# The political economy of electricity market liberalization:

# a cross-country approach

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**Abstract**

More than half of the countries in the world have introduced a reform process in their power sectors and billions of dollars have been spent on liberalizing electricity markets around the world. Ideological considerations, political composition of governments and educational/professional background of leaders have played and will play a crucial role throughout the reform process. Adapting a political economy perspective, this paper attempts to discover the impact of political economy variables on the liberalization process in electricity markets. Empirical models are developed and analyzed using panel data from 55 developed and developing countries covering the period 1975–2010. The research findings suggest that there is a significant negative relationship between electricity market liberalization and the size of industry sector, meaning that countries with larger industry

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sectors tend to liberalize less. Also, we detect a negative correlation between polity score and power sector liberalization, that is; it cannot be argued that liberalization policies are stronger in more democratic countries. On the other hand, our results imply that countries that receive foreign financial aid or assistance are more likely to liberalize their electricity markets. In OECD countries, single-party governments accelerate the reform process by reducing public ownership and vertical integration. Moreover, we detect a negative relationship between the years the chief executive has been in office and the reform progress in OECD countries. Furthermore, we identify a decrease in vertical integration in electricity industry during the terms of parties with "right" or "left" ideologies in OECD countries. Additionally, professional and educational background of head of executive branch (prime minister, president and so on) seem to have very significant impact on reform process in OECD countries, but this is not the case in non-OECD countries. Leaders with a professional background as entrepreneurs speed up electricity market liberalization process in OECD countries while those with a background as economists slow it down. As for educational background, the reforms seem to progress slower in OECD countries if the head of executive has an educational background in economics or natural science. As a final point, the study suggests that EU or OECD membership, the existence of electricity market reform idea, population density, electricity consumption, income level, educational level, imports of goods and services (% of GDP) and country specific features have a strong correlation with liberalization process in electricity markets.

*Keywords: Electric utilities, industrial policy, political economy*

*JEL Classification: L94, L52, Q48*

## 1. Introduction and conceptual framework

By the 1980s, a number of political, financial and technical factors converged and started to undermine the logic that electricity industry should be handled via a vertically integrated (and usually state-owned) monopoly (Gratwick & Eberhard 2008). This shift has also been strongly encouraged by the World Bank, IMF and other international financial institutions (Williams & Ghanadan 2006). The power sector reform began in Chile in 1982 for the first time and then spread through various countries in the world especially after the 1990s. Therefore, last three decades have witnessed widespread power market reforms in both developed and developing countries that cost billions of dollars. Today, reforms are ongoing in many countries and reform process in the power sector is regarded as not only possible and necessary, but also inevitable.

In all reforming countries (whether developed or developing), reforms take place in a political economic environment and are directly affected by the developments taking place in it. In most cases, political structure of a country largely determines the extent of the reforms in that country. In the United Kingdom, for example, privatization of state owned electricity utility reinforced the ideology of the Thatcher government and its interest in reducing the costs of domestic coal subsidies. Similar ideological and political explanations can be found from Norway to New Zealand (Hogan 2002). There is no doubt that without political support the reforms cannot go further in any country. This paper attempts to discover the impact of political economy variables on the liberalization process in electricity markets.

We try to answer following research questions: (i) does domestic political structure of a country affect the reforms in its electricity market? (ii) does foreign influence resulting from

the dependence on foreign financial support have an influence on the electricity market liberalization process? (iii) are government structure (single party or coalition government), political stability, economic policy orientation of the ruling party (left, center or right ideology), electoral system (presidential or majoritarian) and professional/educational background of the head of executive (prime minister, president and so on) important determinants of the reform progress? If yes, what is the direction of the influences originated from these variables?

In general, societies with democratic political institutions tend to encourage a liberal economic system in which monopoly structure is not allowed in any sector, including power industry. Also, democratic countries support income equality as ruling parties try to increase the well-being of the masses in order to sustain their political support. This tendency is supposed to be stronger in countries with a lower rural population since people (meaning "voters") living in urban areas are, in general, much more educated and politically organized than those living in countryside. Besides, in many cases, the most important beneficiaries (and therefore supporters) of the reform programs are large electricity consumers, among which industrial consumers are the most important ones. Increased efficiency and careful regulation in the sector transfer huge benefits to industrial consumers in the form of reduced electricity prices. Therefore, it is reasonable to expect that industry sector supports the reform initiatives in the power industry; and as its size gets bigger and bigger so does its influence. Taking into account all these cause-effect relations, we formulate our first hypothesis as follows:

> **Hypothesis 1:** *Holding everything else constant, countries with a larger industry*
> *sector, a lower rural population, and a lower income inequality are more likely to*

*liberalize their electricity industry. These effects are stronger in more democratic*

*countries.*

In 1992, the World Bank officially changed its lending policy for electricity development from traditional project lending to policy lending. That is, any country borrowing from the Bank on power projects would have to agree to move away from a "single national electricity utility as a public monopoly" and adopt ownership, structural and regulatory reforms (Yi-chong 2006). Other international financial institutions, such as the Asian Development Bank, European Bank for Reconstruction and Development, and the Inter-American Development Bank have followed suit (Williams & Ghanadan 2006). Today, the liberalization of the infrastructure (including electricity) industries is one of the preconditions of any financial support program. Therefore, our second hypothesis is:

**Hypothesis 2:** *Foreign financial aid and/or assistance make liberalization more likely.*

It is almost assumed to be common knowledge that left-wing governments oppose the practices of a liberal economic system (including electricity market reform) and that political stability originating from single-party governments or presidential systems enable the liberalization process to progress faster as they provide a stable political environment for the reforms. Therefore, our third hypothesis is:

**Hypothesis 3:** *Countries with right-wing (or centre) governments are more likely to liberalize their electricity markets. Similarly, single-party governments (rather than coalition governments) and countries with presidential regimes (rather than*

*parliamentary ones) are expected to liberalize more. Likewise, as the number of years the chief executive has been in office increases, so do reform progress.*

The prior knowledge or experience of the head of executive regarding the power market liberalization process may encourage (or discourage) the reform measures. Hence, our final hypothesis turns out to be:

> **Hypothesis 4:** *Educational and professional backgrounds of head of executive branch (prime minister, president and so on) are important determinants of electricity market liberalization.*

The paper proceeds as follows. Next section provides a literature review regarding applied empirical studies focusing on the political economy of electricity market liberalization process. Section 3 describes data. Section 4 summarizes the methodological framework. Following section presents empirical analysis and discusses the results. Section 6 mentions potential limitations of the study. The last section concludes.

