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Martín Rodríguez Pardina and Martín Rossi

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CEER
Centro de Estudios Económicos de la Regulación
Departamento de Economía y Finanzas, Universidad Argentina de la Empresa
Lima 717, 1° piso
C1053AAO Buenos Aires, Argentina
Telephone: 54-11-43797693
Fax: 54-11-43797588
E-mail: ceer@uade.edu.ar
http://www.uade.edu.ar/economia/ceer.

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Technical Change and Catching-up: The Electricity Distribution Sector in South America

Martín A. RODRÍGUEZ PARDINA
Centro de Estudios Económicos de Regulación, UADE, Argentina

Martín A. ROSSI
Centro de Estudios Económicos de Regulación, UADE, Argentina

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1. ABSTRACT

The main purpose of this paper is to analyze technical change in the electricity distribution sector in South America, in the period 1994-1997. We do so by estimating a Maximum Likelihood stochastic frontier. We found that there is no evidence of catching up effects in the sector during this period. Besides, there is partial evidence that suggests that countries which reformed their electricity sector had a better performance than those which did not. We also found an increase in the capital share in the countries that made the reform and an increment in the labor share in the ones that did not make the reform.

I. INTRODUCTION

The main purpose of this paper is to analyze the technological evolution in the electricity distribution sector in South America. We do so by estimating a stochastic production frontier with Maximum Likelihood for the period 1994-1997.

Following the process initiated by Chile in the early ‘80s, many countries in South America have undergone deep transformations in their electric industries, which include both restructuring and privatization of the prevailing public monopolies. As a result of these processes, a strong change in the role of government has occurred, leaving its producer and firm owner roles to become a regulator of those activities that constitute natural monopolies (namely transmission and distribution).

In this new regulatory role, the comparison of the relative efficiency of several regional monopolies seems to be a potentially valuable instrument to reduce the asymmetry of information that characterized the regulator-firm relationship. This fact has been recognized in many of the reform processes in which horizontal break-up of transmission and distribution firms was an important ingredient of the transformations.

In this context, the productive frontier estimates can be helpful to the regulators as a tool in the setting of the X factor in a price cap regime of the form RPI-X+K. This factor reflects the expected price falls due to efficiency gains the firms can achieve during the duration of the price cap. These efficiency gains are basically of two types: shifts of the frontier and efficiency gains due to catching up. The first of these terms must be included in the X factor of all the firms of the sector. That is, if it is expected a productivity growth of 1% per year, all the firms must have this rate incorporated in the X factor. However, the firms that are not on the frontier can reduce their costs (and increase their efficiency) in a magnitude equal to their current inefficiency. The X factor will include, in this case, the shift of the frontier of the sector plus an additional term that will have the purpose of eliminating the differences between the firm and the frontier.

However, to be useful in the regulatory process this tool needs two conditions to be satisfied. On the one hand, it requires a broad set of comparable firms and detailed information about them. In this respect CIER's effort to build up a regional database is a fundamental contribution for the development of efficient regulation of electric utilities. But, on the other hand, this availability of data, although a necessary condition, is far from sufficient. One must count on adequate techniques that allow an exhaustive analysis of the available data with reference to an appropriate conceptual framework. Our objective in this paper fits into this criterion, trying to contribute to the development of instruments that provide an efficient regulation of the firms in this sector.

The rest of the paper is organized as follows. Section II presents the theoretical structure of the estimated production function model. Section III presents the data and empirical results. Section IV concludes.

II. THE MODEL

An important feature of the regulated utilities is that, in general, the firms are under the obligation of providing the service at the specified tariffs. Therefore, the firms must meet the demand for their service and are not able to choose the level of output they will offer. Given the exogeneity of the output levels, the firm maximizes profit simply by minimizing the cost of producing a given level of output. This implies that cost frontiers are the theoretically sound choice to estimate.

