Transaction Costs and Incentive Theory

Abstract
This paper tries to reconcile incentive theory with transaction costs theory. We first discuss the fundamental assumptions underlying the use of the Revelation Principle in the standard mechanism design literature and show how various contractual incompletenesses and externalities induced by transaction costs affect the basic trade-off between allocative efficiency and informational rents highlighted by this literature. We then propose reduced form formula to precisely describe the impact of these transaction costs in various contexts.

Résumé
Cet article propose de réconcilier la théorie des incitations et la théorie des coûts de transaction. Nous rappelons dans un premier temps les hypothèses fondamentales sous-tendant le Principe de Révélation utilisé dans la théorie des mécanismes incitatifs. Nous montrons comment des incomplétes contractuelles et certaines externalités induites par ces coûts de transaction affectent l’arbitrage entre efficacité allocative et rentes informationnelles. Nous proposons alors des formes réduites permettant de décrire précisément l’impact de ces coûts de transaction dans un certain nombre de contextes contractuels.

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I. — INTRODUCTION

Over the last twenty five years, incentive theory has been used as a powerful tool to describe how resources can be allocated in a world of decentralized information. The key achievement of incentive theory is that it provides a full characterization of the set of implementable allocations when resources within an organization must be allocated under informational constraints. The basic tool to obtain such a characterization is the Revelation Principle which was demonstrated independently by several authors (1).

The Revelation Principle stipulates that any contractual outcome achieved by an organization where information is decentralized among its members can equivalently be implemented with a simple direct mechanism where privately informed agents send messages on their own piece of information to a media-
tor who, in turn, recommends plans of actions to those agents. Moreover, the agents' messages are truthful in equilibrium, i.e., the mechanism must satisfy a number of incentive compatibility constraints. If the mechanism must be voluntarily accepted by the agents, some participation constraints must also be satisfied. These two sets of constraints completely characterize the set of feasible allocations under asymmetric information.

Once this first step of the analysis is completed, one can stipulate an objective function for the organization and proceed to further optimization. This optimization leads to an interesting trade off between the achievement of allocative efficiency as Coasian bargaining would permit under complete information and the cost of insuring incentive compatibility. Under asymmetric information, conceding informational rents to privately informed agents must be done at the minimal cost and this has allocative consequences. The distribution of payoffs in the organization and the overall size of the cake to be shared among its members are determined altogether.

This two-step procedure has led to an enormous amount of works which are very much normative by nature and which, over the last twenty five years, have changed our view of economics. Progresses due to incentive theory have spanned as many different fields as labor economics, the theory of the firm (2), regulation and procurement (3), public good provision (4), optimal taxation (5), and more recently international trade (6). Roughly and to simplify, any field in economics benefitted from being reconsidered through the lens of the rent-efficiency trade off.

Interestingly, the optimal direct mechanism which is found following this two-step procedure may be implemented in many different ways by real world institutions, i.e., by some sort of indirect mechanisms. For instance, in the procurement context we analyze below, the optimal output produced by a privately informed seller (the agent) for an uninformed buyer (the principal) can equivalently be implemented by letting the agent report his information to the principal and having the latter choose the particular output target and compensation or by letting the principal offer a nonlinear price and letting the agent choose within this menu his most preferred choice. In the first case, the agent has no freedom of actions except on his report to the principal who exerts formal and real authority. In the second case, the agent exerts some form of real authority within the constrained set of decision proposed by the princi-

(2) See Hart and Holmstrom (1987) for survey of these two fields.
(3) See Laffont and Tirole (1993).
(4) See Laffont and Maskin (1982).
(5) See Mirrlees (1971) for his seminal and pathbreaking paper.
(6) See Brainard and Martimort (1997) for instance.
As a consequence, the optimal scheme cannot explain the allocation of authority within the firm. Moreover, whether the agent works in the buyer’s firm or owns his own productive unit has no consequence on the overall allocation of resources. Firm’s boundaries are irrelevant in this context.

This indetermination in the implementation procedure has fascinating consequences since it amounts basically to an Irrelevance Theorem. One of the most striking applications of this irrelevance theorem is that ownership may have no impact on the optimal allocation of resources in the economy. For instance, Sappington and Stiglitz (1987) have shown that a publicly owned firm and a regulated privately owned one can both be induced to produce the same socially optimal output at the same incentive cost by a clever design of the procedure for auctioning the right to produce to the private sector. In this case, privatization has no impact on how resources are allocated between the public and the private sectors of the economy.

At first glance, this Irrelevance Theorem bears much resemblance with the traditional Coase Theorem which states that decentralized bargaining is enough to achieve allocative efficiency and that this outcome is independent of the allocation of property rights. First, note that this latter theorem presupposes that there is no asymmetric information and no transaction costs of any sort. For a given form of decentralized bargaining, asymmetric information introduces allocative inefficiency (7). However, these inefficiencies depend on the allocation of property rights through the role that those rights play in determining the status quo payoffs of agents in the bargaining (8). The Irrelevance Theorem is different from the Coase Theorem along several lines. First, it assumes a world of asymmetric information. Second, for a given set of property rights, it assumes that decentralized bargaining is replaced by a centralized design of the procedure for allocating resources in the organization. This is the implementation of this centralized design which is somewhat indeterminate since it can be realized in many different ways which have different observational consequences in terms of the distribution of authority in the organization (see our procurement example just above). Third, if the procedure for allocating resources also includes the possibility of allocating ownership through ex ante auctioning, clever design makes the allocation of ownership irrelevant.

