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ABSTRACT

Capital Structure and Regulation: Do Ownership and Regulatory Independence Matter? *

We study the effect of ownership structure and regulatory independence on the interaction between capital structure, regulated prices, and firm value, using a comprehensive panel data of publicly traded European utilities. We find that firms in our sample tend to have a higher leverage if they are privately-controlled and if they are regulated by an independent regulatory agency. Moreover, the leverage of these firms has a positive and significant effect on their regulated prices, but not vice versa, and it also has a positive and significant effect on their market values. Our results are consistent with the theory that privately-controlled regulated firms use leverage strategically to obtain better regulatory outcomes.

JEL Classification: G31, G32, L33 and L51
Keywords: capital structure, leverage, private and state ownership, regulated utilities, regulatory agencies and regulatory independence

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1. Introduction

Ten years after the beginning of large scale privatization and institutional reforms in network industries in Europe, regulated utilities have substantially increased their financial leverage. Casual observation suggests that this trend is widespread across countries and sectors. For example, Telefonica de Espana, the Spanish incumbent telecom operator, increased its leverage after its privatization in 1997 from 36% to 68% in 2005; Autostrade per l'Italia, the largest freight road operator in Italy, increased its leverage from 32% in 1999, when it was completely privatized, to 88% in 2003; National Grid Group Plc, the UK energy transport operator, increased its leverage from 30% in 1997 to 72% in 2005; and Anglian Water Plc, the largest water company in England and Wales, raised its leverage from 7% in 1997 to 49% in 2005. A joint study of the UK Department of Trade and Industry (DTI) and the HM Treasury (DTI-HM, 2004) has expressed a concern about the "dash for debt" or "flight of equity" within the UK utilities sector from the mid-late 1990's and argued that such high leverage "could imply greater risks of financial distress, transferring risk to consumers and taxpayers and threatening the future financeability of investment requirements" (DTI-HM, 2004, p. 6).[1] In light of these concerns and given the importance of regulated utilities sector for the economy as a whole, it is clearly important to understand the determinants of the capital structure of regulated utilities and its implications.

The high leverage of privately-owned regulated utilities is a well-known and well-documented phenomenon in the U.S., where large utilities were always privately owned and subject to rate regulation by state and by federal regulatory commissions since the 1910's.[2] It is therefore interesting to observe a similar trend in network industries in Europe. The typical institutional framework in Europe is different however from that in the U.S. in at least two important respects. First, private ownership and control of utilities is still the exception rather than the rule; indeed, despite the privatization wave, many European utilities are still controlled by central or local governments (see Bortolotti and Faccio, 2008). Second, not all European utilities are regulated by independent regulatory agencies: in some sectors firms are regulated directly by ministries, governmental committees, or local governments. These differences may have important implications for regulated firms' financial decisions.

From a theoretical perspective, when regulators cannot commit to long-term prices, they may have an incentive, once the regulated firm's investments are sunk, to cut prices in

[1] For a related report, see Ofwat and Ofgem (2006).
[2] See for example, Bowen, Daly and Huber (1982), Bradley, Jarrell, and Kim (1984), Smith (1986), and Barclay, Marx, and Smith (2003).

order to benefit consumers at the expense of the firm's owners. High leverage can shield the firm against such regulatory opportunism because regulators are typically concerned about the stability of the industry they regulate and are therefore reluctant to cut prices as this may increase the risk of financial distress (see e.g., Spiegel and Spulber, 1994 and 1997, and Spiegel, 1994 and 1996).[3] Hence, debt financing can alleviate regulatory opportunism and may therefore lead to higher regulated prices. This implies in turn that the capital structure of regulated firms, regulated prices, and firm value are all interrelated.

In this paper, we first document the capital structure of publicly traded regulated utilities in the EU, and then explore its determinants. Given the large variation in the ownership structure of EU regulated firms and in the regulatory framework, we are particularly interested in finding out if and how the interaction between capital structure, regulated prices, and firm value, varies across different ownership structures and whether and how it is affected by the existence of an independent regulatory agency (IRA). To this end, we have constructed a comprehensive panel data on 92 publicly traded EU utilities over the period 1994-2005. Our data covers practically all major publicly traded regulated utilities in the EU 15 founding member states. These firms were involved in major privatization transactions which account for almost a half of the EU15 total privatization revenues across all sectors (including banking and insurance, oil companies, basic materials, and consumer goods).

There are some earlier empirical studies on the capital structure of regulated firms, but with only one exception, they consider U.S. data. Taggart (1985) finds that electric utilities have increased their debt-to-equity ratios following the introduction of rate regulation in various states in the U.S. in the 1910's. Dasgupta and Nanda (1993) study a cross-section of U.S. electric utilities, and find that firms operating in less pro-firm regulatory environments tend to have higher debt-equity ratios. Klein, Phillips and Shiu (2002) study a cross-section of U.S. property-liability insurers and find strong and robust evidence that the degree of price regulation and its stringency have positive effects on the insurers' leverage. Bulan and Sanyal (2005) study a panel of U.S. investor-owned electric utilities for the period 1990-2000 and find that they reduced their debt-to-total assets ratios in response to the heightened regulatory and competitive uncertainty created by the deregulation process. Bulan and Sanyal (2006), use a similar panel to show that after deregulation, U.S. investor-owned electric utilities respond to growth opportunities in a two-step process: first, they accumulate financial slack in

[3] The effect of leverage on regulated prices was first identified by Taggart (1981), although he does not examine the implications of the price-influence effect of leverage for the equilibrium choice of leverage.

anticipation of new growth opportunities, but then, when the growth opportunities become more viable, they use debt finance to finance them. Ovtchinnikov (2008) studies a large sample of U.S. firms in industries which were subject to some form of deregulation during the 1966-2006 period, including entertainment, petroleum and natural gas, electricity, telecommunications, and transportation. He finds that following deregulation, firms significantly reduce their leverage by about 30%, and moreover, leverage becomes much less negatively correlated with profitability and market-to-book ratios and much more positively correlated with firm size. Finally, Correia da Silva, Estache and Jarvela (2006) examine the leverage of 121 regulated utilities in 16 less developed countries over the period 1991-2002 and find that leverage varies significantly across sectors, with the highest leverage being observed in transportation and the lowest in water supply. Moreover, they find that leverage steadily increases over time while investment levels fall.

To the best of our knowledge, our paper is the first systematic study of the capital structure of European utilities and the first to examine empirically the relationship between capital structure, regulated prices, ownership structure, and regulatory independence. The analysis of our panel data reveals the following:

(i) Utilities tend to have higher leverage when they are privately controlled and regulated by an independent regulatory agency (IRA).

(ii) When firms are privately controlled and regulated by an IRA, leverage Granger-causes regulated prices (but not vice versa). When firms are state controlled, leverage and regulated prices do not Granger-cause one another.

(iii) An increase in the leverage of regulated utilities has a significant positive effect on their market value, provided that they are privately controlled.

These results hold even after controlling for various firm-specific characteristics such as size, asset tangibility, profitability and efficiency, and non-debt tax shield, and for key features of the macroeconomic and institutional environment, such as the growth rate of GDP, the political orientation of the government, and the strength of the legal protection of investors' rights.

The rest of the paper is organized as follows. Section 2 presents the theoretical background and the empirical implications that we test. Section 3 provides a brief institutional framework of the regulatory environment in the EU. We describe our panel data in Section 4 and present our empirical results in Section 5. Concluding remarks are in Section 6.

2. Theoretical predictions

Regulators set the prices of regulated firms by explicitly taking into account the firm's capital structure. In the U.S., this practice stems from the need to ensure regulated firms a "fair rate of return" on their investments. This fair rate of return depends, among other things, on the firm's cost of capital, which in turn depends on the firm's capital structure.[4] Under *RPI-X* regulation which is widely used in the EU, regulators set price caps that ensure that the regulated firm's revenue will cover its operating costs, depreciation, and infrastructure renewals charges, and will yield a sufficiently high return on its capital to induce it to enhance and maintain its network. As in the U.S., the return on capital depends on the firm's capital structure.[5]

The fact that regulated prices are set on the basis of the firm's capital structure suggests that regulated firms can affect their prices by appropriately choosing their capital structure. In particular, Spiegel and Spulber (1994 and 1997) and Spiegel (1994 and 1996) show that if regulators are unable to commit to long-term regulated prices, then regulated firms will have an incentive to become leveraged. The idea is that once the firm's investment is sunk, regulators have an incentive to cut prices in order to benefit consumers at the expense of the firm's owners. The firm, however, can mitigate this "regulatory opportunism" by issuing debt, because then, regulators, who are typically concerned about the financial stability of the industry they regulate, will have an incentive to set higher prices than they would otherwise set in order to minimize the risk that the firm will become financially distressed.[6]

These theoretical predictions are based however on the implicit assumption that the regulated firm is privately owned and regulated by an independent regulatory agency. But as mentioned in the Introduction, many European regulated utilities are still state-controlled and in many cases, are regulated by ministries, governmental committees, or local governments rather than by an IRA. These institutional features have important implications.

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[4] In an early decision from 1898, *Smyth v. Ames* (1898) 169 U.S. 466, the Supreme court of the U.S. decided that "what the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience." In its landmark decision *Federal Power Comm. v. Hope Natural Gas Co.,*(1944) 320 U.S. 591, the Supreme court of the U.S., elaborated on the concept of fair rate of return and stated that "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks."

[5] See for example DTI-HM, (2004, p. 16).

[6] For example, Owen and Braeutigam (1978) argue that "One of the worst fears of a regulatory agency is the bankruptcy of the firm it supervises, resulting in 'instability' of services to the public or wildly fluctuating prices."

First, it is clear that when the state controls the regulated firm, it can benefit consumers directly through the firm's actions and does not need to engage in regulatory opportunism to achieve this objective. Hence, unlike privately-controlled regulated firms, state-controlled regulated firms do not need to issue debt for strategic purposes. This suggests that privately-controlled firms would be more leveraged than state-controlled firms.

Second, it is often argued that IRAs have a better ability to make credible long-term commitments to regulatory policies than ministries and government agencies (see e.g., Levy and Spiller, 1994, and Gilardi 2002 and 2005). An empirical support for this argument is provided by Guasch, Laffont, and Straub (2003). They study a sample of 307 transportation and water concession contracts in Argentina, Brazil, Chile, Colombia, and Mexico over the period 1989 to 2000,[7] and find that although 45% of the transport concession contracts and 71% of the water concession contracts were renegotiated, the presence of an IRA lowered the probability of renegotiation by 5%-7.3%. This effect is significant given that the average probability of renegotiation of any individual contract at any point in time is around 1%. The better ability of IRAs to make long-term commitments suggests that IRAs will be less opportunistic than non-independent regulators. As a result, firms which are subject to regulation by IRAs face, other things being equal, a lower risk of financial distress and can therefore issue more debt. The implication then is that regulated firms will be more leveraged when an IRA exists than when it does not exist.[8]

Our first hypothesis then is as follows:

Hypothesis 1: *Regulated firms will have a higher leverage if they are privately controlled and subject to regulation by an IRA.*

When a privately-controlled regulated firm issues debt, it induces regulators to raise regulated prices in order to minimize the risk that the firm will become financially distressed. The higher regulated prices in turn make the firm more profitable than it would be otherwise. Therefore, our second and third hypotheses are as follows:

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[7] A concession is the right to use the assets of a former state company for a limited period of time (usually 20 to 30 years), being fully responsible for all investments and having to secure a number of targets specified in the contract. At the end of the concession, all the assets go back to the government. In a sense then, concessions could be viewed as limited-term privatizations. Guasch, Laffont, and Straub (2003) report that during the 1990's concessions have been used in 67% of the private sector participation cases worldwide, all sectors included.

[8] In Cambini, Rondi, and Spiegel (2008), we present a theoretical model that explicitly accounts for partial ownership of the regulated firm by the state and for the regulator's ability to make long-term commitments and show that debt plays a smaller strategic role when the state has a larger stake in the firm and when regulators are not independent.

Hypothesis 2: *An increase (decrease) in leverage leads to an increase (decrease) in regulated prices provided that the firm is privately-controlled.*

Hypothesis 3: *An increase (decrease) in leverage will lead to an increase (decrease) in the market value of the firm provided that it is privately-controlled.*

Hypotheses 1-3 then exploit the heterogeneity in our sample across ownership structures (private vs. state control) and regulatory frameworks (independent vs. non-independent regulatory agencies) to examine the strategic interaction between regulation and capital structure.

