Navarra Center for International Development

Working Paper nº 04/2010

Privatization under Regulatory Lobbying

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Navarra Center for International Development
WP-04/2010

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May 25, 2011

Abstract

This paper investigates the effect of the share allocation process on the efficiency of a regulated entity operating under imperfect information. A forward looking government privatizes a firm to foster its political agenda. The government pins down the initial ownership structure, i.e. dispersed or concentrated ownership, by choosing the allocation of shares among retail and institutional investors. In addition, it lays out the regulatory policy that will govern the firm following privatization. Under concentrated ownership, institutional investors decide to lobby the government for a favorable regulatory policy in exchange for a monetary transfer. We show that the initial ownership structure plays a key role in post privatization efficiency through its interaction with the endogenous regulatory policy. We characterize the conditions under which high ownership concentration leads to overinvestment with an associated loss of consumer welfare. We show that the generation of this inefficiency is robust to the specification of the information asymmetry as an adverse selection or moral hazard problem.

JEL: D78, D81, L33

1 Introduction

Public debt levels in the advanced economies have surged in recent years to levels not recorded since the end of World War II, surpassing the heights reached during the First World War and the Great Depression (Reinhart, 2011). To reduce debt rollover risks and rising interest expenditures some countries have drawn a plan to privatize public utilities within a macroeconomic stabilization program of policy measures. This has led to the revival of privatization in advanced economies. A case in point is Greece. To support efforts to overcome an acute debt crisis ahead of new talks with EU-International Monetary Fund (IMF), Greece plans to accelerate its privatization sales and raise €3.5-5.5 bn in proceeds in 2011 and €4-6 bn in 2012. Immediate sales of stakes in OTE Telekom, Postbank, the ports of Athens and Thessaloniki, and the Thessaloniki water company have been authorized by the Cabinet in May 2011. The Cabinet has also reiterated its fiscal consolidation commitment by endorsing €6 bn of additional spending cuts (2.8% GDP) to achieve the 7.5% deficit target for 2011. Over the past twenty years more than 1.25 trillion US dollars have been raised in privatization sales around the world (Megginson and Sutter, 2006).

The financial stakes of privatization as well as its impact on the cost and quality of goods and services delivered by privatized industries have generated an extensive theoretical and empirical literature.[1] Although most empirical studies consistently find favorable results regarding the effectiveness of privatization in competitive industries, the results seem to be less conclusive in the case of regulated utilities (EBRD, 2004). Notably, a key feature that characterizes the privatization of regulated utilities is that it is typically accompanied by reforms in the regulatory environment. Crucially, these reforms are likely to have an impact not only on the sale price of the privatized utility but also on its operational efficiency post-privatization. This paper examines the efficiency impact and the distributional implications of privatization taking into account the endogeneity of the regulatory policy that will govern the firm post privatization. That is, we take the view that potential regulatory flaws may put at risk the benefits of privatization. But how pervasive are regulatory imperfections across countries? The World Bank's figures[2] show that this is not an unimportant issue. They estimate that out of 200 new regulatory bodies that have emerged in the last 10 years in the infrastructure sector, only a few achieve the gold standard of an independent body.[3]

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[1]Some relevant theoretical papers include Laffont and Tirole (1991), Vickers and Yarrow (1991), Boycko and Shleifer (1998), and Besley and Ghatak (2001). Empirical evidence is provided in Lopez-de-Silanes et al (1997), Jones et al (1999), Megginson and Netter (2001), Haber (2005), and Boehmer et al (2005).

[2]The World Bank website http://rru.worldbank.org/Toolkits/InfrastructureRegulation/ offers a detailed overview of best practice regulatory systems in infrastructure.

[3]Rather than implementing a best-practice regulatory system from the onset, it is common practice among developing countries to subject regulatory systems to periodic reviews whereby the impact of regulation on sector outcomes is assessed against a regulatory benchmark.

Recent history is rich with instances of regulatory reforms associated with privatization which quickly proved to be significantly sub-efficient. The following three examples illustrate the interaction between regulatory policy and privatization that we have in mind. At the time of the privatization to the Greek company OTE in 1998, the Armenian public telecommunications monopoly ArmenTel was granted 15-year exclusivity rights in fixed line and 5 years in mobile telephony by the Armenian government (EBRD, 2004). Under such protection from competition, the use of mobile communications lagged largely behind other countries in the region, including Azerbaijan and Georgia, and the number of fixed-line subscriptions declined substantially in the years following privatization. In view of the dismay performance of the country's wireless network, the government tried to cancel the exclusivity rights from the terms of the licence in February 2004. This decision prompted ArmenTel and OTE to file a suit in the London Arbitration Court against the Armenian government which was ultimately dismissed in favor of a compromise settlement reached in November 2004. Under this deal, ArmenTel relinquished its monopoly on the mobile telephone market though retained its other exclusive rights.[4] Opening up competition in the mobile telephone industry forced ArmenTel to cut its cell phone tariffs by half by August 2005 (Eurasia Daily Monitor, 2005). This example suggests that in regulated markets, benefits from liberalization may span from increased competition rather than simply from a change in ownership.

In a somewhat different vein, Haber (2005) explains how the Mexican's government decision to maximize revenue from bank privatization in 1991 opened up a new set of problems related to its ability to regulate the privatized banks. By allowing regulatory forbearance and permissive accounting standards, the government increased the auction price at the expense of the regulators being hamstrung by the quality of information. The eventual outcome was the collapse and bailout of the banking system involving an implicit transfer from taxpayers to bank stockholders of 65 billion US dollars, or 15 percent of GDP, in 1999.

Finally, Vickers and Yarrow (1990) provide a classical example of the setting and resetting of price regulation following privatization. When British Telecom (BT) was privatized in 1984, the government adopted a price cap as the regulatory framework on tariff prices. This control mechanism dictated that the firm could implement any changes to prices provided that the average price on a specific basket of goods and services did not increase further than RPI (retail price index) minus X, with the level of X being set to secure a reasonable expected rate of return. Before the flotation of BT, there were considerable consultations between the government, consumers, competitors and producers, concerning the level of X as well as the remaining measures pertaining to the design of the price control. Finally, the regulatory package determined that X should equal 3 percent. In 1989, five years after privatization, the regulator reset the

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[4]In addition, the regulatory body fined ArmenTel with $400,000 for the abuse of its dominant position in the market.

rule by increasing the level of X from 3 percent to 4.5 percent[5]. The interaction between privatization and regulation has been documented in empirical studies on privatization. For instance, Wallsten (2002) finds that investors may be willing to pay a higher price for firms privatized in an environment in which an independent regulator has been established prior to privatization. Likewise, introducing competition and an independent regulator before privatization seems to lead to improved capital efficiency (Fink *et al.*, 2002; Zhang *et al.*, 2005). Despite the expected efficiency gains from establishing an independent regulatory body to boost incentives for capital outlays, there is considerable evidence of political clout in the transitional regulatory regime which prevails at the time of privatization.

This empirical evidence is hard to reconcile with the assumption of regulatory independence which is typically made in the theoretical literature on privatization. Under this assumption, the transfer of property rights from a self-interested government to efficient investors generates efficiency gains from privatization. However, the regulatory flaws documented by the empirical literature raises two main theoretical questions. First, if a self-interested government retains control rights to set regulation, why would its extent of political interference dwindle with privatization? Second, and more fundamentally, why would a self-interested government set up an efficient regulatory policy during the privatization stage while misallocating resources under public ownership?

