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Origins and efficiency of the electric industry regulation in Spain, 1910-1936¹

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Abstract

The aim of this paper is to discover the origins of utility regulation in Spain, and to analyse, from a microeconomic perspective, its characteristics and the impact of regulation on consumers and utilities. Madrid and the Madrilenian utilities are taken as a case study.

The electric industry in the period studied was a natural monopoly². Each of the three phases of production, generation, transmission and distribution, had natural monopoly characteristics. Therefore, the most efficient form to generate, transmit and distribute electricity was the monopoly because one firm can produce a quantity at a lower cost than the sum of costs incurred by two or more firms. A problem arises because when a firm is the single provider it can charge prices above the marginal cost, at monopoly prices. When a monopolist reduces the quantity produced, price increases, causing the consumer to demand less than the economic efficiency level, incurring a loss of consumer surplus. The loss of the consumer surplus is not completely gained by the monopolist, causing a loss of social surplus, a deadweight loss. The main objective of regulation is going to be to reduce to a minimum the deadweight loss. Regulation is also needed because when the monopolist fixes prices at marginal cost equal marginal revenue there would be an incentive for firms to enter the market creating inefficiency.

The Madrilenian industry has been chosen because of the availability of statistical information on costs and production. The complex industry structure and the atomised demand add interest to the analysis. This study will also provide some light on the tariff regulation of the period which has been poorly studied and will complement the literature on the US electric utilities regulation where a different type of regulation was implemented.

1. Madrilenian Industry Structure

This study starts in 1910 when an exogenous technological shock altered the industry structure. From that moment hydropower became the major source in the generation of electricity, while thermoelectricity was only used as a reserve. From then on there was no major technological change in hydropower technology, so we can consider technology as a constant.

¹ This paper has benefited from the financial support of the Ministerio de Ciencia y Tecnología, NISAL SEJ 2007-60845 and HAR2010-20684-C02-01

² Aubanell, Anna (2005), ¿Era la industria de entreguerras un monopolio natural? Evidencia a partir de la sociedad Hisroeléctrica Española, *Revista de Historia Económica*, 3, pp. 489-514.

Before the first major hydroelectricity arrived in Madrid in 1910, there were fifteen big, medium and small sized firms operating in the market, generating and/or distributing electricity. The industry structure was diversified because the council did not give any monopoly rights to electric utilities. As a result from 1890 to 1907 there were several outbreaks of competition between firms.

The incumbent firms did not invest in the construction of the hydropower stations that were to supply cheaper electricity to Madrid. They lacked the capital to embark on such a capital intensive venture and on the other hand they were quite confident that they would be able to survive by concentrating their economic activity on electricity distribution. This strategy cost them dearly. After a price war, which lasted from 1911 to 1913, the structure of the market changed radically. The incumbent firms had disappeared and two new players dominated the market: Sociedad Hidroeléctrica Española (today Iberdrola, result of the 1991 merger: Iberduero and Hidrola) and Unión Eléctrica Madrileña (today Unión Fenosa). The third actor was a small Hydroelectric firm, Hidráulica Santillana, that by 1930 limited its activity to water supply.

Unión Eléctrica Madrileña (from now UEM) was a vertically integrated firm. Although the 1920's expansion strategy of the company meant the founding of two separate generating companies in technical terms there were integrated to UEM and financially controlled by it. Hidroeléctrica Española (Hidrola), on the other hand, was not a vertically integrated firm³. It generated, transmitted and distributed electricity at high voltage but it did not distribute electricity at low tension. Cooperativa Electra Madrid, its subsidiary was in charge of distribution to the Madrid market. In spite of the name of the company it was not a cooperative but a limited company: the origins and the reason for the name will be seen later, as this is linked to regulation.

The two groups' market power was identical during the whole period. The reason being the cartel agreement they reached in 1913 after the price war.

2. The Origins of Electric Utility Regulation

2.1 Local regulation

Regulation in the electric industry started at the local level. Local regulation was implemented when companies had to ask permission for the installation of the power station and extension of the distribution networks. The conditions set by the Council might include price, availability of service and discounts for the municipal electricity consumption. But, generally, price regulation was linked to granting a monopoly.

³ Aubanell, Anna (2000), Estrategia empresarial y estrategia financiera de la Sociedad Hidroeléctrica Española, 1907-1935», *Revista de Historia Industrial*, 2000, 17, pp.153-185.

Madrid's Council did not grant a monopoly to electric utilities, although it did to the gas industry where monopoly rights were given to Compañía de Alumbrado y Calefacción por Gas, a French firm linked to Crédito Mobiliario Español. In relation to other big European cities allowing competition in the electricity market was not too common. In Paris, for instance, the Council divided the city in sections and gave monopoly to a different firm in each one.

Madrid Council allowed the use of the rights-of-way of the public streets to extend the distribution systems to all companies that applied for it. A major difference to other European and American Councils where that the rights-of-way were given for a period of 20 to 50 years in Madrid the right-of-way were given for an indefinite period of time. The conditions imposed by the municipal authorities were limited to technical instructions of how to lay the cables.