## 2. Literature review

Presenting an extensive literature review on political economy of economic reform is both outside the scope of this paper and not possible given limitations on the length of the study. Although there is some academic work that investigates the impact of political economy variables on electricity market reform outcome; to best of our knowledge, this study constitutes the first empirical applied investigation that focuses on the possible implications of political economic environment for electricity market reform process. Therefore, we cannot

cite previous similar studies in this area. Instead, we mention three groups of studies: (1) those presenting an anecdotal discussion of the political economy of the power market reform processes (without any applied analysis); (2) those providing applied evidence from other infrastructure industries (especially from telecommunications industry) on the political economy of economic reform programs; (3) the recent studies focusing on the variables employed in this work.

Clifton et al. (2010) and Victor & Heller (2007) provide the examples of the first group of studies. Clifton et al. (2010) deal with liberalization and incumbent internationalization in electricity markets by focusing on various political economy arguments on this relationship. Victor & Heller (2007) present political economy of power industry reform in five countries: Brazil, China, India, Mexico and South Africa.

Cubbin & Stern (2006), Gasmi & Recuero Virto (2010), Duso & Seldeslachts (2010) and Li & Xu (2002) constitute the examples from the second group of studies. Cubbin & Stern (2006) assess whether a regulatory law and higher quality regulatory governance are associated with superior outcomes in the electricity industry. Their analysis, for 28 developing economies over 1980–2001, draws on theoretical and empirical work on the impact of telecommunications regulators in developing economies. Controlling for privatization and competition and allowing for country-specific fixed effects, they find that both regulatory law and higher quality regulatory governance are positively and significantly associated with higher per capita generation capacity. Their results indicate that this positive impact increases for more than 10 years, as experience develops and regulatory reputation grows. Gasmi & Recuero Virto (2010) seek to identify the key determinants of policies that have been at the heart of the reforms of the telecommunications industry in developing countries, namely,

liberalization, privatization, and the (re)structuring of regulation. They also attempt to estimate the extent to which these policies have translated into actual deployment of telecommunications infrastructure. They conduct their analysis by means of an econometric analysis of a 1985-1999 time-series cross-sectional database on 86 developing countries. Duso & Seldeslachts (2010) concentrate on the change from analogue to digital technologies in the mobile telecom industries at the beginning of the 1990s, which increased the economic rationale for rendering these markets more competitive. They question why the speed of reforms has been remarkably different across countries. They empirically investigate this cross-sectional and temporal variation in entry liberalization of OECD countries during the 1990s. They use a data set obtained by merging different sources on political, government and regulatory institutions as well as private interests and ideologies to explore in detail several dimensions of the political economy of liberalization. Their findings indicate majoritarian electoral systems as important drivers for change, while independent industry regulators slow down such reforms. Furthermore, they conclude that powerful industry incumbents hold up the liberalization process and governing bodies that favor a small welfare state accelerate it. Moreover, Li & Xu (2002) examine the political economy of privatization and liberalization in the telecommunications sector in recent decades. They find that countries with stronger pro-reform interest groups, namely the financial services sector and the urban consumers, are more likely to reform in more democratic countries. Their results suggest that less democratic countries are more likely to maintain the public sector monopoly when the government benefits more from such a governance mode.

The examples for the last group of models include Gasmi et al. (2009), Dreher et al. (2009) and Kim & Pirttilä (2006). Gasmi et al. (2009) deal with the relationship between the quality of political institutions and the performance of regulation. Taking the view that political

accountability is a key factor linking political and regulatory structures and processes; their article empirically investigates its impact on the performance of regulation in telecommunications using time-series cross-sectional data sets for 29 developing and 23 developed countries during 1985–99. In addition to confirming some well-documented results on the positive role of regulatory governance in infrastructure industries, their article provides empirical evidence on the impact of the quality of political institutions and their modes of functioning on regulatory performance. Dreher et al. (2009) analyze whether the educational and professional background of a head of government matters for the implementation of market-liberalizing reforms. Employing panel data over the period 1970–2002, they present empirical evidence based on a data set covering profession and education of more than 500 political leaders from 72 countries. Their results show that reforms are more likely during the tenure of former entrepreneurs. Former professional scientists also promote reforms, the more so, the longer they stay in office. Finally, using data from transition economies, Kim & Pirttilä (2006) examine linkages between political constraints and economic reforms. Their results suggest that progress in reform is positively associated with public support for reforms, which is affected by income inequality and expected individual performance during future reforms. They also find evidence to support reform sequencing starting with a reform that is both popular and stimulatory to other reforms.

## 3. Overview of data

Our data set is based on a panel of 55 countries for a period beginning in 1975 and extending through 2010. List of countries in our data set is available in Figure 1. Years 1975 and 2010 represent, respectively, the earliest and the last year for which data are available at the time the research is conducted. The countries in our sample are determined by data availability,

especially by data on electricity market reform indicators. In our study, the total number of maximum observations for each variable is 1,540. Because of the missing observations, our panel is unbalanced. Table 1 shows descriptive statistics of the variables in our analysis.

Data on overall electricity market reform index are obtained from Conway and Nicolett (2006) and EBRD[3] (2011). Conway and Nicolett (2006) provide data for 30 OECD countries. They also provide data on sub indicators of reform process; namely entry barriers, public ownership and vertical integration. The index ranges from 0 to 6 where 0 represents the fully open market in which entry barriers, public ownership and vertical integration are minimized and a score of 6 is given to a closed market. EBRD (2011) provides a similar indicator for additional 25 developing countries where EBRD operates. The data from EBRD (2011) are available on a 1-4 scale. To establish uniformity between two data sets, the data from EBRD (2011) are converted into 6-0 scale. Figure 1 provides the change in electricity market closeness index from 1989 to 2007 for the countries in our dataset.

The data regarding industry value added as % of GDP, rural population as % of total population and net official development assistance and official aid received in current billion US\$ are taken from World Bank (2011). Gini coefficient[4] and polity score data come from UNU-WIDER (2011) and Center for Systemic Peace (2010), respectively. Data on political economy variables (party structure, the years the chief executive has been in office, party orientation of head of executive, party orientation with respect to economic policy, electoral system) originate from Keefer (2010). Professional and educational background of head of executive data are partly collected by the author and partly provided by Dreher et al. (2009).

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[3] European Bank for Reconstriction and Development.

[4] The Gini coefficient is a measure of the inequality of a distribution, a value of 0 expressing total equality and a value of 1 maximal inequality.

Dummy variables representing being an EU member, an OECD member and the existence of electricity market reform idea are constructed by the author. The dummy variable for the existence of electricity market reform idea takes the value 1 after 1989 when the electricity market reform was implemented, for the first time, in a full scale in a developed country (i.e. the UK); the years before 1989 take the value 0.

