Political renegotiation of regulatory contracts*

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This version: March 2004
First version: November 2000

Abstract

Governmental contracts may be renegotiated after political changes. Current governments can anticipate this and strategically distort contracts to influence renegotiation outcomes. In this sequential common agency game, the initial contract impacts elements of the renegotiation process: outside options (a 'leverage' effect), and the beliefs of the new government through partial information revelation (a 'strategic' effect). We characterize the optimal initial contract, as a function of political stability, time preference, and profits appropriation by the initial government. It always entails either full separation or strategic, partial, information revelation. Last, institutional rules imposing immediate payments to the firm help limit output distortions.

JEL Codes: D82, L51, D73.

Keywords: Renegotiation, Political uncertainty, Regulation.

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*Jean-Jacques Laffont passed away on May, 1^{st}, 2004. We thank Marcel Boyer, Bernard Caillaud, David Martimort, Patrick Rey, as well as seminar participants in Cambridge, Cergy-Pontoise, Nuffield College, Oxford, at the University of Indiana, Bloomington, the CEPR 2001 Industrial Organization Workshop in London, the 2001 EEA-ESEM Congresses in Lausanne and the 2002 summer meeting of the Econometric Society in Los Angeles (UCLA).

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1 Introduction

Governments —and other heads of organizations as well— use their current power to influence future outcomes, and in particular to influence the actions taken by their successors. A way of doing so arises when the current head has the ability, as is often the case, of tying future heads by signing long-lasting contracts. The issue of strategic behavior has been studied with respect to budget deficits, but contracts, ranging from water concessions to civil servant status, can also be used strategically. This paper analyzes the mechanism through which a government can affect future contracting by distorting regulatory requirements to take into account possible political changes, and subsequent contract renegotiation. More precisely, the focus is on how a current government will modify long-term regulatory contracts according to its probability of remaining in power in the next period, and to the divergence in objectives with its potential successor.

We consider regulation under incomplete information of a firm in charge of producing a specific good (or a bureaucracy in charge of providing a specific service). The government[1] may be replaced before the end of the regulatory period, by a new one that will attach a different relative weight to the firm's profits (one type of government is constituted of members who appropriate a larger share of profits than for the other type, even when not in power). Moreover the contract binds all future governments, but the current government can commit only itself not to renegotiate. A newly elected government will have the ability to renegotiate with the firm. When the length of a regulatory contract is greater than that of the political mandate of the

[1]The term 'government' will be used throughout the text, but the modeling primarily applies to a department of the government, or to the members of a regulatory agency who lose their position in case of political change —as when legal dispositions do not impose strict conditions on the removal of head officers. In the remaining of the paper, we will refer to the agent of the government as a 'firm'. It can be any agent whose mandate is invariant to political changes, such as an independent agency.

regulator, as for concessions for instance, the initial contract constrains the future government by defining status quo utility levels in the renegotiation process. In addition —and that is true for short term contracts as well— the degree of information revelation in the first period affects the beliefs of the potential new government in the renegotiation.

More precisely, the model we use is as follows: An initial government offers a binding long-term contract to a firm, for production of some good over two periods. The firm is privately informed on its cost of production. A political change happens with some probability at the end of the first period, in which case the contract can be renegotiated as regards the second period. The initial government commits not to renegotiate the contract if it remains in power. Moreover, it appropriates a larger share of the firm's profits, whether in power or not, than the other type of government, that can come in power in the second period. One can think of the initial government as a 'right-wing' government, with a constituency comprising more capital owners. But other interpretations are possible, depending on the type of 'firm' considered. In our framework, the initial government would always prefer larger rents than the other type of government, if they had the same beliefs as to the efficiency of the firm.

The features of the model relate to imperfect commitment as well as to sequential common agency under asymmetric information. We identify two major effects leading to contract modifications with respect to the situation of perfect commitment.

First, the initial government will delay the payment of the rent to the second period (and will therefore not pay it if not reelected), thereby 'free riding' on the cost of producing a higher quantity and leaving higher rents. The fact that government members can appropriate a part of this rent even when not in power reinforces this effect, and the contract may be distorted to increase renegotiated rents in case of political change. This is done by increasing *status quo* levels in the initial contract. Such increases are costly to the initial government, but not as much as if it had to pay for them with certainty. The specifications of the initial contract that bear on the second period play a 'leverage' effect, and mechanically increase the rents that have to be left in a renegotiation. The effect is complicated by the fact that, when reservation utility levels increase, the binding constraints in the renegotiation program change as well. The impact of an increase in second-period reservation utilities is not differentiable, as a consequence. Distortions arising from this leverage effect can be limited by imposing a constitutional restraints on the ability of governments to delay payments to the firm.

Second, the degree of information revelation in the first period can be strategically determined so as to change the *beliefs* of the new government, and thus the rent-efficiency trade-off it faces when renegotiating contracts. By choosing a semi-separating contract in which the probability of revelation of the firm's efficiency is more or less close to one, the initial government determines the extent to which the new government will be informed in case of political change. The 'strategic' effect of the initial contract consists in inducing beliefs such that the potential new government requires a high output level in the renegotiation, higher even than the output the initial government would be willing to pay for! Despite the intrinsically greater preference for leaving rents of the initial government, the difference in beliefs on the firm's efficiency can induce the new government to leave more rents than the initial one would have done. This happens when the contract is close to a separating one. A crucial parameter determining the size of the two effects is the degree of political stability.[2]

[2]Holburn and van den Bergh (2000) show for the United States that, in the period 1970-1990, political coalitions led by Democrats were more likely to create statutory consumer advocacy institutions when they were less likely to remain in power at the next election. This empirical finding corroborates the idea that governments try to affect regulatory contracts or structures (here by modifying the rules that determine which interest group participates in regulatory hearings), so as to constrain their successors when they are less certain of remaining in power.

Relevant literature

Commitment and renegotiation under asymmetric information It is a well-known result that the optimal dynamic contract with perfect commitment, say in a two-period repeated relationship, consists in the repetition of the optimal static contract (Baron and Besanko, 1984). When renegotiation is possible, the two parties cannot commit to second period inefficiencies that would mitigate the costs of asymmetric information. The 'ratchet effect' then arises (Freixas, Guesnerie and Tirole, 1985). Not having information revealed in period 1 becomes an indirect way to commit. The case we study here is a hybrid one in which renegotiation occurs with a given probability. It presents similarities with the case of renegotiation by the same principal, fully characterized in Laffont and Tirole (1990). New features come from the fact that the information rent is not fully paid by the principal who designs the initial contract, and more fundamentally from the divergence of objectives between the two principals. Bester and Strausz (2001) show that a slightly extended version of the Revelation Principle holds in situations of imperfect commitment: There is no restriction for the principal to use only direct contracts even though she cannot perfectly commit to her second-period actions; an agent who is indifferent between several outcomes chooses truthful revelation with a strictly positive probability, but not necessarily with probability one, contrary to the situation of perfect commitment. This result has been extended by Kartasheva (2004) to a situation in which the second-period principal differs from the first-period one, as in our paper.

Sequential common agency Calzolari and Pavan (2002) consider sequential contracting by an agent with two different principals. They show how the principal who is the Stackelberg leader of the game, influences the contract offer by the following principal, through the utility that the agent gets out of the first contract. They consider secret contracts (the ratchet effect is thus not an issue) and pure strategies only. Governmental contracts are more likely to be public, hence the approach we adopt.

Strategic policies That governments try to influence future outcomes has been well recognized in the literature on the political economy of budget deficits. In this literature, debt is a way of constraining future governments with different preferences. Aghion and Bolton (1990) show that a left-wing party will tend to accumulate debt so as to be able to redistribute more. In Tabellini and Alesina (1990), the median voter tries to constrain future redistributive policies (decided by a future median voter who may have different preferences) through his voting on the composition of public spending. The authors show that larger deficits arise when heterogeneity is larger (there is more polarization). Last, Lizzeri (1999) shows that budget deficits can be used to alter the chances of remaining in power, even if voters have ex ante identical preferences.

Contrary to this strand of literature, we take the probability of remaining in power as exogenous[3]. We indeed believe that regulatory issues are not salient ones in the electoral process and consider a political regulatory agency that is given incentives to maximize social welfare when in power, but is helpless in affecting electoral outcomes.[4]

Last, by committing future governments, the current one can in our model make changes, or reforms, very difficult to implement by its successors. The paper therefore relates, although loosely, to the literature on regulatory persistence (see Coate and Morris, 1999, and Faure-Grimaud and Martimort, 2003, for more specific approaches).

The remainder of the paper is organized as follows. Section 2 describes the model and char-

[3]We could endogenize this probability along the lines of Boyer and Laffont (1999).

[4]Since the probability of remaining in power is exogenous, the model can be extended to non purely democratic economies, but only to the extent that the following assumption holds: Governments must care enough for reputation, to be able to commit to future regulatory policies, and also for new Governments to be willing to respect those commitments when renegotiating.

acterizes the optimal static contract. Useful results and benchmarks are given in Section 3. Section 4 solves the renegotiation game that potentially occurs in the second period, and shows how the initial contract affects the outcome of this game. Section 5 characterizes the equilibrium initial contract as a function of the degree of information revelation. An implication for institutional restraints is given. Section 6 endogenizes the equilibrium probability of revelation, to analyze strategic distortions. Section 7 concludes. All the proofs are gathered in the appendix.

2 The model

We consider the production of a valuable good or service for two periods. The good is produced by a regulated firm and bought by the Government[5]. The firm and the Government have the same discount factor ϱ between the two periods.

2.1 The firm

The firm has private information about its constant marginal cost of production θ, that remains identical over the two periods. It is common knowledge that this cost is drawn from $\{\underline{\theta}, \overline{\theta}\}$, with probabilities $\{\nu, 1-\nu\}$. We denote $\Delta\theta \equiv \overline{\theta} - \underline{\theta} > 0$. And we will underline notations relating to an efficient firm (that has a low cost $\underline{\theta}$), and overline those relating to an inefficient firm (with cost $\overline{\theta}$).

