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Commentary

IT IS A PLEASURE TO TAKE PART in a scholarly conference focusing on empirical and theoretical issues relevant to the conduct of monetary policy and the behavior of financial markets. Most of the discussion at this conference, and indeed most of the work on monetary aggregates, including a great deal by Bill Barnett, has been about the demand side. Demand elasticities and the degree of substitutability of various monetary assets and liabilities are not just of academic interest. They have direct and obvious relevance to the conduct of monetary policy.

While there has been a great deal of work on demand, there has been relatively little work on the supply side of the market. The scarcity of supply studies is perhaps inherited from simpler days when commercial banks, limited in their ability to compete for deposits and constrained in their portfolio choices, dominated the supply of monetary assets. In a world where currency and demand deposits are the primary monetary assets, with no close substitutes, monetary control was relatively simple; control of bank reserves provided a tight control on the supply of demand deposits and shifts between currency and demand deposits were relatively easily monitored and offset. In today's economy, with a rich menu of monies and near monies, the task is not so simple. The instruments of control—the supply of reserves, reserve requirements and the discount rate—have remained essentially the same while the menu of monetary assets has proliferated. Financial firms and markets can alter significantly the suppliers of their assets and liabilities without policy accommodation. In this environment not only is there a question of what to control, but control itself is less direct and the timing and magnitude of the response to policy less certain. In these circumstances, the Barnett-Zhou examination of the competitive supply of money and near monies by financial firms is a welcome and important enterprise.

The authors focus on the supply behavior of the most important of the financial intermediaries, commercial banks. They model the banking industry as a competitive profit maximizing firm, stressing the dynamic nature of bank's optimization problem and the presence of risk. The banking firm maximizes the present discounted value of expected utility, where the utility in each period is a function of that period's "cash flow" and displays risk aversion. The bank decides on its supply of liabilities, taken to be demand and time deposits in the empirical analysis, and its demand for excess reserves and "loans." Both assets and liabilities mature in one period, with the returns on loans being uncertain. A production function determines the real resource costs associated with these portfolio decisions; in the estimation this function is assumed to be weakly separable, so that the relative costs of demand and time deposits do not depend on excess reserves nor on inputs of labor and materials.

The authors develop general methods for estimating dynamic and stochastic models of bank behavior and demonstrate the feasibility of using these techniques in the context of a specific bank model. While the techniques could be applied in a wide range of settings, the model focused on in the paper incorporates two assumptions that severely limit the role for

dynamics. In particular, both bank assets and liabilities are assumed to mature in "one" period and the net proceeds of the borrowing and lending decisions made by a bank in one period are entirely paid out when the assets and liabilities mature one period later. This is implied by equation 2: Liabilities issued in a period exactly cover required reserves, excess reserves, portfolio investment and the payments for real resources. Hence, equity is zero (as the author's indicate there would be no essential difference if it was non zero but constant); there is no room for retaining earnings. As a consequence, the only effect of a decision in period (t) on *net* cash flow occurs at the beginning of period (t+1). The net portfolio returns (the net cash flow consequence of decisions made in the previous period) are all paid out when they arrive. Hence, if dividends—the net cash generated and distributed to the owners of the firm—were entered in the utility function, the firm's optimization problem would be time separable and decisions could be made separately, period by period.

What, then, makes the firm's decision dynamic in Barnett-Zhou? The reason is that the "cash flow" entered in the utility function is not the cash actually generated and distributed, but a measure of profits developed by Diana Hancock (equation 1). This measure differs from actual cash flow by an amount reflecting changes in required reserves. In Hancock's profit function required reserves are not recorded as an asset requiring the use of funds. Yet, from the budget constraint in equation 2, liabilities exceed the sum of excess reserves, loans and resource cost by exactly the amount of required reserves. Hence, the Hancock profit function records as a positive cash flow an amount equal to required reserves in the period liabilities are incurred, and records a negative cash flow in the period they are repaid. These components of Hancock's profit function simply reflect the need to place a portion of the deposits in reserve. I have difficulty understanding how to motivate their inclusion in the utility function; they do not correspond to payments to the owners of the firm, nor do they constitute an increase in the net worth of the bank. Although counting these flows as profits has essentially no effect on the present value of the bank, it does serve to create a link between time periods, making the problem dynamic.

Several features could be added to the author's model of banks which would greatly increase the role for dynamics. Illiquidity and maturity mismatch may be less important today than earlier in the postwar period, but they remain significant reasons for treating the bank as a multiperiod firm. One extension would be to incorporate the fact that some of banks' investments are in assets with maturities substantially greater than the maturity of their liabilities. If held to maturity, investments made today have to be financed by future borrowing. Second, since some bank assets are relatively illiquid, it would be interesting to build into the specification some costs of rapid asset disposal. Similarly, as with physical investment, there are costs of adjustment on the rate of acquisition of assets. Another important extension would be to treat explicitly the dynamics of equity growth. As with any firm, growth in equity, either by new issue or by retention of earnings, plays an important role in the growth of the industry. Explicit treatment of capital accumulation seems particularly desirable given the capital requirements placed on bank portfolios, requirements which many thought were an important constraint on bank lending in recent years. Including these elements would not only substantially increase the importance of dynamics in the model, it would also add to the menu of risks by, for example, allowing for the risks reflecting the interaction of illiquidity and deposit uncertainty. Not only can the author's model be extended to analyze more complicated models of banks, but it will undoubtably be useful in the study of other financial intermediaries, institutions that share many of the features of banks and, like banks, should be analyzed within a dynamic and stochastic framework.

A number of the author's results are quite interesting. After restricting the utility function to the CRRA class, they find the degree of risk aversion significant and on the order of one. They test and find they cannot reject weak separability, hence their estimates are consistent with the existence of a theoretical monetary aggregate. The estimated aggregator function itself, evaluated at a point where demand and time deposits are of equal magnitudes, gives a marginal rate of transformation implying that one dollar of demand deposits is equivalent to approximately three dollars of time deposits. This sounds like a plausible magnitude in the current regulatory environment; it would be interesting to know how different estimates would be for an early subset of the data when

reserve requirements, portfolio restrictions and capital requirements were so different.

In the author's specification, excess reserves are an important input, while required reserves are seen as a sterile asset entering the firms technology neither as an input nor as an output. There was a time when reserve requirements were quite high relative to estimates of bank's own transactions needs and this assumption would seem quite plausible. As reserve requirements have fallen, however, the distinction between required and excess reserves has become less sharp. Another interesting extension of the model, therefore, would be to include required reserves as an input and to test whether their importance has fallen over time.

As these comments suggest, I have found this an innovative and stimulating paper which opens up several new avenues for future research, and I look forward to watching the progress in this important enterprise.