NOTA DI LAVORO

69.2010

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INSTITUTIONS AND MARKETS Series
Editor: Fausto Panunzi

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Keywords: Regulated Utilities, Investment, Capital Structure, Private and State Ownership, Regulatory Independence, Government's Political Orientation

JEL Classification: G31, G32, L33, L51, L90

We thank Bernardo Bortolotti and FEEM- Fondazione Eni Enrico Mattei for financial and ownership data and Fabrizio Gilardi for regulatory data. We also gratefully acknowledge financial support from the Italian Ministry of Education (No. 20089PYFHY_004).

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Regulatory Independence and Political Interference: Evidence from EU Mixed-Ownership Utilities' Investment and Debt*

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This draft: 11 May 2010

Abstract

This paper examines the investment and financial decisions of a sample of 92 EU regulated utilities, taking into account key institutional features of EU public utilities, such as: a) regulation by agencies with various degrees of independence; b) partial ownership of the state in the regulated firm; and c) the government's political orientation, which may ultimately influence the regulatory climate to be either more pro-firm or more pro-consumers. Our results show that regulatory independence matters for both investment and financial decisions. Investment increases under an Independent Regulatory Agency (IRA), while ownership has no effect. Leverage also increases when the IRA is in place, especially so if the regulated firm is privately controlled. Finally political orientation does matter, as firm investment increases under more conservative (pro-firm) governments, but this effect appears to revert when the IRA is in place.

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1. Introduction

Since the early 1990's, the public utilities sector in the European Union has gone through substantial structural reforms that included liberalization of the market, large privatizations of state-owned utilities and the establishment of independent agencies to regulate public utilities. The European Commission promoted these reforms in an attempt to improve the efficiency and service quality of EU utilities, to boost their investments and to improve the effectiveness and efficiency of governmental intervention in the market. The extent of liberalization, the regulatory environment and the degree of privatisation, however, vary considerably across member states and across industries, justifying an analysis of their implications for public utilities' behaviour.

In this paper we argue that regulatory institutions and the residual presence of state ownership following partial privatization both have an influence on EU public utilities' investment and financial decisions, and that this influence is entwined with Government political orientation (partisanship). Notwithstanding the new regulatory and market reforms, in fact, politicians may still try to pursue their partisan goals by interfering with (private and state owned) regulated utilities' decisions, partly to be reelected partly to achieve their personal most favored policy outcome.[1] We thus analyse how the creation of new regulatory institutions, like independent regulatory agencies, affected privatized and partially privatized utilities' decisions and to what extent these new governmental entities have constrained the incidence of political interference.

The rationale behind the creation of Independent Regulatory Authorities (IRAs) lies in the attempt to insulate the policy maker from political interference that may manoeuvre regulated firms' decisions, particularly when firm ownership is in the hand of the government. However, like in all new institutional entities, the degree of independence and, in turn, the credibility of the IRA depends on how much power the Government delegates to the IRA when it is established. Why is regulatory discretion so critical? Institutions that limit political interference are supposed to enhance the regulatory credibility and its commitment. On the contrary, lack of independence reduces the credibility of the regulatory commitments. In this case, whenever regulators cannot commit to long-term regulated prices, they may have an incentive to reduce ex post – i.e. once the firm's investments are sunk - the regulated rates they had set, in order to benefit consumers at the expense of the firm's owners. Regulatory time inconsistency thus deprives the regulated firm's investment incentives. State ownership (even if partial) may, in principle, alleviate regulatory opportunism through direct control of firms' decisions, but it might also exacerbate it, especially if the Government's agenda changes over time for (typically short-term) political purposes. In

[1] See Alesina and Rosenthal (1995) for a general review of the impact of partisan politics and ideology; and Person and Tabellini (1999) and Persson (2002), among the others, for an analysis of the effect of the role of political institutions in shaping economic policies.

addition, the Government (and more generally politicians) can promote (or thwart) liberalization, privatization and regulatory reforms in various directions, depending on its – either pro-firm or pro-consumers - ideology/political stance even in presence of an independent entity.

This paper examines the investment and financial decisions of regulated utilities by taking explicitly into account the evolution of key institutional features that characterized the public utilities sector in Europe in the past two decades, namely: (i) varying degrees of independence of regulatory agencies; (ii) varying degrees of state ownership within regulated public utilities, and (iii) the government's political orientation, as this may ultimately influence the regulatory climate to be either pro-firm or pro-consumers. The econometric analysis uses firm level data for a large panel of publicly traded EU utilities in energy, telecommunication, transport and water industries from 1994 and 2005, which we complement with country and sector specific variables to cover the regulatory framework and the political environment.

The time-inconsistency problem in regulation (the so called hold up problem) and the implication of state vs. private ownership of utilities have both attracted the interest of economic literature.[2] Sappington and Stiglitz (1987) show that both privatization and independent regulation enhance the commitment power of regulators by rendering more credible the regulator's interventions. As shown by Laffont and Tirole (1991), under state ownership the government could force the regulator to use the firm's assets for policy objectives (e.g. to extend the universal service obligation or to provide the service in geographically disadvantaged areas) rather than to pursue profit maximization. Politicians' discretion may thus impair the regulators' commitment capability. On the contrary under private ownership, the double control by shareholders, on one side, and by the regulator, on the other side, would provide proper incentives to managers. Levy and Spiller (1994) show that regulatory independence improves the regulators' ability to make long-term commitments to regulatory policies and that, therefore, sunk investments are less likely expropriated ex post. In a more general framework, Martimort (2006) shows that contract incompleteness and, more specifically, state ownership and limits to regulatory commitment may affect the decision to privatize the utility as well as its ex post performance. On the one hand, private ownership provides managers with stronger incentives to invest in cost reducing activities that secure larger benefits and higher (implicit or explicit) rewards. On the other hand, the promise not to intervene ex post is more credible under private production than under state ownership, and private firms are thus predicted to invest optimally, because regulatory commitment is (supposed to be) more pronounced.

[2] See, for example, Newbery (1999; ch. 2) and the survey by Armstrong and Sappington (2007); see also Shleifer (1998) for a comparison of the implications of state vs. private ownership.

More recently, the literature has focused on how the institutional framework and, in particular, the political stance of the government may affect regulatory reforms and outcomes. Laffont (1996) shows that, in the presence of a privately-owned monopoly, a change from a pro-consumer to a pro-firm government leads to a change in the regulatory regime from cost-plus to fixed price regulation which in turn is expected to lead the regulated firms to reduce costs.[3] Guerriero (2010) analyses the determinants of the adoption of incentive regulation and shows that "performance based regulation" is more likely where regulators are elected, political competition is less harsh, and regulatory resources are more abundant. Potrafke (2010), using data for 21 OECD countries from 1975 to 2003, finds that the government's ideology has a strong influence on the deregulation process, specifically that a right-wing and market-oriented political orientation appear as the driving force of privatization and product market deregulation[4]. Political institutions and politics, however, may also affect firms' decisions. Shleifer and Vishny (1994) theoretically analyse the behaviour of private and public enterprises in situations where politicians try to influence firms to pursue political objectives. They show that "an important determinant of whether politicians want firms to be private or public is their ability to get tangible political benefits out of public ownership. The greater the independence of public firms from politicians, the less attractive is public ownership for politicians" [pp. 1022-1023]. Henisz and Zelner (2001) and Zelner and Henisz (2006) analyse and empirically investigate the impact of political institutions on regulated firms' investment decisions and find that the credibility of the political regime positively affects firms' investment decisions.

In this paper, we take the suggestions of this recent strand of the literature seriously and we investigate the impact of the political environment, along with independent regulation and state partial ownership, on EU utilities' investment and financial decisions.

Regulatory outcomes and interventions, however, are affected not only by the degree of regulatory independence or by the Government's stake in the firm, or by political interference, but also by firms' strategic decisions. Theoretical analysis suggests that for example regulated firms can lobby regulators to obtain favourable outcomes (Evans et. al, 2008), or they can use capital structure to constrain regulators' lack of commitment. Spiegel and Spulber (1994 and 1997) show that the strategic use of capital structure can shield the regulated firms' investment incentives against regulatory opportunism because regulators may decide to keep regulated rates relatively high in order to minimize the risk of financial distress. By allowing the firm to raise its leverage and become exposed to bankruptcy risk, the regulator ties his/her own hands not to reduce the regulated

[3] See also Laffont (2000) for a more general and complete analysis on the interaction among regulatory interventions, firm's behavior and politics.
[4] These results are consistent with previous findings by Bortolotti, Fantini and Siniscalco (2003).

rates *ex-post*, thus disciplining the lack of commitment problem that curbs the investment incentives of the regulated firm. This theory, thus establishes a strategic relationship among price regulation, investment and leverage - through bankruptcy costs. Bortolotti, Cambini, Rondi and Spiegel (hereafter, BCRS 2010), using a large panel of EU utilities, provide empirical evidence that the relationship between financial leverage and regulated rates exists.

This paper departs from existing work on several dimensions. First, while most studies typically focus on utilities in developing countries, we test our models on a large panel of European firms. Second although other papers do examine the relationship between investment and regulatory framework or independence, they neglect its interactions with firm ownership and government partisanship. In our econometric analysis of EU regulated firms' investment decisions, we use the Euler equation approach to test whether the equilibrium level of investment changes when the regulator is independent and when the firm is partially owned by the state while also controlling for the impact of the Government's political orientation (i.e. pro-consumers versus pro-firm ideology). Thirdly, next to investment, we also examine the capital structure decisions of utilities, as this was recognised by BCRS (2010) to have an impact on the regulated rates of privately-controlled firms subject to an IRA; moreover, the huge increase of EU public utilities' indebtedness and its consequences for investment have been identified as a serious problem by governmental institutions.[5] However, differently from BCRS (2010), we estimate a dynamic leverage equation that allows us to estimate the long run impact of an IRA on firms' leverage, and we use a continuous variable, rather than a discrete one to measure the government's stake in the regulated firms and this minimizes the problem of assigning control on the basis of an arbitrary threshold. More importantly, we also estimate the impact of regulation and indebtedness on investment.

Our results show that regulatory independence does matter for investment as well as for financial decisions of regulated firms. More specifically, investment increases when an IRA is in place, or the more independent is the regulator, and this effect is independent of firm ownership, while financial leverage increases when an IRA is in place, but only if the regulated firm is privately controlled. Finally the government's political orientation appears to matter for investment decisions, as firm investment is found to increase under more conservative (pro-firm) governments, but this effect appears to revert if the IRA exists, and the higher is regulatory independence.

The rest of the paper is organized as follows. In Section 2, we review the existing empirical evidence. In Section 3, we describe the institutional context and in Section 4 the dataset. In Sections

[5] In the U.K., a joint study of the Department of Trade and Industry and the HM Treasury (DTI-HM, 2004) has expressed a concern about the high leverage of U.K. utilities and argued that it "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). Similarly, Ofgem (2008) has recently started to consider how to intervene in the event of financial distress of transport electric utilities.

5 and 6, we present the econometric strategy and the empirical results from estimating investment and leverage regressions, respectively. Section 7 concludes.

2. Related empirical literature

The empirical literature that focuses on the relationship between regulation and investment, rarely examines its implications with firm capital structure, and practically never extends the analysis to consider the role of firm ownership and political partisanship or regulatory independence.

Wallsten (2001) shows that, when an IRA is in place, the privatization of telecoms providers in Latin America and Africa is associated with larger investment in connection capacity and phone penetration, but not otherwise. Using data of telecoms companies in Latin American and Caribbean countries from 1980 to 1997, Gutiérrez (2003) shows that regulatory independence has a positive impact on the number of phone lines per capita. Cubbin and Stern (2005) show, for a panel of electric utilities in developing countries from 1980 to 2001, that the existence of an independent regulator is associated with higher generating capacity. More recently, using industry level data from 13 OECD countries, Egert (2009) shows that incentive regulation implemented jointly with an independent sector regulator has a strong positive impact on investment in network industries, though when taken separately the two variables do not display any significant effect. Cambini and Rondi (2009) study the relationship between access regulation, financial structure and investment decisions for the 15 EU Public Telecommunication Operators (PTO), analyzing if financial variables can be used by incumbent companies as a strategic device to influence the regulator's tariff setting decisions the regulated firms' investment decisions. They find that an increase in leverage positively affects both retail and wholesale rates, and that an increase in leverage has a negative impact on competition, but a positive effect on the PTOs' investment rate. Notably, however, none of these studies include, or control for, firm ownership and political orientation. Moreover, most of the studies focus on developing countries while we concentrate on a large panel of EU utilities shortly after the introduction of market reforms.

