Minimax-Nash

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Recently, much attention in economics has been focused on models which are not solvable in the sense of Nash. There is more than one Nash equilibrium, and the strategies of these equilibria are not interchangeable. This is considered a severe problem, as it is taken to imply that the decentralized economy may exhibit pathological behavior. This paper considers another possibility. The problem lies with the solution concept, not the economy. The use of another solution concept is suggested, one which in some relevant economic models yields a unique equilibrium.

When a game is not Nash solvable, there is a natural approach to consider. In this approach one treats a contraction of the game in which only strategies of Nash equilibria are considered. Specifically, we assume that each individual is involved in a two-person game in which the other "person" is all other economic agents who together play any one of the Nash equilibria. The individual herself can play any strategy of the original game. Further, we assume that the individual maximizes her security level in this contracted game, she is a maximiner. As the other, composite, player uses only Nash equilibrium strategies, the individual picks a strategy of a Nash equilibrium. A sufficient condition for this process to be well defined is that the set of Nash equilibria is compact, and the outcomes are continuous functions. The individual may pick one strategy or be indifferent between a set of strategies. Call individual i's chosen strategy set S_i. If there is an element e of XS_i which is a Nash equilibrium of the original game, we say e is an equilibrium. If all such equilibria have interchangeable strategies, then we say the game is solvable. Naturally, not all games are solvable. But the examples given below are.

The intuitive rationale for the above solution concept is as follows. We like Nash equilibria because we believe that somehow the economy will get to one, and we believe the individual believes this as well. But with multiple equilibria the individual has to decide which one the rest of the economy will get to. As he has no idea what process determines the chosen equilibrium, he maximizes security level. Then he decides that everyone else will do the same.

Now we turn to our examples. We consider three: fiat money, capital over-accumulation, and multiple rational expectations equilibria.

Our fiat money example is completely unbacked fiat money in an overlapping generations model as introduced by Samuelson [3]. In such models, there are always at least two Nash equilibria, one in which fiat money has value and one in which it does not. One could assume that an individual of a given generation simply looks at what previous generations have done to decide which equilibrium obtains. This approach has at least two drawbacks. First, it does not tell the economist which equilibrium will have obtained. Second, it implies that earlier generations' decisions can bind later generations. Earlier generations cannot have made a mistake about which equilibrium obtains. But there is nothing in the structure of the problem which suggests such power. A more reasonable interpretation is that the individual takes previous decisions as initial conditions, and views herself as playing a game with the rest of the current and future generations. Then her maximin strategy is obvious. The worst she can do is trade goods for fiat money and then have the next generation not trade goods for fiat money. So the individual does not trade goods for fiat money. With everyone playing this strategy, the solution is valueless fiat money.

Our conclusion in the previous paragraph is that completely unbacked fiat money has no value. This could be taken to mean that Samuelson's model exhibits an unsolvable problem for the (almost) decentralized economy. This, however, is not the case. Fiat money can be backed by a promise to tax future generations, for example. In many models, such a promise, if believed, never has to be exercised. Moreover, the value of the money can exceed the value of the promise. Of course, such a promise is a promised action of some coalition (the government), and that the issuance of this believable promise is the solution strategy of some cooperative game remains to be shown.

Our second example is the well-known capital overaccumulation problem as introduced by Phelps [2]. The basic problem in the capital overaccumulation problem is that in a competitive equilibrium the shadow price of capital may not obey the infinite horizon analog of the transversality condition. However, in such a world, our maximiner picks the best strategy for the lowest competitive shadow price on capital. With everyone doing this, the lowest shadow price obtains, and it is the one which obeys the transversality condition. We conclude that the capital overaccumulation problem does not occur.

Lastly, consider multiple rational expectations equilibria. There are different self-fulfilling price processes. In this world, our maximiner acts assuming the least favorable process from her (myopic) point of view. As these models typically are symmetrical, everyone has the same least favorable process and it obtains. Whether this is the least preferred Nash equilibria is another matter, as we saw in the previous paragraph.

References

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[3] Samuelson, P. A., "An Exact Consumption-Loan Model of Interest With or Without the Social Contrivance of Money," Journal of Political Economy 66, 1958, 467-482.