3. Institutional background

Following a big wave of nationalization after the Second World War, network industries in Europe were largely dominated by vertically integrated, stated-owned, monopolies. Under this regime, utilities were viewed as an operational branch of the government and were instructed to provide universal services at low prices, absorb unemployment, and invest in infrastructure. The government in turn played the dual role of owner and "regulator," and set tariffs, quality standards, and investment levels. This arrangement however created ill-performing and highly inefficient public monopolies (Megginson and Netter, 2001).

Starting from the mid 1980's, the European Commission has promoted a gradual liberalization process intended to improve the efficiency and service quality of EU public utilities and boost their investments. In particular, the European Commission has enacted a number of directives aimed at setting up a common regulatory framework for EU member states, which were in turn required to transpose these directives into national legislation. However, the Commission left the ownership structure of utilities in liberalized markets entirely in the hands of national governments.[9] As a result, central and local governments still hold major ownership stakes in many EU utilities.

The extent of effective liberalization varies considerably across member states and across industries. In telecommunications, liberalization started in 1987 with the publication of the Green Paper for the Development of the Common Market for telecommunication services and equipment. The Green Paper was followed by a sequence of directives, starting from

[9] For a more comprehensive analysis of the privatization process in Europe, see Bortolotti and Siniscalco (2004).

Directive 90/388 on "Competition in the markets for telecommunications services," which established the institution of national IRAs in each member state.[10] In the energy sector, the European Commission has been undertaking legislative actions since 1988 to establish an internal energy market for both electricity and natural gas within the EU. The milestone legislation is Directive 96/92 for the electricity, followed by Directive 98/30 for the gas market; these directives aimed at gradually introducing competition in generation/production and distribution, and at unbundling the different segments in the energy value chain. Importantly, these directives established independent national regulatory agencies.[11] The year in which a telecommunications IRA and an energy IRA were established are shown in Table A1 in the Appendix.

Unlike the telecommunications and energy sectors, the liberalization efforts in the water and transportation sectors are still in early stages. At present, privatization activity is still limited, and, with the exception of the UK, where firms were privatized and two IRAs were established to regulate the water industry (Ofwat) and the railway industry (ORR), no IRAs were yet established, and privatization is still extremely limited and limited to only 6 member states.

4. Data and main variables

Using *Worldscope*, we identify publicly traded firms operating in regulated sectors during the period 1994-2005 in the EU 15 founding member states. We define regulated sectors to be those in which entry and prices are subject to regulatory oversight either by the state or by an IRA. These sectors include electricity, natural gas, water supply, telecommunications, freight roads concessions, and transport infrastructures such as ports, airports authorities, and rail infrastructure. Excluded from the sample are airlines, oil and refinery companies, and companies operating exclusively in wireless telecommunications or in electricity generation because the prices of these services are typically not regulated.

By applying these selection criteria, we end up with an unbalanced panel of 92 publicly traded utilities and transportation infrastructure operators (891 firm-year

[10] Art. 7 Directive 90/388/EC and also preamble 11 to Directive 96/19/CE.

[11] Art. 20 Directive 96/92/EC and Art. 21 of Directive 98/30/EC. Initially, the national energy IRAs were granted powers to settle disputes among operators and were only required to be independent from the regulated firms. Over time however, EC legislation has broadened the powers of the IRAs to encompass the responsibility for ensuring non-discrimination, effective competition, and the efficient functioning of the market, along with the implementation of unbundling rules (see Art. 23 Directive 2003/54 and Art. 25 Directive 2003/55).

observations) in EU 15 founding member states.[12] Table 1 lists the firms in our sample and provides relevant information on each firms while Table 2 provides summary statistics for the entire sample. In all, we have 44 firms that engage in electricity and gas distribution, 13 water supply companies, 15 telecoms (mainly vertically integrated operators), 8 freight roads concessionaires, and 12 transportation infrastructure operators (airport, ports and docks).

As mentioned above, one of our main objectives is to find out if and how capital structure, regulated prices, and firm values, are affected by the ownership structure of the firm. In most of our analysis, we define firms as "privately-controlled" if the state holds less than 50% of the control rights (otherwise the firm is "state-controlled") and define the year of privatization as the year in which the state's control rights dropped below 50% for the first time. We also examine the robustness of the results by using a more restrictive definition of private control, whereby firms are defined as "privately-controlled" if the state holds less than 30% of the firm's control rights instead of 50% (i.e., private investors hold at least 70% of the control rights). Since our sample often exhibits a complex web of cross-ownership patterns among firms (one firm holds the shares of another firm, which in turn holds the shares of a third firm - see Figure 1 for an example), the state may hold both direct as well as indirect control rights in firms. In order to measure the state's ultimate control rights (UCR), we use the weakest link approach (see La Porta, Lopez-de-Silanes, and Shleifer (1999), Claessens, Djankov, and Lang (2000), Faccio and Lang (2002), and Bortolotti and Faccio (2008)). According to this approach, the UCR of a given investor (the state in our case) is simply equal to the minimum ownership stake along a chain (i.e., the weakest link). In the case of multiple chains, the UCR's are summed up across all chains.[13] The sources used to compute the state's UCR are listed in Table A2 in the Appendix.[14]

Among the 92 firms in our sample, 43 firms are privately-controlled throughout our sample, 25 are state-controlled throughout our sample period, and 24 were privatized during our sample period and hence we observe them before and after their privatization. Table 2 shows that the mean UCR of the state (including both central and local governments,

[12] We did not find any listed regulated utility in Luxembourg. The number of observations will vary according to data availability. For example, due to missing data in Worldscope, we only have 795 firm-year observations on market leverage. In the regression analysis, sample size is further reduced due to additional missing data in some control variables.

[13] To illustrate, suppose that an investor has an ownership stake of 50% in firm A and 30% in firm B. Firm A in turn has a 30% ownership stake in firm C, while firm B has a 10% ownership stake in firm C. Then, the investor's UCR in firm C is equal to min (50,30) + min (30,10) = 40.

[14] In some cases, firms in our data have shares with multiple voting rights, although as of May 1998, such shares were outlawed in Italy, Spain, the U.K., and Germany. Unfortunately, our data sources do not report the identity of the owners of these shares and hence we must treat them as ordinary shares. As a result, our data on state's UCR may be biased downward.

ministries, and various branches of public administration) in the firms in our sample is 34.8% for the entire sample, 10% for privately-controlled firms, and 75.1% for state-controlled firms. In terms of size, the mean total assets of firms in our sample are slightly over 200 million dollars (in constant 2005 prices) and this figure is similar for privately and state-controlled firms. The mean annual sales (in constant price 2005) are 10,083 million dollars for privately-controlled firms and 7,924 million dollars for state-controlled firms.

Our definition of private control may be overstated due to the presence of "golden shares" which give the state special control rights in the firm, including the right to appoint board members, the right to veto proposed acquisitions, and the right to cap the share of voting rights that individual shareholders can own. Our sample includes 11 firms with golden shares (see Table 1). Of these firms 4 are telecoms, 4 are electric utilities, 2 are natural gas utilities, and 1 is an airport. In practically all cases, golden shares are present only when the firm is privately-controlled.

By construction, all firms in our sample are subject to some form of regulation. In order to study the effect of regulatory independence on the firm's behavior, we constructed an *IRA* dummy which is equal to 1 in all years in which the firm was subject to regulation by an IRA and equals 0 otherwise. The *IRA* dummy was constructed using data from Gilardi (2002 and 2005) for the energy and telecommunications sectors in which IRAs already exist in all countries in our sample. We complemented this data by drawing from additional sources for freight roads, airports, port and docks, and water.

The main dependent variables in our study are leverage, regulated prices, and market-to-book values. To test our theoretical predictions, it is important for us to use a measure of leverage that captures the risk of default because the theory suggests that leverage induces regulators to raise prices in order to minimize the risk of costly financial distress. Therefore, in most of the analysis, our measure of leverage will be market leverage which is defined as total financial debt (both long- and short-term) in book values divided by the sum of total financial debt and the market value of equity.[15] The latter is computed by multiplying the number of outstanding shares at the end of the relevant year by the share price at that date converted into U.S. dollars. It should be emphasized that market leverage can increase (decrease) either because the face value of debt increases (decreases) or because the market value of equity decreases (increases). We believe however that in both cases the firm becomes

[15] See Rajan and Zingales (1995) for a discussion of alternative leverage measures. Notice that a more precise definition of market leverage would also include the market value of debt. However, since debt is not always publicly traded, we were unable to find reliable data on the market value of debt.

more vulnerable to financial distress and hence regulators may be forced to raise regulated prices. In some of our analysis we will also use two alternative measures of leverage: book leverage, which is total financial debt divided by total financial debt and the book value of equity, and debt-to-total assets, which is total financial debt divided by total assets.

Accounting and financial market data have been collected from *Worldscope*. Table 2 shows that the mean market leverage in our sample is 18.1%, while mean book leverage is 27.2% and mean debt-to-total assets is 13.5%. Moreover, market leverage is higher for privately-controlled firms than for state-controlled firms (19.1% vs. 15.7%). Table 1 shows that on average, the most highly leveraged firms in our sample are electric utilities with a mean market leverage of 22.8%, followed by multiutilities, 19.2%, and telecoms with a mean market leverage of 17.4%. The least leveraged are airports with a mean market leverage of 5.5%, and ports and docs with a mean market leverage of 8.4%.

To test Hypothesis 2, we need data on regulated prices. Unfortunately, we were unable to find reliable data on regulated retail prices at the individual firm level. Instead, we collected country- and sector-specific retail price indices (see Table A2 in the Appendix for the sources).[16] All price indices are in constant 2005 prices. We believe that given that there is still limited competition in the utilities sectors and given that there is little price dispersion, these price indices appropriately reflect the relevant prices for the firms in our sample.[17]

Hypothesis 3 states that leverage boosts the market value of the firm. To test this hypothesis, we will use the market-to-book ratio as a measure of firm value. This ratio is calculated as total assets minus the book value of equity plus the market value of equity divided by the total assets.

Firm level controls will be described below in the relevant regressions in which they are used.

5. Empirical results

Our main goal is to test Hypotheses 1-3 stated in Section 2. In the following subsections we examine these hypotheses in turn.

[16] We were unable however to find price indices for airports, ports, and docks, whose services are considered to be intermediate rather than final services.

[17] Although the telecommunication sector in the EU was gradually deregulated over time, complete deregulation was present during our sample period only in Finland. As of the end of 2005, price regulation in the form of price caps or some other form of tariff approval was widely applied in the EU, especially for basic voice services (see OECD 2006, Table 10).

5.1. Leverage

We begin by dividing our 765 firm-year observations on market leverage into four groups, depending on whether firms are privately- or state-controlled and depending on whether they are regulated by an IRA or by some branch of the government. In Panels A and B of Table 3 we report the mean leverage of each group. Panel A shows that irrespective of whether an IRA exists, the mean market leverage of regulated firms is significantly higher if they are privately-controlled, and irrespective of ownership, the mean leverage is higher when an IRA exists. Panel B of Table 3 shows that these results continue to hold when we use a more stringent definition of private-control (i.e., firms are defined as privately-controlled only if the state's UCR are 30% or less rather than 50% or less). Overall, Panels A and B show that the mean market leverage of firms is particularly high when they are privately-controlled and subject to regulation by an IRA (20.7% in Panel A and 21% in Panel B) and is particularly low when they are state-controlled and not subject to regulation by an IRA (12.7% in Panel A and 13.7% in Panel B).

Panels C and D break down our sample into two subsamples: Panel C examines the market leverage of firms that are either privately- or state-controlled throughout our sample, while Panel D examines firms that were privatized during our sample period.[18] We therefore observe these firms both before and after their privatization. Starting with Panel C, it is clear that the mean leverage of firms that were privately-controlled throughout our sample is significantly higher than the mean leverage of firms that were state-controlled throughout our sample (18.1% vs. 15.3%). The effect of regulation is also significant: leverage is significantly higher if an IRA exists than if it does not (18.8% vs. 15%). Panel D shows that regulated firms significantly increase their leverage from 16.5% before privatization to 23.3% after privatization. Moreover, mean leverage is significantly higher when an IRA exists than when it does not exist (24% vs. 16.4%). Comparing Panels C and D shows that privately-controlled firms tend to have a significantly higher leverage following privatization than if they are privately-controlled throughout our sample (23.3% vs. 18.1%), while state-controlled firms tend to have a higher leverage before they become private than when they are state-controlled throughout our sample (16.5% vs. 15.3%), although here the difference is not significant.

