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# Incentives to Acquire Information under Mandatory versus Voluntary Disclosure

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## Abstract

This paper compares the incentives of a party to acquire information prior to negotiating contractual terms with a second party. Two legal regimes are compared: disclosing information before negotiations start is mandatory or it remains voluntary. By assumption, information can only truthfully be disclosed but, under voluntary disclosure, the fact that no evidence was found cannot credibly be communicated. If the party that may acquire information enjoys encompassing bargaining power, the incentives to acquire information will be excessive relative to first best quite generally. Otherwise, more surprisingly, acquisition incentives turn out insufficient even under voluntary disclosure for an informational setting referred to as selfish acquisition. For another setting, referred to as cooperative acquisition, the incentives under voluntary disclosure are even lower as compared with mandatory disclosure. All results hold independently of the underlying bargaining structure as exclusive use of constraints is made that hold for equilibrium payoffs from any bargaining game.

JEL classification: K12, K13

Keywords: information acquisition, disclosing information, asymmetric information, mandatory disclosure, voluntary disclosure

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# 1 Introduction

More than two thousand years ago, Cicero in “de officiis” constructed cases of contracting parties who had struck a deal under asymmetric information prior to sale. If Rhodos is suffering from a famine and a seller is shipping crop to Rhodos, does he report of other boats approaching with crop or does he remain silent in order to obtain a higher price? Or if a seller sells gold but thinks he sells brass, does the buyer tell him or does he silently buy gold at the price of brass? Ever since Cicero, legal scholars have kept debating about circumstances when such contracts should be enforced and when not.

Mistake is accepted as a valid formation defense in many legal systems. In addition to general rules from contract law, legal systems may provide remedies that are specific for transactions on markets for equity or insurance contracts and may impose duties to disclose explicitly.

Kronman (1978) was among the first to approach the issue from a law and economics perspective. His analysis departs from an apparent inconsistency in contract law. On the one hand, there exist contract cases where a promisor, due to unilateral mistake, is excused from performance. On the other hand, there also exist cases where a party is entitled to withhold information. To resolve the issue, he proposes the following theory. The law tends to recognize a right to deal with others without disclosing what he knows provided that the information is the result of a deliberate and costly search. Such a right, however, is not recognized where the information has casually been acquired.

Shavell (1994), being stimulated by Kronman’s article, introduced a formal model to explore a closely related issue in greater depth and in line with insights from information economics. He compares the incentives to acquire information prior to sale under mandatory disclosure versus voluntary disclosure. Voluntary disclosure is meant to capture those cases where the informed party has the right to deal without disclosing. Mandatory disclosure, in contrast, may reflect these other cases where the informed party will effectively be led to disclose as, otherwise, her partner may be excused from performance or she would face other severe sanctions. Shavell’s main conclusions are as follows. Voluntary disclosure generates excessive incentives (relative to first best) for acquiring information. Mandatory disclosure is socially desirable for sellers whereas, for buyers, the right to deal without disclosing may be

required to spur acquisition of socially desirable information.

The present paper considers a more general but still related model. Nonetheless, rather different conclusions emerge from my analysis. Voluntary disclosure need not generate excessive incentives to acquire information. Voluntary disclosure may result in even lower incentives than mandatory disclosure. Incentives to acquire information under mandatory disclosure remain insufficient quite generally.

Shavell's findings rest on the assumptions that the party who may acquire information has encompassing bargaining power. She can unilaterally propose the contract on a take-it-or-leave-it (TIOLI) basis to the buyer. Moreover, the parameters of his model are chosen such that the buyer is commonly known to value the good higher than the seller (trivial trade decision).

In a regime of voluntary disclosure, bargaining takes place under asymmetric information. The TIOLI-assumption may be convenient as it simplifies the analysis of the underlying bargaining game. Yet, in many situations, the assumption of one party being endowed with encompassing bargaining power simply does not fit. For that reason, the present paper allows for bargaining procedures where both parties may have positive bargaining power.

In contrast to the related literature, however, I do not solve any specific bargaining game explicitly. Rather, the analysis makes use of properties of payoffs only that are shared by the equilibrium outcome of various bargaining procedures. Voluntary participation, in particular, is common to all such procedures and, hence, equilibrium payoffs must satisfy corresponding participation constraints. Moreover, the party that has obtained information may always disclose it prior to negotiations voluntarily. By doing so, she may unilaterally change the informational setting under which negotiations take place. As a consequence, her equilibrium payoffs must satisfy corresponding disclosure constraints.

At one point of the analysis (see section 6 below), use of incentive constraints will be made. Again, equilibrium payoffs of the party that may acquire information will satisfy such constraints quite generally.

The analysis of the present paper concentrates on equilibrium payoffs and makes exclusive use of the above constraints such that the exact specification of the bargaining procedure and the explicit calculation of its equilibria under asymmetric information can be dispensed with. Therefore the results will

hold no matter whether the bargaining is of TIOLI-nature or not and they include non-trivial trade decisions. In fact, particular attention will be paid to cases where, in the absence of information, it would be best to renounce a deal.

In some aspects, my setting may be reminiscent of the hold-up literature as pioneered by Grossman and Hart (1986). In that literature, renegotiations take place under contracts that, for reasons whatsoever, fail being complete. In my setting, incompleteness arises as parties meet and start negotiations only after one of them may have covertly acquired information. Whether, at that point, disclosing information prior to negotiations is mandatory or remains voluntary has been decided by others (law or courts).

