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by

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I - INTRODUCTION

Electricity markets are being radically transformed throughout the world. In the last fifteen years, starting with the pathbreaking restructuring of Chile's electricity sector in 1982, at current count Argentina, Australia, Bolivia, New Zealand, Norway, Peru, and the UK, have undertaken reforms that have introduced commercial incentives into the generation, transmission, distribution and retailing of electricity, with, in many cases, large efficiency gains.[1] These transformations have been undertaken against entrenched believes about security, stability, economies of scale, and so on, that were the code-names of the engineering approach to electricity sector design. Instead, now, the code-words are markets, forward contracts, transmission rights, ISO, and recently direct access.

Although much of the academic discussion on the move towards a competitive electricity sector has focused on the organization of the wholesale market and on transmission pricing,[2] there has been very little academic work on what may be the most important component of the reform: namely, direct access from consumers to the energy suppliers, or direct access, for short. Although there are those that claim that regulation can replicate direct access,[3] in the absence of direct access distribution would remain a franchise monopoly. As such, the standard problems with regulated monopolies will persist, even where, as in California today, it is claimed that more enlightened regulatory structures are being developed for the distribution side of the industry. Regulated franchise monopolies will limit customer choice, limit innovation and the introduction of new products. Direct access, on the other hand, brings the potential of eliminating final price regulation, and focusing, instead, on the regulation of wires, a much simpler undertaking, and one where, as in telecommunications, regulating the negotiations between the distributing company and the energy supplier could be sufficient to generate reasonable incentives at the distribution level, without having to grant any type of monopoly franchise.[4]

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[1] See Gilbert and Kahn (1996) for a discussion of some of these experiments.
[2] See, for example, Hogan (1992), Wu *et al* (1996) and references therein.
[3] Hogan (1994) calls the system where customers don't have choice but regulators set distributors' prices, "efficient direct access."
[4] Obviously, complete direct access eliminates cross-subsidization (Black 1994).

Indeed, with direct access distributing companies would be subject to competition on all fronts: First, large users could disconnect from the distributing company's network and connecting directly to the high-voltage transmission network, and purchasing their energy requirements either from a broker or directly in the wholesale market. Second, new expansion of the network could be undertaken by any operator, including an energy supplier that confronts a distributor that overcharges for wires.[5] Third, customers may bypass the retail dimension of the utility, and purchase their energy needs from brokers who provide all billing, measuring and other retail services at lower prices than the utility.[6] These brokers, in turn, have to contract with the distribution company for wire services.[7] Fourth, energy suppliers, or brokers, with more innovative products will be able to cut in the market share of the distributing company in the final customers' market. Thus direct access makes the distribution side of the sector highly competitive, and hence is the key for deregulating the sector.

These different types of bypass have implications for pricing by the distribution company. The first type of bypass is typical of a large industrial user, who can locate close to high-voltage substations. The second type will be relevant in areas of rapid growth. The remaining two types can be undertaken by any customer willing to install a special meter. Thus, pricing will depend on the demographic characteristics of the area the distribution companies serve. Those with high proportion of large users, with high proportion of high income residential users, and providing services in areas of rapid residential and industrial growth will face substantial actual and potential competition from brokers and other direct access providers, forcing distribution companies to reduce their mark-ups over energy costs. Furthermore, because denser areas are easier to bypass by large users, density should bring prices down. Observe, however, that there are large competitive externalities. A large user that connects itself directly to the transmission grid may start providing services to its

[5] These companies will have to enter into interconnection agreements with the distributing company, including, as in Argentina, payments for transmission services undertaken at low voltage levels.

[6] These brokers would have to have a better portfolio of long term contracts.

[7] In the case of Norway, electricity brokers and traders have emerged as new participants in the market. "Brokers" simply match buyers and sellers for a fee. "Traders" act as independent buyers and sellers of electricity. Brokers bear no risk associated with supply obligations while traders bear the risk of meeting supply just as a utility.

surrounding areas, thus increasing competition for residential services. Thus, prices for residential services are expected to be lower in areas with large users.[8]

The jurisdictions that have restructured their electricity system all have introduced some measure of direct access. Chile was the first to introduce direct access: large users have been allowed to negotiate freely with the generating companies to obtain the type of service they would like. In April 1980 contracts with large clients were deregulated, with a floor of 4MW installed capacity. In 1982 the floor was reduced to 2MW. A similar policy was introduced in the Argentinean reforms, where now customers with as little as .5MW can buy directly from the wholesale market.

