A cross-country analysis of electricity market reforms: Potential contribution of New Institutional Economics

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contribution of New Institutional Economics[1]

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Abstract

The paper explores whether the question of why some countries are able to implement more extensive reforms is closely related to the question of why some countries have better institutions than others. We analyse this question by using an empirical econometric model based on Poisson regression with cross-section data covering 51 states in US, 13 provinces in Canada and 51 other countries. In the course of the study, we check the validity of three important arguments of New Institutional Economics (NIE) for the power market liberalization process. The first argument is the "path-dependency". To test its impact on the reform progress, we try to explain whether the background of the chairperson of the regulatory agency when reforms started or that of the governor/minister responsible for energy policy at that time has an impact on the subsequent reform progress. The second argument is the impact of "democracy" as an institution on the reform progress. We look at the effect of two important indicators of democracy (i.e., civil liberties and political rights) on the reform progress. The final argument of NIE is about transaction costs. We concentrate on the level of

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corruption in a country as one of the key factors that determine transaction costs and try to explore its impact on the reforms. The results show that the backgrounds of the chairperson and the minister/governor, the level of democracy and corruption in a country are significantly correlated with how far reforms have gone in that country. The negative relationship between reform progress and civil liberties may indicate that reforms may be limited in democratic countries with strong civil society institutions such as trade unions or other organized structures in the society that may consider reforms as 'harmful' to their self-interest.

Keywords: Econometric modelling; institutions; international economics; electric utilities

JEL Classification: C5; E02; F; L51; L94

1 Introduction

One of the main objectives of any economic reform is to bring changes in the institutional arrangement so that economic activities can be performed more efficiently. Besides, reforming any sector in an economy requires changing the institutional environment, changing the organisational structure and modifying the governance mechanism. Since the late 1980s, power market reform has become the standard prescription of the multilateral donor agencies like the IMF and the World Bank and the reform program has been implemented vigorously for about three decades now. Although the content of each reform program has differed from one country to another, the policy of functional disintegration, the establishment of regulatory authorities, the formation of wholesale and retail power markets and the privatization of the electricity industry have been generally regarded as the natural components of a reform program without paying much attention to the institutional environment of the country.

Electricity market reform process takes place and is directly affected by the macro level institutional structure of the country in which the reforms are put into practice. The examples of macro level institutional structure of a country include its legal system, measures that guarantee security of

property rights in this country, the degree of political and civil rights provided by the political regime, investment environment in the country and so on. Through reform measures, the pre-reform structure of a power market is transformed into post-reform structure. In general, pre-reform structure corresponds to public monopolies or regulated private monopolies and post-reform structure refers to a competitive electricity market where competition at retail or, at least, wholesale level is possible. Throughout the paper, the concept of "reform" refers to a specific process started in Chile in 1982 for the first time; so, we consider "regulated private monopoly" in pre-1982 period as a form of regulation, not reform. Usually, post-reform structure has some undesirable features that trigger further reforms in the power market. So, post-reform structure of the previous wave of reforms constitutes the pre-reform structure of the latter wave of reforms and the process goes on as such. These cycles of reforms produce economic, social, political and environmental impacts, which may have an impact on the decisions concerning the direction of reforms.

Today, most countries have initiated some reform of their power sector. In some countries, the reforms have progress a lot and transformed the structure of the industry fundamentally. However, the progress has been limited in many parts of the world, especially in developing countries. As reform pauses or progresses slowly, developing countries in particular face problems such as lack of adequate funding for new capacity addition, neglect of utility operation and management, and increase in government involvement in the management and decision-making of the industry, contrary to the expected objectives of the reform (Bhattacharyya, 2007).

The purpose of this paper is to find out whether the question of why some countries are able to implement more extensive reforms is closely related to the question of why some countries have better institutions than others. The interest and motivation for this topic arises from the relatively recent agreement that has emerged among scholars in regarding institutions as a key factor shaping the outcome of an economic transformation. This objective is pursued by discussing implications of the conceptual framework proposed by the New Institutional Economics for power market reform. Besides, evidence resulting from an econometric empirical analysis that investigates the relationship between institutions and reforms is presented as well.

The reform experience so far (especially in developing countries) suggests two consistent findings. First, institutional endowments of a country (such as judicial independence, integrity of the legal system, protection of property rights, legal enforcement of contracts and degree of polity) largely determine the extent of the reforms (Acemoglu et al., 2008; Acemoglu et al., 2001, 2005; Robinson and Acemoglu, 2013). Second, despite the different approaches in the design of regulatory institutions, a separate agency from the government with reasonable levels of autonomy and technical expertise has emerged as the preferred model for a regulatory institution. Due to path dependency, the chairperson of electricity market regulatory agency when reforms started or were considered and the governor/minister responsible for energy policy at that time may play a critical role in the process. Therefore, in this study, we focus on general institutional endowments and backgrounds of the chairperson and the minister/governor as key factors explaining differences in the extent of the reforms implemented in various countries.

We try to answer the following research questions: (i) do differences in institutional structures of countries play an important role in explaining how far reforms have gone in these countries? (ii) if they do, how do specific institutional endowments of a country affect its reform performance? (iii) does the background of the chairperson of the regulatory agency when reforms started or were considered or that of the governor or minister responsible for energy policy at that time have an impact on reform progress?

The paper proceeds as follows. The next section provides a conceptual framework and literature review. Section 3 develops research hypotheses. Section 4 summarizes the methodological framework and describes data. Section 5 presents empirical analysis. Following section discusses the results. The last section concludes.

2 Conceptual framework and literature review

In recent years the role of institutions in promoting and sustaining economic change has been an issue of interest for both theoretical and empirical analyses. The main question is "*what determines the divergent patterns of evolution of countries or economies over time?*" Africa's disappointing economic performance, the East Asian financial crisis, and the weak record of the former Soviet Union have also contributed to an increasing focus on the role of institutions in determining a country's economic growth and performance (Aron, 2000). Within this context, New Institutional Economics (NIE) has emerged as the body of economic thought that considers institutions to be relevant to economic theory, and criticizes the neo-classical mainstream for having pushed them out of the discipline; it deals especially with the nature, origin and evolution of institutions, and their effects on economic performance (Chavance, 2009).

The increasing focus on NIE is also evident in World Bank publications. World Bank (1997, 2002) recommends that states develop strong regulatory mechanisms to encourage legal accountability, minimize corruption, and foster competition via privatization. The World Bank regards privatization as a solution to rent-seeking behaviour of corrupt officials. In response to the bureaucracy's drain on public resources, competition, it is argued, will raise the transaction cost of seeking protection and subsidy from the state, and henceforth promote efficiency between firms.

New institutional economics contributes to the analysis of power sector reforms in multiple ways. First of all, NIE underlines that institutions matter for any economic reform and electricity market reform is not an exception. In essence, electricity market reform is an institutional reform that necessitates *de facto* or *de jure* regime change, creation of new institutional structures and rearrangement or removal of existing ones. Institutions may determine the divergent patterns of evolution of reform processes in various countries over time. In the literature, the relationship between institutions and economic transformations has been investigated by many scholars. For instance, the link between political institutions and economic change is explored by Aghion et al. (2008), Alesina et al. (1996), Alesina and Rodrik (1994), Besley and Kudamatsu (2008), Caselli et al. (1996), Clague et al. (1996), Drury et

al. (2006), Helliwell (1994), Isham et al. (1997), Mauro (1995), Persson and Tabellini (2008) and Scully (1988); while the impact of economic institutions on economic change is investigated by Assane and Grammy (2003), Barro (1991, 1996, 2000), Keefer and Knack (1997), Persson and Tabellini (1994), Spindler (1991) and Vanssay and Spindler (1994).

Second, while analysing reforms in electricity markets, the standard neoclassical assumptions that we have perfect information and unbounded rationality and that transactions are costless and instantaneous should be abandoned. NIE implies that information during whole reform process is rarely complete, and transactions related to reform process have costs associated with them, such as costs of finding out what and how to reform, of negotiating the reform direction with interested parties, of passing necessary legislation, and then of monitoring and enforcing it.

