Inquisitorial vs. Adversarial system and the Right to be Silent

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Abstract

In this paper we aim to compare the precision of a final decision under two legal systems: adversarial and non-adversarial (or inquisitorial). The motivating application for our analysis is the persistent structural differences in the way the antitrust authorities of the US and EU operate; one is adversarial, the other is administrative or non-adversarial.

Under adversarial system a decision maker does not collect any evidence on his own and bases his decision solely on the evidence submitted by the parties. Whereas under inquisitorial system a decision maker acquires evidence on his own and chooses to rely or not on the evidence submitted by the party under the process.

Conventional wisdom suggests that having two opposing parties competing in the amount of the information acquired and asymmetric allocation of a burden of proof leads to an increase in the total information acquired and thus to more precise decisions. A stream of literature supports these arguments and emphasizes this feature as one of the core advantages of the adversarial system.

However the manipulability of the information, or more precisely, the right of the interested parties to be silent, together with costly acquisition, might undermine this result.

Comparing the two systems leads to an additional supportive argument in favor of inquisitorial system: when the stakes of the dispute of the parties are relatively small or the loss from a mistake is high, the inquisitorial system results in a higher precision of the final decision, due to the fact that the effort of a decision maker in evidence collection is higher than the effort of the parties under adversarial system. However when the stake/ loss ratio increases, the adversarial system leads to fewer errors, as the intense competition between the parties results in more information being revealed compared to inquisitorial system.

1 Introduction

In this paper we aim to compare the precision of a final decision under two legal systems: adversarial and non-adversarial (or inquisitorial). Both justice systems insist upon the right adjudication of the accused and the protection of the innocent. But there are basic differences as to the rules of procedures in each of these systems. Each system has been developed in its own historical setting. Each system therefore has its own advantages and disadvantages. We mainly concentrate on the positive analysis of a decision maker behavior, i.e. the precision of a final decision in both systems, and abstract from other advantages and disadvantages without undermining their importance.

The motivating application for our analysis is the persistent structural differences in the way the antitrust authorities of the US and EU operate; one is adversarial, the other is administrative or non-adversarial.

The inquisitorial model of justice relates to Romano Germanic System of Law, which is also known as the civil law system or the continental law system. It aims to attain justice with the composite effort of the decision maker (court, regulator, etc.), and the involved parties (prosecutor, the defense lawyer). The decision maker (DM) himself can play an active role in acquiring evidence under the investigation of the case and the examination of the witness. Since the DM himself is active to secure justice, legal representation from the side of the accused is not regarded as indispensable, however the DM can choose to take the evidence into account submitted by the side of the accused. This system has its advantages and disadvantages that affect the precision of the final decision. The DM plays a substantive role in the trial to secure justice, however this may lead him to have a biased attitude and ignore the evidence provided by the other side. However the DM has to rely on all the information that he acquired and cannot be silent in disclosing this information. In our analysis the DM will always choose to take into account the evidence provided by the accused side and will take his final decision based on all the evidence available, without ignoring evidence provided by the party.

The adversary system is close to Anglo-American system and those of its past colonies. It advocates the supremacy of law, that is, the equal treatment in law of

all segments of society. It places the DM in a neutral position equivalent to that of an referee in a football game. Therefore legal representation from both sides is an indispensable part of this system. The belief is that if both parties were to act according to the rules of the procedure, justice can be secured. The neutral behavior of the DM promotes the sense of justice and the fairness of the process. The accused has the right to silence, and can suppress the available unfavorable evidence. However, in this system, the DM is helpless to correct obvious errors if they are not supported by the information given to him by the parties. In addition, the prosecutor sometimes may not be able to find sufficient evidence against the accused due to an inability to assert sufficient effort. This leads to the collapse of the case.

Conventional wisdom suggests that having two opposing parties competing in the amount of the information acquired leads to an increase in the total information acquired and thus to more precise decisions. A stream of literature supports these arguments and emphasizes this feature as one of the core advantages of the adversarial system (Shavell[1989], Shin [1994, 1998], and Dewatripont and Tirole [1999]). Possession of possibly conflicting evidence and the strategic behavior of parties gives rise to complementarities in the investment decisions at the information acquisition stage. The more information one party has, the more information another party is trying to acquire in order to support its position, as each piece of evidence can be pivotal for the DM's final decision.

However the manipulability of the information, or more precisely, the right to be silent, together with costly acquisition, might bring new insights to the strategic information acquisition and revelation (Angelucci [2012]). These new insights call for the revisiting of the relative performance of the two systems.

We adopt the framework of Angelucci [2012] to compare the performance of the two systems. There are two pieces of evidence available which, once they are acquired and revealed, serve as an informative signal about the underlying state of nature. The parties can exert costly effort and come into possession of either two, one or no pieces of evidence. The probability of evidence possession increases with the amount of effort that each party exerts at the information acquisition stage. All the parties, except of DM, once possessing the evidence, have the right to remain silent and transmit only a sub-set of the gathered evidence.

The adversarial system consists of a decision maker, whose objective is to learn the "truth", and two persuaders that have opposing preferences. The DM does not collect any evidence on his own and bases his decision solely on the evidence submitted by the parties.

The inquisitorial system in contrast involves the decision maker in the information acquisition, i.e. the DM decides how much effort to put into the investigation. The DM may consider referring to a party in question for additional information. The decision maker therefore bases his decision on the information acquired on his own plus the information, if any, from the party.

Evidence collection remains costly for both the party and the DM. The party strategically decides which subset of the gathered evidence to disclose to the DM, while the DM should make a decision based on all the information at his disposal. We compare both system when the burden of proof, (i.e. the DM's status - quo decision favours one party over the other by rule) lies on the prosecution side. However we then discuss the endogenous choice of the burden of proof by the DM. It appears that the allocation of the burden of proof on the prosecution side constitutes an equilibrium in the adversarial system, however the result is inversed in the inquisitorial system, i.e. allocation of the burden of proof on the accused side is an equilibrium choice of the DM.

Our analysis shows that the adversarial system leads to asymmetric investment by the parties in information acquisition, i.e. to non-uniform complementarities in their efforts. The effort of the accused party is a strategic complement whereas the effort of burdened party is strategic substitute. The burdened party's chosen effort is decreasing in his adversary's, while the latter's is increasing in the former's. Whereas in inquisitorial system the strategic nature of efforts of the DM and the accused parties is uniform: the efforts are strategic complements if the burden of proof is on the DM and strategic substitutes if the burden of proof is on the accused party.

In addition the incentives to acquire information in the adversarial system are mainly driven by the stakes for the two opposing parties rather than by the potential loss from an erroneous decision. In the inquisitorial system by contrast the effort of the parties depend as well on the loss from an erroneous decision. In fact a greater loss generates greater investment in information acquisition.

Comparing the two systems leads to the following conclusions: when the stake of the dispute is small relative to the DM's loss from an error, the adversarial system performs better and results in a more precise decision. The errors of the non-adversarial system are mainly favorable for the interested party. However when the stake/ loss ratio decreases, the non-adversarial system leads to fewer errors, as even when the stake of the interested party is small, the information acquisition is driven up by the loss of DM in inquisitorial system, in contrast to the reduced combined effort of both parties in the adversarial system.

Our analysis provides supportive arguments and additional justification for the non-adversarial system, especially when the interests of the parties in the investigation are sufficiently low relative to the loss from a mistake of the decision maker.

We further aim to investigate the performance of a mixed system, i.e. involving three parties, the DM and the two opposing parties, at the evidence collection stage.

Literature overview

A strand of literature emphasizes the superiority of the adversarial system with respect to information revelation. Milgrom and Roberts [1986] show that when parties have opposing interests, and evidence therefore necessarily favoring one side over the other, most relevant information should be disclosed. In their setting however evidence is assumed to be non-manipulable and costless to obtain. Within the literature investigating the performance of adversarial and inquisitorial systems, Shin [1998] considers a set-up in which evidence is costless to acquire and the persuaders differ in their ability to gather information. By appropriately allocating the burden of proof onto the better informed party, the adversarial judicial system is shown to dominate the inquisitorial one. Inquisitorial system is however limited to a decision maker only without allowing a decision maker to rely on the information provided by the interested party. Unlike Shin, in our set-up the parties are ex-ante symmetric and the information acquisition is costly. Allocating the burden of proof on one party rather than the other is in fact the channel through which parties become asymmetric. Another departure from the setting of Shin

is allowing for DM to rely on the information of the interested party. Further, Dewatripont and Tirole [1999] show that competition between persuaders is useful to reduce moral hazard in information acquisition. Although information is both costly to acquire and manipulable, the absence of partial manipulability is such that strategic complementarities play almost no role in their analysis.

The possibility to withhold the obtained evidence and costly acquisition bring new insights to strategic information acquisition and disclosure in the adversarial system. Angelucci [2012] shows that imposing burdens of proofs leads to persuaders behaving asymmetrically when gathering information: one persuader is a "strategic substituter" while the other is a "strategic complementer". These strategic considerations imply that excessive polarization among the persuaders may lower the quantity of information revealed and, consequently, the precision of the decision. This result calls for revisiting the relative performance of the two systems.

