Introduction: why is there no money?

[An] important and difficult question . . . [is] not answered by the approach taken here: the integration of money in the theory of value . . .
Gerard Debreu, *Theory of Value* (1959)

A CHALLENGE

During the 1970s at Yale's Cowles Foundation, the most serious scientific conversations took place in the coffee lounge. As a junior colleague then in the company of leading monetary economists James Tobin, William Brainard and Henry Wallich, I remember a discussion of inflation. One colleague said 'Well, Herb Scarf [a general equilibrium theorist] says . . .'. Bill Brainard replied, 'But Herb can only give you relative prices. He doesn't have a monetary model'. Indeed, it was generally viewed then as impossible to derive a monetary theory from the Arrow–Debreu general equilibrium model. Brainard's remark echoed decades of tradition as Hicks (1935) and Tobin (1961) had challenged microeconomic theory to present a sound account of money.

THE RESPONSE

Professor Brainard's reply was an (almost) fully accurate description of the state of monetary theory embodied in the prevailing Arrow–Debreu general equilibrium model. But I hoped things were changing for the better. I had personally been trying to incorporate money in the Arrow–Debreu model and there had been progress elsewhere. Duncan Foley and I had discussed Foley (1970) prior to publication — that paper seemed a great start. Frank Hahn had presented Hahn (1971) in 1969 at the Econometric Society meeting. By 1973 we had Starrett (1973) which included 'money' in the title.

These essays presented a model of general equilibrium with transaction costs so that the price space was augmented to include bid and ask prices. It seemed only a quick step to identify 'money' as the low transaction cost instrument (as Starrett had done). Then we would surely

have a fully monetized Arrow–Debreu model. Why the focus on this general equilibrium model? Professor Hugo Sonnenschein remarked: ‘The Arrow–Debreu model, as communicated in *Theory of Value* . . . quickly became the standard model of price theory. It is the “benchmark” model’. But even Hahn (1982, p. 1) who had made so much progress was not sanguine: ‘The . . . challenge that . . . money poses to the theorist is this: the best developed model of the economy cannot find room for it. The best developed model is, of course, the Arrow–Debreu version of a Walrasian general equilibrium’.

What puzzles must a price-theoretic fundamental model of money resolve?

- Trade is monetary. One side of almost all transactions is the economy’s common medium of exchange.
- Money is (virtually) unique. Though money differs among economies, almost all the transactions in most places most of the time use a single common medium of exchange.
- Even transactions suitable for barter resolution, displaying a double coincidence of wants, are transacted with money.
- Money is government-issued fiat money, trading at a positive value though it conveys directly no utility or production.

This volume attempts satisfactorily to solve these puzzles using the standard tools of price and general equilibrium theory.

THE IMPOSSIBLE TAKES A LITTLE LONGER

We have been waiting four decades for general equilibrium theory to completely fulfill the promise of Foley (1970) and Hahn (1971), giving us an Arrow–Debreu theory of money. It has not quite happened. Part of the difficulty is that money takes a variety of forms and fulfills a multiplicity of functions: medium of exchange, store of value, unit of account. The other is that the Arrow–Debreu model sets a very high standard of parsimonious structure: assume as little as possible,¹ and infer results as much as possible. So the model of this volume makes just two additions to the Arrow–Debreu model. Exchange is a resource-using activity; the budget constraint applies not merely to the sum of all trades but to each transaction separately. This volume concentrates on the medium of exchange function – something completely absent from the classic Arrow–Debreu model. In that model, trade is costless and instantaneous, subject to a single grand budget constraint. Here, exchange is a resource-using activity

with a requirement that payment be made for acquisitions at each of many separate transactions, thus giving rise to a role for a carrier of value between trades.

PLAN OF THIS VOLUME²

Chapter 1 introduces the array of issues and a historical overview of the monetary theory literature dealing with them. This is a topic that can seem very diffuse, so the closing section gives a price theory perspective on the issues treated in the remainder of the volume – a cheat sheet for the micro-economic theorist. Chapter 2 presents an overview of the Arrow–Debreu general equilibrium model that is the focus of so much attention above. It represents the common classroom exercise of thinking through the implications of an economy operating without money.

