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# REGULATION AND PRIVATISATION: THE CASE OF ELECTRICITY

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## **Abstract**

This paper sheds some light about privatisation in utilities. An empirical analysis based on sales in the electricity sector in 38 countries for the period 1977-97 shows that regulation is a crucial institutional variable in privatisation. Not only it allows governments to increase the pace of divestiture and to sell higher stakes, but also to maximise proceeds reducing regulatory risk. The revenues-efficiency trade-off loses some relevance in electricity privatisation.

**Keywords:** Privatisation; Regulation.

*JEL classification:* G30, L51

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# 1 Privatising Monopolies

Analysing privatisation processes at the world scale, the sectoral distribution of sales appears to follow a common pattern. Typically, privatisation starts with small scale operations in non strategic sectors (viz. agriculture, industry, banking, etc.); at a second stage, privatisation spreads into utilities and network industries (gas, electricity, TLC, transports, etc.), often sold in various tranches due to the dimension of corporate assets. There are obviously substantial differences in the scale of State sell-offs among geographical areas, but virtually in all major regions – i.e. Western Europe, Latin America, Australasia, Former Soviet Union, Middle East and North Africa, and Asia - the percentage of revenues from utilities appears to be increasing over time (see Figures from 1 to 7).

Despite this common trend, privatisation processes evolve at different speed, so that only a very few countries have entered the second stage, privatising fully strategic sectors like energy, telecommunications, or transports. Indeed, the UK went the farthest in privatisation in the shortest time. The Thatcher government started in 1977 with British Petroleum (BP), the national oil company, followed by companies of the industry sector. By the end of the 1980s the process experienced an abrupt acceleration with the sales in the water and sewerage sector, electricity, and TLC, and more recently railways. Similarly, Argentina has quite rapidly entered the second stage. The privatisation process started in 1990 with important sales in utilities. From 1990 and 1996, we report 88% operations in strategic sectors, mainly in the electricity and gas distribution sector.

It is not difficult however to find examples of ambitious privatisation programs that experienced an abrupt interruption despite a promising start. The French privatisation started in 1986-87 in the financial and banking sector (Saint Gobain, Paribas, Sogeval, Banque du Batiment and Travaux Publiques, Credit Commerciale de France). The first sale in the utility and energy sectors took place in 1992 with the partial sale of Elf Aquitaine and Total. After a long interruption, the process regained some momentum in 1997 with the sale of France Telecom; despite some recent announcements, the majority of assets in strategic sectors are still publicly owned. The Italian experience is somehow similar to the French. The privatisation process started in 1985 with partial sales of SIRT and Alitalia. From 1985 to 1995 sales involved mainly the industry and banking sector. The first large floatation in the utility sector took place only a decade later from the very start, with the first tranche of Eni, the national oil company. In the last three years, we report some important sales in the utilities (Eni and Telecom Italia). Nevertheless, privatisation of electricity or railways is still wishful thinking.

Is there anything special in privatising utilities? Which factors determine the speed of privatisation, namely the frequency of sales in strategic sectors? Why some governments have raised substantial proceeds when selling infrastructure while others have been compelled to strongly underprice the shares? Why some governments have decided to transfer ownership and relinquish control in utilities while others have stuck to partial privatisation?

Starting from the seminal work by La Porta, Lopez-de-Silanes, Shleifer, and Vishny [?] and [?]), in an earlier paper (Bortolotti, Fantini, Siniscalco, Vitalini - henceforth BFSV - [?]) we conjectured that institutions - and mostly legal institutions - are useful to explain the diversity of privatisation processes around the world. We presented evidence that on average - maybe due to different constitutional provisions - common law countries appear to be more involved in privatisation. Moreover, French civil law countries typically bypass capital markets, opting more often for private placements than common law countries. Finally, investors legal protection - viz. shareholders rights cum their enforcement - allows governments to sell higher stakes. Our results suggest that genuine privatisation is therefore easier to accomplish where appropriate legal institutions exist.

In this paper we claim that legal institutions - particularly regulation - are maybe even more important in the divestiture of monopolies: the privatisation process can smoothly enter the second stage involving utilities only if governments have injected competition into the market and structured a clear regulatory framework *pre-privatisation*. A well-defined regulatory framework is key in privatisation since it provides a substitute for public ownership, avoiding the pitfalls of private ownership of natural monopolies. It should allow governments to sell more companies in the utility sector and - more importantly - to transfer the majority of stock.

Regulation could also determine the success of privatisation in terms of proceeds. Conventional wisdom suggests that regulation decreases the expected profitability of the investment, given that firms will be forced to operate in a competitive environment post-privatisation. Given rational expectations by investors, future profitability will be perfectly anticipated at the time of the sale. Governments may therefore face a trade-off between revenue maximisation and efficiency. On the other hand, regulatory risk also matters. In the absence of regulation the contract struck by investors and a government privatising an utility will be necessarily incomplete. It is indeed prohibitively costly to specify ex ante all the possible actions that should be taken if the government decided to renegotiate the previous agreement and regulate the market ex post. Contract incompleteness typically generate underinvestment in specific assets and this will be reflected in the price agreed upon in the initial contract. By the same token, a clear

regulatory setting could instead reduce transaction costs and generate a premium on privatisation proceeds. (Klein, Crawford, and Alchian [?], Williamson [?], Hart and Moore [?]).

Obviously regulation is not the only factor explaining the pace of divestiture in network industries. Market structure certainly matters since privatisation might reveal particularly difficult in vertically integrated systems. Selling a vertically integrated business is not efficient, since cross-subsides are possible. As the BP and British Gas experience clearly showed, when governments try to increase the competitiveness of the market after privatisation, the integrated incumbent is typically able to subsidize the competitive side of the business and stifle entry (Helm - Jenkinson [?]). This concerns lead benevolent government and regulators to recommend unbundling of the activities pre-privatisation. But unbundling and liberalisation is certainly difficult where a powerful player dominates the market since it can exert pressure at the legislative stage to maintain the status quo.