Norway and New Zealand, though, allow direct access at all levels of demand.[9] In Norway, the Energy Act of 1990 deregulated the electricity market at both the generation and retail levels to allow individual customers and producers to act as independent buyers and sellers. Only the transmission network remained under regulatory control. It operates as a common carrier with regulated access fees and rates. The new system operates to its full extent since May 1992. Bilateral agreements account for most of the electricity sales in the market, even when futures contracts, spot market purchases, and instant market purchases also take place. York (1994) suggests that although any retail customer can shop for a supplier other than the local distribution utility, natural barriers such as costs of changing suppliers tend to restrict participation to the largest customers.

New Zealand introduced direct access as part of its widespread restructuring of the sector. Indeed, there is, since April 1994, free entry into all aspects of the sector, from

[8] An important point is added by Gilbert and Riordan (1995). They analyze the regulation of complementary products and consider, in particular, the case of the bulk energy and transmission as complementary inputs for the electricity supply. One segment of the industry is potentially competitive, while the other segment can be taken as a natural monopoly. They show that, in general, unbundling (i.e. separating each component) introduces into regulation an additional component of information cost that is similar to "double marginalization" in the monopoly pricing of complementary products. However, unbundling may be advantageous if it allows sufficient competition in nonmonopoly services. Thus, the analysis of the degree and the effects of competition becomes even more relevant.

[9] The State of New Hampshire has passed legislation opening direct access from 1998, and so has California, although with a longer waiting period. Three percent of New Hampshire's customers are now subject to a pilot experiment with direct access.

generation to distribution. Furthermore, distribution companies are subject to no price or profit regulation. The most interesting part of New Zealand's approach to the regulation of utilities, is that it is based on common law and antitrust law, rather than on sector specific regulation. Thus, electricity companies are not subject to any particular pricing requirements, although they are subject to accounting disclosure, and to potential litigation. Furthermore, differing from the approach taken in the UK and currently in California, direct access is deregulated completely, leaving it to the parties to determine metering devices and other operational standards, prices, and conditions. The performance of the distribution sector in New Zealand, then, may have important implications for the evolution of distribution regulation elsewhere, as it serves as a natural experiment to test the appropriateness or not of leaving operational details to be negotiated by the parties rather than mandated by the regulators.

The purpose of this research is to empirically analyze some of the preliminary effects of the implementation of direct access in the New Zealand's electricity market, and in particular, to explore to what extent customers' choice has had the effects that economic theory suggests.

II - NEW ZEALAND'S REFORM PROCESS

With the purpose of creating a more competitive business environment and triggered by a constitutional and foreign exchange crisis in 1984, New Zealand launched into a sequence of economic reforms. These reforms encompassed both macroeconomic stabilization and structural change.[10] A major goal was to deepen the role of markets, establish commercial mechanisms, and eliminate administrative regulation as much as possible. Particular attention was paid on the public sector reforms, whose intellectual foundations were institutional economics and contract theory, and where the experience of the United Kingdom provided practical guidance.[11] Trading government departments were converted into state owned enterprises, many of which have since been sold. The legal framework was molded by competition policy that rested on much less regulation in general, and minimal industry-

[10] See Evans *et al* (1996) for a detailed description of the reforms since 1984.
[11] See Henisz (1996).

specific regulation in particular. The distribution section of the electricity sector is a main example of this soft regulation.

Prior to the mid 1980s, electricity distribution authorities were a mixture of departments within local governments and local body Electric Power Boards. They purchased electricity from the country-wide grid of the electricity department of the central government. The grid was supplied by generators also owned by that same government department. Prices to the commercial and small manufacturing sectors were significantly higher than prices to households, implying a significant degree of cross-subsidization.

In 1987, the Electricity Corporation of New Zealand Limited (ECNZ) was formed as a state owned enterprise and the corporatization of generation and transmission took place. It was followed, in 1988, by the deregulation of generation and the removal of the obligation to supply imposed on ECNZ. In 1992, under the Energy Companies Act, the deregulation of electricity continued with the corporatization of the electricity supply authorities. In April 1994, they fully deregulated the retail segment of the industry and gave customers the right to choose their supplier. This right carried with it the requirement that local grids offer transmission contracts for any individual wishing to transport electricity.

