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Governance in Electricity Regulatory Frameworks: A Comparative Assessment

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Abstract. The electricity industry is in constant transition. From the former wave of market deregulation and liberalization to the current transformation into a decarbonized industry, regulatory bodies have been at the core of the efforts for organizing the energy markets and devising policies for achieving the targeted energy goals for the next few decades. The capability of electricity sector regulators in dealing with the challenges of transition largely depends on the underlying regulatory governance mechanisms and this study aims to assess this crucial aspect of electricity sector regulators. Using a regulatory framework index, the governance mechanism of 20 regulatory bodies across the world is evaluated against the determined criteria. These criteria include the legal scope the regulatory body, separation of operational activities from regulatory activities and four distinct characteristics including autonomy and independence, accountability, clarity of role and objectives, and transparency and participation. The results can help governments and agencies in selection of regulatory frameworks for benchmarking.

Key words: *Electricity Regulation, Regulatory Framework, Governance, Energy Market Liberalization*

INTRODUCTION

Beginning with Chile in the early 1980's, many countries initiated fundamental reforms in the electricity industry in order to restructure the electricity sector towards a more competitive structure. In the 1990's, following the experiment of Chile, other South American countries such as Argentina, Bolivia, Peru and Colombia adopted similar unbundling and restructuring practices in order to deregulate the previously vertically-integrated electricity utilities (Rothwell and Gómez, 2003). In Europe, Norway and England were pioneers in developing restructured, deregulated electricity markets. New Zealand, Australia and Canada similarly introduced competition in their electricity markets and by the end of 1990's, about 70 developing countries and many developed countries had taken some steps towards electricity market liberalization (Nepal and Jamasb, 2015).

The vast extent and rapid pace of the reforms adopted by countries can be attributed to a variety of political, economic and technological drivers. As a public utility with direct implications on the welfare and economic development, the electricity industry has always been subject to political and economic controversy (Victor and Heller, 2009). As the state is pressurized for lower energy costs, electricity utilities exert their monopolistic powers to set higher prices. Furthermore, it was realized

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That some functions within the electricity industry, such as wholesale generation and retailing of electricity can be carried out competitively. Therefore, a structural reform in the electricity industry was required to bring about lesser end-consumer charges and more efficient conduct of the electricity system (Sioshansi et al., 2006).

At the heart of efforts for reforming the electricity sector, lays the establishment of an independent regulator to act as the custodian of public interest (Armstrong et al., 1994). Since the electricity industry is capital intensive and exhibits monopolistic behaviors, the existence of a regulatory framework is required to improve efficiency and reduce costs (Joskow, 2006). Moreover, determining whether the electricity utility costs match the costs of an efficient conduct and the opportunities an electricity utility has in order to reduce costs is not always easy. This is due to the asymmetry of information between the regulator and the regulated firm. Public utilities, such as electricity distribution companies, that are active in large proportions of the electricity market usually have far more information regarding the energy market than other agents present in the market. To overcome this asymmetry of information, a regulatory framework should be established to allow efficient cost recovery for the regulated entities and lower prices for the consumer (Chester, 2014). This role of guaranteeing the efficient functioning of the electricity market, in other words existence of a regulatory framework, has been highlighted since the restructuring efforts began in the 1990's (Bergara et al., 1998).

Since the regulatory framework is at the core of electricity industry reform and has substantial impacts on successful restructuring and efficient functioning of the electricity market, assessing the quality and effectiveness of the electricity regulatory frameworks becomes an important issue. Henisz (2002) used empirical evidence to demonstrate that political and institutional stability can considerably contribute to the investments in public infrastructure. Haney and Pollitt (2011) showed that the existence and experience of an independent regulator is a crucial element in the best practice regulation. Littlechild (1983) also argued that incentive regulation of networks can promote efficiency of a competitive market. Bortolotti et al. (2002) used dummy variables for presence and absence of a regulatory framework in the setting of a privatization process in a telecommunications industry to measure the effects of regulation. Using an econometric mode, Erdogdu (2013) argues that the background of officials and the level of democracy and corruption significantly correlate with the success of electricity market reform in that country and that is why some countries are able to implement more extensive reforms. In a more novel and thorough approach, Gutiérrez (2003) introduced a Regulatory Framework Index (RFI) in order to assess the regulatory governance in the Latin American telecommunications sector. The RFI has three main aspects: the scope of the legal mandate that creates the regulatory institution, the separation of regulatory activities from the operating activities of different entities, and certain main characteristics that a regulatory body should have.