We try to assess the effect of market structure and regulation on the sales in a typically regulated sector, electricity. When analysing market structure we have tried to single out national markets dominated by vertically integrated players; as to regulation, referring to legal documents we have tried to assess quantitatively the extent of regulation of the electric sector in 38 jurisdictions, taking into account institutional aspects about the enforcement of legislation.

Our empirical analysis shows that the speed of privatisation in electricity is partly determined by market structure. The frequency of the sales is sensibly reduced where the system exhibits a high degree of vertical integration. More interestingly, regulation appear to be the key to State assets divestiture in the electricity sector. In highly regulated settings, we find more sales and larger stakes sold. This result provides insights about corporate governance in utilities: regulation may avoid the distortions of private property of infrastructure and substitute public ownership. Finally, revenues appear to be *positively* correlated to regulation. When privatising utilities, possibly governments face no trade-off between revenues maximisation and efficiency. Our results suggest that setting a clear institutional framework possibly allow governments to reduce uncertainty about future policy, with the consequence that the auctioning of the shares will be more successful in terms of proceeds.

To conclude, Friedman ([?], p. 128) once lamented: “There is unfortunately no good solution for technical monopoly. There is only a choice among three evils: private unregulated monopoly, private monopoly regulated by the State, and government operation”. Our results suggest that at the privatisation stage maybe the second option is the lesser evil.

The link between regulation and privatisation of utilities has been the focus of a wide theoretical literature, that we do not survey here. The interested reader may find in Vickers - Yarrow [?] and Laffont - Tirole [?] useful references. Bergara, Hennisz, and Spiller [?] provide a cross-country empirical analysis about the effects of institutional credibility and electric utility investment. In the empirical literature we have not been able to find reliable regulatory indicators for the electric sector in a cross-section of countries nor a systematic statistical analysis about the economic effects of market structure and regulation in privatisation. This paper provides tentative results in that direction.

The paper is organised as follows: section 2 presents the data, describing the variables and the predictions we test; section 3 presents our empirical results; section 4 concludes.

## 2 Data and Variables

Privatisation International - our source for data at the company level - reports 135 sales and \$107.8 billions of revenues in the energy sector (80% of both figures in electricity and 20% in oil and gas) in 26 countries for the period 1977-97. We decided to restrict to electricity for two main reasons: first, sales in this sector account for the largest proportion of the revenues in power; second, oil and gas includes regulated as well as unregulated segments. We further restrict to sales in power generation, excluding transmission and distribution mainly because more countries have been involved in privatisation of the upstream segment of the industry. We will consider companies involved in generation alone, excluding from the sample partially integrated operators like distributors with some generation capacity or generators owning segments of the transmission network.

The choice of the sample is mainly determined by the availability of reliable data about the electric industry and regulation, starting from the 49 countries sample used by LLSV and BSFV. From that sample, we have been able to retrieve regulatory and market structure indicators for 38 countries, mainly drawn from Lewington [?] that to our knowledge is one of the best source for institutional and legal materials concerning regulated sectors. For the countries non included in that source we referred to original national documents.<sup>1</sup>

The analysis at the company level is based upon data for 49 sales in electricity

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<sup>1</sup>We disaggregate UK into England and Wales, Scotland and Northern Ireland mainly because market structure differ substantially: England and Wales are de-integrated systems a high degree of competition in generation, given the existence of a wholesale electricity market (the “pool”). In Scotland we find instead two vertically integrated operators (Scottish Power and Scottish Hydro). In Northern Ireland, we have a single company operating transmission and distribution (Northern Ireland Electricity), but three generators. Furthermore, a separate regulator (Ofreg) is in charge with dual responsibility for gas and electricity.

generation in 19 countries. The sources for the control variables (per country electricity consumption, growth rates, etc.) are listed in Table 1.

## 2.1 Quantity and Quality of Privatisation

The quantity and quality of privatisation in the electric sector will be the dependent variables of our analysis. According to BFSV [?] quantity refers to the variable EL-SALES, defined as the total number of sales in electricity generation in a given country; similarly, ELREVENUES is defined as the per country aggregate proceeds from total sales in US dollars 1996. The quality metric is instead different from BFSV [?]. In order to exploit all the variance in the variable, we replace STOCK as a country average with the cumulative stake sold at the firm level (ELSTOCK), taking into account different tranches if any. In the previous analysis, it was particularly important to have a statistic at the country level. Now it is fundamental to track ownership changes within firms.

## 2.2 Vertical Integration

The industrial organisation of the electric sector varies greatly around the world, spanning from high concentration and vertical integration to more competitive and de-integrated regimes.

At one extreme of the spectrum, we find market arrangements where electricity is mainly provided by a single vertically integrated company operating nation-wide. Many European countries fit to this model: ENEL in Italy, EdF in France, the Electricity Supply Board in Ireland and PPC in Greece operate in generation, transmission and distribution under public ownership. In the Belgian and Austrian systems, different companies appear to be involved in different segments of the market, but at a closer look ownership structures reveal a high degree of concentration of activities within a single entity. In Belgium, up to October 1996 Tractebel owns a majority stake in Powerfin and a solid controlling position in Electrabel. Electrabel itself owns the majority of stock in the “mixed” intermunicipal companies that provide almost 80% of the distribution of electricity. Also in Austria several companies are responsible for generation, transmission and distribution. Nevertheless, VG - the inter-state interconnection transmission company - owns a majority stake upstream in 8 generators and downstream through direct or indirect holdings in the several regional or municipal distribution companies. In both cases, vertical integration is completely replicated by ownership.

In other countries we observe less horizontal concentration of activities - within a single firm or through shareholdings - but often a number of vertically integrated players

operating at a regional scale. Germany is a typical case of this kind of market arrangement: while horizontally decentralised, the generation and transmission (and to some degree distribution) activities are regionally integrated within 9 main utilities. A similar structure is also found in Denmark and Scotland, where supply consists of two vertically integrated regional systems.

At the other extreme of the spectrum, we find de-integrated and often more competitive settings. Vertical separation and liberalisation are often the outcome of a process of deep restructuring of the industry via unbundling. These liberalisation processes are particularly important for the scope of our analysis as they are a part of a well designed privatisation package.

