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Unpacking the post Keynesian black box: bank lending and the money supply

A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it. (Max Planck, quoted in Kuhn, 1962, p. 50)

Introduction

The debate over whether the Fed should rely exclusively on the money stock—somehow defined—as an indicator or a target of monetary policy continues unabated. At the same time there is now widespread recognition that in spite of target growth rates for monetary aggregates, current practices of the FOMC involve guidelines that include a blend of interest rates and money market considerations (Karaken, 1969; Poole, 1979; Hetzel, 1981). Whether or not the money stock can in fact be controlled within relevant limits, particularly over shorter time periods, is still an unresolved issue.[1]

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[1] "The FOMC viewed both the rate of growth of the money supply and the level of short-term interest rates as important intermediate targets of policy in their own right. The spirit of achieving money supply targets was that when the actual differed from the desired rate of growth of the money supply, the funds rate would be gradually altered in order to bring the actual into line with the desired rate of growth. There was never any intention of correcting for overshoots or shortfalls in the money supply that accrued in the process of aligning actual with desired rates of growth of the money supply . . . the

Most people have a basic misunderstanding of the manner in which the Federal Reserve implements monetary policy. Students of economics across the country are still taught how the Fed increases or decreases bank reserves to regulate the quantity of bank deposits. The money stock (M) is a favorite exogenous variable in countless models. Movements of the chosen monetary aggregate are attributed to a specific policy or action by the Federal Reserve.

This traditional view of the bank money creation process relies on the bank reserves-multiplier relation ($M = Bm$). The Fed is posited to be able to affect the quantity of bank deposits, and thereby the money stock, by determining the nominal amount of the reserve base (B) or by changing the reserve multiplier (m).[2] Based on empirically applying the reserves-multiplier relationship, the following conclusion from Meltzer is not unrepresentative: "85 percent of the variance of the monthly change in money . . . resulted from changes in the monetary base and changes in Treasury deposits at commercial banks in the current and previous month" (1969, p. 18). On such evidence Monetarists hold that the money stock is properly considered an exogenous variable.

The purpose of this paper is to argue that in fact the direction of causality is precisely the reverse of that held by the conventional view. There is now mounting evidence that the traditional characterization of the money supply process, which views changes in an exogenously controlled reserve aggregate as "causing" changes in some money stock aggregate, is fundamentally mistaken. Although there is a reasonably stable relationship between the high-powered base and the money stock, and between the money stock and aggregate money income, the causal relationship implied is exactly the reverse of the traditional view. Both the base and the money stock are in fact endogenous. The evidence suggests that the quan-

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tolerance ranges were not manipulated in order to offset overshoots in M_1. This approach toward targeting the money supply . . . can only be explained by a desire to maintain the level of short-term interest rates as an intermediate target of policy in its own right" (Hetzel, 1981, pp. 40-41).

[2] Different investigators have advocated alternative operating *control* variables, covering a broad range of reserve measures. All of these reserve measures are recognized as being mutually determined in the short run by shocks outside of the direct control of the monetary authorities. Nevertheless, it is assumed that the Fed can take offsetting-long-run actions, which ultimately enable it to exercise broad control over aggregate reserve instruments. See Poole (1979).

tity of bank intermediation is determined primarily by the demand for bank credit.[3] "In the real world banks extend credit, creating deposits in the process, and look for the reserves later" (Holmes, 1969, p. 73).

The evidence for reverse causality

The evidence supporting this post Keynesian view that the money stock is endogenous is of four sorts:

1. First, central bank practitioners themselves have long insisted that the Federal Reserve in fact follows a money market strategy.[4] The operational directives of the Open Market Committee always specify values within some range of money market variables that the manager of the account is to maintain. Central bankers insist that in the short run, money stock creation is a joint result of a complex interaction among households, business corporations, financial institutions, the Treasury, and the Federal Reserve. They emphasize that most of the reported short-run movements in monetary aggregates are primarily the result of statistical "noise"—random forces and estimating errors in the data, and argue that the view that the central bank determines changes in the money stock in the short run is simply inaccurate.[5]

[3] Less controversially, the amount of currency outstanding is determined by the transactions' demand for currency balances.

[4] See Guttentag (1966) and Lombra and Torto (1973).

[5] "It is clear that, as a matter of fact, the Federal Reserve does not attempt to increase the money supply by a given amount in any period by furnishing a fixed amount of reserves on the assumption that they would be multiplied to result in a given increase in money" (Maisel, 1969, p. 153).

"To the best of my knowledge . . . the Fed has not attempted to control, within rather wide limits, the growth of the narrowly defined money supply in any week or month" (p. 161).

