BASIL J. MOORE

Money supply endogeneity: "reserve price setting" or "reserve quantity setting"?

Robert Pollin argues that there are two distinct theories of money supply endogeneity within the Post Keynesian literature: he terms these theories "*accommodative*" and "*structural.*" Both theories agree that the supply of credit money is *endogenously* determined by market forces characterizing the demand for bank credit, and not *exogenously* controlled by the monetary authorities, as asserted in the mainstream literature.

The *accommodative* position (Kaldor, 1982, 1985; Lavoie, 1984, 1985; Goodhart, 1975, [1989]; Moore, 1979, 1983, 1985a, 1985b, 1986, 1988, 1989, 1990) maintains that no effective quantity constraints exist on bank reserves. Individual banks can always obtain additional reserves, at the market price, so long as lender confidence in their solvency (ability to repay) is preserved. As a result, solvent banks are never quantity-constrained for reserves. The credit money supply function is *horizontal* in the market period, at an interest rate that depends on the central bank's marginal supply price of reserves. The short-run interest rate is an exogenous policy instrument.

The *structural* position (Minsky, 1982, 1986; Rousseas, 1985, 1986, 1989; Earley, 1983; Earley and Evans, 1982) makes less of a break with the mainstream view that central banks control monetary aggregates exogenously by varying the supply of reserves. It maintains that even though central banks are able to restrict the supply of bank reserves quantitatively, this will be more or less, but not perfectly, offset through innovative bank liability management practices. As a result, although bank reserves can be to some degree at least exogenously controlled by

Professor Basil J. Moore is Professor of Economics at Wesleyan University, Middletown, CT. He is currently Visiting Professor at the National University of Singapore.

the authorities, the supply of credit money is endogenous, due to endogenous variations in the money multiplier. The credit money supply function is therefore *upward sloping* in the short run. Both short-term and long-term interest rates are determined through a "complex interaction" between the monetary authorities and financial market forces.

Before looking at Pollin's proposed "empirical tests" of these two views, it is useful first to attempt to isolate precisely the areas of disagreement. Both positions agree that the supply of credit money is in practice endogenously determined by credit demands. As a result, a casual observer might believe that this is really a "tempest in a teapot," scholastic fratricidal wrangling over no substantive issues of disagreement. There is an element of truth in such an innocent perception. The disagreement between the two views is in no sense profound. It must be stressed that the areas of common agreement are much broader than the areas of disagreement. Both positions are in complete agreement that the supply of credit money should be viewed as endogenously credit-driven, and not exogenously controlled by the monetary authorities. Both can be loosely characterized as "Horizontalists" rather than "Verticalists."

Having stressed the central commonality of the two views, there is one substantive issue at stake: this concerns the autonomy and interest elasticity of the supply function for credit money. If central banks only set the supply price but not the supply quantity of reserves, both the base and the money supply are endogenous. The credit money supply function is then *horizontal* in the market period, i.e., perfectly interest-elastic, at an interest rate exogenously administered by the central bank. But if central banks can and do control reserve quantities, the credit money supply function should be visualized as *upward sloping* in the short run, i.e., less than perfectly interest-elastic. Interest rates will rise, continuously or discontinuously, in response to an increase in the demand for credit, and "crowding out" will still occur. "*Reserve price setting*" and "*reserve quantity setting*" are therefore more accurate (though less colorful) characterizations of the two positions than "accommodative" and "structural," except that some structuralists (e.g., Minsky) would argue that central banks lack the power to set either prices or quantities independent of market forces.

Part of this difference of opinion may merely reflect differences in the time periods considered. Banks are price setters and quantity takers in both their retail loan and their deposit markets. So long as borrowers are

within their credit allocations (overdraft limits), a horizontal market period supply function may simply be viewed as a graphic representation that the supply price is given in the market period, until sellers alter their administered price (Moore, 1990). On this interpretation, even "structuralists" would presumably agree that the money supply function is horizontal *in the market period.*

There is an increasing consensus that central banks can and do administer the level of short term interest rates on a day-to-day basis (Goodhart, 1975 [1989], pp. 214–222). What "structuralists," and many others, deny is the ability of the monetary authorities to set the short-term rate *over the long run.* This may in part also be a matter of semantics. The authorities do not peg the rate (i.e., hold it constant at an unchanged level) over long time periods. Rather, they continually respond to aggregate demand and supply changes in the economy, as they attempt to move key macroeconomic variables toward their preferred target values. This policy response, how and how much interest rates are adjusted in response to changes in economic conditions, is termed the central bank's "reaction function," and defines the shape of the money supply relationship in the short run.

