

## Chapter 4

### Will the Market Keep Brazil Lit Up? Ownership and Market Structural Changes in the Electric Power Sector<sup>\*</sup>

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#### I. Introduction

This paper will analyze some of the consequences of the privatization process that began in 1995 in the Brazilian electricity sector. The privatization program constituted an important part of the Brazilian industrial restructuring process in the 1990s, and brought far-reaching results to various sectors of the economy.<sup>1</sup> However, despite the announcement of a quite ambitious sectoral reform plan, the privatization of electricity progressed very slowly and incompletely. This unsatisfactory performance owes partly to political pressure against privatization but, at the same time, it concerns the very nature of the industry.

The electricity industry is often considered as a typical example of a natural monopoly because of the requirements for large-scale investments, making a single firm operation most efficient due to economies of scale (see Stiglitz 1999, chap. 8). This specific characteristic leads to the justification of public ownership on both economic and political grounds. Economically, economies of scale implies that production by a nonregulated private monopoly will fall short of the socially optimal supply. Politically, public ownership allows the government to secure the nondiscriminatory provision of services to marginal populations who might be underserved by private firms. As Shleifer (1998) recalls, about a half century ago, future Nobel laureates like Arthur Lewis and James Meade were concerned with monopoly power and supported the public ownership (or the socialization of firms), motivated partly by the successes of government control during the war, the failure of competition and regulation during the Great Depression, and the apparent success of the Soviet Union's industrialization.

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<sup>\*</sup> This chapter first appeared in *The Developing Economies* 40(4), December 2002.

Recently, however, publicly owned enterprises have been criticized as inherently inefficient, leading to the global phenomenon of privatization. Public enterprises come under criticism when their operations are directed wrong goals, or they are badly managed. The main source of misdirection is political interventions aimed at realizing private objectives. Bad management often stems from the low morals of bureaucratic managers trying to rationalize operations to maximize social benefits at minimum cost. The theoretical literature points to problems in incentive structures, principal-agent problems, and soft budget constraints (Kornai 1986), as well as the absence of takeover threats, among others.

With pro-privatization arguments prevailing, an increasing number of public utilities in developing countries have been acquired by foreign enterprises. This is partly due to the lack of capacity by local capital to assume responsibility for the large amount of fixed investments with long-term maturities. On the other hand, since their business is basically nontradable, public utility enterprises in industrialized countries are motivated to invest in foreign countries in order to increase their customer base as well as to neutralize market risks by diversifying their markets, and avoiding dependence on the market situation of one country. Foreign companies are also favored by the developed capital markets in their home countries, which enable them to move into new markets. Thus, privatization simultaneously stimulated the trend toward the internationalization of the ownership of productive assets in developing countries and the globalization of a number of transnational enterprises.<sup>2</sup>

It is also important to understand that developing countries are under pressure from international rating agencies and Washington-based international institutions, whose main concern is macroeconomic imbalances with a particular focus on government accounts. Since their evaluations have a tremendous impact on external financing, many highly indebted countries, particularly in Latin America, found it beneficial to sell government assets not only to obtain financial revenues from their liquidation, but also because tight fiscal constraints have made it impossible for governments to promote social welfare without assistance.

The current core of the discussion on private/public ownership and development is how to transfer property rights orderly, ensuring that their monopolistic behavior does not worsen public welfare. Since public ownership was developed under a particular institutional arrangement, privatization does not simply mean the transfer of ownership,

but also requires comprehensive systemic reform. Accordingly, the role of the government should be shifted from being a direct provider to a regulator. This task is complex and requires the careful elaboration of a sophisticated regulatory framework. Thus, in contrast to the private mergers and acquisitions, which were triggered by a series of deregulation measures and stimulated new patterns of competition, privatization was induced by external pressures, and has required the establishment of appropriate regulatory frameworks following the change of ownership.

By focusing on Brazilian electricity we intend to contribute to the discussion on problems arising from the ownership change of public utilities in developing countries given limited regulatory capability and economic uncertainties. The sector was initially developed under public ownership, but the macroeconomic situation of the 1990s made privatization inevitable. However, privatization was implemented under poor planning and coordination. Not only did it fail to bring the ownership change to completion, but it was also unable to create attractive market conditions to stimulate investment into capacity expansion. Our analysis finds that the delayed privatization of generation and transmission led to a long period of defensive adjustment, with low investments and cuts in expenditures. Insufficient capacity building, associated with the rainfall shortage in 1999-2001, led to a severe energy crisis, obliging the population to cut back at least 20 per cent on their energy consumption.

In the following section, we will begin our discussion by reviewing the theoretical literature on the effect of ownership on enterprise performance, from the perspective of private versus public. Based upon this understanding, the logic of the privatization of electricity in Brazil will be characterized in Section III. Then, after reviewing the historical background of the Brazilian electricity sector in Section IV, we will analyze the structural reforms in Sections V to VII. Section VIII will present the reactions of firms, as shown by their financial data. The last section will conclude the discussion.

## II. Ownership Matters: A Review of the Theoretical Literature

This section provides a selective survey of economic theory on how ownership matters in the provision of public utility<sup>3</sup> and of the principal obstacles to privatization. Following Vickers and Yarrow (1988), a public enterprise is defined as one: (a) not maximizing

profit, (b) with no marketable ordinary shares in the firm, and (c) being sustained by public funding. This means that the manager of a public enterprise is supposed to maximize the social welfare as an agent of the government, which in turn represents the public interest, while the internal efficiency of its operation is allowed to be a secondary objective, thanks to the absence of the takeover threat. Instead of engaging in in-house production, the government can contract private enterprises to achieve the same objective. Private enterprises are profit seeking, and will choose the most efficient method under the conditions imposed by the government. The point at issue is whether privately owned enterprises can achieve given social objectives more efficiently than public ones.

We start by recalling that although publicly owned enterprises do not seek efficiency, it is nevertheless possible for them to be operated as efficiently as privately owned enterprises under appropriate incentive structure arrangements (Williamson 1985). A complementary view presented by Sappington and Stiglitz (1987, p. 568) states that “all of the government’s objectives can be attained by an appropriately designed auction of the rights to produce a given product or service.” The latter conclusion depends on: (1) auction for the ownership market being competitive and the bidders sharing symmetric information about the least cost production technology; and (2) the government being able to write a perfect contract or the cost of intervention into delegated production being low. The first condition implies the extraction of monopoly rents through a competitive ownership market and no technological rents or barriers to entry due to symmetry regarding technical information. The second condition ensures that the delegated private firm will choose the most efficient production whose output will be paid the amount exactly equal to its social valuation, which is known to the government. These views lead to the neutrality theorem of Shapiro and Willig (1990) which states that ownership does not matter if the eventualities are contractible, all private information is revealed, and there is no cost of raising government funds for the tax and incentive policies.

Thus, any ownership debate must start from assuming away at least one of these neutrality conditions. The problem of incomplete contracts called the attention of various researchers from industrial organizations, such as Hart, Shleifer, and Vishny (1997), Schmidt (1996) and Laffont and Tirole (1994). Hart, Shleifer, and Vishny (1997) adopt the notion of the residual rights of control introduced by Grossman and Hart (1986).<sup>4</sup> It is assumed that the enterprise manager, whether public or private, can invest in quality improvements and cost reductions in order to obtain more customers and maximize profit,

but that cost reductions have an adverse effect on quality. Neither effort is contractible ex ante. In the case of public ownership, the fruits of noncontractible management efforts belong to the government. The manager is unlikely to invest in this case, since he knows that the reward for his effort will be exploited. By contrast, since privately owned enterprises are fully entitled to residual control rights, privatization will create stronger incentives for both types of efficiency improvement. Yet, despite the cost reductions, consumers may be worse off if: (1) the privatized firm depends too heavily on lowering quality to reduce costs; or (2) incentives for quality improvement are either unimportant or do not differ much depending on the ownership structure. Laffont and Tirole (1994) further remark that if we assume the problem of incomplete contracts between the private owner and the manager in the private ownership case, the manager may produce inefficient results as he tries to respond to two masters, the regulator and the shareholders. Shapiro and Willig (1990) developed an argument regarding the relationship between ownership structures and locations of undisclosed information. According to their formalization of public ownership, a minister represents the public interest and controls the firm. He has access to information about both internal efficiency and social effects, and maximizes social welfare, aggregating the social benefit and enterprise's profit. But the minister does not necessarily choose the first best solution, because he also tries to maximize his private benefits, which are not observable from outside. On the other hand, if the company is privately owned, it pursues profit maximization based on private information on internal efficiency. A regulator then conducts tax and incentive policies to guide the production level to the socially most desirable level. The less the regulator is informed and the more information is privately held by a manager, the more the regulator will have to pay to change the company's decision. Within this framework, privatization means a shift of undisclosed information from the minister to the private manager. Private ownership is more welfare enhancing when the minister/regulator has greater discretionary power to redirect the enterprise to pursue his private interest. This implies that a transparent democratic political regime would reduce such a risk. On the other hand, privatization may yield undesirable outcomes if the information rent for redirecting the firm's decision is very high.