"The idea of a regular injection of reserves . . . suffers from a naive assumption that the banking system only expands loans after the system (or market factors) have put reserves in the banking system . . . In any given statement week, the reserves required to be maintained by the banking system are predetermined by the level of deposits existing two weeks earlier. Since excess reserves in the banking system normally run at frictional levels . . . the level of total reserves in any given statement week is also pretty well determined in advance. Since banks have to meet their reserve requirements each week (after allowance for carryover privileges), and since they can do nothing within that week to affect required reserves, that total amount of reserves has to be available to the banking system. The Federal Reserve does have discretion as to how the banks can acquire this predetermined level of

Central bankers justify their behavior by arguing that the attempt to use measures of money stock growth as the primary short-term target of open market operations would result in an unacceptable range of interest rate variation, which would prove destabilizing to financial markets.[6] Highly specialized financial institutions, operating with low ratios of both cash and equity capital, presuppose the existence of orderly financial markets. If the quantity of reserve growth were controlled tightly, private institutions would have to shoulder the risks of widely fluctuating interest rates resulting from irregular short-term movements. Moreover in the absence of the lender of last resort function undertaken by central banks, it is by no means sure that the liquidity of financial assets could be persistently assured by the holding of greater buffer cash inventories by private agents. The need for an elastic currency to offset weekly, monthly, and seasonal shocks, and avert the resulting chaotic interest rate fluctuations and financial crises, was after all the major determining factor in the historical formation of the Federal Reserve System. If the Fed never regards itself as in practice determining changes in monetary aggregates over the short run, it is hard to see how it can be viewed as determining changes over longer runs, which are simply aggregations of shorter runs.

2. The second body of evidence on the endogeneity of the high-powered base comes from formal causality tests between bank reserves and bank deposits.[7] Using weekly data, Feige and McGee

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needed reserves. The reserves can be supplied from the combination of open market operations and the movement of other reserve factors, or they can come from member bank borrowing at the discount window . . . the suggestion that open market operations should be used in the short run to prevent a rise in total reserves through member bank borrowing is completely illogical. Within a statement week, the reserves have to be there; and, in one way or another, the Federal Reserve will have to accommodate the need for them" (Holmes, 1969, pp. 73-74).

[6] "If the Federal Reserve tried to maintain a rigid monetary growth rate, . . . interest rates would fluctuate widely, and to no good end. The costs of financial intermediation would be increased" (Burns, 1974, p. 556).

[7] To satisfy Granger causality, R is said to "cause" M if past values of R can be used to obtain more accurate forecasts of future values of M than those forecasts formed by using only past values of M (Granger, 1969). Sims developed an important procedure for testing Granger causality conditions. The method involves regressing current values of each of the variables on future, current, and past values of the other variable, after both variables have been similarly prefiltered in order to eliminate serial correlation in the regression residuals. Causality running from the dependent variable is indicated when the increment to R^2 from including future values of the independent variable

found that the money stock was exogenous with respect to reserves for both the seven-year period before and after the imposition of lagged reserve accounting in 1968 (1977). In contrast, one-way causality from money to reserves held in both periods, although the null hypothesis could only be rejected at the 10 percent level for the earlier period.[8]

A recent paper, based on four different causality test procedures, similarly found that the evidence overwhelmingly supported the position that over the period 1973-81 unidirectional causality ran from each of four different monetary aggregates to the money base, and from commercial bank lending to the monetary aggregates (Moore and Stuttman, 1982).[9]

3. The third kind of evidence for the endogeneity of the money stock comes from modern microtheoretic models of the banking firm. Such models view a bank as a two-input, two-output firm. The two inputs are retail and wholesale deposits; the two outputs, loans and wholesale lending. Retail deposits and loans are collected and made through the banks' retail branch systems. They are not marketable, and banks are viewed as price-setters and quantity-takers in both the retail deposit and loan markets. Wholesale deposits and loans are broadly the same security, and a substantial proportion is marketable, such as certificates of deposits, bankers' acceptances, and commercial bills. The wholesale market is the repository of or the source for any surplus or deficit of funds, and banks are price-takers and quantity-setters in the wholesale interbank and CD markets. Both loans and deposits are thus viewed as

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is sufficient to reject the null hypothesis that all future coefficients are zero. The procedure is then repeated, reversing the dependent and independent variables (Sims, 1972).

[8] The signs of the future reserve coefficients were positive, indicating that the monetary authority leans "with" rather than "against" the wind, implying a policy of accommodating reserves to innovations in credit demand. Not surprisingly, during the pre-1968 period the largest single cross-correlation occurred at lag zero, while during the post-1968 period the largest cross-correlation occurred between current reserves and the money stock two weeks earlier. Feige and McGee conclude that their results "raise serious doubts about the Fed's use of the traditional reserve-multiplier mechanism to control the money supply. Our findings also call into question estimated money supply equations predicted on the assumption of reserve exogeneity" (p. 549).