The beginnings of Madrid municipal tariff regulation were a result of consumers' mobilizations against the existing electric utilities, which would be used by hydropower company to ease its entry into the market. The origins of the municipal regulation in Madrid do not respond to the view that it was the existing utilities in the market seeking regulation to maintain and protect their position against potential entrants as Platt explained in the case of Chicago⁴.

In July 1907 the main companies reached an agreement to stop competition and increase prices. That created a social uproar that was channelled by Sanchez de Toca, at that moment head of the Canal de Isabel II⁵. In fact, Sanchez Toca thought that the best solution was that the Council would establish a distribution network that would break the monopoly attempts undertaken by the companies. Knowing that the municipal budget did not allow for such a major investment, they opted for the foundation of a cooperative in order to find the capital necessary to build a new distribution network. The Chamber of Commerce and other Madrilenian business associations⁶ founded in August 1909 a cooperative of consumers, the Cooperative Eléctrica de Madrid. The cooperative would not generate electricity but only distribute electricity to its members, it was expected that the majority of Madrilenians would become members of the cooperative. The cooperative would buy electricity to the larger hydropower stations that were being built far from Madrid.

Sanchez de Toca convinced the Council to give special treatment to the Cooperative. The main argument raised was that the Cooperative would not seek to obtain profits but to distribute electricity, a basic need for the population, at the minimum cost. They would break the monopoly and offer the kWh for lighting at 0,60 pesetas, that is a 40% reduction over the 1909's rates. In April

⁴ Platt, Harold L. (1991). *The Electric City*, Chicago, Chicago University Press.

⁵ Comisario Regio

⁶ Círculo de la Unión Mercantil, Asociación de propietarios, Cámara Oficial de la Propiedad urbana and Federación gremial y Patronal Madrileña. Ayuntamiento de Madrid, Informe del Excmo. Sr. D. Joaquín Sánchez de Toca ante las comisiones de policía urbana y obras sobre los servicios de la Cooperativa eléctrica, Madrid, 1910.

1910 the Council approved an agreement with the Cooperative by which the Council would give permission for the works related to the building all substations needed and extending the distribution network for 20.000 pesetas a year. The use of the right-of-way of the public streets for the whole network - independent of the extension reached - would cost the cooperative 85.000 pesetas. This gave free way to extend the network without any administrative obstacles and gave a significant economic advantage since the other utilities had to pay according to the extension of their network; the largest company paid fifty per cent more. These quantities were fixed and no clause was introduced to cater for inflation. Additionally the Cooperative would not have to pay any extra tax that the Council would charge in the future. In turn, the Cooperative would charge a maximum of 0,60 pesetas per kWh for lighting and the distribution network would become of municipal property after 60 years, the term fixed in the franchise. In this agreement there was no monopoly granting but it facilitated the entry of a new firm in the market.

The origins of local regulation in Madrid do not respond to the traditional public interest view that Regulation was implemented in order to avoid competition in a natural monopoly industry which would have resulted in higher prices paid by consumers. Competition would result in economic inefficiency because of the duplication of networks which means more capital was invested in the industry, higher capital costs and therefore larger production costs compared to a single supplier; neither to a long term contracting interpretation where, since utilities needed to make large investments in fixed plant and distribution systems that were not mobile or easily adapted to other purposes, firms needed the assurance that municipal authorities would not set prices that would ruin them. On the consumer side, they would have wanted some assurance that before investing in fixings for electricity used in their houses they would not have to pay monopoly prices or receive poor service. Therefore a regulatory commission that would cater for both consumers and utilities would have been a way to protect both investments⁷.

In the Madrid case the Council reacted to the pressures from consumers to get cheaper prices easing the entry into the market of a new firm. That is, it broke the 1907 cartel agreement solving the monopoly problem by increasing competition which was against economic efficiency. The Council also responded to the pressures from important hydroproducers that had to enter into the Madrid electricity market. Two months after the signature of the agreement with the Council Cooperative Eléctrica de Madrid merged with Sociedad Electra Madrid a limited company (Hidroila's subsidiary) becoming Cooperativa Electra Madrid, not anymore a cooperative, retaining Hidroila in its control. The merger was conditional on the Council transferring the agreement to the newly born

⁷ Goldberg, Victor (1976), "Regulation and Administered Contracts", *Bell Journal of Economics and Management Science*, 7, pp. 426-452, Williamson, Oliver (1985), *The Economic Institutions of Capitalism*, New York, Free Press, pp. 327-64.

company. The Council voted in favour of transferring all rights from the agreement to the Cooperativa despite the opposition of the socialist party and Centro de Defensa Social⁸. Some level of Municipal corruption surely happened which in the Spanish case, different from the US, did not trigger State regulation⁹.

In less than a year Cooperativa became a major player in the market and the price war broke out. The price war which lasted more than three years ended with a duopoly and cartel agreement between Unión and Hidrola-Cooperativa sharing the market, a monopoly. The cartel fixed prices at the maximum level allowed by the agreement of Cooperativa and the Council. In this peculiar way local regulation was extended to Unión, although there was not an agreement between Unión and the Council that would replicate the one signed by Cooperativa. In other words, Unión could not set prices beyond the maximum tariff of 0,60 pesetas/kWh unless it wanted to break the cartel.

