BOARD OF GOVERNORS
OF THE
FEDERAL RESERVE SYSTEM

Office Correspondence

Date August 15, 1991

To Federal Open Market Committee

Subject: M2 Studies

From Donald Kohn

Attached are two memos reporting on work undertaken by Board staff over the last few weeks in response to the renewed weakness in M2. The memo by Bill Whitesell summarizes a wide variety of exercises initiated to enhance our understanding of the sources and consequences of recent M2 behavior. One set of these exercises looked at the willingness of depositories to supply M2 deposits and the effect of changes in that willingness on the terms on which such deposits are offered. Another set looked at possible shifts in the demand by households and other M2 holders owing to changes in relative yields not captured by our standard equations or to movements in wealth or net worth that deviate from recent income trends. Staff also examined changes in the composition of M2 for clues as to its recent behavior or its possible effects, and looked at alternative measures of household asset holdings.

The second memo by Messrs. Hess, Porter, and Reinhart analyzes possible consequences of the weakness in M2 in a standard IS/LM framework. It also reports the results of tests of lead-lag relationships of various measures of money and income, including the role of money in a larger system of reduced form equations.

Both memos are summarized in their first few pages.

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Subject: The Weakness in M2

From Division of Monetary Affairs[1]

I. INTRODUCTION AND SUMMARY

This memo reviews a number of recent Board staff investigations that address reasons for the recent declines and longer pattern of weakness in M2, and their implications for the economy. Some of the work is still ongoing, and the results found to date may need to be revised as additional pieces of the puzzle fall into place.

Some of the recent shortfall in M2 relative to expectations is ascribable to downward revisions already incorporated into estimates of economic growth. But much of it, and the longer-term weakness in M2, appears to be the product of adjustments by M2 holders and issuers in the size and composition of their balance sheets. Some portion of the developments in M2 remain unexplained. While the recent behavior of M2 may be predominantly a money demand shift, given the severity of its weakness, especially if it were to continue, one cannot rule out the possibility that it may be foreshadowing a further shortfall in economic activity.

This review is divided into three sections, which are summarized below.

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1. Drafted principally by William Whitesell.

The Behavior of Depositories

A part of M2 appears to behave like a managed liability determined by depository behavior, rather than by the public's demand for money. Depositories with inadequate capitalization and weak loan growth have the slowest recent growth of core deposits; brokered deposits fell substantially in the second quarter when bank credit weakened. Less enthusiastic deposit-seeking by banks likely reflects both weakness in the demand for loans and tightness in bank credit availability. Not only current declines in loans, but expectations of sluggish expansion ahead may affect appetites for retail deposits.

Banks liquid deposit and short-term time deposit rates have not been reduced unduly, but rates on their longer-term retail time deposits have. In addition, banks have cut back on deposit advertising considerably. Larger banks have substantially increased deposit-related fees and charges, and an increasing number of depositories make "reserve adjustments" or otherwise compute interest only on a portion of deposit balances.

Banks may also be increasing the promotion of investment services to depositors to obtain immediate commission income, as an alternative to booking deposits and assets at what may be lower risk-adjusted spreads perceived by bankers these days. Changes in the aggressiveness with which banks offer deposit alternatives likely

affects deposit growth with some lag, but the cumulative effects of such behavior may now be showing through in the aggregates.

The Behavior of Households

Some weakness in M2 might be expected in a recession, as households draw down balances to maintain consumption relative to weak income. The effect of this behavior on M2 may have been intensified in this recession, because of the declines in the perceived value of the other components of wealth. In addition, the usual pattern of strong M2 growth early in a recovery has not occurred.

The recent weakness in M2 reflects in part a shift of household portfolios out of nontransaction balances. The balances appear to have been reinvested in part in capital markets, as evidenced by flows into mutual funds and a recent pickup in noncompetitive tenders. They may also have been used to pay down household debt, given the high spreads of loan rates over deposit rates. However, the timing and magnitude of the identifiable shifts into capital market instruments do not seem to be able to account for much of the weakness in M2. Moreover, adding estimated household holdings of government securities and other financial assets to M2 does not create a financial aggregate that seems to behave in recent quarters appreciably more in line with its history than M2. With regard to deleveraging, available models of credit growth do not indicate a persistent unexplained shortfall relative to spending.

Portfolio reallocations among pure saving instruments do not necessarily portend significant adjustments in economic activity. In this case, shifts to longer-term instruments may signal that long rates are too high to sustain substantial investment activity, including durables spending by households, though the yield curve attained its upward slope primarily as a result of the expected pickup in the economy. The shifts could also have important consequences for economic activity if they were symptomatic of a disruption of the intermediation process. Weak deposit growth is unlikely to be driving weak loan growth, however, given the buildup of securities in bank portfolios and the restoration of confidence in depositories this year, as indicated by narrowing risk spreads and rising relative stock prices.

To some extent, households may be sacrificing liquidity to reach for yield. Although M1 has grown rapidly in 1991, it also weakened in July. OCDs, savings deposits and MMDAs have decelerated since June, although model forecasts predicted an acceleration, and MMMFs and short-maturity time deposits have run off sharply. The behavior of household liquidity could imply weaker economic activity to the extent that it signaled scaled down intentions to spend.

The Composition of M2

As noted in the accompanying memorandum, in updated Granger-causality tests, M1 does not perform well in predicting future income

and output. M2 and the non-M1 portion of M2, though, are significant predictors of income and output, even in the presence of interest rate and credit variables.

This memorandum discusses one previous episode, which occurred subsequent to the lifting of regulation Q ceilings, during which M1 accelerated, while M2 decelerated. In that case, M2 seemed to better predict a near-term slowing in GNP.

Other investigations were undertaken of personal and nonpersonal deposits, household M2, corporate money market accounts, and regional patterns of time deposit growth. None of the special characteristics of these series provided particular insights into the causes of the M2 shortfall.

II. DEPOSITORY BEHAVIOR

M2--In Part, A Managed Liability

There is some evidence that at least a part of the recent weakness in M2 reflects shifts in the supply of deposits by banks rather than changes in the demand for deposits by the public.

A study using call report data divided banks into two categories: those with positive growth of loans and those with negative growth during the year ending in March 1991. The recent (June 3 to August 5, 1991) growth rates of core deposits of the institutions with positive loan growth were substantially higher than for the institutions whose outstanding loans declined (1.06 versus 0.68 percent). The difference in deposit growth is remarkable, particularly since offsetting movements of bank security holdings and large time deposits might have been expected to dilute the result. As Table 1 indicates, deposit growth also appeared to be faster at better capitalized banks.

Brokered deposits at banks, clearly a managed M2 liability, showed continued growth through March of 1991, but then apparently fell substantially at about 400 early-reporting (and generally larger) banks by June of this year.

Table 1

Percent Core Deposit Growth at Weekly Reporting Institutions Classified by Capital Ratio and Loan Growth [1,2]

June 3 - August 5

Equity Capital/Assets	(1) Negative Loan Growth	(2) Positive Loan Growth	(3) ALL
(1) ≤ 6%	.33	.84	.59
(2) 6 – 8%	.74	1.02	.94
(3) ≥ 8%	.82	1.13	1.05
(4) ALL	.68	1.06	.95

1. Core deposits defined as OCDs + savings + MMDAs + small time; sample includes nearly 6000 banks that report weekly deposit data.
2. Equity capital, loans and assets taken from the March Call Reports of 1991 and 1990.

Deposit Rates[2]

Deposit interest rates are typically viewed as the key variable used by banks and thrifts to control flows of deposits. Dynamic simulations since the beginning of 1991 using staff deposit rate models generally predict lower deposit rates than have actually prevailed, however, indicating slower-than-expected adjustments to recent reductions in market rates. By July, the underprediction was 7 basis points for OCDs, 37 basis points for MMDAs, and 22 basis points for six-month small time deposits. Developments with respect to these rates therefore do not help to explain the recent weakness in M2.

One possible reason for the sluggish downward adjustment of shorter-maturity deposit rates may be that rates currently are at historically low levels. Banks may fear that further reductions could induce major shifts in the behavior of even those depositors who normally are passive money managers. Pressures on bank profits may thus have led banks to cut deposit-taking costs by measures that have less announcement effect on depositors than further reductions in posted deposit rates.

However, low longer-maturity CD rates may be damping demands for M2. Chart 1 compares the behavior of six-month small time deposit rates with the three-month Treasury bill rate, which are the maturities

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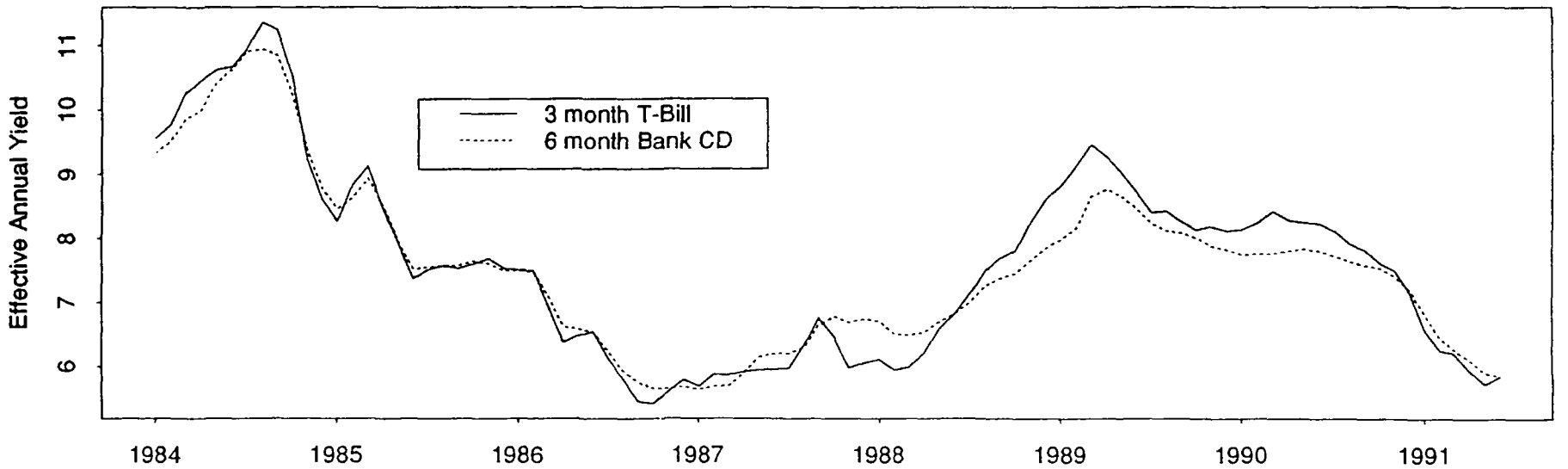
2. Results of a Senior Financial Officer Survey regarding deposit rates and other deposit supply issues will be transmitted under separate cover, as the responses were not available in time for this memo.

used in computing opportunity costs in the staff's money demand model. The chart indicates that usually the bank CD rate about equals the bill rate, while the thrift rate trades at a premium, and that these relationships have not changed substantially since late 1990. Chart 2 compares the behavior of rates on the two-year Treasury note and a similar maturity CD. While the size of the gap between Treasury and CD rates is not unusually large, it has developed in an unusual way. Banks have reduced time deposit rates in 1991 while Treasury rates have been roughly unchanged on balance, in contrast to previous periods when market rates were about flat. Given the steepness of the yield curve, depositories thus appear less willing to compete for longer-maturity time deposits. Use of an alternative small time deposit demand model that includes the longer-maturity CD-Treasury spread virtually eliminates the overprediction error in the growth rates of this M2 component during 1991.

Deposit Fees

Information on bank service charges was extracted from the call reports of March 1989, 1990, and 1991. The aggregate ratio of such service charges to liquid deposits increased from 1.19 percent in 1989 to 1.29 percent in 1990 and 1.35 percent in 1991. On average, therefore, service charges represent a small cost to depositors, and did not increase substantially in the year ending March, 1991 (a year in which the measured own rate on M2 fell by 73 basis points).

3 month Treasury Bill and 6 month CD Rates



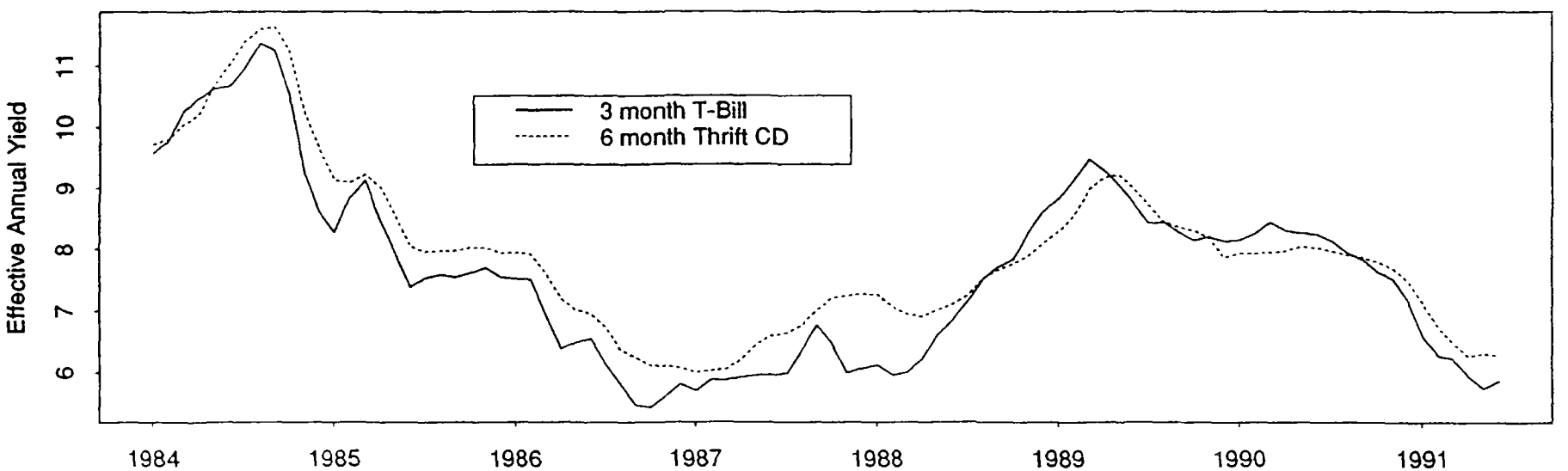


Chart 1

2 year Treasury Note and CD Rates

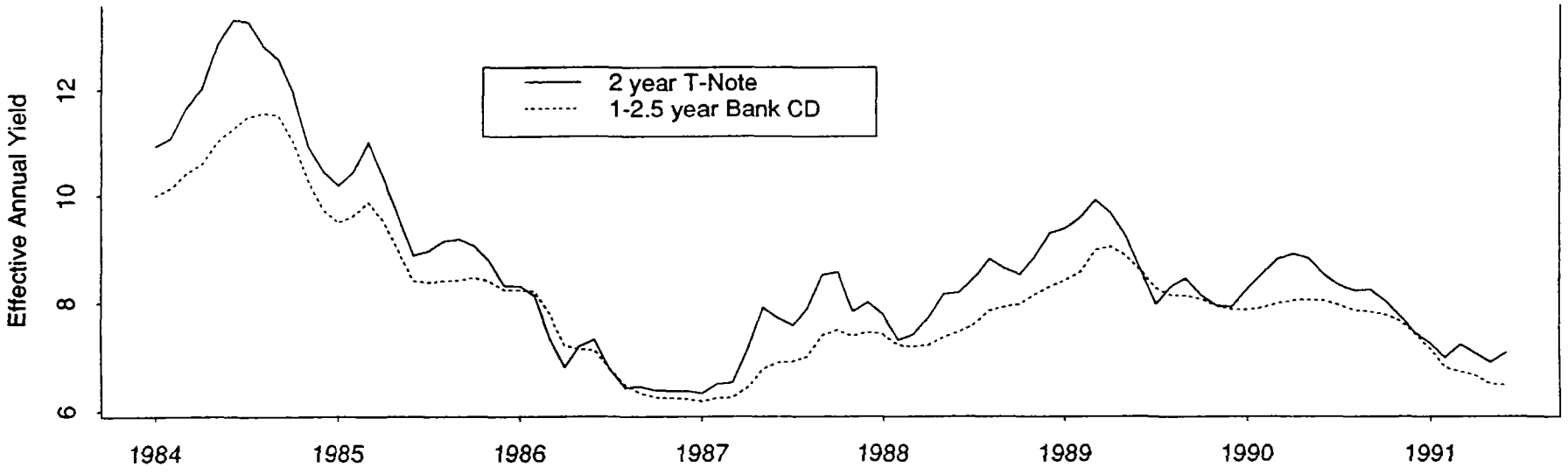
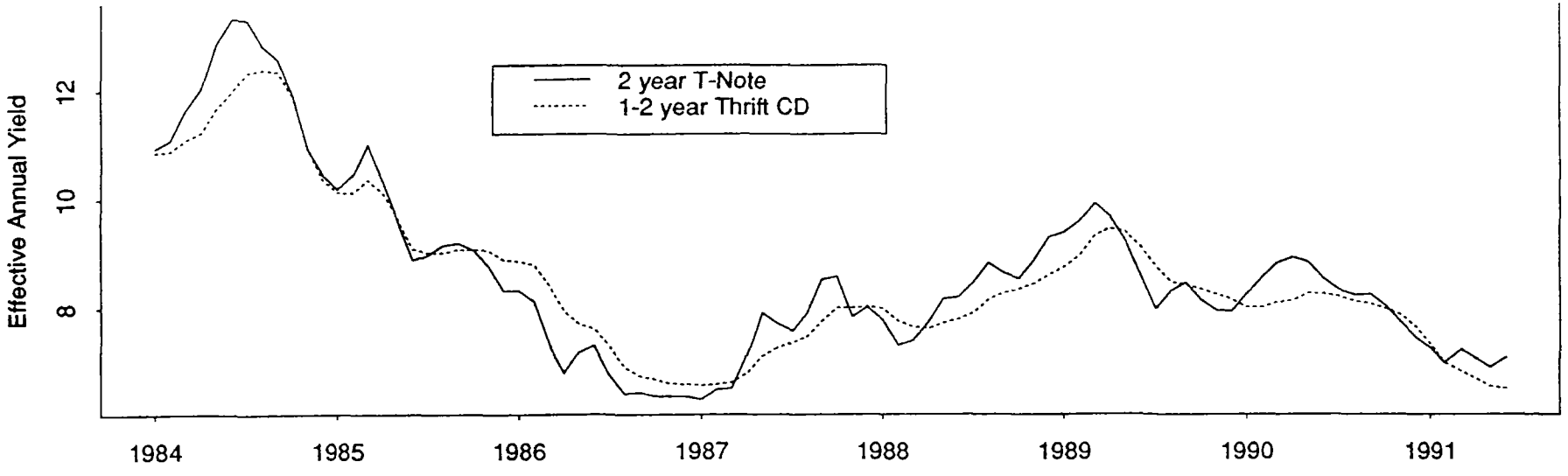


Chart 2



However, closer examination of the data reveals a different pattern of behavior among large banks. For banks with assets of $300 million to $10 billion, service fees were 0.80 percent of liquid deposits in 1989, and increased by 2.5 basis points in 1990 and 9 basis points in 1990. For the largest banks (the 40 or so with assets over $10 billion), fees were 1.22 percent in 1989, then fell by 10 basis points in 1990 and increased by 41 basis points in 1991. Increases in fees may thus be significant in explaining slowing deposit growth at these larger institutions.