[9] The only exception was a bidirectional or feedback relationship found to exist between the monetary base and the M_2 aggregate (Moore and Stuttman, 1982, pp. 13-17).

demand-determined.[10]

4. The fourth sort of evidence for the endogeneity of the high-powered base is the extent to which changes in the base can be "explained" statistically by changes in economic variables, in particular by money wages. Economists have long attempted to fit central bank "reaction functions," related to macroeconomic policy goals such as inflation, unemployment, balance of payments, and interest rates. It has recently been shown that money wage rates are by far the most significant explanatory variable, with a highly significant positive coefficient (Moore, 1979).[11]

There is now considerable evidence that over large sectors of the economy prices are determined as some fairly stable markup over historic normal unit costs (Nordhaus, 1972; Sawyer et al., 1982; Weintraub, 1963, ch. 3). Post Keynesians and others argue that the underlying basic rate of inflation ($\dot{p}$) is governed by the excess rate of growth of money wages ($\dot{w}$) over the rate of growth of average labor productivity ($\dot{A}$) ($\dot{p} = \dot{w} - \dot{A}$). At the same time, the Monetarists have shown that, at least over the long run, excess growth in the nominal money stock ($\dot{M}$) over the growth of the real productive potential of the economy ($\dot{y}$) is also closely reflected in the rate of inflation ($\dot{p} = \dot{M} - \dot{y}$). These two empirical regularities logically imply that the rate of growth of the nominal money stock ($\dot{M}$) must be closely related statistically to the rate of growth of money wages ($\dot{w}$) (see Moore, 1979).

Because they have been unable to specify the transmission mechanism by which monetary change appears empirically to spill over so rapidly into product and factor markets, Monetarists have been accused of having a "black box" in their models. Post Keynesians argue that it is money wage growth which is more nearly exogenous.[12] But until they are able to specify more closely the mecha-

[10] See Wills (1982) for a brief exposition. The supplies of both loans and deposits are thus perfectly elastic in the short run.

[11] Lagged money wage rates alone "explain" 67 percent of the monthly movement in the money stock, and 85 percent of the quarterly movement (Moore, 1979, pp. 60-62).

[12] The central bank is viewed as being forced to accommodate to money wage increases so as to prevent unemployment rates from rising to politically unacceptable levels.

The post Keynesian view that changes in the money stock are determined fundamentally by the rate of growth of money wages explains why in virtually all countries the rate of money growth has been so much higher during the 1970s than during the 1960s. If money growth were truly exogenous, this growth would have to be attributed to massive and coincident errors by different monetary authorities.

nism by which changes in money wages influence the money stock, post Keynesians are similarly open to the accusation of having a "black box." Why do central banks always accommodate? Is it solely a lack of moral fiber?

Credit markets and the provision of liquidity

The process of monetary accommodation, the validation of money wage increases which the data reveal, is mistakenly viewed, by both Monetarists and post Keynesians alike, as the result of a process of *active* policy intervention by the central bank.[13] Such a view overlooks the fact that the central rationale for the creation of central banks, and still by far their most important function, was to provide an elastic currency supply. To ensure the ultimate liquidity of financial assets and so the viability of the financial system, central banks must stand ready to perform the role of lender of last resort.[14] For the system as a whole, as evidenced by the experience of the 1930s, liquidity is determined by what the central bank is willing to purchase. The commercial banking system is the central institution in the liquidity-creating process. As a result by far the most basic obligation of all monetary authorities is to support, maintain, and encourage orderly conditions in financial markets generally, and in the commercial banking system in particular.[15]

In the United States annual changes in the volume of bank intermediation are determined primarily by the quantity of bank lending, although changes in bank security holdings and external capital

[13] The notion appears to be that the monetary authorities as political animals keep their eyes focused on the state of the economy in general, and on the level of unemployment in particular. Whenever unemployment rates approach politically unacceptable levels, the central bank moves to provide additional reserves to accommodate the higher wage and price levels so as to avoid even higher unemployment.

[14] If financial assets are to possess liquidity, they must be capable of being exchanged quickly, easily, and cheaply into cash. Specialized institutional market-makers develop who are willing to buy and sell funds at extremely low margins, and who operate with low ratios of equity capital.

[15] This implies that the supply of money is always horizontal (infinitely elastic) at the going short-term interest rate. In contrast Monetarists view the money stock as determined exogenously by the central bank (Friedman and Schwartz, 1982). The nominal supply is regarded as fixed (vertical), so that economic units in the aggregate cannot by spending reduce any nominal "excess" balances. They have a "hot potato" view of money. Only by raising prices or by increasing output are real balances brought into equilibrium (Friedman and Schwartz, 1982, ch. 2). Excess nominal money growth is viewed as "causing" money wages to rise, like any other price.

flows play an important short-run role. This is hardly surprising, since bank total assets must equal bank total liabilities. The coefficient of determination (R^2) between bank lending and the money stock (M_1) over the past fifteen years is .62 for annual changes, but only .14 for quarterly changes and .01 for monthly changes. It follows that while there is substantial independence in monthly and quarterly movements, in most years increased bank lending is the predominant source of monetary growth (Kaldor, 1982, p. 43).

