Institutional Governance and Performance in the Electricity Sector in Latin America and the Caribbean[1][2]

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1. Introduction

The 21st century started with a new wave of reforms in the electricity sector in Latin America and the Caribbean region (LAC). Reforms included changes in sector organization and regulation to increase the role of smart-grid technologies, distributed generation, and other technological innovations. As these changes are being rolled out, it seems useful to take stock of the outcomes of earlier governance reforms, as their performance outcomes define the baseline from which the new reform wave should be assessed. This assessment can also help policy makers determine which of the undelivered promises the new wave should include in its agenda.

This paper matches country-specific performance and governance characteristics in order to draw conclusions about the correlation between governance features and performance outcomes in the sector. The LAC region lends itself well to such an approach, because it is characterized by significant heterogeneity across countries in the degree to which institutional options were adopted. Countries differ in many dimensions, including whether they still have a vertically integrated service provider, created a separate regulator, rely massively on private capital, or opted for wholesale markets. Heterogeneity in governance is mirrored by heterogeneity in performance along the many dimensions that should drive outcomes.

The knowledge accumulated over the last 30 years suggests that governance affects performance, as Jasmab, Nepal, and Timilsina (2017) note in a survey of the impact of electricity reforms in developing countries. But the interaction between the two is complex. How much—and what kind of—governance matters is not clear.[6] Part of the uncertainty on the sign and strength of the interaction is linked to the fact that many diagnostics focus on a single dimension of governance (e.g., privatization) and/or one performance outcome (e.g., investment). Such a focus can be misleading, because governance is best characterized as a package of institutions characteristics (e.g., market structure, regulation, other institutional dimensions), and outcomes are multiple.

This paper characterizes governance dimensions jointly and assesses their impact on various policy concerns. To do so, we develop a synthetic composite indicator that accounts for the multiple dimensions of governance of the sector and use it to understand the link between the various governance dimensions created and the outcomes of interest.

To identify the main governance and outcome dimensions to account for in LAC, we benefitted from earlier research on the impact of governance reforms in the region. Andres, Guasch, and Azumendi (2008); Andres, Schwartz, and Guasch (2013); and Balza, Jimenez, and Mercado (2013) provide some of the most encompassing recent assessments of the impact of reforms on performance in the region. They provide detailed characterizations of regulatory institutions as proxies for sector governance, using a smaller sample of countries than we study here.[7] All three papers consider a similar range of governance changes (e.g., unbundling, privatization, regulation), but they do so individually. They largely confirm for

[6] Bensch et al. (2016) draw a similar conclusion in their own survey.

[7] Andres, Schwartz, and Guasch (2013) focus on electricity distribution, working with data at the firm level in 26 countries for the 1995–2005 period. Balza, Jimenez, and Mercado (2013) work with sector-level data at the country level. Their study covers 18 countries for the 1971–2010 period.

LAC the conclusion reached by Jasmab, Nepal, and Timilsina (2017) in their summary of global experience. They find, for example, that privatization was associated with improvements in quality and efficiency in the region but not with better access to service. Their results also show that regulatory and institutional quality mattered to outcomes regardless of the level of private participation.

Accounting for the joint effects of all governance reforms, rather than assessing the effect of each of them individually, should yield a better appreciation of the complementarity of the main institutional changes countries adopt. Relying on a single indicator that synthesizes the diverse governance preferences at the country level should make it easier to get a sense of how far governments have moved away from the historical vertically integrated public monopoly that was the global norm in the electricity sector until the 1990s.

Beginning in the 1990s, many countries decide to change the governance of the sector. They typically focused on four dimensions: (a) market structure (unbundled or not), (b) opening to private sector participation, (c) the creation (or not) of a separate regulatory agency, and (d) the introduction of competition in the sector. For each country, these four dimensions can be translated into a single indicator "grading" governance on a scale of 0–100. Using this scale, it is possible to rank countries in terms of their level of adoption of the reforms typically considered desirable during the 1990s reform waves.[8] We do this for 33 countries in LAC.

The synthetic indicator we create refines the indicator produced by the World Bank for 88 developing countries (including 14 in LAC) analyzed by Foster et al. (2017). That indicator synthesizes the four dimensions of power sector reform (the degree of unbundling, the existence of an autonomous regulatory entity, the entry of private management and capital, and the extent to which generators are allowed to compete to supply a monopoly utility and customers to negotiate their supply contracts).[9] A major difference between the World Bank indicator and the one produced here is the approach used to weight the various dimensions. The World Bank assigns equal weights to all dimensions, ignoring the relevance of possible correlation across indicators, a major weakness noted by Polemis (2016). We use a weighting procedure that accounts for interactions among dimensions.

To use this indicator to produce policy insights, we combine the information provided by the governance choices made with the evidence on outcomes at the country level. First, we reinterpret the information provided by the 33 countries in the sample as data points in a continuous indicator of governance change that ranges from 0 to 100. Because for each synthetic governance observation, we have a matching performance outcome observed at the country level, we can correlate governance with a range of performance indicators, to test the extent to which the conclusions reached by earlier research on specific governance dimensions hold when the multidimensionality of governance is accounted for.

[8] This exercise says nothing about the desirability of these reforms.

[9] Foster et al. (2017) then use the indicators to measure the extent to which the reform choices were influenced by country characteristics, such as geography, income group, power system size, and political economy, but do not look at outcomes.

The rest of the paper is organized as follows. Section 2 presents the methodology. Section 3 discusses the results. Section 4 reports the correlation between the index of electricity reforms and the different aspects of quality of the service delivered. Section 5 summarizes the paper's main conclusions.

2. Methodology for Creating the Index of Electricity Reforms

The development of the index can be described in four steps.

Step 1: Identification of the Indicators

Eight indicators capture the main dimensions typically discussed in the context of electricity reforms:

i. degree of competition in electricity transmission
ii. degree of vertical integration (which reflects the range of integration over all industry functions)
iii. participation of the private sector in generation, transmission, and distribution
iv. existence of a separate regulatory entity
v. experience of the regulatory agency (approximated by the number of years it has been in place since its creation)
vi. existence of a transmission system operator
vii. existence of an independent system operator
viii. existence of a wholesale market operator.

To structure the discussion in broad governance dimensions, we aggregate some of the indicators into four separate dimensions:

- market structure (i + ii)
- private sector participation (iii)
- regulatory autonomy and experience (iv + v)
- operational organization (vi + vii + viii).

Step 2: Data Collection

As in most policy diagnostics, data collection proved to be one of the most frustrating parts of the evaluation process. Even after almost 30 years of reforms in the region, it remains a challenge. There is still only limited comparability of information across countries, and most databases are either not open access and/or include only limited coverage of smaller economies. The international community still does not take measurement seriously enough.