The Electricity (Information Disclosure) Regulations introduced a "light-handed" regulatory framework. Information disclosure was implemented to impose further discipline on the performance of monopoly segments of the industry.[12] It includes requirements to disclose audited financial statements which distinguish monopoly activities from competitive activities, contract information, information on pricing policies and methodologies, and other relevant information. ECNZ, however, was not subject to any electricity sector specific regulation, apart from the supply standards and safety regulation. It is, however, subject to the same antitrust and commercial legislation as the private sector.

In July 1994, TransPower was separated from ECNZ and formed as a stated owned enterprise. It owned the main grid and had the responsibility of carrying the electricity of any potential client from an entry point to its destination on the main grid. In 1995 ECNZ was

[12] See, e.g., Teece (1995).

further divided by splitting out 30% of its generation capacity into a state owned enterprise named CONTACT.

In the distribution sector, there is open competition for construction and ownership of new or rebuilt network assets, and entry is open to all. Competition has begun to occur, particularly in conjunction with new development and with retail competition. Since distribution is considered a natural monopoly, separation of line and energy charges has been mandated. The transmission component of the tariffs usually consists of a demand charge, a fixed charge for connection assets, and a transmission service charge. The latter is designed to recover the fixed costs of the transmission network from users with minimum economic distortion. Supply authorities can choose to have their full energy requirements met at fixed time-of-use prices, but most contract for fixed quantities through a two-way hedging contract, with those who use less than their contracted quantities being credited for the difference, and those who use more being charged for the difference, at the spot prices. These spot prices reflect "actual" marginal costs of production as declared by ECNZ.

In the retailing sector, competition to all customers was allowed since April 1994. Some retailers are affiliated with distribution companies and some not, but distributors are required to allow equal access to distribution for all retail competitors. Several strategic alliances have already formed on a dispersed geographical basis. Thus, the number of truly independent energy traders competing on a national basis is relatively small. However, because these traders are no longer closely aligned to any particular local distribution network, the separated lines businesses may have no reason to discourage fairly open competition.

In order to coordinate the market, the Electricity Market Company (EMCO) was established in 1993. It is owned by TransPower, ECNZ, CONTACT and the Electricity Supply Association of New Zealand. The company has established an electricity exchange including a physical spot market and forward markets for short and long term tradable contracts for electricity. The market commenced trading in 1995.

In sum, the electricity industry in New Zealand has been dramatically transformed over the past decade. The reforms, conducted to introduce commercial incentives into all segments of the sector, were accomplished by a variety of means including administrative actions, legal changes, and the promulgation of new legislation. According to the Wholesale Electricity Market Develop Group Report, the benefits of this process have been tangible: between 1987 and 1994, ECNZ's average unit costs have declined and substantial improvements have occurred in efficiency and productivity in distribution and retailing. After corporization, labor and capital productivity showed a generally increasing trend. There has been a movement toward the rationalization of prices, and new businesses supplying retail energy have emerged. Rapid progress has been made on reducing cross-subsidies, while the new organizations were much more oriented toward meeting customers' needs. Culy *et al.* (1996) point out that wholesale supply has achieved impressive economies of staffing and cost-cutting and improved pricing behavior: wholesale prices and unit operating costs have been reduced, while sales volume and profits have increased. Cost reducing was particularly due to reducing staff numbers, automating, contracting out competitively, and negotiating new fuel contracts.

While the reform was taking place, the industry was consolidating. A number of electricity supply firms have merged. Forty one electric energy companies ended 1995 making regulatory disclosures. This is an important decline from sixty one companies in 1986.

Finally, it is worth to note that the Commerce Commission has identified several electricity markets that are routinely evaluated: local distribution markets, retail markets (which can be local or national in scope, depending on the contestability of customer groupings), a national network contracting services market, a national market for the generation and sale of wholesale electricity, and a national market for the ownership and operation of new distribution networks.

III - THE MARKET FOR ELECTRICITY DISTRIBUTION IN 1994-95

The analysis of the New Zealand electricity distribution market developed in this section is based on the data submitted by the Ernst & Young Electric Power Company Information Disclosure Analysis 1995. It has been prepared from the information disclosed by electric power firms under the Electricity (Information Disclosure) Regulations 1994. The report is a compilation of the key financial and operational performance disclosures of all forty three New Zealand electric power companies for the year ending March 1995. It provides considerable information on the relative performance of power firms and give the first insight into the separated monopoly and contestable businesses of these companies.

