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A PARETO OPTIMAL GROUP DECISION PROCESS: A REPLY

by

Earl A. Thompson

I am encouraged by Miss Eysenbach's note. First, by not recognizing as conventional the assumption of equal prior probability distributions of system-relevant events between individuals, she joins a group of others who have indicated to me that it was neither recognized nor demonstrated--before my footnote 5--that the assumption of equal probability distributions of market prices between individuals was necessary for the Pareto optimality of the standard competitive process in an all-private-goods world with transaction (including market information) costs. Second, she has shown (in her Section II) that the optimal solution produced by the D-Process would not be altered if we allowed an individual in the system to have perfect foresight. This last result clearly lends an element of robustness to a D-Process solution which I had not even conjectured. Finally, she, for one, has apparently understood my D-Process paper much better than she has the voluntary contributions literature.

Before elaborating on how Eysenbach has misunderstood the nature of either bargaining problem raised in the voluntary contributions literature or the general problem of the search for Pareto optimal institutional structures, I should like to add a hopefully constructive correction of a statement appearing in the introduction of Eysenbach's note. My assumption that the government is the only source of information as to the prior probabilities is not, as Eysenbach claims, necessary for optimality. For one thing, as I state in the paper, optimality will be achieved without equal prior probabilities so long as the optimists and pessimists cancel each other out. For another, equal prior probabilities could occur in several alternative situations without the government's help. The most practical method of actually determining the probabilities which has occurred to me is to allow the hopefully small segment of the population composed of gambler-types to establish a competitive, pre-"election," specialists' market for "election" bets. This would determine market odds which are substantially acceptable to the rest of the individuals, who have devoted much fewer resources than the specialists market has to the estimation of these odds. The odds would also represent some sort of averaging of individual prior probabilities and would therefore probably generate significant cancelling effects between any remaining optimists and pessimists with

respect to the market odds. This is, after all, just a description of how private insurance markets, long and short bond markets, and commodity futures markets operate to form implicit probabilities for non-specialists to rely upon in a free market system.

We come now to Eysenbach's comparison of the D-Process with a "voluntary contributions scheme." Now the classical voluntary contributions literature is not based on a behavioral model of resource allocation but rather on a normative model of optimal tax-expenditure policy, and therefore any assumption concerning the prior probabilities guiding actual individual behavior would be irrelevant and unconventional to this literature. What Eysenbach is doing is creating behavioral models with contributions that are actually voluntary. In her note, one can decipher two, mutually exclusive models.

The first model appears in Section III. Here, individuals are simply asked to contribute to a collective-good production project. The standard Wicksell-Samuelson-Musgrave under-contributions dilemma is, of course, present in this case. But Eysenbach states that the dilemma is due to mistakes on the part of the contributors. Her incorrect reasoning takes different forms. First, she incorrectly asserts that because simultaneous understatement of true benefits by all consumers significantly affects the supply of a collective good, an understatement by one consumer--given the statements of the others--must also significantly affect the supply. The logical error in the statement is obvious. Next she argues: "A rational taxpayer who expects to benefit by the project will volunteer to pay the difference between the cost of the good to society and what he expects all other citizens will contribute, i.e., the minimum amount necessary to gain acceptance for a project." But if others were to contribute only insignificant amounts, a taxpayer who would receive some benefit from the project would not generally be willing to pay either for the whole project or what the project is worth to him. And there is nothing in the argument to prevent the individuals in this system, even individuals with perfect knowledge, from contributing insignificant amounts. Her argument here is simply insufficient to determine any equilibrium or any properties of an equilibrium. Finally, Eysenbach produces an example of this argument in which $n-1$ individuals somehow contribute an amount such that if and only if the n th individual contributes some positive amount, an amount no greater than what the project is worth to him, the optimum supply of the collective good will be achieved. Assuming the n th individual is rational and sees that his contribution is necessary for a project to be accepted, the optimum is achieved. From this rather trivial example, she concludes that the optimum will always be achieved as long as the individuals see the situation correctly, again completely ignoring the fact that she arbitrarily assumed that everyone else had contributed sufficiently large amounts for the last person's contribution to be necessary and sufficient for the achievement of an optimum. Eysenbach simply has not demonstrated that the Wicksell-Samuelson-Musgrave predicament is resolved when individuals can predict one another's behavior within an allocation

system constrained by the use of a voluntary contributions method in determining the production of collective goods.

There is little doubt, of course, that a completely cooperating group in which everyone is rational and can predict all of everyone else's behavior with perfection will achieve a Pareto optimum. But the whole problem of achieving a Pareto optimal set of institutions in any environment arises because such predictions are neither perfect nor costless. These predictions can be at least partially obviated by decentralized systems (such as the D-Process and the free market process) in which an individual replaces some, if not all, of his information gathering about the behavior of people with information gathering about system-relevant variables (such as future election outcomes and future prices). So, if Eysenbach were to consider, as she may have been doing in some, obscure way, a completely cooperating group with omniscient members purchasing the collective good instead of the non-cooperating individuals of the standard model, she could indeed claim optimality; but she then would also have completely begged the question.

The second model of voluntary contributions used by Eysenbach, stated in her concluding Section IV, is one in which the government states that "the project will not pass unless each person declares his true preferences." This model would indeed result in an optimum if individuals were to believe the government's claims. But the entire Wicksell-Samuelson-Musgrave dilemma results from the fact that individuals know that the government could not be correct in such a claim, because the government does not know the individual's true preferences. As in Eysenbach's first model, if individuals behave rationally under this system, and they see the true situation, each individual will understate rather than reveal his true marginal valuations as nobody else knows what he would give up if his contribution were always necessary and sufficient for the production of a collective good.