The question of political interference has been one of central themes of the debate on public ownership. Vickers and Yarrow (1991) demonstrate that privatization reduces political influence and increases the influence of capital market factors. Boycko, Shleifer,

and Vishny (1996) consider political influence to still be workable under private ownership if shareholders can be convinced by giving subsidies sufficient to compensate for the foregone profit. Thus, privatization alone cannot achieve increased efficiency unless the Treasury implements strict monetary controls to raise the cost of politicians boosting their political benefits.

Thus, one cannot state that private ownership is always more efficient than public ownership. The success or failure of privatization depends on local circumstances and the idiosyncratic features of particular industries with regard to market conditions, contractibility of eventualities, and information structure. If the results are so inconclusive, why has privatization become such a global phenomenon?

On this point, Yarrow (1998) points out that strong fiscal pressure increased the political cost of destabilizing macroeconomic conditions by increasing the public account deficit. Although he apparently underestimates the cost of contracting private firms, and fails to take into consideration information rent and incomplete contracts, the notion of identifying public ownership as a luxury is increasingly gaining force. For example, a World Bank report found an inverse correlation between the weight of publicly owned enterprises and economic growth, with the reason being that the bureaucrats are still in business that there is a lack of political will for public sector reform (World Bank 1995). This kind of ideology<sup>5</sup> is widely held in the international financial community, including country risk rating agencies. Thus, it seems that privatization has been set as an a priori policy objective to demonstrate the determination for sound macroeconomic management, apart from analysis of the welfare consequence of ownership change.

Since the supremacy of this macroeconomic logic has become clear in the development policy agenda, many countries continue to seek ways to protect social welfare by regulation. However, there is great difficulty in implementing regulations in developing countries, due to the lack of monitoring ability of agencies, lack of market infrastructure promoting competition, and the highly asymmetric location of information. Furthermore, while excessive monopolistic rents can be prevented by promoting market competition, the government should also promote additional capacity in order to secure stable supply. For the latter purpose, the interests of delegated producers need to be protected in the long term, to induce investment. In some cases, the promotion of investment may require coordination among participants to share the protected rent, this contradiction makes regulation a very complicated task.

### III. Privatization in Brazil

The Brazilian experience of privatization provides an excellent opportunity for examining the controversies raised above. During the ten years from 1991 to 2001, privatization generated revenues of about U.S.\$103 billion, including U.S.\$85 billion in cash and U.S.\$18 billion in debt transferred to the private sector. This is the largest privatization program ever conducted among developing countries and transition economies. It tells us something about the significance in size and scope of the privatization process, while reminding us of the predominant position held until then by the state in the Brazilian economy.

The program proceeded in three parts: (1) the National Denationalization Program (PND) promoted by the National Bank for Economic and Social Development (BNDES) since 1991; (2) the privatization of telecommunication (Telebrás system) implemented in 1998 by the Ministry of Communication; and (3) the privatization of firms owned by local states, which conducted their own privatization programs starting from 1995. Table I shows that with PND and Telebrás, the federal government accounted for two-thirds of the total results, and that the remaining a third were handled by the state governments. There were two phases in the process. The first corresponds to 1991-94, under President Collor and, after his impeachment, by his successor President Franco.<sup>6</sup> PND during this period included manufacturing firms in areas such as steel (Usiminas, CSN, CST, Cosipa, Açominas), petrochemicals (Copesul, Petroflex, Fosfertil), and aircraft (Embraer), resulting in revenues of U.S.\$11.5 billion. These firms were the legacies of the import-substituting industrial policy that had been pursued until the mid-1980s, in which the government had attributed strategic roles to these industries for deepening and widening industrialization. But their competitiveness was hampered by the limited size of the domestic market as well as by the inability of public finance to continue supplying the funds to build new technological capabilities.

As shown by Figure 1, revenues from privatization increased from 1.3 per cent of GDP in 1991 to 3.5 per cent of GDP in 1993. This revenue was utilized to reduce central government debt, and paved the way to sounder public finances in the later stage. Between 1991 and 1994, the total stock of public sector debt fell from 38.6 per cent to 30.4 per cent of GDP. There were no major political obstacles as the separation of these enterprises did not threaten the public interest as far as social welfare issues were

concerned, except for some nationalistic reaction against selling natural resource-related companies to foreign ownership.<sup>7</sup> As discussed by Yarrow (1998), the privatization program was vigorously pursued as one of major macroeconomic policy instruments. However, it was also expected that privatization would promote the efficient management of firms. It is useful to remember that Hart, Shleifer, and Vishny (1997) present the proposition that a competitive environment is essential in a post-privatization market to stimulate efforts to enhance productivity. In this regard, the liberalization of imports, which took place under the Collor administration, was an important impetus. We can observe that the consolidation of the steel industry, triggered by privatization and international competition, made some Brazilian steel enterprises such as CSN, Usiminas, and Gerdau global players. In another instance, the aircraft producer, Embraer, has become the country's most active export company. Pinehiro (1996) conducted a comprehensive statistical study, finding a substantial increase in the operational efficiency of firms privatized during the first phase.

The macroeconomic situation of the country deteriorated in the first half of the 1990s. The annual inflation rate surged to the four-digit level and the 1995 budget deficit, measured as the public sector borrowing requirement, amounted to 7.3 per cent of GDP, to which public enterprises contributed 1.3 percentage points.<sup>8</sup> While the implementation of the PND was delayed due to the populist characteristics of President Franco's administration, the continuing fiscal crisis paved the way for the second phase of the privatization under President Cardoso beginning in 1995, as a part of the stabilization plan of his administration, the "Plano Real."

In the second phase, the scope of privatization was broadened to include public utilities (electric power, telephones, roads, railways, ports) and the banking sector. These enterprises were originally created to fill the vacuum of interests in the private sector and to promote the wide provision of services. However, as shown by the deterioration of infrastructure conditions due to a lack of adequate investment and maintenance, it was already evident that the state of government accounts was too fragile to allow compliance with such a mission.

Given this fact, the government could have chosen either to privatize or to strengthen corporate governance in order to restore the financial equilibrium of each firm. The adoption of the first option was associated with several local features. Firstly, political interventions had already seriously distorted the management of these firms in favor of



the private agendas of politicians. Especially at the local state level, it would have been difficult to restore management discipline in the short to medium term. It was expected that profit-seeking private firms would opt for efficient production and benefit consumers with lower costs and higher quality of services. Secondly, the government was pessimistic about its future financial capability for the infrastructure investments that would be necessary to avoid bottlenecks to economic growth. Thirdly, it was expected that privatization would have a positive macroeconomic impact in the short run, by increasing revenues, reducing public debt, and increasing foreign direct investment, thus reducing pressure on the balance of payments. Fourthly, demonstrating a determination to carry out privatization would increase confidence in Brazilian economic management. Given the political decision to implement privatization, the introduction of several institutional reforms was in order. Among others, a crucial step was the establishment of the Law of Concessions of 1995. It prescribed that a competitive auction should give a concessionaire a license to operate public utilities for a fixed period of time, without discrimination regarding the nationality of the capital. As reviewed in the previous section, a competitive ownership market is one of the fundamental conditions for successful privatization. Also, by giving regulators the right to intervene and terminate contracts in case of noncompliance of required obligations, the law strengthened their voice.

In addition, in order to stimulate state government privatization programs, the federal government launched a program which allowed the restructuring of state debt with the federal government at low interest rates and long-term maturity, conditional upon an initial cash payment of no less than 20 per cent of the outstanding debt. For most state governments, privatization was the only means to obtain such funds.

The success of the “Plano Real” also gave crucial momentum to the progress of the privatization program. Stabilization boosted confidence in the Brazilian economy and increased investors’ interest in privatization auctions. The participation of foreign investors in privatization was fundamental to covering the current account deficit without creating pressure in the foreign exchange market. This had a strong implication for the “Plano Real” to use fixed nominal exchange rate as the anchor of the monetary policy. This synergistic effect between stabilization and privatization became apparent around 1997-98 (Pinheiro 2000) and privatization continues to be important part of

macroeconomic policy, generating total revenues of U.S.\$91.5 billion between 1995 and 2000.

While privatization has enriched the cash inflow to the government, new challenges have arisen about how to ensure that privatized firms honor the public interest. The public interest resides in the provision of services with regularity, continuity, efficiency, safety, technological modernity, and nondiscriminatory access. Compliance with these conditions requires investment, which can be promoted by guaranteeing profit-making opportunities. It is also in the public interest that abuses of market power are not allowed and that services are provided at low cost. For these purposes, an adequate combination of competition policy and incentive policy is the complicated task for regulatory agencies. The previous review of theories suggests that it is crucial for the regulatory agency to set clear rules to establish confidence between the regulator and firms in order to minimize the information asymmetry problem and increase the efficacy of privatization contracts. In the remaining part of this paper, these issues shall be examined in more detail, through an analysis of the case of the electricity sector.

#### IV. The Rise and Fall of Public Ownership in the Brazilian Electricity Sector

The evolution of Brazil's electricity sector can be characterized by four phases of changes in ownership structure:

- Private ownership with minimal regulatory control (until 1930);
- Private ownership with poor regulation (from the 1930s to the 1940s);
- State ownership with centralized control (from the 1950s to the first half of the 1990s); and
- Mixed ownership, increasing privatization, with more sophisticated regulation (since the second half of the 1990s).