Political institutions also affect investment decisions of regulated firms. Henisz and Zelner (2001) investigate the impact of political variables on regulated firms' investment for a sample of telecommunications operators in 147 countries during the period 1960–1994, and find that stronger constraints on managers' discretion generated by the credibility of the political regime (i.e. the presence of low and upper chambers, judiciary and some federal institutions, the effective systems of checks and balances, etc.) positively affect firms' investment decisions. Zelner and Henisz (2006), using panel data for state-owned Electric Utilities from 78 countries (1970-1994), find that

the effect of political institutions that constraints the behaviour of political actors on investment in electrical infrastructures varies with the level of interest group competition (households vs. industrial users) faced by electric utilities.

Existing evidence on capital structure decisions regulated firms is consistent with the main result that financial leverage increases with the introduction and the severity of regulation. The high leverage of regulated utilities is well-known and well-documented phenomenon in the U.S.[6]. Taggart (1985) finds that U.S. electric utilities 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) find, for a cross-section of U.S. electric utilities, that firms operating in less pro-firm regulatory environments tend to have higher debt-equity ratios. Klein, Phillips and Shiu (2002), using a cross-section of U.S. property-liability insurers, show that the degree of price regulation and its stringency is positively related with the leverage of insurers. Bulan and Sanyal (2005) find, for a panel of U.S. investor-owned electric utilities between 1990 and 2000, that they reduced their debt-to-total assets ratios in response to the higher regulatory and competitive uncertainty that followed deregulation. Correia da Silva, Estache and Jarvela (2006) study the implications of increased debt for investment. They examine 121 regulated utilities in 16 less developed countries from 1991 to 2002 and find that, as leverage steadily increases over time investment levels begin to fall. To the best of our knowledge, BCRS (2010) is the first paper to examine empirically the relationship between capital structure, regulated prices, ownership structure, and regulatory independence using a large panel of EU utilities. The results show that: (i) utilities tend to have higher leverage when they are privately controlled and regulated by an independent regulatory agency (IRA); (ii) leverage Granger-causes regulated prices (but not vice versa) when firms are privately controlled and regulated by an IRA (when firms are state controlled, leverage and regulated prices do not Granger-cause one another). However, none of these studies focuses on the long run effect of regulatory independence on the increase of firm's leverage after controlling for firm's ownership and political partisanship.

3. Institutional features

Until the early Nineties, with the only UK exception, public utilities in Europe were largely characterized by vertical integration, state monopoly and public ownership. Ministries, governmental bodies or committee or local governments were in charge of regulating the market and set tariffs and quality standards. However, in that period regulation was more viewed as a sort

[6] See for example, Bradley, Jarrell, and Kim (1984).

of "political negotiation" among firms and the Ministry itself rather than as an instrument to re-create competitive conditions while amending market failures. Regulated rates were mainly set to counterbalance the rise of inflation and utilities were often asked to absorb labour units whenever unemployment increased. The result of this "un-incentive regulation" was ill performing monopolies and inefficiency (Megginson and Netter, 2001).

Within EU member states, the reforms of the public utility sector were prompted by the European Commission through various Directives, aimed at redesigning the legal and regulatory frameworks so as to enhance economic incentives to raise cost efficiency, service quality, and new investment. The utility sector was therefore gradually liberalized with involvement of private investors in the ownership and control of assets. The Commission, however, though in favour of privatisation, left the decision about public utilities' ownership structure entirely in the hands of national governments. As of 2010, privatization of public utilities within EU member states is far from complete, and central and local governments still hold majority (and minority) ownership stakes in many regulated utilities.[7]

In order to regulate public utilities and avoid the potential conflict of interest by the Government in presence of state owned companies, the European Commission has been promoting, since the mid-Eighties, the delegation of regulatory competencies from central Governments to Independent Regulatory Authorities (IRAs), which are designed to act on the behalf of central government, but are not part of any State Departments or Ministries. These new regulatory institutions would act independently of the ministerial departments, with their own specialized staff and with precise and specific tasks. OECD describes them as "one of the most widespread institutions of modern regulatory governance" (OECD, 2002). Regulatory tasks typically involve price setting decisions, both at retail and wholesale level - whenever granting access to essential facility is needed to the development of market competition, the definition of entry conditions, the imposition of quality standards and all the technical rules to use or access to existing infrastructures. Within this set of regulatory rules, utilities are free to make their own decisions about investments and their financing, using either debt or equity so as to maximize firm's value.

The implementation of market reforms varies considerably across countries and sectors. Reforms are most advanced in the telecom industry where independent regulatory agencies (IRA) have been established in virtually all member states and most of the companies are (at least partially) privatized.[8] Market liberalization reforms are also advanced in the energy sector, where the majority of electric and gas utilities are subject to regulation by an IRAs. However, many large

[7] See Bortolotti and Faccio (2009) for a recent analysis.
[8] In Appendix 2 we report data of establishment of an IRA, the privatization year and the ownership status (up to the end of 2007) for all the EU 27 countries in the energy (electricity and gas) and telecommunications sectors.

utilities are still controlled by the government, particularly in France, Germany, Italy and Portugal and especially so in the natural gas industry. Finally, structural reforms in water supply and in transportation imfrastructure (docks and ports, airports and freight motorways) are still lagging behind; with the exception of the U.K., most water and transportation utilities are still controlled by central and local governments and still subject to regulation by ministries or other branches of the government rather than by independent regulatory agencies.

4. The dataset

For the empirical analysis we use an unbalanced panel of 92 publicly traded utilities and transportation infrastructure operators from EU 15 founding member states tracked from 1994 to 2005.[9] The data covers firms that are either regulated by independent regulatory agencies or by ministries, governmental committees, or local governments, and with various degrees of state ownership.

Accounting and financial market data have been collected from *Worldscope*. To define indebtedness we consider measures that capture the risk of the default.[10] Our variable is the textbook definition of leverage, i.e. the book value of financial debt (both long- and short-term) divided by the sum of the book value of debt and the book value of equity. Investment is the change in the fixed capital stock. In the econometric analysis we use the ratio of gross fixed investment to capital stock at the replacement value.[11] Table 1 summarizes the descriptive statistics for the main variables used in the analysis. Appendix A1 defines and details how we constructed the firm-level economic and financial variables used in the econometric analysis.

Among the 92 firms, 43 firms are privately-controlled throughout our sample, 25 are state-controlled throughout our sample period, and 24 were privatized during our sample period. We

[9] See also BCRS (2010) for a thorough description of the data and the sources used to construct the economic and financial variables.

[10] See Rajan and Zingales (1995) for a discussion of alternative leverage measures.

[11] The accounting data from *Worldscope* only include historic cost valuations of fixed assets, which usually bear little relation to current replacement cost of long-lived fixed capital assets. Hence, we calculate the replacement cost of the capital stock using the perpetual inventory formula: $p_{t+1}K_{t+1} = p_tK_t(1-\delta)(p_{t+1}/p_t) + p_{t+1}I_{t+1}$, where p_t is the country-specific implicit price deflator for gross capital formation in period t sourced by the OECD, K_t is the fixed capital stock in period t, I_t is the investment flow in period t, and δ is the depreciation rate (see Bond and Meghir, 1994). We derived the sector specific depreciation rates from Bureau of Economic Analysis estimates reported in "Rates of Depreciation, Service Lives, Declining Balance Rates, and Hulten-Wykoff Categories and used 4.4% for energy, gas and water supply, 3% for freight roads concessionaires, 8% for telecommunications, and 4.5% for ports and airports. To obtain the starting values for the perpetual inventory formula, we assumed that replacement cost valuations are equal to historic cost valuations for the earlier available capital stock data (usually 1994). Whenever a major acquisition or divestiture may cause a major discontinuity in the investment rate series, we split the firm's time-series into two units accounting for the period "before" and "after" the event, provided that the split unit has at least three consecutive observations.

employ a continuous variable constructed by Bortolotti and Faccio (2009), which uses the weakest link approach to measure the state's ultimate control rights (UCR).[12]

All firms operate in regulated sectors, i.e. where entry and prices are subject to regulatory oversight either by the state or by an Independent Regulatory Agency (IRA). In order to study the effect of regulatory independence on firms' investment and financial behavior, we use an IRA dummy that 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 and information on IRAs' inception dates taken 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 information about the presence of IRAs within freight roads, airports, port and docks, and water supply. As mentioned in Section 3, we found that only the water industry in the UK has an independent regulatory agency. In addition to the IRA dummy, we also directly include the Index of formal *Regulatory Independence* (see Gilardi 2002, 2005) in order to control for differences in the regulatory environment across countries and sectors. The index is obtained by taking the average of five key dimensions of the regulatory framework: (i) the status of the agency head (for example, term of office and appointment and dismissal procedure), (ii) the status of the members of management board, (iii) relationship with government and parliament, (iv) financial and organizational autonomy, and (v) regulatory competencies.[13] It goes from 0 (no independence) to 1 (full independence).

The *Political Orientation Index* is used to capture whether the government's political stance is more pro-firm (right-wing) or pro-consumer (left-wing). Insofar as governments interfere with the regulator's agenda (and the regulator is ultimately *less* independent), this Index is also a proxy of the regulatory climate. The index 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, 2009).

Finally, in the leverage equation, we also use the *Investor Protection* index, i.e. the "anti-director rights" index developed by La Porta *et al.* (1998) and updated by Pagano and Volpin

[12] See La Porta, Lopez-de-Silanes, and Shleifer (1999), Claessens, Djankov, and Lang (2000), Faccio and Lang (2002). According to this approach, the UCR of the state is simply equal to the minimum ownership stake along the control chain (i.e., the weakest link). In BCRS (2010) a dichotomous dummy variable captures the public vs. private control status.

[13] Unfortunately, the index is time invariant and is not available for water utility sector and for transportation infrastructure, where the IRA does not exist. Regulatory independence varies considerably across European countries and across sectors. In telecommunications, Austria, Ireland, Portugal, and the U.K. appear to have the most independent regulators, while Belgium and Germany have the least independent regulators. In electric and gas, Austria, Belgium, and Italy appear to have the most independent regulators, while Spain seems to have the least independent regulators and Germany does not have an IRA dedicated for energy sectors.

(2005). The index goes from 0 to 7 as shareholders' rights become more and more protected. We expect that higher values of this index would be associated with lower cost of equity and hence lower leverage.

5. An Empirical Model of Investment with Independent Regulation, Mixed-Ownership and Political Regimes

In this section we examine the impact of regulatory independence and (partial) state ownership on the equilibrium level of the investment of the regulated firm, taking government's political orientation into account.

5.1 The Empirical Model and the Estimation Strategy

For an empirical model of investment to be tested on firm panel data, we use the Euler equation approach, introduced by Abel (1980) and developed by Bond and Meghir (1994). The Euler equation derives from the first-order conditions for the optimal capital stock and therefore describes the optimal path of firm investment. It is not an investment rule where investment is a function of predetermined or exogenous variables but, rather, a structural relation between investment rates in successive periods as derived from dynamic optimization in the presence of symmetric and quadratic adjustment costs that take the form of foregone production (see Schiantarelli, 1996). The advantage of the Euler equation model of company investment is that it captures the influence of current expectations of future profitability on current investment decisions without having to rely on stock market valuations of the firm as in the usual Q model approach, where the average Q is constructed from financial market data and is a poor proxy for marginal Q.[14]

To obtain an empirical model, the firm is assumed to maximize the present discounted value of current and future net cash flows. Let L_{it} denote variable factor inputs, w_{it} the price of variable factors, p_{it} the price of output, I_{it} fixed investment, K_{it} the capital stock, p^I_{it} the price of investment goods, ρ_{t+j} the nominal discount factor between period t and period $t+j$, δ the rate of depreciation, $F(K_{it}, L_{it})$ the production function and $G(I_{it}, K_{it})$ the adjustment cost function and $E_t(.)$ the expectation operator conditional on information available at t.[15] The firm solves the following optimization problem:

[14] This is obtained by using the first-order condition for investment to eliminate the shadow value of capital from the Euler equation and by estimating the Euler equation itself.
[15] This concise exposition of the Euler equation approach closely follows Bond and Meghir (1994) and Bond, Elston, Mairesse and Mulkay (2003).

$$\text{Max } E_t [\Sigma_{j=0} \rho_{t+j} \Pi(K_{it+j}, L_{it+j}, L_{it+j}] \quad (1)$$

$$\text{s.t.} \quad K_{it} = (1-\delta) K_{it-1} + I_{it}$$

where $\Pi_{it} = p_{it}F(K_{it}, L_{it}) - p_{it}G(I_{it}, K_{it}) - w_{it}L_{it} - p^I_{it}I_{it}$. The Euler equation characterizing the optimal investment path relates the marginal adjustment costs in adjacent periods and can written as follows:

$$-(\partial\Pi/\partial I)_{it} = -(1-\delta)\rho_{t+1} E_t (\partial\Pi/\partial I)_{it+1} + (\partial\Pi/\partial K)_{it}$$

The symmetric adjustment cost function for the capital stock can be described by $G(I_{it}, K_{it}) = b/2\ [(I/K_{it} - c]^2 K_{it}$, where b reflects the importance of adjustment costs and c is the "normal" rate of gross investment. Since we are dealing with imperfect market structures characterized by non constant returns to scale – i.e. natural monopolies or imperfectly competitive markets with dominant firms subject to regulatory agencies - the output price p_{it} is assumed to depend on the output, with a constant price elasticity of demand (ε). We therefore introduce the output to capital ratio $(Y/K)_{it}$ to account for imperfect competition in the product market (see also Schiantarelli and Georgoutsos, 1990).