The choice of indicators was limited by the availability of comparable data for a large number of economies. We opted to maximize the number of economies covered. We collected comparable data for 33 countries in LAC (including Puerto Rico but not Cuba because of lack of available information). Most of the data are for 2018, but some are for years as far back as 2015 (Table 1).

Table 1 Status of electricity reform in Latin America and the Caribbean, by economy

	Dimension									
	Market structure		*Private sector participation*			*Regulatory autonomy and experience*		*Operational organization*		
			Separate							
Economy	*Level of competition*	*Level of unbundling*	*Gene-ration*	*Gene-ration*	*Distri-bution*	*Sepa-rate*	*Year of creation*	*Trans-mission system operator*	*Indepen-dent system operator*	*Wholesale market operator*
Antigua and Barbuda	Monopoly	Vertically integrated	Yes	No	No	No	1973	No	No	No
Argentina	Retail market competition	Fully vertically unbundled	Yes	Yes	Yes	Yes	1992	No	Yes	Yes
Bahamas	Monopoly	Vertically integrated	Yes	Yes	Yes	Yes	2009	No	No	No
Barbados	Monopoly	Vertically integrated	Yes	Yes	Yes	Yes	2001	No	No	Yes
Belize	Retail market competition	Partially vertically unbundled	Yes	Yes	Yes	Yes	1999	No	No	No
Bolivia	Retail market competition	Fully vertically unbundled	Yes	Yes	Yes	Yes	1994	Yes	Yes	Yes
Brazil	Wholesale competition	Fully vertically unbundled	Yes	Yes	Yes	Yes	1996	Yes	Yes	Yes
Chile	Retail market competition	Fully vertically unbundled	Yes	Yes	Yes	Yes	1978	No	Yes	Yes
Colombia	Wholesale competition	Partially vertically unbundled	Yes	Yes	Yes	Yes	1992	No	Yes	Yes
Costa Rica	Monopoly	Vertically integrated	Yes	No	No	Yes	1996	No	No	Yes
Dominica	Retail market competition	Vertically integrated	Yes	Yes	Yes	Yes	2006	No	No	No
Dominican Republic	Wholesale competition	Fully vertically unbundled	Yes	No	No	Yes	1998	Yes	Yes	Yes
Ecuador	Wholesale competition	Fully vertically unbundled	Yes	No	No	Yes	1998	No	Yes	Yes
El Salvador,	Retail market competition	Fully vertically unbundled	Yes	No	Yes	Yes	1997	Yes	Yes	Yes
Guatemala	Wholesale competition	Fully vertically unbundled	Yes	Yes	Yes	No	1996	No	Yes	Yes
Guyana	Monopoly	Vertically integrated	Yes	No	No	Yes	1999	No	No	No
Grenada	Monopoly	Vertically integrated	Yes	Yes	Yes	No	-	No	No	No
Haiti	Retail market competition	Vertically integrated	Yes	Yes	Yes	No	-	No	No	No

Honduras	Retail market competition	Vertically integrated	Yes	No	No	Yes	1995	No	No	Yes
Jamaica	Retail market competition	Vertically integrated	Yes	Yes	Yes	Yes	1995	No	No	No
Mexico	Wholesale competition	Vertically integrated	Yes	No	No	Yes	1995	No	Yes	Yes
Nicaragua	Wholesale competition	Fully vertically unbundled	Yes	No	Yes	Yes	1979	No	No	Yes
Panama	Wholesale competition	Vertically integrated	Yes	No	Yes	Yes	2006	No	Yes	Yes
Paraguay	Monopoly	Vertically integrated	No	No	No	No	-	No	No	No
Peru	Wholesale competition	Fully vertically unbundled	Yes	Yes	Yes	Yes	1996	No	Yes	Yes
Puerto Rico	Retail market competition	Vertically integrated	Yes	Yes	Yes	Yes	2014	No	No	No
St. Kitts and Nevis	Monopoly	Vertically integrated	Yes	Yes	Yes	No	-	No	No	No
St. Lucia	Monopoly	Vertically integrated	Yes	Yes	Yes	Yes	1964	No	No	No
St. Vincent and the Grenadines	Monopoly	Vertically integrated	Yes	Yes	Yes	No	-	No	No	No
Suriname	Retail market competition	Fully vertically unbundled	Yes	No	Yes	No	-	Yes	Yes	Yes
Trinidad and Tobago	Retail market competition	Vertically integrated	Yes	No	No	Yes	1966	No	No	No
Uruguay	Retail market competition	Vertically integrated	Yes	No	No	Yes	1997	No	No	No
Venezuela, RB	Monopoly	Vertically integrated	No	No	No	No	1992	No	No	No

Step 3: Normalization of the Data to Produce a Synthetic Index

The composite index is expressed as

$$I = \sum_{i=1}^{n} w_i x_i, \quad (1)$$

where I is the composite index; x_i is the normalized variable; w_i is the weight of the x_i, $\sum_{i=1}^{n} w_i = 1$, $0 \leq w_i \leq 1$; and $i = 1, \ldots, n$.

The data reported in table 1 are raw; the variables have different measurement units and therefore cannot be aggregated. To eliminate the bias of scale in the calculation of the composite indicator, we standardize the raw data (table 2).

Before normalizing the data, we transform the indicators with qualitative values into quantitative ones:

- For the level of competition, monopoly, retail market competition, and wholesale market competition take the values of 0, 1, and 2, respectively.

- For the level of unbundling, vertically integrated, partially vertically unbundled, and fully vertically unbundled take the values of 0, 1, and 2, respectively.

- For the year of creation, we transformed the variable x_c into $x'_c = 2018 - x_c$, where x'_c is the new value of the indicator for country c and x_c is the year of creation of the regulator for the country c. If the country does not have a regulator, the variable takes the value of 0.

- To eliminate the bias of scale and be able to read all variables in the same direction, we normalized the data using the max-min method, transforming each indicator q for city c as follows:

$$I_{qc} = \frac{x_{qc} - \min(x_q)}{\max(x_q) - \min(x_q)}, \quad (2)$$

where $\min(x_q)$ and $\max(x_q)$ are the minimum and maximum values of x_q across all countries. The normalized indicator I_{qc} has values lying between 0 ($\min(x_q)$) and 1 ($\max(x_q)$).

This approach has the advantage of being simple, but it has limitations. The range, for example, is sensitive to the choice of countries. If any country performs poorly on an indicator and/or another performs every well, the values will be distorted.