The notion of burden of proof has also been the object of much scholarly work. Hay and Spier [1997] for instance investigate its impact on the parties' incentives to gather evidence and provide a normative analysis of its allocation. Because evidence may not be partially manipulated, however, strategic behaviors play a less important role. Furthermore, Bernardo, Talley and Welch [2000] analyse the impact of legal presumptions in a principal agent relationship, and Che and Severinov [2009] investigate the role played by lawyer advice in determining submission strategies, and link it to the burden of proof.

Several experimental works find weak empirical evidence for the superiority of the adversarial system. Lind, Thibaut and Walker [1973] run a series of experiments to study the relative performance of two systems. They find on average that the adversarial system is superior at combating the bias of a decision maker but they do not find strong support in favor of the adversarial system with respect to evidence collection. Firstly, the adversarial system apparently does not generally provoke a more vigorous search for facts, but does instigate a more thorough investigation by advocates initially confronted with unfavorable evidence. Secondly, the total number of unique facts presented to the fact finder is apparently not greater in an adversarial system than in the ideal alternative systems.

In our paper we revisit the comparison of the two systems, allowing for the

interested party to withhold unfavorable evidence and allowing the decision maker in the inquisitorial system to use evidence submitted by the interested party. We discuss the conditions under which one system performs better than the other and find additional supportive arguments for the inquisitorial system.

The rest of the paper is organized as follows: Section 2 introduces the set-up. Section 3 analysis the equilibrium of interest and the precision of the final decision under the two systems. Section 4 concludes.

2 Set-up of the Model

Consider a decision maker, DM, and two opposing parties, A and B. DM and both parties are risk neutral. The example can be a competition authority in the role of DM, a firm under investigation as A and a prosecutor as B, though other interpretations can be given. A wants to take an action, that generates profit S if allowed. B strictly prefers the action to be disallowed. She obtains profit S if the action is forbidden and 0 if the action is undertaken. S can thus be interpreted as the stake of the decision for the interested party. DM has to take a binary decision to allow the action or not, i.e. $a = 1$ or $a = 0$.

Nature draws a state of nature, good or bad, $\omega \in \Omega = \{g, b\}$. If the state is 'good' the action is favorable to DM, and if the state is 'bad', the action is unfavorable to DM. Let L be the loss for DM from disallowing the action when $\omega = g$ and allowing the action when $\omega = b$. The realization of the actual state is unobservable for all the parties and both states are equally likely. All players' common prior is that both states are equally likely.

All the parties have potential access to the two same pieces of evidence: x and y. The first piece of evidence, x, is drawn from a countable set X. The second piece of evidence, y, is drawn from a countable set Y. The whole set of evidence is denoted by $z = (x, y)$, drawn according to the joint pdf $f_\omega(z)$, with marginal probabilities $g_\omega(x)$ and $h_\omega(y)$. Each party can choose to exert some unobservable effort, e_i, $i = DM, A, B$, at cost $C(e_i)$, in order to acquire evidence: upon exerting effort e_i, party i comes into possession of x with probability $\frac{\pi(e_i)}{3}$, y with probability $\frac{\pi(e_i)}{3}$, and no evidence with probability $1 - \pi(e_i)$.

The evidence gathered by party A or B is that party's private information. In

addition, A and B can choose to disclose or not any evidence at their disposal. The submission of evidence costs ε for parties A and B.

We will sometimes refer to these parties as "persuaders". By contrast, DM cannot hide the evidence he obtains, but may be free to rely only on the evidence acquired on his own or to take into account any evidence submitted by the interested party. In addition he cannot commit to any decision rule ex-ante.

2.1 Payoffs

Denote by $\nu_\omega(e_{DM}, e_A)$ the probability that the action is allowed, i.e $a = 1$, given the state of nature ω.

Then A's expected payoff is written as:

$$U_A = \frac{1}{2}\nu_g(e_{DM}, e_A, e_B)S + \frac{1}{2}\nu_b(e_{DM}, e_A, e_B)S - C(e_A) \tag{1}$$

B's payoff is respectively:

$$U_B = \frac{1}{2}(1 - \nu_g(e_{DM}, e_A, e_B))S + \frac{1}{2}(1 - \nu_b(e_{DM}, e_A, e_B))S - C(e_B) \tag{2}$$

DM's payoff is:

$$U_{DM} = -\frac{1}{2}(1 - \nu_g(e_{DM}, e_A, e_B))L - \frac{1}{2}\nu_b(e_{DM}, e_A, e_B)L - C(e_{DM}) \tag{3}$$

2.2 Roles and evidence collection

We will consider two systems: inquisitorial and adversarial.

In the *inquisitorial system* B plays no role: DM can acquire evidence on his own and can rely on the evidence submitted by A, the party under investigation.

In the *adversarial system* the evidence collection is delegated to the parties with opposing interests, A and B. DM cannot acquire evidence on his own. The final decision can only be based on the evidence submitted by A and B.

2.2.1 Timing of the game

The game proceeds as follows:

1. Nature draws ω and z. Realizations are unobserved by all players.

2. DM chooses a system: *adversarial* or *inquisitorial*.

If the inquisitorial system is chosen, DM decides whether to rely on his own evidence or to take as well into account the evidence of the firm, if there is any. If instead the adversarial system is chosen, DM can choose to rely only on A's evidence, only on B's evidence, or on both.

3. The relevant parties (DM and A in the inquisitorial system and A and B in the adversarial system) exert effort levels and possibly obtain some evidence.

4. The parties decide whether to submit (all or part of) their evidence.

5. DM rules.

2.3 Equilibrium concept and Putative Equilibrium

We will focus on pure-strategy subgame perfect equilibria. To describe the equilibrium of interest we follow *Angelucci* (2012) and introduce the following notation: X is divided into two subsets: X^g and X^b, where $X \equiv X^g \cup X^b$, $x \in X^g$ (respectively, $x \in X^b$) if $g_g(x) > g_b(x)$ (respectively, $g_g(x) < g_b(x)$). Similar dichotomies apply to Y and Z. The focus of the analysis is on a putative equilibrium in which:

1 A contemplates submitting x only if $x \in X^g$, and y only if $y \in Y^g$.

2. B contemplates submitting x only if $x \in X^b$, and y only if $y \in Y^b$.

3.If DM observes only x, he rules (not) in favor of A if and only if $x \in X^g (x \in X^b)$. If DM observes only y, he rules (not) in favor of A if and only if $y \in Y^g (y \in Y^b)$. Finally, if DM observes z, he rules (not) in favor of A if $z \in Z^g$ ($z \in Z^b$).

The realizations can be classified into two categories of events:

- Evidence is said to be *consistent* and favorable to A (**event 1**, with probability $p_{1,\omega}$) whenever the pair (x, y) is such that "$x \in X^g$" and "$y \in Y^g$". Evidence is said to be consistent and unfavorable to A (favorable to B) (**event 4**, with probability $p_{4,\omega}$) whenever the pair (x, y) is such that "$x \in X^b$" and "$y \in Y^b$".

- Evidence is instead said to be *conflicting* whenever (x, y) is such that either "$x \in X^g$" and "$y \in Y^b$" or "$x \in X^b$" and "$y \in Y^g$". In these cases, evidence is nevertheless overall favorable to A (**event 2**, with probability $p_{2,\omega}$) if $z \in Z^g$, and overall unfavorable to A (**event 3,** with probability $p_{3,\omega}$) if $z \in Z^b$.

Throughout the paper we denote by $\overline{p}_{j,\omega,x}$ and $\overline{p}_{j,\omega,y}$ the probabilities of event $j = 1, ..., 4$, conditional on being in state of nature ω and for a given realization of, respectively, x or y. Finally, we assume that (i) distributions are symmetric in the sense that $p_{1,g} = p_{4,b}, p_{4,g} = p_{1,b}$, $p_{2,g} = p_{3,b}$, and $p_{3,g} = p_{2,b}$; and (ii) such that $p_{1,g} > p_{4,g}$ and $p_{2,g} > p_{3,g}$.

3 Equilibrium analysis

Throughout the analysis we focus on the case in which $a(\emptyset) = 1$; that is, the allocation of burden of proof is exogenous: it lies on DM in the inquisitorial system and on persuader B in the adversarial system. Later on we will consider an endogenous allocation of burden of proof.

Given the putative equilibrium behavior of DM (see above) we first characterize the persuaders' submission strategies in *Lemma 2*: A in the inquisitorial system A, and B in the adversarial system.

We then analyze the strategic complementarities of the equilibrium levels of effort in both systems, and state the result in *Lemma 3*. Finally, *Proposition 1* establishes the existence of the equilibrium conjectured above.

