Money and Off-Balance-Sheet Liquidity: An Empirical Analysis

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MONEY AND OFF-BALANCE-SHEET LIQUIDITY:  
AN EMPIRICAL ANALYSIS

Abstract

In recent years off-balance-sheet credit facilities have grown dramatically, and now represent the most prevalent contractual framework within which commercial and industrial borrowing from banks occurs. One important role of these facilities is to provide liquidity to bank customers that acts as a substitute for on-balance-sheet liquidity or "money."

This paper provides empirical evidence of the substitutability between on- and off-balance-sheet liquidity. It also discusses the implications of this relationship for interest rate determination and monetary policy. In particular, it is argued that monetary policy should pay more attention to off-balance-sheet liquidity when choosing targets and operating procedures.
I. Introduction

In recent years off-balance-sheet credit facilities provided by banks have been one of the most rapidly growing financial instruments both within the United States and overseas. Loans "under commitment" account for 79 percent of American commercial and industrial loans, 80 percent of construction and land development loans, and 60 percent of farm loans.\(^1\) Continuing credit facilities in the form of credit cards and lines of credit are important sources of funds for consumer loans as well. Investment banks and brokerage houses also offer credit to customers under arrangements somewhat like commercial bank credit facilities.

The increasing role of credit facilities has important implications for the structure of credit markets, the stability and risk exposure of financial institutions, and the operation of monetary policy. Until recently most of the research on credit facilities has concentrated on issues of pricing and contract structure. Recent contributions include Campbell (1978), Thakor, Hong and Greenbaum (1981), Melnik and Plaut (1986), and Ham and Melnik (1988). Yet an important role of private-sector credit facilities that has received less attention is the provision of liquidity, supplementing "ordinary" transactions account balances held by households and firms at banks and other depository institutions. They provide funds on short or no notice that can be used to finance transactions, generally as conveniently as writing checks or using cash.

This paper will explore empirically the interrelationship between on- and off-balance-sheet liquidity. In particular, we will examine "money demand" in the presence of off-balance-sheet liquidity taking the form of unused loan commitments. By analyzing the degree of substitutability between these different forms of liquidity, we attempt to shed more light on the channels through which monetary policy operates.
Off-balance-sheet credit facilities generally have several characteristics in common. They establish maximum credit ceilings, which either may not be exceeded by the customer or may be exceeded only at substantial penalty. They are continuing medium-term or long-term arrangements, often extending over several years. They usually employ multiple-pricing components, including an interest charge, often floating, and facility fees of one sort or another.²

Credit facilities can be seen as providing a number of services to bank customers. They may provide "credit availability insurance," they may provide "option-like" hedging services by protecting customers against disadvantageous changes in the pricing of credit or in customers' credit ratings; they may reduce credit-related transactions costs. Finally, they provide liquidity by entitling the customer to utilize additional funds besides demand deposit balances in order to make transactions.³ In this paper we focus on this last aspect of facilities. Because these various services are provided jointly within the credit facility, it may be impossible to distinguish among them. For example, if credit utilized under a facility is diminished, it may be because the customer's credit needs have declined, because interest rate changes have motivated liability restructuring, or simply because the customer seeks to expand his liquidity by increasing his unused line of credit.

Off-balance-sheet liquidity in the form of unused loan commitments may be regarded as providing bank customers with a stock of liquidity that is potentially a substitute for "money." The notion that off-balance-sheet liquidity might be used as a substitute for on-balance-sheet liquidity ("money") is appealing at both the theoretical and empirical levels. An individual may purchase merchandise using cash, checking account balances, overdraft facilities, credit cards, or personal lines of credit with more or less the same ease, convenience, and transaction costs. Similarly, a firm may purchase goods using cash, checking account balances,
revolving credit facilities or loan commitments, all with negligible differences in terms of convenience and transaction costs. Therefore, for an individual or firm, off-balance-sheet facilities theoretically represent "stocks" of potential transactions-related purchasing power, exactly like money. An individual holding several credit cards, or an unused line of credit, would be expected to hold smaller balances in demand deposits than would a similar individual who did not have these sources of liquidity. Similarly, firms would decrease their demand for money when their holdings of off-balance-sheet liquidity grow. The converse should also be true; holding more funds in transactions accounts should mean lower demand for off-balance-sheet liquidity.⁴

Much of the monetary literature in recent years has focused on how financial deregulation has affected the substitutability between M1 and other on-balance sheet items such as monetary market deposit accounts, passbook savings, and other forms of liquid savings.⁵ We argue that the substitutability of M1 and off-balance-sheet liquidity may be similarly important.

