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Bargaining and the value of money ☆

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Abstract

Search models of monetary exchange have typically relied on Nash [1950. The bargaining problem. Econometrica 18, 155–162] bargaining, or strategic games that yield an equivalent outcome, to determine the terms of trade. By considering alternative axiomatic bargaining solutions in a search model with divisible money, we show that the properties of the bargaining solutions do matter both qualitatively and quantitatively for questions of first-degree importance in monetary economics such as: (i) the efficiency of monetary equilibrium; (ii) the optimality of the Friedman rule and (iii) the welfare cost of inflation.

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1. Introduction

In the last decade search-theoretic models of money have become the dominant framework for studying monetary theory. Contrary to traditional monetary models, trade

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is decentralized and carried out bilaterally. Since Shi (1995) and Trejos and Wright (1995), the standard approach for determining the terms of trade in bilateral matches is to impose the generalized Nash solution, or to use a strategic bargaining game that yields a similar outcome.[1] Recent extensions to allow for policy analysis by Shi (1997) and Lagos and Wright (2005) (LW) produce new results regarding the optimality of the Friedman rule and the welfare cost of inflation. It is unclear, however, whether these new results are robust predictions of models with search and bargaining or if they are driven by the choice of a particular bargaining solution.

We show that the bargaining solution does matter both qualitatively and quantitatively for questions of first-degree importance in monetary economics such as: (i) the efficiency of monetary equilibrium, (ii) the optimality of the Friedman rule and (iii) the welfare cost of inflation. We show that the results of Shi and Lagos and Wright are in fact very sensitive, qualitatively and quantitatively, to the use of the Nash bargaining solution and that other axiomatic bargaining solutions, such as the egalitarian (or proportional) solution proposed by Kalai (1977), yield dramatically different results.[2,3]

Regarding the efficiency of monetary equilibrium, a key result in LW is that the Friedman rule cannot replicate the first-best allocation and output is inefficiently low unless buyers have all the bargaining power. This inefficiency has been attributed to a holdup problem. The difficulty with this argument is that a holdup problem requires an irreversible ex ante investment cost *and* some opportunistic ex post appropriation of the surplus from trade, which typically results from ex post bargaining. In a monetary model the irreversible investment cost occurs when money is costly to hold due to a positive nominal interest rate. But at the Friedman rule the nominal interest rate is zero so money is costless to hold and there is no sunk cost to be 'held up'. Thus the inefficiency identified by LW at the Friedman rule cannot be the result of a holdup problem.[4] We show that, in fact, LW's result is a consequence of the lack of *strong monotonicity* of the Nash bargaining solution. The property of strong monotonicity requires agents' payoffs to be monotonically increasing as the bargaining set expands.[5] It is particularly relevant in a monetary context since the role of money is precisely to enlarge the set of incentive-feasible

[1]For a related literature on alternative trading mechanisms in search-theoretic models of monetary exchange, see Coles and Wright (1998), Rupert et al. (2001), Curtis and Wright (2004), Rocheteau and Wright (2005) and Julien et al. (2006).

[2]While we only compare the Nash solution to the egalitarian solution in this paper, in our earlier working paper, Aruoba et al. (2006a), we also studied the Kalai and Smorodinsky (1975) solution.

[3]For our purpose, the axiomatic approach to bargaining has the advantage of focusing directly on the properties of the solutions that matter for the (in)efficiency of monetary equilibrium. It complements the mechanism design approach of monetary exchange that considers as admissible all trading mechanisms that satisfy agents' individual rationality constraints (Kocherlakota, 1998; Wallace, 2001). It should also be noted that we do not attempt to derive or justify our axiomatic solutions as outcomes of non-cooperative since this is not the focus of our analysis.

[4]While the notion of holdup problem can cover a variety of situations, a key principle is the presence of sunk investment costs that are irrelevant in the bargaining. Because the investing party is not able to appropriate the full return to his (marginal) investment, he underinvests. See, e.g., the seminal paper by Grout (1984). The sunkness of the investment usually arises because of the relationship-specific nature of the investment or because of the presence of trading frictions that prevent the investing party from finding an alternative use for his asset costlessly. Money is not a relationship-specific asset and, in LW, it can be spent in a centralized market (CM) at no cost when the monetary authority deflates at a rate equal to agents' rate of time preference.

[5]The different notions of monotonicity (strong, weak and individual) for bargaining solutions and their importance for economic applications are discussed in Chun and Thomson (1988).