Lemma 1 (submission decisions) *Persuaders (A in the inquisitorial system and A and B in the adversarial system) submit (i) favorable evidence only and (ii), whenever possible, the minimum amount of evidence needed to secure a favorable outcome.*

Proof. 1) Suppose persuader A obtains both x and y. If these are both favorable to her then, regardless of what the other party has found, A will win, as the allocation of the burden of proof on the other party, ensures a favorable outcome; therefore she does not need to submit any evidence. If instead the two pieces of

9

evidence are conflicting but overall favorable to A, then, by submitting only the favorable one, A wins regardless of what the other party has found, and this again saves submission costs. In the case of conflicting but overall unfavorable evidence, A loses surely if the other party has acquired the unfavorable piece of evidence; so A submits the favorable piece, hoping that the other party does not acquire the unfavorable piece.

Consider next that A obtains only one favorable piece of evidence, x or y. In this case there are two possible outcomes: the second piece of evidence can be either favorable or unfavorable. In the case the other piece of evidence is favorable, by not submitting the obtained evidence, A saves ε on submission costs. In the case the other piece is unfavorable, by not submitting her evidence, A loses S if the other party obtains and submits the unfavorable piece. Therefore it is strictly better for A to submit the obtained favorable piece of evidence.

If A obtains only an unfavorable piece of evidence, then by submitting it, A firstly incurs submission costs and secondly increases her chance of losing in the case that the other party does not acquire the unfavorable piece. Therefore A prefers not to disclose her evidence.

2) Suppose now persuader B obtains both x and y. If these are both favorable to her then B surely wins if she submits at least one piece of evidence and surely loses otherwise, as she bears the burden of proof; therefore she submits one piece of evidence that is necessary to ensure a favorable outcome and this saves submission costs. If instead the two pieces of evidence are conflicting but overall favorable to B, then, by submitting only the favorable one, B wins regardless of what the other party has found, and this again saves submission costs. In the case of conflicting but overall unfavorable evidence, B loses surely if the other party has acquired the unfavorable piece of evidence; so B submits the favorable piece, hoping that the other party does not acquire the unfavorable piece.

Consider next B obtains only one favorable piece of evidence, x or y. In this case there are two possible outcomes: the second piece of evidence can be either favorable or unfavorable. In the case the other piece of evidence is favorable then by not submitting the obtained evidence, B loses surely. In the case the other piece is unfavorable, then by not submitting her evidence, B loses surely whereas by submitting her evidence B wins in the case the other party does not submit

anything or if the evidence is overall favorable to B. Therefore it is strictly better for B to submit the obtained favorable piece of evidence.

If B obtains only an unfavorable piece of evidence, then by submitting it she will not change the outcome but will incur submitting costs. Therefore B strictly prefers not to disclose her evidence. ■

Building on *Lemma 1*, the payoffs of the parties can be rewritten as follows:

1. In the inquisitorial system:

$$U_A^I = \sum_\Omega \frac{1}{2}[p_{1,\omega} + p_{2,\omega}(1 - (\frac{\pi(e_{DM})}{3})(1 - \frac{2\pi(e_A)}{3})$$
$$+ p_{3,\omega}(1 - \frac{2\pi(e_{DM})}{3}) + p_{4,\omega}(1 - \pi(e_{DM}))]S - C(e_A) \quad (4)$$

$$U_{DM}^I = -\frac{1}{2}[1 - (p_{4,b} - p_{1,b})(\pi(e_{DM})) - (p_{3,b} - p_{2,b})\pi(e_{DM})(\frac{3 + 2\pi(e_A)}{9})](-L)$$
$$- C(e_{DM}) \quad (5)$$

where superscript I stands for inquisitorial system.

With probability $\sum_\Omega p_{1,\omega}$ the evidence is consistent and favorable to persuader A (*event 1*). In these instances A wins independently to what type of information the other party obtains. With probability $\sum_\Omega p_{2,\omega}$, evidence is conflicting but overall favorable to A (*event 2*). In this case A loses only if she does not obtain the favorable piece of evidence (this happens with probability $(1 - \frac{2\pi(e_A)}{3})$) and DM at the same time obtains only the unfavorable evidence (this happens with probability $\frac{\pi(e_{DM})}{3}$). With probability $\sum_\Omega p_{3,\omega}$, evidence is conflicting but overall unfavorable to A (*event 3*). Under such scenario A wins if DM does not obtain the unfavorable piece of evidence (this happens with probability $\frac{2\pi(e_{DM})}{3}$). Finally with probability $\sum_\Omega p_{4,\omega}$ both pieces of evidence are unfavorable to A: A wins only if DM fails to obtain any evidence (this happens with probability $(1 - \pi(e_{DM}))$).

Based on the putative behavior of DM (see above), his final decision is erroneous with the probability that A loses and the true state is 'good', and the probability that A wins and the true state is 'bad'.

2. In the adversarial system: Building on *Lemma 2* the payoffs of the parties are written as following:

$$U_A^A(e_A, e_B) = \sum_\Omega \frac{1}{2}[(p_{1,\omega} + p_{2,\omega}(1 - \frac{2}{3}\pi(e_B)(1 - \frac{2}{3}\pi(e_A))$$
$$+ p_{3,\omega}(1 - \frac{2}{3}\pi(e_B)) + p_{4,\omega}(1 - \pi(e_B)))]S - C(e_A) \quad (6)$$

$$U_B^A(e_B, e_A) = \sum_\Omega \frac{1}{2}[p_{2,\omega}(\frac{2}{3}\pi(e_B)(1 - \frac{2}{3}\pi(e_A) + p_{3,\omega}\frac{2}{3}\pi(e_B) + p_{4,\omega}\pi(e_B)]S - C(e_B) \quad (7)$$

$$U_{DM}^A = \frac{1}{2}[1 - (p_{1,g} - p_{4,g})\pi(e_B) - \frac{4}{9}(p_{2,g} - p_{3,g})\pi(e_B)\pi(e_A)](-L) \quad (8)$$

where superscript A stands for adversarial system.

With probability $\sum_\Omega \frac{1}{2}p_{1,\omega}$ evidence is consistent and favorable to persuader A (*event 1*). In these instances A wins independently of what type of information B obtains. With probability $\sum_\Omega \frac{1}{2}p_{2,\omega}$, evidence is conflicting but overall favorable to A (*event 2*). A wins except in the event when it does not obtain the favorable piece of evidence and B succeeds in obtaining the unfavorable piece (this happens with probability $\frac{2}{3}\pi(e_B)(1 - \frac{2}{3}\pi(e_A))$). With probability $\sum_\Omega p_{3,\omega}$, evidence is conflicting but overall unfavorable to A (*event 3*). Under such scenario A wins if B does not obtain the unfavorable piece of evidence (this happens with probability $\frac{2\pi(e_B)}{3}$). Finally with probability $\sum_\Omega p_{4,\omega}$ both evidence are unfavorable to A: A wins only if B fails to obtain any evidence (this happens with probability $(1 - \pi(e_B))$).

In the adversarial system DM does not have a bite in evidence collection. The loss of DM in this case is given by the probability that B wins in *'good'* state and A wins in the *'bad'* state.

Note that for an equal levels of effort of the accused party, A, and prosecution party (DM or B) the two systems differ only in the precision of the decision at *event 2: the inquisitorial system* protects A more often from being mistakenly accused and fails to accuse more often when A is guilty. Anticipating that, A should exert more effort for evidence collection under the adversarial system, all else being equal.

Lemma 2 *The decision maker always relies on the evidence provided by the persuader(s).*

Proof. *A brief examination of DM's payoff under both systems and the fact that $p_{2,g} = p_{3,b} > p_{2,b} = p_{3,g}$ establishes the result. DM's payoff in both systems is increasing in the efforts of persuader(s).* ∎

Even though the information provided by interested parties is biased towards their preferred option, it is still informative for a DM and allows him to save the cost of acquiring the information.

The following lemma summarizes formally the nature of strategic complementarities prevailing in this game under the two systems.

Lemma 3 (Reaction functions) *1) Inquisitorial system: Persuader A's reaction function is upward sloping in e_{DM} and DM's reaction function is upward sloping in e_A. Efforts of both parties are strategic complements.*

2) Adversarial system: Persuaders A's reaction function is upward sloping in e_B, while persuader B's function is downward sloping in e_A.

Proof. See *Appendix B*.

First note that it is the existence of two pieces of evidence together with the possibility to remain silent by withholding the obtained evidence that drives the difference in information acquisition in both systems. In the case of only one piece of evidence available the two systems are identical and it is persuader B in the adversarial system and DM in the inquisitorial system that exert effort in evidence acquisition and persuader A exerts no effort.

The existence of a second piece of evidence that can be pivotal and revert the decision of DM gives an incentive to persuader A to invest in information acquisition. However if the other party exerts no effort, then due to the allocation of the burden of proof, A still has no incentives to exert an effort as in this case she surely wins.

The other party therefore always invests a positive amount of effort in order to know more about the actual state of the nature and to possibly revert the final outcome.