The third contribution of NIE is its suggestion that reformers should see institutions as means of reducing information and transaction costs related to reform design and implementation; and never forget that institutions may easily turn into critical constraints on reform performance if not taken into account properly. Fourth, NIE maintains that there is a fundamental relationship between property rights, transaction costs and institutions. When property rights are not clearly defined in the course of an electricity market reform, transaction costs increase and reforms may fail.

The fifth advice from NIE for electricity market reform is that policy makers should pay due attention to non-market transaction costs faced by the firms in the market and do their best to eliminate or, at least, minimize them. The sixth repercussion of NIE relevant to electricity reform is that the process of electricity market reform is largely path dependent, which may explain why some countries succeed and others do not in reforming their power sectors. So, getting the institutions right is critical to reform success as getting them wrong can lead to path-dependency, whereby inefficient electricity markets may persist. So, to prevent inefficient institutional structures in the subsequent reform phases, the utmost attention should be paid to arrangements at the very beginning of the reform programs. Right people should set up right structures. In this context, the chairperson of the electricity market regulator

and the minister responsible for energy policy when reforms started may have an important impact on subsequent reform progress.

To sum up, the NIE approach suggests that the differences in performances of different reform processes are related to institutional endowments. The success or failure of a power market reform initiative depends to some extent on whether a strong legal system, a proper investment environment, clearly defined property rights, control structures for enforcing necessary legislation and enforceable contracting arrangements exist or not. When we take into account the notion that democratic systems encourage and support private participation and free enterprise in the economy, we may assume that democratic countries advance more rapidly in terms of power market reform process than those with less democratic systems. Given the institutional environment, the opportunities provided by the institutional environment will be reflected in the nature and performance of reform process.

In this context, the role of incentive-based regulation in the reform process should be underlined. The market designing and institutional development that followed the power sector reform in many countries has been supported by the ideas of putting in practice price-cap regulation. Incentive-based regulation can be defined as the conscious use of rewards and penalties to encourage good performance in a utility sector. Incentive regulation is often used to regulate the overall price level of utilities. There are four primary approaches to regulating the overall price level: rate of return (or cost of service) regulation, price cap regulation (RPI-X regulation), revenue cap regulation, and benchmarking (or yardstick) regulation. Generally regulators use a combination of these basic forms of regulation. Combining forms of regulation is called hybrid regulation. For example, UK regulators (e.g. Ofgem) combine elements of rate of return regulation and price cap regulation to create their form of RPI - X regulation. Laffont (1994) mentions the new economics of regulation, which is defined as an application of the principal-agent methodology to the contractual relationship between regulators and regulated firms. Laffont (1994) provides a survey of the main results obtained in the new economics of regulation, in particular concerning the implementation of optimal contracts by a menu of linear contracts, the dichotomy between pricing and cost reimbursement rules, the auctioning of incentive contracts, the dynamics of contracting under limited commitment, and the hierarchical

problems in regulation. Laffont (2005), on the other hand, provides the first theoretical analysis of regulation of public services for developing countries. He shows how the debate between price-cap regulation and cost of service regulation is affected by the characteristics of less developed countries (LDCs) and offers a positive theory of privatization that stresses the role of corruption. He develops a new theory of regulation with limited enforcement capabilities and discusses the delicate issue of access pricing in view of LDC's specificities.

3 Hypothesis development

As indicated in the literature we summarized above, the NIE approach suggests that the differences in performances of different reform processes are related to institutional endowments. This section of the paper develops three hypotheses derived from the NIE approach, which are then tested empirically in the next sections of the paper.

3.1 Hypothesis on the background of key policy makers and implementers

One of the main repercussions of NIE relevant to electricity reform is that the process of electricity market reform is largely path dependent, which may explain why some countries succeed and others do not in reforming their power sectors. So, getting the institutions right is critical to reform success as getting them wrong can lead to path-dependency, whereby inefficient electricity markets may persist. So, to prevent inefficient institutional structures in the subsequent reform phases, the utmost attention should be paid to arrangements at the very beginning of the reform programs. Right people should set up right structures. In this context, the chairperson of the electricity market regulator and the minister responsible for energy policy when reforms started may have an important impact on subsequent reform progress.

The ministers responsible for energy-related issues in countries or governors in US states or Canadian provinces set general policies for electricity industry and the regulatory agencies put these policies into practice. Both policy setting and policy implementation are crucial factors that explain the reform

progress in any country. Besides, path dependency implies that the chairperson of electricity market regulatory agency when reforms started or were considered and the governor or minister responsible for energy policy at that time play a critical role in the progress of subsequent reform process. For instance, in Argentina, Carlos Bastos, Secretary of Energy between 1991-96, led the privatisation of the electricity sector within the general policy framework of the Minister of Economy. Bastos was formerly an electrical engineer, researcher and a consultant on electricity issues for the Inter-American Development Bank and the Harvard Institute for International Economic Development. He brought the conceptual vision and insistence on a reformed, privately owned and competitive sector. He gave general direction and control to the privatisation of the energy sector, and took on the political battles, including with parties from the existing industry. The reform was along similar lines to the UK, and even went further with respect to restructuring (Littlechild and Skerk, 2004).

As summarized in Dreher et al. (2009), there is also a growing literature connecting personal traits of policy makers and implementers with policy outcomes. Jones and Olken (2005) find that unpredictable changes in a country's leadership due to the incumbent's death can trigger changes in gross domestic product growth. Göhlmann and Vaubel (2007) provide recent empirical evidence on the impact of education and profession on policy. Their results show that education and profession of the central bank's governing council members matter for the effectiveness in controlling inflation. Regarding education of policy makers, Duflo (2005) shows that reservation of political power for historically disadvantaged groups and women in India does not come at the expense of the quality of decision making, even though reservation brings to power a group of relatively inexperienced and less educated politicians. Besley et al. (2005), to the contrary, use household survey data from India and find that differences in the performance of Indian village politicians are systematically linked to politicians' education. This evidence leads a corresponding World Bank (2005) report to conclude "that more educated politicians are better" adding to "a growing appreciation among economists that education [of politicians] may be important because of its role in inculcating civic values." Besides, previous research suggests that policy outcomes may depend on the time a politician spends in office. For example, Roubini and Sachs (1989) suggest that there is a tendency towards larger deficits in countries characterized by a short average tenure of government.

To sum up, policy makers decide on policies and reform strategies and policy implementers put them into practice. When it comes to designing and implementing a reform policy, politicians' education and professional experience is likely to be important. As Kotsogiannis and Schwager (2006) maintain, "the implementation of new and unknown policies is more demanding than running 'business as usual' since it requires imaginative leadership on the part of a governor, rather than operational routine." Politicians with a certain educational or professional background may be more likely than others to demonstrate such kind of leadership. These politicians thus may have an advantage in fostering reforms. According to Rajan (2004), for example, the "gains from reform are never as clear to the wider public as they are to economists." Hence, reforms might be delayed due to a lack of understanding and education. Some background education in economics could be advantageous for politicians in implementing reforms as they are more likely to distinguish good from bad advice and might be more able to resist the pressure of lobbying groups preferring the status quo. This knowledge might bring them into a better bargaining position as well. They might also have an advantage in communicating the consequences of reforms to the public and the parliament, thus decreasing uncertainty and overcoming the deadlock (Dreher et al., 2009). These considerations lead us to posit the following hypothesis.

> **Hypothesis 1:** *Due to path-dependency, the background of the chairperson of the regulator and that of the governor or minister responsible for energy policy when reforms started have an impact on overall reform progress.*

The New Institutional Economics and the literature summarized above suggest that personal qualifications may matter for the reform progress and some applied studies mentioned above confirm this. In our analysis, we check whether this is also the case for the electricity industry. We do not support or oppose the idea that personal qualifications are important determinants of any reform progress. Hence, Hypothesis 1 is both an immediate application of the NIE and a direct parallel with the empirical findings reported in the literature we cited above. While examining the relationship between the backgrounds of policy makers and implementers and electricity market reforms, the latter

(dependent variable) is represented by the electricity market reform score variable. On the other hand, variables on experience, length of term, education level and educational background of chairpersons and ministers constitute causal variables that represent backgrounds of policy makers and implementers. The details of these variables are provided in the following sections. Like most of other similar analyses; we assume that experience in the industry, length of term, education level, educational background reflect personalities of policy makers and implementers. Of course, there may be some other relevant aspects of the personalities that cannot be measured. However, since we cannot measure such aspects, we cannot include them into our analysis.