The central point is whether central banks have a substantial degree of autonomous discretion as to the level of interest rates they choose. "Price setters" argue that central banks are not forced to raise interest rates to any particular level, nor even to raise them at all, in response to increases in credit demand. Interest rates do not adjust as a market price to equilibrate the supply and demand for loanable funds or liquidity. Economies do not move along a full-employment, balanced-growth path, and central banks always retain some degree of discretion in their interest rate policy. As a result, the "reserve price setting" position holds that there is *no* short-run (or long-run) supply of money function, independent of market forces. Interest rates are an *autonomous* policy instrument. Their level depends on how central banks choose to respond (Moore, 1990). It all depends. As a result, there can be no general theory of business cycles or economic growth.

The key difference between the two positions therefore concerns the degree to which monetary authorities are free to determine the level of short-run interest rates exogenously in the market period as a policy instrument. "Exogenous" does not denote that central banks are free to vary interest rates between minus and plus infinity. But it does imply that central banks always have some substantial *range of discretion* over

which they can vary rates. The range over which the authorities are able to move rates exogenously will depend on a large number of factors (as enumerated in Moore, 1988, pp. 263–265). This range will be very small in small, "open" economies operating under a fixed exchange rate regime. But unless capital were perfectly and instantaneously mobile, so that the law of one price holds for all financial assets precisely and continuously across countries, the authorities always have some freedom to maneuver. The different policy implications of the two positions thus pertain centrally to the freedom of the monetary authorities to administer the level of short-term interest rates exogenously and continuously.

Pollin sets up three sets of empirical tests to discriminate between the two positions:

1. *proportionality* in the relative movement of loans and reserves,
2. *close substitutability* between nonborrowed and borrowed reserves, and
3. *causality* running from the central bank to financial market interest rates.

It will be argued that only the third set of tests discriminates between the two approaches. Moreover, when properly interpreted, the third set of tests provides persuasive and powerful empirical evidence for the accommodative, "reserve price setting" position.

1. Proportionality

The fact that "loans make deposits" and "deposits make reserves" in no sense implies loan–reserves proportionality, i.e., that the ratio L/R must be *stable*. Required reserves (R) are a function of the size and composition of deposits (D), not of loans (L). Reductions in the ratio of R/D, as official reserve requirements are reduced and as banks issue new types of liabilities with lower (or zero) required reserve ratios (e.g., CDs, repos, etc.), also reduce the ratio of R/L. The very substantial fall in the ratio of R/L in the United States over the postwar period, from 0.273 to 0.039 as shown in Pollin's Table 1, is perfectly consistent with the position that "loans make deposits."

The stability of L/R is thus in no sense a test of the two positions. As Holmes said, banks make loans first, and look for the reserves later. In the process, they of course continually seek to reduce their effective reserve requirements, since reserves are nonearning assets.

The real issue is whether banks are "quantity-constrained" in their

search for reserves. The essence of the "reserve price setting" position is that *solvent individual banks can always obtain additional reserves at the market rate.* The Federal Reserve regards lower than market rate (subsidized) borrowing at the discount window "as a privilege and not a right." Since the Fed discount officer is continually observed to turn down requests for funds from individual banks, it superficially appears that the Fed is able quantitatively to control the total amount of reserves it supplies. But while *individual* banks are unable to borrow additional funds at the discount window at the subsidized rate, they are always able to borrow unlimited funds at the market rate, in the federal funds market, the Eurodollar market, by issuing CDs, by selling securities, repos, etc. From the system's point of view, only borrowing from the discount window adds to the total supply of reserves. But from the individual bank's point of view, additional funds from any source whatsoever are exactly equivalent to funds directly borrowed from the central bank in meeting reserve requirements (Goodhart, 1975 [1989], pp. 129–155).

