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THE CASE OF THE "MISSING M2"

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John V. Duca

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John V. Duca*
Senior Economist and Policy Advisor
Federal Reserve Bank of Dallas
Dallas, TX 75222, USA

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The Case of the "Missing M2"

Abstract

Since 1990:Q3, U.S. M2 growth has been weaker than predicted. This study assesses whether this "missing M2" is associated with inflows into bond and equity mutual funds or the thrift resolution process. RTC procedures can depress M2 in ways not reflected in standard models because they force an early call of small time deposits and impart a prepayment risk to small time deposits. This study finds that, although some portion of bond funds are good substitutes for M2, bond and/or equity funds cannot explain the "missing M2." Most of the "missing M2" instead appears related to RTC activity.

JEL Classification Codes: E41, E51, E52

There has been a growing body of evidence that the demand for M2 is more predictable than the demand for M1 (e.g., Hetzel and Mehra (1989), and Moore, Porter, and Small (1990)). Not surprisingly, more economists and policymakers have turned to using M2 as an indicator of economic activity and as a guide to long-run price developments (e.g., Hallman, Porter, and Small (1991)).

However, for more than a year, M2 has been unusually weak. For example, the Federal Reserve Board staff model of M2 (henceforth, the FRB M2 model) has overpredicted M2 growth by an average of 1.8 percentage points over 1990:Q3-91:Q4, and an M2 model developed at the Federal Reserve Bank of San Francisco had been overpredicting M2 growth in late 1990 (see Furlong and Trehan (1990)). Figure 1 presents results from estimating M2 growth with the FRB's econometric model, where the estimated shortfall in M2 growth is the gap between estimated M2 growth and actual M2 growth.

This study assesses two competing explanations for this phenomenon. One is that the missing M2 merely reflects substitution by households into bond and/or equity mutual funds, which are very liquid (e.g., see Farrell and McNamee (1991)). Indeed, coincident with the "missing M2" have been runoffs in small time deposits, unusual weakness in money market mutual funds and large inflows into bond and equity mutual funds. The other explanation is that the missing M2 reflects households' reaction to the activities of the Resolution Trust Corporation (RTC). Indeed, the missing M2 has coincided with the efforts of the RTC to resolve failed thrifts.

Using the FRB M2 model, this study documents the "missing M2" evident since 1990, and finds that RTC activity, rather than inflows into bond and equity funds, appears to account for much of M2's recent weakness. In essence, the RTC's method of resolving failed institutions has lowered the perceived return on thrift deposits in ways not typically accounted for by

Figure 1
Estimated Shortfall in M2 Growth

models of M2. In response, investors have shifted from M2 deposits to other assets, including but not limited to bond and equity mutual funds.

This study is organized as follows. First, the institutional characteristics of bond and equity funds are reviewed. Then, the second section discusses bond and equity funds in a Miller-Orr framework. The third section describes how bond fund adjustments to M2 were computed, and then uses the M2 model of the Federal Reserve Board staff to assess how much of the "missing M2" reflects bond and equity fund inflows. The fourth section reviews several competing explanations for how RTC resolution activity may affect M2 and create a "missing M2" phenomenon. Section five discusses the construction of three proxies for RTC effects on M2, which are then added to the Fed's M2 model. Estimation results are presented in section six, and the final section concludes by reviewing this study's findings.

1. Institutional Characteristics of Bond and Equity Funds

Developed in the mid-1970s, bond funds are mutual shares of bond portfolios and are substitutes for direct bond holdings and M2 deposits. In order to assess the impact of bond funds on M2, we must therefore distinguish between these substitution possibilities. To this end, this section explores the substitutability of bond funds for direct bond holdings and M2 deposits.

Similarly, equity mutual funds potentially substitute for both direct holdings of equity and for other assets such as M2 balances. However, equity funds differ from M2 balances in one important way that bond funds do not. Specifically, equity funds carry a substantial degree of investment risk which makes them much less substitutable for M2 deposits than bond funds. Moreover, in contrast to bond funds, available data do not allow one to easily measure shifts from directly held equities to equity funds. For these reasons, this study focuses more on bond fund rather than equity fund effects.

Substitution Between Bond Funds and Direct Bond Holdings

Bond funds offer three main advantages over directly-held bonds. First, bond funds enable an investor to acquire shares in a well-diversified portfolio with only a modest investment. Portfolio diversification partially protects investors by enabling them to not be overly exposed to the risk that the value of a particular firm's bonds will fall greatly. A second advantage is that bond funds in asset management accounts are more liquid than directly held bonds. That is, bond funds can be converted into transactions accounts more quickly and with less expense than can directly held bonds.

