Electricity Sector Performance: A Panel Threshold Analysis

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ABSTRACT

This paper introduces a panel threshold model to empirically estimate the main drivers of electricity performance. The empirical analysis is based on a panel data set including 30 OECD countries over the period 1975–2013. We argue that effective regulatory reforms have positive interaction with the electricity generated leading to a higher capacity utilization and an increase in the level of labor productivity of the sector. The threshold analysis suggests that for already economically liberalised countries the level of economic freedom does not affect electricity generation and subsequently the level of electricity performance. Finally, the results do not drastically change when the Renewable Energy Sources (RES) are taken into account.

Keywords: Electricity, OECD, Performance, Structural reforms, Threshold analysis

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INTRODUCTION

Until the mid 1990s, the electricity sector in most of the OECD countries was vertically integrated and state-owned (Newbery, 2002; Littlechild, 2001; Pollitt, 2009). Vertically integrated companies mainly involved in the activities of generation, transmission, distribution and supply of electricity to final consumers, serving either exclusively certain regions or even entire Member States dominated the industry. However, during the last decades, many of them were challenged to reform the electricity market due to inefficiencies identified in its vertically integrated segments. As a consequence, the industry has undergone profound structural changes, getting towards a more competitive environment, a process that it is highly controlled and monitored by National Regulatory Authorities (NRAs). Hence, it is very interesting to examine the electricity performance taking also into account the liberalization process of the industry.

Sector performance is usually measured with a cost function or a production function. However, in this paper we use three proxies such as electricity generation per capita, capacity per capita and labour productivity in the electricity sector within a reduced form framework to measure electricity performance. The former two indicators are primarily measures of volume in a demand driven model. We must stress though that volume can be regarded as a component of performance. Another potentially useful measure of performance such as quality of service could not be estimated because of a lack of data. Similarly, we would like to have investigated the impact of reforms on the prices charged for electricity generated, but there is a lack of sufficient comparable data across our sample of countries (i.e developing countries) to carry out such an analysis. However, a number

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of empirical studies have examined the effects of reforms in developing and developed countries by using capacity and generation indicators (see for example Zhang et al, 2005, 2008 and Polemis, 2016). The same approach is followed in the studies by Ros (1999), Wallsten (2001), Gutierrez and Berg (2000) and Bortolotti et al. (1998) who also use a demand function in order to assess performance in the telecommunications sector.

The motivation of this study is to assess the electricity performance in the OECD countries by using for the first time, a threshold panel model (see for example Hansen, 1999, 2000, Kourtellos, et al, 2015) which allows evaluating the main drivers of electricity performance under two different economic regimes (liberalized and non-liberalized conditions). Our model estimates an unknown threshold parameter in a data driven approach that “endogenously” sorts the data into the two different economic regimes, whereby each regime would differ according to the prevailing attitudes of its members towards privatization and competition. The threshold variable that we use to sort observations is the level of economic risk measured by the FRASER index (Gwartney et al., 2012).[1] Subsequently, the sample countries will be sorted according to their level of economic risk placing them into liberalized (i.e taking high values of the index) and non-liberalized (i.e. taking low values of the index). The main novelty of this paper is that it uses for the time in the empirical literature a panel threshold model.

The rest of the paper is as follows. Section 1 reviews the empirical literature, while Section 2 presents the liberalization process in the OECD countries. Section 3 formulates the research hypotheses. Section 4 describes the data. Section 5 depicts the econometric framework and Section 6 portrays the empirical results. Section 7 reports the empirical findings of the sensitivity analysis in order to capture the effect of the use of RES. Lastly, Section 8 encapsulates the paper together with some policy implications. We include additional material in an appendix that is provided separately.

I. REVIEW OF THE LITERATURE

During the last years, there is a plethora of studies targeted at the investigation of the electricity sector’s performance. Many of these studies focus on the causal relationship between economic growth and electricity intensity at the macroeconomic level (Hondroyiannis et. al., 2002; Narayan and Smyth, 2007; Lee and Chang, 2008; Payne, 2010; Ozturk, 2010; Polemis and Dagoumas, 2013). However, within the last ten years the interest of the economists has turned to the examination of certain microeconomics elements of the electricity sector such as the magnitude of price and income elasticities or the competitive conditions of the sector within a certain region or a group of countries (Bernstein and Griffin, 2005; Polemis, 2006; 2007; Fell et al, 2014).

Following this trend several empirical papers have tried to examine the impact of structural reform policies including regulation, competition and privatization on the overall performance of the electricity sector. More specifically, Henisz (2000) and Bacon and Besant-Jones (2001) stress the importance of political and institutional variables in determining the pace of reform and new investment, while Bortolotti, et al, (1998) argue that effective regulation is a crucial institutional

1. This indicator is common in the economics literature (see for example Carlsson and Lundstrom, 2002; Mamatzakis et al, 2013) and consists of five factors: i) size of government, ii) legal system and property rights, iii) access to sound money; iv) freedom to trade internationally and v) regulation of credit, labour, and business. This weighted average index ranges from zero to ten. Values close to zero (ten) indicate the lowest (highest) level of economic freedom (Gwartney et al., 2012).

variable in electricity privatisation. Steiner (2001) analyses the effect of the first wave of reforms (1986–1996) on 19 OECD countries and argues that privatisation and vertical separation of generation from transmission companies has a positive effect on technical efficiency. Zhang et al (2005), study the effect of the sequencing of privatisation, competition and regulation reforms in electricity generation using panel data from 25 developing countries for the period 1985–2001. The study finds significant evidence supporting the notion that establishing an independent regulatory authority and introducing competition before privatisation will result in higher electricity generation, higher generation capacity and capacity utilisation. Cubbin and Stern (2006) investigate whether a regulatory law and higher quality regulatory governance are associated with superior outcomes in the electricity industry. Their empirical model, include 28 developing countries over the period 1980–2001. They claim that regulatory law and higher quality regulatory governance are positively and significantly associated with higher per capita generation capacity. Fiorio et al. (2007) focus on the European Union (EU) countries, studying a longer period from 1975 to 2005. They claim that only the stringency of entry regulation is found to raise electricity prices, whereas the level of public ownership and vertical integration does not affect price formulation.