It is through the credit markets that the process of monetary accommodation to higher nominal money wages occurs. The ability of central banks to control the rate of growth of monetary aggregates therefore hinges on their ability to control the rate of growth of *bank lending*, rather than the monetary base. Once deposits have been created by an act of lending, the central bank must somehow ensure that the required reserves are available at the settlement date. Otherwise the banks, no matter how hard they scramble for funds, could not in the aggregate meet their reserve requirements.[16]

Changes in bank lending have been the proximate source of annual changes in the money stock over the past fifteen years. The credit crunch of 1966 spurred a widespread move toward formalizing, in a legally obligating manner, the hitherto largely informal credit-line arrangements prevailing between banks and their business customers (Wojnilower, 1980). Corporations wanted and were willing to pay for legally-binding credit lines.[17] The controllability of bank lending to business corporations appears distinctly limited. As a result such bank lending is very largely completely demand-determined.

The assumption underlying the following analysis is that banks

[16] With LRA, once loans have been granted and deposits created, bank reserves are a predetermined variable. The monetary authorities have no choice but to provide the banks with the necessary reserves, if orderly conditions in the financial markets are to be maintained. Even with CRA the central bank's only decision concerns whether funds should be provided by open-market operations, or whether the banks should be driven to the discount window.

[17] Monthly data on commitments have been collected only since 1975. Roughly one-half of new long-term and short-term commercial and industrial bank loans are made under previous commitments, yet loans made under commitments are typically only about 30 percent of total commitments. Unused bank credit commitments, currently (1981) about $300 billion, now exceed the total narrowly defined money stock (M_1). See Federal Reserve Board (1980).

set the prime rate and then attempt to meet the loan demand that results (i.e., the supply curve is horizontal). If the resulting demand for credit exceeds the banks' available retail and wholesale supply of funds, they will be forced to raise the prime rate further or to change the degree to which they ration funds.[18]

Commercial industrial lending

In modern economies production costs are normally incurred and paid *prior* to the receipt of sales proceeds.[19] Such costs represent a working capital investment by the firm, for which it must necessarily obtain finance. Whenever wage or raw materials price increases raise current production costs, unchanged production flows will require additional working capital finance. In the absence of instantaneous replacement cost pricing, firms must finance their increased working capital needs by increasing their borrowings from their banks or by running down their liquid assets.[20]

[18] In the United States banks are typically regarded as oligopolists in lending markets, administratively setting their interest rates in line with the prime rate, which is in turn administratively related to short-term money market rates. The quantity of bank loans at least in the short term is then determined largely by demand, although banks have some scope for affecting the quantity of loans granted through nonprice terms, e.g., collateral requirements applied to discriminate among the fringe of unsatisfied borrowers. The amount of funds obtained through deposits, after adjustment for the reserves which must be held against them, must be reconciled with the quantity of loans granted by changing other portfolio items in the wholesale market.

Historically, imbalances between changes in loans and deposits were financed by changes in marketable securities, primarily Federal government debt. Since 1962 the development of an active market in certificates of deposits (CDs) has enabled banks to place large quantities of these liabilities at their own initiative. After the credit crunch of 1966, when the Fed refused to raise CD ceilings further, Eurodollar borrowings substituted admirably for the CD market whenever it became immobilized by rate ceilings. This liability management has enabled banks to run down their precautionary reserves and to rely on "liability side liquidity" to meet demands for funds. As a result they have been better able to accommodate to changes in the demand for loans. For an excellent survey, see Wojnilower (1980).

[19] The approach in this paper stems essentially from the recognition that production takes time, and time must be taken seriously. "During the lengthy process of production the business world is incurring outgoings in terms of *money*—paying out in money for wages and other expenses of production—in the expectation of recouping this outlay by disposing of the product for *money* at a later date" (Keynes, 1923, p. 33).

[20] Working capital needs may also be met by increases in nonbank borrowing or long-term debt issues, raising additional equity finance internally or externally, or realizing nonliquid assets. All of these sources of funds take

This process is shown diagrammatically in Figure 1. At time t_0 the firm faces a cost increase due to, e.g., a new wage agreement. Revenues gradually increase as prices are raised based on a stable markup over historic normal unit costs, depending on the production-sales period (t_1). The shaded area represents the additional working capital finance requirement, which is assumed to be raised by increased bank borrowing.

In this manner additional bank credit is demanded to finance increases in the value of stocks and work-in-progress throughout the production-sales time interval, between the dates of payments for inputs and the dates of receipts from sales revenues. Increases in money wage rates, the single most important factor cost, and in raw materials costs, will thus lead directly to an increase in the quantity of bank credit demanded, and so to a corresponding increase in bank deposits and in the money stock. Increases in the volume of output, costs remaining unchanged, will similarly require an increase in bank loans to finance the larger value of goods