In general, the simple dichotomous choice between mandatory and voluntary disclosure remains too crude an instrument to implement the first best solution. But the choice affects the incentives to acquire information nonetheless. I follow Shavell (1994) by comparing the incentives to acquire information under mandatory versus voluntary disclosure and relative to first best.

I also follow Shavell by assuming that asymmetric information is of exogenous nature. Other boats with crop may or may not approach Rhodos, a piece of land may or may not contain an oil well, the real estate value of a company going public may be unknown to the company itself, or the true risk of a financial asset may remain uncertain for both the seller and the buyer. Under exogenous asymmetric information, the information status of the possibly informed party may also be subject to asymmetric information.

Along these lines, Matthews and Postlewaite (1985) and Shavell (1994) have studied negotiations under exogenously given asymmetric information where one of the parties may acquire information prior to sale.

This is in contrast to endogenous asymmetric information due to the fact that, prior to negotiations, one of the parties has covertly invested to affect the possible gain of the relationship. Notice, under endogenous asymmetric information and in contrast to exogenous asymmetric information, one of the parties is always commonly known to be fully informed.

Gul (2001), Lau (2007) and Hermalin (2013) have examined negotiations among two parties under endogenous asymmetric information in the above sense. Among these studies, Lau is the only one to allow for acquisition

of information by the uninformed party. On this account, I follow her by imposing the same acquisition technology: the party acquiring information decides on the probability of learning the true move of nature where a higher probability causes higher costs. Lau, however, does not compare incentives to acquire information under mandatory versus voluntary disclosure.

In a setting of exogenous asymmetric information, Matthews and Postlewaite (1985) provide such a comparison in a reduced-form game that is consistent with a game in which the firm is a monopoly price-setter. Their acquisition technology, however, deviates from the one studied by Lau and the present paper. Acquisition is assumed free of cost and a firm which decides to test learns the quality of the product for sure.

The literature quoted above has in common that explicit bargaining essentially of TIOLI- nature only is considered. While many papers deal with one-stage TIOLI, Gul (2001) and Lau (2007) also explore the case where one party makes an offer of the TIOLI-type repeatedly.

The present paper examines incentives to acquire information of exogenous nature under mandatory versus voluntary disclosure without TIOLI-assumption. It is organized as follows. In section 2, the general setting is introduced and, as a reference point, the first best solution is discussed. For illustration, an underlying allocation problem is spelled out. All results, however, will hold beyond this allocation problem as proofs do not refer to this underlying specification.

Section 3 deals with the legal regime where mandatory disclosure is effectively imposed such that negotiations take place under symmetric information: either both parties or none of them know the move of nature. Unless the party that may acquire information enjoys encompassing bargaining power, incentives to acquire information remain insufficient (relative to first best) under mandatory disclosure quite generally.

Section 4 deals with investment incentives under voluntary disclosure. If the party who may acquire information obtains the entire surplus (at least in those situations where the move of nature is commonly known) then acquisition incentives under voluntary disclosure turn out to be excessive indeed. Notice, the assumption needed for this general result would certainly be met if the party who may acquire information can propose the contractual terms on TIOLI-basis. At lesser bargaining power, however, the incentives to ac-

quire information may compare quite differently as is shown in the next two sections where I distinguish selfish from cooperative acquisition and deal with cases where, in the absence of information, the deal should not be struck.<sup>1</sup>

In section 5 on selfish acquisition, incentives to acquire information are shown to be insufficient even under voluntary disclosure whereas, in section 6 on cooperative acquisition, incentives under voluntary disclosure are shown to be lower even if compared with mandatory disclosure.

Section 7 concludes. For illustration and to justify the constraints on equilibrium payoffs that were imposed, one way of deriving equilibrium payoffs from a given bargaining game is spelled out in the appendix explicitly.

## 2 First best solution

The general setting is as follows. Two risk-neutral parties A (she) and B (he) meet to negotiate a contract. The joint surplus of their relationship may remain uncertain. Uncertainty is captured by a random move  $\omega$  of nature from the outcome space  $\Omega$ . This outcome space is endowed with a probability measure  $\pi$  in the sense that, for any event  $\Omega' \subset \Omega$ , the function  $\pi(\Omega')$  denotes the probability of this event.

The reservation payoffs (outside option) of party A and B are denoted as  $u(\omega)$  and  $v(\omega)$ , respectively, and may depend on the move of nature.

If the move  $\omega$  of nature is known then the maximum surplus of the relationship amounts to  $\sigma^*(\omega)$ , if not the expected maximum surplus amounts  $\sigma^0$ . It seems natural to assume that the inequalities

$$E[u(\omega) + v(\omega)] \leq \sigma^0 \leq E[\sigma^*(\omega)] \quad (1)$$

hold in expected terms.

For the following specification of the underlying allocation problem, in fact, (1) can even be proven to hold. Think of a buyer-seller or buyer-producer relationship facing some decision  $q$  from a given set  $Q$  of alternatives, including the outside option  $q = o$ . The payoffs of A and B (not including transfer payments) amount to  $A(\omega, q)$  and  $B(\omega, q)$ , respectively,

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<sup>1</sup>The terms selfish and copoperative are borrowed from Che and Chung (1999) where, however, they refer to effects from investments instead of information as in the present paper.

social surplus to  $S(\omega, q) = A(\omega, q) + B(\omega, q)$ . Uncertainty may concern all of these payoffs, including the reservation payoffs  $u(\omega) = A(\omega, o)$  and  $v(\omega) = B(\omega, o)$  of both parties.

Alternatively, the decision  $q$  may have to be taken by the buyer after having bought an indivisible good from the seller. This version of the allocation problem has been studied by Shavell (1994) and by Hermalin (2013).