In contrast to the aforementioned studies, Zhang et al (2008), portray the impact of these reforms on generating capacity, electricity production, capacity utilization and labour productivity in the sector. The main findings suggest that privatization and regulation on their own do not lead to obvious gains in economic performance, though there are some positive interaction effects. Similarly, Erdogdu, (2011) investigates 92 OECD countries during the period 1982–2008. He finds that his own calculated electricity market reform scores have a positive impact on labour productivity, a nonlinear influence on the reserve margin deviation and, at the same time, undesired effects that increase average electricity losses. In another study, Fiorio and Florio (2013), assess the impact of corporate ownership on residential net-of-tax electricity prices in the EU-15. They argue that public ownership is associated with lower residential net-of-tax electricity prices in Western Europe. Pompei (2013) also focuses on the relationship between the stringency of regulation by using the OECD indicators and total factor productivity (TFP) growth in the electricity sectors of 19 EU countries for the period 1994–2007. Empirical findings reveal that only the stringency of entry regulation significantly reduces technological change, whereas vertical integration exhibits a negative and significant impact only on the catching up process (pure efficiency change). Lastly, Polemis (2016) argues that there is a strongly significant interaction impact on the level of electricity performance between regulation and competition. His findings confirm that a robust independent regulatory scheme must be implemented in order to create competitive conditions in the electricity market.

II. ELECTRICITY REFORM IN THE OECD COUNTRIES

During the last thirty years we have witnessed significant efforts towards the deregulation of the electricity sector across the OECD countries. This was done mainly through the introduction of wholesale electricity markets (pools) and the unbundling of the traditional vertically integrated monopolies. The pioneer in the electricity sector reform was Chile, commencing its efforts in 1982. Since then, many OECD countries (i.e. U.S, EU member-states, New Zealand, Canada, etc.) deregulated their electricity markets, following different paths. The differences in the pace and extent of market reforms are mainly related to the starting point of each reform and the problems associated with the internal environment of the market. This is more evident in Europe, where although a goal for a single market has been set back in 1996 (Directive 96/92/EC), different levels of unbundling and introduction of competition have been implemented across the member states (Fiorio and Florio, 2013).

In this context, the United Kingdom is often regarded as a typical example of the European country which paved the way of the electricity reforms back in the 1990s. Its example influenced both energy policy-making at the EU level and national legislation in many countries (Del Bo and Florio, 2012; Fiorio and Florio, 2013). However, there is no evidence that the British post-reform pattern has been more successful than elsewhere in terms of stability of the competitive arrangements, ownership, investment, trade, costs, prices, social affordability and environmental sustainability (Florio, 2012; Pollitt and Haney, 2013).

On the contrary, France has followed a completely different "*liberalisation*" scheme targeted at the strengthening of a dominant national champion in the electricity sector (EDF). However, France has quite recently adopted specific measures to fully comply with the third European Liberalisation Electricity Package (Directive 2009/72/EC) focusing on the security of the energy supply, the diversification of the energy fuel mix and the adaptation of newly designed unbundling policies (i.e access to base load nuclear power plants, NOME auctions, feed-in subsidies for RES, strict environmental regulation, etc.).

All in all, it is important to stress that the forces driving structural changes in the electricity industry differ between industrial and developing countries. In mature industrial countries such as the U.S, Japan and the EU countries, pressure for change has grown with the emergence of excess capacity and from disillusionment with capital intensive generation projects triggered by the oil crises of the 1970s. In this complex environment, structural reforms were prompted and facilitated by technological innovation.

Specifically, for the EU experience, it is stressed that the main reasons that have historically favoured the opening of the European electricity market can be attributed to a number of economic and political factors. First of all, it should be stated that the electricity sector by nature plays a strategic role in the economic growth and competitiveness of all EU member states (Pollitt, 2009). Moreover, it is well acknowledged that this sector is capital intensive and requires vast investments (Newbery, 2002). However, the timing of entry liberalisation was very different. Of course, one could currently observe different unbundling regimes in the EU member states, but common to all EU countries is a gradual movement towards more advanced/stricter forms of unbundling of the transmission grid. While most countries had adopted the European Commission's preferred approach of ownership unbundling of the transmission system operator (TSO), both Germany and France had not done so. Public ownership is very significant in transmission for many countries, indicating reluctance on the part of governments to relinquish control of this central part of their national electricity system (Pollitt, 2009). Overall, there is a consensus among economists that the centralised approach to market liberalisation through the legal framework, has succeeded in maintaining the pace of reform in many of the EU countries (Jamasb and Pollitt, 2005; Pollitt, 2009).

On the contrary, in developing and transition economies such as the Latin American or the Central and Eastern European countries, reforms have been driven by the poor operating and financial performance of vertically state owned electric utilities. These economies are characterised by low labor productivity, poor service quality, lack of public funds and unavailability of services for large portions of the population. Therefore, structural reforms and especially privatization were used as a vehicle of raising public revenues in order to meet social and economic goals.

III. FORMULATION OF RESEARCH HYPOTHESES

In this section we develop the main research hypotheses regarding the impact of privatization, competition and regulation on the performance of the electricity sector, which are then tested empirically in the subsequent section of the paper. In order to be more concise and informative we group them into three relevant subsections.

A. Impact of Regulation

Regulation of electricity sector plays a crucial role in the political and economic agenda for both industrial and developing countries. The regulatory efforts of more developing countries in order to attract investments and enhance the level of effective competition in the industry are hindered by the absence of a sound legal framework, the weak level of regulation, and the extended state interventionism.

In order to overcome these inefficiencies, NRAs are formed to monitor and supervise the energy sector. A carefully designed regulatory scheme can be expected, therefore, to be a key component of a successful process of electricity privatization (Zhang et al, 2008). This can be explained by two reasons. On the one hand, independent power producers (IPPs) will be unwilling to invest and will produce less under risky regulatory conditions (Pompei, 2013; Fiorio and Florio, 2013), while at the same time, a well-established regulatory regime can be expected to reduce '*regulatory risk*' and provide the market participants (i.e. generators, investors, traders, retailers, etc.) with the right signals and incentives (Zhang et al, 2008). Therefore, we can summarise the above considerations in the following two research hypotheses:

Proposition one. *The existence of an effective regulatory regime will increase the electricity generated, improve labour productivity and capacity utilization in the electricity sector.*

B. Impact of Competition

The electricity generation sector is exposed to significant instability and high risks. Due to the high leverage levels and the existence of large sunk costs in tandem with the presence of economies of scale and scope, electricity producers are prone to take excessive risks in their investments. Such risks may be further exacerbated when firms operate in a competitive environment as this may increase the probability of bailouts and the risk of contagion in the case that IPPs fail.

