10. The marginal effect of *soe*: Sensitivity to the sample countries (soe = TA25 or OR25). *Notes*: Country groups: Western Europe (AUT, BEL, FRA, DEU, NLD, GBR); Scandinavia (DNK, FIN, NOR, SWE); Mediterranean countries (ITA, PRT, ESP); Baltics (EST, LVA, LTU); Balkan EU countries (BGR, HRV, ROU); Balkan non-EU countries (BIH, MKD, MNE, SRB); Central Europe (CZE, HUN, POL, SVK, SVN). For further notes, see Fig. 5.

experience of any particular country or country-group.[39]

As regards the construction of the SOE Dataset, we check the sensitivity of the baseline results to the representativity threshold applied in the aggregation of firm-level data. Specifically, we check how the results change when aggregate SOE shares are calculated for those country-year datapoints, which have observations for at least the 60 (80) percent—instead of the baseline 70 percent—of large companies. As can be observed in Tables OA20 and OA21 and Figs. OA11–OA12 in the online appendix, the results are unchanged.

Finally, we check the sensitivity of the results to the independent variables.[40] In the frame of this analysis, we include the explanatory variables, which were dropped in the specification of the basic growth model, one by one. More precisely, we include the government budget balance, the balance of the current account, the hydrocarbon rents, the personal remittances received from abroad, the volume of foreign trade, and the inflow of foreign direct investments one by one in the model as an additional independent variable. The extended models deliver the same conditionality of the SOEs−growth nexus on institutional quality as the baseline models do. Moreover, the included additional independent variables mostly prove to be highly insignificant.[41]

9. Conclusion

This study aimed to investigate the impact of state-owned enterprises on economic growth with a special focus on the conditioning role of institutional quality. To undertake this empirical research, up-to-date comprehensive data on the macroeconomic shares of SOEs is needed. Hitherto, those data have been missing. In order to address this problem, we have constructed a comprehensive dataset on the share of SOEs in the aggregate total assets, operating revenue and employment of large companies. The dataset builds on firm-level data and includes 30 European countries over the period of 2007 and 2016. To account for the changes in ownership structure of the enterprises included in the aggregation, we also compiled a Privatization Dataset based on a broad set of data sources. In the second part of the paper, we conducted an in-depth econometric analysis of the SOEs−growth nexus in the post-Lehman period (2010–2016) relying on our brand-new data on the weight of SOEs in the economy. The results corroborated our hypothesis that the impact of SOEs on economic growth is conditional on the quality of (governmental) institutions in a positive way: better institutions entail a more favorable growth effect of SOEs. More specifically, we found that

[39] As a less conservative sensitivity check, we drop the 30 countries one by one from the sample and rerun the estimations. The results are unchanged and available upon request.The robustness to the country sample also implies that the results are not biased by any occurrent country-specific or region-specific data quality problem concerning the calculated economic shares of SOEs.

[40] We also performed the sensitivity analysis concerning the data source of the dependent variable. In the frame of this analysis, the GDP per capita growth rate is calculated according to the rgdpna series of the Penn World Table 9.1 (Feenstra et al., 2015). The rgdpna is a chained series of GDP measured in 2011 international dollars and calculated according to the growth rate of GDP (in local currency at constant prices) in the national accounts. The results are very similar to the baseline ones and are available upon request.

[41] The results are available in the online appendix (Tables OA22 and OA25, Figs. OA13-OA14).

under bad institutions, SOEs are detrimental to economic growth, while under good institutions they might contribute positively to economic development. This result proves to be robust to a broad set of sensitivity analyses.

The discussion on the rationale of state intervention through enterprises has always been an important part of the economic discourse. With this study, we intended to provide a solid empirical basis to the debate on state ownership. While our results rely on the experience of a short period of time and European countries only, they clearly indicate the importance of the institutional environment as a conditioning factor of the impact of SOEs on economic growth. The main policy conclusion of the study is that if developing (middle-income) countries wish to consider relying on SOEs as a vehicle of economic catch-up, they have to improve their institutions first. Otherwise, companies owned by the state will be obstacles rather than conductors in achieving the standard of living of developed countries.

The paper proposes two areas for future research: first, the assessment of the relative importance of the different aspects of institutional quality in terms of the SOEs–growth nexus; second, the further generalization of the empirical results of the study based on a newer version of the SOE Dataset—extended both in terms of the included countries and years.

Declaration of competing interest

There are no conflicts of interest to report on concerning our research.

Acknowledgments

We are grateful to Theocharis Grigoriadis, Mihály Ormos, Pawel Kawa and the participants of the 2019 Workshop on Macroeconomics at the Cracow University of Economics for insightful comments and suggestions. We are also grateful to William L. Megginson for sharing his privatization data with us and giving us the permission to make our Privatization Dataset including some of his data publicly available. The Authors are indebted to three anonymous Reviewers and the Editors for their invaluable comments and suggestions. Any remaining errors are ours.

Appendix

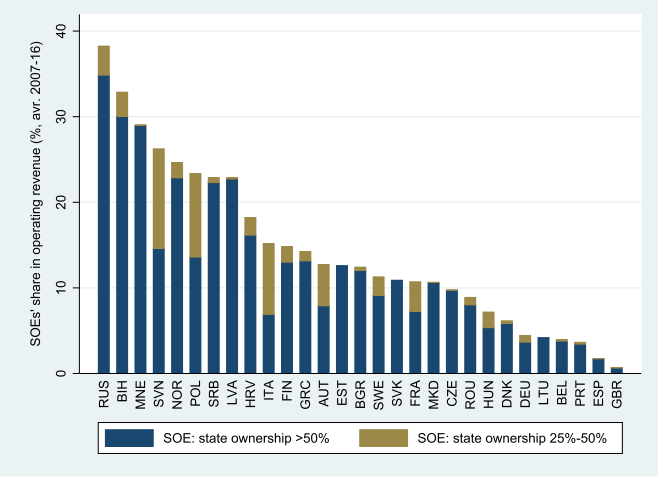

Fig. A1. The scale of state ownership: average share of SOEs in operating revenue (2007–2016).

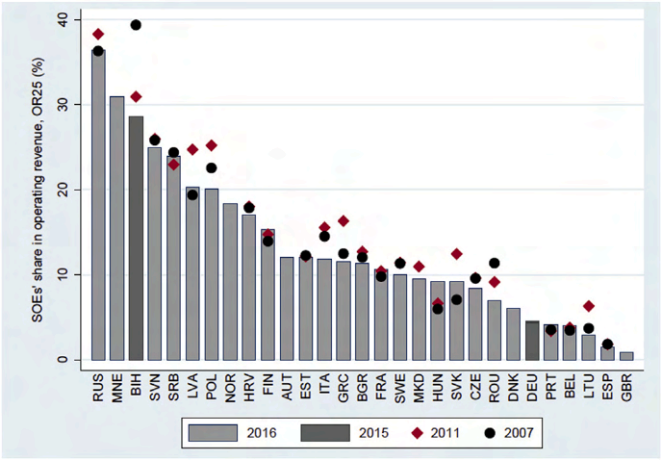

Fig. A2. Changes in the scale of state ownership: share of SOEs in operating revenue (threshold for state ownership: 25%). *Notes*: Data for 2007 and 2011 are missing for AUT, DEU, DNK, GBR, MNE, and NOR. Data for 2007 is missing for MKD. Data for 2016 are missing for BIH and DEU. For the latter countries, the 2015 values are depicted. Data on NLD are not available.

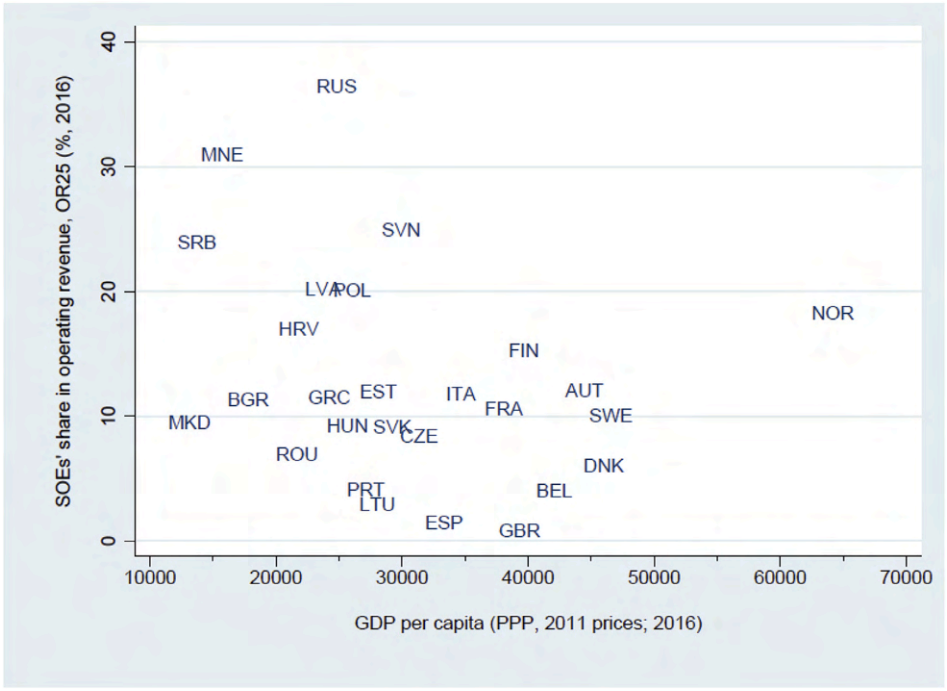

Fig. A3. State ownership and income level, 2016.

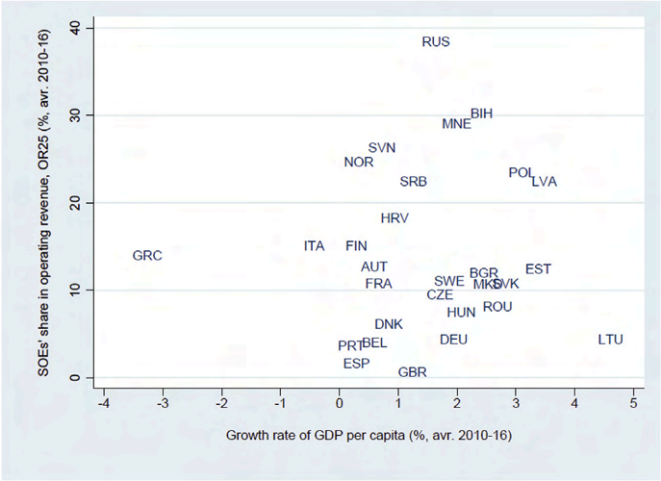

Fig. A4. State ownership and economic growth, 2010–2016.

Table A1
Data description and sources

Variable	Notation	Unit	Data source	Notes
GDP per capita	y	PPP, 2011 prices	WDI	
Growth rate of GDP per capita	gy	%	Own calculation based on y	Δln(y)*100
Share of SOEs in total assets/operating revenue	TA#/ OR#	%	Own data (SOE Dataset)	# = min. share of state ownership (25% or 50%) in case of SOEs (representativity threshold = 70%)
Voice & accountability	VA	index [-2.5; 2.5]	WGIs	Level of democracy (freedom of expression, association, press, and elections)
Political stab. and absence of violence	PSAV	index [-2.5; 2.5]	WGIs	Social stability (absence of politically motivated instability and violence)
Government effectiveness	GE	index [-2.5; 2.5]	WGIs	Bureaucratic quality (quality of public services and civil service)
Regulatory quality	RQ	index [-2.5; 2.5]	WGIs	Quality of governmental policies (competition policy, trade policy etc.)

(*continued on next column*)

Table A1 (*continued*)

Variable	Notation	Unit	Data source	Notes
Rule of law	RL	index [-2.5; 2.5]	WGIs	Quality of jurisdiction (property rights, contract enforcement etc.)
Control of corruption	CC	index [-2.5; 2.5]	WGIs	Level of corruption and state capture by private interest groups
Index of economic freedom (overall)	IEF	index [0; 100]	The Heritage Foundation	Average of 12 components. Economic freedom increases with the index
Political risk index	PRI	index [0; 100]	ICRG (PRS group)	Sum of 12 components. Risk decreases with the index
Corruption perceptions index	CPI	index [0; 100]	Transparency International	Corruption decreases with the index. For the years before 2012, the original scale of CPI was [0; 10]. These years are rescaled by multiplying them by 10.
Unemployment rate (UR) compared to the minimum of the period 2005–2008	URgap	p.p.	Own calculation (UR – total unemployment rate: WDI)	$URgap = UR_t - \min(UR_{2005}, UR_{2006}, UR_{2007}, UR_{2008})$
Growth rate of export markets	gEM	%	Own calculation (GDP growth rates in constant local currency: WDI, bilateral export volumes: UNCTAD)	Weighted average of the GDP growth rates of export markets (weights: share of the individual countries in the overall merchandise export of the underlying country)
Growth of government consumption (GC)	gGC	%	WDI	GC: general gov. final consumption expenditure (constant local currency)
Gross fixed capital formation	GFCF	% of GDP	WDI	
Inflation (price index)	Infl		WEO	100 + annual avr. change of consumer prices
General government gross debt	GD	% of GDP	WEO	
Domestic credit to private sector	DC	% of GDP	GFDD	
Budget balance (general government)	GB	% of GDP	WEO	General government net lending/borrowing
Current account balance	CA	% of GDP	WEO	
Hydrocarbon rents	HC	% of GDP	WDI	Sum of oil and gas rents (rents: value of production – costs of extraction)
Foreign direct investments (inflow)	FDIin	% of GDP	WDI	Net inflows
Personal remittances (received)	Remit	% of GDP	WDI	Received from abroad
Volume of foreign trade	Trade	% of GDP	WDI	Import + export
Number of privatizations	NoP		Own data (Privatization Dataset)	
Urbanization rate in 1500 AD	Urb1500	%	Acemoglu et al. (2002)	Percentage of people living in towns with more than 5000 inhabitants in 1500 AD (Bairoch-equivalent urbanization rate.)
State history from 3500 BCE to 1500 AD	SH1500	index [0; 1]	Borcan et al. (2018)	Accumulated experience with organized statehood from 3500 BCE until 1500 AD
Ethnic fractionalization	Fract	[0; 1]	Alesina et al. (2003)	Reflects the probability that two randomly selected individuals have different ethnicity
Years under central planning	YUCP	years	De Melo et al. (2001)	Length of the period under central planning
Annual growth rate of Total Factor Productivity	TFPgr	%	Own calculation based on the rtfpna data series of PWT 9.1	rtfpna: TFP at constant national prices (2011 = 1)
Annual growth rate of employment	EMPgr	%	Own calculation based on the emp data series of PWT 9.1.	emp: number of persons engaged (in millions)

Notes: GFDD – Global Financial Development Database (The World Bank); ICRG – International Country Risk Guide; PWT 9.1 – The Penn World Table 9.1 (Feenstra et al., 2015); WDI – World Development Indicators database (The World Bank); WEO – World Economic Outlook database (IMF); WGIs – Worldwide Governance Indicators (The World Bank); UNCTAD – United Nations Conference on Trade and Development.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.econmod.2021.03.009.

Funding

This work was supported by the National Science Centre Poland under Grant number 2015/17/B/HS4/00327.