In the inquisitorial system the strategic effect for DM with respect to A's effort rises due to the state of nature in which the evidence is *"conflicting but jointly favorable to A"* (**event 2**) as this is the only instance where the effort of A can revert the decision of DM, in case DM finds only unfavorable evidence and A submits a favorable piece. Therefore the greater the effort of A, the smaller the probability of a mistake of DM in case of event 2. As the marginal benefit for A for exerting effort increases with the effort of DM, DM strategically increases his effort to foster A's information acquisition. Note that in other events the final decision of DM is not affected by the evidence provided by A but only depends on the effort of DM himself. This happens due to the allocation of burden of proof on DM. Persuader A in turn finds it optimal to decrease the effort of DM, as allocation of burden of proof on DM makes the favorable outcome for A more probable. By decreasing her effort, A decreases the marginal benefit for DM from the information acquisition. If on the other hand DM increases his effort, the probability that he will not acquire any evidence decreases and thus, the probability of obtaining unfavorable evidence increases. A's evidence thus can be pivotal mainly in the event 2. Therefore the strategic considerations of both parties in this case go in the same direction and both DM and A are "strategic complementers".

In the adversarial system on the other hand the strategic considerations in information acquisition between the parties are different. Persuader A increases her effort when persuader B increases hers. The intuition is similar to that discussed above for the inquisitorial system. However the strategic motivation of persuader B is different from that of DM. The only relevant state of nature in which persuader B can strategically revert the status-quo is as in the inquisitorial system *event 2*. But in contrast to the inquisitorial system in these instances, as the parties have polar preferences, B does not want A to acquire information as in this case the probability that B's piece of evidence can revert the decision decreases. Therefore if A exerts high effort, the marginal benefit from acquiring additional information for B decreases and therefore B decreases her effort. This in turn decreases the marginal benefit of information acquisition for A and as a result A also decreases her effort. Therefore the strategic complementarities with respect to information acquisition for both parties are not uniform: B is a "strategic substituter" and A

is "strategic complementer". ∎

The following proposition shows that the putative equilibrium exists and that the decision of DM is consistent with Bayesian update of believes.

Proposition 1 (Existence of Equilibrium) *If $a(\emptyset) = 1$ by rule, then there exists a pure-strategy equilibrium in which the decision maker reaches its decision as if based solely on the submitted evidence.*

Proof. See *Appendix A*. ∎

DM being Bayesian, when deciding whether to set $a = 1$ or $a = 0$, he uses both the information at his disposal (that is, the prior and the actual content of evidence at the disposal) and his anticipation of the equilibrium behavior of persuaders (that is, their ability to gather and manipulate information). However, as is stated in *Proposition 1*, the equilibrium under consideration is identical to one in which DM would have been constrained to rule only based on the actual informativeness of disclosed information. In a nutshell, this is due to the fact that (i) both states of nature are equally likely to prevail and (ii) persuaders, not knowing what the state of nature is, do not choose their information gathering effort levels and submissions strategies contingent on ω. These two points imply that, if some evidence is submitted to DM, the informativeness deriving from the disclosed evidence is always superior to that deriving from strategic considerations. Of course, whenever evidence is not being transmitted, we have assumed that DM sets $a = 1$ by rule. In the Appendix we discuss out-of-equilibrium beliefs that sustain the equilibrium: we assume that DM, when faced with an unexpected deviation, believes that a persuader mistakenly discloses evidence with a certain probability. Finally we show in *Proposition 3* below, without an exogenous choice of burden of proof, this equilibrium still exists in the adversarial system. In the inquisitorial system DM's equilibrium choice is to allocate the burden of proof on persuader A. We discuss it in more details when stating *Proposition 5*.

4 Equilibrium information acquisition and a precision of final decision

The equilibrium characterized in *Proposition 1* is particularly amendable to comparative statics as DM's equilibrium decision rule is independent of all parties' effort levels in both systems and therefore is independent of the stakes of the dispute S as well as of DM's loss from an erroneous decision. While we are mostly interested in the impact of changes in S and L on the precision of the decision, we first provide intermediate comparative statics in the following proposition. This highlights the difference in driving forces to invest in information acquisition in both systems.

To do comparative statics we must however specify functions $C(\cdot)$ and $\pi(\cdot)$. We proceed by assuming $C(e_i) = \frac{e_i^2}{2}$ and $\pi(e_i) = e_i$, for $i = A, B, DM$, and stick to these specifications throughout the rest of the analysis.

Proposition 2 (comparitive statics on levels of effort) *1. Inquisitorial System:*

i) both DM's and A's equilibrium levels choice of effort, e_{DM}^* and e_A^*, are non-decreasing in the stakes of both parties, S and L

ii) persuader A's optimal choice of effort e_A^* is greater than DM's optimal choice of effort e_{DM}^* if and only if S is high enough

2. Adversarial System:

i) both persuader A's optimal choice of e_A^* and persuader B's optimal choice of effort e_B^* are increasing in the stake S. Both efforts are independent of the of DM's loss, L.

ii) persuader B's optimal choice of effort e_B^* is always greater than A's optimal choice of effort e_A^*.

Proof. See Appendix B. ∎

In the *adversarial* system the equilibrium investment decisions in information acquisition of persuaders A and B depend on the stakes S and are independent of the loss of DM, L. Therefore the size of loss of DM from an erroneous decision does not affect the equilibrium choices of effort by persuaders. This is the main

difference in comparison with the inquisitorial system. The two persuaders in this system have polar interests, therefore S can be interpreted in this case as the degree of polarization. S affects the effort levels of persuader A and B both through direct and indirect or strategic effect. The direct effect is straightforward: all else being equal, if the persuaders win or lose more money, they are willing to invest more in order to assure their victory. The strategic effect in contrast, occurs via the effort level chosen by the opposing party and is not the same for both persuaders. As discussed in Lemma 3, these effects arise due to the state of nature in which evidence is *"conflicting but jointly favorable to A"* (**event 2**). In these instances B exerts extra effort to acquire a favorable piece of evidence, which, in case A fails to acquire an unfavorable piece, will revert the decision of DM. The effort of B is therefore always higher then the effort of A. It follows immediate that it is the effort exerted by B that motivates A to extract any positive effort, as otherwise A surely wins as B bears a burden of proof. The equilibrium level of effort of persuader A is increasing with the effort of persuader B. When S increases A finds it optimal to further increase her effort in order to decrease B's marginal benefit from acquiring pivotal evidence. The overall effect of S on the effort chosen by A is therefore positive. However the equilibrium choice of effort of B is decreasing with the effort of A. Therefore an increase in A's effort lowers B's marginal benefit from exerting effort. However the direct effect driven by the allocation of burden of proof is very strong and dominates these strategic considerations so that B's effort increases with S at a higher rate than A's effort does. As a result of interaction of the direct and the indirect effect, the effort of B is concave in S, i.e. as S increases the effort of the B increases at a lower rate. Given that B exerts higher effort than A it appears that DM's choice to burden B constitutes an equilibrium of this game. We will state this result in *Proposition 5.*

In the *inquisitorial* system the equilibrium investment decisions in information acquisition of persuader A and DM depend both on the stake of A, S and on the loss of DM, L. Therefore in contrast to the adversarial system the level of effort of the parties depends on the size of loss of DM from an erroneous decision. L affects the effort of DM via the direct effect discussed above and the effort of persuader A via the indirect strategic effect, whereas S affects the effort of A via the direct

17

effect and the effort of L via the indirect effect. Note that when S is small, the effort of DM is higher than the effort of A. When S increases„ the effort of A increases at a higher rate and, for S sufficiently large, A exerts more effort. As discussed in *Lemma 3*, in contrast to the adversarial system the strategic nature of the indirect effect is uniform for both parties as the preferences of the parties are partially aligned. The marginal benefit from information acquisition for one party increases with the effort exerted by the other party. As a result both efforts increase in the stakes of each other, i.e. both efforts increase with S and L.

Above we provide a graphical representation of the results described above.

4.0.1 Numerical Example.

The following figures provide a numerical example of the equilibrium effort levels chosen by the parties as a function of the stakes of the dispute. To compute it we set $p_{2g} = 0.4, p_{3b} = 0.4, p_{3g} = 0.2, p_{2b} = 0.2, p_{4g} = 0.1, p_{1b} = 0.1, p_{1g} = 0.3, p_{4b} = 0.3$.

