CSEF
CENTRO STUDI IN ECONOMIA E FINANZA
CENTRE FOR STUDIES IN ECONOMICS AND FINANCE

WORKING PAPER NO. 42

Decision Rules and Optimal Delegation of Information Acquisition

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May 2000

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Abstract

The paper analyzes the relationship between decision rules and information acquisition in decision-making processes. The setting under consideration is one where information acquisition and decision making are assigned to different agents and the decision-maker's preferences are not observable. The paper argues that the choice of the optimal organizational structure at the information acquisition stage depends on the degree of discretion granted to the decision-maker. High discretion ensures more flexibility but requires that information acquisition is assigned to the parties directly involved in the decision. Since they have conflicting interests, the parties provide a check against abusive decisions although at the cost of information manipulation. Low discretion introduces rigidity but allows the delegation of information acquisition to an unbiased agent who ensures truthful reports. Which of these two "optimal combinations" is preferable is then shown to depend on the probability of finding information when an agent searches. Our analysis sheds light on the stylized fact that Civil Law systems are generally associated with inquisitorial procedures whereas Common Law systems are combined with adversarial procedures.

Keywords: rules, control, manipulation, legal and judicial systems.

JEL Classification: D23, K4

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I benefited from discussions with Micael Castanheira, Mathias Dewatripont, Marcelo Fernandes, Jacob Gyntelberg, Elisabetta Iossa and Patrick Legros. Special thanks to Francesco Giordano for his help on probability theory. I also wish to thank Isabelle Brocas, Richard Posner, Hyun Song Shin and the seminar participants at SITE, Stockholm School of Economics and CSEF, Università di Salerno for their valuable comments. Financial support from Italian National Research Council (CNR), project "Tecnologie Informatiche e Mercati Finanziari" and MURST, project "Mercati Finanziari, Sistema Legale e Tutela Giudiziaria" is also gratefully acknowledged.

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1 Introduction

A decisional process typically involves two stages: information acquisition and decision-making. In the former, information on the basis of which the available alternatives are evaluated is gathered. In the latter, one alternative is picked. Efficiency results from the extent to which the pros and cons of each alternative are made clear *and* by how the decision taken reflects the information produced. In the presence of asymmetric information and misalignment in incentives between the principal and the decision-maker efficiency may be difficult to achieve. On the one hand, when agents' compensations can only be made contingent on the decision taken and not on the information created, truthful disclosure may be difficult to obtain. On the other, whenever the decision-maker's preferences are not observable suboptimal decisions are likely to occur.

Although these issues have already been analyzed in a variety of contexts, much of the literature has focused on one or the other rather than examining them in tandem. The objective of this paper is to investigate how these two potential sources of inefficiency interact with each other and how this interaction affects internal organization design.

The literature on information acquisition and disclosure (see Milgrom and Roberts 1986, Dewatripont and Tirole 1999, Palumbo 2000, Shin 1998) has characterized the optimal organizational structure at the information acquisition stage when the decision-maker's preferences are perfectly aligned with those of the principal. This literature predicts that the delegation of information acquisition to the parties directly affected by the decision is in general more efficient than delegation to an impartial agent. In these analyses the decisional stage is not explicitly modeled, however. Since the decision taken is always optimal conditional on the information created and disclosed, the optimal contract simply consists in delegating all the authority to the benevolent decision-maker. In contrast, the literature on decision-making has emphasized that if preferences are not observable the decision-maker cannot be trusted to implement the goals of the principal. Suboptimal decisions may arise for a number of reasons: dynamic inconsistency (e.g. Kidland and Prescott, 1977 and Gilbert and Newbery, 1988), interest groups' pressure (e.g. Laffont and Tirole, 1991), misalignment of preferences between the principal and the decision-maker, or, more simply, the fact that the decision-maker lacks the ability to compute the optimal policy. Most of this literature concentrates on how contracts should be designed to prevent opportunistic behavior on the part of the decision-maker. The process by which information is created and disclosed is generally treated as exogenous.

This paper is an attempt to bridge these two strands of the literature by looking at the *relationship* between rule-making, i.e. how the decisional rules are designed, and the delegation of information acquisition, i.e. who should provide the necessary information. The main contribution is to show that information acquisition and decision making are intrinsically related and hence the choice of the optimal organizational structure at the information acquisition level depends on how the decision rules are designed. The key to this relationship is the degree of discretion conceded to the decision-maker. When the latter is granted high discretion, information acquisition is optimally delegated to the parties involved in the decision. Conversely, when the decision-maker enjoys little discretion, it is more desirable to rely on a third neutral agent.

We develop a model in which a principal delegates to a decision-maker the task of taking a decision and to one or more different agents the task of providing the necessary information. Delegation may occur because the principal lacks the knowledge and expertise to evaluate the available alternatives or simply because the principal is a dispersed group unable to coordinate on a specific decision. The principal's preferences over decisions depend on the realization of the state of the world. Crucial in our model is the assumption that states are so numerous that the task of verifying ex-post which realization has occurred becomes prohibitively costly. In this context, contracts that specify a decision for each possible state and a punishment in case of deviation cannot be enforced. Thus, the decision-maker acquires the possibility to take arbitrary decisions that are difficult to control.

We compare two instruments that the principal can use to influence the decision-maker's behavior. One is to put limits on the decision-maker's discretion by setting a restrictive decision rule ("control from above"), the other is to delegate the supervisory role to the parties affected by the decision ("control from below"). A restrictive rule is a decision rule that does not discriminate between different states whereas the first best rule does. Clearly, conditioning on subsets of the state space rather than on single states lowers the cost of ex-post verification and allows the principal to verify whether the correct decision has been implemented. The drawback of this solution is the loss of flexibility that is inherent to the use of a rigid rule. The principal can avoid this loss if he assigns the monitoring task to the parties directly affected by the decision. In view of the conflict of interest, there will always be one party to blow the whistle in the case of an abusive decision.[1] The cost of relying on parties' monitoring comes from the

[1] The idea that the creation of a conflict of interests plays an important role in the pro-

possibility of information manipulation. To make sure that the parties can effectively monitor the decision-maker, the principal must give them access to the necessary information. This implies delegating to them the responsibility of producing the information. Such delegation is not without cost: the self-interested parties will hide evidence that is not favorable to their cause.

In the light of this discussion, the relationship between rule-making and delegation of information acquisition should be apparent. If the principal chooses an exogenous system of control through superior reviews, information acquisition is optimally delegated to a non-partisan agent. The latter has no incentives to manipulate the information and thus always reports truthfully to the decision-maker. Instead, if the principal chooses an endogenous system of appeals triggered by the parties involved in the decision, information acquisition must be delegated to them, although at the cost of manipulation.

In section 6 we compare the two efficient combinations (restrictive rule and neutral information collector or discretional rule and biased information collectors) and show that either can be optimal depending on the probability of discovering information when an agent investigates. When this probability is sufficiently high, the principal assigns to the parties the task of acquiring information, for in this case the cost of manipulation is negligible. Consequently, he sets a more discretional rule. Conversely, when the probability of discovering information is small, the loss due to manipulation is large. As a result, the principal is better-off in delegating the task of acquiring information to a neutral agent and, consequently, in resorting to a more restrictive decision rule.

