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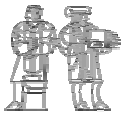
The Restructuring and Privatisation of Electricity Distribution and Supply Business in Brazil: A Social Cost-Benefit Analysis

Raffaella Lisbôa Mota



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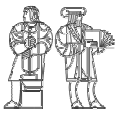

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The Restructuring and Privatisation of Electricity Distribution and Supply Businesses in Brazil: A Social Cost-Benefit Analysis

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Abstract

In the period 1995-2000 approximately 60% of the Brazilian electricity distribution market has been privatised. This has been part of a comprehensive reform of the electricity supply industry, which has included restructuring and regulatory change, as well as some liberalisation of generation and supply. This paper aims to assess the social welfare impact of the process for the distribution and supply markets. We use a social cost-benefit methodology to achieve this objective. We find that net benefits are significant, but producers absorb most net gains. We also conclude that had regulation been tougher since the beginning, consumers could have benefited more from privatisation.

1 Introduction

The Brazilian electricity supply industry (ESI) has been through major changes in the last decade. Beginning with the extinction of the guaranteed rate of return regulation in 1993, the reform has included restructuring, institutional change and extensive privatisation. Approximately 60% of the distribution market and 20% of the generation market have been privatised between 1995 and 2000.

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Privatisation in Brazil (especially the experience of the 90s) reflects the replacement of the import substitution model of development led by public investment for a market-oriented model, with emphasis on efficiency. In the 80s and 90s similar processes took place in other Latin American countries, such as Argentina, Chile and Mexico.[1] However, it was the economic crisis of the end of the 80s that made privatisation politically feasible in Brazil.[2] Macro conditions also dictated the pace of the privatisation process in the ESI. The other aspects of the reform would be more gradual, especially the introduction of competition. The establishment of the regulatory agency, Aneel, would take place only one year after the first auction sale. Coopers & Lybrand, who assisted the government in planning the reform, stated that the main objectives of the reform were to ensure the expansion of capacity by attracting private sector investment, to increase efficiency, and to reduce public expenditure and public debt (Coopers & Lybrand, 1997). This paper seeks to assess the net efficiency gains (or losses) of the restructuring and privatisation of the electricity distribution and supply businesses in Brazil. It also assesses the distribution of these net gains (or losses) to consumers, government and producers.

In order to make our assessment we use the method set out in Jones, Tandon and Vogelsang (1990) and first applied in Galal, Jones, Tandon and Vogelsang (1994). Our study is in line and complements previous social cost-benefit analyses of the impact of privatisation of distribution and supply in England and Wales (Domah and Pollitt, 2001), the Scottish ESI (Pollitt, 1999), the ESI in England and Wales (Green and McDaniel, 1998), the ESI in Northern Ireland (Pollitt, 1997), and the Central Electricity Generating Board (Newbery and Pollitt, 1997). Although there is a growing literature on Brazilian privatisation, so far studies have been based on financial and physical indicators of performance (Lima, 1997; Pinheiro, 1996; Costa, 1994; Gandara and Kaufman, 1994) or have been concentrated on the fiscal impact of privatisation (Carvalho, 2001; Pinheiro and Schneider, 1995 ; Pinheiro and Giambiagi, 1994). We believe that even though they make a relevant contribution to the literature on Brazilian privatisation, the main policy concern should be whether a country is better or worse off with privatisation. Our work is an attempt to address this issue.

This paper uses a social cost-benefit approach to evaluate the change in the performance of a representative sample of distribution/ supply companies privatised in the period 1995-1998. The paper is organised in six sections. The second of these reviews the recent history of the reform in the Brazilian ESI. The third section discusses the theoretical debate over liberalisation and sets out the social cost-benefit methodology. The fourth section presents the data. In the fifth section we introduce and analyse the results. Finally, in the sixth section we draw some conclusions.

[1] For a brief overview of privatisation in these countries, see Pinheiro and Schneider (1995).

[2] See Pinheiro (2000) for a discussion of the political forces that have shaped the move from extensive public intervention to privatisation.

2 Historical background

During the first two decades of the 20th century the role of the state in the Brazilian ESI was minimal. The industry was characterised by the participation of various private companies working in generation, transmission, distribution and supply in states with limited interconnection. With the institution of the 'Water Code' ('Código das Águas') in 1934, regulation of the private sector became more effective.[3] The Water Code set the regulatory framework that would prevail in the electricity supply industry until 1993. It determined that all public use of hydro resources, irrespective of the property rights of the land, would be conditional on concessions granted by the federal government.[4] The Water Code also established the principle of tariffs being based on the historical cost of investment.[5]

However direct public investment in the sector was not relevant until the early 50s, when, in order to ensure power supply, the public sector started to construct its own generating plants. The expansion of the public sector was consolidated with the incorporation of private companies that mainly took place after the military coup in 1964. Roughly 50% of generation and transmission was progressively incorporated by federal enterprises and the remaining half was incorporated by states. Distribution and supply were concentrated at the state level. Just before the privatisation process started, in 1995 state distribution and supply companies accounted for 90% of the national consumption of electricity. Each state (from a total of 26) had its own distribution and supply company and some states had more than one. A few of these companies were totally vertically integrated, with significant generation and transmission networks.[6]

With the debt crisis (1982) and the disappointing economic performance during the 80s ('The Lost Decade'), the public sector faced a severe financial crisis in 1990. At the same time, the political constraints that had limited privatisation in the previous decade were weakened with the entrance into office of an elected civil president. Privatisation and inflationary stabilisation were complementary parts of a programme of structural changes, which included trade liberalisation and deregulation. In the period 1991-1994 33 companies were privatised, with proceedings of US$ 8.6 billion and debt transfers of US$ 3.3 billion (BNDES, 2001). Most of these companies were located in the metallurgic, petrochemical and fertiliser sectors.[7]

[3] Water Code is the name by which Decree no. 24,643/34 became popularly known. It hints the overwhelming predominance of hydro power in electricity generation in Brazil. In 1934 hydro's share in total installed capacity was 80% (Lima, 1995). In 2001 hydro generation represented 87.3% of total installed capacity (70,121 MW) and 88.7% of total generation (296,237 GWh) (Siese, 2001).

[4] In 1957 thermoelectric generation was included by Decree no. 41,019/57.

[5] With the acceleration of inflation in the 60s, a more realistic tariff regulation was introduced. Decree-Law no. 54,936/64 introduced the rate of return regulation based on the investment cost adjusted by the inflation.

[6] For more details on the history of the development of the ESI in Brazil see Tendler (1968) and Baer and McDonald (1998).

[7] Carvalho (2001) distinguishes three phases of the privatisation process in Brazil: the first was the 80s limited privatisation programme, the second was launched by the National Pri-

With the good performance of privatised companies and the success of stabilisation in 1994, there was enough support for the expansion of the privatisation programme. Four factors contributed to the inclusion of infra-structure utilities in the privatisation agenda:

1. The public constitutional monopoly over infra-structure industries was abolished by a constitutional amendment.

2. A constitutional amendment eliminated the differentiation between domestic and foreign capital. This allowed foreign companies to bid for public concessions.[8]

3. According to article 175 of the Federal Constitution of 1988, the public authority is responsible for providing public services, directly or indirectly under the regime of concessions or permissions. The fundamental conditions of the regime of public service concessions would be established by Law no. 8,987/95 (Concessions Law). This legislation, by defining the basic conditions of entry, exit and operation in the infra-structure sector, contributed to reduce the uncertainties of private agents.[9]

4. States had the financing of their debts to the Union conditioned to a certain level of amortisation. For many states the only way to amortise a fraction of their debt was through the sale of assets. Besides, the National Bank of Social and Economic Development (BNDES) launched a special programme for the promotion of state privatisation, conditioning loans to the sale of shares of state-owned companies.

The direct proceeds of privatisation during the period 1995-2002 jumped to a total of US$ 77.8 billion. In addition, debts of approximately US$ 29 billion were transferred to the private sector.

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vatisation Programme (PND) and took place in the 1991-1994 period, and the third began in 1995 with the Fernando Henrique Cardoso government. The most recent phase was characterised by the inclusion of the states in the programme as well as infra-structure sectors. See Carvalho (2001), pp. 2-5.

[8] Constitutional Amendment no. 6/95 eliminated article 171 of the Federal Constitution, which allowed special treatment to Brazilian companies of national capital. The article defined as Brazilian company any firm constituted under Brazilian law, with headquarters and management in the country. Brazilian companies of national capital were defined as those under the control of Brazilian residents or under the control of public institutions.

[9] Baer and McDonald (1998, p. 513) observe that the privatisation of public utilities in the 90s followed the tradition prevailing prior to the nationalisation process – the private sector being allowed to operate on the basis of concessions.

Privatisation of electricity distribution and supply businesses in Brazil - 1995-2000

Company	Auction date	Main buyers	Auction proceeds[1] (US$ million)	Debt transferred (US$ million)	% of capital sold	Value of the company[2] (US$ million)	Units distributed[3] (GWh/year)	Share in the national dist.[4] market (%)	Value/ MWh (US$)
1. Escelsa	11.07.95	Iven/ GTD	385.7	2	50.00	775.4	5,269	2.11	147.16
2. Light	21.05.96	EdF/ AES/ Houston	2,270.9	585.9	55.80	5,119.7	21,689	7.78	236.05
3. Cerj	20.11.96	Endesa (Chile)/ Chilectra/ EDP/ Endesa (Spain)	587.5	364	70.26	1,354.3	6,157	2.34	219.95
4. Coelba	31.07.97	Iberdrola/ BrasilCap Previ	1,597.7	213	65.64	2,758.5	8,406	3.19	328.15
5. AES Sul	21.10.97	AES	1,372.4	64	90.91	1,580.0	6,353	2.40	248.71
6. RGE	21.10.97	VBC/ CEA/ Previ	1,486.0	149	90.75	1,801.6	5,213	1.86	345.60
7. CPFL	05.11.97	VBC/ Bonaire/ Prev	2,730.7	102	47.76	5,931.2	18,054	6.65	328.52
8. Enersul	19.11.97	Iven/ GTD	565.3	218	55.36	1,414.9	2,525	0.92	560.36
9. Cemat	27.11.97	Rede/ Inepar	353.6	461	85.10	957.2	2,396	1.04	399.50
10. Energipe	03.12.97	Cataguazes	520.0	40	86.40	648.1	1,675	0.58	386.95
11. Cosern	12.12.97	Iberdrola/ Previ	606.6	112	77.92	922.2	2,262	0.91	407.69
12. Coelce	02.04.98	Endesa (Chile)/ Chilectra/ EDP/ Endesa (Spain)/ EDP	867.7	378	51.05	2,440.1	5,377	1.90	453.81
13. Eletropaulo Metropolitana	15.04.98	EdF/ AES/ Houston	1,776.6	1,241	29.80	10,126.0	35,578	12.25	284.62
14. Celpa	09.07.98	Rede/ Inepar	387.8	116	54.98	916.3	3,215	1.26	285.02
15. Elektro	16.07.98	Enron	1,273.6	428	46.60	3,651.4	10,767	3.68	339.13
16. Eletropaulo Bandeirante	17.09.98	EDP/ VBC/ Bonaire Previ	859.6	375	29.80	4,143.0	22,974	7.18	180.33
17. CPEE	17.09.99		na	na	na	na	239	0.08	na
18. CELB	30.11.99	Cataguazes	48.6	0.6	75.26	65.4	483	0.17	135.43
19. Celpe	17.02.00	Iberdrola/ Previ	1,004.0	131	79.62	1,425.5	7,425	2.42	191.99
20. Cemar	15.06.00	PP&L	288.7	158	84.70	527.4	2,313	0.76	228.01
21. Saelpa	30.11.00	Cataguazes	185.1	0	74.30	249.1	2,074	0.68	120.12
TOTAL			19,167.9	5,139		46,807.4	170,444	60.16	

Notes: [1] Auction proceeds do not include the revenues of public offerings or of offer to employees (minority stakes).