We expect a statistically significant relationship between the backgrounds of policy makers and implementers and electricity market reform progress; however, direction of this relationship cannot be predicted theoretically. So, we do not develop hypotheses on the direction of this relationship.

3.2 Hypothesis on the impact of democracy on the reforms

According to the NIE theory, institutions are means of reducing information and transaction costs related to reform design and implementation; and they may easily turn into critical constraints on reform performance if not taken into account properly. So, the performance of a reform program largely depends upon the formal and informal institutions, which affect the reforms by influencing the level of transaction costs and, hence, the feasibility of engaging in a reform initiative. Besides, the NIE approach maintains a fundamental relationship between property rights, transaction costs and institutions. Institutional environments that fail to offer credible commitments against arbitrary changes in the rules of the game, including expropriation, raise transaction costs throughout the economy. Also, when property rights are not clearly defined in the course of an electricity market reform, transaction costs increase and reforms may fail. In this context, democracy is one of the most important institutions in a country that determines the credibility of commitments concerning property rights and transaction costs; and therefore, is expected to influence power market reforms. Based on the considerations above, we develop the hypothesis below.

Hypothesis 2: *The level of democracy in a country has an impact on reform progress.*

This hypothesis is an immediate application of the New Institutional Economics. According to NIE approach, the progress in electricity market reforms constitutes a possible outcome and the level of democracy in a country may be one of the determinants of this outcome. By developing this hypothesis, we check whether this correlation actually exists. While examining the relationship between the level of democracy and electricity market reforms, reform progress is represented by the electricity market reform score variable while the level of democracy is signified by two variables, namely political rights score and civil liberties score. The details of these variables are provided in the following sections.

Democracy is a form of government in which all eligible citizens have an equal say in the decisions that affect their lives. Democracy allows eligible citizens to participate equally -either directly or through elected representatives- in the proposal, development, and creation of laws. So, democracy enables both pro- and anti-reform groups to voice their concerns about power market reforms. Therefore, the direction of the impact of democracy on electricity market reforms depends on the composition and relative strength of interest groups in each country, and therefore, cannot be established theoretically.

3.3 Hypothesis on the impact of corruption on the reforms

NIE suggests that the standard neoclassical assumptions that we have perfect information and unbounded rationality and that transactions are costless and instantaneous should be abandoned while analysing reforms in electricity markets. The NIE implies that information during whole reform process is rarely complete, and transactions related to reform process have costs associated with them, such as costs of finding out what and how to reform, of negotiating the reform direction with interested parties, of passing necessary legislation, and then of monitoring and enforcing it. NIE pays attention also to non-market transaction costs faced by the firms. In addition to the costs of searching where information is not efficiently distributed and undertaking economic activity in compliance with

rules and regulations; this type of transaction cost includes the cost associated with corruption in a country (e.g. bribing officials to cut through red tape). Besides, the literature on the factors that influence the decision to reform an infrastructure industry by introducing competition has emphasized the role of corruption of the political system. For instance, Emerson (2006) develops a model where rent seeking firms agree to pay bribes to policy makers to limit market entry. Since corruption increases transaction costs in a country, we expect a negative relationship between the level of corruption and reform progress. Therefore, we suggest the following hypothesis.

> **Hypothesis 3:** *Countries with relatively high corruption tend to introduce less electricity market reforms.*

This hypothesis is also an immediate application of the New Institutional Economics. While examining the relationship between corruption and electricity market reforms, reform progress is represented by the electricity market reform score variable while corruption perceptions index represents the level of corruption in a country. The details of these variables are also provided in the next sections.

3.4 Control variables

Control variables are independent variables not directly related to the background of key policy makers and implementers, level of democracy or corruption; but still may explain a portion of the variations in reform progress. Along with the background of key policy makers and implementers, level of democracy and corruption; we expect that reforms may be affected by the size of population, income level, investment environment, the level of authoritarianism and security of property rights in a country. We also expect that OECD membership may have an impact on the reform progress, and therefore include a dummy variable representing OECD membership into our analysis. The details of these variables are presented in the following sections, too.

4 Methodology and data

In our study, the scope of the reforms in each country is represented by the electricity market reform score variable. Therefore, in our analysis, we describe the electricity market reform score as a function of (a) the background of the chairperson of electricity market regulatory agency when reforms started or were considered; (b) the background of the governor or minister who was responsible for energy policy at that time; (c) corruption perceptions index, civil liberties and political rights scores; and (d) control variables (i.e. population, GDP per capita, dummy variable for being an OECD country, investment freedom index, polity score and property rights index).

In our analysis, our dependent variable is limited, that is, it is a count variable, which can take on nonnegative integer values, $Y_i \in \{0,1,2,3,4,5,6,7,8\}$. As we know, normality is the standard distributional assumption for linear regression. The normality assumption is reasonable for continuous dependent variables that can take on a large range of values. A count variable cannot have a normal distribution (because the normal distribution is for continuous variables that can take on all values), and if it takes on very few values, the distribution can be very different from normal. Instead, the nominal distribution for count data is the Poisson distribution; so we have a Poisson model in our analysis. In principle, the Poisson model is simply a nonlinear regression. It is much easier to estimate the parameter with a maximum likelihood method. While employing Poisson regression, we should keep in mind two important points. First, we cannot directly compare the magnitudes of the Poisson estimates of an exponential function with the OLS estimates of a linear function. Second, although Poisson analysis is a natural first step for count data, it may be restrictive. All of the probabilities and higher moments of the Poisson distribution are determined entirely by the mean. In particular, the variance is expected to be equal to the mean. This is restrictive but, fortunately, the Poisson distribution has a very nice robustness property: whether or not the Poisson distribution holds, we still get consistent, asymptotically normal estimators of coefficients.

Since interpretation of coefficients from a Poisson regression is not straightforward, the incidence rate ratios (IRR) are obtained by exponentiating the Poisson regression coefficients. When we use IRR option, estimated coefficients are transformed to incidence-rate ratios. Standard errors and confidence intervals are similarly transformed. This option affects how results are displayed, not how they are estimated. As we discussed before, Poisson regression coefficients are interpreted as the difference between the log of expected counts. We also know that the difference of two logs is equal to the log of their quotient, log(a) – log(b) = log(a/b), and therefore, we could have also interpreted the parameter estimate as the log of the ratio of expected counts: this explains the "ratio" in incidence rate ratios. In addition, what we referred to as a count can also be called a rate. By definition a rate is the number of events per time (or space), which our response variable qualifies as. Hence, we could also interpret the Poisson regression coefficients as the log of the rate ratio: this explains the "rate" in incidence rate ratio. Finally, the rate at which events occur is called the incidence rate; thus we arrive at being able to interpret the coefficients in terms of incidence rate ratios.

Because of the restrictions on the length of the paper and because it is not one of the aims of this paper, further details of Poisson regression is not presented here but available from Winkelmann (2008), Cameron and Trivedi (1998) and Wooldridge (2009).

Our data set is cross-section and covers 51 states in US, 13 provinces in Canada and 51 other countries[3]. In total, we have 115 potential observations for each variable. Table 1 shows descriptive statistics of the variables used in the study. The sample countries and states in our analysis are determined by data availability. We have some missing observations in our dataset. We acknowledge that the states in US and provinces in Canada are not comparable to other countries. We are aware of the fact that analysing individual states and provinces together with countries create some practical

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[3] Albania, Argentina, Armenia, Australia, Austria, Bangladesh, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Cambodia, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, India, Ireland, Italy, Jamaica, Kenya, Latvia, Lithuania, Luxembourg, Macedonia, Malaysia, Mexico, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Philippines, Poland, Portugal, Romania, Russia, Serbia, Singapore, South Africa, Spain, Thailand, Turkey, Uganda, United Kingdom.

and econometric problems. To avoid these problems, we provide results with and without states in US and provinces in Canada separately.

