

## *Endogenous money*

# The endogenous money supply

BASIL J. MOORE

The statement that central banks cannot control the supply of money tends to provoke stares of incomprehension and incredulity in American economists. The textbook metaphor of the high-powered base-deposit "multiplier" has been so thoroughly indoctrinated, at least in North America, that challenging its correctness consequently appears only slightly less foolish than doubting that the sun will rise. Surely the high-powered-base and bank reserves are the liabilities of the central bank? Surely the central bank can directly affect the total of its liabilities by the open market purchase and sale of securities? Surely the ratio of banking system reserves to banking system total deposits exhibits considerable stability over time? Central bank ability to control the money supply appears to be amply self-evident.

So long as reserves with the central bank do not bear interest, and interest rates are sufficiently positive to cover marginal costs, profit maximization alone implies that individual banks will have an incentive to lend out any reserves in excess of their legally required minimum ratios. As an empirical fact, since the 1930s bank reserve ratios and the accompanying money-base multiplier have been demonstrably stable over time, as the publications of the Federal Reserve Bank of Saint Louis continue monthly to attest. How then can any economist seriously insist that central banks cannot control the money supply, and

The author is Professor of Economics and Chair of the Department of Economics at Wesleyan University.

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not expect to be disregarded and ignored, or written off as a promising candidate for the economic underworld?

But let us just reflect a moment. Banks, after all, are essentially in the business of selling credit. Agreed? Bank assets and liabilities both expand whenever there is an increase in the total quantity of bank earning assets. Agreed? Bank assets are predominantly bank loans. Agreed? As a result it is no surprise that changes in monetary aggregates are closely explained empirically by (or at least closely associated empirically with) changes in total bank loans. Loans make deposits.

Finally and most importantly, increases in bank loans are made at the initiative of bank borrowers, not the banks themselves. Banks may unilaterally increase their advertising budgets, shade their lending rates, or ease their collateral requirements. But as with any other business, the amount of good or service they can sell depends ultimately on the demand for their product. Recent innovations in banking practices, in particular liability management, have enabled banks to grant their borrowing clients enormous off-balance-sheet credit commitments. (It is not widely recognized that total bank credit commitments are now comparable in amount to more than one-half total M1 money balances!) The utilization ratio of business loans to commitments typically lies below 50 percent.

The single most important demand for bank credit is from business firms. Companies borrow funds short term from banks primarily to meet their need for increased working capital. This need arises because companies must pay their factors of production, in particular labor, *before* they receive the sales receipts from the goods and services produced, which take time to manufacture and to sell (Moore, 1983). Increases in factor costs, in the volume of output, and in the quantity of inventories of goods in various stages of process all increase companies' need for working capital, and so result in additional demand for bank loans. Since companies have ample working capital collateral for such short-term loans, and typically in addition have previously negotiated unutilized lines of credit with their bankers, these loan requests are ordinarily granted, and loans increase. The companies' depository accounts are credited, and the proceeds are disbursed as factor payments and incomes.

But if bank loans are largely demand determined, so that the quantity of bank credit demanded is a nondiscretionary variable from the viewpoint of individual banks, this then implies that the money supply is credit driven. How can this be reconciled with the conventional

notion that central banks control the money supply through the base-multiplier process? One of the two explanations must be incorrect.

Let us reconsider the textbook base-multiplier process, in particular the effects of central bank open market operations. Central bank purchases or sales of securities clearly do affect the quantity of nonborrowed reserves as the textbooks demonstrate. But nonborrowed reserves are not identical to total required reserves. Some banks are observed to hold excess reserves, while others to borrow reserves from the Fed. (On average about 3 percent of total reserves held by depository institutions are borrowed from the Fed at the discount window, although this proportion varies widely over time. The remaining 97 percent are nonborrowed reserves, which the Fed provides directly through open market purchases of government securities and foreign exchange.)

Whenever individual banks do not have sufficient deposits with the Fed to meet their reserve requirements, they must make up any deficiency, either by borrowing indirectly or directly from other banks through selling assets or borrowing in the Federal funds market, or by borrowing directly from the Federal Reserve itself through the discount window. It follows that, while the Federal Reserve can directly determine the quantity of nonborrowed reserves, it cannot directly determine the quantity of *total* reserves. (This process is clearer with lagged reserve accounting (LRA), when total required reserves are predetermined by the level of past deposits.) If the banks are to meet their reserve requirements the Fed has no choice but to make the total volume of required reserves available to the banking system, either directly, through open market operations, or indirectly, by forcing banks into the discount window. As will be shown, even with contemporaneous reserve accounting (CRA), required reserves are always made available to banks on demand, at some price.