The positive effect of privatization on leverage stands in contrast to findings in Dewenter and Malatesta (2001), Megginson, Nash, and Van Radenborgh (1994), and

[18] Panels C and D cover only 757 observations (rather than 765) because we omitted from the sample observations on Aeroporti di Firenze which was first privatized and then was nationalized again.

D'Souza and Megginson (1999). They study privatizations in different countries, sectors, and time periods, and show that in most cases, firms lower their leverage following privatization and this decrease can often be substantial. It should be noted however that unlike in our paper, these papers consider only a small number of regulated utilities, and moreover, many of these regulated utilities were not subject to regulation by IRAs.

The preliminary results in Table 3 suggest that both the ownership structure and the existence of an IRA matter for the financial structure of regulated firms. In particular, leverage seems to be higher when (i) firms are privately-controlled, (ii) an IRA exists, and (iii) firms are just privatized. Of course, these results are only suggestive because we are yet to control for various possible alternative determinants of capital structure. We therefore turn now to a regression analysis.

Our baseline regression is the following:

$$\begin{aligned} L_{it} &= \alpha_0 + \alpha_1 Private\,Control_{it} + \alpha_2 IRA_{it} + \alpha_3 Private\,Control_{it} * IRA_{it} \\ &+ \alpha_4 \mathbf{X}_{it} + \alpha_5 \mathbf{Y}_{it} + \sum_n \mu_{in} Country_n + \sum_j \rho_{ij} Sector_j + \sum_t \lambda_t Year_t + \varepsilon_{it}, \end{aligned} \tag{1}$$

where L_{it} is the *Market Leverage* of firm i in year t, *Private Control*$_{it}$ is a dummy which is equal to 1 if firm i was privately-controlled in year t and is equal to 0 otherwise, IRA_{it} is a dummy which is equal to 1 if firm i was subject to regulation by an IRA in year t and is equal to 0 otherwise, $\mathbf{X}_{it}$ is a vector of firm-specific controls, $\mathbf{Y}_{it}$ is a vector of country-specific controls, *Country*, *Sector*, and *Year* are country, sector, and year dummies, and ε_{it} is an error term. We use random effects estimation, because under fixed effects estimation, the time-invariant country- and sector-specific controls are perfectly collinear with the firm dummies. To ensure that our random effects estimation is valid, we use the Hausman (1978) specification test.

The vector of firm-specific controls includes various firm characteristics that were shown in the empirical corporate finance literature to be reliable determinants of capital structure.[19] Our main goal is to find out if the results of Table 3 continue to hold even when we control for these alternative potential determinants of capital structure. Specifically, the vector $\mathbf{X}_{it}$ includes the log of real total assets to control for firm's size (size is typically shown to have a positive effect of leverage), the ratio of fixed to total assets which reflects asset

[19] For common firm characteristics that are included in leverage regressions see for example, Titman and Wessels (1988), Rajan and Zingales (1995), Fama and French (2002), and Frank and Goyal (2007).

tangibility, the ratio of EBIT (earning before interests and taxes) to total assets which is a proxy for profitability and "efficiency" (more efficient firms are likely to make higher earnings with the same assets), and the ratio of depreciation and amortization to total assets as a proxy for non-debt tax shields (tax deductions for depreciations are substitutes for the tax benefits of debt financing). In some of our specifications we also include in the vector $\mathbf{X}_{it}$ the market-to-book ratio as a proxy for growth opportunities (firms with larger growth opportunities may have more to lose from financial distress and may therefore be more reluctant to issue debt). Given that our sample covers firms from 14 different countries over a period of 12 years, we include in the regression a vector $\mathbf{Y}_{it}$ of time-varying country-specific variables which includes *GDP Growth* to account for differences in macroeconomic conditions over time, a *Political Orientation* index which measures the political orientation of the government, and an *Investor Protection* index which measures the legal protection of shareholders' rights (the latter two indices appear in only some of our specifications). The *Political Orientation* index ranges from 0 (extreme left wing) to 10 (extreme right wing) and is computed as the weighted average of the right-left political orientation scores of the parties forming the executive branch of government, where the weights are equal to the number of parliamentary seats held by each party divided by the total number of parliamentary seats held by the ruling coalition as a whole (see Huber and Inglehart, 1995, and Bortolotti and Faccio, 2008). We expect higher values of the *Political Orientation* index to be associated with more pro-firm regulation (this is true even when an IRA exists although naturally to a lesser extent). The *Investor Protection* index we use is the "anti-director rights" index developed by La Porta *et al.* (1998) and updated by Pagano and Volpin (2005). We expect that higher values of this index would be associated with lower cost of equity and hence lower leverage.

The results of our leverage regressions are shown in Tables 4.1-4.4. Table 4.1 shows that the various firm-specific controls are significant and their signs are generally consistent with earlier empirical studies on the determinants of capital structure (see e.g., Rajan and Zingales, 1995). The only exception is the negative and significant coefficient on fixed-to-total assets, which is our proxy for tangibility. Earlier studies typically find that tangibility has a positive effect on leverage, the logic being that tangible assets can serve as a collateral and hence lower the cost of debt financing. In our sample however, fixed assets are highly firm-

specific and non-redeployable (e.g., roads, airports, physical electricity or telecommunications networks) and may therefore serve as poor collaterals.[20]

More importantly for us, Table 4.1 shows that the *IRA* dummy is negative but mostly insignificant, while the *Private Control*IRA* dummy is positive and significant across all specifications. Moreover, the coefficient of the *Private Control*IRA* dummy is bigger in absolute value than the coefficient of the *IRA* dummy.[21] This result is consistent with Hypothesis 1, and suggests that privately-controlled firms which are regulated by an IRA have significantly higher leverage than other regulated firms. Columns (6)-(7) of Table 4.1 show that this result holds even when we replace the *Private Control* dummy with the more restrictive *Private Control_30* dummy. Interestingly, Columns (2) and (5) show that the *Political Orientation* variable, which reflects how right wing the government is, is negative and significant. If we think of right-wing governments as being more pro-firm, then this result suggests firms facing more pro-firm governments do not need not to rely on high leverage to obtain favorable regulatory outcomes as much as firms facing pro-consumer governments. On the other hand, Column (3) shows that as expected, stronger investor protection is associated with lower leverage, presumably because stronger investor protection lowers the cost of equity financing.

One might argue that the results in Table 4.1 are at least partly driven by exogenous fluctuations in equity markets which affect the market leverage of firms for reasons that have nothing to do with our hypotheses. To address this concern, we re-estimate the specification in Column (1) in Table 4.1 by using two alternative measures of leverage: *Book Leverage* (the ratio between total financial debt and the sum of total financial debt and the book value of equity), and *Debt-to-Total Assets* (the ratio between total financial debt and total assets). Both measures are independent of the equity market. The results, reported in Table 4.2, are very similar to those in Table 4.1 and indicate that the positive effect of IRA on the leverage of privately-controlled firms is robust to the measure of leverage that we use.[22]

In Table 4.3 we look more closely at the effect of ownership on leverage. To this end, we separate firms into two subsamples. Columns (1)-(2) examine firms that were privatized during our sample period. Here, the *Private control* dummy captures the difference in

[20] Estimating the leverage regressions separately for the subsamples of telecoms, electric utilities, and energy utilities (electricity and natural gas), reveals that the significant negative coefficient on tangibility is mainly driven by telecoms.

[21] These results are robust to clustering the observations by regulatory agencies (i.e., all firm which are regulated by the same agency are in the same cluster) rather than by firms, as we do in Table 4.1.

[22] To further control for equity market fluctuations, we also added to the regression country-specific stock market indices. These indices however had no significant effect on our results.

leverage before and after privatization. Columns (3)-(5) examine firms that stayed either privately- or state-controlled throughout our sample period. Hence, the *Private control* dummy in Column (3) captures the difference in leverage across different types of ownership structures. Naturally, we do not need to include the *Private control* dummy in Columns (4) or (5) since each of them examines only one type of firms (either privately- or state-controlled). Column (1) in Table 4.3 shows that privatization has no significant effect on the leverage of regulated firms in the sense that both the *Private Control* as well as the *Private Control*IRA* dummies are not significant.[23]

As mentioned in Section 4.2, 11 privately-controlled firms in our sample have golden shares which give the state special control rights. Column (2) in Table 4.3, shows that once we control for the existence of golden shares (the *Golden Share* dummy is equal to 1 in all years in which the firm had golden shares and is equal to 0 otherwise), both the *IRA* and the *Private Control*IRA* dummies become positive and significant, while the *Golden Shares*IRA* dummy is negative and significant. These results suggest that following privatization, the existence of an IRA has a positive effect on leverage, although the presence of golden shares mitigates this effect. To the extent that the presence of golden shares implies that the firm is not fully privatized, this result is consistent with Hypothesis 1. Looking at the coefficients, it follows that other things being equal, the leverage of firms which were eventually privatized during our sample period is 9% higher if they are regulated by an IRA (the coefficient of *IRA*), 15.9% higher if they are already privately-controlled (the sum of the coefficients of the *IRA* and *Private Control*IRA*), but only 2.9% higher if they have golden shares (the sum of the coefficients of the *IRA*, *Private Control*IRA*, and *Golden Shares*IRA*).[24]

In Columns (3)-(5) in Table 4.3, we turn to firms which stayed privately- or state-controlled throughout our sample period. Column (3) shows that once again, that the *Private Control*IRA* dummy is positive and significant and its value exceeds the absolute value of the *IRA* dummy which is negative and insignificant. This result is consistent with our earlier finding in Panel C of Table 3 and provides yet another support for Hypothesis 1. Columns (4) and (5) show that there are several important differences between firms that are privately- or state-controlled throughout our sample period. First, tangibility (fixed-to-total assets) has a significantly negative coefficient in Column (4) but not in Column (5); this difference is

[23] We also added a *Privatization Year* dummy which is equal to 1 in the year of privatization and is equal to 0 in all other years. This dummy was insignificant suggesting that to the extent that leverage increases following privatization, the increase is gradual and does not occur immediately in the year of privatization.

[24] It should be noted that in virtually all cases, golden shares exist only when firms are privately-controlled. Hence, the *Golden Share* dummy is equal to 1 only when the *Private Control* Dummy is also equal to 1.

probably due to the fact that Column (4) includes many telecoms (see Footnote 20 above). Second, the profitability coefficients (*EBIT-to-Total Assets*) has a significantly negative effect in the case of privately-controlled firms, which is consistent with the typical findings in the empirical corporate finance literature, but has a significantly positive effect in the case of state-controlled firms. Third, the *GDP Growth* coefficient is significant only in the case of state-controlled firms but not in the case of privately-controlled firms. Fourth, the *Political Orientation* variable is not significant in the case of state-controlled firms, but is negative and significant in the case of privately-controlled firms. Since an increase in the *Political Orientation* variable indicates that the government is more right-wing and hence likely to be more pro-firm, the latter result suggests that when privately-controlled firms face a more pro-firm government, they do not need to rely on high leverage to obtain favorable regulatory outcomes. The fact that the leverage of state-controlled firms is not affected by the political orientation variable is consistent with the theory since state-controlled firm do not need to issue debt to shield themselves from regulatory opportunism. Finally, the IRA variable is not significant in the case of privately-controlled firms but is negative and significant in the case of state-controlled firms. Since the IRA variable is positive in the case of privatized firms, this suggests that the negative coefficient of the IRA variable in Table 4.1 is driven by firms that were state-controlled firms throughout our sample.

The last piece of evidence on leverage concerns the long-term effects of regulatory independence and ownership. Such long-term effects can arise if firms adjust their leverage in response to the introduction of an IRA and to privatization gradually over time. The question then is what is the overall effect of such gradual partial adjustments when we sum them up over time. To address this question, we add the lagged value of market leverage to the right-hand side of equation (1). The resulting econometric model is then dynamic and the coefficient of the lagged value of the market leverage variable reflects inertia.

A main concern when estimating a dynamic model is that the lagged dependent variable is endogenous to the fixed effects in the error term, thus giving rise to the dynamic panel bias. To deal with this dynamic panel bias, we use the Arellano and Bond (1991) and Arellano and Bover (1995) linear generalized method of moments (GMM) estimators. More specifically we use the dynamic System-GMM model developed by Arellano and Bond (1991) and Blundell and Bond (1998). This model estimates a system of level and first-differenced equations and uses lags of first-differenced variables as instruments for equations

in levels and lags of variables in levels as instruments for equations in first-differences.[25] For the validity of the GMM estimates it is crucial, however, that the instruments are exogenous. We therefore calculate the two-step Sargan-Hansen statistic under the null of joint validity of the instruments and report the resulting p-values with the regression results. The Sargan-Hansen test may be weakened however if there are too many instruments (with respect to the number of observations). We therefore follow a conservative strategy and restrict the number of instruments by using no more than three (but mostly two) lags of the instrumenting variables. To ensure that the lagged variables are valid instruments, we use the Arellano and Bond (1991) autocorrelation test control for AR(1) and AR(2). If AR(2) is detected, instruments dated t-2 are invalid and only instruments dated t-3 and earlier can be used.