Table 2 Normalized values of electricity reforms in Latin America and the Caribbean, by economy (percent)

	Dimension							
	Market structure			*Regulatory autonomy and experience*		*Operational organization*		
Economy	*Level of competition*	*Level of unbundling*	*Private sector participation*	*Separate energy regulator*	*Year of creation of regulator*	*Transmission system operator*	*Independent system operator*	*Wholesale market operator*
Antigua and Barbuda	0	0	33.3	0	83.3	0	0	0
Argentina	50	100	100	100	48.1	0	100	100
Bahamas, The	0	0	100	100	16.7	0	0	0
Barbados	0	0	100	100	31.5	0	0	100
Belize	50	50	100	100	35.2	0	0	0
Bolivia	50	100	100	100	44.4	100	100	100
Brazil	100	100	100	100	40.7	100	100	100
Chile	50	100	100	100	74.1	0	100	100
Colombia	100	50	100	100	48.1	0	100	100
Costa Rica	0	0	33.3	100	40.7	0	0	100
Dominica	50	0	100	100	22.2	0	0	0
Dominican Republic	100	100	33.3	100	37.0	100	100	100
Ecuador	100	100	33.3	100	37.0	0	100	100
El Salvador	50	100	66.7	100	38.9	100	100	100
Guatemala	100	100	100	0	40.7	0	100	100

Guyana	0	0	33.3	100	35.2	0	0	0
Grenada	0	0	100	0	0	0	0	0
Haiti	50	0	100	0	0	0	0	0
Honduras	50	0	33.3	100	42.6	0	0	100
Jamaica	50	0	100	100	42.6	0	0	0
Mexico	100	0	33.3	100	42.6	0	100	100
Nicaragua	100	100	66.7	100	72.2	0	0	100
Panama	100	0	66.7	100	22.2	0	100	100
Paraguay	0	0	0	0	0	0	0	0
Peru	100	100	100	100	40.7	0	100	100
Puerto Rico	50	0	100	100	7.4	0	0	0
St. Kitts and Nevis	0	0	100	0	0	0	0	0
St. Lucia	0	0	100	100	100	0	0	0
St. Vincent and the Grenadines	0	0	100	0	0	0	0	0
Suriname	50	100	66.7	0	0	100	100	100
Trinidad and Tobago	50	0	33.3	100	96.3	0	0	0
Uruguay	50	0	33.3	100	38.9	0	0	0
Venezuela, RB	0	0	0	0	48.2	0	0	0

Step 4: Creation of the Composite Index

The most challenging part is to come up with the partial composite indicator at a given dimension level. It requires two steps: (a) a multivariate analysis to check correlations between indicators and thus redundancy and (b) a principal component analysis followed by a factor analysis to compute the weighting factor for each indicator considering its redundancy (for details, see Freudenberg 2003).

Once weighted, the indicators can be aggregated. The aggregate single score replicates the approach from the partial composite indicators computed for the dimensions (except for private sector participation, for which there is only one indicator). These composite indicators for each dimension are weighted (multivariate analysis followed by principal component analysis/factor analysis) and summed to develop the aggregate single score.

Illustration of the approach

We illustrate the approach by focusing on the dimension *operational organization*, the indicators for which are transmission system operator, independent system operator, and wholesale market operator. We compute the correlations between the indicators within the dimension (Table 3). If they are low, it is unlikely that they share common determining factors. Values marked * are significant at the 5 percent level; values marked ** are significant at the 2 percent level (Pearson correlation test). These levels of significance indicate that a relatively large number of common parameters should be influencing their values. For instance, the existence of a transmission system in a country is significantly correlated with the existence of an independent system operator and a wholesale market operator. Principal component analysis/factor analysis helps reduce redundancy.

Table 3 Correlation matrix of Operational Organization			
	Type of operator		
Type of operator	*Transmission system operator*	*Independent system operator*	*Wholesale market operator*
Transmission system operator	1		
Independent system operator	0.5***	1	
Wholesale market operator	0.4**	0.8***	1

Note: Pearson correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

As the weights significantly affect the composite indicator value, they affect the results. The easiest option is the equal weighting method, which consists of computing the mean of all indicators. Giving all indicators equal weighting implies that there is no redundancy, however. Grouping variables with a high degree of correlation could cause certain performance features to be overestimated. A weighting set was therefore computed from the principal component analysis in order to reduce redundancy.

The principal component analysis transforms correlated indicators into a set of independent factors (principal components) while preserving the maximum proportion of the total variation in the dataset (Nardo et al. 2005). It reduces the overlapping information between two or more variables. Formally, the analysis takes Q variables $x_1, x_2, \dots x_q$ and finds linear combination of them to produce components $Z_1, Z_2, \dots Z_Q$ that are uncorrelated: \

$$Z_1 = a_{11}x_1 + a_{12}x_2 + \cdots + a_{1Q}x_Q$$

$$Z_2 = a_{21}x_1 + a_{22}x_2 + \cdots + a_{2Q}x_Q$$

$$\dots$$

$$Z_Q = a_{Q1}x_1 + a_{Q2}x_2 + \cdots + a_{QQ}x_Q \quad (3)$$

At this point there are still Q principal components—that is, as many components as there are variables. The weights a_{ij} (also called *factor loadings*) of the principal components applied to the variables x_j are chosen so that the principal components Z_i satisfy three conditions:

1. They are uncorrelated/orthogonal.
2. The first supports the maximum proportion of the variance, the second supports the maximum of the remaining variance, and so on, until the last of the principal components absorbs all of the remaining variance not accounted by the preceding components.
3. $a_{i1}^2 + a_{i2}^2 + \cdots + a_{iQ}^2 = 1, i = 1, 2, \dots Q$ (Nardo et al. 2005).

The eigenvalues of the indicators' correlation matrix are the variances of the principal components. They provide information on the variability in the data.

The decision on how many principal components should be retained in the analysis without losing too much information depends on the criteria ("stopping rules") selected. A criteria usually used to select and determine the number of components consists of (a) having associated eigenvalues larger than 1, (b) individually contributing more than 10 percent to the explanation of overall variance, and (c) cumulatively contributing more than 80 percent to the explanation of the overall variance (Nardo et al. 2005).

To illustrate the discussion, we present the results of a principal component analysis on the dimension *operational organization* (table 4). In light of the above analysis, the first two factors are retained. The PCA is conducted with the R software package FactoMineR.

Table 4 Principal component analysis of Operational Organization

	Principal component		
Variable	*1*	*2*	*3*
Variance	2.2	0.6	0.2
Percent of variance explained	72.0	21.2	6.8
Cumulative percent of variance explained	72.0	93.2	100.0

After extraction of the first two principal components representing the data, we consider them as factors for the factor analysis (table 5). We then rotate the factor loadings, in order to minimize the number of individual indicators that have a high loading on the same factor (Nardo et al. 2005). Doig so simplifies the structure of the factors and makes their interpretation easier.

The most common rotational method is the Varimax rotation, which we adopt. It is an orthogonal rotation minimizing the number of variables with high loadings on each factor.