As of March 1995 New Zealand had forty three electric power companies, with fifteen based in the South Island and twenty eight in the North Island. The industry ownership structure is largely dominated by community based entities such as Trusts (24) and Local Government Authorities (11). The continuing trend of ownership changes is, however, seeing an increasing number of company ownership structures dominated by private investors, along with a greater number of companies publicly listed (8). On average, local government owned firms have been the best performers in terms of net profits margin across the total business.[13]

During the year under analysis, the total electricity distributed (after distribution losses) was 23,000 GWh., but it must be noted that the nine largest firms concentrated the 61% and the five largest companies, the 48% of total. As expected, larger firms are located in regions with high density (in terms of line business customers per circuit kilometer of line).

The average system length per firm was around 3,000 km., with a considerable dispersion ranging from 952 km. to 12,692 km. The total number of customers was 1.6 million, i.e. an average of 38,000 per company. The dispersion across firms here was also important, ranging from 4,238 to 242,859 customers. Again, the nine largest companies concentrated 59% of the customers.

The accounting rate of return for the distribution business range from -0.1% to a high of 10.9%, with an average of 4.6%. It is perhaps too soon to form a view on the appropriateness of the level of returns. However, on an average basis, it does not appear that the industry is extracting significant monopoly rents. The local government ownership

[13] Ownership type is defined as at 31 March 1995. Where the ownership type is mixed, the majority ownership determines the classification. Ownership types are as follows:
Public: The dominant ownership of the company is through publicly-held shares, or through private investors other than a trust or local government.
Trust: The dominant ownership of the company is a trust. This category also includes other structures such as co-operatives and "to be decided" ownership.
Local government: The dominant ownership of the company is through a local government authority.

structure has produced the highest returns. This is partially due to the fact most local government-owned networks are in high density areas that enable greater operational efficiencies. Alternative performance indicators also show considerable differences in the profitability of the line businesses. The net profit after tax margins, for example, range from -6.7% to 32.4%, with an average of 12.6%.

It is worth to note that eight companies also operate in the generation business. The net profit after tax margins are largely higher than in the line business: 29.7% as average, with a minimum of 22.1% and a maximum of 50.1%. This might reflect a lower degree of competition in this segment than in the distribution business.

A more detailed assessment of profitability can be made by comparing the line business revenue and costs on a per customer and per kilometer basis. Table I summarizes these indicators, discriminating by density.

Table I

DENSITY	LINE BUSINESS REVENUE		LINE BUSINESS COSTS	
	$/km.	$/Cust.	$/km.	$/Cust.
HIGH	14,181	693	4,237	207
MEDIUM	6,138	700	2,471	282
LOW	3,204	724	1,573	355
AVERAGE	8,712	697	2,979	238

The revenue per customer during the period under analysis was, on average, $700, ranging from $ 409 to $ 995. It was larger in less dense areas. In terms of revenue per kilometer, the mean was short of $ 9,000, while the minimum was $ 1,919 and the maximum $ 42,970. As expected, this ratio was larger as density increases. It is important to note that local government-owned line businesses had the highest revenue per customer, partially explaining their relatively good performance.

As seen in the Table, total line business costs per kilometer were higher as density increases, while on a per customer basis, they were higher in less denser areas.

In general, direct line costs were 21.1% of line revenue (ranging from 6.6% to 50.1%). On a per kilometer basis, these costs were, on average, $ 1,800, with a minimum of $ 357 and a maximum of $ 5,222. Lower direct line costs appears to correspond to companies operating in low density areas.

Indirect line costs represented 18.7% of line revenue, ranging from 4.4% to 51.7%. On a per customer basis, these costs were, on average, $130, with a minimum of $ 32 and a maximum of $ 390. In general, smaller companies incurred higher indirect costs.

It has to be stressed that trust owned companies had the lowest cost structure per customer as well as the lowest cost per kilometer. This is probably due to the dominance in this ownership structure of low density, rural networks with greater line lengths over which to spread fixed costs.

The different profitability performances can partly be explained by considering load factors and capacity utilization. The load factor is a measure of how even or constant the peak demand on a company network is throughout the year. It depends on the load profile of the customers of each electric power company. The load factor can be used as an indicator of the inherent ability of the company to maximize the return on invested capital. The average load factor was 58.4, ranging from 45.1 to 72.0. In general, higher load factors were found in medium and low density areas.

Capacity utilization is a measure of whether the transformers in the networks are adequately utilized. The average capacity utilization was 34.4, while the minimum was 13.8 and the maximum achieved 63.3. The results suggest a correlation between density and capacity utilization. High and medium density areas show higher performances than low density regions. In a high density area, a transformer can provide supply to a large number of customer with greater load diversity.