However, there are other theoretical as well as practical arguments that oppose to the former ones. Among these is the difficulty to obtain accurate information on input prices. Moreover, the estimation of cost frontiers involves the use of variables measured in monetary units (data on costs as well as on input prices is needed), which could be a serious problem if one wishes to make international comparisons. Production functions, instead, only require variables measured in physical units (homogeneous –or at least much more homogeneous among countries).

As a theoretical argument, one could add that whenever there exists public ownership, firms in general do not seek profit maximization as their main goal. Besides, in this kind of firms, prices may not be available nor reliable (Charnes, Cooper and Rhodes, 1978).

(i) Since we are attempting an international comparison on several countries in our sample whose electricity firms are owned by the public sector, in this paper we estimate a production frontier. The stochastic production function model (Cobb-Douglas) with panel data is written as

$$Y_{it} = \beta_0 + X'_{it}\,\beta + \varepsilon_{it},$$

where Y_{it} is the natural logarithm of the output of decision making unit (DMU, hereafter) i (i=1, 2,...,N) at time t (t=1,2,...,T), X_{it} is the corresponding matrix of k inputs (and environmental variables, also in logs) and β is a kX1 vector of unknown parameters to be estimated. The error term is specified as

$$\varepsilon_{it} = v_{it} - u_{it}.$$

The v_{it} are statistical noise and are assumed to be independently and identically distributed, while u_{it} are non-negative random variables which represent technical efficiency. The v_{it} represent those effects that cannot be controlled by the DMU, such as measurement errors, omitted variables and weather conditions. Technical inefficiency, on the other hand, accounts for those factors that can be controlled by the DMU, and can be defined as the discrepancy between a DMU's actual and potential outputs.

Though various distributions have been suggested in the literature for this term the most common in empirical papers, and the one that will be used in this paper, is the half normal. This distribution assumes that the majority of the firms are almost quasi efficient. There is, however, no theoretical reason that impedes that inefficiency be distributed symmetrically as v_i. Since it is not convenient in empirical applications to impose the model an a priori distribution of the inefficiency term, it is preferable to use a more flexible distribution. A proposed distribution is the truncated normal (Stevenson, 1980), which is a generalization of the half-normal distribution. This distribution is obtained by truncating at zero a normal distribution with median μ and variance σ^2. Setting μ to zero reduces to the traditional half-normal model. Therefore, we contrast the null Ho: $\mu=0$. This can be done with a generalized likelihood-ratio test, LR.

To represent the temporal evolution of the inefficiency term we use a model proposed by Battese and Coelli (1992):

$$u_{it} = \exp[-\eta(t-T_i)]u_i \quad (1),$$

where η is a parameter to be estimated and u_i are assumed to be i.i.d. as truncations at zero of the $N(\mu,\sigma^2)$ distribution. The level of technical efficiency of DMU i in period t is obtained as

$$EF_{it} = \exp(-u_{it}).$$

Battese and Coelli (1992) show that the best predictor of $\exp(-u_{it})$ is obtained by using the conditional expectation of $\exp(-u_{it})$ given ε_{it}, $E[\exp(-u_{it})/\varepsilon_{it}]$.

In this specification, since the exponential function, $\exp[-\eta(t-T_i)]$, has a value of one when t=T, the random variable u_i can be considered as the technical inefficient effect for the i-th DMU in the last period of the panel. For earlier periods, the technical efficiency effects are the product of the technical inefficient effect for the i-th DMU in the last period of the panel and the value of the exponential function, whose value depends on the parameter η, and the number of periods before the end period of the panel. If η is positive then the model shows decreasing inefficiency effects, while if η is negative the inefficiency effects are increasing (Coelli et al. 1998). A disadvantage of this specification is that the ordering of the firms according to the magnitude of the technical inefficiency effects is the same at all time periods.[1] The main advantage, at least for our purposes, is that the technical inefficiency changes over time can be distinguished from technical change. The latter is obtained by including a time trend (and eventually its square) in the regressor vector.