As a consequence, this Irrelevance Theorem has often been interpreted as saying that incentive theory has nothing to say about such things as the distribution of authority within an organization, the limits of the firm, the separa-

(7) See Fudenberg and Tirole (1991, Chapter 7). Moreover, Myerson and Satterthwaite (1983) have shown that the Pareto efficient bargaining procedures under informational constraints require some allocative inefficiency.

(8) See Cramton, Gibbons and Klemperer (1987) on this point.
tion between the public and the private spheres of the economy, and more generally nothing to say about organizational forms and designs.

In our view, this criticism is clearly valid. However, we think that scholars who advocate this « criticism approach » fail also to give enough justice to what incentive theory is really. Those « pourfenders » of incentive theory have been too eager « to throw away the baby with the water of the bath ». Indeed, the commonly held view of incentive theory provides us only with an ideal benchmark: it describes a world which is frictionless, a world in which transaction costs are absent or at least negligible. In other words, the Revelation Principle is a natural extension of the Arrow-Debreu world to asymmetric information settings. As it is almost nonsense to explain market conduct and firm’s performance within an Arrow-Debreu world, it becomes almost useless to discuss organizational forms with the Revelation Principle as the only tool at hands.

This paper argues that simple and tractable extensions of standard incentive theory can nevertheless take into account various forms of transaction costs and that those forms of transaction costs lead to various contract incompletenesses which can be easily described. Indeed, those forms of incompletenesses are shown to preserve the great advantage of incentive theory, i.e., its ability to describe feasible allocations. To do this, the standard Revelation Principle must be conveniently amended by introducing some transactional constraints which altogether with incentive and participation constraints again completely describe feasible allocations. This characterization, in turn, leads to interesting third best optimizations which describe a world in which the Irrelevance Theorem does not hold any more. Within this third best approach, various organizational forms can thus be compared and, we believe, interestingly distinguished.

Section 2 presents the standard rent-efficiency trade off to which we will refer all along the paper. It solves also for the second best optimal contract in a transaction cost free world. Section 3 discusses the assumptions underlying the applicability of the Revelation Principle and shows how various transaction costs correspond to relaxation of some of these assumptions and that the corresponding grand-contract becomes then somewhat incomplete. Section 4 shows that those incompletenesses are in fact associated to contractual externalities which affect the third best outcome. We show also that there exist quite general reduced form formula describing the impact of these transactional constraints.

II. — THE RENT-EFFICIENCY TRADE OFF: A PROCUREMENT EXAMPLE

As an example of the two-step procedure underlying the use of the Revelation Principle, let us consider the following procurement setting. A prin-
principal, the buyer, delegates production of an output to an agent, the seller. The principal gets a benefit $S(q)$ (with $S' > 0$, $S'' < 0$) from consuming $q$ units of the procured good. The agent incurs a cost $\theta q$ from producing $q$ units. The marginal cost $\theta$ is privately known by the agent. It is drawn in a common knowledge distribution having for support $\{\overline{\theta}, \underline{\theta}\}$ (we denote $\Delta \theta = \overline{\theta} - \underline{\theta}$ the spread of the uncertainty) with respective probabilities $v$ and $1 - v$.

Of course, first best efficiency obtained under complete information requires that production $q^{FB}(\theta)$ is set such that marginal cost equals marginal benefit, i.e. :

$$S'(q^{FB}(\theta)) = \theta$$

for both values of $\theta$.

This contractual outcome can be easily implemented by allowing the principal to make a take-it-or-leave-it offer to the agent. For a given output target recommended to the agent, the principal compensates the latter with a lump-sum transfer so that the agent is just indifferent between producing or not for the principal.

This first best solution can no longer be implemented under asymmetric information. Indeed, as it can be easily shown, the efficient agent would like to claim that he is inefficient to produce the smaller output $q^{fb}(\theta)$ recommended by the principal to the inefficient agent. By doing so, he can save on the production cost an amount $\Delta \theta q^{fb}(\theta) > 0$.

In what follows, we denote by $GC = \{(q, U) ; (\overline{q}, \overline{U})\}$ the grand-contract offered by the principal to the agent. From the Revelation Principle, this is a direct mechanism which induces production and allocates informational rents $(q, U)$ when the firm claims to be efficient and $(\overline{q}, \overline{U})$ when, on the contrary, it claims to be inefficient.

To induce information revelation from the efficient agent, the principal has to leave an informational rent $U$ to the efficient agent which satisfies the following incentive compatibility constraint :

$$U \geq \Delta \theta \overline{q} + \overline{U}.$$  

Similarly, the principal has to induce participation from the least efficient agent. The following participation constraint has thus to be satisfied :

$$\overline{U} \geq 0.$$
It is standard to show that the optimal contract solves the following reduced form problem (9):

\[
\begin{align*}
(4) \quad & \text{Max}_{\{ (q, U) \} : (\bar{q}, \bar{U})} v(S(q) - \bar{q}) + (1 - v)(S(\bar{q}) - \bar{\bar{\theta}} \bar{q}) \\
& \quad - v\bar{U} - (1 - v)\bar{\bar{U}} \\
\text{subject to (2)-(3)}. 
\end{align*}
\]

In the last maximand, one can recognize on (4) the expected efficiency which would be maximized under complete information and on (5) the expected cost of the informational rent which is now incurred by the principal under asymmetric information. Optimization leads to the following second best outputs:

\[
(6) \quad S'(q^{SB}(\bar{\theta})) = \bar{\theta}
\]

and

\[
(7) \quad S'(q^{SB}(\bar{\theta})) = \bar{\theta} + \frac{v}{1 - v} \Delta \theta.
\]

Comparing second best and first best outputs, we have

\[
q^{SB}(\bar{\theta}) = q^{FB}(\bar{\theta}),
\]

i.e., there is no allocative distortion for the most efficient agent; and

\[
q^{SB}(\bar{\theta}) < q^{FB}(\bar{\theta})
\]

i.e., there is a downward distortion of the output requested from the least efficient seller.

