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**Strengthening Regulation
in Chile: The Case of
Network Industries**

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Luiz de Mello**

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STRENGTHENING REGULATION IN CHILE: THE CASE OF NETWORK INDUSTRIES

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By
Alexander Galetovic and Luiz de Mello

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ABSTRACT/RÉSUMÉ

Strengthening regulation in Chile: the case of network industries

Chile's regulatory framework is working reasonably well. The country's structural reforms since the 1980s, with the privatisation of utilities and deregulation of product and labour markets, have improved resource allocation and increased the population's access to basic services, while calling for a comprehensive upgrading of regulatory institutions. At the same time, public-private partnerships (PPPs) are contributing to closing Chile's infrastructure deficit, particularly in transport. The recurrent cuts in shipments of natural gas from Argentina since 2004 have put additional strain on regulation in the electricity sector to encourage investment in generation and ensure the security of supply. This paper reviews regulatory reform in three network industries (electricity, gas and telecoms), where further liberalisation, particularly in electricity retailing, and improvements in the regulation of telecoms would do much to further improve the business climate. The governance of public-private partnerships can be improved by increasing transparency and accountability in the concession process. In doing so, the government's exposure to contingent liabilities can be contained.

This Working Paper relates to the 2005 OECD Economic Survey of Chile (www.oecd.org/eco/surveys/chile).

JEL Classification: D4, H4, K2

Keywords: Chile, regulation, network industries, electricity, telecommunications, gas

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Renforcer la réglementation au Chili : le cas des industries de réseau

Le cadre de la réglementation chilienne fonctionne assez bien. Les réformes structurelles depuis les années 80, avec la privatisation des services et la déréglementation des marchés des produits et du travail, ont amélioré l'allocation des ressources et augmenté l'accès de la population aux services de base, en même temps que modernisé les institutions de réglementation. Parallèlement, les partenariats public-privé ont contribué à réduire le déficit d'infrastructure du Chili, particulièrement dans les transports. Les coupures récurrentes dans les exportations de gaz naturel de l'Argentine depuis 2004 ont ajouté une contrainte sur la réglementation du secteur d'électricité, qui a encouragé l'investissement dans la production et garanti la sécurité de l'offre. Ce document passe en revue les réformes de la réglementation dans trois industries de réseau (électricité, gaz et télécommunication), dans lesquelles plus de libéralisation, particulièrement concernant la vente de détail de l'électricité, et des progrès dans la réglementation des télécommunications, amélioreraient grandement le climat des affaires. La gouvernance des partenariats public-privé peut-être améliorée en augmentant la transparence et la responsabilité du processus de concession. En faisant ainsi le gouvernement évite de s'exposer à d'éventuels passifs.

Ce Document de travail se rapporte à l'Étude économique de l'OCDE du Chili, 2005 (www.oecd.org/eco/etudes/chili).

Classification JEL: D4, H4, K2

Mots-clés: Chili, réglementation, industries de réseau, électricité, télécommunications, gaz

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Strengthening regulation in Chile: The case of network industries

by

Alexander Galetovic and Luiz de Mello¹

1. Introduction

Much has been done over the years to strengthen the regulation of network industries in Chile. The country is on balance close to international best practice in this area, and appropriate regulation has encouraged investment and facilitated access by the population to affordable services. Nevertheless, there are areas where improvement is needed to continue to strengthen pro-competition regulation.

In the electricity sector, it may be premature to assess the new law (*Ley Corta I*), in place since early 2004. Progress is under way in setting transmission and distribution charges (to boost competition within distribution zones) and unlocking opportunities for small generators. New legislation was approved in May 2005 (*Ley Corta II*) to ensure the security of supply, in view of recurrent cuts in gas shipments from Argentina. In telecommunications, the central regulatory issue is how to foster competition while simultaneously setting efficient prices for dominant firms. The regulatory framework for transport infrastructure through public-private partnerships is perceived as functioning well, although governance needs to be improved to strengthen independent checks and balances and safeguard the budget from undue exposure to contingent liabilities.

Against this background, this paper will provide an overview of regulation of network industries in Chile, with emphasis on electricity, gas and telecommunications and provide recommendations for future reform. Chile's experience with public-private partnerships to build and upgrade transport infrastructure will also be reviewed. The paper is organised as follows. Section 2 discusses cross-sectoral issues and focuses on the theoretical underpinnings of efficient-firm regulation. Section 3 reviews the cases of electricity, telecommunications and gas. Section 4 deals with infrastructure concessions.

1. This paper was originally prepared for the OECD's 2005 *Economic Survey of Chile*. Alexander Galetovic is a Professor at the University of Los Andes and a Researcher at the Centro de Estudios Públicos (CEP), Santiago, Chile. Luiz de Mello is senior economist at the OECD's Economics Department. The authors would like to thank without implicating officials from the Chilean government for helpful discussions and information provided, in particular José Tomás Morel, Ministry of Economy, as well as Val Koromzay, Andrew Dean, Silvana Malle, Peter Jarrett and Nanno Mulder for helpful comments. Thanks are also due to Anne Legendre for technical assistance and Mee-Lan Frank for technical preparation.

2. The regulatory framework : Cross-sectoral considerations

2.1. Overview and main issues

Regulatory reform in network industries has been guided by three principles. *First*, the price paid for a service should reflect the social opportunity costs of providing it: when competition is feasible in a given industry, the market should be liberalised; otherwise, prices need to be regulated by emulating competition according with the so-called efficient-firm standard (Box 1). *Second*, utility providers should be privatised and face hard budget constraints, and tariffs should be set at a level where providers cover their costs. *Finally*, access by the needy to services should be facilitated through means-tested income transfers, rather than price subsidisation, which is more distorting.

Box 1. Regulation: The efficient-firm standard

With the exception of high-voltage electricity transmission and retailing for regulated customers, monopolies are regulated in Chile according to the so-called efficient-firm standard, which is based on the principle that regulation should "emulate competition".

In a competitive industry, prices are set such that: *i)* the value of the marginal unit of consumption is equal to long-run marginal cost (allocative efficiency); *ii)* the good or service is produced at minimum cost, since firms adopt the most efficient technology (productive efficiency); and *iii)* firms exactly cover their long-run costs because long-run average and marginal costs are equal.

In a natural monopoly, regulated prices should be set to ensure that the firm covers its costs (Table 1). But compared with a competitive industry, there are three main differences:

Table 1. Price regulation in network industries

	Liberalised	Regulated
Electricity	Generation Distribution for "free" customers (connected power above 500kW) Retailing for "free" customers	High-voltage transmission (auctions and replacement value) Distribution for regulated customers (efficient firm) Retailing for regulated customers (node price and auctions)
Gas	All	None
Telecoms	Non-dominant fixed-line operators Mobile phone operators Long-distance telephony Internet service providers	Dominant fixed-line operators (efficient firm) Access charges, fixed and mobile telephony (efficient firm)
Water	None	All (efficient firm)

Box 1. Re Regulation: The efficient-firm standard (cont'd)

First, if there are economies of scale (*i.e.* falling average costs) and the price is equal to long-run marginal cost, then the firm will not cover its costs. The solution is to set prices equal to average costs, which is explicitly recognised in Chile by the respective sectoral laws. Average-cost pricing – *Ramsey pricing* – is optimal subject to a self-financing constraint.

Second, to set prices, the regulator needs to estimate operating costs, the cost of capital and the cost of setting up a firm, which are not market-determined. In Chile, prices are fixed so as to cover the operating and capital costs of an “efficient” firm, rather than those of the real firm.¹ Efficiency is encouraged because prices are kept fixed in real terms during tariff reviews: every four years, in the case of electricity distribution, and five years, in water and telecoms. Thus, higher profits resulting from productivity improvements achieved during a given pricing period are absorbed by the firm.

Third, as in a competitive market, prices are derived from a long-term condition, which implies that they are calculated by estimating the cost of setting up a new, efficient firm from scratch, and not by valuing the historic or replacement cost of the assets of an existing firm.

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1. For example, the Telecommunications Law defines an efficient firm as one which “operates with the costs that are indispensable for providing the services [...] subject to price regulation, efficiently, and in accordance with available technology, and maintaining the quality established for the services in question.” The Water Law requires account to be taken of “[...] the geographic, demographic, and technological constraints under which it is required to operate.” In other words, the efficient firm operates at minimum cost with the best technology available at the time, maintaining the service quality standards required by law, but is adapted to local geography and demand in each service area.