1. Inquisitorial System:

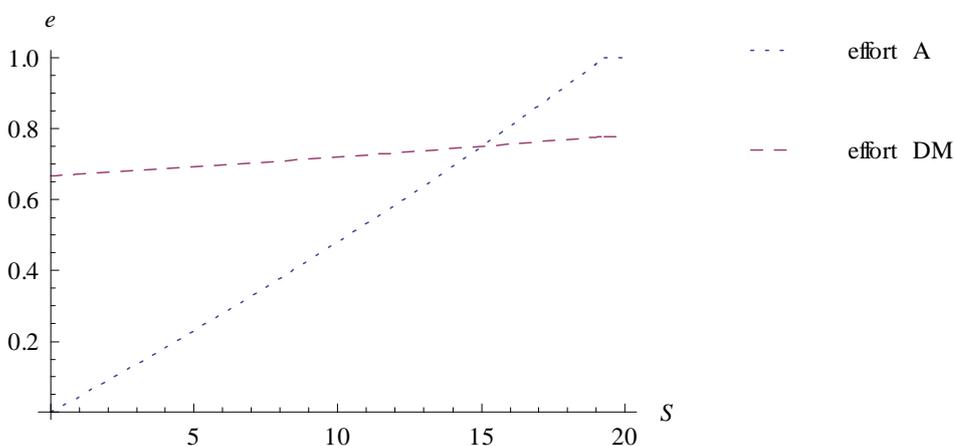a) Equilibrium effort as a function of S for $L = 1$:

Figure 1
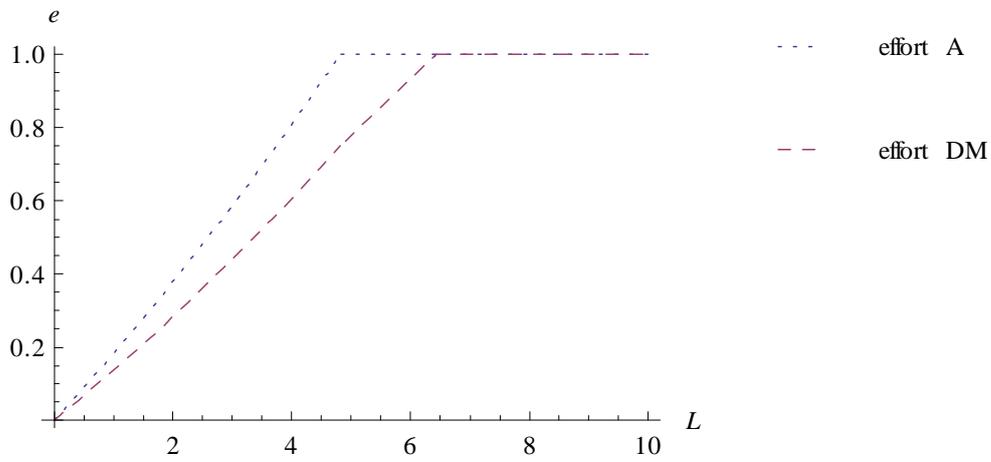
b) Equilibrium effort as a function of L ($S = 20$)

Figure 2

2. Adversarial system:

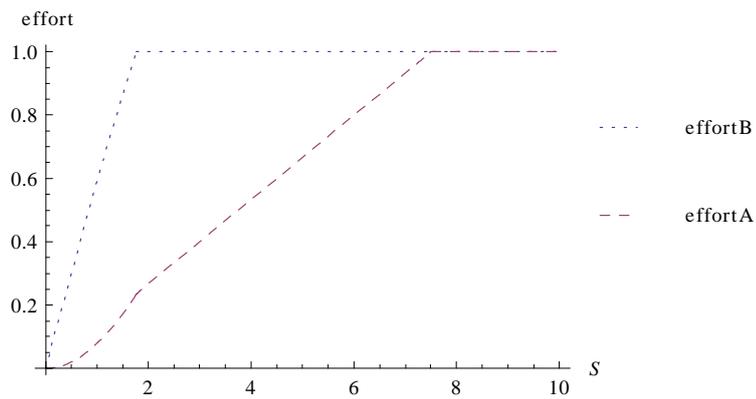   a) Equilibrium effort of A and B as a function of S

Figure 3

Note that under the adversarial system the equilibrium efforts of the parties are more responsive to changes in S, and increase faster with S.

Proposition 3 (payoff of a decision maker) *The payoff of the decision maker in both systems is:*

   i) non-decreasing in S

   ii) decreasing and convex in L

19

Proof. See Appendix C. ∎

The first result of *Proposition 3* follows immediately from the results in *Proposition 2*. As can be seen from (5) and (8), the payoff of DM increases in the efforts of all the parties. The effort of all the parties increases in S, therefore there is more information available and the precision of DM's decision increases.

The second result is less straightforward to establish. The loss of the decision maker affects his utility via two effects: direct and indirect. The direct effect is the actual loss that DM incurs and the utility of DM decreases with L in this case. The indirect effect is the strategic effect of L in shaping the incentives to exert effort in order to obtain evidence. Note that in the adversarial system the indirect effect is absent as the levels of effort of the parties are independent of L. Therefore the payoff of DM in the adversarial system is decreasing in L due to the direct effect described above. In the inquisitorial system on the other hand, the levels of effort of both parties increase in L and therefore the payoff of DM increases in L via the indirect effect. The overall effect therefore depends on the relative magnitude of these direct and indirect effects. With several algebraic manipulations we show in *Appendix C* that the direct effect dominates and as a result the payoff of DM decreases with L. Intuitively this decrease is lower than the decrease of DM's payoff in the adversarial system, due to the indirect effect softening the rate of decrease in the inquisitorial system. In addition the marginal effect of L decreases with L, due to the fact that the direct effect decreases with L when efforts increase.

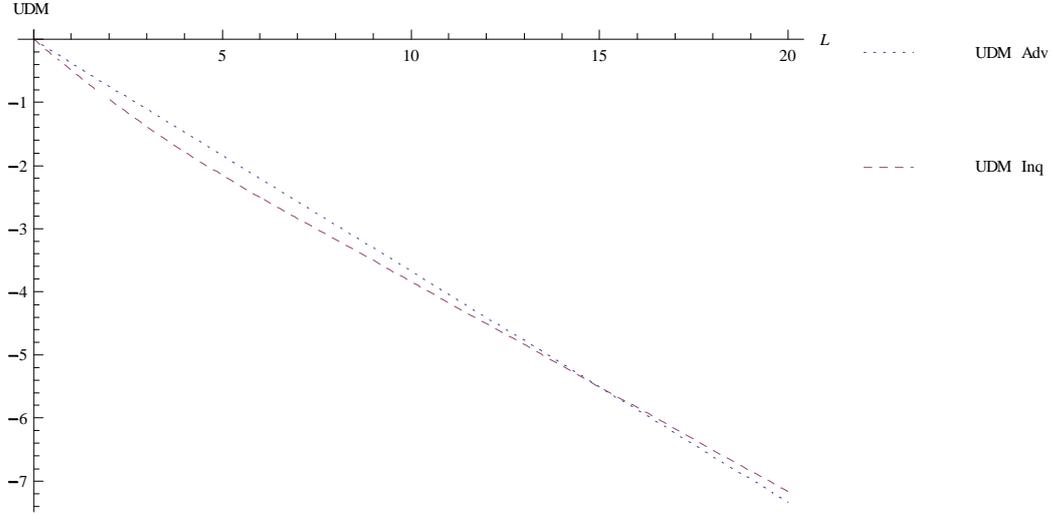Figure 4 illustrates the payoff of DM under adversarial and inquisitorial system.

Figure 4

Proposition 4 (comparision of the two systems) *The difference of DM's payoff under the adversarial and inquisitorial system is:*

   i) increasing in S for S < $\underline{S}$ and non-increasing for S > $\underline{S}$

   ii) is negative for S low enough and for L high enough

Proof. 3. The difference in DM's payoff in the adversarial and the inquisitorial systems, $U_{DM}^A - U_{DM}^I$, can be expressed in terms of equilibrium levels of efforts

$$\frac{1}{2}L[(p_{4,b}-p_{1,b})(e_B^* - e_{DM}^*) + (p_{3,b}-p_{2,b})\frac{1}{9}(4e_B^* e_A^{A*} - e_{DM}^*(3+2e_A^{I*})) + \frac{(e_{DM}^*)^2}{2} \quad (9)$$

In order to distinguish the effort of persuader A in the two systems we denote by e_A^{I*} the equilibrium effort of A in the inquisitorial system.

   i) Note that when S is small the equilibrium effort of both persuaders in the adversarial regime is very small, and as a result the total amount of information acquired is very small and DM makes his decision almost randomly. However in the inquisitorial system the effort of both parties depends as well on L, and therefore for L high enough to ensure a positive effort is exerted, the inquisitorial system will generate more information and therefore a more precise final decision.