Therefore, (7) clearly highlights the rent-efficiency trade off discussed earlier on. By reducing output requested from an inefficient agent, the principal reduces the costly in formational rent of an efficient one. The distribution of informational rents within the organization and the allocative efficiency cannot be disentangled under asymmetric information.

III. — THE IDEAL WORLD OF THE REVELATION PRINCIPLE

That the Revelation Principle describes an ideal world can be easily understood by coming back on the assumptions underlying its applicability. Doing this is important first to understand the real domain of applicability of this

\[
(9) \quad \text{Here, we have omitted the incentive compatibility constraint of the inefficient firm and the participation constraint of the inefficient one which both turn out to be strictly satisfied at the optimum.}
\]
Principle and second to define explicitly what should be a good definition of transaction costs from the point of view of incentive theory.

• **Definition of Transaction Costs for Incentive Theory**: In our view, transaction costs should be understood as *all sorts of impediments* to the applicability of the Revelation Principle.

Our definition is more precise than that given by Coase (1937) and Williamson (1985, 1996) who argue that transaction costs are all sorts of costs incurred both the ex ante (negotiation or writing costs) and ex post (renegotiation, arbitration costs). Concerning ex ante transaction costs, this definition is somewhat unprecise since it puts under the same hat costs of different nature: costs due to asymmetric information (negotiation) and costs due to some limited ability to foresee contingencies or to think about their consequences. Concerning ex post transaction costs, again the definition is unclear. Indeed, renegotiation costs are the consequences of some form of limited commitment which can only be explained by introducing loopholes of the judiciary system, and thus other transaction costs... Arbitration points instead to enforcement problems which are again linked to limits of the judiciary system in case of unforeseen contingencies. In other words, the actual definition of transaction costs à la Coase-Williamson is somewhat self-referencing.

Our definition being stated, we can discuss all the different assumptions underlying the Revelation Principle and trace out the corresponding transaction costs which limit its applicability.

• **Assumption 1: Full Rationality and Complexity**. This is a rather simple observation to make but it deserves to be made. Implicitly, behind the Revelation Principle is the assumption that the mediator (or principal) is able to perfectly reconstruct the strategies of privately informed agents and to include their plans of actions into his recommendations about how the direct mechanism he proposes should be played.

As recognized by Williamson (1975), bounded rationality is one of the possible transaction costs which impedes contractual efficiency. This point is well taken, but neoclassical economics is still having difficulties to deal with this problem and honesty is to recognize that transaction cost economics has not provided us with a powerful analytical treatment of this issue as well. As such, this obviously does not point at a weakness of incentive theory and we will have almost nothing to say on this issue in this paper (10).

(10) In the property right literature, the recent debate between Maskin and Tirole (1999) – Tirole (1999) and Grossman and Hart (1986) – Hart and Moore (1999) also shows that the perfect ability to describe contingencies and the corresponding payoffs and to perform backward induction, in other words, unlimited rationality, is enough to recover efficiency even when no ex ante contract can be written as long as renegotiation of the revelation games used to implement this outcome is not an issue.
• **Assumption 2 : Perfect Communication.** Once communication channels between the mediator and his agents have been opened, information flows up and recommendations flow down costlessly within the organization. This is of course an extreme assumption but little is known on contracting under *communication constraints* (11). The methodological problem here is extremely close to that faced when one wants to deal with bounded rationality. It is quite easy to describe what happens with perfect communication (like with perfect rationality), it is much less easy to introduce convincing restrictions on communication (like convincing restrictions on the ability of agents to perform correct computations). The modeler here necessarily falls in the realm of adhocracy.

Clearly, incentive theory has not yet offered a satisfactory treatment of imperfect rationality and imperfect communication. But again, incentive theory is waiting for more fundamental developments of theory which would help the modeler to cope efficiently with those issues and which would benefit other fields of economic theory as well.

• **Assumption 3 : Full Control of Communication Channels Between Agents.** The mediator used in the Revelation Principle has full control of the communication channels he opens with the privately informed agents. This means that he can prevent at no cost bilateral communication among agents of the organization.

• **Assumption 4 : Full Control of Communication Channels Between Agents and Other Mediators.** The mediator used in the Revelation principle can also prevent at no cost the communication of any of these agents with outsiders or external mediators who do not further communicate with the initial mediator and do not share his objectives.

To understand the consequences of relaxing Assumptions 3 and 4, assume now that there exist some unmodeled transaction costs which make the mediator unable to control all possible communications that an agent of his organization can open.