Although the literature and existing papers on the role of regulation in the electricity industry reform abound, little has been done to independently analyze and assess electricity regulatory frameworks. In spite of the existing literature that focuses on importance and characteristics of electricity regulation, this paper constructs a solid RFI index that allows for assessing and comparing various electricity regulatory frameworks per se by taking into account the major features of an effective regulatory body.

Therefore, using the Regulatory Framework Index introduced by (Gutiérrez, 2003), this paper investigates the regulatory governance in 20 countries around the world. This regulatory framework index encompasses three aspects, namely the scope of the legal mandate, separation of regulatory activities from operating activities and six distinct characteristics of the industry regulator. This study provides an unprecedented assessment of the electricity sector regulators using the RFI.

The remainder of this paper is structured as follows. Section 2 explores the major elements involved in the electricity market restructuring and implications for electricity market regulatory frameworks. Section 3 discusses the construction of the regulatory framework index by identifying the relevant criteria and provides estimates for each selected regulatory body. Section 4 provides a discussion regarding the significance of the results and ultimately, concluding remarks are drawn in section 5.

1. ELEMENTS OF ELECTRICITY INDUSTRY RESTRUCTURING

The standard procedure for the electricity industry reform adopted by Chile and later followed by other countries consisted of specific steps including establishment of an independent regulator, privatization of previously state-owned firms, providing the legal basis for market liberalization, unbundling of activities, incentive regulation, establishment of wholesale market, and introduction of competitive electricity generation (Nepal and Jamasb, 2015). This section categorizes the main elements of electricity restructuring.

1.1 Vertical separation

The new paradigm of electricity industry is based on the notion that competitive electricity markets are in fact possible. The advent of new technologies has eliminated the former economies of scale associated with electricity generation and new markets emerge as interconnection capacities between regions and countries increase. Therefore, since monopoly precludes competition, network activities (transmission and distribution) must be separated from competitive practices i.e. generation and retail. The unbundling of activities can lead to elimination of cross-subsidies (and consequently bring about lower energy prices) and improve efficiency of operation and planning of the power system. This is achieved by removing conflict of interest by eliminating the capability or incentives to discriminate (Pérez-Arriaga, 2013). Fig.1 represents the organization of restructured vertically-integrated electricity company.

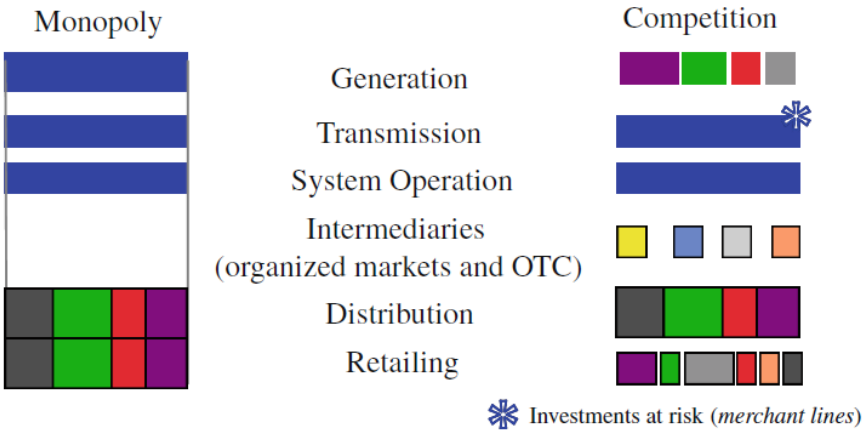

Figure.1 Organization of a restructured vertically-integrated electricity company (Pérez-Arriaga, 2013)

1.2 Private Ownership

Public or state ownership of electricity industry was faced with crisis during the 1990's. One major cause, in Latin America, for example, was the excessively high electricity demand growths combined with incapability of the State to invest in generation facilities due to large external debts. Furthermore, the new lending policies of international financial institutions such as the World Bank and

International Monetary Fund led governments to initiate privatization. Moreover, private owners react to economic and technological transformations more promptly and can more efficiently allocate resources. Therefore, private ownership is a core element in the restructured electricity industry (Rothwell and Gómez, 2003).