References

Acemoglu, D., Johnson, S., Robinson, J.A., 2002. Reversal of fortune: geography and institutions in the making of the modern world income distribution. Q. J. Econ. 117 (4), 1231–1294.
Aghion, P., Howitt, P., 1997. Endogenous Growth Theory. The MIT Press, Cambridge, MA.
Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., Wacziarg, R., 2003. Fractionalization. J. Econ. Growth 8, 155–194.
Antonelli, C., 2015. The dynamics of knowledge governance. In: Antonelli, C., Link, A.N. (Eds.), Routledge Handbook of the Economics of Knowledge. Routledge, London & New York.
Antonelli, C., Amidei, F.B., Fassio, C., 2014. The mechanisms of knowledge governance: state owned enterprises and Italian economic growth, 1950-1994. Struct. Change Econ. Dynam. 31, 43–63.
Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Rev. Econ. Stud. 58 (2), 277–297.
Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. J. Econom. 68 (1), 29–51.
Arrow, K., 1962. Economic welfare and the allocation of resources for invention. In: NBER, the Rate and Direction of Inventive Activity: Economic and Social Factors. National Bureau of Economic Research, pp. 609–626.
Ashraf, Q., Galor, O., 2013. The "out of Africa" hypothesis, human genetic diversity, and comparative economic development. Am. Econ. Rev. 103 (1), 1–46.
Augustynowicz, P., Kwiatkowski, G., 2015. State-owned Enterprises in the Global Economy – Analysis Based on Fortune Global 500 List. Managing Intellectual Capital and Innovation for Sustainable and Inclusive Society, 27-29 May 2015. Proceedings of the MakeLearn and TIIM Joint International Conference, Bari, Italy, 1793-1747.
Bai, C., Li, D., Tao, Z., Wang, Y., 2000. A multitask theory of state enterprise reform. J. Comp. Econ. 28 (4), 716-738.
Bałtowski, M., Kozarzewski, P., 2016. Formal and real ownership structure of the Polish economy: state-owned versus state-controlled enterprises. Post Commun. Econ. 28 (3), 405–419.
Bairoch, P., 1988. Cities and Economic Development: from the Dawn of History to the Present. University of Chicago Press, Chicago, IL.

Barro, R.J., 1991. Economic growth in a cross section of countries. Q. J. Econ. 106 (2), 407–443.
Bartel, A., Harrison, A., 2005. Ownership versus environment: disentangling the sources of public-sector inefficiency. Rev. Econ. Stat. 87 (1), 135–147.
Bator, F., 1958. The anatomy of market failure. Q. J. Econ. 72 (3), 351–379.
Berkowitz, D., DeJong, D.N., 2003. Policy reform and growth in post-Soviet Russia. Eur. Econ. Rev. 47 (2), 337–352.
Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. J. Econom. 87 (1), 115–143.
Bockstette, V., Chanda, A., Putterman, L., 2002. State and markets: the advantage of an early start. J. Econ. Growth 7, 347–369.
Bognetti, G., 2020. History of western state-owned enterprises: from the Industrial Revolution to the age of globalization. In: Bernier, L., Florio, M., Bance, P. (Eds.), The Routledge Handbook of State-Owned Enterprises. Routledge, London & New York.
Borcan, O., Olsson, O., Putterman, L., 2018. State history and economic development: evidence from six millennia. J. Econ. Growth 23 (1), 1–40.
Borghi, E., Del Bo, C., Florio, M., 2016. Institutions and firms' productivity: evidence from electricity distribution in the EU. Oxf. Bull. Econ. Stat. 78 (2), 170–196.
Bortolotti, B., Fantini, M., Siniscalco, D., 2004. Privatisation around the world: evidence from panel data. J. Publ. Econ. 88 (1–2), 305–332.
Bozec, R., Breton, G., Côté, L., 2002. The performance of state–owned enterprises revisited. Financ. Account Manag. 18 (4), 383–407.
Bozec, R., Dia, M., Breton, G., 2006. Ownership-efficiency relationship and the measurement selection bias. Account. Finance 46 (5), 733–754.
Brambor, T., Clark, W.R., Golder, M., 2006. Understanding interaction models: improving empirical analyses. Polit. Anal. 14 (1), 63–82.
Brown, J.D., Earle, J.S., Telegdy, Á., 2006. The productivity effects of privatization: longitudinal estimates from Hungary, Romania, Russia, and Ukraine. J. Polit. Econ. 114 (1), 61–99.
Cahen, F.R., 2015. Internationalization of state-owned enterprises through foreign direct investment. Rev. Adm. Empres. 55 (6), 645–659.
Castelnovo, P., Del Bo, C.F., Florio, M., 2019. Quality of institutions and productivity of State-Invested Enterprises: international evidence from major telecom companies. Eur. J. Polit. Econ. 58, 102–117.
Castelnovo, P., Florio, M., 2020. Mission-oriented public organizations for knowledge creation. In: Bernier, L., Florio, M., Bance, P. (Eds.), The Routledge Handbook of State-Owned Enterprises. Routledge, London & New York.
Christiansen, H., 2013. Balancing Commercial and Non-commercial Priorities of State-Owned Enterprises. OECD Corporate Governance Working Papers no.6. OECD Publishing, Paris.
Comin, D., Easterly, W., Gong, E., 2010. Was the wealth of Nations determined in 1000 BC? Am. Econ. J. Macroecon. 2, 65–97.
Davids, M., van Zanden, J.L., 2000. A reluctant state and its enterprises: state-owned enterprises in The Netherlands in the "long" twentieth century. In: Toninelli, P.A. (Ed.), The Rise and Fall of State-Owned Enterprises in the Western World. Cambridge University Press, Cambridge.
De Melo, M., Denizer, C., Gelb, A., Tenev, S., 2001. Circumstance and choice: the role of initial conditions and policies in transition economies. World Bank Econ. Rev. 15 (1), 1–31.
Djankov, S., Murrell, P., 2002. Enterprise restructuring in transition: a quantitative survey. J. Econ. Lit. 40 (3), 739–792.
Doamekpor, F.K., 2003. A Structural analysis of the value-added effects of enterprises: a re-assessment. Int. J. Comp. Sociol. 44 (2), 129–154.
Easterly, W., Levine, R., 1997. Africa's growth tragedy: policies and ethnic divisions. Q. J. Econ. 112 (4), 1203–1250.
Eggimann, G., 1999. La Population des villes des Tiers-Mondes, 1500-1950. Geneva. Centre d'histoire économique Internationale de l'Université de Geneve, Li-braire Droz.
Estrin, S., Hanousek, J., Kočenda, E., Svejnar, J., 2009. The effects of privatization and ownership in transition economies. J. Econ. Lit. 47 (3), 699–728.
Estrin, S., Meyer, K.E., Nielsen, B.B., Nielsen, S., 2016. Home country institutions and the internationalization of state owned enterprises: a cross-country analysis. J. World Bus. 51 (2), 294–307.
Feenstra, R.C., Inklaar, R., Timmer, M.P., 2015. The next generation of the Penn world table. Am. Econ. Rev. 105 (10), 3150–3182.
Fiorio, C.V., Florio, M., 2013. Electricity prices and public ownership: evidence from the EU15 over thirty years. Energy Econ. 39, 222–232.
Florio, 2013. Network Industries and Social Welfare: the Experiment that Reshuffled European Utilities, first ed. Oxford University Press, Oxford, United Kingdom.
Fowler, P.C., Richards, D.D., 1995. Test evidence for the OECD countries, 1965-85: the relationship between the size of the public enterprise sector and economic growth. Int. J. Soc. Econ. 22 (3), 11–23.
Frydman, R., Gray, C., Hessel, M., Rapaczyński, A., 1999. When does privatization work? The impact of private ownership on corporate performance in the transition economies. Q. J. Econ. 114 (4), 1153–1191.
Godoy, S., Stiglitz, J.E., 2007. Growth, initial conditions, law and speed of privatization in transition countries: 11 Years later. In: Estrin, S., Kolodko, G.W., Uvalic, M. (Eds.), Transition and beyond. Studies in Economic Transition. Palgrave Macmillan, London.
Gouret, F., 2007. Privatization and output behavior during the transition: methods matter! J. Comp. Econ. 35 (1), 3–34.
Griliches, Z., 1992. The search for R&D spillovers. Scand. J. Econ. 94, S29–S47.
Guislain, P., 1997. The Privatization Challenge. A Strategic, Legal, and Institutional Analysis of International Experience. The World Bank, Washington, DC.
Gylfason, T., Herbertsson, T.T., Zoega, G., 2001. Ownership and growth. World Bank Econ. Rev. 15 (3), 431–449.
Huang, X., Li, P., Lotspeich, R., 2010. Economic growth and multi-tasking by state-owned enterprises: an analytic framework and empirical study based on Chinese provincial data. Econ. Syst. 34 (2), 160–177.
Huat, C.B., 2016. State-owned enterprises, state capitalism and social distribution in Singapore. Pac. Rev. 29 (4), 499–521.
Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. J. Financ. Econ. 3 (4), 305–306.
Jian, J., Li, H., Meng, L., Zhao, Ch, 2020. Do policy burdens induce excessive managerial perks? Evidence from China's stated-owned enterprises. Econ. Modell. 90, 54–65.
Kingsley, A.F., Noordewier, T.G., Vanden Bergh, R.G., 2017. Overstating and understating interaction results in international business research. J. World Bus. 52 (2), 286–295.
Koo, R.C., 2014. The Escape from Balance Sheet Recession and the QE Trap: A Hazardous Road for the World Economy. John Wiley and Sons, Singapore.
Kopecký, P., Spirova, M., 2011. 'Jobs for the boys'? Patterns of party patronage in post-communist Europe. W. Eur. Polit. 34 (5), 897–921.
Kornai, J., 1979. Resource-constrained versus demand-constrained systems. Econometrica 47 (4), 801–819.
Kornai, J., Maskin, E., Roland, G., 2003. Understanding the soft budget constraint. J. Econ. Lit. 41 (4), 1095–1136.
Kowalski, P., Buge, M., Sztajerowska, M., Egeland, M., 2013. State-owned Enterprises: Trade Effects and Policy Implications. OECD Trade Policy Papers No. 147. OECD Publishing, Paris.
Lin, L.W., Milhaupt, C.J., 2013. We are the (national) champions: understanding the mechanisms of state capitalism in China. Stanford Law Rev. 65 (4), 697–759.
Liu, F., Zhang, L., 2018. Executive turnover in China's state-owned enterprises: government-oriented or market-oriented? China Journal of Accounting Research 11 (2), 129–149.
Matuszak, P., Kabaciński, B., 2021. Non-commercial goals and financial performance of state-owned enterprises – some evidence from the electricity sector in the EU countries. J. Comparative Econ. https://doi.org/10.1016/j.jce.2021.03.002.
Matuszak, P., Szarzec, K., 2019. The scale and financial performance of state-owned enterprises in the CEE region. Acta Oecon. 69 (4), 549–570.
Mazzucato, M., 2013. The Entrepreneurial State: Debunking Public vs. Private Sector Myths. Anthem Press, London.
Megginson, W.L., 2017. Privatization, state capitalism, and state ownership of business in the 21st century. Foundations and Trends in Finance 11 (1–2), 1–153.
Megginson, W., Netter, J., 2001. From state to market: a survey of empirical studies on privatization. J. Econ. Lit. 39 (2), 321–389.
Mickiewicz, T., 2010. Economics of Institutional Change: Central and Eastern Europe Revisited, second ed. Palgrave Macmillan, New York, NY.
Millward, R., 2005. Private and Public Enterprise in Europe: Energy, Telecommunications and Transport, 1830-1990. Cambridge University Press, Cambridge.
Musacchio, A., Lazzarini, S.G., 2014. Reinventing State Capitalism: Leviathan in Business, Brazil and beyond, first ed. Harvard University Press.
Nelson, R.R., 1993. National Systems of Innovation. Oxford University Press, Oxford.
OECD, 2015. State-owned Enterprises in the Development Process. OECD Publishing, Paris.
OECD, 2017. The Size and Sectoral Distribution of State-Owned Enterprises. OECD Publishing, Paris.
Plane, P., 1992. Productive efficiency of public enterprises: a macroeconomic analysis based on cross-section estimation of a neoclassical production function. Appl. Econ. 24 (8), 833–844.
Ramaswamy, B., Yeung, M., Laforet, S., 2012. China's outward foreign direct investment: location choice and firm ownership. J. World Bus. 47 (1), 17–25.
Robinett, D., 2006. Held by the Visible Hand: the Challenge of State-Owned Enterprise Corporate Governance for Emerging Markets. World Bank, Washington, DC.
Roodman, D., 2009. A note on the theme of too many instruments. Oxf. Bull. Econ. Stat. 71 (1), 135–158.
Roland, R., 2008. Privatization. Successes and Failures. Columbia University Press, New York.
Romer, P.M., 1990. Endogenous technological change. J. Polit. Econ. 98 (5), S71–S102.
Shaheer, N., Yi, J., Li, S., Chen, L., 2017. State-owned enterprises as bribe payers: the role of institutional environment. J. Bus. Ethics 159 (1), 221–238.
Shea, J.S., 1997. Instrument relevance in multivariate linear models: a simple measure. Rev. Econ. Stat. 79 (2), 348–352.
Shirley, M., Walsh, P., 2000. Public versus Private Ownership: the Current State of the Debate. Policy Research Working Paper No. WPS2420. World Bank, Washington, DC.
Shleifer, A., Vishny, R., 1994. Politicians and firms. Q. J. Econ. 109 (4), 995–1025.
Sonin, K., 2013. The end of economic transition. Econ. Transit. 21 (1), 1–10.
Spolaore, E., Wacziarg, R., 2013. How deep are the roots of economic development? J. Econ. Lit. 51 (2), 325–369.
Stiefel, D., 2000. Fifty years of state-owned industry in Austria, 1946-1996. In: Toninelli, P.A. (Ed.), The Rise and Fall of State-Owned Enterprises in the Western World. Cambridge University Press, Cambridge.
Szarzec, K., Nowara, W., 2017. The economic performance of state-owned enterprises in Central and Eastern Europe. Post Commun. Econ. 29 (3), 375–391.
Szarzec, K., Totleben, B., Piątek, D., 2020. How Do Politicians Capture a State? Evidence from State-Owned Enterprises. East European Politics and Societies: and Cultures. https://doi.org/10.1177/0888325420953485.
Telegdy, A., 2016. Employment adjustment in the global crisis. Differences between domestic, foreign and state-owned enterprises. Econ. Transit. 24 (4), 683–703.
Toninelli, P.A., 2000. The Rise and Fall of State-Owned Enterprise in the Western World. Cambridge University Press, Cambridge.
Tõnurist, P., 2015. Framework for analysing the role of state owned enterprises in innovation policy management: the case of energy technologies and Eesti Energia. Technovation 38, 1–14.

Tihanyi, L., Aguilera, R.V., Heugens, P., van Essen, M., Sauerwald, S., Duran, P., Turturea, R., 2019. State ownership and political connections. J. Manag. 45 (6), 2293–2321.
Vernon, R., Aharoni, Y., 1981. State-owned Enterprise in the Western Economies. Croom Helm, London.
Vickers, J., Yarrow, G., 1991. Economic perspectives on privatization. J. Econ. Perspect. 5 (2), 111–132.
Wang, K.T., Shailer, G., 2018. Does ownership identity matter? A meta-analysis of research on firm financial performance in relation to government versus private ownership. Abacus 5, 1–35.
Wang, X., Wang, S., 2013. Chairman's government background, excess employment and government subsidies: evidence from Chinese local state-owned enterprises. China Journal of Accounting Research 6 (1), 51–74.
Wooldridge, J.M., 1995. Score diagnostics for linear models estimated by two stage least squares. In: Maddala, G.S., Phillips, P.C.B., Srinivasan, T.N. (Eds.), Advances in Econometrics and Quantitative Economics: Essays in Honor of Professor C. R. Rao. Blackwell, Oxford, pp. 66–87.
Wooldridge, J.M., 2010. Econometric Analysis of Cross Section and Panel Data, second ed. MIT Press, Cambridge, MA.
World Bank, 1995. Bureaucrats in Business: the Economics and Politics of Government Ownership. A World Bank Policy Research Report. World Bank, Washington DC.