England and Wales represent a blueprint for liberalisation and restructuring in the electric sector. Being the reform set forth in 1988 White Paper strictly implemented, the market has experienced a horizontal and vertical de-integration: the Central Electricity Generating Board (CRGB) has been broken up in two generators (National Power and PowerGen) and the National Grid company. The Regional Electricity Boards were privatised as the Regional Electricity Companies (RECs) with responsibilities for the distribution and supply businesses (Green and Newbery 1998).

Some countries around the world have followed the British path. In the early 1990s Argentina experienced “one of the most drastic, comprehensive and rapid sets of changes ever observed in the electricity services in a modern democracy” (Bastos - Abdala [?], p.21). Up to 1992, the electricity industry was publicly owned and mainly consisted of three vertically integrated operators (SEGBA, AyE and Hidronor). The 1992 privatisation law stated that competition and market mechanisms should be introduced and promoted whenever possible so unbundling of activities would be necessary. The recommendation by the law have been implemented through a split of the three above-mentioned companies in 21 generation companies, 3 distribution companies, and through a merger of the high-voltage transmission to a newly incorporated company, Transener.

To some extent, following the 1992 legislative reform, Peru implemented a radical horizontal and vertical de-integration of the electric supply. The generation activity of Electroperu and Electrolima were split into various entities, while the regional companies kept distribution as their sole activity. Similar processes took also place in Chile, Australia, and Spain.

To our purposes, we are particularly interested in quantifying the existence of a vertically integrated system within a given country. The relevant information concerning the industry structure is captured by the dummy VINT, taking the value one where the market is dominated by a single or various vertically integrated player or by a single



entity owning control stakes in the upstream and downstream electricity business.

Vertical integration may hinder privatisation. As we stated in the introduction, selling a vertically integrated business might not be efficient, since cross-subsides are possible. Efficiency would probably require to issue the shares of the electric companies separating out the natural monopoly side of the business. But this splitting is problematic when the market is dominated by vertically integrated incumbents. We therefore expect a negative correlation between the VINT dummy with our first quantity variable, ELSALES.

## 2.3 Market Regulation

It is unanimously agreed that regulation is a key element in privatisation of infrastructure. A well designed regulatory framework protects consumers from monopoly abuses and investors from arbitrary political action and provides incentives for efficient operation and investment (Braeutigam [?], Laffont - Tirole [?]).

The previous statements are probably uncontroversial to most economists. But how do we measure the quality of regulation? Is it possible to rank the intensity of regulation across jurisdictions referring to objective indicators? The comparative study of different institutional arrangements is intrinsically a difficult task, but with appropriate restrictions of the field the experiment yields some useful results.

If one looks at the institutional setting in our cross section of countries, with very few exceptions (Ireland, Thailand, Philippines, Venezuela, Austria) the electricity market is typically subject to some form of public control. This means that at least a legal document involving the companies operating in the sector has been enacted and in place up to January 1997. Obviously the mere existence of a law involving electricity is not particularly informative to our purposes; so one has to study in more detail what has been regulated and the institutions designed to enforce the existing regulation.

The more interesting aspects of regulation in electricity generation and distribution involve: (i) entry conditions; (ii) access to the network; (iii) prices.

The regulation of market access varies greatly around the world; in the majority of countries, producers must meet certain requirements - capacity, safety, environmental protection, etc. - to obtain licences, that are often allocated on the basis of competitive bidding or other procedures. While licences or the imposition of some standard to generators are a common features of entry regulations almost everywhere, countries differ systematically in the way the access to the network is regulated.

The two sides of electricity supply - generation and local distribution - are linked together through the network. For competition to be effective, access to natural monopoly-

type bottlenecks should be granted by law. Nevertheless, under some jurisdictions, network access is guaranteed to all producers and all eligible customers under objective and non discriminatory conditions (regulated Third Party Access or TPA) whereas in others it is left to the benevolence of the network owner. A somehow intermediate case is when generators have granted access to the network, but at conditions that depend on the agreement with distributors. This case is usually referred to as Negotiated TPA.

The TPA model is explicitly indicated in the European Directive as regards the Internal Electricity Market. Member states that have implemented a more complete liberalisation of network access via regulated TPA include Denmark, Finland, Sweden, England and Wales, and the Netherlands. Negotiated TPA has been adopted in Austria, Portugal, and Germany.<sup>2</sup>

Another important institutional aspect of the functioning of the electric market is the presence of a “pool” or a regulated wholesale electricity market. The pool is an organised market for trading in electricity: generators compete with one another to supply power to the grid. The existence of a pool has to be considered an element of regulation since in most circumstances the pool has been introduced by law and is certainly a good indicator for a high degree of the effectiveness of regulation in fueling competition at least among generators.

A wholesale market for electricity has been firstly established in Chile in the Eighties, in the United Kingdom in 1990, in Argentina in 1992. Competitive pools are also operational in Scandinavia (the Nordpool linking together Norway and Sweden from 1992, the EL-EX in Finland from 1996), in Spain from 1996, in parts of the US, Australia and New Zealand.

Finally, the price formation mechanism is also object of regulation at various level, but typically in transmission and distribution. Excluding some more exotic solutions, essentially prices of the network owner are subject to RPI-X or rate of return regulation. The control on the price formation mechanism is obviously crucial for the efficiency of the system. The problem is that virtually all countries that have a legal document concerning the electricity market somehow regulate prices. Since we have not available a proxy for the “quality” of price regulation across countries (i.e. the X in RPI-X), we prefer to exclude it from the analysis.

The institutional aspects of regulation are often neglected by economists; nevertheless they warrant attention, since they provide valuable information about how regulation is enforced. In our analysis, we try to establish whether the main legal document of a given

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<sup>2</sup>It is important to note in passing that regulation of grid access in Germany is enforced by the Antitrust Authority.

jurisdiction foresees an independent and not advisory regulatory agency. In our definition, independent means that the agency is not a branch of a ministry and engaged only in arm's length relationships with regulated firms and political authorities, facing low risks to be captured by firms or governments; not advisory means that the agency is endowed with decision powers for fixing and implementing tariffs, for establishing regulations concerning security and quality standards, interruptions and reconnections, metering and billing.