1.3 Institutions and economic regulation

Institutions are constraints designed by humans to structure political, economic and social interactions by creating order and reducing uncertainty in exchange (North, 1991). Regulatory institutions can be divided into two elements: institutional environment and institutional arrangements. Institutional environment or governance is made up of laws, acts, authorities etc. that form regulatory decisions and processes. This is also called the *formal* aspect of regulation. The *informal* aspect of regulation or institutional arrangements (also called substance) is comprised of governance mechanisms such as incentives or tariff levels (Brown et al., 2006).

The economic theory of regulation tries to find the optimal arrangement that eventually optimizes social welfare by the means of minimizing social costs and maximizing social benefits. This can be in the form of government ownership of firms and government oversight, or an arrangement such as private ownership with independent regulation (Rothwell and Gómez, 2003). Regardless of the optimal institutional arrangement, the characteristics of the institutions play an important role in determining the effectiveness of the regulatory framework (Haney and Pollitt, 2011).

The electricity regulation encompasses all dimensions and elements of the electricity sector restructuring. Therefore, the characteristics of the regulatory framework as the main mechanism for formulating rules and overseeing the electricity market plays a crucial role in a successful industry deregulation and efficient functioning of market agents. In short, an effective electricity market restructuring largely depends on its regulatory framework. This paper identifies the major essential features of a regulatory framework and based on the determined characterizations, constructs a regulatory framework index that allows for assessing the governance of a power sector regulator.

2. CONSTRUCTING THE REGULATORY FRAMEWORK INDEX

The process of regulating a network infrastructure, e.g. the electricity industry, consists of two distinct dimensions: governance and institutional arrangements i.e. incentives, tariffs, etc. Regulatory governance calls for design and creation of a transparent framework within which market participants can interact. In other words, regulatory governance means the set of laws, rules and regulations that govern the market. This aspect of regulation is usually sustained over longer-term periods in order to provide a predictable and stable environment for the interaction of agents within the market. The other dimension, institutional arrangements, is the set of instruments that address market issues such as pricing, tariff levels and subsidies. These mechanisms influence the behavior of entities in a way that leads to a more efficient functioning of the market. For example, the regulator may set revenue or price cap for electricity distribution companies to encourage increasing efficiency and consequently lower prices for consumers.

Since institutional arrangements primarily rely on the existence of a regulatory framework, the regulatory governance is of greater significance than regulatory instruments. Moreover, the existence of a regulatory environment can be interpreted as the determination and commitment of the government to provide a safe and credible environment for private investment and elimination of opportunistic behavior. Given the primary role of institutional environments in the effective regulation of the electricity industry, the regulatory framework index constructed and calculated in this paper solely addresses the elements of regulatory governance.

2.1 Legal scope of the regulatory framework

The institutional endowment of a country is a major determinant of the institutional environment and consequently the electricity industry regulatory effectiveness of the country can be measured by the characteristics of the institutions at macro-level (Haney and Pollitt, 2011). Therefore, the scope of the legislation that underpins the regulatory framework is a primary element of the regulatory body. This is because the roles, functions and duties of the regulator are shaped and realized through the legislation and the stronger the legal mandate, the more credible the regulatory body will be.

For measuring the strength of the legal mandate, it is investigated whether the regulatory framework is created by parliamentary law or presidential (or royal) decrees. Regulatory bodies established by laws enacted by parliaments comprised of elected representatives are more credible that those created by executive decrees (Gutiérrez, 2003). Table 1 shows the corresponding legal mandate of the selected regulatory bodies, the type and the year they were enacted. It can be seen that most regulatory frameworks are established through parliamentary laws.