A third incentive to hold bond funds rather than bonds relates to taxes. During the mid-1980s, U.S. tax laws created incentives for households to open individual retirement (IRA) and Keogh accounts for which bond and equity funds were better savings instruments than directly held bonds. Mutual funds can be more attractive tax shelters because (1) many funds complete and provide all of the tax-related accounting information for investors and (2) bond funds allow investors to make the maximum annual IRA contribution, $2,000-$4,000, which is less than the $10,000 minimum denomination of most bonds.[1]

The major drawback of bond funds is that for rich investors, the costs of directly investing in bonds may be less than bond fund fees. Nevertheless, bond funds are a more attractive means of holding bonds for many investors.

Substitution Between Bond Funds and M2

Several characteristics of bond funds suggest that they are also

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[1] The maximum contribution is $2,000 for most eligible individuals and $4,000 for most eligible families.

substitutes for M2. In order to evaluate the "moneyness" of bond funds, however, it is helpful first to review the salient features of M2 deposits.

M2 deposits generally share three important characteristics. First, because they are federally insured, investors do not have to worry about the risk that their M2 deposits may fall in nominal value. By contrast, many corporate bonds (especially noninvestment grade or "junk" bonds) pose default risk to investors in that there is a chance that the firms may not be able to pay back investors. A second characteristic of M2 deposits is that they generally have smaller minimum denominations than many bonds and commercial paper issues which typically come in $10,000 increments. As a result, many more households are able to invest in M2 deposits than in bonds. The last important feature of M2 deposits is that households can either write checks on many M2 deposits or shift noncheckable M2 deposits into checkable accounts.[2]

How do bond funds compare to M2 deposits? First, many bond funds typically have little or no credit risk because they are heavily invested in U.S. government guaranteed mortgage-backed securities and high grade corporate bonds.[3] As a result, bond funds are relatively safe and can substitute for small time deposits. Second, many bond funds have minimum investment sizes of under $10,000, and do not require households to invest in $10,000 increments. Third, many bond funds enhance the liquidity of investors by offering check writing priviledges, credit lines, and credit cards. Fourth, many bond fund

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[2] In practice, many institutions do not penalize households signficantly if they must prematurely withdraw small time deposits in an emergency.

[3] Of $354 billion in bond funds in Sept. 1991, $146 billion was invested in municipal bonds, $123 billion in U.S. government securities (including U.S. government guaranteed mortgage-backed securities), $25 billion in junk bonds, and $50 billion in mixed bond funds (primarily, Treasury, municipal, collateralized mortgage obligations, and high grade corporate bonds).

holdings are in asset management accounts--which allow investors to readily shift assets across bond, equity, and checkable money market mutual funds at very low transactions costs.[4] This last feature heightens the responsiveness with which investors shift funds between bond/equity funds and MMMFs when relative rates of return between these assets change. Indeed, the missing M2 has been accompanied by weakness in MMMFs, as well as in small time deposits.

Bond funds differ from M2 deposits in several ways. First, unlike M2 accounts bond funds are marked to market. A change in interest rates affects an investor's balances by altering market price of these assets. Bonds bear a fixed coupon, and thus indirectly so do bond funds. When long-term interest rates rise, therefore, the prices of existing bonds fall in order for the yield to rise. Thus, the market value of bond funds falls as long term rates rise. For this reason, bond funds pose interest rate (price) risk.

A second way that bond funds differ from M2 deposits concerns taxes. Because of the mark-to-market feature of bond funds, investors must consider the capital gains tax consequences of shifting out of bond funds into money market funds. These tax considerations entail costs that may hamper substitution between bond funds and money market funds. A third difference is that bond funds include many IRA/Keogh accounts, which are excluded from M2 because their tax-deferred status reduces their liquidity. Finally, annual fixed fees and minimum balance requirements for bond funds effectively limit the relevance of these instruments to more affluent households. (One reason

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[4] Mutual fund "families" usually allow investors a limited number of free "switches" (transfers) among money market, bond, and equity funds within the same family (Donoghue's Mutual Funds Almanac, 1987-1988, pp. 16-17.). Recently, Citibank has enabled households to easily shift funds among MMDA, checking, MMMF, bond mutual funds, and equity mutual funds, thereby increasing the substitutability of bond (and equity) funds with liquid M2 deposits.

is that many less well-off households may find that these fixed fees are large relative to the interest income on the amounts that they can invest.)