Table II summarizes these indicators, discriminating by density.

Table II

DENSITY	LOAD FACTOR %	CAPACITY UTILIZATION %
HIGH	53.97	37.10
MEDIUM	61.68	34.46
LOW	58.74	29.94
AVERAGE	58.37	34.44

Alternative reliability indicators provide some information on the quality control standards each company has adopted for their network operations.[14] The results indicate a predictably strong correlation between network reliability and density. For high density areas, they show that networks which are interconnected suffered shorter interruption times.

IV - THE INTRODUCTION OF DIRECT ACCESS

In April 1994 the distribution segment of the industry became fully deregulated. This gave customers the right to choose their supplier. As mentioned, competition has begun to occur, particularly in conjunction with retail competition. Some retailers are affiliated with distribution companies, but distributors are required to allow equal access to distribution for all retail competitors.

After only one year of disclosures it is very difficult to assess if there are any trends developing in line charges that may indicate pressure from either competition or regulatory forces. The electricity retailing business is where greater competition is expected, with significant restructuring in retail tariffs and contracts since deregulation. One indication of the level of competition in the electricity retailing area is the electricity distributed on a distribution company's network on behalf of others. This provides an indication of the sales lost by each incumbent electricity retailer due to competition.[15] The total amount of electricity distributed on behalf of other parties was 1,510 GWh., corresponding only to 6.6% of the total electricity distributed. Twenty one out of the forty three companies distributed electricity for other parties, almost all of them operating in areas of high and medium density. Five companies account for the 92% of the electricity distributed under those arrangements, losing between 15% and 36% of their respective sales.

Tables III and IV show various variables for three diverse aggregates of companies, ranked by size. The first row corresponds to all the forty three distribution firms that operated in the year ending in March 1995. The second row corresponds to the twenty one companies

[14] These indicators include different ratios considering the number of faults and interruptions, the duration of interruptions, and the number of customers affected by them.
[15] It must be noted, though, that the results might be somewhat misleading as the electricity retailing operations of some companies are undertaken by another party, in which the company has an interest.

that distributed electricity for other parties. Finally, the third row presents information for the five companies that account for the 92% of the electricity distributed for others.

Table III provides some demographic features of the areas covered by each aggregate of companies. It is useful to check the relationship between demand characteristics and the effect of competition discussed above. It includes the following variables: number of customers (**CUST**), maximum demand in kW (**MAXD**), maximum demand per customer also in kW (**MDCUST**), and revenue per customer (**REVCUST**). All variables are shown in terms of average per firm.

Table III

COMPANIES	CUST	MAXD	MDCUST	REVCUST
43 FIRMS	37,754	112,190	2.9	692
21 FIRMS	54,271	166,104	3.0	705
5 FIRMS	67,780	216,948	3.3	719

It can be seen that the companies that lost sales by distributing electricity on behalf of others had, on average, more customers, a higher maximum demand per user, and a higher revenue per customer. These results appear to be consistent with the fact that those firms operated in high and medium density areas, with a higher proportion of large users and high income customers.

In Table IV, information related to pricing and cost efficiency are shown. It includes, again in terms of average per company: revenue per kW (**REVKW**), total line costs per customer (**TCCUST**), direct line costs as a percentage of revenue (**DLC/REV**), and direct line costs per kilometer (**DLC/KM**).

Table IV

COMPANIES	REVKW	TCCUST	DLC/REV	DLC/KM
43 FIRMS	5.1	286	23.1	1841
21 FIRMS	4.9	293	25.0	2499
5 FIRMS	4.4	308	27.0	2393

Companies that distributed electricity for others received, on average, a lower revenue per kW, but incurred in higher costs per customer, per kilometer, and as a proportion of revenue, suggesting they operated relatively in an inefficient way. These results indicate that firms that faced competition in the retailing segment of the industry were forced to have lower prices and smaller mark-ups over energy costs.

An additional aspect deserves attention. In general, companies chosen by direct access providers to distribute electricity for them were more reliable than the average. All reliability indicators reflected, on average, a better performance developed by firms distributing electricity for other parties. Table V shows two of the reliability indicators suggested by Ernst & Young: the system average interruption frequency index (**SAIFI**) and the system average interruption duration index (**SAIDI**).[16]

Table V

COMPANIES	SAIFI	SAIDI
43 FIRMS	3.9	277.9
21 FIRMS	2.9	206.8
5 FIRMS	2.9	200.9

It must also be recalled that some distribution companies have interests on retailing firms. This fact encourages the distribution firm to remain essentially a line company, while allowing the affiliated energy trader to supply contestable customers. Actually, this appears to be the case of a firm that has lost a considerable proportion of sales and has accounted for the 62% of the total electricity distributed on behalf of others.[17]

To summarize, this description suggests, as discussed above, that demographic features influence pricing behavior of firms facing retail competition. Retail competition seems to be taking place mostly in denser areas, with a higher proportion of large, high income users, and setting lower prices and mark-ups.