Table 1. Establishing legal mandate of each regulatory body

Country	Name of the Regulatory Authority	Mandate	Year
United Kingdom	Office of Gas and Electricity Markets (OFGEM)	Electricity Act	1989
Canada (Ontario)	Ontario Energy Board (OEB)	Ontario Energy Board Act	1989
Saudi Arabia	Electricity and Co-Generation Regulatory Authority (ECRA)	Decree No. M/56	2005
Republic of Ireland	Commission for Energy Regulation (CEM)	Electricity Regulation Act	1999
United States (Texas)	Public Utilities Commission of Texas (PUC)	Public Utility Regulatory Act	1995
India (Gujarat)	Gujarat Electricity Regulatory Commission (GERC)	Electricity Act	2003
Australia (Southern Australia)	Essential Services Commission of South Australia (ESCOSA)	Electricity Act	1996
Jordan*	Energy and Mineral Regulatory Commission	General Electricity Law	2002
South Africa	National Energy Regulator (NERSA)	National Energy Regulator Act	2004
Norway	Norwegian Water Resources and Energy Directorate (NVE)	Energy Act	1990
Albania	Albanian Energy Regulator (ERE)	Power Sector Law	2003
Armenia	Public Service Regulatory Commission (PSRC)	Law on establishment of a regulatory body for public services	2003
Azerbaijan	Tariff Council	Statute of the Tariff	2005
Croatia	Croatian Energy Regulatory Agency (HERA)	Act on the Regulation of Energy Activities	2012
Turkey	Energy Market Regulatory Authority (EMRA)	Law on the Electrical Market	2001
Nigeria	Nigerian Electricity Regulatory Commission (NERC)	Electric Power Sector Reform Act	2005
Uganda	Electricity Regulatory Authority (ERA)	Electricity Act	1999
UAE (Dubai)	Regulatory and Supervisory Bureau (RSB)	Executive Council Resolution No. 2	2010
Poland	Energy Regulatory Office (ERO)	Energy Law	1997
Pakistan	National Electric Power Regulatory Authority (NEPRA)	Electric Power Act	1997

** Jordan's General Electricity Law was initially issued by King Abdullah and later enacted by the Parliament*

In order to account for the type of legal mandate in the index, for regulatory bodies that are created by parliamentary laws, a value of 1 is assigned and for those regulatory frameworks that are

established through executive decrees, a value of 0.5 is assigned. In case of the absence of a regulatory body, the index takes a value of 0.

2.2 Separation of regulatory activities from operating activities

Independence of the electricity industry regulator is a critical characteristic that ensures elimination of conflict of interest. As the regulatory body engages in electricity market activities, it becomes prone to discriminative practices and consequently the effectiveness of the regulatory framework would be lost. Therefore, the regulatory must maintain neutrality. In order to ensure unbiased conduct of the regulatory body, financial interests of the industry regulator in the electricity market should be eliminated. For operationalization of this feature in the index, a value of 1 is assigned if the formal separation of regulatory activities is stated in the corresponding legal mandate and zero if no separation of operating activities from regulatory activities is in place (Andres, 2007).

2.3 Characteristics of a regulatory body

Autonomy and independence, accountability, clarity of roles and objectives, and transparency and participation are the main four characteristics to be found in an effective regulatory body (Stern and Holder, 1999). This section explores the significance of each characteristic and draws quantifiable features for the construction of the regulatory framework index.

2.3.1 Autonomy and independence

The electricity industry regulator is usually assigned with the task of preventing the electricity utilities from conducting monopolistic behavior and charging high prices for consumers while ensuring a reasonable cost recovery for the utilities. In general, the regulatory body is in charge of defending the rights of both consumers and electricity companies. Therefore, it is essential that the regulator maintains independence and autonomy. The effectiveness of the regulatory practice depends on the mechanisms that safeguard the regulator from undue political interventions either from the industry or the government.

In order to account for the independence and autonomy of the industry regulator in the index, two features are determined and investigated: first, financial and budgetary independence from and second, the appointment or removal process of the regulatory commissioners. If the regulatory body is self-financed through license fees, etc. or parliamentary-set budget, the index takes a value or 1. On the other hand, if the budget is solely determined by executive officials such as minister, etc. the index takes a value of 0. As for the selection of personnel, if no free removal of commissioners is possible, the corresponding index is set to 1 and if the regulatory body commissioners can readily be removed by other non-elected executive officials, the index equals zero.

2.3.2 Accountability

Since the regulator is responsible for overseeing the actions of a variety of electricity market participants, the regulator's decisions would consequently affect a large variety of stakeholders. For example, the regulator's decision to decrease revenue caps could alert utility companies. Similarly, allowing companies to increase energy charges will subsequently be faced with opposition from the consumers. Therefore, it is necessary that some sort or dispute resolution exist within the regulatory framework's processes and procedures. The right of challenging the regulator's decisions along with existence of a mechanism for settling these appeals can significantly contribute to the credibility of the regulatory body. This is particularly important for massive investments are required for transition of the current global energy system into the targeted low-carbon industry and the willingness to invest

in the energy industry, in each country, largely depends on the credibility of the corresponding regulatory body.

For operationalization of this index, a value of 1 is assigned if some form of dispute resolution mechanism can be found within the regulatory framework. If no such mechanism is present, the index then takes a value of 0.