**Figure 1.** Electricity market closeness index in OECD countries (*left*) and countries where EBRD operates (*right*) (1989, 2007)



Electricity market closeness index in 2007
Electricity market closeness index in 1989
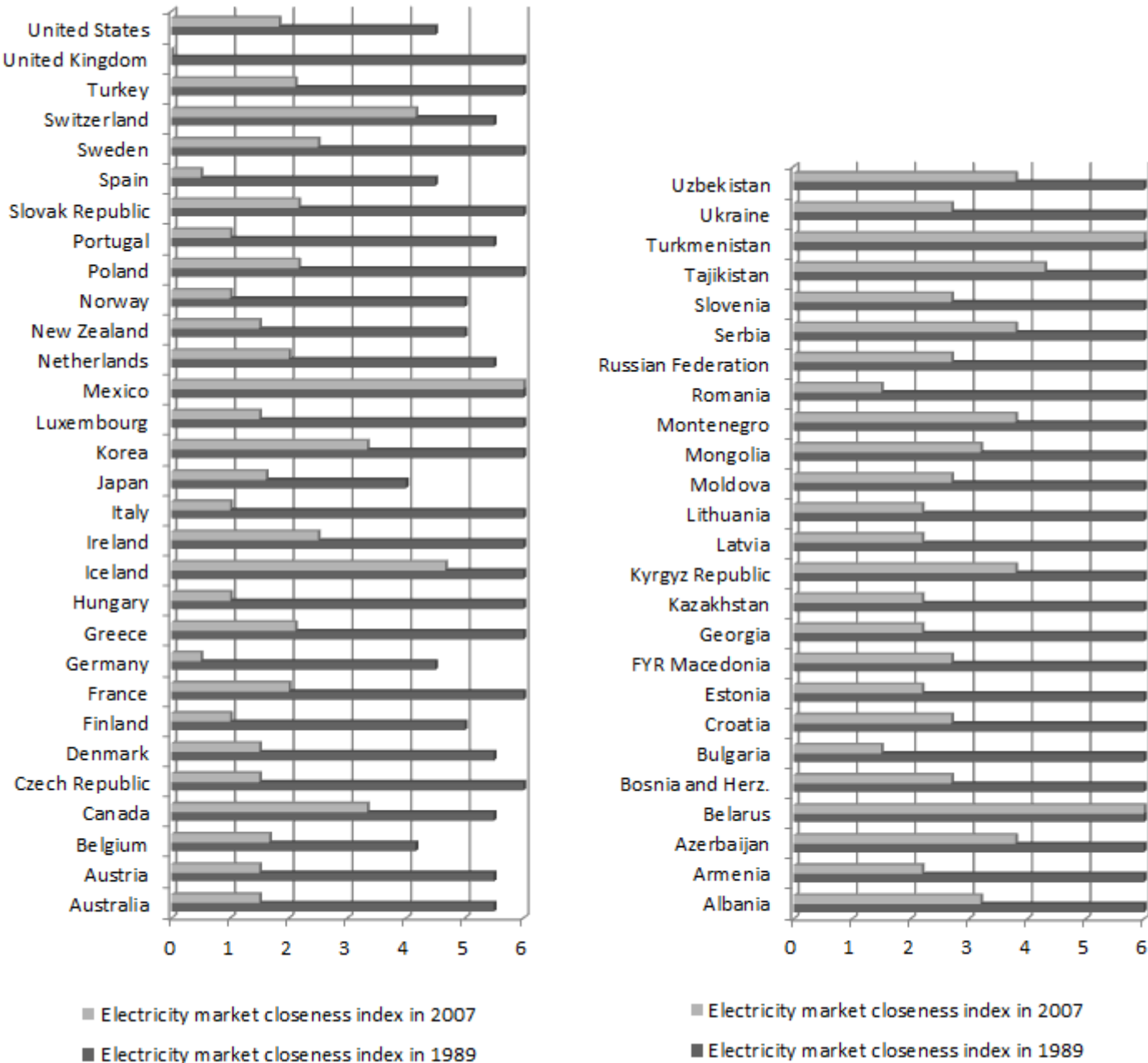
World Bank (2011) provides data on population density (people per sq. km of land area), electricity consumption (MWh per capita), GDP per capita (PPP, current thousand int. $) and imports of goods and services as % of GDP. Average number of years of adult (15+) education is taken from Barro & Lee (2010). The data from Barro & Lee (2010) are available with 5-year intervals; to ensure conformity with other data, we converted them into yearly data by linear interpolation.

**Table 1.** Descriptive statistics of the variables in the models

| Variables (units) | Mean | Std. Dev. | Min | Max | # of Obser. | # of Countries |
|---|---|---|---|---|---|---|
| **Dependent Variables** | | | | | | |
| Entry barriers in electricity market (0-6) | 4.59 | 2.26 | 0 | 6 | 990 | 30 |
| Public ownership in electricity market (0-6) | 4.56 | 1.80 | 0 | 6 | 990 | 30 |
| Vertical integration in electricity market (0-6) | 4.65 | 2.03 | 0 | 6 | 990 | 30 |
| Overall electricity market closeness index (0-6) | 4.46 | 1.61 | 0 | 6 | 1,540 | 55 |
| **Explanatory Variables** | | | | | | |
| Industry value added (% of GDP) | 32.39 | 7.43 | 10.29 | 69.92 | 1,415 | 55 |
| Rural population (% of total population) | 33.95 | 14.47 | 2.66 | 73.60 | 1,514 | 55 |
| Gini coefficient (0-100) | 30.43 | 6.75 | 16.63 | 57.40 | 760 | 54 |
| Polity score (-10,+10) | 6.31 | 6.13 | -10 | 10 | 1,357 | 53 |
| Net official development assistance and official aid received (current billion US$) | 0.11 | 0.28 | -0.46 | 3.79 | 1,408 | 55 |
| Party Structure (1: single-party, 0: coalition) | 0.46 | 0.50 | 0 | 1 | 1,493 | 53 |
| The years the chief executive has been in office | 4.35 | 3.84 | 1 | 35 | 1,437 | 54 |
| Party orientation with respect to economic policy (Right) | 0.40 | 0.49 | 0 | 1 | 1,218 | 51 |
| Party orientation with respect to economic policy (Left) | 0.44 | 0.50 | 0 | 1 | 1,218 | 51 |
| Party orientation with respect to economic policy (Center) | 0.15 | 0.36 | 0 | 1 | 1,218 | 51 |
| Electoral system (parliamentary regimes) | 0.68 | 0.47 | 0 | 1 | 1,475 | 55 |
| Professional background of head of executive: Entrepreneur | 0.06 | 0.24 | 0 | 1 | 1,429 | 54 |
| Professional background of head of executive: Scientist (Economist) | 0.04 | 0.21 | 0 | 1 | 1,429 | 54 |
| Professional background of head of executive: Military | 0.07 | 0.25 | 0 | 1 | 1,429 | 54 |
| Professional background of head of executive: Politician | 0.63 | 0.48 | 0 | 1 | 1,429 | 54 |
| Professional background of head of executive: Scientist (Other) | 0.27 | 0.45 | 0 | 1 | 1,429 | 54 |
| Professional background of head of executive: Unknown/other | 0.37 | 0.48 | 0 | 1 | 1,429 | 54 |
| Educational background of head of executive: Economics | 0.25 | 0.43 | 0 | 1 | 1,429 | 54 |
| Educational background of head of executive: Natural science | 0.18 | 0.38 | 0 | 1 | 1,429 | 54 |
| Educational background of head of executive: Other university | 0.47 | 0.50 | 0 | 1 | 1,429 | 54 |
| Educational background of head of executive: Unknown/other | 0.14 | 0.35 | 0 | 1 | 1,429 | 54 |