It is worthwhile noting that we used the parameterisation of Battese et al. (1977) who replace σ_v^2 and σ_u^2 with $\sigma^2=\sigma_v^2 + \sigma_u^2$ and $\gamma=\sigma_u^2/(\sigma_v^2 + \sigma_u^2)$. The parameter γ must lie between zero and

[1] A more general specification such as the one proposed by Cornwell, Schmidt and Sickles (1990) allows for greater flexibility but is more demanding in terms of data.

one. A value of γ of zero indicates that the deviations from the frontier are due entirely to noise, while a value of one would indicate that all deviations are due to technical inefficiency. This specification allows us to test the null hypothesis that there are no technical inefficiency effects in the model, H_0: γ=0, versus the alternative hypothesis H_1: γ>0.

An important advantage of this model is its great flexibility, which allows testing different specifications in order to choose the one that best fits the data. In this paper we test the hypothesis that the inefficiency term has a half-normal distribution (H_0: μ=0) vis a vis the more flexible truncated (at zero) normal. We also contrast the hypothesis that the inefficiency is time invariant (H_0: η=0), and the null that there is not technical change in the analyzed period.

III. EMPIRICAL RESULTS

The model

The model presented in section II will be used to estimate a production frontier, with which we will test different hypotheses about the behavior of the inefficiency and the technical change in a sample of 36 electricity distribution firms in South America in the period 1994-1997.

The first important decision we have to make was the choice of the variables to include in the model. Neuberg (1977) describes four related but distinguishable activities in electricity distribution. Firstly, distribution properly which includes maintenance of equipment and installations to users and load dispatch. Secondly, meter reading and billing. Thirdly, sales including related activities such as publicity and fourthly administration. Neuberg suggests four variables as main cost drivers in electricity distribution: number of customers served, total KWh sold, Km of distribution lines and Km^2 of distribution area. Burns et al. (1994) add some additional variables: maximum demand (which determines system configuration and size), transform capacity (which affects losses) and demand structure (which determines load factors at different moments of the day).

The main conceptual problem is to identify within this set of variables which one or ones are the output. Neuberg discards the possibility of treating distribution companies as multiproduct firms given that the different variables cannot be separately sold and/or priced. For example, once the number of clients is identified as the product (with a price equal to average annual revenue per customer of the firm), energy sales in (KWh) cannot be sold separately. Given that the remaining variables cannot be considered outputs (nor inputs for which a price is paid) they can be introduced in the model as specific characteristics of the firms to allow for comparisons among them.

The initial estimated production function is:

$$\text{Ln CUSTOMER} = \beta_0 + \beta_1 \text{ Ln KMNET} + \beta_2 \text{ Ln EMPLOYEE} + \beta_3 \text{ Ln AREA} + \beta_4 \text{ Ln TRANSF} + \beta_5 \text{ Ln STRUCT} + \beta_6 \text{ Ln SALES} + \beta_7 \text{ TIME} + \beta_8 \text{ (TIME*DREFORM)},$$

where Ln stands for natural logarithm. The dependent variable is the number of customers (CUSTOMER), and the regressors are the following ones: distribution lines (KMNET, in km), number of employees in the distribution sector (EMPLOYEE), service area (AREA, in km^2), transformers (TRANSF, in KVA), proportion of sales to residential customers (a proxy of the market structure, STRUCT), and sales (SALES, in MWh). We include a time trend in the model to account for technical change, and an interaction variable between time and a dummy, which takes a value of one when the firm belongs to a country which has already reformed its electricity sector and zero otherwise.

The data

The raw data used in this work has been obtained from the Secretaría General de la Comisión de Integración Eléctrica Regional (CIER) reports, "Datos Estadísticos. Empresas Eléctricas. Año 1994", and "Datos Estadísticos. Empresas Eléctricas. Años 1995-1996-1997". The database includes information about a large number of variables for the following countries: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Perú, Uruguay and Venezuela. Table 1 shows the firms and years for which the data was available.

