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Adversarial Decision Making

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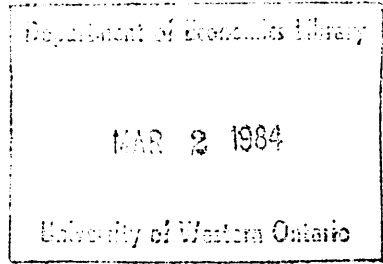
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I. Introduction

Normally, economists study decision making in markets. More recently, other forms of decision making have come under study. The literature dealing with agency problems (e.g., Shavell, 1979; Holmstrom, 1982) studies decision making within a hierarchial context when there is informational asymmetry. There is also a literature dealing with decision making through contests or rank order tournaments (e.g., Nalebuff and Stiglitz, 1983). Such methods of decision making are used in circumstances where information structures are such that the knowledge provided by relative performance is more useful than that provided by any available absolute standard. The argument of this paper is that there is yet another strategy of decision making, based on adversarial procedures. In Part II of the paper, adversarial decision making will be characterized. Part III provides a formal model of such procedures in the context of a trial, and indicates ways in which the model can be applied in other contexts. The last Part summarizes the paper.

II. Adversarial Procedure

Adversarial decision making occurs when two parties take opposite sides on some issue and attempt to convince the decision maker of the merits of their position. The prototype for this method of decision making is of course the trial; here each party

to dispute has an attorney representing his interests and each attorney attempts to convince the decision maker (judge or jury) of the merits of his client's case. This type of decision making occurs in both civil and criminal cases.

Other examples of adversarial decision making occur in large organizations when different subunits are given different goals and again attempt to convince the decision maker of the merits of their positions. For one example, the marketing and production divisions of a manufacturing firm might behave in this way with respect to some design feature of a product; the production division might be concerned with technical virtuosity, while the marketing division would want to minimize price. For another, two divisions of a multiproduct firm might each attempt to convince the finance unit that they should receive additional investment capital. It also appears that economists and lawyers within some government agencies play this role, with the political decision maker weighing the merits of the two cases with respect to the impact on votes. In fact, the democratic political process itself works like this: parties and candidates take adversarial stances and attempt to convince voters of the merits of their position.

These situations may all be characterized by the following factors: First, in all cases there is extreme informational asymmetry. Second, information held by each party is valuable both to that party and also to the decision maker, and it is difficult or impossible to devise a mechanism which will induce

the party to reveal the information. Third, the true information will never be revealed to the decision maker.

Consider, for the best example, a criminal trail. The accused presumably knows whether he is innocent or not, but other parties generally do not have as much knowledge. Moreover, there is no way to induce the accused to truthfully reveal guilt (except by a promise of immunity, which would be a self defeating promise.) It is valuable to society to determine guilt in order to punish the guilty for the purpose of deterring further crime (Ehrlich, 1973). Finally, in the general case, the decision maker will never know for certain whether or not his decision is correct.

A decision maker faced with this set of circumstances may find the establishment of an adversary procedure worthwhile. Such a procedure relies on agents with symmetric and exactly opposed preferences. (The value of such symmetric agents in generating efficiency in legal decisions has been discussed at length in Rubin, 1982.) If such agents do not exist, then the decision maker may find it worthwhile to create an artificial agent whose incentives opposite to those of the natural agent. That is, the artificial agent has an induced utility function which is the inverse of the utility function of the natural agent.

In order to maximize their respective utilities, the adversarial agents will then seek information. By the nature of the utility functions, the information which each seeks is

exactly that which the other agent seeks to conceal. For example, in a criminal trial, the accused criminal will attempt to conceal any information which demonstrates guilt; the prosecutor, an artificial agent, will seek exactly this information. Both sides will then present their information to the court and the decision maker will judge between them.

For the second example, consider politics. Here one party is in office at a given time. This party makes certain decisions. Some of these might be decisions about which it would not want the governed to be aware, such as the decision to accept a bribe. However, a second political party has the incentive to seek out just this information to use in the campaign for election.

We may contrast two types of deicison making procedures. In an inquisitorial system, discussed in detail by Tullock (1980), who prefers such a system, the job of the agent is to attempt to determine the truth. In an adversarial system, each agent attempts to convince a decision maker that his case is strongest. The relative efficiency of an adversarial proceeding over an inquisitorial proceeding is illustrated in the context of a trial. In an inquisitorial system such as that used in Europe, a judge is appointed and assigned the task of determining the guilt or innocence of the accused. In the American and English system there is a judge who is also assigned this task. However, the judge "appoints" an agent, the prosecutor, whose job is to be

an adversary of the accused and attempt to prove that the accused is guilty.