Chile’s experience with efficient-firm regulation has been broadly successful, but the tariff-setting process can be improved.² Efficient-firm regulation can be used as an information-extraction device and therefore in principle solve the information asymmetries about regulated firms’ capital outlays, operating costs, the cost of capital and demand parameters, which naturally exist between the regulated firm and the regulator (Box 2).³ But it has been argued that the requirement to revise the methodology for setting prices (*i.e.* the design of the efficient firm) in each tariff review, while in principle ignoring the actual firm, overburdens the regulator. The regulated firm and the regulator therefore have the incentive to design the efficient firm with a tariff target in mind.⁴ The fact that technical reports published by the

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2. Tariffs are reviewed according to the following sequential procedure: *first*, the methodology that will be used to model the efficient firm and calculate tariffs is elaborated, coupled with a cost study, which includes a preliminary methodology, an exchange of views between the regulator and the regulated firm, and the resolution of disputes, should they arise; and, *second*, tariffs are set. Tariff reviews take between six months and one year. See Butelmann and Drexler (2003), and Galetovic and Sanhueza (2002), for more information.
 3. See, for example, Gómez-Lobo and Vargas (2001), Butelmann and Drexler (2003) and Gómez-Lobo (2005), for more information. This is particularly demanding in the case of water because the extraction technologies vary considerably across the regions. Out of 49 water companies, 18 are controlled by the private sector and supply about 95% of consumers. Only four of these 18 companies (about 4% of the clients) are totally private, without any state participation.
 4. This is also the case of methodologies to calculate key variables. In the case of telecoms, the cost-of-capital methodology presented by the regulated firms and the regulator differ markedly, and so do the point estimates.

Box 2. Price regulation in Chile: The efficient-firm standard in practice

The efficient firm is designed during tariff reviews, in principle independently of the real firm. But in practice some account is taken of the real firm's assets to set tariffs. A number of considerations are noteworthy.

Capital gains and losses

The issue of how to treat capital gains and losses arising from asset obsolescence or appreciation is yet to be resolved. Asset obsolescence may be considerable in telecoms due to technological progress, but also in electricity distribution and water. The value of assets is expected to increase mainly because the costs of building distribution networks tend to rise as the country develops, reflecting higher land prices and the need to comply with tighter urban planning and environmental standards.

Conceptually, the efficient-firm standard implies that both capital losses and gains should be borne by the firm: the likelihood of obsolescence must be incorporated into current tariffs, presumably through a higher discount rate. In practice, however, it is difficult to assign probabilities to obsolescence and, as the case of telecoms suggests, estimates of the cost of capital vary significantly. A related issue is that in many cases costs have increased because the municipalities tend to set urban planning and environment standards, which need to be complied with by the utility providers.

Regulated and unregulated services

The issue of whether profits made by the firm when selling non-regulated services should be considered as part of the regulated firm's income when setting tariffs is difficult to resolve. For example, water companies pass on to regulated users the full costs of cleaning waste water, but then resell part of it to agricultural producers, an unregulated activity. Although in principle economies of scope should be reflected in lower tariffs, in practice it may be desirable that the firm keep some of the rents as an incentive to exploit these economies.

Efficient-firm and price-cap regulation

In comparison with the experience of the United Kingdom and other OECD countries, the Chilean efficient-firm standard differs in the determination of operating costs and the regulatory asset base (*i.e.* those assets that can be included to calculate tariffs). In particular, in the United Kingdom, the regulator and the regulated firm discuss and negotiate during tariff reviews which assets of the real firm will be allowed to earn a return, as well as the operating costs of the real firm. Assets are then priced at their current value and the price cap is calculated to set tariffs. By contrast, in Chile the design and operating costs of the efficient firm are estimated and the self-financing condition is used to calculate the tariff. In practice, however, it has been impossible to ignore the real firm when designing the efficient one. So, in fact, the asset base tends to be a combination of hypothetical and actual assets.¹

An alternative option for regulation would be to adopt a standard price cap that is closer to the actual firm, without abandoning long-run average cost pricing: instead of obtaining the asset base by designing the efficient firm from scratch, the cost of past investments could be added to, and assets could be kept in, the regulatory asset base. Provisions against gold-plating assets would have to be introduced and investments made by the firm would have to be approved by the regulator. Regulation would therefore become an ongoing process, because the regulator would still have to monitor investments in-between tariff reviews. Tariff reviews, by contrast, would be needed only to assess variable costs, which could still be determined on the basis of efficiency-firm criteria.²

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1. See, for example, Rudnick and Raineri (1997), for more information on electricity distribution, and Gönenç *et al.* (2001), for more information on price-cap regulation in the OECD area.
 2. Substituting the real firm for the efficient firm implies that asset obsolescence or appreciations would no longer pose a problem, because assets are always valued at their acquisition cost. Consequently, the discount rate could be lowered to something close to the risk-free rate.

regulator during tariff reviews, including regulatory decisions, are not standardised makes it difficult for analysts and market participants to compare tariff reviews and learn from past experience.⁵ Weak corporate accounting standards also complicate the task of comparing costs across firms during tariff reviews.

Chile's current regulatory institutional set-up suffers from the following main shortcomings:⁶

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5. Legislation requires that administrative acts be made public. Nevertheless, access to technical studies is reported to be difficult because they are not kept in a public repository, but is improving.
 6. See Jadresic *et al.* (2001), for a description of the internal organisation of different regulatory agencies.

- *Institutional fragmentation.* Regulators are political appointees.⁷ The regulatory agencies lack a professional career stream within the civil service, which leads to high staff turnover, and institutional memory is often lost between tariff reviews.⁸ Moreover, each sector has its own regulatory structure. As a result, the regulatory agency that has the authority to make a decision is often not in full possession of all necessary information needed in the decision-making process. Finally, responsibilities often differ among the sectoral regulators, and interaction and exchange of experiences among regulators is said to be limited.
- *Legislative oversight.* Because of Chile's legal tradition, many sectoral regulations need to be set in law, which is time-consuming and involves political risk in otherwise essentially technical matters. It should nevertheless be recognised that the legislative process has sometimes improved the quality of regulation.⁹
- *Conflict resolution.* Until recently, formal conflict resolution mechanisms existed only in the cases of telecoms and water,¹⁰ and only for disputes arising during tariff reviews. Disputes arising outside tariff reviews have been arbitrated by the respective regulators. Resolutions can be appealed through the court system, but procedures are slow and the outcomes are hard to predict because of a lack of technical expertise.

2.2. Options for reform

A comprehensive assessment of Chile's regulatory framework was carried out in the late 1990s by the *Jadresic Commission*, which identified areas for reform. Among its proposals was the creation of three superintendencies, one for each utility sector (electricity, gas and telecoms), which would report to the Minister of Economy, and an undersecretary in charge of research at the Ministry of Economy. Also, it was recommended that the regulatory agencies should issue manuals of procedures and the criteria for decision-making in their respective areas. None of these proposals have so far been adopted. The government's on-going effort to build a professional civil service is a step in the right direction and should be extended to the regulatory agencies.

It would be advisable to start tariff reviews once methodological issues have been resolved. Taking methodological issues out of the tariff review process would force regulators to adopt regular procedures for upgrading methodologies, collecting the necessary information to estimate costs, as well as other key parameters needed for the design of the efficient firm, and setting standards in their areas of activity, making regulation a continuous process between tariff reviews.

7. For example, the telecom regulator is an undersecretary at the Minister of Transport, Telecommunications and Public Works (MOP) and is overseen by the Minister of Economy. But in practice, regulation is delegated to MOP's Undersecretary of Telecommunications. The electricity regulator is also an undersecretary, but reports to a council of ministers. The water regulator is a superintendency reporting directly to the President. For more information on the water sector, see Bitran and Arellano (2005).

8. This problem has been mitigated in the case of the competition authorities with the reforms leading to the creation of the Competition Tribunal (*Tribunal de Defensa de la Libre Competencia*) in November 2003, with a specific career and remuneration schedules for its staff and fixed-term, renewable appointments for its members. See OECD (2004, 2005a), for more information.

9. For example, it is generally agreed that the draft electricity laws submitted to Congress over the last couple of years (*Ley Corta I* and *Ley Corta II*) were improved significantly during the legislative discussion.

10. In the case of water, an expert committee made up of three members (two appointed by the regulator, of which one is chosen from a list of names agreed with the utility company, and a third expert appointed by the utility company) is in charge of conflict resolution.

Conflict resolution should be strengthened. In the case of electricity, the creation of the panel of seven experts in July 2004 is a step in the right direction. These experts are independent, appointed by the Competition Tribunal for a six-year fixed mandate with overlapping terms, so that in any given year most members of the panel are not new, and remunerated adequately.¹¹ When a dispute arises, panel decisions are final and cannot be appealed.¹² The panel began to consider cases only in late 2004, but its resolutions are already being used as precedent in dispute resolution. If deemed successful, this institutional innovation could be replicated in the water and telecom sector.

3. The regulation of network industries: Electricity, gas and telecoms

3.1. Electricity

Overview

Electricity was the first network industry to be restructured in Chile. Generation, transmission and distribution were unbundled in the early 1980s and marginal-cost dispatching was introduced for generation. The industry was privatised in the late 1980s. Performance has been satisfactory: generation capacity has expanded continuously since privatisation in line with demand growth (Figure 1). The price of energy fell over the 1990s, especially with the arrival of Argentine natural gas in 1998, but rose again in the aftermath of the supply cuts in April 2004.¹³ Supply cuts were concentrated in May-June 2004, affecting the North most adversely, and January-April 2005, affecting predominantly the Centre-South (Figure 2). Investment in generation has since stalled and, as of May 2005, the probability of an energy shortage during the next three years was estimated to be on the rise. It is expected that changes to the legislation, approved by Congress in May 2005 (*Ley Corta II*), will remove the obstacles to investment in generation associated with the insecurity of supply and, therefore, reduce the likelihood of shortages.