Table 1

Country	Firm	1994	1995	1996	1997
Argentina (R)	EMSA		X	X	
	EDET			X	X
	EDENOR	X			
Bolivia (R)	CESSA		X	X	X
	CRE	X			
Brasil	CEB	X	X	X	X
	CELG		X	X	X
	CEMAT				X
	CEMIG	X	X	X	X
	CESP	X	X		
	COPEL	X			
Chile (R)	CONAFE	X	X	X	X
	EDELMAG	X	X	X	X
Colombia (R)	CHEC	X			
	EEPPM	X	X	X	X
	ENERCALI		X	X	X
	EPSA			X	X
	ESSA		X	X	X
Ecuador	EEQSA	X			X
	EERCSCA	X		X	
	EERSSA		X	X	X
	ELEPCOSA	X	X	X	X
	EMELMAN ABI	X	X	X	X
Paraguay	ANDE	X	X	X	X
Perú (R)	ELC		X		X
	ELECTRO SUR	X	X	X	X
	LUZ DEL SUR	X	X	X	X
	SEAL	X	X	X	X
Uruguay	UTE	X			

Venezuela	CALEV	X	X	X	X
	CALEY		X	X	X
	ELECAR	X	X	X	X
	ELEGGUA	X	X	X	X
	ELEVAL	X	X	X	X
	ENELCO		X	X	X
	ENELVEN		X	X	X

We mark with an X the data available, and with a (R) the countries that made the reform of their electricity sector.

The summary statistics of the sample of 36 firms are presented in table 1. In the Statistical Appendix the data series are presented.

Table 2
Basic Statistics

Variable	Sample Size	Mean	Standard Deviation
Number of Customers	104	502893	838331
Residential/Total Sales (%)	104	40	15
Km. of net	104	173877	798887
Transformer Capacity (KVA)	104	1395624	2860505
Concession Area (km^2)	104	74354	161194
Sales (MWh)	104	3122201	6430711
Number of Employees at Distribution	104	698	1505

We start our estimates with a flexible model and then we test different specifications using a LR test, which requires the estimation of the model under both the null and the alternative hypotheses. The statistic is calculated as

$$LR = -2[L_R - L_U],$$

where L_R is the log-likelihood of the restricted model (i.e., the half-normal specification) and L_U is the log-likelihood of the unrestricted model. The LR statistic has a chi-square distribution with degrees of freedom equal to the number of restrictions involved (in this instance one).

In a first step we test the null hypothesis that there are no technical inefficiency effects in the model. Comparing the log-likelihood of the ML and OLS model we found that there are significative differences between them.[2] Since the LR statistic is greater than the critical value

[2] Some difficulties arise in testing the null Ho: γ=0 because γ=0 lies on the boundary of the parameter space for γ. In this case, if the null is correct the LR statistic has asymptotic distribution, which is mixture of chi-square distributions. The rule of thumb for a test of size α is: "Reject Ho if LR exceeds the chi-square value for a size 2α" (Battese et al., 1998).

(one degree of freedom), the null that there are no inefficiency effects in the sample can be rejected.[3]

The next step is to test the half-normal model versus the alternative truncated normal. The estimated value of μ is 0.0078, and the log likelihood function of the unrestricted model is not significative different from the log likelihood of the restricted (μ=0) model. Since we cannot reject the null, in the final model the efficiency component is assumed to have a half-normal distribution.

Finally, we test the time invariant inefficiency effect hypothesis. We do so by running two models, one with the parameter η and another without it. The log likelihood of the unrestricted model is 15.7, which is not significative greater than the log likelihood of the restricted (14.7, when η=0) model. Since the LR test cannot rejects the null H_0: η=0, we do not include η in the model. The ML estimates of the initial model are presented in column A of table 3.