State-owned enterprises and economic growth: Evidence from the post-Lehman period

Szarzec, Dombi and Matuszak (2021)

SOE Dataset: data appendix

(To be published as online supplementary material)

SOE Dataset: data appendix

Content:

1. The scope of the dataset

The dataset comprises ***10 years (2007−16) and 30 countries*** of which 16 are post-socialist (Bosnia and Hercegovina, Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, North Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia) and 14 are non-post-socialist (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, UK) countries. It includes only nonfinancial, large companies.[1] For each *country-year* datapoint we present the following measures on the economic weight of state-owned enterprises (SOEs): ***the share of SOEs' total assets (TA), operating revenue (OR) and employment (NoE) in the total of large, nonfinancial companies***. We present these series both at the aggregate country level and at three NACE Rev.2 sectoral levels (C – Manufacturing, D − Electricity, gas, steam and air conditioning supply, H − Transportation and storage). A typical slice of the dataset is depicted in Table 1.

The aggregate data are derived by collecting ***firm-level data from the Amadeus database of Bureau van Dijk***. The Amadeus database contains major business statistics and information on enterprises—including their ownership structure—in European countries. Data in Amadeus are available for the last 10 years. The construction of the ***SOE Dataset*** started in November 2017. This explains the time span: 2007−16. The inclusion of countries was conditioned on data availability in Amadeus and data availability concerning privatizations in the period under consideration (see below).

[1] For the definition of 'large companies', see Section 2.

State-owned enterprises and economic growth: Evidence from the post-Lehman period
SOE Dataset: data appendix

Table 1. Structure of the SOE Dataset

Representativity threshold: 70%			**National Aggregates**							**National Aggregates**									
Company type			**All large, nonfinancial companies (POEs & SOEs)**							**Large, nonfinancial SOEs**									
State ownership threshold										**>50%**									
Business indicator			Total assets	Operating revenue	No. of employees	Total assets	Operating revenue	No. of employees	Companies in Amadeus (2007−16)	Total assets	Operating revenue	No. of employees	Total assets	Operating revenue	No. of employees	Companies in Amadeus (2007−16)	*Total assets*	*Operating revenue*	*No. of employees*
						Number of companies (included)							*Number of companies (included)*						
Unit of measurement			EUR thousand							EUR thousand							% of the total of all large, nonfinancial companies included in the aggregation		
Series code																	TA	OR	NoE
Austria	AUT	2007	NA	NA	NA	2841	2357	2394	3339	NA	NA	NA	213	158	173	246	NA	NA	NA
Austria	AUT	2008	NA	NA	NA	2841	2357	2394	3339	NA	NA	NA	213	158	173	246	NA	NA	NA
Austria	AUT	2009	412361133	NA	NA	2841	2357	2394	3339	72436316	NA	NA	213	158	173	246	17.6%	NA	NA
Austria	AUT	2010	426479000	NA	NA	2841	2357	2394	3339	72681384	NA	NA	213	158	173	245	17.0%	NA	NA
Austria	AUT	2011	446730443	NA	NA	2841	2357	2394	3339	72858916	NA	NA	213	158	173	245	16.3%	NA	NA
Austria	AUT	2012	470594020	NA	NA	2841	2357	2394	3339	73682701	NA	NA	213	158	173	245	15.7%	NA	NA
Austria	AUT	2013	495959714	NA	828416	2841	2357	2394	3339	76541953	NA	88290	213	158	173	245	15.4%	NA	10.7%
Austria	AUT	2014	518214356	401840817	851482	2841	2357	2394	3339	76999725	33117628	90257	213	158	173	245	14.9%	8.2%	10.6%
Austria	AUT	2015	535685748	407968330	870846	2841	2357	2394	3339	76562478	31938974	88171	213	158	173	245	14.3%	7.8%	10.1%
Austria	AUT	2016	571248256	412916068	887432	2841	2357	2394	3339	77695677	31623643	87632	213	158	173	245	13.6%	7.7%	9.9%
⋮				⋮				⋮			⋮				⋮			⋮	

Source: own data elaborated based on data from Amadeus.

Notes: POEs – privately owned enterprises.

After having collected the firm-level business data from Amadeus for the individual countries, the national and sectoral aggregates are calculated both for state-owned and for all (incl. privately owned) large (nonfinancial) enterprises. To have an idea of the magnitude of the micro-data behind the macro-data, for the countries and time period under consideration, the final Amadeus dataset—after applying our search strategy and missing data treatment (see below)—contains ***131,068 large companies***. Among them, companies in which the state is the majority owner amounted to 6,330 in 2016. If one also takes into account those enterprises in which the state holds only a controlling position with a stake between 25.01% and 50%, this number creeps up to 7,353 in 2016.

2. Data download from Amadeus: The search strategy

This section summarizes our search strategy in Amadeus. There were three crucial issues concerning data download: 1. Which type of companies do we focus on? 2. Which sectors do we include in the dataset? 3. Do we need consolidated or unconsolidated company data? In the following, we discuss our choices step by step.

Company type

The dataset includes ***large companies*** both in private and state ownership provided that they were active at the time of data retrieval (November 2017 in our case).[2] The shares of SOEs are calculated in this subset of companies. ***A company is considered to be 'large'***—and thereby included in our data—***if either criterion of the related Eurostat classification is met according to its respective mean value in 2007−2016:***

- (mean 2007−16) Employment ≥ 250,
- (mean 2007−16) Balance sheet total (total assets in our context) > 43 million EUR,
- (mean 2007−16) Turnover (operating revenue in our context) > 50 million EUR.[3]

Our motivation in focusing on large companies is twofold. First, from the technical point of view, data are more available for large companies than for small and medium enterprises in Amadeus. Second, from the economic point of view, state ownership is concentrated in the group of large companies.

[2] The Amadeus database mostly does not contain any data on previous years in case of currently inactive enterprises. Therefore, our focus on active companies is motivated by data availability.

[3] **Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (notified under document number C(2003) 1422)**. *Official Journal L 124 , 20/05/2003 pp.36-41*

Sectors

Amadeus contains data only on nonfinancial companies. Consequently, the financial sector is, by necessity, not included in our dataset. We also exclude noncommercial sectors in which companies—usually—cannot be privatized, such as education, health care, and public administration. So***, companies operating in the following main NACE Rev. 2 sectors are not included in the dataset***:

- K. Financial and insurance activities,
- O. Public administration and defence, compulsory social security,
- P. Education,
- Q. Human health and social work activities.

Consolidation of company data

Data collected from Amadeus were based on ***unconsolidated accounts***. This choice was driven by the fact that by using data from unconsolidated accounts, one can avoid double-counting and can consider a wider range of activities in terms of the sectoral affiliation of subsidiaries in holding companies and conglomerates.[4] Subsidiaries were classified in the same ownership group as their parent companies. Subsidiaries of SOEs operating abroad, that is in a country different from that in which the parent company is registered, were classified as privately owned.

For some parent companies, only consolidated data were available. In the default case, this issue was not handled. However, we also present the alternative data series excluding the relatively few subsidiaries of companies with consolidated data only.

3. Assessment of state ownership

After retrieving the data on large, active companies—in the considered sectors—the next step was to distinguish state-owned enterprises from privately owned enterprises (POEs). The definition of SOEs, however, is not straightforward; it hinges crucially upon two issues. First, what kind of ownerships are considered to accord with 'state ownership'? Second, above which ownership share should the company be considered as 'state-owned' in an economic sense—that is, being dominated by the state? Concerning the first issue, in our dataset, ***state ownership incorporates ownerships both by public authorities and (local and central) governments***. In other words, state ownership is matched with public ownership.

[4] If data are consolidated, the business indicators of the parent company include the values of their subsidiaries too. Moreover, in the case of consolidated data, Amadeus affiliates subsidiaries with the sector of the parent company, irrespective of whether it fits the reality or not.

As regards the second issue, we work with ***two minimum thresholds of state ownership*** when classifying companies either as a POE or an SOE. The first one is set at ***50 percent,*** implying that state-owned enterprises are defined as entities in which the state holds—directly or indirectly—an ownership stake of more than 50 percent (SOE50).[5] The second one is set at ***25 percent,*** with the condition that only those companies that have the state or another SOE as the largest shareholder are classified as an SOE (SOE25). According to the 50 percent and 25 percent thresholds, there are, respectively, 6330 and 7353 SOEs in our dataset in the year 2016. In checking the ownership share of the state according to Amadeus, we filtered companies based on ***the share of the 'state' as an ultimate owner.***[6]

Amadeus publishes ownership structure of companies based on the latest available information and the ownership status refers to the current state.[7] Since our dataset encompasses the period of 2007 to 2016, we have to take into account the changes in the companies' ownership structure due to privatizations and nationalizations in the considered years. Therefore, we also compile a *Privatization Dataset* for the 30 countries and 10 years under consideration.

The ***Privatization Dataset*** concentrates on privatizations in the first place; however, some data on nationalizations are also included. The main sources of the dataset are the following: the Privatization Barometer database,[8] the World Bank's privatization database,[9] the Amadeus database, privatization agencies, national asset management agencies, ministries, media news, and other reports. Furthermore, the privatization dataset of William L. Megginson constitutes an additional important source of our privatization data.[10]

[5] Indirect state ownership refers to the case when the state has a stake in a company through another SOE.

[6] More precisely, we selected enterprises based on the following criteria in Amadeus: "Subsidiaries with Ultimate Owners by profile: Ultimate Owner of one of the following types: Public authorities, States, Governments; Domestic Ultimate Owner only; Definition of the Ultimate Owner: min. path of 50.01% (25.01% in case of minority SOEs)".

[7] Since the Amadeus data underlying our dataset were downloaded in November 2017, the term 'current state' refers to the latter date in our case.

[8] The Privatization Barometer database provides information on the privatizations in European countries (incl. eight Central European post-socialist countries) from 1977—officially—to the 'present' (practically, only to 2013). (http://www.privatizationbarometer.com)

[9] The World Bank's privatization database provides data on privatization transactions of at least 1 million USD in developing countries between 2000 and 2008. (The database is not available online anymore.)

[10] We are grateful to Professor William L. Megginson for sharing his privatization data with us and giving us the permission to make our Privatization Dataset including some of his data publicly available.

We identified ***1160 cases of privatizations and 61 cases of nationalizations***.[11] Our dataset records the exact date (month/year) of privatizations (nationalizations) paired with the ensuing change in the ownership status of the underlying companies—provided that there was any. In our classification of companies involved in privatization (nationalization), we applied the following rule. If the ownership status—according to the respective threshold level of state ownership (50% or 25%)—changed until June, the company was already regarded as a POE (SOE) from the year of the privatization (nationalization). However, if the change occurred in July or thereafter, the company was regarded as a POE (SOE) only from the successive year. The changes in ownership status are important because the underlying companies must be taken into account as SOEs (POEs) for a part of the 10-year period, and as POEs (SOEs) for the remaining years. Table 2 demonstrates our classification procedure in terms of companies with changed ownership status in the considered period.

Our privatization (nationalization) data can be regarded as ***an approximate dataset***. Unfortunately, data availability is a crucial problem in several countries. Thus, some privatizations/nationalizations might have been left out from the dataset, and the related changes in the ownership status of the underlying companies were not taken into account during the calculation of aggregate series.[12] In order to ease the latter concerns, ***we checked the ownership history of the 50 largest companies*** (in terms of operating revenue and total assets) ***in each country in the period of 2007−2016*** in Amadeus and compared them with our privatization data. We identified only two companies out of the 1500 companies checked concerning which our Privatization Dataset originally missed recording the changes in the ownership status. At the same time, we found 49 misspecifications in cases of which Amadeus classified state-owned enterprises erroneously as private ones. The correction of the respective ownership statuses were performed in our firm-level data.

[11] In fact, the Privatization Dataset contains 1591 privatizations, in total. However, 431 privatizations concern companies which are not included in the Amadeus database and, therefore, not taken into account in our SOE Dataset.

[12] Few transactions were ignored intentionally due to the fact that we were unable to find any data on the ownership structure of the underlying companies.

Table 2. Examples on the classification of companies with changed ownership status
(threshold share of state ownership for being classified as an SOE: 50%)

Company	**Transaction: month/year**	**State ownership**		**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
		Before the transaction	***After the transaction***										
A	Privatization: 05/2011	55%	45%	SOE	SOE	SOE	SOE	***POE***	POE	POE	POE	POE	POE
B	Privatization: 07/2011	55%	45%	SOE	SOE	SOE	SOE	***SOE***	POE	POE	POE	POE	POE
C	Nationalization: 05/2011	45%	55%	POE	POE	POE	POE	***SOE***	SOE	SOE	SOE	SOE	SOE
D	Nationalization: 07/2011	45%	55%	POE	POE	POE	POE	***POE***	SOE	SOE	SOE	SOE	SOE

4. Missing data treatment

Missing observations are prevalent in Amadeus, cutting significantly the number of companies that have complete observations on the three business indicators over the 10 years. As will be seen in the next section, at the individual country-series only those companies that dispose of complete observations for the particular indicator over the underlying period will be taken into account in the aggregation. Therefore, it is of first-order importance that the number of companies affected by missing observations could be decreased to the possible minimum. With this end in view, we apply the following ***four-step strategy of interpolation and extrapolation to impute missing values***:

1. *If missing observation at time t is surrounded by available observations*, that is both data on time (t-1) and time (t+1) are available, the arithmetic mean is inserted: $x_t = (x_{t-1} + x_{t+1})/2$.

2. *If missing observation at time t is surrounded by more remote observations*, the rule is that in the case of a maximum two consecutive missing observations, data are interpolated, otherwise missing data are either extrapolated or not estimated at all (see below). In the former case, interpolation builds on the average change—in absolute term—in the respective period. Let us suppose that we have observations at time *(t-1)* and *(t+2)*, but values for time *t* and *(t+1)* are missing. The missing observations of the latter dates are estimated based on the average change in the period of *(t-1, t+2)*: $x_t = x_{t-1} + (x_{t+2} - x_{t-1})/3$ and $x_{t+1} = x_{t-1} + 2 \cdot (x_{t+2} - x_{t-1})/3$.

3. *If the missing observation is not succeeded by available observations in either of the next two years*, forward extrapolation is applied according to a three-level strategy:
   3.1 If data are available for the preceding two years, that is for *(t-1)* and *(t-2)*, we extrapolate data to time *t* based on the increase from year *(t-2)* to *(t-1)*: $x_t = x_{t-1} + (x_{t-1} - x_{t-2})$.

3.2 If data is available only for the previous year, the missing observation is set equal to it: $x_t = x_{t-1}$.

3.3 If data is not available in the preceding two years either—that is, both time *(t-1*) and *(t-2)* are missing too—missing data at time *t* is not imputed.

4. *If the missing observation is not preceded by available observations in either of the previous two years***,** backward extrapolation is applied according to a three-level strategy:

4.1 If data are available for the successive two years—that is for *(t+1)* and *(t+2)*—we extrapolate data to time *t* based on the increase from year *(t+1)* to *(t+2)*: $x_t = x_{t+1} - \left(x_{t+2} - x_{t+1}\right)$.

4.2 If data is available only for the next year, the missing observation is set equal to it: $x_t = x_{t+1}$.

4.3 If data is not available in the succeeding two years either—that is both time *(t+1)* and *(t+2)* are missing too—missing data at time *t* is not imputed.

It must be noted, that our missing data treatment can result in negative or zero values, which are, in most cases, not realistic for active companies.[13] Therefore, ***we decided to drop negative and zero values from the 'treated' data*** and considered the respective company-year points as missing observations. In the original (untreated) dataset, there are also some observations with negative (or zero) OR/TA/NoE.[14] So, in the frame of the latter step, these are imputed to be not available (NA) too.

Another issue that arises during missing data treatment is related to the companies that were established in the period of 2007–2016. In their case, the years preceding the establishment cannot be considered as missing observations. Consequently, as a rule, ***we applied our missing data treatment only for the year of establishment and the successive years***.

A crucial question in the case of any missing data treatment is ***the reliability of imputed data and the magnitude of noise generated in the underlying data series***. In order to test the validity of our missing data treatment and the reliability of the obtained country-series, we resort to the following ***four-step simulation exercise***. In the ***first step,*** we select the subset of companies—embracing all countries—which have complete observations for the ten years in terms of the

[13] For example, if OR is 60 in 2014 and 20 in 2015, our method would extrapolate a negative value for 2016: $OR_{2016} = 20 + \left(20 - 60\right) = -20$.