The set  $Q$  of alternative decisions may even be multi-dimensional, allowing to distinguish trade according to the time when agreement was reached.

For such a specification, if  $\omega$  is known then the maximum surplus amounts to

$$\sigma^*(\omega) = \max_{q \in Q} S(\omega, q)$$

whereas, if the move of nature remains uncertain, the maximum expected surplus is equal to

$$\sigma^0 = \max_{q \in Q} E[S(\omega, q)].$$

With such a specification of the allocation problem, the constraints (1) would obviously be met. The analysis does not refer to any specific allocation problem but, instead, will make use of properties (1) only.

Prior to negotiations, one of the two parties (party A by convention) may invest to acquire information. I use the same acquisition technology as Lau (2008). Accordingly, party A's investment decision  $x \in [0, 1]$  concerns the probability of learning the true move of nature. With probability  $1 - x$ , she learns nothing. To be informed with probability  $x$  causes costs  $k(x)$  that must be borne by her. Investments take place before the two parties meet. At the negotiation stage, investment costs are sunk.<sup>2</sup>

The first best solution requires investments

$$x_w \in \arg \max_{x \in [0, 1]} w(x)$$

that maximize expected welfare  $w(x)$ . Expected welfare (net of search costs) amounts to

$$w(x) = \sigma^0 + x \cdot \Delta_w - k(x)$$

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<sup>2</sup>Notice, in Shavell (1994), parties differ in their exogenously given costs of being informed. The present model, in contrast, introduces the probability of being informed as a decision variable such that the incentives to be informed can be explored. Yet, the difference in modelling is rather a matter of taste than of substance. Under both approaches, it is the value of being informed only that matters.



where

$$\Delta_w = E[\sigma^*(\omega)] - \sigma^0 \geq 0 \quad (2)$$

denotes the social gain from being informed. By assumption (1), this gain can never be negative and it will be strictly positive whenever the information has social value.

After having described the first best solution, the remaining sections deal with deriving and comparing the incentives to acquire information under rules of mandatory versus voluntary disclosure as well as relative to this first best solution.

### 3 Mandatory disclosure

In the present setting, the two parties are assumed to negotiate while being symmetrically informed. At the time of contracting, party A's acquisition effort is sunk and either A knows the true move of nature or she does not. By assumption, if A knows it to be  $\omega$  then, under mandatory disclosure, she meets her duty to disclose  $\omega$  truthfully (to avoid severe sanctions).

If, however, A does not know the true move she cannot disclose and has to remain silent. In this case, under mandatory disclosure, party B is aware of the fact that party A herself does neither know the move of nature.

Therefore, in either case, bargaining takes place among symmetrically informed parties if information sharing is governed by effective mandatory disclosure.

The bargaining game will not be specified explicitly. Rather, the analysis directly refers to the equilibrium payoffs. If parties A and B know  $\omega$  to be the true move of nature, their equilibrium payoffs are denoted by  $\alpha(\omega)$  and  $\beta(\omega)$  whereas, if they do not know it, their expected payoffs are denoted by  $\alpha^0$  and  $\beta^0$ , respectively.

As each party may unilaterally enforce the outside option, the participation constraints

$$u(\omega) \leq \alpha(\omega) \text{ and } v(\omega) \leq \beta(\omega) \quad (3)$$

must hold for any move  $\omega$  that is known whereas the participation constraints

$$E[u(\omega)] \leq \alpha^0 \text{ and } E[v(\omega)] \leq \beta^0 \quad (4)$$

must hold in expected terms if the move of nature remains unknown. These participation constraints concern symmetrically informed parties.

As long as parties negotiate under symmetric information, I assume the *Coase Theorem* to be valid in the sense that

$$\alpha(\omega) + \beta(\omega) = \sigma^*(\omega) \quad (5)$$

holds for all moves of nature whereas

$$\alpha^0 + \beta^0 = \sigma^0 \quad (6)$$

holds in expected terms. In other words, outcomes negotiated by symmetrically informed parties are assumed efficient.

Anticipating these equilibrium payoffs, party A has the incentive of being informed with probability  $x_m$  that maximizes her objective function ( $m$  refers to mandatory disclosure)

$$f_m(x) = \alpha^0 + x \cdot \Delta_m - k(x)$$

where A's private gain from being informed amounts to

$$\Delta_m = E[\alpha(\omega)] - \alpha^0. \quad (7)$$

Under mandatory disclosure, party A has the incentive of learning the true move of nature with probability

$$x_m \in \arg \max_{x \in [0,1]} f_m(x).$$

To compare these incentives with those under first best, it follows from the *Coase Theorem* (5) and (6) and from (2) and (7) that

$$\Delta_w - \Delta_m = E[\sigma^*(\omega) - \sigma^0 - \alpha(\omega) + \alpha^0] = E[\beta(\omega)] - \beta^0$$

must hold. The following proposition summarizes the comparison of incentives.<sup>3</sup>

**Proposition 1** *Suppose investments  $x_w$  maximize the expected welfare whereas investments  $x_m$  maximize party A's objective function under mandatory disclosure. Then  $\Delta_w - \Delta_m = E[\beta] - \beta^0$  and, hence, investment incentives compare as follows:*

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<sup>3</sup>The proof is a further application the intensity principle as proposed by Schweizer (2013).

- (i) If  $\beta^0 < E[\beta]$  then  $x_m \leq x_w$ .
- (ii) If  $E[\beta] < \beta^0$  then  $x_w \leq x_m$ .
- (iii) If  $\beta^0 = E[\beta]$  then  $\arg \max_{x \in X} w(x) = \arg \max_{x \in X} f_m(x)$ .

