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Information gathering and the hold-up problem in a complete contracting framework

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ABSTRACT

A risk-neutral seller exerts effort while producing a good. The risk-neutral buyer can gather private information about his valuation. The ex ante optimal contract may encourage information gathering, although it is ex post efficient to trade regardless of the valuation.

1. Introduction

In traditional agency theory, the information structure is taken as given.[1] More recently, economists have begun to study agency models with an endogenous information structure. In this literature, one can distinguish between situations in which information gathering is a productive activity or strategic rent-seeking only.[2] For example, consider a buyer and a seller who can trade a good. If the buyer's valuation may be larger or smaller than the seller's cost depending on the state of the world, then the ex post efficient trade decision requires information gathering. Hence, provided that information gathering is not too costly, it is a productive activity that should be encouraged. However, if it is common knowledge that the buyer's valuation is always positive while the seller's costs are zero, then the buyer should not waste any resources in order to learn his valuation. Nevertheless, the buyer might gather information in order to enjoy an information rent when subsequently the seller can make a take-it-or-leave-it offer. In this case, information gathering is a strategic rent-seeking activity only and should be discouraged from an ex ante perspective.

In the present paper, it is argued that there is a natural class of problems in which information gathering is a strategic rent-seeking activity (i.e., no productive decision is based on the private information), while nevertheless the parties will write a contract that deliberately encourages information gathering.

Specifically, consider the following situation. There are two risk-neutral parties, a buyer and a seller, who can trade a good at some future date 2. There are no relevant wealth constraints. At date 0, they can write a complete contract (in the sense of Tirole, 1999). At date 1, the seller invests unobservable effort in the production of the good. While it is commonly known that the buyer's valuation for the good is positive, he must spend some resources if he wants to privately learn the exact value. The effort costs are sunk at date 2 and the seller has no other use for the good; i.e., at date 2 it is always ex post efficient to trade. Hence, information gathering is a pure rent-seeking activity that would never be pursued in a first-best world.

If the seller's investment level were verifiable, the buyer would never waste resources to learn his value. The parties would contractually specify that the seller must make the efficient investment and that the good is always traded. At date 0, the parties would agree on a fixed price with which they could divide the expected first-best surplus according to their bargaining powers.[3]

Yet, the results are quite different if the seller's investment is a hidden action. If the buyer does not spend resources to learn his valuation, then the payment that the seller receives cannot be made

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[1] See Laffont and Martimort (2002) for an excellent textbook exposition.

[2] See Crémer, Khalil, and Rochet (1998b) and the literature discussed below.

[3] If the parties failed to write a suitable contract and the seller could make a take-it-or-leave-it offer to the buyer ex post, then the buyer would be tempted to spend resources in order to learn his valuation, so that he would enjoy an information rent. Hence, the contract written at date 0 serves to discourage information gathering.

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contingent on the state of the world. But if the seller's payment is constant, she will have no incentive to invest. Thus, in order to give the seller an incentive to invest, it is necessary that the buyer gathers information. In other words, if the parties want to implement a high investment level, then they will have to write a contract that encourages information gathering, even though it is a rent-seeking activity that has no productive purpose when it is undertaken.

The main result of the present paper is a full characterization of the optimal contract in the setting just outlined. It will turn out that the parties induce the buyer to gather information if the seller's investment costs and the buyer's information gathering costs are sufficiently low. In this case, the parties will distort the trade level downwards in the bad state of the world, just as in models with precontractual private information (although in the current setting, the parties are symmetrically informed when they write the contract). Moreover, it will be demonstrated that even more information gathering occurs when the buyer's decision whether or not to gather information is verifiable.

This paper is related to two different branches of the contract theoretic literature. First, there are by now several papers that endogenize the information structure in otherwise traditional adverse selection models, see Crémer and Khalil (1992, 1994) and Crémer, Khalil, and Rochet (1998a, 1998b). Moreover, in the incomplete contracting literature, Aghion and Tirole (1997) and Dewatripont and Tirole (1999) study models in which information gathering is a productive activity that is to be encouraged by the choice of the governance structure. In contrast, Schmitz (2006) considers strategic information gathering in a property rights model (cf. Hart, 1995) and argues that the optimal ownership structure can serve the purpose to discourage information gathering. Second, the present paper is related to the literature on solutions of the hold-up problem in complete contracting models. While most papers in this literature assume complete information, Rogerson (1992) and Schmitz (2002) analyze the case of asymmetric information. Yet, in contrast to the present paper, they do not endogenize the information structure.[4]

2. The model

There are two risk-neutral parties, a buyer and a seller. At date 0, they can write a complete contract with regard to the production and the terms of trade of a specific good.[5] At date 1, the seller decides whether she exerts high effort ($e=e_h$) or low effort ($e=e_l$) while she produces the good, where $0<e_l<e_h<1$. The seller's decision is a hidden action and her disutility of effort is denoted by $c(e)$, where $c(e_l)=0$ and $c(e_h)=c>0$.