We take the view that a self-interested government exerts political clout on both the privatization process and on the initial regulatory policy post privatization. Prospective investors, anticipating the government's leverage on the firm's regulatory policy, may lobby the government for a favorable regulatory policy ex-post. As a result, regulation is determined endogeneously with the firm's ownership structure. Given the complexity of the privatization process, we restrict attention to the firm's share allocation process, i.e. to the tranches allocated to retail and institutional investors.[6] Negotiations between IPO underwriters and institutional investors have been suggested by the financial press and the academic literature. Aggarwal et al (2002) document a positive relationship between institutional allocation of shares and day one IPO returns. They suggest that underwriters may favor allocate more shares to institutional investors in "hot" IPOs in exchange for a trading commission or for private information on IPO demand. In this

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[5]Although he did not detail the basis for his decision, the regulator pointed at the rate of return as a guiding principle among others including estimates on investment needs and borrowing constraints.

[6]The other key decisions of the privatization process are the *control transfer* decision and the *pricing* decision. The former refers to whether to sell the whole equity holdings at once or in successive sales, and if the latter case holds, which fraction to sell in each stage. For instance, the privatization of British Telecom in 1984 represented a major evolution in the privatization policy, not only by its size and its nature of natural monopoly, but also by selling a controlling stake at the initial offering instead of selling it in slices. The pricing decision includes the choice of the pricing mechanism, typically whether a tender offer, a book-building exercise or a fixed price, and if the latter holds, it establishes who should set the price, whether an underwriter or a privatization committee appointed by the government, as was the case of privatizations in the U.K. and France respectively.

paper, we argue that institutional investors are in a better position than retail investors to negotiate future regulatory policy with the government. As regulation impacts firm efficiency, it follows that the initial degree of ownership concentration bears a major impact on efficiency post privatization, and this despite of the future dynamics of firm's ownership.

By examining the role of political factors on regulation, this paper links the literature on the political economy of privatization with the theory of incentives in regulation. More specifically, the framework builds on Laffont (1996). A regulated utility is committed to implement a predetermined project. This assumption allows us to focus on productive efficiency, abstracting away from the allocative distortions which are inherent to natural monopolies. The firm's productive efficiency is defined as the cost to implement the project. Regulation takes the form of a transfer made by the government to the firm. To give incentives for cost reduction, the regulator could offer high rents to the manager following a low cost realization. Yet, rents are costly under distortionary taxation. Depending on how the manager's utility enters the preference function of the regulator relative to that of taxpayers, the regulatory policy will yield a different incentive scheme for cost reduction. Interestingly, the efficiency implications of this regulatory scheme are equivalent to those under an alternative regulatory scheme governing future tariff increases rather than cost subsidization. Under this alternative regulatory setting, the regulator would strike a balance between setting low tariff increases to benefit consumers and facilitating higher tariff increases to benefit investors thus increasing the revenue from privatization. In sum, any of these two instances of regulation suggests that the government may continue exerting political leverage on a privatized utility through a favorable regulatory policy ex-post in line with the policy of political pursuit assumed under public ownership.[7] The challenge is to understand what are the major implications of privatizing a regulated monopoly in terms of productive efficiency and consumer welfare.

We depart from Laffont (1996) in three main respects. First and most importantly, the government chooses the ownership structure of the privatized utility by either targeting atomistic investors, dispersed ownership, or by taping large investors in which case concentrated ownership ensues. Under concentrated ownership each investor, accounting for a significant fraction of the firm's cash flow rights, coordinates his actions with other investors to press the government for a favorable regulatory schedule. Second, the government is allowed to levy a different tax burden upon its electorate vis-a-vis the rest of the franchise. Third, we check the robustness of the results by changing the informational specification of the model. We replace the hidden information setting by a moral hazard characterization of the cost function. Whereas in the former case, the optimal regulatory policy is contingent on the state of nature reported by the manager,

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[7]Although this argument is somewhat recognized in the literature (Boycko, Shleifer and Vishny, 1996), it is minimized by imposing a contentious assumption that the political cost of foregone profits under state ownership is lower than the cost of subsidies under private ownership.

in the latter, regulation is a function of the publicly observed realization of the cost.

Our results suggest that under concentrated ownership the level of investment may be too high at the expense of consumer welfare proxied by consumer surplus net of taxation. This prediction allows us to shed some light into the political controversy unleashed in various countries with the privatization of natural monopolies. As pointed out by Estache (2003), the privatization of public utilities in Argentina, including telecommunications, electricity, gas, water, and sanitation services have been the target of intense public resentment prompted by the significant increase in the rates paid by consumers augmented by indirect taxes.

The remainder of the paper is organized as follows. Section 2 presents an overview of the related literature. The economic environment is presented in Section 3. Section 4 introduces the basic model of privatization, where a regulated utility is privatized by a self-interested government which targets the welfare of its constituency. Section 5 presents the main model where institutional investors lobby the government for a favorable regulatory policy ex-post. Section 6 presents the concluding remarks and suggests some policy implications.

2 Related Literature

The literature on privatization is considerable. The theoretical foundations of privatization stem mainly from the incomplete contracts literature. For ownership to influence firm efficiency there must be some type of market imperfection, and differences in the response to this imperfection under alternative ownership structures (Grossman and Hart, 1986), or regulatory schemes (Laffont and Tirole, 1993). The contract incompleteness in our paper lies in the inability of the government to set a regulatory schedule that maximizes total welfare under the prevalence of majority rule. Instead, it sets regulation to maximize its own interests. Within the framework of incomplete contracts, several papers have tried to explain the influence of ownership on the efficiency of a privatized firm. Schmidt (1996) describes privatization as a commitment device of the government to award some informational rents to the firm. In his model, the government wants to commit ex ante not to become informed about the state of the nature which has occurred. It designs a subsidy scheme contingent on the state announced, offering an inefficiently low production level if high costs are reported, in order to limit the informational rents accrued by the firm in the good state of the world. The key assumption in this model is that ownership of physical assets gives access to private information. This is a controversial assumption as the manager of a public firm could collude with its employees to protect their joint informational rent. In our paper by contrast, the flow of information between the firm's manager and the government is not contingent on the

firm's ownership structure[8].

There is also a wide theoretical literature on the political determinants of privatization. Much of this literature focuses on the pricing decision at the privatization stage. Perotti (1995) explains the systematic underpricing of SIP by alluding to a model of political economy where underpricing is used as a tool of credible privatization. A committed government is willing to accept lower sale proceeds to signal the lack of public interference following privatization. A populist government by contrast, is less willing to underprice because it anticipates that the economic benefits of privatization will not realize in the future due to continuing government interference[9].

More limited is the theoretical literature on the share allocation process of privatized utilities. The closest analysis to our paper is Trillas (2002), who examines how the extent to which regulators are lenient towards investors –by weighing favorably investors' profits when setting prices– affects the initial decision of the government on corporate ownership. The optimal ownership structure trades off managers' 'initiative incentives', which are larger under dispersed ownership, with big blockholders' 'control incentives', which increase with ownership concentration. A more lenient regime tilts the balance of incentives towards managers, leading to more dispersed structure in the optimum. If the government colludes with the manager during the privatization process, the resulting ownership structure is *too dispersed*. Conversely, if the government colludes with big investors, the observed ownership allocation is *too concentrated*. By contrast, our paper examines the reverse direction of causality since it endogenizes the regulatory policy as a function of the initial ownership structure.

A classical example of the share allocation process in major privatization programs in industrial countries is conducted by Suleiman and Waterbury (1990). On the one hand, the privatization of natural monopolies in Britain is regarded as an instance of popular capitalism whereby each investor holds a small stake in the rents accruing to the privatized firm. This policy gave rise to dispersed ownership[10]. On the other hand, in the main privatizations pursued in France, the government targeted a stable hard core of domestic institutional investors giving rise to concentrated ownership[11]. The remaining

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[8]Underlying this assumption is the belief that, in a regulated industry, the access to private information is determined by the transparency of the regulatory body rather than by the firm's ownership structure.