At trial decisions under uncertainty are made about the guilt of the defendant. The complete truth is never known; instead, decisions are made with more or less accuracy. Since more information increases accuracy but entails a cost, the social objective of the trial proceeding is minimization of the total cost of error. The total cost of error includes the risk of an incorrect decision plus the cost of producing and evaluating evidence. (See Higgins and Langenfeld, 1984)

In an inquisitorial proceeding the judge/prosecutor who has no stake in the outcome may value evidence incorrectly, and no incentive contract conditioned on output is efficient because the trial decision is not verifiable. Furthermore, the judge/prosecutor in such a system discovers evidence at a higher cost than the individuals to the dispute. The adversarial proceeding overcomes these incentive problems by empowering the litigants interested in the outcome to supply evidence. The conventional wisdom (Tullock, 1980, Chapter 6) holds that the adversaries, like rent-seekers (Buchanan, Tollision, Tullock, 1980), produce too much evidence and overburden the court system because they do not pay the full cost of absorbing and using this information. Furthermore, it is maintained that the litigants supply low-quality information to the court in their zeal to influence the fact finder--a problem avoided in the inquisitorial proceeding because of the inquisitor's disinterest.

We argue, on the other hand, that the adversarial proceeding is more than an assignment of responsibility to the litigants for producing evidence. It is also characteristic of adversarial proceedings that there are established rules governing the admissibility of evidence at trial, with the judge as referee, and there is a formal mechanism that enables the litigants to protest the judge's calls. These rules enable one litigant to impose the social cost of evidence on the party submitting the evidence, who would otherwise only incur a lower private cost. Additionally, the input monitoring mechanism is essential because output is not independently observed: the accuracy of the fact finder's decision is determined by the reasonableness of the input decisions made in support of the final outcome. (For a discussion of input versus output monitoring, see Wittman, 1977.)

In an inquisitorial system, the fact finder would request only relevant pieces of information. However, parties would attempt to offer more information, just as occurs in the adversarial process. The judge/prosecutor would then need to make the same type of decision as to admissability as is made in the adversarial system. Within the adversarial system, each such decision is subject to challenge by the opponent; this provides an incentive for the judge to rule carefully on each decision. Moreover, the judge will himself be held accountable because the record of challenges and rulings is available for an appeal. Such input monitoring by appellate courts is especially important when truth is not independently verifiable.

In the inquisitorial system there is no natural mechanism for challenging decisions. This, the judge may behave capriciously or may make erroneous decisions for other reasons. It would be possible for a higher court to monitor the decisions reached by the judge in this system. However, within the adversarial system this monitoring occurs automatically. Moreover, only some decisions are challenged and subject to examination--those most likely to be incorrect. Within a inquisitorial system with review, some fraction of decisions would be examined. However, since there would be no means within this system of choosing the most questionable decisions to challenge, the challenge process would either be more expensive than in an adversarial system (if a larger sample were chosen to compensate for the lack of selectivity, or if all decisions were examined) or the level of accuracy would be lower as a result of the the lack of selectivity within the challenge process. In other words, having an interested antagonist selectively challenge decisions as they are made is probably the least cost way of determining which decisions should be challenged. (This process is also regulated by rules of procedure so that there is a penalty imposed for "frivolous" challenges.)

III. The Adversarial Trial

We suppose there is a legal civil dispute with amount C at stake we may assume that the disputants are equally uncertain about the appropriate decision, perhaps because the appropriate

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legal rule is unknown or because it is not clear on which side of the rule the events fit. (Priest and Klein, 1984, argue that this will be the common situation in those cases which go to trial.) Alternatively, we may assume that each party knows the correct decision, in that each knows the true state of nature. Even in this case, however, from the viewpoint of the disputants, the relevant information is not the true state, but rather the state likely to be decided upon by the decision maker. The decision maker does not know the true state of nature, and presumably has diffuse priors about relative guilt.

The litigants produce evidence and submit it to the court for evaluation. Based on the evidence admitted, a decision is made. The decision is subject to error. We assume that the decision maker makes optimal statistical decisions, that is, expected loss is minimized.

For simplicity we assume that there are only two types of evidence, X and Y. Ex ante, X is evidence favorable to the defendant and Y is favorable to the plaintiff. Thus, we can assume the defendant produces any X that is submitted to the court and the plaintiff produces Y. It is useful to think of X and Y as sequences of random variables. The litigants must choose the length of the sequence. For a given sequence Y^n, $(Y_1,\ldots,Y_n)$, the longer the sequence X^m, the more likely will "not guilty" be the optimal decision of the decision maker. The evidence is produced at a cost; the marginal cost at each stage

at C_x or C_y. We also assume that there is a marginal cost to the court of evaluating X and Y at each state: C_x^e and C_y^e.