The first limit on the ability of the principal to control communication channels among agents raises the issue of collusion and cliques formation among workers or between agents and their supervisors. These collusion have been shown to impact quite significantly on the efficiency of an organization as we have learned from industrial sociologists in the field of the theory of the firm (12) and from political scientists in the field of organization of the government (13).

(12) See Dalton (1959), Gouldner (1961) and Crozier (1963) among others.
The second limit on the ability of the principal to control communication channels between agents and outside mediators points at the fact that there is nothing like a single principal ruling all the activities of the economy. The norm instead is that agents report to several principals who may have conflicting interests. This is clearly the case of the management of the firm who is involved in several bilateral contracts with customers, shareholders, creditors, regulators and so on... (14). But multiprincipals structures also abound within governments (15).

Both contractual limits above can be dealt within an incentive theory framework. In both cases, the Revelation Principle must nevertheless be amended. When collusion among agents matters, the set of implementable allocations is conveniently described by appending to the initial individual incentive and participation constraints that must be satisfied by a direct mechanism, the coalition incentive compatibility constraints which guarantee that the possible coalitions which can form do not gain from collectively manipulating informational reports to the principal. This last step of the analysis has been first performed in the early seventies (16) but it has only received its most convincing treatment with Tirole (1986 and 1992) for collusion under symmetric information and Laffont and Martimort (1997, 1999b) for collusion under asymmetric information. In that latter case, bilateral collusion is itself impeded by asymmetric information among colluding agents. Still, the set of implementable allocations can be easily described and the optimization within this set leads generally to a constrained optimum when collusion is a binding concern of the organization.

When communication with other principals matters, the set of equilibrium allocations of the game among non-cooperating multiprincipals is hard to describe with simple direct mechanisms (17). However, as it was initially suggested in Martimort (1992) and formally proved independently in Martimort and Stole (1999a and 1999b) and Peters (1999), the set of equilibria can be described with a Taxation Principle. This Taxation Principle stipulates that any equilibrium outcome of a game with competing mediators can be replicated when mediators offer non-cooperatively indirect mechanisms which leave to the

(14) See Williamson (1985, Chapter 11) for a clear overview of these bilateral deals and the corresponding contractual externalities.

(15) See Wilson (1989), Martimort (1996b) and Dixit (1996) who all argue or formalize that the difference between public and private bureaucracies comes from the fact that bureaucrats are controlled by multiple principals in the former case.

(16) See Green and Laffont (1977) and various contributions therein.

(17) See Epstein and Peters (1996) for a definition of the set of relevant types to which the Revelation Principle should apply. This set includes both physical types and market like information (the contracts of other principals).
common agents the choices of actions within those initially suggested by these mediators. In other words, when one moves from the one principal setting to a multiprincipal setting, direct mechanisms becomes useless to describe equilibrium allocations. Instead, agents must now keep most decision-making and must keep their information for themselves instead of sending it to their competing principals who would otherwise enter into infinite gaming to induce report manipulations into the mechanisms offered by their respective rivals.

Note that in both cases above, the existence of transaction costs which make a principal unable to control all communication channels within his organization does not make impossible a clear characterization of the set of implementable allocations. Incentive theory can still describe how transaction costs which make the control of all communication difficult or impossible for the principal affect the set of feasible allocations.

• Assumption 5 : Full Commitment. An important assumption behind the use of the Revelation Principle is the fact that the mediator can commit to the mechanism he proposes to the agents. Commitment seems the right benchmark to think of a complete contract. If parties to the contract find beneficial to commit ex ante, they should be able to do so just by committing to pay large penalties in case of renegotiation. However, commitment is hard to justify if it is not sequentially optimal. Indeed, in the course of actions, information which would make beneficial a Pareto improving recontracting may become available (18). This issue naturally arises in the case of long-term contracting where the agent’s choice of action in the first period reveals information to the principal before second period contract is implemented (19). Also, it arises even within a single period of contracting when the principal uses a direct mechanism and learns the agent’s report on his type before sending him a recommendation (20) or when the principal contracts ex ante with the agent (i.e., before the latter learns his information) and the agent’s action is chosen after his own learning of information. In the first case, the mechanism may be subject to ex post renegotiation taking place before the second period contract is executed. In the second case, the mechanism may be threatened by interim renegotiation taking place just before its execution itself.

However, in both cases, the principal can perfectly anticipate the issue of the renegotiation and includes this issue into his initial offer. By doing so, the principal ensures that the initial renegotiation-proof contract he offers will come

(18) Moreover, the French Code des Contrats, for instance, allows contractual partners to write a new contract if they wish so.


(20) See Beaudry and Poitevin (1993).
unchanged as an equilibrium outcome of the game of initial contractual offer cum renegotiation. The Renegotiation-Proofness Principle is a natural extension of the Revelation Principle to this limited commitment environment. Incentive theory can again describe all equilibrium allocations by adding to standard incentive and participation constraints a set of renegotiation-proofness constraints.

Here, the impossibility of intertemporal commitments finds itself its origins in various loopholes of the judiciary system, if one is interested in private contracting, or of the Constitution if one is instead interested in public contracting. Transaction costs make those commitments difficult or impossible. Nevertheless, incentive theory can still describe the set of feasible allocations and can still allow to optimize within this set.