Advertising Expenditures

Board staff recently conducted a survey of newspapers in nine metropolitan areas concerning deposit promotion by banks and thrifts. This survey indicated a major reduction in advertising by depository institutions so far in 1991. With only one exception, the papers reported declines ranging from 15 percent to 40 percent. A similar survey undertaken last year had also indicated general declines in bank and thrift advertising, but of smaller magnitudes. A key reason given for the recent accelerating declines is the reduction in the number of competing depository institutions in the surveyed metropolitan areas, which has been caused by mergers and regulatory takeovers.

A Survey of Bank Brokerage Services

A recent Board staff survey of nine money center banks indicated that five offered discount or full brokerage services to their

customers. Many of the banks provided such services directly out of their branch offices. A key feature in marketing brokerage services has been the ease of transfer of funds between bank deposits and longer-term investments. To the extent that such activities have reduced the transaction costs for depositors, the elasticity of deposits with respect to yields on competing investments outside of M2 may well have increased. General information on the degree of increased promotion of brokerage services through banks is unavailable. However, one very large bank reported that it is increasing the promotion of mutual fund sales through its offices, and is even encouraging customers to purchase such investments rather than roll over its own maturing CDs.

Reserve Adjustment and OCD Rates

Based on data from the FR2042 survey, an increasing number of banks appear to be adjusting OCD balances downward to offset the effects of reserve requirements before calculating interest payments on deposits. Because banks currently do not report an effective rate applicable to the total deposit balance, our measure of the rate on OCDs may be overstated by up to about 12 basis points. The effect of this practice on the model forecast of M2 as a whole is estimated to be small, however, reducing the growth rate by only 5 to 10 basis points per quarter (at an annual rate).

III. HOUSEHOLD BEHAVIOR

Wealth Effects and Permanent Income

Dynamic simulations of the staff's standard money demand model overpredicted the growth of M2 by an average of 2.6 percentage points (at an annual rate) in the five quarters ending in 1991QII. The cumulative shortfall in M2 over that period amounts to about $112 billion. An alternative model, which differed from the standard model by the addition of the growth rate of net wealth excluding human capital, was estimated over the same period as the standard model (1964QI to 1988-QIV). Using the same simulation period as the standard model, the model with the wealth variable had a 20 percent smaller error, amounting to a difference of about $22 billion, over the five quarters ending in 1991QII.

The decline in wealth may interact with the demand for money balances in a number of ways. For one, households may need to draw on assets to maintain consumption in a recession. This recession has been accompanied by an unusually large decline in property values, which could imply that many households have had to draw heavily on M2 assets in particular to maintain consumption, rather than rely on home equity borrowing, for example.

Wealth and total assets have at times been used to explain household portfolio effects on money demand. For instance, anecdotal reports of heavy partial mortgage prepayment activity this Spring could

be interpreted as efforts by households to rebalance portfolios following declines in the equity values of their homes. It is more likely, however, that the loss of property values, particularly if expected to continue, would lead to downward adjustments in the desired real property portfolio share, which would have ambiguous implications for further asset adjustments. If households are investing more equity in real property, the reason is unlikely to be rebalancing after a wealth shock, but rather a response to the recent decline in CD rates well below mortgage interest rates. A double sticker-shock may be at work: Households discover that new CDs pay far less than rates they enjoyed on maturing CDs, at a time when they may also be experiencing the true cost of mortgage finance following concessionary introductory periods of adjustable rate (ARM) financing.

Household Balance Sheets and Portfolio Shifts

Overleveraging Effects

One possible explanation for the weakness in M2 would be a shift away from the use of debt to finance spending, replaced by drawdowns of liquid assets or more limited accumulation of such assets relative to income. Persistent high levels of interest rates on consumer loans and mortgages, especially relative to returns on deposits, might trigger such desires to shrink both sides of balance sheets. If this were in process, models relating credit to spending should overpredict borrowing, just as models relating M2 to spending overpredict.

A staff mortgage financing model overpredicted by nearly $40 billion in 1990QIV. Partial prepayment activity could conceivably contribute to such a result. However, the model appeared to be more on target in 1991QI (the most recent available data). Revolving credit also declined in December and January, and June consumer credit was unexpectedly weak as well. However, investigations using the staff's consumer credit model yielded ambiguous results. In the model, the lagged stock of consumer credit damps the current growth of credit, but this might reflect either desires to deleverage or regular repayment activity. When the model was re-estimated with an experimental repayment series, the overleveraging effect appeared to be reversed. Thus, results so far do not support a hypothesis of unusually weak credit growth and a trend toward household deleveraging.

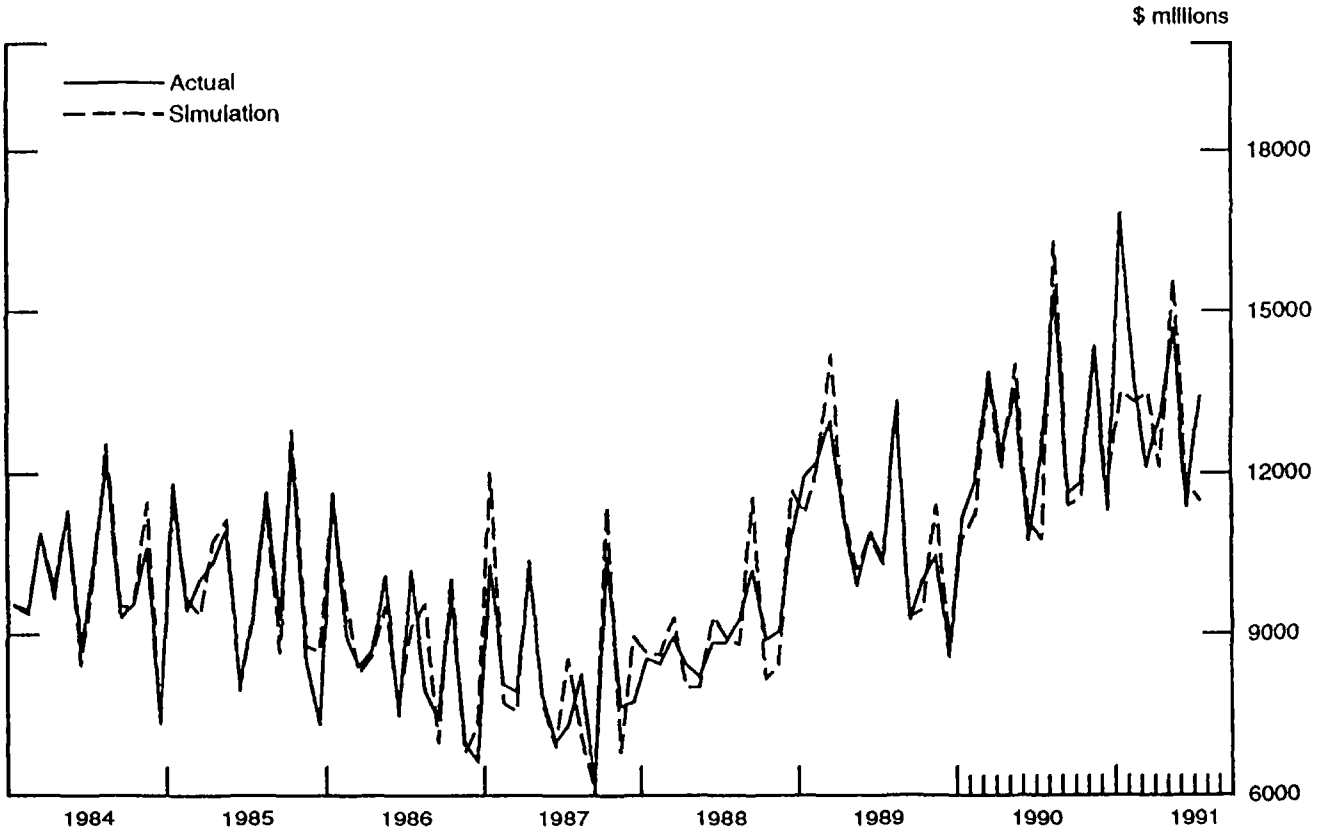
Shifts to Securities Markets

On the asset side of their balance sheets, households might be shifting from M2 to non-M2 assets. Noncompetitive tenders at Treasury auctions and flows into bond and equity funds have often been used as indicators of net household investment in securities markets. As shown in Charts 3 and 4, staff models that explain gross noncompetitive tenders for bills and for the aggregate of bills and notes have generally underpredicted since early 1990, a period during which the money demand

Chart 3

Gross Noncompetitive Tenders for Treasury Bills

January 1984 to July 1991



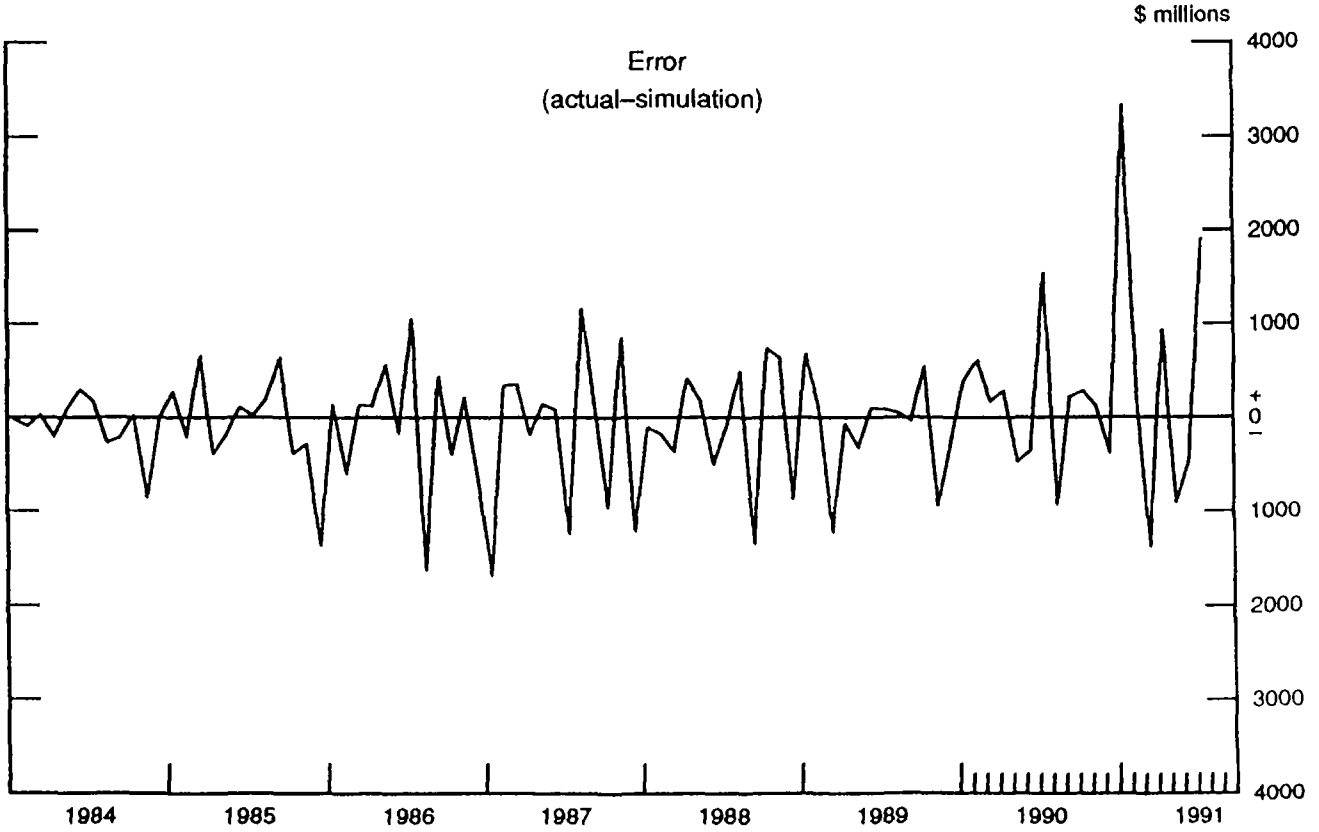
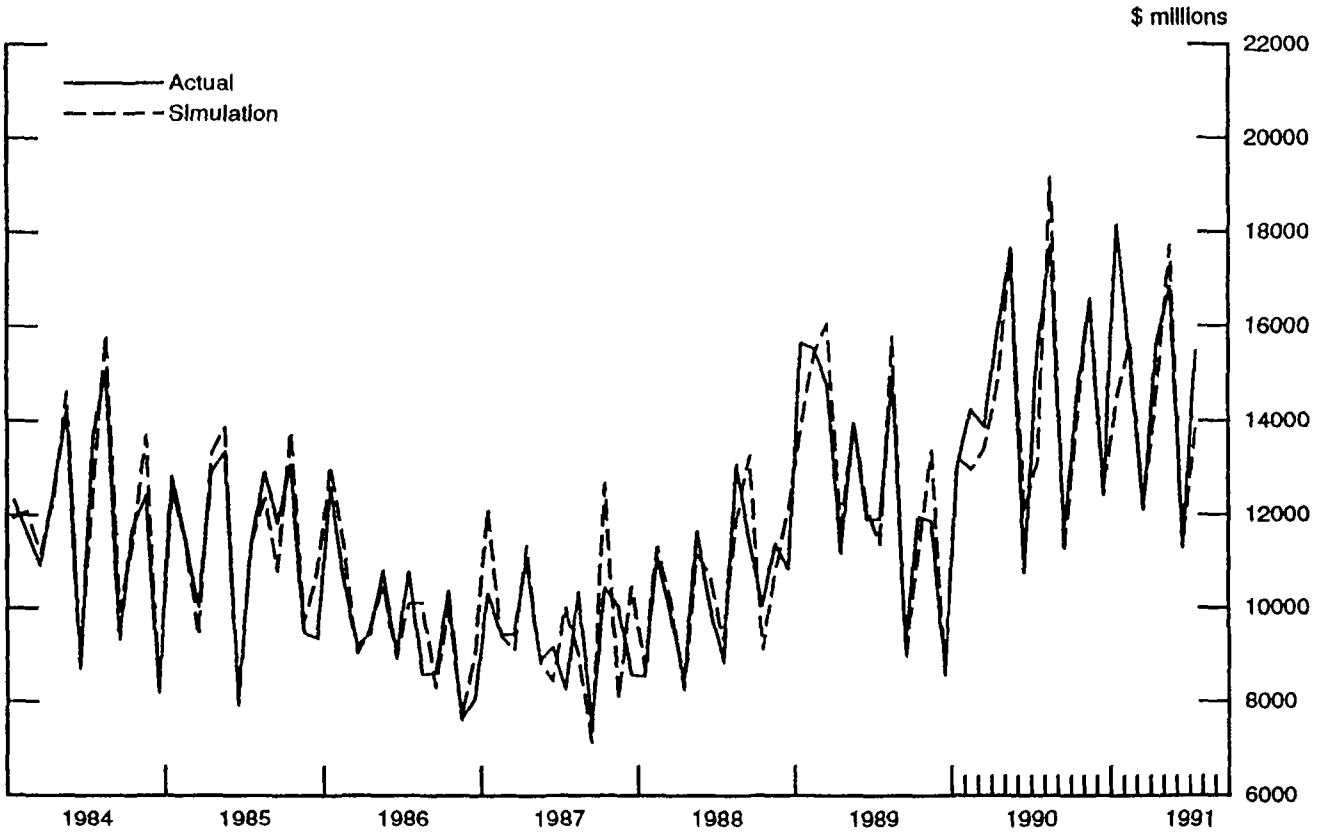
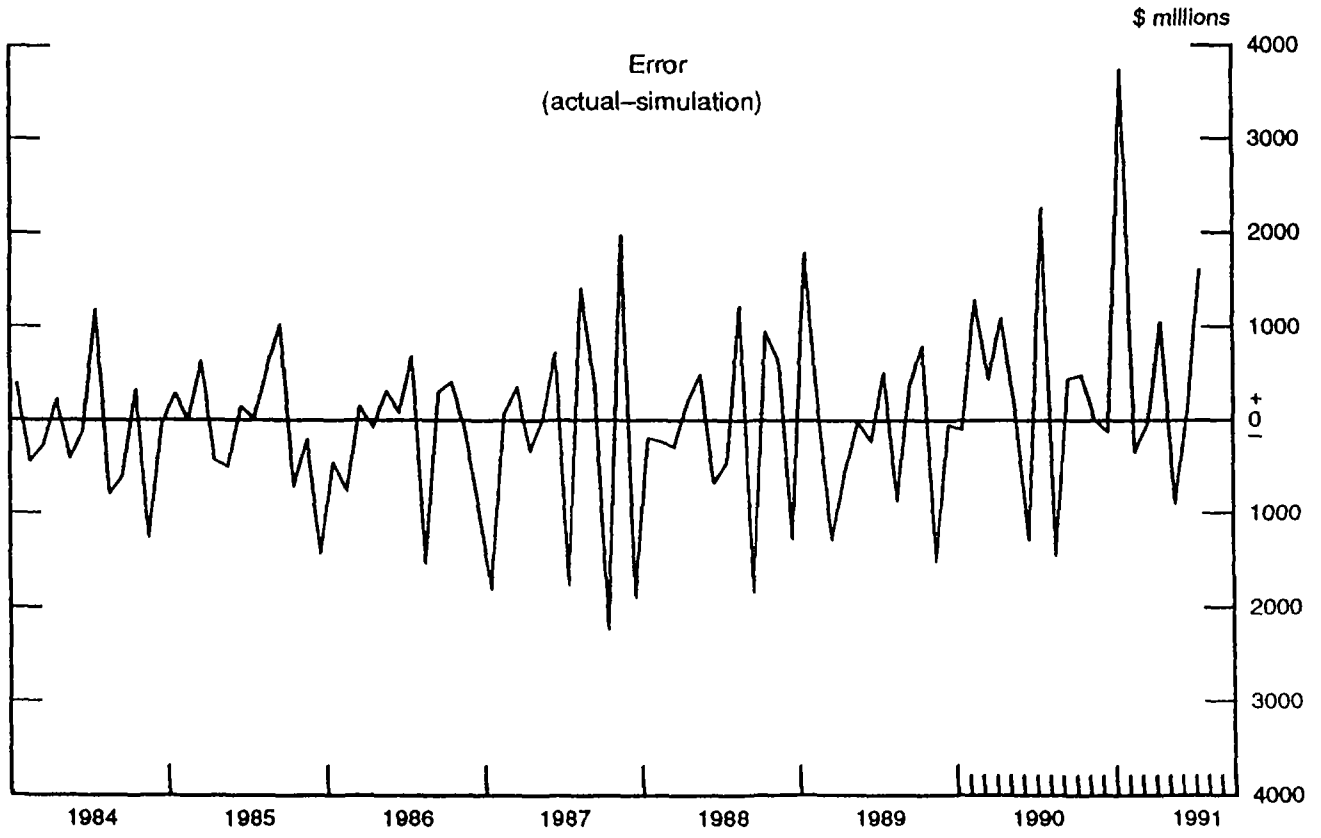


Chart 4

Gross Noncompetitive Tenders for Treasury Bills and Notes

January 1984 to July 1991





NOTE: Treasury bills and two and three year notes.

model overpredicted.[3] Net noncompetitive tenders for bills and notes (up to four years maturity) amounted to $6.7 billion in 1990QII, and then gradually slowed from that rapid pace over the next three quarters, as indicated in Table 2. Heightened Treasury financing needs, due in part to increased RTC activity, contributed to a temporary rise of Treasury bill rates relative to small time deposit rates at banks in mid-1990. By late 1990, with the easing in monetary policy, bill rates had fallen below time deposit rates, which lagged market rates. Net noncompetitive tenders turned negative (- $1.9 billion) in 1991QII, but recovered to $1.6 billion in July, perhaps suggesting some shift toward market securities.