Security of supply and recent regulatory reform

The need to deal with the security of supply has featured prominently in the regulatory debate since publication of the *2003 Survey*. The Argentine gas crisis has increased the volatility of supply in a network that is already vulnerable to weather conditions: Chile's main electricity network, the SIC (*Sistema Interconectado Central*) system, is predominantly hydro-based and droughts are frequent (Table 2).¹⁴ So far the short-run effect of cuts in gas supply has been much smaller than that of a regular.

11. The Competition Tribunal appoints the members of the panel. In principle, care must be exercised when deciding on the composition of the panel between members appointed by the regulator, the government (if any) and the industry, so as to avoid capture by one of the interested parties.

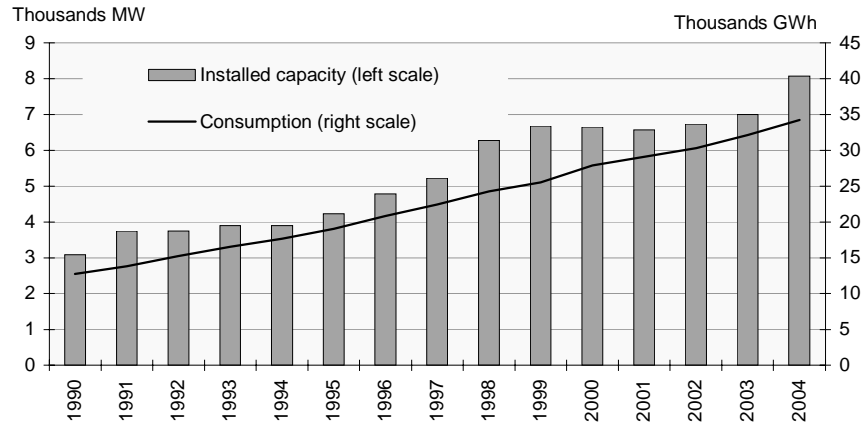
12. The Minister of Economy has the right to veto a resolution of the panel within ten days after it is issued. So far this prerogative has not been exercised.

13. The Argentine government considered the 1995 protocol for gas exports to Chile void when cutting supply in 2004 because it had not been ratified by Congress. Supply restrictions were lifted in part during July-November 2004. The data underestimates the economic magnitude of the supply cuts in March-April 2005, because Chilean generators serving central Chile have been able to secure supply after agreeing with the Argentine authorities to generate electricity in Argentina with coal and fuel oil.

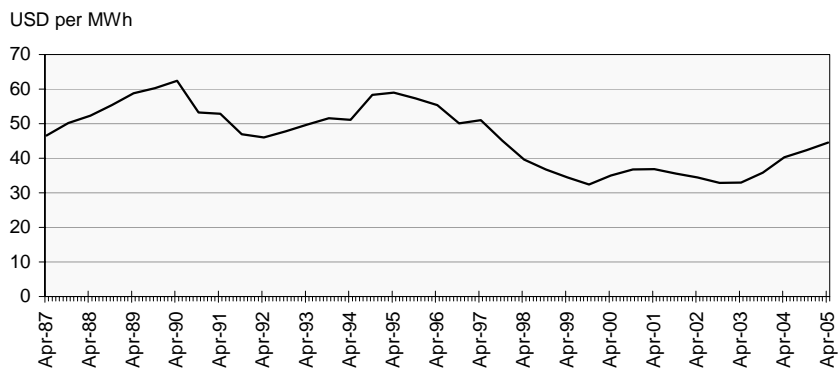
14. Chile's electricity system is divided into four non-connected regional systems: Central Interconnected System (SIC), Interconnected System of the *Norte Grande* (SING), Aysén system and Magallanes.

Figure 1. **Electricity: Installed capacity, consumption, and prices, 1987-2005**
SIC system

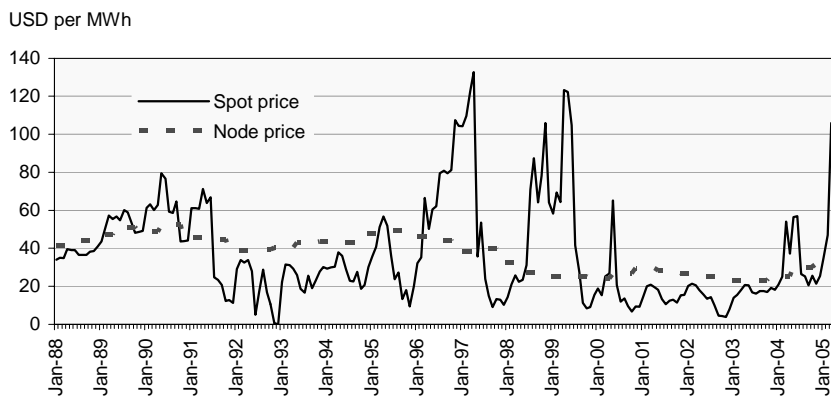
A. Installed capacity and consumption



B. Monomic node price

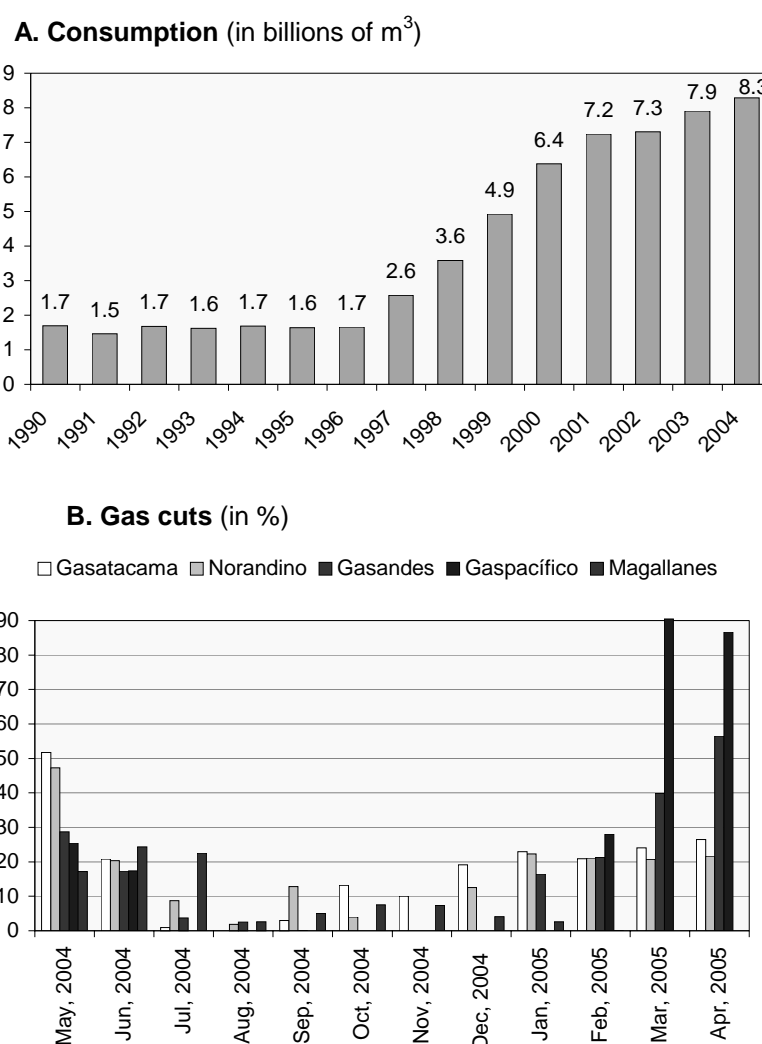


C. Spot and node prices (energy)



Source: Comisión Nacional de Energía.

Figure 2. Natural gas: Consumption and supply cuts, 1990-2005



Source: Comisión Nacional de Energía.

drought.¹⁵ The real problem lies in the price system, which is ill-equipped to deal with adverse supply shocks.¹⁶ Approval of *Ley Corta II* is an important step towards greater flexibility (Box 3). In particular:

15. Total consumption of energy in 2004 was about 34 000 GWh. On average, about 24 000 GWh (70% of energy consumed) can be generated by hydro-power. But the share of hydro-power can climb to almost 100% if the hydrology is very wet (as in 1972) or fall to about 35% (11 000 GWh) in a very dry year, such as 1968 or 1998. In other words, in a very dry year, 13 000 GWh (more than one-half of hydro-energy normally available) is lost. In comparison, if gas imports were to be cut entirely for one year, it would result in a shortfall of about 9 000 GWh. In practice, gas cuts were much lower during 2004, at around 2 000 GWh.
16. See also Pollitt (2004), for more discussion and background information.

Table 2. **Electricity: Composition of installed capacity by source, 2005**
SIC system

Type of plant	Installed capacity (in GW)	Share of total (in %)
Total	8.0	100.0
Hydro-power	4.7	58.9
Run-of-river	1.3	16.3
Reservoir	3.4	42.5
Thermal power	3.3	41.1
Coal	0.9	11.8
Diesel	0.3	3.7
Open cycle, gas	0.2	3.0
Combined cycle, gas	1.5	18.9
Other	0.3	3.7

Source: Comisión Nacional de Energía.

