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# Monetary general equilibrium with transaction costs

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## Abstract

Commodity money arises endogenously in a general equilibrium model with separate budget constraints for each transaction. Transaction costs imply differing bid and ask (selling and buying) prices. The most liquid good—with the smallest proportionate bid/ask spread—becomes commodity money. General equilibrium may not be Pareto efficient. If zero-transaction-cost money is available then the equilibrium allocation is Pareto efficient. Fiat money is an intrinsically worthless instrument. Its positive price comes from acceptability in paying taxes, and its use as a medium of exchange is based on low transaction cost.

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“[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)

## 1. Money in Walrasian general equilibrium

Two generations ago, Prof. Gerard Debreu suggested that the research agenda for mathematical general equilibrium theory should include a theory of money. Money is used to move purchasing power between markets and transactions, precisely the interaction between markets that general equilibrium emphasizes. Thus, general equilibrium modeling is an appropriate setting for microeconomic foundations of money. Nevertheless, an Arrow–Debreu model cannot successfully provide a role for money. The single budget constraint facing

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transactors in that model precludes a carrier of value between transactions. In order endogenously to derive the transactions role of money, multiple transactions—each with a budget constraint—and a motive for carrying value between them needs to be introduced. Though there has been progress on this head, e.g. Howitt (2000), Jones (1976), Kiyotaki and Wright (1989), Wallace (1980), full integration of money as a medium of exchange in the general equilibrium model has been incompletely successful.<sup>1</sup> The general equilibrium foundations of monetary theory should include parsimonious elementary economic conditions that allow commodity or fiat money to be sustained in an individually rational market equilibrium.

This paper's treatment seeks to provide—in a general equilibrium model with complete markets and complete information—weak sufficient conditions to derive a market equilibrium with the elementary properties of actual monetary economies. Under the conditions posited, trade is monetary in equilibrium; one side of almost all transactions is the economy's medium of exchange (Theorem 3). The key to the formalization is in Hahn (1971) and Foley (1970). Those papers remind us that transaction costs create a bid/ask spread between buying and selling prices. Menger (1892) recognized this price spread as a measure of liquidity and argued that the most liquid assets become endogenous commodity money, "goods [are]. . . *more or less saleable*, according to the. . . facility with which they can be disposed of. . . at current purchasing prices. . . with less or more diminution. . . men. . . exchange goods. . . for other goods. . . more saleable. . . [which] become *generally* acceptable media of exchange." A good is liquid if its bid and ask prices are close together. Thus, price theory implies a theory of liquidity. The most liquid good becomes 'money.' That is the outcome of the model below. Fiat money enters when government provides it (backed by the government's undertaking to accept fiat money in payment of taxes—a notion going back to Adam Smith). Then 'money' is government-issued fiat money, trading at a positive value though it conveys directly no utility or production (Theorem 4).

This essay proposes a parsimonious model of an economy where existence of a medium of exchange is an equilibrium result of the optimizing behavior of individual firms and households. The monetary character of trade, use of a medium of exchange, is shown to be an outcome of general equilibrium with transaction costs. Markets are assumed to be segmented;<sup>2</sup> there is a separate budget constraint at each transaction creating demand for a carrier of value between transactions. Commodity money arises endogenously as the most liquid (lowest transaction cost) asset. Government-issued fiat money sustains its function as a medium of exchange through low transaction cost. This essay presents a full information general equilibrium model with realistic modification of the Arrow–Debreu specification sufficient to derive this monetary structure as an outcome.<sup>3</sup>

<sup>1</sup> The papers cited here are successful in bringing money into general equilibrium by introducing major frictions or market imperfections in transactions. The present paper seeks to be more parsimonious, using complete markets with minimal frictions sufficient to generate monetary equilibria.

<sup>2</sup> The notion of market segmentation is essential to monetization, Alchian (1977).

<sup>3</sup> A bibliography of the issues involved in this inquiry appears in Ostroy and Starr (1990). In addition, note particularly Banerjee and Maskin (1996), Carmona (2002), Hellwig (2000), Howitt (2000), Howitt and Clower (2000), Iwai (1996), Kiyotaki and Wright (1989), Kocherlakota and Wallace (1998), Monnet (2002), Rajeev (1999), Rey (2001), Ritter (1995), Townsend (1980), Trejos and Wright (1995), Wallace (2001), Young (1998), Clower (1995), and Marimon et al. (1990). The treatment of transaction costs in this essay (as opposed to the

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