Table 1. Descriptive statistics of the variables

Variables	# of obs.	Mean	Std. Dev.	Min.	Max.
Electricity market reform score in 2011	115	5.48	2.24	1	8
Chairperson[*]					
His/her experience in electricity industry at appointment (years)	95	6.59	8.58	0	36
Length of term (years)	100	4.97	3.05	0	14
Education level (1: BSc, 2: MSc, 3: PhD)	94	1.89	0.99	0	3
Educational background in					
- Business or economics	94	0.40	0.49	0	1
- Engineering	94	0.20	0.40	0	1
- Law	94	0.44	0.50	0	1
- Other	94	0.15	0.36	0	1
Energy minister/governor[**]					
His/her experience in electricity industry (years)	101	3.40	4.92	0	36
Length of term (years)	106	3.48	2.06	0	10
Education level (1: BSc, 2: MSc, 3: PhD)	103	1.64	0.95	0	3
Educational background in					
- Business or economics	103	0.26	0.44	0	1
- Engineering	103	0.17	0.37	0	1
- Law	103	0.31	0.47	0	1
- Other	103	0.44	0.50	0	1
Other explanatory variables					
Civil liberties score in 2011	115	1.60	1.15	1	6
Political rights score in 2011	115	1.62	1.32	1	7
Corruption perceptions index in 2010	115	6.37	2.06	2	9
Control variables					
Population in 2010 (million people)	115	41.80	166.67	0.03	1,338.30
Log of population in 2010	115	1.83	1.86	-3.40	7.20
GDP per capita in 2010 (thousand $)	115	36.43	22.49	1.26	172.25
Log of GDP per capita in 2010	115	3.32	0.91	0.23	5.15
OECD country dummy	115	0.75	0.44	0	1
Investment freedom index in 2011	115	70.83	12.94	25	95
Polity score in 2010	114	8.79	3.13	-10	10
Property rights index in 2011	115	72.61	22.33	20	95

[*] *The Chairperson* refers to the chairperson of electricity market regulatory agency when reforms started or were considered.

[**] *Energy minister/governor* refers to the governor or minister who was responsible for energy policy when reforms started or were considered.

Electricity market reform score in 2011 variable takes the values from 0 to 8; depending on how many of the following reform steps have been taken in each country as of 2011: (1) introduction of independent power producers, (2) corporatization of state-owned enterprises, (3) law for electricity sector liberalization, (4) introduction of unbundling, (5) establishment of electricity market regulator, (6) introduction of privatization, (7) establishment of wholesale electricity market, and (8) choice of supplier. To build this variable, we created 8 dummy variables for each of the reform steps mentioned above and calculated the total number of reform steps taken in each country. Dummy variables for reform steps are created based on the data collected and cross-checked from various international and national energy regulators' web sites[4]. Table 1 presents the distribution of countries in our dataset based on region and income. In the table, countries with a GDP per capita between 0-10 thousand current international USD are classified as "low-income countries" while those with a GDP per capita between 10-30 thousand and 30 thousand and more are classified as "middle-income countries" and "high-income countries", respectively. Figure 1 provides the histogram of the reform score variable showing the frequency of observations while Figure 2 shows current status of electricity reform in US states (US EIA, 2010). When we evaluate Figure 1, we see that all countries in our dataset have taken at least one reform step and more than half of them have taken 5 or more reform steps.

Table 2. Distribution of countries in our dataset based on region and income

	Low-income countries	Middle-income countries	High-income countries
Africa	Uganda (5), Kenya (5), Nigeria (6)	South Africa (5)	
Asia	Bangladesh (5), Cambodia (4), Pakistan (6), India (7), Philippines (7), Armenia (7), China (5), Thailand (5)	Malaysia (6), Russia (7)	Singapore (8)
Europe	Bosnia and Herzegovina (4), Albania (6)	Macedonia (6), Serbia (2), Bulgaria (8), Romania (8), Turkey (8), Latvia (8), Lithuania (7), Croatia (7), Poland (8), Estonia (6), Czech Republic (8), Portugal (8), Greece (8), Cyprus (3)	Italy (8), Spain (8), France (8), United Kingdom (8), Finland (8), Belgium (7), Germany (8), Denmark (8), Austria (8), Ireland (7), Netherlands (7), Norway (8), Luxembourg (6)
North America			Canada (3.5), US (4.8)
S. America & Pacific	Jamaica (5), Colombia (7)	Brazil (7), Mexico (3), Argentina (7)	New Zealand (8), Australia (8)

Note: Reform scores of the countries are shown in parentheses.

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[4] The full list of sources from which data are obtained can be found at IERN web site (http://www.iern.net).

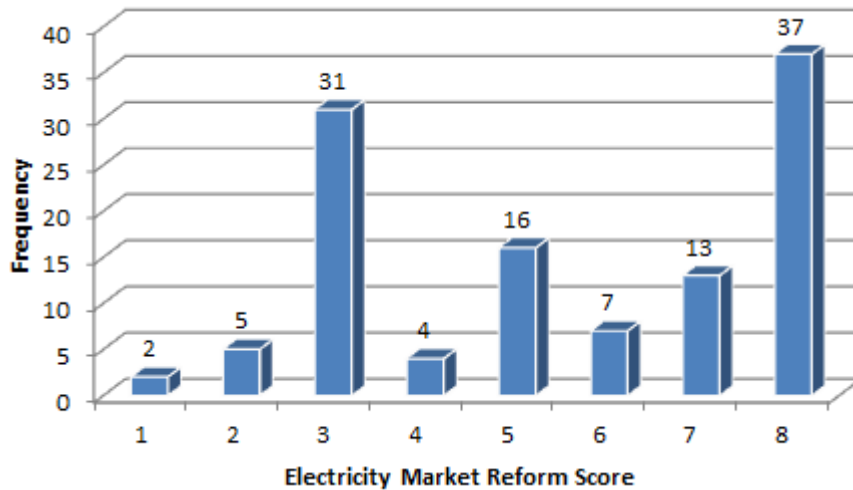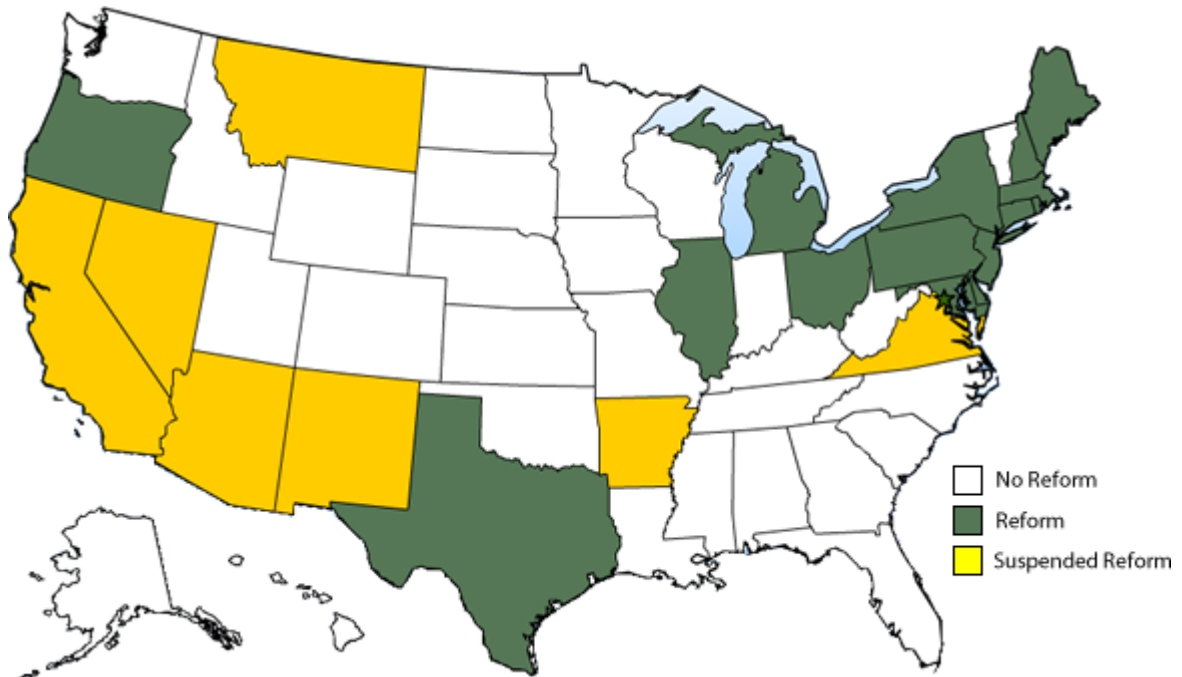**Figure 1.** Histogram of reform score variable