The total quantity of unused credit under off-balance-sheet facilities is in fact about the same order of magnitude as M1 itself. In June 1987 the level of unused commercial and industrial (C + I) commitments at the 110 banks surveyed by the Federal Reserve System represented 51 percent of M1. This figure did not include C + I lines of credit at other institutions nor non-C + I lines.

The monthly percent changes (i.e., changes in the logarithm) of the seasonally-adjusted levels of M1 and of unused commercial and industrial loan commitments (hereafter UC) are illustrated in Figure 1.⁶ Superficial examination suggests M1 and UC tend to change in opposite directions. This is particularly dramatic during the period of the "Carter crunch" in 1980, when a sharp decrease in on-balance-sheet liquidity (M1) occurred simultaneously with a sharp increase in off-balance-sheet liquidity (unused loan commitments). The simple correlation
between contemporaneous changes in M1 and changes in unused commitments for
the period 1976:1 through 1987:6 was -0.27. Indeed, this correlation has been
growing more negative in recent years; for the period for 1979:1 through 1987:6 it
was -0.34. This casual analysis supports the notion that money and loan
commitments may serve as substitute forms of liquidity.

The substitutability between money and off-balance-sheet liquidity has
important implications for the transmission channels of monetary policy. In recent
years attention has refocused on the issue of how monetary changes are transmitted
to the real sector. The traditional view was that money is held primarily due to its
usefulness and efficiency in conducting transactions and that changes in money
aggregates influence real economic activity through the interest rate channel by
affecting the opportunity cost of funds. Such an approach may be traced back at least
to Baumol (1952) and Tobin (1956).

More recently, the monetary literature has attempted to connect off-balance-
sheet credit facilities with monetary policy through the phenomenon of credit
availability and rationing. The credit rationing literature has grown following
As noted by Melnik and Plaut (1986), the most common institutional form for such
rationing is the loan commitment contract. Blinder (1981) and Blinder and Stiglitz
(1983) have theoretically addressed the question of the operation of monetary policy
under credit rationing. They have shown that in a rationing equilibrium, monetary
policy has little if any effect on real activity through interest rate changes, but does
have an effect through its impact on credit availability.

On the empirical side a number of papers have attempted to determine
whether credit quantity variables have real effects. Friedman (1982, 1983) has
argued that total (net) credit is more closely related to real economic activity than
narrower measures of liquidity, as measured by the various monetary aggregates.
However, King (1986) and Bernanke (1986) have found little evidence that bank loans have predictive power for real economic activity or that banks ration loans.\textsuperscript{7} Wojnilower (1985) and Sofianos, Wachtel, and Melnik (1987) have argued that the growth of off-balance-sheet liquidity may explain the weakness of the credit rationing channel. In particular, Sofianos, Wachtel and Melnik empirically analyze the relation of credit utilized under loan commitments with monetary policy and real economic activity. They argue that loan contracts provide bank customers with a kind of insurance against credit rationing, and hence affect monetary policy by eliminating the quantity availability effects for these borrowers. They find evidence that money supply changes affect the volume of loans under commitment.

The existence of an interrelationship between on- and off-balance-sheet liquidity has a number of important implications. First, the traditional view that short-term interest rates are determined by supply and demand for on-balance-sheet monetary aggregates may be incorrect if off-balance-sheet facilities represent a non-negligible alternative source of liquidity. Second, the channels through which monetary policy operates are considerably more complex when both "types" of liquidity coexist. Open-market expansions or contractions of on-balance-sheet liquidity may trigger adjustments in off-balance-sheet liquidity. Interest rates and prices will then have to clear "both" liquidity markets, resulting in equilibria seemingly at odds with money demand analysis. Third, since off-balance-sheet liquidity (in the form of unused loan commitments) is created through private-sector contracting between financial institutions and their customers, the total stock of liquidity (on and off the balance sheet) may be essentially beyond the control of the monetary authorities. An attempt to alter liquidity through open market operations may lead to countervailing adjustments in off-balance-sheet liquidity. The latter may be expanded or contracted by private-sector agents in order to counter the on-balance-sheet effects of monetary policy.\textsuperscript{8}
The plan of the paper is as follows. In Section II we investigate the effects of off-balance-sheet liquidity in the form of unused loan commitments within a conventional money demand equation. In Section III we utilize vector autoregression methods to analyze the interaction of money aggregates and unused loan commitments, and the response of both to external shocks. In Section IV we discuss the implications of our analysis for monetary policy. Finally, in Section V we discuss conclusions.