In Table 4.4 we present the one-step System-GMM estimates. We report results both for the entire sample, as well as for the subsample of firms which stayed either privately- or state-controlled throughout our sample.[26] The lagged value of *Market Leverage* is significant in Columns (1)-(3) (in Column (4) the p-value is 0.109 and hence close to being significant) and its value is around 0.35-0.41. This suggests that a 10% increase in market leverage in year t is followed by a further increase of 3.5%-4% in the year t+1. Hence, we have a multiplier effect: if we denote the coefficient of the lagged value of *Market Leverage* by β, then an increase in market leverage by 1 percentage point in the short run translates into a long-run increase of $1+\beta+\beta^2+\beta^3+\ldots = 1/(1-\beta)$ percentage points. The *Private Control* dummy is insignificant in all columns. The *IRA* dummy by contrast is significant in Columns (1) and (3) and so is its long-run effect, captured by $\alpha_2/(1-\beta)$. The value of this variable indicates that the introduction of an IRA leads to a long-run increase of 5 percentage points in market leverage for the entire sample and 7 percentage points for the subsample of firms which stayed privately- or state-controlled throughout our sample. In Columns (2) and (4) we introduce the *Private Control*IRA* dummy. Now, the *IRA* variable is no longer significant, but the *Private Control*IRA* dummy is significant: the results suggest in the long-run, regulation by an IRA induces privately-controlled firms to raise their market leverage by 11 percentage point for the entire sample and by 17 percentage points for firms which are either privately- or state-controlled throughout our sample. The size of the increase is quite large given that the mean market leverage for firms in our sample is 18.1% (see Table 2).

[25] For estimation we used the xtabond2 Stata command created by David Roodman (2006).
[26] We do not estimate the same model on the subsample of privatized firms because there are too few observations to conduct a dynamic estimation with lagged variables as instruments.

5.2. Leverage and regulated prices

Next, we consider Hypothesis 2 which states that higher leverage induces regulators to raise regulated prices provided that the firm is privately-controlled. When the firm is state-controlled, the state plays a dual role of an owner and a regulator and hence the firm does not need to use its leverage as a way to induce higher regulated prices.

To test Hypothesis 2, we apply the Granger (1969) and Sims (1972) causality tests to examine whether leverage Granger-causes regulated prices.[27] That is, we examine whether an increase in leverage is followed by an increase in regulated prices, but not vice versa.[28] There are three alternative possibilities. First, if regulators can make a long-term commitment to regulated prices, then regulated prices will determine the firm's revenues (up to some exogenous demand shocks), and the firm in turn would adjust its capital structure to match its expected revenue stream. In that case, regulated prices would Granger-cause leverage. Second, it could be that leverage and regulated prices are correlated but neither one Granger causes the other; rather the two variables are correlated with a third variable that causes both of them. A third possibility is that leverage and regulated prices are simply not correlated with one another.

We perform the Granger tests by estimating the following bivariate VAR(2) model for sector- and country- specific retail price indices and leverage:

$$P_{it} = \alpha^{P}{}_{t-1}P_{i,t-1} + \alpha^{P}{}_{t-2}P_{i,t-2} + \beta^{P}{}_{t-1}L_{i,t-1} + \beta^{P}{}_{t-2}L_{i,t-2} + \sum_{i}\mu^{P}{}_{i}Firm_{i} + \sum_{t}\lambda^{P}{}_{t}Year_{t} + \varepsilon^{P}{}_{it}, \qquad (2)$$

$$L_{it} = \alpha^{L}{}_{t-1}P_{i,t-1} + \alpha^{L}{}_{t-2}P_{i,t-2} + \beta^{L}{}_{t-1}L_{i,t-1} + \beta^{L}{}_{t-2}L_{i,t-2} + \sum_{i}\mu_{i}^{L}Firm_{i} + \sum_{t}\lambda_{t}^{L}Year_{t} + \varepsilon^{L}{}_{it}, \qquad (3)$$

where P_{it} and L_{it} are the regulated price and market leverage of firm i in period t, $Firm_i$ and $Year_t$ are firm and year dummies, and $\varepsilon^{P}{}_{it}$ and $\varepsilon^{L}{}_{it}$ are error terms. Our hypothesis that, conditional on individual and time effects, leverage Granger-causes regulated prices, but not vice versa, requires that $\beta^{P}{}_{t-1}$ and $\beta^{P}{}_{t-2}$ are positive and significant, while $\alpha^{L}{}_{t-1}$ and $\alpha^{L}{}_{t-2}$ are not

[27] See Arellano, 2003, Ch. 6, for details regarding the use of Granger causality tests in the context of a panel setting.

[28] Granger causality test were recently used in a similar context to study the causal relationship between the intensity of product market regulation (reflected by various indicators of barriers to entry, state ownership, market share of entrants, and price controls), and investments in 21 OECD countries (Alesina et al, 2005), interconnection rates and regulatory independence in the EU founding 15 member states (Edwards and Waverman, 2006), political accountability and various performance measures in telecommunications in 52 developed and developing countries (Gasmi, Noumba and Recuero Virto, 2006), and telecommunications reforms and network expansion in developing countries (Gasmi and Recuero Virto, 2008).

significant. Moreover, it requires that $L_{i,t-1}$ and $L_{i,t-2}$ contribute significantly to the explanatory power of regression (2), while $P_{i,t-1}$ and $P_{i,t-2}$ do not contribute significantly to the explanatory power of equation (3). We expect these results to hold in the case of privately-controlled firms, but not in the case of state-controlled firms.

As in the case of the dynamic leverage equation estimated in Table 4.4, we use one-step System-GMM estimates to deal with a possible dynamic panel bias. We report the p-values of a two-step Sargan-Hansen statistic under the null of joint validity of the instruments. As before, we control for AR(1) and AR(2) using the Arellano and Bond (1991) autocorrelation test. Since AR(2) was detected, we restrict the lags instrumenting the lagged leverage to *t-3* and *t-4*.

Tables 5.1 and 5.2 report the results from estimating equations (2) and (3). In both tables, we examine the full sample in Column (1), and several subsamples in Columns (2)-(7). Table 5.1 shows that with the exception of firms which are not regulated by an IRA (Column (3)), or are state-controlled (Column (7)), the second lag of market leverage has a significant positive effect on regulated prices. Moreover, a Wald statistics tests indicates that the first and second lags of market leverage are jointly significantly. On the other hand, Table 5.2 shows that the lagged regulated prices do not have significant effect on leverage either individually or jointly. Together, these results imply that, so long as firms are privately-controlled and/or regulated by an IRA, leverage Granger-causes regulated prices, but not vice versa. These results are consistent with the hypothesis that regulated firms which are either privately-controlled or regulated by an IRA (or both), choose their leverage strategically in order to boost their prices, and inconsistent with the alternative hypotheses that long-term regulatory commitments to prices induce firms to adjust their capital structure to match their resulting expected revenue stream, or that leverage and regulated prices are driven by a third variable that causes both of them.

5.3. Market value equations

We now turn to Hypothesis 3 and examine the effect of leverage on the market values of firms.[29] To this end, we use the *Market-to-Book* ratio, defined as total assets minus the book

[29] It is important to note that when leverage is chosen optimally, changes in leverage are driven by changes in exogenous parameters like the size of the firm, asset tangibility, GDP growth, non-debt tax shields, or changes in the regulatory framework. These exogenous parameters in turn may also affect the value of the firm directly, thus producing correlation between leverage and market value which is orthogonal to Hypothesis 3 (i.e., unrelated to the direct effect of leverage on the regulator's behavior which is at the heart of Hypothesis 3). However, our sample examines firms that were only recently privatized and regulated by IRAs, and hence it is

value of equity plus the market value of equity divided by total assets, as a proxy for firm value and estimate the following regression:

$$MTB_{it} = \alpha_0 + \alpha_1 Private\,Control_{i,t-1} + \alpha_2 L_{i,t-1} + \alpha_3 Private\,Control_{i,t-1} * L_{i,t-1} + \alpha_4 \mathbf{X}_{i,t} + \alpha_4 \mathbf{Y}_{i,t} + \sum_i \mu_i Firm_i + \sum_t \lambda_t Year_t + \varepsilon_{it}, \quad (4)$$

where MTB_{it} is the *Market-to-Book* ratio of firm *i* in year *t*, $Private\ Control_{i,t-1}$ and $L_{i,t-1}$ are the lagged values of the *Private Control* dummy and of leverage, and $\mathbf{X}_{it}$, $\mathbf{Y}_{it}$, $Year_t$, and ε_{it} are defined as in Section 5.1. The *Private Control* and the leverage variable are lagged one year to reduce potential endogeneity problems. We use fixed effects estimation because the Hausman test rejected the null of non-systematic differences between the coefficients estimated by the random effects model and the coefficients estimated by the fixed effects model.

Our measures of leverage in regression (4) are either *Book Leverage* or *Debt-to-Total Assets*. The reason for not using *Market Leverage* in this regression is that, as it turns out, the coefficient of leverage when we regress *Market-to-Book* on either measure of leverage is negative. The negative coefficient of *Market Leverage* may either indicate a true negative correlation between firm value and leverage, or may be simply due to spurious correlation resulting from the fact that the market value of equity appears both in the numerator of *Market-to-Book* and in the denominator of *Market Leverage*. Although *Book Leverage* and *Debt-to-Total Assets* may also be spuriously correlated with *Market-to-Book* (*Book Leverage* includes the book value of equity which also appears in the numerator of *Market-to-Book* with a minus sign, and *Debt-to-Total Assets* includes total assets which also appear in the numerator of *Market-to-Book* with a plus sign), this correlation is positive and hence, the negative coefficients of *Book Leverage* and *Debt-to-Total Assets* indicate a true negative correlation between firm value and leverage rather than a spurious one (in fact, the positive spurious correlation may understate the extent of the true negative correlation between firm value and leverage).

The vector of firm controls in this regression includes the *Log of Real Total Assets* to control for size and *EBIT-to-Total Assets* to control for profitability/efficiency, and the vector of country-specific controls includes *GDP growth* to control for contemporaneous macroeconomic shocks, and the *Investor Protection* index to account for the fact that stronger

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realistic to assume that these firms do not yet have an optimal capital structure (indeed our leverage equations in Section 5.1 indicate that leverage responds to changes in ownership only gradually over time).

investor protection may lower the cost of equity and therefore boost the firms value while lowering its leverage.

The results from estimating equation (4) are presented in Table 6. Column (1) shows that when we consider the full sample, the coefficient of *Book Leverage* is negative and significant, while the coefficient of *Book Leverage*Private Control* is positive and significant and larger in absolute value than the *Book Leverage* coefficient. This latter result is consistent with Hypothesis 3 and suggests that, other things being equal, an increase in *Book Leverage* is associated with a higher *Market-to-Book* ratio when the firm is privately-controlled. When the firm is state-controlled, the state plays the dual role of an owner and a regulator and hence the firm does not need to use debt to shield itself against regulatory opportunism. Consequently, Hypothesis 3 does not apply. The negative correlation between *Book Leverage* and *Market-to-Book* in the case of state-controlled firms may then reflect the typical negative correlation between the two variable that has been found in the literature (see e.g., Rajan and Zingales, 1995; Booth *et al.*, 2001; and Frank and Goyal, 2007).

In Columns (2) and (3) we separate the full sample into two subsamples – one for which an IRA exists and one for which an IRA does not exist. The results indicate that the effect of *Book Leverage* on *Market-to-Book* is even stronger when an IRA exists, but it disappears when an IRA does not exist. These results qualify the conclusion from Column (1) and suggest that leverage boosts the value of regulated firms only when they are privately-controlled and regulated by an IRA.

In Columns (4)-(6) we reexamine the effect of leverage on firm value using *Debt-to-Total Assets* as our measure of leverage. Once again, leverage has a positive effect on firm value only when firms are privately-controlled and are subject to regulation by an IRA, although the effect is less significant than in the case of *Book Leverage*.