On the other hand there is a widespread belief that competition is regarded as a reliable mechanism for stimulating both allocative and technical efficiency (Leibenstein 1966). As suggested by many researchers (Zhang et al, 2005, 2008, Akkemik and Oguz, 2011), in a competitive market, prices and profits provide the firm with incentives to improve efficiency minimising costs. Further, competition would deliver production and allocative efficiency, hence lower prices, or lower mark-up over costs (Chiara Del Bo and Florio, 2012). This will lead to higher electricity generation per employee, while lower per-unit costs resulting from increased technical efficiency may be passed through in lower prices, thus increasing the quantity demanded (Zhang et al, 2008). Therefore, we hypothesise the following:

Proposition two. *Increased competition will lead to a larger capacity and an increased output in electricity generation reflecting higher levels of labour productivity.*

C. Impact of Privatization

The impact of privatisation policies targeted at the enhancement of the electricity sector performance is a rather controversial issue. This is because there may be arguments suggesting changes of performance in different directions, particularly about investment, following some aspects of reform. More specifically, the driving force for privatization of electricity utilities is that public ownership is less efficient than private ownership (Chiara Del Bo and Florio, 2012; Pollitt, 2012).

However, it seems highly unlikely that a market mechanism, even a very sophisticated one, can fully internalise the costs (i.e. large sunk investments and non-storable outputs) and the externalities associated with the electricity sector (Chiara Del Bo and Florio, 2012). These features of the industry may provide governments with the possibility of behaving opportunistically and thus private investors may be cautious about investing in capacity (Zhang et al, 2008; Rutledge and Wright, 2010). All in all, privatization reforms may induce the incumbent either to eliminate excess staff or to increase employment as it improves its network (Wallsten, 2001). As a consequence, the expected results of these reforms on labour efficiency are not straightforward. Hence we formulate the relevant hypotheses:

Proposition three. *The transfer of the ownership of the vertically integrated state-owned utilities into a more competitive and privatised scheme increases the performance of the electricity sector thus leading the power producers to generate higher output.*

Proposition four. *Privatization may increase labour productivity and installed capacity provided that the regulatory regime is supportive of investor's confidence.*

IV. DATA AND VARIABLES

Our sample consists of 1170 observations, namely, 30 panels (countries) times 39 years (1975–2013), and the panel data set is strongly balanced. The starting date for the paper was dictated by data availability. However, we must bear in mind that this could not raise any issue regarding the sample selection since little reform of the energy sector occurred before this date. The final date (2013), represented the last year for which data regarding the OECD regulatory indicators were available at the time the research was conducted.

The primary source for our data was drawn from the OECD regulation database which covers the period 1975–2007. For the years 2008–2013 we use information from the Electricity Regulation Database published by the World Bank. The relevant database covers 223 reform variables based on an extensive electricity questionnaire sent to 20 OECD countries. Information for the other countries was mainly drawn from the Country Briefs of the U.S. Energy Information Association (EIA) and the Latin American Energy Organization (OLADE). The use of two different data sources does not raise possible inconsistency issues since each member state sends extensive data on electricity sector (i.e. existence of a regulatory body, level of competition, etc.) directly to the OECD.

Similarly to Zhang et al, (2008), we used three main indicators of electricity performance (GEN, CAP and LAB) denoting net electricity generation per capita, installed electricity capacity per capita and labor productivity per person employed in the industry respectively[2]. These indicators capture the extent of the relative share of the produced electricity to total economy, capacity utili-

2. We tried to use other indicators of performance reflecting the productivity of employees in the electricity sector, or improvements in its finances. However due to data constraints we could not incorporate these indicators into our econometric framework.

zation in the electricity sector and lastly labor productivity per employee in the sector. We must argue that, these indicators have some limitations since electricity performance does not only capture measures of productivity and cost but has a broader definition including also other elements such as the quality and access to service, the prices charged for electricity generated as well as certain financial parameters (Polemis, 2016). The latter could be alternatively measured by utilizing certain indicators such as the System Average Interruption Duration Index (SAIDI) or the Customer Average Interruption Frequency Index (CAIFI).[3] The former index represents the average outage duration for each customer served and is commonly used as a reliability indicator by electric power utilities, while the latter it is designed to show trends in customers interrupted and helps to show the number of customers affected out of the whole customer base (Willis, 2004). However, due to data unavailability the estimation of these indices was not possible.

The RRI indicator presents detailed information allowing one to capture the industry-specific trends of reforms in the electricity sector. It takes values from zero to six and is computed as a weighted average of public ownership, vertical integration, market structure and entry regulation scores, by assigning a cardinal measure to variables that are in itself ordinal (Fiorio and Florio, 2013). A high (low) score in the RRI is attributed to countries characterized by a more (de) regulated sector (Conway and Nicoletti, 2006)[4]. The privatization dummy variable (PRIV) refers to the ownership structure of the largest companies in all of the market segments (i.e generation, transmission, distribution, and supply) of the electricity industry. If the ownership structure is (mostly) public then the dummy variable takes the value of zero otherwise is set to one. Competition dummy variables (WHOL and TPA) capture the extent of competition in the electricity markets. Specifically, the existence of a liberalised wholesale market for electricity (wholesale pool) is measured by the WHOL dummy variable. In sectors where a wholesale pool is present, this dummy variable equals to one; otherwise is set to zero. Lastly, the other competition dummy variable (TPA) accounts for the presence of third party access to the electricity transmission grid by taking the value of one and zero otherwise.

GDP is the per capita gross domestic product in constant prices (base year 2005). The inclusion of GDP as an indicator of the level of economic growth in the OECD countries might raise a possible endogeneity issue, since there is an open debate in the empirical literature whether the direction of the causality runs from growth to electricity consumption or vice versa. Specifically, if the causality runs from income growth to electricity consumption, then environmental policies for electricity conservation may not affect income growth. On the other hand, if the causality is reversed, then environmental policies aimed at conserving electricity consumption may negatively affect economic growth and development (Polemis and Dagoumas, 2013). In our case we used lagged values of GDP per capita as a regressor and checked to see the sensitivity of our results to that choice. Our findings remained robust to whether we used current or lagged values of GDP as an independent variable. Therefore, we feel that the issue of endogeneity is not as severe in our case.[5]

3. SAIDI is calculated as $SAIDI = \frac{\sum U_i N_i}{N_T}$ where N_i is the number of customers, U_i is the annual outage time for location i, and N_T is the total number of customers served. CAIFI is calculated as CAIFI = Total number of customers interruptions / number of distinct customers interrupted.