As we can observe in Figure 2, these regime changes were prompted by periods of saturation of previous models, portrayed by the low growth rates of installed capacity in the 1930s and 40s and between the mid-1980s and 1990s.

Until the first crisis during the 1930s and 40s, the liberal political regime that held power at the time left the responsibility for the development of infrastructure to local governments. Municipal governments granted concession contracts to private companies, most of which were of foreign origin. The Canadian company Light and the American

company Amforp were particularly dominant. Their investments were concentrated especially in the more profitable markets in wealthier São Paulo and Rio de Janeiro. They were favored by contracts which granted automatic tariff adjustments in accordance with currency depreciations, and there was little intervention from the federal government. Beginning in 1931, President Getúlio Vargas introduced a nationalistic political regime, and strengthened centralized control. Previous arrangements between local governments and private electric power companies were suspended, and were placed under the regulation of the federal government. The basic idea of the regulation was to force investments while controlling the tariff, so as to assure a 10 per cent return on the historical cost of capital and granting local monopoly status to concessionaires. However, the minimum rate of return guarantee was ignored in order to keep electricity tariffs at a lower level. The relations between the regulator and regulated companies became confrontational as the federal government began to charge that the private foreign companies were remitting large profits to their home countries. The government also complained about the lack of attention to high-cost consumers, namely, poor populations living in the outskirts of big cities and in rural areas. These conflicts reduced investments during the 1930s and 1940s, leading to power shortages for prolonged periods. The government stopped granting new concessions, contributing further to a decline in the growth of power supply capacity.

The government responded to the energy shortage by increasing public investments. President Vargas announced the National Electrification Plan during his second term, and inaugurated Chesf in 1954 in the poor Northeastern region and Furnas in the industrialized Southeastern region in 1957. Some state governments also established their own power companies. In particular, Rio Grande do Sul, Minas Gerais, and São Paulo made substantial investments financed by the National Economic Development Bank (BNDE). As a result, the share of the public sector in total installed generation capacity expanded from 6.8 per cent in 1952 to 54.6 per cent in 1965, while the share of the private sector shrunk from 82.4 per cent to 33.6 per cent.

The public ownership model was gradually consolidated during the 1960s and 1970s through the creation of the Ministry of Mining and Energy (MME) in 1960 and the Electric Power Company of Brazil (Eletrobrás) in 1962. The MME took responsibility for regulation and Eletrobrás became responsible for planning and implementation.

By the mid-1970s, Eletrobrás had become the most powerful institution in the sector. It became a holding company, controlling four regional generation-transmission utilities: Chesf (Northeast), Furnas (Southeast and Central-West), and Eletronorte (North) and Eletrosul (South). These regional utilities produced and delivered electricity to local power distributors, which were owned by state governments. Later, the power generation capacity of this holding company was further strengthened with the inauguration of a wholly owned nuclear plant and the Itaipú Binational Hydroelectric Power Generation, where Eletrobrás shared control with the government of Paraguay. By the mid-1980s, Eletrobrás accounted for more than 60 per cent of Brazil's total electric power supply capacity, with the state power companies responsible for the remainder.

Eletrobrás controlled the Group of Coordination of Interconnected Operation (GCOI), which operated most of regional transmission networks and high voltage interregional transmission lines (North-Northeast in 1984, South-Southeast in 1986, and North-South in 1999) and traced the planning of their expansion. As a project financier as well, Eletrobrás provided intermediation for government funding and provided sovereign guarantees to syndicated loans to electric power companies during the 1970s.

The MME established a regulatory authority, the National Department of Water and Electric Energy (DNAEE), which was responsible for authorizing concessions for electricity generation, transmission, and distribution as well as determining tariffs. Yet, the role of the DNAEE as a regulator was quite limited since development planning was actually concentrated in Eletrobrás, and competition for concessions did not exist until the implementation of the Concession Law of 1995. Moreover, tariff adjustments were automatic, guaranteeing a minimum rate of return on invested capital, and there were no instruments to stimulate productivity increases. When the regulated tariff revenue fell short of the promised rate of return, the difference was filled by public expenditures credited in the Balance Compensation Account (CRC). Further regulations, introduced in 1974, established the national equalization of tariffs, regardless of differences in the marginal costs of each regional network. Eventual differences in profitability were later leveled through transfers from companies in surplus to others in deficit. Thus, electricity firms were guaranteed profits, at least on paper. It was even said, "the regulator was in hands of the regulated" (Ferreira 2000, p. 188), since most of DNAEE's technical officers were loaned from the power companies.

In retrospect, the public ownership regime contributed to spectacular growth in

electric generation capacity: a roughly ten times increase from 1955 to 1980. According to the same data used for Figure 2, the average annual growth rate of generation capacity during this period was 9.2 per cent. It is worth mentioning that Eletrobrás was successful in implementing the electrification of the rural Northeast and the development of the Tucuruí power plant in the North, allowing energy-consuming industries such as aluminum to locate there, while the expansion of Furnas supported industrialization in the Southeast.

To a great extent, this spectacular growth owed to the funding capability of Eletrobrás. Public ownership was suitable for development in its early stage. Vertical integration allowed the internalization of the information problem. Large-scale reservoirs for power generation and transmission lines were constructed in response to demand projections based on ambitious industrialization plans. External borrowing and credit from the National Economic Development Bank were channeled through Eletrobrás.

However, as pointed out by Baer and McDonald (1998),<sup>9</sup> the financing structure of the Brazilian electricity sector became increasingly vulnerable with the significant changes in the 1970s. In 1967, 34.0 per cent of its financing came from internal resources (tariff revenue) and 31.9 per cent from state resources, while domestic and foreign loans accounted for 13.0 per cent. This structure remained almost unchanged until 1973, but by 1979 the share of internal resource and state resource had dropped to 24.2 per cent and 6.1 per cent respectively, and domestic loans had risen to 30.1 per cent and foreign finance to 32.0 per cent. In the early 1980s, Brazil faced a sudden deterioration of terms of borrowing, and the cost of debt servicing skyrocketed. By 1984, the share of internal resources had fallen further to 17.9 per cent, while that of foreign borrowing had risen sharply to 62.8 per cent. As a result, while the shares of fixed investment and debt servicing in total expenditure were 78 per cent and 15 per cent in 1973, the former declined to 26 per cent and the latter increased to 74 per cent in 1984.

The deterioration of the financial situation of Eletrobrás translated into decreasing investment in generation capacity during the 1980s and 1990s, as shown in Figure 2. The same applies to transmission lines (Table II). It is important to note that there was no expansion of high voltage transmission lines above 500KV in the first half of the 1990s.

Pires (1999) and Ferreira (2000) suggest that these problems are mainly related to political interventions. The most serious problem was the use of tariff controls as an

instrument for the stabilization of inflation. In view of the acceleration of inflation in the late 1970s, authorities at the ministries of planning and finance intensified their intervention in public utility tariff formation. Adjustments in electricity tariffs always lagged behind the rate of inflation. As Figure 3 shows, the electricity tariff declined in real terms during the second half of the 1970s throughout the 1980s. Although the energy policy authority technically maintained the rate of return guarantee, it was not reflected in the actual tariff as the difference was simply accumulated as CRC account credits. Firms did not actually have cash flow and accumulated arrears in federal income taxes and payments for electricity purchased from Eletrobrás.<sup>10</sup>

At the same time, governance problems increased. Since it was common for persons without any particular expert knowledge to be politically appointed to executive positions, they usually served as agents of populist politicians, collaborating to maintain a high level of employment. There were few incentives to rationalize expenditures as profits were guaranteed by the rate of return tariff regulation, at least at the surface and as long as the budget constraints were soft enough to be able to cover the actual cash flow shortage. At the state level, companies were utilized to raise borrowings by proposing investment programs, many of which were not even implemented, and the money was used for other ends, such as to cover the fiscal deficit.

By the end of the 1980s, as predicted by the theoretical literature, the Brazilian electricity sector under the public ownership model found itself with a serious debt overhang, weak investment capability due to lack of cash flow, and low productivity, with an excessive labor force. In order to promote productivity growth, reforms were needed in the balance sheet structure, regulatory framework including tariff adjustments, and the governance structure.

## V. Tariff Reform

The restructuring of the electricity sector was initiated in 1993, with tariff system reform. It eliminated the tariff equalization, allowing tariff differences across regions, and the CRC was subsequently closed. The reform introduced the so-called price cap regulation whose standard formula is described by the following equation:

$$IRT = \{ VPA_1 + VPB_0(\pi - X) \} / PA_0,$$

where  $IRT$  is a tariff adjustment rate ceiling and  $VPA_1$  refers to a firm's uncontrollable costs for the year in operation, including water resource utility fees determined by the

government and the cost of fuel and electricity imports affected by exchange rate fluctuations.  $VPB_0$  is the controllable costs in the previous year, including labor and purchasing of materials and external services, and adjusted to the current value with inflation rate  $p$ , discounted by the productivity improvement factor  $X$ .  $PA_0$  is the annual total revenue of the previous year.