2.3.3 Clarity of roles and objectives

The separation of roles between various regulatory bodies acts as a mechanism to reduce regulatory capture by the interest groups and results in improved commitment (Tirole, 1994). Therefore, it is most advantageous that the legislation unambiguously indicate the regulatory objectives of each entity and the instances where the regulator has an advisory position and the occasions where its role is more of a policy-making nature. Moreover, in order to establish order and credibility, the regulator should be able to actively engage in market policies and react to professional misconduct. This can achieve by utilizing institutional arrangements i.e. penalties and incentives. For operationalization of the index, a value of 1 is assigned if some form of penalty and tariff setting mechanism is in place and a value of 0 is allocated for the regulatory frameworks that are unable to set tariffs and impose penalties.

2.3.4 Transparency and participation

Historically, establishment of incentive-based regulation in the electricity industry has often been accompanied with augmented electricity prices that is followed by the skepticism of consumers (Rothwell and Gómez, 2003). In general, regulators are always under suspicion, especially in developing countries (Tenenbaum, 1996) and the possibility of collusion between the regulator and electricity companies calls for a transparent regulatory design. The main elements of transparency in a regulatory framework can include clear specification of rules and regulations, implementation of decisions and policies through an open process, and publication of decisions and policies. By requiring the regulatory body to conduct its activities in an open, public environment, it can be refrained from secret arrangements with interested parties or political figures. Similarly, relevant information regarding each decision or the process of reaching a decision can be publicized (Fink et al., 2003). Transparency is a core element of an effective regulatory framework because utilities have abundant resources in order to influence decisions of the regulator and clear, transparent conduct of regulatory affairs can prevent lobbying, communication campaigns and revolving doors (Pérez-Arriaga, 2013).

For operationalization of this element of the regulatory framework index, the existence of a clear mechanism for publicizing the decisions of the regulators indicates a value of 1 and otherwise a value of 0.

It should be noted that since the index take account of qualitative elements of a regulatory framework, namely aspects of regulatory governance, it is difficult to determine which factor is of greater weight and which factors can be assigned with smaller weights. It is, however, evident that all aspects relating to the governance of a regulatory body significantly contribute to the effectiveness and success of the regulatory framework as a whole. Therefore, in order to calculate the aggregated RFI, all factors are given the equal weight of 0.125.

Unlike Gutiérrez (2003) that analyzed the evolution of the RFI in a time period of two decades, this study conducts an static assessment of regulatory frameworks using the index and measures the current status of the selected regulatory bodies. This is mainly because it has been decades since the first electricity industry deregulation efforts took place in the 1980's and the present regulatory authorities are mature now and the regulatory framework index can be utilized to evaluate the

effectiveness of full grown regulators. Moreover, this study is not limited to the context of Latin America and has included counties from all five continents primarily because the aim of this paper has been to assess and evaluate regulatory frameworks per se, not the bilateral effects of the regulatory framework and the corresponding economic environment. Although it is beneficial to analyze of the political and economic environment within which a regulatory institution is established, such analysis simply did not fall within the scope of the present study.

Another issue is the magnitude of the RFI. As evident by definition, the index can take a maximum value of 1. This maximum, however, may not reflect that the relevant regulatory body has achieved the perfect framework. It only indicates that the regulatory framework meets the criteria discussed in this paper and many other factors are to be taken into account before a conclusive decision regarding the evaluation of the regulatory framework can be made. Yet despite its limitations, the RFI does in fact provide a preliminary assessment of the regulatory frameworks present in the global electricity industries.

2.3.5 Result

The indicators introduced in the previous sections are calculated and the results analyzed in this section.

Table 2. Data

Country	Legal mandate	Separation	Main features					
			a	b	c	d	e	f
United Kingdom	1	1	1	1	1	1	1	1
Canada	1	1	1	1	1	1	1	1
Saudi Arabia	0.5	1	1	1	1	1	1	1
Ireland	1	1	1	1	1	1	1	1
United States	1	1	1	1	1	1	1	1
India	1	1	1	1	1	1	1	1
Australia	1	1	1	0	1	1	1	1
Jordan	1	1	1	0	1	1	1	1
South Africa	1	1	1	1	1	1	1	1
Norway	1	1	1	1	1	1	1	1
Albania	1	1	1	1	1	1	1	1
Armenia	1	1	0	1	1	1	1	1
Azerbaijan	0.5	1	0	0	1	1	1	1
Croatia	1	1	1	1	1	1	1	1
Turkey	1	1	1	1	1	1	1	1
Nigeria	1	1	0	0	1	1	1	1
Uganda	1	1	1	0	1	1	1	1
UAE	0.5	1	0	0	1	1	1	1
Poland	1	1	0	0	1	1	1	1
Pakistan	1	1	1	1	1	1	1	1

(a) Financial and budgetary independence, (b) appointment and removal process, (c) power to set tariffs, (d) power to impose penalties for misconduct, (e) existence of a dispute resolution mechanism, (f) publication of decisions. Source: Authors' compilation.