   As can be seen from 4.0.1 and 4.0.1, as S increases, the effort levels of the parties in the adversarial system increase at a higher rate than the effort levels of

21

the parties in the inquisitorial system (for details refer to *Appendix B*) until the levels of effort of A and B in the adversarial system reach 1. The effort exerted by the parties in the inquisitorial system continue to further increase with S until reaching their maximum as well.

ii) Consider a case when S is big enough so that all the efforts are equal to 1. In this case 9 can be written as:

$$-\frac{1}{18}L(p_{3,b} - p_{2,b}) + \frac{1}{2} \tag{10}$$

10 is negative iff $L > \frac{9}{(p_{3,b} - p_{2,b})}$. ∎

Numerical Example

Figure 5 illustrates the difference between DM's payoff in the adversarial and the inquisitorial systems for a given level of loss ($L = 5$ and $L = 60$).
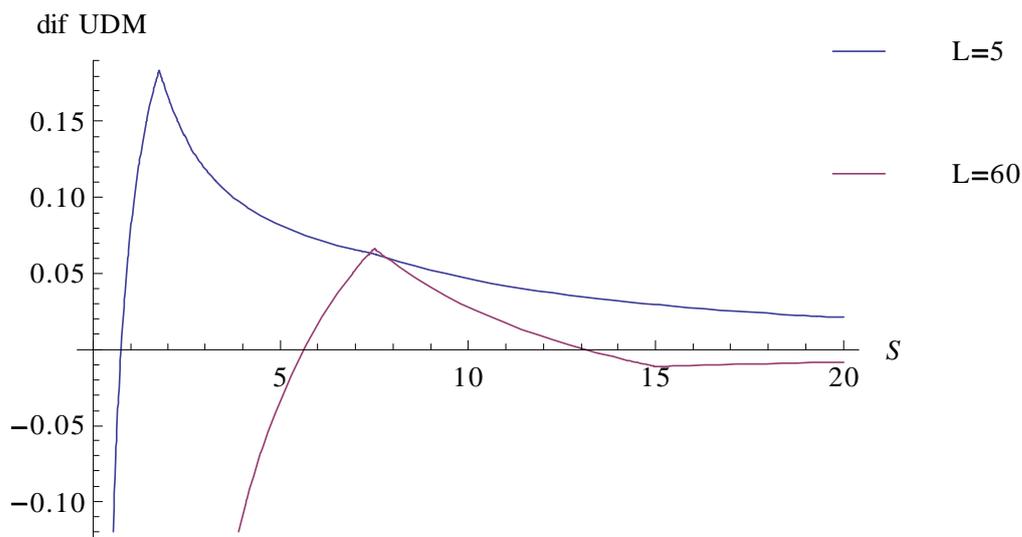

Figure 5

As L increases the range of S for which inquisitorial system dominates adversarial increases.

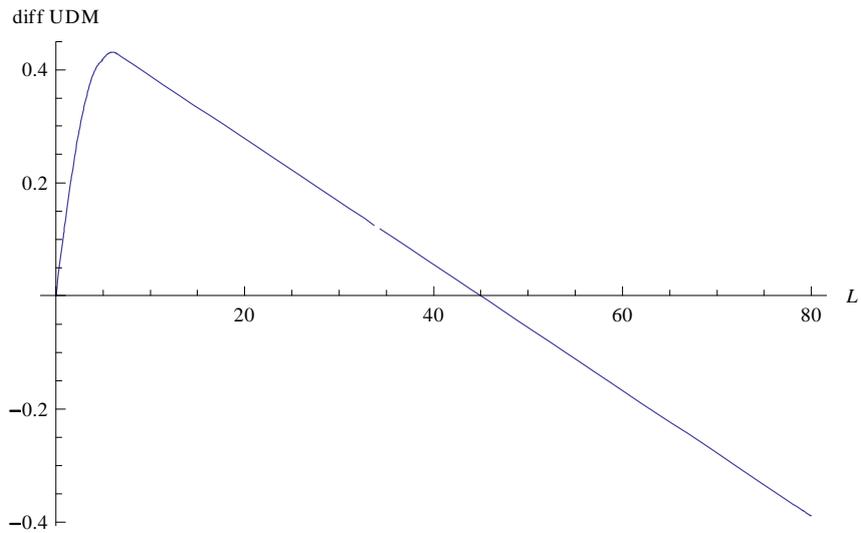Figure 6 illustrates how the difference changes with respect to L ($S = 20$).

22

Figure 6

Note that for small values of L the difference between the two systems increases and as L increases the difference shrinks and becomes negative for L large enough. This non-monotonicity comes exactly from the fact that DM's payoff in inquisitorial system is convex in L. As L increases DM's payoff decreases at a slower rate, with the inquisitorial system finally dominating the adversarial.

Figure 7 plots DM's payoff normalized by L under different system. The solid line plots a precision of DM's decision net of cost of effort of acquired evidence. Note that in this case inquisitorial system dominates adversarial for a wider range of parameters.
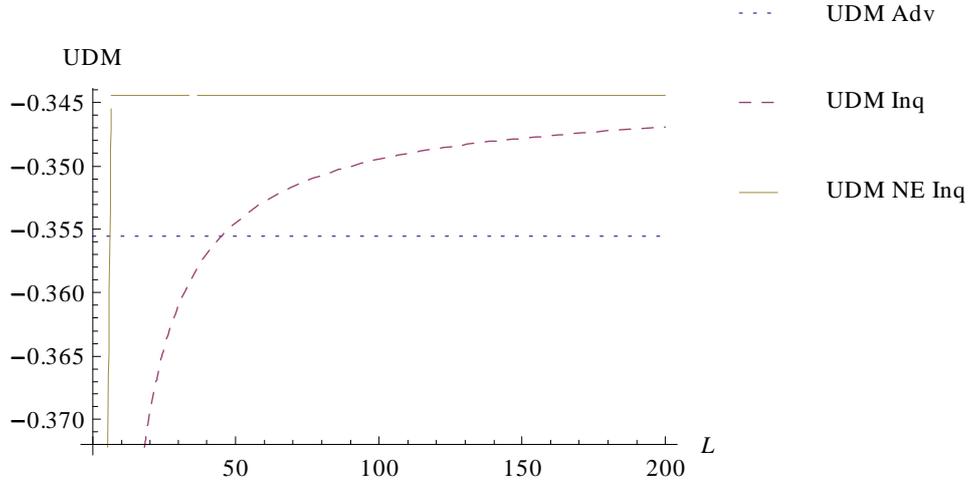
Figure 7

5 Endogenous Burdens of Proof

We now relax the assumption that the burden of proof is exogenously imposed on the players and investigate whether such an equilibrium spontaneously arises.

Proposition 5 *1. Adversarial system: there exists a pure-strategy equilibrium in which the decision maker reaches its decision as if based solely on the informativeness of submitted evidence*

2. Inquisitorial system: i) allocation of burden of proof on DM appears not to be an equilibrium response for DM.

ii) there exists a pure-strategy equilibrium in which the decision maker reaches its decision as if based solely on the informativeness of submitted evidence and burden of proof is allocated to persuader A.

Proof. To be completed.

1. For the detailed proof of the first point of the Proposition refer to Angelucci [2012]. The interlining intuition is the following, it is optimal for a decision maker to burden the party that exerts more effort at the information acquisition stage. Following form *Lemma 2* the equilibrium effort of the burdened party B is always

24

higher than that of the party A, therefore the allocation of the burden of proof on B constitutes an equilibrium.

2. From inequality (13) in the proof of the *Proposition 1* (Appendix A) we deduct that allocation of the burden of proof on DM if not imposed by the rule, does not constitute an equilibrium choice of DM. Following the intuition developed above, it is optimal for the DM to allocate the burden of proof on the party that exerts more effort. In the case of the allocation of the burden of proof on the interested party, she indeed exerts higher effort than DM, and thus such allocation of the burden of proof constitutes an equilibrium. [to be formally shown] ∎

6   Discussion and preliminary conclusions

We have analysed a game of persuasion in which information is both costly to acquire and prone to subtle manipulation, i.e. the parties have the right to remain silent. The focus has been put on pure-strategy equilibria mimicking court bevahior: the decision-maker rules as if based solely on the informativeness of the submitted evidence and one of the parties bears the burden of proof allocated by the rule. We examine the performance of the two legal systems: *inquisitorial* and *adversarial*. In the *adversarial* system evidence collection is delegated to the opposing parties and a decision maker makes a final decision based on the evidence submitted by the parties. In the *inquisitorial* system the decision maker himself is active at the evidence collection stage and can also rely on the evidence submitted by the interested party. The two systems differ in the nature of strategic complementarieties that arise at the information acquisition stage. In the *inquisitorial* system the efforts of the parties that are active in evidence collection are 'strategic complements' when the burden of proof lies on the prosecution side, ie. DM, and are 'strategic substituters' when the burden of proof is on the party that takes the action of interest. In the *adversarial* system by contrast the strategic complementarities of the parties' efforts with respect to evidence collection are non-uniform, with the burdened party being a 'strategic substituter' and her opponent being a 'strategic complementer'. The nature of the strategic complementarities results in the two systems generating different amounts of information and therefore different levels of precision of the final decision. This difference is non uniform with

respect to the stakes of the parties. In the *inquisitorial* system the efforts of the parties depend both on the stake of the interested party as well as on the loss of a decision maker, in contrast to the *adversarial* system, where the efforts of the parties depend only on their stakes but are independent of the loss from an erroneous final decision. As a result the precision of the final decision under the *inquisitorial* system dominates that under the *adversarial* system when the stakes are low relative to the loss of the decision maker. The efforts of the parties under the *adversarial* system are more responsive to an increase in the stakes of the parties, and therefore reach their maximum value faster compared to the efforts of the parties under the *inquisitorial* system. As a result as the stakes increase the *adversarial* system dominates the inquisitorial until the *adversarial* efforts reach their maximum level. At this point the precision of the final decision under the *adversarial* system stays constant, while it continues to improve under the *inquisitorial* system, leading to the latter dominating the former when the stakes are sufficiently high.