Overall, the characteristics and recent behavior of bond funds imply that while they are not perfect substitutes for M2 deposits, their degree of substitutability may be substantial. Expanding M2 to include bond funds would internalize such substitution effects, and thus, at least theoretically, might make M2 more stable. However, including bond funds in M2 could create several complications. First, many bond fund assets have substituted for direct bond holdings. Second, the mark-to-market valuation of bond funds would introduce an interest rate sensitivity that is not a direct "money demand" effect. For example, a rise in bond yields would cause bond fund balances to fall through mark-to-market valuation. Third, it is unclear to what extent households would alter their bond-fund augmented M2 holdings following a change in bond yields. Finally because they are long-term investments, the degree of substitution between bond funds and equity may exceed that between M2 deposits and equity. This implies that putting bond funds in M2 may make M2 less stable as investors shift between stocks and bond funds.

2. Theoretical Considerations About Bond and Equity Mutual Funds

On a more theoretical level, the increased popularity of bond funds likely owes to a reduction in the costs to households of transferring assets from bonds (e.g., now in the form of bond funds) into transactions accounts (especially MMMFs), and a substantial steepening in the yield curve which enhances the attractiveness of long-term bond funds relative to medium-term bank deposits.[5] This development can be discussed in reference to Milbourne's (1986) analysis of financial innovation and liquid assets.

Milbourne's model is a modified Miller-Orr model (Miller and Orr (1966) and Orr (1970)) in which households face stochastic net cash flows in a world of three financial assets: transactions accounts yielding a return of r_m, savings accounts at banks yielding r_s, and bonds yielding r_b which have virtually no credit risk. Net cash changes are stochastic with a mean of 0 and variance σ^2, and whenever transactions balances hit zero, funds are transferred into transactions accounts from either savings accounts at a fixed cost α or from bonds at a fixed cost of β. Milbourne assumes that $r_m < r_s < r_b$, and that the costs of transferring funds from bonds into transactions accounts is greater than that of shifting funds from savings to transactions accounts (i.e., $\alpha < \beta$). Owing to the latter assumption, Milbourne's model implies that households will hold a portfolio of all three financial assets, and that transactions (T), small time (S), and total M2 (T+S) deposits equal:

$$T = (4/3)^{2/3}\sigma^{2/3}(\alpha/[r_b-r_m])^{1/3} , \tag{1}$$

$$S = (4/3)^{2/3}\sigma^{2/3}(\beta/[r_b-r_s])^{1/3} , \text{ and} \tag{2}$$

$$M2 = (4/3)^{2/3}\sigma^{2/3}[(\alpha/[r_b-r_m])^{1/3}+(\beta/[r_b-r_s])^{1/3}] . \tag{3}$$

Among other results, Milbourne shows that (d log M2 /d log β) is positive, which implies that a fall in β will lead to slower M2 growth.

In terms of this model, the advent and development of mutual bond funds and asset management accounts can be seen as both lowering β (through

[5] Most small time deposits have maturities of 1-year or less, and the longest maturities typically range between 2-1/2 and 5 years. The effective maturities of bond funds primarily fall into the range from 3 to 10 years.

enhancing transfers between bond and money funds) and increasing the risk-adjusted spread between yields on bond funds and small time deposits (through providing greater bond diversification benefits).

However, Milbourne's results likely are relevant for long-run, equilibrium analysis because substitution between M2 and bond funds (especially shifts from small time deposits into bonds) entails fixed costs. These costs include those associated with gaining information on mutual funds, front load fees, exit fees, fixed annual fees (which often range from $75 to $100), and meeting minimum required investments (typically $10,000) to open asset management accounts that allow one to shift between bond and money market mutual funds.[6] As a result, M2 may not be noticeably affected by a modest decline in the cost of transferring monies from bond to money market funds (i.e., a fall in β) or by a modest rise in the yield spread between bond and small time deposit yields (i.e., a rise in $[r_b - r_s]$). It is thus plausible that M2 will be substantially affected by only large changes in transfer costs or in the slope of the yield curve.