Table 3

(a) ML Estimates: The dependent variable is Ln CUSTOMERS

Variable	Column A μ=0; η=0	Column B μ=0; η=0	Column C μ=0; η=0
Intercept	5.774 (5.779)	11.79 (26.26)	11.99 (27.19)
Ln KMNET	0.204 (0.341)	0.044 (3.332)	0.036 (2.907)
Ln EMPLOYEES	0.403 (0.415)	0.134 (2.705)	0.163 (3.587)
Ln AREA	0.103 (0.112)	0.047 (1.938)	0.032 (1.225)
Ln TRANSF	0.179 (0.238)	0.012 (0.479)	0.029 (2.091)
Ln STRUCT	-0.153 (-0.157)	0.024 (0.901)	0.022 (0.929)
Ln SALES	0.025 (0.031)	0.013 (1.722)	0.012 (1.828)
TIME	0.012 (0.013)	0.012 (0.479)	0.002 (0.067)
TIME*DREFORM	0.015 (0.016)	0.021 (2.172)	0.031 (0.591)
TIME*Ln KMNET (β_9)		0.0015 (0.684)	-0.001 (-0.439)
TIME*Ln EMPLOYEE (β_{10})		0.0019 (0.503)	0.008 (1.989)

[3] The ML estimate of γ is 0.95, value which reinforces the conclusion above.

TIME*Ln KMNET *DREFORM (β_{11})			0.012 (2.038)
TIME*Ln EMPLOYEE *DREFORM (β_{12})			-0.023 (-3.251)
Log Likelihood	14.7	51.7	57.2

The t statistics are in parentheses.[4]

In the initial model all the slope variables are not significant at the usual levels of confidence.[5] The mean efficiency is 0.60, with a maximum value of 0.97 and a minimum of 0.27. This wide range of values can be explained by the heterogeneity of the sample.

Technical change can be analyzed through the coefficients of the variables TIME and (TIME*DREFORM). Even though the variables were not significant at the usual levels of confidence, the analysis of the signs of the coefficients suggest a better performance in those countries that reformed their electricity sector. Given the ML estimated parameters, the total rate of technical change is obtained as the first derivative of the natural logarithm of the production function with respect to time, dy/dt, which in this particular case is equal to $\beta_7 + \beta_8 *$ DREFORM. Since DREFORM takes a value of one in the countries that made the reform and zero otherwise, technical change is

$$\delta \text{ Ln CUSTOMER}/\delta \text{ TIME} = 0.012 + 0.015 * 1 = 0.027$$

in those countries that reformed their electricity sector, and

$$\delta \text{ Ln CUSTOMER}/\delta \text{ TIME} = 0.012$$

in the ones that did not made the reform. The resulting values can be interpreted as constant annual growth rates, though in this particular case it is important to repeat that the null of non-growth cannot be rejected.

The inclusion of a single time trend reflects what is known as Hicks neutral technical change. That is, the intercept of the function shifts but the slope does not.[6] The non-neutral technical change, on the other hand, can be calculated including the interaction terms between inputs and time. The ML estimated model in this case is presented in column B of Table 3. As can be observed, though in this model some of the variables become significant, the variables KMNET and TIME*Ln EMPLOYEE are not significatively different form zero. Therefore, we can not reject the null of neutrality. The same conclusion is obtained performing the LR test.

An alternative formulation arises if in the above model the interactions of the inputs and the variable DREFORM are included, in order to analyze the different features (related to non-neutral technical change) between the countries that made and did not make the reform. The ML model is presented in column C of Table 3.

[4] For the estimates, we use FRONTIER 4.1, written by Coelli (1996).
[5] It is worthwhile noting the differences between the ML and OLS estimates. In the last one, for example, all the variables are significant.
[6] That is, the marginal rate of substitution does not change.