4. The data regarding the regulation indicator for electricity initially cover the period 1975 to 2007. For the years 2008–2013 the relevant data are taken from the OECD indicators of regulation in nonmanufacturing sectors. The missing data for each year during the period 2009–2012 were filled by using the mean imputation method (Schenker and Taylor, 1996).

5. We thank an anonymous referee for this issue. The results are available from the authors upon request.

URBAN denotes the share of the population living in urban areas. IND is the percentage of industrial output as a share of GDP. EXPORT stands for the openness of the economy and is estimated as the ratio of total exports to GDP, while FRASER is the '*economic risk*' variable proxied by the FRASER index of economic freedom (Gwartney et al, 2012). This index measures the degree to which policies and institutions of countries are supportive of economic freedom expressed by indicators such as personal choice, voluntary exchange, freedom to compete, and security of privately owned property. T is a linear time trend. Finally a_o is the constant term and ε_{it} stands for the idiosyncratic disturbance term (see Equations 2–4).[6]

V. ECONOMETRIC FRAMEWORK

Our analysis adopts a threshold regression (TR) approach introduced by Hansen (1999, 2000) and Kourtellos et al (2015).[7] The TR model allows the level of electricity performance to determine the existence and significance of a threshold level among its main drivers rather than imposing a priori an arbitrary classification scheme. If indeed there exists a well-defined relationship between structural reforms (i.e. regulation, competition and privatization) and the level of electricity performance as expressed by its three proxy variables (GEN, CAP, LAB), the TR model can identify the threshold level and test simultaneously for such a relationship above and below the threshold. To this aim, consider the following threshold model:

$$Y_{it} = n_{\iota} + a_1 FRASER_{it} I(FRASER \leq \gamma) + a_2 FRASER_{it} I(FRASER > \gamma)_{it} + \beta x_{it} + \phi z_{it} + \varepsilon_{it} \quad (1)$$

Where subscripts i = 1, . . ., N represent the country and t = 1, . . . , T index the time. n_i is the country-specific fixed effect. Y_{it} denotes the dependent variables (GEN, CAP and LAB). In addition, x_{it} is the vector of structural reform variables (regulation, privatisation and competition variables) where slope coefficients are assumed to be regime independent. $I(\cdot)$ is the indicator function indicating the regime defined by the threshold variable $FRASER_{it}$, and the threshold level γ. Further, z_{it} is a vector of the exogenous control variables (GDP, URBAN, IND, EXPORT) including the linear time trend (T). Finally ε_{it} denotes the error term which allows for conditional heteroskedasticity and weak dependence.

The TR model uses the variables appeared in previous studies (see for example Zhang et al, 2008; Fiorio and Florio, 2013) with significant extensions. First, in order to address the limited published information on the forms of regulation adopted in certain OECD sample countries (i.e developing countries), we use a superior measure of regulation that is the RRI published by the OECD, allowing for high reliability (Pompei, 2013, Polemis, 2016). This index provides an industry measure that comes from the aggregation of certain elements of structural reforms (i.e. public ownership, vertical integration, market structure and entry regulation). More specifically, RRI, is computed as a weighted average taking values from zero to six, and serves as an indicator of the overall reform in the electricity industry (Fiorio and Florio, 2013). For example if one country is characterized by full public ownership, vertical integration, no access to the electricity sector except for the public operator scores six in the RRI. On the other hand, an industry that is operated by private operators only, with total unbundling of its production process and full market opening will

6. To conserve space we include summary statistics for all the variables used in the econometric analysis in the electronic Appendix A.

7. The TR model is described in its detail in the Appendix B.

score zero (Conway and Nicoletti, 2006, Fiorio and Florio, 2013). Further, in the study of Fiorio and Florio (2013), the RRI and its three sub-components (entry regulation, public ownership and vertical integration) are being used as the main control variables of the empirical model. However, it is argued that the inclusion of the main index and its sub-indexes may raise an issue of multi-collinearity. As a consequence, we examine only the effect of RRI on electricity performance. Second, instead of using a structural concentration index as a proxy for competition by summing the market shares of the three largest power generators of the sector (see for example Zhang et al 2008), we use two dummy variables (WHOL and TPA) that provide significant information of the market structure of the electricity sector overall. Moreover, our approach differs from the empirical study of Fiorio and Florio (2013) since the latter does not capture the level of competition in the electricity market, by including relevant indicators (i.e. Hirschman-Herfindahl index, OECD competition index, etc). The absence of a competitive indicator raises important issues since is a crucial control variable is omitted from the empirical model. Lastly, Zhang et al, (2008) focus solely on developing countries (including five emerging transitional economies) for which they could obtain data on regulation, competition and privatization to create their variables. However, these countries experience significant differences in reforming their electricity sector segments. As a consequence there might be sample selection bias since the countries making this data available have differing results for the dependent variables than those which do not make data available. We address this limitation by including developed countries as well.

We complement the above TR model with a benchmark linear analysis. In this way, we will be able to draw the differences between these results and the traditional benchmark linear specifications in order to focus on issues that were depicted in the TR model and are different from the linear one. We provide below the general exposition of the three linear models (all non-index and non-percentage variables used in the paper took the log form):

$$GEN_{it} = a_0 + a_1 GDP_{it} + a_2 PRIV_{it} + a_3 WHOL_{it} + a_4 TPA_{it} + a_5 RRI_{it} + a_6 URBAN_{it} + a_7 IND_{it} + a_8 EXPORT_{it} + a_9 FRASER_{it} + a_{10} T_{it} + n_i + u_t + \varepsilon_{it} \quad (2)$$

$$CAP_{it} = a_0 + a_1 GDP_{it} + a_2 PRIV_{it} + a_3 WHOL_{it} + a_4 TPA_{it} + a_5 RRI_{it} + a_6 URBAN_{it} + a_7 IND_{it} + a_8 EXPORT_{it} + a_9 FRASER_{it} + a_{10} T_{it} + n_i + u_t + \varepsilon_{it} \quad (3)$$

$$LAB_{it} = a_0 + a_1 GDP_{it} + a_2 PRIV_{it} + a_3 WHOL_{it} + a_4 TPA_{it} + a_5 RRI_{it} + a_6 URBAN_{it} + a_7 IND_{it} + a_8 EXPORT_{it} + a_9 FRASER_{it} + a_{10} T_{it} + n_i + u_t + \varepsilon_{it} \quad (4)$$

where n_i is the unit-specific residual that differs between countries but remains constant for any particular country (unobserved country level effect) and u_t captures the time effect and therefore differs across years but is constant for all countries in a particular year.