2. Substitutability

Pollin's tests of the implied degree of substitutability between borrowed and nonborrowed reserves in the two views are similarly misspecified. Both borrowed and nonborrowed reserves are obviously perfect substitutes with regard to their ability to meet reserve requirements. Since total required reserves are always predetermined by the previously existing quantity of reservable deposits, even with contemporaneous reserve accounting (Moore, 1985b), and total nonborrowed reserves are determined by central bank nondefensive open market operations, the monetary authorities have no choice but to provide the residual quantity (borrowed reserves), if banks in the aggregate are to meet their reserve requirements. The fact that borrowed reserves are currently only 4 percent of total reserves merely reflects the fact that the Fed's "frown costs," under the current degree of borrowing surveilance at the discount window, rise very sharply with increased discount window applications. Subsidized discount window borrowing is primarily for emergencies.

Profit-maximizing banks by definition attempt through arbitrage to equate their marginal cost of funds across all sources, adjusting for any differences in risk, maturity, and transactions costs. One reason why Pollin's substitutability test is misspecified is that different banks have different degrees of reluctance to borrow at the discount window. It is

not merely that "frown costs" increase rapidly with the amount of an individual bank's discount window borrowing (although they do). But "frown costs" (substitutability) also differ widely among different individual banks, for any given level (quantity) of borrowing. Nevertheless, as the differential of the federal funds rate over the discount rate increases, additional banks are incrementally induced to borrow for the first time, and borrowed reserves will rise.

If total reserves were constant, changes in nonborrowed reserves (*NBOR*) would be perfectly negatively correlated with changes in borrowed reserves (*BOR*), even when deflated and transformed into first difference of logs, since the total of $\Delta NBOR + \Delta BOR$ would then have to sum to zero. As a result, whenever the change in total reserves is zero (or very small), changes in *NBOR* will be negatively correlated with changes in *BOR*. This is the relationship Pollin's Table 4 reveals. However, when total reserves change (e.g., increase), the extent to which the Fed chooses to increase *NBOR* by open market purchases, and the extent to which it forces the banks into the discount window so as to increase *BOR*, are both at the Fed's discretion. In periods when the Fed wishes to restrain money supply growth, it will raise *NBOR* as required reserves increase, but by less than the full amount, so that *BOR* also increases. This would imply that in such periods Pollin's β coefficient would be positive. This may explain why the estimated negative value of β is smaller in all regressions in Table 4 for the second subperiod (1967–88) than for the first subperiod (1953–66). The years 1967–88 include the period 1979–82 when the Fed was vigorously attempting to restrict money growth, and as a result raising interest rates more sharply by providing only limited increases in *NBOR*, and forcing banks to a greater extent into the discount window whenever credit demand and monetary growth rose above the Fed's targets. It also explains why the results are less satisfactory with quarterly than with monthly data, since changes in total reserves are greater.

The estimated sign of β thus again sheds no light whatsoever on the extent to which borrowed and nonborrowed reserves are perfect substitutes. The fact that the $\overline{R}^2$ values are low is simply due to the weakness of the test. Depending on Fed policy, positive, negative, or even zero correlation between *NBOR* and *BOR* is perfectly consistent with *NBOR* and *BOR* being *perfect* substitutes. It is thus quite invalid for Pollin to attempt to infer the degree of substitutability between *NBOR* and *BOR* from the estimated values of his β coefficients.

3. Causality

The only tests that bear directly on the validity of "reserve price setting" versus "reserve quantity setting" behavior of the monetary authorities are Pollin's interest rate Granger-causality tests. Properly interpreted, these tests provide very strong supportive evidence for "reserve price setting" behavior.

As Pollin himself explicitly recognizes, his causality tests between the federal funds rate and other short-term rates (the prime, the short-term CD rate, and the discount rate, regressions 9–10, 13–14, and 19–20 of Table 5), clearly demonstrate that Granger-causality runs primarily from the federal funds rate to the other short-term rates. Bank arbitrage keeps short-term market rates (e.g., CDs, TBs) closely aligned with the federal funds rate. The stability of markups keeps the prime aligned, although less closely. With regard to the discount rate, the Fed typically administers the discount rate with a discrete lag, i.e., it follows market interest rates up and down. This is due to the Fed's reluctance to acknowledge responsibility for setting the level of short-term rates. As an unelected agency, it has no popular legitimacy for determining the level of short-term interest rates, unlike its legitimacy for what it cannot do, determining the rate of growth of the monetary aggregates. As a result, it dares not reveal its power to set short-term interest rates too transparently.