2.2 From local to State Regulation

The State regulation was originated to counteract the inflation during WWI. The Ley de Subsistencias of the 11th of November 1916 was an attempt to control the price increase of the basic products. The State regulatory power was delegated to the provincial level. The law created the Juntas Provinciales de Subsistencias that had the power to establish a regulated price for basic goods or services if Councils ask for it. The regulated price would have then to be reviewed every month. The Ley de susbsistencias was supposed to last for one year only but it was renewed annually until November 1922.

The intervention of the State to regulate electricity prices would match the regulatory development experienced in Europe. That is, relative high inflation triggered State regulation in order to avoid social unrest. Let us point out that this regulation was not electricity specific, it intended to regulate all basic products. It was not until the law of 14th of August 1920 when the State specifically regulated the electricity tariffs. Its article two stated that the electricity companies had to supply electricity at the prices currently charged on August the 14th and any price increase would have to be approved by the government. This law did not derogate the Ley de Susbsitencias and Councils could still ask the Juntas Provinciales for lower electricity tariffs.

In fact, when Primo de Rivera came to power some Mayors (la Coruña, Cádiz, Almería, Valencia and Toledo amongst others) intervened to reduce electricity tariffs up to 50% which found a strong response from the Association of Producers and Distributors of Electricity. The Asociación considered that those Mayors “only wanted to please consumers” and doing so went against the

⁸ Archivo de Villa, Libro de actas del Ayuntamiento, sig. 519, sesión 2-7-1910

⁹ Troesken, Werner (2006), “Regime Change and Corruption: A History of Public Utility Regulation” in Edward L. Glaeser and Claudia Goldin, *Corruption and Reform: Lessons from America's Economic History*, Chicago, Chicago UP, pp. 259-81.

laws. The Association insisted that the competences for price regulation rested at the State level with the Ministerio de Trabajo, Comercio e Industria¹⁰.

The Association of Producers and Distributors of Electricity send a letter to Primo de Rivera in October 1923 asking that any petition raised by the local authorities that intended to lower tariffs would be passed to the Ministerio de Trabajo, Comercio e Industria where it should be studied and resolved after consulting the affected utilities and the Asociación.

In spite of the Asociación plea the new Government published the Real Decreto of 3rd November 1923 creating the Junta Central de Abastos (State Regulatory Commission) and the Juntas Provinciales de Abastos which would have the power to regulate prices and intervene in the distribution of basic products. As a result the Tariffs for lighting would be regulated by the Juntas Provinciales de Abastos contrary to what the Association of Producers and Distributors of Electricity had asked for. The main problem for the electric companies was the composition of the Juntas Provinciales de Abastos where they could have little influence¹¹. The main objective of these commissions was the regulation of food products and their members reflected those interests.

Had they managed in their attempts to create a State Regulatory Commission, the regulatory development would perfectly fit with the thesis first put forward by Jarrell by which the State regulation commissions were created at the request of producers to prevent the relatively hostile regulation of the municipalities¹². The argument would be that because consumers were closer to the local regulators than State regulators, local authorities would have a higher incentive to bring low rates to consumers. In the Spanish case producers wanted Primo de Rivera to create a State regulatory commission at the Ministerio de Trabajo, Industria y Comercio but, surprisingly, failed.

In the Real Decreto of 1924 electricity is defined as a public service the first time. The decree establishes that prices would be set by the responsible public administration with the restriction that those prices could never be higher than those set up in any franchise (State or Municipal). When a price increase was approved then the company could only apply it at the new contracts or those that were renewed, not to the current ones. The companies were free to reduce tariffs but would have to ask for permission to increase them back. Finally, companies were obliged to supply electricity to everyone and the quality of the service was controlled.

Electric Industry State regulation in Spain was not implemented to avoid the problems created by natural monopoly but to avoid the consequences that an increase in tariffs would have on the

¹⁰ Boletín de la Asociación de Productores y Distribuidores de electricidad, 21, 1923, p.113.

¹¹ Delegado del Gobierno, subdirector de Agricultura, un jefe de centro por el Ministerio de Hacienda, de Gobernación y Trabajo, un representante de la Asociación de agricultores de España, uno de la Asociación general de Ganaderos del Reino, uno del Consejo Superior de Cámaras de industria y Comercio, uno de las Cooperativas de consumo y uno de las Asociaciones obreras estos dos últimos designados por el Ministerio del Trabajo.

¹² Jarrell, Gregg (1978), "The Demand for State Regulation of the Electric Utility Industry", in *Journal of Law and Economics*, 21:269-96.

population. It also seems that the origins this regulation were linked to the events in the Madrid market.