Table 2 shows the assigned values regulatory framework index for 20 regulatory bodies across the globe. RFI is estimated for the selected regulators and model was tested with collinearity diagnostics through SPSS software version 26.0.0.0 and it was found that for models with dependent variable

RFI, the following variables are constants or have missing correlations: Separation, c, d, e, f. they will be deleted from the analysis and only three indicators remain that are not significant.

Another consideration regarding the estimated RFI is that the selected regulators have been able to achieve the desirable levels of transparency, accountability, and clarity. Also in terms of separation, no regulatory framework is engaged in both business and regulatory activities. This means that mechanisms of tariff setting, dispute resolution, publicizing the decisions, and enforcement exist in the selected regulatory frameworks. However, it is in terms of autonomy and the scope of the legal mandate that some regulatory bodies fall short of the perfect level. Budgetary or financial dependence and free removal of regulatory commissioners can lead to regulatory capture and consequently prevent the regulatory body from performing its duties. Establishment of the regulatory body through a mandate enacted by a parliament or congress can consolidate the position and authority of the electricity industry regulator. The bar chart of the calculated RFI for each regulatory body is presented in Fig.2.

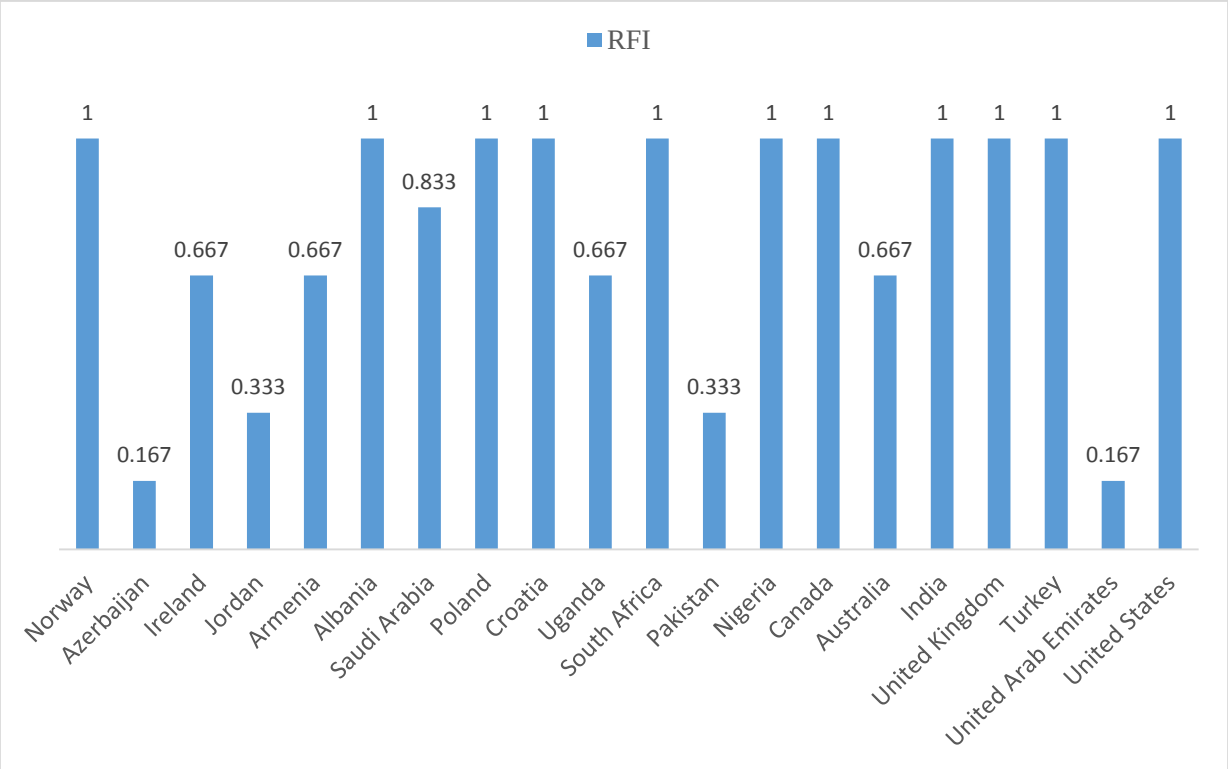

Figure.2 Estimated RFI[1] for the selected regulatory frameworks

It can be seen that in general, developed countries have achieved higher levels of regulatory governance as compared with developing countries. This may indicate that the overall institutional environment of a country can substantially influence the quality and efficiency of micro-level institutions within that economy. This conclusion, however, requires further analysis and research. Furthermore, it can be viewed that countries with longer history of electricity market deregulation and liberalization have higher RFI levels. This means that the maturity of a country's regulatory institution can contribute to the quality of the institutional framework and electricity regulation, particularly regulatory governance.

[1] Average of all indicators

3. DISCUSSION

Network infrastructures such as electricity and telecommunications share a set of characteristics that incapacitate the common market mechanisms leading to efficient performance. Primarily, such infrastructures make use of technologies with significant economies of scale. Moreover, the services delivered by these utilities are essential public goods and consequently subject to opportunistic intervention of governments. On the other hand, the monopolistic characteristics of such public utilities may encourage them to charge higher prices or deliver low-quality services. Therefore the existence of a regulatory body is essential in order to preserve the rights of both consumers and private investors and the ultimate efficient functioning of the market (Singh, 1997). This role of the regulator is more highlighted in developing countries where energy regulation is a new concept and basically designed to remove previous utility monopolies. The deregulation and liberalization challenges necessitate a robust and functional regulatory framework that can lead the industry from monopoly to competition.