These results are derived under the assumption that effort is observable and therefore the cost of acquiring information is the same under both structures. Section 7 extends the basic model to allow for non-observable effort. We find that the probability of discovering information also plays a major role in explaining the differences in the rents paid to the agents under different structures. To compute these rents, we focus on two extreme cases: the case in which the probability of discovering information approaches one and the case in which it equals one-half. In the first case, information-gathering is always more expensive with two agents, for having two agents involves a wasteful duplication of effort. In the second case, costs are higher with a single agent. Comparing these results with those obtained previously, we

vision of incentives was first emphasized by McCubbins and Schwarts (1988) and further developed by Laffont and Tirole (1990).

conclude that, under both structures, there is a trade-off between performance in terms of *efficiency of the decision* and performance in terms of *costs*: high efficiency corresponds to high costs, whereas low efficiency is associated with low costs. Although we do not characterize the optimal solution to this trade-off, we show that the presence of informational rents *in general* does not affect the existence of an optimal relationship between rule-making and the delegation of information acquisition.

Our approach sheds lights on a number of issues related to institution design and can be applied to all situations that involve the design of efficient procedures for decisional purposes. Examples include comparative analysis of legal and judicial systems, anti-trust regulation or aid plans to poor and developing countries. For expositional simplicity, the paper concentrates only on the comparative analysis of legal and judicial systems. However, a brief discussion of these alternative applications is offered in the conclusion.

The remainder of the paper is organized as follows. The key features of the main legal and judicial systems are briefly described in the next section. Section 3 presents the model. Section 4 formalizes the main differences between Civil and Common Law while section 5 analyzes the process by which information is produced and disclosed. The relationship between decision rules and the delegation of evidence acquisition is discussed in section 6. In section 7 we verify the robustness of the results to the introduction of unobservable effort. We conclude in section 8 and 9 with an overview of the related literature and a brief discussion of the results.

2 Comparative legal systems

The legal system contains the body of rules that allocates authority within the judiciary and defines the degree of discretion granted to the judges as well as the procedures they are required to follow. The judicial system regulates the process of acquisition and disclosure of evidence at trial.

The two most widely adopted legal systems are those of Civil Law and the Common Law. The former, which is a derivation of Ancient Roman Law, is typically observed in European continental countries, whereas the latter is more diffuse in the Anglo-Saxon world. Underlying the Civil Law system is the great importance given to the "certainty of decision-making", which is guaranteed by a systematic organization of the law into a code whose provisions the courts should administer without power of amendment. Official discretion is seen as negative and harmful. The code is viewed as complete and to supply a solution for any legal problem that may arise. However, the

difficulty of writing an omni-comprehensive list of provisions has led to a frame of general principles and to the conclusion that whenever the consideration of individualized circumstances prevents the conversion of the bases of the particular decision into a general formula, these considerations should be foregone. In contrast, the Common Law system aims to reach the decision most appropriate to the specific circumstances of each case. Although certainty of decision making is recognized as an important value, finding the best solution for each particular case is considered to be the most important task. As the preference for a case-by-case rule is inconsistent with the existence of predetermined and binding principles, decisions are taken by comparisons of the case in issue with prior cases (the principle of *stare decisis*).

The two most widely adopted judicial procedures are the adversarial and the inquisitorial types. In the latter, the trial is conceived as an official inquest conducted by an investigating judge who is supposed to be impartial and must look for evidence both against and in favor of the accused. By contrast, in the adversarial procedure the proceeding is dominated by the two parties - prosecutor and defense attorney- and evidence is adduced bilaterally through direct and cross-examination. The trial unfolds as a dispute between two competing parties, whose only goal is to win the case.

It is of interest that the same combination of legal and judicial system is observed in nearly all the countries. In particular, Civil Law systems are generally associated with inquisitorial procedures whereas Common Law systems are often combined with adversarial procedures. This paper is an attempt to provide a theoretical justification for this stylized fact.

3 The model

We consider a three-tier hierarchy: founder/judge/evidence collector(s). At the constitutional stage the founder chooses between two legal systems: Civil Law and Common Law and two judicial procedures: inquisitorial and adversarial. The legal system defines the contract offered to the judge. A contract specifies a decisional rule and a transfer. The judicial system establishes who is responsible for collecting and presenting evidence at trial and the rewards for the agent(s).

• *State space:* Let S denote the set of possible states. A state $s \in S$ defines all the circumstances of a case. A state can be described by a set of rules (a causality relationship between the event under judgment and the action taken by the accused, a proportionality rule between the weapons used

by the accused and the victim) and/or by specified events. We assume that $S = S_1 \times S_2$ where $S_1 = \{s_\emptyset, s_G, s_I\}$ and all elements of S_1 are equally likely. Similarly, $S_2 = \{\theta\}$ where θ is a random variable uniformly distributed on the unit interval. This characterization of the state space implies that we have a continuum of possible states each defined by a given combination of the evidence available on S_1 and S_2.

The principal's preferences over the possible decisions depend on the realization of the state of the world. Assuming that decisions are identified with sentences, the principal's preferred outcomes are defined as follows:

$$d^*(s_G, \theta) = G, \forall\theta \tag{1}$$

$$d^*(s_I, \theta) = I, \forall\theta \tag{2}$$

$$d^*(s_\emptyset, \theta) = d(\theta) \tag{3}$$

where G stands for "guilty", I stands for "innocent" and $d(\theta)$ includes all possible sentences between guilty and innocent. We assume that the higher the value of θ, the more evidence there is against the accused. Hence, $\theta = 1$ means that the evidence on S_2 is all against the accused whereas $\theta = 0$ means that it is all in favor. Finally, we assume that $d^*(s_\emptyset, 0) = I + \varepsilon$ and $d^*(s_\emptyset, 1) = G - \varepsilon$, for an arbitrarily small $\varepsilon > 0$. Expressions 1 to 3 can be thought of as the "burden of the proof" set by the principal according to his preferences. Expression 1 says that the accused is guilty when the circumstances which have occurred are those described in s_G. Similarly, expression 2 says that he is surely innocent when the circumstances are those defined by s_I. State $s_\emptyset$ is to be interpreted as a residual state which occurs when evidence is insufficient to identify either guilt or innocence. Hence, learning $s_\emptyset$ is equivalent to learning nothing on S_1. In this case the decision-maker has to rely on $\theta \in S_2$ which refers to other circumstances not specified in s_G or s_I.

• *Principal's preferences.* The principal minimizes the loss of taking a wrong decision. This is defined as the Euclidean distance between the decision taken d and the correct decision d^*

$$l(s_1, \theta) = (d - d^*)^2 \tag{4}$$

• *Judge's preferences:* The judge's preferences over decisions are independent of the state of the world. Therefore, either he is fully benevolent and willing to implement whatever decision rule is imposed on him or he is biased towards a cause and so wants to take his preferred decision independently of the available information. The term "biased" is here used in a

very broad sense. Bias may be due to corruption, to political or ideological positions, to social pressure or to mere incompetency. Let $\alpha \in [0,1]$ denote the probability of encountering a biased judge. Without loss of generality we assume that a biased judge always prefers $d = G$ to any other outcome. The judge is risk neutral and receives income t from the State. We assume that t is received if and only if it is not proved that the judge has violated the decision rule set in the Constitution. If the judge is caught violating he is punished and the optimal decision is implemented. Limited liability limits this punishment to zero income ($t = 0$). For the sake of simplicity we assume that the income received in the absence of evidence of misbehavior is fixed at t by the Constitution.

