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Cartel Stability in the Electricity Industry: The Case of Electricity Distribution in Madrid in the Inter-War Period

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The objective of this paper is to analyze the factors that led to cartel stability in the electricity industry in Madrid from 1913 to the Civil War. This electricity distribution cartel is of interest because it lasted for more than two decades. Among the factors that accounted for internal cartel stability were: similar economic power of the firms (market share and financial backing), the large number of small customers, the fact that demand exceeded supply, the revenue sharing, and regulation. Internal instability came mainly from cost asymmetry. Regulation played an important role in the cartel's achieving external stability, as did the neutralization of the gas company by the cartel's members.

The Electric Industry before the Cartel Agreement

The electric power industry in Madrid until 1910 was formed by one large utility with a market share of 50 percent, two medium firms with 25 and 15 percent of the market, respectively, and eight small power stations that shared the remaining 10 percent. Unlike other large cities, the municipal authorities in Madrid never granted exclusive rights to serve a specific area of the city. The result was overlapping networks (as many as four in some streets), which facilitated several outbreaks of competition from 1891 to 1913.

Coal generation plants produced the majority of the electricity consumed. This changed in 1910 when long distance transmission brought hydroelectricity to Madrid, generated by two hydropower stations situated at 80 and 250 km from the city. One was Sociedad Hidroeléctrica Española (Hidrola), founded by Basque and Madrilenian financiers; the

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other was Salto de Bolarque, financed by the Urquijos, the founders of one of the major industrial banks of twentieth-century Spain. The lower generating costs of hydroelectricity and powerful financial backing put the two new players in a strong position to enter the market.

In 1909, Hidrola and Urquijo tried to reach an agreement with the largest company in Madrid, Sociedad General Madrileña de Electricidad (Madrileña), to act together as producers in the Madrilenian market. At the same time, they were to reach an agreement that the rest of the companies would become distributors only, and cease production in their own power stations. The planned agreement envisaged that the producers would get 40 percent of the income and the distributors 60 percent. They never reached an agreement, however, and at the beginning of 1910 competition started amongst the incumbent firms. One outcome of was the reduction of residential electricity rates by 40 percent by the end of July.[1]

Following this, Hidrola decided to create its own distributor, Cooperativa Electra Madrid (Electra). This option required a large investment, which was the main barrier to entry, but had the advantage of placing the company in a better position than its rivals because of its much more modern and efficient network.[2] Through a political imbroglio, the Hidrola board managed to get an agreement with the City Council for the company to pay a fixed amount, independent of the extension of the network, to sell residential electricity at the maximum rate of 0.60 ptas/kwh with the condition that Electra's assets would become municipal after 60 years.[3] For the Council, aimed at reducing electricity cost for Madrilenians, this rate seemed very favorable, representing a 40 percent reduction. However, it was also perfectly compatible with the company's profitability due to the lower cost of hydroelectricity generation. In addition, the Council almost automatically granted permission for the extension of cables. The advantageous conditions given by the Council, the cheap electricity from Hidrola, and the availability of capital allowed Electra to extend 41km of cables in 6 months. By the beginning of 1911, it was present throughout the whole of the center of Madrid.

During 1910, multiple negotiations amongst all players took place. The Urquijos put forward different proposals to Madrileña that included leasing with an option to buy the hydropower station and just distributing the electricity they produced. By the end of 1910, they had negotiated an agreement with Hidrola to equally share the market. The deal anticipated a one-year period for reaching an agreement with the existing companies.

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[1]Anna M. Aubanell Jubany, "La competencia en la distribución de electricidad en Madrid, 1890-1913," *Revista de Historia Industrial* 2 (1992): 163-65.

[2] For the development of Hidrola see: Anna M. Aubanell Jubany, "Estrategia empresarial y estrategia financiera de la Sociedad Hidroeléctrica Española, 1907-1935," *Revista de Historia Industrial* 17 (2000): 153-85.

[3] *Boletín Oficial del Ayuntamiento de Madrid* (1910): 531.