| Variables (units) | Mean | Std. Dev. | Min | Max | # of Obser. | # of Countries |
|---|---|---|---|---|---|---|
| **Control Variables** | | | | | | |
| EU member (0-1) | 0.30 | 0.46 | 0 | 1 | 1,540 | 55 |
| OECD member (0-1) | 0.56 | 0.50 | 0 | 1 | 1,540 | 55 |
| Existence of electricity market reform idea (0-1) | 0.73 | 0.45 | 0 | 1 | 1,540 | 55 |
| Population density (people per sq. km of land area) | 101.26 | 104.35 | 1.40 | 499.96 | 1,428 | 55 |
| Log of population density | 4.00 | 1.34 | 0.33 | 6.21 | 1,428 | 55 |
| Electricity consumption (MWh per capita) | 5.90 | 4.99 | 0.34 | 36.85 | 1,450 | 54 |
| Log of electricity consumption | 1.47 | 0.80 | -1.07 | 3.61 | 1,450 | 54 |
| GDP per capita (PPP, current thousand int. $) | 14.34 | 10.83 | 0.73 | 84.41 | 1,307 | 55 |
| Log of GDP per capita | 2.32 | 0.92 | -0.32 | 4.44 | 1,307 | 55 |
| Average number of years of education received by people ages 15+ | 9.27 | 1.68 | 2.92 | 12.75 | 1,364 | 47 |
| Imports of goods and services (% of GDP) | 41.33 | 21.00 | 5.88 | 143.72 | 1,427 | 55 |
| Log of imports of goods and services | 3.59 | 0.53 | 1.77 | 4.97 | 1,427 | 55 |

## 4. Methodology

To best of our knowledge, no applied study has been done so far on the political economy of power market reform. Therefore, we cannot find empirical evidence in the applied literature suggesting the possible impacts of political economy variables on the electricity liberalization process and their direction. So, to begin with, we need to decide which indicators to be used in the study. Since we are interested in the impact of political economy variables on power market reform process, we need variables representing political economic environment of a country and those representing the scale and intensity of the reform process. In addition to these variables, we also need a set of control variables which are assumed to be endogenous to reform process and explain a portion of the variations in reform progress. It is almost impossible to observe the real impact of political economy variables on electricity market reform process without separating the effects of market reform from other country specific features. Therefore, we specify our dependent variables (that is, reform indicators) as a function of (i) political economy variables (comparable cross-country indicators), (ii) a set of controls, (iii) country-specific effects (these are assumed to be exogenous and to exist

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independently of reform process, but may explain a portion of the variation in reform progress) and (iv) other unobserved variables that influence the reform process. These variables are then used in panel regressions to assess their impact on variables we are interested in. In panel regressions, the exploitation of both cross-country and time-series dimensions of the data allows for control of country-specific effects. Apart from political economy variables; power market reform in a specific country and year may be influenced by being an EU or OECD member, existence of electricity market reform idea, population density, electricity consumption per capita, GDP per capita, average number of years of adult (15+) education and imports of goods and services as % of GDP. In our models, we include all these control variables in order to isolate the effect of political economy variables on the reform process.

In this paper, we formulate regression equations as below.

$$Y_{it} = \beta_1 + \sum_{j=2}^{k} \beta_j X_{jit} + \sum_{p=1}^{s} \gamma_p Z_{pi} + \delta t + \varepsilon_{it} \tag{1}$$

In the model, $i$ and $t$ represent unit of observation and time period, respectively. $j$ and $p$ are indices used to differentiate between observed and unobserved variables. $X_{ji}$ and $Z_{pi}$ represent observed and unobserved variables, respectively. $X_{ji}$ includes both political economy variables and control variables. $Y_{it}$ is dependent variable (that is, electricity market reform indicators). $\varepsilon_{it}$ is the disturbance term and $t$ is time trend term. Because the $Z_{pi}$ variables are unobserved, there is no means of obtaining information about the $\sum \gamma_p Z_{pi}$ component of the model. For convenience, we define a term $\alpha_i$, known as the unobserved effect, representing the joint impact of the $Z_{pi}$ variables on $Y_{it}$. So, our model may be rewritten as follows:

$$Y_{it} = \beta_1 + \sum_{j=2}^{k} \beta_j X_{jit} + \alpha_i + \delta t + \varepsilon_{it} \tag{2}$$

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Now, the characterization of the $\alpha_i$ component is crucially important in the analysis. If control variables are so comprehensive that they capture all relevant characteristics of the individual, there will be no relevant unobserved characteristics. In that case, the $\alpha_i$ term may be dropped and pooled data regression (OLS) may be used to fit the model, treating all the observations for all time periods as a single sample. However, since we are not sure whether control variables in our models capture all relevant characteristics of the countries, we cannot directly carry out a pooled data regression of Y on X. If we were to do so, it would generate an omitted variable bias. Therefore we prefer to use either a Fixed Effects (FE) or Random Effects (RE) regression. In FE model, the country-specific effects ($\alpha_i$) are assumed to be the fixed parameters to be estimated. In RE model, the country-specific effects ($\alpha_i$) are treated as stochastic. The fixed effect model produces consistent estimates, while the estimates obtained from the random effect model will be more efficient. There are more than 90 countries in the world where a reform process has been initiated so far but data is available only for 55 countries. That is, our sample is limited by data availability. Therefore, we cannot be sure whether the observations in our model may be described as being a random sample from a given population; and cannot directly decide which regression specification (FE, RE or OLS) to use. It will be decided in the course of the analysis based on Hausman test and Breusch and Pagan Lagrangian Multiplier (BPLM) test.