4 Decision Rules: Civil Law vs Common Law

In this section we analyze the benchmark in which the judge is fully informed about which state has occurred. The principal's problem then only amounts to giving the judge appropriate incentives to induce him to take the correct decision. One way to ensure this is by making each decision subject to review and reconsideration by a superior (and possibly unbiased) court before it is enforced. Superior reviews are valuable but may be too costly to implement when states are difficult to describe. The size of this cost is determined by the type of decision rule adopted. With a constant rule, i.e. a rule associating the same decision to all possible states, superior reviews cost zero, whereas with a fully state-contingent rule the cost of reviewing the judge's decisions becomes prohibitively high. In general, the cost increases as finer partitions of the state space are considered. A different way of looking at this is by invoking some form of contractual incompleteness. The literature generally recognizes three causes of incompleteness: unforeseen contingencies, costs of writing the contract, and enforcement costs. Assume that the costs of writing the contract and the costs of verifying the correctness of the judge's decisions coincide. Then our model can be viewed as describing a situation in which contingencies are perfectly foreseeable but so numerous that it is too costly to describe them in the contract. In this context, the optimal decision rule trades-off the advantages of more "completeness" against the higher writing costs.

Although this is a well defined problem, the solution is not trivial. As emphasized by Tirole (1999, pp.772), the main difficulty stems from the fact that "while there is no arguing that writing down detailed contracts is very

costly, we have no good paradigm in which to apprehend such costs".[2] More specifically, a solution to this problem rests on specifying a cost function that maps the set of all possible partition of the state space into the cost of writing the contract. Such task is beyond the scope of the paper. Therefore, we simplify things by assuming that the cost function can take only two values:

Assumption 1: If the decision rule is only contingent on S_1 the cost of writing the contract is zero. If the decision rule is contingent on S_1 and S_2 the cost of writing the contract is infinite.

Although we recognize that this is an over-simplification, we believe that it captures the idea that contracts are costly to write and therefore some kind of incompleteness arises. Under assumption 1, superior control over the judge is possible only if the principal sets a decision rule which is only contingent on S_1. This implies that for every $\theta \in [0,1]$:

$$\widehat{d}(s_G, \theta) = G \tag{5}$$

$$\widehat{d}(s_I, \theta) = I \tag{6}$$

$$\widehat{d}(s_\emptyset, \theta) = L \tag{7}$$

where, given (4), L denotes $d^*(s_\emptyset, E(\theta))$ and $E(\theta) = \frac{1}{2}$. This decision rule enables the principal to verify the optimality of the judge's decision at no cost. The drawback is that the principal disregards some available information that, if taken into account, would allow him to achieve a better decision. We call this inefficiency *"loss of rules"* and denote it by l_R. Under full information, l_R is:

$$l_R = \frac{1}{3} E_\theta (L - d(\theta))^2 = \frac{1}{3} \int_0^1 (L - d(\theta))^2 d\theta \tag{8}$$

It is worth emphasizing that this decision rule is consistent with the spirit of the Civil Law system, where laws take the form of very general propositions systematically organized into a Code. The kind of behavior which is expected from a civil law judge is well described by Damaska (1975, pp.497):

[2] Battigalli and Maggi (1999) have made an important attempt to explicitily model writing cost. Under relatively strong assumptions the authors show that the optimal contract is such that the most important decisions are regulated by contingent clauses, less important decisions are regulated by "rigid rules" of the type analyzed in our paper and the least important decisions are left to the agent's discretion. The approach used by Battigalli and Maggi is, however, very different from the one used here.

"what a [civil law] judge is looking for in the solution of the case is a general legal proposition that will cover the case before him. The specific facts of the decided case will seldom interests him; indeed they constitute a regrettable distraction from his proper business of finding a precisely articulated standard".

The resort to general provisions is precisely what enables superior control over the judge. Moreover, the idea that civil law judges should be controlled "from above" is also reflected in the norms that elevate "the right of appeal" to the constitutional level and make the appellate process very inexpensive and not risky for the parties.[3]

The Common Law system is very different. Here great weight is put on particularized justice and on the principle that slightly different cases should be decided differently. Since it would be impossible to encompass all the specificities of each case in a single written document, the Constitution grants judges higher discretion, only imposing on them the vague mandate to maximize social welfare. In the absence of a written rule, the principal's preferences are implemented through the mechanism of precedents (*stare decisis*). According to this mechanism, when confronted with a new case, the judge takes a decision. If the same decision is also taken by subsequent judges it constitutes a new precedent. Alternatively, the decision can be reversed. Reversions are generally made by superior judges and are binding for lower judges. Several authors (Posner, 1972, Rubin, 1977) have argued that this mechanism ensures that the law evolves gradually and efficiently over time. The underlying idea is that inefficient legal rules are contested and litigated more frequently than efficient decisions. As a consequence, the former are more often subject to improvements through subsequent reversions. This process of iteration increases the stock of efficient rules over time.

In the paper we do not endogenize this dynamics. Instead, we assume that we are at a given point in time where a complete set of optimal precedents has already been set. In terms of our model, a Common Law system can thus be seen as one in which the decision rule is contingent on S_1 and S_2. The latter has the advantage of letting the judge make use of all the information available. The limit is clearly that, under assumption 1, the principal experiences a loss of control: in state $s_\emptyset$ a biased judge will always

[3]The elimination of risk is connected with the general principle of *reformatio in peius*, i.e., preventing the appelate court from using the defendant's appeal as an opportunity to modify the judgment of the court below to the detriment of the defendant.

pretend that $\theta = 1$ and take $d = d(1)$. For sufficiently small $\varepsilon > 0$ the *loss of control* can be approximated as

$$l_C = \alpha \frac{1}{3} E_\theta (G - d(\theta))^2 = \alpha \frac{1}{3} \int_0^1 (G - d(\theta))^2 d\theta \tag{9}$$

A comparison of the two systems yields the following conclusion

Proposition 1 *Under full information, the Civil Law system dominates the Common Law system if the probability of encountering a biased judge is sufficiently high.*

Proof. See the Appendix ■

Proposition 1 has a straightforward interpretation. When the likelihood of facing a biased judge exceeds a given threshold the gains from discretion are outweighed by the cost of inefficient decisions. Thus, the principal benefits from restricting the judge's discretion. Let α^* be the cut-off value such that $l_C - l_R \lesseqgtr 0$ if $\alpha \lesseqgtr \alpha^*$. Since the interesting case is the one in which $l_C - l_R > 0$, throughout the rest of the paper we maintain the assumption that $\alpha > \alpha^*$.

When $\alpha > \alpha^*$, a rational principal will never choose a Common Law system unless he can rely on a third party to perform the role of watchdog. In the context we are analyzing the natural candidates are the prosecutor and the defense attorney: since they have opposing interests with respect to which verdict is pronounced, the parties have the right incentive to provide an efficient monitoring. Yet, to be able to prove that an incorrect verdict has been pronounced they must be informed on the evidence available on the case. The only way this can be ensured is by giving them the responsibility of the proof-taking. This is not without cost: when disclosing the evidence to the judge the biased parties have the incentive to hide the truth and to report only those facts that are favorable to their case. As a result, delegation to the parties is beneficial to the principal only if the loss inflicted by the manipulation is lower than the loss of control. To find conditions under which this is true, we now analyze the process by which evidence is acquired and disclosed. Before this, however, we conclude with one additional consideration.