• Assumption 6 : Mediator's Benevolence. The mediator of the Revelation Principle is assumed to be a benevolent agent taking the objectives of the organization as his own. In reality, there is a substantial amount of delegation to those mediators. These may be political decision-makers to whom power has been given in elections or these may be CEO to whom shareholders have delegated the control of the firm. Those principals have both private information on how the organization should be run and have also private agendas that they may pursue (21).

The delegation of decision-making to those non-benevolent mediators is thus plagued itself with transaction costs. Again, incentive theory can perfectly describe the contractual imperfections associated to these transaction costs by simply adding the necessary incentive constraints characterizing the behavior of these biased mediators.

• Assumption 7 : Costless Enforcement. Within the realm of the Revelation Principle, the contract between the mediator and the agents is supposed to be perfectly enforceable. Contract enforcement is not an issue. In other words, the judiciary system is perfect and uncorruptible. Several problems arise when the judge enters into the picture. First, the set of verifiable variables which can be part of a contract is somewhat endogenous. It depends on the limited amount of attention and time that the judge is ready to spend on the particular contractual issue which is at stake. This is a moral hazard problem. Second, the contract may specify outcomes for some contingencies which have to be clearly assessed by the judge. This raises the issue of collusion between the judge and one of the contracting parties.

(21) In both examples above, the loss of control is particularly acute since there is a multiplicity of « principals of the principal » (voters and shareholders) who may fail to coordinate in exerting perfect control of the latter.
The judiciary system is thus very much the source of various contractual inefficiencies which can only be modeled by making the judge be an actual player of the game with his own incentives and rewards. In a sense, the costly enforcement framework which is called for at this point is badly defined since introducing the judge as an actual player would call for another layer of enforcement device. One can think of reputations and more general repeated relationships as the potential glues to provide the right incentives to the judiciary system. However, if one believes to this last argument, costly enforcement by an imperfect judiciary system can only be a theoretical issue in the short-run and this does not seem to be the case in practice.

In this survey, we will have little to say on this enforcement issue since little or more exactly nothing is so far known about the role of the judge in the design of incentive schemes.

IV. — CONTRACTUAL EXTERNALITIES AND TRANSACTION COSTS

To summarize Section 3, the Revelation Principle presupposes a set of assumptions which describes an ideal world which is free of any transaction cost. Relaxing these assumptions amounts to introducing various transaction costs which imped the achievement of the second best rent-efficiency trade off obtained in the frictionless world. However, except for the case of bounded rationality and perfect communication, incentive theory still provides a useful description of the constrained feasible set. Once this first step of the analysis is completed it becomes easy to find the constrained optimal contract subject to incentive, participation and some newly defined transaction costs constraints.

Importantly, relaxing any of Assumptions (3) to (6) amounts to introducing the possibility that the initial grand-contract offered by the mediator to his agents is perturbed by further contractings. This may be collusive side-contracting between agents of the organization (Assumption 3), this may be external contracting with other mediators (Assumption 4) or, finally, this may be explicit or implicit recontracting with the principal himself (Assumptions 5 and 6). These further contractings introduce various contractual externalities which affect grand-contracting.

Transaction costs imply thus some form of incomplete grand-contracting and some kinds of contractual externalities associated to those incompleteness.

It is useful to classify contractual externalities with respect to their respective impact on the rent-efficiency trade off discussed in Section 2.

We will say that an externality is negative (resp. positive) if the rent-efficiency trade off is tilted towards excessive rent extraction (resp. excessive efficiency). In this case, there is too much (resp. not enough) rent extraction in the
organization with respect to the case without further contracting.

Coming back on our procurement example, it is easy to write \textit{a priori} an ad hoc formula describing the optimal output choice of the organization when the optimal second best trade off between rent extraction and efficiency is achieved.

Since only the inefficient seller's output is affected by contracting under asymmetric information let us write the third-best output of this agent when both incentive and transactional constraints are taken into account as:

\begin{equation}
S' (q^{TH}(\bar{\theta})) = \bar{\theta} + \frac{\nu}{1 - \nu} (1 - \lambda) \Delta \theta.
\end{equation}

\(\lambda\) is a parameter which is \textit{positive} (resp. \textit{negative}) in the case of a positive (resp. negative) externality.

Still in our procurement example, we discuss now how the various transaction costs previously discussed affect the value of \(\lambda\).

\subsection*{4.1. Vertical Collusion}

Let us now assume that the buyer vertically integrates the production stage. To further control the production process, the owner-buyer sets up a monitoring system: a supervisor is used to report any informative signal that he may have learned on the seller's cost parameter (22).

Let us further assume that these signals are hard information (23). With conditional probability \(\varepsilon\) the supervisor learns that the seller is efficient. Otherwise, he learns nothing.

The fact that both the supervisor and the seller know some piece of information unknown to the principal leaves them the possibility of reaching a collusive side-deal to manipulate this information and to share the gain of this manipulation.

\begin{itemize}
\item (22) Note that the assumption of integration is important here, indeed under non-integration the buyer may not have such a monitoring technology at his disposal (see Williamson (1985, Chapter 4)) or even if he has this monitoring technology, he may not have the auditing rights to use it.
\item (23) See Tirole (1986) for a discussion of this kind of informative signals which can be concealed but not manipulated by the supervisor.
\end{itemize}
In this case, the general expression for \( \lambda \) is the following:

\[
\lambda = \varepsilon (1 - k) > 0
\]

where \( k \in [0,1] \) is a parameter representing the efficiency of side-contracting. \( k \) decreases when the collusive side-contract suffers from greater transaction costs.