## 5. Empirical analysis and discussion of the results

Our analysis is composed of estimation of three main groups of models to test our hypotheses. Each main group includes two sub-groups of models: one for sub-indicators (entry barriers, public ownership and vertical integration in OECD countries) and another for overall indicator (OECD countries, non-OECD countries, all countries). In total, we estimate 18

models. Since using logarithms of variables enables us to interpret coefficients easily and is an effective way of shrinking the distance between values, we transform population density, electricity consumption per capita, GDP per capita and imports of goods and services as % of GDP variables into logarithmic form and use these transformed variables in our models.

We start our analysis by applying Hausman test for fixed versus random effects in each model[5]. As usual, we prefer 5% significance level so any p-value less than 0.05 from Hausman test implies that we should reject the null hypothesis of there being no systematic difference in the coefficients. In other words, Hausman test with a p-value up to 0.05 indicates significant differences in the coefficients. Therefore, in our analysis, if we get a p-value less than 0.05, we choose fixed effects model. However, if p-value from Hausman test is above 0.05, we cannot reject the null hypothesis of there being no systematic difference in the coefficients at 5% level. In such a case, we apply Breusch and Pagan Lagrangian Multiplier (BPLM) test for random effects in order to decide on using either pooled OLS or random effects in our analysis. This test is developed to detect the presence of random effects. In this test, the null hypothesis is that variances of groups are zero; that is, there is no unobserved heterogeneity, all groups are similar. If the null is not rejected, the pooled regression model is appropriate. That is, if the p-value of BPLM test is below 0.05, we reject the null, meaning that random effects specification is the preferred one. If it is above 0.05, we prefer pooled OLS specification to carry out our regression. Tables 2-7 show a summary of estimation results that present statistically significant coefficients and their standard errors. Full details of estimation results are provided in Appendix 1; including the full estimation output, the number of observations and the countries included in each model, results of Hausman and BPLM tests and preferred specifications based on these tests.

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[5] Throughout the paper, model estimations are carried out and cross-checked by Stata 11.2 and Eviews 7.1.

**Table 2.** Estimation results for the models testing Hypothesis 1 (sub-indicators)

| Dependent Variables → <br> Explanatory Variables ↓ | Entry barriers (0-6) <br> *(OECD countries)* | Public Ownership (0-6) <br> *(OECD countries)* | Vertical integration (0-6) <br> *(OECD countries)* |
|---|---|---|---|
| Industry value added (% of GDP) | 0.129*** (0.027) | 0.076*** (0.015) | 0.128*** (0.025) |
| Rural population (% of total population) | NS | NS | NS |
| Gini coefficient (0-100) | NS | NS | NS |
| Polity score (-10,+10) | 0.178*** (0.046) | NS | 0.109*** (0.042) |
| EU member (0-1) | -1.61*** (0.319) | NS | -1.407*** (0.294) |
| OECD member (0-1) | 1.717*** (0.419) | NS | 0.907** (0.386) |
| Existence of electricity market reform idea (0-1) | 1.078*** (0.274) | NS | 0.521** (0.252) |
| Log of population density | NS | 9.221*** (1.357) | NS |
| Log of electricity cons. per capita (MWh) | 2.566*** (0.796) | -1.188*** (0.423) | NS |
| Log of GDP per capita (PPP, cur. thousand int. $) | -5.201*** (0.536) | -1.157*** (0.285) | -3.679*** (0.494) |
| Average num. of years of adult (25+) education | NS | NS | NS |
| Log of imports of goods and services (% of GDP) | -2.415*** (0.582) | -0.936*** (0.31) | -1.444*** (0.536) |
| Constant | NS | -25.833*** (5.876) | 17.055* (10.177) |

*Standard errors are shown in parentheses () with coefficients.*
*"NS": The coefficient is not significant even at 10% level.*
Coefficient that is significant at ***1% level, **5% level, *10% level.

**Table 3.** Estimation results for the models testing Hypothesis 1 (overall indicator)

| Dependent Variables → <br> Explanatory Variables ↓ | Overall indicator (0-6) <br> *(OECD countries)* | Overall indicator (0-6) <br> *(Non-OECD countries)* | Overall indicator (0-6) <br> *(All countries)* |
|---|---|---|---|
| Industry value added (% of GDP) | 0.111*** (0.018) | 0.057*** (0.012) | 0.087*** (0.012) |
| Rural population (% of total population) | NS | -0.157* (0.082) | NS |
| Gini coefficient (0-100) | NS | NS | NS |
| Polity score (-10,+10) | 0.091*** (0.03) | NS | 0.063*** (0.023) |
| EU member (0-1) | -0.927*** (0.21) | 0.463* (0.25) | -0.517*** (0.176) |
| OECD member (0-1) | 0.889*** (0.275) | (omitted) | 0.551** (0.242) |
| Existence of electricity market reform idea (0-1) | 0.569*** (0.18) | (omitted) | 0.314* (0.164) |
| Log of population density | 3.153* (1.675) | NS | NS |
| Log of electricity cons. per capita (MWh) | NS | 4.001*** (0.568) | 1.655*** (0.43) |
| Log of GDP per capita (PPP, cur. thousand int. $) | -3.345*** (0.352) | -3.009*** (0.351) | -2.963*** (0.252) |
| Average num. of years of adult (25+) education | NS | NS | -0.336*** (0.108) |
| Log of imports of goods and services (% of GDP) | -1.598*** (0.382) | NS | -1.209*** (0.298) |
| Constant | NS | NS | 14.773*** (5.705) |

*Standard errors are shown in parentheses () with coefficients.*
*"NS": The coefficient is not significant even at 10% level.*
Coefficient that is significant at ***1% level, **5% level, *10% level.

**Table 4.** Estimation results for the models testing Hypothesis 2 (sub-indicators)

| Dependent Variables → Explanatory Variables ↓ | Entry barriers (0-6) (OECD countries) | Public Ownership (0-6) (OECD countries) | Vertical integration (0-6) (OECD countries) |
|---|---|---|---|
| Net official assistance and aid received | -0.628** (0.311) | NS | NS |
| EU member (0-1) | -1.06*** (0.234) | 0.227* (0.119) | -1.171*** (0.214) |
| OECD member (0-1) | 2.136*** (0.287) | -0.371** (0.147) | 1.125*** (0.262) |
| Existence of electricity market reform idea (0-1) | 1.125*** (0.178) | NS | 0.626*** (0.162) |
| Log of population density | NS | 7.314*** (0.73) | 2.843** (1.307) |
| Log of electricity cons. per capita (MWh) | 2.984*** (0.408) | -0.354* (0.208) | 1.297*** (0.373) |
| Log of GDP per capita (PPP, cur. thousand int. $) | -5.987*** (0.347) | -1.273*** (0.177) | -4.536*** (0.316) |
| Average num. of years of adult (25+) education | -0.226** (0.103) | -0.226*** (0.052) | NS |
| Log of imports of goods and services (% of GDP) | -2.491*** (0.399) | -0.621*** (0.203) | -2.002*** (0.364) |
| Constant | 23.5*** (5.198) | -16.994*** (2.651) | 7.825* (4.747) |

*Standard errors are shown in parentheses () with coefficients.*
*"NS": The coefficient is not significant even at 10% level.*
Coefficient that is significant at ***1% level, **5% level, *10% level.