The Government offers a regulatory contract specifying quantities to be produced and transfers to be received by the firm for the two periods. Let us denote q_i the quantity of good produced and T_i the transfer paid by the Government in exchange for the good in each period $i = 1, 2$. The transfer T_i reimburses the actual costs incurred, θq_i, and gives a rent (net

[5]The analysis would be globally unchanged if the good was sold on a market and sales revenues used to pay taxes to the Government. The transfers we refer to would have to be replaced by sales revenues minus taxes.

profit), denoted $U_i(\theta)$, in addition. The discounted expected value of the rents will be denoted $U(\theta) \equiv U_1(\theta) + \varrho \mathbf{E} U_2(\theta)$, with

$$U(\theta) = T_1 - \theta q_1 + \varrho \mathbf{E}(T_2 - \theta q_2).$$

Assumption 1 (Observability) *Both the contract offered by the initial government and the choice of the firm within this contract are observed by all players in the economy, and are therefore known to the new Government in case of political change.*

We assume that the project can only be started in the first period, and cannot be delayed to the second one. The reservation utility of the firm can therefore be normalized to zero.[6] The individual rationality constraint for an efficient firm, $\underline{IR}$, writes: $\underline{U} \geq 0$; similarly, that for an inefficient firm, $\overline{IR}$, states: $\overline{U} \geq 0$. The firm is in addition protected by 'limited liability' constraints for each period, denoted $\underline{LL}_i$ for an efficient firm and $\overline{LL}_i$ for an inefficient one, $i = 1, 2$. They state that costs must be covered in each period: $\underline{U}_i \geq 0 \quad (\underline{LL}_i)$ and $\overline{U}_i \geq 0 \quad (\overline{LL}_i)$, $i = 1, 2$. This assumption limits the extent to which the initial Government can behave strategically. Limited liability constraints will always be more stringent than participation constraints for this Government. If there were no such constraints, it would give negative rents in the first period and promise a very large rent in the second period, thereby condemning the new majority, in case of political change, to paying extremely large transfers. The limited liability constraints may be imposed by some constitutional rule, so as to limit the discretion of Governments.

[6]If the project could be delayed, when deciding whether to accept the contract offered in the first period, the firm would compare the expected utility promised by the initial Government to its expected utility when the project only begins in the second period. The reservation utility in the first period would then be type-dependent.

2.2 The political process

The Government has the mandate of designing a regulatory contract for the firm. We consider a random model in which there is an uncertainty on the identity of the ruling members in the second period (see Laffont, 1996, and Boyer and Laffont, 1999). We denote by p the probability that the initial Government remains in power at date 2. Probability p is considered as given, meaning that the regulation of the firm is not a salient issue and cannot significantly impact the decision to replace a Government[7].

The Government has the constitutional ability to commit to a long-term contract that lasts for two periods: If the Government changes at the end of the first period, the new one is bound by the agreements signed by its predecessor. The Government indeed acts as representative of the State, and since the State is permanent, it can commit to long-term actions (this implies that property rights are sufficiently protected and that the firm is not exposed to large regulatory risks).

On the other hand, the members of the Government may be able to commit themselves not to renegotiate agreements, but they cannot commit their successors not to renegotiate. The Constitution itself should indeed be designed so as to allow such renegotiations, for new majorities to be able to respond to changes in the preferences of the population.

The initial Government offers in the first period a long term regulatory contract that can be expressed in terms of rents and quantities: $\mathcal{C} = \{U_i(\underline{\theta}), q_i(\underline{\theta}), U_i(\overline{\theta}), q_i(\overline{\theta})\}_{\{i=1,2\}}$. The specifications for the second period can be renegotiated if a new Government is elected. In that case a renegotiated contract $\mathcal{C}^r = \{\underline{U}^r, \underline{q}^r, \overline{U}^r, \overline{q}^r)\}$ (with transfers $T^r(\theta)$) applies in the second period.

[7]Besley and Coate (2003) base their comparison of elected versus appointed regulators on the observation that regulatory issues are not salient in a general election. The best way to ensure that regulators are truly made responsible to the population is to have direct voting instead of a process of appointment of regulators.

2.3 The preferences of the Government

The social surplus for the population of production of a quantity q is given by $S(q)$ in each period, where $S(.)$ is a strictly concave function, $S'(q) > 0$, $S''(q) > 0$, $S'''(q) > 0$, and $S'(0) = +\infty$.

We assume that a government cares for the level of social welfare only if it is in power. This assumption is consistent with the view that political appointees must be given incentives by the Constitution to align their objectives with public interest. The possibility of being reelected can provide such incentives since political appointees must ensure that voters' welfare be high enough for them to be reelected. They may also appropriate a fraction of social welfare when in power, in which case they will maximize it. When they are no longer in power, their utility may not depend much on their own consumption of the regulated product, and the regulated activity may represent a relatively negligible part of the taxes they have to pay. In addition, our assumption means that government members are not 'intrinsically motivated' in the sense that they are not altruistic with respect to their constituency — their utility does not directly depend on the welfare of their electors. This assumption allows to solve a number of technical difficulties, by ensuring that former political appointees only care for the rents of the firm when they are not in power, not for the exact quantity of regulated activity provided.[8]

The constituency of a Government can be composed either of 'stake-holders', that share the firm's rent, or of 'non-stake-holders', that have no stake in the firm's profits. If the Government is composed of stake-holders, it will attach an additional positive weight α to the rent of the firm, $\alpha \in]0, 1]$. One can easily extend the model to the case in which both types of Government

[8]If government members continued to care for consumers surplus and for taxes when not in power, at least as far as their constituency is concerned, we would need to specify the size of this constituency (in terms of consumption and taxes) and more importantly, a particular surplus function for the regulated activity, $S(.)$. This would further extend the number of parameters to be taken into account and would make it quite difficult to obtain insights on the different effects at play.

appropriates a strictly positive fraction of the rent, but one type more than the other (α would then measure the difference in weights, and the weight for the 'non-stake-holder' Government would have to be substracted to the cost of public funds).

Let $\lambda > 0$ be the social cost of public funds.

Assumption 2 (Costly rents) *It is assumed that $(1+\lambda)p > \alpha$, so that a Government always prefers to minimize the rent it has to give up to the firm.*

The case of a Government composed of stake-holders is more interesting and more complex, since it has a direct stake in the second period contract even when not in power, contrary to the other type of Government. We will therefore exclusively focus in what follows on the case of an initial Government composed of stake-holders.

The utility of an initial Government (composed of stake-holders) for a given type θ and given contracts can be written as follows:

$$\begin{aligned} W(\theta) &\equiv [S(q_1(\theta)) - (1+\lambda)T_1(\theta) + \alpha(T_1(\theta) - \theta q_1(\theta))] \\ &+ p\varrho[S(q_2(\theta)) - (1+\lambda)T_2(\theta) + \alpha)(T_2(\theta) - \theta q_2(\theta)) + (1-p)\varrho\alpha(T^r(\theta) - \theta q^r(\theta)) \\ &= [S(q_1(\theta)) - (1+\lambda)\theta q_1(\theta) - (1+\lambda-\alpha)U_1(\theta)] \\ &+ p\varrho[S(q_2(\theta)) - (1+\lambda)\theta q_2(\theta) - (1+\lambda-\alpha)U_2(\theta)] + (1-p)\varrho\alpha U^r(\theta). \end{aligned}$$

The Government indeed benefits from social surplus as long as it is in power. If it is not reelected in the second period (with probability $1-p$), it will benefit from the rent obtained by the firm in its relationship with the new Government (the renegotiated rent U^r).

2.4 The timing

The timing of the game is the following:

1. Nature draws the type of the firm, θ, in $\{\underline{\theta}, \overline{\theta}\}$. It is private information of the firm.

2. The initial Government offers the firm a regulatory contract $\mathcal{C}$ that binds the State for the two periods, and commits not to renegotiate it.

3. If the firm refuses the contract, the game ends. If it accepts it, the quantity it produces and the transfer it receives are observed by all players in the economy.

4. At the end of the first period, the uncertainty relative to the political process is realized: With probability p, the initial Government remains in power. It is otherwise replaced by a new one with different preferences (non stake-holder).

5. If the initial Government remains in power, production and transfers take place as specified by the contract. If a new Government has replaced the initial one, then:

   5.1 The new Government offers a renegotiated contract $\mathcal{C}^r$ to the firm;

   5.2 The firm either accepts or refuses the renegotiated contract. If it refuses, the initial contract applies.

3 Some benchmarks

Complete information Let us first note that under complete information and in a static context, both types of Government would choose the same[9] quantities, $\underline{q}^*$ for an efficient firm, and $\overline{q}^*$ for an inefficient one, defined by:

$$\begin{aligned} S'(\underline{q}^*) &= (1+\lambda)\underline{\theta} \\ S'(\overline{q}^*) &= (1+\lambda)\overline{\theta} \end{aligned}$$

[9]The only difference between the two types of Government comes from the way in which they trade off rent extraction and efficiency. Under complete information, there is no such trade-off.

With two periods, perfect commitment, and complete information, the optimal contract would be the repetition of the optimal static contract, with the quantities defined above.

Perfect commitment is here defined as the possibility for the initial Government to commit not only itself, but also new majorities, to the contract signed in the first period, renegotiation being impossible whatever the political outcome at the end of the first period.

Perfect commitment and asymmetric information Under asymmetric information and perfect commitment, the equilibrium contract is obtained from the Revelation Principle: There is no loss of generality in restricting the initial Government to use direct and truthful contracts. The current majority maximizes its objective function subject to participation, limited liability, and incentive compatibility constraints.

The incentive compatibility constraints state that the firm indeed prefers to reveal its true type rather than misreport: $\underline{U} \geq \overline{U} + \Delta\theta(\overline{q}_1 + \varrho\overline{q}_2)$ for a low-cost firm (constraint $\underline{IC}$) and $\overline{U} \geq \underline{U} - \Delta\theta(\underline{q}_1 + \varrho\underline{q}_2)$ for a high-cost one (constraint $\overline{IC}$). As usual, the incentive compatibility constraint of an efficient firm, $\underline{IC}$, is binding in equilibrium together with the limited liability constraint of the inefficient firm (more stringent than the participation constraint).

In addition, one can easily see that the Government will delay paying the rent as much as possible. It must give the firm a non-negative rent in each period. Since the cost of the rent paid in the second period is borne by the initial Government with probability p only, it always prefers to delay its payment to the second period: $\underline{U}_1 = 0$ and $\underline{U}_2 = \frac{\underline{U}}{\varrho}$. The cost of the rent is therefore decreased, from the point of view of the Government, by the possibility of not remaining in power.

With perfect commitment, the initial Government offers the contract defined below, that we will call the 'commitment contract'.

Lemma 1 *The commitment contract entails the following rents and quantities:*

$$\underline{U} = \Delta\theta(\overline{q}_1^c(\nu) + \varrho\overline{q}_2^c(\nu)) \qquad \overline{U} = 0$$

$$S'(\underline{q}_1^c) = S'(\underline{q}_2^c) = (1+\lambda)\underline{\theta} \quad \Rightarrow \underline{q}_1^c = \underline{q}_2^c = \underline{q}^*$$

$$S'(\overline{q}_1^c(\nu)) = (1+\lambda)\overline{\theta} + \frac{\nu}{1-\nu}[(1+\lambda)p - \alpha]\Delta\theta \quad \Rightarrow \overline{q}_1^c(\nu) < \overline{q}^*$$

$$S'(\overline{q}_2^c(\nu)) = (1+\lambda)\overline{\theta} + \frac{1}{p}\frac{\nu}{1-\nu}[(1+\lambda)p - \alpha]\Delta\theta \quad \Rightarrow \overline{q}_2^c(\nu) < \overline{q}^*.$$

The rent is paid in the second period only.