**Proof.** The difference  $w(x) - f_m(x) = \gamma + x \cdot (\Delta_w - \Delta_m)$  of the two objective functions is an affine function of  $x$  with coefficient

$$\Delta_w - \Delta_m = E[\sigma^* - \sigma^0 - \alpha + \alpha^0] = E[\beta] - \beta^0$$

and with constant term  $\gamma = \sigma^0 - \alpha^0$ . Therefore, in case (iii), the two objective functions differ by a constant term only from which claim (iii) follows immediately.

In case (i), the difference is strongly monotonically increasing in  $x$  such that, for any  $x < x_m$ ,

$$w(x) - f_m(x) < w(x_m) - f_m(x_m)$$

and, hence,

$$w(x) < w(x_m) - [f_m(x_m) - f_m(x)] \leq w(x_m)$$

must hold. It follows, that welfare  $w(x)$  cannot attain a maximum in the range  $x < x_m$  and, for that reason, claim (i) must be valid indeed.

Claim (ii) follows analogously. ■

Under mandatory disclosure, party A has insufficient incentives to acquire information provided that  $\beta^0 < E[\beta(\omega)]$  holds. The next proposition provides conditions under which this inequality would be met.

In the hold-up literature as pioneered by Grossman and Hart (1986), parties negotiating under symmetric information are usually assumed sharing the surplus in fixed proportions  $\lambda$  and  $\lambda - 1$  which, in the present setting, means that

$$\alpha(\omega) = u(\omega) + \lambda \cdot [\sigma^*(\omega) - u(\omega) - v(\omega)]$$

as well as

$$\alpha^0 = E[u(\omega)] + \lambda \cdot E[\sigma^0 - u(\omega) - v(\omega)]$$

and, hence,

$$\Delta_w - \Delta_m = (1 - \lambda) \cdot \Delta_w \geq 0$$

must all hold. Therefore, if the surplus is shared in fixed proportions, case (ii) of the above proposition does not occur and, hence, incentives to acquire information can never be excessive under mandatory disclosure.

Moreover, if party A has the entire bargaining power (i.e.  $\lambda = 1$ ) as Shavell (1994) assumes then, under mandatory disclosure, A has efficient incentives to acquire information quite generally as follows from claim (iii) of the above proposition.

If, however, party A has less than full bargaining power (i.e.  $\lambda < 1$ ) and if information has positive social value (i.e.  $\Delta_w > 0$ ) then she has insufficient incentives to acquire information, well in line with the hold-up literature.<sup>4</sup>

Even if the surplus is not shared in fixed proportions, there exists an important class of examples where these incentives can never be excessive. If, in the absence of information, the outside option is efficient such that

$$E[u(\omega) + v(\omega)] = \sigma^0 \quad (8)$$

holds for all moves  $\omega \in \Omega$  of nature then incentives to acquire information can neither be excessive. The following proposition summarizes these findings.

**Proposition 2** *If either,*

(a) *under symmetric information, the surplus is shared in fixed proportions  $\lambda$  and  $1 - \lambda$*

*or if,*

(b) *in the absence of information, the outside option would be efficient then the incentives to acquire information under mandatory disclosure cannot be excessive if compared with first best (i.e.  $\Delta_m \leq \Delta_w$ ).*

**Proof.** It only remains to be shown that the claim is true under assumption (b).

It follows from participation constraint (4), the *Coase Theorem* (6) and assumption (8) that the parties' participation constraints (4) must be binding. In particular,  $\beta^0 = E[v(\omega)]$  must hold. Moreover, it follows from party A's participation constraints (3) that  $E[v(\omega)] \leq E[\beta(\omega)]$  and, hence,  $\beta^0 \leq E[\beta(\omega)]$  must hold. The proof then immediately follows from proposition 1. ■

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<sup>4</sup>To show the inequality  $x_m < x_w$  in the strict sense, the cost function  $k(x)$  must be differentiable and the appropriate Inada condition must be met.

## 4 Voluntary disclosure

In this section, the legal regime is explored where the disclosure of information is at the discretion of party A. More precisely, the following informational setting is imposed.

If party A does not learn the true move of nature, she cannot produce any evidence at all and, hence, she necessarily has to remain silent. In particular, she cannot credibly communicate the fact that she is uninformed as hiding evidence remains always an option under voluntary disclosure.<sup>5</sup>

If, however, party A learns the true move  $\omega$  of nature, she may either voluntarily disclose  $\omega$  truthfully or may hide it, but she cannot reveal any untrue move of nature.

Therefore, if A discloses the (true) move  $\omega$  of nature, negotiations take place under symmetric information such that the parties' equilibrium payoffs amount to  $\alpha(\omega)$  and  $\beta(\omega)$  as discussed in the previous section.

If, however, party A remains silent then party B does not know whether such silence is due to her having not learned the true move of nature or whether she knows the true move of nature but prefers hiding it. As a consequence, parties are asymmetrically informed whenever party A remains silent. Furthermore, let me also assume that the investment decision  $x$  of party A itself remains always hidden to party B.

In (bargaining) equilibrium, the event space  $\Omega$  will be partitioned into

$$\Omega = \Omega_h \cup \Omega_d$$

where  $\Omega_h$  consists of those moves of nature that A hides and  $\Omega_d$  of those that she discloses voluntarily.

If A remains silent but knows the true move of nature to be  $\omega$  then party A's and B's equilibrium payoffs amount to  $\phi(\omega)$  and  $\psi(\omega)$ , respectively. If A remains silent because she is not informed, expected equilibrium payoffs are denoted as  $\phi^0$  and  $\psi^0$ , respectively.