[9]Jones (1999) examines empirically the political objectives of privatization and largely supports the political thesis anticipated by Perotti. Underpricing, proxied by the mean level of excess returns at the first post-issue trading day, reaches 34 percent in a sample of 630 SPIs by 59 countries in 1977-97. Also over 90 percent of SIPs turn out to be oversubscribed. Finally, the returns of initial SIPs are found to be negatively related to the outstanding public deficit used as a measure of the extent of populist governance.

[10]The spreading of ownership was achieved by general underpricing and by the imposition of restrictions in the number of shares acquired per capita.

[11]The choice of the institutional investors, each accounting for 2-5 percent and in total accounting for at least 20 percent of equity, corresponded solely to the minister of finance.

allocation of ownership[12] ensured *de facto* control by the initial group of institutional investors. Moreover, institutional investors were guaranteed an allotment of shares in return for paying a premium and for accepting restrictions in selling their equity stakes over a period of five years.

A crucial issue is whether the initial ownership structure of a privatized utility may matter for future efficiency as any disturbance in the initial structure may in principle be corrected through efficient trading in the stock exchange. This question calls for an examination of shareholdings patterns across time. Boubakri et al. (2005) addresses this issue by analyzing the evolution of post-privatization ownership structures in a sample of 209 firms encompassing both emerging markets and industrialized countries. They show that much of the decrease in government ownership in 1980-2001 has been absorbed by local institutions followed by individuals and foreign investors. Over the three years following privatization, local institutions and foreign investors increased their stake at the expense of employees while individuals' holdings remained largely constant, thus reinforcing initial concentrated ownership structures.

The political factors driving privatization have been widely documented in the empirical literature. Lopez-de-Silanes et al (1997) analyze the privatization of local government services in the United States and show how state laws, by influencing the political benefits of in-house provision by counties, affect the likelihood of privatization. Jones (1999) find that the magnitude of underpricing of initial SIPs, proxied by the mean level of excess returns at the first post-issue trading day returns, is negatively related to the outstanding public deficit used as a measure of the degree of populist governance. McNary (2001) suggests that the negative effect of privatization in the telecommunication industry in over 200 countries between 1987 and 1998 is due to its politically driven motives aimed at raising revenue rather than at generating efficiency gains. Megginson et al. (2004) point at a preference for asset sales by right-wing governments with the ability to stay in office and carry out their declared programs. Tunç (2005) finds that the governing politicians' legislative strength and their security to remain in office plays a crucial role in the implementation of privatization. Boehmer *et al.* (2005) find that bank privatization is more likely the more accountable the government is to its citizens. Finally, there is a large empirical literature on privatization methods and firm performance. See Megginson and Sutter (2006) for a comprehensive survey of privatization in developing countries. Although most of the studies included in their survey suggest improvements in the operating and financial performance of divested firms, they fall short of addressing the distributional impact of privatization across consumers. Nor do they attempt to separate the effect of privatization from concomitant regulatory reforms which is the main focus of this paper.

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[12]The remaining allocation consisted of a ceiling of 20 percent over a dispersed group of foreign investors, a 10 percent of assigned to employees, and an atomistic dispersion of shares to small investors who in addition received incentives to buy and hold.

3   The Economic Environment

The basic structure of the model is based on Laffont (1996). The economy is composed of a population of mass 1 as well as of a firm in a situation of natural monopoly that is to implement an indivisible project. The population is divided into two types of consumers which differ with respect to the level of utility they enjoy from consuming the project to be implemented. A mass $\alpha \in (0,1)$ are type 1 consumers who enjoy utility S_1 from the project, while a mass $1 - \alpha$ are type 2 consumers and enjoy utility S_2. We assume $S_2 > S_1 > 0$ and that S_1 and S_2 are both sufficiently large that it is worth realizing the project from a social welfare's perspective. A government has been elected through majority rule. Without loss of generality, we assume $\alpha > 1/2$ which implies that the elected government has a constituency made of type 1 consumers.

Taxes are levied upon consumers to finance project implementation, i.e. the transfer to the regulated firm[13]. Taxation is distortionary: one unit of funds collected by the government has an associated deadweight loss of $\lambda > 0$ units. By contrast with Laffont (1996), we assume that the government can tax-discriminate between type 1 and type 2 consumers[14].

Denoting by t_1 and t_2 the tax burdens levied upon a type 1 and type 2 individual respectively, total utility V_i of a type i consumer is simply

$$V_i = S_i - (1 + \lambda)\, t_i$$

while the firm receives a transfer from the government

$$t = \alpha t_1 + (1 - \alpha)\, t_2$$

As $\alpha > 1/2$, the elected (non-benevolent) government is inclined to favor the welfare of type 1 consumers at the expense of type 2 consumers.

The firm is subject to regulation by the government irrespective of its ownership structure. The cost C of the project depends linearly on the realized state of nature $\beta \in \{\underline{\beta}, \overline{\beta}\}$, and on the effort $e \in \mathbb{R}^+$ exerted by the firm:

$$C = \beta - e$$

The good (i.e. low cost) state of nature $\underline{\beta}$ occurs with probability $v \in (0,1)$ and the bad state of nature $\overline{\beta}$ occurs with probability $1 - v$. Although the cost level is

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[13]A straightforward example of the regulatory intervention of the government is to grant funds to the firm; but the interpretation can be enlarged to take into account other alterations of the economic environment of the regulated firm: revision of price cap, change of competition policy. (Faure-Grimaud, 1997).

[14]There are several ways in which we can motivate this assumption. Consider for instance a world in which type 1 owns mainly labor whereas type 2 owns mainly capital. Discrimination can be induced by driving a wedge between the tax burden levied upon labor and the tax rate on capital.

public knowledge ex-post, the state of nature is privately observed by the firm and the choice of effort cannot be verified. Therefore, the government cannot conjecture whether a high cost realization is the result of a bad state of nature or of the firm's low level of effort. Firm effort e generates a disutility $\Psi(e)$ where Ψ is a strictly increasing and strictly convex function. As discussed above, the firm is compensated by a net monetary transfer t through regulation. The firm's utility U is therefore

$$U = t - C - \Psi(e)$$

A regulatory contract between the government and the firm is based on two jointly observable variables: the cost C and the transfer t. Therefore a contract specifies a transfer-cost pair for each type of firm, namely $\{\underline{t}, \underline{C}\}$ for type $\underline{\beta}$ and $\{\overline{t}, \overline{C}\}$ for type $\overline{\beta}$. We let $\underline{U}$ and $\overline{U}$ denote the utility of the firm when it selects the transfer-cost pair designed for its type. We normalize the value of the firm's outside option to zero, therefore individual rationality (IR) constraints for each type of firm are simply

$$\underline{U} \geq 0 \tag{1}$$
$$\overline{U} \geq 0 \tag{2}$$

and the incentive compatibility constraints can be written

$$\underline{U} \geq \overline{t} - \overline{C} - \Psi(\underline{\beta} - \overline{C}) \tag{3}$$
$$\overline{U} \geq \underline{t} - \underline{C} - \Psi(\overline{\beta} - \underline{C}) \tag{4}$$

The purpose of our analysis is to examine the effect of alternative ownership structures on the efficiency of the regulated firm under asymmetric information, assuming a self-interested government. As the firm is subject to regulation regardless of who owns it, a mere transfer of ownership to private investors will not compel the government to relinquish all control rights over the design of transfers made to the firm. Yet a change of ownership may influence the government's preferences towards regulation. Suppose that the government decides to privatize by selling shares to financial investors. As part of the privatization process, it has to decide upon the share allocation mechanism. In particular, it may favor a relatively more concentrated ownership structure by awarding preferential allocations to a core of large investors. These investors, being residual claimants to a significant fraction of the rents generated by the firm, would have incentives to overcome the free riding problem and to form a political lobby. This lobby might then offer a monetary contribution to the government in exchange for a favorable regulatory framework. Alternatively, if the government favors dispersed ownership, it would target a large pool of small shareholders (either type 1 or type 2 citizens). Under dispersed ownership, each investor accrues a negligible fraction of the firm's cash flows, which hinders incentives to overcome the temptation of free riding and to constitute a lobbying group.