In the majority of countries, different ministries (Energy, Industry, Development, etc.) are directly charged with regulatory functions. In some cases, an regulatory agency exists but is not independent from government and political interference. For instance, the *Comisión del Sistema Eléctrico Nacional* - the Spanish agency - while formally independent is mainly a consultative body attached to the Ministry of Industry and Energy. Independent regulators endowed with decision powers are frequent in the anglo-saxon world, in some Latin American countries like Brasil and Chile, and in a few countries of Europe particularly committed to introduce institutional innovation in the regulation of the electricity.

From this preliminary description of the regulatory settings around the world, we are now able to build a regulatory index (REG) for each country (see Table 2). REG takes the value 3 when a country's regulatory setting foresees: (i) regulated TPA; (ii) a "pool" or a regulated wholesale market for electricity; (iii) an independent regulatory agency. It is sensible to assume that the higher the index, the more pervasive regulation and the more competitive the electricity market.

We put in relation the regulatory index with the quantity and quality of a country's privatisation testing statistically various hypotheses about the effect of regulation on privatising utilities.

First, a more regulated environment should ease State sell-offs: in well regulated settings, players operate in more competitive regimes. Efficiency losses due to natural monopolies are virtually eliminated and this increases the political feasibility of infrastructure privatisation. We therefore expect a positive correlation between REG and ELSALES.

Second, we put in relation the regulation index with aggregate proceeds from privatisation in the electricity market (ELREVENUES). Conventional theory suggests that regulation decreases the expected profitability of the investment, given that the firm will operate in a more competitive environment post-privatisation. If regulation curbs supernormal profits, investors should be willing to pay less for corporate assets in highly regulated settings. But one cannot also exclude a correlation in the opposite direction

since clear rules already in place reduce uncertainty about future regulatory interventions. Regulatory risk is particularly important for investors in the electric sector, where stranded assets and long-term contracts are common characteristics of firms and transactions. (Helm - Jenkinson [?])

Finally, it is rather sensible to assume that regulation could substitute public ownership, where the latter is essentially due to the presence of natural monopoly. The public property of infrastructure is easy to explain recalling the possible negative consequences for the taxpayer of private ownership of natural monopolies. This is precisely the reason why public property is often recommended by Constitutions. By the same token, effective regulation could avoid the distributive effects of privatisation, allowing governments to privatise larger stakes and eventually relinquish control. To test the effect of regulation on corporate governance in privatised firms, we put together the regulation index to our quality measure, namely the cumulative percentage of privatised stock (ELSTOCK).

## 2.4 Controls

Several variables will be used in the empirical analysis to control for country-specific effects. The average annual consumption of electricity in Kwh for the period 1977-96 (CONS) will allow to control for the size of demand in a given country. Consumption is highly correlated to GDP (correlation 0.95); so through this variable we will be control also for the size of the country. This variable is certainly spurious to measure also the supply side of the market, given that many countries import electricity. Nevertheless, it is reasonable to assume that in larger countries the electricity sector could also be larger; including this variable would also allow to take into account supply side effects in privatisation.

We also include in the analysis average growth rates (GROWTH), the political dummy RIGHT, the institutional credibility index (CREDIBILITY), and the financial market liquidity (FLOAT and TURNOVER). We have picked from BFSV [?] the more interesting variables to explain the quantity and quality of privatisation, to see whether they still have an impact also in the electric sector.

## 3 Empirical results

The results of our empirical work are shown in Table 3 to 6. Many countries did not privatise at all electricity generation so the dependent variable contains a large number of zeros. This very fact is nonetheless interesting to explain, since market structure or weak regulation might be useful to interpret the absence of privatisation. Under these

circumstances, OLS regressions would probably yield downward biased results. We prefer therefore to use Tobit models in our empirical analyses at the country level.

Our quality variable at the company level - i.e. the cumulative stake sold in electricity generators (ELSTOCK) - is instead always positive and assumed continuous. OLS estimation is therefore more appropriate.

Table 3 and 4 show the results for the ELSALES regressions with vertical integration and regulation as independent variable respectively. The estimation using the two variables in the same equation would be impossible due to collinearity problems.

An interesting result in Table 3 is that vertical integration is strongly and negatively correlated with the number of sales in the electricity sector. The coefficient of the VINT variable is indeed significant and relatively stable in different specifications controlling for country-specific effects. This evidence confirms the view that the presence of a vertically integrated system is a great obstacle in electricity privatisation.

As we previously remarked, vertically integrated operators should be split before privatisation to avoid the distortions of private ownership of a natural monopoly. Separating out the potentially competitive side of the market (generation) from the transmission distribution business should reduce the likelihood of cross-subsidisation within the company.

This argument clarifies why the frequency of the sales is lower in electricity markets dominated by a single vertically integrated player. In several circumstances, due to the dimension of corporate assets the operating firm is a very powerful incumbent who can invest resources in the political market to avoid liberalization. Unbundling can be therefore implemented only by government strong enough to counterbalance this pressure to keep the status quo.

We have therefore singled out an important determinant of the speed of a privatisation process: vertical integration. We now turn to comment the results in Table 4 providing evidence the effects of regulation on the variable ELSALES.

Our regulatory index REG is highly significant, positive and stable in different specifications. The frequency of the sales in the electricity sector is therefore highly positively correlated with the extent of regulation. This result is quite easy to explain: if a well defined regulatory framework exist at the time of the sale, privatisation will be easier for governments; if the market is liberalised in the segments where competition is viable and appropriately regulated where natural monopoly-type bottlenecks exists, supernormal profits will be curbed. A well-designed privatization package - including liberalisation and regulation - will therefore be more politically acceptable. If clear rules exist, privatisation can smoothly enter the second stage involving utilities like electricity.