Table 5 Factor loadings of indicators of Operational Organization

	Factor	
Indicator	*1*	*2*
Transmission system operator	0.2	1.0
Independent system operator	0.9	0.3
Wholesale market operator	0.9	0.2

Note: Extraction method: principal components, Varimax rotation

The last step involves constructing the weighting coefficients for the factors loadings matrix after Varimax rotation "given that the square of factors depicts the proportion of the total unit variance of the indicator, which is explained by the factor" (Nardo et al. 2005). We use the method proposed by Nicoletti, Scarpetta, and Boyland (2000), in which each factor loading is squared, the factors with the highest value are selected, and the values are divided

by the sum of the largest factor loadings. The weighting coefficients for each indicator reported in table 6 are the outcome of this procedure.

Table 6 Weights for indicators of Operational Organization	
Indicator	*Weight*
Transmission system operator	0.4
Independent system operator	0.3
Wholesale market operator	0.3

Based on the results reported in table 6, the composite index of *operational organization* can be reduced as follows:

$$Operational\ Organization\ index = 0.364\ Transmission\ system\ operator + 0.293\ Independent\ system\ operator + 0.342\ Wholesale\ market\ operator \quad (4)$$

Using this methodology, we create partial composite indicators for *Market structure* and *Regulatory autonomy and experience*. The results are reported in the appendixes. The final step involves producing a single indicator from these four dimensions for each country.

3. Discussion of the Results

Table 7 reports the correlations between dimensions. *Market structure* and *Operational organization* seem to be significantly correlated, as do *Market structure* and *Regulatory autonomy and experience*. An explanation of the first correlation can be that if there is competition in the market, it is more likely that the operation of electricity system will be unbundled (it will be more likely to have a stand alone transmission system operator, an independent system operator or a wholesale market operator)

Table 7 Correlation matrix of dimensions of Electricity Reform				
	Dimension			
Dimension	*Market structure*	*Private sector participation*	*Regulatory autonomy and experience*	*Operational organization*
Market structure	1.0			
Private sector participation	0.2	1.0		
Regulatory autonomy and experience	0.3*	0.0	1.0	
Operational organization	0.8***	0.1	0.2	1.0

Note: Pearson correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

The principal component and factor analysis step identifies four factors for the aggregate single score. Only the first three seem to matter: They jointly explain 96 percent of the cumulative variance (see appendix, table 23). The others are hence ignored in the following steps.

Once the factor loadings for each dimension have been measured, the weights to be used in the aggregation can be computed. Table 8 reports them, along with final aggregate scores.

Table 8 Aggregate and dimension scores for Electricity Reform in Latin America and the Caribbean, by economy (percent)

	Final aggregate score	*Partial reform dimension specific scores*			
		Market structure	*Private sector participation*	*Regulatory autonomy and experience*	*Operational organization*
Economy		*0.23*	*0.27*	*0.26*	*0.24*
Antigua and Barbuda	19.8	0	33.3	42.0	0.0
Argentina	78.6	75.0	100	74.0	63.6
Bahamas, The	41.6	0	100	58.0	0
Barbados	52.1	0	100	66.0	34.2
Belize	55.7	50.0	100	68.0	0
Bolivia	87.0	75.0	100	72.0	100
Brazil	92.2	100	100	70.0	100
Chile	81.9	75.0	100	87.0	63.6
Colombia	78.6	75.0	100	74.0	63.6
Costa Rica	35.4	0	33.3	70.0	34.2
Dominica	48.1	25.0	100	61.0	0
Dominican Republic	74.3	100	33.3	69.0	100.0
Ecuador	65.3	100	33.3	69.0	63.6
El Salvador	77.4	75.0	66.7	69.0	100
Guatemala	70.3	100	100	20.0	63.6
Guyana	26.5	0	33.3	68.0	0
Grenada	26.5	0	100	0	0
Haiti	32.3	25.0	100	0	0
Honduras	41.4	25.0	33.3	71.0	34.2
Jamaica	50.7	25.0	100	71.0	0
Mexico	54.4	50.0	33.3	71.0	63.6
Nicaragua	71.4	100	66.7	86.0	34.2
Panama	60.6	50.0	66.7	61.0	63.6
Paraguay	0	0	0	0	0
Peru	83.3	100	100	70.0	63.6
Puerto Rico	46.3	25.0	100	54.0	0
St. Kitts and Nevis	26.5	0	100	0	0
St. Lucia	52.5	0	100	100	0
St. Vincent and the Grenadines	26.5	0	100	0	0
Suriname	59.4	25.0	33.3	98.0	0
Trinidad and Tobago	40.1	25.0	33.3	69.0	0
Uruguay	32.5	0	0	24.0	0
Venezuela, RB	6.2	0	0	24	0
Average	51.4	41.7	71.7	54.9	34.7
Standard deviation	0.24	0.39	0.34	0.31	0.38
Maximum value	92.2	100	100	100	100
Minimum value	0	0	0	0	0

The average aggregate figure (51.4) indicates that many countries have not followed the reform wave. The most popular reform was the opening to private capital, with an average score of 71.7. The least widespread reform is the change in the operational organization of the sector, with an average score of 34.7. The standard deviations around the mean are similar for all reforms.

The aggregate scores reveal Paraguay as an outlier; it did not implement any of the reforms assessed in this diagnostic. Brazil performed best, with a score of 91 percent, followed by Bolivia, Chile, and Peru, all of which scored above 80 percent.

Almost all countries (94 percent) had private sector participation in their electricity industry. Other reforms were less widespread. A third of the countries scored 0 on market structure, about a quarter had not created a separate regulatory agency, and almost half had not restructured the operational side of the sector (that is, they had no separate transmission system operator , independent system operator, or wholesale market operator).

Half of the Caribbean countries analyzed (7 of 14) lag the other countries in the region, suggesting that size matters, as Foster et al. (2017) note. Some differences in policy and political preferences are unrelated to size, however.

Are Reforms Correlated with Outcomes?

Are reforms linked to enhancements in the performance of the electricity sector? To investigate the question, we focus on four dimensions of quality:

- Access, as measured by the percentage of the population with access to electricity (World Bank 2016a)
- Technical quality, as measured by the annual duration and frequency of outages per customer, the reliability of supply and the transparency of the tariff index, and energy losses in distribution (World Bank 2017a)
- Process quality, as measured by the number of procedures for getting electricity, the number of days for getting electricity, mechanisms for monitoring outages, mechanisms for restoring outages, financial deterrents aimed at limiting outages, and communication of tariff changes (World Bank 2017a)
- Affordability, as measured by the cost of electricity as a percentage of per capita Gross National Income (World Bank 2017a).

Table 9 reports the results.