Anecdotal evidence is consistent with this view. For example, although the costs of transferring assets from bond funds to money funds has generally fallen during the latter half of the 1980s and early 1990s, bond funds only rose to a noticeable extent during the two periods when the yield curve has been very steep since 1982. As shown Figure 2, the real growth rate of bond funds (using the GNP deflator) has only been substantial during the periods 1985-86 and 1990-91. However, of these two periods, the mid-1980s surge was much larger relative to the slope of the yield curve, and partly reflected

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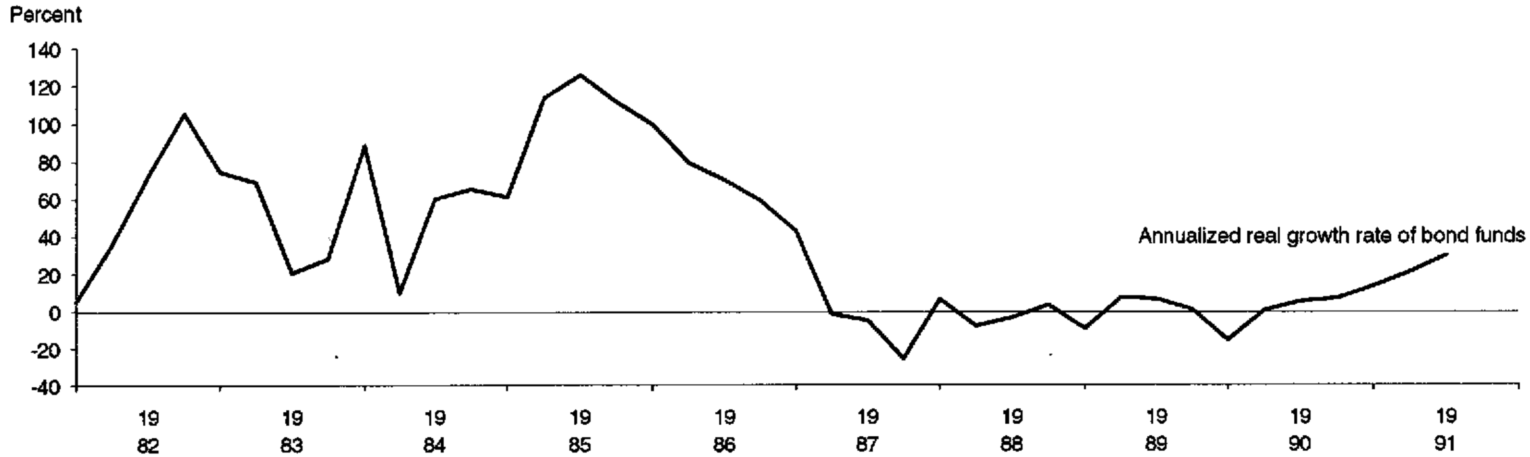
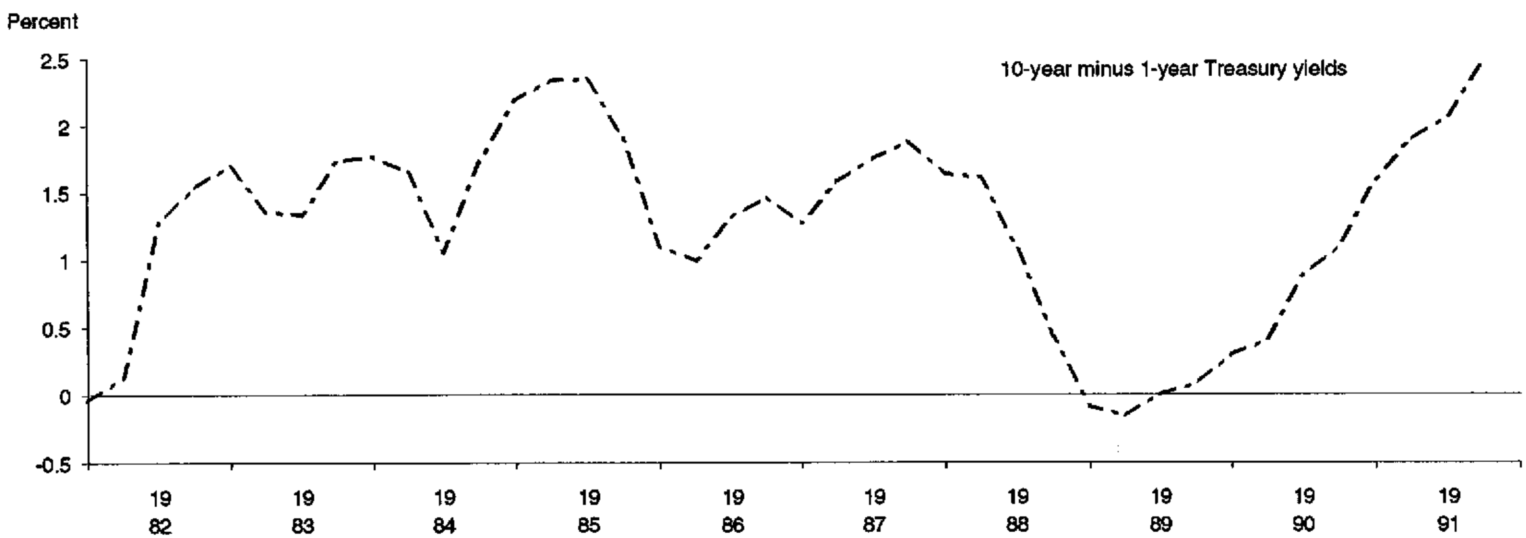
[6] Minimum balances to open just a bond mutual fund account are as low as $500 - $1,000, but do not allow shifting into money market mutual funds.