Some other results in Table 3 and 4 warrant attention. In both sets of regressions, our control variables CONS and GROWTH are not significant, indicating respectively that the scope of a country's privatisation in the electric sector is virtually independent from electricity demand and stage of economic development. Quite interestingly, the political dummy RIGHT is significant and positive: according to the results in BFSV [?], conservative governments appear to be more involved in the privatisation of strategic sectors like electricity.

The fact that vertical integration and regulation have an impact on the speed of State assets divestiture might not be particularly surprising. It is widely recognised that the countries that have more successfully privatised have also deeply restructured and liberalized the electric sector pre-privatisation. The economic effects of regulation upon the proceeds from sales in the electric sector is probably a more controversial issue. Some argue that liberalisation and regulation reduce the expected profitability of the investment, so that bidders should be willing to pay less for assets in the electricity business in highly regulated settings. Other contend that also regulatory risk matters: at the time of the sale, investors might discount the possibility of unexpected regulations or governments' decisions by policy makers, as it happened with the MCC intervention in the BP case.

The results shown in Table 5 provide some tentative answers to this important question. In all our regressions, the higher the regulatory index, the higher the aggregate proceeds from sales in the electric sector. In particular, a one point increase in the index raises revenues of an amount of approximately US\$ 1,12 billions. Regulatory risk seems therefore to matter substantially. We do not report any statistically significant relation neither with the turnover ratio and with the institutional credibility variable (CREDIBILITY). The second financial market development indicator (FLOAT) is instead positively related to the privatisation proceeds, indicating a possible role for liquidity the financial success of the issues.

We think that these results about the effects of regulation on privatisation proceeds can be interpreted within the framework of incomplete contracting (Coase [?], Hart and Moore [?]). Buying an utility is akin to signing a contract with the government. In the privatisation transaction, parties are called to strike this contract with limited information concerning future contingencies. Under these circumstances, regulation reduces uncertainty and therefore transaction costs. Clear rules appropriately enforced help bidders to gauge more precisely the expected profitability of the investment and this will increase their willingness to pay. On the contrary, the absence of a well-defined regulatory framework increases transaction costs: if investors are fully rational, they will discount

the possibility that their counterpart may ex post change the rules of the game. The consequences of hold-up are particularly severe in electricity where long-term investment and stranded assets are intrinsic characteristic of the market.<sup>3</sup>

We have stated in the introduction that the quality of a privatisation process can be evaluated according to the dimension of the stake sold. In our previous analysis, we have shown the relevance of legal institutions - viz. investors' protection - in this respect (BFSV [?]). In utilities, and particularly electricity, an important issue to settle is the following: does regulation affect the willingness of government to transfer ownership and relinquish control in privatised firms?

Table 6 provides some tentative answers. We have run regression for ELSTOCK using the regulatory index of the country in which the privatised company operates and some control variables at the country level. A major flaw of our estimates is that due to lack data we are not controlling for firm specific fixed effects. Albeit still preliminary, the results in Table 6 indicate a clear positive and statistically significant correlation between the regulatory index and the stake sold. The coefficient remain stable and significant also taking into account country-specific effect, whereas the control we use are never significant.

Regulation not only influences the quantity of State assets sold in the electric, as confirmed by the results from the sales and revenues regression, but possibly it also shrinks the residual stake held by government. This evidence has strong implications concerning corporate governance in utilities. Regulation may substitute public ownership: benevolent governments will privatise larger stakes if shareholders will not reap surplus via dividend policy at the expense of consumers. But privatisation by no means is perfectly equivalent to public ownership, since privatisation will expose companies also to the discipline of capital markets. The takeover threat in market for corporate control compels managers to operate utilities efficiently, reducing costs to keep profitability. Obviously, this kind of competition will be strongly limited if governments retain golden shares or other legal devices in order to transfer ownership retaining control.<sup>4</sup>

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<sup>3</sup>Auction theory provides a normative interpretation of our result. The government typically enjoys superior information about the regulatory environment in which the firm will operate. By enacting regulation, he will make it publicly accessible and verifiable. If the bidders' valuations are correlated, under these circumstances it can be shown that expected revenues for governments will increase in all standard auctions. (Schmidt - Schnitzer [?], Milgrom - Weber [?]).

<sup>4</sup>One could claim that our results are potentially affected by endogeneity problems. The extent of privatisation could determine market structure, as the presence of a de-integrated regime could be the outcome of privatisation. The variable VINT is nonetheless defined as a dummy for the presence of a vertically integrated system. It is less evident that vertical integration is endogenous to the quantity of privatisation. Similarly, one could claim that liberalisation, regulation and privatisation are all parts of a structural reform package and simultaneously implemented. This is seldom the case. We observe

## 4 Conclusions

In this paper, we have made an initial attempt to single out some critical aspects in the privatisation of infrastructure. Particularly, we focused the attention upon two factors that may influence the pace of divestiture in network industries: vertical integration and regulation.

Our results are straightforward to summarise: first, the presence of a vertically integrated system reduces substantially the frequency of sales in utilities. Second, regulation appears to be crucial for the success of privatisation in the utility sector. Our regulatory indicators are strongly correlated to the quantity of sales in electricity, to the stake sold, and to the revenues from the sales. As theory suggests, the public-monopoly-turn-private argument does not apply in well regulated settings and consequently an important rationale for public ownership of natural monopolies loses relevance. This reasoning explains the higher number of sales and percentage of stock sold in electricity, but also why sales are so unfrequent where vertical integrated players dominate the market.

Quite surprisingly, regulation does not seem to affect negatively revenue generation. On one hand regulation maybe reduces the expected profitability curbing supernormal profits, but on the other it provides clear rules and a framework where investments and business opportunities can be more appropriately gauged. In our regressions, the latter factor apparently dominates the former in the investors' decision. Governments should not therefore be too wary to regulate and *then* privatise.