In the case of Madrid, the Junta Provincial de Subsistencias did not have to intervene until 1920 because the Madrilenian companies did not want to increase tariffs until February 1920¹³. Tariffs were at the same level of 1913, remaining at 0,60 pesetas/kWh for lighting and 0,30 pesetas/kWh for power at low tension which meant a substantial reduction on the real price due to the high inflation. During WWI the electricity companies had experienced a 24% increase in costs (average medium cost of UEM for 1914-16 to the average of 1917-19) due an increase in costs of materials, labour costs due to the wage increase and the reduction of the working hours, and an increase of the price of coal.

In February 1920 the Madrilenian Electricity Cartel agreed to increase prices from 0,60 to 0,75 pesetas/kWh for lighting and from 0,30 to 0,40 pesetas/kWh for power, that is an increase of 25% and 33% respectively. In this agreement Cooperativa would continue to charge the same old tariffs until it would have managed to introduce this change in the 1910 agreement with the Council.

The Madrid Council did not change any tariff of the agreement with Cooperativa and asked the Junta Provincial de Subsistencias to intervene to regulate the price. The Ministerio de Abastecimientos published a decree on the 24th of March 1920 that forbade the Madrilenian companies to increase prices until the Junta Provincial would have studied the case and decided upon the increase. It was the prelude of the August decree that regulated the whole of the Spanish electric tariffs.

At this moment the Committee of producers and distributors (the executive body of the cartel) started pressing the Administration with multiple technical and economic reports on the industry in order to achieve the increase of tariff.

In October 1922, more than two and a half years later, the government allowed a 17% increase in the maximum tariffs. That was 9 percentage points less that what the companies had asked for lighting and 17 percentage points less for power. The new maximum tariffs of 0,70 pesetas/kWh for lighting and 0,35 pesetas/kWh for power would be applied form January 1923. The rest of the tariff structure could not increase more than 20%. These tariffs remained until the Civil War.

Those tariffs did not affect all customers in Madrid. The 1924 law impeded price rises beyond those ones established in any franchise, therefore the Cooperativa customers served by the power substations linked to the 1910 agreement with the Council kept on paying the 1913 tariffs and would do so until the Civil War. From 1916 to 1935, the period for which there is data available, the

¹³ Actas del Comité de productores y distribuidores de electricidad, (febrero 1920) Archivo Antonio Maura.

Cooperativa charged 33% of the kilowatts sold for lighting at the new regulated tariff of 0,70 and 48% at the old rate of 0,60 pesetas/kWh, the rest of kWh were sold at discounted rates¹⁴. In this respect the State regulation did not overwrite the local regulation, it respected the prices set by it.

3. Price cap regulation versus rate-of returns regulation

The two main types of regulation that were applied before WWII were Rate-of return regulation and price cap regulation. In Spain municipal and State regulation adopted a price cap regulation while the US opted for a rate-of–return regulation. The regulation implemented in Spain had less problems and it is considered in the theory of regulatory economics a more efficient regulation than the US one.

Price cap regulation is a much more efficient regulation method because it gives incentives to the firm to reduce costs. In this case a maximum price is set without regard to the utility's own costs. With this type of regulation the firm has an incentive to minimise costs and maximise sales.

The main problem that this type of regulation can produce is the worsening of the service provided. Since there is usually a single provider, most customers will continue to buy at the regulated tariff even if the service has deteriorated due to the firm's cost reduction. In this case the regulators would have to set standards of service and penalise poor quality.

As for the Rate-of-Return regulation the main problem is the Averch-Johnson effect.¹⁵ When the rate of return allowed by the regulator is greater than the cost of capital the firm has an incentive to use too much capital, resulting in inefficiently high production costs. If the ROR would be below the capital cost then the firm would use less capital and more variable inputs resulting in higher production costs. It is difficult therefore to set a ROR by the regulator that would not induce inefficiencies.

4. Effects of regulation

Comparing the two types of regulation that were applied, Spain seems to have chosen the right type but did it set the right level of prices to make regulation effective? As we have seen the municipal authorities did not set the maximum tariff, in fact it was the tariff proposed by the firm. Nonetheless it could have been the right regulatory price. What is the optimal regulated price?

¹⁴ Calculated from "Resúmenes de generales de facturación". Archivo Histórico de Iberdrola, Salto de Alcántara, Fondo Filiales, CEM, Tarifas

¹⁵ Averch, Harvey and Leland L. Johnson (1962), "Behaviour of the Firm under Regulatory Constraint", American Economic Review. 52, pp

In a competitive equilibrium price should equal marginal cost in order to maximize social welfare. But for a natural monopolist, marginal cost is less than average cost because of the large fixed costs. If price equals marginal cost then the firm has a loss on each kWh sold.

Therefore there are three possible solutions to regulate a price:

- a) fix prices at average costs
- b) Set prices at marginal cost and the Government could subsidize the difference between the marginal cost and the average costs. But that would mean an increase of taxes
- c) Ramsey pricing. Customers are charged according to the demand elasticity.

$$(P-MC)/P=c/Ed$$

Where P is the price, c is a constant that depends on cost structure, Ed the demand elasticity.

It is difficult to establish demand elasticity for electricity because production equals consumption. The observed demand may not reflect the demand customers would buy at a given price, they might want to buy more but there is no more production, for example when there are restrictions due to a draught. Only when there is an excess capacity we could accept that the observable demand at the prices given is the actual elasticity. During this period it is difficult to establish demand elasticity with the data available for the purposes of calculating Ramsey prices because of draught years.