Table 9 Performance of electricity sector in Latin America and the Caribbean, by economy											
	Access	*Technical quality*			*Process quality*						*Affordability*
Economy	*Percent of population with electricity access*	*Total duration and frequency of outages per customer a year*	*Reliability of supply and transparency of tariff index*	*Energy losses in distribution and transmission as a percent of output*	*Mechanisms for monitoring outages*	*Mechanisms for restoring outages*	*Financial deterrents aimed at limiting outages*	*Communi cation of tariff changes*	*Procedures to get service*	*Time to get service*	*Cost of electricity as percent of GNI per capita*
Antigua and Barbuda	97.3	1	5	24.0	1	1	1	1	4	42	115
Argentina	100	0	5	16.0	1	1	1	1	6	92	24
Bahamas	100	0	0	12.0	1	1	0	1	5	67	124
Barbados	100	0	0	6.0	1	1	1	1	8	88	64
Belize	92.2	0	4	12.0	1	1	0	1	5	66	318
Bolivia	93.0	1	6	14.0	1	1	1	1	8	42	689
Brazil	100	0.5[a]	5.4	16.0	1	1	1	1	4	64	54
Chile	100	2	6	9.0	1	1	1	0	5	43	68
Colombia	99.0	1	6	20.0	1	1	1	1	5	106	542
Costa Rica	100	3	8	10.0	1	1	1	1	5	45	168
Dominica	100	3	7	8.2	1	1	0	1	5	61	466
Dominican Republic	100	0	4	34.0	1	1	0	1	7	67	249
Ecuador	99.9	2	7	19.0	1	1	1	1	7	74	636
El Salvador	98.6	1	8	12.0	1	1	1	1	4	88	883
Guatemala	92.3	1	4	7.7	1	1	0	1	5	38	188
Guyana	91.8	2	7	14.0	1	1	1	1	5	44	551
Grenada	84.2	0	4	33.0	1	0	1	1	8	82	442
Haiti	38.7	0	0	56.0	0	0	0	1	4	60	3522
Honduras	87.6	0	0	25.0	0	1	0	1	7	39	791
Jamaica	98.2	2	7	24.0	1	1	1	1	7	95	237
Mexico	100	3	7	17.0	1	1	0	1	6.8	100	314
Nicaragua	81.8	0	4	32.0	1	1	0	1	6	55	856
Panama	93.4	3	8	13.0	1	1	1	1	5	35	17
Paraguay	98.4	0	2	32.0	0	1	0	1	5	67	162
Peru	94.8	1	6	7.0	1	1	1	1	5	67	350
Puerto Rico	100	1	4	13.8	1	1	0	1	5	32	228
St. Kitts and Nevis	100	0	0	17.8	0	0	0	0	4	18	239
St. Lucia	97.8	3	7	9.3	1	1	0	1	6	26	83
St. Vincent and the Grenadines	100	0	0	7.4	1	0	0	1	3	52	52
Suriname	87.2	0	0	8.0	1	1	0	1	4	113	634
Trinidad and Tobago	100	1	6	6.0	1	1	1	1	4	61	212
Uruguay	100	1	6	19.0	1	1	1	1	5	48	11
Venezuela, RB	99.6	0	0	32.0	0	0	0	0	6	208	16713

Note: a. Average of Rio de Janeiro (1) and São Paulo (0).

The data for the 11 performance indicators are then normalized using the max-min procedure, except for indicators that are inversely proportional to quality. For those cases, we adapt the formula in order to link the indicator value positively with quality (an increase in the value will increase the quality character). Indicators inversely proportional to quality are adapted with the following equation:

$$I'_{qc} = 100\, percent - \frac{x_{qc} - \min(x_q)}{\max(x_q) - \min(x_q)}, \qquad (5)$$

where I'_{qc} is the normalized indicator q of type "less is better." We then create the aggregate indicators *Technical quality* and *Process quality* (*Access* and *Affordability* are characterized only by one indicator and therefore do not require a aggregate index) following the same methodology used to create the synthetic governance index (see appendix B). Table 10 provides the normalized values of the performance indicators. Table 11 presents the final scores of the various dimensions of quality.

Table 10 Normalized values of performance indicators in Latin America and the Caribbean, by economy (max-min method results) (percent)

	Access	*Technical quality*			*Process quality*						*Affordability*
Economy	*Percent of population with electricity access*	*Total duration and frequency of outages per customer a year*	*Reliability of supply and transparency of tariff index*	*Energy losses in distribution and transmission as a percent of output*	*Mechanisms for monitoring outages*	*Mechanisms for restoring outages*	*Financial deterrents aimed at limiting outages*	*Communication of tariff changes*	*Procedures to get service*	*Time to get service*	*Cost of electricity as percent of GNI per capita*
Antigua and Barbuda	95.6	66.7	62.5	64.0	100	100	100	100	80	87.4	99.4
Argentina	100	100	62.5	80.0	100	100	100	100	40	61.0	99.9
Bahamas	100	100	0	88.0	100	100	0	100	60	74.2	99.3
Barbados	100	100	0	100	100	100	100	100	0	63.2	99.7
Belize	87.3	100	50.0	88.0	100	100	0	100	60	74.7	98.2
Bolivia	88.6	66.7	75.0	84.0	100	100	100	100	0	87.4	95.9
Brazil	100	83.3	67.5	80.0	100	100	100	100	80	75.6	99.7
Chile	100	33.3	75.0	94.0	100	100	100	0	60	86.8	99.7
Colombia	98.4	66.7	75.0	72.0	100	100	100	100	60	53.7	96.8
Costa Rica	100	0	100	92.0	100	100	100	100	60	85.8	99.1
Dominica	100	0	87.5	95.6	100	100	0	100	60	77.4	97.3
Dominican Republic	100	100	50.0	44.0	100	100	0	100	20	74.2	98.6
Ecuador	99.8	33.3	87.5	74.0	100	100	100	100	20	70.5	96.3
El Salvador	97.7	66.7	100	88.0	100	100	100	100	80	63.2	94.8
Guatemala	87.4	66.7	50.0	96.6	100	100	0	100	60	89.5	98.9
Guyana	86.6	33.33	87.5	84.0	100	100	100	100	60	86.3	96.8
Grenada	74.2	100	50.0	46.0	100	0	100	100	0	66.3	97.4
Haiti	0	100	0	0	0	0	0	100	80	77.9	79.0