Under asymmetric information, the *Coase Theorem* need not hold. Therefore, if party A knows  $\omega$  but hides it, the sum of payoffs may not reach the

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<sup>5</sup>Under mandatory disclosure, in contrast, hiding evidence is prohibited. Therefore, given sufficient sanctions for violations, party A's claim that she has not obtained any information becomes credible under mandatory disclosure.

maximum, i.e. for  $\omega \in \Omega_h$ , only the inequality

$$\phi(\omega) + \psi(\omega) \leq \sigma^*(\omega) \quad (9)$$

is assumed to hold. Similarly, if party A remains silent because she does not know the move of nature, the inequality

$$\phi^0 + \psi^0 \leq \sigma^0 \quad (10)$$

is assumed to hold in expected terms.

Suppose party A knows the true move  $\omega$  of nature but hides it. Then, in equilibrium, her payoff must be at least as high as if she had disclosed. i.e.

$$\alpha(\omega) \leq \phi(\omega) \quad (11)$$

must hold for all  $\omega \in \Omega_h$ . This condition will be referred to as disclosure constraint.

The remaining conditions common to equilibrium payoffs are participation constraints. Since party A may unilaterally impose the outside option even if she does not know the true move of nature, the inequality

$$E[u(\omega)] \leq \phi^0 \quad (12)$$

must hold in equilibrium.

Party B's participation constraint whenever A remains silent can be derived as follows. If A remains silent, party B forms beliefs by thinking of party A as knowing the true move of nature with probability  $p$ . In equilibrium, party B's beliefs must be consistent with what party A actually does (see (15) below).

Therefore, as party B may unilaterally impose the outside option, the participation constraint

$$\begin{aligned} & (1-p) \cdot E[v(\omega)] + p \cdot E[v(\omega) \mid \Omega_h] \\ & \leq (1-p) \cdot \psi^0 + p \cdot E[\psi(\omega) \mid \Omega_h] \end{aligned} \quad (13)$$

must be met in expected terms.

Under voluntary disclosure, party A's expected payoff as a function of  $x$  amounts to

$$f_v(x) = \phi^0 + x \cdot \Delta_v - k(x)$$

where

$$\Delta_v = \pi(\Omega_h) \cdot E[\phi(\omega) \mid \Omega_h] + \pi(\Omega_d) \cdot E[\alpha(\omega) \mid \Omega_d] - \phi^0 \quad (14)$$

denotes A's private value of being informed (subscript  $v$  refers to voluntary disclosure).

In equilibrium, party A chooses a probability of being informed

$$x_v \in \arg \max_{x \in [0,1]} f_v(x)$$

which maximizes her objective function  $f_v(x)$ .

Given such incentives, finally, party B's beliefs are consistent if the condition

$$p = \frac{x_v \cdot \pi(\Omega_h)}{1 - x_v + x_v \cdot \pi(\Omega_h)} \quad (15)$$

is met.

The following proposition shows that, under voluntary disclosure, party A has excessive incentives to acquire information (relative to first best) quite generally, provided that party A enjoys encompassing bargaining power under symmetric information. By that I mean that her payoff amounts to

$$\alpha(\omega) = \sigma^*(\omega) - v(\omega) \quad (16)$$

whenever both parties know  $\omega$  as the true move of nature and  $\alpha^0 = \sigma^0 - E[v(\omega)]$  in expected terms. If this condition is met party A receives, up to party B's reservation payoff, all of the joint surplus.

Notice, condition (16) would, in particular, be met if party A can propose contractual terms on TIOLI-basis as assumed by Shavell (1994) and several other papers of the related literature.

**Proposition 3** *Suppose it is prohibitively costly for party A to learn the move of nature for sure (as, e.g.,  $\lim_{x \rightarrow 1} k(x) = \infty$ ). If, in addition, party A enjoys encompassing bargaining power under full information (i.e. (16) holds) then the following claims must be true:*

$$(i) \ E[\sigma^0 - \phi^0 - v(\omega)] \geq 0.$$

(ii) Party A has excessive incentives to acquire information under voluntary disclosure but efficient incentives under mandatory disclosure (i.e.  $\Delta_m = \Delta_w \leq \Delta_v$ ).

**Proof.** It follows from (9), (10) and party B's participation constraint (13) that

$$\begin{aligned}
& (1-p) \cdot \phi^0 + p \cdot E[\phi \mid \Omega_h] \\
\leq & (1-p) \cdot (\sigma^0 - \psi^0) + p \cdot E[\sigma^* - \psi \mid \Omega_h] \\
\leq & (1-p) \cdot \sigma^0 + p \cdot E[\sigma^* \mid \Omega_h] - \\
& -(1-p) \cdot E[v] - p \cdot E[v \mid \Omega_h]
\end{aligned}$$

must hold.<sup>6</sup>

By rearranging terms, it follows that

$$(1-p) \cdot E[\sigma^0 - \phi^0 - v] \geq p \cdot E[\phi - \sigma^* + v \mid \Omega_h].$$

As becoming informed for sure is prohibitively costly,  $p < 1$  must hold in equilibrium (see (15)). Since party A has encompassing bargaining power in the sense of (16),

$$E[\sigma^0 - \phi^0 - v] \geq \frac{p}{1-p} \cdot E[\phi - \alpha \mid \Omega_h]$$

must hold such that claim (i) now immediately follows from the disclosure constraint (11).