In this model, the new variables are significant (TIME*Ln KMNET*DREFORM and TIME*Ln EMPLOYEE*DREFORM). This could be showing that technical change is non-neutral and different among countries. That is, input elasticities are not constant. The output elasticity with respect to capital (net) is now

$$\delta \text{ Ln CUSTOMER}/\delta \text{ Ln NET} = \beta_1 + \beta_9 \text{ TIME} + \beta_{11} \text{ TIME*DREFORM}$$

whereas the output elasticity with respect to labor is

$$\delta \text{ Ln CUSTOMER}/\delta \text{ Ln EMPLOYEE} = \beta_2 + \beta_{10} \text{ TIME} + \beta_{12} \text{ TIME*DREFORM}.$$

The results are as expected, since the labor share is increasing in those countries that did not made the reform, and the capital share increases in those countries that made the reform.

If technological change is non-neutral (as it is suggested by the model presented in column C), the technical change can be different for different input utilization. Coelli et al. (1998) suggest using a geometric mean to estimate technical change for adjacent periods s and t:

$$\text{Technical Change} = \{[1+\delta f(X_{is},\tau,\beta)/\delta\tau]\times\{[1+\delta f(X_{it},\tau,\beta)/\delta\tau]\}^{0.5}.$$

The first derivative is evaluated at τ=s and the second one at τ=t (f(.) is the analyzed function and τ is time). Using this formula, the estimated mean annual rate of technical change in the countries that reformed their electricity sector is 5.02%, whereas in the others the rate is about 3.55%.

To conclude, it is worth noting that the relative efficiency does not show significative differences between the firms belonging to the countries that made or did not make the reform. In the initial model, the efficiency in the countries that made the reform was higher, but this result was reverted in the final model.

IV. Conclusions

The main purpose of this paper is to analyze the technological evolution in the electricity distribution sector in South America. We do so by estimating a stochastic production frontier with Maximum Likelihood for the period 1994-1997. We found that there is no evidence of catching up effects in the sector. Besides, we found partial evidence suggesting that the countries that made the reform in the electricity sector had performed better than the others. We also found a growth in the capital share in the countries that made the reform, and an increment in the labor share in the ones that did not make the reform.

One aspect that this methodology would allow to test in the future is the discrimination of technical development by type of regulatory mechanism. The idea is that different types of schemes can generate different schedules of technical change, not only regarding the intensity of the technical change but also to qualitative features (for example, different schemes can incentive different evolutions in input shares).

Thinking about the future, this kind of work highlights the importance of having homogeneous databases in the different countries in order to make the comparisons. In this sense, it is important to note the work of the Comisión de Integración Eléctrica Regional (CIER), source of the information on which this study was based.