The Euler equation can then be expressed as:

$$(I/K)_{it} - \gamma_1(I/K)^2_{it} = \gamma_2 E_t(I/K)_{it+1} + \gamma_3[(\Omega/K)_{it} - J_{it}] - \gamma_4(Y/K)_{it} + \alpha \quad (2)$$

where $\Omega_{it} = p_{it}F(K_{it}, L_{it}) - p_{it}G(I_{it}, K_{it}) - w_{it}L_{it}$ is the gross operating profit and J_{it} is the real user cost of capital (with $J_{it} = (p^I_{it}/p_{it})\{1-(1-\delta)\rho_{t+1}p^I_{it+1}/p^I_{it}\}$), while the coefficients γ_1, γ_2, γ_3 and γ_4 can be shown to be positive.[16]

To implement this model, the unobserved $E_t(I/K)_{it+1}$ is replaced by the realized $(I/K)_{it+1}$ plus a forecast error, and the $(I/K)_{it+1}$ term is then moved to the left-hand side to obtain an econometric model that is linear in variables. Finally, the cost of capital term can be replaced by time and firm specific effects. The empirical specification that we estimate then takes the form:

$$(I/K)_{it+1} = \beta_1(I/K)_{it} - \beta_2(I/K)^2_{it} - \beta_3(\Pi/K)_{it} + \beta_4(Y/K)_{it} + d_{it+1} + \eta_i + \nu_{it+1} \quad (3)$$

It can be shown that $\beta_1 \geq 1$ and $\beta_2 \geq 1$, while $\beta_3 > 0$ under the null hypotheses of perfect capital markets. The coefficient β_4 is positive under imperfectly competitive markets or when the company is facing increasing return to scale. In our setting, while it is true that utilities typically face non

[16] More specifically, it is possible to show that $\gamma_1 = 1/(1+c)$; $\gamma_2 = 1/\psi(1+c)$ where $\psi = (p_{it}/p_{it+1})[1/(1-\delta)\rho_{t+1}]$; $\gamma_3 = 1/b\eta(1+c)$ where $\eta = (1 - 1/\varepsilon)$ is the mark up coefficient in a imperfect market; and $\gamma_4 = 1/[b(1+c)(\varepsilon - 1)]$.

constant returns to scale, they are also subject to price regulation by an IRA, a Ministry or other governmental committee. One of the typical purposes of regulation is to ensure that the actions of public utilities mimic those of unregulated companies which operate in a competitive environment. Therefore, utilities prices should be set in order to reach the efficient result of competitive markets. Moreover, public utilities services demand is typically price inelastic hence, $\varepsilon < 1$. Hence, even though the utilities markets are imperfect, the sign of the coefficient β_4 might become ambiguous in a regulated setting as the two effects might compensate each other.

An attractive feature of the Euler equation approach, particularly interesting for our study, is that equation (3) can be extended also to debt as a source of investment finance (Bond and Meghir, 1994). This allows us to test for the impact of bankruptcy risk and financial distress on regulated utilities' investment. The model assumes that the rate of interest paid by the firm on debt finance may be an increasing function of debt issued, a situation that occurs whenever the firm faces a bankruptcy risk, because the probability of bankruptcy is an increasing function of the amount of the debt outstanding. It can be shown that the augmented Euler equation for capital stock can be written as:

$$(I/K)_{it+1} = \beta_1(I/K)_{it} - \beta_2(I/K)^2_{it} - \beta_3(\Pi/K)_{it} + \beta_4(Y/K)_{it} + \beta_5(D/K)^2_{it} + d_{it+1} + \eta_i + \nu_{it+1} \qquad (3bis)$$

where D/K is the financial debt to capital stock ratio. The additional term $(D/K)^2_{it}$ thus controls for the non-separability between investment and financial decisions. The sign on the debt coefficient, β_5, is expected to be negative if bankruptcy costs exist, and zero if there are no bankruptcy costs and debt and investment decisions are separable. The negative coefficient reflects that the expected cost of borrowing is not independent of the probability of bankruptcy and also that the probability of bankruptcy decreases as the firm size increases for a given level of debt.

The main purpose of our test is to investigate the implications of independent regulation, state ownership and government's political orientation for the optimal capital accumulation of the regulated firm. We thus add three variables to the Euler equation for investment: the dichotomous *IRA* 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, $Government\ UCR_{it}$ is a continuous variable measuring the ultimate control rights held by the Government, $Political\ Orientation_{it}$ is an index of the government's political orientation ranging from 0 (extreme left) and 10 (extreme right) to proxy the pro-consumer vs. pro-firm political stance of the government. Finally, in order to investigate whether the impact of independent regulation varies with the government's ownership stake and political orientation, we also estimate a specification where IRA is interacted with Government UCR and, separately, with

Political orientation. We therefore start with the baseline Euler equation model, which adds the institutional variables:

$$(I/K)_{it} = \beta_0 + \beta_1 (I/K)_{it-1} + \beta_2 (I/K)^2_{it-1} + \beta_3 (CF/K)_{it-1} + \beta_4 (Y/K)_{it-1} + \\ + \alpha_1 IRA_{it} + \alpha_2 GovernmentUCR_{it} + \alpha_3 PolOrient_{it} + \eta_i + d_t + \varepsilon_{it}, \tag{4}$$

We then add the interactions of *IRA* with *Government UCR* and with *Political Orientation*:

$$(I/K)_{it} = \beta_0 + \beta_1 (I/K)_{it-1} + \beta_2 (I/K)^2_{it-1} + \beta_3 (CF/K)_{it-1} + \beta_4 (Y/K)_{it-1} + \\ + \alpha_1 IRA_{it} + \alpha_2 GovernmentUCR_{it} + \alpha_3 PolOrient_{it} + \\ + \alpha_4 GovernmentUCR_{it} * IRA_{it} + \alpha_5 PolOrient_{it} * IRA_{it} + \eta_i + d_t + \varepsilon_{it}, \tag{4bis}$$

The third model includes the squared debt term, which tests for the presence of bankruptcy costs:

$$(I/K)_{it} = \beta_0 + \beta_1 (I/K)_{it-1} + \beta_2 (I/K)^2_{it-1} + \beta_3 (CF/K)_{it-1} + \beta_4 (Y/K)_{it-1} + \beta_5 (D/K)^2_{it-1} + \\ + \alpha_1 IRA_{it} + \alpha_2 GovernmentUCR_{it} + \alpha_3 PolOrient_{it} + \eta_i + d_t + \varepsilon_{it}, \tag{5}$$

And the fourth specification adds again the interacted terms:

$$(I/K)_{it} = \beta_0 + \beta_1 (I/K)_{it-1} + \beta_2 (I/K)^2_{it-1} + \beta_3 (CF/K)_{it-1} + \beta_4 (Y/K)_{it-1} + \beta_5 (D/K)^2_{it-1} + \\ + \alpha_1 IRA_{it} + \alpha_2 GovernmentUCR_{it} + \alpha_3 PolOrient_{it} + \\ + \alpha_4 GovernmentUCR_{it} * IRA_{it} + \alpha_5 PolOrient_{it} * IRA_{it} + \eta_i + d_t + \varepsilon_{it}, \tag{5bis}$$

As an alternative to the IRA dummy, we also estimate the full set of specifications (4)-(5) with the index of formal *Regulatory Independence* (see Gilardi 2002, 2005), which is available only for sectors/countries where the IRA is present (electricity and gas industry, telecommunications and, for the UK only, water supply) and allows us to control for differences in the regulatory environment across countries and across sectors.

For any given value of Government UCR and of political orientation, we can calculate the total effect of the presence of the IRA as $\alpha_1 + \alpha_4$*$Government\ UCR + \alpha_5$*$PolOrient$, conditional on different ownership and political patterns. The coefficient α_1 thus measures the (limit) effect of the IRA on leverage as both the Government's shareholding and the Political Orientation index go to zero, i.e., the effect of IRA on fully privately controlled firms and when the government in charge is (extreme) leftwing. The coefficient α_2 measures the direct effect of state ownership while the coefficient α_3 measures the direct effect of the government's political orientation. Finally, the coefficient α_4 measures how the effect of IRA varies with Government ownership (from fully public to fully private) while the coefficient α_5 measures how the effect of IRA differs as the Government political orientation shifts from left to right. The interaction terms *GovernmentUCR*IRA* and *Political orientation*IRA* thus estimate whether the impact of the IRA is different for firms controlled by the state or by private investors and for firms under a left- (pro-consumer) or a right-wing (pro-firm) government, respectively.

To estimate equations (4) - (5bis), we use the Arellano and Bond (1991) and Arellano and Bover (1995) linear generalized method of moments (GMM) estimator, which is especially designed for dynamic models where the lagged dependent variable is included and some of the regressors are not strictly exogenous. More specifically, we use the dynamic System-GMM model developed by Arellano and Bond (1991) and Blundell and Bond (1998), which deals with situations where the lagged dependent variable is persistent and the lagged levels of the dependent variables are weak instruments. 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.[17] 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. Since the Sargan-Hansen test may be weakened if there are too many instruments (with respect to the number of observations), we follow a conservative strategy and use no more than three (but mostly two) lags of the instrumenting variables.[18] We finally report the

[17] For estimation we used the xtabond2 Stata command created by David Roodman (2006).

[18] Lagged values of right-hand variables are used as instruments: lagged levels are used in first-differences equations and lags of first-differenced variables are used in levels equations. The instrument set also includes a dummy to account for the presence of Golden Shares by the government and an index of *political institutional disproportionality* to control for characteristics of institutional and political systems, which may have influenced the decision to privatize utilities and to introduce the IRAs. Specifically we use the *Political institutional Gallagher index of disproportionality* that allows a categorization of countries based on a majoritarian -consensual dimension and is a measure of government stability and of the veto-power of minority parties The index is continuous; it equals zero when the apportionment of parliamentary seats is exactly proportional to electoral results, and it increases as disproportionality increases (Bortolotti and Pinotti, 2008). All regressions include year dummies. Year, sector and country dummies are included as instruments.

Arellano and Bond (1991) autocorrelation test to control for first order and second order correlation in the residuals. If AR(2) is detected, instruments dated t-2 are invalid and only instruments dated t-3 and earlier can be used.

5.2 Results

In Tables 2.1 and 2.2, we report one-step GMM-System estimates of the Euler equation models. To evaluate the impact of the regulatory independency we use the *IRA* dummy in Table 2.1 and the index of formal *Regulatory Independence* in Table 2.2. In both tables, Columns (3) and (4) include the debt squared term which allows us to test for the presence of bankruptcy costs (see Equations 5 and 5bis).

Our results show that the coefficients on lagged investment and lagged investment squared terms have the right sign and are significant in all columns. More importantly, their magnitude is close to 1 in absolute value as predicted by the theory (t-tests on the point estimates cannot reject the hypothesis that the coefficients are one). This suggests that the investment dynamics implied by the theory is supported by the data. All estimated models however show the same inconsistency with the theoretical model underlying the Euler investment equation, namely the lack of significance of the coefficients on the cash flow term, our proxy for the gross operating profit. Since the cash flow was predicted to have a negative and significant coefficient, this result suggests the presence of imperfections such as asymmetric information and contract enforcement or incentive problems in the capital markets (see Hubbard, 1998). We note that the coefficient on the output to capital stock ratio is insignificant in all columns. As suggested in section 5.1, this might be due to the combined effects of imperfect market competition in a regulated environment and of inelastic demand of public utilities services that may compensate each other leading to an insignificant or even negative estimated coefficient.

Finally, the point estimate of the coefficient on the lagged debt term has the expected negative sign and is significantly different from zero, both in column (3) and in column (4). This suggests that the investment and financing decisions for our sample of regulated utilities are not separable due to the presence of deadweight costs associated to bankruptcy. This result is consistent with the idea of a strategic use of leverage that, through the bankruptcy threat, may induce the regulator not to reduce ex-post regulated rates (as shown in BCRS, 2010), so as to allow the regulated firm to follow the optimal investment path.