[14] There were 15,520 out of 923,069 (1.68%) datapoints with values equal to or smaller than 0 for OR. Respective numbers for TA and NoE were as follows: 74 out of 1,047,409 (0.007%) and 13,557 out of 825,701 (1.64%).

given indicator. In the ***second step***, we artificially generate missing data in this subset of companies by dropping randomly a given share of observations in each year. Concerning the latter, we run the simulation for four scenarios: 10%, 20%, 30% and 40% of observations are dropped each year. In the ***third step***, we apply our missing data treatment for the data with artificially generated missing observations and, afterwards, calculate the forecast error concerning the imputed values based on the *median absolute percentage error (Median APE)* and the *sum of errors (SE)* in each year. We present the *SE* compared to the total annual OR/TA/NoE in the untreated, original data—that is, the set of companies with complete observations for the given indicator. This scaling delivers an *SE* indicator which represents the relative magnitude of aggregation error triggered by our missing data treatment. The formulas of the two measures of forecast error are the following:

$$(1) \qquad Median\ APE_{iy} = median_{iy}\left(\frac{\left|x_{iyc} - \hat{x}_{iyc}\right|}{x_{iyc}}\right)\cdot 100\ ,$$

$$(2) \qquad SE_{iy} = \frac{\sum_{c=1}^{n_{iy}}(x_{iyc} - \hat{x}_{iyc})}{\sum_{c=1}^{N_i} x_{iyc}}\cdot 100\ ,$$

where x and $\hat{x}$ are the actual and the forecasted values, respectively, n_{iy} is the number of companies in year y for which observed data are dropped and forecasted data are inserted, N_i is the number of companies—selected in step 1—that dispose of complete observations in terms of the underlying indicator in the 10 years, while i, y, c are the indexes of the business indicator, year, and company, respectively.[15]

In the final step of our simulation, we repeat the first three steps 100 times and calculate the average of median APE ($\overline{Median\ APE}$) and SE ($\overline{SE}$) for each year and indicator. The results of the simulation are presented in Tables 3 to 6. As can be observed, the two forecast error measures related to the individual indicators evolve similarly over the four scenarios. Consequently, the conclusions are not affected by the share of randomly imputed missing data. According to the median APE, our missing data treatment tends to generate values that deviate

[15] Note that n_{iy}/N_i equals to 10/20/30/40 percent, depending on the underlying simulation. Furthermore, n_{iy} is the same in each year for a given indicator.

from their observed counterparts mostly by between 5 and 10 percent. This is fairly high. However, as expected, these errors are largely averaged out at the aggregate level. According to the *SE* indicator, the sum of these errors amounts only to a marginal share of the observed annual aggregates. This confirms the reliability of our missing data treatment.

Table 3. Average errors of missing data treatment: **Missing share = 10%** (100 replications)

		2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2007-2016**
OR	$\overline{Median\ APE}$ *(%)*	18.79	10.95	12.00	7.36	7.06	6.97	7.09	7.30	8.18	13.61	9.93
	$\overline{SE}$ *(%)*	1.63	-0.74	1.25	0.06	-0.39	-0.09	-0.02	0.08	0.08	0.06	0.19
TA	$\overline{Median\ APE}$ *(%)*	17.01	9.55	7.90	6.25	5.96	6.08	6.52	6.64	7.61	12.95	8.65
	$\overline{SE}$ *(%)*	-0.20	0.20	0.22	-0.05	-0.16	-0.01	0.19	0.09	-0.22	0.40	0.05
NoE	$\overline{Median\ APE}$ *(%)*	6.56	3.81	3.39	3.24	2.95	2.78	2.75	2.75	2.72	4.64	3.56
	$\overline{SE}$ *(%)*	0.67	-0.17	0.11	0.11	-0.03	0.04	-0.01	0.02	-0.01	0.14	0.09

Table 4. Average errors of missing data treatment: **Missing share = 20%** (100 replications)

		2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2007-2016**
OR	$\overline{Median\ APE}$ *(%)*	18.02	11.49	12.37	7.83	7.40	7.31	7.43	7.66	8.56	13.25	10.13
	$\overline{SE}$ *(%)*	1.42	-0.73	1.23	0.04	-0.39	-0.07	-0.04	0.05	0.08	0.01	0.16
TA	$\overline{Median\ APE}$ *(%)*	16.41	9.95	8.31	6.57	6.24	6.38	6.80	7.05	8.02	12.51	8.82
	$\overline{SE}$ *(%)*	-0.13	0.17	0.23	-0.03	-0.15	-0.02	0.18	0.08	-0.18	0.33	0.05
NoE	$\overline{Median\ APE}$ *(%)*	6.33	3.99	3.58	3.43	3.09	2.94	2.92	2.91	2.92	4.52	3.66
	$\overline{SE}$ *(%)*	0.51	-0.13	0.11	0.11	-0.06	0.03	0.02	0.03	-0.01	0.06	0.07

Table 5. Average errors of missing data treatment: **Missing share = 30%** (100 replications)

		2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2007-2016**
OR	$\overline{Median\ APE}$ *(%)*	17.26	11.92	12.80	8.33	7.76	7.68	7.81	8.13	8.98	12.84	10.35
	$\overline{SE}$ *(%)*	1.41	-0.90	1.19	0.04	-0.38	-0.11	-0.05	0.11	0.10	0.00	0.14
TA	$\overline{Median\ APE}$ *(%)*	16.00	10.21	8.73	6.92	6.55	6.74	7.15	7.42	8.38	12.06	9.02
	$\overline{SE}$ *(%)*	-0.13	0.16	0.22	-0.03	-0.14	-0.01	0.18	0.06	-0.19	0.20	0.03
NoE	$\overline{Median\ APE}$ *(%)*	6.08	4.14	3.77	3.60	3.27	3.11	3.06	3.05	3.09	4.38	3.75
	$\overline{SE}$ *(%)*	0.40	-0.11	0.12	0.10	-0.05	0.07	-0.01	0.03	0.01	0.06	0.06

Table 6. Average errors of missing data treatment: **Missing share = 40%** (100 replications)

		2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2007-2016**
OR	$\overline{Median\ APE}$ *(%)*	16.48	12.38	13.28	8.94	8.20	8.07	8.22	8.54	9.27	12.50	10.59
	$\overline{SE}$ *(%)*	1.41	-0.85	1.27	0.05	-0.37	-0.07	-0.06	0.08	0.08	0.05	0.16
TA	$\overline{Median\ APE}$ *(%)*	15.60	10.40	9.15	7.29	6.88	7.07	7.47	7.80	8.63	11.65	9.20
	$\overline{SE}$ *(%)*	-0.11	0.12	0.18	-0.02	-0.13	-0.01	0.17	0.11	-0.13	0.17	0.04
NoE	$\overline{Median\ APE}$ *(%)*	5.82	4.27	3.95	3.76	3.41	3.27	3.20	3.20	3.24	4.27	3.84
	$\overline{SE}$ *(%)*	0.31	-0.13	0.10	0.09	-0.01	0.04	0.01	-0.01	-0.01	0.05	0.04

Notes to tables 3 to 6: average median APE ($\overline{Median\ APE}$ **)** and average SE ($\overline{SE}$) of 100 replications; *Median APE*: median absolute percentage error; *SE*: sum of errors (compared to the total annual OR/TA/NoE in the untreated

dataset of companies with complete observations on the given indicator in the period of 2007−2016); during the simulations the respective missing share was imputed for each year separately.

5. Aggregation: From microdata to aggregate shares

A major challenge of constructing aggregate data based on firm-level micro-data is missing observations. In our case, ***missing observations*** have first-order importance because they ***can introduce artificial variation in the country-level data series***. For example, consider the case when data are available for a major SOE in 2007−2014 but unavailable in 2015−2016. If this company was taken into account in the aggregation, each of the three series on the economic weight of SOEs would suffer a drop in the underlying country in 2015, signaling falsely the withdrawal of the state as an owner. To avoid these kinds of artificial jumps in the country-level data, and ***to preserve consistency over time, at each country and indicator, we only include those enterprises in the calculation of the aggregate data series for which we have complete observations—on the given indicator—after missing data treatment in the considered period***.[16,17]

At this point, we highlight the necessity of missing data treatment in Amadeus in order to arrive at aggregate data that can be considered to be representative for the economy. Table 7 presents the share of companies with complete observations on the individual business indicators over the whole period, both in the case of treated and untreated data. As can be observed, ***without missing data treatment, Amadeus would provide a considerably less sound micro-basis for aggregation***.

According to Table 7, despite the considerable improvement in the share of companies with complete data, there are ***some country-series*** (gray-colored cells) that prove to be ***still problematic even after missing data treatment***. In order to have a clear overview of the problem, we constructed a heat map of missing data for the 30 countries, 10 years and 3

[16] Theoretically, it would be more appropriate to base the aggregation on that subset of companies that have complete observations on each of the three indicators between 2007 and 2016. This would ensure consistency in the variation of the SOEs' share not just over time, but across the considered business indicators as well. Unfortunately, this tighter restriction would leave us with a very small number of companies compared to the total, and result in aggregate ratios that are not representative.

[17] The companies established in the period between 2008 and 2016 (i.e. after the start of the SOE Dataset, 2007) are included in the aggregation for the respective years provided that they have complete observations on the given financial indicator starting with the year of establishment. For example, if the enterprise is established in 2011 and has complete observations on a given indicator throughout the whole successive period, it is included in the respective aggregation for the years between 2011 and 2016.

indicators (Table 8). In Table 8, the respective country-year-indicator datapoints are assigned to five categories, according to the percentage of companies with missing data in the total number of large companies. If more than 30 percent of the companies had no data on the given indicator in the given year and country in Amadeus, the respective datapoint is denoted by 4. If this share falls in the range of (25−30%), (20−25%), (15−20%), and (0−15%), the datapoint is denoted by 3, 2, 1, 0 respectively.

Table 7. Companies with complete observations between 2007 and 2016: treated vs. untreated data

	With missing data treatment							Without missing data treatment						
	OR	*TA*	*NoE*	*Total*	*% OR*	*% TA*	*% NoE*	*OR*	*TA*	*NoE*	*Total*	*% OR*	*% TA*	*% NoE*
AUT	233	362	5	3339	7%	11%	0%	51	108	0	3339	2%	3%	0%
BIH	104	107	105	235	44%	46%	45%	85	86	84	235	36%	37%	36%
BEL	2661	2981	2515	3488	76%	85%	72%	2310	2623	2184	3488	66%	75%	63%
BGR	753	739	778	1015	74%	73%	77%	8	7	2	1015	1%	1%	0%
CZE	1833	1883	1713	2386	77%	79%	72%	1419	1444	1034	2386	59%	61%	43%
DEU	7285	12131	8456	19223	38%	63%	44%	3450	5858	3577	19223	18%	30%	19%
DNK	0	0	0	2253	0%	0%	0%	0	0	0	2253	0%	0%	0%
EST	217	235	140	274	79%	86%	51%	195	216	108	274	71%	79%	39%
ESP	5989	6510	5591	8027	75%	81%	70%	4395	4728	3870	8027	55%	59%	48%
FIN	1013	1055	889	1497	68%	70%	59%	851	892	509	1497	57%	60%	34%
FRA	7597	7916	4445	10165	75%	78%	44%	5320	5608	682	10165	52%	55%	7%
GBR	11374	17576	10004	27887	41%	63%	36%	8394	13722	7255	27887	30%	49%	26%
GRC	662	693	603	807	82%	86%	75%	520	544	467	807	64%	67%	58%
HRV	451	468	438	555	81%	84%	79%	392	408	383	555	71%	74%	69%
HUN	987	1007	867	1238	80%	81%	70%	901	951	699	1238	73%	77%	56%
ITA	7868	8276	6857	9743	81%	85%	70%	6894	7346	5330	9743	71%	75%	55%
LTU	374	302	390	449	83%	67%	87%	317	247	338	449	71%	55%	75%
LVA	251	245	248	300	84%	82%	83%	233	206	229	300	78%	69%	76%
MNE	12	12	12	65	18%	18%	18%	6	6	6	65	9%	9%	9%
MKD	16	8	64	158	10%	5%	41%	0	0	12	158	0%	0%	8%
NLD	1824	3060	2105	5220	35%	59%	40%	1044	2019	696	5220	20%	39%	13%
NOR	1800	2249	0	3494	52%	64%	0%	1655	2117	0	3494	47%	61%	0%
POL	3035	3123	401	4172	73%	75%	10%	2052	2070	165	4172	49%	50%	4%
PRT	1461	1581	1345	1868	78%	85%	72%	1260	1421	1148	1868	67%	76%	61%
ROU	1487	1541	1471	1845	81%	84%	80%	1273	1303	1198	1845	69%	71%	65%
SRB	466	480	408	571	82%	84%	71%	398	407	390	571	70%	71%	68%
RUS	9632	9903	9858	15321	63%	65%	64%	8138	8324	7266	15321	53%	54%	47%
SWE	2577	2944	2160	4251	61%	69%	51%	2185	2509	1801	4251	51%	59%	42%
SVN	285	289	283	346	82%	84%	82%	264	265	246	346	76%	77%	71%
SVK	620	644	600	876	71%	74%	68%	521	548	490	876	59%	63%	56%

Notes: In each block, the number of companies with complete observations on OR/TA/NoE and the total number of large companies in Amadeus ('Total') are presented first, and the shares of the former in the latter, second. In the case of the countries where data availability is problematic concerning either of the three indicators, the respective cell is colored gray. Data availability is considered to be problematic if less than 70 percent of the companies have complete observations in terms of the given indicator in 2007−2016. In the untreated data, the cases of zero (or very low) number of companies with complete observations are—partly—explained by the fact that in some countries no (or very few) data are available for particular years (e.g., there are no data for Denmark between 2007 and 2009, and for North Macedonia between 2007 and 2010—except of NoE—while only few data are available for Montenegro between 2007 and 2012).