As shown in Table 3, net flows to bond and equity funds from March 1990 to June 1991 amounted to $80 billion, part of which likely came from M2 assets. In the preceding 15 months, such flows had amounted to only $41 billion. Increases in these funds were especially large in the second quarter of this year, and there are anecdotal reports of record inflows to bond funds in July 1991.

Movements from M2 into stock and bond markets may reflect attempts to increase returns by shifting out the yield curve. Incentives to shift out the yield curve are not embodied in the staff's regular money demand model, whose sole opportunity cost measure is the

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3. The explanatory variables are the spread of the three-month bill rate over the M2 own rate (the opportunity cost measure in the M2 model), a lagged dependent variable, and seasonal dummies.

Table 2

Total Net Noncompetitive Tenders for Selected Treasury Securities

(Monthly totals; millions of dollars)

	BILLS				NOTES				
	Based on settlement dates								
	Number of weekly bill auctions	3- & 6-mo.	1-yr.	Total bills	2-yr.	3-yr.	4- & 5-yr.	Total notes	Total bills & notes
Quarterly:									
1988--QII	13	592	219	811	1230	-216		1014	1825
QIII	13	2629	173	2802	2062	-69		1993	4795
QIV	13	2891	633	3524	1083	91		1174	4698
1989--QI	13	5130	2272	7402	4081	943		5024	12426
QII	13	-1028	910	-118	906	472		1378	1260
QIII	13	-778	341	-437	-417	-51		-468	-905
QIV	13	-1484	-128	-1612	-157	-71		-228	-1840
1990--QI	13	3471	-635	2836	300	524		824	3660
QII	13	2912	469	3381	1895	1440		3335	6716
QIII	13	2585	545	3130	685	127		812	3942
QIV	13	1460	409	1869	-445	289		-156	1713
1991--QI	13	1830	-269	1561	-1311	130	67	-1114	447
QII	13	-1065	-595	-1660	-1064	-56	848	-272	-1932
Monthly:									
1990--Jan.	4	606	-458	148	-4#	*		-4	144
Feb.	4	1352	-127	1225	304	524		828	2053
Mar.	5	1513	-50	1463	*	*		*	1463
Apr.	4	1109	80	1189	1560#	*		1560	2749
May	5	1153	203	1356	335	1440		1775	3131
June	4	650	186	836	*	*		*	836
July	4	914	193	1107	537#	*		537	1644
Aug.	5	980	246#	1226	148	127		275	1501
Sept.	4	691	106	797	*	*		*	797
Oct.	4	57	168	225	236#	*		236	461
Nov.	5	826	99	925	-67	289		222	1147
Dec.	4	577	142	719	-614	*		-614	105
1991--Jan.	5	1421	64	1485	-663	*	543n	-120	1365
Feb.	4	400	-139	261	-648	130	-476	-994	-733
Mar.	4	9	-194	-185	*	*	*	*	-185
Apr.	4	-214	-223	-437	-884#	*	701#n	-183	-620
May	5	-506	-223	-729	-180	-56	147	-89	-818
June	4	-345	-149	-494	*	*	*	*	-494
July	4	-64	-100	-164	324#	*	1415#n	1739	1575
Aug.	2	34	43	77	!	-133p	!	!	-56

#--Two securities of this type settled during the month.
*--No securities of this type settled during the month.
!--To date, no securities of this type have settled during the month.
p--The security has been auctioned but has not yet settled.
--Security raises all new cash; no 4yr. or 5yr. notes mature during month.
8/09/91

Table 3

Net Flows to Mutual Funds<1>
Excluding Short-term Funds
(Millions of Dollars, NSA)

			Bond				
	Total	Equity	Gov't	Muni	Other	Total	Mixed<2>
1987	4,044	2,101	763	355	655	1,733	170
1988	-468	-877	-701	689	621	609	-201
1989	2,462	1,158	-684	1,307	283	906	398
1990	3,596	1,714	-264	1,184	682	1,601	280
1988-Q1	470	-988	41	641	836	1,518	-61
-Q2	112	-250	-734	713	627	607	-244
-Q3	-1,759	-1,458	-1,121	518	566	-37	-264
-Q4	-696	-812	-989	883	457	350	-235
1989-Q1	-276	-465	-1,304	1,147	522	364	-175
-Q2	2,237	868	-901	1,568	754	1,421	-51
-Q3	2,940	1,409	-342	1,167	-28	797	734
-Q4	4,945	2,820	-190	1,347	-116	1,041	1,084
1990-Q1	3,726	2,273	-187	1,308	-25	1,096	357
-Q2	5,396	3,285	-485	1,424	881	1,821	290
-Q3	1,293	-606	-322	898	1,071	1,647	253
-Q4	3,968	1,905	-64	1,106	801	1,843	221
1991-Q1	6,692	2,237	820	1,624	1,690	4,134	321
-Q2	9,427	2,967	1,459	2,251	1,955	5,664	796
1990-JAN	821	145	-313	1,021	-367	341	335
-FEB	4,855	2,954	49	1,768	-267	1,551	351
-MAR	5,502	3,720	-296	1,134	557	1,396	386
-APR	3,648	2,634	-677	731	613	667	347
-MAY	7,722	4,636	-371	2,166	965	2,760	327
-JUN	4,817	2,585	-406	1,374	1,066	2,034	198
-JUL	3,270	473	-334	1,835	998	2,499	299
-AUG	-1,195	-2,499	-544	-2	1,586	1,041	263
-SEP	1,805	208	-88	860	628	1,400	196
-OCT	2,601	906	-213	1,114	667	1,567	128
-NOV	3,946	1,542	0	1,455	810	2,265	139
-DEC	5,358	3,266	21	749	926	1,696	396
1991-JAN	5,207	880	1,421	1,638	1,172	4,231	97
-FEB	7,441	3,222	539	1,285	1,918	3,742	476
-MAR	7,427	2,610	499	1,948	1,981	4,428	389
-APR	10,525	3,359	1,440	2,666	2,055	6,160	1,006
-MAYr	10,379	3,855	1,560	2,223	2,013	5,797	728
-JUNp	7,377	1,688	1,376	1,863	1,797	5,036	653
Memo:Assets ($billions)							
1991-JUN	660.5	293.4	111.3	133.4	74.7	319.4	47.7

r--revised p--preliminary.
<1> The categories of funds reported below differ from those reported by the Investment Company Institute in press releases.
<2> ICI has moved the funds labeled 'Mixed:Equity and Bond' between the pure equity and bond categories over the years. The categorization above is necessary in order to get consistent series over time.
Source: Investment Company Institute, monthly survey.

three-month Treasury bill rate less the own rate on M2. To capture incentives to shift money to long-term markets, including direct purchases of stocks and bonds, as well as flows to long-term mutual funds, the slope of the yield curve has been added to the regular model. Such an addition does reduce the shortfall in the model over the 1990QI to 1991QII period to $78 billion, $34 billion less than the overprediction of the standard M2 model. Within the model itself, the yield spread variable tends to depress M2 growth by an average rate of 0.6 percent over the five quarters ending in 1991QII, representing about $25 billion of M2 over the period. Related models show that yield slope variables are particularly significant in explaining the behavior of M2-type money funds.

In addition, recent experimentation with a model for small time deposits indicates that the spread between long-maturity CD and Treasury rates contributes significantly to explanatory power. This is especially important this year in light of the widening spread of market rates over long-term CD rates discussed above. Thus, some of the shift from time deposits to market instruments may not be a symptom of reaching out the yield curve for return, but rather of looking to alternative investments of similar maturity but higher yield.

While yield slope variables contribute to the money demand model, their interpretation is problematic in some respects. Spreads themselves are not good indicators of holding period returns, which

arbitrage should tend to equalize (after adjusting for risk). If long rates embody averages of expected future short rates (plus a risk premium), a divergence of expectations between households and corporations is needed to explain recent behavior, with households betting that long rates will fall and corporations betting that they will rise. Furthermore, yield spreads have not always been associated with substitutions between M2 assets and long-term mutual funds. For instance, in 1986, long-term funds increased by an enormous $153 billion, despite a low yield spread, and M2 increased 9 percent. Even in the first half of this year, flows into long-term mutual funds were as large in February and March, the months of greatest M2 growth, as they were in June.

M2 Plus Other Household Financial Assets

If part of the explanation of weak M2 is a shifting around of M2 assets, expanded measures of household assets that encompassed a wider menu should show more stability. Table 4 compares the growth rates since 1985 of M2 and other groupings of household financial assets. Alternative aggregates, which add household holdings of government securities and mutual funds to M2, tend to grow at a faster rate than M2, but in a similar pattern over time. The differentials in growth tend to narrow over the three quarters ending in 1991QI, when the staff money demand model had its largest misses; a widening in

Growth Rates for Selected Financial Assets

	1985	1986	1987	1988	1989	1990	1990Q1	1990Q2	1990Q3	1990Q4	1991Q1	1991Q2
1. M2 (sa)	8.7	9.2	4.3	5.2	4.7	3.8	6.2	3.9	3.0	2.0	3.4	4.6
2. M2 + Govt Securities	10.1	7.1	5.7	8.1	7.5	6.2	8.2	7.3	5.6	3.0	4.5	6.8
3. M2+ Govt Securities + Mutual Funds	12.0	10.9	7.2	7.2	7.7	6.6	8.2	7.9	5.7	4.0	5.5	7.9
4. Total Financial Assets	5.2	4.5	3.7	4.2	3.0	3.0	3.7	4.4	2.0	1.8	2.0	3.4

Table 4

Notes:

(1) All data taken from flow of funds accounts, except for M2.

(2) Growth rates for flow of funds data are computed as current quarter flows divided by previous period levels.

(3) Annual Growth Rates are Q4 to Q4 basis. Quarterly growth rates are annualized.

these differentials would have been more consistent with the hypothesis. Total financial assets, which include household holdings of bonds, equities, pensions, life insurance, and large time deposits, have grown at a slower rate than M2, but also in a similar pattern.

Chart 5 shows the velocity of the alternative aggregates indicated in the tables. (Personal income is used rather than GNP.) The velocity of the broader alternative aggregates has been only slightly more stable than that of M2 over this period, and it is not evident that their behavior in 1991 is any less of a deviation from trend than that of M2.

Corporate Money Market Accounts

Another possibility is that these are shifts to new M2-like assets not included in this variable. Corporate money market accounts (also called variable denomination floating rate demand notes) are checkable accounts offered by a nonbank employer. These demand notes substitute for commercial paper issuance by a firm. When we last visited this issue (in December 1990), IBM, GMAC, and Ford Credit had set up demand note programs. Since then, AT&T has begun offering such accounts to its employees, but has only attracted $21 million so far. IBM and AT&T both reported that at the rates they pay, which are based on money fund rates, their accounts are not attracting much investor interest. Thus, while these accounts are not included in M2, they appear to have had no significant effect as yet on M2 growth.

Velocities for M2 and Expanded Measures of Household Financial Assets

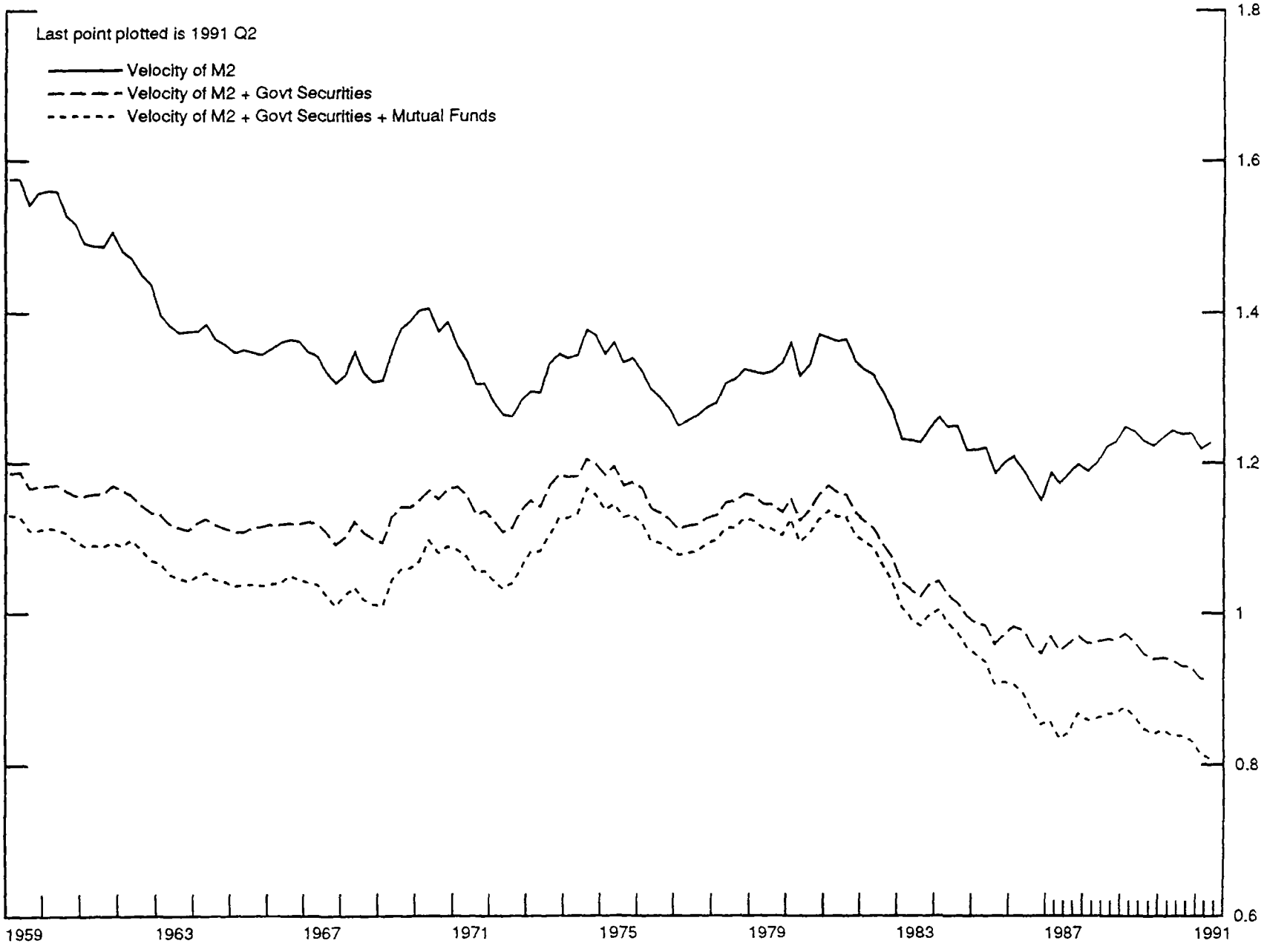

Chart 5

IV. COMPOSITION OF M2

M1 and Liquid Household Deposits

The pattern of weakness in M2 since June 1991 differs from that of late 1990 in several respects. The previous period had been surprising in that liquid deposits were so sluggish despite declining market interest rates and opportunity costs. The recent period has also included a deceleration in liquid deposit growth, but in an environment of a small rise in opportunity costs. The more surprising aspect of the current weakness is the steepness of the declines in small time deposits and M2-type money funds.

Though affected by currency movements in the Gulf War period, M1 has grown more robustly than M2 on balance during 1991 (6.7 percent from QIV to July versus 2.8 percent for M2). A shift in the composition of M2 toward components with higher turnover rates provides some support for expectations of an increase in velocity. As is evident in Chart 6, 1985 witnessed a similar pattern of behavior, with heavy flows into long-term mutual funds while M1 accelerated and M2 decelerated. M2 seemed to be the better predictor of the slowing of GNP in 1986.

The above anecdote illustrates a broader conclusion obtained from reduced-form regressions--that M2 generally outperforms alternative aggregates. In fact, non-M1 M2 outperforms M1 in predicting

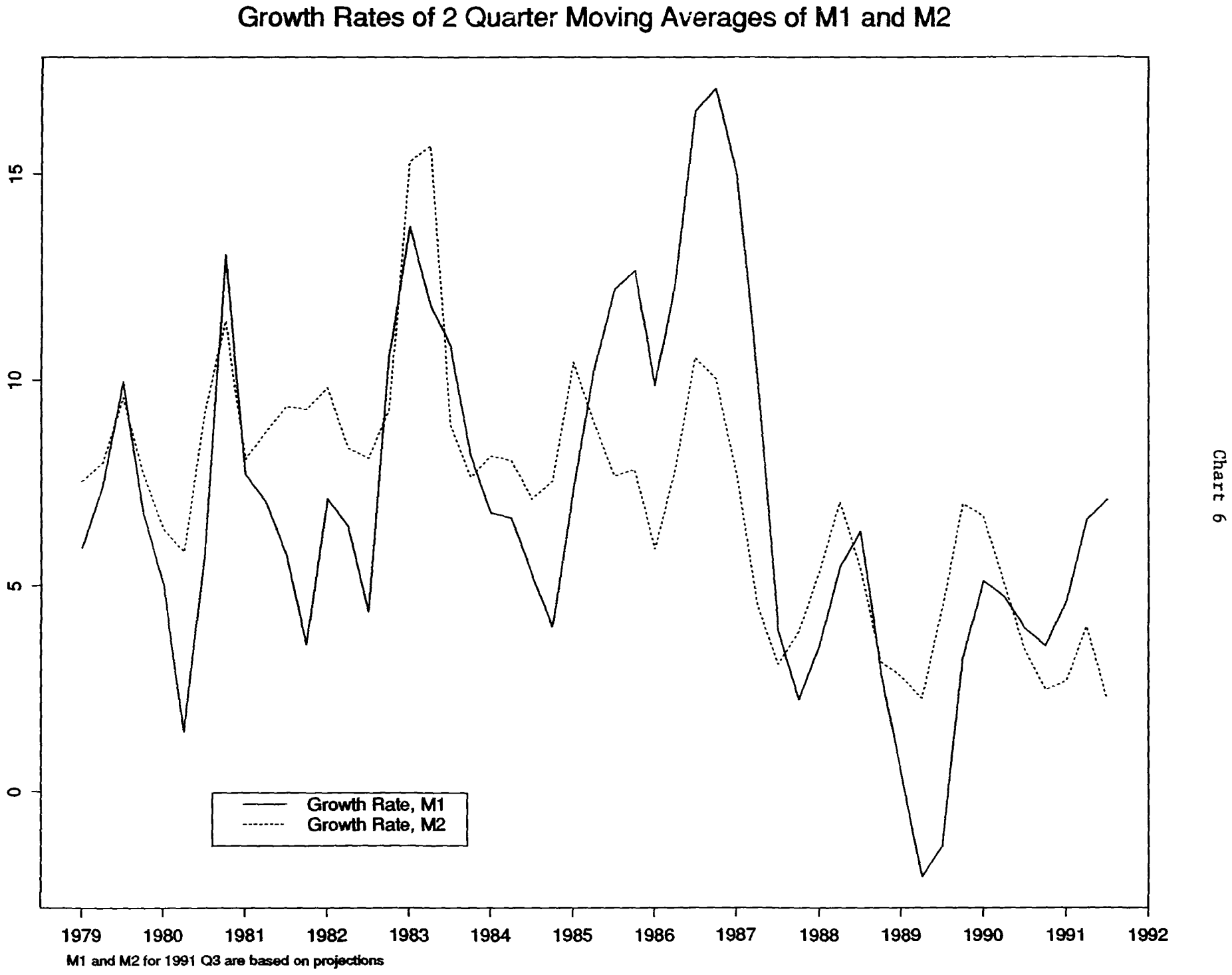

Chart 6

future spending and output.[4] Nevertheless, there is no guarantee that average historical relationships will prevail during the current period.