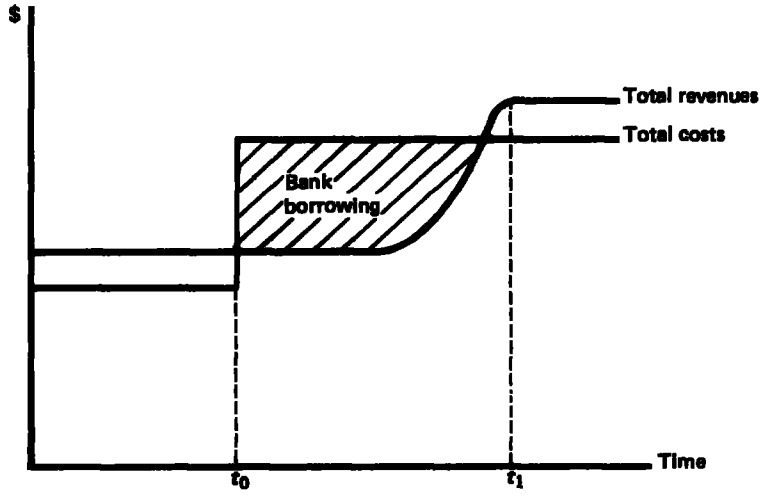

Figure 1

longer to arrange. In the UK study alternative definitions of the dependent variable were tried in an attempt to specify the extent to which companies would increase bank loans or draw down their bank deposits or other liquid assets to meet increases in their working capital requirements. Somewhat surprisingly gross bank borrowing was more clearly determined by changes in working capital needs than either of the net definitions. See Moore and Threadgold (1980), pp. 24-26.

in process, until larger sales receipts cover the additional working capital finance.[21] If costs or output stabilize at some higher level, the level of bank borrowing will also stabilize at a new higher level.

The demand for business loans will be estimated first, utilizing a single-equation reduced form approach.[22] Short-term commercial (working capital) loans to companies were long considered the raison d'être of bank lending and are still by far the single most important component. The interest sensitivity of credit demand will be estimated directly. Changes in the degree of credit rationing will be estimated by the use of proxy dummies to reflect the four Federal Reserve engineered periods of "credit crunch": 1966Q3, 1969Q3, 1974Q3, 1980Q2.[23]

A basic equation relating increases in commercial and industrial borrowing to increases in company working capital needs was first developed, and the significance of additional variables was then tested additively. Because of the different time periods over which various costs enter the production and pricing process, total working capital needs were decomposed into the following four components:

1) employment costs;
2) materials costs;
3) stock-building costs;[24]
4) corporate tax payments.

[21] The amount which working capital needs increase in response to an increase in costs or output will vary among industries and will depend on the length of time before output prices are raised in response to higher historic costs. The length of the production period will ordinarily set a plausible upper limit to this time lag. Workers, other factor suppliers, and even customers do provide companies with interest-free working capital finance, depending on wage payment periods and trade credit and prepayment conventions. But this ordinarily is very short compared with the total production period, over which such working capital needs must be financed with profit if the company is to remain in business. See Coutts, Godley, Nordhaus, (1978), esp. pp. 35-59; also see Davidson, (1982), pp. 124-6.

[22] Any such single-equation approach is obviously frought with difficulties, but a fully simultaneous model of sector bank borrowing behavior is beyond the scope of this paper. The paper rather seeks more modestly to indicate some of the more important determinants of bank lending.

[23] These periods were taken from Wojnilower (1980).

[24] Changes in working capital resulting from variations in the level of output are captured in two ways: first, by defining the employment and materials

It is only *increases* in costs which generate demand for additional working capital finance, since existing cost-flow levels are assumed to be fully financed out of current sales proceeds. In consequence all explanatory variables are entered as first differences. All variables were entered for both the current and preceding quarters, as suggested by the price markup literature.

The initial equation was:

$$\Delta TLCIC_t = a_0 + a_1 \Delta WBill_t + a_2 \Delta WBill_{t-1} + a_3 \Delta MBill_t + a_4 \Delta MBill_{t-1} + a_5 \Delta PS_t + a_6 \Delta PS_{t-1} + a_7 \Delta TBill_t + a_8 \Delta TBill_{t-1},$$

where

TLCIC = bank loans to commercial and industrial corporations (CICs);
WBill = a proxy for the wage bill of CICs;
MBill = a proxy for the materials costs of CICs;
PS = current price value of stock levels of CICs;
TBill = corporate tax payments by CICs;
Δ = quarterly change.

The results of fitting this equation are presented as Equation 1 in Table 1. It succeeds in explaining about one-half of the total variation in commercial and industrial borrowing. The one-quarter lagged changes in the materials bill and in stock-building are not significant, and the tax bill is either insignificant or wrongly signed. On dropping these variables a basic equation (Equation 2) was selected. Each variable with the exception of the constant is significant, and the magnitude of the coefficients on each of the components of working capital needs, with the exception of stock-building, is not significantly different from unity. These coefficients suggest that bank borrowing by CICs increases substantially on a one-for-one basis with their requirements for additional working capital.