[2] Debt transferred is included in the calculation of the total value of the company.

[3] Refers to the total of sales on the year of the auction or on the year immediately after the auction

[4] Refers to the national distribution market in 2000.

Sources: Aneel (2002), Mercado de distribuicao Brasil 2000 - concessionarias de energia eletrica, www.aneel.gov.br.;
BNDES (2001), Privatization in Brazil 1991-2001, Federal Privatization Office, March 13, 2001;
Annual Reports (year of privatisation).

Table 1

The privatisation of the electricity sector attracted a great interest, resulting in considerable premiums over advertised prices. Privatisation proceeds are even more impressive considering that most distribution companies had considerable assets of doubtful value – the debts of Municipalities. Beginning in 1995, 21 distribution companies representing over 60% of the market have been privatised. Most of the shares were sold through public auctions, with minority stakes sold to employees or by public offerings. Table 1 summarises some important facts of the privatisation process.

Company values per MWh increased gradually, reaching a peak in 1997. The first sales faced a high regulatory risk.[10] The uncertainties of private investors would be progressively reduced, especially with the establishment of the regulatory agency in 1996, with the publication of the Coopers & Lybrand final report in 1997, as well as with the improvement of concession contracts.

The ESI was unbundled into four businesses: generation, transmission, distribution and supply, which were required to be accounted for separately. All businesses not considered related to the object of the concession were also required to be accounted for separately. Purchase of electricity was required to be contracted separately from the access and use of transmission and distribution network. Decree no. 2,655/98 required distribution companies to register separately revenues, expenditures and costs relative to distribution, supply for the captive market and supply for the free market. The distribution concession includes the authorisation for supply. All transmission network of voltage less than 230 kV was considered distribution asset and could be kept by the distribution company. Distribution companies were also allowed to keep some own generation up to the limit of 30% of their captive market.[11]

Distribution companies (as well as their shareholders) had to comply to market share limits. A single company (or shareholder) was not allowed to have a market share greater than 35% of the North/Northeast distribution market, 25% of the South/ Southeast/ Central-West distribution market or 20% of the national distribution market. (Resolution Aneel no. 278/00, which replaced Resolution Aneel no. 94/98)[12]

The model established a gradual transition of nine years to a competitive environment in generation. This was devised partly to minimise uncertainties,

[10] The regulatory risk faced by private investors in the early privatisations resulted from the lack of rules for operation in the sector and from the uncertainties concerning the new institutional framework and the market structure. The new regulatory agency, Aneel, would be established by Law 9,427 of 26th December 1996 – therefore, after the sales of Escelsa, Light and Cerj. The model framework would only be set by Law 9,648/98. For a discussion on the doubts investors faced in the privatisation of Light and Escelsa, see Gomes and Monnerat (1996).

[11] This was first established by Resolution Aneel no. 94/98, later replaced by Resolution Aneel 278/00.

[12] The limits to horizontal integration were determined by the potential bargaining power of the company in contracting its electricity supply and by its ability to capture economies of scale. Because the companies of the North/ Northeast market are smaller their limits to market concentration are more generous. For the definition of national market share limits, transmission constraints between the interconnected regional systems were also considered. See Coopers & Lybrand (1997).

partly to minimise tariff increases as the price of new generation is supposed to be higher than that of old amortised hydro generation. Distribution and generation companies were required to sign Initial Contracts, which would be valid in full from 1998 until 2002. Only added capacity would be traded in the free market. From 2003 onwards 25% of the volume defined in the Initial Contracts would be annually added to the free market.[13]

The transition to a competitive environment in supply would also be gradual. Initially customers with demand greater or equal 10 MW, connected to a 69 kV voltage network, were to be allowed to contract their supply directly with independent power producers.[14] From 1998 these customers were allowed to contract with any concessionary or supplier in the interconnected system. From 2000 customers with demand greater or equal 3 MW, connected to a 69 kV voltage network, joined the free market (Law no. 9,074/95, modified by Law no. 9,648/98).[15] In 2003 these limits can be reduced. The majority of potentially free customers have opted to stay in the regulated market. There are several reasons for this behaviour. First, the prices prevailing in the Initial Contracts are lower than any new generation that could possibly be contracted by free customers. Second, there are cross-subsidies in the current tariff structure that benefit industrial customers. Finally, only recently conditions for contracting access, including the use and connection to transmission and distribution networks, were regulated (Resolution Aneel no. 281/99). This, combined with the complexity of the rules of the wholesale market, discourages switching.

Aneel is in charge of both economic and technical regulation. It is responsible for the monitoring of concession contracts, the establishment of the criteria for transport pricing, and the readjustment and review of tariffs. Aneel can delegate its monitoring activities to state-level regulatory agencies.

Each distribution company owns and operates the distribution network in its concession area and is authorised to supply the customers located in this area. The distribution business consists of overhead and underground lines – the network on higher voltage (138 kV, 88 kV, 69 kV or 34.5 kV) is referred to as subtransmission and the network on lower voltage can be either a primary (15 kV, 13.8 kV or 11.9 kV) or a secondary (380 V, 220 V or 127 V) distribution network – substations with a varied combination of transformers, distribution transformers, posts, control systems and meters. Public lighting is usually owned by Municipalities. The supply business involves the metering, billing and bundling of contracts.

The speed of privatisation in the distribution and supply businesses reflects the investors' interest in a rapidly expanding market. In the 70s electricity consumption was growing at 11.8% per year; in the 80s the rate of growth was

[13] This transition mechanism does not apply to the electricity generated by Itaipu (see note 16) or by the nuclear generator (Eletronuclear).

[14] In 1995 *new* customers with demand greater or equal 3 MW were also allowed to choose their supplier (Art. 16, Law 9,074/95).

[15] The 'above 10 MW' market is estimated as roughly 14% of total consumption. The 'above 3 MW' market is estimated as approximately 19% of total consumption (Coopers & Lybrand, 1997).

6% per year and in the 90s it fell to 4.3% per year (CCPE, 2001). Besides, the average wholesale price represented only 40% of the average retail price in the 90s (Eletrobrás, 1996, 1998). This indicates room for operational improvement in the distribution sector, but in part reflects the significant transport costs in a country with the dimensions of Brazil.

Concession contracts usually specify initial tariffs and the formula and conditions for reviews and inflationary adjustments (exceptionally, the concession contract of Escelsa did not specify the formula for tariff adjustment and review). Contracts use the same basic formula in which non-controllable costs are adjusted annually to a inflationary index and controllable costs are adjusted to the same index minus a productivity factor (Factor X). Therefore, price cap regulation replaced the traditional rate of return regulation. As usual, X remains fixed for a number of years and in the tariff review process a new X is fixed by the regulator for the next period. X was set to zero for the first period for all distribution companies. Most companies have their first tariff review scheduled for 2003 or 2004. The gap between reviews after the first one is 4 or 5 years. In the review process the level of tariffs is also reset. Besides, there is the possibility of extraordinary tariff reviews, which can occur whenever the financial and economic equilibrium of the concession contract is broken. Escelsa was the only company to have experienced a tariff review so far. Its two tariff reviews, which imposed positive Xs, seem to indicate that the regulator will attempt to transfer to consumers at least a fraction of the efficiency gains of privatisation.

While during the 80s real tariffs had been kept low for anti-inflationary purposes, since 1993 average retail prices in US$/MWh have increased. For most companies profits have increased since privatisation, with an interruption of this trend in 1999 and 2001. In 1999 this was due to a currency devaluation, which increased the cost of debt and immediately increased the cost of the electricity purchased from Itaipu (quoted in dollars).[16] In 2001 Brazil faced its worst electricity supply crisis in fifty years.[17] The shortage of electricity supply was caused by underinvestment in generation and transmission, exacerbated by severe drought conditions. As a consequence, a rationing of electricity consumption by 20% was imposed from June to November 2001. With the loss of revenue caused by the rationing, distribution companies incurred in serious financial losses.[18] In order to avoid legal disputes between distribution and generation companies concerning the interpretation of contractual obligations, as well as a generalised financial crisis in the ESI, an agreement was reached between the various agents, with the supervision of the Committee for

[16] Itaipu, one of the largest hydroelectric projects currently in operation (12,600 MW of installed capacity), is located on the border between Paraguay and Brazil. It was constituted as a binational enterprise and its prices are quoted in dollars. The two countries share the energy produced, but each has the the right to buy the energy not consumed by the other. Often Brazil buys most of Paraguay's energy surplus.

[17] For analyses of the Brazilian electricity supply crisis see Araújo (2001) and Jardini, Ramos, Martini, Reis and Tahan (2002).

[18] The distribution companies calculate losses due to rationing of R$ 10.7 billion. Comitê de Revitalização do Modelo do Setor Elétrico (2002), p. 92.

the Revitalisation of the Electricity Sector Model.[19] This agreement established an extraordinary tariff increase (2.9% for residential and rural customers, and 7.9% for other types of customers). Furthermore, distribution and generation companies can contract special loans with BNDES. These loans will be serviced over time with the proceeds from the tariff increase. Although the most immediate consequences of the supply crisis have already been dealt with, the whole model came under serious criticism. The official reaction to this was the proposal of measures for the improvement of the model, especially concerning governance issues, the incentives for free customers and the co-existence of private and public generators for the foreseeable future. However, the fundamental market orientation of the model was preserved. With the landslide victory of opposition in the 2002 presidential elections, there is increasing concern whether there will be a complete change of course.

3 Methodology

3.1 The rationale for privatisation and methodology alternatives

The major rationale for privatisation is that it improves efficiency. This hypothesis is what most empirical studies aim to test.

Both public and private ownership involve a principal-agent problem, but with distinct control structures. In the case of public ownership, the owners are the public in general, who are represented by the government. The government then delegates power to bureaucrats, who are responsible for running the company. In private companies, shareholders appoint directors to run their business. Therefore, there are more "layers" of agents in the case of public ownership.

Considering the principal-agent framework, we divide the theoretical arguments relating ownership and efficiency into two categories: the arguments concerning agent's incentives and the ones concerning their constraints. Property rights theories (Alchian, 1965) concentrate on the incentives that owners face. According to these theories, the limited transferability of public rights, typical of public ownership, reduces the incentives to minimise costs. This stems from the owners' inability to capitalise gains, as well as from the higher monitoring costs they face. Private ownership implies a clearer assignment of property rights to those with a comparative advantage in running the company. Public choice and bureaucracy theories (Niskanen, 1971, 1975) claim that politicians and bureaucrats maximise their own utility rather than the profitability of the company or the public interest. Concerning constraints, we note that diffuse ownership restricts the ability to write complete contracts with managers. The contracting

[19] The Committee for the Revitalisation of the Electricity Sector was created by the Chamber of Management of the Electric Energy Crisis (GCE), with the objective of correcting problems of the model and improving its design, preserving the fundamental characteristics of the market-oriented model.

technology of public ownership does not allow contracts that tie manager's to the returns of their decisions (for instance, contracts that pay manager's effort with shares). Besides, bureaucrats might face a softer budget constraint as they usually do not have to face the risk of bankruptcy.

However, these arguments might not be applicable for all market structures. Galal, Jones, Tandon and Vogelsang (1994) reminds us that the predictions of the theory are ambiguous for large monopoly markets, depending on how the private sector is structured and regulated, and how the public sector operates. Depending on regulation, it is possible that the monopolistic market structure allows the creation of incentives similar to those in public enterprises. When theoretical conclusions are ambiguous – as it is the case for monopoly structures such as the distribution market – we must turn to empirical evidence.