Nonpersonal Deposits

Another line of investigation was whether there were significant differences in the growth rates of personal and nonpersonal deposits during 1991. As can be seen in Chart 7, nonpersonal deposits have been quite strong so far in 1991. The spike in growth this year results almost entirely from the issue of Yankee CDs by branches and agencies of foreign banks, a development spurred by the reduction of reserve requirements to zero on such deposits. Excluding Yankee CDs, nonpersonal nontransaction deposits have grown at a modest rate this year.[5]

Chart 8 compares the performance of personal and nonpersonal MMDAs since 1984. After pausing in late 1984, personal MMDAs continued to grow rapidly until 1987. They decreased over the following two years as market rates rose, and have rebounded with the decline in rates since that time. Nonpersonal MMDAs stayed roughly constant during the 1987-88 period, then dropped as market rates peaked in early 1989. They have also grown on balance with the decline in market rates since that time. The drop in nonpersonal MMDAs in early 1990 could be

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4. See the accompanying memo by Messrs. Hess, Porter, and Reinhart.
5. A breakdown of nonpersonal time deposits between small and large time deposits is not available.

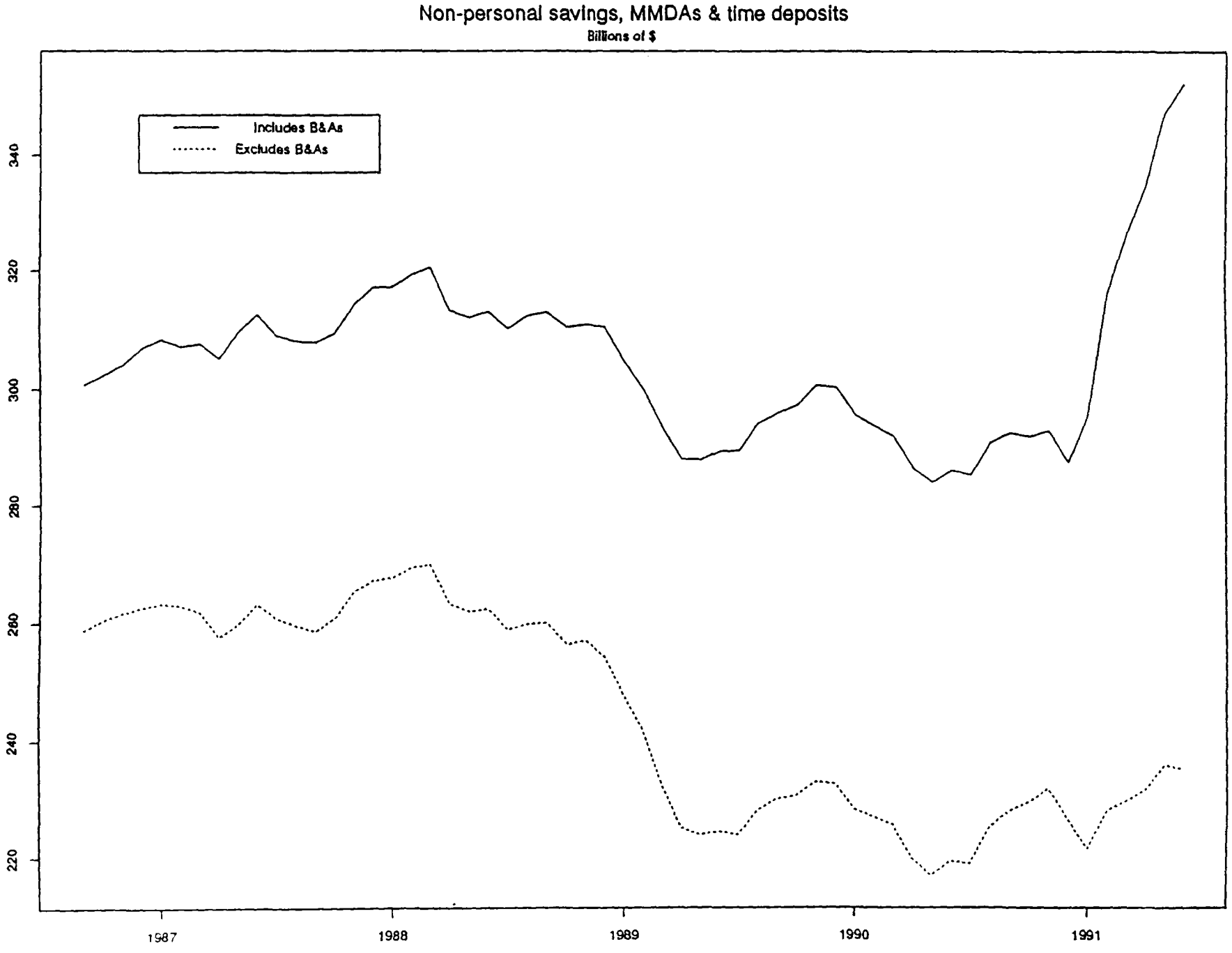


Chart 7

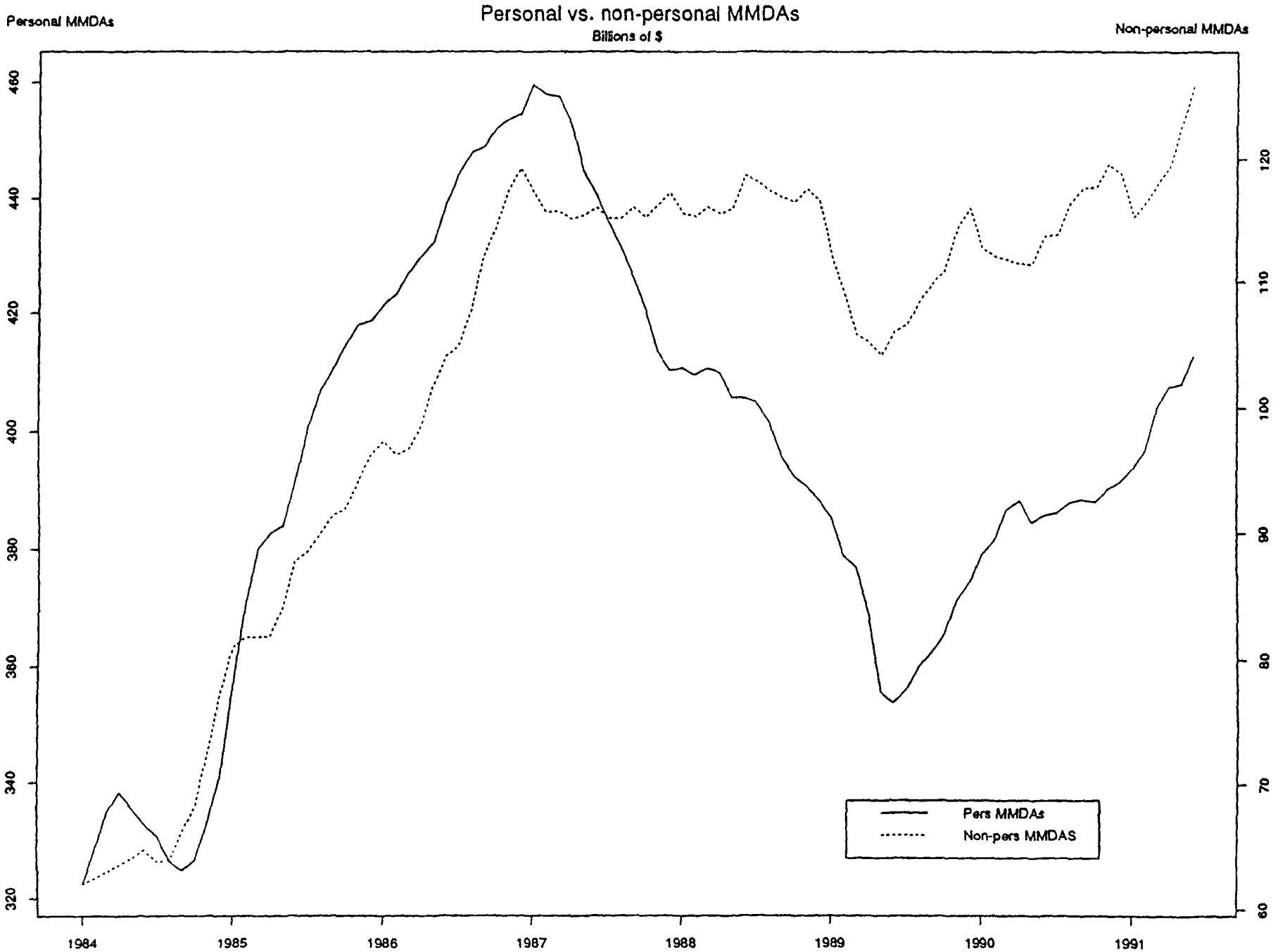


Chart 8

attributed in part to the backing up of market rates at that time. In late 1990 and early 1991, there appeared to be a strengthening of the usual seasonal pattern of a rise in nonpersonal MMDAs late in the year, and a run-off early the following year. Aside from this seasonal, the behavior of personal and nonpersonal MMDAs has been broadly similar over recent quarters, suggesting that the aberrant behavior of M2 has not been ascribable to a particular class of holders.

Velocity of Household M2

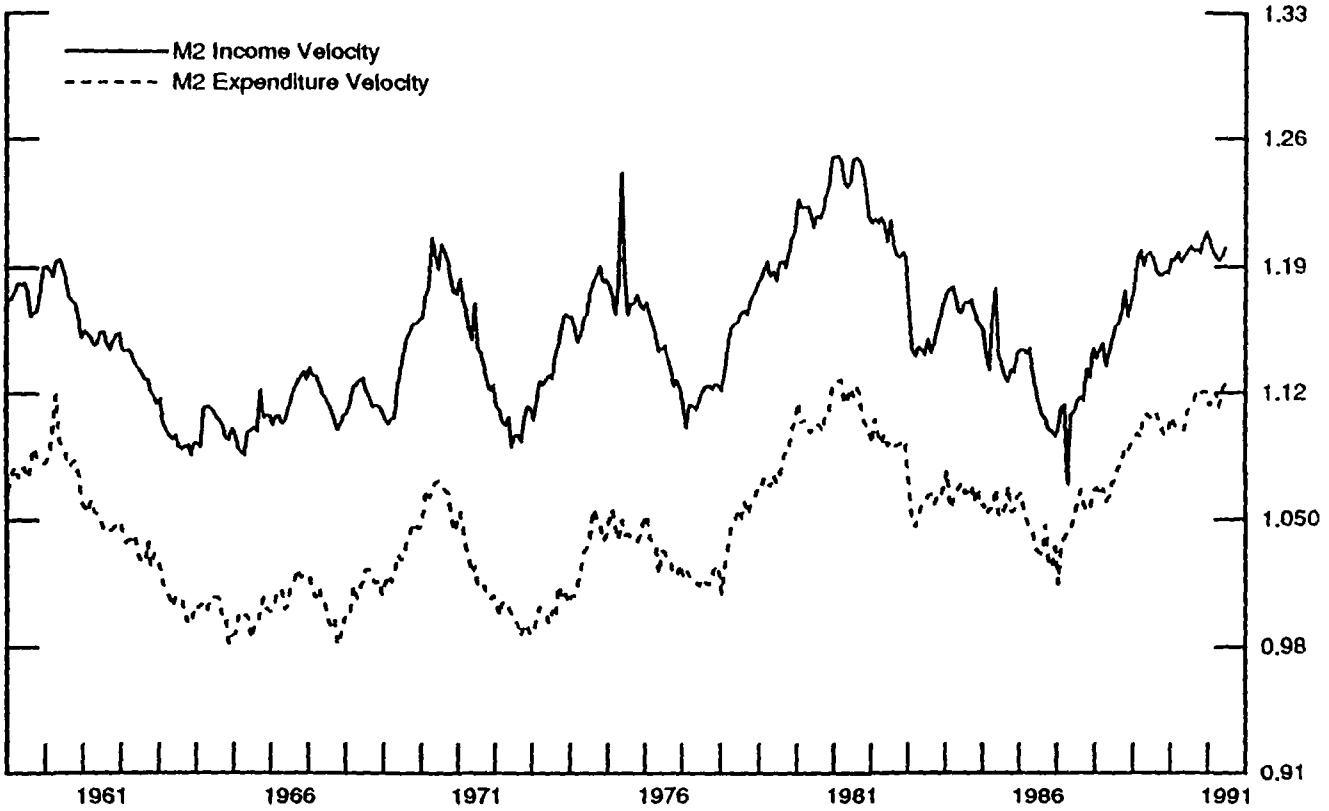
In another attempt to isolate household money demand behavior, Charts 9 and 10 show various monthly measures of velocity over two time periods: 1959 to the present and 1986 to the present. The velocities are calculated by dividing disposable personal income and personal consumption expenditures by M2 and, alternatively, household M2.[6] Measured this way, M2 velocity has been roughly trendless since 1959, while the velocity of household M2 has trended down over the period. Since early 1989, M2 velocity has risen slightly while the velocity of household M2 has been flat. As might be expected given consumption smoothing behavior, expenditure velocities have not dropped as much as income velocities since late 1990, and also appear to have recovered more recently. Comparing the solid lines and dashed lines in both

6. M2 less currency, demand deposits, overnight RPs and Eurodollars (the sum of seasonally-adjusted components).

Chart 9

M2 and Household M2 Ratios 1959-Present

Ratios of Personal Income and Consumer Expenditure to M2



Ratios of Personal Income and Consumer Expenditure to Household M2

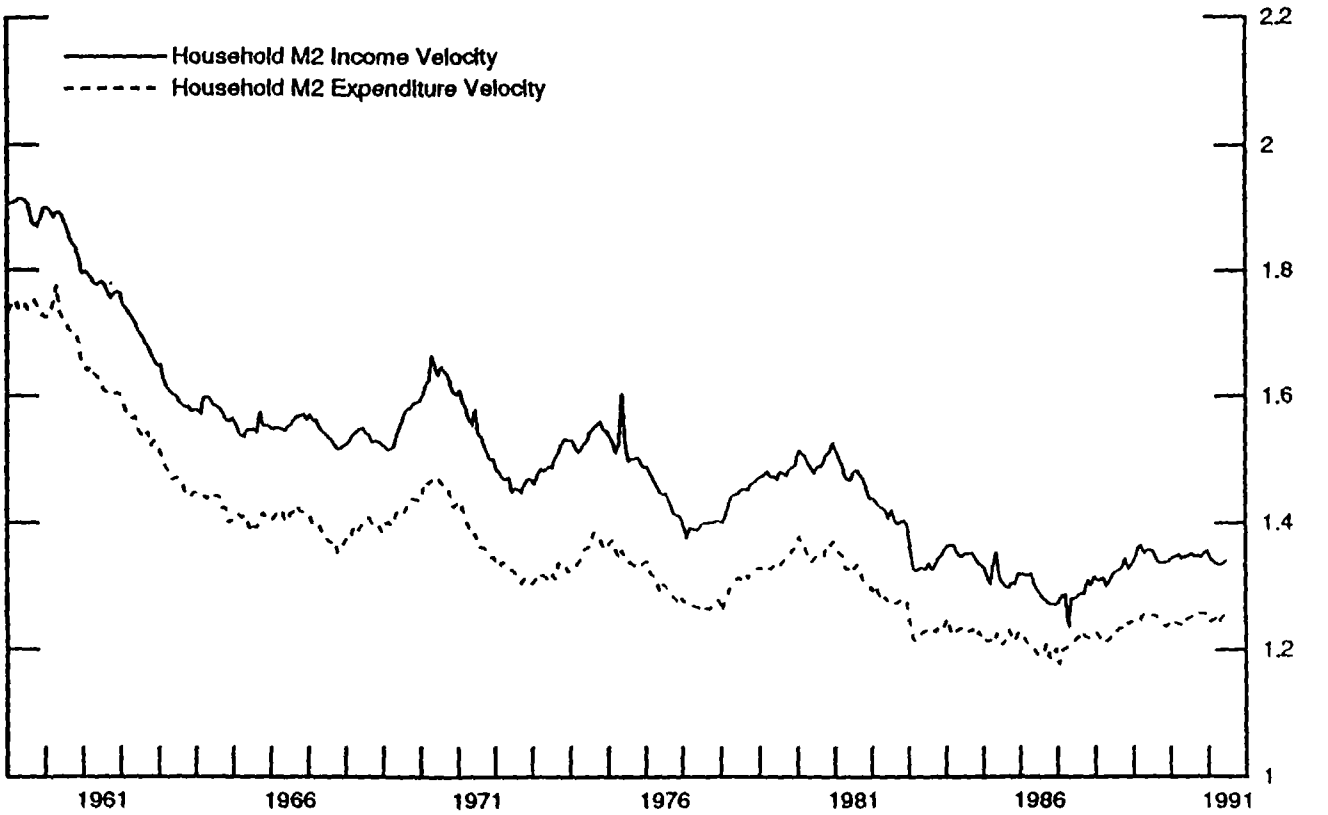
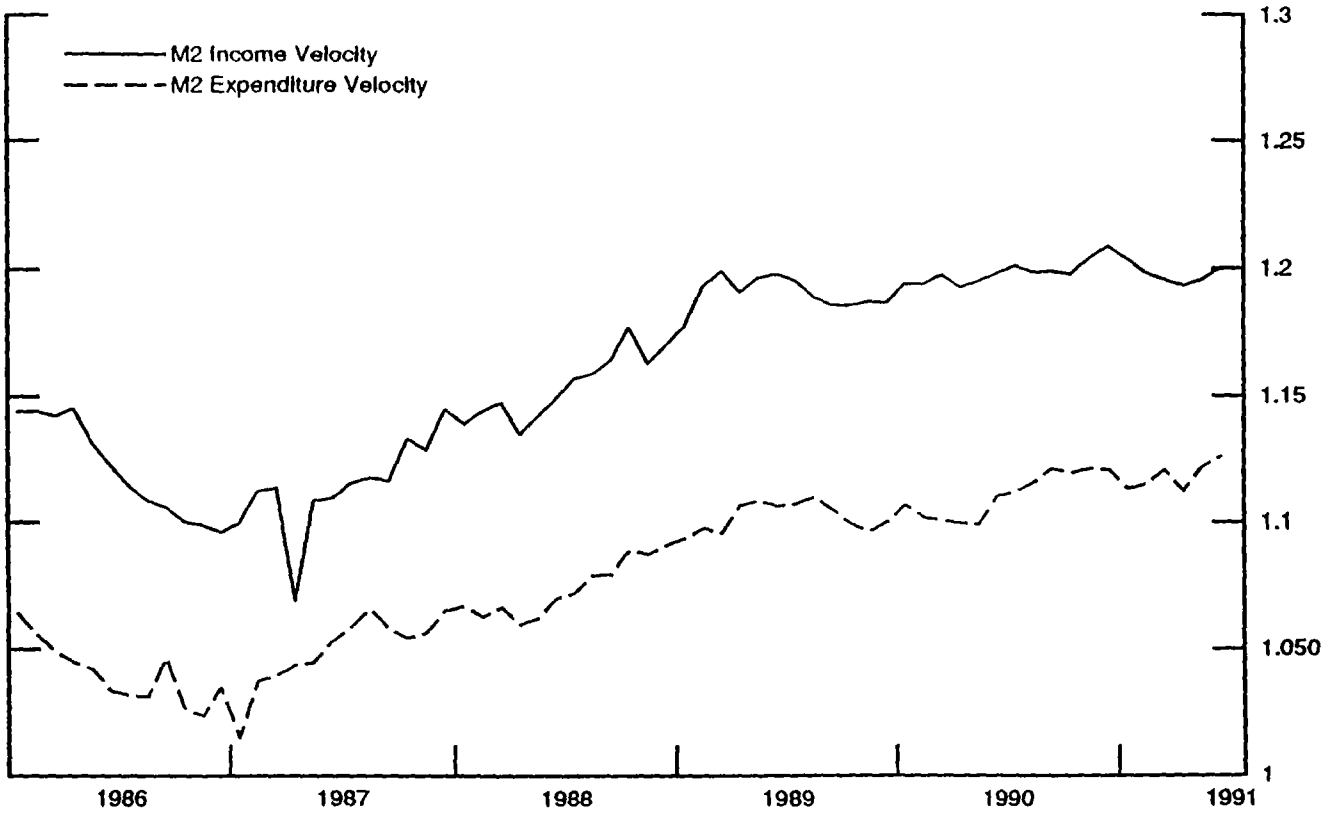