Here, the overall contractual externality is positive. Setting up a monitoring system improves incentives within the integrated firm and this definitively tilts the rent-efficiency trade off towards efficiency. However and this last point illustrates the Williamson's view of the large integrated firm as a bureaucratic structure (24), setting up a monitoring system also creates the scope for collusion between the supervisor and the seller unit. This last force is in fact a positive contractual externality. With respect to the case of no-collusion \((k = 0)\), output should be more reduced as collusion becomes more efficient \((k \) increases). Since the collusive stake is proportional to output, the cost of the binding collusion proofness constraint necessary to induce information revelation from the supervisor is reduced with these downward distortions of output. The optimal contract moves towards a more bureaucratic rule leaving little discretion to the privately informed supervisor.

Several theories are now available to describe the behavior of these vertical collusions, i.e., to give foundations to the parameter \( k \).

- **Exogenous \( k \) : Hidden Transfers.** Tirole (1992) argues that, side-transfers being implicit, enforced by a word of honor or by cultural norms within the organization, members of a collusive deal must incur some transaction costs of side-contracting so that necessarily \( k < 1 \).

Laffont and Martimort (1999a) show that the design of the monitoring structures and in particular the division of tasks (25) between supervisors helps to reduce the overall cost of implementing a collusion-proof allocation. Laffont and Meleu (1997) argue informally that the reciprocity of favors in an organization reduces these transaction costs of side contracting.

- **Endogenous \( k \) : Repeated Collusive Relationships.** Martimort (1999a) endogenizes this parameter by explicitly modeling the repeated relationship between a principal, his supervisor and his agent. Side-contracts are now

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(24) See Williamson (1985, Chapter 6).

(25) These authors interpret this division of tasks as a separation of powers in their application of this idea to a regulatory framework.
enforced as self-enforcing collusive equilibria of a repeated game (26). More precisely, one has:

\[
(10) \quad k = \frac{\nu \epsilon}{\nu \epsilon + r - 1}
\]

where \( r > 1 \) is greater if collusive agents have a shorter life in the organization. More informative signals for the supervisor and greater future prospects of a continuing collusive relationship increases the efficiency of side-contracting and tilts the optimal grand-contract towards more rent extraction.

- **Endogenous \( k \) : Delegated Monitoring.** Faure-Grimaud, Laffont and Martimort (1999a and b) analyze hierarchical supervisory structures as nexi of bilateral vertical contracts between first, a principal and an informed supervisor and second, an informed supervisor and an even more informed agent. The design of the delegated contract can be viewed as the choice of a moral hazard variable from the point of view of the top principal. With risk-aversion at the supervisory level, there is an interesting trade-off between providing incentives to this supervisor to choose the right contract with the agent from the point of view of the overall organization and providing him insurance against shocks in the agent’s cost parameter.

In those nested information structures, formula (9) is still valid provided that:

\[
(11) \quad k = k (\epsilon, \rho, \Delta \theta \bar{q})
\]

Now the efficiency of side-contracting is greater when the supervisor has more informative signals on the agent (\( \epsilon \) greater), when he is harder to control (greater degree of risk aversion \( \rho \)) and when collusive stakes are greater (\( \Delta \theta \bar{q} \) greater).

Note that with endogenous \( k \), \( \lambda \) becomes now a function of various organizational parameters: information structures, preferences of the agents, technology, bargaining power of the supervisor at the side-contracting stage. In this third-best world, the exact design of the organization is no more neutral with respect to the rent-efficiency trade-off. The Irrelevance Theorem no longer holds in this context and there is scope for such things as authority structures, limits of the firm, ownership and limits between the public and the private

(26) Martimort (1997) applies the same idea and technics to an instance of horizontal collusion between workers. This model also endogenizes the observation made in Laffont and Meleu (1997) that reciprocal deals are easier to enforce.
spheres (27) since these are all parameters which influence significantly the transaction costs of side-contracting.

4.2. Delegation

Suppose that the buyer cannot procure the good directly but must rely on an intermediary to do the job. This intermediary acts thus as a principal for the seller, he may have a productive task himself or not. The impossibility of a direct contract between the final buyer and the seller creates a setting of sequential contractings between different layers of the hierarchy. Here, the exact timing of contracts signing and the information structure at the time of this signing is quite important to evaluate the true loss (if any) of delegated contracting.

Baron and Besanko (1992), Mookherjee and Reichelstein (1995) and Laffont and Martimort (1998) isolate conditions under which delegation per se does not affect the rent-efficiency trade-off, i.e., \( \lambda = 0 \). In those settings characterized by risk-neutrality of the intermediary and ex ante contracting, some form of the Irrelevance Theorem still applies even if the intermediate principal may be privately informed. The exact design of the organization does not really matter.

This is no longer true when there is some communication constraint and (or) some form of interim contracting (28) as in Laffont and Martimort (1998) and McAfee and McMillan (1995) or some form of moral hazard constraint (veto constraint) on the intermediate principal as in Faure-Grimaud and Martimort (1999) (29).

In this case, summarizing various results in the literature, we have:

\[
\lambda = -1 - \frac{v}{1 - v} (1 - \phi(v, \rho, \Delta \theta \bar{q})) < 0.
\]

where \( \phi(v, \rho, \Delta \theta \bar{q}) \in [0, 1] \) and is equal to 0 in the case of a risk neutral intermediate and 1 in the case of an infinitely risk averse one. Moreover, as shown in Faure-Grimaud and Martimort (1999), \( \phi(v, \rho, \Delta \theta \bar{q}) \) is increasing in the stake

(27) On this last issue, see Martimort and Rochet (1999).