We classify the empirical studies on the impact of privatisation according to the methodology used. Studies based on financial and physical indicators of performance (such as Lima, 1997; Pinheiro, 1996; Bishop and Green, 1995; World Bank, 1995; Megginson, Nash and van Randenborgh, 1994; Costa, 1994; Duncan and Bollard, 1992; Yarrow, 1992; Hutchinson, 1991; Yarrow, 1989; and Bishop and Kay, 1988) outnumber the others. Another category of empirical work concentrates on the analysis of labour and total factor productivity measures (e.g. Parker and Martin, 1995; Bishop and Thompson, 1992). Frontier methodologies (e.g. Hawdon, 1996; Burns and Weyman-Jones, 1994), whatever the precise method adopted, estimate the most efficient cost or production level (the frontier) and measure the level of inefficiency of any particular company by its distance from the frontier. Although these studies might provide a starting point for the analysis, they do not address directly the relevant question from the point of view of policy choice: is privatisation socially worth it? Social cost-benefit analysis attempts to address this question and also to determine the distribution of the net gains (or losses) of privatisation. However, social cost-benefit is a partial equilibrium analysis. Especially in the case of economy-wide privatisations, it might be of interest to compute a general equilibrium model (e.g. Chisare, Estache and Romero, 1999). The problem of these studies is common to computable general equilibrium models – their parametrisation may be vulnerable to criticism.

Social cost-benefit analysis is the only approach to try to measure the social welfare impact of privatisation directly. The methodology initially proposed in Jones, Tandon and Vogelsang (1990) is comprehensive enough to potentially incorporate efficiency gains, externalities, distributional impacts, dynamic and qualitative effects. We will apply this methodology to the privatisation and restructuring of Brazilian electricity distribution and supply businesses.

3.2 The social cost-benefit methodology

A full social cost-benefit analysis would involve the determination of net welfare changes and the distribution of these net changes. We should be able not only

to value the overall impact on economic efficiency, net of the costs of privatisation and restructuring, but also to identify who gained, who lost and by how much. Therefore our main concerns should be economic efficiency and equity. There are two distinct categories of efficiency: productive or allocative. We ignore allocative efficiency effects for simplicity as, by the standard measure of deadweight loss, $\frac{1}{2}\varepsilon t^2$, they appear to be relatively small, and concentrate on productive efficiency.[20]

We follow the method set out in Jones, Tandon and Vogelsang (1990) and applied in Galal, Jones, Tandon and Vogelsang (1994) to twelve case studies of privatisation, including two electricity companies. Our analysis will be based on the fundamental formula of divesture, spelled out in Jones, Tandon and Vogelsang (1990, p. 16):

$$\Delta W = V_{sp} - V_{sg} + (\lambda_g - \lambda_p)Z, \qquad (1)$$

where
W =social welfare,
V_{sp} =social value under private operation,
V_{sg} =social value under continued government operation,
λ_g =shadow multiplier on government revenue,
λ_p =shadow multiplier on private funds,
Z =actual price at which the sale is executed.

The impact on social welfare is therefore made up of two components. The first gives the difference between welfare after the sale and welfare before the sale. The second gives the welfare effect of the sale transaction itself.[21] Privatisation is considered socially worthwhile if $\Delta W > 0$.

Because we address the privatisation impact from the point of view of the public policy maker, we follow Little and Mirrlees (1974) tradition and set public income as numeraire.[22] Thus we must determine all shadow multipliers in terms of the shadow multiplier on government revenue. In order to make clear the role of weighting in the final results, we adopt an additive framework to our

[20] We follow Newbery and Pollitt (1997, p. 280) and measure allocative efficiency effects by the deadweight loss, $\frac{1}{2}\varepsilon t^2$ as a proportion of total revenue, where ε is the elasticity of demand and t is the proportional difference between actual and counterfactual price. In the year during which calculated prices diverged most the counterfactual price was 26% higher than the retail price of electricity (net of price of electricity purchased and transmission). Given an electricity elasticity of demand of 0.06 (Andrade and Lobão, 1997) and a revenue (net of electricity purchased and transmission) of R$ 7.8 billion (1994 values), the maximum deadweight loss would be around R$ 15.8 million p.a. (1994 values). Given the magnitude of annual productive efficiency gains, we can ignore the allocative effects.

[21] As pointed out in Jones, Tandon and Vogelsang (1990, p. 16), a complete description of the welfare impact would require the inclusion of the transaction costs of executing the sale. We will simplify the analysis and will not include these costs as, given their relative size, they are negligible.

[22] "Since social cost-benefit analysis is essentially addressed to governments, to help them solve problems of public expenditure in general and investment in particular, it seems natural to use as numeraire something in terms of which they must think and operate." (Little and Mirrlees, 1974, p. 146)

analysis.[23] First, we abstract from issues of sale price and focus on the change in the social value of operation. We achieve this by setting all shadow prices equal to 1. Second, we make the case for the use of weights for developing countries and specifically for Brazil, and introduce weights in the analysis. We then determine the effect of using differentiated weights in social welfare.

Since initially we are only interested in the difference between the social value under private operation and the social value under government operation, the problem is to identify the changes in costs which differ under the two types of operation.[24] The social cost-benefit analysis should determine the difference in the actual and predicted path of costs under private ownership and the counterfactual path of costs under continued government operation. In the construction of the counterfactual scenario we must determine what would have happened had the company continued under public ownership. Although it is not possible to be certain of what would have happened, we can strenghen our exercise by studying historical trends and performing sensitivity analyses.

The calculation of cost changes involves three elements: the costs of restructuring and privatisation – which includes both the costs incurred shortly before privatisation to prepare the company for sale and the restructuring costs incurred after privatisation – the cost savings due to increases in efficiency, and the costs savings arising from improvement in investment decisions. On this first exercise, we will not consider investment savings. To evaluate the cost savings due to increases in efficiency we deduct the controllable costs under private operation from the counterfactual controllable costs under public ownership. ΔW is then given by the costs savings net of restructuring and privatisation costs.

3.2.1 Initial adjustments

First of all, in order to have comparable data before and after privatisation we must make the necessary adjustments. This is required because some of the companies selected (such as Eletropaulo, CEEE and Cesp) went through extensive restructuring. The unbundling process is detailed in Appendix 1. Because distribution companies were allowed to keep own generation up to the 30% limit, we need to exclude generation from our accounts as well as other minor businesses. Therefore we must first adjust each company's individual accounts in order to deal with the unbundling process and to exclude other businesses from the accounts. These adjustments and the rearrengements of our sample are spelled out in Appendix 2.

With the individual companies' data adjusted we are able to construct consolidated accounts of the 12 (after some grouping also explained in Appendix

[23] This is line with the two-step procedure of Squire and van der Tak (1975) social cost-benefit approach. First, one determines the outcome in terms of economic efficiency. Second, one adjusts the outcome using weights and other parameters in order to obtain the social net benefits of a project.

[24] This is what Jones, Tandon and Vogelsang (1990, p. 20) refer as the Difference Principle. The fact that we only need to know the difference $(V_{sp} - V_{sg})$ is immensely fortuitous. Except under very simplistic assumptions, we are not able to determine the individual values. The Difference Principle simplifies our analysis and makes our task feasible.

2) distribution companies of our sample for the period 1989 to 2000 (Table 2). For a detailed account of the variables, sources and adjustment methods used see Appendix 3. These consolidated accounts represent the actual performance of the companies in our sample. All our projections, counterfactual scenarios and consequently results stem from these accounts.

The next step is the construction of the privatisation scenario (Panel 1) and the preferred counterfactual scenario (Panel 2). These panels (see Appendix 4) show the actual and projected behaviour of the key variables of our analysis (operating controllable costs, depreciation, operating profits, operating revenue and taxes) for operation under private ownership and under public ownership. The values of the variables for the privatisation scenario for the period before 2000 are actual values, taken directly from our consolidated accounts. The values for the privatisation scenario for the period 2001 to 2007 are estimated values. To construct the counterfactual scenario we start with a base year and project the variables based on our assumptions on the operation under public ownership. With the information organised in the two panels we can calculate the efficiency cost savings and their distribution.

Accounts for Brazilian distribution companies at real prices

R$ million (1994 prices)	1989	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Operating Revenue	6924.70	7042.94	7749.78	8357.58	8072.59	6928.75	8065.39	8675.22	9264.89	9441.13	10042.30
of which:											
Electricity supply revenue	6801.02	6885.93	7655.87	8262.99	7908.75	6821.50	7922.80	8560.66	9118.57	9266.43	9688.79
Bulk electricity revenue	13.14	13.93	15.51	15.01	11.93	10.03	12.74	31.16	47.31	57.91	191.86
Other	110.54	143.09	78.40	79.58	151.91	97.22	129.85	83.40	99.00	116.79	161.65
Less Purchase of electricity	2717.68	3038.41	3800.24	3714.13	2935.03	2551.13	2727.92	2995.73	3294.20	3570.22	3655.73
Less Transport	70.97	60.98	72.08	78.67	58.72	51.67	67.08	62.06	283.43	378.76	467.89
Equals **Net Op. Revenue**	4136.05	3943.56	3877.47	4564.78	5078.84	4325.94	5270.38	5617.43	5687.26	5492.14	5918.68
Total Operating Costs	4014.27	3829.14	4955.55	5494.63	4831.68	4297.05	4674.63	4942.19	4796.97	4705.62	5019.23
Less **Depreciation**	247.99	186.07	663.17	609.62	641.58	615.45	424.60	387.73	474.49	603.42	689.10
Less **R&P costs**	0.00	0.00	0.77	0.00	8.60	57.32	121.24	310.98	90.13	62.04	32.25
Equals **Net Op. Costs**	3766.28	3643.07	4291.61	4885.01	4181.50	3624.28	4128.78	4243.49	4232.36	4040.16	4297.88
Less **Op.Non-cont.costs**	1157.42	1471.23	1529.85	1757.57	1776.21	1676.36	2004.53	2184.23	2373.09	2599.21	2827.49
Equals **Net Op. Cont.Costs**	2608.86	2171.84	2761.76	3127.44	2405.28	1947.92	2124.25	2059.26	1859.26	1440.96	1470.40
Op. Profits	121.79	114.42	-1078.08	-929.85	247.16	28.89	595.75	675.24	890.28	786.52	899.45
Working assets	na	na	13567.60	14213.29	15743.06	16788.74	16321.91	15752.70	17488.77	15296.96	15376.85
Taxes on op. profits (1)	573.74	-133.56	-105.72	130.83	-284.16	15.50	53.95	-241.45	-56.90	-246.16	-81.12
of which:											
Income tax	573.74	-133.56	-108.95	137.93	-296.46	1.39	23.91	-191.69	-60.98	-201.64	-92.93
Social Contribution	0.00	0.00	3.23	-7.09	12.30	14.11	30.04	-49.76	4.08	-44.52	11.81
Total GWh distributed	119356	120051	124481	129783	134993	142662	147181	153724	161881	164662	172204
Number of employees	na	na	68039	71627	73353	64913	54467	45029	40043	36202	31670

Notes: (1) positive values indicate tax payments; negative values indicate tax reimbursements.

Table 2

3.2.2 Counterfactual scenarios

To arrive at the counterfacual controllable costs, we calculate a base pre - privatisation figure using a three-year average of the unit operating controllable costs (equal to operating controllable costs divided by total units distributed) centring on 1992. We do not use the immediate pre-privatisation year, as it may not be representative of the business as usual operation of the industry under public ownership. We then project costs from the base year assuming various counterfactual cost declines. The rate of counterfactual cost decline is assumed to be constant until the end of the period (2007).

We use five counterfactual scenarios – 0, 1, 2, 3 and 4% counterfactual operating controllable cost decline. We perform the social cost-benefit analysis using a 0, 1, 2 and 3% counterfactual cost fall. We detail the analysis for our preffered counterfactual scenario (or central-case scenario), which is the 2% p.a. counterfactual cost fall. We provide more support for this choice in Section 5.