To establish claim (ii), it follows from (14), (2) and (16) that

$$\begin{aligned}
& \Delta_v - \Delta_w \\
= & \pi(\Omega_h) \cdot E[\phi \mid \Omega_h] + \pi(\Omega_d) \cdot E[\alpha \mid \Omega_d] + E[\sigma^0 - \phi^0 - \sigma^*] \\
= & \pi(\Omega_h) \cdot E[\phi - \alpha \mid \Omega_h] + E[\sigma^0 - \Phi^0 - \sigma^* + \alpha] \\
= & \pi(\Omega_h) \cdot E[\phi - \alpha \mid \Omega_h] + E[\sigma^0 - \Phi^0 - v].
\end{aligned}$$

It then follows from the disclosure constraint (11) and claim (i) that  $\Delta_v - \Delta_w \geq 0$  must be satisfied.

From the encompassing bargaining power of party A, finally, it follows that

$$\Delta_w - \Delta_m = E[\sigma^*(\omega) - \alpha(\omega)] - (\sigma^0 - \alpha^0) = E[v(\omega)] - E[v(\omega)] = 0$$

must hold, such that the proposition is fully established. ■

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<sup>6</sup>Notice, for convenience, I occasionally suppress  $\omega$  as an argument.



Endowing the party that searches for information with encompassing bargaining power turns out to be crucial for establishing excessive incentives under voluntary disclosure. At less than full bargaining power, the result may collapse as will be shown in the next two sections.

For that purpose, I will consider two informational settings at the extreme edges to which I refer to as selfish and cooperative acquisition of information. For these two settings, incentives to acquire information can be compared without specifying the bargaining procedure explicitly provided that, in the absence of information, the outside option would be efficient in the sense of condition (8).

## 5 Selfish acquisition of information

Under selfish acquisition of information by party A, the informational setting is such that party B's reservation payoff  $v(\omega) = b$  remains independent of the move of nature. Moreover, to ensure party B's participation, the constraints

$$v(\omega) = b \leq \psi(\omega) \quad (17)$$

must hold for all moves of nature  $\omega \in \Omega_h$  that party A would hide in equilibrium whereas

$$E[v(\omega)] = b \leq \psi^0 \quad (18)$$

will be met in expected terms whenever party A remains silent because she does not know the move of nature.

To justify these properties, let me refer to the possible specification of the underlying allocation problem as introduced in section 2. For this specification, selfish acquisition of information by party A means that the move of nature directly affects her own payoff function  $A(\omega, q)$  only whereas party B's payoff function  $B(q)$  remains independent of  $\omega$ . Party B's reservation value  $v(\omega) = B(o)$  will then also be independent of the move of nature.

Moreover, party B knows his payoff from any trade decision  $q$  and transfer payment  $t$  to be  $B(q) - t$  and can compare it with the value of his outside option  $v(\omega) = b$ . In equilibrium, his payoff cannot be lower such that the participation constraints (17) and (18) will hold indeed under this particular

specification.<sup>7</sup>

In the following, exclusive use of (17) and (18) will be made such that the next proposition remains valid for other specifications of the allocation problem that satisfy these two constraints.

**Proposition 4** (*selfish acquisition of information*) *Suppose that the participation constraints (17) and (18) are met and that, in the absence of information, the outside option is efficient (i.e. (8) holds). Then the following claims are valid:*

$$(i) \alpha^0 = \phi^0 = E[u(\omega)] \text{ and}$$

$$\beta^0 = \psi^0 = E[v(\omega)] = \sigma^0 - \phi^0.$$

(ii) *Party A has insufficient incentives to acquire information even under voluntary disclosure (i.e.  $\Delta_v \leq \Delta_w$ ).*

(iii) *Under mandatory disclosure, incentives are even lower (i.e.  $\Delta_m \leq \Delta_v$ ).*

**Proof.** To establish claim (i), use of the participation constraints (4), (12) and (18) will be made. Due to the *Coase Theorem* (6) and the constraint (10), it follows from the assumption (8) of the outside option being efficient in the absence of information that the above constraints must all be binding.

In particular, the equalities

$$\alpha^0 = E[u(\omega)] = \phi^0 \text{ and } \beta^0 = E[v(\omega)] = \psi^0$$

as well as

$$\phi^0 + \beta^0 = \sigma^0$$

must all hold such that claim (i) is fully established.

To establish claim (ii), it follows from (2), (14) and claim (i) that

$$\begin{aligned} \Delta_w - \Delta_v &= E[\sigma^* - \sigma^0 + \phi^0] - \pi(\Omega_h) \cdot E[\phi \mid \Omega_h] - \pi(\Omega_d) \cdot E[\alpha \mid \Omega_d] = \\ &= \pi(\Omega_h) \cdot E[\sigma^* - \phi \mid \Omega_h] + \pi(\Omega_d) \cdot E[\sigma^* - \alpha \mid \Omega_d] - \beta^0 \end{aligned}$$

and hence, from (5), (9) and claim (i), that

$$\Delta_w - \Delta_v \geq \pi(\Omega_h) \cdot E[\psi - \beta^0 \mid \Omega_h] + \pi(\Omega_d) \cdot E[\beta - \beta^0 \mid \Omega_d]$$

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<sup>7</sup>Notice, this argument holds even under sequential bargaining<sup>l</sup>, at least in the absence of discounting.

must hold.

It now follows from claim (i) and (17) that  $\beta^0 = E[v(\omega)] = b$ . Since, again due to (17),  $\beta^0 = b \leq \psi(\omega)$  and since, due to (3),  $\beta^0 = b \leq \beta(\omega)$  it follows that  $\Delta_w - \Delta_v \geq 0$  must hold indeed. Claim (ii) is established.