One possible criticism of this analysis is that "control from above" and "control from below" are just two ways of avoiding abusive decisions and that more "refined" schemes would allow to improve upon these simple tools. While this may be true, there are three main reasons why we have decided

not to consider them. First, the goal of the paper is to compare the pros and cons of these two forms of control rather than to characterize the optimal contract to be offered to the judge. Second, limitations on the agents' discretion and monitoring are what we normally observe in reality. This probably suggests that more sophisticated mechanisms, while they can be constructed, may not be easy to implement. Third, the analysis required to construct these mechanisms would in general be rather demanding but, arguably, would not add much to the points we make.

5 Evidence acquisition: inquisitorial vs adversarial procedure

In this section we compare two institutions. In the first, evidence acquisition is delegated to a single impartial agent. In the second, the same task is performed by two agents, each the advocate of a specific cause. We assume that agents are risk neutral and are rewarded on the basis of the decision taken rather than on the amount of information created or disclosed. These incentive schemes, which are sometimes referred to as "indirect rewards", are frequently observed in real life. In general, they abound in all situations in which it is difficult or too costly for the principal to evaluate the information produced by the agents. The classical example is provided by political decisions. The average voter lacks the expertise to evaluate the arguments used to sustain a given policy measure but can easily observe whether the unemployment rate has fallen as a consequence of that measure.[4] Indirect rewards are natural also in the context under consideration. Here, the single agent case corresponds to the inquisitorial system where the prooftaking is delegated to an impartial investigator IJ ($\equiv$ *investigating judge*) who searches for evidence in favor and against the accused. Investigating judges are generally public officials and members of the judiciary. They receive a fixed monetary wage and are mainly motivated by the prospect of future promotions. Promotions are decided by superior bodies according to their evaluation of the judges' performance. Although many factors contribute to the measure of this performance, the ability to *solve* the cases is clearly the most important one. The two agents case instead corresponds to the adversarial system where the prosecutor and the defense attorney are responsible for collecting the evidence. In the adversarial procedure, the trial unfolds as a contest between two opposing parties, each driven by the

[4] For a more complete discussion of decision-based rewards see Dewatripont and Tirole (1999).

desire to *win* the case and to increase the market evaluation of their ability. The prosecutor (denoted by P) wishes to prove the accused guilty whereas the defense attorney (denoted by D) wishes to prove his client's innocence. The differences in the agents' incentives highlighted in the above discussion have important consequences. If the principal's goals are to promote judge's monitoring and to ensure full disclosure of information, it turns out that these two goals are necessarily in conflict.

In the remainder of this section we prove this and compute the loss of manipulation under the adversarial system. To this end, we introduce further assumptions on the nature of the signals observed by the agents, on the concealment technology, and on the information structure.

• *Signals:* Let $\hat{s}_I$, $\hat{s}_G$, $\hat{s}_\emptyset$ and $\hat{\theta}$ denote the signals observed when the true state is s_I, s_G, $s_\emptyset$ θ respectively. Signals are characterized as follows:

i) $\hat{s}_I \equiv (g_I, i_I)$ and $\hat{s}_G \equiv (g_G, i_G)$

where g stands for evidence against and i stands for evidence in favor of the accused;

ii) $\hat{\theta} \equiv h(\theta_G - \theta_I)$ and $\frac{\partial h(.)}{\partial(\theta_G - \theta_I)} > 0$

where θ_G and θ_I stand for evidence against and in favor of the accused, respectively. Further, $\theta_G \in [\frac{1}{2}, 1]$ and $\theta_I \in [0, \frac{1}{2}]$ are random variables uniformly distributed and h is the cumulative distribution of $(\theta_G - \theta_I)$.[5]

This characterization of the signals captures the fact that the evidence available in each state is a combination of different pieces which may be of a conflicting nature. In other words, the fact that the accused is innocent (guilty) does not preclude the existence of unfavorable (respectively favorable) evidence. We assume that if a signal is fully disclosed, the judge is able to correctly identify the correspondent state of the world. By contrast, if a signal is partially disclosed the judge may make errors. As an illustrative example, consider a situation where "innocence" is the true state and the agent observes $\hat{s}_I \equiv (g_I, i_I)$ where g_I is "the accused was videotaped while leaving the scene of the crime" and i_I is "a passerby saw someone else commit the crime". In this example the accused is undoubtedly innocent nevertheless there exist two pieces of evidence such that innocence can be established only if they are both disclosed.

• *Concealment:* As just mentioned, when an agent observes a signal he

[5] These assumptions are compatible with our previous assumption that θ has a uniform distribution. To see why, let $y \equiv \theta_G - \theta_I$ where y is a random variable with support $[0, 1]$ and distribution function $h = \begin{cases} \int_0^z (1+y)dy & if\ 0 \leq y \leq \frac{1}{2} \\ \int_{\frac{1}{2}}^z (1-y)dy & if\ \frac{1}{2} < y \leq 1 \end{cases}$. It follows that $\theta = h(y) \equiv h(\theta_G - \theta_I)$ is also a uniform random variable on the interval $[0, 1]$.

can decide whether or not to report it fully to the judge. More specifically, if an agent observes $\hat{s}_K \equiv (g_K, i_K)$, $K = G, I$ he can report both pieces of evidence or he can disclose either g_K *or* i_K. Similarly, if $\hat{\theta} \equiv h(\theta_G - \theta_I)$ is observed an agent can show it to the court or he can disclose either θ_G *or* θ_I. Reports are verifiable. Therefore, agents can withhold unfavorable evidence but cannot forge false evidence.

• *Information structure:* To acquire evidence about S_1 and S_2 an agent must undertake a search. If he does not search he learns nothing with probability one. If he searches on S_1, with probability q the agent learns the true $s_1 \in S_1$, and with probability $1 - q$ he learns nothing ϕ.

Assumption 2 If he searches on S_2 an agent always learns the true θ_G and θ_I.

One may argue that the assumption of perfect learning on S_2 induces a bias in the comparison between the two systems. This is because in the Civil Law system learning θ is irrelevant whereas in the Common Law system different θ are associated with different decisions.[6] While recognizing this, we will later show that a more symmetric information structure would make the analysis more cumbersome but would not change the main results.

We are now ready to prove our first point that with indirect rewards full disclosure is not compatible with judge's monitoring. To formalize this argument we assume that the rewards received by the agents only depend on the judge's decision but not on the evidence on which this decision is based. To simplify the analysis we make the assumption that agents only respond to monetary incentives and refer the reader to Dewatripont and Tirole (1999) for formal proof of the robustness of the results to the introduction of career concern. To set agency costs aside, we also make the assumption (to be relaxed later) that effort is observable and therefore that the principal can induce information acquisition at no cost.