**Table 5.** Estimation results for the models testing Hypothesis 2 (overall indicator)

| Dependent Variables → Explanatory Variables ↓ | Overall indicator (0-6) (OECD countries) | Overall indicator (0-6) (Non-OECD countries) | Overall indicator (0-6) (All countries) |
|---|---|---|---|
| Net official assistance and aid received | -0.334* (0.202) | -0.557** (0.252) | NS |
| EU member (0-1) | -0.668*** (0.152) | NS | -0.778*** (0.14) |
| OECD member (0-1) | 0.964*** (0.187) | (omitted) | 0.671*** (0.18) |
| Existence of electricity market reform idea (0-1) | 0.576*** (0.116) | (omitted) | 0.342*** (0.108) |
| Log of population density | 3.429*** (0.933) | NS | 1.314* (0.698) |
| Log of electricity cons. per capita (MWh) | 1.309*** (0.266) | 2.208*** (0.309) | 1.571*** (0.213) |
| Log of GDP per capita (PPP, cur. thousand int. $) | -3.932*** (0.226) | -1.898*** (0.219) | -3.139*** (0.154) |
| Average num. of years of adult (25+) education | -0.115* (0.067) | -1.353*** (0.209) | -0.338*** (0.063) |
| Log of imports of goods and services (% of GDP) | -1.705*** (0.26) | NS | -1.099*** (0.168) |
| Constant | NS | 11.222* (6) | 10.84*** (2.601) |

*Standard errors are shown in parentheses () with coefficients.*
*"NS": The coefficient is not significant even at 10% level.*
Coefficient that is significant at ***1% level, **5% level, *10% level.

**Table 6.** Estimation results for the models testing Hypotheses 3 and 4 (sub-indicators)

| Dependent Variables → Explanatory Variables ↓ | Entry barriers (0-6) (OECD countries) | Public Ownership (0-6) (OECD countries) | Vertical integration (0-6) (OECD countries) |
|---|---|---|---|
| Single-party government (0-1) | NS | -0.144* (0.085) | -0.229* (0.139) |
| The years the chief executive has been in office | 0.042** (0.018) | 0.033*** (0.009) | 0.044*** (0.015) |
| Economic policy orientation of ruling party: Right | NS | NS | -0.526** (0.211) |
| Economic policy orientation of ruling party: Left | -0.423* (0.246) | NS | -0.38* (0.214) |
| Economic policy orientation of ruling party: Center | (omitted) | (omitted) | (omitted) |
| Parliamentary regimes (0-1) | NS | -0.407* (0.231) | NS |

| Prof. bgr. of head of executive: Entrepreneur | NS | -0.457*** (0.161) | -0.591** (0.264) |
|---|---|---|---|
| Prof. bgr. of head of executive: Scientist, Economics | 1.333*** (0.389) | NS | 1.982*** (0.335) |
| Prof. bgr. of head of executive: Military | NS | NS | NS |
| Prof. bgr. of head of executive: Politician | 0.482** (0.213) | -0.201* (0.117) | 0.443** (0.191) |
| Prof. bgr. of head of executive: Scientist, Other | 0.446* (0.243) | -0.484*** (0.132) | NS |
| Prof. bgr. of head of executive: Unknown/other | 0.516** (0.227) | -0.302** (0.124) | 0.725*** (0.202) |
| Educ. bgr. of head of executive: Economics | NS | NS | 0.814* (0.468) |
| Educ. bgr. of head of executive: Natural science | NS | 1.123*** (0.33) | 1.75*** (0.541) |
| Educ. bgr. of head of executive: Other university | NS | NS | NS |
| Educ. bgr. of head of executive: Unknown/other | NS | NS | NS |
| EU member (0-1) | -0.829*** (0.233) | NS | -1.282*** (0.206) |
| OECD member (0-1) | 1.697*** (0.327) | -0.474*** (0.181) | 0.966*** (0.293) |
| Existence of electricity market reform idea (0-1) | 0.749*** (0.181) | NS | 0.384** (0.158) |
| Log of population density | 0.606*** (0.14) | NS | 0.47** (0.218) |
| Log of electricity cons. per capita (MWh) | 2.886*** (0.318) | NS | 1.778*** (0.349) |
| Log of GDP per capita (PPP, cur. thousand int. $) | -5.73*** (0.321) | -0.638*** (0.187) | -4.266*** (0.299) |
| Average num. of years of adult (25+) education | -0.24*** (0.085) | -0.333*** (0.055) | NS |
| Log of imports of goods and services (% of GDP) | -1.202*** (0.272) | NS | -1.484*** (0.296) |
| Constant | 16.661*** (1.214) | 9.582*** (0.972) | 14.172*** (1.352) |

*Standard errors are shown in parentheses () with coefficients.*
*"NS": The coefficient is not significant even at 10% level.*
Coefficient that is significant at ***1% level, **5% level, *10% level.


**Table 7.** Estimation results for the models testing Hypotheses 3 and 4 (overall indicator)

| Dependent Variables → <br> Explanatory Variables ↓ | Overall indicator (0-6) <br> *(OECD countries)* | Overall indicator (0-6) <br> *(Non-OECD countries)* | Overall indicator (0-6) <br> *(All countries)* |
|---|---|---|---|
| Single-party government (0-1) | NS | NS | NS |
| The years the chief executive has been in office | 0.038*** (0.011) | NS | 0.031*** (0.01) |
| Economic policy orientation of ruling party: Right | NS | (omitted) | NS |
| Economic policy orientation of ruling party: Left | -0.268* (0.159) | NS | -0.273** (0.137) |
| Economic policy orientation of ruling party: Center | (omitted) | NS | (omitted) |
| Parliamentary regimes (0-1) | NS | NS | NS |
| Prof. bgr. of head of executive: Entrepreneur | -0.431** (0.196) | NS | -0.412** (0.177) |
| Prof. bgr. of head of executive: Scientist, Economics | 1.195*** (0.248) | NS | 0.642*** (0.202) |
| Prof. bgr. of head of executive: Military | NS | NS | NS |
| Prof. bgr. of head of executive: Politician | 0.262* (0.141) | NS | NS |
| Prof. bgr. of head of executive: Scientist, Other | NS | NS | NS |
| Prof. bgr. of head of executive: Unknown/other | 0.342** (0.149) | NS | NS |
| Educ. bgr. of head of executive: Economics | NS | NS | NS |
| Educ. bgr. of head of executive: Natural science | 0.948** (0.402) | NS | NS |
| Educ. bgr. of head of executive: Other university | NS | NS | NS |
| Educ. bgr. of head of executive: Unknown/other | NS | NS | NS |
| EU member (0-1) | -0.752*** (0.152) | NS | -0.583*** (0.15) |
| OECD member (0-1) | 0.791*** (0.215) | (omitted) | 0.831*** (0.217) |