V - SOME PRELIMINARY ECONOMETRIC RESULTS

[16] The system average interruption frequency index is defined as the ratio of the number of customers affected by the interruptions and the average number of customers to which the line business supplies electricity. The system average interruption duration index is defined as the ratio between the sum of interruption duration for all interruptions and the average total number of customers.

[17] Power NZ distributed 936.4 GWh on behalf of others, corresponding to the 36.45% of its total electricity distributed. Power NZ is now essentially a line company affiliated with an energy trader, Pacific Energy.

Based on the previous analysis and using the information contained in the Ernst & Young report, we report some empirical results of estimating the extent of direct access across the different distribution companies. As mentioned, the period under study is the year ending March 1995 and the data comes from the information disclosed by the forty three New Zealand electric power firms under the Electricity (Information Disclosure) Regulations 1994.

V.1 - Exogenous and Endogenous Variables

We use three (obviously related) dependent variables:

LEDBO = log of electricity distributed on behalf of other parties;

DEDBO = 1 if the firm distributed electricity for others, 0 otherwise; and

LPORC = log of the proportion of electricity distributed for others with respect to total sales.

Those used as explanatory variables are:

LDCC = log of the direct line costs per customer;

LLOAD = log of the load factor, defined as the ratio of the annual amount of electricity entering the system to the corresponding maximum demand;

LCAP = log of the capacity utilization, defined as the ratio of maximum demand to transformer capacity;

LCUST = log of the number of customers;

SAIFI = system average interruption frequency index, defined as the ratio of the number of customers affected by the interruptions and the average number of customers to which the line business supplies electricity; and

GEN = dummy variable equal to 1 if the company operates in the generation segment of the industry, and 0 otherwise.

The rationale for using these explanatory variables is as follows: first, direct line cost per customer is a measure of how expensive the network is. Holding constant other network characteristics, the higher line costs are, the higher the probability of direct by-pass. Thus, to avoid bypass, the network operator will offer selective discounts that will trigger, instead, direct access. Second, a high load factor reflects that the distribution company adjusted its prices to even out consumption throughout the day. As such, temporal cross-subsidies have been reduced, and as a consequence, the incentive for direct access has fallen. Thus, we should expect that the higher the load factor, the lower the penetration of competitive suppliers. On the other hand, a high value for capacity utilization, reflects the fact that maximum demand is close to transformer capacity. There is room, then, for innovative pricing that sheds load in an efficient fashion. In other words, there is need for assurance of supply, which direct access can provide. Thus, we should observe that high capacity utilization should trigger a higher percentage of direct access. Fourth, the marketing of retail services are easier in environments with higher number of customers. Thus, direct access should be more common for distribution companies with large amount of customers. Fifth, direct access would not be very good if network maintenance is a problem. Since direct access usually will not involve maintenance, direct access customers still have to depend on the distribution company for their maintenance work. If the network is of low quality, the fear that direct access customers will be discriminated against will reduce their incentives to purchase their energy supplies from a competitive supplier. Thus, we should observe that the lower the quality of service the lower the penetration of competitive suppliers. Finally, we include a dummy for whether the distribution company also generates power. The reason is that distribution companies with their own power plants could, under some conditions, reduce the probability of a system-wide black-out affecting their own customers. This would increase the quality of supply, and hence the penetration of direct access.

V.2 - Empirical Results

The analysis is developed in three steps. First, a probit model is estimated to identify the demographic and operational factors affecting the probability that a company is chosen to distribute electricity on behalf of other parties.[18] Next, and given the censored nature of the data, tobit models are developed in order to analyze on the one hand the effect of the different demographic an operational factors on the amount of electricity distributed for others and on the proportion of this amount with respect to the total electricity distributed by each company. **LEDBO** and **LPORC** are the dependent variables of these models respectively.

[18] In such a model, **DEDBO** is the relevant dependent variable.