Proposition 2 *If the wage scheme is such that truthful disclosure is the optimal strategy, then no monitoring will be exercised. Conversely, any wage scheme that ensures control over the judge entails manipulation.*

Proof. Let v_x denote the reward when the decision is $x = \{G,\ I,\ d(\theta)\}$. To obtain a truthful release of information the wage scheme must satisfy: $v_G = v_I$ and $v_{d(\theta)}$ is constant for any $\theta \in [0, 1]$. The first condition stems

[6] In the Civil Law system the decision rule forbids the judge to make use of this information. Thus, learning θ is irrelevant. In the Common Law system instead different θ are associated with different decisions.

from the fact that if $v_G > v_I$, then the agent would report g_I, whenever $\hat{s}_I \equiv (g_I, i_I)$ is observed. Similarly, if $v_{d(\theta)}$ is not constant in θ the agent discloses only the information that allows him to obtain the higher wage whenever he can do so. It is not difficult to see that this wage scheme gives no incentive to the agent to monitor the decision-maker. Monitoring requires the wage scheme to be such that any deviation from the efficient decision is harmful for at least one agent. To ensure this, two conditions are to be met. First, information collection must be assigned to two different agents. Second, the incentive scheme must be monotonically increasing in θ with $v_G \geq v_{d(\theta)} \geq v_I$ for agent one and monotonically decreasing in θ with $v_I \geq v_{d(\theta)} \geq v_G$ for agent two. This wage scheme gives the agents incentive to misreport their evidence. Specifically, when $\widehat{s}_K$ is observed, agent one only shows g_K whereas agent two only shows i_K. Similarly when the information is $\widehat{\theta} \equiv h(\theta_G - \theta_I)$, the former only shows θ_G whereas the latter only shows θ_I. ■

Thus, under proposition 2, the choice between the inquisitorial and the adversarial system can be seen as one between a procedure that ensures full disclosure but no monitoring and a procedure that induces judge's control but at the expense of manipulation.

5.1 The loss due to manipulation

In this sub-section we compute the loss suffered by the principal when the proof-taking is delegated to the prosecutor and the defendant. The first thing one should notice is that manipulation is not harmful when both parties are informed: since any piece of evidence favors one party or the other, for any piece of evidence there will be a party who has the incentive to disclose it to the judge. In terms of this model this means that manipulation on $\widehat{\theta}$ is ineffective whereas manipulation on S_1 can be harmful to the principal as long as $q < 1$. To illustrate how concealment of evidence can induce the judge to pronounce a wrong verdict suppose that both parties undertake one search on S_1. The information structure is the following: if the true state is $s_\emptyset$, the agents observe $\hat{s}_\emptyset$ with probability one. If the true state is s_G, with probability $1-(1-q)^2$ at least one agent learns $\hat{s}_G$ and with probability $(1-q)^2$ both learn nothing. Similarly, if the true state is s_I with probability $1-(1-q)^2$ at least one agent learns $\hat{s}_I$ and with probability $(1-q)^2$ both learn nothing. Table 1 shows that there are two circumstances in which manipulation is harmful: the first is when the true state is s_I and the prosecutor observe $\hat{s}_I$ whereas the defendant only observes $\hat{s}_\emptyset$. In this case, the prosecutor reports g_I and the defendant is not able to provide

the counterargument i_I which proves his innocence. The second is when the true state is s_G and the defendant observe $\hat{s}_G$ whereas the prosecutor only observes $\hat{s}_\emptyset$. Accordingly, the defendant reports i_G and the prosecutor cannot show the counterargument g_G that proves the accused guilty.

State	Information		Report		Probability	Decision
	P	D	P	D		
$s_\emptyset$	$(\hat{s}_\emptyset$	$\hat{s}_\emptyset)$	$(\phi$	$\phi)$	$\frac{1}{3}$	$d(\theta)$ or L
s_G	$(\hat{s}_G$	$\hat{s}_G)$	$(g_G$	$i_I)$	$\frac{1}{3}q^2$	G
s_G	$(\hat{s}_G$	$\hat{s}_\emptyset)$	$(g_G$	$\phi)$	$\frac{1}{3}q(1-q)$	G
s_G	$(\hat{s}_\emptyset$	$\hat{s}_G)$	$(\phi$	$i_G)$	$\frac{1}{3}q(1-q)$	I
s_G	$(\hat{s}_\emptyset$	$\hat{s}_\emptyset)$	$(\phi$	$\phi)$	$\frac{1}{3}(1-q)^2$	$d(\theta)$ or L
s_I	$(\hat{s}_I$	$\hat{s}_I)$	$(g_I$	$i_I)$	$\frac{1}{3}q^2$	I
s_I	$(\hat{s}_\emptyset$	$\hat{s}_I)$	$(\phi$	$i_I)$	$\frac{1}{3}q(1-q)$	I
s_I	$(\hat{s}_I$	$\hat{s}_\emptyset)$	$(g_I$	$\phi)$	$\frac{1}{3}q(1-q)$	G
s_I	$(\hat{s}_\emptyset$	$\hat{s}_\emptyset)$	$(\phi$	$\phi)$	$\frac{1}{3}(1-q)^2$	$d(\theta)$ or L

Table 1

It can be easily verified that when confronted with these reports, an unbiased judge is indifferent between following or not the agents' advice. We assume that an indifferent judge follows the report and thus take $d = G$ in the first case and $d = I$ in the second. The loss associated with the manipulation when both parties search is thus equal to

$$l_M = \frac{2}{3}q(1-q)(G-I)^2 \tag{10}$$

6 Comparison

The purpose of this section is twofold. First, we measure the efficiency properties of the adversarial and inquisitorial procedure under Common and Civil Law. Then, we compare the two "optimal combinations" and derive conditions under which one or the other is preferred.

The first result is immediate: under Civil Law the inquisitorial procedure is always optimal. Intuitively, the rigid decision rule implied by the Civil Law prevents the judge from abusing his authority. Therefore, the inquisitorial procedure is preferred as it avoids manipulation. Under Common Law, the efficient procedure can be identified comparing the loss of control

when the proof-taking is assigned to the investigating judge and the loss of manipulation when the same task is performed by the prosecutor and the defense attorney. In order to have a meaningful comparison, we assume that the *same* amount of evidence is collected under both procedures. This implies assuming that prosecutor and defense attorney exert one search each on S_1 while the investigating judge searches twice. The relevant expression for the loss of manipulation is the one in (10). Conversely, for the loss of control we have:

$$l_C = \alpha \frac{1}{3}(1 + (1-q)^2) \int_0^1 (G - d(\theta))^2 d\theta \tag{11}$$

Note that this expression is larger than (9). The reason is that when the true state is s_I, with probability $\frac{1}{3}(1-q)^2$ the investigating judge fails to discover it and thus reports ϕ. Consequently, the probability of incurring a loss of control increases by $\frac{1}{3}(1-q)^2$. Comparing (10) and (11) yields:

Proposition 3 *Under Civil Law the inquisitorial procedure is always optimal. Under Common Law the adversarial procedure is optimal if the probability of discovering information is sufficiently high whereas the inquisitorial procedure is optimal if the probability of discovering information approaches* $\frac{1}{2}$.

Proof. See the Appendix ■

The intuition behind proposition 3 is again very simple. When q approaches 1 the cost of manipulation becomes negligible and therefore delegation to the parties is optimal. By contrast, when q is close to $\frac{1}{2}$ the loss inflicted by the manipulation is large and therefore the principal prefers a more neutral evidence collector. It should be noticed that relaxing the assumption of perfect learning on S_2 does not change our insights. Imperfect learning would only result in a larger loss of manipulation when $q = \frac{1}{2}$.