Otherwise, they would supply the entire market through Hidrola's distributor. In January 1911, negotiations took place in Paris between Madrileña, Urquijo, and Hidrola that led to an agreement to share the electricity market in Madrid. The companies decided to divide the total revenue depending on the level of sales achieved, as outlined in the Table 1.

TABLE 1
Distribution of revenue in the Paris Agreement

Revenue (ptas)	Electra (%)	Madrileña (%)	Producers (%)
4,000,000	20.00	54.25	25.75
6,000,000	28.00	44.50	27.50
8,000,000	33.00	39.63	27.38
10,000,000	33.00	35.70	31.30

Source: Minutes Board of Directors SHE, 31 Jan. 1911

The agreement was short lived; it had collapsed by the end of the year. Although Urquijo accused Hidrola of not complying with the agreement, it seems obvious that the former caused the break because they had the most to gain. Urquijo began negotiations with the French committee of the Madrileña that culminated in the merger of Madrileña and the electricity business of Urquijo, formally founding the new company, Unión Eléctrica Madrileña (Unión), in February 1912. In this scenario, the Urquijos were much better off, as illustrated by the data in Table 2, which shows a comparison between the Paris agreement and the new scenario. Columns two and three show the distribution coefficients for Electra and its parent and the newly created Unión. The fourth shows the Urquijo share under the Paris agreement; the last shows its share after the merger.

TABLE 2
Distribution of Revenue between Two Groups

Revenue (ptas)	Hidrola-Electra (%)	Unión (%)	Urquijo Paris (%)	Urquijo Unión (%)
4,000,000	32.87	67.12	12.87	28.98
6,000,000	41.75	58.25	13.75	25.15
8,000,000	46.68	53.31	13.68	23.02
10,000,000	48.65	51.35	15.65	22.17

Source: Elaborated from Minutes Board of Directors SHE, 31 Jan. 1911

These data clearly show the incentives Urquijo had to break the agreement and to opt for a merger with the main incumbent. By the end of 1911, the two hydro producers had solved the problem of selling their

production, Hidrola by creating its own distribution company and Urquijo by merging with the largest existing company. The ongoing competition during 1911 forced the small companies to sell or rent their installations to one of the two new groups.

With two medium players still in the market, and Electra needing to extend its market, a price war broke out. A 33 percent price cut in October 1911 was followed in February 1912 by a further 37.5 percent reduction, and another 20 percent a month later. The residential rate was reduced from 1 pta/kwh in mid 1910 to 0.20 ptas/kwh in March 1912. Those rates were very low for the period. In comparison, average U.S. residential rates were 10 cents/kwh in 1910 and 8 cents/kwh in 1915 (0.50 and 0.40 ptas/kwh respectively).[4]

The number of customers doubled in 5 years (from 47,622 in 1909 to 95,289 at the end of 1914). As expected, the company that profited most from the price war was Electra, which entered the market in 1910 and had conquered half of it by March 1913.

Agreement Reached

With the same market power, the Cooperativa Electra Madrid and Unión Eléctrica Madrileña relatively easily reached an agreement, which they signed on February 21 1913. The two companies agreed to share the electricity distribution market in equal parts. Both groups would "distribute practically the same number of kilowatts, divided in approximately the same number of customers."[5] Note that the agreement did not imply dividing the city into two areas where each firm would act as a monopolist. The two companies continued to have overlapping networks over almost the entire city. Thus, competition could start at any moment with no new investment required.

The market was limited to supply contracts of less than 75kw measured by meter or to 15kw for flat rates. The reason for this restriction was the arrangement established between Electra and its parent: Hidrola itself reserved the right of distribution to bigger customers.

The agreement contemplated the creation of the Distributors Mixed Committee, which had the task of developing the rules of the Cartel. It would also oversee its functioning. The rules developed by the Committee show that it was a shared monopoly where firms jointly fixed rates and divided customers.[6] In other words, the rate structure was common and the market share fixed.