We now turn to the coefficients of the institutional variables of interest: the IRA dummy, the *Government UCR* and *Political Orientation*. The results in Table 2.1 show that the coefficient on the lagged IRA term is positive and significant in all columns, which indicates that the equilibrium level of investment is higher when the independent regulator exists. This result is consistent with theory showing that regulatory independence improves the regulated firm's investment incentives (Levy and Spiller, 1994). The Government UCR coefficient, however, is not significantly different from zero, a result which does not support theoretical predictions that investment is lower when the firm is (fully or partly) owned by the state (see, for example, Martimort, 2006).[19] Political orientation is also insignificant, in columns (1) and (3), but when we add its interaction with IRA, in columns (2) and (4), we find that the coefficients on the standalone variable turn positive and significant. In contrast, *Government UCR* is never significant nor is its interaction with IRA.

We thus focus on the interrelations between IRA and political orientation in Columns (2) and (4) to examine whether the increase in investment due to the presence of the IRA differs with the pro-firm vs. pro-consumer political stance of the government. The coefficients α_1 and α_3 on the IRA dummy and on the Political orientation control variable are both positive and significant while their interaction, α_5, is negative and also significant. α_1 and α_3 thus imply that utilities tend to invest more when the IRA exists and when the government is conservative, hence pro-firm, while α_5 suggests that, when the IRA is in place, the increase in investment is less pronounced if the government is rightwing. To illustrate how the impact of the IRA on investment changes with political orientation we graph in Figure 1 the partial effect of the IRA conditional on *PolOrien* (i.e. the sum: $\alpha_1 + \alpha_5$**PolOrient*) and the corresponding 95% confidence intervals. To supplement the analysis we also estimate and graphically depict in Figure 2 the partial effects of political orientation, conditional on the presence of the IRA ($\alpha_3 + \alpha_5$**IRA*).

Figure 1 shows that the positive effect of IRA on investment shrinks as the political orientation index increases, i.e. as the government gets more pro-firm. Since we know from α_3 that pro-firm governments have a direct positive effect on investment, this result suggests that the presence of the IRA somewhat has a counteracting influence on political interference. Further insight can be derived from Figure 2 which shows how the marginal effect of political orientation on *IK* varies with the presence of the IRA. As reported in column (2), the coefficient of Political orientation is positive while its interaction with IRA is negative. The figure shows that the increase in investment experienced by firms when governments are rightwing vanishes when the IRA is in

[19] The lack of significance of the ownership variable is consistent with empirical evidence in Cambini and Rondi (2010) for energy utilities in Italy, Spain, France, Germany and UK from 2000 to 2007. Results show that private and state-owned firms' investment rates do not significantly differ.

place. If the IRA exists (i.e. when the dummy is one), the total effect of political orientation is summarized by the algebraic sum of the point estimates in Column (2): +0.008 – 0.013 = -0.005, indicating that the IRA has a counteracting effect on political interference.

In Table 2.2 we replace the IRA dummy with the *Regulatory Independence* Index, which graduates the formal level of regulatory independence from 0 (no independence) to 1 (full independence). Although the index is time invariant, using a continuous variable, instead of a dummy, allows us to account for differing levels of regulatory independence across countries and sectors in which an IRA exists. The results are very similar to those in Table 2.1. The coefficient on the *Regulatory Independence* Index is positive and significant, suggesting that the higher the (formal) regulatory independence the higher the investment, while the ownership variables remain insignificant in all specifications. Like in Table 2.1, *Political Orientation* turns significant in the specifications that include the interacted terms (Columns (2) and (4)). Again the results suggest that the positive effect of pro-firm (conservative) governments on regulated utilities' investment weakens and possibly reverts, as regulators get more independent. Figure 3 shows the effect of regulatory independence on the investment rate conditional on changes in the government's political orientation, confirming that the increase in investment due to the presence of the IRA is smaller under a rightwing government. Finally, Figure 4 illustrates the effect of political orientation on investment as regulatory independence increases, and shows, consistently with the earlier evidence, that the investment increase due to the rightwing government drops as regulatory independence increases. The results with the index of *Regulatory Independence* on the subsample of utilities that eventually got an IRA confirm the results we obtained using the IRA dichotomous dummy for the full sample.

6. Modeling Capital Structure in Heterogeneous Regulatory and Political Environments

In this section we investigate the impact of regulatory independence and (partial) state ownership on the leverage of regulated firms, taking government's political orientation into account, and also examine whether the impact of regulatory independence differs with various degree of state ownership and with different political orientation of the government.

6.1 The Leverage Equation and the Estimation Strategy

We estimate a dynamic leverage equation to account for possible adjustment process that firms may follow whenever they want to obtain a target level of leverage. An attracting feature of

the dynamic model is that it enables us to estimate the log-run effects of regulatory independence that arise if firms adjust their leverage in response to the introduction of the IRA gradually over time. Our baseline regression is the following:

$$L_{it} = \alpha_0 + \beta_1 L_{it-1} + \alpha_1 IRA_{it} + \alpha_2 Government\ UCR_{it} + \alpha_3 PolOrient_{it} + \alpha_4 \mathbf{X}_{it} + \alpha_5\ GDP\ Growth_{it} + \alpha_6 Investor\ Protection_{it} + \eta_i + d_t + \varepsilon_{it}, \quad (6)$$

where L_{it} is the *Book Leverage* of firm *i* in year *t*, L_{it-1} is the *Book Leverage* at time *t*-1 which accounts for the adjustment process, IRA_{it} is a dummy which is 1 when the independent regulatory agency exists, *Government* UCR_{it} is a continuous variable which measures the ownership stake held by the state, the *Political Orientation Index* measures the left-to-right political stance of the government in charge, $\mathbf{X}_{it}$ is a vector of firm-specific controls, *Investor Protection*$_{it}$ is an index which measures the legal protection of shareholders' rights, and *GDP Growth* accounts for differences in macroeconomic conditions over time across the 14 different countries of origin of our sample firms, η_i and d_t are firm and time fixed effects and ε_{it} is an error term. The vector $\mathbf{X}_{it}$ of firm-specific controls includes various firm characteristics that were shown in the empirical corporate finance literature to be reliable determinants of capital structure.[20] The log of real total assets controls for firm's size (size is typically shown to have a positive effect of leverage), the ratio of fixed to total assets reflects asset tangibility, the ratio of EBIT (earning before interests and taxes) to total assets 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 is a proxy for non-debt tax shields (tax deductions for depreciations are substitutes for the tax benefits of debt financing).

In order to investigate whether the impact of independent regulation varies with the government's ownership stake and political orientation, we also estimate a specification where IRA is interacted with Government UCR and with Political orientation:

$$\begin{aligned} L_{it} &= \alpha_0 + \beta_1 L_{it-1} + \alpha_1 IRA_{it} + \alpha_2 Government\ \ UCR_{it} + \alpha_3 PolOrient_{it} + \\ &+ \alpha_4 Government\ \ UCR_{it} * IRA_{it} + \alpha_5 PolOrient_{it} * IRA_{it} + \\ &+ \alpha_6 \mathbf{X}_{it} + \alpha_7 Investor\ \ \text{Pr}otection_{it} + \alpha_8\ \text{GDP Growth}_{it} + \eta_i + d_t + \varepsilon_{it}, \end{aligned} \quad (6bis)$$

Similarly to the investment equation, the specifications with the interacted terms allow us to estimate the partial effect of the IRA on public utilities' investment rate conditional on changes in

[20] 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).

their ownership structure as well as on changes in the government's political orientation. Besides the direct average effect of the institutional variables, we therefore examine whether the impact of the IRA on leverage is different for publicly- or privately-controlled firms, and across pro-firm or pro-consumers governments, and we provide the graphical representation of all these effects.

6.2 Results

In Table 3 we present the one-step System-GMM estimates. The lagged values of the *Leverage* terms are significant in all Columns. In Column (1) the point estimate is .494 suggesting that a 10% increase in book leverage in year *t* is followed by a further increase of nearly 5% in year *t*+1. Our results show that the various firm characteristics that we control are significant and their signs are generally consistent with earlier empirical studies on the determinants of the capital structure. The only exception is the negative and significant coefficient on *fixed-to-total assets*, which is our proxy for tangibility. Earlier studies on non-regulated firms 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. The coefficient on the *Investor protection* index is negative though not significant at the conventional levels (the p-value is 13.1%), and suggests that leverage tends to be lower in countries where investors' rights are better protected and investors are therefore more inclined to buy equity shares.

If we look at the effect of independent regulation on leverage in Column (1) we find that the coefficient on *IRA* is positive and significant: the point estimate shows that the direct effect of IRA across all firms is a leverage increase of 4.2 percent on average. The coefficient on *Government UCR* is negative and also significant, suggesting that leverage decreases as the Government's stake in the regulated utility increases. *Political Orientation* is not significant. The lack of significance might be due to the fact that there may be opposite effects of political orientation that have to be disentangled in relation with the presence of an IRA.[21]

In Column (2) we estimate equation (6bis) to investigate whether the impact of independent regulation on the financing decisions of utilities differs across different ownership structures and with the Government's political orientation. We therefore interact the *IRA* dummy with *Government UCR* and, separately, with the *Political Orientation* index. The results show that the IRA has a

[21] Analogously to the investment equation, we also use the continuous *Regulatory Independence* index instead of the dichotomous *IRA* dummy. This variable turns out to be never significant and therefore we do not report the results (available on request).

positive coefficient that is highly significant, while the coefficient on *Government UCR* is still negative but is now insignificant. Finally, the coefficient α_4 of the interaction of IRA with *Government UCR* is negative and significant. This indicates that the effect of the IRA on leverage is different across private and state ownership and, more precisely, that the increase in leverage due to the IRA is smaller for utilities that are partially (or fully) owned by the state.

Turning to *Political Orientation*, we notice in Column (2) that the coefficient α_3 is significant and positively signed, suggesting that regulated firms tend to raise less (more) debt when the Government is leftwing (rightwing), hence presumably more "pro-consumer" ("pro-firm"). This result is consistent with the idea that regulated firms may be less inclined to use their capital structure strategically to influence the regulator if the political stance is ideologically in favour of low tariffs (pro-consumer) because they think it is less effective than it would be under a pro-firm political regime (see, for example, Biais and Perotti, 2005). In contrast, if the government is more pro-firm, then firms may think they have more room for manoeuvre to obtain higher tariffs, hence that the strategic use of leverage is worthwhile. The *IRA*Political Orientation* interaction tests whether the increase in leverage due to the presence of the IRA differs depending on the political orientation of the government. We find in Column (2) that α_5, the coefficient on the interaction, is negative and significant, suggesting that the leverage increase is less pronounced when the government is rightwing and pro-firm. (We already know that firms have higher leverage under a rightwing government because we include the *Political Orientation* index as a standalone control variable and this enters with a positive coefficient). The negative coefficient suggests that when the IRA is in place the effect of political orientation on regulated utilities' capital structure is weaker. It is as though the drive to increase debt if the government is pro-firm becomes less strong when the IRA is in place, thus suggesting that political interference is somewhat curbed by independent regulation. [22]

To further illustrate this finding we rely again on graphical evidence. For this purpose we further estimate separately the specification with *IRA* interacted with *Government UCR* (Column 3) and *IRA* interacted with *Political Orientation* (Column 4) from which we derive the partial effects reported in Figures (5)-(8).[23]

In Figure (5) we observe how the marginal effect of the IRA changes – i.e. decreases - as the ownership stake of the state increases. We can also gauge the effect of state ownership conditional

[22] We also estimated the same specifications using *Market leverage*, defined as the ratio between financial debt (short and long-term) and the sum of market value of equity and financial debt. As emphasized by Rajan and Zingales (1995) the literature is mixed about whether one should use book or market leverage We found very similar results which confirm that our findings are not influenced by the choice of the dependent variable. Results are available upon request.

[23] To check whether cross effects exist among IRA, political orientation and state ownership we also estimated a specification with the interaction *IRA*PolOrient*Government UCR*. We found that the interactive term was insignificant.

on the presence of the IRA by computing $\alpha_2 + \alpha_4 * IRA$. In column (1) we found that the direct average effect of state ownership is to decrease leverage. Figure (6) confirms that leverage drops when the IRA is set in place. In Figure (7), we depict the partial effect of IRA on leverage, conditional on changes in the political orientation of the government. In Figure (8), we graph the effect of political orientation conditional on the presence of the IRA and we observe that the increase in leverage due to the political interference reduces almost to zero when the IRA is in place. One can easily compute that when IRA=1, $\alpha_3 + \alpha_5 * IRA = 0.023 - 0.035 = -0.012$.

