Soft Budget Constraint and Stock Price Information

By

Antoine Faure-Grimaud

DISCUSSION PAPER 251

November 1996

FINANCIAL MARKETS GROUP
AN ESRC RESEARCH CENTRE

LONDON SCHOOL OF ECONOMICS

E·S·R·C
ECONOMIC & SOCIAL RESEARCH COUNCIL

ISSN 0956-8549-251

Soft Budget Constraint and Stock Price Information.

Antoine Faure-Grimaud *

January 97

Abstract

This article investigates the ability of regulatory agencies to keep firms to fixed budgets. The budget implemented at an interim date is always superior to the one efficient ex ante, since, at the interim stage, regulators do not internalize the disincentive effect of their intervention on firm's effort. Budget constraints are more or less soft according to the information available to regulators. The ability of financial markets to generate information is endogenized. It is shown that stock price information may increase the softness of the budget constraint, decrease firms' incentives to exert effort and may reduce social welfare. It also appears that the "softness" of these constraints depends on the type of claims used to finance initial investments. A straightforward application of the model sheds light on the privatisation decision.

Jel Classification: D82, G14, G32, L51

*London School of Economics, Houghton Street, London WC2A 2AE, UK. Fax: +44 171 242 10 06. I would like to thank J.J. Laffont for his encouragement and very insightful comments. I am also grateful to G. Chemla, J. Crémer, M. Habib, J.C. Rochet, J. Tirole, D. Webb and seminar participants at the London Business School, the University of Southampton, HEC, the ESEM 96, the EEA 96, the conference on "Organizations and Incentives" in Copenhagen and the Winter Meeting of the European Econometric Society for helpful comments. All errors are mine.

1 Introduction:

Since the beginning of the eighties, numerous utilities have been privatised in Western European countries. Also the number of contractual relationships between regulatory agencies and private suppliers has increased. The present paper is interested in the type of budget constraints faced by these firms and investigates the existence of an informational link between the capital structure of these firms and the "soft budget constraint" syndrome. According to Maskin (1996), this syndrome "pertains whenever a funding source -e.g. a bank or a government- finds it impossible to keep an enterprise to a fixed budget. That is, the enterprise can extract ex post a bigger subsidy or loan than would have been considered efficient ex ante" [1]. The "softness" of budget constraints faced by regulated firms has been a central theme in the regulatory debate over the last few years.

When a firm is publicly traded, stock prices may convey information. The finance literature has emphasized the capacity of financial markets to generate prospective information, i.e. regarding firms' future performances. Stock prices are informative when traders have the ability to anticipate future returns, and trade accordingly[2]. In particular, one strong argument for privatising public utilities is that this additional information can be used by regulators to implement more efficient regulations.

The paper shows that stock price information may make budget constraints softer, lessen the power of the incentive scheme and decrease welfare. The broad intuition of this result is the following: budget constraints are more or less soft according to regulators' beliefs concerning firms' future performance. The

[1]see also Laffont and Tirole (1993): "a public enterprise is not subject to the discipline of the bankruptcy process because the government always bails it out in case of difficulty". As emphasized by these authors, the argument could easily be extended to regulated firms, in general.

[2]see for example Laffont and Tirole (1993): " Stock market prices contain information about the firm's future prospects and thus about the managers' long term decisions."

ability of a regulator to stick to a given budget depends on the information she receives. News can be good or bad, according to the stock price evolution, and more or less informative. The consequence of this information is asymmetric: good news does not affect the regulator's incentives to alter budget constraints although bad news does. But the extent to which bad news is really bad depends on the informational content of prices: the more informative, the higher these incentives. Hence, with a more precise financial signal, firms anticipate softer regulation, their own incentives to exert effort diminish and welfare decreases. This result has some policy implications for the privatisation process but also sheds light on the debt-equity choice of a firm mainly engaged in a procurement relationship: the pecking order of financing projects depends, in this regulatory setting, on the amount of information contained in security prices.

In a very simple moral hazard setting, the regulator has to provide incentives to induce managers to exert effort. If the firm is privatised, the regulator receives financial information -the security price is observed- regarding an interim state of the world conditioning the future prospects of the firm. The price is an imperfect signal on the interim state because the identity of traders, whether or not they are informed, is unknown. The regulator updates beliefs accordingly and may decide to undertake an action which is socially costly, which increases the odds that the firm's project eventually succeeds. A straightforward example is when the regulator grants new funds to the firm. But the interpretation can be enlarged to take into account other alterations of the economic environment of the regulated firm: the price cap is reviewed in a less stringent fashion, the competitive policy is changed in a more favorable way etc... This "regulatory intervention" is more valuable when the project encounters real difficulties at the interim date. Last, ex post, the social surplus of the project is realized and the security returns paid.

There are two basic trade-offs driving the model's results. First, the managerial effort and the regulatory rescue at the interim date are substitute. If the firm anticipates ex ante that the regulator is willing to intervene, its willingness to exert effort is decreased. As a consequence, the regulator has to give up higher informational rents when a regulatory rescue is expected. But, in a complete contracting world, this sole fact does not make the budget constraint soft: it is possible to stipulate intervention levels and informational rents in a contract, whatever these levels. The soft budget constraint problem arises endogenously when contracts are incomplete. At the interim stage, the effort of the firm is sunk. Then, the regulator chooses an intervention level by comparing the cost of this decision to its expected benefit at this date, i.e. for a given level of wages for the firm. Compared to the usual second best contract, the regulator intervenes too often, as the negative effect on rents is not taken into account at this date. Hence, the constraint is soft because of the impossibility to commit ex ante to a particular level of intervention.

The second trade-off deals with the informational content of security prices: the positive effect of precise information is that it allows the regulator to choose the right decision at the interim date. But with this benefit comes a cost: consider a case in which the intervention cost is sufficiently high such that the regulator would never intervene when she receives good news. Now, a precise, bad signal increases her willingness to intervene relative to an imprecise one. Ex ante, the firm expects a higher probability of intervention when the signal is precise which, as just mentioned, decreases its incentive to exert effort. It may happen that this cost overwhelms the benefit and the expected welfare is a non monotonic function of the information precision.

The above non monotonicity of the informational effect on welfare gives rise to the normative part of the paper: how should regulators control the informativeness of security prices? The point is to endogenize information revelation. A simple model of informed trading *à la Kyle* is used. Strategic investors can become informed about the underlying state of the world and place orders to benefit from this information. Consequently, the equilibrium price is a signal of the future prospects of the project. But, considering that these traders have to pay a search cost for this information, they will eventually invest in this search if and only if the extra benefit associated is sufficiently high. This benefit depends on the uncertainty of the security return. If the security pays the same amount in all states, private information has no value. In such a case, strategic traders will not pay for the cost and financial agents, anticipating that trading orders do not reflect any information. Alternatively, for sufficiently differentiated payoffs, potential informed traders will invest to find out the promised return and stock prices will be informative about the interim state. Considering that privatisation entails the issuance of risky securities, such a decision is optimal, other things being equal, when the intervention cost is not too high. Note also that this model can be extended to take into account liquidity considerations and the choice between partial or total privatisation. A more liquid market allows informed traders to make greater profits on their information and increase the price informativeness. Public ownership or partial privatisation is socially desirable for high intervention costs as it alleviates the soft budget constraint syndrome. Similarly, for these values, debt financing is preferable to a more informative security like equity.

This paper is of course related to the literature on soft budget constraints, initiated by Kornai (1979). In particular, like Dewatripont and Maskin (1996), the softness of this constraint is due to contract incompleteness. Their paper focuses on the importance of centralised or decentralised credit relationships but the key force driving their results deals with information flows: in a centralised system, creditors are fully informed about firm's prospects while they have no information at all under decentralisation. From a methodological standpoint, less drastic information structures are considered here to obtain additional comparative results. Moreover, information flows are endogenized through security design. There is also an abundant literature about the privatisation of monopolistic firms. Shapiro and Willig (1990) consider that politicians pursue their own agenda and compare the internal and allocative efficiency under the two ownership stuctures. Another approach, due to Sappington and Stiglitz (1987), argues that privatisation increases the transaction cost of governmental subsidies. Nonetheless, it is unclear in these models why an "efficient" regulator could not replicate any outcome induced by a particular ownership structure[3]. Closer to this analysis, Schmidt (1996) endogenizes this government failure in viewing privatisation as a commitment not to acquire new information about firms. It makes credible the threat to cut back subsidies to an inefficient firm which in turn provides incentives for managers to exert effort. Like this paper, the present one tries to model the regulatory process. In contrast with it, it allows for contingent wage contracts and also models how information is revealed. Without imposing an exogenous information structure, it appears that privatisation generates additional information about the firm. This result is consistent with the finance literature about the monitoring role of financial markets as well as with some casual evidence[4]. What is particularly interesting is the prospective (or speculative to adopt the Holmström-Tirole terminology) nature of this information. Of course, listing a firm necessitates the public revelation of retrospective information, i.e. regarding past performances. But there is no reason to believe that a regulator could not obtain this information from a state owned firm. Nonetheless, as pointed out by Holmström and Tirole (1993): " it seems clear that the stock market today performs an important role as a monitor of management...", the argument being that stock prices are informative about *future* payoffs. These ideas have been widely used to investigate the consequences of financial information on manager incentives. The present paper adopts the same perspective but looks at the informational effect

[3]see Laffont and Tirole (1993) for an explanation based on a multiprincipal approach.

[4]Information acquisition is always costly and one has to wonder whether or not a state agency has more incentives to acquire information than speculators in financial markets. For instance, regulators in the UK have recently expressed concerns about a possible *delisting* of regulated firms following a takeover, on the ground that valuable information may be lost.

on the regulator (principal)'s incentives instead of the manager (agent)'s ones.

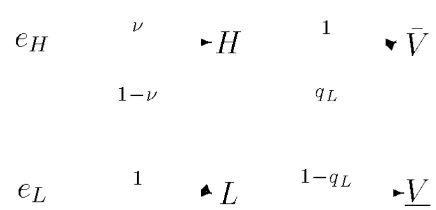
The paper is organized as follows: section 2 presents the model and the second best contract, section 3 considers the incomplete contract case and section 4 endogenizes the financial signal. A final section concludes the paper.