The social objective is to minimize total risk. Total risk is the sum of the _ex ante_ cost of error for evidence (X^m, Y^n) and the cost of producing and evaluating (X^m, Y^n).

Formally,

(1)   minimize

$$C\ \text{Prob}(NG)\ \alpha[D(X^m, Y^n)]$$
$$+\ C\ \text{Prob}(G)\ \beta[D(X^m, Y^n)]$$
$$+\ (C_x + C_x^e)m\ +\ (C_y + C_y^e)\ n$$

In (1), the first two terms are the expected costs of type I and type II error, respectively, and the last two terms are the costs of producing and evaluating evidence (X^m, Y^n).[1]

The sum of the first two terms--risk or _ex ante_ expected loss--is the sum of the expected losses based on prior probabilities weighted by the probabilities of types I and II error, α and β, whose values subsume a substantial amount of prior optimization. Specifically, for each possible realization of (X^m, Y^n), $[(X_1,...,X_m), (Y_1,...,Y_n)]$, a decision would have to be made. We assume that the decision maker minimizes expected loss conditional on the realization, that is, we assume the optimal decision, D, is made. Given the optimal decision rules and the amounts or evidence X^m and Y^n, there are implied probabilities of types I and I and II error, α^* and β^*. Thus,

alternatively, we can describe (1) for our purposes more simply as

(2) minimize

$$(C/2) \ [\alpha(m,n) + \beta(m,n)] \\ + (C_x + C_x^e)m + (C_y + C_y^e) \ n$$

where the priors are assumed to be diffuse.

By virtue of our assumptions about the value to the litigants of evidence X and Y, we know that $\alpha_m < 0, \alpha_n > 0, \ \beta_m > 0,$ and $\beta_n < 0.$

The social objective is to produce evidence X and Y cost effectively (choose m and n) in order to raise the accuracy of the fact-finding process. Minimization of (2) will yield a socially optimal amount of X and Y. We show that the adversarial proceeding, if suitably constrained, will yield this same X and Y.

The defendant, like the plaintiff, maximizes his expected winnings net of the cost of producing evidence. Specifically, initially without accounting for the discipline which application of the rules of evidence imposes on the litigants, the defendant

(3) $\max\limits_{m}$

$$C \ \text{Prob}[NG^D] - C_x m =$$

$$C \ [\text{Prob}(NG^D|G)\text{Prob}(G) + \text{Prob}(NG^D|NG)\text{Prob}(NG)] - C_x m =$$

$$C \ [\text{Prob}(NG^D|G)\text{Prob}(G) + [1 - \text{Prob}(G^D|NG)]\text{Prob}(NG)] - C_x m$$

$$(C/2) \ [\beta(m,n) + [1 - \alpha(m,n)]] - C_x m$$

Thus the defendant

(4) $\min_{m}$ $(C/2)[\alpha(m,n) - \beta(m,n)] + C_x m$

In the same way, we can show that the plaintiff

(5) $\min_{n}$ $(C/2)[\beta(m,n) - \alpha(m,n)] + C_y n$

Certainly, the marginal conditions associated with (4) and (5) are not identical to those describing the socially optimal m and n. We see from (4) that the defendant produces evidence X to minimize type I error regardless of type II error, and the defendant ignores the cost to the court of evaluating evidence since court services are not purchased for a fee.[2] Similarly, the plaintiff is also oblivious to the full social cost of his evidence, and the plaintiff produces Y to lower β regardless of α. Thus, if the adversarial proceeding merely gave the litigants with a stake in the trial outcome the right to supply evidence to the court, the socially optimal amounts of X and Y would not get produced. Instead, we would expect too much X and Y to be produced on two counts: First, each litigant incurs a private cost of production that ignores an essential component of the social cost, and second, each litigant ignores an essential cost of error in his valuation of the type of evidence more favorable to his case.

However, some key rules of the game have been neglected in setting out the litigants' objective functions. When the litigants' choices are constrained by the court's admissibility rules, their objective functions converge on the social objective function.

In Anglo-Saxon courts the judge is empowered to exercise his discretion about the admissibility of evidence subject to some rules of evidence that limit his discretion and prescribe specific decisions.[3] The judge acts as referee responding to objections by opposing counsel about the value and cost of evidence. For example, objections may be raised that the evidence introduced is irrelevant, protractive, or prejudicial and should, therefore, not be admitted or be stricken if it has already been presented. These bases for objections are the law's way of describing evidence that is allegedly of no value in raising the accuracy of the fact finder, that is too costly to evaluate even though it may be probative and that is subject to bias. This is not the place for a treatise on the law of evidence, but we maintain that these judicial determinations may be viewed as being concerned entirely with the costs and benefits of evidence that the litigants submit to the court. With this authority of the judge formally established in adversarial proceedings, the incompatibility of the litigants' objective functions and the social objective function is removed.