4   A Simple Model of Privatization

As is well known, when the government dislikes leaving a rent to the firm, the optimal regulation mechanism induces truth-telling at the expense of awarding a positive informational rent to the firm when the good state of nature is reported (Laffont and Tirole, 1993, Chap. 1). In that case, the restrictions imposed by the incentive compatibility constraints dictate that the informational rent Φ depends on the level of effort $\overline{e}$ induced under the bad state of nature:

$$\Phi\left(\overline{e}\right) = \Psi\left(\overline{e}\right) - \Psi\left(\overline{e} - \Delta\beta\right)$$

where $\Delta\beta \equiv \overline{\beta} - \underline{\beta}$.[15] Given the convexity of the disutility of effort, the informational rent is strictly increasing in $\overline{e}$. The firm's ex ante utility from implementing the project is given by:

$$U = \left\{ \begin{array}{l} \underline{U} = \Phi\left(\overline{e}\right) \text{ with probability } v \\ \overline{U} = 0 \text{ with probability } 1 - v \end{array} \right.$$

If the bad state of nature is reported, the funds transferred by the government just cover the cost of the project pushing the net utility of the firm down to zero. Alternatively, if the firm reports a good state of nature, it receives a transfer in excess of the cost of production and its disutility of effort as a mechanism to induce truth telling.

4.1   Public Ownership

As a benchmark, we first study the contract offered to the firm under public ownership. Under public ownership, the government chooses a system of transfers that maximizes the welfare of its constituency, i.e. type 1 consumers, and these consumers are able to appropriate the firm's rent. When choosing the optimal system of transfers $(\underline{t}_1, \overline{t}_1, \underline{t}_2, \overline{t}_2)$, the government faces two sets of constraints: the firm's incentive compatibility and individual rationality constraints (1)-(4) described above, and each type of consumer's

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[15]Both the incentive compatibility constraint of the efficient type (3) and the individual rationality constraint of the inefficient type (2) bind in equilibrium. Therefore

$$\underline{U} = \overline{t} - \overline{C} - \Psi\left(\overline{e} - \triangle\beta\right)$$

and

$$\overline{U} = \overline{t} - \overline{C} - \Psi\left(\overline{e}\right) = 0$$

which implies

$$\underline{U} = \Phi\left(\overline{e}\right) = \Psi\left(\overline{e}\right) - \Psi\left(\overline{e} - \triangle\beta\right)$$

participation constraint. Indeed we assume that a consumer's net utility cannot be negative if he is to participate in the political system. Algebraically, this means

$$S_1 - (1 + \lambda)\underline{t}_1 \geq 0 \tag{5}$$

$$S_1 - (1 + \lambda)\overline{t}_1 \geq 0 \tag{6}$$

$$S_2 - (1 + \lambda)\underline{t}_2 \geq 0 \tag{7}$$

$$S_2 - (1 + \lambda)\overline{t}_2 \geq 0 \tag{8}$$

As type 2 consumers derive a higher utility from the project than type 1 consumers and the government is not directly concerned about their welfare, the participation constraint of type 1 consumers cannot be binding.[16] Since we are mostly interested in the firm's level of cost-reducing effort, we shall write the government's optimization problem in terms of effort levels $(\underline{e}, \overline{e})$ rather than in terms of costs $(\underline{C}, \overline{C})$ as follows:

$$Max_{(\underline{e},\overline{e},\underline{t}_1,\overline{t}_1,\underline{t}_2,\overline{t}_2)}\{\alpha S_1 - \alpha(1 + \lambda)\left[v\underline{t}_1 + (1 - v)\overline{t}_1\right] + v\underline{U} + (1 - v)\overline{U}\}$$

$$s.t$$

$$\begin{cases} (1)\text{-}(4) \\ \alpha\underline{t}_1 + (1 - \alpha)\underline{t}_2 = \underline{\beta} - \underline{e} + \Psi(\underline{e}) + \underline{U} \\ \alpha\overline{t}_1 + (1 - \alpha)\overline{t}_2 = \overline{\beta} - \overline{e} + \Psi(\overline{e}) + \overline{U} \\ (7)\text{-}(8) \end{cases}$$

From the government's objective function, one can see that it dislikes leaving rents to the firm. Therefore we have $\overline{U} = 0$ and $\underline{U} = \Phi(\overline{e})$. Also, the optimal level of taxes levied upon type 2 consumers is the same irrespective of the state of nature. The government expropriates all surplus enjoyed by type 2 consumers via discriminatory taxation:

$$\underline{t}_2 = \overline{t}_2 = \frac{S_2}{1 + \lambda}$$

In addition, the government sets the tax levied on type 1 consumers to cover the remaining amount of the transfer to the firm. Noting e^* the first-best level of effort, the optimal firm effort $(\underline{e}^P, \overline{e}^P)$ under public ownership is characterized in the following proposition:

Proposition 1 *Under public ownership, the optimal managerial effort $(\underline{e}^P, \overline{e}^P)$ satisfies*

$$\Psi'(\underline{e}^P) = 1 \Rightarrow \underline{e}^P = e^*$$

$$\Psi'(\overline{e}^P) = 1 - \frac{\lambda}{1 + \lambda}\frac{v}{1 - v}\Phi'(\overline{e}^P)$$

which implies

$$\overline{e}^P < e^*$$

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[16]Remember that we have assumed that S_1 and S_2 are always large enough that the project is always worth implementing.

Proof.   The results are straightforward from the first order conditions. The last inequality holds because the function Φ is strictly increasing. ∎

As in the classic treatment of optimal regulation under asymmetric information, the firm exerts an effort lower than first-best in the bad state of nature. This distortion arises to limit the informational rents accruing to the firm under the good state of nature. One can easily see that the optimal level of effort of the inefficient type $\overline{e}^P$ decreases with the probability of the good state of nature and with the level of taxation-induced distortions. More interestingly, the optimal transfer scheme offered by a self-interested government is the same as if the government were benevolent and aimed at maximizing total social welfare.[17]   The reason is twofold. First, because the government can tax discriminate, type 1 consumers are liable to the full residual burden of taxation which the government uses to finance the transfer (and therefore the rent) to the firm. Second, under public ownership, type 1 consumers can appropriate the rent accruing to the firm. As a consequence, the equilibrium efficiency of the firm does not depend on the size of the government's constituency.

4.2   Dispersed Private Ownership

We now consider the case where the firm has been transferred into private hands. Specifically, we suppose that ownership has been transferred to one of the two groups of consumers, a case we shall refer to as dispersed private ownership. If the type 1 consumers are the owners, the informational rent accrues to the government's constituency. As the value of this rent is then internalized by the government, the equilibrium regulatory policy is the same as under the case of public ownership analyzed above. We therefore have the following result:

Proposition 2 *Under type 1 dispersed private ownership, the equilibrium firm effort is the same as under public ownership.*

Alternatively, the firm can be transferred to the group of type 2 consumers. As the informational rent now accrues to these individuals, the government can levy higher taxes upon them, thus decreasing the tax burden on its constituency. To set regulation under these circumstances, the government solves the following maximization problem:

$$Max_{(\underline{e},\overline{e},\underline{t}_1,\overline{t}_1,\underline{t}_2,\overline{t}_2)} \left\{ \alpha S_1 - (1+\lambda)\,\alpha\left[v\underline{t}_1 + (1-v)\,\overline{t}_1\right] \right\}$$
$$s.t.$$

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[17]See Laffont and Tirole (1993, Chap. 1).