6. Conclusion

Following the large scale privatization and structural reforms in network industries in Europe in the last 15 years, it appears that European regulated utilities in telecommunications, electricity, natural gas, water, and transportation, have accumulated large amounts of debt. This phenomenon has been described by the UK Department of Trade and Industry (DTI) and the HM Treasury (DTI-HM, 2004) as the "dash for debt," and has raised concerns among policymakers about the financial stability of regulated utilities and their ability to finance future investments. Theoretical models suggest however that high leverage is a natural response of regulated firms to the inability of regulators to make long-term commitments to

prices. High leverage protects regulated firms against the risk of future price reductions once their investments become sunk.

In this paper we examine this theory empirically, using a comprehensive panel of virtually all major publicly traded regulated utilities in the EU 15 founding member states. Our data covers firms with various degrees of state ownership which are either regulated by independent regulatory agencies or by ministries, governmental committees, or local governments. These heterogeneity allows us to examine the effect of private- versus state ownership and of regulatory independence on the capital structure of regulated firms and its implications for regulated prices and firm value. Our analysis shows that privately-controlled regulated firms which are subject to regulation by independent regulatory agencies have an incentive to raise their leverage and the resulting increase in leverage seems to boost regulated prices and the market value of the firm. By contrast, we do not find an effect of leverage on prices and market values in the case of state-controlled firms. These results provide strong support for the hypothesis that privately-controlled regulated firms rely on debt financing as a way to shield themselves against regulatory opportunism on the part of independent regulatory agencies. This suggests in turn that debt financing may have some desirable consequence since it may boost the incentives of privately-regulated firms to invest. Of course, given that debt financing also leads to higher regulated prices and may also increase the likelihood of financial distress, it is clear that more research, both theoretically and empirically, is needed to determine if the “dash for debt” is a desirable phenomenon and (at least in part) a solution to a regulatory opportunism problem, or whether it is an unintended consequence of the privatization of firms in network industries and should be discouraged.

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Figure 1 -- The evolution of the state's control rights in Edison (Italy)

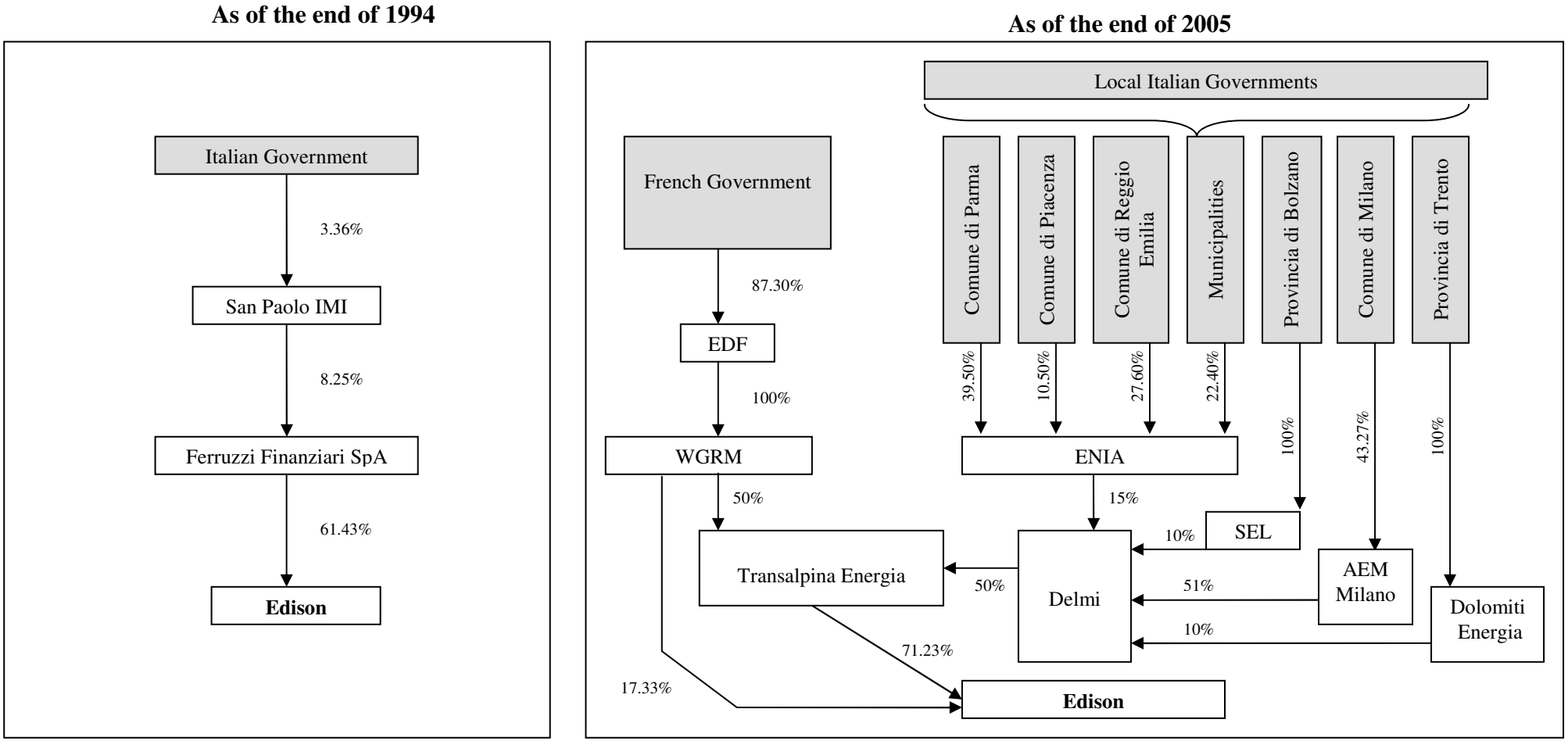

Table 1 – The sample firms

The year in which the firm became privately controlled is the first year in which the state's stake in the firm fell under 50%. An asterisk next to the year in which the firm became privately controlled indicates that the state holds a golden share which gives it special control rights, such as the right to appoint board members or veto proposed acquisitions. The status column indicates whether the firm is privately-controlled throughout our sample (PC), state-controlled throughout our sample SC), or was privatized during our sample period (PRIV).

Company	Country	Sample period	IPO year	Year of privatization	Status	Average state's UCR	Market cap. US$bn (2005)	Average market leverage
Telecommunications (15 firms)								
Telekom Austria AG	Austria	1998 – 2005	2000	2000	PRIV	0.50	10.84	0.20
Belgacom SA	Belgium	1994 – 2005	2004	------	SC	0.61	11.08	0.01
TeleDanmark AS	Denmark	1994 – 2005	1994	1998*	PRIV	0.17	11.64	0.12
Sonera	Finland	1998 – 2002	1998	------	SC	0.52	------	0.16
France Telecom	France	1994 – 2005	1997	2004	PRIV	0.68	64.58	0.28
Deutsche Telekom AG	Germany	1994 – 2005	1996	------	SC	0.75	69.74	0.17
OTE (Hellenic Telecom Organization)	Greece	1994 – 2005	2000	2002	PRIV	0.64	10.43	0.11
EIRCOM	Ireland	1999 – 2005	------	1999	PC	0.00	1.98	0.27
Telecom Italia SpA	Italy	1994 – 2005	1991	1997*	PRIV	0.18	56.04	0.38
Koninklijke KPN NV	Netherlands	1994 – 2005	1994	1994*	PC	0.34	21.32	0.17
Portugal Telecom SA	Portugal	1994 – 2005	1995	1997*	PRIV	0.30	11.27	0.44
Telefonica de Espana SA	Spain	1994 – 2005	1987	1994	PC	0.04	71.88	0.19
Telia AB	Sweden	1997 – 2005	2000	------	SC	0.77	24.10	0.08
British Telecommunications PLC	UK	1994 – 2005	1984	1994	PC	0.00	33.02	0.12
Kingston Communications	UK	1998 – 2005	1999	2000	PRIV	0.54	0.70	0.08
Electricity (27 firms)								
EVN AG	Austria	1994 - 2005	1989	------	SC	0.51	3.69	0.08
Verbund	Austria	1994 - 2005	1988	------	SC	0.78	10.98	0.24
Fortum	Finland	1994 - 2005	1998	------	SC	0.81	16.39	0.23
Electricité de France	France	1994 - 2005	2005	------	SC	0.99	68.88	0.20
MVV Energie AG	Germany	1996 - 2005	1999	------	SC	0.81	1.17	0.43
VEBA AG	Germany	1994 - 2005	1987	1994	PC	0.02	68.14	0.15
VIAG AG	Germany	1994 - 1999	1986	1994	PC	0.25	------	0.20
Public Power Corporation SA	Greece	1998 - 2005	2001	------	SC	0.77	5.06	0.23
Enel	Italy	1994 - 2005	1999	2004*	PRIV	0.75	48.29	0.16
Edison	Italy	1994 - 2005	------	1994	PC	0.18	8.62	0.55
AEM Milano	Italy	1996 - 2005	1998	2004*	PRIV	0.59	3.40	0.19
AEM Torino SpA	Italy	1999 - 2005	2000	------	SC	0.73	1.14	0.31
Terna (Enel)	Italy	2000 - 2005	2004	2004*	PRIV	0.58	0.40	0.14
EnerTad	Italy	1996 - 2005	------	1996	PC	0.05	0.32	0.20
EDP Electricidade de Portugal	Portugal	1994 - 2005	1997	2004*	PRIV	0.64	11.18	0.39
ENDESA (Empresa Nacional de Electricidad SA)	Spain	1994 - 2005	1988	1997	PRIV	0.21	8.26	0.30
Iberdola	Spain	1994 - 2005	------	1994	PC	0.00	24.60	0.21
Red Electrica de Espana SA	Spain	1995 - 2005	1999	1999	PRIV	0.41	4.18	0.24
Union electrica Fenosa	Spain	1994 - 2005	------	1994	PC	0.07	11.31	0.39
National Grid Group PLC	UK	1995 - 2005	1995	1995	PC	0.00	28.67	0.21
ScottishPower/Hydro-Electric	UK	1994 - 2005	------	1994	PC	0.00	14.44	0.13
Scottish and Southern Energy	UK	1994 - 2005	1990	1994	PC	0.00	14.33	0.09
United Utilities	UK	1994 - 2005	------	1994	PC	0.00	8.53	0.20
British Energy PLC	UK	1996 - 2005	1996	1996	PC	0.00	2.95	0.29
Viridian	UK	1994 - 2005	------	1994	PC	0.00	1.92	0.12
National Power - PowerGen Ltd	UK	1994 - 2001	1991	1994	PC	0.05	------	0.15
Yorkshire Electricity Group	UK	1994 - 1997	1990	1994	PC	0.00	------	0.14
Gas (11 firms)								
OMV AG	Austria	1994 - 2005	1987	1994	PC	0.37	17.48	0.16
Distrigaz SA	Belgium	2001 - 2005	1996	2001*	PRIV	0.44	3.21	0.14
Fluxys	Belgium	2001 - 2005	------	2005*	PRIV	0.62	1.92	0.07
Gaz de France	France	1994 - 2005	2005	------	SC	0.98	28.80	0.09
Amga SpA	Italy	1996 - 2005	1996	------	SC	0.52	0.68	0.09
Acsm SpA	Italy	1998 - 2005	1999	------	SC	0.63	0.10	0.18
SNAM Rete Gas SpA	Italy	2000 - 2005	2004	2000	PC	0.31	8.02	0.21