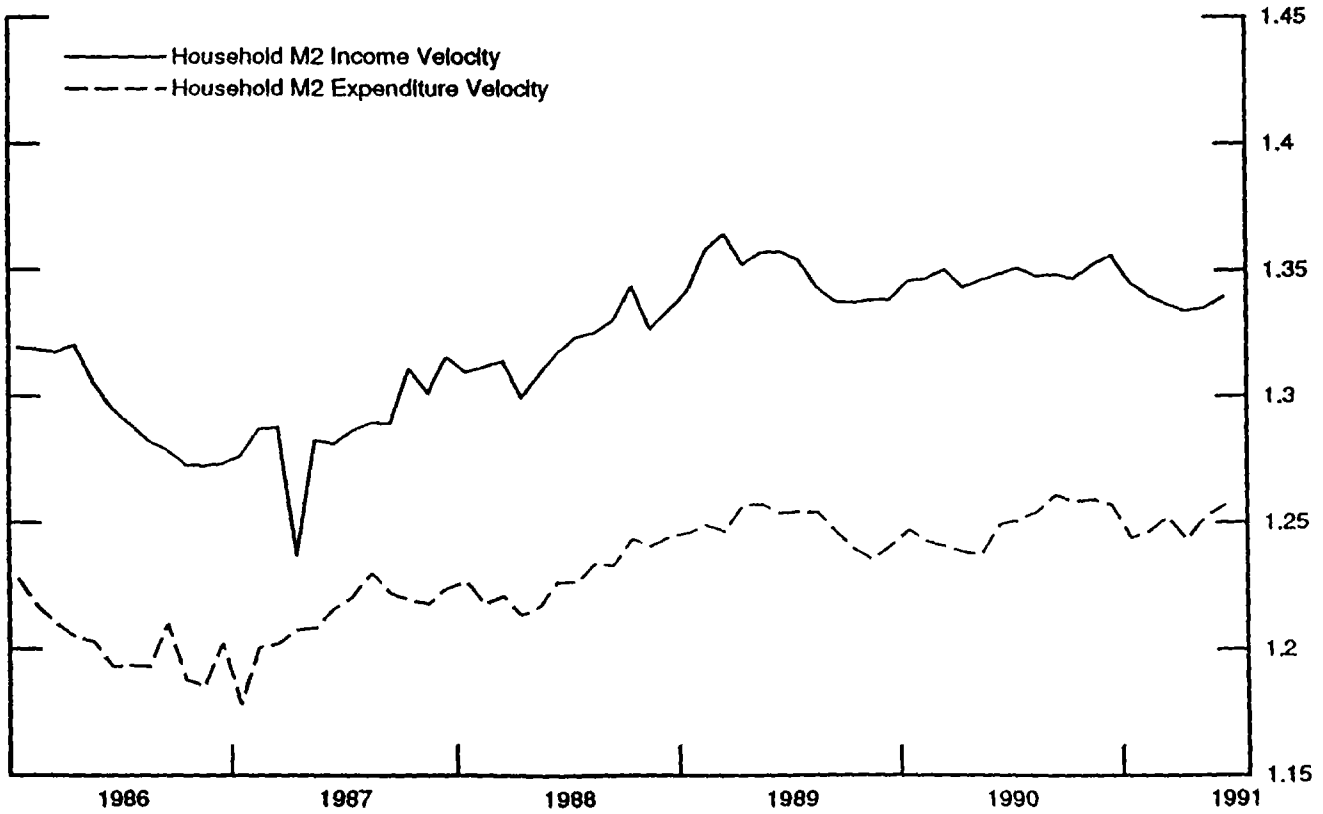
Chart 10

M2 and Household M2 Ratios 1986-Present

Ratios of Personal Income and Consumer Expenditure to M2



Ratios of Personal Income and Consumer Expenditure to Household M2



charts, the behavior of these velocities seems about the same, suggesting little gain from analyzing household M2 alone.

Regional Deposit Growth Patterns

An attached memo provides a series of charts on growth rates of time deposits at domestic banks by region during 1991. The data have not been purged of the effects of mergers on surviving institutions, which may help to explain the faster growth rate of deposits at larger banks this year. In general, deposit growth has been stronger in the Dallas and Chicago districts, and weaker in the St. Louis and Minneapolis districts. However, the differences in growth rates are not so pronounced as to contribute substantially to our understanding of the recent shortfall in M2.

V. CONCLUDING COMMENT

The above investigations of geographic and nonpersonal/personal breakdowns of deposit growth, and the review of corporate money market accounts, have not contributed substantially to understanding the recent weakness in M2. The velocity of alternative aggregates has been only slightly more stable than that of M2, and their behavior in 1991 does not appear to be any less a deviation from trend than that of M2.

The recent weakness in M2 may in part reflect mismeasurement of opportunity costs, the influence of changes in wealth and household leverage that our model's scale variables do not reflect, and other

measurement problems. A part of the shortfall in M2 remains unexplained. Given the econometric evidence on the historical performance of M2, surprises in this aggregate may be indicators of surprises in future spending performance.

STRICTLY CONFIDENTIAL (FR)
CLASS II - FOMC

August 15, 1991

MONEY AND ECONOMIC ACTIVITY[1]

I. Introduction and Summary

This memorandum summarizes some of the staff work on the weakness in the monetary aggregates and its possible links to economic activity, providing some perspective on the recent money demand errors, including an analysis of their business cycle properties, and on the robustness by which M2 leads income in reduced-form relationships. The current sluggishness in M2 goes beyond what would be predicted from a standard demand relationship given even the most pessimistic forecast of current income.

Might the recent behavior of M2 portend subsequent weakness in income? This memo sketches the range of possible explanations for anemic money growth, using the familiar IS/LM apparatus to focus on three cases with markedly different policy implications. First, the weakness in the monetary aggregates may reflect an inexplicable shift in the demand for money which, if the level of interest rates is consistent with recovery, calls for no policy adjustment. More seriously, money demand could interact with spending behavior. As discussed in the second case, the factors reducing the demand for money--say a loss in confidence in depository institutions by retail investors--might also lead households to reduce their planned expenditure. Or, reversing the causal link, the sluggishness in money could be a symptom of a contraction in intermediation services as depositories strive to shrink their balance sheets. Against this backdrop, an unchanged interest rate supports only a lower level of aggregate demand. As suggested in the last case, the reduction in the demand for money may signal that real income has fallen or is expected to fall. For example, if money demand depends on forward-looking

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1. Prepared by Gregory Hess, Richard D. Porter, and Vincent R. Reinhart, Division of Monetary Affairs.

permanent income, then a sharp downward revision to income prospects results in an immediate reduction in the demand for money. Hence, M2 might be a better indicator of permanent income shifts than income itself or the real-side indicators, providing a warning flare for corrective policy action.

We then turn to the historical record to assess if money provides reliable information about the subsequent course of real income, finding that reduced-form relationships support the notion that money matters. Even controlling for interest rates and other financial variables, movements in M2 systematically precede movements in real economic activity, a result that does not owe to feedback from income to money. In the language of the vast literature on this subject, M2 Granger causes (or is temporally prior to) standard measures of activity--nominal and real consumption and industrial production. It also appears that M1 is a less reliable indicator of subsequent movements in these activity variables.

Work with larger systems of behavioral relationships assesses the economic significance of this causal link and provides point estimates of the consequences of weakened money growth for economic activity. A system of nine reduced-form equations predicts that a slowing in M2 growth of 1 percentage point in the second half of 1991 and for all of 1992 trims a forecast of the growth rate of real disposable income by somewhat less, 1/4 percentage point this year and the next. However, those effects are quantitatively modest relative to the uncertainty about those forecasts. Knowledge of the actual paths of the monetary aggregates for the next three years narrows the confidence band surrounding a forecast of real income by only about 15 percent.

II. The Shortfall in Money

Recently, M2 growth has been relatively sluggish and considerably below the model forecast, prompting concern over the reliability of the relationship between movements in money and

subsequent changes in income. These concerns will be heightened if, as appears certain, M2 growth will once again fall below the model forecast in the third quarter. For the current quarter, the projected standstill in M2 is especially puzzling given the near 5 percent forecast for nominal GNP growth, particularly since the implied large increase in velocity occurs with several quarters of relatively unchanged short-term interest rates. If the current third quarter forecasts for M2 and nominal income hold, all the model's projected M2 growth, at about 5-1/2 percent, represents an overprediction.

From a purely arithmetic point of view, since a 1 percent change in spending induces about a 1 percent change in M2 after a lag of about two quarters, estimates of the growth of spending would have to be lowered by about 5 percentage points to account for the money miss in the current quarter. If we assume that the published GNP figures for the first half of 1991 are correct and that the staff's money demand model is well specified, nominal spending would have to fall at about a 16 percent annual rate to account for the apparent lack of growth in M2 in the current quarter. Such an outsized estimate is clearly not credible, but one could consider less extreme examples.

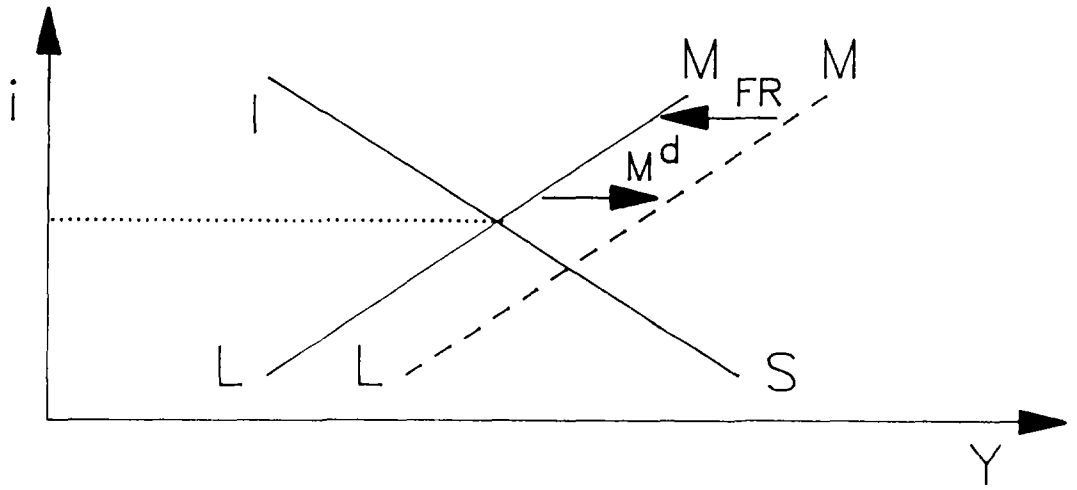
The staff model has run off track for the last year, with forecast errors averaging more than 2-1/2 percent. If we assume, as the margin of our ignorance, that this average error were to continue in the third quarter, then about 3 percentage points of missing money growth needs to be explained. Allowing this and raising the impact spending coefficient by twice its standard error as a rough limit on the largest possible value for this term, the required decline in spending would be considerably smaller, at almost a 2 percent rate. If we specified the model to allow for a contemporaneous income effect along with the consumption effect and increased the coefficients on both by twice their standard errors, nominal spending still would have to be growing at less than 1 percent to account for the third-quarter

residual in M2, assuming, as above, that about half the error is not associated with income.

III. Three cases

We now turn to the IS/LM apparatus to perform a rough triage of the possible damage to the economy associated with the sluggish behavior of the monetary aggregates.

1. *A portfolio shift away from money*, portrayed in the figure below, merely moves the LM schedule outward, since at an unchanged interest rate, a given money stock now supports higher



income. Poole's 1970 advice holds: Keeping the interest rate unchanged will insulate aggregate demand from the shift from monetary assets.[2] While the money stock would fall, there would be no adverse real consequences, since the Federal Reserve would simply be accommodating the drop in money demand.[3] Mistaking the weakness in

2. "Optimal Choice of Monetary Policy Instrument in a Simple Stochastic Macro Model," *Quarterly Journal of Economics*, vol. 84 (1970), pp. 197-216.

3. The horizontal distance of the shift in the LM (from the solid to the dashed line) is measured by the arrow labelled M^d. Federal Reserve action to reduce the money supply to peg the interest rate shifts that LM schedule back, as measured by the arrow denoted FR

money as a sign of weakened aggregate demand risks a policy mistake, as lowering the interest rate and maintaining a constant stock of money would over-stimulate aggregate demand.

Thus, the weakness in money, this argument runs, reflects a shift out of money and toward other assets, facilitated by Federal Reserve actions to keep the interest rate steady. However, it is difficult to identify non-M2 financial assets that have benefitted sufficiently enough from this shift in liquidity preference, either in terms of increased flows into any group of assets or heightened prices of assets bid up by investors abandoning deposit instruments. As the table below indicates, the obvious alternatives to M2-type deposits for the retail investor, bond and equity mutual funds, picked up

Net Inflows into M2 Alternatives

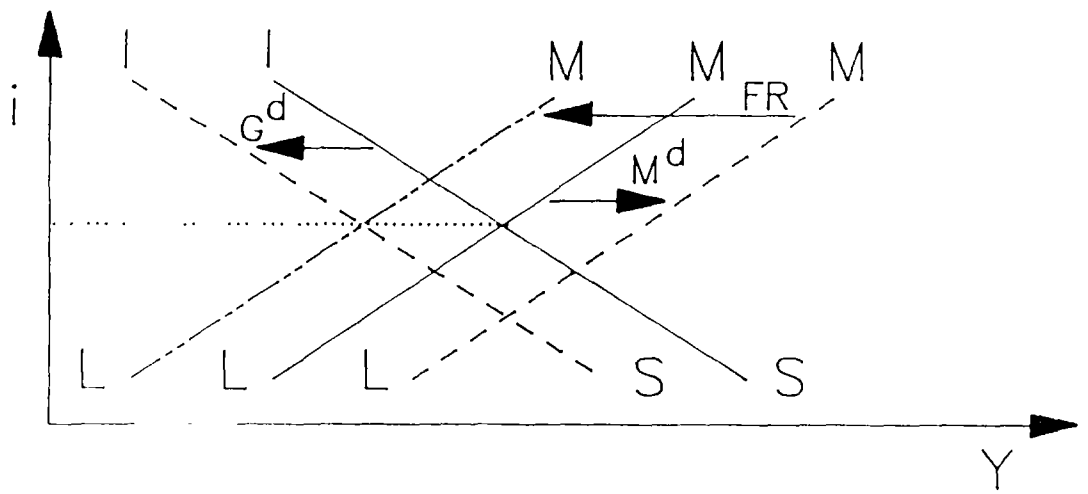
monthly rate, billions of dollars, n.s.a

	Flows into mutual funds			Net noncompetitive tenders of bills and notes
	Bond	Equity	Total	
1990				
Q3	1.6	-0.6	1.3	1.3
Q4	1.8	1.9	4.0	0.6
1991				
Q1	4.1	2.2	6.7	0.1
Q2	5.7	3.0	9.4	-0.6
May	5.8	3.9	10.4	-0.8
June	5.0	1.7	7.4	-0.5
July				1.6

noticeably in the second quarter. More recently, noncompetitive tenders at Treasury auctions--an uncertain indicator of retail interest in Treasury securities--have expanded. However, tenders in July were modest relative to that witnessed late last year when financial markets seemed more fragile. Moreover, the dollar swings in these M2 alternatives are small relative to the shortfall that must be explained. For example, had the inflows into long term mutual funds in June appeared completely in M2 deposits in July, that monetary

aggregate still would have declined, albeit at only a 1-1/4 percent pace. Also, the timing is off. Inflows into long-term funds in June were only a touch above their first-quarter pace, while M2 decelerated 3-1/4 percentage points over that same period. In terms of asset prices, most major equity indexes are about unchanged from their April levels, the likely date of the economic trough, while commodity prices--in particularly the price of gold--are somewhat lower.[4] Perhaps, the simultaneous decisions of households and firms to hold less deposits would be reflected in other aspects of behavior, a possibility that is discussed in the next scenario.