Figure 2. Electricity reform in US states as of 2011

Some countries considered introducing electricity market reforms but decided not to implement such reforms in their power markets. Some other countries also considered implementing reforms and decided to do so. For reforming countries, we collected data on the background of the chairperson of electricity market regulatory agency **when reforms started**, and the governor or minister who was responsible for energy policy at that time. For non-reforming countries, we collected data on the background of the chairperson of electricity market regulatory agency **when reforms were**

considered, and the governor or minister who was responsible for energy policy at that time. The data on chairperson include his/her experience in electricity industry, his/her length of term, his/her education level (BSc, MSc or PhD) and his/her educational background (business or economics, engineering, law, other/unknown). We also gathered data about the governor or minister who was responsible for energy policy when reforms started or were considered. Similarly, these data include his/her experience in electricity industry, his/her length of term, his/her education level (BSc, MSc or PhD) and his/her educational background (business or economics, engineering, law, other/unknown). Here, two points are important. First, in our study, the length of term refers to time period that the regulator or minister/governor remained in office after the reforms started or were considered. Second, we are only interested in the regulators or ministers/governors when the reforms started or were considered; and collected data on their background. We are not interested in the regulators or ministers/governors in office when the data were collected, and our dataset do not include observations on them.

The data on chairpersons and the ministers/governors are obtained from various reports and documents published by regulatory agencies and ministries of the countries. While deciding on which educational backgrounds to include into our analysis, we select the three most common backgrounds, namely business or economics, engineering and law. We also create an "other/unknown" category to represent other educational backgrounds. For instance, when we look at the educational backgrounds of chairpersons, we see that 36.6% of them have a background in law, 33.9% in business or economics, 17% in engineering and 12.5% in other/unknown educational backgrounds.

Civil liberties and political rights scores for 2011 are taken from Freedom House (2011). The Freedom in the World survey conducted by Freedom House provides an annual evaluation of the state of global freedom as experienced by individuals. The survey measures freedom -the opportunity to act spontaneously in a variety of fields outside the control of the government and other centres of potential domination- according to two broad categories: political rights and civil liberties. Political rights enable people to participate freely in the political process, including the right to vote freely for distinct alternatives in legitimate elections, compete for public office, join political parties and organizations,

and elect representatives who have a decisive impact on public policies and are accountable to the electorate. Civil liberties allow for the freedoms of expression and belief, associational and organizational rights, rule of law, and personal autonomy without interference from the state. Political rights and civil liberties scores range from 1 to 7, with 1 representing the highest and 7 the lowest level of freedom. Since civil liberties and political rights are two important but different components of democracy, Freedom House does not provide a composite variable. A composite variable may be created by taking the average of these two scores, but then it cannot be argued that new variable represents democracy and therefore we do not prefer to use it in our analysis.

Corruption perceptions index for 2010 is taken from Transparency International (2011). It ranks countries according to their perceived levels of public sector corruption on a scale of 0 (highly corrupt) to 10 (very clean). Perceptions are used because corruption is to a great extent a hidden activity that is difficult to measure. The index is an aggregate indicator that combines different sources of information about corruption, making it possible to compare countries. The index draws on assessments and opinion surveys carried out by independent and reputable institutions. These surveys and assessments include questions related to the bribery of public officials, kickbacks in public procurement, embezzlement of public funds, and the effectiveness of public sector anti-corruption efforts.

Data on population and GDP per capita of the countries and the states in 2010 are taken from World Bank (2010), Statistics Canada and US Census Bureau. Since using the logarithm of a variable enables us to interpret coefficients easily and is an effective way of shrinking the distance between values, we transform population and GDP per capita variables into logarithmic form and use these transformed variables in our model. We also include a dummy variable into our dataset to represent OECD member countries.

The data on polity score for each country in 2010 are obtained from Center for Systemic Peace (CSP, 2010). The polity score ranges from +10 (strongly democratic) to -10 (strongly autocratic). Investment freedom index and property rights index scores for 2011 are provided by Heritage Foundation (2011)

and both indexes range from 0 to 100. In an economically free country, there would be no constraints on the flow of investment capital. Individuals and firms would be allowed to move their resources into and out of specific activities both internally and across the country's borders without restriction. Such an ideal country receives a score of 100 in Heritage Foundation's Investment Freedom Index. In practice, however, most countries have a variety of restrictions on investment. Some have different rules for foreign and domestic investment; some restrict access to foreign exchange; some impose restrictions on payments, transfers, and capital transactions; in some, certain industries are closed to foreign investment. Moreover, labour regulations, corruption, red tape, weak infrastructure, and political and security conditions can also affect the freedom that investors have in a market. The index evaluates a variety of restrictions typically imposed on investment. Points are deducted from the ideal score of 100 for the restrictions found in a country's investment regime. Moreover, the property rights index assesses the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the government. It measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyses the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. The more certain the legal protection of property, the higher a country's score; similarly, the greater the chances of government expropriation of property, the lower a country's score.

5   **Empirical analysis**

Throughout our analysis, we explain electricity market reform score as a function of (i) the background of the chairperson of electricity market regulatory agency when reforms started or were considered, (ii) the background of the governor or minister who was responsible for energy policy at that time, (iii) corruption perceptions index, civil liberties and political rights scores, and (iv) control variables.

The assumption of the Poisson model is that the conditional mean is equal to the conditional variance. Poisson regression will have difficulty with over dispersed data, i.e. variance much larger than the

mean. Therefore, before starting our analysis, we need to look at the mean and variance of our dependent variable, that is, electricity market reform score. In our case, the mean of reform score variable is 5.48 and the variance is 5.01. Even though these numbers are for the unconditional mean and variance it can be informative because it gives us some indication of whether a Poisson regression should be used. In our analysis, reform score variable appears not to be overdispersed, as the mean is larger than the variance, and the predictor variables should help, so it may be reasonable to fit a Poisson regression model. Moreover, to make sure that Poisson regression is an appropriate tool to analyse our dataset, we report the results of the two Poisson goodness-of-fit tests (Deviance and Pearson goodness-of-fit tests) in the regression output table. The large value for chi-square in these tests may be an indicator that the Poisson distribution is not a good choice. A significant ($p < 0.05$) test statistic from the tests indicates that the Poisson model is inappropriate. In our model, values for chi-square in these tests are quite small and the test statistics are insignificant even at 80% level. So, it is obvious that Poisson regression is an appropriate method for our analysis.

We start the empirical analysis by estimating a Poisson regression for our model[5]. Cameron and Trivedi (2009) recommend the use of robust standard errors when estimating a Poisson model, so we use robust standard errors for the parameter estimates. Table 2 presents Poisson estimation results. In the output table, we also report "Log pseudolikelihood", which is the log likelihood of the fitted model. It is used in the calculation of the Likelihood Ratio (LR) chi-square test of whether all predictor variables' regression coefficients are simultaneously zero. Moreover, we provide the number of observations. This is the number of observations used in the Poisson regression. It may be less than the number of cases in the dataset if there are missing values for some variables in the model. By default, Stata and Eviews do a listwise deletion of incomplete cases. Besides, we also report *Wald chi2* value, which is the LR test statistic for the omnibus test that at least one predictor variable regression coefficient is not equal to zero in the model. The degrees of freedom (the number in parenthesis) of the LR test statistic are defined by the number of predictor variables. Finally, "Prob>chi2" value indicates the probability of getting a LR test statistic as extreme as, or more so, than the one observed under the

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[5] Throughout the paper, model estimations are carried out and cross-checked by Stata 12.0 and Eviews 7.1.