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[4] William M. Emmons, "Franklin D. Roosevelt, Electric Utilities, and the Power of Competition," *The Journal of Economic History* 54 (Dec. 1993): 888.

[5] Minutes Board of Directors, UEM, 21 Feb. 1913, Headquarters of Union Fenosa, Madrid, where the agreement was transcribed.

[6] Minutes of Comité mixto, 13 March 1913, folder 496, Archivo Fundación Antonio Maura, Madrid.

The jointly agreed price structure set the maximum rates at 0.60 ptas/kwh for lighting and 0.25 ptas/kwh for power. These rates kept Electra in compliance with the agreement signed with the City Council in 1910, which did not allow higher rates. Thus, the cooperative price did not reach the monopoly level, but it was well above the competitive price.

Customers were relatively free to choose their electricity supplier. The Committee's rules established that firms could accept new customers in those buildings that they served exclusively; in buildings where both or neither of the firms were present the managers of the two firms would jointly decide how to share them. Two years later this rule was modified and alternative assignment of new buildings depended on technical considerations and the customer's will.

The firms agreed to exchange the weekly movements of customers, sharing information with each other. The absence of antitrust laws in Spain meant they did not encounter the problems they would face due to antitrust legislation in the United States.

The fourth and final clause of the agreement established sharing the joint revenue (after deduction of the expenses of the Committee) at 50 percent between the two firms. They created a joint payments collection service with one section for each company, which included an inspector from the other company. The original idea was that those sections would collect payments independent of the firms, but this did not happen. Nonetheless, at the end of every month they equally split the total revenue.

Cartel Stability

A cartel contains the seeds of its own undoing because it sets prices above the competitive level and marginal revenue for a firm is greater than its marginal cost. This creates a clear incentive to cheat. Once a cartel agrees on prices that would maximize industry profits, a free-rider has the incentive to reduce price, increase its production, and, as a result, its profits.

A cartel is stable if it has both internal and external stability. Claude D'Aspremont et al., noted that a cartel will be internally stable if the departure of one of the members reduces prices sufficiently to make defection unprofitable, assuming that firms are identical in a price-setting cartel and that the cartel's objective is joint profit maximization.[7] A cartel will be externally stable if, when a firm joins, the resulting price increase is sufficient to compensate for the higher profit earned by free riding.

The cartel's stability depends on the incentives to cheat, the capability of detection, and the effectiveness of prevention strategies.

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[7]Claude D'Aspremont, Alexis Jacquemin, Jean Jaskold Gabszewicz, and John A. Weymark, "On the Stability of Collusive Price Leadership," *Canadian Journal of Economics* 16 (Feb. 1983): 17-25.

Internal Stability

Incentives to cheat have a direct relation to the demand's elasticity. If demand is elastic, a firm will increase profits, because the increase in the quantity sold more than compensates for the reduction in price. There is evidence that electricity demand was elastic between 1913 and 1930 and inelastic from 1931, so there would have been incentives to cheat before 1930.[8]

The demand structure also plays a role in Cartel stability. A small number of customers with infrequent sales make cheating easy because a firm can obtain large profits by reducing the price to capture another big customer before its defection is detected. The number of customers in Madrid was 81,000 in 1913, 132,000 10 years later, and 199,000 in 1935. This large number of customers would discourage cheating. Consumption per customer was small (246 kwh a year in 1913, 345 kwh in 1923, and 375 kwh in 1935).[9] Because of such small, infrequent electricity sales, the temptation to cheat was low because a price decrease would not result in a large increase in the quantity sold before cheating would be detected.

Thomas Ulen stresses the importance of the economic cycle in U.S. railway cartel stability. In the expansive phase of the cycle, when firms' market share was equal to capacity, the cartel was stable and firms did not have any incentive to cheat. However, when demand decreased, excess capacity incited firms to lower prices in order to increase sales.[10] In Madrid, demand was always above capacity until 1927. In 1928 there was an excess of production, but consumption grew sufficiently to absorb it, and only in 1933 did supply begin to exceed demand. This was another factor explaining the Cartel stability until the thirties. Thus, until 1930 elastic demand and no excess capacity neutralized the incentive to cheat, as did the large number of small customers.