The results of proposition 3 "feeds back" into the choice of the optimal legal system leading to the following conclusion:

Proposition 4 *When the probability of discovering information is sufficiently close to one, delegating evidence acquisition to the parties is optimal. Consequently, the Common Law system dominates the Civil Law system. When the probability of discovering information is sufficiently close to one-half the inquisitorial procedure is more efficient. For* $\alpha \geq \alpha^*$ *the Civil Law system dominates the Common Law system.*

Proof. When $q \to 1$, $l_M = 0$. Therefore by choosing the adversarial procedure the principal obtains both control ($l_C = 0$) and the truthful revelation of information. Consequently, Common Law is preferred. When $q \to \frac{1}{2}$, the inquisitorial procedure dominates under both legal systems. However, if $\alpha \geq \alpha^*$ the loss of control is larger than the loss of rules and thus Civil Law is more desirable. ■

Proposition 3 seems to contradict the intuition that there exists an optimal relationship between rule-making and delegation of evidence acquisition. Specifically, it says that for some values of q the inquisitorial procedure also dominates under Common Law. Proposition 4 rules out this "degenerate combination". It says that for those values of q in which the inquisitorial procedure is preferred under both legal systems, Common Law is always dominated.

7 The cost of inducing evidence acquisition

So far we have maintained the assumption that effort is observable and therefore information acquisition is not costly for the principal. In practice, the principal is unable to monitor the effort exerted by the agents who exploit this informational advantage to extract a rent. Since the size of this rent may differ across structures, to be complete about the optimality of each procedure we must introduce such costs into the analysis. For simplicity we shall concentrate on the two cases for which we have obtained more clear predictions: the cases where $q = 1$ and $q = \frac{1}{2}$.

Suppose that each search costs ψ to the agents. We find that, for any given amount of information produced, hiring two agents instead of one is more expensive when $q = 1$ and less expensive when $q = \frac{1}{2}$. Contrasted with our previous conclusions, this result highlights the existence of a trade-off between performance in terms of quality of the decision and performance in term of costs. For each value of q and each procedure efficiency in decision making is associated with high costs of collecting information whereas low costs imply less efficient decision making. Investigating this trade-off is not within the scope of the paper.[7] Instead, we shall content ourselves with showing that *in general* introducing costs does not affect the main argument here on the existence of an optimal relationship between rule-making and delegation of evidence acquisition.

[7] However, see Palumbo (1997).

7.1 Case 1: $q = 1$

Recall that when $q = 1$, proposition 4 says that the adversarial procedure dominates the inquisitorial procedure and consequently Common Law is optimal. To check whether this result carries through when costs are introduced, notice that when $q = 1$ it suffices that the investigating judge searches once to have a fully informed adjudicator. In the adversarial system, instead, at best the principal can obtain the same result, i.e. $l_{M} = 0$, by inducing both parties to search on S_1. Insofar as the principal must compensate both agents for the effort provided, such duplication of effort is clearly unprofitable. To see the implications of this on proposition 4, consider the Common Law system and let v_x^k denote the reward for agent $k = \{IJ, P, D\}$ when the decision is $x = \{G,\ I,\ d(\theta)\}$. As shown in proposition 2, to ensure truthful disclosure the wage scheme for the investigating judge must be such that $v_{G}^{IJ} = v_{I}^{IJ} \equiv \overline{v}^{IJ}$ and $v_{d(\theta)}^{IJ} \equiv \underline{v}^{IJ}$ for any $\theta \in [0,1]$. Taking these constraints into account, incentive compatibility for full investigation requires:

$$\frac{2}{3}\overline{v}^{IJ} + \frac{1}{3}\underline{v}^{IJ} - 2\psi \geq \frac{2}{3}\overline{v}^{IJ} - \psi \tag{12}$$

$$\frac{2}{3}\overline{v}^{IJ} + \frac{1}{3}\underline{v}^{IJ} - 2\psi \geq \underline{v}^{IJ} - \psi \tag{13}$$

Expression (12) says that the investigating judge prefers to investigate S_1 and S_2 rather than S_1 only. Expression (13) says that investigating S_1 and S_2 is also preferred to investigating S_2 only. Simple algebra shows that to ensure full investigation the principal must pay: $\overline{v}^{IJ} = \frac{9}{2}\psi$ and $\underline{v}^{IJ} = 3\psi$. The investigating judge enjoys a rent $\Phi^{COL+INQ} = 2\psi$.

In the adversarial procedure, monitoring is ensured by offering the parties a wage scheme in which more favorable decisions are associated with higher wages. As shown in the Appendix, the equilibrium in which both parties search on S_1 and S_2 can be implemented as a dominant strategy only by paying each agent a rent $\frac{1}{2}\psi$. The reason why this rent is lower than the one paid to the investigating judge is the following. To induce the investigating judge or the parties to search *also* on S_2 the principal must pay a (expected) wage 3ψ when the decision is $d(\theta)$. This wage gives the agents an incentive to search *only* on S_2 and appropriate a positive rent $3\psi - \psi$. Consequently, to force the investigating judge to search also on S_1 the principal must increase the wage associated with decisions $d = G$ or I. Similarly, to make each party "deviate" from the equilibrium in which both search only on S_2, a higher wage must be paid to the party who wins the case. Although this wage is

the same for the investigating judge and for the parties, the *expected* wage is higher in the inquisitorial system.

Despite the lower rent, the total cost under the adversarial procedure $TC^{COL+ADV} = 5\psi$, is larger than the total cost under the inquisitorial procedure $TC^{COL+INQ} = 4\psi$, due to the inefficiency of having two information collectors rather than one. This yields:

Proposition 5 *Suppose q equals one. Under Civil Law, the inquisitorial procedure is still optimal. Under Common Law, the adversarial procedure is optimal iff $l_C > \psi$.*

Proposition 5 suggests that when costs are introduced into the analysis and $q = 1$ the adversarial procedure loses some of its appealing . The advantage of having control without manipulation must be now confronted with the higher cost of hiring two agents rather than one. If this cost is sufficiently small ($\psi < \min\{l_C, l_R\}$) proposition 4 continues to hold and the combination of Common Law and adversarial procedure is still optimal. On the contrary, if this cost is high ($\psi > l_C$) the inquisitorial procedure becomes preferred under both systems. Yet, proposition 4 ensures that the combination of Civil Law and inquisitorial procedure is optimal, thereby confirming the general result of the paper on the existence of an optimal relationship between decision rule and information acquisition.

7.2 Case 2: $q = \frac{1}{2}$

Consider now the case where q is equal to one-half. Propositions 3 and 4 say that in this case the combination of Civil Law and inquisitorial procedure is optimal. To verify the validity of this result when costs are introduced, notice that with $q \to \frac{1}{2}$ the cost of collecting information with one agent is equal or larger than with two agents.[8] To see this consider the Civil Law system. To ensure that the same amount of information is collected on S_1 under both procedures, the investigating judge must undertake two searches. Incentive compatibility requires:

$$\frac{1}{2}\overline{v}^{IJ} - 2\psi \geq \frac{1}{3}\overline{v}^{IJ} - \psi \tag{14}$$

$$\frac{1}{2}\overline{v}^{IJ} - 2\psi \geq 0 \tag{15}$$

[8] This is the case here because the technology shows decreasing return to scale.