The quantities produced by a low-cost firm are not distorted ('no distortion at the top' result) since they only affect the incentive constraint of an inefficient firm, $\overline{IC}$, that is not binding. The quantities for a high-cost firm, on the other hand, are downward distorted in order to lessen the information rent of a low-cost firm. Moreover, since the initial Government does not derive any utility from the surplus generated by production when it is not in power, the relative cost of the rent, compared to the benefit of production, is lower in the first period than in the second; the Government therefore imposes a larger distortion on the second-period quantity for a high-cost firm than on the first-period one: $\overline{q}_2^c(\nu) < \overline{q}_1^c(\nu)$.

Because the payment of rents is delayed to period 2, it is as if all rents were paid only with probability p, and enjoyed in fraction α with probability one. The cost of the rent is given by $(1+\lambda)p - \alpha$, compared to $1 + \lambda - \alpha$ without political uncertainty. This first effect of political uncertainty induces a distortion in the quantities offered even when the initial Government can perfectly commit its potential successor. We will refer to this specific impact of political uncertainty as the 'free-riding' effect. It will always arise in an optimal contract.

4 The renegotiation process in case of political change

Let us consider in this section that the majority changes at the end of period 1, and that a new Government composed of non stake-holders is elected. The initial contract is still valid. The rent obtained by the firm in the first period is irrelevant for the new majority. The rent obtained in the second period, on the other hand, determines the reservation utility that the firm must necessarily get.

From Bester and Strausz (2001) and Kartasheva (2004), we can consider direct mechanisms for which the firm truthfully reports with a strictly positive probability, but not necessarily with probability one. Let us assume here that the contract offered initially entails semi-separation of the efficient type, which truthfully reveals its type with some probability x, and chooses the contract designed for an inefficient type with probability $1-x$ (the following sections will characterize the shape of the initial contract). Probability x measures the degree of information revelation in the first period.

Then two situations may have occurred in the first period: Either the firm has chosen the contract designed for the efficient type, thus revealing its efficiency; the new Government is under complete information and requires production of the first best output, $\underline{q}^*$, while giving the firm its status quo utility only, $\underline{U}^r = \underline{U}_2$.

Or the firm has chosen the contract designed for the inefficient type. The new Government is then uninformed on the type of the firm but has revised beliefs; the Revelation Principle then applies. The revised probability that the firm be efficient, using Bayesian updating, is equal to $\hat{\nu}(x) = \frac{(1-x)\nu}{1-\nu x}$. Figure 1 shows the tree corresponding to contract choices in each period. Both majorities cannot observe on which branch exactly they are located at the end of the first period, unless the firm has chosen the upper branch, i.e., the contract designed for an efficient

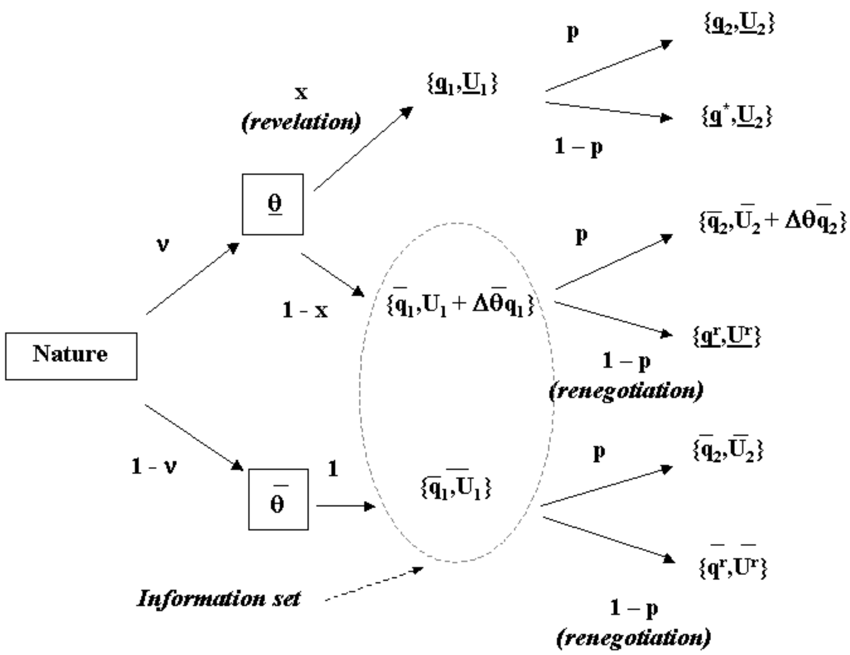

Figure 1: Regulatory contracts in the two periods

firm only.

In the reverse case, in which the firm has chosen $\overline{q}_1$, the program of the new majority is:

$$\max \mathbf{E}_{\{\theta/\overline{q}_1\}}\{S(q^r(\theta)) - (1+\lambda)\theta q^r(\theta) - (1+\lambda)U^r(\theta)\}$$

$$\begin{array}{rrcl l} s.t. & \underline{U}^r \geq & \overline{U}_2 + \Delta\theta\overline{q}_2 & & \underline{IR}^r \\ & \overline{U}^r \geq & \overline{U}_2 & & \overline{IR}^r \\ & \underline{U}^r \geq & \overline{U}^r + \Delta\theta\overline{q}^r & & \underline{IC}^r \\ & \overline{U}^r \geq & \underline{U}^r - \Delta\theta\underline{q}^r & & \overline{IC}^r. \end{array}$$

The participation constraints, $\underline{IR}^r$ and $\overline{IR}^r$ for an efficient and an inefficient firm respectively, are here more stringent that the limited liability constraints, that are therefore omitted. The reservation levels in this program are type-dependent: The more efficient firm also has a higher reservation utility since it will derive a higher profit than a high-cost one when producing the status quo quantity, $\overline{q}_2$. Due to this feature, five intervals appear, according to which constraints are binding in the renegotiation program (see Lewis and Sappington, 1989).

Lemma 2 *The shape of the contract offered by a new Government at the renegotiation stage is crucially affected by the initial contract: The rent obtained by the firm is a continuous (but non differentiable everywhere) function of the second period quantity initially specified for an inefficient firm,* $\overline{q}_2$.

The characteristics of the equilibrium, as a function of $\overline{q}_2$, are summarized in Table 1.

Quantity $\overline{q}^r_{ic}$ denotes the optimal output for the new majority when only $\underline{IC}^r$ and $\overline{IR}^r$ are binding:

$$S'(\overline{q}^r_{ic}) = (1+\lambda)\overline{\theta} + \frac{(1-x)\nu}{1-\nu}(1+\lambda)\Delta\theta.$$

Table 1: Optimal renegotiated contract

$\overline{q}_2$	$[0, \overline{q}^r_{ic})$	$[\overline{q}^r_{ic}, \overline{q}^*)$	$[\overline{q}^*, \underline{q}^*)$	$[\underline{q}^*, \underline{q}^r_{ic})$	$[\underline{q}^r_{ic}, +\infty)$
Bind	$\underline{IC}^r, \overline{IR}^r$	$\underline{IC}^r, \overline{IR}^r, \underline{IR}^r$	$\overline{IR}^r, \underline{IR}^r$	$\overline{IR}^r, \underline{IR}^r, \overline{IC}^r$	$\underline{IR}^r, \overline{IC}^r$
$\underline{U}^r$	$\overline{U}_2 + \Delta\theta\overline{q}^r_{ic}$	$\overline{U}_2 + \Delta\theta\overline{q}_2$	$\overline{U}_2 + \Delta\theta\overline{q}_2$	$\overline{U}_2 + \Delta\theta\overline{q}_2$	$\overline{U}_2 + \Delta\theta\overline{q}_2$
$\overline{U}^r$	$\overline{U}_2$	$\overline{U}_2$	$\overline{U}_2$	$\overline{U}_2$	$\overline{U}_2 + \Delta\theta(\overline{q}_2 - \underline{q}^r_{ic})$
$\underline{q}^r$	$\underline{q}^*$	$\underline{q}^*$	$\underline{q}^*$	$\underline{q}_2$	$\underline{q}^r_{ic}$
$\overline{q}^r$	$\overline{q}^r_{ic}$	$\overline{q}_2$	$\overline{q}^*$	$\overline{q}^*$	$\overline{q}^*$

This quantity is the one that the new Government would chose in a static game of incomplete information (with null reservation utilities) if it had beliefs represented by $\hat{\nu}(x) = \frac{(1-x)\nu}{1-\nu x}$.

Quantity $\underline{q}^r_{ic}$ is obtained in a similar way when only $\overline{IC}^r$ and $\underline{IR}^r$ are binding ('countervailing incentives'):

$$S'(\underline{q}^r_{ic}) = (1+\lambda)\underline{\theta} - \frac{1-\nu}{(1-x)\nu}(1+\lambda)\Delta\theta.$$

For very large values of the difference between the reservation utilities of an efficient and an inefficient firm, $\Delta\theta\overline{q}_2$, countervailing incentives may appear: The incentive constraint of the inefficient type and the participation constraint of the efficient one are binding.

The role of beliefs updating is important: If the beliefs of the first Government and the new one were the same at the time at which they offer a contract, the first Government would always prefer a larger output level, the firm's rent being less costly for stake-holders than for non stake-holders; one would always have $\overline{q}_2 \geq \overline{q}^r_{ic}$. The different cases obtained can arise in equilibrium since the two types of Government have different beliefs at the time at which they intervene. At the beginning of the second period, the new Government is less likely to contract with an efficient firm than the initial Government was (since an efficient firm has revealed its type with some positive probability during the first period). As a consequence, the new Government does not want to decrease so much the efficient firm's rent, nor the quantity produced by the inefficient firm.

Note that if the initial Government had preferences such that it wanted to decrease the renegotiated rent, it would not be able to do so through its choice of second period quantities. Only upward changes are feasible, since a decrease in $\underline{q}_2$ would only make constraints less binding for the new Government. As we will see, another type of distortion, on the degree of revelation x, could instead be used.

5 Rents and quantities in the initial contract

The computation of the optimal contract will be done in two steps. In this section, we will take the probability of truthful revelation by an efficient firm $x \in]0,1]$ as given, and we will characterize the optimal quantities and rents for a given value of x. Section 6 will then analyze the optimal contract structure when x is a choice variable of the initial Government.