Table 3. Poisson regression estimation results for the full sample

Variables	Variable Type	Coefficient	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
Electricity market reform score	Dependent						
Chairperson of the regulator when reforms started/considered							
His/her experience in electricity industry at appointment	Explanatory	0.001	0.0039	0.35	0.730	-0.0063	0.0090
Length of term	Explanatory	0.019	0.0129	1.44	0.149	-0.0066	0.0438
Education level (1: BSc, 2: MSc, 3: PhD)	Explanatory	0.073*	0.0442	1.65	0.098	-0.0136	0.1597
Educational background in							
- Business or economics	Explanatory	-0.186*	0.1106	-1.69	0.092	-0.4031	0.0303
- Engineering	Explanatory	0.083	0.1085	0.76	0.447	-0.1301	0.2953
- Law	Explanatory	0.002	0.1117	0.02	0.984	-0.2167	0.2213
- Other	Explanatory	0.019	0.1389	0.14	0.891	-0.2532	0.2912
Energy minister/governor when reforms started/considered							
His/her experience in electricity industry	Explanatory	-0.007	0.0092	-0.80	0.424	-0.0253	0.0106
Length of term	Explanatory	-0.001	0.0217	-0.05	0.963	-0.0436	0.0416
Education level (1: BSc, 2: MSc, 3: PhD)	Explanatory	0.096*	0.0572	1.67	0.095	-0.0165	0.2077
Educational background in							
- Business or economics	Explanatory	-0.194*	0.1117	-1.74	0.083	-0.4129	0.0250
- Engineering	Explanatory	-0.339**	0.1624	-2.09	0.037	-0.6574	-0.0209
- Law	Explanatory	-0.154	0.1394	-1.10	0.270	-0.4273	0.1193
- Other	Explanatory	-0.275**	0.1160	-2.37	0.018	-0.5021	-0.0474

Variables	Variable Type	Coefficient	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
Other explanatory variables							
Civil liberties score in 2011	Explanatory	0.281***	0.1071	2.62	0.009	0.0711	0.4910
Political rights score in 2011	Explanatory	-0.148	0.0926	-1.59	0.111	-0.3290	0.0339
Corruption perceptions index in 2010	Explanatory	0.203***	0.0772	2.63	0.008	0.0520	0.3546
Control variables							
Log of population in 2010	Control	0.177***	0.0330	5.37	0.000	0.1126	0.2421
Log of GDP per capita in 2010	Control	0.315***	0.0943	3.34	0.001	0.1300	0.4997
Dummy (1: OECD country, 0: non-OECD country)	Control	-0.306*	0.1567	-1.95	0.051	-0.6134	0.0010
Investment freedom index in 2011	Control	0.012***	0.0043	2.87	0.004	0.0039	0.0207
Polity score in 2010	Control	0.045	0.0328	1.38	0.167	-0.0189	0.1097
Property rights index in 2011	Control	-0.021***	0.0062	-3.43	0.001	-0.0332	-0.0090
Constant	Constant	-0.772	0.8297	-0.93	0.352	-2.3986	0.8539

Coefficient that is significant at ***1% level, **5% level, *10% level.

Note: *Log pseudolikelihood: -173.87, Number of obs: 86*

    Wald chi2(23): 107.98, Prob > chi2: 0.000

    Deviance goodness-of-fit: 48.87, Prob > chi2(62): 0.8876

    Pearson goodness-of-fit: 48.28, Prob > chi2(62): 0.8989

Table 4. Poisson regression estimation results for the full sample as Incident Rate Ratios (IRR)

Variables	Variable Type	IRR	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
Electricity market reform score	Dependent						
Chairperson of the regulator when reforms started/considered							
His/her experience in electricity industry at appointment	Explanatory	1.001	0.0039	0.35	0.730	0.9937	1.0091
Length of term	Explanatory	1.019	0.0131	1.44	0.149	0.9934	1.0447
Education level (1: BSc, 2: MSc, 3: PhD)	Explanatory	1.076*	0.0475	1.65	0.098	0.9865	1.1731
Educational background in							
- Business or economics	Explanatory	0.830*	0.0918	-1.69	0.092	0.6682	1.0307
- Engineering	Explanatory	1.086	0.1179	0.76	0.447	0.8780	1.3435
- Law	Explanatory	1.002	0.1120	0.02	0.984	0.8051	1.2477
- Other	Explanatory	1.019	0.1415	0.14	0.891	0.7763	1.3380
Energy minister/governor when reforms started/considered							
His/her experience in electricity industry	Explanatory	0.993	0.0091	-0.80	0.424	0.9750	1.0107
Length of term	Explanatory	0.999	0.0217	-0.05	0.963	0.9573	1.0425
Education level (1: BSc, 2: MSc, 3: PhD)	Explanatory	1.100*	0.0629	1.67	0.095	0.9836	1.2308
Educational background in							
- Business or economics	Explanatory	0.824*	0.0920	-1.74	0.083	0.6617	1.0253
- Engineering	Explanatory	0.712**	0.1157	-2.09	0.037	0.5182	0.9793
- Law	Explanatory	0.857	0.1195	-1.10	0.270	0.6523	1.1267
- Other	Explanatory	0.760**	0.0881	-2.37	0.018	0.6052	0.9537

Variables	Variable Type	IRR	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
Other explanatory variables							
Civil liberties score in 2011	Explanatory	1.325***	0.1419	2.62	0.009	1.0737	1.6339
Political rights score in 2011	Explanatory	0.863	0.0799	-1.59	0.111	0.7196	1.0345
Corruption perceptions index in 2010	Explanatory	1.225***	0.0946	2.63	0.008	1.0534	1.4256
Control variables							
Log of population in 2010	Control	1.194***	0.0394	5.37	0.000	1.1192	1.2739
Log of GDP per capita in 2010	Control	1.370***	0.1292	3.34	0.001	1.1388	1.6482
Dummy (1: OECD country, 0: non-OECD country)	Control	0.736*	0.1154	-1.95	0.051	0.5415	1.0010
Investment freedom index in 2011	Control	1.012***	0.0043	2.87	0.004	1.0039	1.0210
Polity score in 2010	Control	1.046	0.0343	1.38	0.167	0.9812	1.1159
Property rights index in 2011	Control	0.979***	0.0060	-3.43	0.001	0.9674	0.9910
Constant	Constant	0.462	0.3833	-0.93	0.352	0.0908	2.3489

*Coefficient that is significant at ***1% level, **5% level, *10% level.*

Note: *Log pseudolikelihood: -173.87, Number of obs: 86*

    Wald chi2(23): 107.98, Prob > chi2: 0.000

    Deviance goodness-of-fit: 48.87, Prob > chi2(62): 0.8876

    Pearson goodness-of-fit: 48.28, Prob > chi2(62): 0.8989

null hypothesis that all of the regression coefficients are simultaneously equal to zero. In other words, this is the probability of obtaining this chi-square test statistic if there is in fact no effect of the predictor variables. This p-value is compared to a specified alpha level, our willingness to accept a Type I error, which is typically set at 0.05 or 0.01. The small p-value from the LR test, $p < 0.0001$, would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero.

While analysing the estimated Poisson regression coefficients, we should keep in mind that the dependent variable is a count variable, and Poisson regression models the log of the expected count as a function of the predictor variables. We can interpret the Poisson regression coefficient as follows: for a one unit change in the predictor variable, the difference in the logs of expected counts is expected to change by the respective regression coefficient, given the other predictor variables in the model are held constant. For instance, the coefficient of the variable "Chairperson's education level" can be interpreted as follows: If Chairperson's education increases by one level (e.g. from MSc to PhD), the difference in the logs of expected counts would be expected to increase by 0.073 unit, while holding the other variables in the model constant. Since interpretation of coefficients from a Poisson regression is not straightforward, the incidence rate ratios (IRR) are obtained by exponentiating the Poisson regression coefficients. Table 3 shows Poisson estimation results as incident rate ratios. The output tables also present the standard errors of the individual regression coefficients. They are used both in the calculation of the z test statistic and the confidence interval of the regression coefficient. P-value gives the probability that a particular z test statistic is as extreme as, or more so, than what has been observed under the null hypothesis that an individual predictor's regression coefficient is zero given that the rest of the predictors are in the model.