The paper might be improved and extended in a number of directions. First, we focused only on vertical integration as an obstacle to privatisation; it is nonetheless important to bring into the analysis horizontal concentration as a critical determinant of market structure and privatisation in the electricity sector. Our regulatory indicators should be also improved taking into account qualitative aspects of price regulation and other institutional aspect of the enforcement of regulation. The statistical analysis at the company level should also be improved controlling for fixed effects using appropriate balance sheet data. Furthermore, we would like to extend the analysis in other strategic sectors, like TLC and transports.

We leave all this for future research.

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instead that in the electricity sector with few exceptions (i.e. Spain) regulation is typically followed by the privatisation decree. In order to test for possible simultaneity we have performed Hausman tests, obtaining mixed evidence. Nevertheless, the results are more supportive of the hypothesis of exogeneity of the variables of interest.



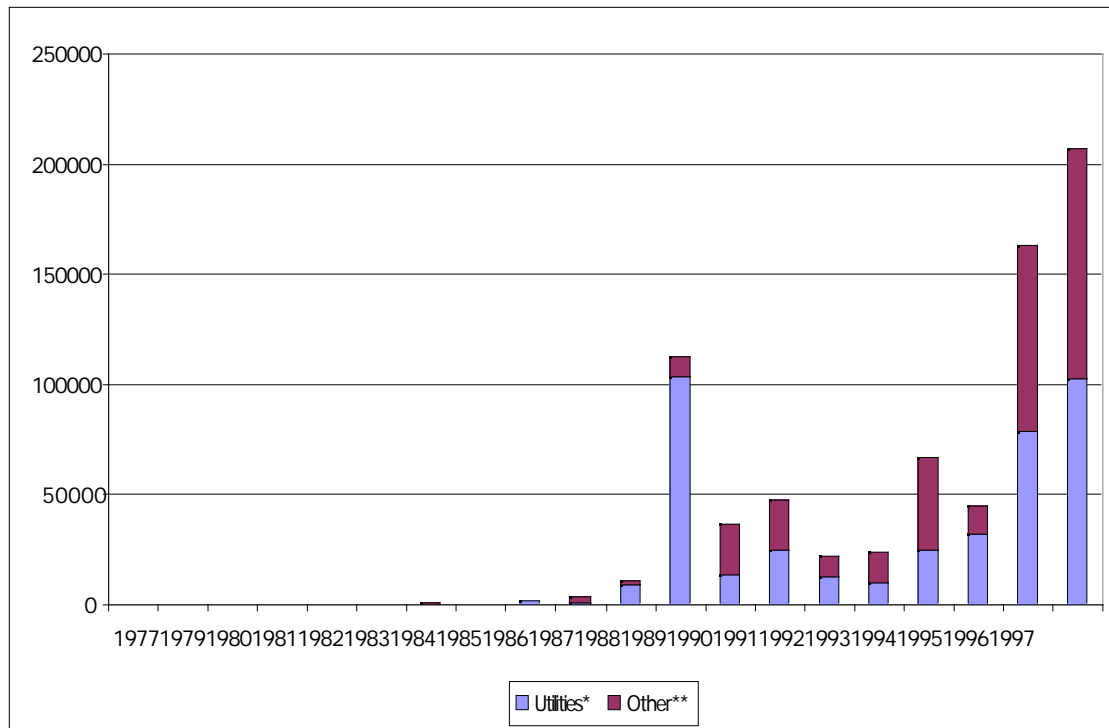
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**Fig.1 Distribution of Revenues in the World**