2 The Model and the Second Best Allocation.

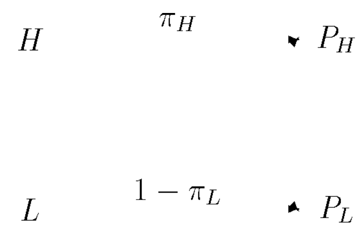
I first present the informational structure of the model. Then, assuming that contracts are complete, the second best allocation is characterized.

2.1 The Model.

Consider a regulated firm which has an investment project of a given size I. Once this amount is invested, the social surplus generated by this project may be high, $V = \bar{V}$ or low, $V = \underline{V}$. The probability distribution of this surplus depends on an effort exerted by the manager of the regulated firm. For simplicity, assume that this effort is $e \in \{e_L, e_H\}$ and that the corresponding probabilities are such that:



The main features the model is intended to capture are the following: the odds of success, $(\nu + (1-\nu)q_L)$, are higher when the manager chooses $e = e_H$ than when a low effort level is exerted (q_L). It is assumed that the project goes through an interim stage defined by a state of the world $\sigma \in \{L, H\}$. This intermediary state determines the conditional probability of success. The conditional probability is higher in a good state $(\sigma = H)$ than in a bad one $(\sigma = L)$. The interim state of the world is not observable by the various agents. Nonetheless, there exists a signal associated with this state. Consider that this signal is given by the price of a security issued by the firm. It will be endogenized in the last section. For the moment, I suppose that both parties observe a price $P = \{P_L, P_H\}$, with $P_L < P_H$, (if the firm stays in public hands, no signal is issued, or equivalently $P_L = P_H$) which depends on the interim state in the following way:



Of course $\pi_H > \pi_L$. If $\pi_H = \pi_L$, the observation of P_j is uninformative.

Suppose now that the regulator has the possibility to increase the odds of success at the interim date. The most straightforward interpretation is that the regulator provides the firm with new funds at this date: the budget is increased. But even if direct transfers from regulators to firms are precluded, this action may also refer to different sorts of "interventions": the regulator may decide to relax the regulatory environment, e.g. by increasing a price cap, changing the competition policy in a favorable way, etc... Whatever the interpretation, this intervention is socially costly and ρ denotes this cost. On the other hand, this action has also a benefit: it increases q_L by $\Delta q_L = q_L^1 - q_L^0$. For simplicity, it is assumed that $\Delta q_H = q_H^1 - q_H^0 = 0$: the idea is that the "marginal" benefit of the intervention is higher when the interim state is indeed bad (the analysis could be extended to $\Delta q_H < \Delta q_L$). Hence, denoting by i the probability of the regulator's intervention, the conditional probability of success is: $q_L(i) = q_L^0 + i\Delta q_L$.

As a benchmark, assume that the manager's effort is observable. What would be the first-best effort and intervention levels? First, it is assumed that e_H is optimal:

$$(\nu+(1-\nu).q_L(i)).\bar{V} + (1-\nu).(1-q_L(i))\underline{V} - e_H \geq q_L(i).\bar{V} + (1-q_L(i))\underline{V} - e_L$$

$$\Leftrightarrow \Delta V \equiv \bar{V} - \underline{V} \;\geq\; \frac{e_H - e_L}{\nu(1 - q_L^1)} \tag{1}$$

The optimal level of intervention depends, of course, on the signal received. Let i_j be the probability of intervention when the price of the security is $P_j \in \{P_L, P_H\}$. i_j^{fb} maximizes the expected welfare at the interim stage, i.e. conditionally on P_j:

$$\begin{aligned}\max_{i_j} W(i_j) &= \\ & Prob(H\backslash P_j).\bar{V} + Prob(L\backslash P_j)(q_L(i_j)\bar{V} + (1 - q_L(i_j))\underline{V}) - i_j\rho \end{aligned} \tag{2}$$

Then, i_j^{fb} satisfies:

$$i_j^{fb} = \begin{cases} 1 \; if \; \rho \leq Prob(L\backslash P_j)\Delta q_L \Delta V \\ 0 \; otherwise \end{cases} \tag{3}$$

If $\rho \leq \rho_0 \equiv Prob(L\backslash P_H)\Delta q_L \Delta V$, the regulator intervenes irrespective of the signal received, if $\rho \geq \rho_1 \equiv Prob(L\backslash P_L)\Delta q_L \Delta V$, she does not intervene at all and finally, for intermediary values of ρ, she intervenes if and only if the signal is bad. It is worth remarking that in this first best world, the budget constraint is not soft: ex ante, the regulator can decide to intervene following the previous first best rule and she has no incentive to renege on that rule. Note also that when the first best is implemented, a more accurate signal enhances social welfare. In our framework, a simple measure of precision is $\pi_H - \pi_L$. For extreme values of ρ, an increase in π_H for a given π_L does not affect social welfare at all. But for $\rho \in [\rho_0, \rho_1]$, W^{fb}, the social welfare if the first best is implemented is equal to:

$$\begin{aligned} W^{fb} &= \Big(\nu + (1-\nu)(\pi_L.q_L^0 + (1-\pi_L)q_L^1)\Big).\Delta V + \\ & \underline{V} - (\nu(1-\pi_H) + (1-\nu).(1-\pi_L)).\rho \end{aligned} \tag{4}$$

$W^{fb}(.)$ increases with π_H (and decreases with π_L). Finally, the thresholds for ρ also depend on $\pi_H - \pi_L$ as:

$Prob(L\backslash P_H) = \frac{(1-\nu).\pi_L}{\nu.\pi_H+(1-\nu).\pi_L}$ *and* $Prob(L\backslash P_L) = \frac{(1-\nu).(1-\pi_L)}{\nu.(1-\pi_H)+(1-\nu).(1-\pi_L)}$

Thus, an increase in π_H diminishes ρ_0 and increases ρ_1. A more accurate signal expands the interval where the regulator intervenes only if the security price is low: given that the signal is accurate, the odds of choosing the wrong decision, i.e. intervening when, in fact, the interim state is the good one, are low. The *expected* welfare under symmetric information increases with the accuracy of the signal.

2.2 The Contractible Case

Consider now that the effort choice is a moral hazard variable. I assume here that the final outcome (V) [5], the security price (P_j) and the intervention i_j are contractible. The timing of the game is as follows: first, the regulator offers a contract stipulating R, a transfer to the firm, and i, the intervention level. Then, the firm chooses e. The signal P_j is received and the regulator's intervention is i_j. Last, V is realized. In this complete contracting world, a contract is defined by a vector of transfers $R = \{R_H, R_L, \bar{R}, \underline{R}\}$ and a pair of intervention probabilities $i = \{i_H, i_L\}$. Assuming that the firm is risk neutral, its expected utility is simply:

$$\begin{aligned} U_f = Prob(P_H).\Big[R_H + Prob(H\backslash P_H)\bar{R} \\ +Prob(L\backslash P_H).(q_L(i_H)\bar{R} + (1-q_L(i_H))\underline{R})\Big] \\ + Prob(P_L).\Big[R_L + Prob(H\backslash P_L)\bar{R} \\ +Prob(L\backslash P_L).(q_L(i_L)\bar{R} + (1-q_L(i_L))\underline{R})\Big] - e \end{aligned} \quad (5)$$

To induce a high effort level, the contract has to be incentive compatible. The incentive compatibility constraint (IC) is:

[5]One may introduce an adverse selection parameter ex post without affecting the results.

$$(\pi_H - \pi_L).(R_H - R_L) \; + \; (\bar{R} - \underline{R}).(1 - \pi_L.q_L(i_H) - (1 - \pi_L).q_L(i_L)) \geq \frac{e_H - e_L}{\nu} \quad (6)$$

The limited liability of the firm implies that the payments R be non negative[6]. For simplicity, I assume that the incentive problem is sufficiently severe to guarantee that the individual rationality constraint of the firm is not binding: $e_L \leq e_H \nu/(\nu + (1-\nu).q_L)$. Finally, I consider that the financial signal is not too precise, $q_L^1.\pi_H < \pi_L$ to avoid the extreme case where all incentives depend only on the financial signal[7]. The objective function of a benevolent regulator is then :

$$\begin{aligned} W = {} & Prob(P_H).\Big[Prob(H \backslash P_H).\big(\bar{V} - (1-\alpha)\bar{R}\big) + Prob(L \backslash P_H). \\ & \big(q_L(i_H).(\bar{V} - (1-\alpha)\bar{R}) + (1 - q_L(i_H))(\underline{V} - (1-\alpha)\underline{R})\big) - (1-\alpha)R_H - i_H.\rho\big)\Big] \\ & + \; Prob(P_L).\Big[Prob(H \backslash P_L).\big(\bar{V} - (1-\alpha)\bar{R}\big) + Prob(L \backslash P_L). \\ & \big(q_L(i_L).(\bar{V} - (1-\alpha)\bar{R}) + (1 - q_L(i_L))(\underline{V} - (1-\alpha)\underline{R})\big) - (1-\alpha)R_L - i_L.\rho\big)\Big] \\ & - I - \alpha e_H \end{aligned} \quad (7)$$

where α denotes the weight of the firm in the welfare function (see for example Baron and Myerson (1982) for such a modelling). Maximizing this objective subject to the incentive constraint yields the second best contract:

Proposition 1 *The second best contract satisfies:*

- $R_H^\star = R_L^\star = \underline{R}^\star = 0$; $\bar{R}^\star = \frac{e_H - e_L}{\nu.\big(1 - \pi_L.q_L(i_H^\star) - (1-\pi_L).q_L(i_L^\star)\big)}$

[6] Alternatively, the firm can be considered as infinitely risk averse below zero.

[7] Holmström and Tirole (1993) show that basing managerial compensation schemes on interim stock prices is useful only if prices contain information which cannot be recovered from ex post profit realizations. It may happen that interim information is useless for incentive purposes but that it helps choosing a better intervention decision.

- *The probability of intervention decreases with ρ and is lower when P_H is observed than when $P = P_L$.*

Proof and details: see appendix 1.