This formula implies that  $IRT$  is determined by an arbitrary determination by the regulator of  $X$ . Since the firm's revenue is capped by  $IRT \cdot PA_0$ , the formula induces a reduction of controllable costs greater than  $X$  per cent because the residual belongs to the firms. This scheme is coherent with private ownership, under which residual control rights belong to companies. If the agency problem between capital owners and managers is negligible, productivity improvement efforts are enhanced. However, such incentives are weak under public ownership because the residual control rights do not belong to the manager, and the public owner in the face of soft budget constraints is not motivated to enforce cost reductions. Thus, while the price cap regulation is conducive to productivity improvements, the ownership structure matters in determining whether the regulation change is effective.

The formula also suggests that tariff increases can be contained to levels below inflation. Therefore, the benefits of cost reductions are theoretically shared with consumers. However, once privatization takes place, the fact that information on private production costs are not fully visible from the outside implies that regulations should encourage information disclosure to adequately determine  $X$ . The regulator should also be careful to ensure that cost reductions were not achieved through a deterioration of the quality of services. To be effective, such a framework requires strong capability by the regulatory agency.

The new tariff scheme was intended to restore the financial equilibrium of electric companies, by allowing tariff revenues that could ensure current cost recovery and also the generation of the necessary cash flow to implement reasonable investment plans. However, the continuing pressure to contain tariff rises in order to control inflation, as well as inflation itself, prevented the real values of tariffs from rising quickly in 1993-94. Only starting from 1996, with the success of the "Plano Real" which reduced inflation rates dramatically, did real tariff revenue start to recover slightly (see Figure 3).

## VI. Institutional and Regulatory Reform

In 1996, the MME contracted consulting firm Coopers & Lybrand to outline a model for privatization based on this law. The Coopers & Lybrand (1996) report (hereafter CL report) became the basis for the restructuring of the electric power sector.

It proposed fundamental changes in the structure of the sector. The proposal included not only privatization but also the introduction of market competition through the creation of a wholesale electricity market. In order to prepare a competitive environment, it made a controversial recommendation for the separation of ownership among power generation, transmission, and distribution. The historical process of public sector-based development had resulted in the sectoral structure centralized around Eletrobrás and vertically integrated, as depicted by Figure 4.

Vertical disintegration became essential for the market-based sectoral model to lead to a competitive environment, as it would prevent cross-subsidies from the regulated sector (whose profits were guaranteed) to the competitive sector in order to deter the entry of competitors. Moreover, it would prevent collusion between different segments. For example, a generation company might collude with a transmission company to reject the transmission of other generators' electricity in order to exploit monopoly profits. Or a distribution company could conspire with a transmission company to exert monopsonistic pressure on generators.

On the other hand, from the viewpoint of transaction cost theories, vertical integration is advantageous in preventing information asymmetry problems, which make risk-averse generators cautious about capacity expansion, eventually leading to power shortages. Especially due to economies of scale and networks, the transmission segment has stronger characteristics of a natural monopoly.

In 1996, concerned with these conflicting views, Brazil created the National System Operator (ONS), a nonprofit private organization representing generation companies and distribution companies, to assume the control rights over energy flow. ONS was entrusted with operating networks by transmission companies in exchange for receiving a profit-guaranteeing regulated transmission fee. Real time technical information on the availability and cost of supply, location of demand, and level of congestion of energy traffic were concentrated in ONS to optimize the system to minimize the marginal cost of the integrated power supply system. This institutional change laid the groundwork for decentralizing ownership while centralizing the control of the system, as a means to



internalize network externalities and prevent private information from creating high transaction costs. The government planned not only to give the concessions for new transmission to private companies but also to privatize the existing transmission networks owned by Eletrobrás and the state utilities. The ultimate structure of these ownership changes was to have led to Figure 5.

Cut off from transmission, the generators were considered simply as commodity suppliers with much smaller sunken costs. Assuming that no company would have sufficient market power, the generators would be induced to minimize costs to maximize profit, which in turn would contribute to increasing the efficiency of the system as a whole. On the demand side, while large consumers would have direct access to the wholesale market, small customers would be represented by distribution companies which would act like brokerage agents, with the retail price regulated by a price cap mechanism. By encouraging more customers to enter the free market by lowering barriers, competitive pressure in the retail market could also be strengthened and cost reductions induced. ONS would guarantee nondiscriminatory access to the transmission network for generators and consumers.

The technical role of ONS was complemented by the policy on the regulatory supervision of competition laid out by the National Agency for Electrical Energy (ANEEL), which was established at the end of 1996. ANEEL obtained financial independence from the MME by gaining a special purpose tax as a financial source, and independence from political interference regarding the appointment of executive positions, while maintaining transparency through public audits as well as the disclosure of financial information through the Internet. Among the competencies of ANEEL are the authorization of bilateral contracts, realization of auctions for concession, standardization and monitoring of quality of services, and regulation of market concentration.<sup>11</sup> It is endowed with the power of veto over ONS decisions.

However, from the viewpoint of transaction cost economics, the separation of ownership entails problems arising from the previously discussed information problems. Generation companies facing competition try to minimize costs and avoid investment. Since investments in power generation have long maturity periods, the supply system tends to lose its buffer supply, increasing the risk of failure if there is a sudden significant increase in demand. Moreover, the unpredictability of investment plans in other subsectors may hold investment down at a level lower than what is socially desirable. While the regulator

expects a sort of formal or informal agreement for coordinating investments among private companies (which will also enhance their profit), uncertainties in final demand and cost variables<sup>12</sup> tend to encourage firms to collude as a means of overcoming those externalities (Yarrow 1994). Such difficulties complicated privatization in Brazil, because sufficient confidence was not created that market regulation would be compelling enough to ensure that the competition-based model would be able to supply energy more efficiently than the traditional public ownership model.

The idea of a competitive wholesale market was put into practice with the approval of Law 9648 of 1998, which established the Electricity Wholesale Market (MAE). Initially, the MAE was created as a spot market to adjust for real time surpluses/deficits of electricity load. Generators with excess supply capacity, and distributors which were overloaded after compliance with the bilateral contract, would be sellers,<sup>13</sup> while generators which could not fulfill bilateral contracts with their own generation and distributors in deficit were to be buyers. It differs from the usual concept of a marketplace in that the spot price is not defined at the point that clears supply and demand but rather is calculated by ONS using engineering computational programs based on the marginal cost of the generation output of the entire system.

When the MAE was created, it was predicted that the generating companies would prefer to sell in the MAE, seeking higher prices and avoiding prices that were fixed for long period of time. Out of concern that the sudden transition to the MAE would raise consumer tariffs, ANEEL decreed in 1997, prior to its introduction, that all existing generators and distributors would have to bilaterally negotiate and sign agreements of so-called initial contracts, with a duration of nine years, fixing transaction prices with an option for regular adjustments. The initial contracts fixed all transactions at that time, with projection of a partial liberalization of transactions to MAE starting in 2003, at an annual rate of 25 per cent, with complete liberalization in 2006. Until that time, only new entrants would be allowed to sell without restriction on the MAE spot market, as a measure to encourage new entry.

Despite these expectations, a large part of the wholesale trade is still actually realized outside the MAE through bilateral contracts, in which generators and distributors negotiate amounts and prices for a determined period of time. The old energy (secured by the initial contracts) was for the large part (nearly 95 per cent) generated by hydroelectric plants which had already been fully depreciated and whose running costs were very low,

when the reservoirs held sufficient levels of water. On the other hand, new entrants had to bear high capital cost and/or pay high running costs for imports of natural gas fuel denominated in dollars, in the case of thermoelectric plants. Distributing companies, for their part, were regulated by ANEEL in accordance with the price cap regulation, which did not allow them to automatically add cost increase, to the retail price. Therefore, the privatized distributing companies fulfilling their obligations under bilateral contracts for the old energy have been reluctant to use the spot market for procurement. A lack of demand and the high volatility of the exchange rate after the floating of the real in 1999 discouraged new entrants.

## VII. Privatization – Ownership Changes

With the privatization of electricity in its sights, the government enacted in 1995 the law of concessions (Law 8987) and a specific sectoral law of concession (Law 9074) which set the following conditions for the exploration of energy services:

Concession periods of thirty-five years for generation, and thirty years for transmission and distribution, renewable for the same period, if concessionaires satisfied the operational requirements;

Hydroelectric generation of 1,000KW or above and thermoelectric generation of 5,000KW or above would be subject to competitive auctions. Smaller power generation could be explored upon notification to the regulatory authority. Generation for self-use would need to be communicated and authorized;

Independent power producers (IPPs) could sell electricity to distributors and large consumers;

Large-scale consumers, of 10,000KW or above, could contract directly with IPPs. The criterion of large consumers would be reduced to 3,000KW in eight years (by 2003), and could be further reduced by the judgment of the admission authority;

Ownership of transmission lines comprising the basic network could be auctioned, but its operation had to be subordinated to coordination with independent system operators who would optimize the use of the interconnected system.