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STATISTICAL APPENDIX

	Year	Country	Cust.	Sales	Struct.	Net	Transf.	Area	Empl.
EMSA	1995	ARGENTINA	101721	388175	31	5346	227034	16206	261
	1996	ARGENTINA	103798	418088	29	5526	253017	16206	257
EDET	1996	ARGENTINA	259667	881514	44	8825	520814	22434	197
	1997	ARGENTINA	276560	961472	45	9365	548226	22434	190
EDENOR	1994	ARGENTINA	2083425	9086460	39	23426	3110000	4637	1155
CESSA	1995	BOLIVIA	28988	80901	35	43116	43116	49	53
	1996	BOLIVIA	30685	84426	34	48822	48822	49	54
	1997	BOLIVIA	33289	91969	36	52587	52587	49	51
CRE	1994	BOLIVIA	141809	661502	45	4983	409423	30828	226
CEB	1994	BRASIL	428580	2468832	39	6855	1317000	5783	734
	1995	BRASIL	443912	2752474	39	12072	1359000	5783	764
	1996	BRASIL	463958	2972650	39	12618	1427050	5783	743
	1997	BRASIL	484384	3201539	39	13114	1496000	5783	668
CELG	1995	BRASIL	1149901	4865680	34	88541	2078706	337008	155
	1996	BRASIL	1226236	69571	34	92352	2146539	337008	208
	1997	BRASIL	1306017	5506092	35	94831	2202414	337008	178
CEMAT	1997	BRASIL	498427	2388674	44	5606	436000	901420	98
CEMIG	1994	BRASIL	3853651	30984232	16	7575500	562762	562762	8416
	1995	BRASIL	4048556	32113038	18	253681	8159800	562762	7904
	1996	BRASIL	4248069	33316098	19	263174	8633786	562762	7205
	1997	BRASIL	4472975	34973256	20	274960	9266600	562762	6449
CESP	1994	BRASIL	1295725	8935918	22	72380	2102261	120884	3606
	1995	BRASIL	1351919	9409343	23	79640	23881238	120884	3087
COPEL	1994	BRASIL	2310120	11636838	26	39661	7247000	191136	3286
CONAFE	1994	CHILE	104637	366959	34	1775	107660	615	133
	1995	CHILE	109854	400613	34	1060	114972	638	121
	1996	CHILE	115035	438932	33	1177	122780	1494	119
	1997	CHILE	119517	467897	33	1265	131120	1494	118
EDELMAG	1994	CHILE	38778	116323	23	775	56103	61	28
	1995	CHILE	39907	117432	51	781	58810	59	30
	1996	CHILE	40588	125966	50	794	62983	60	32
	1997	CHILE	41297	130308	51	800	65028	61	28
CHEC	1995	COLOMBIA	286650	1048235	56	5962	326590	9526	348
EEPPM	1994	COLOMBIA	643041	4542049	34	13393	2285637	1152	450
	1995	COLOMBIA	680275	4589000	46	10866	2388502	1152	779
	1996	COLOMBIA	711396	4621000	47	11111	2507982	1152	781
	1997	COLOMBIA	756425	4929000	44	11354	2610000	1152	751
ENRCALI	1995	COLOMBIA	410310	3069	41	2120	984750	862	982
	1996	COLOMBIA	428877	30.59	40	2096	1108040	862	982
	1997	COLOMBIA	439643	3017	40	2096	1110900	862	915
EPSA	1996	COLOMBIA	281015	1216600	94	10947	293100	18572	251
	1997	COLOMBIA	295726	1241200	94	14018	307200	18572	242

	Year	Country	Cust.	Sales	Struct.	Net	Transf.	Area	Empl.
ESSA	1995	COLOMBIA	348753	1113222	43	35900	637604	30950	404
	1996	COLOMBIA	359870	1070962	46	36150	640604	30950	308