Table VI

	PROBIT		TOBIT		TOBIT	
Dependent variable	**DEDBO**		**LEDBO**		**LPORC**	
CONSTANT	**3.40**	**(0.30)**	**-11.91**	**(-0.92)**	**-15.99**	**(-0.63)**
LDCC	**5.46**	**(2.76)**	**5.83**	**(3.40)**	**11.18**	**(3.31)**
LLOAD	**-6.95**	**(-1.91)**	**-5.11**	**(-1.62)**	**-9.93**	**(-1.61)**
LCAP	**1.65**	**(1.43)**	**2.54**	**(2.14)**	**4.65**	**(2.00)**
LCUST	**2.01**	**(2.47)**	**3.05**	**(3.67)**	**4.55**	**(2.80)**
SAIFI	**-0.41**	**(-2.58)**	**-0.44**	**(-2.80)**	**-0.86**	**(-2.77)**
GEN	**0.79**	**(1.08)**	**---------**		**---------**	
SIGMA	**---------**		**1.74**	**(5.88)**	**3.41**	**(5.90)**
R^2	**0.50**		**---------**		**---------**	
Fraction of correct predictions	**0.84**		**---------**		**---------**	

Table VI presents the main results.[19] The values between parentheses correspond to the respective *t*-statistics of the estimated coefficients, and the **SIGMA** value reflects the coefficient of the inverse Mills ratio in the tobit models. In the first column, the key factors that appear to determine whether or not a company will distribute electricity for others are the direct line costs, the number of customers, and the average interruption frequency index. The load factor and the capacity utilization also seem to play an important role in this process. Thus, the probability of a firm to face retail competition increases as it operates inefficiently in a large demand area, but with high reliability standards. Apparently, retailers are able to successfully enter in large demand, dense areas, where incumbents are not distributing electricity efficiently, but they try to reduce their risks by contracting with relatively reliable distribution companies.

The fraction of correct predictions is considerably high (84%) for the whole sample. This indicator is also high for each subsample (those firms who distributed and those who did not distribute electricity for others): 86% for the former, and 82% for the latter.[20]

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[19] Several other variables related to revenue, ownership type, company's size, and whether or not the firm was in the north island, had no impact on the probability of, or amount of, direct access.
[20] These results are virtually the same when the probability model was estimated using a logistic function.

The second and third columns give essentially the same results. The amount and percentage of electricity distributed for others are essentially linked to the same factors that determine whether or not a firm will face direct access competition (demand size, cost efficiency, and reliability), as well as to the capacity utilization and the load factor. Recall that, in general, the capacity utilization is low across companies in the industry, but it is highly correlated with density. It reinforces the intuition that the denser the area, the higher the scope for retail competition.[21]

Finally, Table VII adds some quantitative information to the study. The Table shows how much the probability in the probit model increases as each relevant variable increases in an amount equivalent to its standard deviation.

Table VII

dProb./d(STD)	**PROBIT**
Dependent variable	**DEDBO**
Log of Direct Line Costs per Customer	**0.24**
Log of Load Factor	**-0.14**
Log of Capacity Utilization	**0.09**
Log of Number of Customers	**0.16**
System Average Interruption Frequency Index	**-0.22**
Generation Dummy	**0.03**

Table VII shows that relatively modest changes in some of the relevant explanatory variables (in particular, those related to demand size, reliability, and cost efficiency) might have important effects on the probability of a company to be chosen for distributing electricity for others. It provides some indication that the distribution sector faces incentives to improve operational efficiencies and to rebalance prices so as not to lose market share to retailing competitors.

[21] The residuals are well behaved in both models. We found no evidence of heteroskedasticity. Also, in order to test the robustness of the results, we run the three models omitting Power NZ (the only clear outlier), and the results were virtually the same. For example, the estimate coefficients for the probit model excluding Power NZ are the following, with t-statistics in parentheses: LDCC 5.40 (2.72); LLOAD -6.70 (-1.75) LCAP 1.58 (1.34); LCUST 1.97 (2.33); SAIFI -.41 (-2.58); GEN .80 (1.08). As can be seen, the results are almost identical. Thus, Power NZ is not contaminating the results.

VI - CONCLUSIONS

New Zealand introduced direct access in the electricity industry as part of its widespread restructuring of the sector. Since April 1994, there is free entry into all aspects of the sector, from generation to distribution. Furthermore, distribution companies are subject to no price or profit regulation.