This section first describes the best separating contract, and then the quantities and rents in the best semi-separating contract. We omit pooling contracts that cannot be optimal, as we know from Bester and Strausz (2001) and Kartasheva (2004), and as we checked in our framework.[10]

5.1 The best separating initial contract

Let us assume that the initial Government prefers to induce perfect revelation of the firm's type ($x = 1$). Then the new Government in case of political change is perfectly informed on θ at the time it offers a renegotiated contract. It therefore sets the renegotiated rents equal to the

[10]We have checked this result by computing the 'optimal pooling contract' and comparing the welfare it yields with separating and semi-separating ones. We indeed obtained that inducing some revelation from the efficient type always dominates complete pooling.

reservation utility of the firm: $\underline{U}^r = \underline{U}_2$ if it is efficient, and $\overline{U}^r = \overline{U}_2$ otherwise, and has no reason to distort quantities since this has no effect on rents. Hence, the renegotiated quantities are the optimal ones, $\underline{q}^*$ for an efficient firm, and $\overline{q}^*$ for an inefficient one.

Let us now consider the program of the initial Government. It always prefers to delay the payment of the firm's rent to the second period. In order to induce revelation by the firm in the first period, it has to satisfy not only the limited liability constraints of the firm, but also the following two-period incentive compatibility constraints:

$$\underline{U}_1 + \varrho\underline{U}_2 \geq \overline{U}_1 + \varrho\overline{U}_2 + \Delta\theta[\overline{q}_1 + \varrho(p\overline{q}_2 + (1-p)\overline{q}^*)] \quad \underline{IC}^s$$

$$\overline{U}_1 + \varrho\overline{U}_2 \geq \underline{U}_1 + \varrho\underline{U}_2 - \Delta\theta[\underline{q}_1 + \varrho(p\underline{q}_2 + (1-p)\underline{q}^*)] \quad \overline{IC}^s.$$

An efficient firm knows that mimicking a high-cost one will yield an additional gain of $\Delta\theta\overline{q}_2$ in the second period if there is no political change, and $\Delta\theta\overline{q}^*$ otherwise. Renegotiation thus increases, by a constant, the information rent that must be given to an efficient firm to obtain truthful revelation and to prevent it from mimicking an inefficient type.

The incentive compatibility constraint of an efficient firm and the limited liability constraint of an inefficient one are binding. Maximization under these constraints yields the quantities given below.

Lemma 3 *The best separating contract entails the following rents and quantities:*

$$\underline{U} = \Delta\theta[(1+\varrho p)\overline{q}^s + (1-p)\varrho\overline{q}^*] \qquad \textit{and} \qquad \overline{U} = 0$$

$$S'(\underline{q}_1^s) = S'(\underline{q}_2^s) = (1+\lambda)\underline{\theta} \qquad \Rightarrow \qquad \underline{q}_1^s = \underline{q}_2^s = \underline{q}^*$$

$$S'(\overline{q}_1^s) = S'(\overline{q}_2^s) = (1+\lambda)\overline{\theta} + \frac{\nu}{1-\nu}[(1+\lambda)p - \alpha]\Delta\theta \qquad \Rightarrow \qquad \overline{q}_1^s = \overline{q}_2^s = \overline{q}_1^c(\nu)$$

The renegotiated quantities are the first-best ones, and the renegotiated rents equal the ones promised in the initial contract, for both types of firm.

Once the new majority is under complete information, its preferences do not affect the trade-off between rent extraction and efficiency. The second period quantity chosen by the initial Government will affect the information rent of the efficient type with the same weight as the surplus generated from production (ϱp). The relative cost of the rent compared to the value of production is therefore the same in both periods. This explains why the quantities produced by an inefficient firm in the initial contract are identical for the two periods (contrary to the case of perfect commitment, for which $\overline{q}_1^c(\nu) \neq \overline{q}_2^c(\nu)$).

5.2 The characteristics of the best semi-separating initial contract

Randomization in a semi-separating equilibrium The general case of a semi-separating contract has been represented in Figure 1. Before characterizing the equilibrium quantities in this case, let us note that the outcome obtained with randomization by the efficient firm can be implemented in several ways. First, the initial Government can use stochastic mechanisms (i.e., can commit to a randomization device over alternatives that may not give the same expected value). Second, if it is unable to commit in such a way, it may use a noisy communication device, as in Bester and Strausz (2003). Such a device maps a truthful report on θ, according to a given distribution, into another report in $\{\underline{\theta}, \overline{\theta}\}$, that is not necessarily truthful. Last, the Government may induce randomization by the firm itself.[11]

[11] This last solution is not equivalent to the previous two, since it constrains the firm to be indifferent over the two allocations offered by the contract. In renegotiation problems in which the identity of the principal does not change, stochastic contracts are constrained by the fact that the principal must commit not to learn all the information of the agent, so as to commit to give the agent some rent in the future. This is done by offering a contract such that the agent does not always report the truth, i.e., by inducing randomization by the agent. Noisy communication allows an additional degree of freedom. Here, on the other hand, what matters is that the future Government remains uninformed. With stochastic contracts and noisy communication, the initial Government directly chooses the probability that an efficient firm produce the quantity corresponding to its type, x, under the constraint that the expected welfare of an efficient firm, given this probability, be at least as large as if it was misreporting its type. This constraint is less stringent than the constraint for randomization by the firm (i.e., indifference over the two allocations), except when it is binding — in which case both constraints are identical. In our model, the constraint will be binding in equilibrium. Hence, we can ignore which device is used by the

An efficient firm will choose to randomize between the contracts offered to the efficient type and to the inefficient one only if they yield the same expected utility, that is:

$$\underline{U}_1 + \varrho \underline{U}_2 = \overline{U}_1 + \Delta\theta \overline{q}_1 + \varrho[p(\overline{U}_2 + \Delta\theta \overline{q}_2) + (1-p)\underline{U}^r]. \tag{1}$$

If the firm reveals its type in the first period, it will obtain $\underline{U}_2$ in the second period, be the Government reelected or not (if a new Government is elected, it will be informed and will not have to give up information rents; the firm will therefore get exactly its promised utility, $\underline{U}_2$).

If the firm misreports on the other hand, it will obtain $\overline{U}_2 + \Delta\theta\overline{q}_2$ if the Government remains in power; it will otherwise accept the renegotiated contract designed for an efficient firm, thereby earning $\underline{U}^r$.

We can rewrite condition (1) as

$$\underline{U} = \overline{U} + \Delta\theta\overline{q}_1 + p\varrho\Delta\theta\overline{q}_2 + (1-p)\varrho(\underline{U}^r - \overline{U}_2). \tag{2}$$

The program of the initial Government The first Government thus designs the initial contract so as to maximize his expected utility under the limited liability constraints $\underline{LL}_i$ and $\overline{LL}_i$, $i = 1, 2$, and under the constraint that the efficient type is indifferent between the two contracts[12], (2):

$$\begin{aligned}\max \mathbf{E}_\theta W = \quad & \nu x \quad \{[S(\underline{q}_1) - (1+\lambda)\underline{\theta}\underline{q}_1] + \varrho p[S(\underline{q}_2) - (1+\lambda)\underline{\theta}\underline{q}_2] - \varrho p(1+\lambda-\alpha)\underline{U}_2\} \\ & +(1-\nu x) \quad \{[S(\overline{q}_1) - (1+\lambda)\overline{\theta}\overline{q}_1] + \varrho p[S(\overline{q}_2) - (1+\lambda)\overline{\theta}\overline{q}_2] - \varrho p(1+\lambda-\alpha)\overline{U}_2\} \\ & +\varrho(1-p) \quad \alpha[\nu x \underline{U}_2 + (1-x)\nu\underline{U}^r + (1-x)(1-\nu)\overline{U}^r].\end{aligned}$$

Since the initial Government always prefers to delay the payment of the rent, $\underline{U}_1 = \overline{U}_1 = 0$. The rent left to an inefficient firm in the initial contract will always be set to zero, since rents

initial Government.

[12]This implies that the incentive constraint of the inefficient firm is satisfied.

remain costly when weighted by $(1+\lambda)p-\alpha$.

The second-period quantity for an inefficient firm, $\overline{q}_2$, constitutes a crucial instrument, since it affects the renegotiated rents. The latter not only have a direct effect on the initial Government through the share α that it gets, but also an indirect one, through the randomization constraint, on the rent to be paid to an efficient firm in the second period.

Determining the potential optimal values for quantity $\overline{q}_2$ is not straightforward since the effect of $\overline{q}_2$ on the renegotiated rents is not continuous, as seen in Section 4. If $\overline{q}_2 < \overline{q}^r_{ic}$ (first interval considered in Section 4), the renegotiated rents do not depend on $\overline{q}_2$. If $\overline{q}_2 > \underline{q}^r_{ic}$ (last interval considered in Section 4), both renegotiated rents are a function of $\overline{q}_2$. And for $\overline{q}^r_{ic} \leq \overline{q}_2 \leq \underline{q}^r_{ic}$, only the renegotiated rent of the efficient firm is a function of $\overline{q}_2$. One can therefore distinguish three intervals, over which renegotiated rents are not expressed in the same way. As a consequence, the objective of the initial Government is not characterized in the same way either over these intervals. And the second-period quantity $\overline{q}_2$ that maximizes this objective will be defined in a different way according to the interval to which it belongs.

Lemma 4 *The equilibrium initial contract will never induce countervailing incentives in the renegotiation game:* $\overline{q}_2 < \underline{q}^r_{ic}$.

The proof is given in appendix A.2.2.

From this lemma, we know that in equilibrium the renegotiated rent for an inefficient firm will not depend on the second-period quantity specified in the initial contract: $\frac{d\overline{U}^r}{d\overline{q}_2} = 0$. The choice of quantity $\overline{q}_2$ is thus somewhat restricted. But it remains to be computed whether a value lower, equal to, or higher than $\overline{q}^r_{ic}$ is optimal, given the discontinuity in the effect of $\overline{q}_2$ on $\underline{U}^r$ at this point. This problem will be exposed in more detail in subsection 5.3.

Table 2 summarizes the relationship between $\overline{q}_2$ and renegotiated rents.

Table 2: Renegotiated rents and second-period quantity in the initial contract

$\overline{q}_2$	$[0, \overline{q}^r_{ic})$	$[\overline{q}^r_{ic}, \underline{q}^r_{ic})$	$[\underline{q}^r_{ic}, +\infty)$
$\underline{U}^r$	$\overline{U}_2 + \Delta\theta\overline{q}^r_{ic}$	$\overline{U}_2 + \Delta\theta\overline{\mathbf{q}}_\mathbf{2}$	$\overline{U}_2 + \Delta\theta\overline{\mathbf{q}}_\mathbf{2}$
$\overline{\overline{U}}^r$	$\overline{U}_2$	$\overline{U}_2$	$\overline{U}_2 + \Delta\theta(\overline{\mathbf{q}}_\mathbf{2} - \underline{q}^r_{ic})$
Potential equilibrium value for $\overline{q}_2$	Yes	Yes	No

The initial contract for a given probability of revelation The following proposition characterizes the equilibrium initial contract for a given degree of information revelation, x.