II. Money Demand in the Presence of Off-Balance-Sheet Liquidity

Traditionally, money demand analysis has dealt with on-balance-sheet liquidity separately from off-balance-sheet liquidity. If however the two forms of liquidity are substitutes or if interest rates depend on total "liquidity demand," then analyzing money demand separately from off-balance-sheet liquidity demand will lead to both an incorrect representation of the interest rate determination process as well as misleading guidelines for monetary policy.

As a first step toward shedding light on the interrelationship between on- and off-balance sheet liquidity, we investigate the effects of including loan commitments in a conventional money demand equation by adapting the error-correction specification approach of Hendry (1980). This specification is employed to take account of the lagged adjustment of private demand for money to changes in macroeconomic variables that determine this demand. More specifically, we posit the following long-run relation between money and its determinants:

$$\log M_{1t} = a_0 + a_1 \log Y_t + a_2 R_t + a_3 \log UC_t + e_t. \quad (1)$$

Here $M1$ is the monetary aggregate, $Y$ is an income scale variable, $R$ is a short-term money market rate, $UC$ is unused loan commitments, $e$ is an error term representing
the extent to which the public's actual money stock diverges from its equilibrium level, and $t$ is a time subscript.

The short-run adjustment of money demand in a given period is assumed to depend on the divergence between its actual and equilibrium level at the beginning of the period, $e_{t-1}$, and on current (and possibly lagged) changes in the explanatory variables:

$$\Delta \log M_{1t} = b_0 - b_1 e_{t-1} + \sum_p \Delta b_{2p} \Delta \log M_{1t-p} + \sum_q \Delta b_{3q} \Delta \log Y_{t-q} + \sum_s \Delta b_{4s} \Delta R_{t-s}$$

$$+ \sum_v \Delta b_{5v} \Delta \log UC_{t-v},$$

where $\Delta$ denotes the first difference operator.

Substituting (1) into (2) gives

$$\Delta \log M_{1t} = b_0 + \sum_p b_{2p} \Delta \log M_{1t-p} + \sum_q b_{3q} \Delta \log Y_{t-q} + \sum_s b_{4s} \Delta \log R_{t-s} + \sum_v b_{5v} \Delta \log UC_{t-v}$$

$$- b_1 \left( \log M_{1t-1} - a_0 - a_1 \log Y_{t-1} - a_2 R_{t-1} - a_3 \log UC_{t-1} \right).$$

(3)

In this equation $a_1$ represents the long-run income elasticity of demand for money, and $a_2$ multiplied by the level of $R$ is the long-run interest elasticity. The stock of money approaches its long-run equilibrium level more quickly, the larger are the coefficients on the lagged level of money ($b_1$) and the smaller are those on the changes in money, income, and the interest rate ($b_{2p}$, $b_{3q}$, and $b_{4s}$, respectively). The coefficient $a_3$ may be interpreted as the long-run substitutability of loan commitment liquidity for on-balance-sheet liquidity (or $M1$).
We estimated equation (3) using monthly data for the period 1976:1-1987:6. M1 as currently defined by the Federal Reserve System is used as the monetary aggregate. Y is measured by nominal personal income, R by the three-month Treasury bill rate, and UC by total unused commercial and industrial loan commitments, as reported by the sample of large U.S. banks in the Monthly Survey of Commercial and Industrial Loan Commitments. Two dummy shift variables are also used to remove outlying observations, one for the "credit crunch" period 1980:3-1980:4, and a second for a short period of unusually large monetary growth, 1986:12.

Representative results are reported in column 1 of Table 1. Observe that changes in income, unused loan commitments, and (lagged) money are all statistically nonsignificant, while the change in the interest rate is significant. However, the lagged levels of these variables, representing the long-run determinants of money demand, are all significant. As expected, changes in current money demand depend positively on income, and negatively on the interest rate and lagged money holdings. Most importantly for our purposes, money demand depends negatively on the level of unused loan commitments (UC). An increase in the level of unused loan commitments leads to a fall in money demand.