To illustrate our point, we will focus on the protraction objection. Recall that based on (4) and (5) and defense produces too much X and the plaintiff too much Y. Now suppose in contrast that when the defendant seeks to introduce additional X, the plaintiff objects that additional X would overburden the court. The judge is forced--at the initiative of counsel, whose interests are in restricting ths supply of X--to balance the social value of the additional evidence and its cost to the court. The social value of additional X includes the reduction in the type II error as well as type I error. Also, that component of the marginal social cost of evidence omitted from the defendant's objective function in (4) is imposed on him when opposing counsel raises the cost objection to the judge. Thus, ex ante the defendant will anticipate the application of these admissibility rules when the production decision is made. As a consequence, the defendant does not ignore the cost of type II error as in (4) in assessing the value of X, nor does the defendant incur only the private cost of producing and evaluating X.

Of course, what we have just shown for the defendant applies with equal force to the plaintiff. The upshot is that the litigants in an adversarial proceeding with a rational fact finder subject to judicial decisions about admissibility-- decisions that each counsel can force at his initiative and which his interest in the trial outcome prompt him to initiate--

independently choose reaction functions whose joint solution is identical to the social optimum.

The anlaysis so far has dealt with a civil trial in which the litigants are naturally chosen and in which the incentives are opposite and symmetric, as required for the model. In a criminal trial, there are no such natural agents. However, an artificial agent, the prosecutor, is created by the court system and given a reward function which essentially depends on his having preferences which are of the just the sort needed for the adversarial system to function in the way described (Forst and Brossi, 1977.) That is, the promotion and reward prospects for the prosecutor depend on his achieving convictions, and this induced utility function provides the exact set of incentives described above. Moreover, public defenders have rewards which depend on achieving acquittals, so that the criminal system works in exactly the way described in the model.

Another example of an adversarial system is the electoral process; here, political parties or candidates are the adversaries and voters are the decision makers. This system is not constrained by rules of evidence or by appeal procedures, so it may appear that the system would work inefficiently. However, recall that the main inefficiency from an unconstrained adversary system is that too much evidence is introduced. We would not expect this to be a problem in the political system; the problem in democratic decision maing is generally that voters consider too little, rather than too much, evidence (Downs, 1957). That

is, in such a system, voters tend to be "rationally ignorant", since gathering of information for making "correct" decisions does not generally pay. In this system, then, there is a built in check on the parties generating too much information; the decision makers will simply ignore any excess of information. Thus, we should expect the adversarial system to work in this context as well as in the trial context. In other circumstances where an adversarial system is relied upon, as in internal decision making within a firm or government agency, decision makers have rather tight control of the process and are therefore able to structure rewards and penalties based not only on the outcome of the process, but also on the inputs used.

IV. Summary

Adversarial decision processes are used in many circumstances where three criteria are met. These are: information asymmetry; information is valuable to the party with the information and also to the decision maker, but there are no effective mechanisms to induce the possessor of the information to reveal it; and the truth of the information which is revealed will never be known. In these circumstances, correct decision making is facilitated by monitoring inputs to the process rather than by comparing outputs with a target. An efficient way to monitor inputs is to create an adversary system, where the agents in the system have symmetric and opposite utility functions. Such systems are used in trials, both civil and criminal, in

electoral decision making, and in certain internal decision making procedures within organizations.

The major disadvantage of these processes is that disputants have incentives to generate too much information. In trials, this problem is solved through the rules of procedure. In political decision making, the voters tend to underutilize information, so that the problem does not manifest itself. In internal oranization decision making, the supervisor can control the amount of information provided by subordinates.

The study of adversarial decision process is thus another tool available for economists in examining alternative decision procedures.

FOOTNOTES

1 Type I error is mistakenly deciding "guilty" when the defendant is innocent, and type II error is mistakenly deciding "not guilty" when the defendant is guilty.

2 Since α and β are functionally related for a given (m,n) and since $d\alpha/d\beta < 0$ and $\alpha = 0$ when $\beta = 1$ and $\alpha = 1$ when $\beta = 0$, we can disregard the presence of β in (4) and α in (5).

3 For example, several types of communications are privileged information and are inadmissible at trial, and the judge is subject to reversal upon appeal if he violates these rules.

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