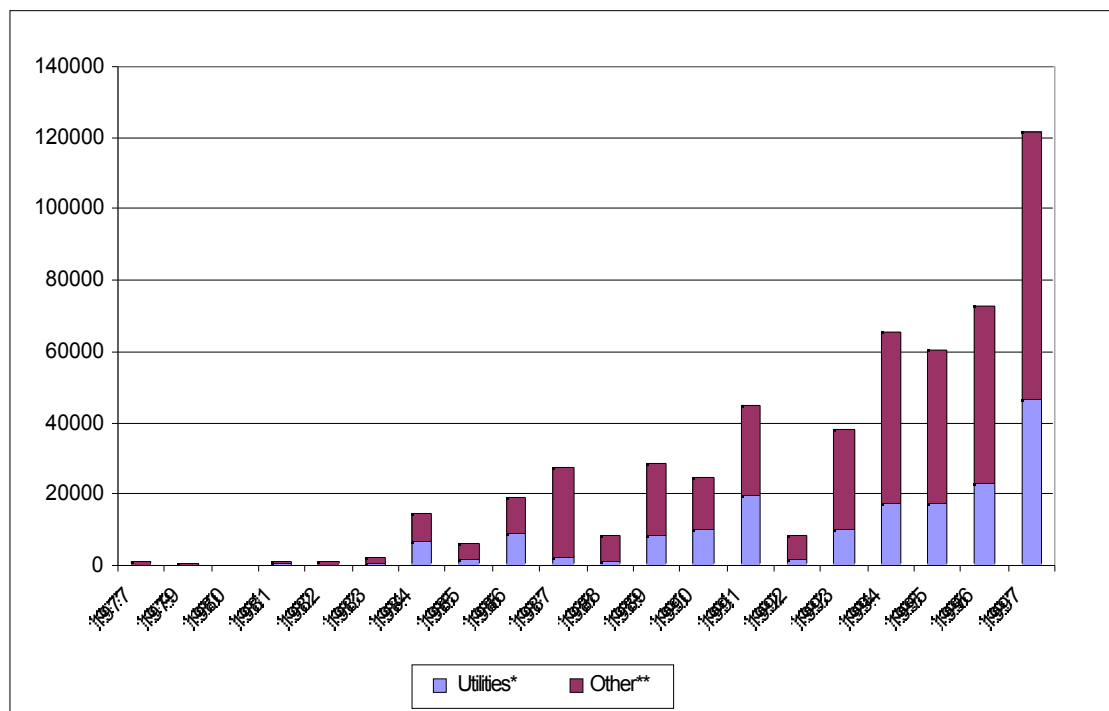


**Note:**

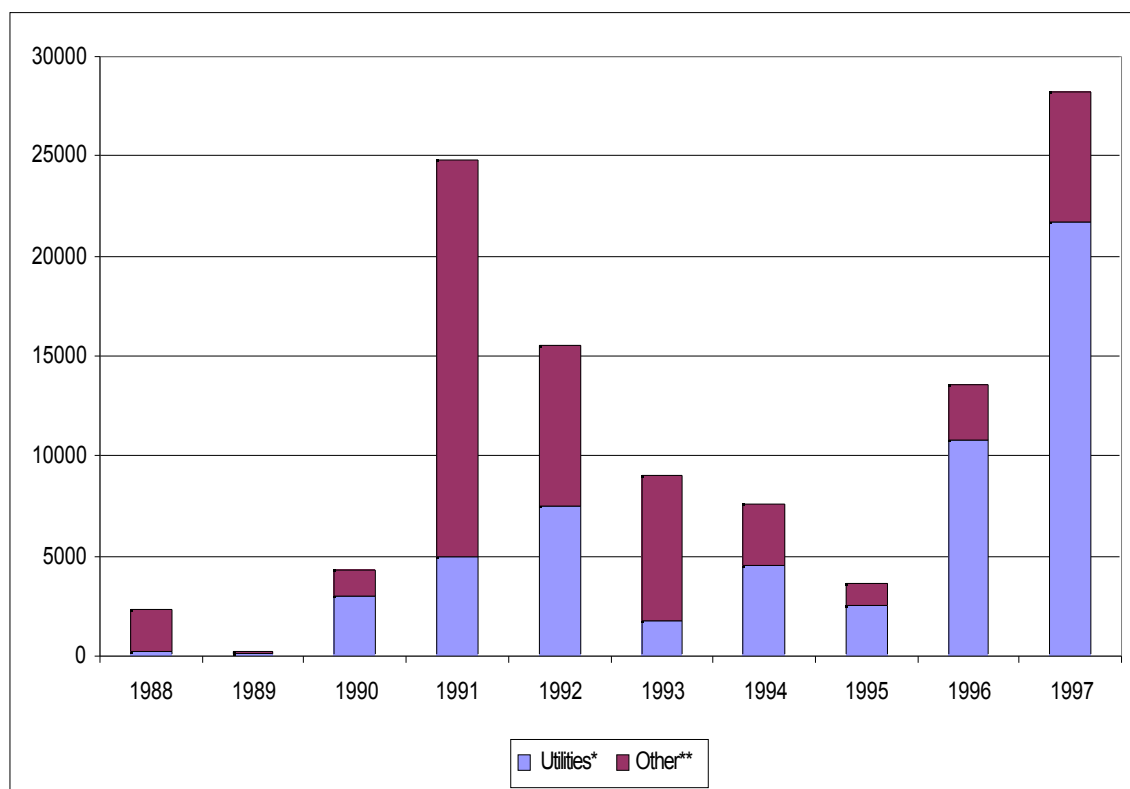
**\*Utilities include:** Airport, Bus and taxi services, Electricity, Gas transmission and distribution, Postal services, Rail service, Road, Seaport, Telecommunications, Transport, Water and sewerage.

**\*\*Other include:** Agriculture, Airline, Airspace, Banking, Broadcasting, Catering and bars, Chemicals and allied products, Construction, Construction materials, Electrical and electronic equipment, Engineering, Financial miscellaneous, Food and beverage manufacturing, Forestry and fishing, Holding company, Hotel, Insurance, Machinery, Metals and metal products, Mining, Miscellaneous manufacturing, Miscellaneous services, Motor vehicle, Multiple, Oil and Gas, Paper and board, Pharmaceuticals, Post, Printing and publishing, Rail equipment, Real estate, Retailing, Roads, Rubber and plastic, Science and engineering, Scientific instruments, clocks, photographic, Shipbuilding, Shipping, Telecommunications equipment, Textiles, Tobacco, Tourism.

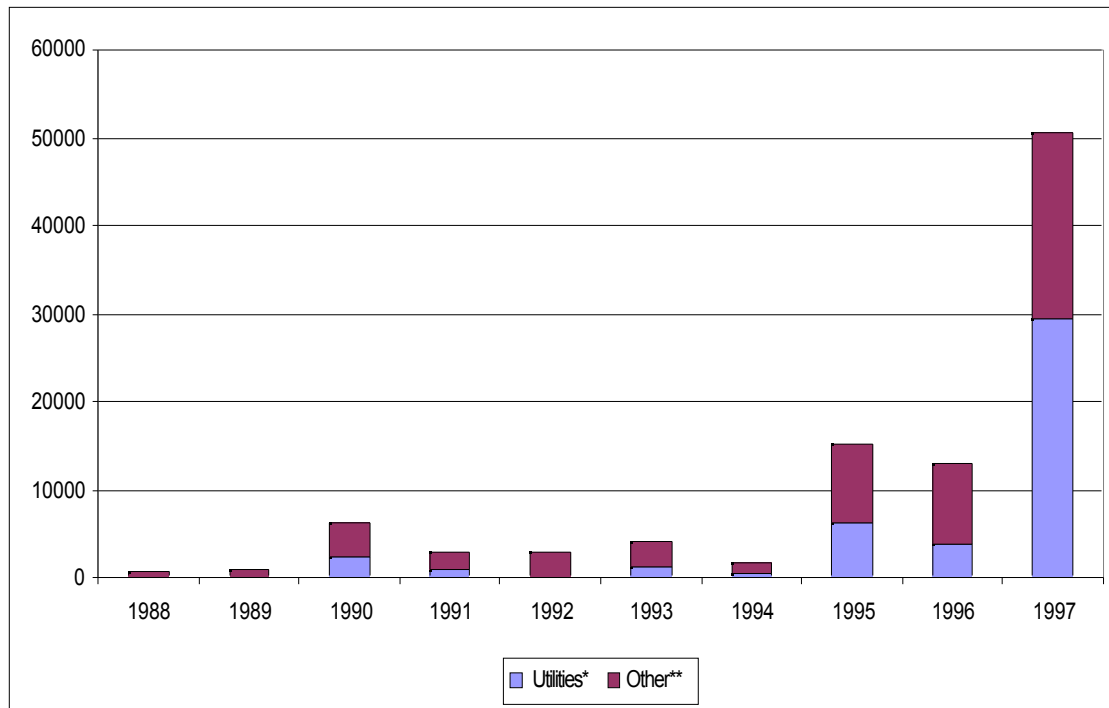
**Fig.2 Distribution of Revenues in Western Europe**