Table 8. The heat map of missing data after missing data treatment

		AUT	BIH	BEL	BGR	CZE	DEU	DNK	EST	ESP	FIN	FRA	GBR	GRC	HRV	HUN	ITA	LTU	LVA	MNE	MKD	NLD	NOR	POL	PRT	ROU	SRB	RUS	SWE	SVN	SVK
OR	*2016*	3	4	0	0	0	4	2	0	0	0	0	2	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0
	2015	2	0	0	0	0	3	1	0	0	0	0	2	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0
	2014	2	0	0	0	0	2	1	0	0	0	0	2	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0
	2013	3	0	0	0	0	2	1	0	0	0	0	2	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0
	2012	3	0	0	0	0	2	2	0	0	0	0	2	0	0	0	0	0	0	4	0	4	3	0	0	0	0	0	0	0	0
	2011	3	0	0	0	0	2	4	0	0	0	0	2	0	0	0	0	0	0	4	0	4	3	0	0	0	0	0	0	0	0
	2010	4	0	0	0	0	3	4	0	0	0	0	3	0	0	0	0	0	0	4	4	4	4	0	0	0	0	1	0	0	0
	2009	4	0	0	0	0	4	4	0	0	0	0	3	0	0	0	0	0	0	4	4	4	4	1	0	0	0	0	0	0	1
	2008	4	0	0	0	1	4	4	0	1	0	0	4	0	0	0	0	0	0	4	4	4	4	1	0	0	0	0	0	0	2
	2007	4	0	0	0	2	4	4	0	2	0	0	4	0	0	0	0	1	1	4	4	4	4	2	0	1	1	0	1	0	3
TA	*2016*	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2015	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2014	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2013	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2012	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
	2011	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4	0	1	1	0	0	0	0	0	0	0	0
	2010	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	4	4	2	2	0	0	0	0	0	0	0	0
	2009	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	1	0	4	4	3	3	0	0	0	0	0	0	0	1
	2008	4	0	0	0	1	2	4	0	0	0	0	0	0	0	0	0	2	0	4	4	4	4	1	0	0	0	0	0	0	1
	2007	4	0	0	1	1	2	4	0	1	0	0	0	0	0	0	0	3	1	4	4	4	4	2	0	0	0	0	0	0	3
NoE	*2016*	2	4	1	0	0	0	3	4	1	1	2	4	0	0	0	0	0	0	0	0	3	4	4	0	0	1	0	4	0	0
	2015	1	0	1	0	0	0	3	3	0	0	2	4	0	0	0	0	0	0	0	0	2	4	4	0	0	0	0	4	0	0
	2014	1	0	1	0	0	0	4	3	0	0	2	4	0	0	0	0	0	0	0	0	2	4	4	0	0	0	0	3	0	0
	2013	2	0	1	0	0	0	4	3	0	0	2	4	0	0	0	0	0	0	0	0	2	4	4	0	0	0	0	3	0	0
	2012	2	0	1	0	0	0	4	4	1	0	3	4	0	0	0	0	0	0	4	0	3	4	4	0	0	0	0	3	0	0
	2011	2	0	1	0	0	0	4	3	1	0	3	4	0	0	0	0	0	0	4	0	3	4	2	0	0	0	0	3	0	0
	2010	4	0	1	0	0	3	4	2	1	0	4	4	0	0	0	0	0	0	4	0	3	4	0	0	0	0	0	3	0	1
	2009	4	0	1	0	1	4	4	0	1	0	3	4	0	0	0	1	0	0	4	0	4	4	0	0	0	0	0	2	0	2
	2008	4	0	1	0	2	4	4	0	2	1	3	4	0	0	0	1	0	0	4	4	4	4	1	0	0	0	0	3	0	2
	2007	4	0	1	0	3	4	4	0	2	1	3	4	0	0	1	1	0	1	4	4	4	4	3	0	1	1	0	3	0	3

Notes: Categories based on the share of large companies with missing data (in the given year and according to the respective indicator): ***4***: 30−100%; ***3***: 25−30%; ***2***: 20−25%; ***1***: 15−20%; ***0***: <15%. The years that are dropped in the frame of the time period adjustment in order to surpass the 70 percent threshold of company representativity are enframed.

Comparing Tables 7 and 8 with each other, it is observable that ***in some cases, only few years are responsible for having a low share of companies with complete observations*** for the whole 10-year period. For example, in the case of Bosnia and Hercegovina, the low shares of companies with complete observations both with respect to OR, TA, and NoE (Table 7) are obviously the results of the large number of companies with missing data in 2016 (Table 8). So, in the case of Bosnia and Hercegovina, the reduction of the time period by one year to 2007−2015 would increase the share of companies with complete data considerably at each indicator. This observation leads us to consider carefully the possibility of reducing the time period of the problematic country-series.

Before presenting our interpretation of 'problematic' country-series, we highlight the crucial importance of the issue. Recall, that in order to preserve the consistency of the particular country data series over time, we calculate the aggregate share of SOEs on the basis of those companies that have complete observations on the given indicator in the considered time period. However, ***if the number of companies with complete observations is too small compared to the total number of large companies***—including also those with incomplete observations—***the aggregate share of SOEs in OR/TA/NoE will not be representative***. Two options emerge: either to drop 'problematic' country-series, or to adjust the time-period accordingly to get rid of the years with the highest share of companies with missing data. We opt for the latter and adjust the time period at each 'problematic' country-series accordingly.

Now we turn to the interpretation of the qualifier 'problematic'. It is clear that in order to have representative data on SOEs' share, proportionally, a large enough number of companies must be included in the aggregation. Of course, the question from which share of involvement can we reasonably consider a country data series to be representative is subjective. In our default dataset, we opt for 70 percent as a threshold the included companies must surpass based on their relative number. In other words, ***we consider the calculated shares of SOEs as representative if at least 70 percent of the large companies met the requirement of having complete data on the particular indicator in the given (sub)period*** and are therefore included in the aggregation. In some countries, and at some indicators, the original 10-year period is not needed to be cut back in order to have more than 70 percent of the (large) companies being included in the aggregation, but in several cases the time period must be reduced to achieve this threshold (gray-colored cells in Table 7).

We apply a ***piecewise strategy of adjusting the time period of 'problematic' country data series*** by dropping the years step by step and checking the share of companies with complete observations

in the remaining period after each drop. We stop cutting back the time period of the underlying country data series when the 70 percent representativity threshold is passed. As a general rule, we strive to keep the latest years and drop the earliest years when it is possible. So, the reduction of the time period always starts from 2007—with the exception of some straightforward cases, such as Bosnia and Hercegovina. In Table 8, we enframe the dropped years for each country-series with a bold line. (The same exercise is also performed according to both the 60 percent and the 80 percent representativity threshold shares, and for the SOE shares calculated at sectoral levels. The resulting SOE data are included in the dataset.)

We ***double-check the representativity of our aggregate SOE shares in two ways***. First, we calculate the ratio of total OR (TA) of included companies to the overall OR (TA) of all companies—that is both small, medium, and large companies—in Amadeus for each country. Table 9 presents the calculated economic weight of included companies—based on the 70 percent threshold share of representativity—in the period of 2014 to 2016.[18] For the majority of countries, the calculated aggregate ratios are considerably high. However, there are some (gray-colored) cases with less impressive levels of representativity. (In Table 9, we considered arbitrarily ratios below 30% as 'less impressive'.) The underlying reasons are partly straightforward. In the case of the blank cells, the 70 percent representativity threshold was not reached and the economic share of SOEs was not calculated. In the other cases, either the relatively low number of large companies in the economy or some systemic data quality problem in Amadeus might explain the low ratio of included companies' aggregate to the overall economic aggregate.

As an alternative double-checking of the representativity of our data, we calculate the ratio of SOEs included in the aggregation to the overall number of (large) SOEs (Table 10). As can be observed in Table 10, the SOEs considered in the aggregation represent a reasonable share of the state-owned part of the national economy—at least from a numerical point of view. The calculated shares are considerably high. The few zeros represent those cases when aggregation was not performed because of the inadequate share of companies with complete data in all subperiods of the 10-year interval (see Table 8).

[18] In Amadeus, overall OR (TA) data—including all companies—are available only between 2014 and 2016. Nevertheless, the calculated ratios show considerable persistency, so Table 9 can be considered to be informative for the earlier years too.

State-owned enterprises and economic growth: Evidence from the post-Lehman period
SOE Dataset: data appendix

Table 9. The economic share of companies included in the aggregation compared to the total set of companies

		AUT	BIH	BEL	BGR	CZE	DEU	DNK	EST	ESP	FIN	FRA	GBR	GRC	HRV	HUN	ITA	LTU	LVA	MNE	MKD	NLD	NOR	POL	PRT	ROU	SRB	RUS	SWE	SVN	SVK
OR	*2016*	80%		71%	35%	51%		78%	29%	49%	54%	57%	82%	62%	45%	53%	55%	36%	29%	34%	32%		52%	49%	45%	42%	37%	44%	51%	45%	47%
	2015	76%	36%	70%	37%	39%	87%	80%	29%	49%	55%	59%	83%	58%	48%	56%	56%	32%	31%	32%	32%		55%	48%	47%	43%	42%	47%	53%	46%	48%
	2014	83%	37%	73%	38%	51%	82%	84%	31%	51%	58%	55%	85%	58%	50%	55%	58%	36%	33%	34%	32%		59%	50%	48%	45%	40%	49%	53%	47%	47%
TA	*2016*	46%		60%	32%	46%	66%	43%	32%	37%	68%	56%	64%	68%	57%	59%	57%	23%	31%	44%	35%	26%	46%	48%	50%	43%	46%	52%	57%	48%	48%
	2015	46%	50%	59%	33%	47%	66%	44%	32%	36%	66%	55%	67%	63%	58%	59%	57%	22%	30%	43%	36%	27%	49%	47%	50%	44%	55%	53%	59%	49%	48%
	2014	52%	47%	60%	34%	48%	67%	43%	33%	37%	67%	55%	68%	60%	60%	56%	57%	22%	31%	42%	37%	28%	50%	50%	50%	45%	49%	52%	59%	50%	51%

Notes: (*OR/TA of included large companies*)$_{y,cr}$ / (*OR/TA of all companies in Amadeus*)$_{y,cr}$, where *cr* is the country index and *y* is the year index. 'All companies in Amadeus' includes both small, medium, and large companies. Note, that the overall OR/TA of all companies in the denominator is calculated based on the original (pure) Amadeus data being void of any missing data treatment. At each country data series, the time period was adjusted according to the 70 percent threshold share of companies to be included.

Table 10. The share of SOEs included in the aggregation in the total number of all large SOEs

		AUT	BIH	BEL	BGR	CZE	DEU	DNK	EST	ESP	FIN	FRA	GBR	GRC	HRV	HUN	ITA	LTU	LVA	MNE	MKD	NLD	NOR	POL	PRT	ROU	SRB	RUS	SWE	SVN	SVK
SOE50	*OR*	64%	98%	87%	72%	85%	80%	90%	83%	84%	91%	80%	79%	90%	88%	95%	89%	65%	87%	81%	100%	0%	75%	77%	86%	76%	86%	85%	86%	63%	76%
	TA	87%	98%	99%	71%	86%	90%	96%	96%	88%	95%	88%	88%	97%	88%	95%	93%	65%	79%	81%	100%	57%	80%	77%	91%	76%	86%	88%	92%	64%	78%
	NoE	70%	97%	75%	82%	81%	90%	49%	74%	87%	75%	70%	0%	74%	86%	90%	81%	71%	87%	81%	100%	62%	0%	85%	83%	76%	75%	88%	76%	69%	80%
SOE25	*OR*	65%	98%	90%	80%	85%	80%	92%	83%	85%	90%	84%	82%	92%	93%	82%	89%	65%	90%	86%	100%	0%	83%	81%	87%	78%	90%	85%	86%	68%	77%
	TA	88%	98%	99%	79%	86%	89%	98%	96%	89%	94%	90%	90%	96%	93%	82%	93%	65%	81%	86%	100%	67%	87%	81%	93%	78%	90%	88%	93%	69%	80%
	NoE	68%	97%	78%	90%	81%	89%	52%	74%	86%	74%	73%	0%	77%	91%	74%	79%	71%	90%	86%	100%	72%	0%	90%	84%	78%	76%	88%	77%	73%	82%

Notes: (Number of SOEs included)$_{i,cr}$ / *(Overall number of large SOEs)*$_{cr}$, where *i* is the indicator index and *cr* is the country index. At each country data series, the time period was adjusted so that the number of companies included would surpass the 70 percent threshold share.

sciendo

Economics and Business Review, Vol. 6 (20), No. 4, 2020: 95-117
DOI: 10.18559/ebr.2020.4.6

What determines the scale of state ownership in enterprises? Some evidence from post-socialist countries[1]

Piotr Matuszak[2]

Abstract: State-owned enterprises still play an important role in many countries around the world. The aim of this research is to indicate which factors had a significant impact on the scale of state ownership in enterprises in the group of twenty eight post-socialist countries. The large scale privatisation indicator from the EBRD and the novel micro-level-based SOE measure were regressed on sets of cultural, political, economic and control variables. The results show that cultural factors—represented by the dominant religion—had a substantial impact on the scale of state ownership in enterprises while the role of political and economic factors was less pronounced. These results emphasise the importance of cultural factors in shaping the scale of state ownership in enterprises. This study contributes to the literature by analysing factors influencing the scale of state ownership in enterprises in contemporary economic conditions which has been missing until now.

Keywords: state-owned enterprises, state ownership, post-socialist countries, privatisation, transition.

JEL codes: O11, P26, L32, L38.

Introduction

A discussion on the role of the state as an owner of enterprises has been an important part of contemporary economic literature. The importance of this topic is driven by the fact that the scale of state ownership in enterprises is substantial in many countries around the world. Christiansen and Kim (2014) showed that 282 out of the 2,000 largest publicly listed companies worldwide were state-owned in 2012–2013. Szarzec, Dombi and Matuszak

[1] Article received 17 July 2020, accepted 7 December 2020. Acknowledgements: The author acknowledges the support from the Polish National Agency for Academic Exchange under the Iwanowska Programme (2018/1/00065).

[2] Poznań University of Economics and Business, Institute of Economics, Department of Macroeconomics and Development Studies, al. Niepodległości 10, 61-875 Poznań, Poland, piotr.matuszak@ue.poznan.pl, ORCID: https://orcid.org/0000-0003-4572-3168.

(2019) indicated that state-owned enterprises (SOEs) accounted for more than 20% in terms of total assets in the group of very large enterprises over the period 2007–2016 in nineteen out of thirty European countries and that state-owned enterprises played an important role not only in post-socialist countries but also in the 'old-EU' states such as Greece, Italy, Austria and France as well as in Norway.

The topic of state ownership in enterprises is analysed in the literature mainly at the microeconomic level and studies focus largely on the comparison of financial performance between SOEs and privately owned enterprises, causes of the SOE underperformance and the impact of privatisation at firm-level. Despite the importance of state involvement in the economy through enterprises there is still a lack of research analysing the factors influencing the scale of the SOE sector. This study contributes to the literature by analysing the determinants of state ownership in enterprises in contemporary economic conditions.

The focus in this study is on post-socialist countries of Central-Eastern Europe and the former Soviet Union. Nearly thirty years ago this set of states started a process of rapid institutional changes as a group of quite homogenous countries from the perspective of their political and economic systems (Piątek, Pilc, & Szarzec, 2019). The radical transformation involved the transition from authoritarian to democratic systems and from centrally planned to market economies (Ratajczak, 2009). At the beginning of the transition state ownership dominated in the group of large enterprises in the region and privatisation was perceived as a means to increase the efficiency of divested enterprises, to reduce government interference in the economy, to enhance competition and as a source of budget revenues (Megginson & Netter, 2001; Mihályi, 2017). It was also expected that the role of state ownership would gradually decline over time and that most economies in the region would become very much alike (Bałtowski & Mickiewicz, 2000). However the scale of state ownership in companies differs substantially among post-socialist countries nowadays and SOEs still remain important in many countries in Central-Eastern Europe and the former Soviet Union (see Figure 1 and Table A1 in Appendix). What is more privatisation processes have slowed down in recent years and the scale of state ownership in enterprises seems to be relatively stable from the mid-2000s (see Figure 2; Szarzec et al., 2019).

The aim of this research is to indicate which factors had a significant impact on the scale of state ownership in enterprises in the group of post-socialist countries. The data employed in the econometric analysis covers twenty eight post-socialist countries. State ownership in enterprises is represented in the econometric analysis by the large scale privatisation indicator by the European Bank for Reconstruction and Development (EBRD) for the years 2007–2014 and the share of SOEs in the group of large enterprises in terms of total assets from the novel dataset by Szarzec and others (2019) for the

years 2007–2016.[3] This set of the data was chosen for the following reasons: first, state ownership in enterprises is concentrated in the group of large entities; second, the group of post-socialist countries started the transition with fairly homogenous economic systems and a large enterprise sector strongly dominated by SOEs[4] but the role of the state as an owner differs substantially in the region currently; third, the focus on recent years allows the analysis of the heterogeneity in terms of state ownership in enterprises as a result of deliberate choices of economic policies of states rather than as an effect of selected modes of privatisation and the speed of economic reforms. Cultural, political and economic factors are considered as independent variables in the econometric analysis. The results show that the scale of state ownership in enterprises is substantially affected by cultural factors represented by the dominant religion. The role of political and economic factors is less pronounced.

The paper is structured as follows. In Section 1 a brief literature review on the factors influencing institutional changes in post-socialist countries is presented. Section 2 introduces the dataset and Section 3 presents the research design. Section 4 contains the results. Results are discussed in Section 5. The last section concludes.

