ABOUT ASYMMETRIC INFORMATION IN ECONOMIC MODELS

(an incentive discussion paper)

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Abstract

The informational structure, which subsists in a game run, receives specific connotations when particular contexts are analyzed, not only the theoretic ones. Under risk, the distorted perception of a situation, by the decision makers who are loss averters or by those who care about their image, is present especially in the case of probabilities having values close to extremes (low odds or high odds). For instance, the children or teenagers often take risky actions only as a challenge, in order to prove that they are not afraid. The concern for reputation could explain a wide range of behavioral anomalies. When skill shakes hands with chance, the success or failure changes the informational structure related to the decision maker's behavioral endowment. Resuming the main economic models of asymmetric information within a risky context is one of our goals. The second objective consists in reviewing some specific problems regarding the computer implementation of these models.

Keywords*: asymmetric information, reputation systems,*

1. SOME ECONOMIC MODELS OF ASYMMETRIC INFORMATION

There are times when markets fail due to imperfect information. The first type of imperfect information is public incomplete information. We mean that information is randomly insufficient and not manipulated by any agent in the markets, generating inefficient resource allocation and thus creating welfare losses. The second type is asymmetric information. We talk about asymmetric information when somebody knows more than somebody else. In this case the information is purposely incomplete and manipulated by some actors. This will result in misallocation of resources, causing more welfare losses. Two of the most well-known asymmetric information problems are moral hazard and adverse selection.

In 1996, the Prize of Bank of Sweden for Economic Sciences in Memory of Alfred Nobel was awarded to James Mirrlees and William Vickrey for their fundamental contributions to the theory of incentives under asymmetric information, in particular its application to the design of optimal income taxation and resource allocation through different types of auctions. In 2001, the same prize was granted to George A. Akerlof, A. Michael Spence and Joseph E. Stiglitz for their analyses of markets with asymmetric information.

Mirrlees (1974) analysed a one-period static relation Principal-Agent. Holmstrom (1979) analysed further Mirrlees's case and proved that there is a loss in efficiency in the case in which the Agent is risk averse and its actions are not observable.

Grossman and Hart (1983) continued the way opened by Mirrlees and Holmstrom by analysing the role of information in the model Principal-Agent. Radner (1985) tried a dynamic analysis of the model by considering the dynamic model as an infinitely repeated version of the static model. He demonstrated that the loss in efficiency disappears under certain conditions. The payoff scheme is historical-dependent and penalizes the Agent if his outcomes are worse than the expected ones in case of optimum actions, but the modeling is forced under conditions of a long-term contract.

Akerlof (1970) showed how we could obtain adverse selection in the markets in the presence of informational asymmetries. Spence (1973) demonstrated that informed

economic agents in such markets may have incentives to take observable and costly actions to credibly signal their private information to uninformed agents, so as to improve their market outcome. Stiglitz (1974,1981) showed that poorly informed agents can indirectly extract information from those who are better informed, by offering a menu of alternative contracts for a specific transaction, so-called screening through self-selection.

The Principal-Agent literature has found that a concern for skill reputation can explain a wide range of anomalous behavior from herding to the sunk cost fallacy. The idea that a rational concern for skill reputation can induce irrational behavior has a long history starting with Holmstrom (1982). Harbaugh (2003) show that the standard Principal-Agent model can be also extended to analyse the phenomenon of probability weighting.

The behavior of agents will vary depending on the information available to the parties, the beliefs of observers and the type of skill that is being evaluated. A concern for skill reputation leads to behavior that is consistent with large weights on low probabilities relative to high probabilities. If the decision maker varies in his ability to evaluate the probability of success of a risky endeavour, his behavior is consistent with overweighting of low probabilities and underweighting of high probabilities, a pattern predicted by prospect theory.

Behavior in information-based models is generally less predictable than in psychological models because information flows in social environments are difficult to fully monitor or control.

All these represent only the beginning of the study of the problems of informational asymmetry. We keep in mind that if two economic agents shall do a business together and they are in the presence of asymmetrical information then their incentives are deformed and it is entered an important inefficiency.

2. SOME PROBLEMS REGARDING COMPUTER IMPLEMENTATION

A game is a synergetic collection of several types of objects that interact among them. Thus, time and its lapse, states of the world, allowed changes to other states of the world, visiting rules, causality, areas with lack of complete information, the moment of decision- making, possible actions, dictatorial rules, the beginning and the potential ends, history of movements, future evolution, path rules, utility function, rational players, irrational players, memory of the players, rules about the type of players, player's payoff, player's strategy, player's beliefs, behavior rules, individualism and cooperation, coalitions' rules, equivalent games and main goal of the game are basic parts in game construction. But, only the complete structure must be taken into account.

The main forms of game representation (normal or extensive form) enjoy the property that they are manipulabile by computer using proper data structures. All these forms are specific to the standard model for human behavior in economics. It is the context where the individuals maximize their own utilities subject to a set of constraints. But there are anomalistic behaviors

(Gintis, 2000) of Homo economicus like Homo equalis, Homo reciprocans and Homo parochius. By its consequences, building of an armistice (the selection of equilibrium) is sometimes a real and difficult problem.

Homo economicus is the one who wants to find the behavior that leads to the maximization of this utility function. The modeling of this behavior brings two problems to our attention.

The first depends on our technique and ability to determine this behavior when the utility functions are known. We said that we look at this problem from a normative viewpoint. It is a specific problem of Optimization Theory. This problem of Decision Theory may be a problem of Linear or Nonlinear Programming, Calculus of Variations, Control Theory or Stochastic Optimization. We wonder whether we said all. We are in the presence of some solvers packages dedicated to several narrow classes of problems. But how could we recognize the solving method? For example, to find the bottom of a very narrow abyss that is placed somewhere in a perfectly flat area may be sometimes crowned by success if a genetic algorithm is used for instance. Creating an expert system for orientation in this very wide field is of real use.