Aside from the inherent characteristics of network infrastructures, particularly the electricity industry, that necessitates the existence of a regulatory framework, there are emerging national and global challenges that require immediate, decisive actions from energy regulatory institutions. Competitiveness, energy security and transition into a low-carbon energy industry are the challenges that call for regulatory interventions. This role of the regulatory bodies can more often be perceived in developed countries where the struggle to further the penetration of renewables and de-carbonization of the energy industry is intense and regulatory bodies lie at the center of this challenge of providing clean, secure sources of energy.

Regardless of the nature of the problem regulatory agencies deal with, either in developing or developed countries, the effectiveness and functionality of the electricity industry regulators largely depends on the basic governance framework of the institution. Without a solid, reliable and credible regulatory framework, no institutional arrangements, no matter how mathematically and economically accurate, can effectively be carried out. The governance mechanisms underlying each regulatory agency delineate the frame within which interactions between different participants in the industry is possible. Therefore, assessing the regulatory governance can be helpful in determining the potentials of each regulatory framework. Since benchmarking analyses is common in adopting regulatory policies (Jamasb and Pollitt, 2003), the present study can help governments and agencies conduct a preliminary evaluation of the regulatory frameworks around the world as part of the process of selecting the best regulatory framework for benchmarking.

CONCLUSIONS

Since the 1980's, political and economic ideologies along with technological developments and changing of the lending policy of international financial institutions, many countries have been pursuing deregulation and liberalization of the electricity industry.

Deregulation of the electricity market has been accompanied by increased energy prices. Furthermore, privatized electricity utilities have always been prone to undue government intervention that puts their investments at stake. Therefore, the existence of a robust and effective regulatory framework is a must in the new energy business environment.

Given the importance of regulatory bodies in the transitional phases of electricity industry, this study aims to assess the governance of electricity industry regulators. Using a regulatory framework index, this paper estimates a quantitative measure of governance for 20 regulatory bodies across the globe. In order to construct the index, major elements involved in the governance aspects of a

regulatory framework are identified. These aspects consist of the legal scope of the mandate establishing the regulatory body, the separation of operational activities from regulatory activities and four characteristics including autonomy and independence, accountability, clarity of roles and objectives, and transparency and participation. The results can help governments and agencies in choosing the optimal regulatory framework for benchmarking purposes.

The index calculated in this study measures governance aspects of electricity regulatory frameworks. Future studies may investigate construction of an index that takes into account both the institutional arrangements and the institutional environment of the electricity regulation and combines them into a unified, aggregated index.

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