With the counterfactual costs calculated, we can find the gross efficiency savings from restructuring and privatisation just by subtracting the controllable costs under private ownership from the counterfactual controllable costs. These values are then aggregated on a present-value basis using a discount rate. The relevant discount rate for the social cost-benefit analysis is the social discount rate, which is the rate of fall in the value of the numeraire over time. Because we chose public income as our numeraire we must determine a discount rate that represents the opportunity cost of government resources. Considering the nature of our variables (flow variables) and the rates of interest available, we opted for the use of the Selic interest rate.[25] The Selic rate of interest is a weighted and adjusted average of the nominal interest that the public sector pays on a daily basis to finance its debt. These rates – as one would expect – are very volatile over time. Thus we found it useful to experiment with different rates. We performed the cost-benefit analysis for discount rates varying from as low as 9% to as high as 15%.

3.2.3 The efficiency gains from restructuring and privatisation

Encouragements to efficiency can come from the product market or the capital market. The change of ownership *per se* does not increase product market competition, but privatisation can introduce relevant capital market competition, with potential gains of productive efficiency. Besides, privatisation is often accompanied by liberalisation, which can increase pressures from the product market as well.

In the case of Brazilian electricity distribution, competition is not an issue. With respect to the supply market, there is very limited competition. Only customers with demand greater or equal 3 MW, connected to a 69 kV voltage

[25] For December 1998 the Selic was 31.24% p.a.; for December 1999 it was 18.99% p.a. and for December 2000 it was 16.19% p.a. (Banco Central do Brasil, Boletim Agosto 2002). These are nominal values. For our analysis we deflated Selic interest rates using the IGP-M. The calculated average Selic rate for the period 1996-2001 was 12.8 % p.a. in real terms.

network (therefore, industrial customers), are able to switch suppliers, and only recently (1999) transport charges have been regulated. Because of the limitations of Brazilian capital markets, we expect that the incentives to cut costs will most probably come from shareholders' pressure and from the new incentive regulation.

The value of the efficiency gains from restructuring and privatisation is given by the present value of the controllable costs differences net of restructuring and privatisation costs. Appendix 6 illustrates the magnitude of the restructuring and privatisation costs.

3.2.4 The distributional impact

The next step is the assessment of the distributional impact. Jones, Tandon and Vogelsang (1990) identify three groups affected by privatisation: consumers, producers and government. We can express the welfare change in terms of its distribution among the relevant groups:

$$\Delta W = \lambda_c \Delta Cust + \lambda_p \Delta Prod + \lambda_g \Delta Gov + (\lambda_g - \lambda_p) Z, \qquad (2)$$

where
$\Delta Cust$ =customers' welfare change,
$\Delta Prod$ =producers' welfare change,
ΔGov =government's welfare change,
λ_c =shadow multiplier on consumers' revenue,
λ_g =shadow multiplier on government revenue,
λ_p =shadow multiplier on private funds,
Z =actual price at which the sale is executed.

In accordance to our additive procedure, we initially compute the distribution of welfare change setting all shadow multipliers equal to 1. Thus our initial equation of welfare change distribution is reduced to:

$$\Delta W = \Delta Cust + \Delta Prod + \Delta Gov \qquad (3)$$

Consumers' welfare change is given by the difference between private and counterfactual average revenue. The computation of counterfactual average revenue involves the sum of counterfactual operating profits, depreciation, counterfactual operating controllable costs and operating non-controllable costs. Net operating non-controllable costs are all operating costs excluding purchase of electricity, payments for transport, depreciation and operating controllable costs. There is no assumed difference between private and counterfactual net operating non-controllable costs. Counterfactual controllable costs are computed from unit counterfactual controllable costs considering a counterfacual cost decline. Counterfactual operating profit (pre-tax) is calculated using a rate of return on working assets.

The difference between private and counterfactual taxes gives the welfare impact on the government. Both counterfactual and estimated private taxes

are calculated by projecting tax rates over operating profits. Tax rates are estimated using actual data on income tax and social contribution.

Following Newbery and Pollitt (1997), we calculate producers' welfare change as the residual after subtracting consumers' and government's net gains from total net benefits: $\Delta Prod = \Delta W - \Delta Cust - \Delta Gov$.

Finally, we introduce differentiated weights and assess how they affect our results.

3.3 Assumptions

We make a few important assumptions to construct the privatisation and the counterfactual scenarios presented in Appendix 4:

1. In order to project our variables we must define demand growth rates for the years 2001 to 2007. We used the rates suggested by the Coordinator Committee for the Planning of Electric Systems Expansion (CCPE) in its 10-year plan for the electricity supply industry. We used its defined 'Scenario C', which is the only one that incorporates the rationing of electricity with reasonable accuracy.[26] Demand growth rates are assumed as follows:

Demand growth rate							
Year	2001	2002	2003	2004	2005	2006	2007
rate (%)	-8	9.2	9.4	5.5	6	7.4	7.4

Table 3

2. Our key variables (revenues, costs) are net of the payments for purchase of electricity and transport. This avoids incurring in further assumptions on what will happen in the wholesale electricity market during the transition period when the Initial Contracts gradually cease to be valid, but unfortunately does not capture the possible different ability of private companies in contracting their electricity purchases. All variables are expressed in real values.

3. Projected net operating revenue per kWh under private ownership keeps constant until 2003. From 2004 it is assumed to decline at 1.8% p.a. until 2007. This assumption is based on the contractual price review conditions of each concession contract and on the only tariff reviews that happened so far – the two tariff reviews of Escelsa. Appendix 5 contains details on price controls.

4. Net operating controllable costs per kWh fall at the expected rate of productivity growth. This is given by the regulator as X^p (technical produc-

[26] For more details on the assumptions of 'Scenario C' see CCPE (2001).

tivity). We use the value assumed by the regulator for the second tariff review of Escelsa, i.e. 1.56%, for the period 2001 to 2007.[27]

5. Operating non-controllable costs (e.g. RGR, RGG, RNCR and CCC quotas, taxes on revenue) per kWh grow at 4% p.a. from 2001.[28] This is given by the average growth rate of unit non-controllable costs after privatisation.

6. Working assets grow at the demand growth rate. However we smoothed the rates of the first three years (2001, 2002 and 2003) as it seemed unreasonable to assume reductions of the asset base of the magnitude of 8% in 2001. Depreciation rate is constant at 3% on working assets for the projected period. This is based on the actual depreciation rates of the period 1995-2000. Because in this first exercise we are not accounting for effects on investment, we use the same working assets base for the calculation of the counterfactual operating profits.

7. Counterfactual operating profits (or losses, in our case) for the years 1995-2000 are calculated using the average 1991-1994 rate of return on working assets. From 2001 we assume that the public sector would improve its performance and have null profits.

8. Tax rates are the quotient of the sum of income tax and social contribution over operating profits. This is clearly an artificial construction as both income tax and social contribution are actually calculated as percentages of total profits, which include not only operating profits but also non-operating and financial profits. However it is a necessary construction for our analysis. The calculated values of the tax rate vary significantly, especially with the sign of profits. Because in our counterfactual scenario profits are negative until 2000 and null thereafter we decided to choose different rates for the two scenarios. The tax rate for the privatisation scenario is 0 until 2003, from 2004 it is 25%. The tax rate for the counterfactual scenario is 8%, which implies that companies would receive tax credits until 2000.[29]

[27] We use the value for the second tariff review because it will be valid for 2002 and 2003 (the values for the first review were valid for 1999 and 2000).

[28] RGR (Global Reversion Reserve) is a fund designed to provide resources for the reimbursement of the concessionary company whenever the concession period is over and the contract is not renewed. RGG (Global Guarantee Reserve) is a fund designed to ensure the economic and financial equilibrium of the concession contract. RNCR (National Reserve for Return Compensation) was a fund designed to ensure the previous rate of return regime. CCC (Fuel Consumption Account) is designed to ensure that distribution companies share the extra costs of thermal generation. Taxes on revenue are all taxes and contributions that fall directly upon total revenue.

[29] We performed a sensitivity analysis to check the effects of different tax rate assumptions. We calculated the results of our central-case for two other sets of taxation rules, but did not find significant changes.

4 Data

To undertake our social cost-benefit analysis, data on revenue, payments for electricity purchase and transport, controllable operating costs, non-controllable operating costs, depreciation, restructuring and privatisation costs, operating profits, income tax, social contribution, employment, units distributed and a price index (IGP-DI) were required for the whole period – 1989 to 2000. We also analysed all information available before 1989 and used it to strengthen our assumptions. Other indices – such as IGP-M, government bonds (BTN) and a fiscal index (Ufir) – were required for shorter periods in order to make adjustments on the asset base. The CPI was used to obtain values in 2001 (US$) prices. A list of the items used and their sources is given in Appendix 3. Table 2 shows the data used. The composition of revenue per kWh is depicted in Figure 1. We computed values for the counterfactual scenario using actual data on operating controllable costs, operating non-controllable costs, depreciation, working assets, operating profits, income tax and social contribution. Appendix 4 summarises the data relative to the privatisation scenario and to the counterfactual 'central-case' scenario.

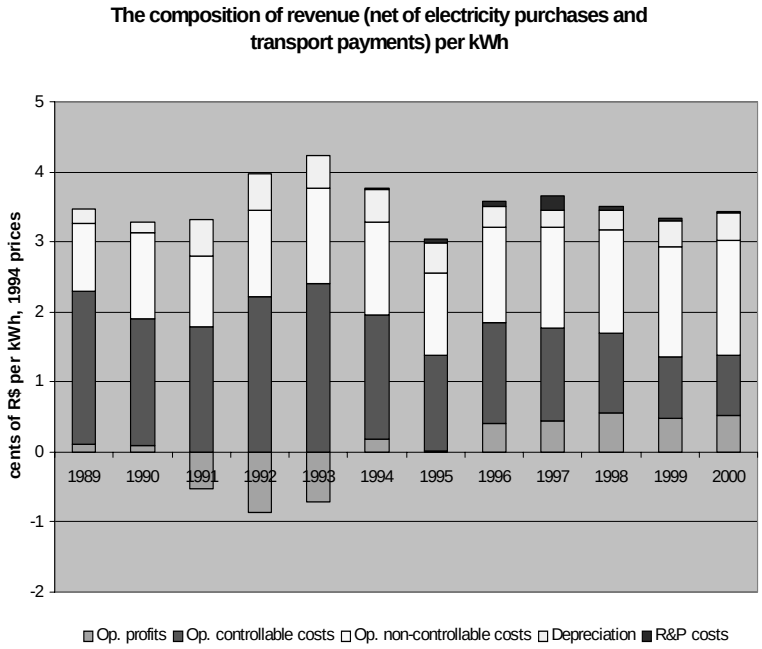

Figure 1

Operating costs consist of the payments for RGR, RGG, RNCR, and CCC quotas, taxes on revenue, labour costs, costs of material and third-party service contracts, depreciation, provisions and other running costs. Operating controllable costs are defined as labour costs, costs of material and third-party service contracts, provisions and the remaining costs classified as other.

Our sample represents 56% of the national distribution market and it includes most of the distribution companies privatised until 1998.[30] Because we wanted to have at least two complete years after privatisation for each individual company, we decided not to go beyond 1998.

5 The Results

5.1 Cost changes

We observe that real unit distribution and supply controllable costs rise significantly two years before privatisation, with costs reaching a peak in 1993[31]. Unit controllable costs increase 35% between 1991 and 1993. From 1993 onwards real unit controllable costs decrease steadily (with a small break in the declining trend in 1996).