At the first meeting of the year, the Federal Open Market Committee (FOMC) announces target ranges for the growth of M1 and several broader measures of monetary and credit aggregates over the course of the year. At the July meeting the FOMC reviews the historical performance of these aggregates relative to their target ranges. In addition, the committee formulates a directive to the Open Market Desk of the Federal Reserve Bank of New York. Under the pre-1979 procedure, with the Federal funds rate as the operating instrument, the Desk was directed to use open market operations to keep the Federal funds rate

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closely aligned to some target level believed consistent with returning the money supply to its announced path. During the stagflation of the 1970s money supply growth for most aggregates persistently exceeded the Fed's monetary targets. In response the Fed dramatically changed its operating procedures. On October 6, 1979, the Fed with great fanfare adopted a nonborrowed reserve instrument (NBR) operating procedure. Open market operations were used to target not the Federal funds rate but nonborrowed reserves, to the level believed consistent with the desired growth path of the money supply. Yet as will be shown these new procedures have in effect only changed direct to indirect, or what may be termed "dirty," interest rate targeting. Meanwhile as is well known the growth of the M1 aggregate continued to overshoot widely its target range.

Under these new procedures, since reserve requirements were then calculated on a lagged accounting basis, this meant that the Fed's operating instrument became largely indistinguishable from net borrowed reserves. Net borrowed reserves (alternatively termed net free reserves) are simply the difference between required reserves and nonborrowed reserves. With a nonborrowed reserve instrument, the Fed supplies some target or predetermined volume of nonborrowed reserves ( $\bar{NBR}$ ) each reserve statement week. Since under LRA required reserves ( $\bar{RR}$ ) are also predetermined and known at the beginning of each statement week, operating with a nonborrowed reserve instrument necessarily also amounted to targeting net borrowed reserves ( $BR - ER$ ) in any given reserve statement week. (Since  $TR = RR + ER = NBR + BR$ , then  $\bar{RR} - \bar{NBR} = BR - ER$ .)

The Fed has long relied on an established set of lending procedures to limit the amount individual banks will borrow at the discount window. Depository institutions seek to use these borrowing privileges to their best advantage, without violating the rules. The Fed's "adjustment credit" program provides banks with short-term funds, while "seasonal" borrowing is longer term. It will also lend for longer periods to financial institutions in distress under an "extended credit" program. As stated, the Fed currently defines its policy in terms of a greater or lesser degree of reserve restraint, that is, the extent to which it supplies nonborrowed reserves relative to required reserves, thus forcing banks "into the window" to a greater or lesser degree.

The Fed traditionally sets the level of the discount rate, the rate at which banks can borrow short-term funds at the discount window,

below prevailing short-term market interest rates. But the Fed does not intend for banks to use the discount window as an inexpensive and subsidized source of funds. Borrowing to support profitable net additions to security holdings is unambiguously condemned. The Fed wants banks to view discount window borrowing only as a "last resort"—a residual source of funds when they face unexpected needs for funds. (This is stated categorically in the Fed's Regulation A, which sets out the guidelines for discount window borrowing, and in "The Federal Reserve Discount Window," an explanatory pamphlet that the Fed provides to all eligible depository institutions.) Borrowing from the window is intended as "a privilege and not a right." Nevertheless, by maintaining the discount rate below short-term interest rates, the Fed cannot help but in effect subsidize those banks that choose to borrow at the window.

While the Fed frowns on the notion of discount window borrowing for profit, the operational guidelines for discount window lending are extremely broad. As a result, the discount officer at each Federal Reserve Bank has considerable discretionary authority to decide on the appropriateness of each borrowing bank's request. This discretionary procedure imposes additional *implicit* costs on banks that borrow, namely, the costs of providing information to and negotiating with the Federal Reserve Bank, plus the threat of future denial of access. Ultimately, a too active borrower may be turned down and told to avoid the window for "an extended period." These implicit nuisance or "frown" costs are sufficient to keep most banks away from the window, unless market rates rise substantially higher than the discount rate. Nevertheless each bank has its price, and this price appears to be higher for smaller banks. Banks always have the option of borrowing reserves from other banks in the Federal funds market and simply paying the market interest rate with no Federal Reserve surveillance.