The second option is completely ahistorical. Therefore, we have opted for the first one which is the one widely use by regulatory agencies.

Total costs include labour, capital and other variable costs. All costs except for capital cost are taken from the firm's data. Capital is the value of the tangible assets and the rate of return is the UEM bonds rate. Revenue is the company's revenue from electricity sales. Kilowatts sold are use to calculate average cost and revenue. The difference between average revenue and average costs are shown in table 1.

The data available for this exercise is the firm's own internal data; it is not the data that the firm supplied to the regulator. There is no asymmetry of information problem that faces today's regulatory agencies.

Table 1. Difference between average cost and average revenue (1912-1935)

	Hidrola	Cooperativa	UEM
1912	0,02	-0,09	-0,05
1913	0,02	0,00	-0,02
1914	-0,02	0,10	0,07
1915	0,02	0,11	0,08
1916	0,02	0,12	0,09
1917	0,00	0,11	0,08

1918	-0,04	0,11	0,04
1919	-0,01	0,14	0,08
1920	-0,06	0,14	0,06
1921	-0,08	0,15	0,02
1922	-0,03	0,17	0,04
1923	-0,01	0,20	0,04
1924	0,01	0,23	0,06
1925	0,01	0,25	0,06
1926	0,01	0,23	0,07
1927	0,02	0,23	0,06
1928	0,03	0,25	0,07
1929	0,03	0,24	0,06
1930	0,03	0,25	0,07
1931	-0,01	0,25	0,05
1932	-0,01	0,26	0,06
1933	0,03		0,07
1934	0,03		0,08
1935	0,04		0,08

Source: HE: Archivo Histórico de Iberdrola, Salto de Alcántara, Fondo HE. Cooperativa: Estadística anual desde la constitución de la sociedad, 1910-1932, Archivo Histórico de Iberdrola, Salto de Alcántara, Fondo Filiales, CEM. UEM: Balance sheets and financial report, Actas del Consejo de Administración, 1912-1935.

These results show that the tariffs implemented by local and State regulation were not the optimal if we assume optimal regulatory price equal to average costs with no profits.

An alternative approach to check if an optimal regulatory price was set is the method used by the Rate-of-Return regulation. In this case if the firm's revenue is higher than the one allowed with RoR regulation then the prices set would not have been the optimal. The difference with the method use above is that considerers a return on equity.

The process of determining Rate-of-return regulation is:

Revenue=Expenses + allowed rate of return*rate base

The idea behind the RoR regulation is that utility revenues must equal its costs, so that the economic profit is zero. Profits are included in the allowed rate of return. The most common method of choosing the allowed rate of return by the regulatory agencies is to calculate the weighted cost of shares and bonds. In this case the most controversial is to determine the cost of equity capital which depends on a comparison of the utility with similar utilities. Here we have used the average return on equity of Hidroeléctrica Ibérica, Eléctricas Reunidas de Zaragoza, Hidroeléctrica Española and Sevillana de Electricidad. The bonds rate is the UEM bonds.

The evaluation of the rate base is done by original cost valuation which is the amount that the company paid for its plant less depreciation. For this the value of the tangible and intangible assets is taken. We used the UEM data because it is vertically integrated.

Table 2. Efficiency using Rate of Return Regulation Method, UEM, 1912-1935

	Actual		allowed		RoR	Difference
	Revenue	Expenses	ROR	Rate base	Revenue	in Revenue
1912	2.861.495	2.284.378	6,51174	40649710	4.931.381	2.069.886
1913	3.992.765	2.867.963	6,592335	42011088	5.637.475	1.644.710
1914	5.671.832	2.320.053	6,172409	42464827	4.941.156	-730.676
1915	5.945.163	2.424.311	8,27875	42607088	5.951.645	6.482
1916	6.490.465	2.392.957	8,94073	42899010	6.228.442	-262.023
1917	6.605.631	2.817.818	9,567118	44044210	7.031.580	425.949
1918	6.794.879	3.927.233	8,416652	43591749	7.596.199	801.320
1919	7.731.379	3.573.034	9,719621	45969339	8.041.080	309.701
1920	8.799.219	5.140.631	6,870064	45450038	8.263.078	-536.141
1921	9.620.794	7.336.755	5,260928	46279619	9.771.492	150.698
1922	10.888.787	7.492.754	6,551163	50539229	10.803.661	-85.126
1923	13.450.146	9.049.727	6,803871	70888783	13.872.908	422.762
1924	14.034.092	8.483.379	8,059597	74282436	14.470.244	436.152
1925	16.668.161	10.891.935	8,150628	79089002	17.338.185	670.024
1926	16.679.964	8.932.854	8,016379	81879201	15.496.601	-1.183.363
1927	17.706.688	10.107.079	8,072407	86179306	17.063.823	-642.865
1928	19.269.158	10.375.667	8,019184	91510760	17.714.083	-1.555.075
1929	21.910.642	12.346.993	8,600628	93310141	20.372.251	-1.538.391
1930	23.199.642	12.175.328	9,05577	116395586	22.715.844	-483.798
1931	24.670.950	14.709.633	7,955388	122051428	24.419.297	-251.653
1932	26.114.165	16.182.259	8,042522	127493190	26.435.926	321.761
1933	27.344.189	16.509.005	8,507867	136919386	28.157.925	813.736
1934	26.454.034	13.643.561	8,075304	139261904	24.889.383	-1.564.651
1935	28.618.091	15.792.635	8,026142	139707730	27.005.776	-1.612.315

Source: UEM balance sheets and financial report Actas del Consejo de Administración, 1912-1935.