VI. RESULTS AND DISCUSSION

In this section, we present the results of the TR fixed effects model for each of the three alternative specifications of the electricity performance. In addition, we offer a comparative discussion between the threshold effects and the static panel fixed effects linear specification benchmark models.

Table 1: Test for Threshold Effects

Test for single threshold	**Model (5)** *Dependent variable: GEN*	**Model (6)** *Dependent variable: CAP*	**Model (7)** *Dependent variable: LAB*
Parameter estimate	**8.00**	**7.48**	**8.00**
LM_1	84.37***	93.36***	146.81***
Bootstrap P-value	0.00	0.00	0.00
Test for double threshold			
LM_2	3.37	2.36	2.81
Bootstrap P-value	0.38	0.56	0.52

Note: Testing for a First Sample Split, Using Fraser variable. Test of Null of No Threshold Against Alternative of Threshold Allowing Heteroskedastic Errors (White Corrected). The trimming percentage is set to 0.15. Significant at ***1%.
Source: Authors' elaboration

We carry out the first part of the empirical analysis by determining the number of thresholds (Hansen, 2000). For this reason, Equation (1) is estimated by least squares, allowing for (sequentially) zero, one and two thresholds respectively. The test statistics LM_1 and LM_2, along with their bootstrap p-values, are shown in Table 1. It is worth mentioning that 1000 bootstrap replications were used for each of the two bootstrap tests. Specifically, we find that the test for a single threshold LM_1 is highly significant in all of the three models with a bootstrap p-value of 0.00. On the other hand, the test for a second threshold LM_2 is not close to being statistically significant, with a bootstrap p-value for each of the three models (GEN, CAP and LAB) equal to 0.38, 0.56 and 0.52 respectively. As a consequence, we infer that there is only one threshold in all of the regression relationships.

The point estimates of the single threshold for the three models are also reported in the relevant table. The estimates are very close ranging from 7.48 (Model 6) to 8.00 (Models 5 and 7). Thus the two classes of countries indicated by the point estimates are those with medium and very high level of economic freedom respectively.

The results for the empirical relation between the electricity generation (GEN) and its main drivers in liberalised and non-liberalised countries are presented in Table 2. It is evident that nearly all of the control variables are statistically significant and plausibly signed. As expected the estimates of the RRI when significant are negative. This might be attributed to the fact that an increase (decrease) in the RRI, indicating the existence (absence) of regulatory restrictions, leads to a less (more) liberalized environment in the sector, which in turns negatively (positively) affect the level of electricity performance proxied by GEN. More specifically, the relevant coefficient, when significant, lies within the range of −0.020 to −0.045. This means that a 10% decrease (increase) in the index of electricity regulation (i.e by lifting certain regulatory barriers), triggers an increase (decrease) in the electricity performance (proxied by GEN) ranging from 2% to 4.5%. As suggested by Polemis (2016), "*The statistically significant impact of regulation on the level of electricity performance, clearly states that a well-defined regulatory framework can be expected to reduce 'regulatory risk' and provide incentives for private investment which in turns leads to an increase in the level of installed electricity capacity. In other words, imposing an independent regulator where state ownership persists seems to be effective*". This finding is not in alignment with previous studies such as Zhang et al, (2008) in which the impact of regulation on the level of electricity performance is absent. This could be attributed to the different methodology applied in the formulation of the regulatory variable (Polemis, 2016). However, the impact of competition on the electricity performance measured by its proxy variable (GEN) is negative in two out of three specifications (see columns 1, 3 and 5). The coefficients of primary interest are those of FRASER index.

Table 2: Regression Estimates for the Single Threshold Model (GEN)

Variables	(1) GEN bellow	(2) GEN above	(3) GEN bellow	(4) GEN above	(5) GEN bellow	(6) GEN above
Constant	16.719*** (0.371)	18.929*** (0.557)	16.554*** (0.367)	18.625*** (0.407)	17.122*** (0.583)	18.821*** (0.427)
RRI	-0.004 (0.007)	-0.002 (0.013)	-0.045*** (0.011)	0.020 (0.023)	-0.020* (0.012)	-0.003 (0.013)
PRIV	0.072*** (0.020)	-0.118*** (0.043)	0.140** (0.063)	-0.216*** (0.077)	0.008* (0.098)	-0.207* (0.125)
WHOL	-0.128*** (0.023)	0.025 (0.023)	-	-	-0.328*** (0.065)	0.086** (0.041)
TPA	-0.036** (0.017)	0.019 (0.028)	-0.487*** (0.080)	0.195** (0.079)	-	-
lnGDP	0.439*** (0.046)	0.587*** (0.062)	0.493*** (0.044)	0.582*** (0.046)	0.378*** (0.065)	0.576*** (0.056)
IND	0.041*** (0.001)	0.005 (0.005)	0.010*** (0.002)	-0.002 (0.004)	0.004* (0.002)	-0.004 (0.004)
URBAN	0.001*** (0.001)	0.001 (0.001)	0.038*** (0.001)	0.006 (0.005)	0.047*** (0.003)	0.005 (0.005)
EXPORT	0.009* (0.001)	-0.007 (0.005)	0.002*** (0.001)	0.001* (0.001)	0.007*** (0.001)	0.001 (0.001)
FRASER ≤ 8.00	0.074*** (0.008)	-	0.082*** (0.011)	-	0.059*** (0.017)	-
8.00 <FRASER	-	0.049 (0.041)	-	0.048* (0.028)	-	0.065* (0.037)
TREND	0.011*** (0.002)	0.0001 (0.003)	0.008*** (0.002)	0.0002 (0.003)	0.008*** (0.002)	0.001 (0.002)
PRIV*RRI	-	-	-0.027** (0.014)	0.020 (0.009)	0.038* (0.024)	0.006 (0.040)
PRIV*TPA	-	-	0.062** (0.032)	0.114 (0.028)	-	-
PRIV*WHOL	-	-	-	-	0.099 (0.073)	0.060 (0.090)
RRI*WHOL	-	-	-	-	0.049** (0.021)	-0.027 (0.013)
RRI*TPA	-	-	0.104*** (0.019)	-0.044 (0.017)	-	-
Diagnostics						
Observations	828	166	828	166	828	166
Number of countries	30	11	30	11	30	11
Periods included	36	29	36	29	36	29
Adjusted R^2	0.99	0.99	0.99	0.99	0.98	0.99
Standard error of regression	0.16	0.06	0.16	0.06	0.17	0.006
F-statistic	8166.26*** [0.00]	15994.88*** [0.00]	6065.91*** [0.00]	19193.63*** [0.00]	1464.83*** [0.00]	14174.72*** [0.00]
D-W	0.13	0.75	0.14	1.15	0.17	0.79