Box 3. The new electricity law (*Ley Corta II*)

In May 2005, Congress approved important changes to the regulatory framework for the electricity sector to remove the obstacles to investment associated with the Argentine gas supply cuts, which had started in April 2004 and had considerably increased the probability of an energy shortage in the coming years. The main changes to the legislation are:

First, the new law substitutes competitive bidding for the regulated node price (energy), which is paid by regulated customers. New contracts between generators and distributors will be signed for up to 15 years. The price set in auction will be kept unchanged in real terms over the entire duration of the contract (adjusted periodically for changes in fuel and other costs). Node prices will still be calculated and used to set a ceiling for the auction prices.

Second, the law modifies the rule to calculate the upper and lower bounds of the band around the average monomic free price, within which the regulated node price must fall. If the node price differs from the average free price by less than 30%, the bound is kept at the current 5% range. For a price discrepancy of 30%, the band is broadened to plus/minus 10%, and for a price discrepancy of 80% and above, the band is broadened to plus/minus 30%. For a price discrepancy greater than 30% but lower than 80%, there is a gradual linear increase in the band. This will allow prices to increase much faster in response to an adverse supply shock.

Third, generators are now allowed to offer incentives to regulated customers for adjusting consumption. This is yet to be regulated but, in the event of an energy shortage, it would be desirable to allow a generator who secures a reduction in consumption by regulated customers to credit this reduction against its contracts with the distributor, without the need to compensate users, except for the incentives offered to reduce consumption.

- Incentives for regulated customers to adjust consumption in response to changes in supply have been strengthened. Generators are now allowed to offer regulated customers served by distributors incentives to reduce consumption, thus efficiently rationing the available quantity of energy in a situation of shortage. This complements the existing compensation mechanism, introduced in the late 1980s, requiring generators to pay the equivalent of the outage cost (*i.e.* the value of an additional kWh when energy is rationed) for each kWh saved in response to a supply shock. This mechanism gives regulated customers the right price signal at the margin, because the opportunity cost of consuming an additional kWh is equal to the compensation foregone

(i.e. the value of an additional kWh consumed). In practice, however, the mechanism was deficient for two main reasons. *First*, it was difficult to understand, being interpreted as a “punishment” that generators had to pay for not meeting demand, ignoring its role as a price signal.¹⁷ *Second*, as currently calculated, the outage cost overestimates the value of a kWh in the presence of a supply shock because it assumes that all users will reduce consumption by the same proportion.¹⁸

- Regulated prices can now insulate investment from long-term supply volatility. The long-run equilibrium price (under uninterrupted supply from Argentina) is currently estimated in the neighbourhood of USD 30-35/MWh, hence below the level alternatives fuels (e.g. coal or liquid natural gas, LNG) are estimated to be profitable in the long term (USD 45-50/MWh). Uncertainty about the supply of Argentine gas discouraged investment in generation using alternative fuels because, instead of being set in long-term contracts, about 60% of generators’ sales were carried out at the monomic (energy and power) node price (i.e. the regulated price equal to the estimated marginal cost over the following 48 months), which is calculated every six months in April and October, so that it changes often, reflecting volatility in medium-run supply.¹⁹ Recent changes to the law substituted prices determined in competitive auctions, which will be maintained for up to 15 years, for the monomic node price. This is expected to shield generators from further volatility in the supply of Argentine gas, encouraging them to invest in expanding capacity. In addition, the setting of prices in an auction results in a partial liberalisation of prices paid by regulated customers, although the tariff structure and contract conditions remain regulated.

Further liberalisation has been desirable to better deal with the problems created by vertical integration in electricity distribution and retailing, which prevents competition in retailing. In particular, regulation of access tariffs has so far discouraged generators from serving “free” customers. The distribution tariffs paid by regulated customers are fixed every four years by the regulator. But, until recently, the law was silent on the distribution tariffs for free customers, discouraging generators from serving free customers located within the service area of a distribution company.²⁰ Nevertheless, the *Ley Corta I*, approved in March 2004, requires distributors to report the tolls for each free customer (more than 500 kW of connected power) based on a formula set by the regulator. Thus, a generator who wishes to serve a free customer served by a distributor will now know the toll before making an offer, and the distributor will not therefore be able to hike the distribution toll to make the generator’s offer uncompetitive.

17. See Fischer and Galetovic (2003), for more discussion.

18. For example, Benavente *et al.* (2005) estimate that, if the compensation mechanism is maintained for nine months (the usual duration of a drought in central Chile), residential consumption would fall by about 12%. By contrast, during the 1998-99 drought, the overall deficit was only 3%. Because generators have to compensate each kWh at the outage cost, such a large reduction will probably mean bankruptcy for those in deficit. Not surprisingly, generators have fought vigorously in court against paying compensation. The result is that in all likelihood a deficit will lead to outages, as in 1998-99. See also Fierro and Serra (1997), for more information.

19. For example, the node price fell even before imports of Argentine gas began in 1997. If the supply of Argentine gas resumes without interruption, then the node price would fall, discouraging investment. New coal or LNG-run plants would come on stream in 2009 at the earliest, and until 2008 the probability of a deficit is increasing and without precedent in the history of the private electricity sector.

20. This is because the distribution company could adjust the access tariff to render a generator’s offer uncompetitive. In fact, so far only once did a generator win a contract to serve a free customer located within the service area of a distribution company, the state-owned Santiago Metro, owing predominantly to a political decision by the government. In the SIC system, generators have contracts with about 60 free customers.

The retail tariff structure is rigid. There are many different regulated tariffs which vary with the type of connection (*e.g.* high or low tension) or the hours when power consumption is measured. Tariffs are made up of four charges: a fixed charge, a distribution charge, an energy charge and a peak power charge. But the overwhelming majority of residential customers pay a simple tariff – the so-called BT-1 tariff – which combines these charges in one per-kWh rate.²¹ About 40% of the amount paid per kWh remunerates distribution facilities, another 15-20% pays for peak power demand, and the remainder pays for energy. The main advantage of the BT-1 tariff is its simplicity, but it is inefficient for three reasons. *First*, residential customers use too little energy because the tariff is high at the margin.²² *Second*, because the BT-1 tariff does not differentiate between energy and peak power charges, residential customers do not receive any incentives to cut power consumption at peak hours.²³ *Finally*, no regulated tariff, including BT-1, reflects short-run supply conditions.²⁴

Important improvements have been made to the functioning of CDEC, the Load Dispatch Centre.²⁵ *First*, the expert committee has been granted the prerogative of resolving disputes among CDEC members, and its decisions cannot be contested. This should facilitate decision-making. *Second*, the new electricity law sets a four-year term for the Director, thus increasing his/her autonomy, although the Board can remove him/her with two-thirds of the votes. *Finally*, the inclusion of a representative of free customers and firms that own sub-transmission companies should broaden representation and therefore reduce incumbents' incentives to prevent entry.

Options for reform

The option of unbundling retailing from distribution could be considered to encourage a more efficient use of electricity. In this case, distribution cables would be priced and let separately from energy and power sales. Distribution tariffs would still be regulated, essentially as in the current system, but electricity would be sold by retailers, who would buy it from generators and set contract prices freely. Pricing distribution separately from consumption would allow retailers to design efficient price schedules adapted to consumer preferences. In doing so, the regulation of distribution would also become less burdensome and the risk of rationing/outages would be minimised when energy is in short supply because retailers would have the incentive to find those consumers who are willing to reduce consumption at the lowest cost. The experience of OECD countries is diverse in this area. Whereas in countries such as

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21. There is also a per kWh surcharge during the winter months, which is paid by customers consuming more than 200 kWh. The surcharge affects no more than 10% of residential consumers.
 22. Galetovic *et al.* (2004) estimate that, at the current level of residential consumption, the welfare loss is in the order of USD 50 million per year.
 23. Galetovic *et al.* (2004) show that the cost of supplying residential customers could be cut by about USD 2/MWh by increasing their load factor (*i.e.* the ratio of peak power consumption to average power consumption; a ratio of one implies that the customer's load is constant all the time) from the current 70% to the system average, 74%.
 24. Montero and Rudnick (2001) estimate that, if energy rates reflected their current opportunity cost, generation capacity could be cut by at least 20%, based on the elasticity of residential energy demand estimated by Benavente *et al.* (2005).
 25. CDEC was created in 1985 as an association of generators with more than 2% of installed capacity. In 1997 transmission companies with at least 100 km of lines were included. *Ley Corta II* extended membership to firms that own sub-transmission installations (mainly distributors) and a representative of free customers. Until 1998 CDEC had been ruled by a Board of Representatives of each company and the operation of the system was rotated among them. In 1998 generators created a separate Operations Direction, although its operational autonomy is limited. See Rudnick (2005), for more information.

Canada and the United States there is considerable vertical integration in the industry, other countries (e.g. Netherlands and United Kingdom) have gone a long way in unbundling retailing from distribution.

The liberalisation of retailing would need to be complemented by prudential regulations. This is because all users are connected to the same grid and, in a supply shortage, an outage will occur if nobody reduces consumption. Retailers must have incentives to enforce their contracts and must either contract enough energy and power to meet them or write contracts that encourage users to reduce consumption when there is a shortage. Otherwise, an opportunistic retailer could sell “cheap” electricity and default when a deficit occurs.