Several attempts were made to introduce interest rate terms, both nominal and real, but most of the results were unsatisfactory.[25]

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bills to include the effect of changes in the level of employment and inputs, and second, by including the price value of stock-building (excluding stock appreciation) as an additional explanatory variable. Conceptually this is double counting, since stock values are the integral of past-employment and material costs over the appropriate period.

[25] When the current and lagged short-term lending rate on business loans were added to the equation, the coefficients were insignificant, and the sign

Table 1

Industrial and Commercial Companies
Δ Total Bank Borrowing 1964Q1-1979Q4
(*t* values in parentheses)

Equation number	Constant	Δ Wage bill		Δ Materials bill		Δ Stock-building		Δ Tax bill		Interest rate		Δ Interest rate	Expected inflation	Real interest rate	Δ Real interest rate	D.W.	RHO	$\bar{R}^2$
		t	*t*−1	*t*	*t*−1	*t*	*t*−1	*t*	*t*−1	*t*	*t*−1	*t*	*t*	*t*	*t*			
1	−1.695	0.945	2.417	1.553	0.363	0.594	0.451	0.139	−0.864							1.44		.524
	(1.9)	(1.0)	(2.8)	(3.4)	(0.8)	(1.2)	(0.99)	(0.37)	(2.75)									
	−1.462	1.394	1.809	1.455	0.398	0.642	0.536	0.030	−0.736							1.82	.266	.425
	(1.4)	(1.5)	(2.2)	(3.4)	(1.0)	(1.4)	(1.3)	(0.1)	(−2.5)									
2	−1.098	1.187	1.474	1.660		0.663										1.42		.490
	(1.3)	(1.7)	(2.3)	(3.9)		(1.5)												
	−0.484	1.601	0.991	1.314		0.486										1.72	.276	.389
	(0.5)	(2.4)	(1.7)	(3.1)		(1.2)												
3	−3.571	1.782	0.666	0.949		0.202				0.578	−0.013					1.76	.233	.424
	(1.8)	(2.5)	(1.1)	(2.0)		(0.4)				(1.1)	(0.0)							
4	−0.435	1.382	1.005	1.352		0.513						0.415				1.71	.228	.403
	(0.4)	(2.0)	(1.7)	(3.2)		(1.2)						(0.8)						
5	−1.783	1.738	0.598	0.894		0.200						0.355	0.384			1.68	.281	.405
	(1.4)	(2.5)	(1.0)	(1.9)		(0.5)						(0.7)	(1.8)					
6	−0.394	1.587	1.041	1.326		0.491								−0.122		1.63	.235	.395
	(0.4)	(2.3)	(1.7)	(3.1)		(1.1)								(0.4)				
7	−0.590	1.684	0.934	1.363		0.521									−0.375	1.75	.251	.413
	(0.6)	(2.5)	(1.6)	(3.3)		(1.3)									(1.5)			

When the *change* in the real interest rate was entered, its coefficient was negative and weakly significant (Equation 7). The implied interest elasticity, calculated at the mean values, was –0.11. To the extent CIC borrowing is primarily for working capital purposes, this very low implied interest elasticity is not surprising.[26] Taken at face value, the results imply that the ability of the monetary authorities to restrain the growth of company borrowing indirectly, by varying short-term interest rates, is very limited. In the short run, loan demand appears largely insensitive to interest cost variations, given working capital requirements.[27]

The attempt to catch changes in credit-rationing effects was modeled by dummy variables to capture any effects of credit crunch periods. Two such dummies had negative coefficients as expected, but none even approached significance. To the extent credit rationing was directed by banks primarily at loans to per-

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changes from positive to negative for quarter t and $t-1$ (Equation 3). The very high serial correlation of such interest rates (Simple Correlation = .9) may account for such results. The change in interest rates was then substituted (Equation 4). Its coefficient was positive but insignificant. One explanation for the positive coefficient is the much-discussed positive expectations effect, in which a rise in interest rates induces an increase in business borrowing so as to ensure the future availability of funds. A proxy for the expected inflation rate was then added, derived from a simple ARIMA model of four-quarter past inflation rates. The proxy for the expected inflation rate was as follows:

$$\dot{P}_t = \underset{(1.6)}{0.640} + \underset{(7.8)}{0.992}\dot{P}_{t-1} - \underset{(2.6)}{0.427}\dot{P}_{t-2} + \underset{(3.0)}{0.519}\dot{P}_{t-3} - \underset{(1.2)}{0.165}\dot{P}_{t-4} \quad DW = 2.06,\ R^2 = .785$$

The coefficient was positive as expected, but the explanatory power of the equation was not increased (Equation 5). An expected real bank lending rate was then constructed. Its coefficient was negative but still insignificant (Equation 6).

[26] It is generally believed that CICs also borrow from banks to finance fixed investment expenditures as well as working capital needs, at least temporarily until they have arranged sufficient longer-term financing. The inclusion of a term representing changes in current prices corporate fixed investment (predominantly CICs) proved insignificant and wrong-signed. The results are not reported as the inclusions of this variable had virtually no effect on the other coefficients.