Note: The table reports the fixed effects regression results for the major components of the electricity performance. The dependent variable is the net generating electricity per capita (GEN). GDP stands for the per capita GDP in the sample countries, PRIV stands for the ownership structure of the largest companies in all of the electricity market segments, RRI stands for the OECD regulatory reform index in the industry, TPA accounts for the third party access to the electricity transmission grid, WHOL stands for the existence of a liberalised wholesale market for electricity (wholesale pool), EXPORT measures the exports as a percentage of GDP, FR stands for Fraser Index of Economic Freedom, IND, measures the industrialising rate, URBAN stands for the urbanisation rate and TREND stands for the linear trend capturing time effect. The use of the fixed effects specification is justified after a Hausman test for each model. Robust standard errors are in parentheses. The numbers in square brackets are the p-values. Significant at ***1%, **5% and *10% respectively.

The point estimates suggest that the level of electricity performance (GEN) is positively related to the level of economic freedom in all of the alternative specifications (with or without structural interaction terms). However, it is evident that the FRASER index is more important in the sample below the threshold (non-liberalised countries) since the relevant coefficients are highly statistically significant. This means that for already economically liberalised OECD countries the level of economic freedom does not affect electricity generation and subsequently the level of electricity performance. On the contrary, the relevant index helps for those that are in the process of liberalisation. Further, countries with very high level of economic freedom do have a lower coefficient than the typical country in all but one specification (see columns 5 and 6).

The discussion now turns to the results of the empirical relation between the installed capacity (CAP) and its main components (see Table 3). The empirical findings reveal that structural

Table 3: Regression Estimates for the Single Threshold Model (CAP)

Variables	(1) CAP bellow	(2) CAP above	(3) CAP bellow	(4) CAP above	(5) CAP bellow	(6) CAP above
Constant	-0.298 (0.465)	1.326** (0.683)	-0.630 (0.455)	2.033*** (0.538)	-0.231 (0.432)	1.600** (0.695)
RRI	0.007 (0.012)	-0.010 (0.008)	0.022 (0.018)	-0.026*** (0.006)	0.005 (0.007)	-0.028*** (0.008)
PRIV	0.033 (0.050)	-0.172*** (0.031)	0.281 (0.214)	-0.264*** (0.046)	-0.125*** (0.039)	-0.281*** (0.056)
WHOL	-0.052* (0.029)	0.042** (0.018)	-	-	-0.020 (0.030)	-0.019 (0.038)
TPA	0.004 (0.028)	0.027* (0.017)	0.012 (0.100)	-0.029 (0.026)	-	-
lnGDP	0.110** (0.054)	0.248*** (0.058)	0.085* (0.053)	0.164*** (0.042)	0.119** (0.053)	0.229*** (0.058)
IND	0.006*** (0.002)	-0.001 (0.002)	0.006*** (0.002)	-0.003*** (0.001)	0.006*** (0.002)	-0.0004 (0.002)
URBAN	0.052*** (0.003)	-0.005** (0.002)	0.052*** (0.003)	-0.003 (0.002)	0.052*** (0.003)	-0.005** (0.003)
EXPORT	0.002** (0.001)	-0.003*** (0.001)	0.003*** (0.001)	-0.002*** (0.001)	0.002*** (0.001)	-0.003*** (0.001)
FRASER ≤ 7.48	0.035** (0.016)	-	0.040*** (0.017)	-	0.036** (0.015)	-
7.48< FRASER	-	-0.030 (0.024)	-	-0.010 (0.012)	-	-0.022 (0.025)
TREND	0.017*** (0.017)	0.010*** (0.002)	0.016*** (0.002)	0.011*** (0.001)	0.017*** (0.003)	0.010*** (0.002)
PRIV*RRI	-	-	-0.064 (0.055)	0.006* (0.005)	0.029* (0.018)	0.020 (0.011)
PRIV*TPA	-	-	-0.163 (0.138)	0.054*** (0.015)	-	-
PRIV*WHOL	-	-	-	-	0.141** (0.064)	0.088** (0.038)
RRI*WHOL	-	-	-	-	-0.020* (0.011)	0.010 (0.015)
RRI*TPA	-	-	0.002 (0.019)	0.013 (0.008)	-	-
Diagnostics						
Observations	427	370	427	370	427	370
Number of countries	30	22	30	22	30	22
Periods included	28	28	28	28	28	28
Adjusted R^2	0.99	0.99	0.99	0.99	0.99	0.99
Standard error of regression	0.09	0.07	0.09	0.06	0.09	0.07
F-statistic	1684.83*** [0.00]	7335.68*** [0.00]	1586.93*** [0.00]	11203.07*** [0.00]	1608.41*** [0.00]	6916.69*** [0.00]
D-W	0.23	0.35	0.23	0.43	0.24	0.37

Note: The table reports the fixed effects regression results for the major components of the electricity performance. The dependent variable is the installed electricity capacity (CAP). GDP stands for the per capita GDP in the sample countries, PRIV stands for the ownership structure of the largest companies in all of the electricity market segments, RRI stands for the OECD regulatory reform index in the industry, TPA accounts for the third party access to the electricity transmission grid, WHOL stands for the existence of a liberalised wholesale market for electricity (wholesale pool), EXPORT measures the exports as a percentage of GDP, FR stands for Fraser Index of Economic Freedom, IND, measures the industrialising rate, URBAN stands for the urbanisation rate and TREND stands for the linear trend capturing time effect. The use of the fixed effects specification is justified after a Hausman test for each model. Robust standard errors are in parentheses. The numbers in square brackets are the p-values. Significant at ***1%, **5% and *10% respectively.

reform variables (RRI, PRIV, WHOL and TPA) do affect the level of volume which is a component of electricity performance in most of the specifications as measured by its proxy variable (CAP). It is worth emphasising that when the analysis is focused on the key variables of interest (FRASER) some interesting results emerge. First, in line with the aforementioned results, the level of economic freedom captured by the FRASER index is positively and statistically significant correlated with electricity performance if it is less than the threshold. The opposite holds for the liberalised OECD countries, since the estimated coefficients come with the negative sign and are not statistically significant in all of the specifications.