6   Discussion of the results

The empirical results presented above are in line with our hypotheses. So, we fail to reject our hypotheses. Reviewing our findings in relation to the research hypotheses, we find that the background of the chairperson of the regulator and that of the governor or minister responsible for energy policy

when reforms started have a statistically significant impact on overall reform progress (Hypothesis 1). Besides, we see that the democracy has also an impact on reform progress (Hypothesis 2). Finally, our results show that countries with relatively high corruption tend to introduce less electricity market reforms (Hypothesis 3). The interpretation of the results in detail and their policy implications are provided in the sub-sections below.

6.1   Impact of the background of key persons on the reforms

Our empirical findings suggest that the educational background and education level of the chairperson of the electricity market regulatory agency are two determinants of the scope of power industry reform in a country. We could not detect any statistically significant relationship between experience or length of term of the chairperson and scope of reforms. We find a positive correlation between chairperson's education level and reform progress. Besides, we detect a negative relationship between educational background of the chairperson in business or economics and scope of reforms. One difficulty with our analysis here is that the perception among the majority of the economics profession of what sound economic policy actually is did change substantially since the 1980s. The impact of education on market reforms might thus change over time. That is, most of those with a degree in business or economics may regard the vertical integration as the best model for electricity markets if they were educated in pre-1980s period as this was the dominant view at that time.

The educational background and education level of the governor or minister responsible for energy policy when the reforms started or were considered seem to be other two determinants of the scope of power industry reform in a country. We could not detect any statistically significant relationship between length of term or experience of the minister/governor and scope of reforms (see Table 3). Our findings imply that a minister/governor's education level positively contributes to the reform process. The results also show that if the minister/governor holds a degree in business/economics or engineering in a country/state, reform progress is expected to be limited in this country/state (see Table 3).

Based on the results above, we clearly fail to reject Hypothesis 1. That is, due to path-dependency, the background of the chairperson of the regulator and that of the governor or minister responsible for energy policy when reforms started seem to have a statistically significant impact on overall reform progress. Since Hypothesis 1 is both an immediate application of the New Institutional Economics and a direct parallel with the empirical findings reported in the literature we summarized in Section 3.1, our results not only imply that NIE may be a useful approach to explain differences among various countries in terms of reform progress but also contribute to the literature connecting personal traits of policy makers and implementers with policy outcomes. Our findings confirm one of the main assumptions of NIE that the process of any economic reform (e.g. electricity market reform) is largely path dependent; so, getting the institutions right is critical to reform success as getting them wrong can lead to path-dependency, whereby inefficient electricity markets may persist. Therefore, to prevent inefficient institutional structures in the subsequent reform phases, the utmost attention should be paid to arrangements at the very beginning of the reform programs.

Overall, our results show that the background of policy makers and policy implementers are associated with the progress in liberalizing reforms in electricity markets. The most important policy repercussion of these results is that, to secure a rapid reform progress, right people should set up reform policies and structures; and right people should put them into practice. Therefore, while appointing regulators and policy makers, their backgrounds should be taken into account.

6.2 Impact of democracy on the reforms

Our results imply that any improvement in civil liberties score of a country results in a decline in the reform score of that country. Civil liberties score ranges from 1 to 7, 1 representing the highest and 7 the lowest level of freedom. We detect a positive correlation between civil liberties score and the extent of reforms. We could not detect a statistically significant relationship between political rights score and reform progress.

Based on these results, we clearly fail to reject Hypothesis 2, meaning that the level of democracy in a country seems to have a statistically significant impact on reform progress. Since Hypothesis 2 is also an immediate application of the New Institutional Economics, the results above reconfirm that NIE may be a useful approach to explain the differences among various countries in terms of reform progress. The findings in this sub-section verify another main assumption of NIE that institutional structure of a country (like democracy) is one of the determinants of the extent of an economic reform program (such as electricity market reform) in that country.

This result may imply that some dimension(s) of democratic systems may obstruct or interrupt reforms, which is in line with the empirical evidence provided by World Bank (1995). They may be in the form of prolonged legislation periods due to opposition in the parliament, frequent changes in government (and therefore, reform policy), and the negative impact of anti-reform pressure groups or populist policies that damage reform progress especially in election times. Therefore, policy makers and implementers in countries with strong democratic traditions should take into account these factors, and design and carry out reforms accordingly.

6.3   Impact of corruption on the reforms

Our results indicate a positive relationship between reform progress and corruption perceptions index (which increases as corruption declines in a country). This result clearly suggests that we fail to reject Hypothesis 3. That is, our results indicate that countries with relatively high corruption tend to introduce less electricity market reform, which reinforces another key assumption of NIE that non-market transaction costs (like corruption) is one of the determinants of the reform progress. This result also constitutes another confirmation that NIE may be a valuable approach to explain the differences among various countries in terms of reform progress.

Our findings clearly show that reforms go much further in corruption-free countries. So, countries should do their best to reduce and, if possible, eliminate all structures, rules and procedures that may cause or tolerate corruption.

6.4   Results from control variables

Population and per capita income of a country seem to be other important factors in the reform progress. According to our results, population and GDP per capita of a country are positively correlated with its reform score. Moreover, being an OECD country has a statistically significant negative impact on reform progress. Although we cannot conclude this from the econometric analysis in this paper, this result may be regarded as an indication that in countries with well-established institutions the backgrounds of the chairpersons and the ministers/governors are much less important than in those with weaker institutions in terms of reform progress. We also see that reform progress is highly correlated with investment freedom index. Our findings suggest a positive relationship between investment freedom index and reform progress. We could not detect a statistically significant relationship between reform score and polity score. Additionally, we detect a negative relationship between property rights index and reform score.

The results above imply that wealthier and highly-populated countries progress faster in the reform process. So, middle and low income countries with limited population should be cautious in designing power market reforms and should take into account income and size effects during reform implementation. Besides, an appropriate investment environment seems to be positively correlated with the reform progress. So, countries wishing a rapid reform progress may consider putting into practice measures to set up and maintain a proper investment climate.

6.5   Results without the states in US and provinces in Canada

In our analysis so far, we used observations from countries together with those from the states in US and provinces in Canada. The states in US and provinces in Canada are similar in terms of their geographical location (i.e. North America) and income level (i.e. high income group), which implies that they may have common tendencies towards electricity market reform. Taking into account also the fact that the observations from the states in US and provinces in Canada constitute more than half

of the observations in our dataset (64 of 115 observations), our results may be dominated by common characteristics of the states in US and provinces in Canada that may or may not be relevant to reform process. Therefore, re-estimating our models without the states in US and provinces in Canada may produce useful insights into our analysis. In this second phase of estimation, we look at the impact of the backgrounds of policy makers/implementers and democracy & corruption on reforms separately. Table 4 presents Poisson regression estimation results without the states in US and provinces in Canada as Incident Rate Ratios (IRR) for the impact of the backgrounds of chairpersons and ministers on the reforms while Table 5 does the same for the impact of democracy and corruption.

The empirical findings from the second phase of estimation (that is, the results without the states in US and provinces in Canada) suggest that the length of term and educational background of the chairperson of the electricity market regulatory agency are two determinants of the scope of power industry reform in a country. We could not detect any statistically significant relationship between experience in electricity industry or education level of the chairperson and scope of reforms in a country. We find a positive correlation between chairperson's length of term and reform progress. Moreover, we detect a positive relationship between educational background of the chairperson in engineering and law and scope of reforms in a country.

Experience of the minister responsible for energy policy and his/her educational background seem to be other important determinants of the scope of power industry reform in a country. We find a negative correlation between minister's experience in electricity industry and reform progress, meaning that minister's experience in electricity industry adversely affects the reform process. When we take into account the fact that the ministers coming from public electricity utilities are usually 'captured' by the bureaucrats controlling the electricity sector especially in developing countries, this result seems plausible. So, the previous presence of the minister in the electricity industry for a long time may translate into a situation where s/he is too responsive to the demands of the bureaucrats controlling the electricity sector, who usually oppose to the reforms (especially privatization) to keep their privileged position intact. So, for a faster reform progress, the ministers without a professional background in the electricity sector of the country may be preferred. We could not detect any

statistically significant relationship between length of term or education level of the minister and scope of reforms. The results also indicate a positive impact of minister's degree in economics or business and a negative one his/her degree in law on the reform score.