Enagas	Spain	2000 - 2005	------	2000	PC	0.03	4.46	0.21
Gas Natural SDG SA	Spain	1994 - 2005	1996	1994	PC	0.09	12.52	0.12
British Gas PLC	UK	1994 - 2005	1986	1994	PC	0.00	35.03	0.10
Centrica	UK	1996 - 2005	------	1996	PC	0.00	15.83	0.06
Freight Roads (8 firms)								
Autoroutes du Sud de la France	France	1999 – 2005	2002	2005	PRIV	0.65	13.65	0.10
SAPRR (Autoroutes Paris-Rhin-Rhone)	France	2001 – 2005	2004	2005	PRIV	0.74	8.07	0.10
SANEF (Autoroutes du Nord et de l'Est de la France)	France	2002 – 2005	2005	2005	PRIV	0.79	6.21	0.05
Autostrade SpA	Italy	1994 – 2005	1999	1999	PRIV	0.39	13.69	0.21
Autostrada Torino-Milano	Italy	1994 – 2005	------	1994	PC	0.03	1.66	0.20
Sias – Società Autostrada Torino Milano	Italy	1998 – 2005	------	1998	PC	0.03	1.55	0.15
Brisa Auto Estradas de Portugal	Portugal	1995 – 2005	1997	1998	PRIV	0.31	5.04	0.28
Abertis	Spain	1994 – 2005	------	1994	PC	0.10	14.36	0.08
Multiutility (7 firms)								
Suez	France	1994 - 2005	1987	1994	PC	0.16	39.10	0.38
HERA	Italy	2003 - 2005	2003	------	SC	0.51	2.71	0.27
ACEA SpA	Italy	1998 - 2005	1999	------	SC	0.57	2.11	0.22
Acegas	Italy	1997 - 2005	2001	------	SC	0.89	0.50	0.19
Meta SpA	Italy	2002 - 2004	2003	------	SC	0.80	------	0.02
RWE	Germany	1994 - 2005	------	1994	PC	0.34	41.47	0.18
Fraport AG	Germany	1994 - 2005	2001	------	SC	0.87	4.83	0.09
Water (13 firms)								
Vivendi	France	1994 – 2005	------	1994	PC	0.30	36.00	0.27
Veolia	France	2000 – 2005	------	2001	PRIV	0.26	17.71	0.37
Water Supply & Sewerage Systems Co of Athens	Greece	2000 – 2005	1999	------	SC	0.71	0.91	0.06
Thessaloniki Water	Greece	2001 – 2005	2001	------	SC	0.74	0.10	0.00
Acquedotto Nicolay	Italy	1994 – 2005	------	------	PRIV	1.00	0.07	0.09
Condotta Acque Potabili (dal 2005: Acque Potabili)	Italy	1994 – 2004	------	2001	PC	0.79	------	0.11
Severn Trent PLC	UK	1994 – 2005	1989	1994	PC	0.00	5.99	0.23
Yorkshire Water PLC	UK	1994 – 2005	1989	1994	PC	0.00	4.25	0.12
South West Water PLC	UK	1994 – 2005	1989	1994	PC	0.00	2.36	0.17
Anglian Water PLC	UK	1994 – 2005	1989	1994	PC	0.00	2.25	0.27
Thames Water PLC	UK	1994 – 2000	1989	1994	PC	0.00	------	0.03
Wessex Water PLC	UK	1994 – 1998	1989	1994	PC	0.00	------	0.27
AEA Technology PLC	UK	1997 – 2005	1996	1997	PC	0.00	0.17	0.26
Airports (6 firms)								
Flughafen Wien AG	Austria	1994 – 2005	1992	2000	PRIV	0.49	1.50	0.02
Kobenhavns Lufthavne A/S	Denmark	1994 – 2005	1994	2000*	PRIV	0.47	2.33	0.12
Aeroporto di Venezia	Italy	2002 – 2005	2005	------	SC	0.68	0.61	0.10
Aeroporto di Firenze SpA	Italy	1999 – 2005	2000	2000	SC	0.44	0.15	0.00
Aeroporti di Roma	Italy	1994 – 2000	1997	2000	PRIV	0.67	------	0.02
BAA PLC	UK	1994 – 2005	1987	1994	PC	0.00	11.90	0.07
Ports and Docks (5 firms)								
Piraeus Port Authority	Greece	2001 – 2005	2003	------	SC	0.85	0.47	0.02
Associated British Ports Hldgs	UK	1994 – 2005	1983	1994	PC	0.00	3.04	0.05
Forth Ports PLC	UK	1994 – 2005	1992	1994	PC	0.00	1.25	0.09
Mersey Docks & Harbour Co	UK	1994 – 2004	1970	1994	PC	0.05	------	0.09
Railtrack Group PLC	UK	1996 – 2002	1996	1996	PC	0.14	------	0.17

Table 2 - Summary statistics

Panel A - Full sample 1994 – 2005

Variable	Mean	Std. Dev.	Min	Max	No. Obs.
Market Leverage	0.181	0.168	0	0.881	765
Book Leverage	0.272	0.215	0	1	889
Debt-to-Total Assets	0.135	0.174	0	2.982	889
Real Total Asset (in millions of 2005 dollars)	202,447	329,508	29,702	205,179	891
Real Sales (in millions of 2005 dollars)	9,262	14,750	3,682	80,226	891
Tangibility	0.622	0.210	0.034	0.967	890
EBIT-to-Total Asset	0.074	0.099	-1.948	0.299	871
Market-to-Book	1.416	0.736	0.572	14.176	767
Non-debt Tax Shield	0.052	0.03	0	0.183	891
State's UCR	0.348	0.359	0	1	891

Panel B - Privately-controlled utilities (50%)

Variable	Mean	Std. Dev.	Min	Max	No. Obs.
Market Leverage	0.191	0.175	0	0.881	537
Book Leverage	0.287	0.222	0	1	552
Debt-to-Total Assets	0.149	0.201	0	2.982	552
Real Total Assets (in millions of 2005 dollars)	203,355	282,270	41,076	156,216	552
Real Sales (in millions of 2005 dollars)	10,083	14,757	3,681	75,287	552
Tangibility	0.620	0.225	0.034	0.967	551
EBIT-to-Total Asset	0.075	0.104	-1.948	0.293	546
Market-to-Book	1.388	0.575	0.664	9.675	537
Non-debt Tax Shield	0.048	0.029	0.003	0.183	552
State's UCR	0.10	0.15	0	.499	552

Panel C – State-controlled utilities

Variable	Mean	Std. Dev.	Min	Max	No. Obs.
Market Leverage	0.156	0.150	0	0.757	228
Book Leverage	0.246	0.202	0	1	337
Debt-to-Total Assets	0.112	0.114	0	0.841	337
Real Total Assets (in millions of 2005 dollars)	200,970	394,498	29,702	205,179	339
Real Sales (in millions of 2005 dollars)	7,924	146,401	7,987	80,266	339
Tangibility	0.625	0.184	0.068	0.962	339
EBIT-to-Total Asset	0.071	0.090	-0.975	0.299	325
Market-to-Book	1.482	1.015	0.572	14.177	230
Non-debt Tax Shield	0.058	0.031	0	0.161	339
State's UCR	0.751	0.196	0.5	1	339

Table 3 – Mean market leverage by ownership and regulation types

Market Leverage is total financial debt divided by the sum of total financial debt and the market value of equity. The latter is based on the price and number of outstanding shares at the end of the relevant year in U.S. dollars. Firms are defined "privately-controlled" if the state's UCR does not exceed 50% (Panels A and C) or 30% (Panels B and D) and are defined as "state-controlled" otherwise. (Standard errors are in parenthesis). The p-values are based on two-sided test of the Null hypothesis that the difference in the average leverage between two different groups is equal to 0.

Panel A: Mean market leverage 1994-2005 (50% control threshold)				
	Total observations N = 765	**IRA exists** N = 464	**IRA does not exist** N = 301	**Regulation difference p-value**
Total observations		19.9% (0.8%)	15.2% (0.9%)	4.7% p = 0.0001
Privately-controlled	19.1% (0.7%) N = 537	20.7% (0.9%) N=333	16.4% (1.1%) N = 204	4.3% p = 0.004
State-controlled	15.6% (0.9%) N = 228	17.8% (1.2%) N = 131	12.7% (1.5%) N = 97	5.1% p = 0.010
Ownership difference p-value	3.4% p = 0.009	2.9% p = 0.103	3.6% p = 0.058	
Panel B: Mean market leverage 1994-2005 (30% control threshold)				
	Total observations N = 765	**IRA exists** N = 464	**IRA does not exist** N = 301	**Regulation difference p-value**
Total observations		19.9% (0.8%)	15.2% (0.9%)	4.7% p = 0.0001
Privately-controlled	19.4% (0.8%) N = 434	21.0% (1.1%) N = 279	16.6% (1.3%) N = 155	4.4% p = 0.0131
State-controlled	16.3% (0.8%) N = 331	18.2% (1.1%) N = 185	13.7% (1.2%) N = 146	4.5% p = 0.006
Ownership difference p-value	3.1% p = 0.009	2.8% p = 0.086	2.85% p = 0.115	

Panel C: Mean market leverage 1994-2005 of firms that are privately-controlled or state-controlled throughout our sample (50% control threshold)				
	Total observations N = 560	**IRA exists** N = 360	**IRA does not exist** N = 200	**Regulation difference p-value**
Total observations		18.8% (0.8%)	15% (1.1%)	3.8% p = 0.0072
Privately-controlled throughout	18.1% (0.8%) N = 422	19.5% (1%) N = 270	15.6% (1.2%) N = 152	3.9% p = 0.023
State-controlled throughout	15.3% (1.1%) N = 138	16.6% (1.2%) N = 90	12.7% (2.4%) N = 48	3.9% p = 0.122
Ownership difference p-value	2.8% p = 0.073	2.9% p = 0.150	2.9% p = 0.256	

Panel D: Mean market leverage 1994-2005 of privatized firms before and after privatization (50% control threshold)				
	Total observations N = 197	**IRA exists** N = 103	**IRA does not exist** N = 94	**Regulation difference p-value**
Total observations		24% (1.9%)	16.4% (1.6%)	7.6% p = 0.0028
After privatization	23.3% (1.7%) N = 112	26.1% (2.4%) N = 63	19.7% (2.5%) N = 49	6.4% p = 0.078
Before privatization	16.5% (1.7%) N = 85	20.8% (2.9%) N = 40	12.7% (1.8%) N = 45	8.1% p = 0.021
Privatization difference p-value	6.8% p = 0.0089	5.3% p = 0.175	7% p = 0.032	

Table 4.1 – Leverage regressions

The dependent variable is *Market Leverage*; it is defined as in Table 3. *IRA* is a dummy equal to 1 if an IRA is in place and is equal to 0 otherwise. *Private Control* is a dummy equal to 1 when the firm is privately-controlled (i.e., the state's UCR are below 50%) and is equal to 0 otherwise. *Private control_30* is a dummy equal to 1 when the state's UCR are below 30%. Market-to-Book ratio is (Total Assets - Book Value of Equity + Market Value of Equity)/Total Assets). *Political Orientation* ranges from 0 (extreme left wing) to 10 (extreme right wing) and is equal to a weighted average of scores given in expert surveys supporting government (see Huber and Inglehart, 1995, and Bortolotti and Faccio, 2008). *Investor Protection* is the time-varying "antidirector rights" index by Pagano and Volpin (2005). All regressions include year, sector and country dummies. Random-effects estimates. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation. The Wald χ^2 tests the null of that all coefficients are jointly equal to zero. The Hausman χ^2 tests the null of non-systematic differences of the fixed and random effects model. ***, **, * denote significance at 1%, 5% and 10%.

Market Leverage	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Log of Real Total Assets	0.035***	0.033***	0.034***	0.030***	0.027***	0.034***	0.030***
	(0.010)	*(0.009)*	*(0.009)*	*(0.010)*	*(0.009)*	*(0.010)*	*(0.006)*
Fixed-to-Total Assets	-0.131**	-0.131**	-0.105**	-0.149***	-0.151***	-0.120**	-0.153***
	(0.055)	*(0.052)*	*(0.051)*	*(0.054)*	*(0.051)*	*(0.057)*	*(0.056)*
EBIT-to-Total Assets	-0.322***	-0.317***	-0.315***	-0.290***	-0.284***	-0.332***	-0.298***
	(0.079)	*(0.079)*	*(0.080)*	*(0.078)*	*(0.079)*	*(0.079)*	*(0.073)*
Non-debt Tax Shield	-1.187***	-1.259***	-1.284***	-1.087***	-1.158***	-1.202***	-0.857***
	(0.405)	*(0.374)*	*(0.329)*	*(0.361)*	*(0.331)*	*(0.403)*	*(0.256)*
Market-to-Book ratio	-	-	-	-0.034**	-0.035**	-	-0.033**
	-	-	-	*(0.015)*	*(0.015)*	-	*(0.014)*
GDP Growth	-0.029***	-0.029***	-0.032***	-0.027***	-0.027***	-0.028***	-0.019***
	(0.008)	*(0.008)*	*(0.008)*	*(0.008)*	*(0.008)*	*(0.008)*	*(0.007)*
Political Orientation	-	-0.015**	-	-	-0.015**	-	-
	-	*(0.007)*	-	-	*(0.007)*	-	-
Investor Protection	-	-	-0.036**	-	-	-	-
	-	-	*(0.016)*	-	-	-	-
Private Control	-0.020	0.002	0.001	-0.017	0.006	-	-
	(0.028)	*(0.028)*	*(0.028)*	*(0.027)*	*(0.027)*	-	-
Private Control_30	-	-	-	-	-	-0.003	-0.004
	-	-	-	-	-	*(0.026)*	*(0.025)*
IRA	-0.064*	-0.028	-0.044	-0.059	-0.023	-0.045	-0.023
	(0.037)	*(0.038)*	*(0.036)*	*(0.036)*	*(0.037)*	*(0.030)*	*(0.024)*
Private Control*IRA	0.077**	0.067**	0.056*	0.072**	0.061*	-	-
	(0.035)	*(0.033)*	*(0.033)*	*(0.034)*	*(0.032)*	-	-
Private Control_30*IRA	-	-	-	-	-	0.063**	0.051*
	-	-	-	-	-	*(0.032)*	*(0.030)*
R squared within	0.257	0.269	0.279	0.275	0.288	0.255	0.271
Wald-test χ^2 (p-value)	843.63 (0.00)	1144.25 (0.00)	770.25 (0.00)	2579.99 (0.00)	1539.2 (0.00)	945.73 (0.00)	219.5 (0.00)
Hausman test χ^2 (p-value)	2.49 (0.999)	18.31 (0.502)	14.38 (0.811)	7.38 (0.995)	10.19 (0.976)	9.58(0.945)	2.66 (0.999)
N. Firms [N. Obs.]	92 [755]	92 [755]	92 [755]	92 [755]	92 [755]	92 [755]	92 [755]