While UC is an important explanatory variable for money demand, the converse was not the case. Column (2) in Table 1 reports the results of estimating an equation for the demand for unused off-balance-sheet liquidity, analogous to (1). We observe that neither changes nor levels of M1 seem to affect the demand for unused loan commitment facilities. Interestingly, the sign of the coefficient of the interest rate in the demand for off-balance-sheet liquidity is opposite that for money demand. When the interest rate rises, people demand less money but more off-balance-sheet liquidity. This may be because they are substituting the latter for on-balance-sheet liquidity, the holdings of which drop due to increases in opportunity costs. Similarly,
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(1) (\Delta \log M1_t)</th>
<th>(2) (\Delta \log UC_t)</th>
<th>(3) (\Delta \log M1_t)</th>
</tr>
</thead>
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<tr>
<td>Constant</td>
<td>0.522</td>
<td>0.525</td>
<td>0.456</td>
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<tr>
<td></td>
<td>(4.07)</td>
<td>(1.82)</td>
<td>(3.59)</td>
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<tr>
<td>(\Delta \log M1_t)</td>
<td>0.115</td>
<td>0.090</td>
<td>0.091</td>
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<tr>
<td></td>
<td>(1.38)</td>
<td>(0.48)</td>
<td>(1.12)</td>
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<td>(\Delta \log Y_t)</td>
<td>0.055</td>
<td>-0.155</td>
<td>0.029</td>
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<tr>
<td></td>
<td>(0.53)</td>
<td>(0.66)</td>
<td>(0.28)</td>
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<tr>
<td>(\Delta R_t)</td>
<td>-0.036</td>
<td>0.123</td>
<td>-0.043</td>
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<td></td>
<td>(0.65)</td>
<td>(0.98)</td>
<td>(0.78)</td>
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<td>(\Delta R_{t-1})</td>
<td>-0.139</td>
<td>-0.100</td>
<td>-0.147</td>
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<td></td>
<td>(2.64)</td>
<td>(0.84)</td>
<td>(2.38)</td>
</tr>
<tr>
<td>(\Delta \log UC_{t-1})</td>
<td>0.014</td>
<td>-0.060</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>(0.38)</td>
<td>(0.71)</td>
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<td>(\Delta \log UC_{t+1})</td>
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<td>--</td>
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<td>(1.75)</td>
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<td>(0.29)</td>
<td>(3.90)</td>
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<td>0.069</td>
<td>0.072</td>
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<td></td>
<td>(4.26)</td>
<td>(1.57)</td>
<td>(3.74)</td>
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<tr>
<td>(\log R_{t-1})</td>
<td>-0.142</td>
<td>0.264</td>
<td>-0.144</td>
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<tr>
<td></td>
<td>(4.68)</td>
<td>(3.87)</td>
<td>(4.91)</td>
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<tr>
<td>(\log UC_{t-1})</td>
<td>-0.014</td>
<td>-0.051</td>
<td>-0.008</td>
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<tr>
<td></td>
<td>(1.96)</td>
<td>(4.03)</td>
<td>(1.48)</td>
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</table>

\[ R^2 \] 0.46 0.40 0.48
SEE 0.0045 0.0101 0.0044
DW 2.06 1.99 2.10
Degrees of freedom 126 126 125

Note: t-statistics are given in parentheses below coefficients. Coefficients for dummy variables are not reported.
it may be due to the fact that utilization of credit under these lines decreases, leaving greater unused liquidity. As we have seen, a change in off-balance-sheet liquidity subsequently causes changes in M1.

A major conclusion from Table 1 thus seems to be that changes in interest rates feed into the components of liquidity demand through different channels. A rise (fall) in the interest rate lowers (raises) demand for M1 and raises (lowers) demand for UC. Changes in UC, in turn, have a further effect on M1, by causing M1 to be substituted for UC. The two effects on M1 work in opposite directions (see Figure 2).