The different cost structures of the two firms acting in the Madrilenian market were the main source of instability. The Cartel agreement set the price level and the rate structure for firms, but they were free to offer the type of contract (by meter or flat rate) that would suit their individual cost structure best.

Electra was a distribution company with a peculiar cost structure because it did not pay for the number of kilowatts received. Hidrola, its parent and supplier, had set a gross profit percentage as payment for the electricity supplied. That is, once installation, maintenance, and administration costs were deducted, producer and distributor shared the

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[8] Based on Unión annual data. The elasticity of demand was calculated from total electricity consumption (low and high voltage). Anna M. Aubanell Jubany, *La industria eléctrica y la electrificación de la industria en Madrid entre 1890 y 1935*, PhD thesis, European University Institute (Florence, 2001), 365.

[9] Anna M. Aubanell Jubany, *La industria eléctrica*, 584-85.

[10] Thomas Ulen, "Railroad Cartels before 1887: the Effectiveness of Private Enforcement of Collusion," *Research in Economic History* 8 (1983): 125-44.

rest. Any electricity distributor cost function depends on the cost of capital, price of kilowatts, and distribution costs that include the kilowatts lost in the network, invoicing, collection of payments, and so forth. The revenue function depends on the price vector and the different quantities sold. Therefore, profit maximization depends on the price at which electricity is bought, the rates for which it is sold, the sales structure, and the distribution costs. In the case of Electra profit maximization did not take into account the cost of buying electricity, but only the rate structure, quantity sold, and distribution cost. It did not have to consider generation costs.

Electra's strategy was to maximize revenue and accordingly promoted flat-rate contracts, because they meant an increase in revenue. The profit those contracts yielded was lower than contracts by meter. Flat rate contracts had a fixed price related to the kilowatts installed. Customers had no incentive to limit the use of electricity, and therefore their consumption increased. On the other hand, Unión, which was both generating and distributing electricity, tried to avoid flat rate contracts because it was taking into account the costs of producing electricity.

In 1913 when the Cartel established its rates, the electricity companies tried to increase the minimum watts installed for the flat rate contracts from 16 to 24 watts.[11] They had to back down due to customer pressure. The price war had made electricity available to the lower income groups that could barely afford to pay for a 16 watts contract.

These different strategies generated a different customer structure. Electra had more clients than Unión, 107,255 versus 91,179 in 1935. Electra served between 52 and 56 percent of the Madrilenian customers from 1914 to 1935.[12] This difference was against the intent of the agreement to have the same number of customers, and thus dissatisfied Unión managers: "Electra only cares about the increase in revenue with no consideration for the excess of production that the flat rate market demands."[13] Why then did Unión not break the agreement?

Electra's strategy benefited Unión because they were sharing joint revenue in equal parts. The reasons why Unión disagreed with the strategy, apart from having fewer customers, were that flat rate contracts increased the costs of the joint collection of payments unit and gave customers the option of a cheaper service. The question is: could those customers on flat rate contracts have afforded metered electricity? Because we can argue that they could not, Unión did not lose many customers in the end. The different cost structure of the two firms

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[11] The minimum flat rate contract was for a lamp of 16W costing 1.6 ptas a month. Minutes of Comité mixto 6, 13 and 15 March 1913, folder 496, Archivo Fundación Antonio Maura, Madrid.

[12] Anna M. Aubanell Jubany, *La industria eléctrica*, 584-85.

[13] Minutes Board of Directors UEM, 27 May 1922.

introduced instability in the cartel. The joint revenue system neutralized this instability.

Firms that enter a collusive agreement must be able to detect price cuts or output increases initiated by their rivals, because of the existence of incentives to cheat. In the case of the electricity distribution market, a price cut would have been very rapidly detected. Madrid had one of the highest ratios of electricity customers per inhabitant, 145 per thousand inhabitants in 1913 and 219 in 1935.[14] Because electric lighting was widespread and networks overlapping, a reduction in price would have stimulated customers to swap suppliers, as happened during the competition phases. With only two companies, the loyal member would know immediately that the other company was cheating because customers would cancel their contracts with them.