Thus, Eysenbach is not correct in concluding that her apparently non-cooperating voluntary contributions models will yield optimality if people are correct in predicting the behavior of others.

Even if she were correct in this, or even if she were considering a perfect cooperation model, it would be incorrect to conclude, as Eysenbach does, that both her voluntary contributions models and the D-Process stand or fall under the same informational conditions. For the types of information used in the two systems are vastly different. Pareto optimality under the D-Process does not require an individual to have any information about the behavior of others. In this respect, the D-Process is a purely decentralized system. On the other hand, Eysenbach's voluntary contributions systems require individuals to make estimates of the behavior of others in order to arrive at rational decisions. These systems, as many authors have recently noted, represent very complex, oligopoly-bargaining situations. For example,

the properties of the equilibrium of such a system, if one exists, obviously depend upon the numerical values of the relevant probabilities whereas this is not the case with the probabilities relevant to the D-Process.

Finally, I certainly did not assume, or claim it was conventional to assume, the absence of informational differences between individuals regarding the complete behavior patterns of individuals. My assumption was only that individuals all place the same prior probabilities on the system-relevant events; and it was explicitly claimed to be conventional only in that the same assumption must be made to prove the Pareto optimality of a free market system.

NOTE ON A PARETO-OPTIMAL DECISION PROCESS

by

Mary L. Eysenbach

Professor Thompson has proposed that an insurance scheme could lead to a Pareto optimal group decision process.¹ This note argues that his result follows not from the insurance scheme but rather from a change in the other conditions of the problem, namely the assumption about the information on which individual citizens act.

The Thompson insurance scheme is designed to overcome the dilemma of the voluntary contributions or free market approach to financing social goods. As Musgrave has stated the difficulty, "Preferences will not be revealed since the exclusion principle does not apply. Any one individual will find it profitable to understate his preference, knowing that this will have no significant effect on the total supply but result in a smaller assessment on himself."²

In the insurance scheme individuals could insure against the acceptance of either one of each pair of political alternatives. The group decision rule is to choose that alternative for which the payoff on claims will fall short of the receipts from collection of insurance premiums.³ The traditional difficulty with voluntary contributions is said to be overcome "because non-paying individuals are completely excluded from enjoying the benefits of insurance even though individuals who would refuse to pay for the insured alternative would not be excluded from enjoying the benefits of that alternative."⁴

A necessary assumption for the insurance scheme is that the insuring institution, e.g. the government, is the only source of information as to the likelihood of each outcome of the election, in which case the numerical magnitude of the odds is irrelevant to the result. Thompson has called this a "rather restrictive, but conventional specification."⁵ I argue that his assumption is not only rather restrictive but also unconventional; it breaks with the conventional presentation of the voluntary contributions dilemma, and it is this change in assumption rather than the insurance scheme per se which gives the Pareto optimal result.

Consider what would happen if the assumption is dropped. A citizen no longer believes that the insurance odds are the true odds, e.g. he might believe

that the true odds in favor of his pet project were 3:1 while insurance was offered at premiums implying odds of only 1:1. The rational man would not reveal his true preferences through his purchase of insurance in these circumstances. In fact, he would insure against the acceptance of his own project, believing that the total premiums paid for the project would decide the "vote" in its favor anyway while he collected on his insurance policy as a "loser". To maximize his gain he should insure against the acceptance of his pet project for as large a sum (regardless of his true preferences) as would still leave the expected decision in favor of his pet project, i.e. he insures against his own interests for as large a sum as he believes will still leave the total premiums paid greater than the claims of all those who, like himself, have insured against the event of his pet project being accepted.

Now compare this result with the conventional voluntary contributions scheme. Thompson states, "As regard decisions guided by the free market, it is in the self-interest of each individual to grossly understate the true value which he places on a collective alternative because he will receive close to the same benefit regardless of the amount which he states he is willing to contribute."⁶ This is not correct. The rational individual would offer to pay the lesser of two amounts: 1) the value to himself of the social good, or 2) the difference between the cost of the social good and the total amount he expects all other citizens to contribute.

The parallel with the insurance result is obvious. If we allow the Thompson specification, i.e. the individuals accept the government estimation of probability, then in the voluntary contributions case that the citizens would be told, and believe, that the project would be built if, and only if, each individual contributes to the full extent of his expected benefit; in this case the two amounts above are equal. With the Thompson information restrictions, a voluntary contributions' scheme leads to a Pareto optimal result.

The voluntary contribution problem arises because of the conventional assumption that the citizen has information, or believes that he has information, which contradicts the government's assertions. The Musgrave statement quoted is explicit on this point: "Any one individual will find it profitable to understate his preferences knowing that this will have no significant effect on total supply . . ." (emphasis added). The Thompson formulation quoted likewise implies that the individual believes he will receive close to the benefit regardless of what he contributes and regardless of what the government collector says to the contrary.

In both situations, i.e. with the voluntary contributions or with insurance, what the individual reveals to be his preferences depends on what he expects his fellow citizens are doing. If we accept the restrictive assumption of the Thompson model either scheme will reveal true preferences; if we reject it, both schemes may lead to erroneous choices because of mistaken expectations.

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1. Thompson
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2. Musgrave
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3. Thompson
4. *ibid.* p
5. *ibid.* p
6. *ibid.* p

Perhaps as a practical matter the insuring agency could set plausible odds, but as a theoretical matter the change in assumption about information is crucial to the result.

NOTES

1. Thompson, E.A., "A Pareto Optimal Group Decision Process", Papers on Non-Market Decision Making. Charlottesville: 1966.
2. Musgrave, R.A. The Theory of Public Finance. New York: McGraw-Hill, 1959.
3. Thompson, op. cit. p. 135.
4. ibid. p. 134.
5. ibid. p. 137.
6. ibid. p. 133.