Proposition 1 *The contract offered by an initial Government composed of stake-holders entails the following profile of output:*

$$\begin{aligned}
S'(\underline{q}_1) &= (1+\lambda)\underline{\theta} \quad \Rightarrow \underline{q}_1 = \underline{q}^* \\
S'(\underline{q}_2) &= (1+\lambda)\underline{\theta} \quad \Rightarrow \underline{q}_2 = \underline{q}^* \\
S'(\overline{q}_1) &= (1+\lambda)\overline{\theta} + \frac{\nu x}{1-\nu x}[(1+\lambda)p - \alpha]\Delta\theta \quad \Rightarrow \overline{q}_1 = \overline{q}^c_1(\hat{\nu}(x)).
\end{aligned}$$

Quantity $\overline{q}_2$ is given by:

$$S'(\overline{q}_2) = (1+\lambda)\overline{\theta} + \frac{\nu x \Delta\theta}{1-\nu x}[(1+\lambda)p - \alpha] - \alpha\frac{1-p}{p}\frac{(1-x)\nu}{1-\nu x}\frac{d\underline{U}^r}{d\overline{q}_2}, \tag{3}$$

where $\frac{d\underline{U}^r}{d\overline{q}_2} = \Delta\theta$ when the solution to this equation is larger than $\overline{q}^r_{ic}$, and $\frac{d\underline{U}^r}{d\overline{q}_2} = 0$ otherwise. The initial contract never gives rise to countervailing incentives in the renegotiation game.

The time preference of the initial Government, ϱ, does not directly affect the quantities specified in the contract. The quantity designed for an efficient firm is always the first best one, whatever the allocation of rent, for both periods. The 'no distortion at the top' result continues to hold. As a consequence, one can compute the ex ante probability that the contract be renegotiated in the following period: it equals $(1-p)(1-\nu x)$ (no renegotiation is needed when the firm has revealed its efficiency, since it then produces the optimal quantity). Renegotiation will be more likely if a political change becomes more probable, if the firm is likely to be inefficient, and if the initial contract entails little revelation by the efficient firm (x small).

The quantity designed for an inefficient firm on the other hand, is distorted away from the first best quantity. The quantity produced in the first period is distorted in the same way as in the perfect commitment contract, but for beliefs represented by the revised probability $\hat{\nu}(x) = \frac{(1-x)\nu}{1-\nu x}$. This quantity corresponds to the 'conditionally optimal' outcome in Laffont and Tirole (1990). The distortion comes from a trade-off between rent extraction and productive efficiency.

The quantity designed for an inefficient firm in the second period is distorted for the same reason. An additional distortion arises when the initial majority is composed of stake-holders, due to the partial appropriation of rents by the initial Government. The renegotiated rents in case of political change are constrained by $\overline{q}_2$. The initial majority of stake-holders has therefore an incentive to distort this quantity so as to increase the rents that the other party will have to give up if it is elected (the 'leverage effect'). The last term in (3) represents this distortion, that is weighted by the relative probability of not being reelected, $\frac{1-p}{p}$ (note that the other terms are weighted by $1 = \frac{p}{p}$, since they all correspond to the effects of $\overline{q}_2$ on the rent to be left an efficient firm, through the randomization constraint, when no political change occurs). There would be a third distortion coming from the impact of $\overline{q}_2$ on $\overline{U}^r$ if countervailing incentives in the renegotiated contract were possible in equilibrium, but we know from Lemma 4 that this is not the case.

We will separate two cases, a) and b), and investigate which is an equilibrium given the value of the parameters:

a) As long as $\overline{q}_2$ is small enough ($\overline{q}_2 \in [0, \overline{q}^r_{ic}[$), one has $\frac{dU^r}{d\overline{q}_2} = 0$; the expression characterizing the second-period quantity is then the same as for the first-period quantity in the commitment contract, for revised beliefs, and the same as the first-period one: $\overline{q}_2 = \overline{q}^c_1(\hat{\nu}(x)) = \overline{q}_1$.

b) If $\overline{q}_2$ is larger ($\overline{q}_2 \in [\overline{q}^r_{ic}, \underline{q}^r_{ic}[$), on the other hand, increasing this quantity imposes an increase in the renegotiated rent obtained by an efficient firm that has not revealed its type in the first period. The additional distortion given by the last term in (3) then appears. We will denote by q^b the corresponding quantity.

5.3 Profits appropriation and equilibrium quantities

The two intervals corresponding to cases a) and b) are defined as sets of the various parameters of the problem. We will express them as functions of α, the share of the rents appropriated by the Government, in order to link in a clear way the distortions to the Government's private interests.

Consistency requires that, if $\overline{q}_2$ is postulated to belong to an interval, the equilibrium value indeed belongs to this interval. Hence, for case a), inequality $\overline{q}^c_1(\hat{\nu}(x)) \leq \overline{q}^r_{ic}$ should be satisfied for $\overline{q}^c_1(\hat{\nu}(x))$ to be an equilibrium. This implies that α must be small enough. Similarly, if the equilibrium quantity for an inefficient firm is given by q^b as in case b), then we must have $\overline{q}^r_{ic} \leq q^b \leq \underline{q}^r_{ic}$, and this is only consistent with large values of α.

One can check that the set of parameter values for which $\overline{q}^c_1(\hat{\nu}(x))$ is a relevant candidate does not intersect with the set for which q^b is relevant ($\overline{\alpha}^a < \underline{\alpha}^b$, with the notations defined below). If a quantity is a relevant candidate, it is also the optimum for the initial Government.

Hence the following results:

Proposition 2 *The second-period quantity for an inefficient firm specified in the equilibrium initial contract is*

- *equal to the conditionally optimal quantity* $\overline{q}_1^c(\hat{\nu}(x))$ *when* α *is smaller than some threshold:* $\alpha \leq \overline{\alpha}^a \equiv (1+\lambda)[p - \frac{(1-\nu x)(1-x)}{x(1-\nu)}]$,
- *equal to the quantity chosen by the new majority when the participation constraint of an efficient firm is not binding in the renegotiated contract,* $\overline{q}_{ic}^r$, *when* $\alpha \in]\overline{\alpha}^a, \underline{\alpha}^b[$,
- *and equal to quantity* q^b *when* α *is higher than some threshold,* $\alpha \geq \underline{\alpha}^b \equiv (1+\lambda)p\frac{x(1-\nu)-(1-\nu x)(1-x)}{(1-\nu)(1-p(1-x))}$.

Quantity q^b *is characterized by*

$$S'(q^b) = (1+\lambda)\overline{\theta} + \frac{\nu}{p(1-\nu x)}[x(1+\lambda)p - \alpha(1-p(1-x))]\Delta\theta.$$

In the conditionally optimal case, case a), strategic motives are not sufficient to distort the quantity produced by the inefficient firm in the second period from the conditionally optimal one, i.e., the one that corresponds to standard renegotiation-proof contracts. It is therefore intuitive that this corresponds to a low share α of stake-holders in the profits of the firm.

In case b), appropriation of a fraction α of the profits leads to an upward distortion of quantity so as to increase the renegotiated rent for an efficient firm ('leverage effect'). This additional distortion increases with the Government's share α in profits, but decreases with its probability of remaining in power, p. In addition, increases in ν and $1 + \lambda$ make 'leverage' (upward) distortions more costly. One should note that less developed countries are more likely to suffer from high costs of public funds, but also to have industrial rents that are appropriated by a concentrated few (as with oligarchies and corrupt Governments). One can therefore not state whether they are more or less likely to adopt 'leverage' contracts than richer countries.

5.4 Institutional restrictions on the allocation of transfers across time

The initial Government can use its freedom to allocate rents over the two periods so as to affect the renegotiated contract designed by the other Government in case of political change. The question that naturally arises is whether the Constitution can improve total expected welfare by imposing restrictions on the allocation of rents across time. The question is difficult to answer, since social welfare is not completely defined in this model: The proportion of stake-holders in the total population, in particular, is not specified. And consumers, when they differ from tax-payers, benefit from upward distortions. We can nevertheless study the impact of Constitutional arrangements on the type of contract that emerges.

Consider in this subsection that the proportion of the rent that is paid in the first period, ϵ, is fixed by the Law. Then the initial Government pays in expectation[13] $\epsilon + p(1-\epsilon)$ for each monetary unit promised to the firm. Increasing ϵ makes rents more costly for the initial Government. A leverage contract, in which rents are increased in the second period to free-ride on the other majority, becomes less attractive. The Constitution can therefore use this tool to affect the size of the upward distortion on $\overline{q}_2$.

Proposition 3 *An institutional restriction that prevents the current Government from delaying payments to the firm, allows to decrease the occurrence of 'leverage'-inducing contracts. The larger the proportion of the total transfer that has to be paid in the first period, the more likely it is that the regulatory contract will be the conditionally optimal one.*

[13] One has $U_1 = \epsilon U$ and $U_2 = \frac{\epsilon U}{\varrho}$.

The proof is straightforward.[14]

6 Information revelation in equilibrium and the political process

Let us now turn to the equilibrium probability of revelation in the first period, x. This probability can be used strategically by the initial Government to affect the beliefs of the new majority in case of political change.

6.1 The link between initial quantities and revelation

By inducing more revelation in the first period, the initial Government makes it more likely that a new majority will renegotiate with an inefficient type, thereby increasing the quantity $\overline{q}^r_{ic}$ that results from the trade-off between efficiency and rent extraction when the participation constraint of the low-cost firm is not binding. Increasing x, and thus indirectly $\overline{q}^r_{ic}$, means that the conditionally optimal contract, in which the renegotiated rent is larger than the one promised by the initial Government, emerges more often. When there is more separation in the first period, it becomes more likely that the firm be inefficient if it has produced $\overline{q}_1$ in the first period. A larger quantity $\overline{q}^r$ is then preferred by the new Government in the renegotiation, since this quantity is likely to be actually produced. This ultimately benefits the initial Government since a higher renegotiated quantity for an inefficient firm translates into higher rents for an efficient firm. One should note that this type of effects also exist with short term contracts, as shown in appendix A.4.

The choice of x by the initial Government results from the trade-off between i) the benefits

[14] The conditions defining cases a) and b) are still valid but p has to be replaced by $\epsilon + p(1-\epsilon)$. Since we always have $\epsilon + p(1-\epsilon) \geq p$, the share α appropriated by the initial Government will less often be large enough for distorted contracts to emerge.

of increasing a rent, the renegotiated rent $\underline{U}^r$, that is enjoyed with weight α but never paid for, and ii) the costs of inducing more separation in the first period.

To a given degree of information revelation, is associated a given value of the second period quantity $\overline{q}_2$. This imposes consistency requirements, since this quantity must belong to a particular interval. These requirements imply that the strategically distorted contract emerges for small values of x. This contract is optimal from the point of view of the initial Government, whatever the value of the other parameters, when x tends to zero. On the other hand, it emerges only if α becomes very close to $1+\lambda$, when x tends to one. The link between the equilibrium quantities and the probability of revelation is summarized in Table 3.