To establish claim (iii), finally, it follows from (14), (7) and claim (i) that

$$\begin{aligned}\Delta_v - \Delta_m &= E[\alpha^0 - \alpha - \phi^0] + \pi(\Omega_h) \cdot E[\phi \mid \Omega_h] + \pi(\Omega_d) \cdot E[\alpha \mid \Omega_d] = \\ &= \pi(\Omega_h) \cdot E[\phi - \alpha \mid \Omega_h] + \alpha^0 - \phi^0\end{aligned}$$

and, hence, from the disclosure constraint (11) and claim (i), that  $\Delta_v - \Delta_m \geq 0$  must hold. Claim (iii) is fully established. ■

Under selfish acquisition of information, the intensity of incentives to acquire information can unambiguously be ranked provided that, in the absence of information, the outside option would be efficient. Voluntary disclosure generates insufficient but still stronger incentives than mandatory disclosure. Recall that this ranking of the two regimes based on the intensity of incentives holds independently of details of the bargaining game.

## 6 Cooperative acquisition of information

Under cooperative acquisition of information, the equilibrium payoff of party A will be constant whenever she remains silent, i.e.

$$\phi(\omega) = \phi^0 \tag{19}$$

is assumed to hold for all moves  $\omega$  of nature from the event  $\Omega_h$ . Moreover, her reservation payoff

$$u(\omega) = a \tag{20}$$

also remains independent of the move of nature under cooperative acquisition.

To justify these conditions, I refer again to the specification of the underlying allocation problem from section 2. In this specification, acquisition is of cooperative nature if the information acquired by party A directly affects the payoff function of party B only. This means that party A's payoff function  $A(q)$  remains unaffected by the move of nature.

The bargaining strategy of party A who knows  $\omega$  to be the true move of nature may still be different from the strategy if she does not know this move.

Yet, since party A could easily mimic these different bargaining strategies, in equilibrium, her payoff must be the same. Otherwise, she would always deviate to the strategy that yields the highest payoff. For a formal derivation of condition (19), the reader may visit the appendix.

In the setting of cooperative acquisition, party A has even lower incentives to acquire information under voluntary disclosure if compared with mandatory disclosure as the following proposition establishes.

**Proposition 5** (*cooperative acquisition of information*) *Suppose that the constraints (19) and (20) are met and that, in the absence of information, the outside option is efficient (i.e. (8) holds). Then the following claims are valid:*

- (i)  $\alpha^0 = a \leq \phi^0$  and  $\alpha^0 = a \leq \alpha(\omega)$  for all moves of nature  $\omega \in \Omega$ .
- (ii) *The incentives to acquire information under voluntary disclosure are even lower than under mandatory disclosure (i.e.  $\Delta_v \leq \Delta_m$ ).*
- (iii) *Even under mandatory disclosure, the incentives to acquire information are insufficient relative to first best (i.e.  $\Delta_m \leq \Delta_v$ ).*

**Proof.** Due to the participation constraints (4) and the *Coase Theorem* (6), it follows from (20) and (8) that

$$a = u(\omega) = E[u(\omega)] = \alpha^0 \text{ and } \beta^0 = E[v(\omega)]$$

must hold. Claim (i) then immediately follows from party A's participation constraints (12) and (3).

To establish claim (ii), consider

$$\Delta_m - \Delta_v = E[\alpha - \alpha^0 + \phi^0] - \pi(\Omega_h) \cdot E[\phi \mid \Omega_h] - \pi(\Omega_d) \cdot E[\alpha \mid \Omega_d]$$

which can be rearranged, using  $\alpha^0 = a$  from claim (i), to

$$\begin{aligned} \Delta_m - \Delta_v &= \pi(\Omega_h) \cdot E[\alpha(\omega) - a \mid \Omega_h] + \pi(\Omega_h) \cdot \{\phi^0 - E[\phi \mid \Omega_h]\} + \\ &\quad + \pi(\Omega_d) \cdot \{\phi^0 - a\}. \end{aligned}$$

The first and the last term are non-negative as follows from claim (i). The second term vanishes due to (19). Claim (ii) is established.

Claim (iii) directly follows from proposition 2. ■

## 7 Conclusion

Investments to acquire information prior to negotiations may fail to be contractible. As a substitute, law and courts delineate residual rights in the form of disclosure duties. Such residual rights, if anticipated, affect the incentives to acquire information. The present paper has compared acquisition incentives under mandatory versus voluntary disclosure.

In general, acquisition incentives will be distorted under both regimes. If the party that may acquire information has encompassing market power, incentives turn out to be excessive under voluntary disclosure but insufficient under mandatory disclosure. As a consequence, no general results on the ranking based on welfare under the two regimes can be expected to hold.

Under less than encompassing bargaining power, even the ranking based on the intensity of incentives may become ambiguous. I have identified, however, two particular informational settings where a ranking based on the intensity of acquisition incentives can be established independent of the bargaining procedure. In the setting of selfish acquisition of information, incentives are insufficient even under voluntary disclosure whereas, under mandatory disclosure, they are even lower. In the setting of cooperative acquisition, however, it is the other way round: incentives to acquire information are lower under voluntary than mandatory disclosure. These results hold at least if, in the absence information, it would be best not to strike a deal.

Under cooperative acquisition, the rankings based on intensity of incentives and welfare coincide. In fact, under voluntary disclosure, not only incentives are lower but the negotiated outcome, due to asymmetric information, may fail to be ex post efficient.