When a bank does decide to come to the window, the Fed's administrative procedures serve to limit the quantity and duration of its borrowing. Whenever a particular institution borrows too frequently, or in relatively large amounts, the Fed becomes concerned that some of its borrowing may be inappropriate. As a result it subjects each additional request for borrowing to ever closer scrutiny. As a result, the more a bank borrows at the window, the more costly each additional dollar of borrowing becomes. While the explicit interest cost stays the same, the implicit "frown" costs, including discretionary surveillance and the

potential costs of impaired future borrowing privileges, rise with each additional dollar borrowed.<sup>1</sup>

The wider the spread between market rates and the discount rate, the greater the benefit from each dollar borrowed. As a result discount window borrowings rise systematically as the Federal funds rate rises above the discount rate.<sup>2</sup> Nevertheless this positive relationship between borrowings and the spread is highly variable, so that measures of the degree of reserve restraint are not always easy to interpret. Numerous proposals for discount window reform have been made to reduce the uncertainty in the interest-sensitivity of discount window borrowing. One obvious reform, a penalty discount rate, has until now been rejected, on the grounds that it would make short-term interest rate movements larger and even more volatile.

There are many reasons for the looseness of this linkage between discount window borrowing and the funds rate. First, distributional effects are sometimes operative. Special circumstances may create a reserve distribution distortion tending to shift reserves toward or away from smaller institutions, thus requiring a higher or lower funds rate to reallocate reserves. Secondly, dynamic factors play a role. There are obvious time dependencies between borrowing decisions made in adjacent weeks. Past discount window borrowers may become more cautious about their present borrowing in anticipation of future demands, forcing other more reluctant borrowers into the window. Finally there are seasonal factors. Some banks attempt to increase the size of their excess reserves at their statement dates, in particular at year end, a process called window dressing! These actions result in irregular temporary increases in excess reserves, discount window borrowings, and the Federal funds rate.

Excess reserves as a result vary erratically over time. The spread between the Federal funds rate and the discount rate is occasionally even observed to widen in periods when discount window borrowing falls. Thus while there is an underlying positive relationship between the spread between the Federal funds rate over the discount rate and the volume of discount window borrowing, the Fed cannot be sure precise-

<sup>1</sup>In 1980 and 1981 the Fed formally imposed a surcharge on adjustment borrowing by large institutions which borrowed in successive weeks or more than four weeks in a calendar quarter, so that the explicit interest cost rose as well.

<sup>2</sup>This relationship has long been recognized in the literature (Polakoff, 1960; Goldfield and Kane, 1966).

ly what spread will result for any given "degree of reserve restraint" or quantity of borrowed reserves. The variability in the Federal funds rate resulting from this "degree of reserve restraint" operating procedure, on average perhaps as large as 30 basis points, has appositely been termed "dirty" interest rate targeting (Goodfriend, 1983).

This relationship between the spread of the Federal funds rate over the discount rate and the borrowed reserves target is illustrated in Figure 1. Required reserves (RR) depend on the volume and composition of bank deposits, which in turn are some function of the volume of bank earning assets, that is, nonmarketable loans and marketable securities. With CRA they are no longer entirely predetermined and depend in part on current bank lending activity. Excess reserves (ER), as discussed above, are not easy to forecast precisely, so that the sum (RR + ER) is shown as indeterminate within some range. The Federal Reserve sets the discount rate ( $r_d$ ) and the quantity of non-borrowed reserves ( $\overline{NBR}$ ). This defines "the degree of reserve pressure," that is, the anticipated required amount of borrowed reserves ( $\widehat{BR}$ ). The slope of the reserve supply relationship ( $S_R$ ) is also determined by the Fed. This depends on the degree of harassment imposed upon discount window borrowers, plus an error term as described above. The resulting uncertainty in the Federal funds rate for any given targeted degree of reserve restraint ( $\widehat{BR}$ ) is shown as the shaded band between  $r_{ff_0}$  and  $r_{ff_1}$ .

A tighter degree of "reserve restraint" necessarily involves an increase in the differential of the Federal funds rate over the discount rate. This will occur whether the Fed tightens its criteria for discount window borrowing (increasing the slope of the  $S_R$  relationship) or forces more borrowing from the discount window (raises the borrowed reserves target  $\widehat{BR}$ ). But only a small proportion of banks experience that their reserves are quantitatively restricted, those actually turned down at the window. All banks, including all discount window borrowers, always have the option of acquiring additional reserves by borrowing Federal funds, selling liquid assets, or issuing additional managed liabilities. No banks are quantity restrained for reserves.