Population of a country seems to be a positive factor contributing to the reform progress but its impact is quite limited. Being an OECD country has also a significant positive impact on reform progress.

Table 5. Poisson regression estimation results without the states in US and provinces in Canada as IRR (Micro Model)

Variables	Variable Type	IRR	Robust Std. Err.	p-value (P>|z|)
Electricity market reform score	Dependent			
Chairperson of the regulator when reforms started/considered				
His/her experience in electricity industry at appointment	Explanatory	1.007	0.007	0.351
Length of term	Explanatory	1.042**	0.021	0.044
Education level (1: BSc, 2: MSc, 3: PhD)	Explanatory	1.120	0.133	0.338
Educational background in				
- Business or economics	Explanatory	0.946	0.165	0.752
- Engineering	Explanatory	1.459*	0.313	0.078
- Law	Explanatory	1.477**	0.228	0.011
Energy minister when reforms started/considered				
His/her experience in electricity industry	Explanatory	0.978**	0.011	0.038
Length of term	Explanatory	0.998	0.045	0.963
Education level (1: BSc, 2: MSc, 3: PhD)	Explanatory	1.012	0.095	0.900
Educational background in				
- Business or economics	Explanatory	1.601***	0.252	0.003
- Engineering	Explanatory	1.403	0.333	0.154
- Law	Explanatory	0.737*	0.127	0.077
Control variables				
Population in 2010 (million people)	Control	1.001***	0.000	0.000
Dummy (1: OECD country, 0: non-OECD country)	Control	1.471**	0.269	0.035
Polity score in 2010 [-10, +10]	Control	1.090***	0.034	0.006

*Coefficient that is significant at ***1% level, **5% level, *10% level.*

Note: *Log pseudolikelihood: -78.25, Number of obs: 35*

    Wald chi2(15): 3384.83, Prob > chi2: 0.000

    Deviance goodness-of-fit: 26.42, Prob > chi2(19): 0.1188

    Pearson goodness-of-fit: 27.68, Prob > chi2(19): 0.0898

Table 6. Poisson regression estimation results without the states in US and
provinces in Canada as IRR

Variables	Variable Type	IRR	Robust Std. Err.	p-value (P>|z|)
Electricity market reform score	Dependent			
Explanatory variables				
Civil liberties score in 2011	Explanatory	1.339***	0.097	0.000
Political rights score in 2011	Explanatory	0.870	0.076	0.110
Corruption perceptions index in 2010	Explanatory	1.054*	0.032	0.081
Control variables				
Log of population in 2010	Control	1.094***	0.291	0.001
Log of GDP per capita in 2010	Control	1.413***	0.099	0.000
Dummy (1: OECD country, 0: non-OECD country)	Control	0.989	0.168	0.949

*Coefficient that is significant at ***1% level, **5% level, *10% level.*

Note: Log pseudolikelihood: -110.86, Number of obs: 51

  Wald chi2(5): 3979.59, Prob > chi2: 0.000

  Deviance goodness-of-fit: 32.16, Prob > chi2(43): 0.9072

  Pearson goodness-of-fit: 33.90, Prob > chi2(43): 0.8642

The results from Table 5 confirm that variables representing civil liberties and corruption perceptions have a strong impact on the reform progress. As in the case of the first phase of estimations, the results from the second phase verify that any improvement in civil liberties score of a country results in a decline in the reform score of that country.

As we mentioned before, the data on macro variables (i.e. civil liberties score, political rights score and corruption perceptions index) are provided on country level and not available for specific states in US and provinces in Canada. Therefore, we cannot estimate our regressions for states in US and provinces in Canada alone. Nonetheless, it is possible to estimate our regressions to detect the impact of the backgrounds of regulators and governors on the reform progress in US states and Canadian provinces only. However, when we estimate our regressions with data from US states and Canadian provinces only, we see that the coefficients of all variables are statistically not significant even at 10% level with the exception that a governor with an engineering degree seems to decrease the reform score by a factor 0.647. It seems that the impact of the backgrounds of regulators and governors on the

reform progress is quite limited in the states in US and the provinces in Canada. Since almost all coefficients are not significant, we do not provide the further details of the estimation table here.

Table 6 compares the results from the first and second phase of estimations. It presents statistically significant coefficients only. As can be seen in Table 6, the results from two groups of estimations are similar in general with some slight differences in details. When we take into account the fact that number of observations are quite different for the first (115 observations) and second (51 observations) group of estimations, the similar results confirm the robustness of our results. In both groups of estimations, we see that backgrounds of chairperson and minister/governor and variables representing democracy and corruption levels have a statistically significant impact on reform progress. The only noteworthy difference between two groups of estimations is the impact of OECD membership on the reforms. The results from the observations *with* the states in US and provinces in Canada indicate that OECD membership negatively affects the reform progress while those from the observations *without* the states in US and provinces in Canada imply that OECD membership has a positive impact on reform progress. When we evaluate these two results together, we may conclude that OECD membership contributes to reform progress in reforming countries other than US and Canada. When we include observations from US and Canada into our analysis, some common features of the states in US and provinces in Canada (that may or may not be relevant to reform process) seem to distort the impact of OECD membership on the reform progress. Removing observations from the states in US and provinces in Canada makes the true impact of OECD membership clear.

Table 7. Results with and without the states in US and provinces in Canada as IRR

Variables	Coefficient (with US and Canada)	Coefficient (without US and Canada)
Electricity market reform score		
Chairperson of the regulator when reforms started/considered		
His/her experience in electricity industry at appointment		
Length of term		1.042**
Education level (1: BSc, 2: MSc, 3: PhD)	1.076*	
Educational background in		
- Business or economics	0.830*	
- Engineering		1.459*

Variables	Coefficient (with US and Canada)	Coefficient (without US and Canada)
- Law		1.477**
- Other		
Energy minister/governor when reforms started/considered		
His/her experience in electricity industry		0.978**
Length of term		
Education level (1: BSc, 2: MSc, 3: PhD)	1.100*	
Educational background in		
- Business or economics	0.824*	1.601***
- Engineering	0.712**	
- Law		0.737*
- Other	0.760**	
Institutional variables		
Civil liberties score in 2011	1.325***	1.339***
Political rights score in 2011		
Corruption perceptions index in 2010	1.225***	1.054*
Control variables		
Log of population in 2010	1.194***	1.094***
Log of GDP per capita in 2010	1.370***	1.413***
Dummy (1: OECD country, 0: non-OECD country)	0.736*	1.471**

Coefficient that is significant at ***1% level,* **5% level,* *10% level.*

7 Conclusion

This study offered an analysis that focuses on the possible contribution of New Institutional Economics to the study of electricity market reforms. In the course of the study, we checked the validity of three important arguments of NIE for the power market liberalization process. The first argument is the "path-dependency". To test its impact on the reform progress, we tried to explain whether the background of the chairperson of the regulatory agency when reforms started or were considered or that of the governor/minister responsible for energy policy at that time has an impact on the subsequent reform progress. The second argument is the impact of "democracy" as an institution on the reform progress. We looked at the effect of two important indicators of democracy (i.e., civil liberties and political rights) on the reform progress. The final argument of NIE we tested in this study

is about transaction costs. We concentrated on the level of corruption in a country as one of the key factors that determine transaction costs and tried to explore its impact on the reforms.

To observe the impact of these variables, we constructed empirical econometric models using cross-section data from 51 states in US, 13 provinces in Canada and 51 other countries. As a result of the study, we found that the backgrounds of the chairperson and the minister/governor, and the level of democracy and corruption in a country are significantly correlated with how far reforms have gone in that country. Although we tested the applicability of only three arguments of NIE to the study of reform process in electricity markets, the results from our study confirm that NIE as a school of thought has the potential to provide a useful framework that can possibly be used to investigate power market reforms.

Acknowledgements

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