1. Literature review

The focus in this study is on addressing the question about the factors influencing the scale of state ownership in enterprises based on the experience of post-socialist countries. In order to facilitate the discussion on the cultural, political and economic factors as potentially impacting the share of SOEs in the economy this review builds on the broadly analysed literature on determinants of institutional performance (e.g. La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1999; De Melo, Denizer, Gelb, & Tenev, 2001; Di Tommaso, Raiser, & Weeks, 2007; Piątek, Szarzec, & Pilc, 2013; Alesina & Giuliano, 2015; Piątek et al., 2019).

Guiso, Sapienza and Zingales (2006) described culture as 'those customary beliefs and values that ethnic, religious and social groups transmit fairly unchanged from generation to generation'.[5] In the opinion of Pejovich (2003), a process of the institutional transition of post-socialist countries was a cultural issue rather than a simple technical one. The formal institutions are strongly influenced by cultural factors and the pace of the transition depends on the in-

[3] 2014 is the last year for which transition indicators from the EBRD are available and the SOE measures by Szarzec and others (2019) cover the period 2007–2016.

[4] The large scale privatisation indicator was equal to 1 (little private ownership) in all of twenty eight post-socialist countries included in the analysis in 1989.

[5] The literature on the culture-institutions nexus was surveyed by Alesina and Giuliano (2015). For a review of the literature on the deeply rooted determinants of economic development, see: Spolaore and Wacziarg (2013).

teraction between prevailing informal rules and new formal rules—when both are not coordinated the transition costs of institutional restructuring are much higher (Pejovich, 2003). One of the most commonly used proxies of unobservable cultural factors is a dominant religion (e.g. Schweickert, Melnykovska, Belke, & Bordon, 2011; Piątek et al., 2019). The religion impacts the society's attitudes towards the role of the state in the economy, including expectations regarding the provision of certain goods through market incentives or directly by the state (Grigoriadis, 2016), and one can expect that SOEs would play a more substantial role in countries dominated by collectivist religions (Eastern Orthodox and Muslim populations) than by individualist religions (Protestant). Gorodnichenko and Roland (2011) analysed the culture-growth nexus with a number of cultural dimensions and concluded that individualism versus collectivism is the main dimension in shaping long-run growth differences across countries. The most commonly used measure for individualism was developed by Hofstede (2001) which distinguished also the dimensions such as power distance, masculinity, uncertainty avoidance, long-term orientation and indulgence. Based on Hofstede's typology and the dataset by Beugelsdijk, Maseland and van Hoorn, (2015), Tarabar (2017) showed for post-socialist countries that individualist and low power-distance cultures are associated with greater reform efforts.

Several decades of the centrally planned economy had a substantial effect on the individual and social behaviours of East-European and the former Soviet Union countries. As indicated by Ratajczak (2009) the societies of the countries undergoing transformation were characterised by a low level of social trust, a high level of corruption and egalitarian attitudes, which had a negative impact on the pace of changes towards a market economy. Similarly Landes (2000) emphasised that even after the fall of the socialist regime people were afraid of uncertainties of the market and longed for the safe monotony of state employment. Therefore one can expect that the longer the period under central planning, the more a society is dependent on the provision of goods by enterprises owned by the state, which can lead to the larger SOE sector.

An accession to the international organizations can been perceived as an important political determinant of institutional changes (e.g. Di Tommaso et al., 2007; Staehr, 2011; Piątek et al., 2019). Democratization and economic reforms in many post-socialist countries were supported by steps towards joining the European Union. States that plan to become a member of this organization need to fulfil the Copenhagen criteria. They require that a candidate country is located in Europe, has a market economy and formal institutions that preserve democratic governance and human rights. Moreover, rules operating within the member countries of the EU—*acquis Communautaire*—need to be adopted before joining the organization. As developed Western countries hold smaller SOE sectors than post-socialist countries (Szarzec et al., 2019), the accession to the EU might be seen as a factor that might lead to the decrease in the scale of state ownership in enterprises.

Another potentially important political factor influencing the scale of state ownership in enterprises is the ideological orientation of the rulers. Governments on the right of the political spectrum are likely to be more market-oriented and supportive of private ownership, while left-leaning parties tend to keep larger state-owned sectors. Opper (2004) showed that for transition economies privatisation processes of large enterprises were more intense when right-leaning parties were in power. Bjørnskov & Potrafke (2011) indicated that right-leaning governments fostered ownership changes in post-socialist countries and that the difference in privatisation processes between market-oriented and leftist governments was more substantially pronounced in the group of smaller-scale industries than in large-scale ones.

Large SOE sectors were traditionally associated with developing countries (World Bank, 1995). Szarzec and others (2019) showed that a negative correlation between the level of income and the scale of state ownership in enterprises was also present in the group of European states in the more recent period. In post-socialist economies state-owned enterprises were employed to provide social stability in terms of keeping employment and subsidising some crucial services especially at the beginning of the transition when an efficient social security system was missing (Bai, Li, Tao, & Wang, 2000). As this multitask role of SOEs was more likely in less-developed countries one can expect higher SOE shares at lower income levels.

State-owned enterprises are dominant in the natural resource sector (Kowalski, Buge, Sztajerowska, & Egeland, 2013; Szarzec & Nowara, 2017). Income from extraction of natural resources might also lower the pressure for economic restructuring—Esanov, Raiser and Buiter (2004) showed that resource abundance in Azerbaijan, Kazakhstan, Uzbekistan and Turkmenistan did not positively influence economic reforms. Therefore the scale of state ownership in enterprises may be higher in resource-abundant countries.

At the beginning of the transition period economies of the countries of Eastern-Central Europe and the former Soviet Union were substantially maladjusted to market conditions (Kowalski, 2013). What is more the newly formed independent states had to establish national institutions—including systems of justice and security, central banks and customs bureau—from scratch. The initial conditions of the transition are analysed in many empirical studies with the dataset proposed by de Melo and others (2001). It includes state independence and market reforms before the transition, the degree of over-industrialization, black market exchange rate premium, trade shares with socialist economies and repressed inflation. These measures reflect the level of maladjustment of post-socialist economies to market conditions and one can expect larger SOE shares in economies that at the beginning of the transition were less adapted to market rules.

To sum up, the literature on institutional changes provides a broad set of cultural, political and economic factors that potentially determine the scale of

state ownership in enterprises. The aim of the following parts of the paper is to show which of them had a substantial impact on the scale of state ownership in enterprises in post-socialist countries.

2. Description of dataset

The empirical literature on the role of SOEs at the macroeconomic level is very limited because of a lack of comprehensive datasets on the scale of state involvement in the economy through enterprises. Szarzec and others (2019) addressed this substantial research gap by constructing micro-level-based economic weights of SOEs for European countries in the years 2007–2016. The state ownership indicator based on the share of SOEs in the group of large enterprises in terms of total assets and the 25% ownership threshold (*TA25*) is employed in the current analysis. As this variable covers only sixteen out of twenty eight post-socialist countries in the CEE region and the former Soviet Union it was decided to employ the large scale privatisation indicator (*LSP*) from the EBRD as a proxy of the scale of state ownership in enterprises for all twenty eight states.[6] It can be argued that since SOEs are concentrated in the

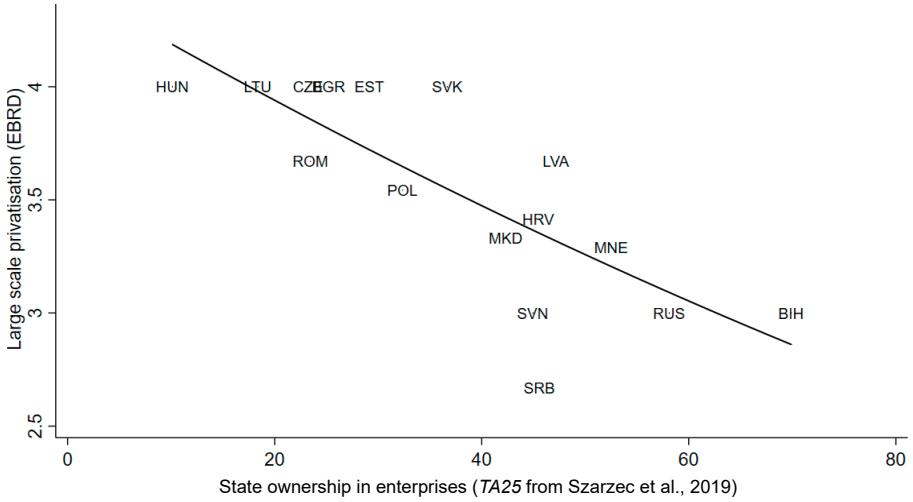

Figure 1. *LSP* (EBRD) and *TA25* from Szarzec et al. (2019)
Note: Mean values of *LSP* (2007–2014) and *TA25* (2007–2016). *TA25* is the share of SOEs in the group of large enterprises in terms of total assets and based on the 25% ownership threshold (Szarzec et al., 2019). Correlation coefficient = –0.78.
Source: Own elaboration based on (data from the EBRD and Szarzec et al., 2019).

[6] CEE non-EU: Albania, Bosnia and Herzegovina, Macedonia, Montenegro, Serbia. CEE EU: Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia. CIS: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan.

group of large enterprises and that the analysed countries started the transition with the large enterprise sector dominated by SOEs, the scale of SOEs in the economy should reflect the progress in privatization of the largest companies. In order to check this conjecture the *LSP* variable was compared with *TA25*. The correlation coefficients was equal to –0.78. This shows the strong negative correlation and one can point out that greater progress in privatisation of large enterprises (measured by the *LSP* variable) leads, unsurprisingly, to a lower share of state-owned enterprises in the economy. Therefore the *LSP* variable can be considered as a proper proxy of state ownership in enterprises for post-socialist countries. Figure 1 presents the correlation between mean values of *LSP* (2007–2014) and *TA25* (2007–2016).

LSP and *TA25* are employed as dependent variables in the econometric analysis. Based on the literature review from Section 2 sets of cultural, political and economic factors were included as independent variables. The data and their sources along with descriptive statistics are presented in Table 1. A correlation matrix of the variables is presented in Table A2 in the Appendix.

Based on the *TA25* variable the SOE shares were the lowest in Hungary and Lithuania, while the highest in Russia and Bosnia and Herzegovina (see Figure 1). For the *LSP* variable (see Table A1 in Appendix; 2007–2014 mean values), the highest values (i.e., the smallest SOE shares) were recorded for Bulgaria, the Czech Republic, Estonia, Georgia, Hungary, Lithuania and Slovakia (4.00), while the lowest were for Azerbaijan (2.00), Belarus (1.59) and Turkmenistan (1.00). Figure 2 shows how the average values of the *LSP* variable were changing across three groups of post-socialist states: Central-Eastern European countries not being the EU member (CEE non-EU), the EU members (CEE EU) and the former Soviet Union countries being members of the Commonwealth of Independent States (CIS). At the beginning of the transition period SOEs were dominant in each group of post-socialist countries and in the first half of the 1990s substantial progress was made in privatization not only in the group of current EU members but also among the CIS countries. However after the year 1997, the pace of ownership changes in the latter group was much slower than in other post-socialist countries. The scale of state ownership in enterprises remained rather stable starting from 2005–2007 and the largest progress in large scale privatisation was made in the group of current EU members, while the smallest among the CIS countries.

In the group of cultural factors the dominant religion and years under central planning were included.[7] The dataset consisted of eleven predominantly Orthodox, eight predominantly Muslim, seven predominantly Catholic and

[7] It was decided not to include the measure of individualism from Hofstede (2001) because this indicator is non-missing for only thirteen out of twenty eight post-socialist countries included in this analysis and the inclusion of this variable would substantially limit the number of observations in the econometric analysis.

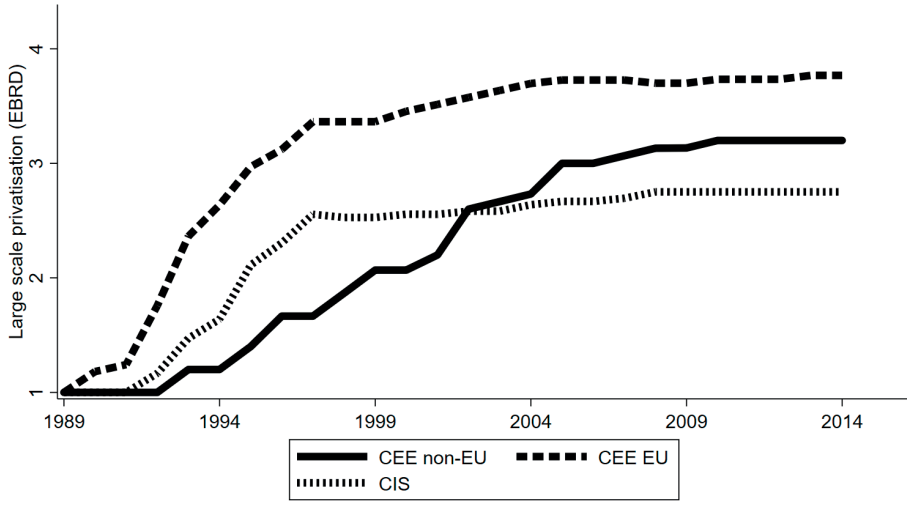

Figure 2. LSP (EBRD) by group, 1989–2014
Source: Own elaboration based on data from the EBRD (2014).

two predominantly Protestant countries. Figure 3 presents the box plot of the *LSP* and *TA25* variables by dominant religion. Protestant and Catholic countries were characterized by the higher levels of the large scale privatisation indicator than the Orthodox and Muslim states which shows that the role of the state as an owner of enterprises was limited in the former groups compared to the latter. Based on data from Szarzec and others (2019) differences between Catholic, Protestant and Orthodox countries were less pronounced and the only predominantly Muslim country, Bosnia and Herzegovina, had the largest SOE share. The length of the period under central planning was the longest in eleven states of the former Soviet Union (70 years and more). Another post-Soviet republics—Estonia, Latvia, Lithuania and Moldova—had a *legacy* of a non-market system of 51 years. Seven Balkan and six Central-European countries had a centrally governed economy for 41–47 years. The number of years under central planning was negatively correlated with *LSP* and positively with *TA25* which suggests that the longer periods under central planning were associated with the larger SOE sector.

The group of political variables consisted of variables indicating an armed conflict, signing the Association Agreement with the European Union and the ideological orientation of the largest government party. The number of years in which a country was involved in an armed conflict (over the period 1991–2006) was negatively correlated with *LSP* and positively with *TA25*. The opposite relationship was indicated for the number of years after signing the Association Agreement with the EU. Finally the longer periods of the rule of right-leaning parties were associated with the smaller SOE sector when both

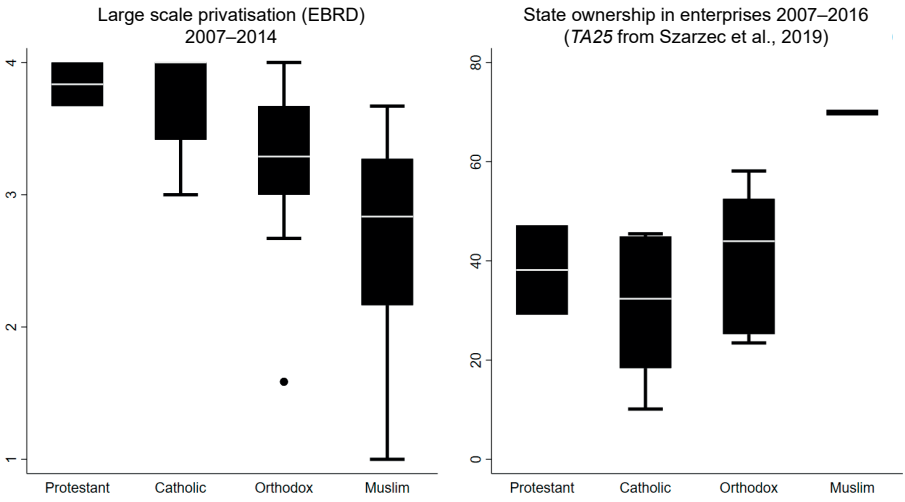

Figure 3. State ownership in enterprises and religion

Note: the horizontal line inside the box presents the median value, upper hinge—75th percentile, lower hinge—25th percentile, upper adjacent line—the highest value in the group, lower adjacent line—the lowest value in the group (unless a dot is presented), dot—outside value.