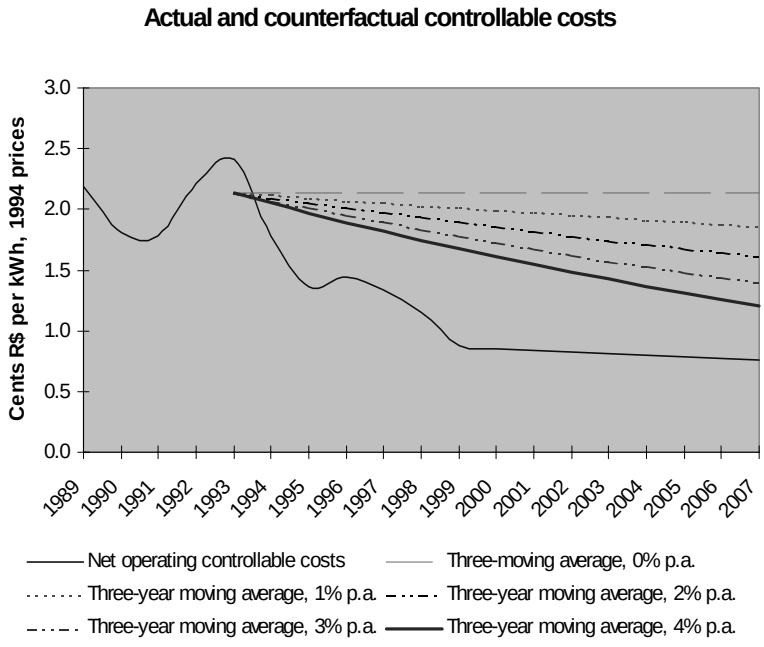

Figure 2

The starting point in our social cost-benefit analysis is 1993. Considering that the sales in our sample took place between 1995 and 1998, we distinguish

[30] Celpa and Cemat belong to the same controller group and are the only major distribution companies privatised until 1998 not included in our work. They refused to make available the information required for our social cost-benefit analysis.

The distribution of CEEE – which is still state-owned – was included in order to have comparable data before and after privatisation. For a summary of company rearrengements in our sample see Appendix B.

[31] We stress that these costs do not include restructuring and privatisation costs.

two phases: the period 1993-1995 and the period 1995-2000. During the first phase, in preparation for privatisation, real controllable costs experienced a decline of R$ 1.2 billion, which represents a reduction of 43% in real controllable costs per unit. Between 1995 and 2000 there were further reductions of R$ 477 million in real controllable costs and a 37% decline in real unit controllable costs. Most of this decline was observed after 1998 – what could be expected as the bulk of the sales in our sample (See Table 1) occurred in 1997 and 1998. After 2000 we project a 1.56% annual decline in real unit controllable costs, what is in line with the forecasts of the regulator for productivity growth. This is small in comparison to the average annual fall in controllable costs per unit of 10% in the period 1995-2000. We are being conservative by implicitly assuming that most of the gains of privatisation and restructuring have already been achieved.

Finally, we note that our post-privatisation results are not driven by the initial rise in real unit controllable costs. By 1994 the values were back at 1991 levels and the declining trend was maintained after privatisation. From the analysis of controllable costs we conclude that there were considerable savings both in preparation for and after the sales. The pre-privatisation period, however, should be taken considering the 1991-1993 rise in unit controllable costs.

5.2 Efficiency gains

Given our hypotheses on counterfactual cost fall, we then compute the savings of privatisation and restructuring relative to each counterfactual public scenario. These results are shown in Table 4 for five different discount rates. All the assumptions made in Subsection 3.3 are maintained.

We note that, at a discount rate of 12%, efficiency gains due exclusively to controllable cost reductions amount to R$ 9 billion (1994 prices), with a counterfactual cost fall of 2% p.a. This is equivalent to US$ 12.7 billion (2001 prices) or 2.6% of the Brazilian 1994 GDP. These gains are partly offset by restructuring and privatisation costs of R$ 487.57 million, yielding net efficiency gains of R$ 8.5 billion. Appendix 6 describes the evolution of restructuring and privatisation costs and their net present values at different discount rates.

In Figure 3 we observe that the growth of labour productivity (expressed in MWh distributed per employee) accelerated after privatisation. From 1994 to 2000 the values in our sample increased by an impressive 147%. The total number of employees was halved in the same period. If we are adequately representing in our counterfactuals the previous public sector performance, we can attribute – at least partly, as there might be other factors affecting efficiency – the net efficiency gains to these significant increases in labour productivity.

Operating costs and net efficiency gains

Counterfactual	*Discount rate*				
cost fall	9%	10%	12%	14%	15%
	R$ billion, 1994 prices				
0%	14.5	13.6	12.0	10.7	10.1
1%	12.5	11.8	10.4	9.3	8.8
2%	10.7	10.1	9.0	8.0	7.6
3%	9.1	8.6	7.7	6.9	6.5
4%	7.6	7.2	6.4	5.8	5.5
Net eff. gains 0%	14.0	13.1	11.5	10.2	9.6
Net eff. gains 1%	12.0	11.3	9.9	8.8	8.4
Net eff. gains 2%	10.2	9.6	8.5	7.6	7.2
Net eff. gains 3%	8.6	8.1	7.2	6.4	6.1
Net eff. gains 4%	7.1	6.6	5.9	5.3	5.1

Table 4

Labour productivity of the distribution/ supply businesses

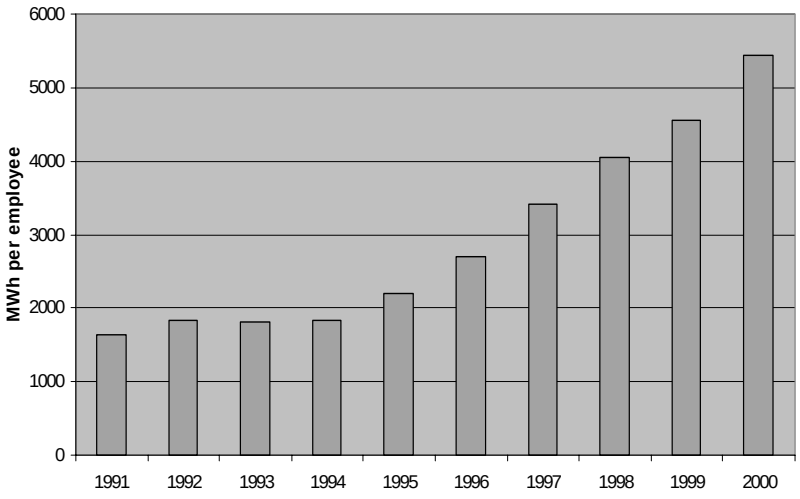

Figure 3

5.3 Efficiency gains for each scenario

Table 5 provides the results and their distribution for four possible counterfactuals, using five different discount rates. We observe that for each discount rate

the net efficiency gains accruing to the government and to producers do not vary with counterfactual scenarios. Therefore, consumers absorb all the difference in efficiency gains between counterfactual scenarios (considering a given discount rate). This stems directly from the way we calculate the distributional impact. The result can be easily obtained by manipulating the expressions presented at 3.2.4.[32]

Our choice of real unit controllable cost decline of 2% for the central-case scenario is based on the performance of the companies in our sample in the period 1989-1994 and on the previous performance of individual companies.[33] In many cases their long-term performance was quite poor, with positive rates of growth of real unit controllable costs. In the 90s their performance starts to improve, especially in the pre-privatisation period. Quite a few companies launched redundancy and early retirement programmes before privatisation. There was some voluntary acceptance of these programmes by employees, possibly because of the threat of worse conditions in the post-privatisation future.[34] There are reasons to believe that, given the political and macro conditions of the 90s, especially the financial situation of the states, the companies would have implemented similar programmes had privatisation not taken place.

Using a 12% discount rate, efficiency gains net of restructuring and privatisation costs amount to R$ 8.5 billion (at 1994 prices) for our central case scenario. At a discount rate of 10%, net efficiency gains rise to R$ 9.6 billion at 1994 prices. Considering that privatisation took place between 1995 and 1998 (with a concentration in 1997 and 1998) and most cost savings occurred between 1995 and 2000, it is straightforward to see why lower discount rates increase our present values at 1994 prices.

Given the history of state-owned companies and their traditional objective of expansion of capacity rather than cost minimisation, one can argue that the

[32] We will briefly show the result:

ΔW = Net op. cont. costs$_{public}$ − Net op. cont. costs$_{private}$ − R&P costs

$\Delta Cust$ = Revenue$_{public}$ − Revenue$_{private}$

Revenue consists of op. profits, depreciation, net op. cont. costs and net op. non-cont. costs. Because depreciation and net. op. non-cont. costs under public operation are the same as under private operation, we can simplify the expression of $\Delta Cust$:

$\Delta Cust$ = Op. profits$_{public}$ − Op. profits$_{private}$ + ΔW+ R&P costs

ΔGov = Taxes$_{private}$ − Taxes$_{public}$

Substituting $\Delta Cust$ into $\Delta Prod$ and making the necessary simplications we obtain:

$\Delta Prod$ = Op. profits$_{private}$ − Op. profits$_{public}$ − ΔGov− R&P costs

Considering our definitions for the variables, all the components of producer's and government's welfare change are invariant with the counterfactual assumption.

[33] If we look only at the period 1989-1994 controllable costs are declining *faster* than 2% p.a., with the exception of the 1991-1993 increase. In order to establish a reasonable counterfactual, we studied the long-term behaviour of unit controllable costs under public operation. For the companies for which we had a longer time series we found *positive* rates of growth of controllable costs in the 1980s. For instance, for Eletropaulo, Brazil's largest distribution company, the average annual *rate of growth* of controllable costs per MWh in the 1981-1989 period was 13%. Its performance would improve significantly in the 1990s and in the period previous to privatisation unit controllable costs would *decline* at a 2.1% p.a. rate, which is approximately our counterfactual decline rate.

[34] Afterwards companies would often outsource services from firms established by the employees they previously made redundant.

improvements of the beginning of the 90s would not have been sustainable. The attempt to improve state-owned companies performance had failed in the past, when some states introduced performance contracts. From our interviews with companies personnel (as well as from the documentation we could gather), we understood that these contracts were not much more than a formality to please banks (and to help winning elections), and often their objectives were not achieved. This is line with the empirical results of a World Bank assessment of performance contracts in six other developing countries (World Bank, 1995).

At a discount rate of 12% net efficiency gains amount to R$ 9.9 billion (1994 prices) for a counterfactual cost decline of 1% p.a. If we assume that there would be no cost change under the public counterfactual, net efficiency gains would be R$ 11.5 billion (1994 prices), using a 12% discount rate. For the least probable scenario – a counterfactual cost decline of 3% p.a. – we still have substantial net benefits from privatisation at all discount rates. Net efficiency gains would amount to R$ 7.2 billion (1994 prices), using a 12% discount rate.

With respect to the distribution of net benefits we observe that, under the assumptions made in Subsection 3.3, a disproportionate share of net benefits goes to producers. Under all counterfactual cost decline scenarios (and at all discount rates), they gain at least half of the total net benefits. Consumers also benefit from privatisation. Consumers benefit more for lower counterfactual cost declines as they absorb all increases in net efficiency gains. At discount rates of 9, 10 and 12% the government has small gains, but for higher discount rates government results become negative.[35] This is due to the fact that government will start to benefit more consistently only from 2004.

[35] These results can only be detected when we use R$ million instead of R$ billion.