Eletrobrás was formally incorporated into the PND in May 1995, and made ready for privatization. The first privatization occurred in 1995, when the distribution company of the State of Espírito Santo (Ecelsa), then controlled by Eletrobrás, was brought to auction

(Table III). This was then followed by the privatization in 1996 of a distributor in Rio de Janeiro metropolitan area, Light, which was also controlled by Eletrobrás, and which was acquired by a consortium formed by the French national company EDF and the American firm AES, with the participation of other power distributing companies owned by local states.

The privatization moves in the States of São Paulo and Rio Grande do Sul deserve particular attention as they involved the separation of the ownership of vertically integrated system, following the CL report recommendation. São Paulo State owned two integrated electric power systems – Cesp and Eletropaulo – and a distribution company CPFL, which operated in different market areas for historical reasons. CPFL was sold in its entirety to a Brazilian business consortium in 1997. Cesp first sold off its distribution business and then established Elektro, which was sold to the American company Enron in 1998. The remaining part of Cesp was divided into three generators (Paranapanema, Tietê, and Cesp) and one transmitter (CTEEP). In the privatization of 1999, the American firm Duke Energy acquired Paranapanema and AES obtained Tietê. Eletropaulo, for its part, was unbundled into four companies: two distribution firms (Eletropaulo Metropolitana and Bandeirante), one generator (Empresa Metropolitana de Águas e Energia Elétrica: EMAE), and one transmission company (Empresa Paulista de Transmissão de Energia: EPTE). In 1998, Eletropaulo Metropolitana was sold to the EDF-AES consortium, which also obtained the control of Light.<sup>14</sup> In the same year, Bandeirante was sold to a local consortium, VBC. In total, the State of São Paulo privatized the entire distribution business and a part of generation, maintaining control over the generation sections of Cesp and EMAE and the transmission business of CTEEP and EPTE, which are planned to be merged together in the near future.

In the privatization of CEEE by Rio Grande do Sul, the state separated the distribution in the North-Northeastern region (sold to AES) and Central-Western region (sold to VBC). CEEE still maintains control over distribution in the Southern-Southeastern region, which includes the state capital, Porto Alegre. Generation and transmission were separated from CEEE and joined into another state company, CGTEE.

Several observations can be drawn from Table III. First, the privatization of the electricity sector has been ongoing for more than six years, but the process is not yet completed. This is very different from the case of telecommunication, where the Telebrás system was totally privatized in 1998 (see, for example, Goldstein 1999). Although the first

privatization took place even before the presentation of the CL report, key institutions such as ANEEL, ONS, and MAE have been established only gradually. Due to this systemic uncertainty, the first privatizations did not attract much interest from investors. Secondly, most sales took place by distribution segment. To date, only a few cases of privatization of generation have been realized and not a single transmission company has been privatized. In particular, there has only been one case of privatization of the generation and transmission assets of Eletrobrás,<sup>15</sup> with regard to the generation of Eletrosul. The integrated power companies of the States of Paraná and Minas Gerais have not yet been privatized. Thirdly, foreign companies obtained control of many of these companies. Investment by EDF of France, AES of the United States, and Endesa (together with its Chilean affiliates Chilectra and Enersis) and Iberdrola of Spain have been particularly noticeable. Brazilian electric power operators Rede, Inepar, and Cataguases-Leopoldina, as well as financial capital-based consortium VBC, have also strengthened their positions. This concentration of ownership implies the possibility of a future consolidation of the sector into a smaller number of groups through post-privatization mergers and acquisitions. Some group formations have already been seen, such as Escelsa's buy-out of Enersul and CPFL's acquisition of Eletropaulo Bandeirante. Also interestingly, Spanish power company Endesa has used its Chilean subsidiaries Chilectra and Enersis to make acquisitions in Brazil, such as CERJ, Cachoeira Dourada, and Coelce.

After the slow and incomplete implementation of privatization, the ownership structure was reformed into the form depicted by Figure 6, which is still far different from the pattern shown in Figure 5. Private ownership is now dominant in the distribution section, and the entry of free consumers has started. On the other hand, the generation segment is still largely owned by the public sector, and vertical disintegration has not been completed. The figures in Figure 6 tell us that almost 90 per cent of electricity is generated by the public sector, including the Eletrobrás system (accounting for 52 per cent) and state power companies (37 per cent), while private generating companies are responsible for only 8 per cent, with 3 per cent being carried out by self-generation by distributing companies. The picture also shows that the governance of the interconnected transmission has been separated from ownership, and assumed by the ONS.

## VIII. Firm Performance

In this section, we analyze a data set compiled from the financial reports of the electric power companies in order to identify the characteristics of the adjustment carried out during the process of ownership reform. The data is reported annually by each company to the Security Exchange Commission (CVM), and is available from its website. Table IV shows changes in employment and fixed assets, comparing the status before the reform and the most recent figures. For ease of comparison, the post-privatization figures aggregate all separated companies. For example, data for Cesp after privatization includes Elektro, Paranapanema, Tietê, Cesp, and CTEEP.

Table IV demonstrates that employment fell sharply after privatization, without exception. The rate of the reduction reached 40-50 per cent in most privatized firms. Nonprivatized companies as CEMIG and COPEL also reduced their work force, but we found that the rate of reduction was smaller. However, this rule does not apply generally, because Eletrobrás implemented rather deep employment adjustments.

In terms of investment, Table IV shows that firms that were not privatized or only partially privatized tended to invest less, while the growth of fixed assets of the privatized firms tended to be much higher. In particular, members of the group of largest firms Eletrobrás and CEMIG did not show any substantial increases. This corresponds to the low growth of generation and transmission, as observed in Figure 2 and Table II. With regard to the relatively higher growth of investment in privatized distributors, many cases correspond to expansions of self-generation capacity, which is allowed by ANEEL up to a level of 30 per cent.<sup>16</sup>

Table V shows changes in shareholders' equity/total liabilities ratios. The decline of the ratio implies that a growing portion of company assets is being financed by borrowings, making them more vulnerable to external shocks. This figure is very important for Brazilian companies, because any macroeconomic shock -- such as an interest rate hike or sharp devaluation -- will affect financial costs significantly. According to the table, there was a tendency by privatized firms to reduce shareholder's equity ratios during the years following privatization, implying an increase in borrowing to finance asset acquisitions relative to equity. Most notably, Escelsa and Light, which were privatized early on, reduced their shareholders' equity ratios substantially as a result of increased borrowings for the acquisition of Enersul and Eletropaulo Metropolitana, respectively. In other instances, CERJ and Coelba increased investment into their own

fixed assets, as shown by Table IV, and saw continuous declines in their equity ratios. On the other hand, while CPFL, Cosern, and Coelce also increased their investments significantly, they were sustained by increases in equity financing, leading to increases in the equity ratio. The vulnerability of companies with low equity ratios became apparent in 1999, when the Brazilian real experienced a sharp depreciation, and interest rates were raised substantially to stabilize the economy. In that year, AES Sul, Escelsa, Light, CERJ, and Coelba suffered large operational losses, while CPFL, Cosern, Coelce maintained stable performance.

The publicly owned generation enterprises and integrated utilities performed relatively well because of increasing electricity demand accompanying growth recovery during the second half of the 1990s. Financial data on Eletrobrás and CEMIG suggests that particular efforts were made to redirect profits to the reduction of long-term debt, instead of investing in fixed assets, to strengthen their balance sheet structures. On the other hand, COPEL made substantial investments into fixed assets, increasing the composition of debt financing in relation to equity, while making operational profits in each year (Table VI).

To summarize, electric companies carried out a variety of adjustment strategies during the period of ownership change in the second half of the 1990s. All of them attempted to restore financial equilibrium, firstly by reducing the excessive work forces they had acquired during the public ownership period. These adjustments tended to be more accentuated in privatized companies. Some privatized companies reduced their equity ratios by increasing borrowings to finance their initial post-privatization restructurings or for the acquisition of other privatized firms. Larger borrowings translated into vulnerability, which was revealed in the 1999 currency crisis. Several companies made investments using equity financing, and maintained relatively more stability under the turmoil. Among the companies remaining under public ownership, CEMIG and Eletrobrás were more defensive in making balance sheet adjustments, while COPEL was more expansionist; it carried out smaller employment reductions, increased investment substantially, and made more borrowing.

## IX. CONCLUDING REMARKS

Although privatization in Brazil achieved far-reaching results in general, the case of electricity was not successful, and left many lessons to be learned. The original idea contemplated in the CL report envisaged a shift toward a private ownership model, separating ownership into generation, transmission, and distribution. While the transmission and distribution segments were to be rigidly regulated, a wholesale marketer was created to stimulate competition in the generation market. It was expected that the introduction of this new structure would stimulate cost reductions and induce an expansion of supply capacity.

However, rather disappointingly, the new model did not obtain support. While state ownership had already been rejected because of the lack of the public sector's financial capability, the future of the market competition-based sector model for electric power remains highly uncertain and at this moment we cannot be sure if the market will really keep Brazil lit up. Some of the evidence presented in our analysis suggests that privatization under high uncertainty led companies to conservative strategies, maintaining a passive attitude toward investment and seeking short-term financial gains through sharp job cuts. This uncertainty arose from substantial delays in defining new market institutions through the establishment of regulatory institutions and clear rules of competition as well as ownership structure reform. Making the companies even more conservative were the fluctuations of interest rates and exchange rates during the late 1990s, which increased the financial vulnerability of highly indebted firms.