Expressions (14) and (15) say that two searches on S_1 is better than one or none. The wage that implements two searches is $\overline{v}^{IJ} = 6\psi$ and the investigating judge enjoys a rent $\Phi^{CIL+INQ} = \psi$. In the adversarial system, by paying a wage $v_G^P = v_I^D = \frac{3}{8}\psi$ to the party that wins the case and zero to the other, the principal can obtain the same amount of information without leaving any rent to the parties. Thus, under Civil Law, the inquisitorial procedure is optimal only if:

$$l_M > \Phi^{CIL+INQ} \tag{16}$$

The difference in costs further increases for the Common Law system, for a second effect takes place. Not only is the cost of inducing information acquisition on S_1 larger but also the rent that must be paid to convince the agents to search on S_1 *and* S_2 is also larger for the investigating judge. Consequently, under Common Law, the inquisitorial system dominates only if:

$$l_M > l_C + TC^{COL+INQ} - TC^{COL+ADV} \equiv \Delta TC \tag{17}$$

The intuition for this result is the same as for the case $q = 1$ and a formal derivation is relegated to the Appendix. The combination of expressions (16) and (17) leads to the following conclusion. If $l_M > \max\left\{\Phi^{CIL+INQ}, l_C + \Delta\Phi\right\}$ proposition 4 continues to hold. The inquisitorial procedure is always optimal and, as in the case $q = 1$, the combination Common Law plus inquisitorial procedure is always dominated by the combination Civil Law plus inquisitorial procedure. If $\Phi^{CIL+INQ} < l_M < l_C + \Delta TC$ the inquisitorial procedure is preferred under the Civil Law system whereas the adversarial procedure is preferred under the Common Law. Which of these two combinations is optimal depends on the impact of costs. In the other cases the results are more ambiguous and, depending on the values of the parameters, it is possible to have "degenerate" combinations.

8 Related Literature

The paper coming closest to this is Dewatripont and Tirole (1999). Here a principal/decision-maker has to choose between two alternative projects but has little information about which is the best one. Information can be produced by either one or two agents. In the first case the agent has to find information about both projects, in the latter each agent is supposed to make the case for only one project. Dewatripont and Tirole argue that advocacy

has two main advantages: first, information collection is less costly, second, the distortions in decision making are *in general* smaller under advocacy. Two important differences exist between this and our model. As already mentioned, in Dewatripont and Tirole most of the analysis assumes that the decision-maker has preferences which are perfectly aligned with those of the principal. The case of misaligned preferences is only discussed informally. Consistent with our analysis, Dewatripont and Tirole argue that while the two parties can be relied to provide a check against a self-interested decision-maker, this is not true with a single agent. Further, Dewatripont and Tirole allow for the case in which both projects have the same value and thus "the status quo" is the optimal decision. For this reason manipulation occurs also under nonpartisanship. In our model this can never be the case. Since there is only one project and the "states" refer to the quality of this project, one realization automatically excludes all the others.[9] Another paper related to us is Shin (1997). Shin argues that the superiority of the adversarial system lies in the fact that the decision-maker can rely on two sources of information instead of one. This enables him to better infer the facts of the case, also when the prosecutor and the defendant are not better informed on average than the investigating judge. Although the decisional problem in Shin is modeled similarly to ours, two differences remain. First, the decision-maker is again identified with the principal, second the proof-taking process is taken as exogenous. Also related to our paper is the work by Armstrong (1994) on discretion and delegation. Armstrong discusses the pros and cons of limiting discretion when a principal delegates decisions to a better informed agent. Armstrong's main result is that the less likely the agent's preferences are to coincide with the principal's, the less discretion the agents should be given. This paper can be seen as complementary to ours in the sense that here the degree of discretion granted to the agent is endogenous and the optimal contract offered to the decision-maker is derived as a solution of the principal's optimization problem. However, in this paper information acquisition is not modeled and it is exogenously assumed that the decision-maker is better informed than the principal.

9 Conclusion

We have analyzed a decisional process and argued that information acquisition should be delegated to the parties involved in the decision or to a third impartial agent depending on the rules set at the decisional stage. This

[9] A project can be good or bad but can never be good and bad at the same time.

result has been used to explain why we observe particular combinations of legal and judicial systems.

As we mentioned in the introduction, our framework applies to other contexts as well. One example is anti-trust policy. When two firms decide to merge they must ask for the authorization of the relevant anti-trust authority. The latter analyses the case and decides whether or not to authorize the merge. The wave of mergers that has taken place in recent years has drawn attention on how the procedure for the authorization should be designed. In particular, the debate has focused on two points. One relates to the criteria to use when evaluating the consequence of the merger on consumer welfare and market competition. The main issue is whether the authority should rely on general and fixed rules or should proceed on a "case by case" basis. Obviously, the first rule has the advantage of being simpler and more objective whereas the second has the positive feature of ensuring more flexibility. The second issue tackled in the debate concerns the acquisition of information. Should this task be allocated to the parties interested in the decision (consumers lobbies on the one side and merging firms on the other) or to a more neutral party? Our analysis suggests that these problems should be addressed simultaneously and that in choosing a decision rule the authority should be guided by how easy it is to collect the relevant information.

Our approach can also say something on the issue of aid to poor and developing countries. The failure of many financed projects has raised the question of how they should be selected and who should provide the information on the relative merits of different projects. According to our results the answer lies in the relationship between decision rules and incentives of the agents. Assume that the criteria for the selection of the projects are defined by the World Bank according to some general principles. In this case, the government of the beneficiary state can be easily monitored to implement the right project and thus information provision is better assigned to a third neutral party. By contrast, when the choice of the projects is assigned directly to the government of the beneficiary state, monitoring becomes more difficult. In this case, to prevent opportunistic behaviors of the government, information provisions should be delegated to the parties affected by the decision.

10 Appendix

Proof of proposition 1

It suffices to show that $l_C - l_R > 0$ for some arbitrary value of α. Notice that, for $\alpha = 1$, l_C and l_R can be re-written as:

$$l_C = \frac{1}{3}\int_0^{\frac{1}{2}} (G - d(\theta))^2 d\theta + \frac{1}{3}\int_{\frac{1}{2}}^1 (G - d(\theta))^2 d\theta \qquad (A1)$$

and

$$l_R = \frac{1}{3}\int_0^{\frac{1}{2}} (L - d(\theta))^2 d\theta + \frac{1}{3}\int_{\frac{1}{2}}^1 (L - d(\theta))^2 d\theta \qquad (A2)$$

The second term on the right hand side of both expressions coincides. To see this, notice that in $(A1)$, $(G - d(\theta))^2$ equals $(G - L)^2$ when $\theta = \frac{1}{2}$ and zero when $\theta = 1$ while in $(A2)$ $(L - d(\theta))^2$ equals $(L - G)^2$ when $\theta = 1$ and zero when $\theta = \frac{1}{2}$. By the same token it is easy to see that the first term on the right hand side of $(A1)$ is always greater than its equivalent in $(A2)$. Hence, $l_C - l_R > 0$.