Net efficiency gains from restructuring and privatisation and their distribution at various discount rates

R$ billion, 1994 prices

	Discount rate				
	9%	**10%**	**12%**	**14%**	**15%**
(a) Strong pro-privatisation scenario (0% p.a. counterfactual cost decline)					
Consumers	6.8	6.2	5.2	4.4	4.1
Government	0.0	0.0	0.0	0.0	0.0
Producers	7.2	6.8	6.3	5.8	5.5
Total	14.0	13.1	11.5	10.2	9.6
(b) Pro-privatisation scenario (1% p.a. counterfactual cost decline)					
Consumers	4.8	4.4	3.7	3.1	2.8
Government	0.0	0.0	0.0	0.0	0.0
Producers	7.2	6.8	6.3	5.8	5.5
Total	12.0	11.3	9.9	8.8	8.4
(c) Central-case scenario (2% p.a. counterfactual cost decline)					
Consumers	3.0	2.7	2.2	1.8	1.7
Government	0.0	0.0	0.0	0.0	0.0
Producers	7.2	6.8	6.3	5.8	5.5
Total	10.2	9.6	8.5	7.6	7.2
(d) Pro-public scenario (3% p.a. counterfactual cost decline)					
Consumers	1.4	1.2	0.9	0.7	0.6
Government	0.0	0.0	0.0	0.0	0.0
Producers	7.2	6.8	6.3	5.8	5.5
Total	8.6	8.1	7.2	6.4	6.1

Table 5

5.4 The distribution of benefits based on the central-case scenario

We concluded from the previous analysis that, even using equal social weights, $\Delta W > 0$ for all counterfactual scenarios, at all discount rates used in our cost-benefit analysis. Having obtained a positive result in terms of efficiency, we must consider the equity impact of privatisation and restructuring (still assuming non-differentiated weights). In this subsection we will focus on the central-case scenario of a 2% counterfactual controllable cost decline per unit.

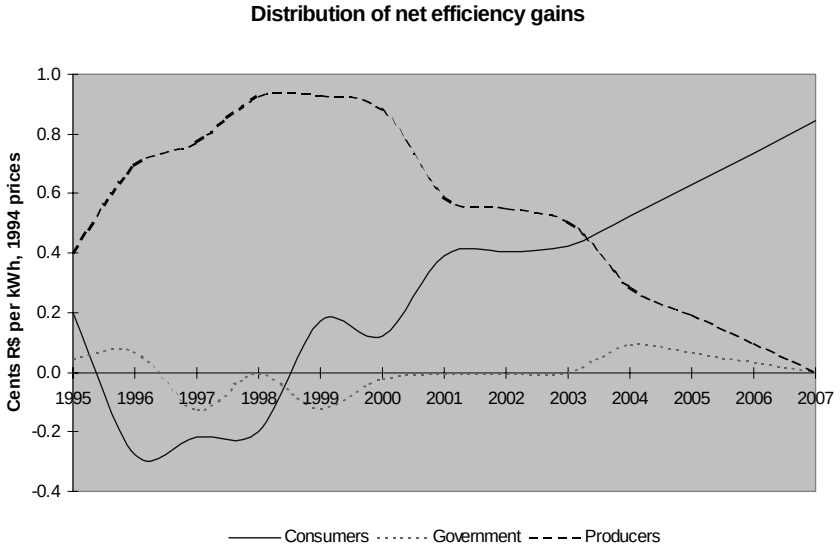

Figure 4

Figure 4 illustrates the distribution of net efficiency gains for every year after privatisation. We observe that producers absorbed most of the benefits in the period 1995-2000. Consumers start losing because initially prices do not fall as much as they would have had the companies remained publicly-owned.[36] From 2000 to 2003 we assume no change in real prices and from 2004 onwards we assume that the regulator would impose a 1.8% annual price fall. As a result of these assumptions consumers start receiving a greater share of the net efficiency benefits from 2004. Net present values at 1994 prices magnify producers' gains relative to consumers' because producers are benefited earlier.

We note that, in order to foster sales, the regulator allowed producers to keep *all* productivity gains until 2003 or 2004, when the first tariff reviews will take place (See Appendix 5).[37] Had the regulator imposed tougher regulation since the beginning more gains could have been transferred to consumers. Still, if tougher regulation is imposed in the future, we can expect more benefits accruing to consumers.

There is one aspect of the price review process that we do not specifically address in our analysis. In the occasion of the price review not only the X factor is set, but the level of prices can also be changed. If we consider that price levels are only changed to maintain real price levels, this is no problem for our analysis as we are using real unit variables. Besides, we do not include the possible future pressure on prices of increased competition in the supply market. Because of the limited impact of competition in the supply market so

[36] The prices that we refer here are our computed real prices excluding the fraction relative to the price paid for electricity purchased and transmission charges. Therefore they can vary in relation to retail prices in real terms.

[37] With the exception of Escelsa, which already suffered two tariff reviews.

far, we opted for a more conservative approach assuming that there will be no further liberalisation during our projected period.

Government is affected the least by privatisation and restructuring, bearing in mind that we are not including the effects of the sale itself at this moment. Net welfare impact on government can change its sign depending on the discount rate used, but remains relatively small.

5.5 The impact of differentiated weights

Galal, Jones, Tandon and Vogelsang (1994, p. 25) note that, when an economy is highly distorted (by distortionary taxes or capital markets imperfections, for instance), the different components of welfare may require different weights. Jones, Tandon and Vogelsang (1990, pp. 26-27) argue that there is strong reason to believe that public income should receive a higher weight, at least from the taxation point of view. Their point is that taxes generally cause welfare losses greater than the revenue they collect. Therefore the social welfare impact of the increase in government expenditure as a result of the tax must be greater than its costs to consumers and producers. The higher the tax distortion, the higher the public income weight. From the side of government expenditures, it is more difficult to argue for a higher public income weight. We would have to measure the benefits of government expenditure. Squire and van der Tak's (1975) approach assumes that in developing countries the government is the main internal investing agency. It also assumes that the government invests at least as efficiently as the private sector. If investment is to be valued more highly than consumption (as it is the main determinant of economic growth), then public income should also be valued more.[38]

With respect to the shadow price on corporate funds, λ_p, the usual assumption in welfare economics is that $\lambda_p = \lambda_c$. However, if the level of investments is suboptimal, then private profits become relatively more valuable as they lead to investment. Newbery and Pollitt (1997) value private profits less than domestic consumption. Their justification is that the recipients of private profits are richer than domestic electricity consumers. Jones, Tandon and Vogelsang (1990) argue that the values of λ_g and λ_p are likely to be close to one another. They are nevertheless unable to make any definitive statement about which of these two parameters is actually larger. Domah and Pollitt (2001) assume $\lambda_p = \lambda_g = 1$, considering that in a developed economy there should be no big difference in shadow multipliers.

The determination of social welfare weights requires an empirical country-specific analysis, which is well beyond the scope of our paper. We will opt to present our results for three sets of weights, imposing public income as our numeraire. Considering that there is empirical evidence of estimates of λ_g higher than λ_c (Jones, Tandon and Vogelsang, 1990, pp. 29-30) for less developed

[38] Unfortunately, there is no way to avoid the weighting problem. Brent (1998) reminds us that the traditional efficiency-school is merely a particular school that sets all weights equal to 1. In short: "the set of schools of cost-benefit analysis that can avoid distributional weights is the null set" Brent (1984).

countries, we will impose $\lambda_c < 1$. As in the analysis of Teléfonos de México carried out in Galal, Jones, Tandon and Vogelsang (1994), we can argue that Brazil was certainly in disequilibrium when the privatisation programme was launched and that in these situations money is more valuable in government's hands.

We will also impose $\lambda_p < 1$, because if $\lambda_p > \lambda_g$ government would try to minimise the sale price, which is counter-intuitive.[39] Since we should be concerned with both equity and economic growth, we calculate the results for three different cases: $\lambda_c = \lambda_p$, $\lambda_c > \lambda_p$ and $\lambda_c < \lambda_p$. The unweighted sales proceeds of the companies in our sample was US$ 18.7 billion (2001 prices). Table 6 illustrates the impact of different weights on social welfare change.

From our additive procedure it is clear that the use of welfare weights makes a substantial impact on social welfare change, especially when $\lambda_p = 0.5$. This is due to the fact that sales proceeds are large relative to the net efficiency gains of privatisation. In our central-case scenario, with $\lambda_c = \lambda_p = 0.5$, social welfare jumps from US$ 12 billion to US$ 15.3 billion, at a 12% discount rate. 61% of the total social welfare stems from the sale itself in this case. It implies that although the government's net efficiency gains are still relatively small, the public sector benefits directly from the sale. When we impose $\lambda_c = 0.8 > \lambda_p = 0.5$, the impact on social welfare is even more considerable. Using a 12% discount rate social welfare change is now US$ 16.3 billion. When we give a lower weight to the sale proceeds, as in our Case 2, the impact of using differentiated weights is reduced. In this case social welfare change amounts to US$ 12.4 billion, at a 12% discount rate. Therefore the use of differentiated weights is conditioned to what we believe about the impact of the sale itself. We turn then to the empirical evidence of the fiscal impact of privatisation in Brazil.

[39] This result can be easily derived by maximising the fundamental formula of divesture with respect to Z.

The central-case and the pro-privatisation scenarios under different assumptions on social weights

US$ billion, 2001 prices[(1)]

		Central-case		Pro-privatisation	
	Social weights	10%	12%	10%	12%
Net efficiency gains		13.6	12.0	15.9	14.0
Case 1					
Government	1	0.0	0.0	0.0	0.0
Consumers	0.5	1.9	1.6	3.1	2.6
Producers	0.5	4.8	4.4	4.8	4.4
Value of the sales	0.5	9.3	9.3	9.3	9.3
Social welfare impact		16.1	15.3	17.3	16.4
Case 2					
Government	1	0.0	0.0	0.0	0.0
Consumers	0.5	1.9	1.6	3.1	2.6
Producers	0.8	7.7	7.1	7.7	7.1
Value of the sales	0.2	3.7	3.7	3.7	3.7
Social welfare impact		13.4	12.4	14.6	13.4
Case 3					
Government	1	0.0	0.0	0.0	0.0
Consumers	0.8	3.1	2.5	5.0	4.2
Producers	0.5	4.8	4.4	4.8	4.4
Value of the sales	0.5	9.3	9.3	9.3	9.3
Social welfare impact		17.3	16.3	19.2	17.9

Note: [(1)] All present values calculated relative to 1994 (base year), then converted to 2001 prices using the average CPI.

Table 6

Pinheiro and Giambiagi (1994) discusses two aspects of the fiscal impact of privatisation. First, the sale proceeds may temporarily offset the public deficit. Second and more importantly, if privatisation leads to a positive restructuring of the activities, assets or liabilities of the public sector there may be a permanent net gain. The magnitude of this effect, however, will depend not only on the specificities of the privatisation process, but also on the timing of other measures of fiscal adjustment.

Under preffered assumptions, Pinheiro and Giambiagi (1994), in their assessment of Brazilian privatisation in the early 90s, estimate an annual reduction in the public sector borrowing requirements of about 0.4% of the GDP, which is relatively small. Pinheiro and Schneider (1995) develop a model which shows that major fiscal benefits of privatisation can be expected only under rare cir-

cumstances. They estimate the fiscal impact of privatisation in Chile, Mexico, Argentina and Brazil, and only observe significant fiscal impacts in the case of Argentina. Carvalho (2001) assesses the impact of the privatisation programme on public debt, focusing on the 1995-1999 period. This study computes a reduction in the public debt of 8.4% of the GDP and a reduction in the public sector borrowing requirements of 5.4% of the GDP in the period. By the use of cash proceeds for amortisation of costly debt and by allowing the use of *junk bonds* as privatisation currency, the process also contributed to the restructuring of public sector liabilities.[40] At the same time, there is a positive impact on interest rates in the short term and, in the medium and long term the conditions for further reduction of interest rates are improved as the public sector gains credibility. The difference in results between Carvalho (2001) and Pinheiro and Giambiagi (1994) can be explained by the difference in the magnitude of the sales between the two periods (1991-1993 and 1995-1999) as well as by the more concerted fiscal adjustment effort – in this respect, the role of privatisation in the state-level adjustment was crucial – and the success of inflationary stabilisation in 1994. Because the privatisation period in our study is 1995-1998, we consider the results of Carvalho (2001) more relevant to our analysis. Therefore we would expect the sales to have a significant impact on social welfare, as reflected in Cases 1 and 3. Under these assumptions, the magnitude of social welfare net gains is above US$ 15 billion (2001 prices).