Honduras	79.8	100	0	62.0	0	100	0	100	20	88.9	95.3
Jamaica	97.1	33.3	87.5	64.0	100	100	100	100	20	59.5	98.6
Mexico	100	0	87.5	78.0	100	100	0	100	24	56.6	98.2
Nicaragua	70.3	100	50.0	48.0	100	100	0	100	40	80.5	94.9
Panama	89.3	0	100	86.0	100	100	100	100	60	91.0	100
Paraguay	97.4	100	25.0	48.0	0	100	0	100	60	74.2	99.1
Peru	91.5	66.7	75.0	98.0	100	100	100	100	60	74.2	98.0
Puerto Rico	100	66.7	50.0	84.4	100	100	0	100	60	92.6	98.7
St. Kitts and Nevis	100	100	0	76.4	0	0	0	0	80	100	98.6
St. Lucia	96.4	0	87.5	93.4	100	100	0	100	40	95.8	99.6
St. Vincent and the Grenadines	100	100	0	97.2	100	0	0	100	100	82.1	99.7
Suriname	79.1	100	0	96.0	100	100	0	100	80	50.0	96.3
Trinidad and Tobago	100	66.7	75.0	100	100	100	100	100	80	77.4	98.8
Uruguay	100	66.7	75.0	74.0	100	100	100	100	60	84.2	100
Venezuela, RB	99.3	100	0	48.0	0	0	0	0	40	0	0

Table 11 reveals that the region performs well on average in terms of access and affordability, with average scores 91.3 percent and 94.6 percent, respectively. It performs much less well on service and technical quality, where the averages are 70.4 percent and 66.3 percent, respectively. For all indicators, the standard deviation is large, because of the presence of outliers such as Haiti (for access rate and technical quality) and the República Bolivariana de Venezuela (for affordability and service quality).

Table 11 Scores on dimensions of performance in the electricity sector in Latin America and the Caribbean, by economy (percent)

	Dimension			
Economy	*Access*	*Technical quality*	*Process quality*	*Affordability*
Antigua and Barbuda	95.7	64.3	93.2	99.4
Argentina	100.0	80.4	79.4	99.9
Bahamas, The	100.0	62.8	67.1	99.3
Barbados	100.0	67.2	71.5	99.7
Belize	87.3	79.2	67.3	98.2
Bolivia	88.6	75.7	76.5	95.9
Brazil	100.0	76.9	90.7	99.7
Chile	100.0	69.1	72.5	99.7
Colombia	98.4	71.3	82.0	96.8
Costa Rica	100.0	66.3	88.7	99.1
Dominica	100.0	63.5	67.8	97.3
Dominican Republic	100.0	63.2	58.8	98.6

Ecuador	99.8	65.9	77.2	96.3
El Salvador	97.7	85.4	88.2	94.8
Guatemala	87.4	72.1	70.3	98.9
Guyana	86.6	69.6	88.8	96.8
Grenada	74.2	63.9	60.0	97.4
Haiti	0.0	30.8	49.3	79.0
Honduras	79.8	53.3	51.3	95.3
Jamaica	97.1	62.3	74.9	98.6
Mexico	100.0	57.1	56.0	98.2
Nicaragua	70.3	64.6	64.3	94.9
Panama	89.3	64.1	89.8	99.9
Paraguay	97.4	56.4	56.5	99.1
Peru	91.5	80.8	86.3	98.0
Puerto Rico	100.0	67.6	71.0	98.7
St. Kitts and Nevis	100.0	58.6	37.5	98.6
St. Lucia	96.4	62.7	67.5	99.6
St. Vincent and the Grenadines	100.0	66.1	64.9	99.7
Suriname	79.1	65.7	66.3	96.3
Trinidad and Tobago	100.0	81.5	91.1	98.8
Uruguay	100.0	72.1	88.4	100
Venezuela, RB	99.3	48.2	8.3	0
Average	91.4	66.3	70.4	94.6
Standard deviation	0.18	0.11	0.18	0.17
Maximum value	100	85.4	93.2	100
Minimum value	0	30.8	8.3	0

Table 12 reports the correlations among the four performance measures. The Pearson correlation is usually used to assess the linear relationship between two continuous variables. As we normalized all indicators, we are de facto relying on continuous variables. Pearson assumes that the variables are normally distributed and linear. The Spearman correlation coefficient provides insights on the ranked values for each variable. It measures the monotonic relationship of the variables (meaning that the variables might tend to move in the same direction but not necessarily at a constant rate) and does not make assumptions about the distribution of the data. The two measures usually yield similar results unless the data are not normally distributed or significant nonlinearities characterize them.

Table 12 Correlation matrix of dimensions of performance				
	Dimension			
Measure	*Access*	*Technical quality*	*Process quality*	*Affordability*
Pearson				
Access	1			
Technical quality	0.6***	1		
Process quality	0.2	0.7***	1	
Affordability	0.1	0.4**	0.7***	1
Spearman				
Access	1			
Technical quality	0.1	1		
Process quality	0.2	0.7***	1	
Affordability	0.5***	0.2	0.4**	1

Note: Pearson and Spearman correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

This analysis provides a number of insights for policy:

- Access and affordability are nonlinearly correlated. This finding is not unexpected, given the complexity of tariff structures in many countries in the region and the widespread mistargeting of subsidies.
- Access and affordability are both positively and statistically significantly linearly correlated with technical quality. This finding suggests that the poor are likely to benefit from improved technical efficiency in the region.
- Affordability is positively correlated with process quality. This finding suggests that improvements in the way service caters to users are likely to have strong social payoffs.
- The strongest correlation is between the two quality dimensions. This finding, together with the social payoffs to quality improvements, points to the importance of measuring technical quality as rigorously as possible as part of the regulatory supervision of the sector.

To assess the relationship between governance and performance, we assess their correlations using both the Pearson and Spearman measures. We do so for the synthetic governance index as well as for each of its main components. To complement the assessment, we report include the results of a very basic ordinary least square linear regressions (figure 1) between the overall reform score and each performance dimension.

The results of the Pearson and Spearman tests lead to two main conclusions (table 13). First, there is no correlation between the reform index and access or affordability. Second, there is some correlation with quality variables. The Pearson correlation shows a positive correlation with both technical and process quality. The Spearman correlation is significant only for technical quality. The difference may reflect the presence of outliers, which leads the Pearson correlation to be higher than the Spearman correlation.

Table 13 Correlation between aggregate reform index and performance outcomes		
	Reform aggregate index	
Performance outcome	*Pearson correlation*	*Spearman correlation*
Access	0.1	0.0
Technical quality	0.6***	0.5***
Process quality	0.4**	0.3*
Affordability	0.3**	0.0

Note: Pearson and Spearman correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

The results in Table 13 largely confirm the conclusions reached by Andres, Schwartz, and Guasch (2013) and Balza, Jimenez, and Mercado (2013) from their reading of various partial assessments. To make the comparison more precise, it may be useful to see how strong the correlation is with each of the four individual governance dimensions analyzed separately in earlier research. None of the Pearson correlations is statistically significant, suggesting that the links between performance and these partial governance dimensions are unlikely to be simply linear. Table 14 reports the results for the Spearman correlations.