We further investigate the endogenous choice of the allocation of the burden of proof. The two systems also differ in the equilibrium choice of effort of the burdened party. This difference arises due to the difference in the nature of the strategic complementarities with respect to information acquisition. In the *adversarial* system the choice to allocate the burden of proof on the prosecution constitutes an equilibrium choice of the decision maker, as it is the prosecution party that invests more in evidence collection. In contrast, in the inquisitorial system, the decision maker at equilibrium prefers to burden the party that takes an action, i.e. the accused party. We aim to further investigate the relative performance of the two systems under the endogenous allocation of the burden of proof.

In this paper we provide a further argument supporting the *inquisitorial* system. We consider an expanded framework that allows for an opposing party in the inquisitorial system, party B. The question then becomes when, if ever, it pays for the decision maker to collect the evidence on his own when there are opposing parties competing for information acquisition.

7 Appendix

A Proof of Proposition 1

The evidence submission strategies stated in *Lemma 1* were characterized under the assumption that DM takes his decision as following:

1. decides to allow the action, i.e. sets $a = 1$ if in possession of either nothing or $x \in X^g, y \in Y^g$, or $z \in Z^g$, and

2. decides to disallow the action, i.e. sets $a = 0$ if in possession of either $x \in X^b, y \in Y^b$, or $z \in Z^b$

We now must verify that such behavior indeed constitute an equilibrium. We first analyze behavior and corresponding beliefs on the equilibrium path, taking evidence submission strategies as stated in *Lemma 1*. We then analyze the off-equilibrium behavior and state that the equilibrium exists if DM believes, when faced with an unexpected deviation, that a submission mistake was made with probability ϵ (per piece of evidence mistakenly submitted) We provide a proof in case of inquisitorial system. Similar logic applies for adversarial system. For detailed proof concerning adversarial system refer to Angelucci (2012).

Equilibrium Path

On the equilibrium path under both DM may either receive the whole set of evidence z, one piece of evidence (x *or* y), or nothing.

Let us consider the submission strategy of persuader A under *Inquisitorial system*.

When DM obtains both pieces of evidence on his own, the submission of evidence by A is irrelevant, as DM knows full information.

One piece of evidence We first analyze partial submission. Suppose that $\tilde{z}_A = (x, \emptyset)$ while $z_{DM} = (\emptyset, \emptyset)$, where $x \in X^g$. DM then indeed rules in favour of

A if and only if

$$g_g(x)(1 - \pi(e_{DM}^*))(\underbrace{\overline{p}_{1,g,x}\frac{2}{6}\pi(e_A^*)}_{I} + \underbrace{\overline{p}_{2,g,x}\frac{2}{3}\pi(e_A^*)}_{II} + \underbrace{\overline{p}_{3,g,x}\frac{2}{3}\pi(e_A^*)}_{III}) \quad (11)$$

$$> \quad g_b(x)(1 - \pi(e_{DM}^*))(\underbrace{\overline{p}_{1,b,x}\frac{2}{6}\pi(e_A^*)}_{I} + \underbrace{\overline{p}_{2,b,x}\frac{2}{3}\pi(e_A^*)}_{II} + \underbrace{\overline{p}_{3,b,x}\frac{2}{3}\pi(e_A^*)}_{III})$$

Proof. given that $x \in X^g$ implies $g_g(x) > g_b(x)$, together with $\overline{p}_{3,g,x} = \overline{p}_{2,b,x}$, $\overline{p}_{2,g,x} = \overline{p}_{3,b,x}$, and $\overline{p}_{1,g,x} > \overline{p}_{1,b,x}$ conclude the proof. ∎

DM does not obtain any evidence on his own with probability $(1 - \pi(e_{DM}^*))$.

Component I represents the event in which evidence is *"consistent and favorable to A "*. In this case, persuader A submits only x in case it has either *"observed only x"* (which happens with probability $\frac{\pi(e_A^*)}{3}$) or it has *"observed both x and y"*, but does not submit y to save on disclosure costs (which happens with probability $\frac{\pi(e_A^*)}{3}$ and A chooses x with probability $\frac{1}{2}$). Component II represents the event in which evidence is conflicting but jointly favorable to A. In such a case, persuader A only submits the favorable piece of evidence (be it x or y), in order to secure the final outcome. This occurs only when A happens to posses it, i.e. with probability $\frac{2}{3}\pi(e_A^*)$. The same logic applies in case evidence is conflicting but jointly unfavorable to A.

Notice that (11) holds by definition of X^g, the fact that $\overline{p}_{1,g,x} > \overline{p}_{1,b,x}$, and the fact that $\overline{p}_{4,b,x} = 0$ when $x \in X^g$.

Two pieces of evidence We now turn to the case when DM acquires one piece of evidence and A submits one piece of evidence.

1. Suppose that $\tilde{z}_A = (x, \emptyset)$ while $z_{DM} = (\emptyset, y)$, where $x \in X^g$, y$\in Y^b$ and z$\in Z^g$. DM rules in favor of A if and only if:

$$f_g(z)(\frac{2}{9})\pi(e_A^*)\pi(e_{DM}^*) > f_b(z)(\frac{2}{9})\pi(e_A^*)\pi(e_{DM}^*) \quad (12)$$

Where DM obtains only one piece of evidence with probability $\frac{\pi(e_{DM}^*)}{3}$ and A submits x either if he possesses only x or if he possesses both x and y. Inequality (12) obviously holds just by definition of Z^a.

The reasoning developed here is very similar for other the cases when DM possesses one evidence and persuader A submits also only one piece of evidence that are left out.

No evidence Then, by definition of a burden of proof, we have $a = 1$.

Comment on inefficiency of burden of proof

$$(1 - \pi(e_{DM}^*))(\overline{p}_{2,g,\emptyset}(1 - \frac{2}{3}\pi(e_A^*)) + \overline{p}_{3,g,\emptyset}(1 - \frac{2}{3}\pi(e_A^*)) + \overline{p}_{4,g,\emptyset}) \quad (13)$$
$$> (1 - \pi(e_{DM}^*))(\overline{p}_{2,b,\emptyset}(1 - \frac{2}{3}\pi(e_A^*)) + \overline{p}_{3,b,\emptyset}(1 - \frac{2}{3}\pi(e_A^*)) + \overline{p}_{4,b,\emptyset})$$

Note that this inequality does not hold and DM just follows a rule of allocation of burden of proof.

Off Equilibrium Path

Consider now out-of-equilibrium behavior.

When faced with an unexpected event, DM believes that a party made a mistake (per piece of evidence mistakenly submitted) with probability ϵ.

Consider following outcome $\widetilde{z}_A = (x, \emptyset)$ while $z_{DM} = (\emptyset, \emptyset)$, where $x \in X^b$. DM then disallows the action iff

$$g_b(x)(1 - \pi(e_{DM}^*))(\overline{p}_{2,b,x}\frac{1}{3}\pi(e_A^*)\epsilon + \overline{p}_{3,b,x}\frac{1}{3}\pi(e_A^*)\epsilon + \overline{p}_{4,b,x}\frac{2}{3}\pi(e_A^*)\epsilon) \quad (14)$$
$$> g_g(x)(1 - \pi(e_{DM}^*))(\overline{p}_{2,g,x}\frac{1}{3}\pi(e_A^*)\epsilon + \overline{p}_{3,g,x}\frac{1}{3}\pi(e_A^*)\epsilon + \overline{p}_{4,g,x}\frac{2}{3}\pi(e_A^*)\epsilon)$$

Since $x \in X^b$, events $2, 3$ and 4 are the only relevant ones. In case $y \in Y^g$, it cannot be the case that A observed it, for otherwise it would have submitted it. Thus, since $\widetilde{z}_A = (x, \emptyset)$ it must be the case that persuader A acquired only x (with probability $\frac{1}{3}\pi(e_A^*)$), and made a submission mistake with probability ϵ. Since we also have that $z_{DM} = (\emptyset, \emptyset)$, then DM did not succeed in acquiring information, which happens with probability $(1 - \pi(e_{DM}^*))$.

Inequality (14) holds since $\overline{p}_{4,b,x} > \overline{p}_{4,g,x}$ when $x \in X^b$. It can be easily shown that all the other scenarios in which a submission mistake could occur work in a

29

similar fashion.