The results also show that the regulation applied to the Madrilenian electric utilities was not the optimal. Until 1925 regulation brought lower tariffs but from 1926 onwards the regulation implemented failed to obtain lower tariffs for consumers.

Failure to set the optimal regulatory price does not mean that regulation had a neutral or negative effect on consumer welfare when compared to the alternative scenario. In that particular historical context the plausible alternative to regulation was the absence of intervention. Given that the electric industry of the period had natural monopoly characteristics, markets would have become monopolies in the short run. Indeed, the majority of markets in Spain electricity were supplied by a single provider. In the case of Madrid, as we have seen, there was a cartel that proved very stable and lasted for the whole period. Under these circumstances the absence of regulation would have resulted in customers paying monopoly prices. There is no need to estimate monopoly prices since we know that in the absence of regulation firms would have charged higher prices because the cartel had agreed a bigger increase in tariffs (a 25% increase for lighting and 33% for power) than

the one finally allowed by the regulator (17% increase). Madrilenians would have had to pay the kWh for lighting at 0.75 pesetas and at 0.4 pesetas the kWh for power and they would have done so from February 1920 instead of January 1923.

In the case of Madrid regulation lowered the tariff paid by customers different from what happened in the US. The empirical historical studies in the US showed that regulation did not make a difference in lowering the price. The study by Stigler and Friedland showed that there were no significant statistical differences between regulated and non regulated states, so the effects of Rate-of-return regulation were not visible¹⁶. Jarrel comparing the periods before and after the introduction of regulation found out that regulation had resulted in higher rates, lower output and higher profits which led him to conclude that regulation was adopted on the “behest of the electric utility companies in detriment of their customers”¹⁷. In this case utilities would have captured the regulator. For Joskow the problem was that the regulatory agencies did not care about the rate of return unless prices increased¹⁸. Once a firm increased the price then the regulatory commissions were much more diligent at keeping rates of return of those companies much closer to the cost of capital. But if there was no price increase the ROR could be substantially higher than the capital cost.

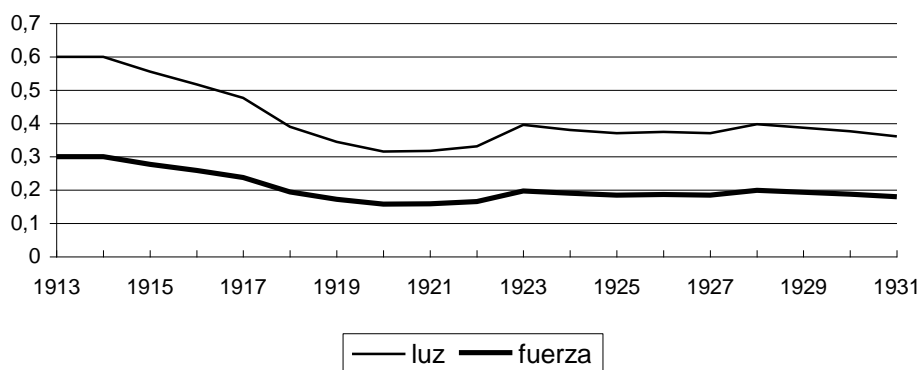
A major benefit from the type of regulation implemented in Madrid came from the effects of inflation. Nowadays in price cap regulation regimes the regulatory agency would fix the maximum tariff that would be adjusted annually by inflation. Since in the Spanish case there was no automatic adjustment that meant that any change in tariffs would have had to generate another regulatory process. Between 1913 and 1922 the maximum electricity tariffs almost halved in real terms due to inflation. After the 1923 tariff increase, prices remained stable because there was a period of price stability. Price cap regulation and inflation reduced the real maximum tariff by 33% between 1913 and 1936.

¹⁶ Stigler, George Stigler, George J., and Claire Friedland (1962) “What Can Regulators Regulate? The Case of Electricity.” *Journal of Law and Economics* 5: 1–16.

¹⁷ Jarrell, Gregg A. (1978): “The Demand for State Regulation of the Electric Utility Industry.” *Journal of Law and Economics* 21, no. 1, pp 269–95.