Figure 2

Interest Rate (R) → M1

| Utilization of Credit Facilities | Off-Balance Sheet Liquidity (UC) |

Another way of looking at the interrelationship between M1 and UC is to note that when interest rates (or anything else) changes, people may alter their demand for money already knowing that they will subsequently adjust their off-balance-sheet liquidity as well. Supporting evidence is found in column (3) of Table 1, where a money demand equation is shown including a change in the UC term with a one-period lead. While the use of a lead term is problematic, this equation may be interpreted as showing that people adjust money demand assuming that they know one period in advance how they will subsequently alter off-balance-sheet liquidity.
Observe that the UC term with one lead is large (relatively) and significant at 10 percent. The magnitudes and degrees of significance of the other coefficients are about the same as in column (1). While future changes of UC may occur for reasons other than "plans" established in earlier periods, these results are consistent with such foresight and with the notion that people jointly adjust on- and off-balance-sheet liquidity when other variables change.\textsuperscript{11}

III. VAR Analysis

In this section we utilize vector autoregression (VAR) methods to analyze the interaction of money aggregates and off-balance-sheet liquidity in the form of unused loan commitments, and the responses of both to external "shocks."

A VAR is a method of examining the relationship between a set of variables and their past values by imposing a relatively small number of restrictions on the dynamic relationships between the variables in the model. Statistical tests are used to determine whether the past values of a given variable are significant in a particular equation. The estimated equations can then be transformed to obtain impulse response functions that show how the variables respond over time to various shocks, or unpredicted movements, in the variables of the system.\textsuperscript{12}

The VAR we estimated included all the variables that appeared in the money demand equations estimated in the previous section: M1, nominal personal income (Y), the 3-month Treasury bill rate (R), and unused loan commitments (UC). In addition the quantities of the monetary assets believed to be close substitutes for M1 were included. These were net M2 (or NM2), defined as M2-M1, and net M3 (or NM3), defined as M3-M2. The inclusion of these latter two aggregates, in combination with M1, UC, and the interest rate, enables us to capture the combined effects of portfolio adjustments in the demand for M1, including changes in the relevant interest rate spreads, changes in preferences for term-to-maturity and risk,
as well as any other factors that cause individuals to reallocate their portfolios across various assets.\textsuperscript{13} This set of monetary components permits the analysis of portfolio substitutions among near-money assets that have occurred in recent years.

The sample period for the VAR analysis was 1976:1 to 1987:6. All variables are included as the first differences of logs. In addition, a trend term and several intercept dummies were included for periods of unusual events or breaks in the data series: 1980:3-1980:4, 1982:12, 1983:1, and 1986:12. The Chi-square test suggested by Sims (1980), with a correction for the number of explanatory variables in each equation, was used to determine the appropriate lag length for the VAR. Tests revealed that a lag length of 2 months was statistically indistinguishable (at 5 percent) from lag lengths of 4 and 6.

The top panel of Table 2 shows summary statistics from the estimated equations over the sample period. The marginal significance levels indicate which variables are important in predicting ("Granger-causing") future values of the various components.\textsuperscript{14}

The results in Table 2 are largely consistent with those of Sofianos, Wachtel and Melnik (1987), who examined the impact of monetary policy on loan behavior. They found that loans under commitment "Granger-caused" M1 and that the interest rate "Granger-caused" M1.\textsuperscript{15} Since an increase (decrease) in loans made under commitment is the same as a decrease (increase) in unused commitments, their results are consistent with the relations in Figure 2 for R→M1 and UC→M1. Indeed when substituting bank reserves for M1, they also found the interest rate "Granger-caused" loans under commitment (and hence UC), completing the causality pattern in Figure 2.

Interestingly, the residuals from our VAR equations for UC and R were positively correlated, while those for M1 and R were negatively correlated (Table 2, bottom panel). This suggests that in the event of shocks to interest rates, M1 and UC
### Table 2

<table>
<thead>
<tr>
<th>Equation for:</th>
<th>Y</th>
<th>R</th>
<th>NM3</th>
<th>NM2</th>
<th>M1</th>
<th>UC</th>
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<tr>
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<td>.01</td>
<td>.35</td>
<td>.86</td>
<td>.31</td>
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<tr>
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<td>.07</td>
<td>.06</td>
<td>.02</td>
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<td>.90</td>
<td>.00</td>
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<td>.00</td>
<td>.20</td>
<td>.04</td>
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<td>.55</td>
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<td>.61</td>
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<table>
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<th>Equation for:</th>
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<td>NM2</td>
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<tr>
<td>M1</td>
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might adjust in opposite directions. Such a pattern is in fact clearly evident in the impulse response functions that are described below.