Given this anxiety, private firms have tended to demand high rents for private information in order to neutralize risks, and to be induced to investment, especially since with privatization the government lost access to information on the profitability and viability of investment projects. For example, in order to promote investment into thermoelectric power generation, the generating companies are demanding much higher tariffs, coverage of exchange rate risks for the importation of natural gas from Bolivia, and sharing in project risks by equity participation of the national oil company Petrobrás and the national development bank BNDES. The government is still unsure of what kind of market regulation will be sufficient to amend such market failures, and how great a burden should be given to fiscal accounts and consumers' expenses. It needs to carefully calculate whether such costs will really be less than the cost of public ownership.

An alternative path suggested by the opposition parties, which will be taking power after winning the 2002 presidential election, would be to go back to the public sector



ownership model. Even the outgoing government itself, in view of the energy crisis in 2001, announced in December 2001 that the structural reform in the past years had been a failure, and suspended the privatization of the Eletrobrás system. Still, it has not been able to provide an alternative model for the electric power sector, or for rebuilding the financial capability of Eletrobrás, nor has it presented any vision of what kind of governance structure should be constructed.

The Brazilian experience shows that privatization driven by macroeconomic problems should be carefully reexamined, especially for public utilities that have natural monopoly characteristics, given that the market tends to fail to supply socially optimal supply.

People can be seriously affected when market regulations cannot be clearly defined and the regulatory agency is not capable of managing the transition appropriately.

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Footnotes:

- 1 Rocha and Kupfer (2002) provide a broad overview of this process.
- 2 De Paula, Ferraz, and Iootty (2002) discuss the emergence of mixed consortia, jointly formed by foreign and local investors.
- 3 For more comprehensive surveys, see Sheshinski and López-Calva (1999), Megginson and Netter (2001), and Shleifer (1998).
- 4 While Grossman and Hart (1986) discuss comparisons of benefits from acquiring vertically/horizontally related firms or contracting them at arm's length from a private profit maximization view, Hart, Shleifer, and Vishny (1997) analyze the cases of public and private ownership from a government social welfare enhancing view.
- 5 It can rightly be considered ideological, because it is not known a priori whether the fiscal cost of contracting the private enterprise under regulation is lower than that of in-house provision by the public sector.
- 6 President Collor was impeached in 1992 and replaced by Vice-President Itamar Franco.
- 7 Pinheiro (2000) observes that the expansion of state intervention during the period of import-substituting industrialization was an expression of a pragmatic approach to promoting industrialization urgently, through the occupation by the government of open spaces, which could not be filled by the private sector, rather than anything based on a well-defined political ideology. The pragmatism was reflected in the fact that in the late 1970s to the 1980s, the objective of state ownership was switched to macroeconomic stability and external adjustment, and state enterprises were used for price control and as borrowers of external credit. In this vein, when the budget deficit became the main problem in the 1990s, the government made another pragmatic move to large-scale privatization, without any harsh ideological confrontation.
- 8 Data obtained from Giambiagi and Além (2000, p. 129, table 5.1).
- 9 Data from Baer and McDonald (1998, table 2).
- 10 When the CRC was eliminated in 1993 as a part of the tariff reform, it had already accumulated credits of approximately U.S.\$25 billion, the equivalent of almost 2.5 years of electricity sales of the entire sector (Ferreira 2000). These credits were utilized to cancel delayed payments of state power distributors for purchased electricity from Eletrobrás and federal tax.
- 11 In order to avoid a concentration of market power, the market share of generation and distribution/commercialization should be less than 20 per cent at the national level, or less than 25 per cent at the regional level in Southeast and South and 35 per cent in North, Northeast, and Central-West.
- 12 Final demand will depend on macroeconomic performance, and cost variables will fluctuate depending on the exchange rate, fuel prices, and interest rates.
- 13 Actually, they have an incentive to sell at any price, because electricity is not storable.
- 14 It is reported that EDF and AES will dissolve the consortium in Brazil by an exchange of shares, where EDF will concentrate in Light and AES, which also controls ex-Cesp generator Tietê, will take Eletropaulo Metropolitana.
- 15 Since the power shortage of 2001 revealed an urgent necessity to expand generation-transmission capacity, the government announced in December 2001 that the privatization of Eletrobrás would be suspended for an undetermined period in order to increase investment based on centralized decisions.
- 16 Detailed information on investment can be found at <http://www.provedor.nuca.ie.ufrj.br/Eletrobrás/>.

TABLE I

## Results of Privatization in Brazil (as of July 2001)

(U.S.\$ million)

Program	Revenue in Cash	Transferred Debt	Total Result
National Denationalization Program (PND)	28,234	9,201	37,435
Telecommunication (Telebrás)	28,793	2,125	30,918
State governments	27,919	6,751	34,670
Total	84,946	18,077	103,023

Source: BNDES web page (<http://www.bndes.gov.br/privatizacao/pndnew.asp>), accessed in April 2002.

TABLE II

## Growth in Electricity Transmission Lines, by Voltage Capacity

(km)

Year	69KV	88KV	138KV	230KV	345KV	440KV	500KV	525KV	750KV
1970	16,418	1,593	14,531	6,050	2,228	1,097			
1975	22,996	2,082	22,522	11,854	4,405	2,873			
1980	29,094	3,396	31,929	17,700	6,669	5,778	6,185	361	
1985	34,493	3,569	37,587	22,715	7,478	5,763	7,920	1,545	568
1990	37,600	3,437	45,953	26,996	7,434	5,652	14,783	1,612	1,782
1995	39,084	3,529	51,913	28,381	8,545	5,923	13,973	1,612	1,783
2000	39,986	3,291	56,080	34,050	8,952	6,498	18,617	1,612	2,379
Growth rate (%: annual average):									
1970s	5.7	7.6	7.9	10.7	11.0	16.6	-	-	-
1980s	2.6	0.1	3.6	4.2	1.1	-0.2	8.7	15.0	-
1990s	0.6	-0.4	2.0	2.3	1.9	1.4	2.3	0.0	2.9

Source: Eletrobrás, Sistema de Informações Empresariais do Setor de Energia Elétrica, *Relatório estatístico de linhas de transmissão e subestações*, various issues.

TABLE III

## Privatization in the Electric Power Sector

Name of Firm	Year	Seller	Sub-sector	Value (U.S.\$ Million)	Acquirer	Partners
Escelsa	1995	Federal	D	520	Iven and GTD* (BR)	
Light	1996	Federal	D	2,508	EDF (France)	AES (U.S.)
CERJ	1996	Rio de Janeiro	D	587	Chilectra (Chile)	Enersis (Chile)
Coelba	1996	Bahia	D	1,598	Iberdrora (Spain)	Previ (BR)
Cachoeira Dourada <sup>+</sup>	1996	Goiás	G	714	Endesa (Spain)/Enersis (Chile)	
CEEE Centro-Oeste	1997	Rio Grande do Sul	D	1,372	AES (U.S.)	
CEEE Norte-Nordeste	1997	Rio Grande do Sul	D	1,486	VBC (BR)	CEA (U.S.), Previ (BR)
CPFL	1997	São Paulo	D	2,731	VBC (BR)	Bonnaire (BR)
Enersul	1997	Mato Grosso do Sul	D	565	Escelsa (BR)	
Cemat	1997	Mato Grosso	D	353	Rede/Inepar (BR)	
Energipe	1997	Sergipe	D	520	Cataguases-Leopoldina (BR)	
Cosern	1997	Rio Grande do Norte	D	606	Iberdrora (Spain)	Previ (BR)
Coelce	1998	Ceará	D	868	Enersis (Chile)	Endesa (Spain)
Eletropaulo Metropolitana	1998	São Paulo	D	1,777	AES (U.S.)	EDF (France), Houston (U.S.)
Celpe	1998	Pará	D	388	Rede/Inepar (BR)	
Elektro	1998	São Paulo	D	1,489	Enron (U.S.)	Power Holding (U.S.)
Eletropaulo Bandeirante	1998	São Paulo	D	860	CPFL (BR)	EDP (Portugal)
Gerasul <sup>†</sup>	1998	Federal	G	880.2	Tractebel (Belgium)	
Cesp-Paranapanema	1999	São Paulo	G	682	Duke Energy Co. (U.S.)	
Cesp-Tietê	1999	São Paulo	G	472	AES (U.S.)	
Celpe	2000	Pernambuco	D	1,004	Iberdora (Spain)	Previ, BB Banco de Investimentos (BR)
Cemar	2000	Maramhão	D	289	Pennsylvania Power & Light (U.S.)	
Sealpa	2000	Paraíba	D	185.1	Cataguases-Leopoldina (BR)	

Source: <http://www.bndes.gov.br/pndnew/compriv.htm>.

Note: VBC = consortium composed of Brazilian business groups, Votorantim, Bradesco, and Camargo Correa. GTD = group of pension funds. G = generation. D = distribution. BR = Brazil.