The second is related to the elicitation of the utility function that describes as accurate as possible the behavior of an agent given a certain context. We say that we look at the problem from a descriptive viewpoint, and after twenty-five years of research, the prospect theory remains the best descriptive model. The cumulative prospect theory (Tversky and Kahneman, 1992) uses the same basic principles as the original theory, the major technique innovation being the use of a rank-dependent functional with a view to extending the prospect theory to an arbitrary number of consequences, as well as under risk and uncertainty. In the case of risk, the gains and losses of a prospect were applied separate rank-dependent transformations. As to the uncertainty, the cumulative prospect theory used a special model called the Choquet expected utility. The particular form of the weighting function explains the violations of the expected utility theory. Resuming, the problem of eliciting the utility function with high accuracy in real time faces us with a balance (or a dilemma!) as a high accuracy requires a significant period of time and to spend some resources as well. Even in the simplest case, where the utility function depends only on the monetary consequences, its elicitation is solved by approximating from a given class of utility functions (trade-off, Bleichrodt-Pinto, Abdellaoui). This is the reason why multicriterial decision algorithms (which avoid its elicitation) become valuable. In this respect, we could take AHP (Saaty, 1977) as an example. And when to breathe freely, we discover two alternatives to yield an outcome, depending on what we want, either its suitability or its optimality.

We have not done anything else but to review the problems related to the modeling of one of the basic elements of a game. All the elements of the game have the same importance, but the problems of implementation modeling are specific to each one. Even in the case (trivial apparently) of modeling the time and its lapse, for instance, a problem occurs in determining the relation between hyperreals numbers and numbers used in its computer representation, that might not be a negligible element for a differential game.

Not only the basic elements of game can give us problems. Let's talk about reputation.

In the classical theory of social choice a set of agents is called to rank a set of alternatives. Arrow's impossibility theorem (Arrow 1963) shows that there is no aggregation rule that satisfies some minimal requirements, while by relaxing any of these requirements appropriate social aggregation rules can be defined. Given the agents' individual rankings, a social ranking of the alternatives is generated.

Reputation systems introduce a new social choice model. When the set of agents and the set of alternatives coincide, we get the so-called reputation systems setting. The input is a reputation graph. Agents are ranked based on other agents' reports on their quality of service, behavior, or importance. We consider three basic postulates for reputation systems:

Generality: The social ranking should be defined for any reputation graph.

Transitivity: If the set of agents that provide positive (resp. negative) feedback on agent a is more important (resp. more reliable) than the set of agents that provide positive (resp. negative) feedback on agent b then agent a should be ranked higher (resp. lower) than agent b.

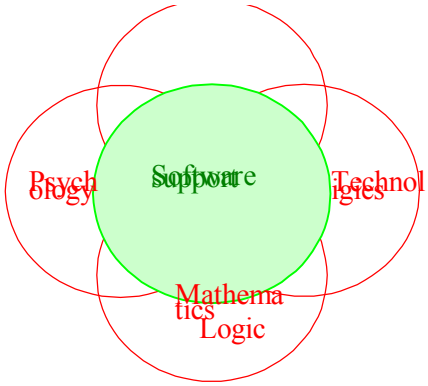
Weak Monotonicity: If the set of agents that provide positive (resp. negative) feedback on agent a is not more important (resp. not more reliable) than the set of agents that provide positive (resp.negative) feedback on agent b, and a is ranked socially higher (resp. socially lower) than b, then there should be at least one agent who provides positive (resp. negative) feedback on a which is more important (resp. more reliable) than at least one agent who provides positive (resp. negative) feedback on b.

It is impossible to satisfy all 3 postulates for reputation systems settings with positive and negative feedbacks. Relaxing any of these postulates will allow generating appropriate social rankings (Tennenholtz, 2004). This result doesn't make less valuable the famous types of reputation system that include page ranking in the context of search engines and traders ranking in the context of e-commerce. It is easy to use like a black box the reputation. See by example the building of reputational mechanism in credible government policies (Ljungqvist, Sargent, 2000). But reputation may be a bomb. We know nothing about the reputation proprieties.

We underline just three thinks: the game's complexity, adequate accuracy of modeling, working limitation.

3. FINAL REMARS

By using three fundamental hypotheses, namely the knowledge of rules, the rationality of participants and the fact that this information is public knowledge, the game theory tries to build a state of armistice (equilibrium) as a result of satisfying the competitive interests of



participants (players). The experience is accumulated by studying real competitive situations occurred during the time, as well as by studying mathematical models which define a hypothetical competitive situation. But, the software support is not present in all subjects' areas of interest.

What do we mean by informational asymmetry? Before receiving an answer, another question must get an answer, that is: what is the additional information that someone possesses in comparison with another person? The classic examples show us that this supplementary information may be packed into "type of player" and manipulated without affecting the framework of game. Is this framework appropriate for explaining the confrontation between the two parties in September 11, 2001? We face an extreme case, in which one part saw a position in the game tree and the other part did not. We have a new type of informational asymmetry. The future real problems, already prefiguring to horizon, will be not only military, as a way to take possession of some resources, but particularly socio-economic issues seen from the point of
view of some specific beliefs. Belief is one of the basic elements of a game. How will the game solving look when the basic element of the informational asymmetry is the succession of changes in beliefs? If the study of classic examples was initiated in the seventh decade of the last century and we could not tell that we know all, what would be the prospects for the solving of these problems of informational asymmetry to be known? Who knows? It is certain that the informational asymmetry, as referred, is no longer capable to model and describe the severe confrontations in the world of the beginning of the third millennium.

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