Our dynamic specification allows us to estimate the long run effect of the introduction of the IRA on the leverage. We exploit the multiplier effect captured by the lagged leverage variable: if we denote the coefficient of the lagged value of *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. At the bottom of the table we report the long run coefficients and their significance levels. We find that the introduction of an IRA leads to a long run increase in the leverage of 8.3 percentage points (Column 1). When we included the *Government UCR*IRA* interacted term to explore cross-ownership differences, we found that the introduction of an IRA induces, for utilities controlled by the state, not an increase but a decrease in the leverage. We can quantify the long run effect on the book leverage by multiplying the estimated long run coefficient ($\alpha_4/(1-\beta)$ in Column 2) with a hypothetical change in the government's ownership average stake (0.348 from table 1). If we consider a sale of a 20% of stake by the Government (so that the new state's share decreases to approximately 15%), this change would generate a long run increase in the book leverage of 4.4 percentage points (-0.22 * -0.20), quite a large increase. Since the average book leverage from table 1 is 0.272, this would imply an increase to 0.316. If we instead consider a full privatization of state's utilities, so that the government's stake decreases from 0.348 to 0, the long run increase would be of 7.7 percentage points.

7. Conclusions and Implications

Over the last 20 years, regulatory competencies have been delegated to independent regulatory authorities mainly to limit potential conflict of interest that surfaces when politicians directly or indirectly control firms which manage essential services for citizens. The establishment of IRAs has been typically seen as a way to improve the credibility of the regulatory commitments. It is expected therefore that this new institutional arrangement, in turn, does affect the utilities companies' financial and investment choices. Still, politicians can influence the regulatory decision according to their partisanship purposes and the government intervention could be more intense

especially when utilities are (totally or partially) controlled by the State. Regulatory Independence, the government's political orientation and the State's ownership are thus intertwined institutional features that might affect firm's real and financial decisions.

Notwithstanding the establishment of IRAs was a key institutional change in many countries, the empirical literature on the effect of regulatory independence on utilities' real and financial decisions, and of its interaction with ownership and partisanship is scant, especially when we consider the European scenario. In this paper we attempt to fill this gap.

Our results show that regulatory independence does matter for the financial as well as for the investment decisions of our sample of 92 regulated EU firms from 1994 to 2005.

When an Independent Regulatory Agency is place, or more independent is the regulator, investment increases. This result suggests that the creation of a new regulatory environment seems to have contributed to create an environment which somewhat reduces the differences between private and public performances. Public ownership does not display a significant impact, whereas political orientation is found to matter also for investment decisions, as firm investment is higher under more conservative (pro-firm) government. But this effect appears to revert when the IRA is in place and the higher is regulatory independence.

When an IRA exists, financial leverage also increases, consistent with theories predicting a strategic use of debt to influence regulators' tariff setting decisions. Political orientation also affects utilities' financial decisions, as firms appear to have lower leverage under left-wing governments, possibly because the strategic use of debt is ineffectual when the government is less pro-firm; however, when the IRA is in place, political interference seems to be curbed.

Overall, the empirical findings for the leverage and the investment equations point to a similar conclusion: when the IRA is set up, politics has a weaker impact on the financial and investment decisions. Our results support the disciplining effect of independence in disentangling regulatory intervention from political interference.

References

Abel, A.B. (1980), "Empirical Investment Equations: An Integrative Framework," in K. Brunner and A. Meltzer (Eds.), *On the State of Macroeconomics*, Carnegie-Rochester Conference series 12: 39-93.

Alesina A. and H. Rosenthal (1995), *Partisan Politics, Divided Government and the Economy.* Cambridge: Cambridge University Press.

Arellano M. and S. Bond (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, **58(2)**, 277-297.

Arellano M. and O. Bover (1995), "Another Look at the Instrumental-Variable Estimation of Error-Components Models," *Journal of Econometrics*, **68,** 29-51.

Armstrong, M. and D. Sappington (2007) "Recent Developments in the Theory of Regulation," in M. Armstrong and R. Porter (eds.), *Handbook of Industrial Organization (Vol. III)*, Elsevier Science Publishers: Amsterdam.

Bias B. and E. Perotti (2001), " Machiavellian Privatization", *American Economic Review*, **1**, 240-258.

Blundell R. and S. Bond (1998), "Initial Conditions and Moment Restrictions in Dynamic Panle Data Models," *Journal of Econometrics*, **87**, 115-143.

Bond S., Elston J., Mairesse J., Mulkay B. (2003), "Financial Factors and Investment in Belgium, France, Germany, and the U.K.: A Comparison Using Company Panel Data", *The Review of Economics and Statistics,* **85(1),** 153-165.

Bond S., Meghir C. (1994), "Dynamic Investment Models and the Firm's Financial Policy," *Review of Economic Studies*, **61(2)**, 197-222.

Bortolotti, B., Fantini, M., and Siniscalco, D. (2003). "Privatisation around the World: Evidence From Panel Data", *Journal of Public Economics*, **88(1–2)**, 305–332.

Bortolotti B., Cambini C., Rondi L. and Y. Spiegel (2010), "Capital Structure and Regulation: Do Ownership and Regulatory Independent Matter?", *Journal of Economics & Management Strategy*, forthcoming.

Bortolotti B. and P. Pinotti (2008), "Delayed privatization", *Public Choice,* 3, 331-351.

Bortolotti B. and M. Faccio (2009), "Government Control of Privatized Firms," *Review of Financial Studies*, **22(8)**, 2907-2939.

Bradley M., G. Jarrell, and H. Kim (1984), "On the Existence of an Optimal Capital Structure: Theory and Evidence," *Journal of Finance,* **39(3)**, 857-878.

Cambini C. and L. Rondi (2009), "Access Regulation, Financial Structure and Investment in Vertically Integrated Utilities: Evidence from EU Telecoms", *European University Institute Working Papers – RSCAS* n. 68/09.

Claessens S., S. Djankov, and L. Lang, (2000), "The Separation of Ownership and Control in East Asian Corporations," *Journal of Financial Economics*, **58**, 81-112.

Correia da Silva L., A. Estache and S. Jarvela (2006), "Is Debt Replacing Equity in Regulated Privatized Infrastructure in LDCs?," *Utilities Policy*, **14**, 90-102.

Cubbin J. and J. Stern (2005), "Regulatory Effectiveness and the Empirical Impact of Variations in Regulatory Governance: Electricity Industry Capacity and Efficiency in Developing Countries." *World Bank Policy Research*, Working Paper n. 3535, Washington D.C.

Department of Trade and Industry and HM Treasury (2004), *The Drivers and Public Policy Consequences of Increased Gearing*, October, London.

Egert B. (2009), "Infrastructure Investment in Network Industries: The Role of Incentive Regulation and Regulatory Independence", *CESifo Working paper* n. 2642, May.

Evans J., P. Levine and F. Trillas (2008), "Lobbies, Delegation and the Under-investment Problem in Regulation", *International Journal of Industrial Organization*, **26(1)**, 17-40.

Fama E. and K.R. French (2002), "Testing Trade-Off and Pecking Order Predictions about Dividends and Debt," *Review of Financial Studies*, **15**, 1-33.

Frank M. and V. Goyal (2007), "Capital Structure Decisions: Which Factors are Reliably Important," Mimeo.

Faccio, M., and L. H. P. Lang (2002), "The Ultimate Ownership of Western European Corporations," *Journal of Financial Economics*, **65**, 365-395

Gallagher, M., (1991), "Proportionality, Disproportionality and Electoral Systems," *Electoral Studies*, **10**, 33-51.

Gilardi F. (2002), "Policy Credibility and Delegation to Independent Regulatory Agencies: A Comparative Empirical Analysis," *Journal of European Public Policy*, **9(6)**, 873-893.

Gilardi F. (2005) The Formal independence of regulators: a comparison of 17 countries and 7 sectors, *Swiss Political Science Review*, **11(4),** 139-167.

Guerriero C. (2010), "The Political Economy of Incentive Regulation: Theory and Evidence from U.S. States", IEFE-Bocconi Working Paper, 31, Milan.

Gutièrrez L.H. (2003), "The Effect of Endogenous Regulation on Telecommunications Expansion and Efficiency in Latin America", *Journal of Regulatory Economics*, 23(3), 257-286

Henisz, W.J. and B.A. Zelner (2001), "The Institutional Environment for Telecommunications Investment", *Journal of Economics & Management Strategy*, **10(1)**, 123-147.

Hubbard R.G. (1998), “Capital-Market Imperfections and Investment”, *Journal of Economic Literature*, **36**, 193-225.

Huber, J., and R. Inglehart (1995), “Expert Interpretations of Party Space and Party Locations in 42 Societies,” *Party Politics*, **1**, 73-111.

Laffont J.J. (1996), “Industrial Policy and Politics”, *International Journal of Industrial Organization*, **14**, 1-27.

Laffont J.J. (2000), *Incentives and Political Economy*, Oxford University Press.

Laffont J.J. and J. Tirole (1991), "Privatization and Incentives", Journal of Law, Economics and Organization, **7**, 84-105.

La Porta R., F. Lopez-de-Silanes, and A. Shleifer (1999), “Corporate Ownership Around the World,” *Journal of Finance*, **54**, 471-518.

Levy B. and P. Spiller (1994), "The Institutional Foundations of Regulatory Commitment: A Comparative Analysis of Telecommunications Regulation," *Journal of Law, Economics, and Organization*, **10(2)**, 201-246.

Martimort D. (2006), "An Agency Perspective on the Costs and Benefits of Privatization," *Journal of Regulatory Economics*, **30(1)**, 5-44

Megginson W., and J. Netter (2001) “From State to Market: A Survey of Empirical Studies on Privatization,” *Journal of Economic Literature*, **39(2),** 321–89.

OECD (2002), *Regulatory Policies in OECD Countries. From Interventionism to Regulatory Governance*, Paris.

Ofgem (2008), *Responding to Financial Distress*, Position Paper no. 158/08, December, London.

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

Persson, T. (2002), “Do Political Institutions Shape Economic Policy?,” *Econometrica*, **70(3)**, 883-905.

Persson, T. and G. Tabellini (1999) “The Size and Scope of Government: Comparative Politics with Rational Politicians.” *European Economic Review*, **43**, 699-735.

Potrafke N. (2010), “Does Government Ideology Influence Deregulation of Product Markets? Empirical Evidence from OECD Countries”, *Public Choice*, forthcoming.

Rajan R. and L. Zingales (1995), “What Do We Know about Capital Structure? Some Evidence from International Data,” *The Journal of Finance*, **50(5)**, 1421-1460.

Roodman D. (2006), “How to Do xtanbond2: An Introduction to “Difference” and “System” GMM in Stata,” *The Center for Global Development*, WP n. 103.

Sappington, D.E.M. and J. Stiglitz (1987), "Privatization, Information and Incentives", *Journal of Policy Analysis and Management*, **6**, 567-582.

Schiantarelli F. (1996), "Financial Constraints and Investments: Methodological Issues and International Evidence", *Oxford Review of Economic Policy*, **12(2)**, 70-89.

Schiantarelli F. and D. Geourgoutsos (1990), "Monopolistic Competition and the Q Theory of Investment", *European Economic Review*, **34**, 1061-1078.

Shleifer A. (1998), "State versus Private Ownership", *Journal of Economic Perspectives*, **12(4)**, 133-150.

Shleifer A. and R. Vishny (1994), "Politicians and Firms", *Quarterly Journal of Economics*, **109(4)**, 995-1025.

Spiegel Y. (1994), "The Capital Structure and Investment of Regulated Firms," *Journal of Regulatory Economics*, **6**, 297-320.

Spiegel Y. and D. Spulber (1994), "The Capital Structure of a Regulated Firm," *RAND Journal of Economics*, **25(3)**, 424-440.

Taggart R. (1985), "Effects of Regulation on Utility Financing: Theory and Evidence," *Journal of Industrial Economics*, **33(3)**, 257-276.

Titman S. And R. Wessel (1988), "The Determinants of Capital Structure Choice," *Journal of Finance*, **43**, 1-19.

Wallsten S. (2001), "An Econometric Analysis of Telecom Competition, Privatization and Regulation in Africa and Latin America.", *Journal of Industrial Economics*, **49(1)**, 1-19.

Zelner B.A. and W.J. Henisz (2006), "Interest Groups, Veto Points, and Electricity Infrastructure Deployment", *International Organization*, **60(1)**, 263-286.