Bank arbitrage keeps the Federal funds rate and other short-term market rates closely aligned. As a result a tighter degree of "reserve restraint" operationally simply means a higher level of short-term

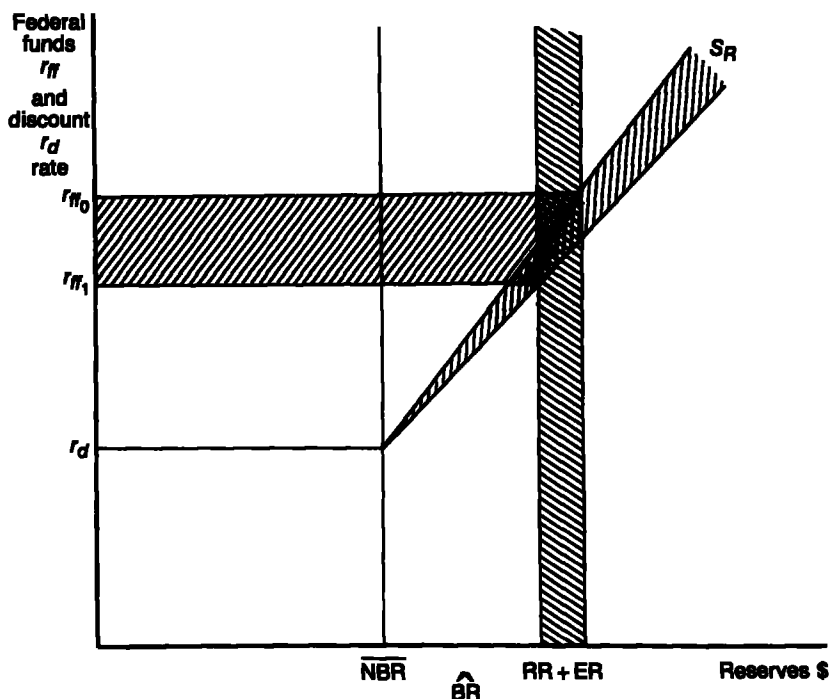


Figure 1

### Borrowed reserves and the spread between the Federal funds rate and the discount rate

interest rates.<sup>3</sup> Providing banks are willing and able to pass on these higher marginal costs of funds in higher lending rates to their borrowing clients, the volume of bank loans and deposits will continue to increase, depending on the interest elasticity of demand for bank credit. Empirical evidence suggests that this interest elasticity is very low in the short run, so that interest rates and loan volume typically move together. As market interest rates are driven ever higher, the Fed will increasingly provide additional nonborrowed reserves through open

<sup>3</sup>The "reserve restraint" rhetoric serves admirably to disguise the Fed's responsibility for the level of market interest rates. High interest rates are always unpopular, so that to preserve their independence central banks prefer to be seen as merely responding to market-determined levels of interest rates. Conflicts surrounding interest rates are ultimately political questions. It has recently been argued that the Fed's awesome powers to set rates represent an abdication of representative democracy (Greider, 1987).



market security purchases, due to its desire to smooth fluctuation in interest rates so as to preserve breadth and liquidity in financial markets.

The central bank in its role as lender of last resort plays a crucial role by setting the supply price of funds into the wholesale markets and so the behavior of wholesale rates. Depending on the extent to which it supplies funds to the wholesale markets relative to the wholesale markets' net demand for funds, it is able to raise or lower the general level of short-term wholesale interest rates. The central bank as the monopoly issuer of fiat money is thus in a position to determine at its discretion over a wide range the supply price of finance, that is, the level of short-term market interest rates.

The upper and lower limits of this range will depend on the level of world interest rates as set by other central banks, the level of the domestic exchange rate, and the size and openness of the domestic economy, since interest rate differentials induce international capital flows in foreign exchange markets. The level of interest rates and exchange rates is mutually interdependent, so that a flexible exchange rate regime increases the range over which a central bank can administer domestic short-term rates without provoking undesired capital flows. For the Federal Reserve System, as the central bank of the world's largest economy, changes in domestic rates typically do not result in corresponding one-for-one changes in the differential between foreign interest rates. This applies particularly to interest rate increases and less so to rate decreases. Insofar as other central banks raise their interest rates in a parallel manner to protect their foreign exchanges, changes in interest rate differentials will be muted. As a result the discretionary range over which the Fed can vary short-term rates is greater than that for most other central banks.