In this paper, we analyze some of the initial effects of distribution deregulation, in particular of allowing customer direct access. Although after only one year of direct access it may be too soon to derive very strong implications, what we find is that the companies that lost sales had, on average, more customers, a higher maximum demand per user, and a higher revenue per customer. These results appear to be consistent with the fact that those firms operate in high and medium density areas, with a higher proportion of large users and high income customers. They received, on average, a lower revenue per kW, but incurred in higher costs per customer, per kilometer, and as a proportion of revenue, suggesting they operated inefficiently. These results indicate that firms that faced competition in the retailing segment of the industry may have been forced to have lower prices and smaller mark-ups over energy costs. In general, companies chosen by direct access providers to distribute electricity for them were more reliable than the average. In sum, even after only one year of operation, and realizing that in New Zealand there is no regulation concerning how direct access is to be implement (like metering standards or access protocols), direct access is having, at least qualitatively, the expected effects. Thus, the fact that New Zealand has allowed direct access without imposing operational standards on direct access suppliers seems not to have been a detriment to the appearance and development of retail competition. Electricity sector reformers should pay closer attention to this result.

REFERENCES

Black, B. (1994): "A Proposal for Implementing Retail Competition in the Electricity Industry", The Electricity Journal, October.

Blumstein, C. and J. Bushnell (1994): "A Guide to the Blue Book: Issues in California's Electric Industry Restructuring and Reform", The Electricity Journal, September.

Carroll, A. (1991): "Agency Issues of the Firm and their Application in an Institutional Comparison", mimeo.

Culy, J., E. Read, and B. Wright (1996): "The Evolution of New Zealand's Electricity Supply Structure", in International Comparisons of Electricity Regulation, Gilbert and Kahn Eds., Cambridge.

Electricity Market Company, Dispatch Working Group (1995): several discussion papers.

Ernst & Young (1995): Electric Power Company Information Disclosure Analysis, Energy Consulting Group, New Zealand.

Evans, L., A. Grimes, B. Wilkinson, and D. Teece (1996): "Economic Reform in New Zealand 1984-95: The Pursuit of Efficiency", mimeo.

Gilbert, R. and M. Riordan (1995): "Regulating Complementary Products: A Comparative Institutional Analysis", Rand Journal of Economics, Vol. 26.

Glynn, R. (1994): "Offering Customers Direct Access: Using Choice to Stimulate Competition", The Electricity Journal, December.

Greene, W. (1993): Econometric Analysis, second edition, Prentice Hall.

Henisz, W. (1996): "A Case Study of the Institutions and Governance of Economic Reform: New Zealand's State Owned Enterprises", University of California, Berkeley.

Hogan, W. (1992): "Contract Networks for Electric Power Transmission", Journal of Regulatory Economics, Vol. 4, N° 3.

Hogan, W. (1993): "Electric Transmission: A New Model for Old Principles", mimeo.

Hogan, W. (1994): "Efficient Direct Access: Comments on the California Blue Book Proposals", The Electricity Journal, September.

Holmstrom, B. and P. Milgrom (1991): "Multi-task Principal and Agent Analyses: Incentive Contracts Asset Ownership and Job Design", Journal of Law, Economics and Organization, Vol. 7.

Mc Fadden, D. (1984): "Econometric Analysis of Qualitative Response Models", in Handbook of Econometrics, Vol. II, Griliches and Intriligator Eds.

Oren, S., P. Spiller, P. Varaiya, and F. Wu (1995): "Nodal Prices and Transmission Rights: A Critical Appraisal", The Electricity Journal, April.

Pace, J. (1995): Affidavit in the High Court of New Zealand, September 29th.

Ruff, L. (1994): "Stop Wheeling and Start Dealing: Resolving the Transmission Dilemma", The Electricity Journal, June.

Shuttleworth, G. (1994): "Electricity Transmission Pricing: Contracts Must Reflect Costs", The Electricity Journal, December.

Spiller, P., A. Cox, and D. Teece (1994): "Transmission Pricing Issues in New Zealand", mimeo.

Spiller, P. and L. Viana (1996): "How Not to Do It: Electricity Regulation in Argentina, Brazil, Uruguay and Chile", in International Comparisons of Electricity Regulation, Gilbert and Kahn Eds., Cambridge.

Teece, D. (1995): Affidavit in the High Court of New Zealand, September 25th.

Wu, F., P. Varaiya, P. Spiller, and S. Oren (1996): "Folk Theorems on Transmission Access - Proofs and Counterexamples", Journal of Regulatory Economics, pp. 5-23.

York, D. (1994): "Competitive Electricity Markets in Practice: Experience from Norway", The Electricity Journal, June.