2. ***A portfolio shift with feedback to spending***, plotted in the next figure, assigns real consequences for spending from the change in asset behavior. Suppose, for instance, the demand for monetary assets falls because consumers lose confidence in the safety and soundness of the banking system. This hit to household faith also



may be reflected in their willingness to invest in durable goods, and purchases that could be delayed would be delayed. As a result, the reduction in the demand for money that shifts the LM curve outward also pulls the IS curve inward. Thus, with an unchanged interest

4 Of course, for assets that are very close substitutes to M2, only small price effects are required to induce the relevant substitutions.

rate, the money stock falls owing to the shock to liquidity preference as households switch toward securities and the compounding effects of the reduction in income.[5]

A policy that pegs the interest rate insulates the economy from the LM schedule shift but exacerbates the income consequences of an IS schedule shift. In this case, an unchanged interest rate represents incremental tightening that reduces income. Policy needs to ease to the point where the effects on aggregate demand of the shift in money demand are offset (but likely not to the point where the effects on the money stock are completely offset--so that the growth of the money stock will still appear weak).

We need not rely on confidence effects entering both the IS and LM schedules to explain the middle panel. Suppose that depository institutions provide unique intermediation services, perhaps by channeling funds to small and intermediate-sized firms without ready access to capital markets (a mechanism advanced by Bernanke, among others).[6] A shift by households away from depository liabilities and toward market instruments would reduce those institutions' ability to intermediate as their access to relatively inexpensive retail funding shrank. As a result, investment would suffer, leading (through the Keynesian multiplier) to a decline in income as the IS curve shifted inward.

More in keeping with current circumstances, the opposite sequence of events--a contraction in intermediation producing weakened money growth--could result in identical shifts in the IS and LM schedules. The legislated contraction of the thrift industry and newly chastened commercial bankers could lead depository institutions

5. In addition to the shifts already discussed, the figure adds the movement in the IS curve, marked by the arrow denoted G^d.

6. See, for example, "Nonmonetary Effects of the Financial Collapse in the Propagation of the Great Depression," *American Economic Review*, vol. 73 (1983), pp. 257-276.

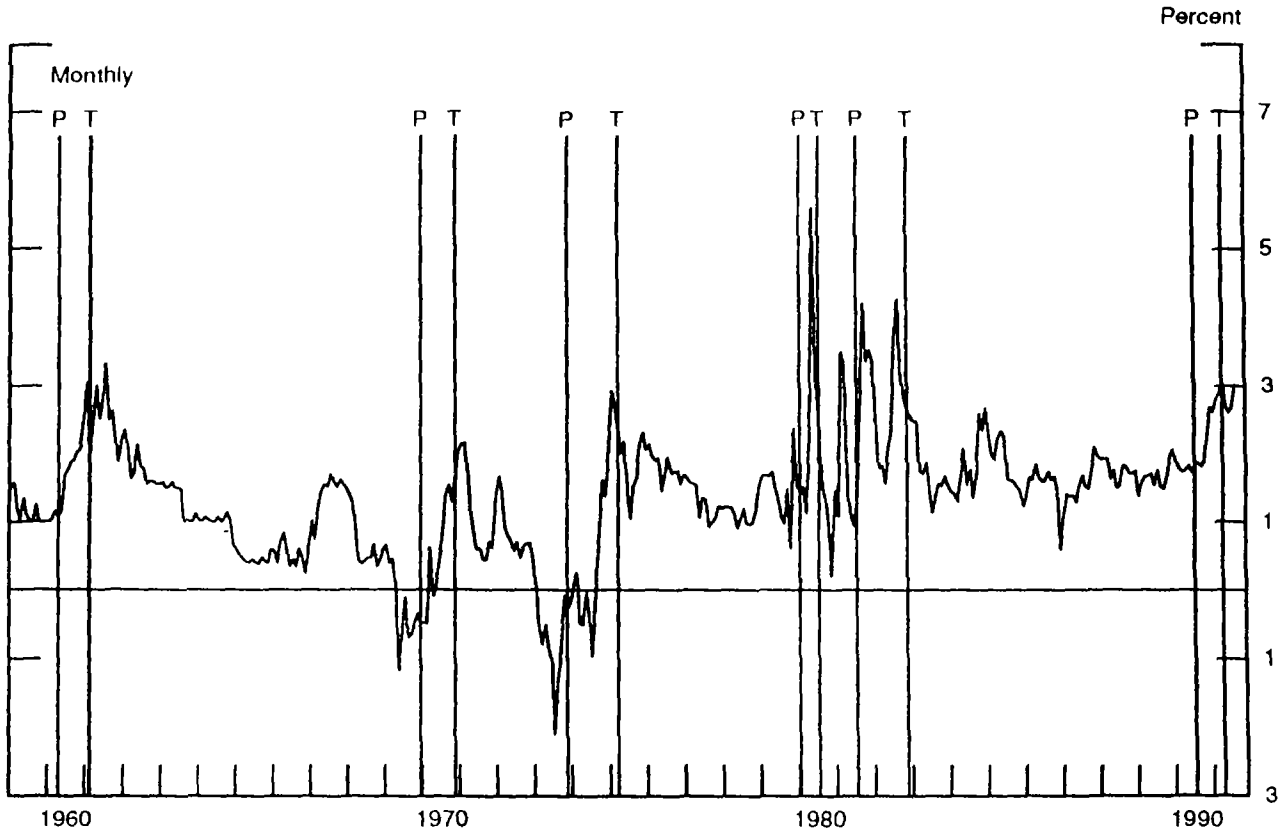
to bid less aggressively for retail funds. In terms of the original figure, an increased reluctance to lend pulls the IS curve inward and, for the same level of market rates on the vertical axis, is associated with lower deposit rates and a lessened demand for money--an outward shift in the LM curve.

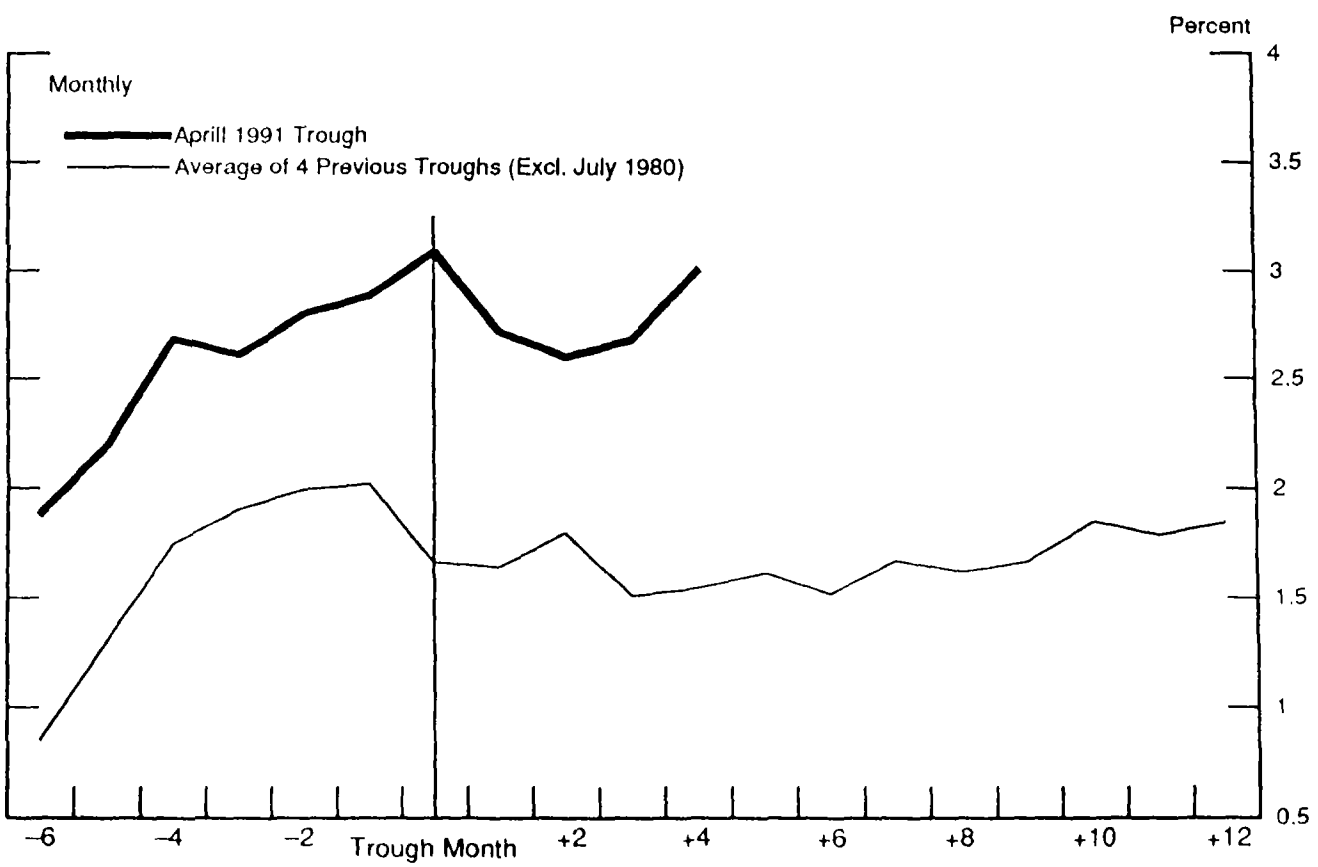
The weakness in loan growth at depository institutions suggests a Bernanke-type mechanism may be at work. Similarly, the most publicly available loan rate--the prime rate--remains stubbornly high relative to most measures of the cost of funds, even taking account of its cyclical behavior (chart). On the liability side, some retail offering rates are low relative to alternative investments, such as Treasury notes. These rate movements suggest that the cost of intermediating through depositories has risen of late.

However, while banks may be chary in extending loans, the marketplace has been charitable in valuing banks exactly when M2 growth has been its weakest. The second half of last year took a toll on depositories in financial markets, but in 1991 bank stock prices have outperformed the broader market (chart); similarly, most risk spreads, whether Eurodollar deposit rates relative to comparable maturity Treasury securities or yields on bank debentures to other corporate rates, have remained remarkably narrow. This suggests that the strains on the banking system have not caused investors to view banks as generally more risky, at least not to the degree required to explain the weakness in M2 as the result of depositors fleeing those institutions. Rather, this can be viewed as supporting the notion that bank efforts to pare their balance sheets induced the deposit shift.

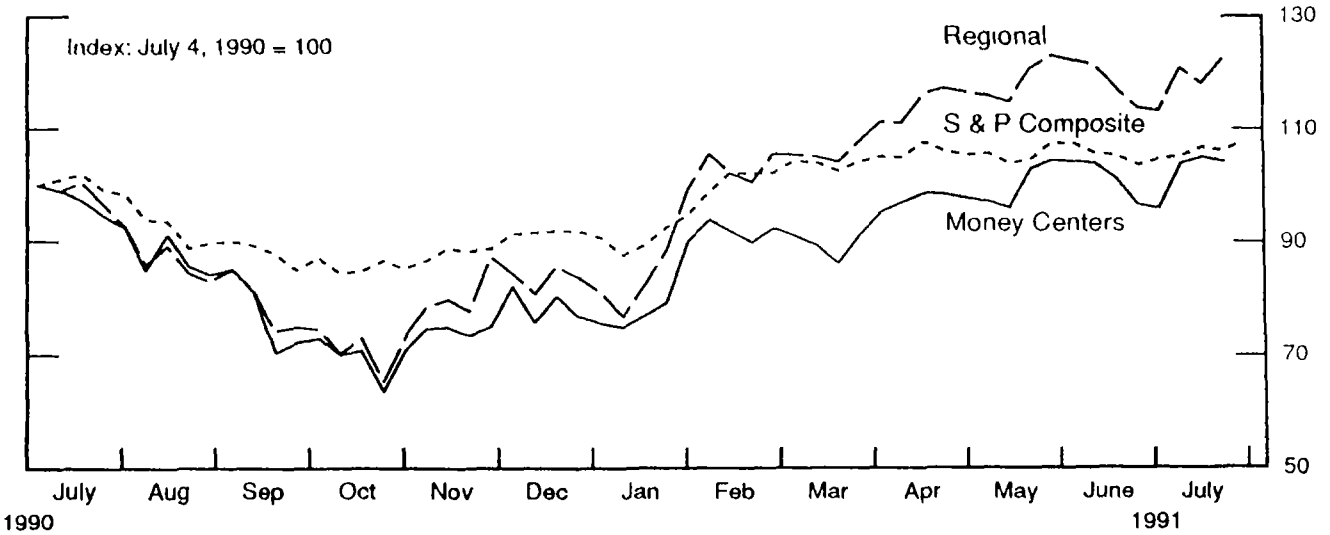
Alternatively, this weakness in money may not speak strongly to the financial side of the economy, but rather may provide a message about real activity. That message, however, may be hard to discern given the difficulties in modelling the interaction of spending and financial behavior. This possibility is discussed in our next case.

Prime – Federal Funds Rates

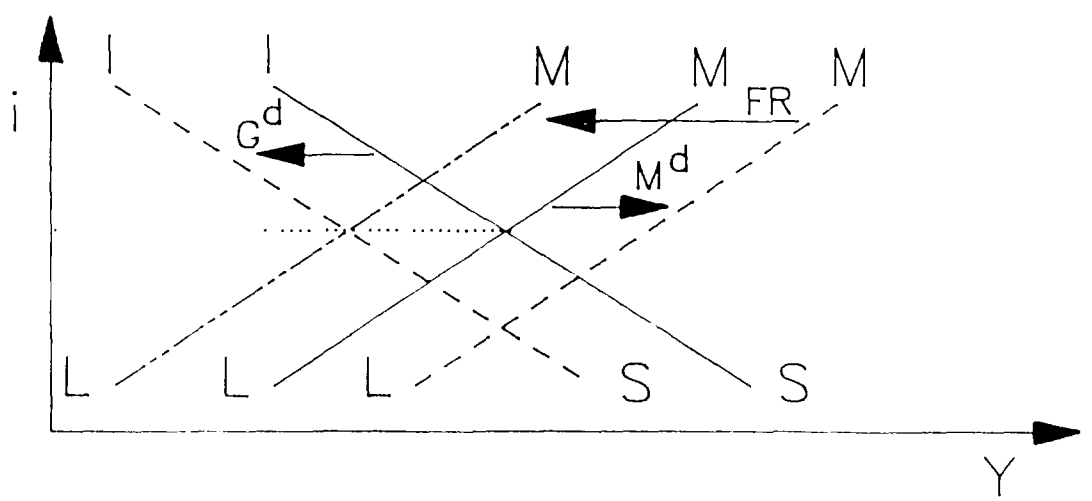




Bank Stock Prices and the Broader Market



3. ***Forward-looking money demand behavior*** is sketched in the next figure. The demand for money could well interact with the position of the IS curve, making the LM schedule a reduced-form relationship subject to structural shifts. Specifically, suppose that the demand for money depended on permanent, not actual, income. The normal correlation between the two notions of income would permit



predicting the position of the LM with some accuracy. However, an anticipated change in income would confound the relationship An inward shift in the current IS schedule that was expected to worsen would lower permanent income by more than its immediate effect on current income. The LM schedule, depending on permanent income, would shift out when drawn against current income on the horizontal axis,

reflecting the lessened demand for money. With an unchanged interest rate, income and real balances would fall. If those expectations come to fruition and the IS schedule subsequently shifts further inward, the fall in real balances will have reliably preceded the drop in income.

Thus, it is possible that real M2 balances may be providing a forward-looking reading on income developments. Without the appropriate policy response to that message, the central bank implicitly allows the shift in the IS curve to deduct directly from real income. Relating the demand for money to permanent income may explain that empirical regularity but creates another puzzle: Why does M2 adjust so slowly to changes in income? For the retail investor that is choosing between deposits and other financial instruments, transactions costs are low and information about investment opportunities flows freely.[7] If money demand depends on forward-looking income, real balances should be quickly adjusted. Yet, most empirical demand functions--including the Board staff M2 model--rely on lags to capture a sluggish response of real balances to movements in income.

One solution is to step away from the assumption that households continuously satisfy their money demand schedules but, rather, only periodically make decisions about their portfolios. If those decisions, as is likely the case, are not synchronous, in any short period of time only part of the investor populace is reshuffling its asset portfolio. The remainder operates with holdings decided at some earlier date. As a result, we arrive at the two-sided dynamics

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7. Marvin Goodfriend, for example, takes exception to relying on adjustment costs in empirical money demand equations. "Reinterpreting Money Demand Regressions," *Carnegie-Rochester Conference Series on Public Policy*, vol. 22 (Spring 1985), pp. 207-42.

that Phelps and Taylor applied to wage contracting.[8] That is, the individual decision to change real balances is made with an eye toward the future, but at any point in time the aggregate level of real balances is inherited from prior decisions.

Suppose, for instance, that current income drops to a permanently lower level. Investors about to replan take this into account and move their holdings down in line, but they make up only a fraction of the population. Over time, more and more investors get around to their periodic asset allocation and real balances move down. An econometrician would observe a dynamic correlation: Income falls and real balances drop slowly over time. Or, one might posit, the gap between desired and actual money holdings is narrowed in some partial adjustment or error-correction scheme.

The Board staff model of M2 implies such an adjustment mechanism by giving a role to a distributed lag of income as the scale variable.[9] However, such proxies fail to capture anticipated effects. If income is expected to fall in the future, permanent income would be immediately marked down. Newly set real balances, a current reading on permanent income, would fall sympathetically, while total real balances gradually decline as an increasing share of investors replan.

Such forward-looking behavior predicts that the misspecification in the Board staff M2 model should produce errors whenever there are sharp revisions to permanent income--perhaps in

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8. This approach is explained in John B. Taylor, "Aggregate Dynamics and Staggered Contracting," *Journal of Political Economy*, vol. 88 (1980), pp. 1-24.

9. A complete description of the Board staff M2 model is given in George R. Moore, Richard D. Porter, and David H. Small, "Modeling the Disaggregated Demands for M2 and M1 in the 1980's: The U.S. Experience" in *Financial Sectors in Open Economies: Empirical Analysis and Policy Issues*, Board of Governors, 1990, pp. 21-105.

periods around an economic turning point. Moreover, in those periods another mechanism could reinforce this, as the theoretical framework assumed that decisions are made asynchronously. Well-publicized concerns about the economy and the fragility of the financial system could bunch portfolio reallocations. Rather than the smooth adjustment consistent with reduced (but unobserved) permanent income, real balances would drop to the new level in a puzzling free fall, apparently at odds with precedent.