The buyer's valuation for the good is high ($v=v_h$) with probability e and low ($v=v_l$) with probability $1-e$, where $v_h>v_l>0$. If the buyer invests $\psi>0$ after the good has been produced, then he privately learns his valuation v. Otherwise, the buyer remains uninformed. At date 2, trade can occur and payments are made according to the contract.

Let $x\in[0,1]$ denote the trade level and let t be the transfer payment from the buyer to the seller. Hence, the seller's payoff is given by $t-c(e)$. The buyer's payoff is given by $xv-t-\psi$ if he gathers information and by $xv-t$ otherwise. The reservation utilities of the parties are zero.

Note that it is always ex post efficient to trade, regardless of the buyer's valuation. Thus, in a first-best world, the buyer would not waste any resources in order to learn the valuation. Moreover, in a first-best solution, high effort would be exerted by the seller if $c<(e_h-e_l)(v_h-v_l)$.

3. The second best

Assume first that the buyer's decision whether or not to invest ψ into information gathering is a hidden action. We will consider direct revelation mechanisms which prescribe a trade level $x(\tilde{v})$ and a transfer payment $t(\tilde{v})$ contingent upon the buyer's announcement of his type, $\tilde{v}\in\{v_l,v_u,v_h\}$, where the message v_u means that the buyer claims to be uninformed. For notational simplicity, let (x_l,t_l), (x_u,t_u), and (x_h,t_h) represent the alternatives between which the buyer can choose. The incentive compatibility conditions which make truth-telling an optimal strategy for the buyer are

$$x(v)v-t(v)\geq x(\hat{v})v-t(\hat{v})\qquad \forall v,\ \hat{v}\in\{v_l,v_u,v_h\}^2,$$

where $v_u=ev_h+(1-e)v_l$ when effort level e is implemented. If the buyer is induced to gather information, the seller is willing to choose high effort whenever the following incentive compatibility condition is satisfied:

$$e_ht_h+(1-e_h)t_l-c\geq e_lt_h+(1-e_l)t_l.$$

This condition can be rewritten as

$$t_h-t_l\geq\frac{c}{e_h-e_l}.$$

When the buyer is not induced to gather information, the seller will never choose high effort, because in this case she always gets the payment t_u, regardless of the state of the world.

The parties are symmetrically informed at date 0. Hence, according to the Coase Theorem, they will always write a contract that makes the expected total surplus as large as possible.[6]

Proposition 1.

(i) If $c\geq(e_h-e_l)(v_h-v_l)$, then there is no information gathering, the parties implement low effort, and trade always takes place; i.e., the first-best solution is attained.

(ii) If $c<(e_h-e_l)(v_h-v_l)$, then the first-best solution requires high effort. In this case, it is impossible to achieve the first-best, regardless of ψ.

It is trivial to implement the first-best when the effort costs are so large that low effort would be chosen even in a first-best world.[7] In the remainder of the paper, we thus focus on the interesting case:

Assumption 1. $c<(e_h-e_l)(v_h-v_l)$.

We have already seen that the seller will never choose $e=e_h$ if the buyer remains uninformed, because then the transfer payment that the seller gets cannot depend on the buyer's valuation. If high effort is to be implemented, the information gathering costs ψ must be incurred, which never happens in a first-best world. Yet, there must be an additional deviation from the first-best if the parties want to implement high effort. Since it is always ex post efficient to trade, the truth-telling constraints imply a constant transfer payment when the parties insist on first-best trade levels. Hence, the seller would not

[4] Note also that the present paper considers investments with direct externalities. See the buyer–seller example in Maskin and Moore (1999) for an analysis of such investments in an incomplete contracting framework. Cf.also Che and Hausch (1999) and De Fraja (1999).

[5] Hence, there are no ad hoc restrictions on the class of feasible contracts. In particular, renegotiation can be ruled out. Maskin and Tirole (1999) argue that differing assumptions in the incomplete contracting literature are motivated by considerations that lie outside the existing models. In any case, the complete contracting framework is an important benchmark.

[6] They can divide the expected total surplus between them by suitable lump-sum components of the payments. It depends on the parties' ex ante bargaining powers how they divide the expected total surplus. For example, if the buyer is a "principal" who can make a take-it-or-leave-it offer, then he will extract the expected total surplus, so that the seller's expected payoff is zero.

[7] In this case, the parties contractually specify $x_l=x_u=x_h=1$ and a lump-sum payment $t_l=t_u=t_h$ in order to divide the expected total surplus $e_lv_h+(1-e_l)v_l$ between them. Clearly, the seller will choose the low effort level and the buyer will not spend any resources to gather information.