There are reasons for not liberalising the spot market. Currently, dispatch is centralised in strict variable-cost merit order (Box 4), and generators should not be free to choose plant operation and the price at which they bid. The main reason against liberalisation is that the largest generator, ENDESA, would have ample room to exercise market power. It would withhold reservoir water in periods when the system operates close to capacity and release it when demand is low.²⁶ In turn, the second-largest generator, GENER, would have incentives to withhold capacity when there is little water available.

The functioning of CDEC can be improved further. This can be achieved by introducing explicit operating rules and procedures to constrain discretion. In addition, while the introduction of new members has the merit of broadening representation, they may also block decisions because each member of CDEC has veto power. Thus, CDEC’s voting rules could be reviewed. It is also probably desirable to grant CDEC’s greater operational autonomy.

3.2. Gas

Overview and main issues

Chile’s natural gas market is heavily reliant on imports from Argentina, as discussed above. There are four disjoint natural gas markets (North, Centre, South and the Magellan region). Only the Magellan market is supplied in part by the only domestic producer, the state-owned *Empresa Nacional del Petróleo* (ENAP).²⁷ The first pipeline connecting Argentina and Chile came on stream in 1996 to serve a single firm, the *Methanex* plant in the Magellan region. The *Gasandes* pipeline, which connects the Neuquén basin in Argentina with central Chile, came on stream in 1997. These were followed in 1999 by two pipelines serving the north of Chile (*Gas Atacama* and *Norandino*) and by the *Gasoducto del Pacífico* pipeline serving the Concepción area in the south of Chile, which entered in operation in 2000. Natural gas is used predominantly for electricity generation and industrial consumption (Table 3). More than one-half of total industrial consumption (one-quarter of total consumption) is accounted for by *Methanex*.

The cuts in gas shipments from Argentina have raised concern about the security of supply. Because most natural gas consumption is backed up (Table 4), most users (except residential customers) can switch rapidly to alternative fuels at some additional cost.²⁸ In electricity generation, which accounts for nearly one-half of consumption of natural gas, it was argued above that the adequate policy response to input volatility would be to introduce flexible tariffs and contract conditions. If distortions in the price

26. See Arellano (2004a, 2004b), for estimates of consumer surplus and average welfare in the event of liberalisation of the spot market. Because the supply curve of generators, other than ENDESA, is inelastic when the system operates at close to capacity, the residual demand curve confronted by ENDESA at those hours is inelastic, creating an incentive to withhold water.

27. See Balmaceda and Serra (2005), for more information.

28. Back-up is provided by (in order of importance): diesel, fuel oil, LNG, coal, coke gas and kerosene.

system can be corrected, then there is no need for mandatory back-up provisions, except for residential customers, for which back-up is already in place.

Box 4. The electricity generation industry: An overview

The generation market is structured around three prices – spot, node (or regulated) and free – each corresponding to a separate market.

The spot market

The sequence in which generators operate is set by CDEC (*Centro de Despacho Económico de Carga*), the Load Dispatch Centre. Given current demand, dispatch is made according to strict merit order after accounting for transmission constraints. The generators do not make bids; dispatch is made according to their marginal operating costs, which are fixed according to technical parameters and fuel costs. The spot price always equals the opportunity cost and changes hourly. Dispatch is mandatory whenever the plant is available and CDEC commands it to start operating. This implies that dispatch is independent of a generator's contracts. Generators that sell more energy than they produce are required to buy the difference in the spot market at the spot price. Each month CDEC settles accounts between generators.

Under normal conditions, the spot price equals the operating cost of the most expensive thermal plant dispatched. By contrast, in all the hydrological scenarios in which the model (below) predicts a shortage, energy transfers among generators are valued at the "outage cost", which is the average cost to users of a proportional reduction in consumption, estimated from user surveys (which are nevertheless conducted infrequently).¹ Outage costs assume that restrictions are planned and announced well ahead of time so that large consumers can adjust production or install generating capacity and residential users can adjust consumption. The cost of unexpected energy or power cuts is obviously much higher.

The regulated market

The spot price is subject to extreme variations over the year and even during shorter periods. When the law was introduced it was thought that such volatility was unacceptable to residential customers and generators. Hence, the price at which distributors sell to residential and other small users was regulated.² Moreover, it is mandatory for generators to sell at the regulated price to distributors.

The regulated (node) price is calculated every six months by CNE (*Comisión Nacional de Energía*) and corresponds to the expected marginal cost averaged over the following 24 to 48 months.³ To fix this price CNE runs a stochastic dynamic programming model which, given a ten-year projection of peak power and energy demand, minimises the expected cost of generation and outage by optimally using water in all reservoirs. This model takes existing plants as given, but optimises entry of future plants over the ten-year horizon. It estimates the probability of future hydrologies using a sample of 40 past hydrologies. The regulated price effectively paid by users must fall within a band centred in average monomic "free" prices (see below). If the price estimated by CNE falls below the lower bound of the band, the regulated price is set equal to the lower bound. Similarly, if it falls above the upper bound, the price is set equal to the upper bound. Until 2004 the width of the band was 10% of the average monomic free price. The law approved in March 2004 (*Ley Corta I*) narrowed it to 5% of the average monomic free price. Finally, in May 2005 (*Ley Corta II*) the width of the band was widened again (see Box 3).

The node price remains fixed for 6 months, independently of demand and supply conditions. Nevertheless, there is a mechanism to ration excess energy demand. When a shortage occurs, the regulator issues a rationing decree and regulated consumers are paid the difference between the outage cost and the node price (*i.e.* around USD 230/MWh for a restriction of 10% or less) for each undeliverable kWh; that is, the energy that would have been consumed at the regulated price had it been available.

The "free" market

The "free" customers, those with installed power of more than 500 kW (formerly, 2 MW), have a much simpler pricing regime. These users negotiate energy contracts directly with the generators. While a significant fraction of these contracts are set at prices that reflect supply conditions only in the long run, contracts can be freely renegotiated during a supply restriction. If the spot price of energy exceeds the user's valuation of energy, the generator and the user are expected to undertake a mutually advantageous renegotiation. Notwithstanding this flexibility, prices have remained fairly stable over time.

1. Surveyed users are asked to estimate the cost of reducing "normal" energy use by 10, 20, and more than 20%. Users are told that these restrictions would be announced months in advance, given that energy (as opposed to power) outages can be predicted.
2. Until 2004, customers were considered small if their connected power was below 2 MW (for example, a small shopping centre). In 2004, the law was amended and the limit was reduced to 500 kW.
3. CNE chooses the exact length of the period. In the SIC system, the expected marginal cost is averaged over the following 48 months (24 months in the SING system).

Table 3. Daily average natural gas consumption, 2004
In millions of m³ (per cent share in parentheses)

Regions	Electricity generation	Industry	Residential use	Total
Total	11.2 (49.3)	10.8 (47.6)	0.7 (3.1)	22.7 (100.0)
North	4.0 (17.6)	0.8 (3.4)	..	4.8 (21.0)
Centre	7.2 (31.7)	3.0 (13.4)	0.6 (2.9)	10.9 (48.0)
South	..	1.3 (5.8)	0.1 (0.2)	1.4 (6.0)
Magellan	..	5.7 (25.0)	..	5.7 (25.0)

Source: Asociación de Distribuidores de Gas Natural.

Table 4. Natural gas consumption with back-up, 2003 and 2005
Industrial use, in %

Region	2003	2005
North	100	...
V Region (Centre)	72	87
Santiago Metropolitan Region (Centre)	66	81
South	86	96
Average	75	86

Source: Asociación de Distribuidores de Gas Natural.

Policy options

The introduction of import ceilings and origin restrictions should be resisted. Because all imports of natural gas come from Argentina, proposals have been made to cap imports from any given country at 85% of total imports. The requirement was included in *Ley Corta II* but subsequently turned down by Congress. This restriction would fail to enhance the security of supply because gas cannot currently be imported at comparable cost from countries other than Argentina. Similarly, it can be argued that prohibiting further imports from Argentina would do little to minimise the costs of supply restrictions and prevent users from taking advantage of Argentine natural gas reserves and amortising sunk capacity when this crisis is over.

It would be advisable to reform the mechanism used by the Competition Tribunal to regulate the price paid by small consumers. There is a monopoly in natural gas and current regulations allow gas prices

to be set freely, but the unit price charged to customers that consume similar amounts must be the same.²⁹ It has been argued that the price of natural gas paid by residential and industrial customers should be regulated, on the grounds that distributors limit-price alternative fuels, particularly diesel and fuel oil. Nevertheless, regulation in this area would be unadvisable. Switching costs are higher for residential users, and residential prices have so far not been regulated, with the exception of the Magellan region. The Competition Tribunal can instruct the Ministry of the Economy to regulate the price paid by small customers, but only if the concessionaire obtains returns which are at least 5 percentage points above the cost of capital (Law No. 18 856 of 1989). Delegating such a prerogative to the Competition Tribunal is prudent, but the current mechanism has the disadvantage of encouraging over-investment. It would therefore be advisable to reform it.