For very low values of ρ, the regulator always intervenes, then she randomizes when she receives a good signal and intervenes if the signal is bad, then intervenes only if the signal is bad, then randomizes in this case, and last, when intervention is very costly, never intervenes. Relative to the first best case, the regulator has to give up rents to the firm in order to obtain a high effort level. The point is that these rents increase with the intervention level. There is a free-rider problem since the agent substitutes the regulator's intervention at the interim stage for its own effort ex ante. The agent's incentives to exert effort are reduced if the regulatory rescue is anticipated: to the extreme, the reasoning is that managerial effort is useless since in any case, the regulator will rescue the firm. As a result, the regulator faces a trade-off between the efficiency of the intervention -social benefits minus direct social costs- and the level of incentives. Consequently, the second best intervention level is lower than the first best one. Note that there is no room for a soft budget constraint if contracts are complete: the level of intervention is given by the optimal contract and in that sense the firm is kept to a fixed budget. In this setting, one can show the following comparative result:

Proposition 2 *Let $\hat{P}_j$ and $\tilde{P}_j$ be two different financial signals. Assume that $\hat{\pi}_H > \tilde{\pi}_H$ and $\hat{\pi}_L = \tilde{\pi}_L$. Denote by $W^\star(\pi_H, \rho)$ the expected social welfare if the second best contract is implemented for ρ, π_H. Then: $\forall\ \rho, \quad W^\star(\hat{\pi}_H, \rho) \geq W^\star(\tilde{\pi}_H, \rho)$.*

Proof: immediate. A precise signal makes intervention less attractive when P_H is received, and more attractive if the signal is P_L. Moreover, the slope of $W^\star(\pi_H, \rho)$ with respect to ρ increases with π_H.

The intuition presented in the symmetric information setting still holds: a more accurate signal ($\hat{P}_j$) allows the regulator to intervene when it is really necessary, i.e. when $\sigma = L$. The difference is that now, a higher level of intervention implies that the regulator has to give up larger informational rents to induce effort. Nonetheless, *for a given level of informational rents*, the expected welfare is higher when the signal is precise, whatever the value of these rents.

The main conclusion of this section is that the conventional wisdom according to which "more information is better" is indeed true in the present context. If one thinks that financial markets may generate this information, there is definitely no cost to use them for that purpose. In particular, applying this result to the privatisation decision (meant as a public floatation of a state owned company), the regulator can benefit from additional information once the firm is quoted to implement better regulatory controls. Actually, this argument has often been put forward in favor of privatisation, like for example in the debate about the delisting of companies following a takeover. From that point of view, privatisation is indeed socially desirable and the more informative the stock price, the better. The next section shows that if the intervention level is not contractible, the budget constraint is soft and the previous results are no longer valid.

3 Non Verifiable Intervention and Soft Budget Constraint.

In most cases, the contractibility of regulators' intervention is a very strong assumption. For instance, a third party such as a court may be unable to verify whether or not a regulatory environment has been relaxed, or if a "less" stringent price cap has been implemented: the court would have to compare the current regulation with a *potential* one and the judicial system may simply lack competence and/or information to achieve this role. Empirical evidence clearly suggests that regulators have room to alter firms' budgets or regulatory environment.

I first show that the impossibility to write ex ante enforceable contracts stipulating future interventions makes the budget constraint soft. This is due to the fact that at the interim date, regulators always prefer a level of intervention greater or equal to the efficient one ex ante. The intuition comes from the substitutability of the regulator's intervention and the firm's effort. In the second best contract, the regulator takes into account the negative effect on incentives of her own intervention. But at the interim stage, once the effort has been sunk, the regulator prefers a higher level of intervention. The second result of this section is that, for a whole range of parameter values, a more accurate signal is socially harmful. An imprecise signal decreases the regulator's incentives to intervene once P_L is received: with respect to a precise signal, it is less likely that the true state is a bad one. But as regulators tend to intervene too much, an imprecise signal makes it easier to induce effort ex ante, and informational rents are saved. Faure-Grimaud (1995) shows that all the results in this section also hold if intervention is verifiable but contracts can be renegotiated.

When i_j is not contractible, the regulator determines her intervention level on the basis of the signal received at the interim date. Three situations may arise: the regulator intervenes in any case, i.e. even if the signal is P_H; the regulator intervenes only if she observes a drop in the price, i.e. $P = P_L$; or there is no intervention at all. Hence, the regulator has to solve the three problems corresponding to the different cases and then to compare the three optimal contracts offered to the firm. The generic program of the regulator can be stated in the following way:

$$\max_{\bar{R},\underline{R}} \quad Prob(P_H).\Big[Prob(H\backslash P_H).\Big(\bar{V}-(1-\alpha)\bar{R}\Big)+Prob(L\backslash P_H).$$

$$\Big(q_L(i^\circ_H).(\bar{V}-(1-\alpha)\bar{R})+(1-q_L(i^\circ_H))(\underline{V}-(1-\alpha)\underline{R})\Big)-(1-\alpha)R_H-i^\circ_H.\rho\Big)\Big]$$

$$+\quad Prob(P_L).\Big[Prob(H\backslash P_L).\Big(\bar{V}-(1-\alpha)\bar{R}\Big)+Prob(L\backslash P_L).$$

$$\Big(q_L(i^\circ_L).(\bar{V}-(1-\alpha)\bar{R})+(1-q_L(i^\circ_L))(\underline{V}-(1-\alpha)\underline{R})\Big)-(1-\alpha)R_L-i^\circ_L.\rho\Big)\Big]$$

$$-I-\alpha e_H \qquad (8)$$

s.t.: $IC(i^\circ)$: $$\bar{R}-\underline{R}\ \geq\ \frac{e_H-e_L}{\nu(1-\pi_L q_L(i^\circ_H)-(1-\pi_L)q_L(i^\circ_L))}$$

and some *regulator's incentive constraints* to ensure that the level of intervention chosen at the interim date corresponds to the particular case considered:

Case A: Intervention even if $P=P_H$: $i^\circ_H=i^\circ_L=1$:

- $Prob(L\backslash P_H).(q^1_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^1_L)(\underline{V}-(1-\alpha)\underline{R}))-\rho\geq$
  $Prob(L\backslash P_H).(q^0_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^0_L)(\underline{V}-(1-\alpha)\underline{R}))$

Case B: Intervention only if $P=P_L$: $i^\circ_H=0$ $i^\circ_L=1$

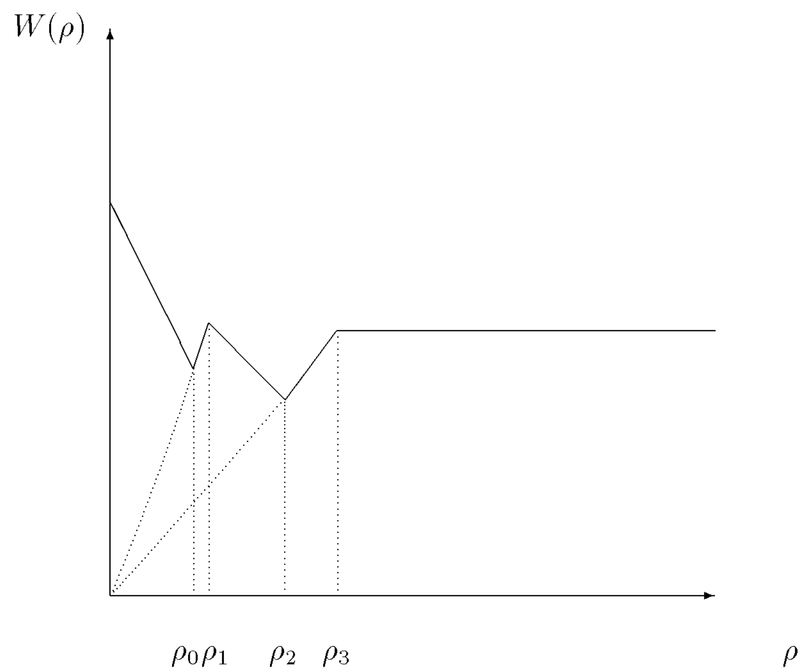
- $Prob(L\backslash P_L).(q^1_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^1_L)(\underline{V}-(1-\alpha)\underline{R}))-\rho\geq$
  $Prob(L\backslash P_L).(q^0_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^0_L)(\underline{V}-(1-\alpha)\underline{R}))$
- $Prob(L\backslash P_H).(q^1_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^1_L)(\underline{V}-(1-\alpha)\underline{R}))-\rho\leq$
  $Prob(L\backslash P_H).(q^0_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^\circ_L)(\underline{V}-(1-\alpha)\underline{R}))$

Case C: No Intervention: $i^\circ_H=i^\circ_L=0$:

- $Prob(L\backslash P_L).(q^1_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^1_L)(\underline{V}-(1-\alpha)\underline{R}))-\rho\leq$
  $Prob(L\backslash P_L).(q^0_L(\bar{V}-(1-\alpha)\bar{R})+(1-q^0_L)(\underline{V}-(1-\alpha)\underline{R}))$

To illustrate the significance of these constraints, the first one in Case B, for instance, states that the regulator prefers to intervene if she observes bad news; the second one that she does not intervene if $P=P_H$. The following proposition summarizes the results:

Proposition 3 *If the intervention of the regulator is not contractible, the levels which are implemented, as well as the informational rents of the firm, are always greater or equal to the second best levels. The expected welfare is a non monotonic function of the intervention cost , ρ, and can be illustrated with the* *following graph:*



Proof and details: See appendix 2. For low values of ρ, the regulator always intervenes, for values between ρ_0 and ρ_2, only if the stock price goes down and last, when intervening is very costly, $i^\circ = 0$. In all cases, however, the regulator tends to intervene too often (for instance, $\rho_0 > \rho_a$).

In the second best case, the regulator maximizes her welfare *simultaneously* (at the ex ante date) with respect to wages and intervention levels. A higher intervention level decreases the incentives to exert effort and consequently requires a higher transfer to the firm to obtain e_H. But the second best contracts solve optimally this trade-off between informational rents and intervention levels. Now, if the intervention is not contractible, the regulator chooses her preferred level at the interim date, i.e. *once the effort has been* *chosen.* Hence, the negative effect of a higher intervention level is no longer internalized. At this date, wages are fixed and the regulator, conditional on her information, decides to rescue the firm or not on the sole basis of economic efficiency (i.e. she compares the marginal cost ρ with the marginal benefit $\Delta q_L Prob(L \backslash P_j)(\Delta V - \Delta R)$). Ex ante, the firm anticipates this effect and asks for a higher transfer to exert effort. To put it in another way, the regulator faces a *time inconsistency problem*: the optimal decision ex ante differs from the optimal interim decision. Expected welfare is always lower or equal to the one which would prevail in the complete contract setting.