The Federal Reserve has no choice but to accommodate and provide all increases in required and excess reserves demanded, albeit at a supply price (interest rate) of its own choosing. The Federal funds rate, as set by the Federal Reserve through the "dirty" interest rate targeting procedure described, represents the marginal supply price of additional financial system liquidity. All wholesale short-term rates are maintained through bank arbitrage closely aligned with the Federal funds rate, after appropriate adjustments for any maturity, liquidity, and risk differentials. An arbitrage process similarly operates to determine market long-term rates so as to equalize expected holding period yields. Long-term rates thus represent the weighted average of capital market participants' current expectations of the level of future short-

term rates which will be set by the Fed over the relevant maturity, plus any required liquidity premium. Hence the importance of "Fed watchers": any "inside" information as to the Fed's likely future interest rate proclivities, commitment to money growth paths, responses to unanticipated changes in price or wage inflation, output growth, unemployment, trade balance, and so on can be extremely valuable in the money and capital markets.

As is well known, inflation has fallen dramatically over the 1980s. Nevertheless over the period from 1980 to 1985 the monetary aggregates, both narrow and broad, coincidentally grew at roughly the same rate as they had over the previous five years from 1975 to 1980. The striking difference of course was in the behavior of short-term interest rates, which in 1981 for the first time in the Fed's history were raised to above 20 percent.<sup>4</sup> The resulting capital inflows caused the exchange rate to appreciate, thus directly reducing the price of imports. This led to an increase in import penetration and a fall in exports, which in turn lowered the inflation rate of domestic prices and wages. It is the level of short-term interest rates, rather than the supply of credit money, which is the chief exogenous instrument under the control of central banks. The true indication of the degree of ease or tightness of monetary policy is the average level of *ex ante* real interest rates expected by the private sector.

Monetary endogeneity implies that central banks do not exogenously determine the quantity of credit money in existence, but rather the price at which it is supplied, that is, the short-term interest rate. The money supply is endogenously determined by market forces. Credit money is credit driven, so that loans make deposits rather than the reverse. In all modern economies, so long as borrowers have large unutilized lines of credit or overdraft facilities, the quantity of loans outstanding is determined by bank borrowers, not by banks. But the supply of credit money is also demand determined. Insofar as money is always generally accepted in exchange for nonmonetary goods and services, no economic units can ever find themselves with an excess supply of money. The supply and demand for money are interdependent.

The central argument for the endogeneity of credit money may be very simply put: Banks are *price setters* and *quantity takers* in both their retail loan and their deposit markets. As a result both loans and deposits are demand determined.

<sup>4</sup>For a fascinating description of how the Fed was able to raise interest rates to these levels, see Greider (1987).

Banks must attempt to administer a level of loan and deposit rates that satisfies two separate conditions:

(1) the markup of their loan rate over their deposit rate must be sufficient to cover all their costs of intermediation plus some normal or target profit return on equity;

(2) the quantity of total deposits and total loans demanded of individual banks must satisfy some desired ratio relationship, which for the banking system as a whole cannot diverge too far away from unity.

For individual banks, and for the system as a whole, any short-run excess or deficiency of loan demand over deposit supply of funds can be met in the wholesale markets (e.g., CDs, BAs, TBs, etc.) where banks in contrast are price takers and quantity setters. Bank borrowers and lenders (depositors) constitute different groups. There is nothing to assure that the quantity of bank loans demanded by bank borrowers will be precisely equal to the quantity of bank deposits demanded by bank lenders. Banks must administer their lending and deposit rate so that their desired relationship of total loans to deposits is achieved.

Due to the nature of credit money the demand for money is not independent of the supply. There is a sort of Say's law of money operating: "Supply (of money) creates its own demand." Any increase in borrower demand for bank credit will result in an increase in both loans and deposits, providing only that banks' loan collateral standards are met. Loans make deposits. These deposits will be expended by bank borrowers in the acquisition of real or financial assets. The sellers of these goods will always be willing to accept bank deposits in exchange; that is, they will always be demanded, providing merely that deposits retain their moneyness (their general acceptability as means of payment).