Source: Own elaboration in Stata based on data from the EBRD.

LSP and *TA25* were considered and for left-leaning parties this relationship was ambiguous—the higher number of years of left-leaning parties in power was associated with the larger SOE sector as measured by *LSP* but with the smaller one measured by *TA25*.

The set of economic variables contained the level of proved reserves of crude oil and natural gas per capita and GNP per capita in 1989. It was decided to use values of reserves to indicate resource abundance instead of the share of resource export in GDP or in total exports due to a problem of endogeneity of the latter indicators (this issue is discussed in e.g. Brunnschweiler & Bulte, 2008). The values of oil and gas reserves were highly correlated (correlation coefficient = 0.86) and the first principal component of these variables was included in the econometric analysis in order to limit a problem of multicollinearity.[8] There was a positive correlation between the variable representing natural resource abundance and the larger scale of state ownership in enterprises. Higher income levels at the beginning of the transition were related to the smaller future SOE sector.

Control variables consisted of initial economic conditions of the transition and physical proximity of Western Europe. Initial economic conditions were reflected by the first principal components of the variables indicating the de-

[8] The first principal component explains 93.3% of the sample variation of natural resources variables and has a positive factor loading for oil and gas reserves (scoring coefficients = 0.71).

Table 1. Description of variables

Variable	Short description	Source	Obs.	Mean	Standard dev.	Min	Max
Dependent variables							
LSP	Large scale privatisation indicator, mean values 2007–2014 (measured from 1 to 4.33): 1: little private ownership, 2: comprehensive scheme almost ready for implementation; some sales completed, 3: more than 25% of large-scale enterprises assets in private hands or in the process of being privatised, but possibly with major unresolved issues regarding corporate governance, 4: more than 50% of SOEs and firms' assets in private ownership and significant progress with corporate governance of these enterprises, 4.33: standards and performance typical of advanced industrial economies: more than 75% of enterprise assets in private ownership with effective corporate governance)	EBRD (2014)	28	3.216	0.772	1	4
TA25	The share of state-owned enterprises in total assets in the group of large enterprises, based on the 25% ownership threshold, mean values 2007–2016	Szarzec et al. (2019)	16	37.80	15.84	10.14	69.90
Independent variables							
Cultural factors							
Catholic *Orthodox* *Protestant* *Muslim*	Dominant religion	Froese (2004), Barrett, Kurian & Johnson (2001)	28	0.250 0.393 0.071 0.286	0.441 0.497 0.262 0.460	0 0 0 0	1 1 1 1

YUCP	Length of the period under central planning, in years	De Melo et al. (2001)	28	55.93	13.03	41	74
Political factors							
WAR	Armed conflict (equals 1 in years when a country experienced an armed conflict classified at least as "Category 3—Serious Political Violence" in the source), sum of years in 1991–2006	Center for Systemic Peace (2020)	28	1.679	3.163	0	11
EUA	EU accession (equals 1 starting in the year of signing Association Agreement with the EU), sum of years in 1991–2006	European Commission web page	28	4.536	5.751	0	13
GovRight *GovCenter* *GovLeft* *GovUn*	Party orientation of the largest government party (right [conservative, Christian democratic, right-wing], centrist, left [communist, socialist, social-democratic, left-wing], non-classified [for all those cases that do fit into the above-mentioned category, including party's platform not focusing on economic issues, or there are competing wings])	Cruz, Keefer & Scartascini (2017)	28	2.536 1.607 5.857 4.679	3.958 3.624 5.563 5.271	0 0 0 0	13 13 15 16
Economic factors							
NatRes	First principal component of variables reflecting the mean levels of log values of oil and gas reserves per capita in 1991–2006	Own calculation based on BP (2019)	28	0	1.34	–0.64	4.19
GNPpc1989	GNP per capita in 1989 (in thousand US$ at PPP)	De Melo et al. (2001)	28	5.465	2.040	1.400	9.200
Control variables							
InitCond	First principal component of variables reflecting degree of over-industrialization in 1990, independent state before 1989, market reforms during the socialist era, black market exchange rate premium in 1990, trade shares with socialist economies as % of GDP in 1990, repressed inflation 1987–1990	Own calculation based on De Melo et al. (2001)	28	0	1.80	–3.11	2.19
KMBrussels	Physical proximity of Western Europe, measured as the distance between the capital of the country and Brussels, in ths km	Internet sources	28	2.165	1.276	0.717	4.828

Source: Own elaboration.

gree of over-industrialization in 1990, independent state before 1989, market reforms during the socialist era, black market exchange rate premium in 1990, trade shares with socialist economies as % of GDP in 1990 and repressed inflation 1987–1990 (collected from De Melo et al., 2001).[9] As the first principal component demonstrates a positive factor loading for the black market premium, trade dependency and repressed inflation and negative factor loading for market reforms and independent state, this variable can be regarded as a measure of the maladjustment of economies to market conditions at the beginning of the transition. The higher level of maladjustment was related to the larger future SOE sector as measured by *LSP*, however this relationship was insignificant for *TA25*. Physical proximity of Western Europe was measured by the distance between the capital of the country and Brussels. This approach allows to control for the possible spatially dependent nature of the diffusion of institutions and norms being crucial to the construction of market economies including privatisation and the country's integration into the EU (Kopstein & Reilly, 2000). In the analysed dataset, the smaller distance to Western Europe was associated with the smaller SOE sector.

3. Research design

This study aims to indicate which factors had a significant impact on the scale of state ownership in enterprises in the group of post-socialist countries. The estimated model takes the following form:

$$State\ ownership_i = \beta_0 + \beta_1\ Cultural_i + \beta_2\ Political_i + \beta_3\ Economic_i + \\ + \beta_4\ Controls_i + e_i,$$

where *State ownership* is the dependent variable representing the average values of the *LSP* (2007–2014) or *TA25* (2007–2016) indicators of a country *i*, *Cultural*, *Political*, *Economic* and *Controls* represent the sets of variables as presented in Table 1. These sets are added to the model according to the procedure explained below. The model is estimated via OLS with identification based on the exogeneity of explanatory variables employed. This approach assumes that the scale of state ownership at the beginning of the transition was not correlated with omitted factors that were themselves correlated with the subsequent ownership changes and that the sets of cultural, political and economic fac-

[9] The first principal component explains 54.1% of the sample variation of initial conditions variables and has a positive factor loading for the black market exchange rate premium (scoring coefficient = 0.53), trade dependency (0.47), repressed inflation (0.49) and negative factor loading for over-industrialization (–0.04), market reforms (–0.38), independent state (–0.29).

tors were not affected by the subsequent shares of state ownership in enterprises. The former assumption can be considered as plausible because when socialist systems were on the decline and the transition was about to begin the large enterprise sector was strongly dominated by SOEs (see Figure 2), which was a result of the domination of the socialist ideology favouring state ownership in the region. With the end of the socialist era this imposed ideological favouring of state ownership was likely to disappear. For the latter assumption an important issue is the fact that ownership changes introduced once seem to be long-lasting (see Figure 2; correlation coefficient between *LSP* and its first-lagged value was 0.97). Therefore state ownership indicators calculated for the periods 2007–2014 (*LSP*) and 2007–2016 (*TA25*) are likely to strongly depend on their values from previous years (after the beginning of the transition). This leads to the question as to whether state ownership shares in the previous transition years might have affected some of explanatory variables. Dominant religion, years under central planning, an armed conflict, oil and gas reserves, income level in 1989, initial conditions of the transition and physical proximity to Western Europe can be definitely considered as not affected by the subsequent shares of state ownership in enterprises. However, the signing of the Association Agreement with the EU and ideological orientation of the largest government party might have been endogenous—the decision to join the EU might have been affected by the previous progress in economic reforms[10] and changes of the party in power might have been influenced by society's (dis)satisfaction with the progress or lack of privatisation.

The following procedure is used in the calculations. First, the dependent variable is regressed on the sets of cultural and control variables (Models 1 and 7 in Table 2). Then the sets of political (Models 2 and 8) and economic (Models 3 and 9) factors, for which potential endogeneity can be definitely ruled out, are added separately and jointly (Models 4 and 10). Finally factors for which there were some doubts in terms of their exogeneity, are added in Models 5 and 12.[11] As many of the explanatory variables are significantly correlated with each other (see Table A2 in Appendix), the variance inflation factor was checked at each step. The VIF values exceeded the level of 10 for at least one variable in Models 5, 10 and 12, which showed that a problem of multicollinearity was present in these models. To overcome this issue, the variables with the highest p-values were excluded stepwise until the VIF values were below 10—these results are presented as Models 6, 11 and 13. Each model was also

[10] In fact countries that signed the Association Agreement with the EU were characterised by substantially higher values of *LSP* in the year before the signing than other states in the same periods (these differences ranged from 0.41 points of *LSP* in 2002 to 1.37 points in 1995).

[11] In the literature the variables representing the signing of the Association Agreement with the EU and the ideological orientation of the ruling party are often assumed as exogenous to progress in economic reforms and privatisation (e.g. Bjørnskov & Potrafke, 2011; Piątek et al., 2019).

Table 2. Econometric analysis, OLS, dependent variables: *LSP* (2007–2014), *TA25* (2007–2016)

Dep. variable	*LSP*						*TA25*						
Model No.	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
Muslim	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Catholic	1.168*	1.126*	1.259	1.248	1.552	1.731**	−47.281***	−45.593**	−32.338*	−32.696	−32.545*	12.468	11.662
	(0.59)	(0.61)	(0.82)	(0.78)	(0.92)	(0.71)	(12.03)	(13.86)	(16.11)	(17.49)	(15.11)	(40.70)	(16.92)
Orthodox	0.906*	0.890*	0.892*	0.890*	0.910*	0.973**	−19.567	−18.911	−7.938	−7.701	−8.937	6.056	−0.450
	(0.50)	(0.51)	(0.49)	(0.46)	(0.46)	(0.40)	(12.82)	(13.69)	(15.49)	(16.75)	(14.06)	(30.43)	(15.69)
Protestant	1.542**	1.537**	1.769	1.767*	1.676	1.897*	−27.249	−25.471	1.155	1.616	−1.201	21.684	15.387
	(0.60)	(0.63)	(1.12)	(0.96)	(1.22)	(0.99)	(15.21)	(17.08)	(26.00)	(28.15)	(22.76)	(52.78)	(24.09)
YUCP	−0.034*	−0.029	−0.019	−0.017	−0.015	−0.020	1.998***	1.784*	2.916**	3.068*	3.027**	1.679	–
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.61)	(0.96)	(1.06)	(1.47)	(0.90)	(3.41)	
WAR	–	−0.027	–	−0.009	−0.019	−0.027	–	0.489	–	−0.296	–	−1.321	–
		(0.04)		(0.06)	(0.05)	(0.04)		(1.62)		(1.80)		(2.63)	
NatRes	–	–	−0.152	−0.146	−0.139	−0.130	–	–	10.514	2.221	–	−0.919	–
			(0.12)	(0.18)	(0.11)	(0.10)			(9.21)	(8.36)		(14.20)	
GNPpc1989	–	–	−0.042	−0.042	−0.138	−0.137	–	–	−0.444	−5.470	−4.773	−2.858	–
			(0.14)	(0.14)	(0.13)	(0.12)			(4.62)	(4.47)	(3.24)	(7.08)	
EUA	–	–	–	–	0.017	–	–	–	–	–	–	−1.756	−2.259**
					(0.05)							(2.63)	(0.71)
govCenter	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.	ref.

govRight	–	–	–	–	–0.016	–0.015	–	–	–	–	–	–3.757	–3.615*
					(0.04)	(0.04)						(3.02)	(1.61)
govLeft	–	–	–	–	–0.087**	–0.086**	–	–	–	–	–	–4.718	–4.152*
					(0.03)	(0.03)						(4.42)	(2.09)
govUn	–	–	–	–	–0.015	–0.008	–	–	–	–	–	–2.442	–2.218
					(0.04)	(0.03)						(3.30)	(1.88)
InitCond	–0.069	–0.091	–0.115	–0.122	–0.166	–0.168	–0.025	0.213	0.897	0.889	0.201	–5.294	–3.922
	(0.12)	(0.13)	(0.14)	(0.14)	(0.12)	(0.12)	(3.14)	(3.41)	(4.20)	(4.53)	(2.96)	(9.15)	(3.18)
KMBrussels	0.391	0.373	0.372	0.365	0.401	0.443**	–43.617*	–42.152*	–68.571*	–71.279	–63.124**	–21.089	1.213
	(0.25)	(0.26)	(0.23)	(0.28)	(0.24)	(0.20)	(19.67)	(21.30)	(32.58)	(38.79)	(22.77)	(69.62)	(16.87)
Intercept	3.544***	3.361***	2.898**	2.859**	3.661**	3.801***	34.664	40.950	44.987	43.839	29.258	56.757	89.706***
	(0.96)	(1.07)	(1.21)	(1.16)	(1.27)	(1.16)	(25.92)	(34.36)	(68.17)	(73.80)	(24.67)	(129.95)	(22.00)
N	28	28	28	28	28	28	16	16	16	16	16	16	16
Adj. R^2	0.309	0.287	0.324	0.289	0.522	0.551	0.545	0.494	0.544	0.470	0.597	0.227	0.678
Dep. var. mean	3.22						37.80						

Note: Standard errors are reported in parentheses. Asterisks denote significance levels: ***–1%, **–5%, *–10%. *N* denotes the number of observations, ref. denotes a reference group. *Adj.* R^2 is adjusted *R*-square.

Source: Own elaboration with Stata 15.

tested for heteroskedasticity and heteroskedasticity robust standard errors were calculated if needed.

4. Results

Table 2 presents the results of the econometric analysis. For the *LSP* dependent variable (Models 1–6), the coefficients representing predominantly Catholic, Orthodox and Protestant countries had positive signs and were all significant at least at the 10% level in Models 1, 2 and 6. For Model 4, the coefficients are significantly different from zero for *Orthodox* and *Protestant*, while for Models 3 and 5, for *Orthodox* only. In order to discuss whether the obtained results are not only statistically but also economically significant, one can compare the magnitudes of the coefficients to the average levels of the dependent variables. The mean value of the *LSP* variable was equal to 3.22. As the (statistically significant) coefficients for the *Catholic*, *Orthodox* and *Protestant* variables vary from 0.890 to 1.897, it can be indicated that differences in the scale of state ownership in enterprises between these countries and predominantly Muslim states were substantial not only statistically but also economically. When *TA25* was considered the only cultural variable with the statistically significant coefficient was *Catholic* in Models 7, 8, 9 and 11. The magnitude of this coefficient (ranging from 32.545 to 47.281) and its negative sign suggest that predominantly Catholic countries had substantially smaller SOE sectors than predominantly Muslim ones. However, this difference was not significant when (potentially endogenous) political variables were included in Models 12 and 13.

The length of the period under central planning was statistically significant at the 10% level in Model 1, however, it turned out to be insignificant when other sets of independent variables were added to the analysis with the *LSP* dependent variable (Models 2–6). For *TA25*, more years under central planning were statistically significant related to higher SOE shares in Models 7–11. The magnitudes by these coefficients show that an additional ten years under central planning led to the SOE shares higher by 18–31 percentage points.