Lemma 5 *The conditionally optimal contract is only compatible with a large enough probability of revelation: It cannot emerge if x is lower than $\frac{1-\sqrt{1-\nu}}{\nu}$, whatever the value of p.*

Table 3: Optimal quantity $\overline{q}_2$ in the initial contract

α	$]0, \overline{\alpha}^a]$	$]\overline{\alpha}^a, \underline{\alpha}^a[$	$]\underline{\alpha}^b, p(1+\lambda)[$
Contract	'Strategic', or conditionally optimal	'Boundary'	'Leverage'
$\overline{q}_2$	$\overline{q}_1^c(\hat{\nu}(x))$	$\overline{q}_{ic}^r$	q^b
x	Large	Intermediate	Small

6.2 Equilibrium initial contract and revelation

Let us now rewrite the welfare of the initial Government using the results of the previous section.

$$\begin{aligned}\max_x \mathbf{E}_\theta W = \quad & \nu x(1+\varrho p)[S(\underline{q}^*) - (1+\lambda)\underline{\theta}\underline{q}^*] \\ + \quad & (1-\nu x)\{[S(\overline{q}_1(x)) - (1+\lambda)\overline{\theta}\overline{q}_1(x)] + \varrho p[S(\overline{q}_2(x)) - (1+\lambda)\overline{\theta}\overline{q}_2(x)]\} \\ - \quad & \nu x \varrho[(1+\lambda)p - \alpha]\underline{U}_2(x) + (1-p)(1-x)\alpha[\nu \underline{U}^r(x)].\end{aligned}$$

The calculations given in appendix A.3. allow us to derive the following results. When x is a choice variable of the initial Government, the 'leverage' contract — in which the second period quantity for an inefficient firm is given by q^b — will never arise. Increasing second-period quantities being costly, the initial Government tend to prefer to play on beliefs via more or less information revelation in the first period.

Proposition 4 *There is always some degree of information revelation when the initial Government can use semi-separating contracts and can choose the probability with which the efficient firm randomizes: The optimal probability x satisfies $x > 0$.*

Moreover, quantity $\overline{q}_2$ is always lower than (or equal to) $\overline{q}^r_{ic}$.

As noted before, pooling is never optimal. The only possible initial contracts are

- the perfectly separating one,
- the conditionally optimal one for some value of x higher than a given threshold $\underline{X}^a$,
- and the one in which $\overline{q}_2 = \overline{q}^r_{ic}$,

depending on the values of the parameters.

The separating initial contract always dominates for low discount factors: There exists some threshold $\varrho^0 > 0$ such that for any ϱ lower than $\varrho^0 > 0$, perfect separation is preferred by the initial Government: $x^* = 1$.

Proposition 5 *The equilibrium entails perfect separation of types in the first period ($x^* = 1$) if:*

- *the initial Government cares essentially only for the first period (ϱ close to 0);*
- *and/or the share of the initial Government in the firm's profit is negligible (α close to 0).*

7 Conclusion

To summarize, the crucial tools that can be used by the initial Government to affect future outcomes are:

- the second period quantity designed for an inefficient firm — through its effect on reservation utilities in the second period, and thus on renegotiated rents,
- and the degree of information revelation in the first period — which affects the beliefs of a new majority, and therefore the renegotiated contract it offers.

The first effect, the 'leverage' one, is a consequence of the possibility of free riding. The initial Government anticipates benefiting with probability one from the firm's rent, as a stake-holder with a stake of α, while it will pay the corresponding cost with probability p only. It can thus impose an increase in rents, via higher quantities, without paying the full cost of this increase. The second effect is the strategic use by the initial Government of randomization by an efficient firm, to make the new Government less willing to impose downward distortions on the renegotiated quantity for a high-cost firm, and therefore more willing to give up rents to a low-cost firm.

Distortions in long-term contracts are more likely to appear if the political regulator has a large share in the rent of the firm, and is likely not to remain in power, as could be expected. A small cost of public funds and a low probability that the firm be efficient also favor distortions. There is always less revelation of information in the first period when there are 'leverage' distortions. Yet complete pooling is always dominated by some degree of separation. And, as we have seen, institutional restrictions preventing Governments from delaying payments are an efficient way of reducing the probability that contracts be distorted because of a 'leverage' effect.

Strategic motives may give rise to the conditionally optimal contract. The very source of the power of the initial Government comes from the asymmetry of information from which the new one suffers in case of political change. The trick that the initial Government then uses to free ride consists in affecting its successor's beliefs in such a way that the latter pays for a higher quantity than the initial Government would have done.

An aspect that has not been studied here is the potential endogeneity of α, for instance through appointment of family, friends, or members of the ruling elite as heads of regulated firms. In other words, a governing party can obtain a share in regulatory rents from the very fact of being in power. One could use a model in which a government can always extract some of the firm's rent for private purposes, as long as it can replace the firm by another, whose owners belong to its constituency. Since a new government would have to give the current firm its promised utility as a compensation, when it is replaced, the initial government would still be able to affect future outcomes — especially the rent obtained by its own firm — by distorting the long-term contract. Distortions in the initial contract might also arise to make replacement a too costly option for the new majority, and to ensure that the initial firm remains in charge of executing the project or producing the good.

Appendix

In the following, we denote by $\mathbf{q}$ the vector of all quantities (first-period, second-period and renegotiated ones).

A.1. Separating initial contract

If the initial Government offers a completely separating contract, in case of political change, the new one is completely informed and requires that the firm produces the first-best quantity corresponding to its type. The program of the initial Government can be written as:

$$\max_{\{\underline{q}_i,\underline{U}_i,\overline{q}_i,\overline{U}_i\}_{i=1,2}} \quad \nu\Big[S(\underline{q}_1) - (1+\lambda)\underline{\theta}\underline{q}_1 + \varrho p[S(\underline{q}_2) - (1+\lambda)\underline{\theta}\underline{q}_2 - (1+\lambda-\alpha)\underline{U}_2]\Big]$$
$$+(1-\nu)\Big[S(\overline{q}_1) - (1+\lambda)\overline{\theta}\overline{q}_1 + \varrho p[S(\overline{q}_2) - (1+\lambda)\overline{\theta}\overline{q}_2 - (1+\lambda-\alpha)\overline{U}_2]\Big]$$
$$+\alpha\varrho(1-p)[\nu\underline{U}_2 + (1-\nu)\overline{U}_2]$$

subject to

$$\begin{aligned}
\varrho\underline{U}_2 &\geq \varrho\overline{U}_2 + \Delta\theta[\overline{q}_1 + \varrho p\overline{q}_2 + \varrho(1-p)\overline{q}^*] && \underline{IC}^s \\
\varrho\overline{U}_2 &\geq \varrho\underline{U}_2 - \Delta\theta[\underline{q}_1 + \varrho p\underline{q}_2 + \varrho(1-p)\underline{q}^*] && \overline{IC}^s \\
\varrho\underline{U}_2 &\geq 0 && \underline{LL}^s \\
\varrho\overline{U}_2 &\geq 0 && \overline{LL}^s.
\end{aligned}$$

Constraints $\underline{IC}^s$ and $\overline{LL}^s$ are binding in equilibrium. Replacing the rents defined thanks to these two constraints in the objective function enables to compute immediately the optimal quantities.

A.2. The second-period quantity in a semi-separating contract

The quantity produced by an inefficient firm (or an efficient firm that chooses the contract designed for an inefficient one) is relatively difficult to determine. Indeed, the program of the Government is continuous but not strictly concave in $\overline{q}^2$, due to the shape of the renegotiated rents.

A.2.1. Extending pieces of the objective as separate concave functions

In order to solve this technical problem, we define three 'objectives', which are all strictly concave. Since we focus on the determination of the optimal second-period quantity $\overline{q}_2$, we will omit the other arguments of these functions, denoted $W^a(.)$, $W^b(.)$, and $W^c(.)$:

$$\begin{aligned} W^a(\overline{q}_2) &\equiv V(\mathbf{q}, x) + h^a(x)\overline{q}^r_{ic} \\ W^b(\overline{q}_2) &\equiv V(\mathbf{q}, x) + h^a(x)\overline{q}_2 \\ W^c(\overline{q}_2) &\equiv V(\mathbf{q}, x) + h^a(x)\overline{q}_2 + h^c(\overline{q}_2 - \underline{q}^r_{ic}), \end{aligned}$$

where functions $h^a(.)$ and h^c are defined as:

$$\begin{aligned} h^a(x) &\equiv -\nu\varrho(1-p)[(1+\lambda)xp - \alpha]\Delta\theta \\ h^c &\equiv (1-\nu)\varrho(1-p)\alpha\Delta\theta > 0, \end{aligned}$$

and $V(\mathbf{q}, x)$ is the part of the objective function of the Government that does not depend on the renegotiated rents:

$$\begin{aligned} V(\mathbf{q}, x) \equiv\ & \nu x\{[S(\underline{q}_1) - (1+\lambda)\underline{\theta}\underline{q}_1] + \varrho p[S(\underline{q}_2) - (1+\lambda)\underline{\theta}\underline{q}_2]\} \\ & +(1-\nu x)\{[S(\overline{q}_1(x)) - (1+\lambda)\overline{\theta}\overline{q}_1(x)] + \varrho p[S(\overline{q}_2(x)) - (1+\lambda)\overline{\theta}\overline{q}_2(x)]\} \\ & -\nu x[(1+\lambda)p - \alpha](\overline{q}_1 + \varrho p\overline{q}_2)\Delta\theta. \end{aligned}$$

The actual objective function of an initial Government composed of stake-holders, $\mathbf{E}_\theta W$, is equal to $W^a(\overline{q}_2)$ on the interval $I^a \equiv [0, \overline{q}^r_{ic}]$, to $W^b(\overline{q}_2)$ on $I^b \equiv [\overline{q}^r_{ic}, \underline{q}^r_{ic}]$,and last to $W^c(\overline{q}_2)$ on $I^c \equiv [\underline{q}^r_{ic}, +\infty[$.

Moreover, $W^a(\overline{q}_2) - W^b(\overline{q}_2) = h^a(x)(\overline{q}^r_{ic} - \overline{q}_2)$ is of the same sign as $h^a(x)$ on I^a and of the opposite sign on I^b and I^c. $W^b(\overline{q}_2) - W^c(\overline{q}_2)$ is positive on I^a and I^b and negative on I^c. This implies in particular that $W^b(.)$ cannot have its maximum on I^c while $W^c(.)$ has its maximum on either I^a or I^b. It is also useful to notice that $h^a(x) < 0 \quad \Leftrightarrow \quad x > \frac{\alpha}{p(1+\lambda)}$ (or equivalently $\alpha < xp(1+\lambda)$).

An example is given in Figure 2, where the optimal value is $\overline{q}^a$.