Chapter 3 presents the real workhorse of this volume, the trading post model. The model posits separate trading arrangements for each pair of commodities that may trade for one another. If there are N commodities in the economy, there are $\frac{1}{2}N(N - 1)$ distinct trading posts where exchange may take place. Chapter 4 presents the first tentative step at fulfillment of the plan, an example of a linear economy with active trade in a trading post model where the price system guides all trade to use the low transaction cost instrument as the common medium of exchange. Chapter 5 uses the same model to demonstrate that in a linear economy, *absence* of double coincidence of wants is essential to monetization of trade.

Chapter 6 focuses on scale economies as an explanation for the uniqueness of ‘money’ as the medium of exchange. Scale economy – a natural monopoly – leads to a corner solution. Chapter 7 considers the dynamics of the model, converging to a unique ‘money’ through a dynamic tâtonnement adjustment. Chapter 8 considers the government issue of fiat ‘money’. Government’s power to tax can give value to a fiat instrument through government’s willingness to accept it in taxes. Government’s large scale, when there are scale economies in transaction costs, leads the economy to the corner solution where government-issued fiat money is the unique common medium of exchange.

Chapter 9 takes up efficiency. Trade is a resource-using activity; an efficient structure of trade will economize on its costs. Among trading post allocation mechanisms, how can we demonstrate that monetary exchange with its $N - 1$ active trading posts (out of $\frac{1}{2}N(N - 1)$ possible) is an efficient allocation mechanism? Chapter 10 tackles a foundational issue: can we explain Jevons’s insistence on double coincidence of wants

as a condition for barter trade as a result of transaction costs? The answer turns out to be ‘yes’ with a corresponding family of trading post equilibria.

Chapters 11 and 12 return to the traditional concerns of the general equilibrium theory: existence and efficiency of general equilibrium. Chapter 11 restates the trading post model in a general Arrow–Debreu style setting and shows that the conventional approach of general equilibrium modeling leads to the demonstration of existence of market equilibrium. The setting of course is quite different; instead of N prices there are $N(N - 1)$ bid and ask prices at $\frac{1}{2}N(N - 1)$ separate submarkets. Chapter 12 considers the economic efficiency of monetary equilibrium. When monetary trade itself is costless, the resulting general equilibrium allocation is Pareto efficient. When non-null transaction costs affect the pattern of trade, it is easy to find examples, and a general principle, where general equilibrium allocations are not Pareto efficient (contrary to the well-known first fundamental theorem of welfare economics).

Chapters 13 and 14 conclude. Chapter 13 discusses alternative models of monetary economies. Chapter 14 summarizes the results presented here and suggests a research agenda.

ACKNOWLEDGEMENTS

I have had useful discussions over decades regarding the research in this volume with the late Walter P. Heller, the late James Tobin, with Kenneth Arrow, Duncan Foley, Dror Goldberg, Frank Hespeler, Joseph Ostroy, Valerie Ramey, Meena Rajeev, Max Stinchcombe, Irina Telyukova, and with my students Daphne Chang, Xue Hu, Herbert Newhouse, Yu-Jung Whang, and Qiaoxi Zhang. Preparation of the manuscript of this book was facilitated by the hospitality of the Federal Reserve Bank of San Francisco and of the Stanford University Economics Department. It is a pleasure to thank my colleagues and hosts and to absolve them of responsibility for the content and any errors.

NOTES

1. Fulfill the principle of Occam’s razor.
2. This volume reflects a decade of general equilibrium modeling of a trading post economy. The issues and modeling approach of Starr (2003, 2004) appear throughout Chapters 3, 5, 6, 7, and 8. Starr (2008a) is used in Chapter 4. Chapter 9 is based on Starr and Stinchcombe (1999). Chapter 10 is based on Starr (2010). The modeling approach of Starr (2008b) is applied in Chapters 11 and 12. The treatments in this volume are intended to be more easily accessible and less formal than their journal counterparts.