Proof of proposition 3

When $q \to 1$ the adversarial system is always optimal as (10) becomes zero. When $q = \frac{1}{2}$, $l_M = \frac{1}{6}(G - I)^2$ whereas $l_C = \alpha\frac{5}{12}\int_0^1 (G - d(\theta))^2 d\theta$. Suppose $\alpha = 1$, then the inquisitorial procedure is optimal if $l_M - l_C = (G-I)^2 - \frac{5}{2}\int_0^1 (G - d(\theta))^2 d\theta > 0$. The convexity of the loss function ensures that this inequality is always satisfied. Since l_C is decreasing in α the result holds true for any α.

Optimal incentive scheme under Common Law

The adversarial procedure

$q = 1$. As shown in section 5 under Common Law the wage schemes for the parties pay more for more favorable decisions. Since the set of possible decisions is a continuum, the wage schemes are continuum functions. Moreover, these incentives schemes induce parties' monitoring over the judge. We start our proof by showing that the same can be provided by a simpler contract in which only five wage levels are specified. For simplicity we prove the lemma only for the case of the prosecutor. However, the same argument works for the defendant.

Lemma 6 *We can restrict to a wage scheme:* $(\overline{w}, \overline{v}, v_0, \underline{v}, \underline{w})$ *where* $\overline{w} \equiv v^P_G$, $\overline{v} \equiv v^P_{d(E(\hat{\theta}'))}$, $v_0 \equiv v^P_{d(E(\hat{\theta}))}$, $\underline{v} \equiv v^P_{d(E(\hat{\theta}''))}$, *and* $\underline{w} \equiv v^P_I$, *where* $\hat{\theta}' \equiv h(\theta_G)$ *and* $\hat{\theta}'' \equiv h(\theta_I)$.

Proof. Suppose that neither of the two parties has found evidence on S_1. Three cases may occur. Both parties search on S_2, only the prosecutor searches on S_2 or only the defendant searches on S_2. In the first case, manipulation is ineffective and the judge learns $\hat{\theta} \equiv h(\theta_G - \theta_I)$. The expected wage for the prosecutor is $E_{\hat{\theta}}(v_{d(\hat{\theta})})$. However, under the assumption of risk neutrality the prosecutor is indifferent between getting this expected wage and getting v_0. Similarly, when only the prosecutor investigates S_2, the report is $\hat{\theta}'$ which ensures him an expected wage $E_{\hat{\theta}'}(v_{d(\hat{\theta}')})$. Again, the prosecutor is indifferent between receiving this wage and receiving $\overline{v}$. Finally, when only the defendant searches on S_2 the report is $\hat{\theta}''$ which ensures the prosecutor an expected wage $E_{\hat{\theta}''}(v_{d(\hat{\theta}'')})$ which gives him the same utility of $\underline{v}$ ■

Under lemma 6, the principal's implementation problem becomes:

$$\frac{1}{3}(v_0 - \underline{v}) - \psi \geq 0 \qquad (A3)$$

$$\frac{1}{3}\overline{v} - \psi \geq 0 \qquad (A4)$$

$$\frac{1}{3}(v_0 - \underline{v}) - \psi \geq 0 \qquad (A5)$$

$$\frac{1}{3}(\overline{w} - \underline{w}) - \psi \geq 0 \qquad (A6)$$

$$\frac{1}{3}(\overline{w} - \underline{w}) - \psi \geq 0 \qquad (A7)$$

$$\frac{2}{3}\overline{w} - \frac{1}{3}v_0 - \psi \geq 0 \qquad (A8)$$

Expressions $(A3)$ to $(A5)$ ensure that each agent prefers to search on S_1 and S_2 to searching only on S_1, independent of their opponent move. Expressions $(A6)$ to $(A8)$ ensure that this is also preferred to searching only on S_2. A quick inspection of the incentive scheme shows that only four constraints are relevant. Recalling that limited liability imposes $\underline{w} = 0$, with simple algebra it is easy to show that the cost minimizing scheme inducing full investigation is: $\overline{w} = \frac{9}{2}\psi$, $\overline{v} = v_0 = 3\psi$, $\underline{v} = \underline{w} = 0$. Each agent enjoys

a rent: $\Phi^{COL+ADV} = \frac{1}{2}\psi$. One may argue that the reduced form incentive scheme we have used is not optimal and that a more sophisticated scheme would entail a lower or even zero rent. While this is possible, a lower rent would affect our result quantitatively but not qualitatively. Indeed, the inefficiency of the adversarial system stems from the duplication of effort that is required to annihilate the effect of manipulation.

$q = \frac{1}{2}$. Using the same reasoning as before, it can be showed that when $q \to \frac{1}{2}$ the equilibrium strategy in which both parties search on S_1 and S_2 can be implemented as dominant strategy by setting a wage scheme ($\overline{w}$, $\overline{v}$, v_0, $\underline{v}$, $\underline{w}$) which satisfies:

$$\frac{1}{2}(v_0 - \underline{v}) - \psi \geq 0 \qquad (A9)$$

$$\frac{1}{2}\overline{v} - \psi \geq 0 \qquad (A10)$$

$$\frac{2}{3}(v_0 - \underline{v}) - \psi \geq 0 \qquad (A11)$$

$$\frac{1}{4}\overline{w} - \frac{1}{6}v_0 - \psi \geq 0 \qquad (A12)$$

$$\frac{1}{4}\overline{w} - \frac{1}{6}\overline{v} - \psi \geq 0 \qquad (A13)$$

$$\frac{1}{3}\overline{w} - \frac{1}{3}v_0 - \psi \geq 0 \qquad (A14)$$

Solving constraints $(A9)$ to $(A14)$ yields: ($\overline{w} = \frac{16}{3}\psi$, $\overline{v} = v_0 = 2\psi$, $\underline{v} = \underline{w} = 0$). The agents enjoy a rent: $\Phi^{COL+ADV} = \frac{1}{3}\psi$ and the total cost for the principal is equal to: $TC^{COL+ADV} = \frac{13}{3}\psi$

The inquisitorial procedure

To produce the same amount of information under the inquisitorial system the investigating judge needs to exert two searches on S_1 and one search on S_2. Incentive compatibility requires:

$$\frac{1}{6}\overline{v}^{IJ} - \frac{1}{6}\underline{v}^{IJ} - \psi \geq 0 \qquad (A15)$$

$$\frac{1}{2}\underline{v}^{IJ} - \psi \geq 0 \qquad (A16)$$

$$\frac{1}{2}\overline{v}^{IJ} - \frac{1}{2}\underline{v}^{IJ} - 2\psi \geq \qquad (A17)$$

From constraint $(A16)$ we obtain $\underline{v}^{IJ} = 2\psi$. The binding constraint between $(A15)$ and $(A17)$ is the latter, from which we get: $\overline{v}^{IJ} = 8\psi$. This wage scheme leaves the investigating judge a rent: $\Phi^{INQ+COL} = 2\psi$. The total cost is then equal to: $TC^{COL+INQ} = 5\psi$, which is greater than $TC^{COL+ADV}$. Notice that this is true despite the fact that under assumption 2, the investigating judge exerts only one search on S_2. Hence, relaxing this assumption would only strengthen our result.

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