5.6 A note on quality

A full social cost-benefit analysis should incorporate all impacts on social welfare due to restructuring and privatisation, including the impact on quality. As noted in Galal, Jones, Tandon and Vogelsang (1994), consumer surplus does not tell the whole story – besides price, consumers are concerned about the quality of service. However, the incorporation of quality involves many complications. First, there are non-quantifiable dimensions of quality. Second, "incorporating it [the quality of supply] in the full social cost-benefit analysis would require the measurement and valuation of the quality of supply and the identification of a counterfactual of what might have happened in the absence of liberalisation (...)" Domah and Pollitt (2001, p. 132). Third, we consider that it is too early to draw definitive conclusions in this respect. The last privatisation in our sample took place in September 1998 (2000 is our final data point). If privatised companies are investing more or better, the results in terms of quality may take a while to be perceived by consumers, as the replacement or expansion of lines (or the modernisation of equipment) may result in temporary interruptions of supply. We can however check the evolution of indicators so far, as well as observe the performance of the companies which were privatised first.

[40] Goldstein (1999) observes that it is profitable for the state to sell assets to redeem debt as the return on investment of state-owned enterprises in Brazil has traditionally been below the cost of servicing the debt.

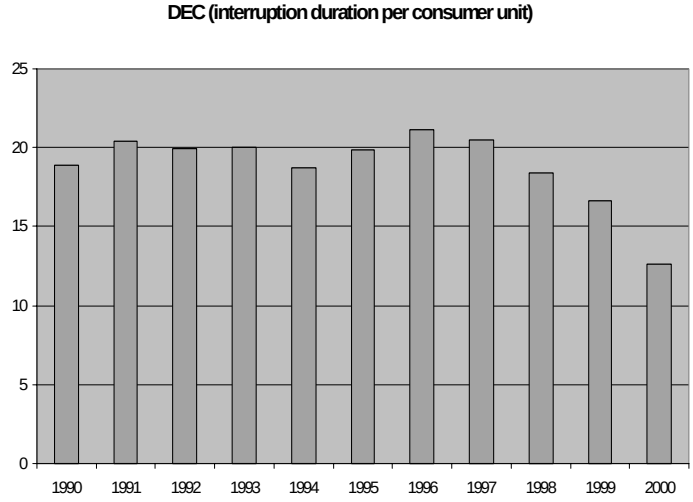

Figure 5

Availability and security of supply are two important and quantifiable aspects of quality. In Brazil there are two main indicators of these aspects: DEC (Interruption Duration per Consumer Unit) and FEC (Interruption Frequency per Consumer Unit). DEC is an indicator of availability and is defined as the average number of hours of off-supply experienced by a consumer unit. FEC is an indicator of security and is defined as the average number of interruptions experienced by a consumer unit.[41]

Figure 5 shows the evolution of DEC since 1990 for our sample of companies.[42] We observe that since 1996 there has been a consistent decline. DEC has been reduced by a significant 40% in the 1996-2000 period. At the same time, the standard deviation has also been reduced, which means that companies with the worst performances are catching-up.[43] This process is particularly impressive for the smaller Northeastern companies, which from the year of privatisation until 2001 had reductions above 60%. However, some companies experienced an increase in DEC during the immediate year after the sales (in fewer cases, during the first two years). Initial restructuring and modernisation can partly

[41] Both DEC and FEC are defined in DNAEE Order ('Portaria') no. 46/78 of 17/04/78.

[42] Values of DEC were weighted by the share of each company in the total distribution of our sample. As we did for the social cost-benefit analysis, we included CEEE distribution (which is still state-owned) in the sample. By doing this we aimed to capture the overall impact of restructuring and privatisation on the state of Rio Grande do Sul. All quality data taken from the website of the Brazilian Association of Electric Energy Distributors (Abradee). The same applies to the analysis of FEC.

[43] Although the variation between companies has been reduced, it is still high. This can be explained by the great differences in terms of market density between the companies in our sample. Eletropaulo, for instance, whose concession area is basically the metropolitan area of the capital of São Paulo, had 1,084.5 consumers per km^2 and 7,177 MWh per km^2 in 2001. On the other end of the density spectrum, there is Enersul, who distributes electricity to the less populated state of Mato Grosso do Sul. In the same year, Enersul had a density of only 1.7 consumers per km^2 and 8 MWh per km^2.

explain this, but radical redundancy programmes (which resulted in the loss of technically qualified personnel) and management changes also had an impact on performance. Figure 6 depicts the results for the companies privatised in the first two years, 1995 and 1996. The results of these companies confirm the overall trend, indicating a continuous improvement after privatisation. Light and Escelsa have experienced reductions above 60% and CERJ has also improved its performance considerably, after an initial period of adaptation.

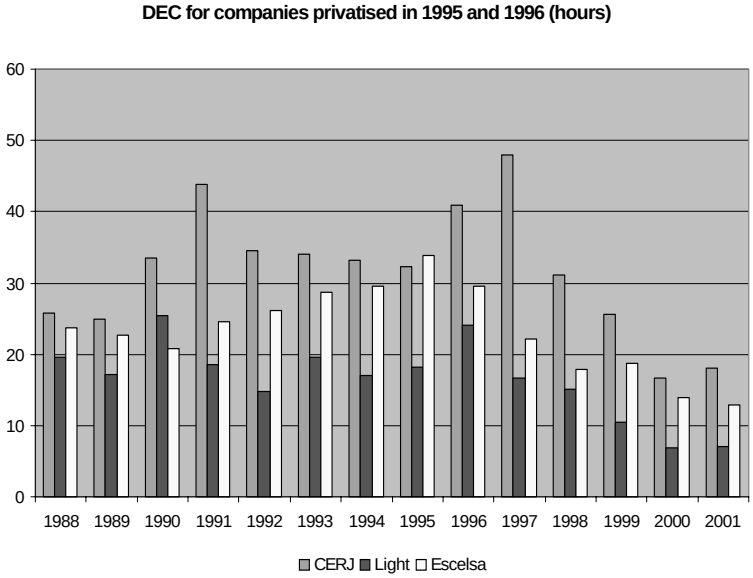

Figure 6

The story for the FEC indicator is very similar to the one mentioned before, with one difference – the improvement starts one year later, in 1997. In the period 1997-2000 FEC was reduced by 30%. After 1997 there is also a reduction of standard deviation. For individual companies we observe that FEC changes slightly less than DEC, but the trend is similar for most of the sample. The results for companies privatised early also confirm our expectations.

If quality of service has improved some of the credit should be given to a more active regulation. More recent concession contracts specify minimum standards of quality of supply, as well as standards of customer services. These standards can vary with time, allowing an initial period of adaptation or transition.[44] They can be supplemented and reviewed by specific legislation. So far the regulator monitors the data and the indicators sent by the companies, but a new system of monitoring of quality will soon be implemented, allowing the regulator to have direct and automatic access to all required information.

Besides the standards of customer service, the regulator has attempted to

[44] See, for instance, the concession contract of Eletropaulo Metropolitana Eletricidade de São Paulo S.A., signed on 15th June, 1998, which establishes three periods for the monitoring of standards of quality of service: an initial period of adaptation, a period of transition and a period of maturity.

measure consumers' satisfaction by an opinion poll. In time this shall reflect the evolution of the quality of service as perceived by customers. The Brazilian Association of Electric Energy Distributors (Abradee) has also conducted opinion polls to measure consumers' satisfaction with the quality of service and to make comparisons between associated companies. This shows some concern with a more customer-oriented service, but as we do not have a similar measure for the pre-privatisation period these results are not very useful for our analysis. From press reports (such as Chaves, 2000) it seems that some companies faced an initial period of customers' (and employees') unrest.[45] Coelce, for example, was threatened by the regulator to have its concession revoked. The regulator played a decisive role in ensuring the improvement of standards of service. Light and CERJ faced similar problems.

We conclude that there has been some consistent improvement in quality after an initial adaptation period, as well as some catching-up by the worst companies. Even considering that it is a little too early to draw definitive conclusions, we observe that the improvement of the companies firstly privatised has been continuous and significant. If the rest of the sample follows similar trends we can expect further improvements in the future. The experience so far shows that, in order to ensure continuous quality gains for the consumers, constant and efficient monitoring is essential. Besides, it should be of interest to examine whether the benefits have accrued to all customers equally, but the required data is not yet available.

Finally, what would have happened had privatisation not taken place? Developing a counterfactual from the erratic behaviour of indicators of individual companies before privatisation seems to be a difficult task. However, we can be sure that there were no previous consistent *declining* trends of DEC and FEC. We can also observe the behaviour of one distribution company in our sample that remained state-owned, CEEE (more precisely, the part of the original CEEE that remained publicly-owned). From all companies in the sample, CEEE experienced the smallest decline in DEC and FEC. Moreover the behaviour of CEEE's indicators was rather erratic. Therefore some net quality benefits of privatisation relative to the counterfactual seem probable. Thus, by not incorporating the quality of service in our social cost-benefit analysis we are being conservative with respect to the net benefits of the process, in particular to the net benefits accruing to customers.

6 Conclusions

This paper has attempted to determine the net efficiency impact of the restructuring and privatisation of electricity distribution and supply businesses in Brazil. We assessed the distribution of these net effects among consumers, pro-

[45] Customers were specially concerned with the parallel improvement in billing and deterioration of quality of service. Employees had to adapt to a reduced organisational structure, in some cases headed by foreign business men (the so-called 'imported labour'), with limited understanding of the company culture.

ducers and government. In order to achieve our objective we performed a social cost-benefit analysis, using as a guide the procedure set out in Jones, Tandon and Vogelsang (1990). To determine the welfare change due to privatisation we constructed a counterfactual public scenario, based on the previous performance of the companies. The counterfactual provided a benchmark against which the performance of the privatised industry could be assessed. We also considered the future effects of privatisation by including the regulator's next price review (2003-2004).

1. We observed an impressive average annual fall in controllable costs per unit of 10% in the period 1995-2000. From 1993 to 1995, in preparation for privatisation, real controllable costs were reduced by R$ 1.2 billion, and between 1995 and 2000 they were cut by further R$ 477 million (1994 prices). This was partly driven by a considerable growth of labour productivity. From 1994 to 2000 the number of employees was halved. If we use the MWh per employee ratio as a measure of labour productivity, we note that there was an increase of 147% in the period.

2. Considering the political and macro conditions of the early 90s, we have reasons to believe that the companies would have implemented programmes similar to the ones they carried out before the sales even if privatisation had not taken place. Therefore we used a 2% p.a. counterfactual decline of real unit controllable costs as our central-case scenario. Considering the poor long-term performance of individual companies and their traditional focus on capacity expansion (rather than cost minimisation), we found it useful to examine the results under 1% p.a. and 0% p.a. counterfactual cost declines.

3. At a 12% discount rate, efficiency gains due to cost reductions amount to R$ 9 billion, what is equivalent to 2.6% of the Brazilian 1994 GDP, under our central-case counterfactual. Some of these gains are offset by restructuring and privatisation costs of R$ 487.57 million, yielding net efficiency gains of R$ 8.5 billion (at 1994 prices or US$ 12 billion at 2001 prices).

4. Using equal (unit) social weights, we observed that producers received a disproportional share of the net benefits of privatisation. Under all counterfactual cost declines, they gain at least half of total net benefits. At a 12% discount rate, consumers come second, with net gains of R$ 2.2 billion under our central-case counterfactual. Government net welfare change is relatively small (R$ 3 million at 1994 prices) and can change sign for higher discount rates. The distribution of net efficiency gains is in line with the findings of Domah and Pollitt (2001) and Newbery and Pollitt (1997), with one main difference: in our study consumers always have positive gains, irrespective of assumptions concerning discount rates and counterfactual scenarios.