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$$\begin{cases} \underline{U} = \Phi\left(\overline{e}\right) \\ \alpha\underline{t}_1 + (1-\alpha)\underline{t}_2 = \underline{\beta} - \underline{e} + \Psi\left(\underline{e}\right) + \underline{U} \\ \alpha\overline{t}_1 + (1-\alpha)\overline{t}_2 = \overline{\beta} - \overline{e} + \Psi\left(\overline{e}\right) \\ (1-\alpha)[S_2 - (1+\lambda)\underline{t}_2] + \underline{U} \geq 0 \\ S_2 - (1+\lambda)\overline{t}_2 \geq 0 \end{cases}$$

where we have already incorporated that $\overline{U} = 0$. Since they enjoy the benefit of the informational rent under the good state of nature, type 2's are more heavily taxed in that state, i.e.

$$(\underline{t}_2, \overline{t}_2) = (\frac{S_2 + \dfrac{\Phi\left(\overline{e}\right)}{1-\alpha}}{1+\lambda}, \frac{S_2}{1+\lambda})$$

As before, having simplified the optimizations program's set of constraints, we easily obtain the following result:

Proposition 3 *Under type 2 dispersed private ownership, the optimal firm effort is the same as under public ownership.*

Proof.   The first order conditions again yield

$$\Psi'\left(\underline{e}\right) = 1 \Rightarrow \underline{e} = e^*$$

and

$$\Psi'\left(\overline{e}\right) = 1 - \frac{\lambda}{1+\lambda}\frac{v}{1-v}\Phi'\left(\overline{e}\right)$$

which implies

$$\overline{e} = \overline{e}^P$$

∎

Why is the regulatory outcome prevailing under dispersed private ownership identical to that under public ownership even when it is type 2 consumers who hold shares in the firm? This is a consequence of tax discrimination. The government tries to limit the extent of the informational rent left to the firm as this rent does not fall into the hands of its constituency. Yet, tax discrimination allows the government to recoup the full cost of this rent through higher taxation. Again, type 1 consumers are the marginal taxpayers. Therefore the government, despite being self-interested, offers again the same regulatory outcome to the firm as if it were maximizing total social welfare. The only difference lies in the distribution of taxes, since type 2 consumers are now responsible for the payment of a higher per-capita share of the total amount of the transfer. Plugging the equilibrium values into the welfare function of type 1 consumers, it is easy to see that its value is invariant to type 1/type 2 dispersed ownership. Therefore the government is indifferent between the two privatization schemes.

5   Privatization as a Lobbying Game

Next we consider the case in which firm ownership is transferred to a more concentrated group of investors. Specifically, we analyze the case where the firm is sold to a core of type 2 individuals. We assume that these investors are able to coordinate their actions to constitute a lobby. This lobby offers a monetary contribution to the government contingent on the regulatory policy set at the privatization stage, before the state of the world is realized.[18]

We denote by $L(\mathbf{R}, P)$ the expected utility of the lobby, where $\mathbf{R} \equiv (\underline{R}, \overline{R}) \equiv ((\underline{e}, \underline{t}_1, \underline{t}_2), (\overline{e}, \overline{t}_1, \overline{t}_2))$ is the policy vector chosen by the government and P denotes the contingent contribution offered to the government. Likewise, we denote by $G(\mathbf{R}, P)$ the expected utility of the government. Both utility functions have a quasi-linear form:

$$L(\mathbf{R}, P) = \nu V_L(\underline{R}) + (1 - \upsilon)V_L(\overline{R}) - P$$

where V_L is the lobby's utility net of the contribution to the government and,

$$G(\mathbf{R}, P) = a[\upsilon W(\underline{R}) + (1 - \upsilon)W(\overline{R})] + P$$

where $a > 0$ is the weight attached to the welfare of the government's constituency W relative to the monetary contribution received from the lobby. One can think of the value of a as a function of the nature and size of the winning majority. For instance, in a model in which the ideological preferences of citizens would be determined partly by nature and partly by political parties' activism, more weight on political activism would be reflected in a lower a. A low value of a could also be interpreted as the incumbent government having enjoyed a narrow majority in the latest election. In this case, the government would find it more useful to receive a monetary contribution from the lobby to facilitate the financing of future electoral campaigns and try to swing the votes of undecided citizens. Conversely, if the government relied on a winning majority of faithful voters or enjoyed a comfortable majority, the value of a would be driven higher.

In the spirit of Bernheim and Whinston (1986), we model the lobbying game as a two-stage game. In the first stage, the lobby offers a contingent contribution schedule, anticipating the response of the government's policy decision. In the second stage, the government chooses a policy vector optimally, given the contribution schedule offered by the lobby[19]. Without loss of generality, we shall restrict attention to a contribution schedule whereby the lobby offers a contribution $\widehat{P}$ for its preferred policy vector $\widehat{R}$ and

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[18]The analysis of a game with several lobbies is outside of the scope of the paper.

[19]An alternative modeling option would be to assume that the regulatory policy is determined through bargaining between the government and the lobby. Results would be qualitatively similar.

zero for all other effort levels.[20] The pair $\left(\widehat{P}, \widehat{R}\right)$ is the solution to

$$Max_{\mathbf{R},P} \, L\left(\mathbf{R}, P\right)$$

$$s.t.$$
$$\begin{cases} G\left(\mathbf{R}, P\right) \geq \max_{\mathbf{R}_0} G\left(\mathbf{R}_0, 0\right) \\ \quad \mathbf{R}, \mathbf{R}_0 \text{ satisfy } (1)\text{-}(8) \end{cases}$$

This implies that the chosen policy vector $\widehat{R}$ satisfies

$$\widehat{R} = \arg\max_{\mathbf{R}} aW\left(\mathbf{R}\right) + V\left(\mathbf{R}\right)$$
$$s.t. \qquad \mathbf{R} \text{ satisfy } (1)\text{-}(8)$$

Thus, it is as if the objective function of the government became a weighted sum of the welfare of type 1 citizens and the fraction of type 2 investors that form the lobby. As a result of the government now caring for the welfare of some type 2 consumers, it is not obvious which of type 1 or type 2 consumers participation constraint binds in equilibrium. Denoting $\delta \in (0,1)$ the fraction of type 2 consumers that constitute the lobby group, the government's optimization problem is:

$$Max_{\mathbf{R}} a\alpha \left\{ S_1 - (1+\lambda)\left[v\underline{t}_1 + (1-v)\overline{t}_1\right] \right\}$$
$$+ (1-\alpha)\,\delta\{S_2 - (1+\lambda)\left[v\underline{t}_2 + (1-v)\overline{t}_2\right]\} + v\underline{U} + (1-\nu)\overline{U}$$

$$s.t. \begin{cases} \underline{U} \geq \Phi\left(\overline{e}\right) + \overline{U} \\ \overline{U} \geq 0 \\ \alpha\underline{t}_1 + (1-\alpha)\underline{t}_2 = \underline{\beta} - \underline{e} + \Psi\left(\underline{e}\right) + \underline{U} \\ \alpha\overline{t}_1 + (1-\alpha)\overline{t}_2 = \overline{\beta} - \overline{e} + \Psi\left(\overline{e}\right) + \overline{U} \\ \qquad\qquad (5)\text{-}(8) \end{cases}$$

This formulation implicitly assumes that the government cannot discriminate between investors and the remaining type 2 citizens.[21] As a result, type 2 consumers' participation constraint may be binding for those that do not hold shares in the privatized firm but be slack for investors.

Depending on the model's parameter values we can distinguish two main cases that are analyzed below.

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[20]If there were several lobbies, as in Dixit, Helpman and Grossman (1997), the equilibrium vector of actions would depend on the selection of individual contribution schedules. There would therefore be multiple equilibrium vectors of actions, and the concept of Truthful Nash Equilibrium as proposed by Bernheim and Whinston (1986) could be applied to select among equilibria. With only one lobby, there exist multiple equilibrium contribution schedules, but only one possible equilibrium policy vector.