Table 1 - Summary statistics –

92 publicly listed European regulated firms, 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
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
Government's UCR	0.348	0.359	0	1	891
Investment Rate	0.111	0.072	0.000	0.674	703
Debt-to-Capital Stock	0.212	0.304	0.000	3.356	719
Sales-to-Capital Stock	0.775	0.779	0.023	5.500	720
Independence Regulatory Agency dummy	0.585	0.493	0	1	720
Index of Regulatory Independence	0.616	0.116	0.36	0.83	503
Political Orientation	5.662	1.481	3.665	8.025	720

Table 2.1 – GMM Estimates of the Investment Euler Equation with independent regulation, mixed ownership and political orientation

The dependent variable (I/K) is the investment rate measured as the ration between capital expenditures and capital stock at replacement value. CF/K is the ration between operational cash flow and the capital stock at replacement value. Y/K is the sales to capital stock (at replacement value) ratio while D/K is the financial debt to capital stock (at replacement value) ratio. *IRA* is a dummy equal to 1 if an independent regulatory agency (IRA) is in place and equal to 0 otherwise. *Government's UCR* measures the ultimate control rights held by the government. *Political orientation* measures the government's political stance. Dynamic panel-data estimation, one-step system GMM estimates. Lagged values of right-hand variables 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 both as regressors and as instruments. 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.. 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%.

I/K_t	(1)	(2)	(3)	(4)
$(I/K)_{t-1}$	0.930***	0.937***	0.885***	0.871***
	(0.128)	*(0.129)*	*(0.089)*	*(0.114)*
$(I/K)^2_{t-1}$	-1.164***	-1.183***	-1.095***	-1.088***
	(0.186)	*(0.189)*	*(0.132)*	*(0.170)*
$(CF/K)_{t-1}$	-0.033	-0.023	-0.032	0.010
	(0.039)	*(0.037)*	*(0.061)*	*(0.066)*
$(Y/K)_{t-1}$	0.002	0.002	0.000	0.000
	(0.006)	*(0.006)*	*(0.003)*	*(0.003)*
$(Debt/K)^2_{t-1}$	-	-	-0.002*	-0.004**
	-	-	*(0.001)*	*(0.002)*
IRA_{t-1} (α_1)	0.015**	0.083**	0.017***	0.117**
	(0.007)	*(0.040)*	*(0.006)*	*(0.049)*
Government UCR_{t-1} (α_2)	0.004	0.001	0.005	0.138
	(0.007)	*(0.011)*	*(0.008)*	*(0.012)*
Political $Orientation_{t-1}$ (α_3)	-0.000	0.008*	-0.002	0.009**
	(0.002)	*(0.005)*	*(0.003)*	*(0.005)*
Government UCR_{t-1}*IRA (α_4)	-	0.009	-	-0.008
	-	*(0.017)*	-	*(0.019)*
Political $Orientation_{t-1}$*IRA (α_5)	-	-0.013**	-	-0.018**
	-	*(0.007)*	-	*(0.008)*
Arellano-Bond test for AR(1) *(p-value)*	0.008	0.007	0.011	0.013
Arellano-Bond test for AR(2) *(p-value)*	0.715	0.849	0.963	0.758
Sargan-Hansen test *(p-value)*	0.344	0.399	0.354	0.720
P-value test on $\alpha_1 + \alpha_4 = 0$	-	0.02	-	0.02
P-value test on $\alpha_1 + \alpha_5 = 0$	-	0.03	-	0.01
P-value test on $\alpha_3 + \alpha_5 = 0$	-	0.12	-	0.04
N. Firms [N. Obs.]	85 [457]	85 [457]	85 [439]	85 [438]

Table 2.2 – GMM Estimates of the Investment Euler Equation with the degree of formal regulatory independence

The dependent variable (I/K) is the investment rate measured as the ration between capital expenditures and capital stock at replacement value. CF/K is the ration between operational cash flow and the capital stock at replacement value. Y/K is the sales to capital stock (at replacement value) ratio while D/K is the financial debt to capital stock (at replacement value) ratio. Government's UCR measures the ultimate control rights held by the government. *Reg Independence* is an index of formal regulatory independence (Gilardi, 2005). *Political orientation* measures the government's political stance. Dynamic panel-data estimation, one-step system GMM estimates. Lagged values of right-hand variables 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 both as regressors and as instruments. 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.. 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%...

I/K_t	**(1)**	**(2)**	**(3)**	**(4)**
$(I/K)_{t-1}$	0.816***	0.823***	0.952***	0.948***
	(0.134)	*(0.122)*	*(0.156)*	*(0.140)*
$(I/K)^2_{t-1}$	-1.063***	-1.054***	-1.247***	-1.242***
	(0.191)	*(0.176)*	*(0.232)*	(0.214)
$(CF/K)_{t-1}$	-0.076	-0.042	0.000	-0.014
	(0.071)	*(0.084)*	*(0.070)*	*(0.065)*
$(Y/K)_{t-1}$	-0.002	0.002	0.001	0.004
	(0.004)	*(0.003)*	*(0.003)*	*(0.003)*
$(Debt/K)^2_{t-1}$	-	-	-0.006***	-0.005***
	-	-	*(0.002)*	*(0.002)*
Reg Independence $_{t-1}$ (α_1)	0.166**	0.314**	0.113*	0.377**
	(0.082)	*(0.157)*	*(0.060)*	*(0.155)*
Government UCR $_{t-1}$ (α_2)	-0.003	-0.015	0.005	0.018
	(0.013)	*(0.070)*	*(0.009)*	*(0.075)*
Political Orientation $_{t-1}$ (α_3)	-0.003	0.028**	-0.002	0.034**
	(0.005)	*(0.014)*	*(0.003)*	*(0.013)*
Government UCR $_{t-1}$* Reg Independence (α_4)	-	0.041	-	-0.005
	-	*(0.117)*	-	*(0.128)*
Political Orientation $_{t-1}$* Reg Independence (α_5)	-	-0.051**	-	-0.060**
	-	*(0.026)*	-	*(0.024)*
Arellano-Bond test for AR(1) *(p-value)*	0.023	0.022	0.009	0.009
Arellano-Bond test for AR(2) *(p-value)*	0.930	0.966	0.955	0.997
Sargan-Hansen test *(p-value)*	0.584	0.293	0.759	0.981
P-value test on $\alpha_1 + \alpha_4 = 0$	-	0.06	-	0.02
P-value test on $\alpha_1 + \alpha_5 = 0$	-	0.05	-	0.02
P-value test on $\alpha_3 + \alpha_5 = 0$	-	0.07	-	0.02
N. Firms [N. Obs.]	60 [302]	60 [302]	60 [344]	60 [345]

Table 3 – GMM estimates of a Dynamic Leverage Equation with Independent Regulation Mixed Ownership, and Political Orientation

The dependent variable is Book Leverage; it is defined as the ratio between financial debt (short and long-term) and the sum of book equity and financial debt. IRA is a dummy equal to 1 if an independent regulatory agency (*IRA*) is in place and is equal to 0 otherwise. *Government's UCR* measures the ultimate control rights held by the government. *Political orientation* measures the government's political stance. *Investor protection* is the time-varying "antidirector rights" index by Pagano and Volpin (2005). Dynamic panel-data estimation, one-step system GMM estimates. Lagged values of right-hand variables 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. Year, sector and country dummies are included as instruments. 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.. 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%.

	(1)	**(2)**	**(3)**	**(4)**
$Leverage_{t-1}$ (β)	0.494***	0.506***	0.476***	0.494***
	(0.078)	*(0.077)*	*(0.080)*	*(0.078)*
Log of real total assets	0.014**	0.015***	0.014**	0.016***
	(0.005)	*(0.005)*	*(0.005)*	*(0.006)*
Fixed-to-Total Assets	-0.104*	-0.098*	-0.110*	-0.103*
	(0.061)	*(0.060)*	*(0.061)*	*(0.060)*
Non-debt Tax Shield	-0.928***	-0.909***	-1.061***	-1.016***
	(0.292)	*(0.283)*	*(0.328)*	*(0.310)*
EBIT-to-Total Assets	-0.301***	-0.294***	-0.304***	-0.297***
	(0.086)	*(0.084)*	*(0.087)*	*(0.085)*
GDP Growth	-0.004	-0.005	-0.005	-0.006
	(0.007)	*(0.006)*	*(0.007)*	*(0.007)*
Investor Protection	-0.028	-0.300*	-0.035*	-0.035**
	(0.019)	*(0.018)*	*(0.018)*	*(0.018)*
IRA (α_1)	0.042**	0.073***	0.249**	0.248***
	(0.019)	*(0.023)*	*(0.106)*	*(0.096)*
Government UCR (α_2)	-0.082**	-0.019**	-0.080**	-0.015
	(0.039)	*(0.049)*	*(0.039)*	*(0.049)*
Political Orientation (α_3)	0.001	0.003	0.023**	0.021**
	(0.005)	*(0.005)*	*(0.011)*	*(0.010)*
Government UCR *IRA (α_4)	-	-0.109	-	-0.112**
	-	*(0.049)*	-	*(0.049)*
Political Orientation*IRA (α_5)	-	-	-0.035**	-0.030*
	-	-	*(0.017)*	*(0.015)*
$\alpha_1/(1-\beta)$ *(p-value)*	0.083** (0.04)	-	-	-
$\alpha_4/(1-\beta)$ *(p-value)*	-	-0.22**(0.015)	-	-0.22*** (0.01)
$\alpha_5/(1-\beta)$ *(p-value)*	-	-	-0.066** (0.027)	-
$\alpha_1+\alpha_4$ *(p-value)*	-	0.346	0.017	0.007
$\alpha_1+\alpha_5$ *(p-value)*	-	-	0.173	0.335
$\alpha_3+\alpha_5$ *(p-value)*	-	-	-	0.004
$\alpha_2+\alpha_4$ *(p-value)*	-	0.003	-	-
Arellano-Bond test for AR(1) *(p-value)*	0.000	0.000	0.000	0.000
Arellano-Bond test for AR(2) *(p-value)*	0.169	0.163	0.168	0.162
Sargan-Hansen test *(p-value)*	0.261	0.240	0.406	0.280
N. Firms [N. Obs.]	92 [695]	92 [695]	92 [695]	92 [695]