Table 4.2 – Leverage regressions: alternative measures of leverage

The dependent variable in Columns (1) and (3) is *Book Leverage* which is total financial debt divided by the sum of total financial debt and the book value of equity. The dependent variable in Columns (2) and (4) is *Debt-to-Total Assets* which is total financial debt divided by the total value of assets. The explanatory variables are defined similarly to Table 4.1. All regressions include year, sector, and country dummies. Random-effects estimates. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation. The Wald χ^2 tests the null of that all coefficients are jointly equal to zero. The Hausman χ^2 tests the null of non-systematic differences of the fixed and random effects model. ***, **, * denote significance at 1%, 5% and 10%.

	(1) **Book Leverage**	**(2)** **Debt-to-Total Assets**	**(3)** **Book Leverage Excluding firms that were privatized during our sample period**	**(4)** **Debt-to-Total Assets Excluding firms that were privatized during our sample period**
Log of Real Total Assets	0.035*** *(0.011)*	0.006 *(0.006)*	0.039** *(0.019)*	0.010 *(0.008)*
Fixed-to-Total Assets	-0.264*** *(0.077)*	-0.167** *(0.069)*	-0.256*** *(0.087)*	-0.122** *(0.052)*
EBIT-to-Total Assets	-0.332*** *(0.097)*	-0.069 *(0.063)*	-0.312*** *(0.110)*	-0.021 *(0.044)*
Non-debt Tax Shield	-0.900** *(0.453)*	-1.262*** *(0.479)*	-0.299 *(0.497)*	-0.768** *(0.388)*
GDP Growth	-0.021** *(0.010)*	-0.032*** *(0.012)*	-0.026* *(0.015)*	-0.015** *(0.007)*
Private Control	-0.047 *(0.031)*	-0.003 *(0.020)*	-0.108** *(0.049)*	-0.045 *(0.030)*
IRA	-0.102*** *(0.034)*	0.009 *(0.030)*	-0.156*** *(0.034)*	-0.029 *(0.022)*
Private Control*IRA	0.115*** *(0.038)*	0.050** *(0.030)*	0.166*** *(0.036)*	0.068*** *(0.023)*
R squared within	0.201	0.150	0.166	0.107
Wald-test χ^2 (p-value)	906.21 (0.00)	602.30 (0.00)	1098.67 (0.00)	600.79 (0.00)
Hausman test χ^2 (p-value)	0.93 (1.000)	3.58 (1.000)	5.37 (0.999)	19.14 (0.447)
N. Firms [N. Obs.]	92 [869]	92 [869]	66 [627]	66 [627]

Table 4.3 – The effect of ownership structure on market leverage

Variables are defined similarly to Table 4.1. Columns (1)-(2) examine a subsample of firms that were privatized (i.e. the state's UCR went below 50%) during our sample period. We observe these firms before and after privatization. *Golden Shares* is a dummy equal to 1 when golden shares are in place and equals 0 otherwise. Columns (3)-(5) report results for a subsample of utilities which remained either privately- or state-controlled throughout our sample period. All regressions include year, sector, and country dummies. Random-effects estimates. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation. The Wald χ^2 tests the null of that all coefficients are jointly equal to zero. The Hausman χ^2 tests the null of non-systematic differences of the fixed and random effects model. ***, **, * denote significance at 1%, 5% and 10%.

Market Leverage	**(1) Privatized utilities**	**(2) Privatized utilities**	**(3) Privately- or state-controlled throughout our sample**	**(4) Privately-controlled throughout our sample**	**(5) State-controlled throughout our sample**
Log of Real Total Assets	0.040***	0.042***	0.037**	0.028**	0.026**
	(0.010)	*(0.010)*	*(0.015)*	*(0.014)*	*(0.010)*
Fixed-to-Total Assets	-0.075	-0.110*	-0.160**	-0.172***	0.152
	(0.063)	*(0.063)*	*(0.065)*	*(0.057)*	*(0.146)*
EBIT-to-Total Assets	-0.929***	-0.879***	-0.280***	-0.363***	0.134**
	(0.207)	*(0.209)*	*(0.092)*	*(0.038)*	*(0.057)*
Non-debt Tax Shield	-2.151***	-2.439***	-1.028**	-0.996*	-2.950***
	(0.485)	*(0.475)*	*(0.479)*	*(0.514)*	*(0.792)*
GDP Growth	-0.025**	-0.027**	-0.029***	-0.028	-0.016*
	(0.012)	*(0.011)*	*(0.011)*	*(0.017)*	*(0.009)*
Political Orientation	-0.006	-0.005	-0.019**	-0.026***	-0.001
	(0.017)	*(0.018)*	*(0.008)*	*(0.009)*	*(0.013)*
Private Control	-0.000	-0.018	-0.051	-	-
	(0.033)	*(0.038)*	*(0.059)*	-	-
IRA	0.067	0.090*	-0.063	0.050	-0.232***
	(0.050)	*(0.047)*	*(0.050)*	*(0.037)*	*(0.044)*
Private Control*IRA	0.016	0.069*	0.096**	-	-
	(0.043)	*(0.041)*	*(0.044)*	-	-
Golden Shares	-	0.066	-	-	-
	-	*(0.069)*	-	-	-
Golden Shares*IRA	-	-0.130*	-	-	-
	-	*(0.078)*	-	-	-
R squared within	0.445	0.447	0.229	0.251	0.332
Wald-test χ^2 (p-value)	2225 (0.00)	5234.86 (0.00)	1198.32 (0.00)	524.89 (0.00)	993950 (0.00)
Hausman test χ^2 (p-value)	7.57 (0.991)	12.90 (0.912)	1.02 (1.000)	0.29 (1.000)	17.97 (0.458)
N. Firms [N. Obs.]	25 [195]	25 [195]	66 [552]	42 [417]	24 [135]

Table 4.4 –Long-run effects of regulation and ownership on leverage

Variables are defined similarly to Table 4.1. Columns (1)-(2) examine the full sample while Columns (3)-(4) report results for a subsample of utilities which remained either privately- or state-controlled throughout our sample period. Dynamic panel-data estimation, one-step system GMM estimates. Right-hand side variables are used as instruments: lagged levels are used in first-differences equations and lags of first-differenced variables are used in levels equations. All regressions include year dummies. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation. AR(1) (AR(2)) tests the null hypothesis of no first-order (second-order) correlation in the differenced residuals (Arellano-Bond test is still valid if differenced errors are AR(1) (AR(2))). The Sargan-Hansen statistic tests the null hypothesis that the over-identifying restrictions are valid. ***, **, * denote significance of the coefficients at 1%, 5% and 10%.

Market Leverage	**(1) Full sample**	**(2) Full sample**	**(3) Privately- or state-controlled throughout our sample**	**(4) Privately- or state-controlled throughout our sample**
Market Leverage$_{t-1}$ (β)	0.358*	0.381**	0.404*	0.361
	(0.183)	*(0.188)*	*(0.217)*	*(0.221)*
Log of Real Total Assets	0.018**	0.019***	0.012**	0.016**
	(0.007)	*(0.007)*	*(0.005)*	*(0.006)*
Fixed-to-Total Assets	-0.133**	-0.129**	-0.126**	-0.140***
	(0.057)	*(0.055)*	*(0.049)*	*(0.049)*
EBIT-to-Total Assets	-0.268***	-0.254***	-0.239**	-0.241**
	(0.080)	*(0.084)*	*(0.114)*	*(0.109)*
Non-debt Tax Shield	-1.802*	-1.582	-1.384***	-1.523***
	(1.087)	*(0.959)*	*(0.364)*	*(0.386)*
GDP Growth	-0.004	-0.005	0.000	-0.004
	(0.008)	*(0.008)*	*(0.0087)*	*(0.009)*
Private Control	0.0017	-0.040	0.0009	-0.076
	(0.018)	*(0.032)*	*(0.020)*	*(0.048)*
IRA (α_2)	0.030*	-0.025	0.043**	-0.0395
	(0.016)	*(0.032)*	*(0.018)*	*(0.0509)*
Private Control*IRA (α_3)	-	0.069*	-	0.111*
	-	*(0.039)*	-	*(0.057)*
$\alpha_2/(1-\beta)$	0.05*	- 0.040	0.07**	- 0.061
P-value on $\alpha_2/(1-\beta) = 0$	0.060	0.458	0.021	0.441
$\alpha_3/(1-\beta)$	-	0.11*	-	0.17*
P-value on $\alpha_3/(1-\beta) = 0$	-	0.09	-	0.063
Arellano-Bond test for AR(1) *(p-value)*	0.020	0.020	0.041	0.046
Arellano-Bond test for AR(2) *(p-value)*	0.825	0.838	0.935	0.893
Sargan-Hansen test *(p-value)*	0.410	0.336	0.579	0.534
Instruments	t-2/t-4; Δt-2	t-2/t-4; Δt-2	t-2/t-4; Δt-2	t-2/t-4; Δt-2
N. Firms [N. Obs.]	88[612]	88[612]	63[445]	63 [445]

Table 5.1 – Regulated Price Equations – Granger Tests

The dependent variable in Table 5.1 is the country-sector-specific utility price index (see Section 3 and Appendix A.3). The dependent variable in Table 5.2 is *Market Leverage*. Column 3 focuses on firms that are subject to regulation by an IRA (telecom, energy, and water supply firms in the U.K.) (see Gilardi, 2002). Dynamic panel-data estimation, one-step system GMM estimates. Lagged values of Market Leverage and Utility Price used as instruments: lagged levels are used in first-differences equations and lags of first-differenced variables are used in levels equations (see last row). All regressions include year dummies. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation. AR(1) tests the null hypothesis of no first-order correlation in the differenced residuals (Arellano-Bond test is still valid if differenced errors are AR(1)). AR(2) tests the null hypothesis of no second-order correlation in the differenced residuals (Arellano-Bond test is not valid if differenced errors are AR(2)). The Sargan-Hansen statistic tests the null hypothesis that the over-identifying restrictions are valid. ***, **, * denote significance of the coefficients at 1%, 5% and 10%.