(28) i.e. contracting with the intermediate principal once he has learned some information on the seller.

(29) These latter two authors model explicitly the possibility that the top principal and the intermediate one may have conflicting preferences on the subset of agents who must definitively produce. This adds a « no-shut-down » constraint which creates new agency costs.
\( \Delta \theta \tilde{q} \), capturing the fact that delegation becomes more costly as the intermediate principal has more stake to control.

The contractual externality here is negative. Indeed, the contractual chain of contracts induces distortions extremely close to the « double marginalization effect » of the industrial organization literature (30). The top principal does not internalize the fact that the intermediate principal has already reached a balance between efficiency and rent extraction at the time of contracting with the latter.

4.3. Multiprincipals

A multiprincipal setting is extremely close to a model of delegation. The main difference is that there is no principal on top of the organization, i.e., sequential contracting has to be replaced by simultaneous bilateral contracting between the common agents and their non-cooperative principals.

Let us come back on our procurement example and assume that instead of one buying unit, there are two buyers each with a surplus \( S_i(q_i) \) from consuming \( q_i \) units of the procured good (31). Each of these buyers contracts independently with the common seller. Two cases must be distinguished.

4.3.1. The Case of Complements

Suppose that the seller is a Research and Development venture which provides to both parents an indivisible innovation. This innovation is in fact a public good from the point of view of both principals. In this case, we have (32):

\[
\lambda = -1.
\]

Since none of the principal takes into account the fact that the other principal is also paying the cost of information revelation, there is now excessive rent extraction and the contractual externality is negative. Achieving the right


(31) The case of Type 1 externality (see Laffont and Martimort (1997) for a typology of these externalities in a common agency framework) where \( S_i(q_1, q_2) \) depends on both outputs is fully analyzed by Martimort and Stole (1999b).

(32) Martimort (1998) shows that there exist multiple equilibria in a two type model with perfect complementarity as above. We select thereafter the Pareto dominant one. In the case where \( \theta \) is a continuous variable, Martimort (1992, 1996a) and Stole (1990) show also that there exists multiple ranked symmetric equilibria for imperfect complementarity.
trade-off between efficiency and rent extraction becomes a public good and principals free ride in providing enough incentives to their common agent.

4.3.2. The Case of Substitutes

Suppose now that the seller provides to both parents $q_i$ units from an essential input. More generally, the production cost of the common agent writes now as $\theta C(q_1 + q_2)$ where $q_1$ and $q_2$ are perfect substitutes from the point of view of the agent’s utility function (with $C'' < 0$) (33).

$\lambda = 1$.

With perfect substitutes, the setting is very close to an auction between the principals. The two competing principals are now bidding for the common agent’s services. They do this by conceding a large amount of rent to the agent. Since informational rent is increasing with output, efficiency raises up until first best output is achieved.

In both cases, substitutes and complements, allocative distortions depend on the set of outputs which are under the control of both principals. This third best world leads again to failures of the Irrelevance Theorem. For instance, if ownership of an asset is associated with the auditing rights on the streams of profit generated by this asset, different owner-ship structures of a common venture yield different Nash equilibria between the parents of this common subsidiary and different trade offs between allocative efficiency and rent extraction. An optimal ownership structure should thus minimize on the cost incurred by the organization because of these contractual externalities.

4.4. Renegotiation

Renegotiation of a contract can only be accepted by the agent if he gets more informational rent than without any limit on commitment, i.e. more rent than in the optimal contract without renegotiation described in (7). Since informational rent is increasing in output, allocative distortions implemented in a rene-

(33) In the case of imperfect substitutes, there exists no pure strategy equilibrium in the two type models as shown in Martimort and Stole (1999). Martimort (1992, 1996a) and Stole (1990) show also that there exists a unique symmetric equilibrium in the case of substitutes (perfect and imperfect) with $\theta$ being distributed continuously over an interval. In the case of a continuous variable, we have $\lambda(\theta) \in [0,1]$ with $\lambda(\theta) = 0$ and $\lambda$ is defined over the whole interval $[\theta, \bar{\theta}]$ and where $\frac{v}{1-v}$ is replaced by the hazard rate $\frac{F(\theta)}{f(\theta)}$ of the distribution with $F(\theta)$ the cumulative distribution of $\theta$ and $F' = f$. 

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gotiation-proof contract must induce more production than the second best outcome.

Indeed, again summarizing results in the literature, a whole range of values of \( \lambda \) correspond to renegotiation-proof allocations and they write as:

\[
\lambda = 1 - \mu > 0,
\]

where \( \mu \in [0, 1] \).

The tension between reducing the informational rent for incentive reasons and increasing the informational rent to make the allocation renegotiation-proof tilts the rent-efficiency trade off towards efficiency. The possibility of further recontracting between the principal and the agent creates a positive externality on the initial grand-contract.

Interestingly, this tension is the same whether one is interested in interim or in ex post renegotiations and renegotiation-proof final allocations (i.e., allocations taking place just after the renegotiation stage) can be expressed in the same way.