Moreover, Table 4 depicts the results for the empirical relation between the labour efficiency (LAB) and its main drivers in liberalised and non-liberalised countries. According to the relevant table, nearly all of the structural variables are statistically significant and plausibly signed. In this case, the impact of competition on the electricity performance when significant is positive, revealing that the presence of a liberalised wholesale market induce firms to increase employment to improve service in nearly all of the models. On the other hand, privatization has no identifiable

Table 4: Regression Estimates for the Single Threshold Model (LAB)

Variables	(1) LAB bellow	(2) LAB above	(3) LAB bellow	(4) LAB above	(5) LAB bellow	(6) LAB above
Constant	3.567*** (0.080)	6.095*** (0.165)	3.661*** (0.172)	6.596*** (0.106)	3.684*** (0.088)	6.490*** (0.119)
RRI	0.002 (0.002)	0.010*** (0.002)	0.003 (0.006)	0.007*** (0.002)	-0.011*** (0.003)	0.007*** (0.002)
PRIV	-0.016** (0.006)	0.063*** (0.015)	-0.087** (0.044)	0.132*** (0.013)	-0.061*** (0.018)	0.146*** (0.030)
WHOL	0.017*** (0.003)	0.009* (0.005)	-	-	-0.031*** (0.012)	-0.018 (0.015)
TPA	0.024*** (0.006)	0.016*** (0.006)	0.100*** (0.031)	-0.001 (0.010)	-	-
lnGDP	0.717*** (0.010)	0.529*** (0.019)	0.697*** (0.020)	0.485*** (0.011)	0.718*** (0.010)	0.494*** (0.013)
IND	-0.002*** (0.001)	-0.006*** (0.001)	-0.001* (0.001)	-0.003*** (0.001)	-0.001* (0.001)	-0.002*** (0.001)
URBAN	0.001*** (0.000)	-0.005*** (0.001)	0.001* (0.001)	-0.005*** (0.001)	-0.0001 (0.000)	-0.005*** (0.001)
EXPORT	0.000 (0.000)	0.000 (0.000)	-0.001*** (0.000)	0.000 (0.000)	0.0002 (0.000)	0.000 (0.000)
FRASER $\leq$ 8.00	0.029*** (0.003)	-	0.048*** (0.005)	-	0.028*** (0.003)	-
8.00 < FRASER	-	0.004 (0.011)	-	-0.012 (0.008)	-	-0.011 (0.007)
TREND	-0.001** (0.000)	0.003*** (0.001)	-0.002*** (0.001)	0.004*** (0.001)	-0.0002 (0.000)	0.004*** (0.001)
PRIV*RRI	-	-	0.008 (0.011)	-0.045*** (0.004)	0.003 (0.004)	-0.047*** (0.011)
PRIV*TPA	-	-	0.017 (0.027)	-0.020*** (0.007)	-	-
PRIV*WHOL	-	-	-	-	0.058*** (0.013)	-0.019 (0.022)
RRI*WHOL	-	-	-	-	0.010*** (0.003)	0.009* (0.005)
RRI*TPA	-	-	-0.013* (0.007)	0.005*** (0.002)	-	-
Diagnostics						
Observations	828	166	828	166	828	166
Number of countries	30	11	30	11	30	11
Periods included	36	29	36	29	36	29
Adjusted R^2	0.99	0.98	0.98	0.99	0.99	0.99
Standard error of regression	0.05	0.02	0.05	0.02	0.05	0.02
F-statistic	2561.29***[0.00]	442.34***[0.00]	1040.05***[0.00]	729.19*** [0.00]	2473.10***[0.00]	685.91*** [0.00]
D-W	0.10	0.38	0.14	0.55	0.09	0.52

Note: The table reports the fixed effects regression results for the major components of the electricity performance. The dependent variable is the labour productivity in the electricity sector (LAB). GDP stands for the per capita GDP in the sample countries, PRIV stands for the ownership structure of the largest companies in all of the electricity market segments, RRI stands for the OECD regulatory reform index in the industry, TPA accounts for the third party access to the electricity transmission grid, WHOL stands for the existence of a liberalised wholesale market for electricity (wholesale pool), EXPORT measures the exports as a percentage of GDP, FR stands for Fraser Index of Economic Freedom, IND, measures the industrialising rate, URBAN stands for the urbanisation rate and TREND stands for the linear trend capturing time effect. The use of the fixed effects specification is justified after a Hausman test for each model. Robust standard errors are in parentheses. The numbers in square brackets are the p-values. Significant at ***1%, **5% and *10% respectively.

impact since the sign of the relevant coefficients is rather mixed. More specifically, the relationship between privatization and labour efficiency is negative (positive) when the threshold is low (high). This means that for non-liberalised economies privatization induce firms to increase efficiency by reducing employment, while the opposite holds for the liberalised countries. In addition, the level of electricity performance (LAB) is positively related to the level of economic freedom in all of the alternative specifications (with or without structural interaction terms). However, it is evident that the FRASER index is statistically significant only in the sample below the threshold (non-liberalised countries). The relevant coefficients range from 0.028 to 0.048. This means that for non-liberalised OECD countries the level of economic freedom does affect labour efficiency and subsequently the level of electricity performance, while the opposite does not hold.

Regarding the cross terms between privatization and competition it is worth emphasising that are positively and statistically significant correlated with the level of electricity performance in all of the specifications below the threshold. This denotes that it is competition and ownership change that is crucial in defining electricity performance rather than competition on its own. This finding contradicts other recent studies (see for example Polemis, 2016). Similarly, for the specifications below the threshold, privatization and regulation (PRIV*RRI) has shown a positive and statistically significant interaction in two out of three models. The magnitude of the relevant coefficient varies between the range of 0.006 to 0.038. The positive sign indicates that the establishment of a sound effective regulatory framework enhances the investors' interests leading to an increased electricity performance for the non-liberalised OECD countries. Likewise, the interaction terms between regulation and competition (RRI*WHOL and RRI*TPA) for the non-liberalised countries, are positive and statistically significant in nearly all of the specifications.