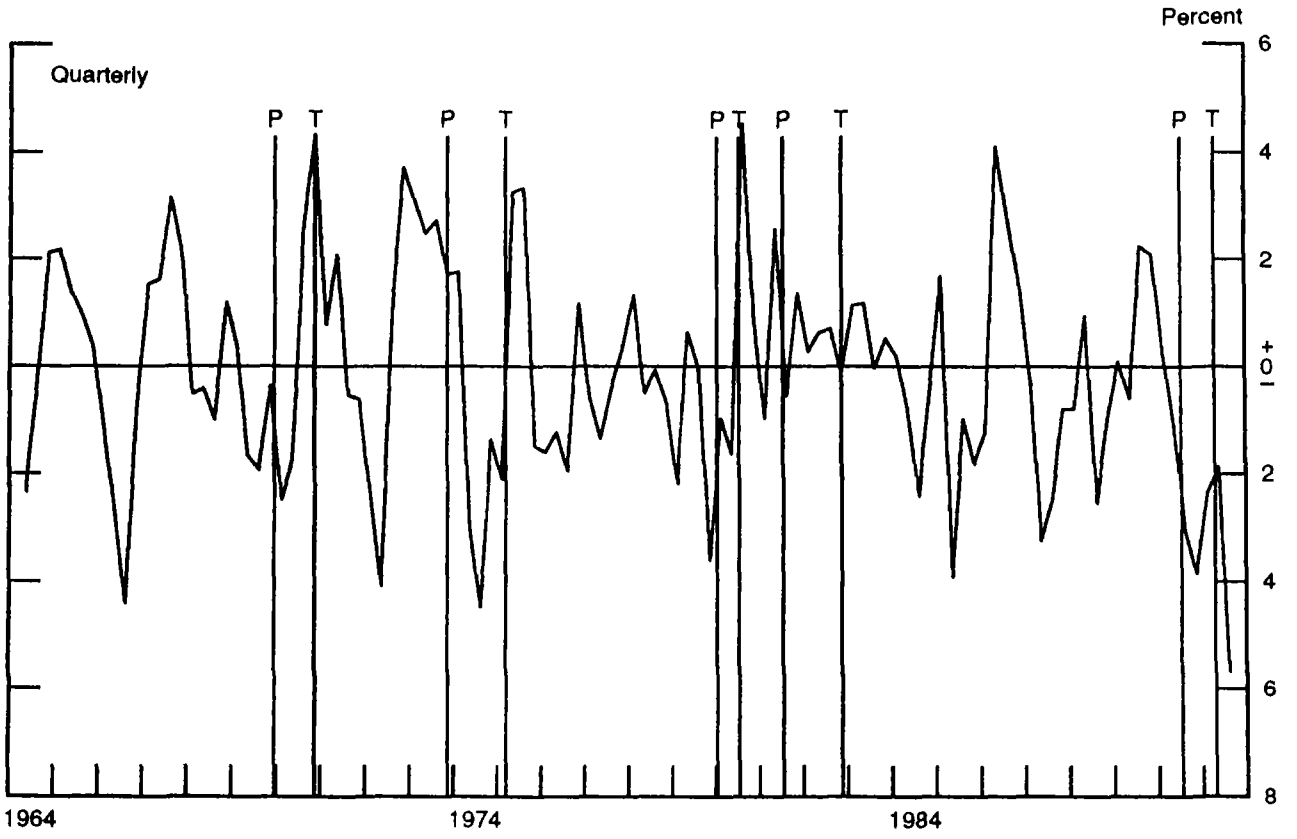
The next chart examines some of these issues using a longer-term perspective on the Board staff M2 model errors, comparing those made in the 1990-91 recession with average errors made in the four previous recessions encompassed by the current money demand specification.[10] The model tended to overpredict in recessions, only to underpredict at and immediately after troughs in the economic cycle. The systematic nature of these errors might imply that the money demand function is particularly misspecified in periods around a recession, suggesting that the normal lead-lag patterns between spending and M2 are disrupted in a business downturn. This might occur because households take a darker view of permanent income in the depths of a recession but revise their estimates quickly--more quickly than that captured by the model--as the recovery takes hold.

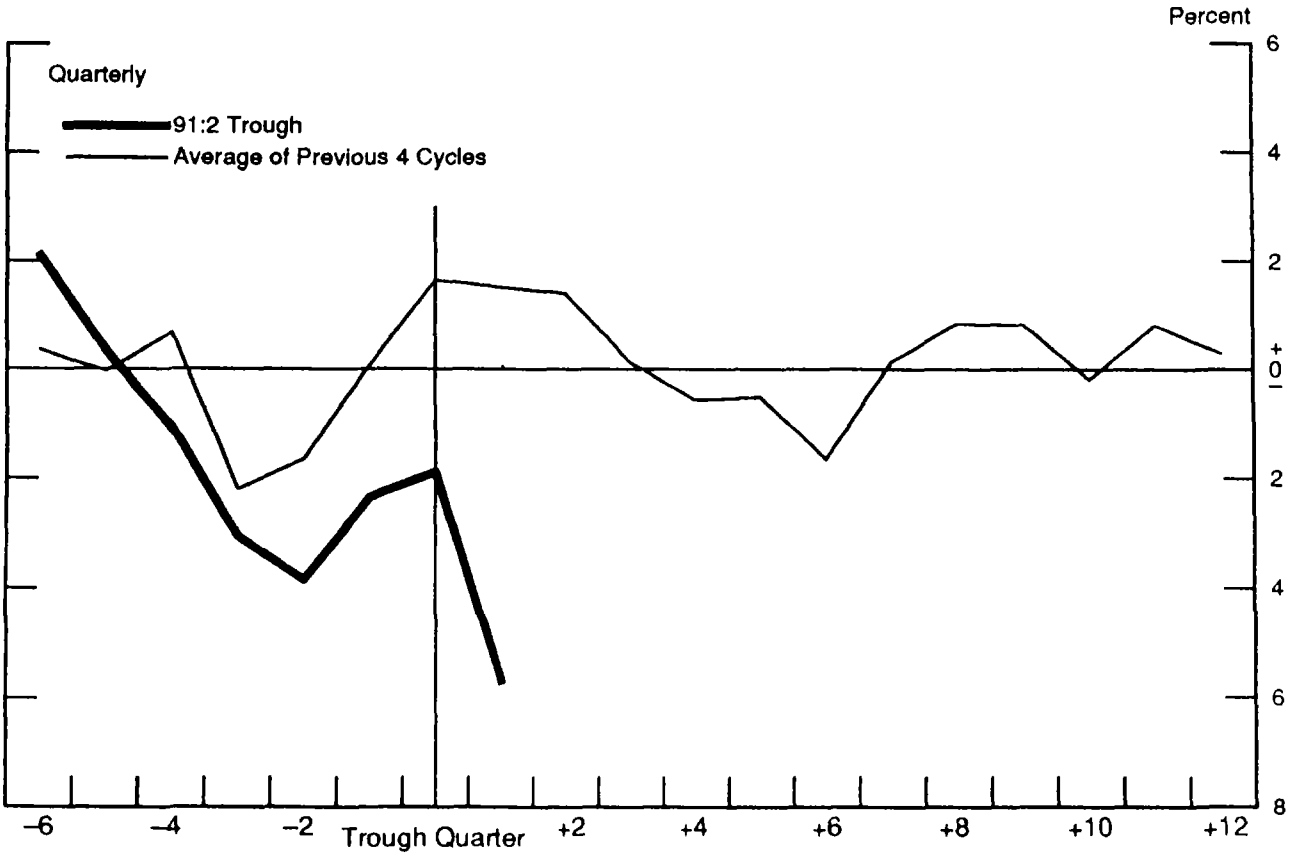
However, the correspondence between the recent experience and the cycle average apparently has broken down. In past episodes, the underprediction of the surge in M2 balances associated with the economic trough lead to a near four-percentage-point swing in the

10. The results are based on a dynamic simulation of the model starting in 1964. M2 is adjusted for the introduction of MMDAs to eliminate distortions in the 1982-83 recovery. The credit control and MMDA dummies are eliminated from the equation to get a clearer reading on the cyclical characteristics of the underlying specification.

Forecast Errors of the Staff Conference M2 Model

Actual Less Predicted Annual Growth Rate





forecast error. With current estimates of nominal income and M2, no such swing seems to be under way; the model continued to overpredict the second quarter trough, and that overprediction is projected to increase in the current quarter.[11]

Relying on permanent income essentially ties the recent behavior of money to an unobservable. If this story were correct, the influence of a drop in permanent income should be seen elsewhere as well. For example, the purchase of a durable good is an investment decision for the consumer and should be sensitive to future income prospects. As the chart suggests, the growth of real durable consumption in the most recent experience did weaken more than typical for recession and is recently weaker than in prior recoveries. Additionally, the equation in the Board's MPS model explaining the flow of services from consumer durables has been overpredicting of late. However, the miss in the current recovery is far smaller for durables than for real M2.

Also, this explanation requires an anticipated drop in income, which likely would be associated with a similar downward trajectory for short-term interest rates. Long-term interest rates, which under the expectations approach are weighted averages of the current and expected future short-term rates, should drop concurrently with the revision to the income path. Thus, the yield curve should flatten. However, the recent recession witnessed an unusually steep yield curve that has since tilted further upward (chart).

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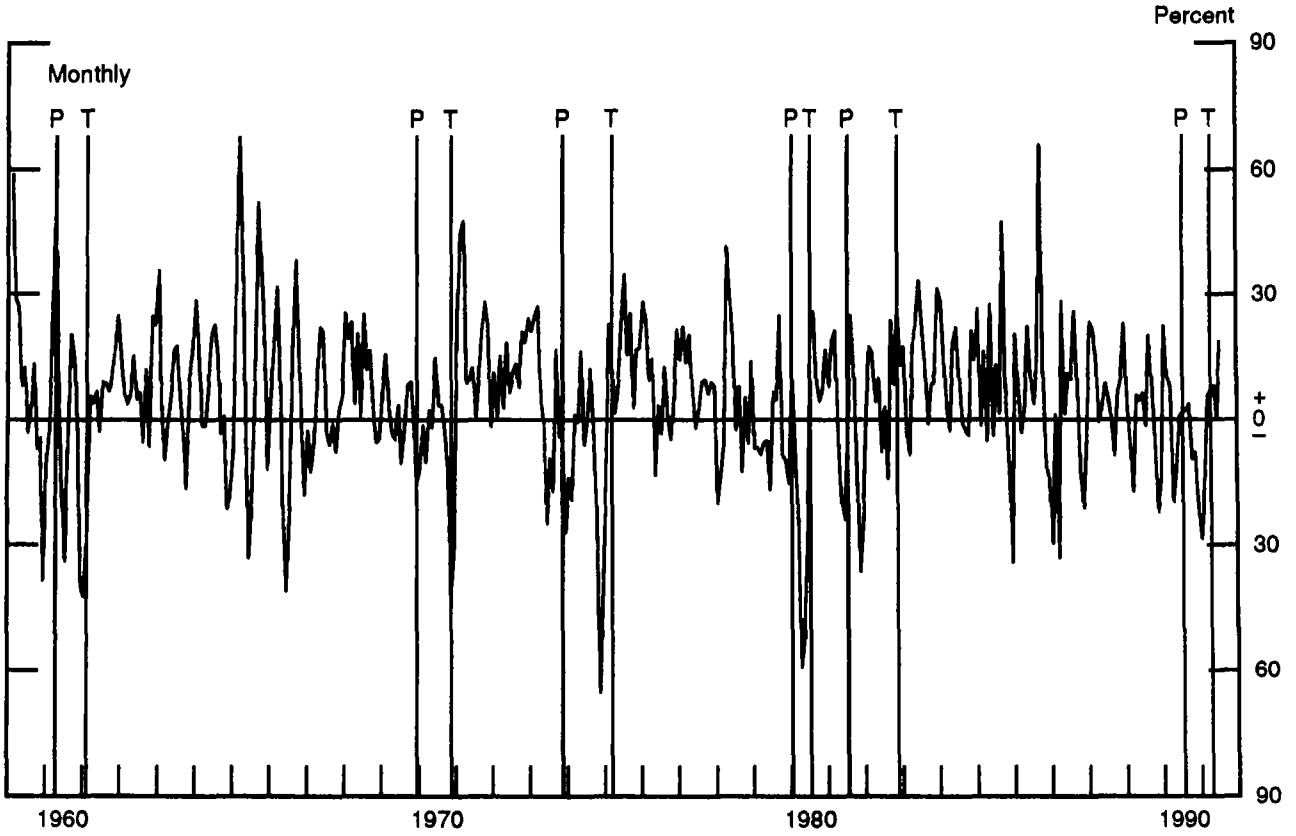
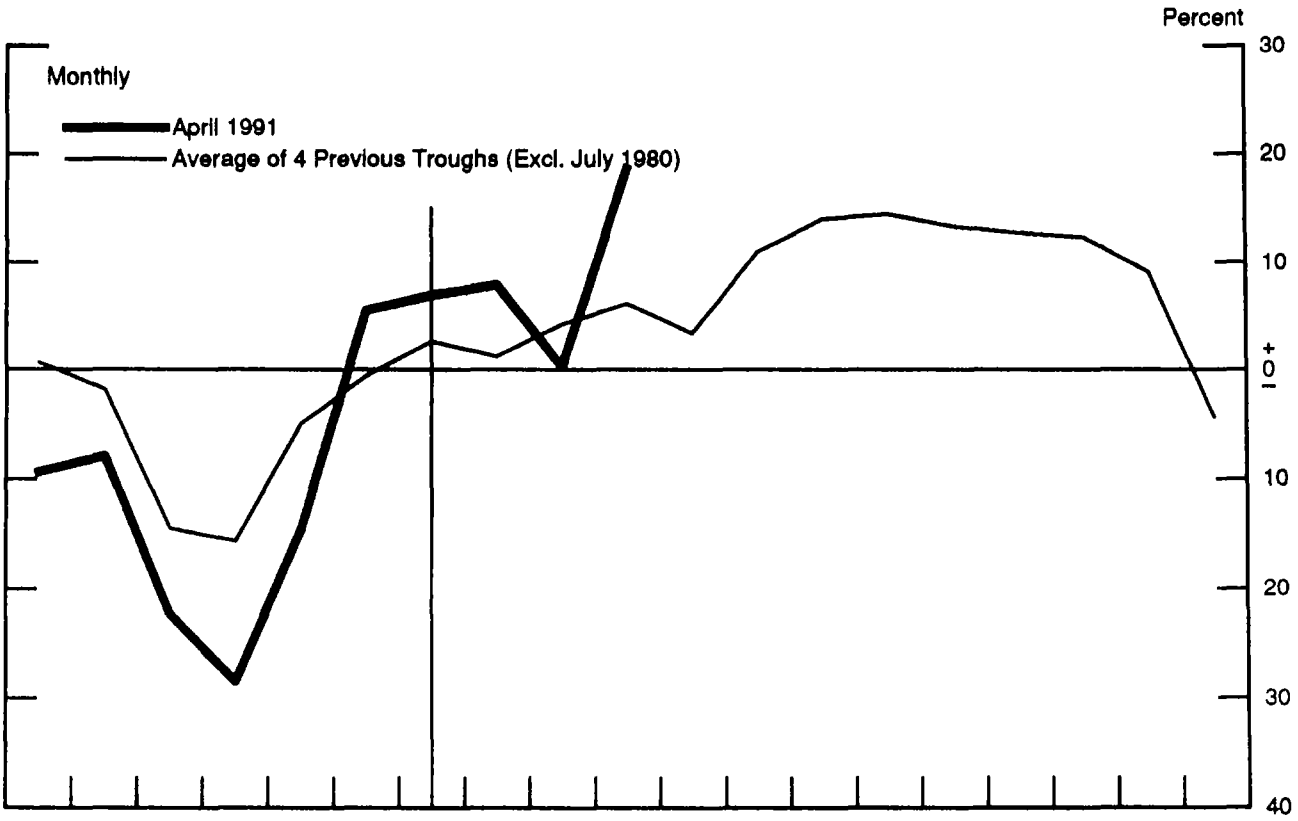
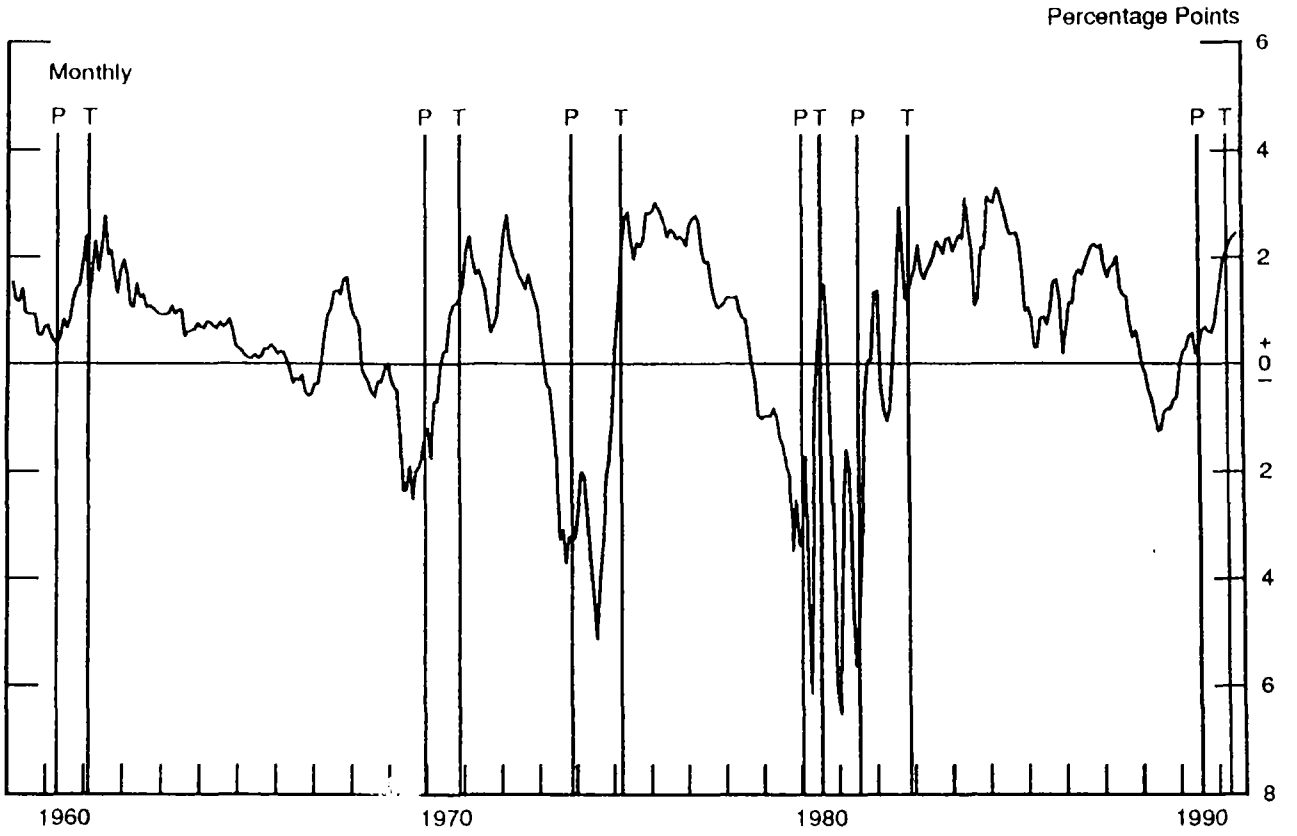
11. The model results in the current recession match most closely with those from the 1973-75 episode, especially when allowance is made for the longer length of the earlier recession. However, as reflected in the cycle average, in the first quarter after the trough in 1975, M2 grew very rapidly, much to the surprise of model-based forecasts.