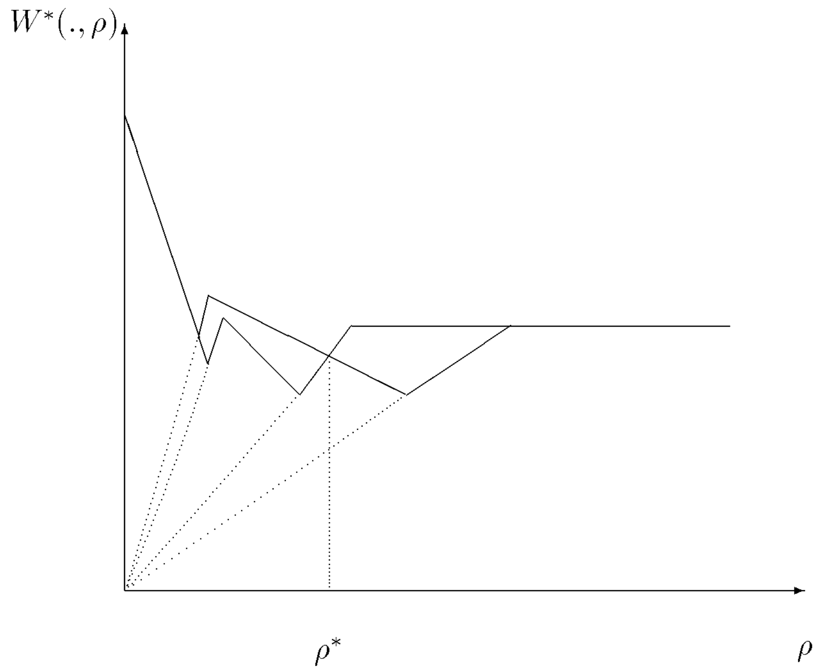
The most intriguing part of the proposition deals with the range of parameters for which the welfare function increases along with the intervention cost. This occurs when the "no-intervention" constraint of the regulator is binding. For instance, between $[\rho_0, \rho_1]$, the regulator is better off not intervening if she observes a rise in the stock price. Nonetheless, the intervention cost is relatively small and the constraint ensuring that the regulator does not intervene is indeed binding. In this case, an increase in ρ *softens* this constraint and, overall, welfare is increased.

This non-monotonicity of the welfare function explains why a more accurate signal may be socially harmful.

Proposition 4 *Let $\hat{P}_j$ and $\tilde{P}_j$ be two different financial signals. Assume that $\hat{\pi}_H > \tilde{\pi}_H$ and $\hat{\pi}_L = \tilde{\pi}_L$. Denote by $W^\circ(\pi_H, \rho)$ the expected social welfare if the optimal incomplete contract is implemented for ρ, π_H. Then, there exists a threshold ρ^* such that:*

- $\forall \rho \leq \rho^*, \quad W^\circ(\hat{\pi}_H, \rho) \ \geq \ W^\circ(\tilde{\pi}_H, \rho)$
- $\forall \rho \geq \rho^*, \quad W^\circ(\hat{\pi}_H, \rho) \ \leq \ W^\circ(\tilde{\pi}_H, \rho)$

Proof: immediate. ρ_0 decreases and ρ_2 increases if the signal is more accurate. However, $W^\circ(\rho_2)$ remains constant. Last, one can check that the threshold value is $\rho^*=\frac{\Delta q_L Prob(L\backslash\tilde{P}_L)}{\nu+(1-\nu)q_L^e+Prob(\hat{P}_L)\Delta q_L(Prob(L\backslash\hat{P}_L)-Prob(L\backslash\tilde{P}_L))}.(\nu+(1-\nu)q_L^e).(\Delta V-\Re_e)$.



A more precise signal decreases the willingness of the regulator to intervene when $P=P_H$ and increases it when $P=P_L$. The intervention is marginally more efficient if the true state of nature is indeed bad, i.e. L. The conditional probability, given $P=P_H$, that the true state of the world is bad is lower if the signal is more precise. Ex ante, the regulator knows that if she observes P_H, she will be less tempted to intervene if the signal is precise. Conversely, a precise, bad signal increases the incentives to intervene relative to an imprecise, bad signal. Then, remember that the regulator intervenes too often compared to the second best contract. These two facts together give the result: the discrepancy between the solution if the intervention is not verifiable and the usual second best contract depends on the precision of the signal. For low values of the intervention cost, a precise signal reduces the difference between the two contracts. For high values, the reverse holds. The argument that the regulator could simply ignore the signal and obtain a welfare at least as high as what she would get without the signal, is not valid.

The counter-intuitive result of this section is that, for $\rho \geq \rho^\star$, less information is socially desirable. In this "third best" world, and for these values of the project cost, it is as if *less information* is the only way for the regulator to *commit not to intervene*. Ex ante, some informational rents can be saved and the welfare enhanced. Another interpretation is that the signal affects the opportunistic behavior of the regulator. The above setting is close to a double moral hazard problem in which both the agent (the firm) and the principal (the regulator) can put efforts into the project. The difficulty is to make the regulator choose the right level of intervention, that is to say the second best one, which in turn determines the incentive contract. The precision of the signal modifies the regulator's incentives to behave opportunistically by affecting her willingness to intervene. This result is related to those of Aghion and Tirole (1994), Crémer (1994, 1995) or Dewatripont and Maskin (1995): in an incomplete contract setting, the information flows alter principals' incentives which in turn modify the set of implementable contracts.

The next section deals with the regulator's ability to control financial information flows. Is it possible for regulators to modulate these information flows through the design of securities? What are, in particular, from this informational standpoint, the costs and benefits of privatising a public utility?

4 Security Design and Financial Information.

The ability of financial markets to generate information about firm's management or its long term prospects is a well known theme in financial literature. This section aims at providing a normative answer to the previous questions by endogenizing this informational process. A simple microstructure model, *à la* Glosten-Milgrom (1985) is employed to represent the functioning of financial markets. Agents can be of two types: either informed traders (or speculators as defined by Holmström-Tirole (1993)) or liquidity traders. Informed traders are active traders. They can be referred to as "insiders" but the key idea is that they are agents who are particularly skillful in processing information. Liquidity traders are "passive" ones in the sense that they trade for exogenous reasons. The special feature of the model is that informed traders are considered as *potential* ones. They have to pay a search cost to obtain their piece of information. They are willing to pay for this cost if and only if it is overcompensated by the associated expected benefits. These benefits in turn depend on the uncertainty of the future earnings paid by the security: knowing in advance the true state of the world is valueless if the security yields the same return in all states of the world. The next step is to assume that the regulator has the ability to design the regulated firm security (see below for a discussion of this assumption) at the beginning of the game to finance the initial investment I. Stock prices are informative provided that final payoffs are "sufficiently uncertain". Focusing on the privatisation issue, a public flotation may allow to generate information. Whether or not this decision is optimal depends on the softness of the budget constraint: there exists a threshold $\rho^{\star}$, above which privatisation decreases welfare. Some refinements of the privatisation decision are also considered, in particular liquidity issues are taken into account. The stock has to be sufficiently liquid to be informative and some conclusions are drawn regarding partial privatisation. These results can be reinterpreted and adapted to provide insights for designing the capital structure of a private regulated firm: the choice between debt and equities is also governed by the value of ρ. Projects with a "high rescuing cost" should be financed by debt to decrease the accuracy of the signal and the oprobability of a regulatory intervention. Conversely, equity financing dominates if the budget constraint is not too soft.

Before presenting the financial model, a few comments regarding the hypothesis that the regulator designs the regulated firm's securities may be useful.

In the privatisation case, there is little doubt that the regulator - who is also the initial owner, directly or indirectly through a governmental agency - controls the process. But even if the firm is in private hands, this assumption seems appropriate. First, at a theoretical level, the security choice is observable and verifiable. There is no reason why this choice should not be part of a regulatory contract. The regulator has the possibility to control the financial structure unless she decides herself not to do so. At an empirical level, most regulators design regulated firms' capital structure either formally or informally. For example, in the United States, "a majority of the state commissions have the power to regulate or control purchases, mergers, consolidations, issuance of securities, property and security transactions with affiliated companies [...] In addition, a few state commissions (fifteen) have the authority to regulate dividends" (Phillips, 1988). But other informal agreements may also allow a tight control on the issuance of securities. As an example, regulators can control the choice of investment projects via the monitoring of capital expenditures. This may also take the form of an implicit control on the financing of these projects. There is a last case in which this assumption seems less appropriate: a procurement relationship between a private supplier and a regulatory agency. A priori, this agency does not control the capital structure of the supplier. Nonetheless, there are still many examples where the supplier is a state owned firm like, for instance, military industries of many countries. Note also that the regulator can choose a firm according to its existing capital structure.

4.1 The Financial Market.

The objective of this section is to introduce a model in which the security price is a signal of the interim state of the world. The simplest way to do that is to assume there exists a class of financial agents who are able to discover the true state of nature at the interim stage. They are the speculators or informed traders. In fact, this representation is a "black box" which does not explain how this information is acquired. One may imagine that the information acquisition process is something complex, based on the ability to aggregate different pieces of information etc... Allen (1993) provides a rationale for this assumption: an informed trader has the competence to process different pieces of information. Indeed, a speculator is like an expert who may have a better knowledge of the intermediary situation than the firm itself. The crucial assumption is not that the firm ignores σ, but that a direct revelation mechanism is not feasible. More generally, one can wonder why the regulator does not simply hire this expert. This question arises in our model, but also in the real world. The conventional wisdom takes for granted not only that financial market have a monitoring role, but also that they are the only ones, or equivalently the most efficient ones, performing such a role. A possible explanation for the impossibility of hiring an expert or asking the firm to reveal (if known) the interim state could lie in the nature of the information generated: the regulator cannot remunerate this expert directly if the information is hardly transferable or non verifiable. Another reason may involve collusion issues: the firm and the expert have an incentive to collude to announce that the project is in trouble to push the regulator to rescue.

To obtain an imperfect signal on σ, it is also essential that some other agents trade for liquidity reasons. Hence, a market maker does not know if a trading order comes from an informed or a liquidity trader. He updates his beliefs accordingly. It is also assumed that there are at least two market makers, competing *à la Bertrand* such that a fair price is quoted on the basis of the posterior beliefs.