[27] It must be noted that variations in the cost of borrowing may nevertheless have strong effects which cannot be caught by this simple single-equation reduced-form approach. High interest costs may induce companies to lower their demand for working capital, by cutting back directly on their wage and materials bills, thus reducing their volume of employment, production, and inventories of goods in process. Such effects could only be caught by a simultaneous equation system in which interest rates were allowed to affect the various uses for working capital finance.

sons, real estate, and other financial companies, these results for CICs are perhaps not too surprising.

To test the robustness of the coefficient estimates, the data were divided into two subperiods, 1965-72 and 1973-80, and Equation 7 was reestimated independently for each. As shown in Table 2, the magnitudes of most coefficients vary significantly between subperiods. In particular, the change in real interest rate and stock-building are significant only in the second subperiod. The explanatory power of the equation was greater for the second subperiod than it was for the first. There is evidence of heteroscedasticity over the whole sample period, but a Chow test indicated that the equations were stable.[28]

The uses of working capital finance, in particular increases in money wage rates, appear to be the most important determinants of bank lending to companies.

Commercial bank loans: total

Four major lending components—commercial and industrial loans, real estate loans, loans to individuals, and loans to financial institutions—together account for nearly 90 percent of total bank lending. The second and third categories are governed primarily by the change in household financing demand for new homes and consumer durables. The determinants of loans to financial institutions are presumably some complex function of interest rates and conditions in financial markets, which govern portfolio behavior and the relative growth rates of financial intermediation and disintermediation among different financial institutions. Rather than attempt to model these individual credit markets separately, it was decided to attempt to isolate the main variables governing commercial bank loans in the aggregate.[29]

All data taken were taken from the NBER data tape. The total loan series started in 1973.1, which constrains all equations to this time period. The change in total wage disbursements was

[28] One possible explanation for the observed coefficient instability is that with the rise in the inflation rate, finance has undergone a transformation since 1972. Nevertheless it is perhaps comforting that the model provides a more satisfactory explanation of later and therefore current commercial and industrial corporate bank borrowing.

A similar result was found for company borrowing in the UK. See Moore and Threadgold (1980), pp. 21-23.

[29] There are obvious difficulties in any such single-equation reduced-form ap-

Table 2

Industrial and Commercial Companies
Δ Total Bank Borrowing 1965Q1-1979Q4
(t values in parenthesis)

Estimation period	Constant	Δ Wage bill t	Δ Wage bill $t-1$	Δ Materials bill t	Δ Stock-building t	Δ Real interest t	D.W.	RHO	$\bar{R}^2$
1965Q1-1972Q4	1.095 (2.6)	0.886 (2.3)	0.308 (0.7)	0.520 (2.2)	0.216 (0.8)	.001 (0.0)	1.54	.404	.259
1973Q1-1979Q4	−4.061 (1.7)	1.444 (1.2)	1.582 (1.4)	2.597 (3.1)	1.483 (1.8)	−0.930 (1.7)	1.89	.024	.454

chosen as the proxy for business working capital loan demand and for household income. A producer's price index for industrial commodities was chosen to proxy for the materials component of working capital needs. Total construction put in place for private residential buildings was entered to explain the real estate component of total bank lending. Finally, an index of consumer sentiment was added in the expectation that it would be positively related both to household demand for houses and consumer durables. Each variable was entered for both the current and previous quarter.

The initial equation to be estimated was as follows:

$$\Delta TL_t = a_0 + a_1 \Delta WB_t + a_2 \Delta WB_{t-1} + a_3 \Delta PPI_t + a_4 \Delta PPI_{t-1} + a_5 HOUSE_t + a_6 HOUSE_{t-1} + a_7 HHSENT_t + a_8 HHSENT_{t-1},$$

where TL = total loans and leases, all commercial banks ($billions SA) (LCLL);
WB = wage and salary disbursement ($billions SA) (GW);
PPI = producer price index; industrial commodities (Δ = percentage change) (1967 = 100 NSA) (PWIC);

proach. Colinearity of the data, particularly among various interest rate series, but also between the wage bill and household disposable income, will prevent precise identification and encourage both type-one and type-two errors. Nevertheless the present intention is modest. If total bank loans can be shown to be systematically related to obvious income, balance sheet, and interest rate variables, they may to that extent be regarded as endogenously determined. To the extent over the longer run the behavior of the monetary stock is largely dominated by movements in bank loans, it follows that the money stock is similarly endogenously determined, in spite of the Federal Reserve's formal ability to determine the high-powered base.

HOUSE = construction put in place; private residential buildings ($ billions SA) (CONNFR);
HHSENT = index of consumer sentiment (1966 = 100 NSA) (*HHSENT*);
Δ = quarterly change;

The results of fitting the above equation are shown in Table 3 (Equation 1). On dropping all insignificant or incorrectly signed variables, a basic equation was selected (Equation 2). Each variable is now significant and correctly signed, although the magnitude of the coefficient on the wage bill seems implausibly large.[30] The equation succeeds in explaining 60 percent of the variation in the change in total bank lending. Several attempts were made to search for interest rate effects, both nominal and real, but the results were again unsatisfactory.[31] As shown in Table 3, none of the interest variables was statistically significant, suggesting the limited responsiveness of total bank lending to changes in the level of interest rates. All credit crunch dummies were again insignificant.