All series are integrated of order one (I-1) and are cointegrated.[8] In terms of the other control variables, GDP has a positive and highly statistically significant impact on electricity performance in all of the estimated models. This implies that an increase in the level of economic growth leads to an increase in the level of electricity performance as expressed by its three main indicators. As expected, the level of industrialisation (IND) appears to be positively correlated with the level of electricity performance in all of the specifications as suggested by Zhang et al, (2008). Surprisingly, the relevant coefficient is negative and statistically significant in the labour equation models (Table 4), implying that an increase of the level of industrialisation will lead to a marginal decrease in the level of labour efficiency in the sector. Also, as expected by theory, the larger the degree of urbanisation (URBAN) in a country, the higher is the average amount of generation and the installed electricity capacity available to each individual. The degree of openness of the economy, as reflected in the exports variable (EXPORT) increases the level of electricity generation, while it is negative or insignificant in the installed capacity and labour productivity specifications.

Finally in order to test for the validity of the threshold model, we have estimated Equations 2–4 in a static fixed-effects linear framework. All the results are also collected in the Appendix C. The results of the benchmark static model compared with the threshold effects model that we use in the paper revealed significant differences in the interpretation of the key variables of interest (regulation, competition and privatization). The threshold model is better suited to assess the effect of these structural reforms on electricity performance under two different regimes (non-liberalised and liberalised countries).

VII. SENSITIVITY ANALYSIS[9]

In order to check for the robustness of our findings, and assess the impact of Renewable Energy Sources (RES) on the electricity performance, we re-estimate our basic threshold model (expressed by Eq.1) which is accordingly adjusted for the presence of four distinct dummy variables. These variables capture the effect of RES on the decomposition of the electricity sector performance in the OECD countries. Moreover, we re-estimate once again our threshold model and use instead of four distinct dummy variables one index accounting for the overall effect of RES policies. This indicator is known as the Renewable Energy Policy index (hereafter "REP") and is based on the exploitation of a comprehensive dataset made available by the International Energy Agency (IEA, 2004), which provides information on the year of adoption of selected RES policies for most of the OECD countries (Nesta et al, 2014)[10]. More specifically, Nesta et al, (2014) constructed this index by utilizing a series of dummy variables reflecting the adoption of the following eight policies:

8. Due to space limitations, the results of the stationarity/cointegration testing are available upon request.

9. Due to space limitation the relevant section is available in its detail upon request as suggested by a referee.

10. We are grateful to Francesco Vona, the corresponding author of the cited paper for providing us the data regarding the use of the REP index.

a) investment incentive schemes, b) tax measures, c) incentive tariffs, d) feed-in tariffs, e) voluntary programs, f) obligations, g) tradable certificates, and finally h) public investment in research and development in renewable energy. The empirical results when RES policies are taken into consideration do not reveal significant differences regarding the structural reform estimates and the set of the other explanatory variables. Mostly in all of the specifications, the control variables are statistically significant with the correct signs.

VIII. CONCLUSIONS AND POLICY IMPLICATIONS

This paper provides new insights on the relationship between electricity performance and its main structural reform elements (regulation, competition and privatization). To this aim we apply a static panel threshold model based on Hansen, (1999) and empirically estimate the main drivers of electricity performance. We must stress however that indicators such as generation per capita and capacity per capita do not usually account for the assessment of the structural reform outcomes in developed countries. In this case, other proxies could be used in order to capture the impact of these reforms on the electricity performance such as prices, cost and quality of services in the industry. However, these aspects of electricity performance could not be easily estimated since there is lack of sufficient comparable data across the OECD countries making extremely difficult this kind of analysis.

Our empirical results suggest that there is a single threshold in all of the regression relationships, splitting our sample into two regimes (non-liberalised and liberalised countries). This finding does not change when the empirical model is adjusted in order to account for the effect of RES. Specifically, for non-liberalised OECD countries, structural reforms may have beneficial impact on the level of electricity performance expressed by the three alternative indicators (electricity generation, installed capacity and employment). This finding has important policy implications, since the policy makers and government officials should pursue liberal policies toward electricity sectors targeted at the opening of the market and the establishment of competitive conditions. On the other hand, for the economically liberalised countries the level of economic freedom does not clearly affect electricity generation and subsequently the level of electricity performance. As a consequence, critical attention must be paid on demand management, since power producers will not build generation based solely on the structural conditions prevailing in the electricity sector (i.e. competition and regulation level), but in response to growth in demand, due to their obligation to serve.

Reviewing our findings in more detail and in relation to the research hypotheses, we find that regulation seems to have significant effect on the performance variables. Specifically we argue that an increase in the index of regulation which includes certain comprehensive elements such as ownership, conditions of entry, separation of business has positive interaction with the electricity generated leading to a higher capacity utilization and an increase in the level of labour productivity of the sector thus justifying the validity of Proposition one. In other words, we argue that it is not "*more regulation*" that is needed, or even "*better regulation*," but structural reforms such as the transfer of public to private ownership, the restructuring and the removal of entry barriers in the electricity sector. We also tested for the validity of Proposition two and conclude that a fiercer competition will lead to a larger capacity and a decreased output in electricity generation. Moreover, we argue that the presence of a liberalised wholesale electricity market induces firms to increase employment to improve the level of services offered to consumers. Further, the transfer of the ownership of the vertically integrated state-owned utilities into a privatised regime leads the power producers of the liberalised countries (i.e Australia, Canada, Switzerland, New Zealand United

Kingdom, and U.S.) to generate lower output thus leading to the rejection of Proposition three. Lastly, the relationship between privatization and labour efficiency is negative (positive) when the threshold is low (high). This means that for non liberalised economies (i.e., Turkey, Poland, Mexico, Greece, Spain, etc) privatization induce firms to increase efficiency by reducing employment. On the other hand the opposite holds for the liberalised countries such as Australia, Canada, Switzerland, Ireland, New Zealand United Kingdom, U.S, where privatization increases labour productivity and installed capacity, thus leading to the validity of Proposition four. Lastly, for the non liberalised countries, the transfer of the ownership of the vertically integrated state-owned utilities into a more competitive and privatised scheme seems to induce energy utilities (power plants) to generate higher output accounting for the validity of Proposition three, while the opposite holds for the already liberalised countries.

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