All economic units who accept credit money (deposits) in exchange for real goods and services are in effect selling their goods on credit, as compared with direct exchange by barter. They are willing to increase their holdings of deposits and to increase their "convenience lending" to the banking system, providing they are confident that all other units will in turn also accept deposits as payment for goods and services when tendered. Such "convenience lending" involves no sacrifice of liquidity or deferral of consumption or investment expenditures. As a result an increase in such lending requires no additional interest rate "bribe." There is no need for the supply of credit money to be upward sloping.

When economic units' deposit balances accumulate beyond the

amount demanded for convenience purposes, they will exchange their deposits into less liquid assets yielding higher pecuniary returns. Banks are quantity takers in their deposit markets, so that the amount of bank deposits outstanding is always demand determined. Commercial banks like all other financial intermediaries must tailor the pecuniary and nonpecuniary returns on their liabilities to suit wealth-owner preferences. In the short run banks will rely on the wholesale markets to ensure that they have no excess supply or demand for funds. But over the longer run banks as a system must administer their lending and deposit rates to assure that the total quantity of credit they supply to borrowers is approximately equal to the total supply of deposits they receive from lenders.

Banks may be assumed to adjust their borrowing and lending rates on profit-maximizing grounds. This implies equality of marginal cost and marginal revenue. The marginal and average cost of wholesale assets is identical, so that banks will set a lending rate in particular markets as some markup over the wholesale rate, depending on their degree of market power. The marginal cost of funds to the banking system is governed ultimately by the supply price of bank reserves. In a closed economy this is set exogenously over a wide range by the central bank as the ultimate monopoly supplier of liquidity. Reserves must always be supplied endogenously. Legal reserve requirements simply serve to manipulate the quantity of bank reserves demanded for any given level of bank loans and deposits. Interest rates are set exogenously within relatively wide limits by the central bank itself in pursuit of its policy goals.

In an open economy bank reserves may also be supplied from outside the system, at a supply price set by foreign central banks. As a result central banks must determine the exchange rate as well as the domestic short-term interest rate. These two exogenous policy instruments are interdependent. Flexible exchange rates increase the range of discretion over which central banks can administer domestic rates, since they can affect the spot-forward premium which governs interest rate parity. Once the exchange rate has been fixed, central banks in open economies, unless they resort to exchange controls, will be unable to move the level of domestic short-term rates very far above or below the level ruling in foreign financial centers, without causing large arbitrage-induced private foreign exchange inflows or outflows. Long-term interest rates similarly reflect the expectations of capital market participants of the level of short-term interest rates which will

be set in future periods by the central bank, through an analogous arbitrage process of equating holding period returns.

An endogenous money supply is sometimes interpreted as implying that central banks are passive and cannot affect the behavior of money growth. This is clearly a misperception. An endogenous money supply simply denotes that the money supply is determined by market forces. Central banks are able to administer the level of short-term interest rates exogenously within a substantial range. This will obviously affect the quantity of credit and money demanded, and so the behavior of money growth.

Alternatively an endogenous money supply is sometimes interpreted as implying that the central bank fixes (pegs) the level of short-term interest rates, that is, sets them at an unchanged level over time, in which case the money supply becomes endogenous. It is then concluded that this has happened only for particular short historical periods. But by setting interest rates, the central bank does not have to maintain them unchanged at a constant level over time. Rather central banks are generally observed to change the level of their interest rate instrument, depending on the state of the economy and their ultimate policy objectives. In this sense a long-run money supply function does not exist, since the level of interest rates cannot be specified independently of demand conditions. But the central point is that the short-run money supply is always horizontal.

It just remains to note that, even though the supply of credit money is endogenously credit driven as described above, *ex post* the high-powered base multiplier will always appear to be fully confirmed. The Fed will have determined the level of the high-powered base by the assets it purchases. The relationship between the base and the money supply will appear to be reasonably stable. But the base multiplier is in fact only a descriptive identity. So long as the ratio of the base to deposits remains stable, the multiplier will always be calculated as some broadly constant number. Monetarists will always be able *ex post* to attribute any excessive rate of growth of the money supply to an excessive growth of the base and hence to conclude that the Fed is ultimately responsible.

Only once it is fully comprehended that the supply of credit money is inherently endogenous and that the money supply function should be viewed as *horizontal* in interest-money space, at a level of short-term interest rates established by the central bank, can the base-multiplier relationship be understood for what it is: a purely descriptive tautology.

It can then be finally discarded as possessing no causal or explanatory relevance whatsoever. At that point there will occur a short growth bubble: the rewriting of money and macro textbooks.

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