[21]This assumption can be motivated by institutional constraints or by the existence of asymmetric information on the identity of the investors.

5.1 High Ownership Concentration

This case arises when

$$\delta < a$$

In this scenario, the government is more biased towards the welfare of its electorate than towards that of investors despite their negotiating power through the lobbying game. Therefore, the participation constraint of type 2 consumers is binding while that of type 1s' is not. Still, the government benefits indirectly from the informational rents awarded to the private investors through the monetary contribution received from the lobby. We need to distinguish two subcases

5.1.1 Weak political activism

This is the case where

$$a(1 + \lambda) > 1$$

In that case the government dislikes leaving rents to the firm since leaving rents hurt the welfare of its constituency. Therefore $\overline{U} = 0$. The first order conditions of the government's maximization problem are

$$\Psi'\left(\underline{e}^H\right) = 1 \Rightarrow \underline{e}^H = e^*$$
$$\Psi'\left(\overline{e}^H\right) = 1 - \frac{v}{1-v}\left[1 - \frac{1}{a(1+\lambda)}\right]\Phi'\left(\overline{e}^H\right) \Rightarrow \overline{e}^H > \overline{e}^P$$

Again the first-best effort is induced in the good state of nature. In the bad state of nature, the policy induces higher effort than under public ownership or dispersed private ownership (which corresponds to the limiting case $a \longrightarrow 1$). This is because although the government dislikes leaving rents to investors as these are financed at the margin by its electoral constituency, it places more weight on contributions received from the lobby than to its constituency's welfare. Therefore the arbitrage between efficiency and low rents shifts towards greater efficiency. The chosen regulatory policy is independent of δ as long as δ is small enough that the government can continue to ignore type 2 consumers' welfare.

5.1.2 Strong political activism

This is the case where

$$a(1 + \lambda) < 1$$

In that case, the government cares little about its constituency relative to the monetary contribution and therefore its net benefit from leaving high rents to the firm is positive,

as high rents translate into high lobby contributions. The participation constraints of both types of consumers binds while the firm's two individual rationality constraints are slack. This means

$$
\begin{aligned}
\underline{t}_1 &= \overline{t}_1 = \frac{S_1}{1+\lambda} \\
\underline{t}_2 &= \overline{t}_2 = \frac{S_2}{1+\lambda}
\end{aligned}
$$

The first order conditions are then[22]

$$
\begin{aligned}
\Psi'\left(\underline{e}^H\right) &= 1 \Rightarrow \underline{e}^H = e^* \\
\Psi'\left(\overline{e}^H\right) &= 1 \Rightarrow \overline{e}^H = e^*
\end{aligned}
$$

Therefore when the government cares sufficiently little about its constituency's welfare relative to the lobby's contribution, first-best effort is restored, as the expense of higher taxation of consumers. Consumer welfare and social welfare are clearly worse-off than under public ownership or dispersed ownership. This result holds regardless of δ as long as δ remains sufficiently small.

5.2 Moderate to Low Ownership Concentration

The case of moderate ownership concentration arises when

$$
\delta > a
$$

In that case the government cares more about the welfare of investors than about the welfare of its own electorate. This implies that the participation constraint of type of type 1 consumers is binding. The government limits the burden imposed on investors and therefore on type 2 consumers via taxation in order to obtain a higher contribution from the lobby. When choosing the optimal regulatory scheme the government now faces the following trade-off. On the one hand, higher informational rents increase the surplus of the lobby and hence the contribution that is willing to offer. On the other hand, higher rents lead to higher taxation that decreases the net surplus of the lobby and hence the amount of its contribution. Again we need to distinguish between two cases.

5.2.1 Low concentration

This is the case where

$$
\delta(1+\lambda) > 1
$$

---

[22]One can easily see that the incentive compatibility constraint $\underline{U} \geq \overline{U} + \Phi(\overline{e})$ is satisfied since $\underline{U} - \overline{U} = \Delta\beta$ while $\Phi(\overline{e}) = \psi(e^*) - \psi(e^* - \Delta\beta) < \psi'(e^*)\Delta\beta = \Delta\beta$ (since ψ is strictly convex).

In equilibrium, the efficiency of the firm is defined implicitly by:

$$\Psi'\left(\underline{e}^L\right) = 1 \Rightarrow \underline{e}^L = e^*$$

$$\Psi'\left(\overline{e}^L\right) = 1 - \frac{v}{1-v}\left[1 - \frac{1}{\delta\left(1+\lambda\right)}\right]\Phi'\left(\overline{e}^L\right)$$

Since $a < \delta < 1$, it is easy to see that

$$\overline{e}^P < \overline{e}^L(\delta) < \overline{e}^H$$

which means that the efficiency of the firm is lower under low ownership concentration than under high concentration of ownership. Indeed the relatively more numerous investors are marginal taxpayers and this decreases the amount of rent which the government wants to leave the firm with.

5.2.2   Moderate concentration

This is the case where

$$\delta(1+\lambda) < 1$$

In that case, the government cares less about investors as consumers than about the lobby's monetary contribution and therefore its net benefit from leaving high rents to the firm is positive, as high rents translate into high lobby contributions. The participation constraints of both types of consumers binds while the firm's two individual rationality constraints are slack. This means

$$\underline{t}_1 = \overline{t}_1 = \frac{S_1}{1+\lambda}$$

$$\underline{t}_2 = \overline{t}_2 = \frac{S_2}{1+\lambda}$$

The first order conditions are then

$$\Psi'\left(\underline{e}^M\right) = 1 \Rightarrow \underline{e}^M = e^*$$

$$\Psi'\left(\overline{e}^M\right) = 1 \Rightarrow \overline{e}^M = e^*$$

Therefore when the government cares sufficiently about the lobby's contribution, first-best effort is restored, as the expense of higher taxation of consumers. Consumer welfare and social welfare are clearly worse-off than under public ownership or dispersed ownership. This result holds regardless of δ as long as δ remains sufficiently small.

In sum, when monetary contributions are highly valued by the government, i.e. $a \in [0,1]$, the efficiency of a natural monopoly is greater under highly concentrated

ownership. The intuition follows from the double role played by investors as taxpayers and shareholders. When they account for a small fraction of the total population, they internalize partially the cost of higher taxation levied upon type 2 consumers. However, they enjoy all the informational rents awarded to the firm. As informational rents increase with efficiency, so does too the net payoff of the lobby. Given the characterization of the equilibrium contribution as a truthful schedule, this marginal increase in the lobby's net payoff will lead to an increase in the contribution offered to the government, which by assumption is more valuable to the government than the welfare of type 1 consumers. However, when investors account for a bigger fraction of type 2 consumers, the increase in the cost of taxation from higher efficiency becomes more important in the payoff function of the lobby. Therefore, they will be willing to rise their optimal contribution for a regulatory schedule leading to relatively lower efficiency, though still greater than under dispersed ownership.

6 Concluding Remarks

There is broad agreement that the government must design the share allocation process and the regulatory regime of a privatized utility before privatization can move to the sale phase in order to increase transparency. This paper suggests that the regulatory policy may be endogenous to the share allocation process. This paper shows that the policy trade-off between obtaining a higher sales price today at the expense of higher taxation in the future is dictated by the political game of privatization. Failure to design an adequate regulatory regime may jeopardize the gains from privatization as documented by the EBRD (2004) for south-eastern Europe and CIS. Likewise, it is widely accepted that weaknesses in the underlying governance of financial regulation were at the heart of the collapse of the global financial system (Levine, 2010).