\* Later acquired by EDP of Portugal.

<sup>+</sup> Generation of CEG (electricity company of the State of Goiás).

<sup>†</sup> Generation of Eletrosul of Eletrobrás.

TABLE IV

## Adjustments of Employment and Investment during the Ownership Reform Period

	Employment (Number of Employees)			Fixed Assets (R\$ Billion at Current Prices)		
	Before	After	Rate of	1995		
	Privatization	Privatization	Reduction (%)	(a)	2000 (b)	(b)/(a)
Firms privatized:						
Escelsa	2,789	1,604	42	638	1,510	2.37
Light	10,618	6,142	42	6,472	7,369	1.14
CERJ	4,806	1,842	62	509	1,688	3.31
Coelba	6,494	3,541	45	1,601	2,343	1.46
CPFL	6,786	3,842	43	2,701	4,419	1.64
Enersul	2,017	1,048	48	605	721	1.19
Cemat	2,483	1,479	40	796	792	0.99
Cosern	1,615	656	59	239	329	1.38
Celpe	2,914	2,243	23	785	835	1.06
Coelce	3,510	1,775	49	569	1,556	2.74
Celpe	3,838	2,158	44	568	715	1.26
Cemar	2,147	1,689	21	524	571	1.09
Firms deverticalized and partly privatized:						
CEEE*	8,760	4,184	52	5,061	5,875	1.16
Eletropaulo*	18,199	11,542	37	11,567	11,203	0.97
Cesp*	10,165	6,649	35	22,124	28,549	1.29
Firms not privatized:						
Eletrobrás*	24,311	12,625	48	76,207	77,801	1.02
CEMIG	16,452	11,648	29	10,201	9,364	0.92
COPEL	8,835	6,142	30	4,918	6,225	1.27

Sources: Demonstrações Financeiras Padronizadas (DFP) published annually by each company (available from the sub site “companhias abertas” of the website of the Comissão de Valores Mobiliários [CVM] -- <http://www.cvm.gov>).

\* Figures after privatization and for the year 2000 aggregate those companies which were separated in the process.

Figures for firms not privatized are simply comparisons between 1995 and 2000.

TABLE V

## Changes in Shareholders' Equity/Total Liabilities Ratios

	1995	1996	1997	1998	1999	2000
CEMIG	0.7446	0.7122	0.7094	0.7073	0.6616	0.6577
COPEL	0.6979	0.6502	0.6536	0.6306	0.6012	0.6156
Eletrobrás (consolidated)	0.6588	0.6456	0.6349	0.6794	0.6975	0.6815
Gerasul				0.5716	0.5435	0.5334
CEEE	0.5440	0.4484	0.3329	0.2412	0.2168	0.2143
RGE			0.6354	0.6493	0.5912	0.5168
AES Sul			0.5952	0.3262	0.1249	0.0488
Eletropaulo (Metropolitana)	0.5352	0.4135	0.5140	0.3102	0.3346	0.2904
Bandeirante				0.3139	0.2280	0.2495
Cesp	0.5322	0.5144	0.5373	0.5795	0.5449	0.5467
Elektro				0.4687	0.5027	0.4699
AES Tietê					0.2243	0.3338
Duke Paranapanema					0.6446	0.6181
Escelsa	0.8030	0.8012	0.5082	0.4889	0.3864	0.3623
Light	0.8498	0.6932	0.6648	0.3785	0.2761	0.2397
CERJ	0.2230	0.2558	0.2552	0.1531	0.1033	0.1372
Cachoeira Dourada		0.8139	0.7812	0.7940	0.7741	0.8044
Coelba	0.5742	0.5324	0.5077	0.4954	0.4221	0.4451
CPFL	0.7498	0.6916	0.5389	0.5029	0.6999	0.6814
Enersul	0.5204	0.4233	0.4772	0.5577	0.4814	0.4818
Cemat	0.2433	0.0226	0.4330	0.4103	0.3303	0.2474
Energipe	n.a	n.a.	0.5737	0.6054	0.5649	0.6633
Cosern	0.4000	0.4575	0.2521	0.2809	0.3616	0.4811
Celipa	0.4737	0.4663	0.4253	0.5085	0.4606	0.4173
Coelce	0.5894	0.5435	0.5100	0.4630	0.6996	0.6482
Celpe	0.7351	0.6924	0.7009	0.6014	0.5735	0.4888
Cemar	0.6718	0.6130	0.5771	0.4903	0.4694	0.2966

Source: Same as Table III.

Note: Shaded cells correspond to private ownership.



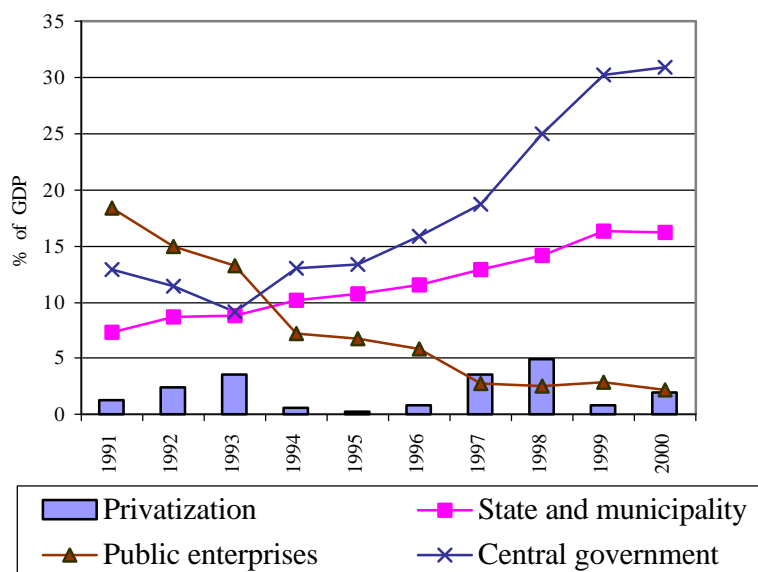
TABLE VI

## Changes in Operational Profits

	(R\$ million)					
	1995	1996	1997	1998	1999	2000
CEMIG	109,357	307,388	266,086	213,090	-96,727	434,655
COPEL	102,754	160,585	272,507	327,660	286,043	448,347
Eletrobrás	-1,895,716	1,514,945	1,093,839	2,405,358	1,626,768	3,070,843
Gerasul				-13,574	-111,279	206,733
CEEE	-104,127	-523,887	-690,940	-235,163	-230,299	-149,268
RGE			-21,233	37,127	-77,479	-77,226
AES Sul			10,175	20,536	-482,504	-168,963
Eletropaulo	-537,456	207,734	-436,433	391,803	376,591	161,078
Bandeirante				-108,768	-181,886	160,495
Cesp	-168,409	-491,482	-1,188,147	-540,007	-2,055,299	-307,494
Elektro				72,913	-486,182	-79,525
AES Tietê					-194,468	93,672
Duke Paranapanema					-47,669	16,619
Escelsa	-135,742	119,316	131,117	107,982	-185,923	10,887
Light	-4,192	133,186	227,448	-555	-404,706	-465,939
CERJ	-59,845	-264,185	28,665	60,101	-45,687	-97,821
Cachoeira Dourada		n.a	1,859	47,072	41,112	68,086
Coelba	-159,105	-4,987	95,242	3,257	-102,805	127,397
CPFL	-53,626	179,892	174,290	199,347	79,043	80,425
Enersul	23,088	-108,683	-63,876	4,640	-50,838	17,091
Cemat	-86,943	-152,936	-126,703	-21,383	-101,401	-128,457
Energipe	n.a	n.a.	-3,404	401	-18,355	-4,126
Cosern	-4,008	2,712	-79,206	38,303	20,993	78,855
Celipa	-73,519	42,437	-56,731	-3,440	11,572	-11,361
Coelce	-11,961	17,920	1,991	21,845	46,419	51,347
Celpe	32,732	22,402	26,004	7,757	10,771	-97,823
Cemar	-40,983	-28,182	13,265	-56,525	-106,365	-177,959

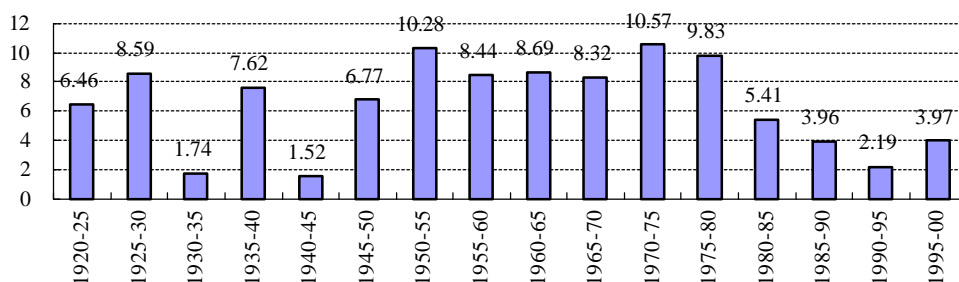
Source: Same as Table III.