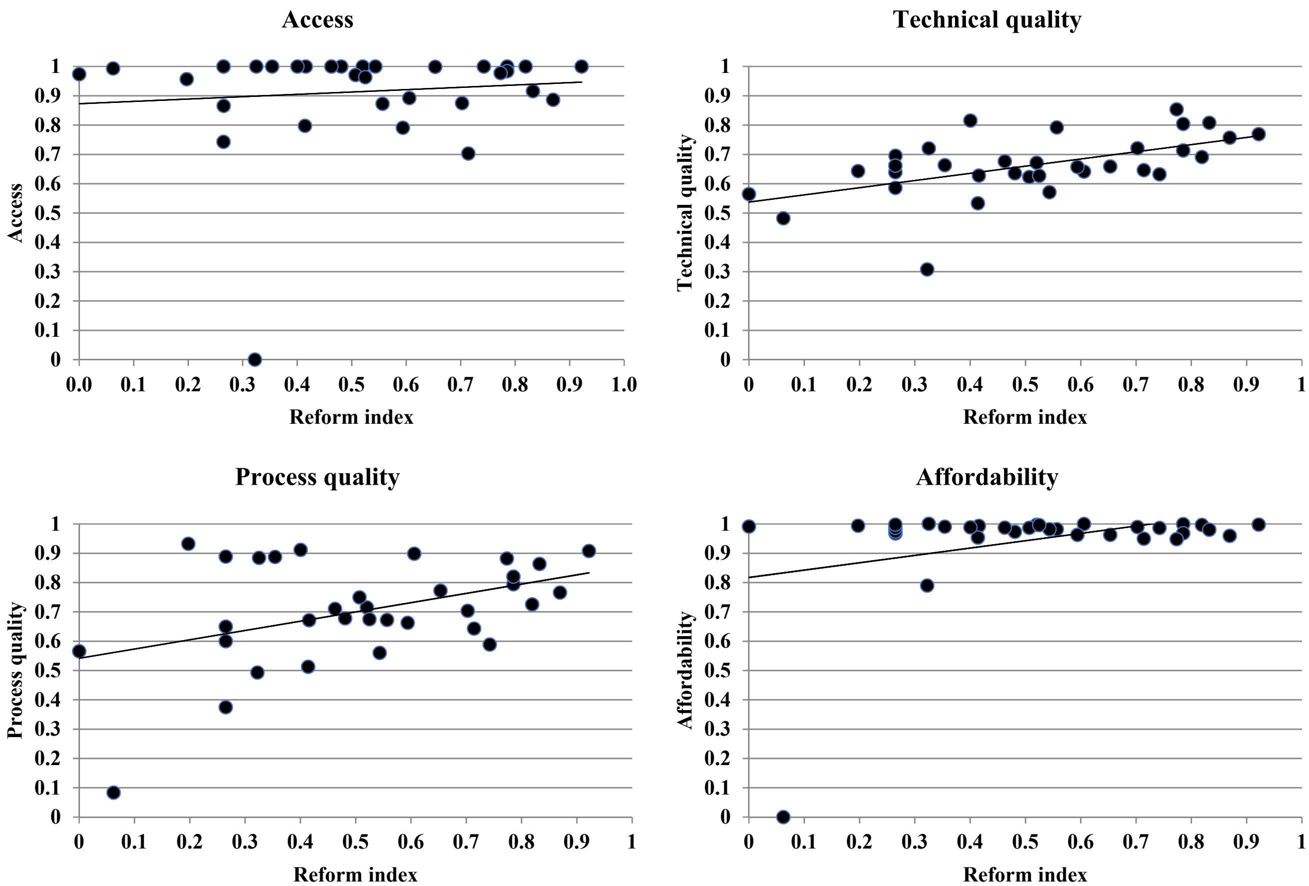
Table 14 Correlation matrix between dimensions of Electricity Reforms and Performance				
	Dimension of electricity reform			
Measure of performance	*Market structure*	*Private sector participation*	*Regulatory autonomy and experience*	*Operational organization*
Access	–0.1	0.0	0.2	0.0
Technical quality	0.4***	0.2	0.3**	0.4**
Process quality	0.2	0.0	0.4**	0.2
Affordability	–0.2	0.2	0.1	–0.1

Note: Pearson correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

Table 14 highlights the fact that governance affects technical quality and to a lesser extent process quality. None of the partial dimensions defining the overall governance index has any impact on access and affordability. The creation of a separate regulatory agency is uncorrelated with either variable—a surprising result in a region in which social concerns should be part of the agenda relevant for sector regulators. The only partial dimension without any effect on any of the performance dimensions is private sector participation. This finding reinforces a recurring message that private participation alone will not lead to significant improvements. For the aggregate index, the correlation with performance is higher than the correlation for any of the partial governance indicators, suggesting that reform packages may be more effective than individual changes.

Figure 1 illustrates the much larger dispersion for the two quality measures compared with the access and affordability measures. The simple linear regressions confirm the earlier results on the stronger correlation between the governance and quality variables than between governance and access or affordability. The higher a country is on the governance scale, the more likely performance is to be positive.

Figure 1 Correlation between reform index and selected measures of performance in the electricity sector in Latin America and the Caribbean



4. Conclusion

This paper provides a baseline snapshot of the state of the governance of the electricity sector in LAC and four outcome dimensions that should be of interest to policymakers. Although it is based on analysis of a small dataset—and does not therefore present results that are the output of econometric analysis—it provides useful insights.

The analysis confirms that governance matters to outcomes but that changes to governance in LAC's electricity sector did not have the desired impact on key social performance dimensions: The overall measure of governance is not correlated with either access or affordability. In contrast, the higher the governance index, the higher the quality measures. Social payoffs are achieved only indirectly, as quality is positively correlated with better access and affordability. This finding confirms earlier results that suggest that the failure to

develop regulatory capacity to explicitly address social concerns is one of the weak spots of the first wave of governance reforms in the region.

The results also provide insights on the baseline from which the new wave of reforms is starting. Simply building on the inherited governance characteristics of the earlier reforms is not enough. Changes are needed. One of the most important ones may be the need to recognize that a given reform may have different results in different countries. One size does not fit all; the reforms most likely to reach the desired policy goals are those designed to deal most explicitly with the institutional weaknesses and limitations of a particular country (for a survey, see Estache 2018).

A better matching of reforms adopted with local institutional constraints is not enough. Governance options needs to be broadened to account for other regional specificities. Procurement has been a weak spot in the region, as the Lava Jato corruption scheme in Brazil revealed. A review of procurement should be part of any governance assessment, including in the electricity sector.

It would also make sense to account more explicitly for the growing role of less formal institutions in the sector, which have been effective at mitigating some of the weaknesses of formal actors. The region has benefited from an increased role for consumer associations, cooperatives, nongovernmental organizations, and other civil society actors. Any of these actors could have made a difference in the social outcomes observed. Many are likely to be able to have an impact in the implementation and monitoring of the new wave of reforms aiming at greening the sector— but there is not yet systematic monitoring of their role.