Figure 2
Growth in Real Bond Funds and Yield Spreads





shifts from direct bond holdings to IRAs/401Ks invested in bond funds when tax deductibility requirements were more generous.

Including the spread between rates on long-term and short-term Treasury securities in M2 regressions is unlikely to pick up surges in bond funds owing to changes in the tax code and the unusually fast growth of new instruments during periods of innovation.[7] In the past, these sorts of empirical difficulties have been handled by expanding the definition of M2 (e.g., adding MMMFs and MMDAs to M2), rather than by solely relying on adjusting the opportunity cost terms in money demand models. Indeed, Figure 3 illustrates the importance of including past innovations, such as MMMFs and MMDAs, in M2.[8] Taking this approach, this study compares the behavior of M2 with that of M2 plus adjustments for bond and/or equity mutual funds.

3. Do Bond and Equity Funds Account for the "Missing M2"?

This section begins by measuring household bond and equity fund assets. Then, the history of bond funds is reviewed to provide the background needed in subsequently adjusting the bond fund assets for substitution from direct bond holdings. Finally, the impact of bond funds on M2 growth is empirically assessed using money models developed by the Federal Reserve Board staff.

Measuring Household Bond and Equity Fund Assets

Bond and equity fund outstandings data since 1975 are available from the Investment Company Institute (ICI). Federal Reserve Board staff have classified mutual fund holdings into several asset groupings which can be

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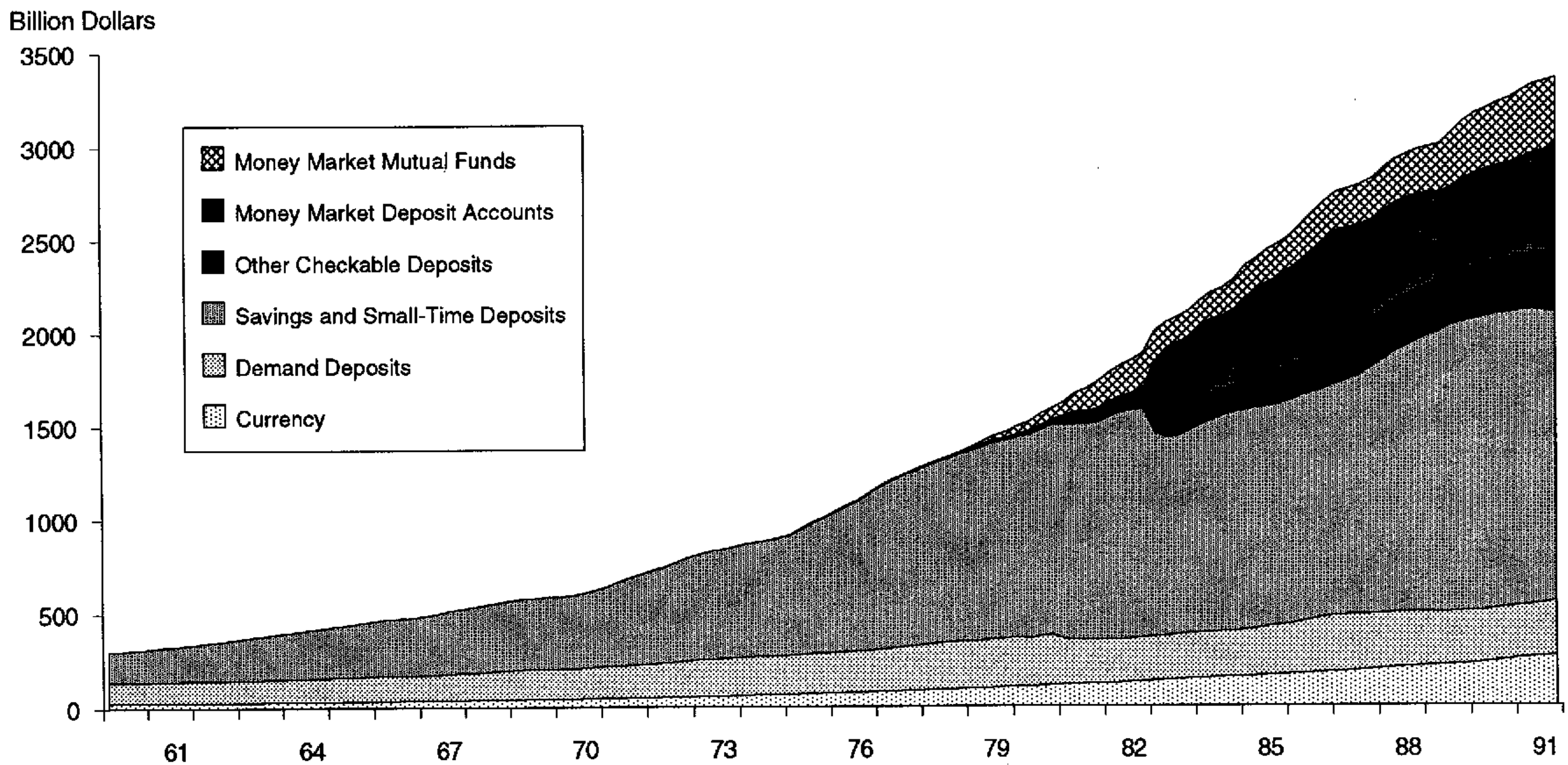
[7] The spread between yields on 10- and 1-year Treasury securities was insignificant when added to the M2 models used in this study.