FIGURE 1 - MARGINAL EFFECT OF IRA ON *IK* AS POLITICAL ORIENTATION SHIFTS FROM LEFT TO RIGHT

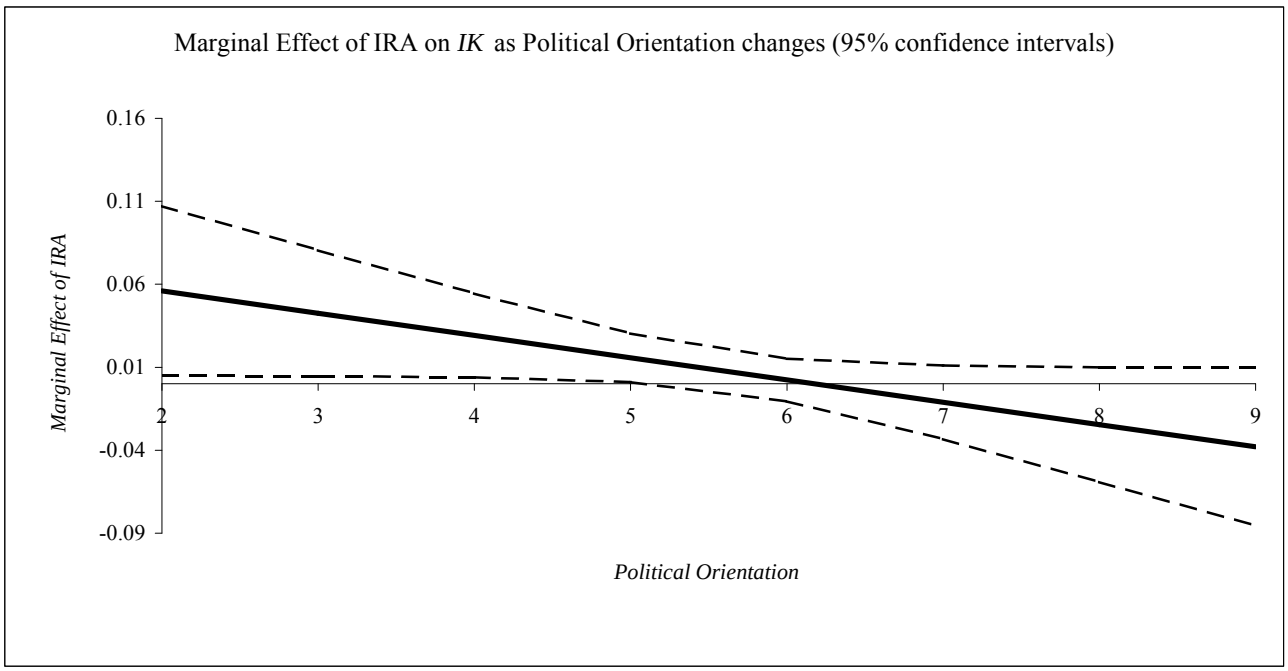


FIGURE 2 - MARGINAL EFFECT OF POLITICAL ORIENTATION ON *IK* AS THE IRA IS SET IN PLACE

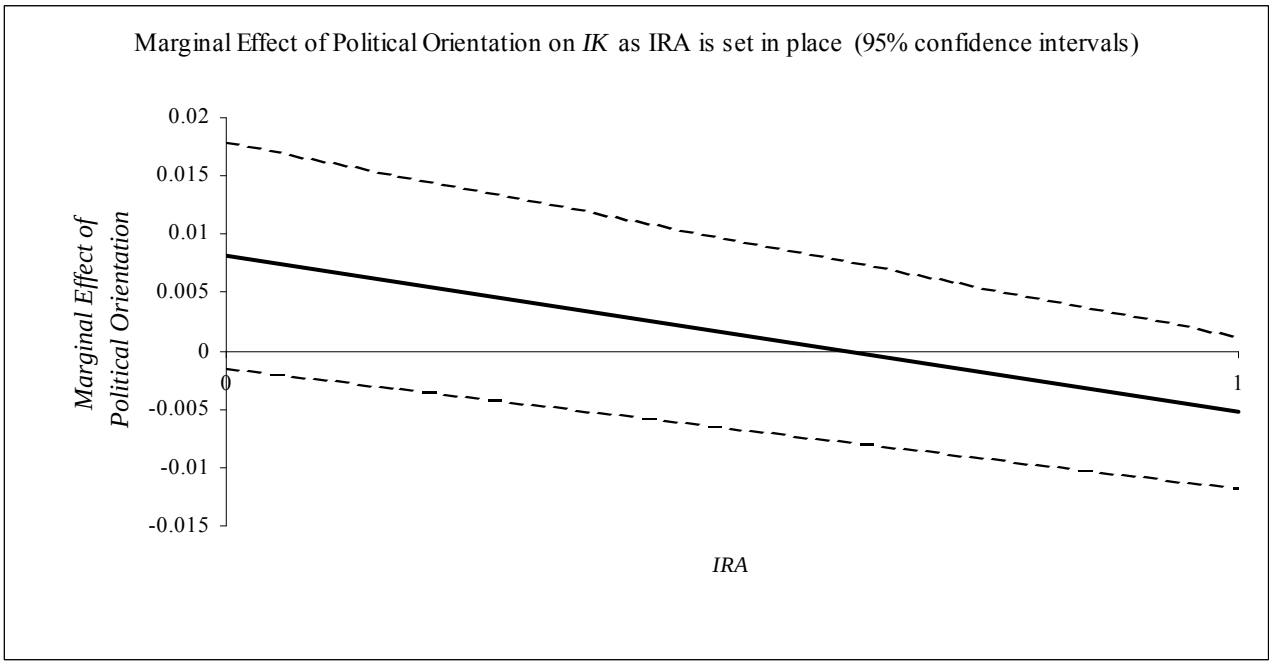


FIGURE 3 - MARGINAL EFFECT OF REGULATORY INDEPENDENCE ON *IK* AS POLITICAL ORIENTATION SHIFTS FROM LEFT TO RIGHT

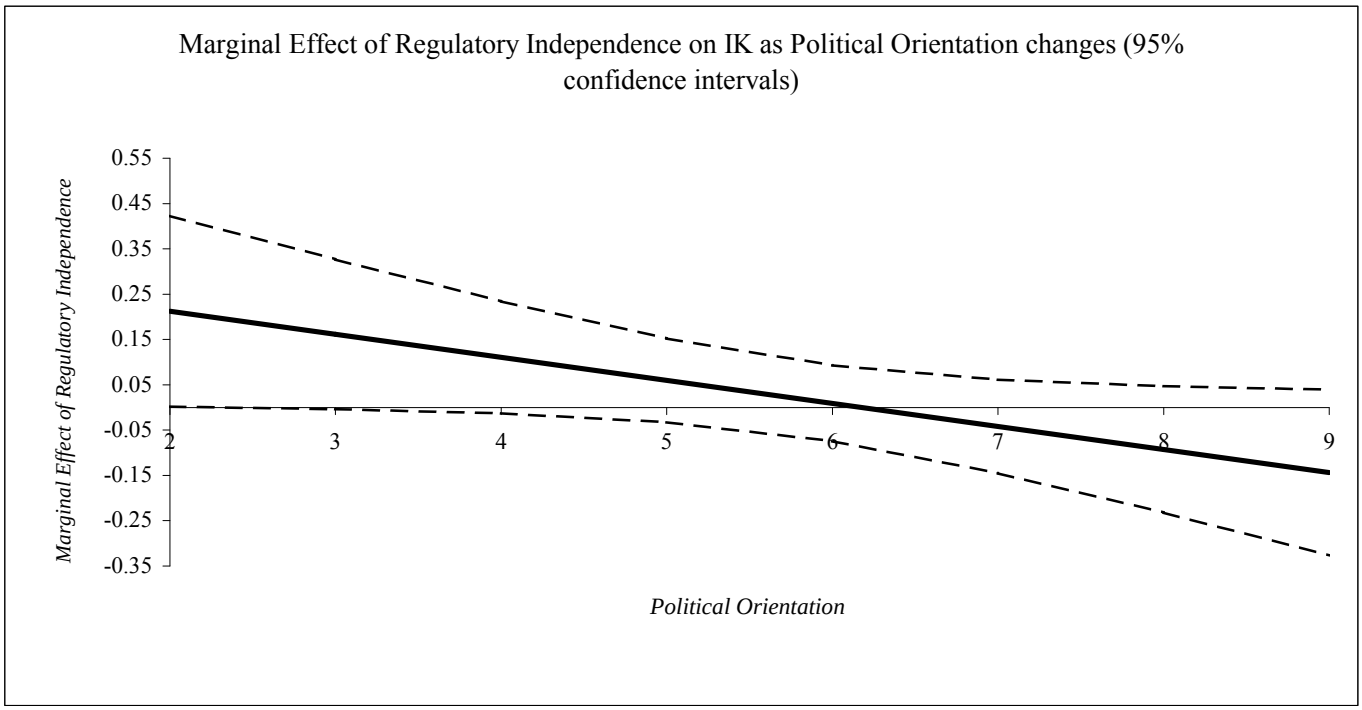


FIGURE 4 - MARGINAL EFFECT OF POLITICAL ORIENTATION ON *IK* AS REGULATORY INDEPENDENCE INCREASES

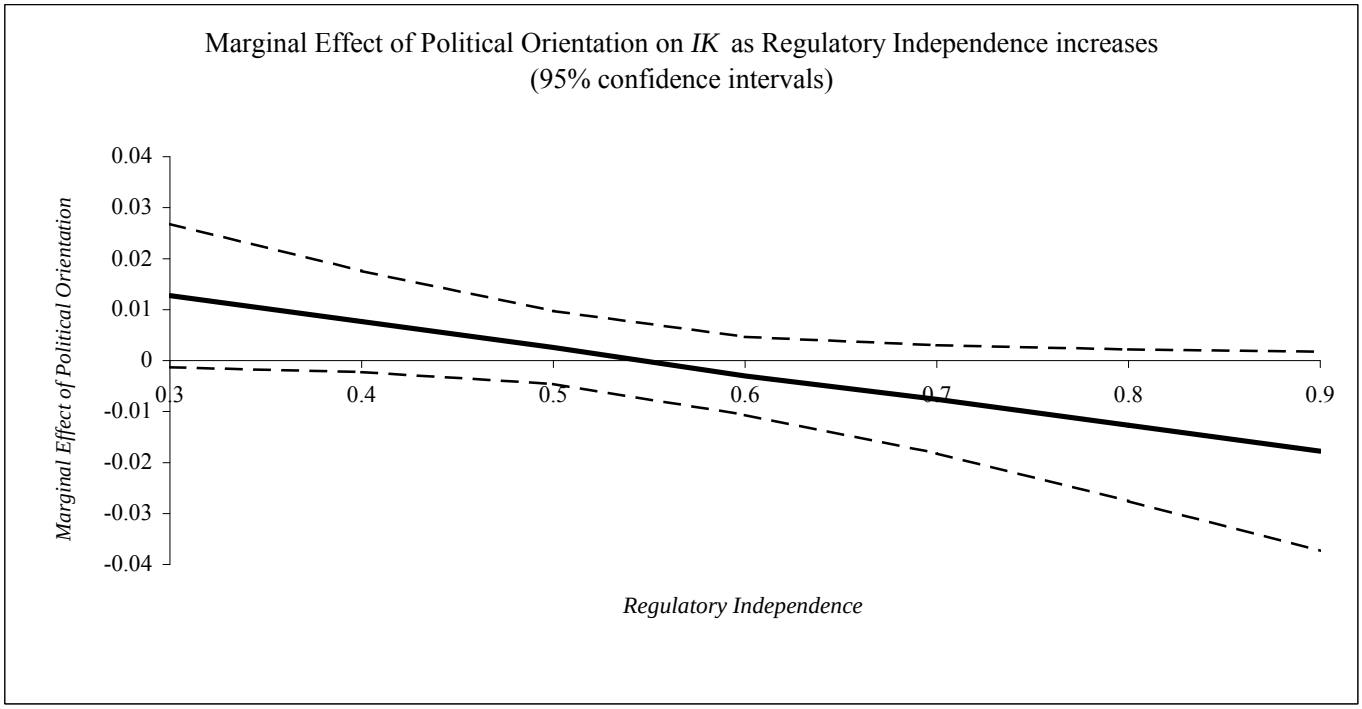


FIGURE 5 - MARGINAL EFFECT OF IRA ON *LEV* AS STATE OWNERSHIP INCREASES

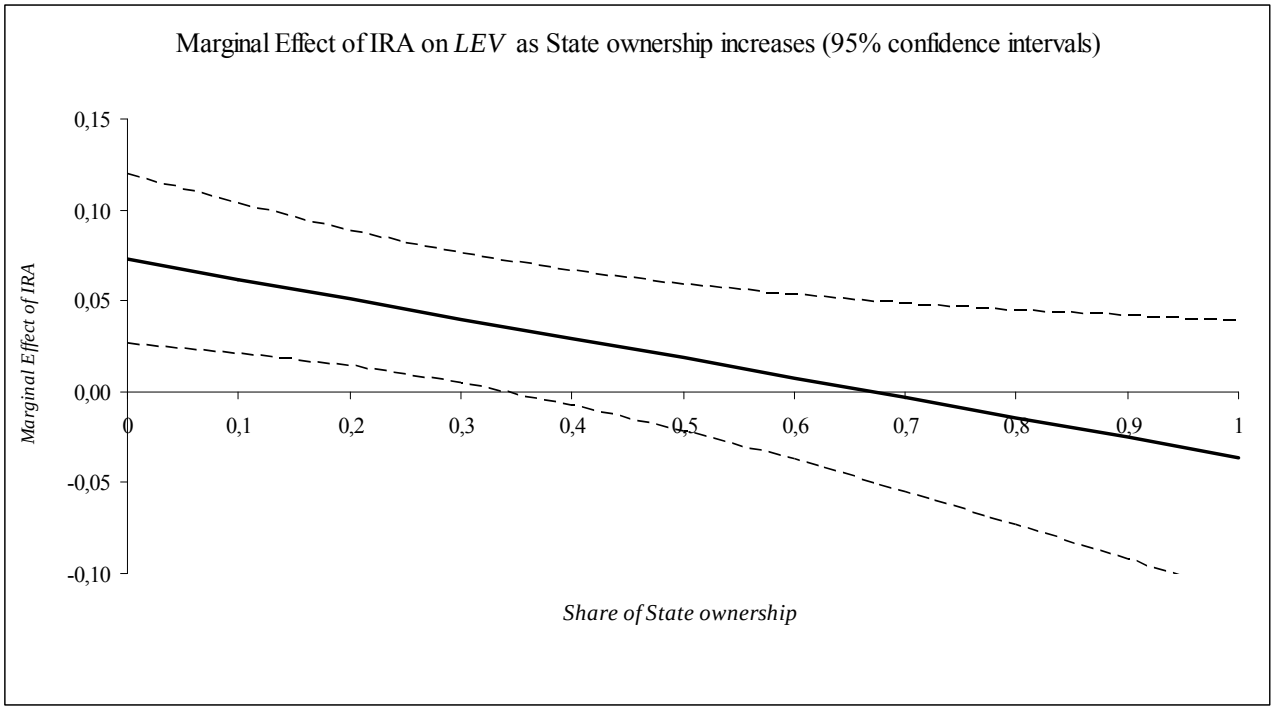


FIGURE 6 - MARGINAL EFFECT OF STATE OWNERSHIP ON LEV WHEN THE IRA IS IN PLACE

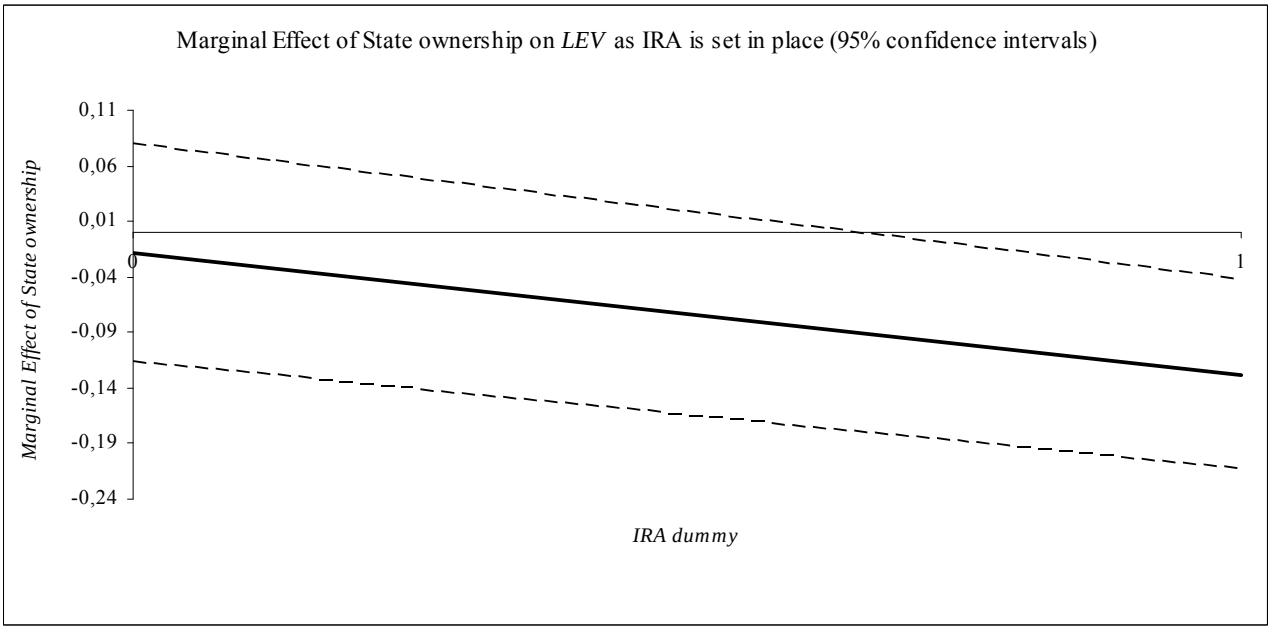


FIGURE 7 - MARGINAL EFFECT OF IRA ON *LEV* AS POLITICAL ORIENTATION SHIFTS FROM LEFT TO RIGHT

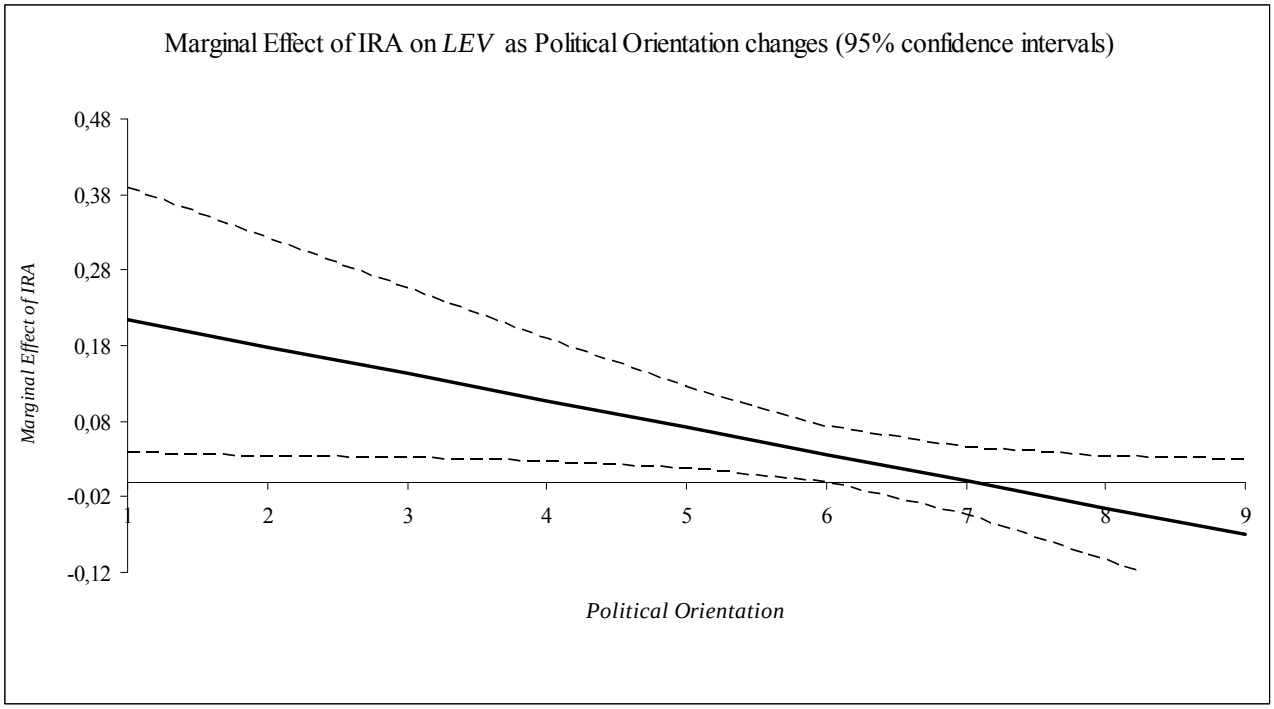
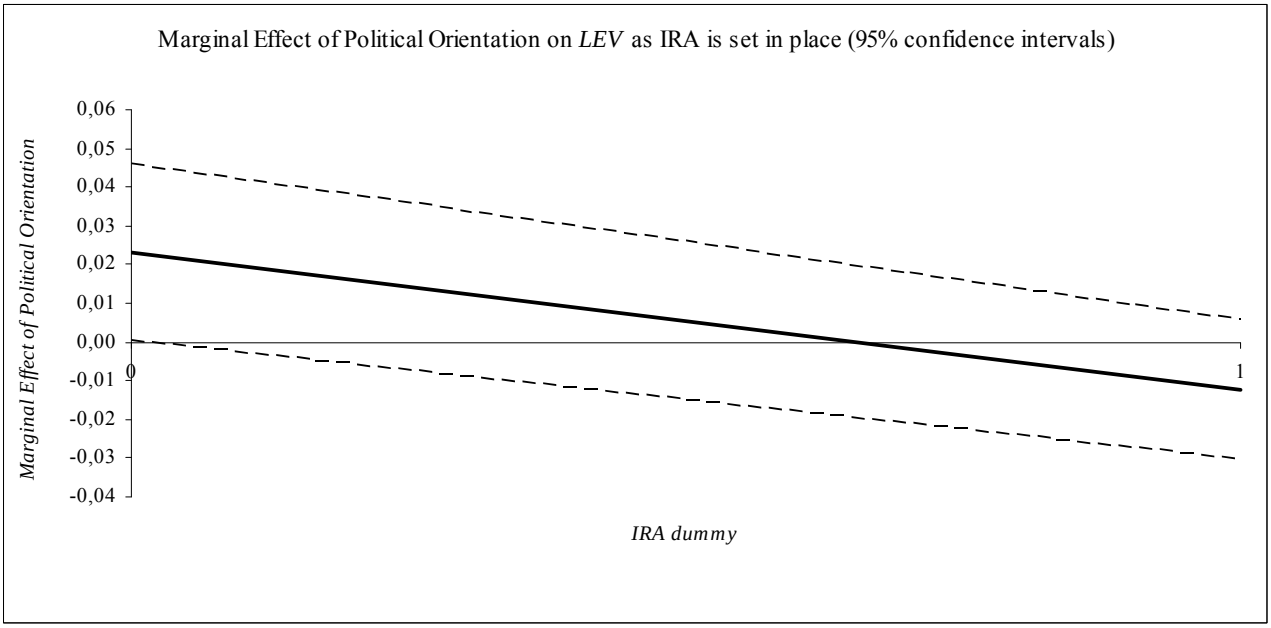


FIGURE 8 - MARGINAL EFFECT OF POLITICAL ORIENTATION ON *LEV* AS THE IRA IS SET IN PLACE



Appendix A1 – Variable definitions

Variable Definitions	
Investment Rate	Capital Expenditure/Capital Stock at replacement value
Book Leverage	(Short and long term financial debt)/(Book Equity+ST+LT financial debt)
Market Leverage	(Short and long term financial debt)/(Market Equity+ST+LT financial debt)
Total Assets (log)	Log of real total assets
Real sales (log)	Log of real sales
Tangibility	Net fixed assets/ Total Assets
EBIT-to-Asset	Earnings before interests and taxes/Total Assets
Non-Debt Tax Shield	(Depreciation and amortization)/Total Assets
Cash Flow to Capital Stock	Cash Flow/Capital Stock at replacement value
Debt to Capital Stock	(Short and long term financial debt)/Capital Stock at replacement value
Sales to Capital Stock	Sales/ Capital Stock at replacement value

Appendix 2 -The timing of regulation and privatization in the energy and telecommunications sectors in European countries (EU27)

		Electricity		Gas		Telecommunications		
Country	**Date of establishing an IRA**	**Privatization Year**	**Ownership at end 2007**	**Privatization Year**	**Ownership at end 2007**	**Date of establishing an IRA**	**Privatization Year**	**Ownership at end 2007**