Because price visibility and sales frequency were high and because there were only two firms, the detection lag was short, reducing the incentive to cheat. Detection is not sufficient to deter cheating. The offender must receive dissuasive and credible punishment.

In the agreement of 1913, the Madrilenian firms set a 250,000 ptas indemnity in case of defection. This type of penalty did not play any role in the cartel stability because it was only 6 percent of the firms' revenue.
Alexis Jacquemin and Margaret Slade maintain that reducing prices below average cost to drive the cheater out of the market might not be a credible threat, as it would not be in the firm's best interest.[15] However, generalization on this topic is difficult. Past events have an impact in the formation of business strategies. In the price war in Madrid, the two companies had reduced prices below average cost, so that was a credible threat. The bad economic consequences of the price war were enough of a deterrent to prevent another conflict.[16]

Instead, Jacquemin and Slade propose the use of long-term contracts with buyers and the introduction of contractual clauses that make defection more costly. Long-term contracts would not stop cheating just as they had not deterred competition in the past when customers did change companies despite having signed a long-term contract. The costs of bringing the customer to court for breach of contract were too high in comparison to the little importance of each individual contract.

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[14] Anna M. Aubanell Jubany, *La industria eléctrica*, 381.

[15] Alexis Jacquemin and Margaret E. Slade, "Cartels, Collusion, and Horizontal Merger," in *Handbook of Industrial Organisation*, ed. Richard Schmalensee and Robert Willig (Amsterdam, 1989), 415-73.

[16] For the relation between price war and stable cartel see Margaret C. Levenstein, "Do Price Wars Facilitate Collusion? A Study of the Bromine Cartel Before World War I," *Explorations in Economic History* 33 (Jan. 1996): 107-37, Peter Grossman, "The Dynamics of a Stable Cartel: The Railroad Express 1851-1913,,"*Economic Inquiry* 34 (April 1996): 220-36.

D. K. Osborne proposes that if the cheater increases output and the other members react to maintain market share, they deter cheating. Output increases by all members in the same proportion as the defector would result in a new equilibrium at a lower price level, so profits would decline.[17] The main problem for this strategy is that retaliation has to be instantaneous so that the cheater does not have an incentive to cheat. This strategy is perfectly plausible in the electric industry because increases in capacity are easy to observe by all members of the cartel, well before production reaches the market. However, the incapacity to reach a certain level of production in some years was what created problems of stability for the Madrilenian Cartel.

The main deterrent devised by the electricity firms was sharing revenue. The joint collection of payments service would collect revenue. In principal, this is an excellent deterrent against free-rider behavior, because if a firm decides to increase production, thus increasing its market share, the other firm would benefit from an increase in total revenue. In this case, sharing revenue mitigated the destabilizing effects of Electra's commercial strategy.

On certain occasions, however, the joint collection of payments destabilized the Cartel. The different cost structure of the firms and the fact that one had the whole production process integrated while the other was only distributing, generated several problems. In 1918 and 1921, severe droughts caused an important reduction in the hydroelectricity produced, which by that time was 95 percent of the overall electricity generated. Although companies increased the generation of thermo-electricity, they could not fulfill all demand. Unión increased the production of thermoelectricity to match demand even though this raised costs. On the other hand, Electra's dependence on the electricity that Hidrola supplied forced it to lower the voltage, causing the meter to register less consumption and to introduce restrictions that implied a decrease in revenue. Electra was acting as a free rider because it benefited from the efforts Unión undertook without incurring any of the costs. Unión tried to get the agreement changed, but these situations did not end the Cartel, because they were short-lived. Given that electricity is a public service, firms cannot just stop production when costs increase. The Madrilenian Cartel could have avoided this transitory destabilizing effect if the agreement included the obligation of all members to maintain production at an agreed level compatible with the long-term development of the industry.