The Fed's argument that it merely follows market rates, which are purportedly determined by other factors (such as the stage of the cycle, expectations of inflation, or the magnitude of the federal government's deficit, etc.), is disingenuous in the extreme. As shown the Fed is responsible for the differential between the federal funds rate and the discount rate, and so is responsible for the level of the federal funds rate and short-term market rates generally, by the degree of reserve restraint it imposes on the system (i.e., the extent to which it forces banks "into the window"). This complicated process, which has appositely been termed "dirty" interest rate targeting, is precisely designed to hide the controlling hand of the Federal Reserve Board behind the level of short-term market interest rates. (Unfortunately, since its change in operating procedures in 1979, the Fed has also succeeded in fooling most of the academic profession as well as the general public, although much less so the money market cognoscenti; see Moore, 1988, pp. 136–137.)

The Granger-causality relationship demonstrated between market short-term and long-term rates (regressions 15–16 and 21–22 in Table

5) is, however, illuminating and informative. Pollin interprets these results literally, and concludes that predominate causality runs from the long-term rate (corporate bonds) to the short-term rates (discount rate and short-term CD rate)! But long-term rates "Granger-cause" short-term rates precisely the way that long-term rates are observed to "Granger-cause" inflation rates, or stock prices to "Granger-cause" corporate profits. In all these cases, the fact that *future* values of the independent variable are associated statistically with *present* values of the dependent variable does not imply dependent variable causality, but simply reflects the fact that the present value of the dependent variable is based on current expectations of future values of the independent variable. As is well known in the case of behavior dependent on expectations of future events, Granger-causality must be read in reverse (Zellner, 1979).

It is admittedly unclear why two-way rather than one-way causality is revealed between the federal funds rate and the long-term corporate bond rate (regressions 17 and 18). (These two regressions also have the lowest $\bar{R}^2$ and least satisfactory *D-W*s.) But since it has previously been demonstrated that the federal funds rate significantly Granger-causes other short-term rates, and it is well known how the Fed controls the federal funds rate, long-term → short-term Granger-causality is in fact very strong supportive evidence for the proposition that current long-term rates are based on the markets' expectations of future short-term rates. These in turn are determined by future values of the federal funds rate.

Pollin objects that, in trying to predict future rates, market participants attempt to assess a wide range of market considerations, such as the future behavior of inflation, real output, the exchange rate, financial fragility, etc., rather than simply the future values of the federal funds rate. While true, this is quite consistent with the "reserve price setting" position. In attempting to estimate future interest rates, market participants must first form estimates of the monetary authorities' "reaction function," i.e., how the authorities are likely to respond to deviations of inflation, exchange rate, money and income growth rates from their target values. Market forces play a substantial role in long-term interest rate determination, since the monetary authorities administer short-term interest rates in response to current and expected deviations of market outcomes from the authorities' preferred positions. This is precisely what the notion of a "reaction function" implies. The key point is that the

authorities always retain a considerable "degree of freedom" or "range of discretion" as to the level at which they set short-term interest rates.

In conclusion, short-term interest rates are an exogenous policy instrument, under the control of the monetary authorities, rather than an endogenous market price equilibrating supply and demand for either loanable funds or liquidity, or a "complex interaction" of authorities' and market forces. Central banks must be held accountable for the ruling level of short-term interest rates, no matter how much they disavow. Working capital demand, ultimately driven largely by money wage growth, endogenously determines the demand for bank credit (or the demand for "loanable funds"). But the marginal supply price of additional bank credit (the supply of "loanable funds") is exogenously set by the monetary authorities.

Overall, the evidence from Pollin's interest rate causality tests provides strong, if indirect, support for the position that the Fed sets short-term interest rates exogenously as its key monetary policy instrument, while long-term rates are based on expectations of future short-term rates. Market forces do have a substantial role in the determination of long-term rates, insofar as long–term rates depend on market participants' collective expectations of the level of future short-term rates. These in turn are jointly dependent on expectations of macroeconomic performance and of the Federal Reserve's "reaction function." This is precisely why experienced Federal Reserve insiders are held in such high esteem as "Fed watchers," and valued so highly in the marketplace. Would it be too cynical to suggest that this may play a part in explaining the Fed's current highly obfuscatory practices?

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