This paper represents one more step in the much-needed effort to identify the full set of factors most likely to deliver improvements in the electricity sector. The first wave of reforms failed to fully deliver on the social agenda. Progress on the social agenda has been important in LAC (at least measured by progress in access) but it was probably the result of policy decisions rather than the output of sector regulatory/governance reforms. More also needs to be done to improve service quality. A much more detailed diagnostic would help policy makers improve the results of reform efforts.

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Appendix A Aggregate Indicator of Electricity Reforms

Table A.1 Correlation matrix of Market Structure dimension

	Indicator	
Indicator	*Level of competition*	*Level of unbundling*
Level of competition	1.0	
Level of unbundling	0.6***	1.0

Note: Pearson correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

Table A.2 Principal component analysis of Market Structure dimension

	Principal component	
Variable	*1*	*2*
Variance	1.6	0.4
Percent of variance explained	80.3	19.7
Cumulative percent of variance explained	80.3	100.0

Table A.3 Factor loadings of indicators of Market Structure dimension

Indicator	*Factor*
Level of competition	0.9
Level of unbundling	0.9

Note: Extraction method: principal components, Varimax rotation.

Table A.4 Weights for indicators of Market Structure dimension

Indicator	*Weight*
Level of competition	0.5
Level of unbundling	0.5

Table A.5 Correlation matrix of regulatory autonomy and experience dimension

	Indicator	
Indicator	*Separate energy regulator*	*Year of creation of regulator*
Separate energy regulator	1.0	
Year of creation of regulator	0.4**	1.0

Note: Pearson correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

Table A.6 Principal component analysis of Regulatory autonomy and experience dimension		
	Principal component	
Variable	1	*2*
Variance	1.4	0.6
Percent of variance explained	71.0	29.0
Cumulative percent of variance explained	71.0	100.0

Table A.7 Factor loadings of indicators of Regulatory autonomy and experience dimension		
	Factor	
Indicator	*1*	*2*
Separate energy regulator	0.8	–0.5
Year of creation of regulator	0.8	0.5

Note: Extraction method: principal components, Varimax rotation.

Table A.8 Weights for indicators of Regulatory autonomy and experience dimension	
Indicator	*Weight*
Separate energy regulator	0.5
Year of creation of regulator	0.5

Table A.9 Principal component analysis of aggregate index of Electricity Reforms				
	Principal component			
Variable	1	2	3	4
Variance	2.0	1.0	0.8	0.2
Percent of variance explained	49.6	25.1	20.8	4.4
Cumulative percent of variance explained	49.6	74.7	95.6	100.0

Table A.10 Factor loadings of dimensions of aggregate index of Electricity Reforms			
	Factor		
Indicator	*1*	*2*	*3*
Market structure	0.9	0.1	0.2
Regulatory autonomy and experience	0.1	0.0	1.0
Operational organization	1.0	0.0	0.1
Private sector participation	0.1	1.0	0.0

Note: Extraction method: principal components, Varimax rotation.

Table A.11 Weights of dimensions of aggregate index of Electricity Reforms	
Dimension	*Weight*
Market structure	0.2
Regulatory autonomy and experience	0.3
Operational organization	0.2
Private sector participation	0.3

Appendix B Aggregate Performance Indicators

Table B.1 Correlation matrix of Technical Quality dimension

	Indicator		
Indicator	*Total duration and frequency of outages per customer a year*	*Reliability of supply and transparency of tariff index*	*Energy losses in distribution/ transmission as a percent of output*
Total duration and frequency of outages per customer a year	1.0		
Reliability of supply and transparency of tariff index	−0.8***	1.0	
Energy losses in distribution/transmission as a percent of output	−0.4**	0.3*	1.0

Note: Pearson correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

Table B.2 Principal component analysis of Technical Quality dimension

	Principal component		
Variable	*1*	*2*	*3*
Variance	2.0	0.8	0.2
Percent of variance explained	66.7	26.1	7.2
Cumulative percent of variance explained	66.7	92.8	100.0

Table B.3 Factor loadings of indicators of Technical Quality

	RC	
Indicator	*1*	*2*
Total duration and frequency of outages per customer a year	−0.9	−0.2
Reliability of supply and transparency of tariff index	0.9	0.1
Energy losses in distribution/transmission as a percent of output	0.2	1.0

Note: Extraction method: principal components, Varimax rotation.

Table B.4 Weights for indicators of Technical Quality	
Indicator	*Weight*
Total duration and frequency of outages per customer a year	0.3
Reliability of supply and transparency of tariff index	0.3
Energy losses in distribution/transmission as a percent of output	0.4

Table B.5 Correlation matrix of Process Quality dimension						
	Dimension					
Dimension	*Mechanisms for monitoring outages*	*Mechanisms for restoring outages*	*Financial deterrents aimed at limiting outages*	*Communication of tariff changes*	*Procedures for getting electricity*	*Time for getting electricity*
Mechanisms for monitoring outages	1.0					
Mechanisms for restoring outages	0.5***	1.0				
Financial deterrents aimed at limiting outages	0.4**	0.3	1.0			
Communication of tariff changes	0.5***	0.5***	0.1	1.0		
Procedures for getting electricity	−0.1	−0.1	−0.1	−0.1	1.0	
Time for getting electricity	0.1	0.2	0.0	0.2	0.2	1.0

Note: Pearson correlation matrix. Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

Table B.6 Principal component analysis of Process Quality dimension						
	Principal component					
Variable	*1*	*2*	*3*	*4*	*5*	*6*
Variance	2.3	1.2	0.9	0.7	0.5	0.4
Percent of variance explained	37.7	20.5	15.0	11.6	8.6	6.6
Cumulative percent of variance explained	37.7	58.2	73.2	84.8	93.4	100.0

Table B.7 Factor loadings of indicators of Process Quality dimension				
	Factor			
Indicator	*1*	*2*	*3*	*4*
Mechanisms for monitoring outages	0.7	0.5	0.1	0.0
Mechanisms for restoring outages	0.7	0.2	−0.1	0.2
Financial deterrents aimed at limiting outages	0.1	0.9	−0.1	0.0
Communication of tariff changes	0.9	−0.1	0.0	0.1
Procedures for getting electricity	−0.1	−0.1	1.0	0.1
Time for getting electricity	0.1	0.0	0.1	1.0

Note: Extraction method: principal components, Varimax rotation.

Table B.8 Weights for indicators of Process Quality dimension	
Indicator	*Weight*
Mechanisms for monitoring outages	0.1
Mechanisms for restoring outages	0.1
Financial deterrents aimed at limiting outages	0.2
Communication of tariff changes	0.2
Procedures for getting electricity	0.2
Time for getting electricity	0.2