[8] For a discussion of how and why the definition of M2 has evolved over time, see a study by W. Michael Cox and Harvey Rosenblum (1989).

Figure 3
Selected M2 Components



categorized into bond, equity, and mixed bond/equity funds.[9] In general, the mixed funds tend to hold more equity than bonds, and for this reason, mixed funds are treated as equity funds.

One difficulty with the ICI data is that they aggregate holdings by households and institutions, whereas money market mutual funds held by institutions are not included in M2, but rather, in M3. To correct for this problem, bond and equity funds held by households were calculated as follows. It was assumed that 75% of all bond funds represented investments by individuals on grounds that their share of bond and equity funds has remained around 75 percent according to available year-end data for 1983-1990. These monthly bond and total mutual fund outstandings were then seasonally adjusted with an X'11 procedure.

The Behavior of Bond and Equity Mutual Funds Since the mid-1970s

Before adjusting these total mutual fund data for substitution between direct bond and bond fund holdings, it is useful to review the history of bond funds. As shown in Figure 4, equity funds grew moderately over the late-1970s and early 1980s. During the stock market boom of the mid-1980s, equity funds surged reflecting higher prices of existing shares and inflows spurred by substantial price appreciation. Equity funds fell sharply during the stock

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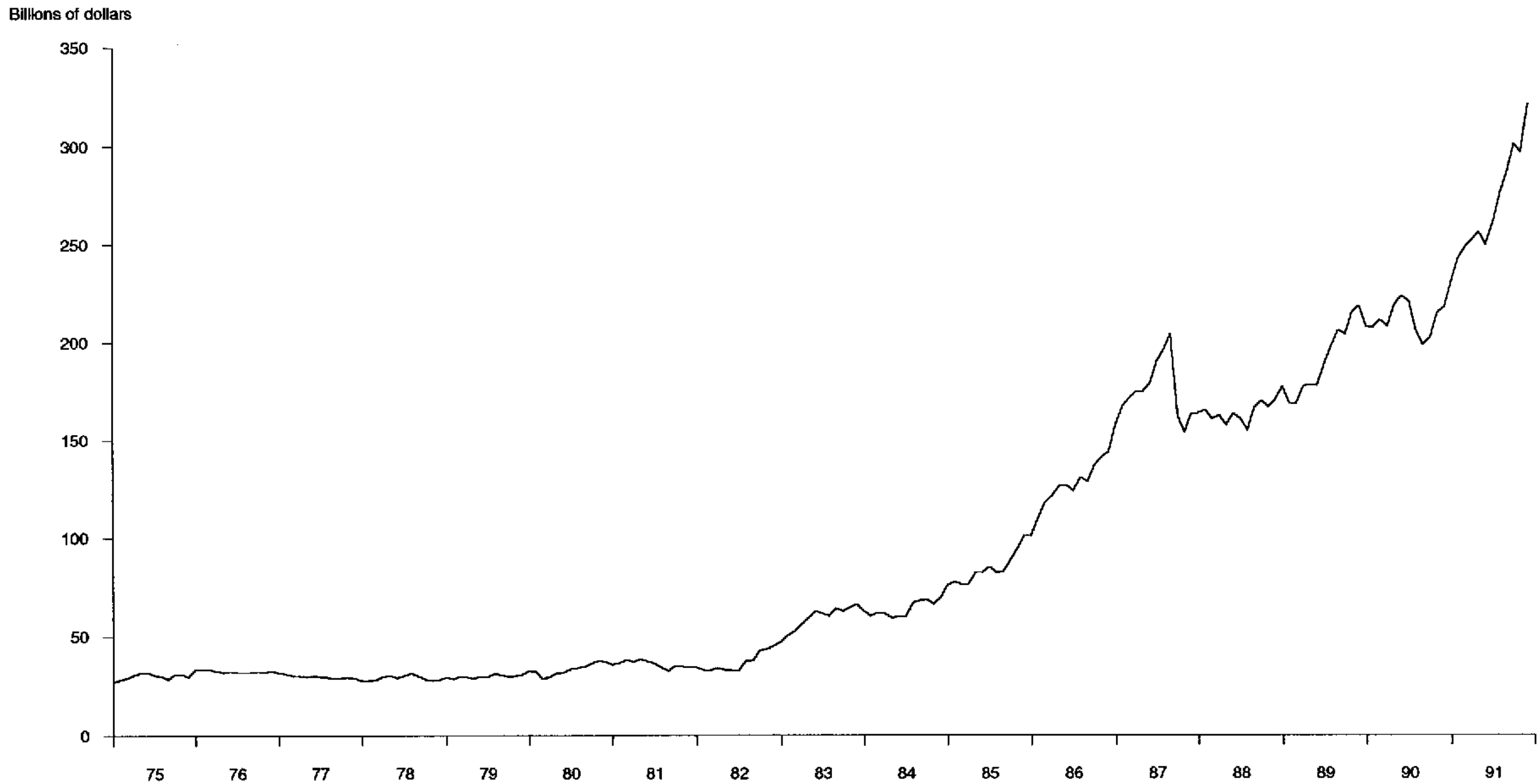
[9] Using FRB staff classifications (organized by Pat White), bond funds are defined as the FRB category entitled "bond funds." Over 1976-1982, bond funds are defined as the sum of "municipal (long-term) bond" and "bond" funds. Using the FRB classification system from 1983 to the present, bond funds are defined to include the following <u>non</u>money market, mutual fund assets: state (long-term), other municipal (long-term), income bond, government, GNMA, global bond, and high yield bond. Current FRB categories of funds that are generally blends of bonds and equities include: flexible portfolio, balanced, and income-mixed funds. Mixed funds include ICI mutual fund categories whose definitions have changed over time. Equity funds were defined to include these mixed funds plus the following FRB non-MMMF categories: aggressive growth, growth, growth and income, precious metals, international, global equity, income equity, and option income.

Figure 4
Household Equity Funds



market crash of 1987 and then remained flat until late-1990. More recently, equity funds have grown rapidly as investors have reacted to declining yields on short-term debt securities and small time deposits.