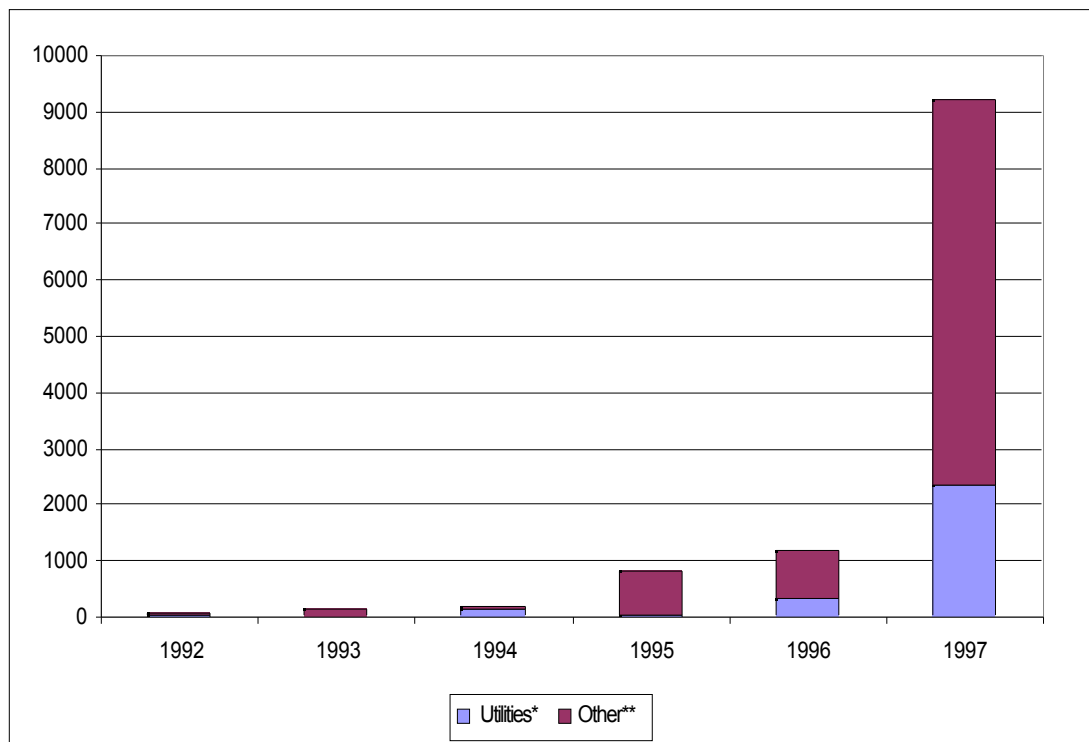
**Fig.3 Distribution of Revenues in Latin America**



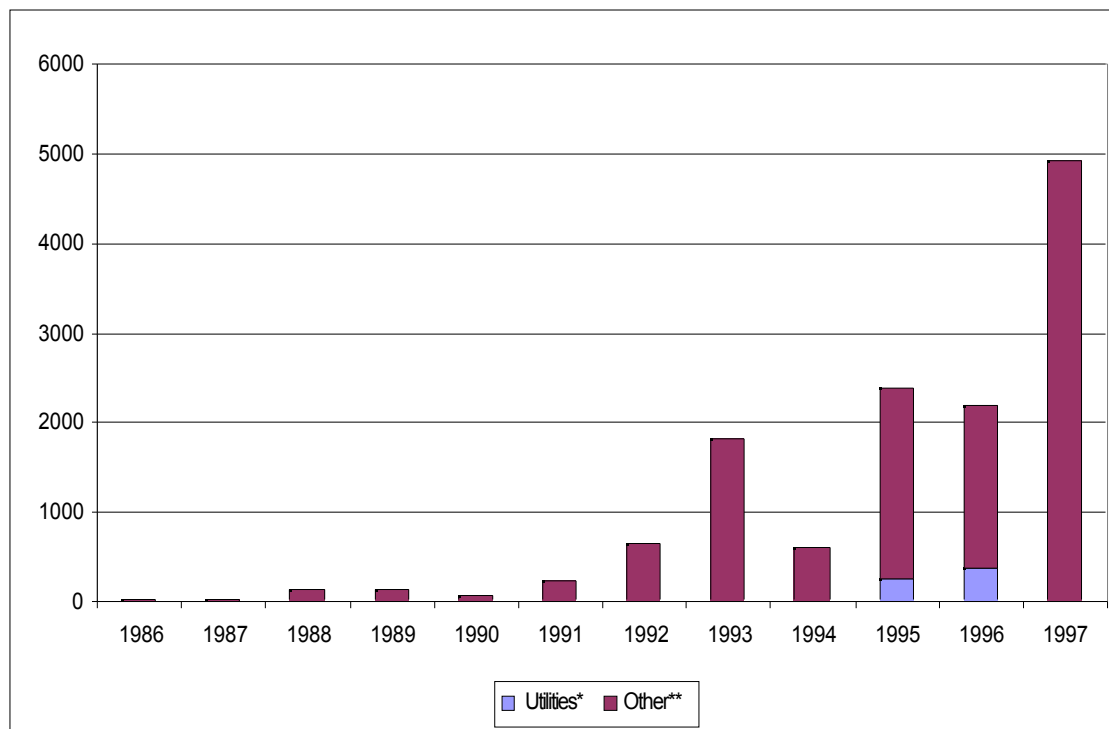
**Fig.4 Distribution of Revenues in Australasia**



**Fig.5 Distribution of Revenues in Former Soviet Union**



**Fig.6 Distribution of Revenues in Middle East and North Africa**



**Fig.7 Distribution of Revenues in Asia**