	1997	COLOMBIA	372536	1115335	46	36329	642854	30980	306
EEQSA	1994	ECUADOR	378376	1477993	44	9159	873176	8765	278
	1997	ECUADOR	454450	1845241	45	10011	1433000	13368	279
EERCSCA	1994	ECUADOR	136632	311718	40	7564	224414	9138	206
	1996	ECUADOR	159315	357970	43	9056	255627	10152	204
EERSSA	1995	ECUADOR	76718	92972	87	2889	81000	35000	315
	1996	ECUADOR	80532	107429	87	3304	90000	35000	306
	1997	ECUADOR	84309	115725	59	3408	92203	35000	336
ELEPCOSA	1994	ECUADOR	55914	111837	31	1816	36849	3000	50
	1995	ECUADOR	59271	116950	31	1985	39717	3000	52
	1996	ECUADOR	60580	120646	37	2092	41162	3000	52
	1997	ECUADOR	63476	134407	35	2192	38782	3000	52
EMELMANABI	1994	ECUADOR	115549	348491	42	3267	205483	16800	117
	1995	ECUADOR	119798	370615	42	3337	304000	16800	91
	1996	ECUADOR	128799	422223	41	3498	340570	16800	96
	1997	ECUADOR	141475	467031	42	3570	362423	16800	99
ANDE	1994	PARAGUAY	589008	328974	41	24776	1537563	406752	760
	1995	PARAGUAY	669325	3439887	42	33416	1712642	406752	758
	1996	PARAGUAY	785370	3630065	44	39952	1825324	406752	745
	1997	PARAGUAY	821622	3861080	45	45893	1941292	406752	749
ELC	1995	PERU	184672	395018	6	5473	143248	133255	153
	1997	PERU	231187	398669	31	7602	1198956	133255	104
ELECTRO SUR	1994	PERU	50810	172224	34	1591	102839	31796	47
	1995	PERU	55089	130998	42	1578	97000	31810	50
	1996	PERU	63933	131193	44	1598	99000	31810	55
	1997	PERU	70641	137701	44	1624	101000	31810	43
LUZ DEL SUR	1994	PERU	499644	2806165	37	10478	692105	2880	519
	1995	PERU	556319	3007786	36	13161	1439300	2900	501
	1996	PERU	603134	2837666	40	13718	1547300	2900	360
	1997	PERU	628553	3045317	40	14062	1649800	2900	427
SEAL	1994	PERU	138110	332531	30	400	94950	63345	114
	1995	PERU	154092	516673	28	4390	150000	63345	90
	1996	PERU	175037	573118	27	4620	160000	63345	67
	1997	PERU	189442	577134	26	5046	185000	63345	61
UTE	1994	URUGUAY	1054035	4632156	48	44239	2803000	176215	1810
CALEV	1994	VENEZUELA	281786	2461905	34	1583221	576	489	315
	1995	VENEZUELA	276367	2686290	31	1615490	576	480	280
	1996	VENEZUELA	275934	2566789	10	1619663	576	479	270
	1997	VENEZUELA	277193	2576961	32	1660927	576	481	240
CALEY	1995	VENEZUELA	43664	176574	52	84905	1000	44	75
	1996	VENEZUELA	44212	172129	51	84905	1000	44	73
	1997	VENEZUELA	45465	189500	49	84905	1000	45	73

	Year	Country	Cust.	Sales	Struct.	Net	Transf.	Area	Empl.
CALEY	1995	VENEZUELA	43664	176574	52	84905	1000	44	75
	1996	VENEZUELA	44212	172129	51	84905	1000	44	73
	1997	VENEZUELA	45465	189500	49	84905	1000	45	73
ELECAR	1994	VENEZUELA	562491	5805964	39	3302	3088081	2704	1431

	1995	VENEZUELA	557000	5762687	24	3685	3201281	2704	1473
	1996	VENEZUELA	560998	5690810	25	3754	3248590	2704	1133
	1997	VENEZUELA	570068	5952225	24	3870	3264698	2704	1071
ELEGGUA	1994	VENEZUELA	56513	472956	30	388556	896	63	102
	1995	VENEZUELA	57268	516393	29	400492	896	64	117
	1996	VENEZUELA	59527	485106	32	429041	896	66	117
	1997	VENEZUELA	63230	527524	32	455591	896	71	117
ELEVAL	1994	VENEZUELA	92684	702476	40	485	459480	240	138
	1995	VENEZUELA	89416	733568	40	519	598914	240	135
	1996	VENEZUELA	91817	788615	40	774	600614	240	110
	1997	VENEZUELA	96343	860436	39	774	6216915	240	102
ENELCO	1995	VENEZUELA	90603	1628986	51	1938	557796	7746	121
	1996	VENEZUELA	95804	1896832	49	2020	587154	7746	117
	1997	VENEZUELA	101157	2162017	51	2243	638211	7746	131
ENELVEN	1995	VENEZUELA	315627	5282542	71	7379	2187136	41442	274
	1996	VENEZUELA	335639	5500398	73	7895	2193000	41442	279
	1997	VENEZUELA	358365	5847708	73	8411	2303000	41442	256

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