| | | | |
|---|---|---|---|
| Existence of electricity market reform idea (0-1) | 0.465*** (0.117) | (omitted) | 0.27** (0.116) |
| Log of population density | 0.272* (0.141) | NS | NS |
| Log of electricity cons. per capita (MWh) | 1.696*** (0.249) | 2.266*** (0.43) | 1.779*** (0.254) |
| Log of GDP per capita (PPP, cur. thousand int. $) | -3.628*** (0.218) | -1.245*** (0.37) | -3.14*** (0.192) |
| Average num. of years of adult (25+) education | -0.169*** (0.063) | -1.613*** (0.292) | -0.321*** (0.068) |
| Log of imports of goods and services (% of GDP) | -0.954*** (0.212) | NS | -1.127*** (0.186) |
| Constant | 13.918*** (0.94) | NS | 12.551*** (3.054) |

*Standard errors are shown in parentheses () with coefficients.*
*"NS": The coefficient is not significant even at 10% level.*
Coefficient that is significant at ***1% level, **5% level, *10% level.

When we look at the results from the first groups of models (Tables 2 and 3), at first sight, we notice that there is a significant negative relationship between electricity market liberalization and the size of industry sector in OECD countries, meaning that countries with larger industry sectors tend to liberalize less. Urbanization and income equality seem to have almost no significant impact on regulatory reform in electricity markets. Besides, although there seems to be no relation between public ownership and polity score, overall we detect a negative correlation between polity score and power sector liberalization in OECD countries; that is; we cannot argue that liberalization policies are stronger in more democratic countries. These results are also valid for overall indicators for both OECD and non-OECD countries. There are two exceptions to this trend. First of all, the market liberalization process seems to speed up in non-OECD countries as the share of rural population in total population increases. Second, polity score does not have an impact on reform process in non-OECD countries. As for the second groups of models (Tables 4 and 5), apparently, the countries that receive foreign financial aid or assistance are likely to liberalize their electricity markets and especially tend to reduce entry barriers to their power sector. In the last groups of models (Tables 6 and 7), we see that government structure (coalition or single-party) has an impact on the reform process in OECD countries but does not seem to affect liberalization process in non-OECD countries. In OECD countries, single-party governments accelerate the reform process by reducing public ownership and vertical integration. Moreover, we detect a negative

relationship between the years the chief executive has been in office and the reform process in OECD countries. The same relationship is not observed in non-OECD countries. Furthermore, we identify a decrease in vertical integration in electricity industry during the terms of parties with "right" or "left" ideologies in OECD countries. The ruling parties with "left" ideology seem to reduce entry barriers in OECD countries. Economic policy orientation of the ruling party does not affect the reform process in non-OECD countries. Similarly, electoral system (majoritarian or presidential) does not seem to influence liberalization process much while entry barriers seem to be lower in countries with parliamentary systems. In addition, professional and educational background of head of executive branch (prime minister, president and so on) have very significant impact on reform process in OECD countries. Background of head of executive branch is not important in non-OECD countries. Leaders with a professional background as entrepreneurs speed up electricity market liberalization process in OECD countries while those with a background as economists slow it down. Non-economist scientists decrease public ownership but increase entry barriers. We could not detect a statistically significant relationship between a military background and reform process. Head of executives with a background as politicians decrease public ownership but increase entry barriers and vertical integration. As for educational background, the reforms seem to progress slower in OECD countries if the head of executive has an educational background in economics or natural science. Especially, those with a background in economics increase vertical integration while those with a background in natural science increase both vertical integration and public ownership. The interpretation of the results in detail is as follows.

## 5.1. Results from the first group of models testing Hypothesis 1

In the first group of models, our empirical findings suggest that there is an inverse relationship between the size of the industry sector and electricity market liberalization process. As industry value added (as % of GDP) increases in a country, power market structure of that country becomes less liberal. For example, if industry value added of an OECD country increases from 40% to 50% of GDP; entry barriers, public ownership and vertical integration scores (on 0-6 scales) of that country increase by 1.29, 0.76 and 1.28 points, respectively. Urbanization and income equality seem to have almost no impact on reform process. The only statistically significant impact is that an increase in rural population in non-OECD countries (as % of total population) seems to speed up liberalization process in electricity industry; however this impact is quite limited. For instance, if rural population in a non-OECD country increases from 20% to 30% of total population, overall indicator (on a 0-6 scale) of that country decreases by 1.57 points. One of the most surprising results is that in most cases there is a negative relationship between polity score and electricity market liberalization process in OECD countries, meaning that politically more liberal OECD countries prefer to liberalize their electricity markets less. Democracy does not seem to be an important factor explaining the reform process in non-OECD countries. For example, if polity score (on a -10 +10 scale) of an OECD country increases from 3 to 8, entry barriers and vertical integration scores (on 0-6 scales) of that country increases by 0.89 and 0.55 points, respectively.

**5.2. Results from the second group of models testing Hypothesis 2**

Our analysis reveals that countries that receive foreign financial assistance or aid tend to liberalize their electricity market more than a country that does not receive any. This finding holds true for both OECD and non-OECD countries. However, the tendency of liberalization in OECD countries is towards reducing entry barriers to their electricity market. We could not detect any statistically significant impact of assistance or aid on public ownership or vertical integration. Our results imply that if an OECD country receives foreign financial assistance or aid, its entry barriers score (on a 0-6 scale) reduces by 0.6 point.

**5.3. Results from the third group of models testing Hypothesis 3**

We could not detect any statistically significant result for the impact of government structure (single party or coalition) on overall electricity market liberalization process. The only exception is that single-party governments seem to reduce public ownership and vertical integration in OECD countries. The same holds true for the electoral system (majoritarian or presidential) with the only exception that public ownership score (on a 0-6 scale) of a country with parliamentary system tend to be 0.4 point less than one with presidential system. As for economic policy orientation of ruling party, our results imply that right wing governments do not have a statistically significant overall effect on reform process. However, we see that they reduce vertical integration in OECD countries. On the other hand, left wing governments seem to speed up the reform process in OECD countries.  Left wing governments in OECD countries reduce entry barriers and vertical integration scores (on 0-6 scales) by 0.42 and 0.38 points, respectively. Our findings suggest that as the number of years the chief executive has been in office increases, the reform progress slows down in OECD countries. We could not

detect a statistically significant relationship between political stability and reform process for non-OECD countries.