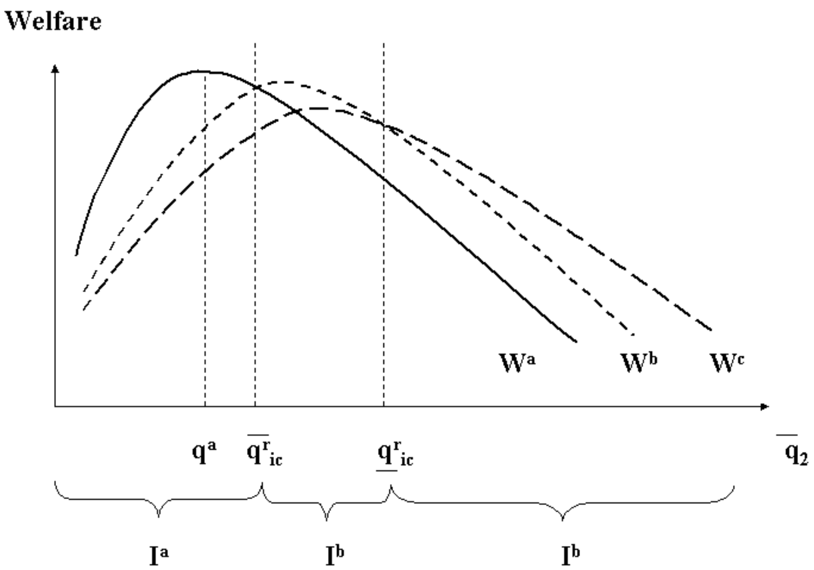

Figure 2: An example of welfare comparison on the three intervals

A.2.2. The quantities maximizing $W^a(.)$, $W^b(.)$ and $W^c(.)$

Let us denote q^k the value of the second-period quantity $\overline{q}_2$ that maximizes function $W^k(\overline{q}_2)$, $k = a, b, c$. It is defined by the first-order condition of the maximization program, since each of the three functions is strictly concave:

$$
\begin{aligned}
S'(q^a) &= (1+\lambda)\overline{\theta} + \frac{\nu x}{1-\nu x}[(1+\lambda)p - \alpha]\Delta\theta \\
S'(q^b) &= S'(q^a) + \frac{(1-p)\nu}{p(1-\nu x)}[x(1+\lambda)p - \alpha]\Delta\theta \\
&= (1+\lambda)\overline{\theta} + \frac{\nu}{p(1-\nu x)}[xp(1+\lambda) - \alpha(1-p(1-x))]\Delta\theta \\
S'(q^c) &= S'(q^b) - \alpha\frac{(1-p)(1-\nu)}{p(1-\nu x)}\Delta\theta \\
&= (1+\lambda)\overline{\theta} + \frac{1}{p(1-\nu x)}[\nu xp(1+\lambda) - \alpha(1-p(1-x))]\Delta\theta.
\end{aligned}
$$

Either of these quantities, as well as the boundaries of the intervals, $\overline{q}_{ic}^r$ and $\underline{q}_{ic}^r$, can be the solution of the global optimization of $\mathbf{E}W$ by the initial Government. Yet quantity q^k, $k = a, b, c$, cannot be an equilibrium if it does not belong to the interval on which the function it maximizes, W^k, is identical to the actual objective $\mathbf{E}_\theta W$. More precisely, q^a can be an equilibrium quantity in our game only if it belongs to $I^a \equiv [0, \overline{q}_{ic}^r]$. Similarly, q^b must belong to I^b to be a relevant candidate, and q^c to I^c. Using the characterization of all quantities given by the first-order conditions of the optimization programs, we obtain the following conditions:

$$
\begin{aligned}
q^a \in I^a \quad &\Leftrightarrow \quad S'(q^a) > S'(\overline{q}_{ic}^r) \\
&\Leftrightarrow \quad \frac{x}{1-\nu x}[(1+\lambda)p - \alpha] > \frac{1-x}{1-\nu}(1+\lambda) \\
&\Leftrightarrow \quad \alpha < \overline{\alpha}^a \equiv (1+\lambda)[p - \frac{(1-\nu x)(1-x)}{x(1-\nu)}].
\end{aligned}
$$

Similarly, $q^b \in I^b \quad \Leftrightarrow \quad \overline{q}^r_{ic} < q^b < \underline{q}^r_{ic}$, with:

$$\begin{aligned}
q^b > \overline{q}^r_{ic} \quad &\Leftrightarrow \quad S'(q^b) < S'(\overline{q}^r_{ic}) \\
&\Leftrightarrow \quad \frac{1}{p(1-\nu x)}[x(1+\lambda)p - \alpha(1-p(1-x))] < \frac{1-x}{1-\nu}(1+\lambda) \\
&\Leftrightarrow \quad \alpha > \underline{\alpha}^b \equiv (1+\lambda)p\frac{x(1-\nu)-(1-\nu x)(1-x)}{(1-\nu)[1-p(1-x)]} \\
q^b < \underline{q}^r_{ic} \quad &\Leftrightarrow \quad S'(q^b) > S'(\underline{q}^r_{ic}) \\
&\Leftrightarrow \quad \frac{1}{p(1-\nu x)}[x(1+\lambda)p - \alpha(1-p(1-x))] > -\frac{1-\nu x}{\nu(1-x)}(1+\lambda) \\
&\Leftrightarrow \quad \alpha < \overline{\alpha}^b \equiv (1+\lambda)p\frac{(1-x)x\nu^2+(1-\nu x)^2}{(1-x)\nu[1-p(1-\nu x)]}.
\end{aligned}$$

The last condition is always satisfied since $\overline{\alpha}^b > (1+\lambda)p$.

Last,

$$\begin{aligned}
q^c \in I^c \quad &\Leftrightarrow \quad S'(q^c) < S'(\underline{q}^r_{ic}) \\
&\Leftrightarrow \quad \frac{1}{p(1-\nu x)}[\nu x p(1+\lambda) - \alpha(1-p(1-x))] < -\frac{1-\nu x}{\nu(1-x)}(1+\lambda) \\
&\Leftrightarrow \quad \alpha > \underline{\alpha}^c \equiv (1+\lambda)p\frac{(1-x)x\nu^2+(1-\nu x)^2}{(1-x)\nu[1-p(1-\nu x)]}.
\end{aligned}$$

Here, the condition can never be satisfied, since

$$\underline{\alpha}^c > (1+\lambda)p \quad \Leftrightarrow \quad \frac{(1-x)x\nu^2+(1-\nu x)^2}{(1-x)\nu[1-p(1-\nu x)]} > 1$$

$$\Leftrightarrow \quad (1-\nu x)[1-\nu x+\nu p(1-x)-\nu(1-x)] > 0 \quad \Leftrightarrow \quad 1-\nu+p\nu(1-x) > 0,$$

which is always true. Case c) is thus not compatible with the constraint that α be lower than $(1+\lambda)p$.

These conditions also enable to rule out candidates in specific cases: Thresholds $\overline{\alpha}^a$ and $\underline{\alpha}^b$ are always lower than $p(1+\lambda)$ (they equal it for $x=1$). $\overline{\alpha}^a$ is positive if and only if $p > \frac{(1-x)(1-\nu x)}{x(1-\nu)}$. This condition cannot hold in particular, since $p \leq 1$, when $x < \frac{1-\sqrt{1-\nu}}{\nu}$. This first condition implies that the 'conditionally optimal' contract cannot emerge if the probability that the Government remains in power, p, is too small (relative to x). It is also not compatible with a small probability of revelation in the first period.

A.2.3. The globally optimum quantity (Proposition 2)

A first step consists in showing that I^a and I^b are disjoint. Indeed,

$$\begin{aligned}
\underline{\alpha}^b - \overline{\alpha}^a &= \frac{1+\lambda}{1-\nu}\Big[p\frac{x(1-\nu)-(1-\nu x)(1-x)}{1-p(1-x)} - \frac{px(1-\nu)-(1-x)(1-\nu x)}{x}\Big] \\
&= (1+\lambda)\frac{(1-x)[px(1-\nu)+p(1-\nu x)(x+p(1-x))-p^2x(1-\nu)-(1-\nu x)]}{(1-\nu)x(1-p(1-x))} \\
&= (1+\lambda)\frac{1-x}{(1-\nu)x(1-p(1-x))}[x(1-p)(2p+\nu)+1+p^2] > 0.
\end{aligned}$$

Since the intervals on which q^a and q^b can be relevant candidates do not intersect, q^a is necessarily optimal on I^a (for $\alpha < \overline{\alpha}^a$) and q^b on I^b (for $\alpha > \underline{\alpha}^b$). For $\alpha \in [\overline{\alpha}^a, \underline{\alpha}^b]$, the global solution must be $\overline{q}^r_{ic}$ since $W^a(.)$ is increasing at this point while $W^b(.)$ is decreasing (both functions are strictly concave). Hence Proposition 2.

A.3. The optimal probability of revelation

We first derive the optimal probability of revelation for each possible initial contract: conditionally optimal (a), strategically distorted (b) and constrained by $\overline{q}_2 = \overline{q}^r_{ic}$. The welfare levels obtained by the initial Government at the solutions must then be compared, and be compared to those of pooling and perfect separation.

Let us denote by x^a the optimal value of the probability of revelation when the optimal initial contract corresponds to case (a) ($\overline{q}_2 = q^a = \underline{q}_1$), i.e., when $\alpha < \overline{\alpha}^a$. This value is the solution to:

$$\max_{x^a} W^a(q^a) = (1+\varrho p)\{\nu x[S(\underline{q}^*) - (1+\lambda)\underline{\theta}\underline{q}^*] + (1-\nu x)[S(q^a) - (1+\lambda)\overline{\theta} q^a]\}$$
$$-\nu x(1+\varrho p)[(1+\lambda)p - \alpha]\Delta\theta q^a - \nu\varrho(1-p)[x(1+\lambda)p - \alpha]\Delta\theta \overline{q}^r_{ic}$$
$$\text{subject to} \quad \alpha \leq \overline{\alpha}^a(x).$$

Using the envelope theorem (q^a maximizes $W^a(.)$), the impact of x on the renegotiated quantity $\overline{q}^r_{ic}$ (that appears in the renegotiated rent of an efficient firm) is given by: $\frac{d\overline{q}^r_{ic}}{dx} = \frac{-\nu(1+\lambda)}{(1-\nu)S''(\overline{q}^r_{ic})}\Delta\theta$. Moreover,

$$\alpha - \overline{\alpha}^a(x) < 0 \Leftrightarrow x(1-\nu)[\alpha - (1+\lambda)p] + (1+\lambda)(1-x)(1-\nu x) < 0$$
$$\Leftrightarrow 1+\lambda - x\Big[(1-\nu)[(1+\lambda)p - \alpha] + (1+\lambda)(1+\nu)\Big] + x^2\nu(1+\lambda) < 0$$
$$\Leftrightarrow 1 - x[(1-\nu)(p - \frac{\alpha}{1+\lambda}) + 1 + \nu] + x^2\nu < 0.$$

Equating the last expression to zero yields a second-degree equation that has two real solutions, and the expression is negative between its roots. We know that the smallest root is larger than 0 and that the largest root must be larger than 1, since the expression is positive for $x = 0$ and negative for $x = 1$.