Fig. 1. Results of Privatization and Stocks of Public Debt at Each Administrative Level



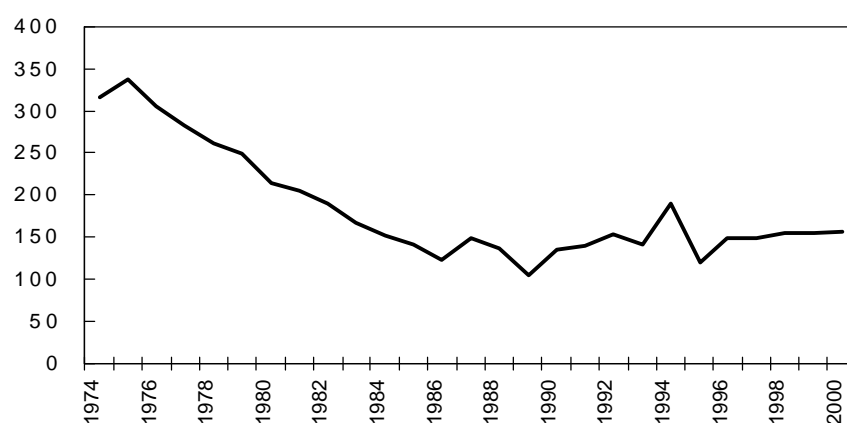
Sources: Results of privatization are periodically published by BNDES, <http://www.bndes.gov.br/privatizacao/pndnew.asp>; stocks of public debt are taken from IPEA data, <http://www.ipeadata.gov.br/>. Both accessed in April 2002.

Fig. 2. Installed Electric Power Generation Capacity: Average Annual Growth Rate (%)



Sources: 1920-80: Comitê Nacional Brasileiro da Conferência Mundial da Energia, *Estatística Brasileira de Energia*, vol. 5 (1981); 1985-2000: Ministério de Minas e Energia, *Balanço Energético 2000*.

Fig. 3. Changes in the Electricity Tariff for Residential Users  
(R\$ at 2000 prices)



Sources: Eletrobrás, *Anuário de Tarifas de Energia Elétrica*, 1993; and Eletrobrás, *Tarifas Médias do Mercado de Energia Elétrica-Síntese*, 2001.

Fig. 4. Public Ownership Structure before the Reform

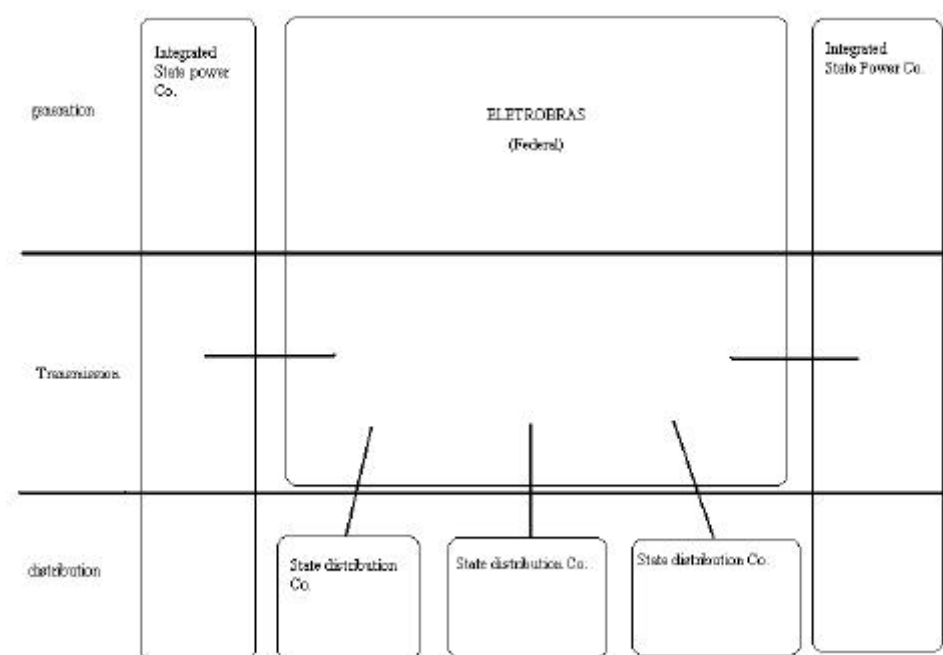


Fig. 5. Privatization Ownership Structure Proposed by the CL Report

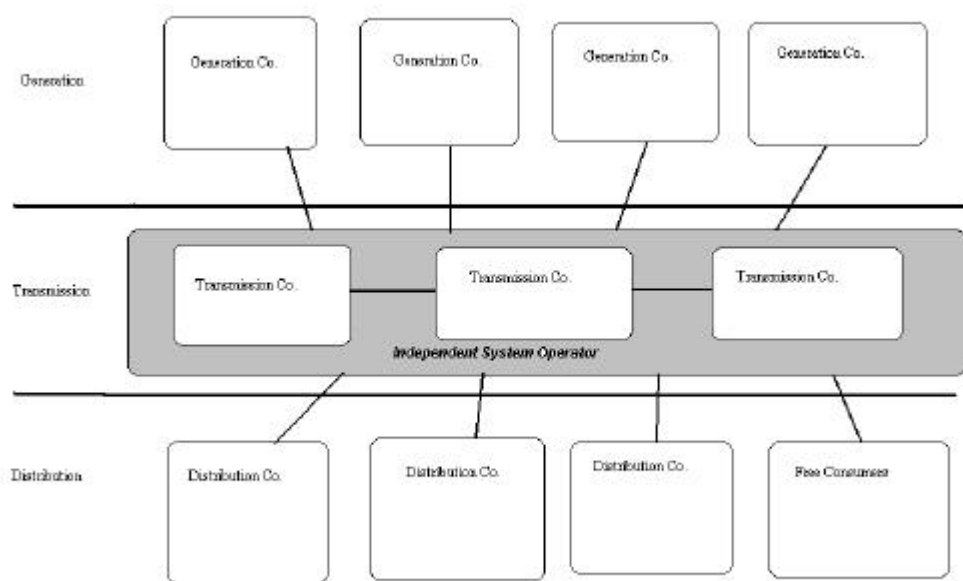
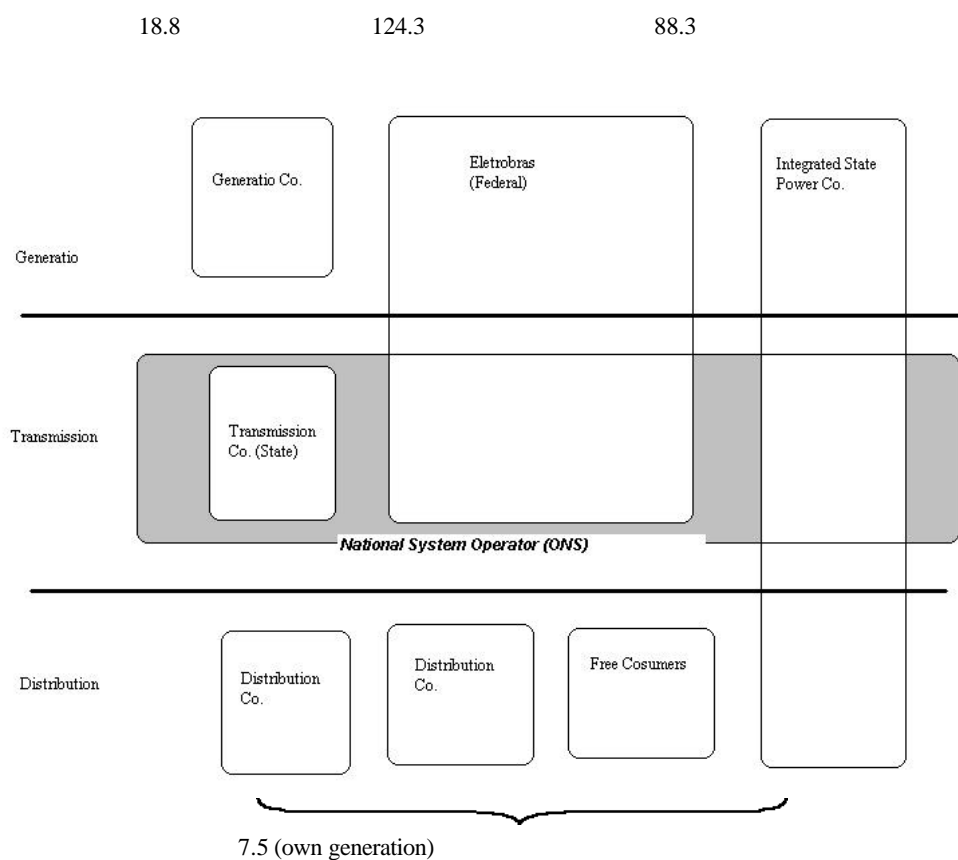


Fig. 6. Current Ownership Structure after the Partial Reform of Ownership



Note: Figures show electricity generated in 2000 (in 1,000 GWh), obtained from BNDES, "Ranking 2001: Setor Elétrico," *Cadernos de Infra-Estrutura*, vol. 1, Rio de Janeiro, 2001.