Austria	2001		State 51%		State 31%	1997		State 30%
Belgium	2000					1991	1995	State 50%
Bulgaria	1999	-	State 100%	-	State 100%	2006	2004	Private
Czech Rep.	2001	-	State 66%	-	State 100%	2005	2005	Private
Cyprus	2003	-	State 100%	-	State 100%	2002	-	State 100%
Denmark	2000					2002		Private
Estonia	*	-	State 100%	-	State 100%	*	-	State 28%
Finland	2000	1998	State 54%			1987		State 60%
France	2000	2005	State 87%	2005	State 80%	1996		State 32%
Germany	1998**	-	-	-	-	1996	1996	State 58%
Greece	2000					1992	1996	State 38%
Hungary	1994	1995	Private	-	State 100%	2003	1993	Private^
Ireland	1999					1997		Private
Italy	1997		State 33%		State 31%	1997	1994	Private ^
Latvia	2001**	-	State 100%	1997	Private (State 3%)	2001**	1994	State 51%
Lithuania	1997	-	State 80%	-	State 100%	2004	1998	Private
Luxemburg	1997					1997	-	State 100%
Malta	2001	-	State 100%	-	State 100%	2001	1998	Private
Netherlands	1998					1997		Private (State 8%)
Poland	1997	1996	Private	-	State 100%	2006	2001	Private
Portugal	1996	1996	State 43%			2001	1995	Private (State 13%)

Romania	1998	-	State 100%	-	State 100%	2006	-	State 46%
Slovenia	2000	-	State 100%	-	State 100%	2001	-	State 49%
Slovakia Rep.	2001	-	State 100%	-	State 100%	2004	2006	State 74%
Spain	1998		Private		Private	1996		Private
Sweden	2008					1992	2000	State 60%
UK	1989		Private		Private	1984		Private

* Since 1998 regulation is carried on by a branch of the Estonian Competition Authority. No an IRA specifically dedicated to regulated utilities.
** IRA for both energy and telecoms together. In Germany a dedicated IRA for energy sectors is expected in 2009

^ With Golden Shares

Source: International European Regulation Network (www.iern.net) for energy markets and European Regulators Group (http://www.erg.eu.int/) for telecommunications

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(lxxxvi) *This paper was presented at the Conference on "Urban and Regional Economics" organised by the Centre for Economic Policy Research (CEPR) and FEEM, held in Milan on 12-13 October 2009.*

(lxxxvii) *This paper was presented at the Conference on "Economics of Culture, Institutions and Crime" organised by SUS.DIV, FEEM, University of Padua and CEPR, held in Milan on January 20-22 2010.*