¹⁸ Joskow, Paul (1974), “Inflation and Environmental concern: Structural Change in the Process of Public Utility Price Regulation”, *Journal of Law and Economics*, XVII. Pp. 291-327.p. 326

Figure . Maximum deflated tariffs, 1913-31 (ptas 1913)



On the other hand the regulatory process established had a negative effect at least from 1933. Although the Spanish regulation was a price cap where companies were free to lower prices they could not go back to the maximum tariffs without authorisation from the regulatory commission. Companies might have lowered prices, definitely after 1932 when there was an excess of capacity, but were hesitant because of the past experience. They had to wait for almost three years between asking for the increase and being able to apply new tariffs.

With regard to the effects of price cap regulation on the quality of service there is no clear evidence of the link. The number of complains rose in the early twenties which could be due to a lower maintenance, which in turn could be the companies' response to the government's negative to increase tariffs. But there had been an increase in demand due to the lower real prices and a decrease in the hydroelectricity produced due to the draughts in 1920 and 1921. Companies would have tended to increase the generation of thermoelectricity to a lesser degree than the decrease of hydroelectricity, because of the substantial increase in costs, and therefore the quality of the service provided worsened. This problem felt in Madrid let the regulatory commission to allowing the tariff increase with the condition that the utilities had to improve the service¹⁹.

In spite of regulation having a positive effect on consumer welfare in Madrid the same cannot be expected for the rest of the country. The major problem of the State regulation implemented in Spain is that it did not set nominal maximum tariffs; it just did not allow an increase over the existing tariffs. As we have seen Madrid customers benefited from the previous local regulation which set nominal tariffs and when the State regulation was implemented the level of tariffs was sufficiently

¹⁹ Real Orden 31st October 1922, Gaceta 2nd November 1922. José Castel y Nicasio Navascués, *Disposiciones relativas a la intervención de la Administración en los suministros de energía eléctrica, gases y líquidos, en su relación con la Verificación Oficial de Contadores e Inspectores provinciales de industria*, Madrid, Imprenta Latina, 1922.

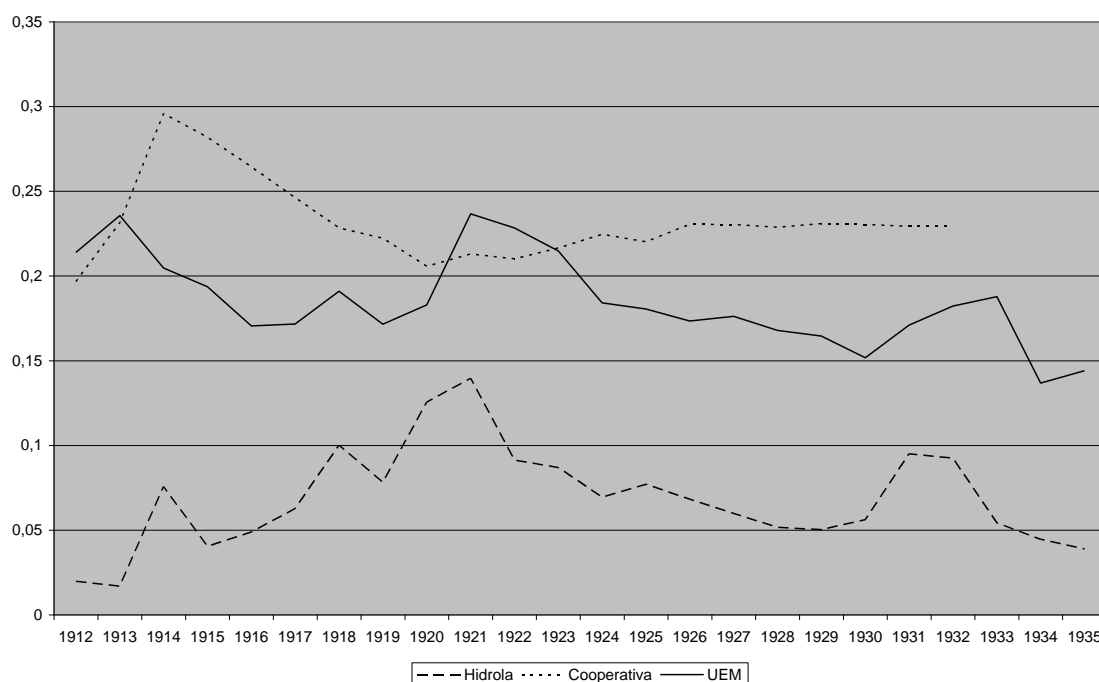
low to have an impact. On the contrary in cities lacking local regulation the freezing of tariffs could not have had the same positive effect. In the worse case scenario, a market with a monopoly and no local regulation, tariffs would have been at the monopoly level and the firm would have freely increased them during the inflation period. In this case the State regulation would have had no effect fixing prices at monopoly level. Only in those cities where competition and/or local regulation were present could State regulation have a positive effect.

4.2 Effects of regulation on the firms efficiency

Due to the lack of data from a large enough number of electricity companies it is difficult to calculate the technological frontier and analyse the effects that regulation had on the economic efficiency of the regulated firms.

A more rudimentary way of assessing the effects of regulation on the economic efficiency of the firms is to analyse the evolution of the firms' costs.