A priori, from the point of view of the execution of the last stage of contracting there is always some cost of committing to a renegotiation-proof allocation which is not the second best conditionally optimal outcome (34). However, these commitments may have also some benefit in more complex environments.

First, such commitments make credible actions of the agent which may affect the behavior of some third-party who interacts with the principal as it has been shown by Dewatripont (1988). For instance, by committing to excess efficiency with his seller, the buyer commits also to put lots of output on the final product market and this may help him to get a Stackelberg position on this market (35).

Second, in long term relationship, such commitment makes also easier information revelation in the first period. Since the efficient seller has a credible promise on the amount of informational rent he will receive in the future, he does not fear to reveal (at least partially) his type in the first periods of the relationship. This is this trade off between first period and second period incen-

(34) This is the expression coined by Laffont and Tirole (1993, Chapter 10).

(35) Of course, in such a setting, the objective function of the buyer writes as \( S(q, q_e) \) where \( q_e \) is the output put on the final market by his competitor.
tives which has been studied by Dewatripont (1988), Hart and Tirole (1988) and Laffont and Tirole (1993).

There has been very few works dealing with the organizational consequences of renegotiation. However, one can still prove here also that the Irrelevance Theorem fails. For instance, Poitevin (1995) argues that the distribution of information matters at the renegotiation stage and that an organization should be chosen to minimize the burden of renegotiation. Martimort (1999b) shows that combining renegotiation and multiprincipal considerations provides a theory of optimal renegotiation design among competing principals. The basic idea is that the positive externality of recontracting can be mitigated by introducing the negative externality of common agency. In the firm’s context, various creditors should be given contracting rights on the firm’s profit to harden renegotiation and improve the firm’s overall ability to commit. In the context of the organization of the government, the separation of powers helps intertemporal commitment as it has been very often argued by political scientists (36).

4.5. Biased Principals

Let us now consider public procurement and let us assume that delegation of the public decision-making is imperfect in the sense that social welfare is not maximized by elected biased political principals. Let us take the following example. With probability \( \frac{1}{2} \), a rightist government gets elected and he takes a pro industry stance putting a weight \( \alpha \in [0,1] \) on the seller’s informational rent into his objective function. Here the motivation is that rightist parties are financed by the defense industry and their policy choice reflects somewhat the pressure of this industry. With probability \( \frac{1}{2} \), a leftist government gets elected and, still because of reelection concerns, he takes a stance against the industry putting now a weight \( -\alpha \) on the seller’s informational rent into his objective function. Hence, the political biased of the principal, i.e., his degree of non-benevolence, can be viewed as a random variable \( \bar{\alpha} \).

Third best output can still be described with (8) provided that \( \lambda \) satisfies:

\[
\lambda = \bar{\alpha}.
\]

Contractual externalities are now positive (resp. negative) with a rightist (resp. leftist) party.

As shown in Laffont (1995), there are excessive fluctuations of the optimal policies around the socially optimal outcome. In this framework also the

Irrelevance Theorem fails, organizational forms may still be designed to reduce those fluctuations and brings the outcome closer, at least in expectations, to the second best outcome.

For instance, Laffont (1995) shows that simple policy instruments may be preferred to optimal contracts to reduce those fluctuations. Faure-Grimaud and Martimort (2000a and b) and Gabillon and Martimort (1999) show respectively that independence of a regulatory agency and of a central bank from the political sphere improves expected social welfare and can be used strategically by the incumbent principal.

V. — CONCLUSION

This paper has given a definition of transaction costs which proves to be operational to adapt standard incentive theory and make it a better tool to describe real world institutions and organizations. These transaction costs should be taken as primitives of the model. These transaction costs create contractual incompletenesses and not the reverse as it appears often in the transaction cost economic literature. These incompletenesses of the grand-contract leaves the scope for further contractings and as a result various contractual externalities emerge. These externalities, in turn, perturb the rent-efficiency trade-off of the standard incentive literature. Reduced form formula to analyze these perturbations were given. These forms should be viewed as guidelines for the modeler facing more complex and probably untractable settings than those described in this article. In those settings possibly multiple contractual incompletenesses may interact and a reasonable starting point of the economic analysis should be to see how the various contractual externalities add up and how the resulting organization is far away from the optimal rent-efficiency trade-off.

The approach followed in this paper acknowledges some limitations: we did not talk about the hold-up problem, specific investments and more generally the derived property right literature à la Grossman-Hart (1986). In our view, the profession as a whole has somewhat emphasized too much this hold up problem in the definition of contractual incompleteness it has tried to come with over the last fifteen years. Basically, it has become quite natural in the folklore of the profession to think of this type of incompleteness as the only possible explanations of organizational forms and authority structures. This approach may have been relatively successful in explaining firm’s boundaries, but, we feel less convinced by its insights when it comes to understand the internal structure of the firm itself or the design of political constitutions where, clearly, other contractual incompletenesses which have nothing to do with the hold-up problem are at work.

The point of this paper is that some other types of contractual incompletenesses can still be analyzed with almost standard tools and this kind of analysis is clearly worth to be made in a first step. In a second step, more ambitious works should be devoted to explain and endogenize what we have taken as the
primitives of our approach: the various transaction costs which are the impediments to the use of the Revelation Principle. This seems an exciting challenge for further research.

REFERENCES


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MARTIMORT, D., 1998, « Multiprincipal Charter as a Safeguard against Opportunism », mimeo IDEI.