The impulse response functions in Figures 3 through 7 show what happens to the levels of individual variables in the system over time in response to unanticipated shocks ("innovations") from other variables, taking into account the full dynamic interactions estimated in the VAR. These responses are plotted in terms of the cumulative percent changes of the responding variable caused by a one-standard deviation change in the "shock" variable. The results were based on the following VAR ordering of the model's variables: Y, R, NM3, NM2, M1, and UC. Since our interest is in the substitutions between different forms of liquidity, we focus on the effects of various shocks upon M1 and UC.

In general, we find that the responses of on- and off-balance-sheet liquidity to "shocks" are invariably in opposite directions, reinforcing the view that they represent substitute forms of liquidity. Figure 3 shows the cumulative responses of M1 and UC to an interest rate shock (increase). As can be seen, not only do the two variables move in opposite directions, but the changes are almost mirror images, with long-run changes of about equal dimensions. An unpredicted increase in R causes M1 to fall and UC to rise, leaving the "net change" in liquidity (taking the sum of both components) to be small or negligible.

While other "shocks" to the system do not produce the same degree of near-perfect symmetry produced by shocks to R, the essential substitutability of M1 and UC remains apparent. In Figure 4 the cumulative effect of a shock (increase) to nominal personal income Y is shown. M1 demand rises briefly, but then falls. UC demand rises monotonically. The "net" impact on aggregate liquidity is positive, even though on-balance-sheet liquidity declines.

In Figure 5, a shock to M1 is shown, which might be considered to represent a one-time monetary "surprise." In this case, both M1 and UC rise initially. However,
FIGURE 3. CUMULATIVE RESPONSE TO TBILL INNOVATION

PERCENT

-4 -2 0 2 4

x10^-2 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

M1
UC
FIGURE 5. CUMULATIVE RESPONSE TO M1 INNOVATION
FIGURE 6  CUMULATIVE RESPONSE TO UNUSED LOAN INNOVATION

PERCENT

1.8

1.4

1.0

0.6

0.2

-2

x10^-2

1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24

MI

UC
FIGURE 7  CUMULATIVE RESPONSE OF TBILL RATE
after its initial rise, on-balance-sheet liquidity declines, almost mirroring the continued increase in UC. From two months after the shock, M1 and UC move in opposite and near-symmetric paths. This is in sharp contrast to a UC shock as shown in Figure 6. A shock to UC leads to continued expansion in UC, but has only a small (but negative) impact on M1.

Not only are M1 and UC countervailing substitutes when being "caused," but also when they are "causing." In Figure 7, the effects of shocks to M1 and UC, as well as of both shocks combined, upon R are shown. The two effects are in opposite directions, although the M1 shock is somewhat "stronger."

The major conclusion from this analysis is that off-balance-sheet liquidity tends to be adjusted in the opposite direction from on-balance-sheet liquidity in response to virtually all disturbances. Hence the net impact of such disturbances on total liquidity is softened or cushioned by the substitution. In the next section the monetary implications of these phenomena will be discussed.

V. The Implications for Monetary Policy

Under current regulations, off-balance-sheet liquidity in the form of revolving credit facilities, lines of credit, and loan commitments represents a largely unregulated source of liquidity. These facilities are generally exempt from regulatory costs imposed on banks through reserve requirements, capital ratios, etc. Banks and their customers may fully expand or contract the quantity of this form of liquidity on the basis of their own needs and costs.

The existence of off-balance sheet liquidity may influence the effectiveness of traditional monetary policy. When monetary policy produces expansion or contraction of on-balance-sheet liquidity (or "money"), private sector agents may choose to offset this change to some extent through adjustments in their off-balance-sheet liquidity "holdings." They may do so through altering the extent to which
credit is utilized under existing lines of credit, raising or lowering the unused portion of the commitment. In addition, they may alter their off-balance-sheet liquidity through recontracting, purchasing new lines, or cancelling old lines.\(^{19}\)