I consider a simple version of the Glosten-Milgrom model. Assume first that the security is given, yielding $(\bar{R}_I, \underline{R}_I)$ according to the value of V or equivalently to the firm's revenue R. There is another riskless asset in the economy whose return is normalized to zero. Financial markets are open at date 0 (ex ante) when the security is issued, at date 1 (interim) and at date 2 (ex post). All the contracts are observable and investors are able to anticipate effort and intervention choices. At the interim date, a speculator can discover the true state of nature σ by paying a cost c. This cost represents the price of information[8]. Investors are supposed to be risk neutral. Finally, I make the convention that $\bar{R}_I \geq \underline{R}_I$.

With a probability δ, traders do not need liquidities at the interim date and can trade for strategic reasons. They have the possibility to discover the true interim state σ if they pay a cost c. With probability $(1-\delta)$, trade at that date is stochastic: according to their liquidity needs, financial agents buy with probability μ and sell with probability $1-\mu$. The number of securities issued, N, is normalized to 1[9].

It is assumed that agents have rational expectations, given their information. In particular, potential informed traders or market makers correctly anticipate the intervention level of the regulator following trading orders and price equilibrium. Identically, the regulator and market makers know if, for a given $(\underline{R}_I, \bar{R}_I)$, a potential insider is willing to pay c to get the information. Now, for a given security, what are the equilibrium prices at the different dates?

Consider first the ex ante date. At t=0, information is symmetric and the market price, given that the manager is induced to exert effort and given the anticipated intervention level of the regulator, is simply[10]:

$$P_0 = (\nu + (1-\nu)q_L^e)\bar{R}_I + (1-\nu)(1-q_L^e)\underline{R}_I \tag{9}$$

where q_L^e is the expected probability of success if $\sigma = L$. As the cost of the

[8]Note that our formulation could be extended to the case where a potential informed trader may find the true state with a probability $p(e)$ by exerting an effort e at a cost $c(e)$. Here, $e \in \{0;1\}$ and $c(0)=0,\ c(1)=c,\ p(0)=0,\ p(1)=1$.

[9]Trading volumes are restricted to be either -1 (sell) or $+1$ (buy): what matters for the model is that the market can be bull or bear.

[10]Note that I abstract from any underpricing issue: if the initial offer is subscribed by uninformed agents who may have liquidity shocks at the interim date, they anticipate that they are going to make losses when trading with informed agents. Holmström and Tirole (1993) show that uninformed traders are willing to buy the security only if the amount of underpricing compensates these expected losses. This underpricing would add a cost to the privatisation decision.

investment is I, $NP_0 \geq I$. With $N = 1$, this individual rationality constraint is:

$$(\nu + (1-\nu)q_L^e)\bar{R}_I + (1-\nu)(1-q_L^e)\underline{R}_I \geq I \tag{10}$$

At the interim date, the equilibrium price depends on the possibility that strategic traders are informed about the interim state. Assume first that the security issued induces them to pay for the search cost. Knowing that, market makers update their beliefs and quote a price satisfying:

$$P_j = Prob(H\backslash j)\bar{R}_I + Prob(L\backslash j)R_I^{m_j} \tag{11}$$

where $j = b, a$ according to the order (b stands for bid and a for ask). $R_I^{m_j}$ denotes the expected return given that $\sigma = L$ and the anticipated intervention i_j: $R_I^{m_j} = q_L(i_j)\bar{R}_I + (1 - q_L(i_j))\underline{R}_I$. An informed trader buys if $\sigma = H$ and sells if $\sigma = L$. Hence, the equilibrium price given that speculators pay for the search cost c (assuming that market makers anticipate this) is:

$$P_a^* = R_I^{m_a} + \frac{\nu(\delta + (1-\delta)\mu)}{\nu\delta + (1-\delta)\mu}.(\bar{R}_I - \underline{R}_I)(1 - q_L(i_a)) \tag{12}$$

$$P_b^* = R_I^{m_b} + \frac{\nu(1-\delta)(1-\mu)}{(1-\nu)\delta + (1-\delta)(1-\mu)}.(\bar{R}_I - \underline{R}_I)(1 - q_L(i_b)) \tag{13}$$

When $i_a = i_b$, the ask price is greater than the bid price: trading reveals some information and a spread arises endogenously to reflect this fact. When $i_b = 1$ and $i_a = 0$, the regulator's intervention has the opposite effect on prices, but it is still assumed that P_a is greater than P_b , which is true if $\nu\delta/(1-\delta)\mu(1-\nu\delta-(1-\delta)\mu) > \Delta q_L/(1-q_L^1)$.

The optimal strategy of a potential informed trader at the interim stage can now be characterized: buying the information is optimal if the expected gain is greater than the search cost, i.e.:

$$\bar{R}_I - \underline{R}_I \geq \frac{c}{\nu Prob(L \backslash a)(1-q_L(i_a)) + (1-\nu)Prob(H \backslash b)(1-q_L(i_b))} \quad (14)$$

Hence, to be informative, the security has to be sufficiently "risky".

The second case to be considered is if the security issued does not satisfy (14). Hence, any potential speculator refuses to pay for the search cost. In this case, market makers know that any demand cannot come from an informed agent. Thus, demand is uninformative and $P_a^\star = P_b^\star = P_0$. The regulator does not observe any financial signal and keeps her *a priori* at the interim stage to base her intervention.

4.2 The Privatisation/Security Design Problem.

The objective of this paragraph is to endogenize the privatisation decision or equivalently, the security choice. Ex ante, the regulator has two options: either she chooses a security whose returns satisfy (14), e.g. by privatizing a sufficiently large proportion of the firm's capital - or she decides not to obtain a signal at the interim date. The timing of the whole game is as follows: initially, the regulator chooses contracts: $(\bar{R}, \underline{R}, R_H, R_L)$ is the regulatory contract, $(\bar{R}_I, \underline{R}_I)$ the financial one. P_0 is determined at t=0. At the interim date, H or L is realized. If investors do not need liquidity, they may choose to pay c and the security price is established. On the basis of this price, the regulator may intervene. Ex post, the social surplus is realized and transfers are paid. In any event, the price is supposed to be either non contractible or insufficiently informative (as in the previous section) such that wage contracts are not contingent on it. It is equivalent to δ not too large.

The regulator has to solve a program identical to those of the previous section except that now security design matters. It is assumed that the regulator's objective is unchanged if privatisation occurs: financial agents' welfare does not enter the regulatory agency program. This assumption is required because of the necessity to keep things comparable in order to isolate the pure informative effect. Another argument could be that regulatory agencies pursue their own objectives, as some casual evidence (like conflict of interest between e.g., Ofgas and British Gas shareholders in the UK) may indicate. Hence, the problem can be written as in the previous section except that now, the regulator takes into account the payoffs paid by the security. According to the values of $\bar{R}_I - \underline{R}_I$ and the inequality (14), investors decide whether or not they want to invest in the search cost and the price may or may not reflect some information. In fact, the effect of $\bar{R}_I - \underline{R}_I$ on the welfare is twofold: an increase in the spread decreases, other things being equal, the absolute benefit of an intervention: $\Delta V - \Delta R - \Delta R_I$. Hence, it introduces a bias toward less intervention. In the privatisation case, this effect can easily be interpreted: once the firm is in public hands, the regulator gets the full benefits of a success while in the private case, some of these benefits accrue to private shareholders. In the latter case, intervening is relatively less desirable.

The methodology employed is the following (see appendix 3 for details): first, the program is solved given that the security price at the interim date is uninformative (i.e. with (14) not satisfied). This program is divided into two "sub-programs" according to the intervention level of the regulator. As the price is uninformative $i_a = i_b = i^{\circ}$. I first solve for the non intervention case (i.e. subject to the following non-intervention constraint: $\rho \geq Prob(L)\Delta q_L(\Delta V - \Delta R - \Delta R_I)$), and then under the alternative assumption. One particular solution of these programs is $\bar{R}_I = \underline{R}_I = I$, which is similar to riskless debt. Second, the program is solved when the security price is an imperfect signal of the interim state, i.e. when $\Delta R_I \geq c/K(i_b, i_a)$ with $K(i_b, i_a) \equiv \nu Prob(L \backslash a)(1 - q_L(i_a)) + (1 - \nu)Prob(H \backslash b)(1 - q_L(i_b))$. In that case, there exist three "sub-programs" identical to those sketched in the previous section. In any case, the constraint $\Delta R_I \geq c/K(i_b, i_a)$ has to be satisfied. One can prove the next proposition:

Proposition 5 *When the intervention cost is sufficiently high, it is optimal to finance the project with a security offering a small spread between its returns. Conversely, for low values of the intervention cost, a more "risky" security is socially desirable.*

Proof: see appendix 3.

This last proposition shows how informational considerations and budget constraint softness can drive security design. Given the impossibility to contract on a particular intervention level, the regulator ex ante looks for an alternative, and imperfect, way to control her intervention. As information flows influence the softness of the budget constraint, this constraint is linked to the type of claim used to initially finance the project. The benefit of being privately informed in the financial market depends on the variability of the security's return. More or less risky securities generate more or less information. If the soft budget constraint problem is severe, a regulator will be better off without any additional information at the interim stage. It will diminish her willingness to rescue a firm in trouble, which in turn will increase ex ante effort incentives. Proposition 5 indicates that, in this case, the regulator should oblige the firm to issue a security close to riskless debt, or should avoid a public quotation of the firm. This result is obtained while a priori, privatisation decreases the regulator's incentives to rescue a firm. Alternatively, when intervention cost is low, a riskier stock is socially desirable as it provides more information upon which to base regulatory intervention. One implication of this proposition is that, other things being equal, only firms which have a "low cost of rescue" should be publicly floated. If one interprets this low cost as the firm's quality, only the "jewels of the crown" should be privatised. This interpretation may highlight some aspects of the privatisation pattern which occurred in France.

So far, privatisation has been identified as a way of obtaining stock price information. This view is roughly consistent with the finance literature and conventional wisdom. Nonetheless, it is possible to "refine" these considerations. In particular, partial privatisations of public utilities are frequently observed. It seems intuitive to link stock liquidity to the percentage of the floated capital: the lower the stake held by the state, the more liquid the market. According to Holmström and Tirole (1993), a more liquid market increases the probability that trade occurs for liquidity reasons: the larger the capital privatised, the lower δ. Now, for a given security, it is possible to obtain the following corollary:

Corollary 1 *For a given $\underline{R}_I, \bar{R}_I$, a sufficiently large number of shares has to be sold to ensure that stock prices are informative. If $\rho \geq \rho^*$, a partial, and uninformative, privatisation is socially desirable.*

The intuition is simply that a more liquid market increases informed traders' benefits: when a trade order is placed, the probability that this order is given by an informed agent is lower and consequently market makers' beliefs are closer to their a priori. Hence, traders' incentives to become informed increase with the liquidity. Therefore, the stock price in an illiquid market is not informative. Once more, this is the optimal solution if the budget constraint is really soft. Note also that governments can control for the market liquidity by concentrating shares in few hands. In France, the privatisation process has generally provided large stakes to few shareholders (called the "noyaux durs"). The previous corollary could justify such a mechanism, regardless of any control considerations.