Utility Price	**(1)** **Full sample**	**(2)** **IRA exists**	**(3)** **IRA does not exist**	**(4)** **Privately-controlled (50%)**	**(5)** **Privately-controlled (30%)**	**(6)** **Privately-controlled throughout our sample**	**(7)** **State-controlled**
α^P_1 Utility Price$_{t-1}$	0.759*** *(0.083)*	0.694*** *(0.073)*	0.738*** *(0.200)*	0.787*** *(0.074)*	0.807*** *(0.065)*	0.736*** *(0.100)*	0.821*** *(0.134)*
α^P_2 Utility Price$_{t-2}$	0.183* *(0.103)*	0.289** *(0.109)*	0.078 *(0.180)*	0.161* *(0.092)*	0.129 *(0.085)*	0.176 *(0.132)*	0.025 *(0.118)*
β^P_1 Market Leverage$_{t-1}$	-0.052 *(0.053)*	0.021 *(0.057)*	-0.013 *(0.021)*	-0.019 *(0.038)*	-0.049 *(0.042)*	-0.130 *(0.097)*	0.040 *(0.065)*
β^P_2 Market Leverage$_{t-2}$	0.154*** *(0.057)*	0.192*** *(0.064)*	-0.004 *(0.017)*	0.154*** *(0.055)*	0.153*** *(0.054)*	0.266** *(0.102)*	0.001 *(0.045)*
P-value test on H_0: $\beta^P_1 = \beta^P_2 = 0$	*0.025*	*0.012*	*0.679*	*0.024*	*0.024*	*0.038*	*0.604*
P-value test on H_0: $\beta^P_1 + \beta^P_2 = 0$	*0.048*	*0.011*	*0.388*	*0.023*	*0.050*	*0.095*	*0.327*
Arellano-Bond test for AR(1) *(p-value)*	*0.000*	*0.000*	*0.10*	*0.000*	*0.000*	*0.008*	*0.031*
Arellano-Bond test for AR(2) *(p-value)*	*0.898*	*0.087*	*0.17*	*0.475*	*0.235*	*0.537*	*0.764*
Sargan-Hansen test *(p-value)*	*0.191*	*0.358*	0.994	*0.264*	*0.839*	*0.523*	*0.964*
N. Firms [N. Obs.]	74 [482]	58 [350]	26[132]	57 [362]	44 [296]	37 [276]	30 [120]
Instruments	t-3; t-4; Δt-2	t-3; t-4; Δt-2	t-3; Δt-2	t-3; t-4; Δt-2	t-3; t-4; Δt-2	t-3; Δt-2	t-2; Δt-1

Table 5.2 – Leverage Equations – Granger Tests

Market leverage	**(1)** **Full sample**	**(2)** **IRA exists**	**(3)** **IRA is not in place**	**(4)** **Privately-controlled (50%)**	**(5)** **Privately-controlled (30%)**	**(6)** **Privately-controlled throughout our sample**	**(7)** **State-controlled**
α^L_1 Utility Price$_{t-1}$	-0.205	-0.166	- 0.008	-0.082	-0.233	-0.145	0.154
	(0.192)	*(0.188)*	*(0.012)*	*(0.197)*	*(0.177)*	*(0.188)*	*(0.263)*
α^L_2 Utility Price$_{t-2}$	0.326	0.160	0.011	0.070	0.252	0.017	-0.183
	(0.230)	*(0.236)*	*(0.011)*	*(0.200)*	*(0.223)*	*(0.142)*	*(0.218)*
β^L_1 Market Leverage$_{t-1}$	0.390**	0.191	0.423***	0.367*	0.292	0.332	0.546***
	(0.187)	*(0.210)*	*(0.142)*	*(0.219)*	*(0.203)*	*(0.250)*	*(0.151)*
β^L_2 Market Leverage$_{t-2}$	0.135	0.168	0.102	0.265	0.205	-0.067	0.065
	(0.143)	*(0.154)*	*(0.206)*	*(0.187)*	*(0.156)*	*(0.224)*	*(0.137)*
P-value test on $\alpha^L_1 = \alpha^L_2 = 0$	*0.364*	*0.639*	*0.193*	*0.912*	*0.374*	*0.718*	*0.674*
Arellano-Bond test for AR(1) *(p-value)*	*0.022*	*0.083*	*0.103*	*0.090*	*0.024*	*0.016*	*0.078*
Arellano-Bond test for AR(2) *(p-value)*	*0.275*	*0.153*	*0.126*	*0.138*	*0.250*	*0.817*	*0.109*
Sargan-Hansen test *(p-value)*	*0.126*	*0.306*	*0.996*	*0.179*	*0.821*	*0.700*	*1.000*
N. Firms [N. Obs.]	74 [479]	58 [348]	26[131]	57 [360]	44 [294]	37 [274]	30 [119]
Instruments	t-3; t-4; Δt-2	t-3; t-4; Δt-2	t-3; Δt-2	t-3; t-4; Δt-2	t-3; t-4; Δt-2	t-2; Δt-1	t-2; Δt-1

Table 6 – Leverage and Market-to-Book Values

The dependent variable is the Market-to-Book ratio defined in Table 4.1. Private Control is defined as in Table 4. *Book Leverage* is defined in Table 4.2. Investor Protection is the time-varying "antidirector rights" index by Pagano and Volpin (2005). Fixed-effects estimates. All regressions include year dummies. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation. ***, **, * denote significance at 1%, 5% and 10%.

Market to Book	**(1) Full sample**	**(2) No IRA**	**(3) IRA exists**	**(4) Full sample**	**(5) No IRA**	**(6) IRA exists**
Book Leverage$_{t-1}$	-0.607*	-0.085	-0.984*	-	-	-
	(0.314)	*(0.200)*	*(0.529)*	-	-	-
Debt-to-Total Assets $_{t-1}$	-	-	-	-1.188	-0.001	-1.683
	-	-	-	*(0.752)*	*(0.472)*	*(1.054)*
Private Control $_{t-1}$	-0.434	0.073	-1.030	-0.445	0.081	-1.018
	(0.286)	*(0.092)*	*(0.763)*	*(0.299)*	*(0.100)*	*(0.756)*
Book Leverage $_{t-1}$*Private Control $_{t-1}$	0.762**	0.193	1.088*	-	-	-
	(0.366)	*(0.229)*	*(0.649)*	-	-	-
Debt-to-Total Assets $_{t-1}$*Private control $_{t-1}$	-	-	-	1.459*	0.217	1.864[a]
	-	-	-	*(0.799)*	*(0.479)*	*(1.131)*
Log of Real Total Assets	-0.327***	-0.108	-0.377**	-0.325***	-0.114	-0.370**
	(0.102)	*(0.099)*	*(0.145)*	*(0.102)*	*(0.096)*	*(0.147)*
EBIT-to-Total Assets	0.884	0.341	0.881	0.854*	0.358	0.822
	(0.548)	*(0.330)*	*(0.598)*	*(0.510)*	*(0.331)*	*(0.545)*
GDP Growth	0.046	0.102**	0.057	0.045	0.106**	0.043
	(0.036)	*(0.042)*	*(0.053)*	*(0.038)*	*(0.042)*	*(0.056)*
Investor Protection	0.094*	0.111**	0.062	0.100**	0.113**	0.068
	(0.044)	*(0.048)*	*(0.098)*	*(0.048)*	*(0.049)*	*(0.105)*
R squared (within)	0.156	0.250	0.200	0.160	2.534	0.204
Wald-test χ^2 (p value)	9.68 (0.00)	6.62 (0.00)	8.00 (0.00)	10.52 (0.00)	5.63 (0.00)	7.85 (0.00)
N. Firms [N. Obs.]	92 [705]	43 [270]	62 [435]	92 [705]	43 [270]	62 [435]

[a] The p-value is 0.105.

Appendix A1 - The timing of regulation and privatization in the energy and telecommunications sectors in European countries

	Energy (Electricity & Gas)		Telecommunications	
Country	**Date of establishing an energy IRA**	**Privatization revenues before an IRA was established**	**Date of establishing a Telecom IRA**	**Privatization revenues before an IRA was established**
Austria	2000	70.8%	1997	0%
Belgium	1999	10.1%	1991	0%
Denmark	1999	0%	2002	100%
Finland	1995	0.4%	1987	0%
France	2000	2.5%	1996	2.2%
Germany	2006	100%	1996	0%
Greece	2000	0%	1992	0%
Ireland	1999	-	1997	0%
Italy	1995	0	1997	5.7%
Netherlands	1998	0%	1997	41.9%
Portugal	1995	12.9%	2001	100%
Spain	1998	52.6%	1996	22.2%
Sweden	1998	0%	1992	0%
UK	1989	18.6%	1984	3.1%

Appendix A2 -- Data Sources

Panel A. Ownership Data

Country	Individual Countries Sources 1994-2004	All Countries Sources 1994-2004
Austria	**1.** Austrian Holding and Privatisation Agency, www.oiag.at	**1.** Company Web Sites; **2.** Annual Reports; **3.** 20-F Reports; **4.** SEC, Filings & Forms (EDGAR), ww.sec.gov/edgar.shtml; **5.** Hoovers Company In-dept Records; **6.** SDC Thomson Financial; **7.** Amadeus, Bureau van Dijk; **8.** Lexis Nexis, Business News; **9.** Privatization Barometer, www.privatizationbarometer.net; **10.** Financial Times; **11.** For Banks and Financial Institutions: IMF Working Paper, 2005, "State-Owned Banks, Stability, Privatization, and Growth: Practical Policy Decisions in a World Without Empirical Proof," www.imf.org/external/pubs/ft/wp/2005/wp0510.pdf
Belgium	**1.** Bureau Fédéral du Plan (BFP), www.plan.be, "Participations Publiques dans le Secteur Marchand en Belgique, 1997-2003"	
Finland	**1.** Ministry of Trade & Industry, "State - Owned Companies" Publications, 1995, 2005	
France	**1.** La Caisse des Dépôts, www.caissedesdepots.fr/FR/index.php **2.** L'Agence des participations de l'État (APE), www.ape.minefi.gouv.fr/ **3.** Euronext, www.euronext.com/home/0,3766,1732,00.html	
Germany	**1.** KfW, www.kfw.de/EN_Home/index.jsp	
Greece	**1.** Athens Stock Exchange, www.ase.gr/default_en.asp **2.** Hellenic Capital Market Commission, Annual Reports 1999-2005, www.hcmc.gr/english/index2.htm	
Italy	**1.** MEF, Dipartimento del Tesoro, "Libro bianco sulle privatizzazioni," April 2001, 2002 and 2003 **2.**MEF, Dipartimento del Tesoro, "La relazione sulle privatizzazioni," 1997-2000 **3.** MEF, Dipartimento del Tesoro, "Libro verde sulle partecipazioni dello Stato," November 1992 **4.** MEF, www.dt.tesoro.it/Aree-Docum/Partecipaz/Partecipaz/Partecipate.htm_cvt.htm **5.** IRI (2001) "Le privatizzazioni in Italia, 1992-2000," edited by Bemporad S. and E. Reviglio **6.** Mediobanca (2000) "Le privatizzazioni in Italia dal 1992" **7.** Borsa Italiana, "Operazioni di Privatizzazione - Anni 1993-2006," www.borsaitaliana.it/documenti/ufficiostampa/datistorici/privatizzazioni_pdf.htm **8.** Consob, www.consob.it	
Netherlands	**1.** Ministry of Finance, www.minfin.nl/en/subjects,government-participation **2.** Morgan Stanley, *Journal of Applied Corporate Finance*, Vol. 9, Number 1, Spring 1996 **3.** OECD, 1998, Reforming Public Enterprises: The Netherlands	
Portugal	**1.** Ministry of Finance and Public Administration, Economic Research and Forecasting Department (DGEP), www.dgep.pt/menprinci.html	
Spain	**1.** Sociedad Estatal de Participaciones Industriales, www.sepi.es **2.** Economic Monthly Report (1995 and 1999), La Caixa, www.lacaixa.comunicacions.com **3.** The Comisión Nacional del Mercado de Valores (CNMV), www.cnmv.es	
Sweden	**1.** Ministry of Industry, Employment and Communication, Annual Report for Government-Owned Companies, 2000 - 2005, www.sweden.gov.se/sb/d/2106/a/19792	
UK	**1.** "Who Owns Whom in the UK Electricity Industry," *Electricity Association Policy Research*, June 2003 **2.** www.ukprivatisation.com	

Appendix A2 -- Data Sources (continued)

Panel B. Additional Company Data

Data sources used to identify privatized companies through public offers of shares in EU markets, and track name changes and M&A activity

1. Thomson Financial Securities Data Corporation, SDC Platinum Global New Issues Database and Mergers & Acquisitions Database

2. Dow Jones Newswires, Dow Jones

3. The Privatization Barometer (www.privatizationbarometer.net)

Accounting and Financial Market Data

1. Worldscope

Panel C. Institutional Data

Data sources used for the IRA establishment, legal protection of investors and political orientation

1. Gilardi. F. (2002) "Policy Credibility and Delegation to Independent Regulatory Agencies: A Comparative Empirical Analysis," *Journal of European Public Policy*, **9(6)**, 873-893 not in use anymore?

2. Pagano, M. and Volpin, F. (2005) "The Political Economy of Corporate Governance," *American Economic Review*, **95(4)**, 1005-1030

3. Bortolotti B. and M. Faccio (2008), "Government Control of Privatized Firms," Forthcoming in *Review of Financial Studies*.

Panel D. Price Data

Data sources used to identify series of price indexes of final consumer prices in regulated sectors

1. EUROSTAT – New Cronos: for electricity, gas, water, telecommunications

2. National statistics and ASECAP for freight roads

Data sources for country specific interest rates

1. Long term interest rates. OECD Factbook 2006, Environmental and social statistics