Thus, for example, an open-market operation involving the sale (purchase) of securities by the monetary authorities would initially contract (expand) liquidity and increase (decrease) the supply of bonds. If the private sector subsequently increased (decreased) its off-balance-sheet liquidity through reducing (increasing) credit utilized under commitments, then the impact of the open-market operation on interest rates and the real sector is unclear. (See Figure 8.) If interest rates are determined by the aggregate supply and demand for "credit," then the open-market operation and the off-balance-sheet adjustment response work in opposing directions, resulting in a small (or even ambiguous) net shift in credit demand. Similarly, the net stock of liquidity would decline by less than the change in "money," and this might cushion the impact of open market operations on interest rates and real activity. In a sense monetary policy would become less effective.\(^{20}\)

**Figure 8**

\[
\begin{align*}
\text{Open-Market Operation} & \rightarrow \text{M1 Supply} \rightarrow \text{Interest Rate} \rightarrow \text{Prices, Real Activity} \\
\downarrow & \\
\text{Off-Balance-Sheet Liquidity} & \rightarrow \text{Money Demand}
\end{align*}
\]
Another aspect of the role of off-balance-sheet facilities in monetary policy relates to the proper aggregate to be targeted. Traditionally, M1 was considered to be the appropriate aggregate for money targeting, in the sense that it measured the volume of the medium of transactions payment and was thought to be the aggregate most closely correlated with prices and real activity. In recent years M1 has been increasingly abandoned, both by researchers and by policy-makers. Monetarists today often speak of M2 or some broader monetary aggregate as their recommended target. The Federal Reserve System currently focuses more on M2 and M3 (to the extent that it targets any monetary aggregate) rather than M1.

The abandonment of M1 seems to have been motivated by the fact that M1 velocity has shifted excessively in recent years. Over the same period, quasi-money aggregates have expanded rapidly and the M1-based money-demand equations have seemed to lose much of their predictive powers and some of their econometric fit.\textsuperscript{21} However, off-balance-sheet liquidity also grew rapidly over this period. Financial innovation related to these facilities probably occurred as quickly as it did for the non-transactions account components of M2 and M3. It remains for future empirical research to determine whether a "liquidity" measurement, consisting of M1 plus off-balance-sheet unused facilities, performs better than M2 or M3 in terms of explaining market equilibria and as a guideline or target for monetary policy. In any case, M2 and M3 may reflect substitution away from M1, but so again may off-balance-sheet facilities.

Finally there seems to have occurred in recent decades a general increase in the volatility of interest rates. Certainly the 1970's and 1980's have been "noisier" than the 1950's and 1960's. Some have interpreted this as a symptom of a general loss in monetary control by central banks. It may be that the "noise" stems from the rapid growth in off-balance-sheet liquidity, reducing the correlation between M1 and total liquidity. We know of no evidence that monetary authorities have looked at
unused commitments when formulating policy or that they have targeted total liquidity or even considered it as a relevant factor. Our analysis suggests that such an experiment should be considered.

V. Conclusions and Summary

The debates over monetary policy and monetary targeting have been largely restricted to forms of liquidity appearing on the balance sheets of financial institutions. Much of the debate has been over which liabilities of these institutions should be properly counted as "money," and hence which are thought to represent the appropriate target for monetary policy.

Interestingly, little attention has been paid to the monetary importance of contingent liabilities of these institutions in the form of off-balance-sheet credit facilities. These facilities provide a medium of exchange capacity and represent a liquidity substitute for on-balance-sheet "money."

We have presented empirical evidence consistent with this view. Unused commitments appear to be a significant argument in money demand functions. Firms and individuals appear to jointly determine their demand for on-balance-sheet and off-balance-sheet liquidity, where one may be substituted for the other. The fundamental substitutability of the two forms of liquidity is apparent in their responses to various economic shocks. Invariably "money" and off-balance-sheet liquidity adjust in opposite directions.

This has a number of important implications for interest rate determination and monetary policy. To the extent that interest rate adjustment ultimately clears a "liquidity" market, the substitutability of on- and off-balance sheet aggregates weakens the relationship between money, interest rates, and other variables of concern to policymakers.
If this view is correct, monetary authorities should be targeting, or at least watching, total liquidity, including unused off-balance-sheet credit facilities. Short-term discretionary control of this aggregate may prove quite difficult, however, given the tendency of off-balance-sheet liquidity to countervail changes in "money," including those generated by monetary "surprises" or unanticipated shocks in monetary policy.