The present results have to be contrasted with the paper of Sappington and Stiglitz (1987) which argues that privatisation increases the transaction cost of subsidies. This increase can be interpreted as a way of hardening budget constraints. This effect can be accounted for in the model by assuming that the intervention cost is $\rho' > \rho$ if the firm is privatised. Then, the welfare function in the informative case is translated to the left which favors the privatisation decision. Nonetheless, there may still exist a range of values for which the informational effect compensates for the cost increase. Note also that the present results are obtained without taking into account the utility of shareholders in the welfare function. Introducing this component will increase the softness of the budget constraint in the privatisation case. Moreover, as paying returns to private investors is a pure cost from the regulator's point of view, the model takes into account that the regulator is more willing to intervene if she owns one hundred percent of the firm: it is as if she fully benefits from a successful outcome. Still, the proposition shows that less intervention may occur in the case of a public company because of the informational effect.

A strong argument in favor of public quotation deals with managerial incentives. Managers can be rewarded on the basis of stock performances and the market for corporate control helps disciplining them. There is an important literature focusing on these aspects. In this paper, we abstracted from any conflict of interest between managers and shareholders. Introducing these aspects would favor the issuance of informative securities. Note, however, that the results would be unchanged for a whole range of parameters: if the signal is not too accurate, the optimal contract bases all the incentives on the final payoffs. Moreover, regulated firms are generally more "takeover-proof" than other firms. In general, one would have to balance the positive effect on direct internal efficiency (better incentives for managers) with the risk of a softer budget constraint.

5 Conclusion

Over the last few years, two topics have frequently been discussed in the regulatory debate. First, regulators often suffer from a "soft budget constraint"; second, security prices are informative and regulators should exploit this information to improve regulations. These have been strong arguments for privatising utilities.

The present paper is concerned with the possibility of a conflict between these two conjectures. The model, and the results as well, can be illustrated with a fictitious example. Consider a firm manufacturing military aircraft, engaged in a procurement relationship with the Department of Defense (DoD) of her own country. The DoD has ordered a new type of aircraft manufactured by this firm which represents the main activity of the firm for the next 10 years. The final (after 10 years) "social" value of this project can be high but it can also be zero if the plane is faulty. The probability of a faulty or useless plane is negatively related to the effort (intensity of R&D etc...) that the firm puts into the project. Before the completion of the aircraft, say after 5 years, the DoD has the possibility to increase the budget by an amount ρ. Allocating new funds increases the odds of success if the project is in a bad intermediary state, but is useless if it is going well. The DoD only observes an imperfect signal on this intermediary state.

The first results deal with the endogeneity of soft budget constraints. If the firm anticipates a budget increase in the future, her incentives to exert effort are decreased: she knows that it is more likely that the project will eventually succeed and she free-rides on the DoD's action. When contracts are incomplete, the DoD decides whether or not to increase the budget at the interim date. But at this date, (at least some of) the firm's effort is *sunk*. The DoD does not take into account the negative effect of a budget increase on the firm's incentives. Typically, there is a time inconsistency problem as the level chosen after 5 years is *always* higher than what would have been deemed efficient ex ante.

Now, what is the effect of information on the softness of the budget constraint? If the cost of improving the odds of success is high, increasing the budget following a positive signal is out of the question. The problem that the DoD is facing is asymmetric: should the budget be increased when a *bad signal* is received? A more accurate signal makes the budget constraint softer: the probability that the project is indeed in trouble, and consequently the usefulness of a budget increase, is higher. The DoD benefits from a accurate information at the intermediary stage as she can intervene if necessary. But it entails a cost when the project is started: the firm is less willing to work hard. The overall effect can be negative and more information can decrease welfare.

The third line of results links the softness of the budget constraint with the type of claim used to finance the initial investment. Stock prices may convey information regarding the current state of the project if some strategic traders in financial markets invest in a search cost. They will do so if the benefits of informed trading are high. These profits depend on the nature of the security and increase with both the uncertainty of final payoffs and the security's liquidity. So if the DoD can control the security issued, she can partly control future informational flows. Assume now that the aircraft firm is state owned. A large privatisation of this firm is not socially desirable when the soft budget constraint syndrome is severe: the informativeness of the stock price increases the possibility of a budget increase and induces less effort within the firm. A security such as riskless debt may allow the DoD to stick to the initial budget.

The results of this paper may shed a new light on the privatisation debate. They show that the argument according to which regulators benefit from additional information following a privatisation process should not be taken for granted. Interestingly, the economic inefficiency -a softer budget constraint- comes from the financial markets efficiency, meaning their propensity to reveal information.

APPENDIX

Appendix 1: proof of proposition 1.

Let λ denote the Lagrange multiplier of the incentive constraint and λ_H, λ_L, λ_0, λ_1 those of the transfer non negativity constraints : $R_H \geq 0$, $R_L \geq 0$, $\bar{R} \geq 0$, $\underline{R} \geq 0$. The derivatives of the Lagrangian with respect to (R_k, i_k) are:

$$\frac{\partial L}{\partial R_H} = -(\nu\pi_H + (1-\nu)\pi_L)(1-\alpha) + \lambda(\pi_H - \pi_L) + \lambda_H = 0$$

$$\frac{\partial L}{\partial R_L} = -(\nu(1-\pi_H) + (1-\nu)(1-\pi_L))(1-\alpha) - \lambda(\pi_H - \pi_L) + \lambda_L = 0$$

$$\frac{\partial L}{\partial \bar{R}} = -(\nu + (1-\nu)(\pi_L q_L(i_H) + (1-\pi_L)q_L(i_L)))(1-\alpha) \\ +\lambda(1 - \pi_L q_L(i_H) - (1-\pi_L)q_L(i_L)) + \lambda_0 = 0$$

$$\frac{\partial L}{\partial \underline{R}} = -(1-\nu)(1-\alpha)(1 - \pi_L q_L(i_H) - (1-\pi_L)q_L(i_L)) \\ -\lambda(1 - \pi_L q_L(i_H) - (1-\pi_L)q_L(i_L)) + \lambda_1 = 0$$

$$\frac{\partial L}{\partial i_L} = (1-\nu)(1-\pi_L)\Delta q_L(\Delta V - (1-\alpha)(\bar{R} - \underline{R})) - Prob(P_L)\rho \\ -\lambda(1-\pi_L)\Delta q_L(\bar{R} - \underline{R}) = 0$$

$$\frac{\partial L}{\partial i_H} = (1-\nu)\pi_L\Delta q_L(\Delta V - (1-\alpha)(\bar{R} - \underline{R})) - Prob(P_H)\rho \\ -\lambda\pi_L\Delta q_L(\bar{R} - \underline{R}) = 0$$

It is straightforward to check that $\underline{R}= R_L = 0$. From $\frac{\partial L}{\partial \bar{R}} = 0$, then (with $q_L^e = \pi_L q_L(i_H) - (1-\pi_L)q_L(i_L)$):

$$\frac{\partial L}{\partial R_H} = \frac{(1-\alpha)}{1-\bar{q}_L}\Big((\nu + (1-\nu)q_L^e)(\pi_H - \pi_L) - (1-q_L^e)(\nu\pi_H + (1-\nu)\pi_L)\Big) \\ -\lambda_0\frac{\pi_H - \pi_L}{1-q_L^e} + \lambda_H$$

Hence, $\lambda_H > 0$ as long as $q_L^e\pi_H < \pi_L$. But $q_L^1\pi_H < \pi_L$ so $\lambda_H > 0$ et $R_H = 0$. As $\lambda > 0$ then $\bar{R} = (e_H - e_L)/\nu(1-q_L^e)$. We remark that $\partial L/\partial i_L > \partial L/\partial i_H$ and we solve according to the value of ρ. Using the following notations $\Re_k = (1-\alpha).\frac{e_H - e_L}{\nu.(1-q_L^k)}$ with $k{=}0{,}1{,}e$, then:

-$i_H^\star = i_L^\star = 1$ if $\rho \leq \rho_a = \frac{\pi_L.\Delta q_L}{Prob(P_H)}.((1-\nu)\Delta V - \frac{\Re_1}{1-q_L^1})$

-$i_H^\star = \frac{1-q_L^e}{\pi_L.\Delta q_L} - \sqrt{\frac{(1-\alpha).(e_H-e_L)}{\nu\Delta q_L\pi_L(\Delta q_L\pi_L(1-\nu)\Delta V - Prob(P_H)\rho)}}$; $i_L^\star = 1$ if $\rho \in [\rho_a, \rho_b]$ with $\rho_b = \frac{\pi_L.\Delta q_L}{Prob(P_H)}.((1-\nu)\Delta V - \frac{\Re_e}{1-q_L^e})$

-$i_H^\star = 0$; $i_L^\star = 1$ if $\rho \in [\rho_b, \rho_c]$ with $\rho_c = \frac{(1-\pi_L).\Delta q_L}{Prob(P_L)}.((1-\nu)\Delta V - \frac{\Re_e}{1-q_L^e})$

-$i_H^\star = 0$; $i_L^\star = \frac{1-q_L^0}{(1-\pi_L).\Delta q_L} - \sqrt{\frac{(1-\alpha).(e_H-e_L)}{\nu\Delta q_L(1-\pi_L)(\Delta q_L(1-\pi_L)(1-\nu)\Delta V - Prob(P_L)\rho)}}$ if $\rho \in [\rho_c, \rho_d]$ $\rho_d = \frac{(1-\pi_L).\Delta q_L}{Prob(P_L)}.((1-\nu)\Delta V - \frac{\Re_0}{1-q_L^0})$

-$i_H^\star = 0$; $i_L^\star = 0$ if $\rho \geq \rho_d$

I assume that the value of the parameters are such that there exists at least an interval where intervention is desirable:

$$(\nu+(1-\nu)q_L^1)(\Delta V-\Re_1) > (\nu+(1-\nu)q_L^e)(\Delta V-\Re_e) > (\nu+(1-\nu)q_L^0)(\Delta V-\Re_0)$$

Appendix 2: proof of proposition 3.