In the group of political factors the estimated impact of the number of years with an armed conflict was close to zero at each step of the analysis. The coefficient by the variable indicating the signing of the Association Agreement with the EU was insignificant for *LSP* (Model 5) and this variable dropped because of multicollinearity from Model 6 (as the variable with the highest p-value), but was significant and negative (i.e., associated with lower SOE shares) for *TA25* (Model 13). The relationship between the number of years of right-leaning parties in power was insignificant for the *LSP* variable (Models 5 and 6), however, it was significant for *TA25* in Model 13 and its negative sign shows that these parties were associated with the smaller SOE sector. The results were ambiguous for the variable representing left-leaning parties—the larger number of years

in power of left-leaning parties was related to the larger SOE sector when *LSP* was considered (Models 5 and 6) but the opposite held for *TA25* (Model 13). In the group of economic factors both natural resources and initial income levels were insignificant in each model.[12]

5. Discussion

The results of the econometric analysis suggest that cultural factors had a substantial influence on the scale of state ownership in enterprises in post-socialist countries and the role of political and economic factors was less pronounced. The role of culture as an important determinant of institutional performance is broadly discussed in the literature (Alesina & Giuliano, 2015). The smaller scale of the SOE sector in predominantly Protestant and Catholic post-socialist countries might be perceived as being in line with the previous studies on this group of states that show that countries with dominant Protestant and Catholic religions were characterized by the higher pace of institutional changes towards the market economy and free political system (Schweickert et al., 2011; Piątek et al., 2019). What is more predominantly Orthodox states also had a smaller SOE sector than Muslim countries. As religion might shape the society's expectations towards the provision of goods based on market incentives or directly by the state (Grigoriadis, 2016; Tarabar, 2017) the analysis of the role of SOEs in the economy focusing on the differences between individualistic and collectivistic societies is an interesting avenue for further research.

The analysis with the data from Szarzec and others (2019) indicated the substantial relationship between the number of years under central planning and the larger SOE sector. This suggests that a longer period under central planning was associated with larger a SOE share. However, this result should be treated with caution, as in the group of sixteen countries for which *TA25* is available, fifteen of them had a centrally planned economy for 41–51 years and Russia for 74 years. Therefore the relationship between *TA25* and *YUCP* might be driven solely by a single country. In order to test this conjecture a dummy variable for Russia was additionally introduced into the analysis and the impact of the years under central planning turned out to be insignificant.[13]

The impact of natural resource abundance—represented by the first principal component of oil and gas reserves—was insignificant in each model. As large

[12] Additional analyses were conducted with the following independent variables: an accession to WTO, the former Soviet Socialist republics, population size, religion and ethnic diversity. Each of these variables turned out to be insignificant and led to the problem of multicollinearity.

The models presented in this paper were also recalculated with the dependent variables *LSP* and *TA25* for the year 2014 instead of their average values. These calculations lead to the same conclusions as presented in the article. Results available upon request.

[13] Results available upon request.

enterprises operating in the natural resources' sectors are often state-owned (Kowalski et al., 2013; Szarzec & Nowara, 2017), this indication is quite surprising. Therefore this field should be further investigated, especially in studies employing a broader set of analysed countries and more complex measures of natural abundance.

The signing of the Association Agreement with the EU was shown to be insignificant in the analysis with the *LSP* variable and as significant with *TA25*. The negative sign in the latter case shows that the higher number of years after the signing of the agreement was associated with the smaller SOE sector, which is in line with Di Tommaso and others (2007), Schweickert and others (2011) and Piątek and others (2019) that showed that the prospect of membership in the EU was positively associated with market reforms. However the results of the analyses employing the signing of the Association Agreement with the EU as an exogenous variable should be treated with caution because this decision might be affected by the previous progress in reforms. The relationship between the number of years of left-leaning and right-leaning parties in power and the scale of state ownership is ambiguous. Similarly to the last discussed variable these results should be also taken with a grain of salt.

An important caveat to the interpretation of the results and a comparison between the analyses with the *LSP* and *TA25* variables is that the latter indicator is available for only sixteen out of the twenty eight post-socialist countries. What is more the selection to this sample is also likely to be biased because the construction of the dataset by Szarzec and others (2019) was dependent upon micro-level data availability, which seems to be substantially worse for less-developed economies. In fact the average values of the *LSP* indicator for countries included in the dataset of Szarzec and others (2019) was 3.54, while for those not included—2.79. Therefore the set of countries included in the analysis with *TA25* is likely to be less heterogenous than the overall group of post-socialist countries, which might lead—along with the smaller sample size—to the smaller explanatory power of independent variables. Concerning the *LSP* variable one needs to keep in mind that the measure from the EBRD includes a component related to corporate governance, which might lead to relatively lower values of *LSP* in countries where corporate governance improvements were lagging behind. Therefore, despite a strong correlation between *LSP* and *TA25*, the large scale privatisation indicator might suggest relatively higher SOE shares when privatisations were not accompanied by corporate governance restructuring. The two above-mentioned caveats unambiguously indicate the need to establish micro-level-based SOE measures for a broader set of countries.

Conclusions

This study contributes to the literature by analysing the little studied field of factors influencing the scale of state ownership in enterprises. To address this research gap the data for twenty eight post-socialist countries were collected and the large scale privatisation indicator from the EBRD and the SOE measure from Szarzec and others (2019) were regressed on sets of cultural, political, economic and controls variables. The results show that cultural factors—represented by the dominant religion—had a substantial impact on the scale of state ownership in enterprises while the role of political and economic factors was less pronounced. This emphasises the importance of cultural factors in shaping the scale of state ownership in enterprises.

State-owned enterprises still play an important role in the world economy and state ownership in enterprises is present not only in post-socialist countries, but also in developed states. While this study provides some empirical evidence on the determinants of the prevalence of SOEs in the economy, further research focusing on the broader set of countries, as well as including more precise measures of economic weight of SOEs is still needed.

Appendix

Table A1. Large scale privatization, EBRD, mean values 2007–2014

Bulgaria	4.00	Romania	3.67	Slovenia	3.00
Czech Republic	4.00	Albania	3.54	Ukraine	3.00
Estonia	4.00	Poland	3.54	Serbia	2.67
Georgia	4.00	Croatia	3.41	Uzbekistan	2.67
Hungary	4.00	Macedonia	3.33	Tajikistan	2.33
Lithuania	4.00	Montenegro	3.29	Azerbaijan	2.00
Slovakia	4.00	Bosnia and Herzegovina	3.00	Belarus	1.59
Armenia	3.67	Kazakhstan	3.00	Turkmenistan	1.00
Kyrgyzstan	3.67	Moldova	3.00		
Latvia	3.67	Russia	3.00		

Source: Own elaboration based on data from EBRD.

Table A2. Correlation matrix

	LSP	*TA25*	*Muslim*	*Catholic*	*Ortho-dox*	*Protes-tant*	*YUCP*	*WAR*	*NatRes*	*GNPpc-1989*	*EUA*	*gov-Center*	*govRight*	*govLeft*	*govUn*	*InitCond*	*KM-Brussels*
LSP	1.00																
TA25	–0.78*	1.00															
Muslim	–0.48*	0.54*	1.00														
Catholic	0.38*	–0.44*	–0.37*	1.00													
Orthodox	–0.05	0.18*	–0.49*	–0.47*	1.00												
Protestant	0.23*	0.01	–0.18*	–0.17*	–0.23*	1.00											
YUCP	–0.54*	0.41*	0.44*	–0.52*	0.12*	–0.10	1.00										
WAR	–0.32*	0.56*	0.15*	–0.18*	0.11*	–0.15*	0.30*	1.00									
NatRes	–0.51*	0.28*	0.38*	–0.27*	–0.04	–0.13*	0.51*	0.42*	1.00								
GNPpc1989	0.28*	–0.17*	–0.63*	0.48*	–0.11*	0.46*	–0.17*	–0.05	–0.06	1.00							
EUA	0.61*	–0.78*	–0.51*	0.64*	–0.31*	0.37*	–0.67*	–0.40*	–0.31*	0.55*	1.00						
govCenter	0.07	0.16*	0.01	–0.22*	0.13*	0.12*	0.34*	–0.24*	0.11*	0.10	–0.17*	1.00					
govRight	0.43*	–0.29*	–0.03	0.20*	–0.36*	0.40*	–0.25*	–0.16*	–0.28*	0.14*	0.32*	–0.17*	1.00				
govLeft	–0.30*	–0.24*	0.11*	0.23*	–0.14*	–0.31*	–0.21*	–0.18*	–0.10	–0.26*	–0.02	–0.32*	–0.30*	1.00			
govUn	–0.02	0.19*	–0.10	–0.16*	0.30*	–0.12*	0.20*	0.42*	0.26*	0.09	–0.03	–0.24*	–0.26*	–0.60*	1.00		
InitCond	–0.35*	0.03	0.29*	–0.54*	0.06	0.29*	0.77*	0.05	0.28*	–0.06	–0.39*	0.32*	–0.11*	–0.29*	0.16*	1.00	
KMBrussels	–0.42*	0.21*	0.72*	–0.52*	–0.13*	–0.11*	0.80*	0.17*	0.47*	–0.47*	–0.55*	0.25*	–0.10	–0.02	–0.05	0.65*	1.00

Notes: Pairwise correlations. The asterisk denotes significance at the 1% level.

Source: Own elaboration.

References

Alesina, A., & Giuliano, P. (2015). Culture and institutions. *Journal of Economic Literature*, *53*(4), 898-944.

Bai, C., Li, D., Tao, Z., & Wang, Y. (2000). A multitask theory of state enterprise reform. *Journal of Comparative Economics*, *28*(4), 716-738.

Bałtowski, M., & Mickiewicz, T. (2000). Privatisation in Poland: Ten years after. *Post-Communist Economies*, *12*(4), 425-443. doi:10.1080/14631370050216498

Barrett, D., Kurian, G., & Johnson, T. (2001). *World Christian encyclopedia: A comparative survey of churches and religions in the modern world*. New York: Oxford University Press.

Beugelsdijk, S., Maseland, R., & van Hoorn, A. (2015). Are scores on Hofstede's dimensions of national culture stable over time? A cohort analysis. *The Global Strategy Journal*, *5*, 223-240.

Bjørnskov, C., & Potrafke, N. (2011). Politics and privatization in Central and Eastern Europe: A panel data analysis. *Economics of Transition*, *19*(2), 201-230. doi:10.1111/j.1468-0351.2010.00404.x

BP. (2019). *BP statistical review of world energy 2019*. Retrieved April 15, 2020 from www.bp.com/en//global/corporate/energy-economics/statistical-review-of-world-energy.html

Brunnschweiler, N., & Bulte, H. (2008). The resource curse revisited and revised: A tale of paradoxes and red herrings. *Journal of Environmental Economics and Management*, *55*(3), 248-264.

Center for Systemic Peace. (2020). *Major episodes of political violence 1946-2014*. Retrieved April 15, 2020 from www.systemicpeace.org/warlist/warlist.htm

Christiansen, H., & Kim, Y. (2014). *State-invested enterprises in the global marketplace: Implications for a level playing field*. (OECD Corporate Governance Working Papers 14). doi:10.1787/5jz0xvfvl6nw-en

Cruz, C., Keefer, P., & Scartascini, C. (2018). *Database of political institutions 2017 (DPI2017). Inter-American Development Bank. Numbers for Development*. https://mydata.iadb.org/Reform-Modernization-of-the-State/Database-of-Political-Institutions-2017/938i-s2bw

De Melo, M., Denizer, C., Gelb, A., & Tenev, S. (2001). Circumstance and choice: The role of initial conditions and policies in transition economies. *World Bank Economic Review*, *15*(1), 1-31.

Di Tommaso, M. L., Raiser, M., & Weeks, M. (2007). Home grown or imported? Initial conditions, external anchors and the determinants of institutional reform in the transition economies. *The Economic Journal*, *177*(520), 858-881.

Esanov, A., Raiser, M., & Buiter, W. (2004). *Nature's blessing or nature's curse: The political economy of transition in resource-based economies*. (Discussion Papers on Development Policy 81. ZEF: Bonn).

European Bank for Reconstruction and Development (EBRD) database. (2014). *Transition indicators by country*. Retrieved April 15, 2020 from www.ebrd.com/documents/oce/transition-indicators-by-country.xlsx

Froese, P. (2004). After atheism: An analysis of religious monopolies in the post-communist world. *Sociology of Religion*, *65*(1), 57-75.

Gorodnichenko, Y., & Roland, G. (2011). Which dimensions of culture matter for long-run growth?. *American Economic Review: Papers & Proceedings*, *101*(3), 492-498.

Grigoriadis, T. (2016). Religious origins of democracy & dictatorship. *Journal of Policy Modelling*, *38*(5), 785-809.

Guiso, L., Sapienza, P., & Zingales, L. (2006). Does culture affect economic outcomes?. *Journal of Economic Perspectives*, *20*(2), 23-48.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Kopstein, J., & Reilly, D. (2000). Geographic diffusion and the transformation of the post-communist world. *World Politics*, *53*(1), 1-37.

Kowalski, T. (2013). *Globalization and transformation in Central European countries: The case of Poland*. Poznan: Poznan University of Economics Press.

Kowalski, P., Buge, M., Sztajerowska, M., & Egeland, M. (2013). *State-owned enterprises: Trade effects and policy implications*. (OECD Trade Policy Paper 147, 1-33). doi:10.1787/5k4869ckqk7l-en

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (1999). The quality of government. *The Journal of Law, Economics and Organization*, *15*(1), 222-279.

Landes, D. (2000). Culture makes almost all the difference. In: L. E. Harrison & S. P. Huntington (Eds.), *Culture matters: How values shape human progress* (pp. 2-12). New York: Basic Books.

Megginson, W., & Netter, J. (2001). From state to market: A survey of empirical studies on privatization. *Journal of Economic Literature*, *39*(2), 321-389.

Mihályi, P. (2017). The motivation of business leaders in socialist and market-based systems (an essay to celebrate the 90th birthday of János Kornai). *Economics and Business Review*, *3*(17), 100-111. doi 10.18559/ebr.2017.3.6

Opper, S. (2004). The political economy of privatization: Empirical evidence from transition economies. *Kyklos*, *57*(4), 559-586. doi:10.1111/j.0023-5962.2004.00269.x

Pejovich, S. (2003). Understanding the transactional costs of transition: It's the culture, stupid. *The Review of Austrian Economics*, *16*(4), 347-361.

Piątek, D., Pilc, M., & Szarzec, K. (2019). What determines the institutional change in transition economies?. *Argumenta Oeconomica*, *1*(42), 235-272.

Piątek, D., Szarzec, K., & Pilc, M. (2013). Economic freedom, democracy and economic growth a casual investigation in transition countries. *Post-Communist Economies*, *25*(3), 267-288.

Ratajczak, M. (2009). Transformacja ustrojowa w świetle ustaleń i założeń ekonomii instytucjonalnej [Political transition in the light of the assumptions and findings of institutional economics]. *Ruch Prawniczy, Ekonomiczny i Socjologiczny*, (2), 233-251.

Schweickert, R., Melnykovska, I., Belke, A., & Bordon, I. (2011). Prospective NATO or EU membership and institutional change in transition countries. *Economics of Transition*, *19*(4), 667-692.

Spolaore, E., & Wacziarg, R. (2013). How deep are the roots of economic development?. *Journal of Economic Literature*, *51*(2), 325-369.

Staehr, K. (2011). Democratic and market-economic reforms in the post-communist countries. The impact of enlargement of the European Union. *Eastern European Economics*, *49*(5), 5-28.

Szarzec, K., Dombi, Á., & Matuszak, P. (2019). *State-owned enterprises and economic growth: Evidence from the post-Lehman period*. (Working Paper. Poznan University of Economics and Business: Poznan, Poland; Eötvös Loránd University: Budapest, Hungary). Retrieved April 15, 2020 from https://www.researchgate.net/publication/339433139_Stateowned_enterprises_and_economic_growth_Evidence_from_the_post-Lehman_period

Szarzec, K., & Nowara, W. (2017). The economic performance of state-owned enterprises in Central and Eastern Europe. *Post-Communist Economies*, *29*(3), 375-391.

Tarabar, D. (2017). Culture, democracy, and market reforms: Evidence from transition countries. *Journal of Comparative Economics*, *45*(3), 456-480.

World Bank. (1995). *Bureaucrats in business: The economics and politics of government ownership*. Oxford: Oxford University Press.