3.3. *Telecoms*

Overview and main issues

The telecom sector has developed fast in Chile. This is due in part to robust GDP growth during most of the 1990s and the regulatory reforms implemented since the early 1980s, and particularly in the mid-1990s. In October 1994, a long-distance multi-carrier replaced a regulated monopoly.³⁰ Several firms entered the market upon liberalisation, tariffs plummeted almost instantly, and traffic almost doubled in less than one year (Table 5). Price competition has been intense; tariffs fell during 1995-99 and have stabilised since then.³¹ Tariffs have also fallen significantly in mobile and long-distance telephony since liberalisation, largely facilitated by regulation that has kept switching costs low (Figure 3).³² Tariffs have fallen much less, if at all, in residential and small commercial fixed telephony, despite the fact that entry has been substantial. This is because services are still available from only one operator in many cases, given that entry has been concentrated in high-traffic areas. But even in those areas where two or more operators are present, entrants have taken as given, or at most limit-priced, the residential tariffs charged by the dominant firm.³³

As noted in the *2003 Survey*, the central regulatory issue in the telecom sector is how to foster competition while simultaneously setting efficient prices for dominant firms.³⁴ Regulation and industrial organisation have changed considerably in the sector over the last two decades, in part due to continuous

29. Decree No. 263 of 1995. See Balmaceda and Serra (2005), for more information.

30. See OECD (2005b), for more descriptive information.

31. For example, calls to the United States during business hours are significantly cheaper than those estimated by Fischer and Serra (2002) had tariffs remained regulated.

32. For example, each long-distance carrier has been accessible through a two-digit code system since the early stages of liberalisation and the competition authorities made it illegal for firms to block direct access to competitors in exchange for more favourable rates. This kept switching costs low, favouring price competition. In mobile telephony, prices plummeted when the "calling party pays" system and pre-paid phones were introduced in 1999. Pre-paid phones can be discarded and are sold through regular retailers. Switching costs are therefore lower and price competition, more intense. More recently, the Competition Tribunal has made it illegal for mobile phone operators to code-block handsets to prevent use in competitor networks (Resolution No. 2 of 2005).

33. Telefónica CTC, the former government-controlled telecom monopoly, is still the dominant firm in Chile. Nevertheless, its share in total fixed lines fell from 94% in 1990 to 73.2% in 2003. Cable companies (VTR and Metropolis) have taken advantage of economies of scope to serve residential customers, and Entel Phone has targeted the commercial market. See Fischer and Serra (2002), for more information.

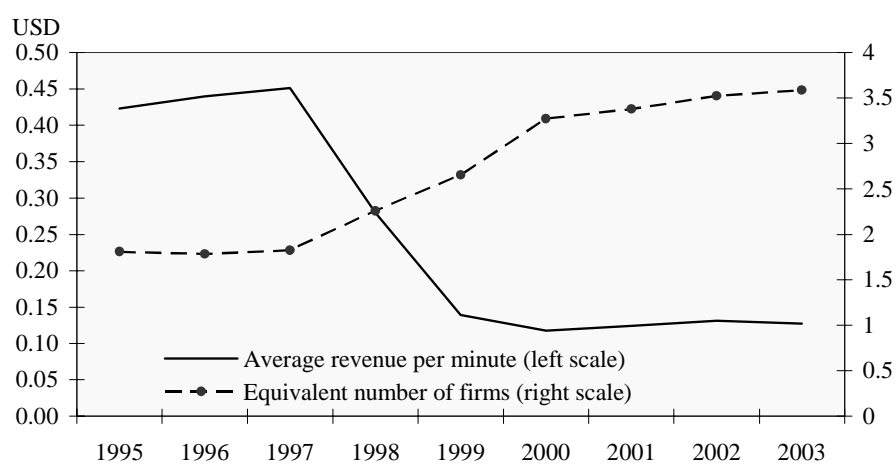
34. See Jadresic (2002), for further discussion.

Table 5. **Telecoms: Selected indicators, 1980-2004**

	Fixed lines (in millions)	Density (lines per 100 inhabitants)	Mobile phones (in millions)	International long- distance outgoing traffic (in millions of minutes)	Internet connections (in thousands)
1980	0.4	8.0	..
1985	0.5	13.4	..
1986	0.6	16.2	..
1987	0.6	4.7	..	21.2	..
1988	0.6	4.9	..	27.5	..
1989	0.7	5.4	0.0	29.9	..
1990	0.9	6.5	0.0	38.8	..
1991	1.0	7.8	0.0	47.0	..
1992	1.3	9.4	0.1	53.1	..
1993	1.5	11.0	0.1	59.5	..
1994	1.6	11.6	0.1	63.5	..
1995	1.9	13.2	0.2	113.6	..
1996	2.3	15.6	0.3	144.2	..
1997	2.7	18.3	0.4	198.8	62.8
1998	3.0	20.4	1.0	215.0	75.0
1999	3.1	20.3	2.3	210.2	150.0
2000	3.3	21.6	3.4	224.0	586.2
2001	3.5	22.4	5.3	254.9	698.2
2002	3.5	22.1	6.4	273.8	757.8
2003	3.3	20.5	7.5	235.6	836.0
2004	3.3	20.7	9.6	247.5	805.3

Source: SUBTEL.

Figure 3. **Average revenue per minute and number of mobile phone operators, 1995-2003**
Mobile and long-distance telephony



Source: Based on Galetovic and Sanhueza (2002).

technological innovation, which has characterised the industry worldwide, and as a result of pro-competition regulatory reform. The basic tenets of the law that regulates telecoms in Chile are that no

legal monopolies are granted to any operator, technical interconnection is mandatory at regulated access charges, and operators are free to set end-user tariffs unless they are considered “dominant” by the Competition Tribunal. In this case, tariffs are regulated by the Ministry of Public Works, Transport and Telecommunications in conjunction with the Ministry of Economy in periodic reviews according to the efficient-firm standard (discussed above) and based on procedures set out by SUBTEL (*Subsecretaría de Telecomunicaciones*). The most recent tariff review was in 2004. In several rulings the Competition Tribunal has stated that the tariff structure must aim at efficiency and has consistently pressed for unbundling the networks of incumbent operators.³⁵ The law also regulates service quality.

Regulation has focused on fostering entry. It is believed that, as entrants become strong enough, tariff regulation will no longer be necessary. For example, access charges for mobile-to-mobile and fixed-to-mobile calls are much higher than for mobile-to-fixed calls. This tariff structure has promoted the expansion of mobile telephony. Similarly, the authorities did not escalate access charges to Telefónica CTC’s network in 1999, arguing that, in doing so, it would give the operator an undue advantage in other vertically-related markets, long-distance and mobile telephony. Also, until recently, Telefónica CTC was not allowed to lower tariffs selectively in areas where it faces competition, but had to do so in all areas. This facilitated entry, but softened price competition in service areas with more than one operator to avoid predatory behaviour. It is nevertheless important to note that entry does not necessarily imply more intense price competition. In fact, concentration tends to be higher in equilibrium in markets where price competition is more intense.³⁶ This is because, if higher margins can be sustained in equilibrium, then more firms can cover their sunk costs. Moreover, the objective of liberalising tariffs after enough firms have entered the market is not necessarily sustainable, as there are density and scale economies in the provision of local telephony (Box 5).

The stated aim of tariff regulation has been to set efficient prices. Because telephone networks exhibit density and scale economies with limited traffic-sensitive costs, efficient tariffs will most probably involve cross-subsidies (*i.e.* the additional revenue generated by a given set of customers is less than the added costs of serving them.). For example, in fixed telephony, the authorities have kept fixed connection charges low, combined with higher variable charges. It has been argued that high fixed charges discourage connections (*i.e.* the demand for connections is more elastic than the demand for traffic). In doing so, in all likelihood users from high-income-and-traffic areas cross-subsidise those in low income-and-traffic areas. While cross-subsidies are not inefficient *per se*, they tend to be vulnerable to cream-skimming by competitors. It is likely that this problem has been present in Chile.

Options for reform

Further empirical analysis is needed on the current price structure to determine the extent and incidence of existing cross-subsidies. This is important for further network unbundling, which, if pursued, should be consistent with the regulation of dominant firms. Because entry continues to be decided on the basis of average costs, unbundled parts of a network should also continue to be priced at average cost, and most cross-subsidies would need to be eliminated. In any case, the aim of tariff and access charge regulation should be allocative efficiency, rather than the pursuit of industrial policy objectives.

35. For example, in Resolution No. 515 of 1998 the Competition Tribunal stated that when setting tariffs, SUBTEL should also unbundle the services offered by dominant firms as much as technically possible. More recently, in Resolution No. 2 of 2005, the Tribunal recommended that SUBTEL force all mobile phone operators to sell capacity to virtual mobile operators.

36. See Sutton (1991), for further discussion.

Box 5. Telecoms: The technology of a telephone network, and entry and competition

The basic technology of a telephone network

The telephone network is made up of three parts: the "local loop", which connects each subscriber with its local exchange; a "switchboard", which identifies the called number and establishes the physical channel that carries the conversation; and the "inter-office transport", which connects each local exchange with all others.

The local loop is made of copper wires which connect each phone with its local exchange (there are also local networks that use coaxial cables normally used to provide cable TV). Each copper wire is dedicated to one user and its average cost does not depend on traffic, but on the "density of users". Broadly speaking, the higher the density in a given area, the lower the average cost of reaching each user, because fixed investments, such as transmission posts, are spread over more users. Also, the number of copper wires installed equals the number of potential, not actual, users. Therefore, average costs fall with penetration (*i.e.* the fraction of potential users actually connected).