We conjecture that institutional investors may have incentives to lobby politically motivated authorities in favor of the preferred regulatory policy. The quid-pro-quo for such favorable regulation is a higher market valuation at the auction stage that policy makers may use to offset pressing fiscal pressures or to finance future elections. Regulation affects investment and efficiency due to the existence of information imperfections on the cost of investment. This is supported by the EBRD's survey of regulators that highlights the enormous challenges faced by regulators to devise a tariff system that promotes efficiency and encourages investment. Likewise, uncertainty of the economic impact of the new regulatory standards on investment under the Basel III reform has unfolded a vivid discussion. As in the classic model of Laffont and Tirole (1993), we model asymmetric information between the government and the privatized utility as a combination of hidden information held by the firm on the cost of production (adverse selection) and of private information on the firm's effort to reduce the cost of production (moral hazard). To foster investment, the regulator has to provide incentives in the form of informational rents that are costly in terms of taxation.

We show two main results. First, the operational efficiency of a regulated firm is greater under concentrated ownership provided monetary transfers are sufficiently valued by the government. Yet if they are too valuable, regulation may lead to firm's *overinvestment*, prompting a socially inefficient level of taxation to finance transfers, and reducing overall welfare. Second, the same level of operational efficiency emerges under public ownership and dispersed private ownership as long as the government is allowed to discriminate in taxation across consumers.

The paper has focused on the privatization of a firm in the utilities sector characterized by a natural monopoly. Efficient regulation forces the monopolist to reduce prices so that marginal cost intersects market demand, causing output to increase and prices to fall but causing the monopolist to incur a lost. This requires a government subsidy to keep the firm in business. Crucially, the form of the subsidy depends on the economic sector that is regulated. In the public utility sector the subsidy is characterized by cost plus regulation or revenue cap regulation. In the financial sector the subsidy takes the form of deposit insurance or bail-out of systemically important institutions.

Finally, we could argue that not only domestic but also foreign investors may be willing to bargain with the government for a favorable regulatory policy. Introducing competition in the lobbying game may allow the government to capture most of the rents from the lobbying game by threatening each lobby to set the regulatory framework favored by the other lobbying group. We might expect competition rising the likelihood of observing concentrated ownership. Likewise, one may conjecture that agency issues may arise not only between the government and the firm's manager but also between the latter and the firm shareholders. In a general environment characterized by a double agency problem the size of informational rents would likely rise. Provided institutional investors are able to improve the effectiveness of corporate governance, we should expect overinvestment under concentrated ownership to prevail, thus reinforcing the predictions of the model.

7 Appendix: A Moral Hazard Approach

In this section we check the robustness of our results to the informational imperfections of the model. So far, the impediment to perfect contracting between the government and the firm has lied on the impossibility of the government to observe the state of nature driving the cost of production. As this information is learned by the manager after his employment contract has been signed, it constitutes an illustration of hidden knowledge.

In this section, we change the informational environment of the model. In particular, we assume that the government can observe the state of nature. But it cannot verify the effort of the manager to enhance the probability that the good state of nature realizes. In this moral hazard setting, the inability of the government to observe the action taken by the manager is the only source of inefficiency.

By contrast with the previous specification, we allow for a non-linear relation between investment and efficiency. More specifically, we assume that the marginal increase in efficiency from exerting effort is a positive yet decreasing function of effort. Otherwise, the basic structure of the model is the same presented in the previous section. The only difference lies on the cost structure of the project. Now the cost of implementing the project, β, is stochastic at the contracting stage, and can take up one of two values: $\beta = \underline{\beta}$ with probability $v(e)$ and $\beta = \overline{\beta}$ with probability $(1 - v(e))$ with $\overline{\beta} > \underline{\beta}$, where $e \in \overline{E}$ denotes the effort spent by the manager in cost reduction. Finally, $v(e)$ is assumed to be an increasing and concave function. The cost of the project is observed by the government ex-post but the choice of effort is non verifiable. Therefore, the government is constrained to provide incentives to the manager to elicit positive effort.

The firm receives a transfer from the government $t(\beta)$, where β represents now the cost of the project instead of the state of nature reported by the manager.

We shall replicate the analysis performed in Section 2 to determine which ownership structure minimizes the efficiency distortions created by asymmetric information.

7.1 Benchmark

Let us start the analysis by considering the first-best case, where effort is chosen to maximize total expected surplus:

$Min_e v(e) \underline{\beta} + (1 - v(e)) \overline{\beta} - e$

F.O.C.

$v'(e^*)(\overline{\beta} - \underline{\beta}) = 1$ and,

$v'(e^*) = \dfrac{1}{\overline{\beta} - \underline{\beta}}$

But the choice of effort is non verifiable. Therefore, in order to induce first-best, the government should provide appropriate incentives to the manager through an optimal system of transfers satisfying both the participation constraint of the manager as well as his incentive compatibility constraint. We assume the manager to be credit constrained. Therefore, his utility should be weakly positive in both states of nature:

$\underline{U}(\widehat{e}), \overline{U}(\widehat{e}) \geq 0$

where $\underline{U}$ and $\overline{U}$ denote his utility in the good and bad state of nature respectively. Also:

$\widehat{e} = \arg\max_e \left\{ v(e)\left(\underline{t} - \underline{\beta} - e\right) + (1 - v(e))\left(\overline{t} - \overline{\beta} - e\right) \right\}$

$v'(\widehat{e}) = \dfrac{1}{\left(\underline{t} - \overline{t}\right) + \left(\overline{\beta} - \underline{\beta}\right)} \Rightarrow \underline{t}(e^*) = \overline{t}(e^*)$

But the government will set the efficiency of the firm to maximize its own objective function, namely the welfare of its electorate together with the rents accruing to the firm. The constrained optimization problem faced by the government is the following:

$Max_e a\left\{ \alpha S_1 - (1 + \lambda)\alpha\left[v(e)\underline{t}_1 + (1 - v(e))\overline{t}_1\right] \right\} + v(e)\underline{U}(e) + (1 - v(e))\overline{U}(e)$

s.t.

$\underline{U}(e), \overline{U}(e) \geq 0$

$e = \arg\max_e \left\{ v(e)\left(\underline{t} - \underline{\beta} - e\right) + (1 - v(e))\left(\overline{t} - \overline{\beta} - e\right) \right\}$

$S_2 - (1 + \lambda)\underline{t}_2 \geq 0$
$S_2 - (1 + \lambda)\overline{t}_2 \geq 0$

where:

$\underline{t} = \alpha\underline{t}_1 + (1 - \alpha)\underline{t}_2 = \underline{\beta} + e + \underline{U}(e)$

$\overline{t} = \alpha\overline{t}_1 + (1 - \alpha)\overline{t}_2 = \overline{\beta} + e + \overline{U}$

The optimal system of transfers that solves this constrained optimization problem is given by:

$\underline{t}(e) = \underline{\beta} + e + \underline{U}(e)$ and,

$\overline{t}(e) = \overline{\beta} + e$

where $\underline{U}(e)$ is defined by:

$\underline{U}(e) = \dfrac{1}{v'(e)} + \left(\overline{\beta} - \underline{\beta}\right)$ for all $e \in E$

We can rewrite the utility of the manager in the good state of nature as:

$\underline{U}(e) = \xi(e)$ where $\xi'(e) > 0$ given the assumption that $v''(e) < 0$ for all $e \in E$

Therefore, the effort choice induced by regulation is defined implicitly by:

$$(1 + \lambda) v'(e^1) (\overline{\beta} - \underline{\beta}) = (1 + \lambda) + \lambda v'(e^1) \xi(e^1) + v'(e^1) \xi'(e^1)$$

The LHS captures the marginal benefit to the government from an increase in efficiency, namely the greater probability that the good state of nature arises. The RHS represents its marginal cost, namely the increased cost of effort, the higher probability of awarding rents to the manager and the marginal increase in the amount of these rents as a result of higher efficiency. As the manager's payoff is internalized by the government, the cost of granting rents is only given by the economic distortions created by taxation. Solving for $v'(e^1)$:

$$v'(e^1) = \frac{1 + \dfrac{\lambda}{1 + \lambda} v(e^1) \xi'(e^1)}{(\overline{\beta} - \underline{\beta}) - \dfrac{\lambda}{1 + \lambda} \xi(e^1)}$$

As $v(e), \xi(e) > 0$ and $\xi'(e) > 0$ for all $e \in E$ then:

$$e^1 < e^*$$

There is a distortion in the effort induced to the manager with respect to first-best. Tax discrimination allows full expropriation of the surplus received by type 2 consumers. This means that any increase in taxation necessary to induce higher efficiency is fully levied upon the electorate of the government. Efficiency is costly since taxation is distortionary. Although the benefit enjoyed by the manager is internalized in the objective function of the government, still is lower than the corresponding cost of raising additional funds.