5. The net present value at 1994 prices magnifies somewhat producers' net welfare change relative to consumers'. This is due to the fact that consumers start benefiting more significantly from privatisation later (from 1999). Domah and Pollitt (2001) find a similar result, but net efficiency gains start accruing to consumers relatively later than in our study. We note that, in order to foster sales, the regulator allowed producers to keep all productivity gains until 2003 or 2004, when most tariff reviews will take place. Had tougher regulation been imposed earlier, consumers could have started to benefit earlier. We can also argue that, had regulatory institutions been fully established *before* the beginning of the privatisation process, this could have been the case.[46] Still, we can expect more benefits accruing to consumers if tougher regulation is imposed in the future. However, we cannot be certain that tougher regulation would have ensured the transfer of efficiency gains to consumers. Strict regulation can have perverse effects on producers' incentives and we speculate whether there would have been efficiency gains in the first place. Besides, at least for the immediate future tougher regulation should be taken with extreme caution, given the perverse effects of the 2001 electricity supply crisis in the financial situation of distribution companies.

6. Considering the distortions of a developing economy such as the Brazilian, we find it wise to examine the impact of imposing differentiated social weights in our analysis. We observe that our social welfare results are especially sensitive to the $(\lambda_g - \lambda_p)$ difference, which is the social weight given to sale proceeds. The explanation is straightforward – privatisation proceeds are large (US$ 18.7 billion, 2001 prices) relative to net efficiency gains. If we have strong reasons to believe that the impact of the sale itself is considerable, the use of differentiated weights is satisfactory. Empirical evidence shows that the recent extensive privatisation programme has produced temporary and permanent fiscal gains. Therefore we would expect a net social welfare impact greater than the one calculated without the use of differentiated social weights – of a magnitude over US$ 15 billion (2001 prices).

7. With respect to the impact of privatisation on quality, there has been a consistent and significant improvement in the two main measures of quality of supply – security and availability. Considering the behaviour of the companies before privatisation as well as the performance of the only distribution company in our sample that remained state-owned throughout the whole period, we argued that there probably have been net quality benefits relative to the counterfactual. Therefore our analysis of the net welfare impact of privatisation is on the conservative side.

[46] The problem of establishing a regulatory structure with the necessary speed in Brazil had already been observed in a more general context (and for a different period) in Abreu and Werneck (1993).

1 Summary of the unbundling process

Original company	Businesses of the original company	Unbundling details
CEEE	Hydro and thermal generation, transmission distribution	Three companies were unbundled from CEEE in 1997: CEEE North-Northeast (distribution), CEEE Central-West (distribution) and CGTEE (thermal generation). In October 1997 CEEE North-Northeast and CEEE Central-West were privatised and renamed as RGE and AES Sul, respectively. The control of CGTEE was transferred to the Federal Union in November 1998. Hydro generation, transmission and South-Southeast distribution businesses remain in CEEE.
Cesp	Substantial hydro generation, transmission, distribution	In June 1998 a distribution company (Elektro) was unbundled from Cesp. It was privatised in July 1998. In March 1999 Cesp was restructured again. A transmission company was established (CTEEP) and two generation companies were created, Tietê and Paranapanema. The generation companies were privatised in the same year. Generation, residual transmission and distribution remain in Cesp.
Eletropaulo	Hydro and thermal generation, transmission, distribution, water supply, control of floods and river navigation	In December 1997 the unbundling of Eletropaulo into 4 companies was approved. Eletropaulo Metropolitana (61% of distribution), Bandeirante (39% of distribution), EPTE (transmission) and EMAE (hydro and thermal generation, water supply, control of floods and river navigation). More recently, in 2001 Bandeirante was unbundled in two companies, Piratininga and a company that remained called Bandeirante. In 2001 EPTE and CTEEP were merged in one transmission company for the state of São Paulo, Transmissão Paulista.
CPFL	Hydro and thermal generation, distribution	In September 2001 a generation company (CPFL-G) was unbundled from CPFL.

2 Summary of sample rearrangements

Companies (whose reports were used)	Adjustments	Adjusted companies (final sample)
Eletropaulo (unbundled), Eletropaulo Metropolitana, Bandeirante, EPTE and EMAE	Exclusion of generation, transmission, water supply, control of floods and river navigation businesses	Eletropaulo
Cesp and Elektro	Exclusion of generation and transmission	Elektro
CPFL and CPFL-G	Exclusion of generation	CPFL
CEEE, RGE, AES Sul, CGTEE	Exclusion of generation and transmission	CEEE
CERJ	Exclusion of generation	CERJ
Light	Exclusion of generation	Light
Escelsa	Exclusion of generation and transmission	Escelsa
Enersul	Exclusion of generation	Enersul
Coelba	Exclusion of generation and transmission	Coelba
Energipe	No adjustments required	Energipe
Cosern	No adjustments required	Cosern
Coelce	No adjustments required	Coelce

3 Constructing consolidated accounts, 1989 to 2000: variables, methods and sources of data

The accounting information is mostly drawn from the companies' annual reports and financial statements. The physical data are also largely drawn from the annual reports. However some data are not published and we resorted to information provided directly by the companies.

All items were adjusted to exclude other businesses of the companies. All accounting figures were converted to nominal values in R$ (Real, Brazilian currency since 1994), according to the official conversion rates available at the Brazilian Central Bank website, and then deflated in order to obtain real values. With the exception of working assets, the figures were deflated by the IGP-DI (1994) of the Getúlio Vargas Foundation. Working assets were deflated using the BTN, the Ufir and IGP-M. IGP-DI and IGP-M values were obtained at the Ipeadata website and BTN and Ufir were extracted from the Brazilian Central Bank website. The CPI was obtained from the US Department of Labour website (http://data.bls/gov/cgi-bin/surveymost).

Item	Source and details
Total operating revenue	This item has been taken from the financial statements of the companies. It is composed of electricity supply revenue (or sales to final customers), bulk electricity revenue (sales to other concessionaires or to customers connected to the transmission network) and other (revenue derived from other activities related to the distribution business).
Purchase of electricity	This has been taken from the financial statements of the companies. If the company has some generation capacity, it may include the expenditure with fuel for electricity generation and the payment of a compensation for the use of hydro resources. When transport is not specified, this item includes payments for transport
Transport	This has also been taken from the financial statements of the companies.
Total operating costs	Information on total operating costs has been drawn from the financial statements of the companies. Total operating costs of distribution and supply are made up of RGR, RGG, RNCR and CCC quotas, taxes on revenue, labour costs, R&P costs, purchases of material, third-party service contracts, depreciation, provisions and other operating costs. This item is net of purchase of electricity and transport payments.
Net operating controllable costs	These are total controllable costs of distribution and supply, net of depreciation and R&P costs. They are made up of labour costs, purchases of material, third-party service contracts, provisions and other operating costs.
Working assets	This item has been taken from the financial statements of the companies. Because of the consequences of Law no. 8,200/91, we only use the figures from 1991 onwards. Besides adjusting for other businesses, we deflated the values according to the accounting procedures used by the companies. For 1991 we used the BTN, for 1992/95 we used the Ufir and for the rest of the period we used the IGP-M to obtain real values.
Taxes on op. profits	This has been drawn from the financial statements of the companies. Taxes are composed of income tax and social contribution.
Total GWh distributed	Most data have come from the explanatory notes of the financial statements. Whenever possible this item includes internal consumption but does not include bulk electricity sales.
Number of employees	Most data have been extracted from the annual reports of the companies. This was complemented with information provided to us directly by the companies.
R & P costs	The way R & P costs are accounted for varies greatly across companies. In most cases direct contact with each company was required to establish the figures of the costs and to determine how they were accounted for. Expectionally when these costs were not made available we estimated them by using the R & P cost per employee of other companies. R & P costs are total costs of redundancy programmes (both voluntary dismissal and early retirement programmes). They exclude flotation costs and the costs associated with Aneel.

4 Actual, projected and counterfactual data

Panel 1: Data for the private sector

R$ million 1994 prices	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net op. cont. costs	1948	2124	2059	1859	1441	1470	1332	1431	1542	1604	1674	1770	1871
Depreciation	615	425	388	474	603	689	476	491	507	536	568	610	655
Op. profit	29	596	675	890	787	899	932	951	961	769	550	301	7
Net op. revenue	4326	5270	5617	5687	5492	5919	5445	5946	6505	6752	7028	7413	7818
Tax on profits	16	54	-241	-57	-246	-81	0	0	0	192	138	75	2

Panel 2: Data for the public sector using a 2% p.a. counterfactual cost decline

R$ million 1994 prices	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net op. cont. costs	2930	2963	3033	3130	3120	3197	2883	3085	3308	3426	3559	3746	3943
Depreciation	615	425	388	474	603	689	476	491	507	536	568	610	655
Op. profit	-672	-653	-630	-700	-612	-615	0	0	0	0	0	0	0
Net op. revenue	4551	4739	4974	5278	5710	6099	6064	6649	7310	7805	8363	9088	9883
Tax on profits	-54	-52	-50	-56	-49	-49	0	0	0	0	0	0	0

5 Tariff review timetable

Company	Date of signature of contract	Initial X	Date of 1st tariff review	Gap for tariff reviews after the 1st (years)
Eletropaulo	15/06/1998	0	Jul-03	4
Bandeirante	23/10/1998	0	Oct-03	4
CPFL	20/11/1997	0	Apr-03	5
Elektro	27/08/1998	0	Aug-03	4
CEEE	25/10/1999	0	Oct-04	4
RGE	06/11/1997	0	Apr-03	5
AES Sul	06/11/1997	0	Apr-03	5
CERJ	09/12/1996	0	Dec-03	5
Light	04/06/1996	0	Nov-03	5
Escelsa	17/07/1995	na	Aug-98	3
Enersul	04/12/1997	0	Apr-03	5
Coelba	08/08/1997	0	Apr-03	5
Energipe	23/12/1997	0	Apr-03	5
Cosern	31/12/1997	0	Apr-03	5
Coelce	13/05/1998	0	Apr-03	4

Escelsa tariff reviews

	Date	Average tariff adjustment (%)	X	Years for the application of X
1st tariff review	Aug-98	-3.4	1.5	1999
			0.8	2000
2nd tariff review	Aug-01	19.89	1.89	2002 and 2003

6 Restructuring and privatisation costs

R & P costs	1992	1993	1994	1995	1996	1997	1998	1999	2000
R$ million, 1994 values	0.77	0.00	8.60	57.32	121.24	310.98	90.13	62.04	32.25
Cents of R$ per kWh	0.00	0.00	0.01	0.04	0.08	0.20	0.06	0.04	0.02

Discounted R & P costs:

Discount rate	9%	10%	12%	14%	15%
R$ million (1994 values)	527.68	513.77	487.57	463.35	451.93

List of acronyms in order of appearance

ESI	electricity supply industry
Aneel	National Agency for Electric Energy
BNDES	National Bank of Social and Economic Development
PND	National Privatisation Programme
CCPE	Coordinator Committee for the Planning of Electric Systems Expansion
GCE	Chamber of Management of the Electric Energy Crisis
IGP-M	General Price Index – Market
RGR	Global Reversion Reserve
RGG	Global Guarantee Reserve
RNCR	National Reserve for Return Compensation
CCC	Fuel Consumption Account
IGP-DI	General Price Index – Internal Availability
BTN	National Treasury Bond
Ufir	Fiscal Unit of Reference
CPI	Consumer Price Index
DEC	Interruption Duration per Consumer Unit
FEC	Interruption Frequency per Consumer Unit
Abradee	Brazilian Association of Electric Energy Distributors

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