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[17] D. K. Osborne, "Cartel Problems," *American Economic Review* 66 (Dec. 1976): 835-44.

Regulation as a Deterrent

Regulation played an important role in deterring cheating and destabilizing the Cartel. The first type of regulation in the electric industry was municipal. In Madrid, Electra was the only regulated electric utility due to the price cap regulation agreement reached in 1910 with the City Council. The obligation of Electra not to go beyond rates of 0.60 ptas/kwh for lighting and 0.25 ptas/kwh for power meant that the Cartel agreement indirectly regulated the other company. This regulation did not have a direct effect on internal Cartel stability, but it was crucial in external stability.

State regulation in Spain was the government response to the inflationary effects of World War I. The two firms did not attempt to increase prices until 1920 when the Committee agreed that Unión would increase lighting rates from 0.60 to 0.75 ptas/kwh. Electra would keep the old prices until the City Council would allow changing the 1910 agreement. The Council not only refused to allow Electra to increase rates, but also blocked the price increase announced by Unión by resorting to the *Ley de Subsistencias*. The *Ley de Subsistencias* passed on November 23, 1916 contemplated the introduction of regulated prices for raw materials and food, which included electricity.[18] Before the administration had decided which price to set, the first specific law regulating electric prices was promulgated. The law of August 14, 1920 established that electric companies should sell electricity at the prices prevailing at the time the law was published, and compelled electric utilities to supply electricity to anyone in their market at those prices. Unlike the municipal price cap regulation that affected only the maximum rates, State regulation involved the whole of rate structure. No rate increases without government permission.

Deterrence by regulation relied on firms having to apply in each case for government permission to increase rates. State regulation did not forbid a defecting firm from reducing prices but it would have to ask permission to increase prices again, even if it wanted to return to the previous price level. The Madrilenian electric utilities asked for a 25 percent price increase in 1920. The Administration took a year and a half to allow them a 16 percent increase. Considering the difficulties the utilities encountered when they asked for a price increase, it was very unlikely that either of the two would reduce prices and break the Cartel agreement.

In fact, prices remained at the same level until the Civil War. State regulation and Spanish bureaucracy had a positive effect on internal cartel stability, but regulation was a much more important factor for external stability.

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[18] Ley de subsistencias, 23 Nov. 1916.

External Stability

By setting prices at a cooperative level, a Cartel automatically attracts other firms to the market. The larger the difference between the cooperative and competitive prices, the higher the incentive to enter the market. A factor that contributed to external cartel stability was regulation. Municipal regulation and then State regulation forced rates to remain the same from 1913 to 1922, which in a period with high inflation meant a price reduction in real terms of nearly 50 percent. In this way, regulation did not allow prices to get closer to the monopoly level and therefore reduced the incentive to enter the market for new firms.

Another external factor that can contribute to the destabilization of a cartel is substitute products. If cartel prices are relatively high compared with its substitutes, customers can change to, or new customers opt for, the cheaper product. The firms that do not belong to the same industry can therefore start competition. Because the Madrilenian Cartel was limited to small customers consuming electricity for lighting or power, the substitute industry was gas. In principle, electricity customers could switch from electricity to gas when gas prices decreased. That could force a reduction in Cartel prices that would cause no problem if all firms agreed, but would have reduced profits and incentives to stay in.

Unlike the case of the electric utilities, the City Council granted a monopoly to the Sociedad Madrileña de Alumbrado y Calefacción por Gas in 1868 for a period of 30 years, later extended until July 1914. In that year, the municipal authorities took charge of the company because there were many problems in the service caused, among other factors, by the lack of coal.

Paradoxically, the gas industry did not achieve substantial development until electricity appeared, mainly because of the monopoly prices set by the gas company and the low income of the vast majority of Madrilenians. Competition amongst the two systems stimulated the growth of both during the first decade of the twentieth century. During the price war from 1910 to 1913, and from 1914 to 1922, gas could not compete with electricity. The start of World War I caused a substantial reduction in coal imports, and an increase in coal prices followed. The real coal price rose from 23 ptas/Tm in 1914 to 93 ptas/Tm in 1918.[19] A four-fold price increase in less than 4 years set back the capacity to compete of the gas industry.