Ex post inefficiency may also be the reason why, in the setting of selfish acquisition, the ranking based on the intensity of incentives may differ from the one based on welfare. While incentives to acquire information are higher under voluntary disclosure, the negotiated outcome may fail to be efficient. For this reason, distortions due to ex post inefficiency may outweigh those from lesser acquisition of information.

## 8 Appendix: equilibrium payoffs derived from a bargaining game

For illustration, I refer to the underlying allocation problem as introduced in section 2 above. Parties A and B have to agree on a decision  $q \in Q$  (including mixed decisions) and a transfer payment  $T \in \mathbb{R}$  from A to B. Given the random move  $\omega \in \Omega$  of nature, the payoffs of A and B amount to

$$A(\omega, q) - T \text{ and } B(\omega, q) + T,$$

respectively.

Bargaining procedures are usually described in extensive form. Yet, in the following, I directly look at the associated normal form. The sets of strategies of A and B (including mixed strategies) are denoted by  $A$  and  $B$ . At strategy profile  $(a, b) \in A \times B$ , the (possibly mixed) decision  $q(a, b) \in Q$  is assumed to result whereas  $T(a, b)$  denotes the resulting (expected) payment from A to B. Notice, the set  $A$  and  $B$  of available bargaining strategies and the outcome in terms of decisions  $q(a, b)$  and payments  $T(a, b)$  do not depend on the actual move  $\omega$  of nature (they constitute a game form) but the parties' payoff functions do.

In fact, at strategy profile  $(a, b) \in A \times B$ , the resulting payoffs of parties A and B amount to

$$A(\omega, q(a, b)) - T(a, b) \text{ and } B(\omega, q(a, b)) + T(a, b),$$

respectively. The game in normal form with  $A$  and  $B$  as strategy sets and the above payoff functions is played whenever party A remains silent, be it that A does not know the move of nature or that A knows  $\omega$  but hides it.<sup>8</sup>

As a particular option, both strategy sets contain the decision to leave negotiations. By choosing this strategy, each party may unilaterally enforce the outside option  $q = o$ .

Under asymmetric information, a Bayesian Nash equilibrium consists of mutually best responses combined with consistent beliefs. Given that party B does not learn the move of nature on his own, his best response always

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<sup>8</sup>The same game game form may, of course, be used to describe the outcome under mandatory disclosure. Yet, as none of these games is solved explicitly, such an assumption will not be needed.

consists of some non-contingent bargaining strategy  $b^N \in B$  ( $N$  refers to Nash). Notice, while B's strategy has to be non-contingent, B may learn from A's bargaining behavior nonetheless and may update his beliefs accordingly.

Party A may or may not know the true move of nature. If she does not know it, her best response consists of a non-contingent bargaining strategy  $a^{N0} \in A$  as well. If, however, she knows the true move  $\omega$  of nature yet hides it, her bargaining strategy  $a^N(\omega) \in A$  may still be state-contingent.

To qualify as a Bayesian Nash equilibrium, the following conditions of best responses must be met. If A does not know the move of nature, she chooses a non-contingent best response

$$a^{N0} \in \arg \max_{a \in A} E [A(\omega, q(a, b^N))] - T(a, b^N) \quad (21)$$

to B's equilibrium strategy  $b^N$  that maximizes her expected payoff. If, however, she knows  $\omega$  to be the true move of nature, her best response

$$a^N(\omega) \in \arg \max_{a \in A} A(\omega, q(a, b^N)) - T(a, b^N) \quad (22)$$

to  $b^N$  will typically be state-contingent. For convenience, I am specifying such a best response even for moves  $\omega$  of nature where A, by disclosing voluntarily, would actually trigger the game being played under symmetric information instead.

From this setting, the following equilibrium payoffs will emerge:

$$\phi(\omega) = A(\omega, q(a^N(\omega), b^N)) - T(a^N(\omega), b^N)$$

$$\psi(\omega) = B(\omega, q(a^N(\omega), b^N)) + T(a^N(\omega), b^N)$$

$$\phi^0(\omega) = A(\omega, q(a^{N0}, b^N)) - T(a^{N0}, b^N)$$

and

$$\psi^0(\omega) = B(\omega, q(a^{N0}, b^N)) + T(a^{N0}, b^N)$$

In the paper, I have directly argued in terms of these equilibrium payoffs. In this appendix, I derive them from a bargaining game. Under this construction, all the constraints imposed on equilibrium payoffs in the paper can be proven to hold.

Party A knowing  $\omega$  to be the true move of nature could leave negotiations to end up with reservation payoff  $u(\omega) = A(\omega, o)$ . Since  $a(\omega)$  is a

best response to B's bargaining strategy  $b^N$ , it follows that the participation constraint

$$u(\omega) = A(\omega, o) \leq \phi(\omega)$$

must hold indeed. The other participation constraints must hold for similar reasons.

Furthermore, let me consider the setting of cooperative acquisition of information in which party A's payoff function  $A(q)$  remains independent of the move of nature. In this setting, the two optimization problems (21) and (22) are identical such that the equilibrium payoffs

$$\phi(\omega) = E [\phi^0]$$

must coincide as assumed in the paper.

Shavell (1994) and Hermalin (2013) examine the case where an indivisible commodity is exchanged for sure and where the decision  $q$  reflects an investment choice that is taken by the buyer after trade. Negotiations concern the transfer payment only which the buyer must pay to the seller. Again, equilibrium payoffs in such a setting would satisfy all constraints imposed on them in the paper as well.

The same holds true for infinitely repeated bargaining procedures provided that, if played under symmetric information, agreement is reached in the first period such that the *Coase Theorem* remains valid.

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