Summary

In conclusion, it appears possible to identify a single equation for bank lending that has a relatively high degree of explanatory power. The implicit assumption of the analysis is that banks set their lending rates and attempt to meet the demand for loans that results. There was no evidence that changes in the degree to which banks ration credit are important. In the absence of credit controls, the monetary authorities' ability to control the expansion of bank credit is primarily through their ability to influence the levels of short-term interest rates. The low interest elasticity of real lending rates, and the failure of nominal rates to be significant and negatively signed, suggests that the authorities' power to control the volume of credit expansion through this means is slight, particular-

[30] Wage *increases* generate business working capital loan demand, but the *level* of the wage bill also serves as collateral for consumer lending.

[31] When the current prime rate was entered, its coefficient was negative but insignificant (Equation 3). The change in the prime rate was then substituted, but its coefficient was again insignificant (Equation 4). The inflation rate, the real interest rate, and the change in the real rate were then entered sequentially (Equations 5-7).

Table 3

Δ Total Bank Loans 1973.1-1981.3
(*t* values in parentheses)

Equation number	Constant	Δ *WB*		Δ *PPI*		*HOUSE*		*HHSENT*		Interest rate	Δ Interest rate	Inflation	Real interest rate	Δ Real interest rate			
		t	*t*−1	*t*	*t*−1	*t*	*t*−1	*t*	*t*−1	*t*	*t*	*t*	*t*	*t*	*D.W.*	*RHO*	$\bar{R}^2$
1	−38.96	2.697	−1.976	.456	.0524	.786	.343	−.277	.616						1.98		.591
	(2.1)	(2.2)	(2.1)	(1.7)	(0.2)	(0.5)	(0.2)	(1.0)	(2.3)								
2	−32.93	2.147		.482		.613			.295						2.17		.556
	(2.4)	(2.6)		(2.3)		(1.4)			(1.8)								
	−34.43	2.042		.492		.651			.331						1.97	−.117	.600
	(2.8)	(2.5)		(2.5)		(1.6)			(2.1)								
3	−25.90	2.135		.496		.781			.207	−.351					1.97	−.063	.570
	(1.4)	(2.6)		(2.4)		(1.6)			(0.9)	(0.6)							
4	−33.69	2.487		.518		.583			.289		−.876				1.96	−.042	.565
	(2.6)	(2.5)		(2.5)		(1.3)			(1.6)		(.0.7)						
5	−33.49	2.018		.516		.687			.300			.103			1.98	− 106	.582
	(2.0)	(2.4)		(1.9)		(1.3)			(1.0)			(0.1)					
6	−31.09	2.155		.443		.654			.269				−.217		1.97	−.104	.583
	(2.0)	(2.5)		(1.9)		(1.6)			(1.5)				(0.4)				
7	−32.66	2.043		.468		.667			.288					−.289	1.98	−.096	.582
	(2.5)	(2.5)		(2.3)		(1.6)			(1.9)					(0.5)			
8																	

ly over the short run, due to the positive expectations effect.[32]

The historical evidence suggests that the ability of the monetary authorities to control the rate of bank credit expansion in the United States is severely limited. The behavior of money wage rates, both as a component of companies' demand for working capital finance and as determinants of disposable personal income, plays a central role in determining private demand for bank credit. The central bank, consistent with its paramount supportive role to the financial system, appears to operate to allow the money stock to accommodate to increases in the demand for bank credit. Whenever money wages are rising rapidly, it will prove very difficult for the Federal Reserve to restrict the rate of monetary growth.

Monetarists are not justified in regarding the money stock as an "exogenous" variable, simply because the cash base is in principle under the control of the monetary authorities. On the basis of the historical record, the money stock varies endogenously, and the single most important determinant appears to be the behavior of money wages. Whenever money wages are rising rapidly, it will prove very difficult for the Federal Reserve to restrict the rate of monetary growth.

The economics profession in general must come round to the view that the supply of money is horizontal at every going short-term interest rate. Since the quantity of money is always demand-determined, there can never be an "excess" supply of nominal money balances. Bank reserves cannot be quantity constrained. Central banks can determine the short-term interest rate at which they will be willing to supply liquidity. But the money stock itself is not a control variable.

[32] However, indirect interest rate effects, working on the magnitude of working capital needs, and any disintermediation effects of sharp rises in the level of interest rates, particularly for real estate loans, are likely to be important and could not be estimated in the above procedure. The failure to find larger and more significant interest rate effects may alternatively be due to the unwillingness of the Federal Reserve to permit wider short-run fluctuations in the level of interest rates over much of the period.

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