The electricity companies were well aware of the threat the gas company posed. In fact, when in 1913 the Mixed Committee was setting the electricity rates they already raised the need to reach an agreement with the gas company. "Because there might be problems of applying the agreed rates due to the potential competition of the gas company [...] we

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[19] Sebastián Coll and Carles Sudrià, *El carbón en España 1770-1961* (Madrid, 1987), 408-9, 488-89.

should negotiate with the company producing gas."[20] At the end of 1913, they reached an agreement with the gas company to study the equivalencies between electricity and gas rates. Less than a year later, when the gas company went into the hands of the municipal authorities, the agreement was broken, but this did not matter for the Cartel stability, because at that moment the coal shortage impeded gas company competition.

When in 1919 coal prices started to come down, the electric companies began to consider how to neutralize the potential competition of gas. Managers of the two electricity groups considered buying shares of the gas company to control it. Hidrola's director explained to the board in January 1920 why the company should have an active role in the gas company, namely, "to allow the development of the gas consumption in those uses that would affect least the development of the electric industry in Madrid."[21] By the end of 1920, the electric utilities had reached an agreement to get control of the gas company. They definitely solved the problem of external cartel destabilization as expressed in the Union's Board meeting of October 1920: "with the property of the gas company our electric market in Madrid is secured."[22] A new gas company was created at the end of 1921, in which the Madrilenian electricity companies held 37.5 percent of the capital, a sufficient share to control the company. The potential external destabilizing threat had been neutralized.

Conclusions

The price war that began in 1910 and ended in 1913 changed the structure and the players of the electricity industry in Madrid. Although Electra and Unión emerged victorious, the devastating effects on profits were to stay in the memories of the managers and acted as an incentive to avoid competition at any cost.

The fact that there were only two companies with similar market and financial power facilitated reaching an agreement and helped the stability of the Cartel. Other important factors accounted for the Cartel's internal stability. Even though demand was elastic from 1913 to 1930, the fact that there was no excess capacity during that period discouraged firms from cheating. On the other hand, the large number of small customers deterred defections because a reduction in price would not have yielded a large increase in profit before detection. In addition, it would have been easy to detect defection because there were only two firms and each company had an inspector in the other's collection of payments service.

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[20] Minutes of Comité mixto, 15 March 1913 and 15 Sept. 1913.
[21] Minutes Board of Directors SHE, 21 Jan. 1920, Headquarters of Iberdrola, Madrid.
[22] Minutes Board of Directors UEM, 7 Oct. 1920.

Internal instability came from cost asymmetry. Electra was only a distributor, while Unión was both producer and distributor. Electra's cost structure did not account for the generation cost, thus profit maximization implying revenue maximization prompted the firm to offer flat-rate contracts, attracting more customers than Unión. Sharing revenue compensated for this destabilizing effect because Unión got 50 percent of the increase of revenue generated by Electra.

On the other hand, the deterrent that the firms designed by sharing revenue was also a source of instability. In instances when hydro production was not enough due to severe droughts, Unión reacted by increasing thermal production and consequently increasing its costs. Electra, dependent on Hidrola, did not have enough production, which caused a reduction in revenue. In other words, Electra acted as a free rider.

Regulation together with Spanish bureaucracy contributed to the internal stabilization of the Cartel because it discouraged companies from decreasing prices because they needed authorization to return to the same price level. Regulation also played a major role in securing external stability because it set prices below the monopoly level thus discouraging potential entrants.

The Cartel finally achieved external stability by neutralizing the substitute industry (gas) through an agreement with the gas company to set equivalent prices for the two products. The takeover by the City Council could have had a destabilizing effect, but the lack of coal and the surge in prices caused by World War I put a stop to that. When coal prices started to decrease, the electricity firms achieved control of the gas company, thus eliminating any potential competition.