B Proof Proposition 2:

For computational and expositional easiness we provide a proof for the following specifications: $\pi(e_i) = e_i$ and $C(e_i) = \frac{e_i^2}{2}$, for $i = A, B$ and DM.

1. Inquisitorial System

Differentiating (4) and (5) with respect to e_A and e_{DM} gives us the following system of FOC:

Proof.

$$\frac{1}{2}L\pi'(e_{DM})[(p_{2,g} - p_{2,b})(\frac{2\pi(e_A)}{9}) + (p_{4,b} - p_{4,g})] = C'(e_{DM}) \tag{15}$$

$$\pi'(e_A)\frac{1}{2}S\sum_\Omega[\frac{2\pi(e_{DM})}{9}p_{2,\omega}] = C'(e_A) \tag{16}$$

Plugging $\pi(e_i) = e_i$ and $C(e_i) = \frac{e_i^2}{2}$ and solving the system for e_A^* and e_{DM}^* controlling for the fact that probability cannot exceed , we obtain the following solution:

$$e_A^* = \min\left[1, \quad \frac{3SL(p_{2,g}+p_{2,b})[p_{2,g}-p_{2,b}+3(p_{4,b}-p_{4,g})]}{162-2SL(p_{2,g}+p_{2,b})(p_{2,g}-p_{2,b})}\right] \tag{17}$$

$$e_{DM}^* = \min\left[1, \quad \left\{\begin{array}{ll} \frac{27L[p_{2,g}-p_{2,b}+3(p_{4,b}-p_{4,g})]}{162-2SL(p_{2,g}+p_{2,b})(p_{2,g}-p_{2,b})} & for\ e_A^* < 1 \\ \frac{1}{2}L[(p_{2,g}-p_{2,b})(\frac{2\pi(e_A)}{9}) + (p_{4,b}-p_{4,g})] & for\ e_A^* = 1 \end{array}\right\}\right] \tag{18}$$

∎

Rather trivially we have $e_A^* > e_{DM}^*$ if and only if $S > \widehat{S}_{inq} = \frac{9}{p_{2,g}+p_{2,b}}$,
Therefore $e_{DM}^* < e_A^* < 1^*$ for $S > \widehat{S}_{inq}$ and $L < \underline{L} = \frac{18}{[(5(p_{3,b}-p_{3,g})+9(p_{4,b}-p_{4,g}))]}$
Note that for $e_A^* < 1\ and\ e_{DM}^* < 1$ following holds:

$$e_A^* = \frac{S(p_{2,g} + p_{2,b})}{9}e_{DM}^*$$

Therefore to examine the behavior of e_A^* with respect to S and L it is sufficient to know the sign of a derivatives of e_{DM}^* for $e_{DM}^* < 1$.

The derivative with respect to S:

$$\frac{de_{DM}^*}{dS} = \frac{27L^2(p_{2,g}^2 - p_{2,b}^2)(p_{2,g} - p_{2,b} + 3(p_{4,b} - p_{4,g}))}{2(81 - L(p_{2,g}^2 - p_{2,b}^2)S)^2} > 0$$

The derivative with respect to L :

$$\frac{de_{DM}^*}{dS} = \frac{2187(p_{2,g} - p_{2,b} + 3(p_{4,b} - p_{4,g}))}{2(81 - L(p_{2,g}^2 - p_{2,b}^2)S)^2} > 0$$

2. Adversarial System:

Differentiating (6) and (7) with respect to e_A and e_B respectively we obtain:

$$\pi'(e_A)\frac{1}{2}S\sum_\Omega[\frac{4\pi(e_B)}{9}p_{2,\omega}] = C'(e_A) \tag{19}$$

$$\pi'(e_B)\frac{1}{2}S\sum_\Omega[\frac{2}{3}(1 - \frac{2}{3}\pi(e_A))p_{2,\omega} + \frac{2}{3}p_{3,\omega} + p_{4,\omega}] = C'(e_B) \tag{20}$$

Plugging $\pi(e_i) = e_i$ and $C(e_i) = \frac{e_i^2}{2}$ and solving the system for e_A^* and e_B^* we obtain:

$$e_B^* = \min[1, \frac{27(4(p_{2,g} + p_{2,b}) + 3(p_{4,g} + p_{4,b}))S}{162 + 8(p_{2,g} + p_{2,b})^2S^2}] \tag{21}$$

$$e_A^* = \min[1, \begin{cases} \frac{3(p_{2,g}+p_{2,b})(4(p_{2,g}+p_{2,b})+3(p_{4,g}+p_{4,b}))S^2}{81+4(p_{2,g}+p_{2,b})^2S^2} & for\ e_B^* < 1 \\ \frac{1}{2}S\sum_\Omega[\frac{4}{9}p_{2,\omega}] & for\ e_B^* = 1 \end{cases}] \tag{22}$$

$e_B^* < 1$

$$S < \underline{S} = [\frac{9(3(p_{2,g} + p_{2,b}) + 9 - \sqrt{[(4 + 5(p_{2,g} + p_{2,b}))(9 + 11(p_{2,g} + p_{2,b}))]})}{16(p_{2,g} + p_{2,b})^2}] \tag{23}$$

$e_B^* > e_A^*$ if and only if $S < \widehat{S}_{adv} = \frac{9}{2(p_{2,g}+p_{2,b})}$.

It can be shown that $\widehat{S}_{adv} > \underline{S}$ therefore $e_B^* \geq e_A^*$ for all values of S.

Note that for $e_A^* < 1$ *and* $e_B^* < 1$ following holds:

$$e_A^* = \frac{2S(p_{2,g} + p_{2,b})}{9} e_B^*$$

Therefore to examine the behavior of e_A^* with respect to S it is sufficient to know the sign of a derivatives of e_B^* for $e_B^* < 1$.

The derivative with respect to S:

$$\frac{de_B^*}{dS} = -\frac{27(4(p_{2,g} + p_{2,b}) + 3(p_{4,b} + p_{4,g}))(-81 + 4(p_{2,g}^2 + p_{2,b}^2)S^2}{2(81 + 4(p_{2,g}^2 + p_{2,b}^2)S^2)^2} > 0 \; for \; S < \overline{S}$$

C Proof Proposition 3

The payoff of DM under two systems can be expressed as following:

1. Under Inquisitorial system:

$$U_{DM}^I = -\frac{1}{2}L[1 - (p_{4,b} - p_{1,b})(\pi(e_{DM}^*)) - (p_{3,b} - p_{2,b})\pi(e_{DM}^*)(\frac{3 + 2\pi(e_A^*)}{9})] - C(e_{DM}^*)$$

$$U_{DM}^I = -\frac{1}{2}L[1 - (p_{4,b} - p_{1,b})(e_{DM}^*) - \frac{1}{3}(p_{3,b} - p_{2,b})e_{DM}^* - \frac{2}{81}(p_{3,b}^2 - p_{2,b}^2)e_{DM}^{2*}S] - C(e_{DM}^*)$$

The payoff increases with e_{DM}^* and with e_A^*. Both e_{DM}^* and e_A^* increase in S, therefore U_{DM}^I increases in S.

Plugging in the expressions for e_{DM}^* and e_A^* and differentiating with respect to L we obtain the following expression:

$$\frac{dU_{DM}^I}{dL} = -\frac{1}{2} - \frac{59049L[p_{3,g} - p_{3,b} + 3(p_{4,g} - p_{4,b})]^2}{4(SL(p_{2,g} + p_{2,b})(p_{2,g} - p_{2,b}) - 81)^3}] \tag{24}$$

Note that this expression can be rewritten as the function of e_{DM}^* and its

derivative with respect to L, and it is negative.

$$-\frac{1}{2} + e^*_{DM}\frac{de^*_{DM}}{dL} \tag{25}$$

In order for this expression to be negative, $e^*_{DM}\frac{de^*_{DM}}{dL}$ should be less than $\frac{1}{2}$, which is true for $L < \frac{18}{[(5(p_{3,b}-p_{3,g})+9(p_{4,b}-p_{4,g}))]}$

Therefore U^I_{DM} is decreasing with L

The second derivative of U^I_{DM} with respect to L is given by:

$$\frac{59049L[p_{3,g}-p_{3,b}+3(p_{4,g}-p_{4,b})]^2(2SL(p_{2,g}+p_{2,b})(p_{2,g}-p_{2,b})+81)}{4(SL(p_{2,g}+p_{2,b})(p_{2,g}-p_{2,b})-81)^4} > 0$$

Therefore U^I_{DM} is convex in L.

2. Under adversarial system:

$$U^A_{DM} = -\frac{1}{2}L[1 - (p_{4,b}-p_{1,b})\pi(e^*_B) - \frac{4}{9}(p_{3,b}-p_{2,b})\pi(e^*_B)\pi(e^*_A)] \tag{26}$$

The efforts are independent of L so only direct effect of L matters, so trivially U^A_{DM} decreases with L.

U^A_{DM} increases in both levels of efforts, and therefore increases in S.

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