Switching and inter-office transport are shared by many users and designed to accommodate peak traffic. While investments in switchboard capacity and transmission equipment are, by and large, proportional to traffic, other investments, such as housing, energy back-up and air-conditioning equipment, are subject to indivisibilities. Hence, there are economies of scale in traffic; as a result, average costs fall as traffic increases.

Entry and competition

In principle, three types of entry could be considered to foster competition.

First, entrants could be forced to use their own network to serve all areas already served by the incumbent. In that case, an entrant whose costs are as high as the incumbent's cannot exploit cross-subsidies in the tariff structure.¹ But in any case entry would be unlikely because, even if the entrant is more efficient than the incumbent, the existing network is already sunk and, because of network externalities, one user will switch in equilibrium only if most other users also do so. Thus, Chilean policy-makers opted to allow entry by firms who had to build their own network (*i.e.* facility-based competition), but could choose which areas to serve (*i.e.* selective entry), subject to mandatory interconnection by the incumbent at regulated access charges.

Second, mandatory interconnection at regulated access charges solves the problem caused by network externalities because users who switch to an entrant can still access all subscribers. Selective entry makes small-scale entry feasible because entrants can target those zones where traffic and densities are large enough, leaving to the incumbent those areas where traffic and densities are low. This reduces the diseconomies of scale arising when the same firm builds two local loops that serve disjoint areas. But selective entry creates two problems.

- *First*, it is duplicative, as each local loop is subject to density economies. Because the local loop comprises a significant part of the cost of a network, it is unlikely that facility-based competition can ever converge to a competitive market with tariffs equal to marginal cost; density economies imply that all firms would lose money.² Hence, price competition must be weakened for more than one firm to be sustainable.
- *Second*, for long-run average cost (Ramsey) pricing may be inconsistent with self-financing if the dominant firm faces the threat of selective entry. The problem is that entry decisions depend on the average costs of serving target areas. Thus, a selective entrant will choose markets where prices are higher than the average costs of service. But then the dominant firm will not cover its costs in areas where Ramsey prices are fixed below average costs. The practical implication is that the finer selective entry is allowed to be, the closer must be the tariff structure to average cost of each part of the network.³

Third, the incumbent's network can be unbundled (*i.e.* entrants can pay to separately use the local loop, inter-office transport, and so on). Compared with facility-based competition, unbundling avoids the duplication of local loops and facilitates entry. To mitigate the problem of cream-skimming, which may be exacerbated by unbundling, prices must be set at provision cost and the unbundled firm must be granted enough price flexibility to operate in a more competitive environment.

1. See Baumol *et al.* (1977), for more information.

2. Whether some competition is better than only one regulated firm is an empirical question. It depends on the trade off between lost density economies and smaller information rents of the regulated firm. See Gasmi *et al.* (2002), for more information.

3. Braeutigam (1979) shows that Ramsey prices are still optimal if the dominant firm is subject to competition, in the sense that optimal prices satisfy the same first-order conditions. The point made by Faulhaber (1975), however, is that these Ramsey prices may be vulnerable to selective entry and thus unsustainable.

Price competition should probably be enhanced in areas when there is more than one service provider. In this regard, the decision made by the Competition Tribunal in 2003 to allow dominant operators to offer alternative tariffs, is a step in the right direction, while being mindful of the risk of predatory price competition. The access charges for dominant firms were raised in the 2004 tariff review, resulting in a more symmetrical regulation of access charges.

4. Infrastructure concessions

4.1. Overview and main issues

Congress passed a law in 1991 allowing the government to carry out concessions for most public works, including roads, ports and airports. Concessions are carried out predominantly through build-operate-and-transfer (BOT) arrangements, where a concessionaire finances, builds, operates and maintains the infrastructure facility. In exchange, tolls are collected for a fixed length of time, and the infrastructure facility reverts to the government when the concession contract expires. Concessions are granted in competitive auctions open to any participant, national or foreign, and the duration of contracts is usually between 15 and 30 years. Moreover, most contracts include minimum revenue guarantees by the government in the event that toll proceeds fall short of an agreed amount. By the end of 2002, the most important highways, ports and airports had been franchised, with total investment worth around USD 5 billion.

The overall assessment of the concession programme is by and large positive.³⁷ In the early 1990s, Chile had a large infrastructure deficit in highways, airports, ports and roads and, as a result, rates of return, both social and private, were high.³⁸ There is widespread agreement that a substantial part of the infrastructure deficit would not have been reduced over the past decade, concomitantly with the strengthening of public finances, without these public-private partnerships.³⁹ Cost-benefit analysis must be the overriding criterion for selecting the projects to be eligible for government guarantees. Governance could be improved to deal with the following issues:

- The concession programme lacks an external regulatory framework. Concessions are designed (including the setting of tolls) and carried out, projects are implemented and monitored, and contracts are renegotiated under the authority of the Ministry of Transport, Telecommunications and Public Works (MOP). Each project is designed independently and conditions are contract-specific. This creates some tension between the pressure for performance, measured in terms of value of concessions tendered, and the enforcement of contracts.⁴⁰ The Ministry of

37. See Engel *et al.* (2000, 2003) and Gómez-Lobo and Hinojosa (2000) for comprehensive overviews.

38. For example, Echenique (2005) estimates the rate of return of the urban highway concessions in Santiago to be of the order of 70%.

39. Because under BOT a private concessionaire finances and operates the infrastructure in exchange for tolls, it is often claimed that BOT contracts deliver the same efficiency gains as privatisation. It is argued that: *first*, a firm that is responsible for construction and maintenance should have the right incentives to invest in quality; *second*, private firms are supposedly better managers than governments; *third*, BOT contracts might be desirable on distributional grounds, since cost-based tolls might be easier to justify politically when infrastructure providers are private; and, *finally*, in contrast to the traditional approach, under BOT only privately profitable projects are built because the market mechanism screens projects. Nevertheless, BOTs may not encourage productive efficiency when the franchise-holder's budget constraint is soft.

40. For example, a report issued by the National Controller in October of 2002 concludes that MOP relies solely on traffic measurements made by the concessionaire, instead of independent measurements. This is worrisome, since government guarantees are triggered by low traffic flows, and franchise-holders have incentives to underreport traffic.

Finance evaluates the future budget impact of guarantees, as well as their contingent liabilities. It is unclear, however, whether this has been enough to enforce good practices.

- Chile has had a social evaluation programme for government-financed projects for more than three decades. This evaluation, which is carried out by the Ministry of Planning, ranks projects according to their estimated social returns. But “complementary contracts” can be negotiated outside the regular screening process. This makes it difficult for policymakers to assess the overall social returns of projects and, therefore, their relative merits when awarding government guarantees. Also, contract renegotiation and ensuing compensations are not published. MOP may face disincentives for renegotiating contracts for fear of exposing weaknesses in project evaluation.⁴¹ But many highway projects have been renegotiated during construction, and the conditions under which these contracts have been renegotiated are not public.⁴²

The government introduced a revenue-distribution mechanism in 2002. This allowed concession-holders to insure themselves against *ex post* demand risk by making the duration of contracts contingent on expected future demand. Many of the highway contracts eligible for renegotiation were signed in 1997-98, when estimates of traffic volumes had been based on optimistic GDP growth projections. The revenue-distribution mechanism consists of offering the concession holder a guarantee of 4-5% revenue growth per year in exchange of upfront additional work equivalent to 6-10% of the net present value of the guaranteed revenue flows. Should the revenue target not be met, the duration of contracts can be extended.⁴³

4.2. Options for reform

Public-private partnerships should be restricted to projects with high social returns. When private returns are high, the infrastructure project should be carried out privately, with no need for government guarantees. As Chile’s infrastructure deficit is closing, social rates of return on new investments are likely to decline, calling for increasingly more judicious project evaluation and enhanced governance to introduce independent checks and balances and safeguard the Treasury from undue exposure to contingent liabilities. In particular:

- The planning, execution and regulatory stages of infrastructure concessions should be unbundled and assigned to different agencies. These agencies should in turn report to an oversight body, preferably independent from government, which should also be in charge of evaluating projects and monitoring compliance with contractual covenants. Chile’s experience with independent expert panels in support of fiscal policymaking could be extended to the assessment of contingent liabilities associated with government guarantees awarded to infrastructure projects. This would

41. Evidence is essentially anecdotal. For example, after signing the concession contract for *Route 78*, which connects Santiago to the port city of San Antonio, MOP required additional works that were not included in the original contract. The concessionaire asked for compensation for the additional works and MOP raised the toll by 18.1% during five years. No further explanation was given, the agreement was made public after it was signed, and the calculations that defined the compensation were not made public. See Paredes and Sanchez (2004), for more information.

42. Twelve out of the 16 highway projects awarded by 1998 had been renegotiated by May 2002. There were 31 modifications to the original contracts, with total value of USD 0.5 billion. These projects were valued at USD 3.4 billion, that is, there was an average cost increase of about 15%. Additional construction work or early completion of sections of the highways were repaid with extensions of the concession length, direct payments from MOP, higher tolls, early operation of toll booths and reductions in other construction work. There was no external supervision to ensure that the renegotiation process was fair.