There are 3 programs to solve, corresponding to the three cases listed in the text. Considering $\underline{R}$ and $\Delta R = \bar{R} - \underline{R}$ as the two variables, it is straightforward to get the solutions: the welfare function is a decreasing function of both variables and the constraints simply stipulate a minimum level for ΔR. According to the value of ρ, one particular constraint binds. I simply give the different solutions.

Case A: A solution exists only if $\rho \leq \rho_0 = \Delta q_L Prob(L\backslash P_H)(\Delta V - \Re_1)$. Then $\bar{R} = (e_H - e_L)/\nu(1-q_L^1)$, $\underline{R} = 0$ and :

$$W = (\nu + (1-\nu)q_L^1)(\Delta V - \Re_1) + \underline{V} - I - \alpha e_H - \rho$$

Case B: For ρ between ρ_0 and $\rho_1 = \Delta q_L Prob(L\backslash P_H)(\Delta V - \Re_e)$, the incentive constraint "no intervention if P_H" is binding: $\bar{R} = \frac{\Delta V}{1-\alpha} - \frac{\rho}{(1-\alpha)\Delta q_L Prob(L\backslash P_H)}$

The welfare function is:

$$W = (\frac{\nu+(1-\nu)q_L^0+(1-\nu)\Delta q_L Prob(P_L\backslash L)(1-\frac{Prob(L\backslash P_H)}{Prob(L\backslash P_L)}}{\Delta q_L Prob(L\backslash P_H})).\rho + \underline{V} - I - \alpha e_H.$$

Then, for $\rho \geq \rho_1$ and lower than $\rho_2 = \Delta q_L Prob(L\backslash P_L)(\Delta V - \Re_e)$, the incentive constraint of the firm is binding and $\bar{R} = \frac{e_H - e_L}{\nu(1-q_L^e)}$.

$$W = (\nu + (1-\nu)q_L^e)(\Delta V - \Re_e) + \underline{V} - I - \alpha e_H - Prob(P_L).\rho.$$

Case C: For $\rho \geq \rho_2$ and lower than $\rho_3 = \Delta q_L Prob(L\backslash P_L)(\Delta V - \Re_0)$, the constraint "no intervention if P_L" is binding, $\bar{R} = \frac{\Delta V}{1-\alpha} - \frac{\rho}{(1-\alpha)\Delta q_L Prob(L\backslash P_L)}$ and:

$W = (\frac{\nu+(1-\nu)q_L^0}{\Delta q_L Prob(L\backslash P_L)}).\rho + \underline{V} - I - \alpha e_H$.

Last, for high value of ρ, the regulator does not intervene and $\bar{R} = \frac{e_H - e_L}{\nu(1-q_L^0)}$,

$W = (\nu + (1-\nu)q_L^0)(\Delta V - \Re_0) + \underline{V} - L - \alpha e_H$.

Appendix 3: proof of proposition 5.

There are two programs to solve according to the constraint (17). First, I consider the case where stock prices are informative, i.e. (17) satisfied. There are three subprograms according to the intervention of the regulator. I start with Case C, i.e. when the regulator does not intervene even though $P = P_b$.

$$\begin{aligned}\max_{\bar{R}\underline{R},\bar{R}_I,\underline{R}_I} \quad & Prob(P_a).\Big[Prob(H\backslash P_a).\big(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I\big) + Prob(L\backslash P_a). \\ & \Big(q_L^0.(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I) + (1-q_L^0)(\underline{V} - (1-\alpha)\underline{R} - \underline{R}_I)\Big)\Big] \\ & + \; Prob(P_b).\Big[Prob(H\backslash P_b).\big(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I\big) + Prob(L\backslash P_b). \\ & \Big(q_L^0.(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I) + (1-q_L^0)(\underline{V} - (1-\alpha)\underline{R} - \underline{R}_I)\Big)\Big] - \alpha e_H\end{aligned}$$

s.t.:

$$IC_f : \quad \bar{R} - \underline{R} \geq \frac{e_H - e_L}{\nu(1-q_L^0)}$$

$$\begin{aligned}IC_R : Prob(L\backslash P_b).(q_L^1(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I) + (1-q_L^1)(\underline{V} - (1-\alpha)\underline{R} - \underline{R}_I)) - \rho \leq \\ Prob(L\backslash P_b).(q_L^0(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I) + (1-q_L^0)(\underline{V} - (1-\alpha)\underline{R} - \underline{R}_I))\end{aligned}$$

$$IC_I : \bar{R}_I - \underline{R}_I \geq \frac{c}{\nu Prob(L\backslash a)(1-q_L^0) + (1-\nu)Prob(H\backslash b)(1-q_L^0)}$$

$$IR_I : (\nu + (1-\nu)q_L^0)\bar{R}_I + (1-\nu)(1-q_L^0)\underline{R}_I \geq I$$

If IC_R is not binding, then $\bar{R} = (e_H - e_L)/\nu(1-q_L^0)$ and $\underline{R} = 0$. The IR_I constraint is binding and $\underline{R}_b^* \in [0, y]$ with $y = min\{I - (\nu + (1-\nu)q_L^0)\mathcal{R}_0; I - (\nu + (1-\nu)q_L^0)(\Delta V - \Re_0 - \frac{\rho}{Prob(L\backslash b)\Delta q_L})\}$. $\mathcal{R}_0 = c/(\nu Prob(L\backslash a)(1-q_L^0) + (1-$

$\nu)Prob(H\backslash b)(1-q_L^0)$. I assume that c is small to ensure that $\frac{I}{\nu+(1-\nu)q_L^0} \geq \mathcal{R}_0$. When $\rho \geq \rho_3'' = \Delta q_L Prob(L\backslash b)(\Delta V - \Re_0 - \frac{I}{\nu+(1-\nu)q_L^0})$, IC_R is not binding and:

$W_0^I(\rho) = \underline{V} - I - \alpha e_H - +(\nu + (1-\nu)q_L^0)(\Delta V - \Re_0)$

Assume now IC_R is binding: $(1-\alpha)(\bar{R} - \underline{R}) + (\bar{R}_I - \underline{R}_I) = \Delta V - \frac{\rho}{Prob(L\backslash b)\Delta q_L}$, we can rewrite the program:

$$\max_{\bar{R}_I, \underline{R}_I} (\nu + (1-\nu)q_L^0) . \frac{\rho}{Prob(L\backslash b)\Delta q_L} + \underline{V} - \alpha e_H - (1-\alpha)\underline{R} - \underline{R}_I$$

s.t.:

$$(\nu + (1-\nu)q_L^0)\bar{R}_I + (1-\nu)(1-q_L^0)\underline{R}_I \ \geq \ I$$

$$\bar{R}_I - \underline{R}_I \geq \mathcal{R}_0$$

$$\bar{R}_I - \underline{R}_I \leq \Delta V - \Re_0 - \frac{\rho}{Prob(L\backslash b)\Delta q_L}$$

There exists a solution for $\rho \leq \rho_4'' = Prob(L\backslash b)\Delta q_L(\Delta V - \Re_0 - \mathcal{R}_0)$ and $\underline{R}_I^* = max\{0; I - (\nu + (1-\nu)q_L^0)(\Delta V - \Re_0 - \frac{\rho}{\Delta q_L Prob(L\backslash b)}\}$. Remark that for $\rho \in [\rho_3'', \rho_4'']$ we obtain the previous solution and in that case, the welfare is the same. Now, for $\rho \leq \rho_3''$:

$W_0^{I'}(\rho) = (\nu + (1-\nu)q_L^0) . \frac{\rho}{Prob(L\backslash b)\Delta q_L} + \underline{V} - \alpha e_H$

The two other case are solved in the same way. The solutions are:

- Case A: intervention even if $P = P_a$.

We need $\rho \leq \rho_0'' = Prob(L\backslash a)\Delta q_L(\Delta V - \Re_1 - \mathcal{R}_1)$, and then $\underline{R}_b^* \in [x, I - (\nu + (1-\nu)q_L^1\mathcal{R}_1]$, assuming $I > (\nu + (1-\nu)q_L^1)\mathcal{R}_1$. $x = max\{0; I - (\nu + (1-\nu)q_L^1)(\Delta V - \Re_1 - \frac{\rho}{Prob(L\backslash a)\Delta q_L})\}$. $\bar{R}_b^*$ is such that IR_I is binding.

$W_1^I(\rho) = \underline{V} - I - \alpha e_H - \rho + (\nu + (1-\nu)q_L^1)(\Delta V - \Re_1)$

- Case B: Intervention only if P_b:

For $\rho \in [\rho_1'', \rho_2'']$ with $\rho_1'' = \Delta q_L Prob(L\backslash a)(\Delta V - \Re_e - \frac{I}{\nu+(1-\nu)q_L^e})$, $\rho \leq \rho_2'' = \Delta q_L Prob(L\backslash b)(\Delta V - \Re_e - \mathcal{R}_e)$. IC_R is not binding. $\underline{R}_b^* \in [y, I - (\nu + (1-\nu)q_L^e)\mathcal{R}_e]$ with $y = max\{0; I - (\nu + (1-\nu)q_L^e)(\Delta V - \Re_e - \frac{\rho}{Prob(L\backslash b)\Delta q_L})\}$. We have: $I > (\nu + (1-\nu)q_L^e)\mathcal{R}_e$. The welfare function is:

$W_e^I(\rho) = \underline{V} - I - \alpha e_H - Prob(P_b)\rho + (\nu + (1-\nu)q_L^e)(\Delta V - \Re_e)$

For $\rho \leq \rho_1''$ the incentive constraint of the regulator is binding. $\underline{R}_I^* = 0$ and $\bar{R}_I^*$ is such that IR_I is binding. Then,

$W_e^{I'}(\rho) = (\frac{(\nu+(1-\nu)q_L^e)}{Prob(L\backslash a)\Delta q_L} - Prob(P_b)).\rho + \underline{V} - \alpha e_H$

• I assume that c is sufficiently small to ensure that $\rho_0'' < \rho_1''$ (i.e. $\Re_1 + \mathcal{R}_1 > \Re_e + \frac{I}{\nu+(1-\nu)q_L^e}$) and $\rho_2'' < \rho_3''$ ($\Re_e + \mathcal{R}_e > \Re_0 + \frac{I}{\nu+(1-\nu)q_L^0}$). Then, there exists $\rho_a' = Prob(L\backslash a)\Delta q_L(\Delta V - \Re_1 - \frac{I}{\nu+(1-\nu)q_L^1})$ and $\rho_b' = Prob(L\backslash b)\Delta q_L(\Delta V - \Re_e - \frac{I}{\nu+(1-\nu)q_L^e})$ such that:

-If $\rho \leq \rho_a'$: the regulator always intervenes and $W = W_1^I(\rho)$

-If $\rho \in [\rho_a', \rho_b']$: the regulator intervenes only if $p = P_b$ and: $W = W_e^{I'}(\rho)$ if $\rho \in [\rho_a', \rho_1'']$; $W = W_e^I(\rho)$ if $\rho \in [\rho_1'', \rho_b']$

-If $\rho \geq \rho_b'$: the regulator never intervenes and $W = W_0^{I'}(\rho)$ for $\rho \in [\rho_b', \rho_3'']$ and $W = W_0^I(\rho)$ for $\rho \geq \rho_3''$

The same type of program has to be solved in the case where prices are non informative. But now there are only two subprograms whether the regulator intervenes or not. I sketch the non intervention case:

$$\max_{\bar{R},\underline{R},\bar{R}_I,\underline{R}_I} \Big[\nu.\big(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I\big) + (1-\nu).\big(q_L^0.(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I) + (1-q_L^0)(\underline{V} - (1-\alpha)\underline{R} - \underline{R}_I)\big)\Big] - \alpha e_H$$

s.t.:

$$IC_f : \quad \bar{R} - \underline{R} \geq \frac{e_H - e_L}{\nu(1-q_L^0)}$$

$$IC_I : \bar{R}_I - \underline{R}_I \leq \frac{c}{\nu Prob(L\backslash a)(1-q_L(i_a)) + (1-\nu)Prob(H\backslash b)(1-q_L(i_b))}$$

$$IR_I : (\nu + (1-\nu)q_L^0)\bar{R}_I + (1-\nu)(1-q_L^0)\underline{R}_I \geq I$$

$$IC_R : (1-\nu).(q_L^1(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I) + (1-q_L^1)(\underline{V} - (1-\alpha)\underline{R} - \underline{R}_I)) - \rho \leq (1-\nu).(q_L^0(\bar{V} - (1-\alpha)\bar{R} - \bar{R}_I) + (1-q_L^0)(\underline{V} - (1-\alpha)\underline{R} - \underline{R}_I))$$

The right hand side of IC_I depends on the optimal i's when the regulator solves the informative program. Using the previous solutions, the corresponding values for $\mathcal{R}_\rho$ are computed. Assume first that:

$\rho \geq \rho_1' = (1-\nu)\Delta q_L(\Delta V - \Re_0 - \mathcal{R}_\rho)$. According to ρ, there are two sub intervals corresponding to the range where the regulator would intervene if $P = P_b$ (implying $\mathcal{R}_\rho = \mathcal{R}_e$) and where she would never intervene ($\mathcal{R}_\rho = \mathcal{R}_0 \leq \mathcal{R}_e$). IC_R is not binding and: $\bar{R} = (e_H - e_L)/\nu(1 - q_L^0)$ and $\underline{R} = 0$. The problem relative to $(\bar{R}_I, \underline{R}_I)$ is:

$$\max_{\bar{R}_I, \underline{R}_I} (\nu+(1-\nu)q_L^0).(\Delta V - \Re_0) - ((\nu+(1-\nu)q_L^0)\bar{R}_I + (1-\nu)(1-q_L^0)\underline{R}_I) + \underline{V} - \alpha e_H$$

s.t:

$$(\nu + (1-\nu)q_L^0)\bar{R}_I + (1-\nu)(1-q_L^0)\underline{R}_I \geq I$$
$$\bar{R}_I - \underline{R}_I \leq \mathcal{R}_\rho$$
$$\bar{R}_I \geq \underline{R}_I + \Delta V - \frac{\rho}{(1-\nu)\Delta q_L} - \Re_0$$

Then, $\underline{R}_I^* \in [I - (\nu+(1-\nu)q_L^0)\mathcal{R}_\rho, y]$ with $y = min\{I; I - (\nu+(1-\nu)q_L^0)(\Delta V - \Re_0 - \frac{\rho}{(1-\nu)\Delta q_L})\}$. For $\rho \geq \rho_1'$, $y \geq I - (\nu + (1-\nu)q_L^0)\mathcal{R}_\rho$ and there exists such a solution. $W_0(\rho) = \underline{V} - I - \alpha e_H - \rho + (\nu + (1-\nu)q_L^0)(\Delta V - \Re_0)$

If $\rho \leq \rho_1'$ then IC_R is binding. Rewriting the program, we get:

$$\max_{\bar{R}_I, \underline{R}_I} (\nu + (1-\nu)q_L^0).\frac{\rho}{(1-\nu)\Delta q_L} + \underline{V} - \alpha e_H - (1-\alpha)\underline{R} - \underline{R}_I$$

s.t:

$$(\nu + (1-\nu)q_L^0)\bar{R}_I + (1-\nu)(1-q_L^0)\underline{R}_I \geq I$$
$$\bar{R}_I - \underline{R}_I \leq \mathcal{R}_\rho$$
$$\bar{R}_I - \underline{R}_I \leq \Delta V - \Re_0 - \frac{\rho}{(1-\nu)\Delta q_L}$$

Then, $\underline{R}_b^* = I - (\nu + (1-\nu)q_L^0)\mathcal{R}_\rho$ and $\bar{R}_I^* = I + (1-\nu)(1-q_L^0)\mathcal{R}_\rho$. As a result: $W_0'(\rho) = (\nu + (1-\nu)q_L^0).\frac{\rho}{(1-\nu)\Delta q_L} + \underline{V} - \alpha e_H - I + (\nu + (1-\nu)q_L^0)\mathcal{R}_\rho$

I assume that c is sufficiently small to ensure that $\Re_1 > \Re_0 + \mathcal{R}_\rho \ \forall \rho$. There is $\rho_a = (1-\nu)\Delta q_L(\Delta V - \Re_1 - \frac{\nu+(1-\nu)q_L^0}{\nu+(1-\nu)q_L^1}\mathcal{R}_e)$ such that: $\forall \rho \leq \rho_a$, the regulator always intervene and $W = W_1(\rho)$; $\forall \rho \geq \rho_a$, there is no intervention and $W = W_0'(\rho)$ if $\rho \in [\rho_a, \rho_1']$ and then $W = W_0(\rho)$ if $\rho \geq \rho_1'$.

The last step is to compare the welfare functions in both cases. For extreme values of ρ, the welfare is the same. As $\rho_a > \rho_a'$, there exists a range of value where an informative security yields a higher welfare. Conversely, if $\frac{(1-\nu)}{Prob(L\backslash b)} \leq \frac{\Delta V - \Re_0 - \frac{I}{\nu+(1-\nu)q_L^0}}{\Delta V - \Re_0 - \mathcal{R}_0}$ there exists ρ^* such that for ρ higher than this threshold value, an uninformative security is preferred.

References

Aghion, P. and J. Tirole, 1994, "Formal and Real Authority in Organizations." *Mimeo IDEI.*

Allen, F., 1993, "Stock Markets and Resource Allocation." in *Capital Markets and Financial Intermediation*, C. Mayer and X. Vives eds. Cambridge University Press.

Baron, D. and R. Myerson, 1982, "Regulating a Monopolist with Unknown Costs." *Econometrica,* 50, 911-930.

Bhattacharya, S. and G. Chiesa, 1995, "Proprietary Information, Financial Intermediation and Research Incentives." *Journal of Financial Intermediation,* 4, 328-57.

Boot, A. and A. Thakor, 1993, "Security Design." *Journal of Finance,* 48, 1349-78.

Burkart, M., D. Gromb and F. Panunzi, 1995, "Large shareholders, Monitoring and the Value of the Firm." *WP 220 Financial Markets Group.*

Crémer, J., 1995, "Arm's length relationships." *Quaterly Journal of Economics* CX, 275-296.

Crémer, J., 1995, "A Theory of Vertical Integration Based on Monitoring Costs." *mimeo GREMAQ, Université de Toulouse.*

Dewatripont, M. and E. Maskin, 1995, "Credit and Efficiency in Centralized and Decentralized Economies." *Review of Economic Studies.*

Glosten, L and P. Milgrom, 1985, "Bid, Ask, and Transaction Prices in a Specialist Market with Heterogenously Informed Traders." *Journal of Financial Economics,* 14, 71-100.

Grossman, S., 1989, *The Informational Role of Prices.* The MIT Press.

Holmström, B. and J. Tirole, 1993, "Market Liquidity and Performance Monitoring." *Journal of Political Economy,* 101,4, 678-709.

Kornai, J., 1979, "Resource-constrained versus Demand-constrained Systems." *Econometrica,* 47, 801-819.

Kyle, A., 1985, "Continuous Auctions and Insider Trading." *Econometrica,* 53, 1315-35.

Laffont, J.J. and J. Tirole, 1993, *A Theory of Incentives in Procurement and Regulation.* Chapter 11. The MIT Press.

Lewis, T. and D. Sappington, 1994, "Optimal Capital Structure in Agency Relationships." *mimeo, University of Florida.*

Maskin, E., 1996, " Theories of the Soft Budget Constraint." *Japan and the World Economy,* 8, 125-133.

Perotti, E, 1995, "Credible Privatization." *American Economic Review,* 85(4), 847-859

Phillips, C., 1988, *The Regulation of Public Utilities. Theory and Practice.* Public Utilities Reports, Inc.

Sappington, D. and J. Stiglitz, 1987, "Privatisation, Information and Incentives." *Journal of Policy Analysis and Management,* 6, 567-82.

Schapiro, C. and R. Willig, 1990, "Economic Rationales for the Scope of Privatisation." *The Political Economy of Public Sector Reform and Privatisation.* Suleiman and Waterbury eds., Westview Press.

Segal, I., 1993, "Monopoly and Soft Budget Constraint." *mimeo, University of California at Berkeley.*

Schmidt, K., 1996, "The Costs and Benefits of Privatisation: an Incomplete Contract Approach." *Journal of Law, Economics, & Organization.*, April, 1-24.

Spiegel, Y. and D. Spulber, 1994, "The Capital Structure of a Regulated Firm." *Rand Journal of Economics,* 25, 424-450.