## 5.4. Results from the fourth group of models testing Hypothesis 4

Our results clearly show that the professional and educational background of head of executives (prime ministers, presidents and so on.) are significant for the reform process in OECD countries. For non-OECD countries, we could not identify a statistically significant relationship. In OECD countries, leaders with an educational background in economics or natural sciences influence the reform process. We could not detect such an effect for other university degrees. The same influence holds true for leaders with a professional background as businessman, scientist (economist and others), or politician. Our results do not indicate significant results for military officers. We observe a negative relationship between educational backgrounds in economics or natural sciences and the vertical integration score in OECD countries. This relationship is much stronger with an educational background in natural sciences. Our findings suggest that if the head of executive of a country has an educational background in economics or natural sciences, vertical integration score (on a 0-6 scale) of that country increases by 0.81 and 1.75 points, respectively. As for entry barriers and public ownership, we could not detect a meaningful relationship for an educational background in economics but leaders with a background in natural sciences seem to increase public ownership by 1.1 point. As for professional backgrounds, our study finds that businessmen speed up the regulatory reform in OECD countries while scientists (economists) and politicians slow the liberalization process down. If head of executive of a country has a professional background as entrepreneur, then public ownership and vertical integration scores (on 0-6 scales) of that country reduce by 0.45 and 0.59 points, respectively. On the

other hand, if s/he has a professional background as scientist (economist), entry barriers and vertical integration scores increase by 1.33 and 1.98 points, correspondingly. In OECD countries, heads of executive with a professional background as politician decreases public ownership but increases entry barriers and vertical integration. On the other hand, those with a background as scientist (other than economist) have a tendency to increase entry barriers but to reduce public ownership.

## 5.5. Results from the control variables

Out of 18 models we estimate, 12 models suggest that being an EU member country considerably contributes to efforts for electricity market liberalization. In most cases, this effect is large and statistically significant even at 1% level. The reverse holds true for being an OECD country. The results from 12 models imply that being an OECD country slows down electricity market liberalization process. The relative magnitude of these effects changes from one model to another. Therefore, being a member of both EU and OECD does not have a uniform effect on the reform process. Surprisingly, the existence of electricity market reform idea limits the reform progress, which implies that the early reformers had an advantage than the late comers in terms of reform implementation. This result may be explained by reform failures in some countries (e.g. California disaster). Population density and electricity consumption per capita seem to have a negative correlation with liberalization process in power industry, meaning that densely populated countries with higher per capita electricity consumption tend to liberalize their electricity markets less. On the other hand, per capita income, education level and imports of goods and services (% of GDP) tend to have a positive correlation with liberalization process. Countries with higher per capita income and education level that import a higher portion of goods and services from abroad introduce more reform

elements in their electricity markets. Finally, we see that country specific features tend to have a high power in explaining regulatory reform in electricity industries.

To sum up, based on our results, we reject Hypothesis 1 and partially reject Hypothesis 3; but clearly fail to reject Hypotheses 2 and 4.

## 6. Limitations of the study

The research may have a number of limitations that we acknowledge. In fact, we have no reason to believe that any of these limitations should be existent in our analysis, but cannot of course rule them out.

To start with, like all other econometric studies on electricity reform, the issue of endogeneity may be raised in our study. The analysis dealt to some extent with this potential problem by including country and year fixed effects. The country fixed effects control for country-specific propensities to reform and matters such as institutional characteristics, and year fixed effects control for any general trend in the reform of electricity sector. Also, problems associated with qualitative nature of data collection process tend to reduce the usefulness of cross-country data. Besides, objective comparisons across countries are inherently difficult in any study and our analysis is not an exception. The main steps of electricity reform process are usually established progressively and have a qualitative dimension. Accounting for these measures with the use of dummy variables does not reveal their true scope or intensity (Jamasb *et al.* 2004). To lessen the impact of this drawback, we did not use individual dummy variables for reform elements in our study. Instead, we used various electricity market reform indicators constructed by OECD and EBRD. Furthermore, our sample is composed of 55

countries for which we could obtain data on all variables in our models. There will be sample selection bias if the countries making this data available have differing results for the dependent variables than those which do not make data available. Finally, any measurement error and omission of explanatory variables may bias estimates of coefficients in the models. In our study, however, omitted variables may be captured at least in part by the country-specific effects, mitigating the potential for bias.

## 7. Conclusion

In this paper, we empirically analyze the political economy of reform in the electricity industries of 55 countries during the period 1975–2010, with the aim of shedding light on the differing pace of reform in different countries. Our findings are consistent with the rationale that the structure of political economic system has a strong effect on reform outcomes, and that the relative strength of economic and political variables matters for the implementation of the reforms. That is, consistent with a generalized interest group theory, our results suggest that a portion of the cross-country reform experiences of the electricity sector in the past three decades can be explained by differences in the political structure, in the ideology of the government and in the professional and educational backgrounds of the political leaders.

In the course of the study, we discover that democracy negatively affects the pace of reforms, maybe, by magnifying the voices of anti-reform interest groups. We also surprisingly notice that countries with a strong presence of pro-reform interest groups, indicated by a larger industrial sector, are less likely to liberalize their power industry. This may be an indication that industrial consumers prefer guaranteed subsidized prices in a closed market to the possibility of future reduced prices in a liberal market. Besides, as expected, our results imply

that countries receiving foreign financial support are more likely to liberalize their electricity markets, which underlines the point reforms may not be always voluntary. We also discover single-party governments have an accelerating impact on the reform process in OECD countries but government structure does not seem to affect liberalization process in non-OECD countries. Moreover, we see a negative relationship between the years the chief executive has been in office and the reform progress in OECD countries, which falsifies the assumed linkage between political stability and reform progress. Furthermore, our study identifies a decrease in vertical integration in electricity industry during the terms of parties with "right" or "left" ideologies in OECD countries. The ruling parties with "left" ideology seem also to reduce entry barriers in OECD countries.

The study also analyze whether politicians' education and profession matter for the introduction of market reforms. Overall, our results show that education and professional background of leaders are associated with the implementation of market reforms. According to our results, reforms are more likely to occur if the head of government has been an entrepreneur before entering into politics. Personal capabilities required to manage a company thus seem to be advantageous in promoting economic reform. Moreover, during the tenure of former professional economists, reforms are less likely. We also provide evidence that the reforms seem to progress slower in OECD countries if the head of executive has an educational background in economics or natural science. Especially, those with a background in economics increase vertical integration while those with a background in natural science increase both vertical integration and public ownership in the sector. In summary, our analysis confirms that the personal background of political leaders may be important. The most important single policy implication that can be derived from these findings is that future reforms should give due attention to the political economic environment of the countries.

**Acknowledgements**

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