43. The government can extend the concession period by 60 to 100 months should the revenue target not be met and, if the situation persists, it can pay the difference to the concession-holder or let the contract run until the target revenue has been achieved. See IMF (2005) for more information.

be particularly welcome when assessing social rates of return, which are notoriously difficult to estimate, and consequently selecting projects eligible for government guarantees. In general, government guarantees should only be granted if there is a discrepancy between social and private returns associated with projects that are not privately profitable. If a project is privately profitable, even if risky, it should not be eligible for a subsidy or guarantee. International experience suggests that the public interest tends to be better served, and transparency is enhanced, when social welfare computations are carried out by an independent agency.

- Existing guarantees should be incorporated into the normal budgetary process and oversight procedures. This should be done in three steps: *First*, standard accounting principles should be used to evaluate the cost of guarantees to the budget. The estimation of contingencies is already reported in the budget law and the regular public debt management reports issued by the Ministry of Finance, which is a step in the right direction, but could be strengthened by requiring in each budget law publication of information on the value of concessions awarded and the guarantees exercised in the reference period. *Second*, information about the terms of contracts should be made public, preferably in a regular report to be submitted to the legislature. *Third*, guarantees exercised in a given reference period should be paid out of the current budget.

Box 6. Summary of the main recommendations

Cross-sectoral issues

- Settle methodological issues prior to tariff reviews, making regulation a continuous process between tariff reviews.
- Strengthen the regulatory agencies by building a professional career stream for them within the civil service.
- Set up expert panels for conflict resolution in the areas of telecoms and water, following the example of the electricity sector.

Network industries: energy (electricity and gas) and telecoms

- In electricity, consider the option of unbundling retailing from distribution and continue to improve the functioning of CDEC by introducing explicit operating rules and procedures, and possibly granting it greater operational autonomy.
- In natural gas, avoid the introduction of import ceilings and origin restrictions to ensure security of supply.
- In telecoms, continue to boost price competition in areas with multiple providers. Conduct further analysis on the current price structure to determine the extent and incidence of existing cross-subsidies.

Infrastructure

- Strengthen the cost-benefit analysis for selecting infrastructure projects eligible for government guarantees.
- Separate the planning, execution and regulatory stages of infrastructure concessions and assign these functions to different agencies. Set up an oversight body, preferably independent from government, in charge of evaluating projects and monitoring compliance with contractual covenants.
- Make information about the terms of contracts public, preferably in a regular report to be submitted to the legislature.

Bibliography

- Arellano, S. (2004a), “Market Power in Mixed Hydro-Thermal Electric Systems”, *CEA Working Paper*, No. 187, Centre for Applied Economics, University of Chile, Santiago.
- Arellano, S. (2004b), “Reformando el Sector Eléctrico Chileno: Diga No a la Liberalización del Mercado Spot”, *CEA Working Paper*, No. 197, Centre for Applied Economics, University of Chile, Santiago.
- Balmaceda, F. and P. Serra (2005), “The Chilean Natural Gas Market”, in P. Beato and J. Benavides (eds.), *Gas Market Integration in the Southern Cone*, Inter-American Development Bank, Washington, DC.
- Baumol, W., E. Bailey and R. Willig (1977), “Weak Invisible Hand Theorems on the Sustainability of Multiproduct Natural Monopoly”, *American Economic Review*, Vol. 67, pp. 350-65.
- Benavente, J.M., A. Galetovic, P. Serra and R. Sanhueza (2005), “Estimando la Demanda Residencial por Electricidad en Chile: El Consumo Responde al Precio”, *Cuadernos de Economía*, forthcoming.
- Bitrán, G. and P. Arellano (2005), “Regulating Water Services: Sending the Right Signals to Utilities in Chile”, *Public Policy for the Private Sector No. 286*, World Bank, Washington, DC.
- Braeutigam, R. (1979), “Optimal Pricing with Intermodal Competition”, *American Economic Review*, Vol. 69, pp. 38-49.
- Butelmann, A. and A. Drexler (2003), “La Regulación de Monopolios Naturales en Chile”, Unpublished manuscript, Santiago.
- Echenique, M. (2005), “Las Vías Expresas Urbanas? Qué tan Rentables Son?”, forthcoming in A. Galetovic (ed.), *Santiago: Dónde Estamos y Hacia Dónde Vamos*, Centro de Estudios Públicos, Santiago.
- Engel, E., R. Fischer and A. Galetovic (2000), “El Programa Chileno de Concesiones de Infraestructura: Evaluación, Experiencias y Perspectivas”, in F. Larraín and R. Vergara (eds.), *La Transformación Económica de Chile*, Centro de Estudios Públicos, Santiago.
- Engel, E., R. Fischer and A. Galetovic (2003), “Privatizing Highways in Latin America: Fixing What Went Wrong”, *Economía*, Vol. 4, pp. 129-64.
- Faulhaber, G. (1975), “Cross-Subsidiation: Pricing in Public Enterprises”, *American Economic Review*, Vol. 65, pp. 966-77.
- Fierro, G. and P. Serra (1997), “Outage Costs in Chilean Industry”, *Energy Economics*, Vol. 19, pp. 417-34.
- Fischer, R. and A. Galetovic (2003), “Regulatory Governance and Chile’s 1998-1999 Electricity Shortage”, *Journal of Policy Reform*, Vol. 6, pp. 103-24.

- Fischer, R. and P. Serra (2002), "Evaluación de la Regulación de las Telecomunicaciones en Chile", *Perspectivas en Política, Economía y Gestión*, Vol. 6, pp. 45-77.
- Galetovic, A., J.R. Inostroza and C. Muñoz (2004), "Gas y Electricidad: Qué Hacer Ahora?", *Estudios Públicos*, Vol. 96, pp. 49-106.
- Galetovic, A. and R. Sanhueza (2002), "Regulación de Servicios Públicos: Hacia Dónde Debemos Ir?", *Estudios Públicos*, Vol. 85, pp. 101-37.
- Gasmi, F., J.J. Laffont and W. Sharkey (2002), "The Natural Monopoly Test Reconsidered: An Engineering Process-Based Approach to Empirical Analysis in Telecommunications", *International Journal of Industrial Organization*, Vol. 20, pp. 435-59.
- Gómez-Lobo, A. (2005), "Bottom-up or Top-down Benchmarking in Natural Monopoly Regulation: The Cases of Chile and the United Kingdom", forthcoming in O. Chisari (ed), *Regulation in Latin America*, Edward Elgar, Northhampton, MA.
- Gómez-Lobo, A. and S. Hinojosa (2000), "Broad Roads in a Thin Country: Infrastructure Concessions in Chile," *World Bank Policy Research Working Paper*, No. 2279, World Bank, Washington, DC.
- Gómez-Lobo, A. and M. Vargas (2001), "La Regulación de las Empresas Sanitarias en Chile: Una Revisión del Caso EMOS y una Propuesta de Reforma Regulatoria", *Working Paper*, No. 177, Economics Department, University of Chile, Santiago.
- Gönenç, R., M. Maher and G. Nicoletti (2001), "The Implementation and the Effects of Regulatory Reform: Past Experience and Current Issues", *OECD Economic Studies*, No. 32, pp. 11-98.
- International Monetary Fund (2005), Chile's Selected Issues, IMF Country Report No. 05/316, International Monetary Fund, Washington, D.C.
- Jadresic, A., V. Blanlot and G. San Martin (2001), *La Nueva Regulación*, Dolmen, Santiago.
- Jadresic, A. (2002), "Agenda Pro-crecimiento y Telecomunicaciones," *Perspectivas en Política, Economía y Gestión*, Vol. 6, pp. 129-39.
- Montero, J.P. and H. Rudnick (2001), "Precios Eléctricos Flexibles", *Cuadernos de Economía*, Vol. 38, pp. 91-109.
- OECD (2004), *Competition Law and Policy in Chile: A Peer Review*, OECD, Paris.
- OECD (2005a), *The Relationship between Competition Authorities and the Sectoral Regulators: Contribution from Chile*, Global Forum on Competition, Internal OECD Document, OECD, Paris.
- OECD (2005b), *Roundtable on Bringing Competition into Regulated Sectors: Contribution from Chile*, Global Forum on Competition, Internal OECD Document, OECD, Paris.
- Paredes, R.D. and J.M. Sanchez (2004), "Government Concessions Contracts in Chile: The Role of Competition in the Bidding Process", *Economic Development and Cultural Change*, Vol. 53, pp. 215-34.
- Pollitt, M. (2004), "Electricity Reform in Chile: Lessons for Developing Countries", Unpublished manuscript, University of Cambridge, Cambridge.

Rudnick, H. and R. Raineri (1997), “Chilean Distribution Tariffs: Incentive Regulation”, in F. Morandé and R. Raineri (eds.), *(De)regulation and Competition: The Electric Industry in Chile*, Ilades/Georgetown University, Santiago.

Rudnick, H. (2005), “Un Nuevo Operador Independiente de los Mercados Eléctricos Chilenos”, Unpublished manuscript, Santiago.

Sutton, J. (1991), *Sunk Costs and Market Structure*, MIT Press, Cambridge, MA.

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