Finally, it may be desirable to address the issue of regulation of off-balance-sheet liquidity. Similar debates for on-balance-sheet money and bank liabilities often involve tradeoffs between macro and micro considerations. The former include arguments for regulation to improve monetary control and prevent macroeconomic instability. Micro considerations might dictate opposition to more regulation in order to achieve efficiency in banking operations and credit allocation. Off-balance-sheet liquidity or contingent liabilities for financial institutions have been much less regulated than on-balance-sheet activities. Any changes in this state must be weighed in light of the same sorts of micro and macro considerations.
Endnotes


2. Facility fees are sometimes specified as a fixed amount, sometimes assessed on the total credit commitment, and other times assessed on unutilized funds.

3. Technically when funds are drawn under a credit line, they are credited to the customer’s transactions account and are then used to complete transactions.

4. Of course, firm and individual decisions regarding holdings of on- and off-balance-sheet liquidity are not made independently. Moreover, they are not necessarily made simultaneously, since purchasing off-balance-sheet facilities involves recontracting. (Typically, one alters his checking-account balance more often than he does the number of his credit cards.) Hence adjustments in on-balance-sheet liquidity would be expected to occur more often, and faster, if taken in aggregate.


6. The loan commitment data were obtained from the Monthly Survey of Commercial and Industrial Loan Commitments, Federal Reserve Board, Statistical Release G-21. While this survey dates from 1973:7, early breaks in the series, particularly 1975, led us to use data only from 1976:1 on. This survey was discontinued after June 1987. The banks in the survey accounted for about $184 billion out of a total of about $400 billion of C + I loans made under commitment, as of the first half of 1987. At the same time these banks provided about $380 billion of unused lines.

7. The evidence provided by Bernanke is actually mixed. Using vector autoregression (VAR) techniques he finds no support for the existence of credit rationing. However, using a mixed VAR-structural approach, he finds evidence that credit flows may influence real activity as strongly as monetary aggregates.

8. See Glick and Plaut (1988), a theoretical companion paper. There it is argued that monetary authorities lose control of interest rates and real variables due to such countervailing adjustment.

9. An advantage of the Hendry specification is that it does not require the long sample period needed for the estimation of explicit distributed lags, and implies fewer restrictions on the response of money to its determinants than the partial adjustment model. It also allows the short run impacts of changes in macroeconomic variables to differ from their long run effects. For an application of this specification see Motley (1988).

10. This may reflect the fact that recontracting to alter UC occurs infrequently.
11. The results in this section are illustrative. A more refined technique should try to estimate simultaneously the demand for money and off-balance-sheet liquidity.


14. According to convention, a significance level of less than 5 to 10 percent suggests that past values of that variable do have an impact on the dependent variable.

15. They examine the behavior of loan utilization under loan contracts, whereas we concentrate on unused commitments. Data inconsistency aside, the two series should add to total commitments. It should be noted that their analysis is in terms of levels, not changes, and employs a longer lag structure.

16. The ordering imposed upon the variables is a way of transforming the residuals from the VAR so that they can be interpreted as disturbances ("innovations") to specific variables in the system. This transformation is necessary because of the correlations among the residuals to the VAR. By placing income first we implicitly assume that the entire contemporaneous correlation between unpredicted movements in income and other variables in the system is due to shocks to income. In other words, it is assumed that a shock to any of the other variables has no contemporaneous impact on income. By placing R second in the ordering, it is assumed that the contemporaneous correlation between R and the remaining variables in the system (other than income) is due to shocks in the interest rate, etc. The ordering chosen is equivalent to that imposed in studies of the money demand function whereby contemporaneous shocks to income and the interest rate are allowed to have an impact on money, but money is not allowed to have an impact on the others. In general, our results are not highly sensitive to changes in ordering.

17. In the combined case, the system is shocked by a one-standard deviation change in M1 growth together with an appropriately scaled change in UC growth, calculated as a one-standard deviation change in M1 growth multiplied by the ratio of the average levels of M1 and UC over the sample period. This method of scaling the magnitude of the UC shock implies that the absolute change in the levels of M1 and UC are equal.

18. New capital requirements for off-balance-sheet items are currently under consideration in the United States and several other countries.

19. Because contracting for facilities occurs infrequently, adjustments in off-balance-sheet liquidity may occur slowly. Hence the monetary implications of off-balance-sheet liquidity are likely to be different in the long and short run. This indeed is supported by the findings in the above empirical section, where lagged unused commitment levels and anticipated future adjustments therein seem to affect money demand.


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