7.2 Privatization

We shall analyze separately both dispersed and concentrated ownership as they lead to different economic implications.

Suppose first that the government privatizes the firm by spreading ownership holdings among type 2 consumers. The new shareholders will now receive any income rights accruing to the firm. Given tax discrimination, higher rents will allow the government to transfer the higher cost of taxation from greater efficiency to type 2 consumers. Hence the constrained optimization problem of the government becomes:

$$Max_e \left\{ \alpha S_1 - (1 + \lambda) \left[\alpha v(e) \underline{t}_1 + (1 - v(e)) \overline{t}_1 \right] \right\}$$

$s.t.$:

$$\xi(e) > 0$$

$$S_2 - (1 + \lambda) \underline{t}_2 + \frac{\xi(e)}{1 - \alpha} \geq 0$$

$$S_2 - (1 + \lambda) \overline{t}_2 \geq 0$$

where:

$$\underline{t} = \alpha \underline{t}_1 + (1 - \alpha) \underline{t}_2 = \underline{\beta} + e + \xi(e) \text{ and,}$$

$$\overline{t} = \alpha \overline{t}_1 + (1 - \alpha) \overline{t}_2 = \overline{\beta} + e$$

Now the difference in taxation levied upon a type 2 consumer between the good and the bad state of the world is determined by the rents to which he is entitled as a shareholder of the firm. In particular,

$$\underline{t}_2 - \overline{t}_2 = \frac{\xi(e)}{1 - \alpha}$$

The first order condition that implicitly defines the effort chosen by the manager in cost reduction is given by:

$$v'(e^2) = \frac{1 + \dfrac{\lambda}{1 + \lambda} v(e^2) \xi'(e^2)}{(\overline{\beta} - \underline{\beta}) - \dfrac{\lambda}{1 + \lambda} \xi(e^2)} \Rightarrow e^2 = e^1 < e^*$$

Now the government although does not internalize directly the utility accruing to the shareholders, it does internalize their payoff indirectly through tax discrimination.

7.3 Lobbying Game

Consider the case where the government sells off the natural monopoly to a group of institutional investors within the group of type 2 consumers. As in Section 2, investors form a lobby and offer a contingent monetary contribution in exchange for a favorable regulation. The government chooses a system of transfers optimally, given the contribution function offered by the lobby.

Given the preference functions of the lobby and the government presented in the previous section, namely:

$$U(e, P) = V(e) - P \text{ and,}$$

$$G(e, P) = aW(e) + P,$$

where $a \in [0, 1]$, the truthful equilibrium of the game, $\{P^o(e), e^o\}$ is characterized by:

$$e^o = \arg\max_e \; a \left\{ \alpha S_1 - (1 + \lambda) \alpha \left[v(e) \underline{t}_1 + (1 - v(e)) \overline{t}_1 \right] \right\} + $$
$$+ a \left\{ a(1 - \alpha) \delta \left(S_2 - (1 + \lambda) \left[v(e) \underline{t}_2 + (1 - v(e)) \overline{t}_2 \right] \right) \right\} + $$
$$+ v(e) \xi(e)$$

$$s.t. :$$

$$\xi(e^o) > 0$$

$$S_2 - (1 + \lambda) \underline{t}_2 + \frac{\xi(e^o)}{1 - \alpha} \geq 0$$

$$S_2 - (1 + \lambda)\bar{t}_2 \geq 0$$

$$G\left(e^3, P^o\left(e^3, u^o\right)\right) = \max_e G(e, 0) = W\left(e^1\right)$$

By the same argument presented in Section 2, the efficiency of the firm will depend on whether ownership is highly concentrated or not.

7.3.1   High Ownership Concentration

As before, the relationship between the parameters of the model is the following: $\delta < a\dfrac{\alpha}{(1 - \alpha)}$

The equilibrium effort induced to the manager of the firm is defined implicitly by:

$$v'\left(e^3\right) = \frac{1 + \dfrac{a(1+\lambda) - 1}{a(1+\lambda)}v\left(e^3\right)\xi'\left(e^3\right)}{\left(\bar{\beta} - \underline{\beta}\right) - \dfrac{a(1+\lambda) - 1}{a(1+\lambda)}\xi\left(e^3\right)}$$

$$a < 1 \Rightarrow \frac{a(1+\lambda) - 1}{a(1+\lambda)} < \frac{\lambda}{(1+\lambda)} \Rightarrow e^3 > e^2$$

The optimal contribution schedule defines the utility u^o captured by the lobby from bargaining with the government, so that the government is indifferent between privatizing the firm or keeping the firm under public ownership.

The expected rent is higher under concentrated ownership. In effect, not only the probability of awarding positive rents is higher, as $v\left(e^3\right) > v\left(e^1\right)$ but also the amount of the rent is greater as $\xi(e) > 0$. But the expected cost of the project is lower under concentrated ownership as the probability of a low cost realization is higher than the probability of a high cost realization.

7.3.2   Moderate Ownership Concentration

This case is complementary to the one presented above, that is: $\delta > a\dfrac{\alpha}{(1 - \alpha)}$

The weight attached to the surplus of institutional investors in the objective function of the government is higher than the weight corresponding to the welfare   of its electorate. Therefore, the participation constraint of type 2 citizens does not bind and the optimal level of effort solves the following equation:

$$v'\left(e^4\right) = \frac{1 + \dfrac{\delta(1+\lambda) - 1}{\delta(1+\lambda)}v\left(e^4\right)\xi'\left(e^4\right)}{\left(\bar{\beta} - \underline{\beta}\right) - \dfrac{\delta(1+\lambda) - 1}{\delta(1+\lambda)}\xi\left(e^4\right)}$$

The assumption that $\alpha a < (1 - \alpha)\delta$ together with the fact that $\alpha > \frac{1}{2}$ implies that $e^4 < e^3$.

7.3.3   Discussion

Our results are robust to the characterization of the informational environment as a hidden information problem (where the manager holds private information concerning the state of nature) or as a moral hazard problem (where the effort exerted by the manager influences the distribution of the cost function).

This result hinges on the equivalence between both specifications. In the hidden information problem, the marginal benefit of effort is constant, whereas its marginal cost is an increasing function of effort. This is due to the convexity of the cost function, which implies that the cost of informational rents to induce truth telling increases with the efficiency of the firm.

By contrast, in the moral hazard approach the marginal cost of effort is constant whereas its marginal benefit decreases with the efficiency of the firm (as the probability of a good state is concave in effort). Therefore, the cost of incentives to elicit higher efficiency increases with the effort of the manager.

To summarize, the efficiency of a firm under public ownership is the same as under private ownership and dispersed shareholding. In both cases the firm is inefficient irrespective of the informational setting. Rising the concentration of equity leads to higher efficiency. However, when monetary contributions are too valuable to the government (e.g. when the size of indecisive voters is significant), concentrated ownership may lead to overinvestment with significant fiscal costs to the economy.

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