Graph 2. Average cost for Hidrola, Cooperativa and UEM (1912-1935) (ptas/kWh)



Source: HE: Archivo Histórico de Iberdrola, Salto de Alcántara, Fondo HE. Cooperativa: Estadística anual desde la constitución de la sociedad, 1910-1932, Archivo Histórico de Iberdrola, Salto de Alcántara, Fondo Filiales, CEM. UEM balance sheets and financial report and Actas del Consejo de Administración, 1912-1935..

From the above graph we could argue that regulation had a positive effect on the efficiency of Cooperativa because of the significant decrease in the average costs between 1914 and 1920. But the decrease in average costs is due to a higher demand and an increase on the economies of density linked to the condition of natural monopoly²⁰. On the other hand, because of regulation prices did not increase in nominal terms and decreased in real terms so it would have stimulated demand and caused a reduction of average costs. In this case the price cap regulation would have had a positive effect on firm efficiency because the firm objective was to maximize sales. It is not clear that the achievement of this objective was due only to regulation. Cooperativa was a distribution company with a peculiar cost structure since it did not pay for the amount 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 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, etc. The revenue function depends on the price vector and the different quantities sold. Therefore profit maximisation 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 Cooperativa profit maximisation 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. The increase in costs in the other two companies cannot be explained by a failure of regulation to increase efficiency. During WWI the electricity companies had experienced a 24% increase in costs due an increase in costs of materials, labour costs due to the wage increase and the reduction of the working hours, and an increase of the price of coal. In this period Hidrola was building the second hydropower station and was more affected by the increase in the costs of materials than UEM in the same period. The peaks in the Hidrola and UEM cost curves in the early twenties and early thirties are due to the increase in thermoelectricity generation. The first increase was due to the draughts and the second to an increase in demand that companies needed to cover because they were building new hydropower stations.

The question once more is what would have been the expansion strategy of these utilities in absence of regulation. The answer is not an easy one since more companies entered in the generation phase. The increase in capacity experienced by UEM came from neutralising the potential competitors. Hidrola had an expansive strategy from the competition faced in the Valencia Market.

²⁰ Aubanell, Anna (2005), ¿Era la industria de entreguerras un monopolio natural? Evidencia a partir de la sociedad Hisroeléctrica Española, *Revista de Historia Económica*, 3, pp. 489-514

5. Conclusions

Regulation of the electric utilities started at the local level as a result of a franchise between the Council and one of the companies in Madrid. The beginnings of Madrid municipal tariff regulation were a result of consumers' mobilizations against the existing electric utilities. The origins of the municipal regulation in Madrid do not respond to the view that it was the existing utilities in the market seeking regulation to maintain and protect their position against potential entrants. Neither does it confirm the traditional public interest view that Regulation was implemented in order to avoid competition in a natural monopoly nor the long term contracting interpretation where, since utilities needed to make large investments in fixed plant and distribution systems that were not mobile or easily adapted to other purposes, firms needed the assurance that municipal authorities would not set prices that would ruin them. In the Madrid case the Council reacted to the pressures from consumers to get cheaper prices which fitted with the interests of important hydroproducers that had to enter into the Madrid electricity market to sell their production.

The intervention of the State to regulate electricity prices would match the regulatory development experienced in Europe. That is, relative high inflation triggered State regulation in order to avoid social unrest. There is no evidence that Municipal corruption, that surely existed, would have triggered State regulation different from the US. Also different from the US, State Regulation was not created at the request of producers to prevent the relatively hostile regulation of the municipalities. The Association of Producers and Distributors of Electricity tried that local authorities' demands would be dealt at the Ministerio de Trabajo, Comercio e Industria but they failed.

In sum, electric Industry State regulation in Spain was not implemented to avoid the problems created by natural monopoly but to avoid the consequences that an increase in tariffs would have on the population. It also seems that the origins this regulation were linked to the events in the Madrid market.

Although the regulation applied to the Madrilenian electric utilities was the most efficient type, price cap regulation, the tariff set was not the optimal one. Until 1925 regulation brought lower tariffs but from 1926 onwards the regulation implemented failed to obtain lower tariffs for consumers.

Failure to set the optimal regulatory price does not mean that regulation had a neutral or negative effect on consumer welfare when compared to the alternative scenario. In that particular historical

context the plausible alternative to regulation was the absence of intervention in a monopoly market, which would have resulted in higher tariffs.

A major benefit from the type of regulation implemented in Madrid came from the effects of inflation since there was no inflation adjustment introduced by the regulatory commission.

The negative effects were due to the regulatory process established. Although the Spanish regulation was price cap where companies were free to lower prices they could not go back to the maximum tariffs without authorisation from the regulatory commission. This meant that companies were hesitant to reduce rates because of the uncertainty of being able to increase them back, which from 1933 there was a clear possibility because of the excess of capacity.

In spite of regulation having a positive effect on consumers welfare in Madrid the same cannot be expected for the rest of the country. The major problem of State regulation implemented in Spain was that it did not set nominal maximum tariffs; it just did not allow an increase in the existing tariffs. Therefore it depended on the previous existence of local regulation and the level of tariffs set. Since State regulation was introduced in 1920 the potential benefits derived from inflation were substantially reduced.