The smallest root, denoted $\underline{X}^a$, is:

$$\underline{X}^a \equiv \frac{1}{2\nu}\Big[(1-\nu)(p - \frac{\alpha}{1+\lambda}) + 1 + \nu - \sqrt{(1-\nu)^2(p - \frac{\alpha}{1+\lambda})^2 + 2(1-\nu^2)(p - \frac{\alpha}{1+\lambda}) + 1 - \nu}\Big].$$

$\alpha < \overline{\alpha}^a$ is equivalent to $x > \underline{X}^a$.

Let us define L^a the Lagrangean of the program, with μ the shadow cost of the constraint. Its derivative with respect to x is:

$$\frac{dL^a}{dx} = \nu(1+\varrho p)\{(S(\underline{q}^*) - (1+\lambda)\underline{\theta}\underline{q}^*) - (S(q^a) - (1+\lambda)\overline{\theta} q^a) - [(1+\lambda)p - \alpha]\Delta\theta q^a\}$$
$$+\nu\varrho(1-p)(1+\lambda)\Big[\frac{\nu^2}{1-\nu}[(1+\lambda)px - \alpha]\frac{(\Delta\theta)^2}{S''(\overline{q}^r_{ic})} - p\overline{q}^r_{ic}\Big] + \mu.$$

The optimal value x^a will be 1 if $\frac{dL^a}{dx} - \mu = \frac{dW^a}{dx}$ is positive on all the relevant interval $([\underline{X}^a, 1])$, and $\underline{X}^a$ if it is negative on this interval. It is otherwise equal to the value, denoted x^a, such that $\frac{dW^a}{dx}|_{x^a} = 0$.

The optimal probability of revelation in case (b) is easier to obtain, since the problem is now independent of $\overline{q}^r_{ic}$, except in the definition of the higher bound on x compatible with this case. The objective function $W^b(q^b)$ is linear in x, and the solution must be bang-bang. The smallest possible value of x consistent with $\alpha > \underline{\alpha}^b(x)$ is 0. The highest one corresponds to $q^b = \overline{q}^r_{ic}$. Hence, case (b) must be equivalent, either to the case of pooling, if $\frac{dW^b}{dx} < 0$, or to the case in which $\overline{q}_2 = \overline{q}^r_{ic}$ if $\frac{dW^b}{dx} > 0$.

We have:

$$
\begin{aligned}
\frac{dW^b}{dx} &= \nu\{(1+\varrho p)[S(\underline{q}^*) - (1+\lambda)\underline{q}^*] - \Big[S(\overline{q}_1 - (1+\lambda)\overline{\theta}\overline{q}_1 + \varrho p[S(\overline{q}_2 - (1+\lambda)\overline{\theta}\overline{q}_2]\Big] \\
&\quad - \Big[[(1+\lambda)p - \alpha]\overline{q}_1 + \varrho p(1+\lambda-\alpha)\overline{q}_2\Big]\} \\
&= \nu\{\Big[S(\underline{q}^*) - (1+\lambda)\underline{q}^* - [(1+\lambda)p - \alpha]\Delta\theta\overline{q}_1 - [S(\overline{q}_1 - (1+\lambda)\overline{\theta}\overline{q}_1]\Big] \\
&\quad + \varrho p\Big[S(\underline{q}^*) - (1+\lambda)\underline{q}^* - (1+\lambda-\alpha)\Delta\theta\overline{q}_2 - [S(\overline{q}_2 - (1+\lambda)\overline{\theta}\overline{q}_2]\Big]\}.
\end{aligned}
$$

The first term of the second equality equals the difference in net welfare obtained from an efficient and an inefficient firm in a one-period game with perfect separation. Separation is always preferred in such a game, implying that this difference is positive. The second term is positive for the same reason (it is equivalent to the same difference in welfare for $p = 1$).

To conclude, $\frac{dW^b}{dx} \geq 0$ and the optimal quantity is $q^b = \overline{q}^r_{ic}$. Pooling is never optimal. This proves Proposition 3.

Simple computations show that $\underline{\alpha}^b(0) < 0$ and $\underline{\alpha}^b(1) = (1+\lambda)p$. Case (b) is thus always possible when x tends to zero, but is incompatible with $x = 1$. It is nevertheless compatible with x close to 1, but only for values of α very close to $(1+\lambda)p$. Case (b) is therefore possible only if x is smaller than some function of α. $\alpha > \underline{\alpha}^b$ is equivalent to:

$$[p(1+\lambda)+\alpha(1-\nu)(1-p)] - xp[2(1+\lambda)-\alpha(1-\nu)] + x^2\nu p(1+\lambda) > 0.$$

Solving the associated second-degree equation in x yields two roots, and the expression is negative between them. Since it is positive for $x=0$ and negative for $x=1$ (it then equals $-(1-\nu)[(1+\lambda)p-\alpha]$, we know that the largest root is above 1, and the smallest root larger than 0 but smaller than 1. We will denote $\overline{X}^b$ this smallest root. $\alpha > \underline{\alpha}^b$ is equivalent to $x < \overline{X}^b$.

When $x \in]\overline{X}^b, \underline{X}^a[$, the relevant case is $\overline{q}_2 = \overline{q}^r_{ic}$. This quantity is itself a function of x. The optimal value of x in this interval can be obtained, by the same reasoning as for x^a, by the study of the derivative, with respect to x, of $\mathbf{E}_\theta W$ evaluated at $\overline{q}_2 = \overline{q}^r_{ic}$. No analytical results can be obtained in general, as for x^a.

The comparison between the different cases cannot easily be carried out except when taking limits of the parameters of the problem, which is done in the body of the text. The last proposition can be shown by using limits as follows: When the discount factor, ϱ, tends to zero, the objective function of the initial Government tends to $\nu x[S(\underline{q}^*)-(1+\lambda)\underline{\theta}\underline{q}^*]+(1-\nu x)[S(\overline{q}_1)-(1+\lambda)\overline{\theta}\overline{q}_1]$, which increases in x. The equilibrium value x^* must therefore tend to 1 when ϱ tends to 0 and equals 1 at the boundary $\varrho = 0$ (the equilibrium contract is the static one, which entails perfect revelation).

A.4. Optimal short-term contracts when commitment is not feasible

To allow for comparison, we have computed the optimal short-term contracts when the initial Government is not able to commit at all. We use backward induction. Denoting by $\hat{\nu}$ the revised probability that the firm be efficient, the second-period contract is the optimal static one for $\hat{\nu}$:

- If the initial Government remains in power, the second-period contract entails the following rents and quantities:

$$\underline{U}_2 = \Delta\theta\overline{q}_2 \qquad \overline{U}_2 = 0$$

$$\underline{q}_2 = \underline{q}^* \qquad S'(\overline{q}_2) = (1+\lambda)\overline{\theta} + (1+\lambda-\alpha)\frac{\hat{\nu}}{1-\hat{\nu}}\Delta\theta.$$

- If the initial Government is replaced by a new one, the second-period contract entails the following rents and quantities:

$$\underline{U}^{NG} = \Delta\theta\overline{q}^{NG} \qquad \overline{U}^{NG} = 0$$

$$\underline{q}^{NG} = \underline{q}^* \qquad S'(\overline{q}^{NG}) = (1+\lambda)\overline{\theta} + (1+\lambda)\frac{\hat{\nu}}{1-\hat{\nu}}\Delta\theta.$$

A semi-separating first-period contract entails revelation by an efficient[15] firm with some probability x. This randomization implies that it is indifferent between revealing its type or mimicking the other, so that we must have $\underline{U}_1 = \overline{U}_1 + \Delta\theta\overline{q}_1$ (the second-period rent of an efficient firm does not depend on its first-period choice, contrary to the situation of imperfect commitment). One obtains the specifications of the optimal first period contract given the degree of information revelation, x:

$$\underline{U}_1 = \Delta\theta\overline{q}_1 \qquad \overline{U}_1 = 0$$

$$\underline{q}_1 = \underline{q}^* \qquad S'(\overline{q}_1) = (1+\lambda)\overline{\theta} + (1+\lambda-\alpha)\frac{\hat{\nu}}{1-\hat{\nu}}\Delta\theta.$$

This contract is identical to the second period one ($\overline{q}_1 = \overline{q}_2$ in particular). The expected welfare of the initial Government with short-term contracts, W^{ST}, that will be maximized over x, is

[15] It would be costly to induce randomization by the inefficient firm in our context. The inefficient firm strictly prefers to reveal its type in equilibrium.

thus:

$$\begin{aligned} W^{ST}(x) &= (1+\varrho p)\nu x\Big[S(\underline{q}^*) - (1+\lambda)\underline{\theta}\underline{q}^* - (1+\lambda-\alpha)\Delta\theta\overline{q}_1\Big] \\ &+(1+\varrho p)(1-\nu)\Big[S(\overline{q}_1) - (1+\lambda)\overline{\theta}\overline{q}_1\Big] \\ &+(1-x)\nu\Big[S(\overline{q}_1) - (1+\lambda)\underline{\theta}\overline{q}_1 + \varrho p(S(\underline{q}^*) - (1+\lambda)\underline{\theta}\underline{q}^*) - (1+\varrho p)(1+\lambda-\alpha)\Delta\theta\overline{q}_1\Big] \\ &+\varrho(1-p)\alpha(1-x)\nu\Delta\theta\overline{q}^{NG}. \end{aligned}$$

After simplification, and using the fact that $\frac{d\overline{q}^{NG}}{dx} = -\frac{\nu}{1-\nu}\frac{(1+\lambda)\Delta\theta}{S''(\overline{q}^{NG})}$, we obtain:

$$\begin{aligned} \frac{dW^{ST}(x)}{dx} &= \nu\Big\{[S(\underline{q}^*) - (1+\lambda)\underline{\theta}\underline{q}^*] - [S(\overline{q}_1) - (1+\lambda)\underline{\theta}\overline{q}_1] \\ &\quad -\varrho(1-p)\alpha\Delta\theta\Big[\overline{q}^{NG} - (1-x)\frac{\nu}{1-\nu}\frac{(1+\lambda)\Delta\theta}{-S''(\overline{q}^{NG})}\Big]\Big\}. \end{aligned}$$

The expression is simpler than with commitment: The efficient firm obtains exactly the same rent in both periods when it reveals its type than when it does not, provided that the initial Government remains in power (the quantities required by this Government do not vary over time, contrary to the situation of imperfect commitment). The quantity chosen by the new Government in case of political change has the same shape independently of the first-period contract. In addition, the loss of welfare due to the production of an inadequate quantity by a low-cost firm when it mimics a high-cost one lasts only for the first period, contrary to the imperfect commitment case.

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