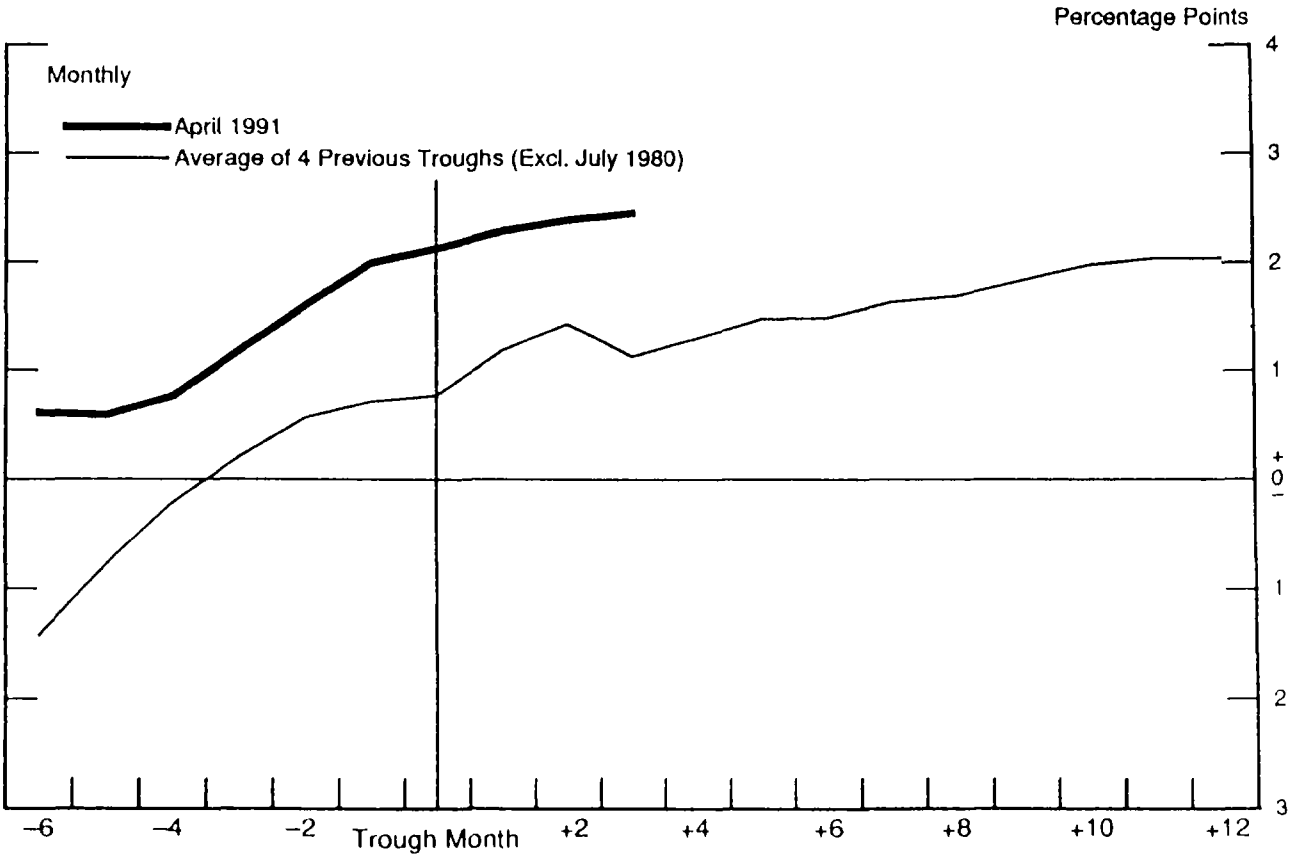
Growth in Real Durable PCE
(Three Month Moving Average)





Spread Between 10–Year Treasury Note Yield and Federal Funds Rate





IV. Evidence from Reduced-Form Relationships

There are limits to the guidance provided by theoretical models and the contemporaneous movement among macroeconomic variables. We now turn to reduced-form evidence to get a sense of the strength and reliability of the links between money and economic activity, first examining compact systems that assess that dynamic correlation. However, the regularity that real balances appear to move before economic activity may capture the systematic role of omitted variables, perhaps interest rates and other financial prices. Indeed, in a world in which the Federal Reserve has tended to accommodate shifts in the demand for money in order to smooth fluctuations in interest rates, some might be surprised to find an important additional role for money, once the level of interest rates is accounted for. That, however, is an empirical issue which we investigate in larger representations of the economy.

1. ***Causality tests*** are part of a body of work, advanced by Christopher Sims, in which simple unstructured dynamic relationships are used to establish rigorously the pattern of temporal precedence among various macroeconomic variables. Money-income causality tests are intended to reflect the extent to which money might affect both real and nominal variables of interest. Sims's pioneering work used quarterly data on M1 and nominal GNP, finding that causality does not run from GNP to M1, i.e., lagged values of GNP do not help forecast M1 in a linear regression using lagged values of M1.[12] In the other direction, however, "the evidence agrees quite well with the null hypothesis that causality runs entirely from money to income without feedback."[13] Subsequently, Sims added interest rates and prices to the system and examined a four-variable system with M1, a short-term interest rate (the four-to-six-month rate on commercial paper), a real

12. "Money, Income, and Causality," *American Economic Review*, vol. 62 (1972), pp. 540-552.
13. Op. cit. p. 542.

output measure (industrial production) and an aggregate price level, the producer price index .[14] The results generally reversed the initial findings in the two-variable system: By adding interest rates to the system, the explanatory power of money evaporated.[15]

Stock and Watson have further advanced the work on this subject by carefully examining the time-series properties of the variables that enter the regression equations, finding that detrended monthly growth in M1 significantly helped predict the growth of industrial production from 1959 to 1985.[16] Importantly, and in contrast to Sims, this result holds whether or not additional variables are included in the causality tests (e.g., the change in the rate on three-month Treasury bills and the rate of inflation) and are not affected by the particular lag structure.

In our research, we updated the Stock and Watson results to the present (June 1991), using M1, M2, and their difference as measures of money, and real consumption, nominal consumption, and industrial production as measures of activity. For each combination of these measures for money and output two hypotheses were tested: (H1) "money" does not Granger cause "output"; and (H2) "output" does not Granger cause "money". Further, we included interest rates and prices in the money and output system and re-tested hypotheses (H1) and (H2), and also tested the hypotheses that (H3) interest rates do

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14. "Comparison of Interwar and Post War Business Cycles: Monetarism Reconsidered," ***American Economic Review***, vol. 70 (1980), pp. 250-257.

15. For an update see Richard M. Todd, "Vector Autoregression Evidence on Monetarism: Another Look at the Robustness Debate," Federal Reserve Bank of Minneapolis ***Quarterly Review***, vol. 14 (1990), pp. 19-37.

16. "Interpreting the Evidence on Money-Income Causality," ***Journal of Econometrics***, vol. 40 (1989), pp. 161-181.

not Granger cause "output", and (H4) interest rates do not Granger cause "money".[17]

The following table presents the results for the alternative money and output variables in terms of the level of significance of the test results. The lower the reported significance level, the stronger the rejection of the indicated hypothesis (the column headings). For example, reading the first line in the top panel of the table and using the 10 percent significance level as the cutoff for rejecting the tested hypothesis, we accept the hypotheses that M1 does not Granger cause nominal consumption and that nominal consumption does not Granger cause any of the money measures. Further along that row, the hypotheses that M2 and non-M1 M2 do not Granger cause nominal consumption are rejected at the 1 percent and 4 percent significance levels, respectively.

To summarize the findings from the table, in all cases using M2 and non-M1 M2 to measure money, money Granger causes output.[18] In addition, in most instances the hypothesis that income causes M2 or non-M1 M2 is rejected. Moreover, these results hold for all the measures of output considered and are not sensitive to the inclusion of an interest rate in the regression equations, whether that interest rate is measured by the three-month Treasury-bill rate, the own rate on M2 deposits, a relative measure of the

17. Some care should be taken in interpreting the results from the larger systems, since Granger causality is a concept for a two-variable system. Depending on the magnitudes of the cross correlations in the data, X may not Granger cause Y, despite the fact that X Granger causes Z and Z Granger causes Y.

18. In contrast to Stock and Watson, M1 appears to be a poor indicator of economic activity. It appears that by extending the time period to June 1991, the usefulness of detrended M1 growth as a predictor of the growth in economic activity decreases markedly.

Granger Causality Tests
Levels of Significance for Rejecting Alternative Hypotheses

Money Growth and Nominal Consumption Growth

	M1				M2				Non-M1 M2			
	H1	H2	H3	H4	H1	H2	H3	H4	H1	H2	H3	H4
Bivariate	.21	.92	--	--	.01	.63	--	--	.04	.17	--	--
Multivariate	.10	.04	.77	.01	.01	.19	.75	.01	.02	.11	.76	.01

Money Growth and Real Consumption Growth

	M1				M2				Non-M1 M2			
	H1	H2	H3	H4	H1	H2	H3	H4	H1	H2	H3	H4
Bivariate	.37	.70	--	--	.05	.44	--	--	.05	.06	--	--
Multivariate	.63	.22	.80	.01	.03	.23	.87	.01	.03	.06	.84	.01

Money Growth and the Growth in Industrial Production

	M1				M2				Non-M1 M2			
	H1	H2	H3	H4	H1	H2	H3	H4	H1	H2	H3	H4
Bivariate	.09	.26	--	--	.01	.12	--	--	.01	.02	--	--
Multivariate	.14	.33	.14	.01	.01	.67	.18	.01	.01	.21	.27	.01

All variables are in log growth rates except for the interest rate variable which is first differenced.
Granger causality tests include a constant and for M2 and non-M1 M2 a separate dummy variable for Credit Control in 1980:3,4 and 5 and for the introduction of MMDA's in 1982:11, 12 and 1983:1. The Granger causality tests using M1 and non-M1 M2 also include a linear time trend.
The multivariate Granger Causality tests include inflation as measured by the producer price index and the effective rate on 3 month T-bills.
The estimation range is 1959:1 to 1991:6, and six lags of the explanatory variables are used in each test.

H1 (M $\not\rightarrow$ Q): Money does not Granger cause Output.
H2 (Q $\not\rightarrow$ M): Output does not Granger cause Money.
H3 (R $\not\rightarrow$ Q): Interest Rates do not Granger cause Output.
H4 (R $\not\rightarrow$ M): Interest Rates do not Granger cause Money.

opportunity cost of holding M2, or the slope of the yield curve. Lastly, these results appear robust to varying the lag length or estimation period.

2. ***A larger system of macroeconomic relationships*** may clarify the relative importance of the links summarized in the Granger causality tests and provide point estimates of the consequences of weakened money growth for economic activity. To that end, two simple vector autoregressive models (VARs) were estimated, using the monthly data available from June 1960 to December 1988.[19] The first captures the correlations among money, income, and prices without attempting to describe the possible transmission mechanisms. Money was measured by M2 and income and prices were proxied by real disposable income and its implicit deflator. The deterministic elements included dummy variables for the Carter credit controls and the introduction of MMDAs, as well as the change in relative energy prices and a trend term with a pace that varies with the staff estimate of potential output. Relationships in levels were estimated since tests indicated that at least one long-run link among the levels of the variables existed.

The larger system expands the variable list to nine by broadening the description of depository institution balance sheets and adding financial market variables. Four variables capture financial aggregates--M1, non-M1 M2, non-M2 M3, and bank credit--while the asset prices include the fed funds rate, the ten-year Treasury rate, and the S&P 500 index. This system, which used the same activity and price measures as well as the identical deterministic elements, was also estimated in levels.

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19. Vector autoregressions treat the endogenous variables symmetrically: Each variable to be explained is regressed against lagged values of itself and all the other endogenous variables, as well as common deterministic elements, such as a constant and trend terms.

Since these VAR estimates use only lagged regressors as explanatory variables, they cannot explain any contemporaneous comovement among money and economic activity. That is, any effect of money on economic activity (or the reverse influence of activity on money) that occurs within a month will appear in the residuals to the reduced-form equations that make up the VAR. Over time, systematic within-month effects will show up as a pattern of correlation among those residuals, information that should be taken advantage of when forecasting. It is possible to obtain structural estimates of these within-month effects in a second round of estimation by imposing a set of identifying assumptions that explicitly spell out the directions of influence. This second-stage estimation produces values for the contemporaneous impacts of the respective variables as if their current values had been included in the VAR.[20]

There are many uses of VARs, but we will focus on two: explaining the variance of time series and conditional forecasting. With the complete model--the VAR coefficients and estimates of the

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20. In the three variable VAR, for example, residuals from the M2 and real income reduced forms are positively correlated--they move together within a month. That correlation can be explained by either assuming that money influences income or that income influences money within a month, which, respectively, would be equivalent to including current money in the income equation or current income in the money equation. Identification is the process of choosing between those alternatives. We chose a conservative ordering in both systems by explaining money's role in terms of a conventional money demand relationship. These structural decompositions have been advanced by Ben Bernanke," Alternative Explanations of the Money-Income Correlation," ***Carnegie-Rochester Conference Series on Public Policies*** (1986), pp. 49-100, and Olivier J. Blanchard, "A Traditional Interpretation of Macroeconomic Fluctuations," ***American Economic Review***, vol. 79 (1989), pp. 1146-1164.

within-month effects--we can forecast over any desired horizon. The uncertainty attached to the forecast path for any one variable, say M2, depends on how poorly the equation fits, as well as the fit of the equations of the other variables that enter importantly in the M2 equation. If, for instance, the reduced form for real income is estimated with a great deal of error, then that uncertainty will be compounded into the M2 equation in a dynamic simulation, with this effect being larger the more important is income's role in explaining M2. In fact, since a VAR is a linear system of equations, it turns out that we can readily express the forecast errors for any variable k-months ahead as a linear combination of the errors impinging on the system over that horizon. Thus, the variance of the forecast errors is the variance of this linear combination, which can be calculated from the estimates of the VAR coefficients and the within-month effects. This information is summarized in a variance decomposition for different forecast horizons. Such a decomposition reports, for each variable and any horizon, the share of the variance of the forecast error attributable to each variable in the system.

This decomposition is provided in the two panels of the following table for our two models for five different forecast horizons. As the top panel indicates, in the smaller system, uncertainty about movements in M2 accounts for about one-third the uncertainty attached to a three-year-ahead forecast of real income. That is, one-third of the width of an estimated confidence band around a projection of income three years hence owes to uncertainty about M2. Taken literally, this black-box monetarist model cautions that unexplained weakness in M2 will be followed by misses in the real income equation. However, the time horizon is long, with the bulk of

the effect felt only after two years.[21]

The nine variable system affords a role to other financial variables in directly influencing income. Apparently, as seen in the lower panel, those effects lessen the explanatory power of the

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Decomposing the the Forecast Error Variance of Real Income over different horizons

with a model estimated from June 1970 to December 1988

A. Three-variable VAR

Months ahead	percent of variance attributable to: M2	Real Income	Prices
1	0	100	0
6	1	98	2
12	5	90	4
24	22	68	10
36	35	52	13

B. Nine-variable VAR

Months ahead	percent of variance attributable to: M1	M2-M1	M3-M2	Real Income	Other
1	0	0	0	100	0
6	1	1	0	93	5
12	2	2	0	81	15
24	5	5	1	61	28
36	9	4	2	49	36

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21. It is possible that this lag length is overly long because we have not included enough explicit exogenous variables in the model. In the absence of such determinants, the model necessarily reaches back through its own lag terms to explain the variation in the dependent variables. In any event, the results are quite typical of the lags found in this literature.

monetary aggregates. Taken together, the components of M3 explain about 15 percent of the variability in the forecast errors of real income three years hence, with most of that success owing to the narrower aggregates. Moreover, that influence makes itself felt over a long stretch of time. Income developments and other factors garner the lion's share of explanatory power.

These findings should not be interpreted as contradicting the Granger causality tests, which weigh a measure of statistical significance. The results from the Granger tests strongly favor the view that movements in money precede movements in income against the view that there is no influence. However, such statements do not speak to either magnitude or timing. The variance decompositions suggest that uncertainty about income matters most for longer-term but not near-term forecasts and, at least in the larger system, that those effects may not account for a major part of the variability of real income.

The next table considers our second use of the VAR models--conditional forecasts for real income. The table reports two exercises for each model to get some sense of the consequences of weakened money growth for point estimates of real economic growth. In the first, M2 and M3 grow along the staff forecast until the end of 1992. In the second, the aggregates grow one percentage point below the baseline forecast after September. Since VARs basically extrapolate recent trends, with weak income and sluggish M2 growth in the first half of 1991, it is almost preordained that the three-variable VAR would forecast meager income growth. As shown in the top line of the table, using the staff's money projection, the simple model forecasts 1-3/4 percent growth in real income from June to December, followed by 1-1/2 percent growth over the course of 1992. As the next row shows, the simple model predicts that a modest slowing in the growth rate of M2 will be associated with about half as much

Conditional Forecasts of Real Disposable Income from the VAR Models

percent change, annual rate

	over the period: June 1991 to December 1991	December 1991 to December 1992
A. Three-variable system		
With M2 at:		
• Baseline	1-3/4	1-1/2
• Weaker money alternative	1-1/4	1
B. Nine-variable system		
With the monetary aggregates at:		
• Baseline	2-3/4	3-1/4
• Weaker money alternative	2-1/2	3
Memo: Growth rates of the monetary aggregates		
• Baseline		
M2	2	5
M3	1/2	2-1/2
M1	5-3/4	5-1/2
• Weaker money alternative		
M2	1	4
M3	-1/4	1-1/2
M1	5	4-1/2

slowing in real income growth. Thus, a slowing in M2 growth by 1 percentage point in the second half of 1991 and for all of 1992 shaves about 1/2 percentage point from real income growth over that period.

The next lines performs these same calculations for the nine variable system. The more finely detailed information on the aggregates, as well as the additional impact of financial prices, significantly boosts the baseline forecast. This larger model projects 2 3/4 percent growth in real income in the second half of the year and for 1992, given the staff forecast of money growth. Within the larger system, weaker money reduces that projection of real income growth for the next 1-1/2 years by about 1/4 percentage point.

V. Conclusions

The current weakness in M2 and credit may embody special factors which have shifted down the demands for M2 and restricted the supply of credit. Alternatively, the weakness may cast doubt about the strength of any upturn in the economy that is under way, despite the more supportive messages from real-side indicators. The work described here has aimed at shedding light on these questions. The evidence suggests that the typical relationship between money and income, controlling for the appropriate opportunity cost, tends to break down around cyclical troughs. Perhaps some of the smoke clears by modelling money demand as depending on a forward-looking variable and admitting to behavior shifts by stage of the business cycle. However, supporting evidence for this view awaits further work. The evidence also suggests that money historically has mattered, in that a forecaster knowing the path of M2 would outperform a competitor left in the dark about that aggregate. However, recognizing important roles for other financial variables narrows that advantage.