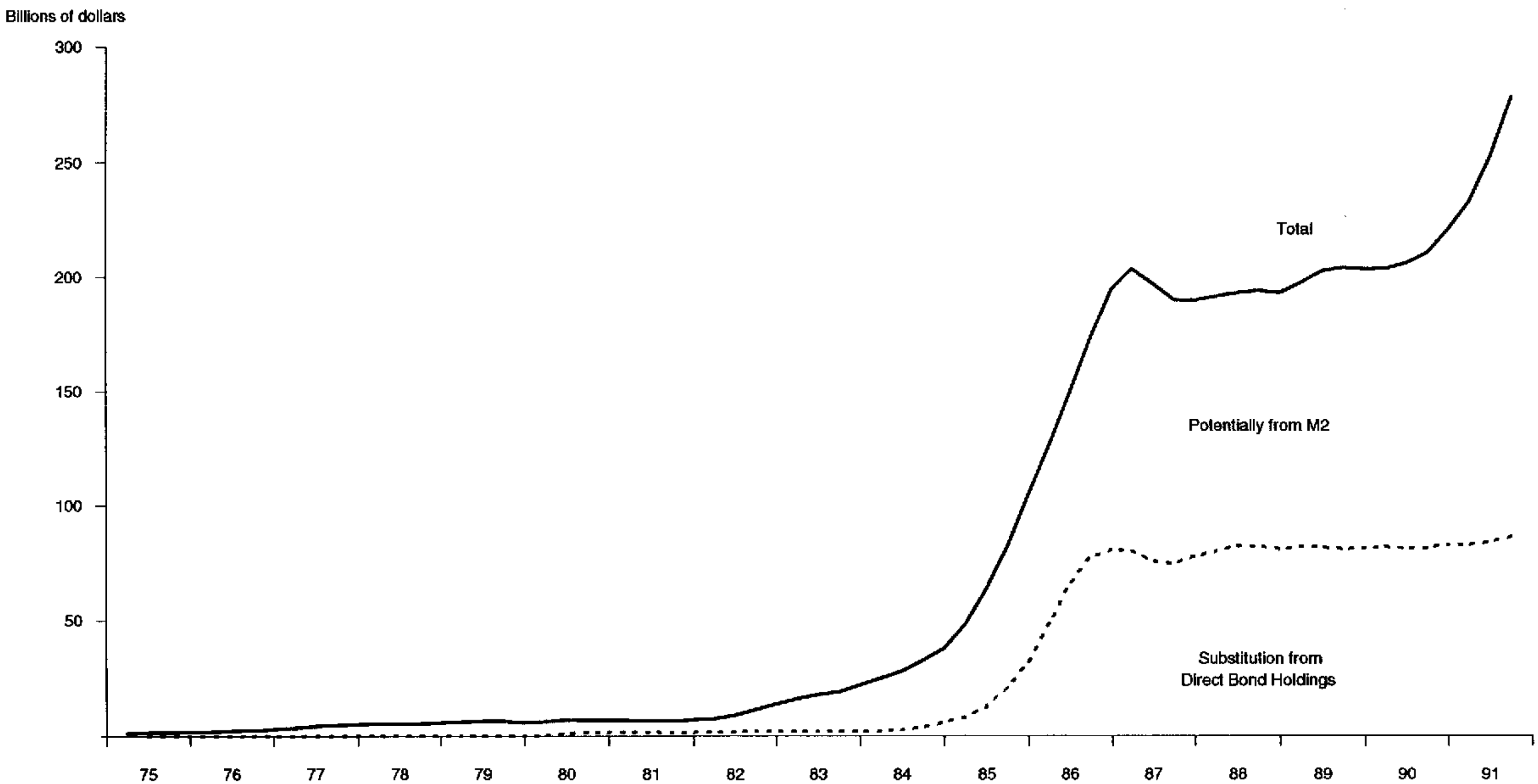
As illustrated in Figure 5, bond funds showed modest growth over the late 1970s and early 1980s. They then grew rapidly during 1985-86, then were about flat over 1987-1989, and then began growing rapidly in early 1991.

Over 1985:Q1-1986:Q4, bond fund outstandings (SA) attributable to households (ICI data) rose by $143.4 billion compared to a $80.4 billion increase in overall holdings of government (less savings bonds) and tax exempt securities plus corporate bond holdings (Flow of Funds data, NSA). These data suggest that much of the surge in bond funds during the mid-1980s reflected substitution from directly held bonds to bond mutual funds. This hypothesis is consistent with then existing tax incentives that encouraged households to shift funds from long-term financial assets to IRA's, for which mutual funds tended to be more attractive savings vehicles as discussed earlier.

After the Tax Reform Act of 1986 severely restricted the eligibility requirements for IRAs in 1987, bond fund holdings were little changed up through the late-1980s. Although bond fund inflows have recently accelerated, the current spurt differs from that of the mid-1980s. Over 1990:Q3-91:Q2, bond funds (SA) held by households rose $32.5 billion, while household holdings of government (less savings bonds) and tax exempt securities plus corporate bonds increased by $100.5 billion. Relative to the the mid-1980s, these data suggest that the acceleration in bond fund holdings in the early 1990s mainly reflected substitution away from nonbond assets (e.g., M2 deposits) rather than shifts away from direct bond holdings.

Indeed, the most recent surge in bond funds appears to reflect shifts

Figure 5
Household Bond Mutual Funds



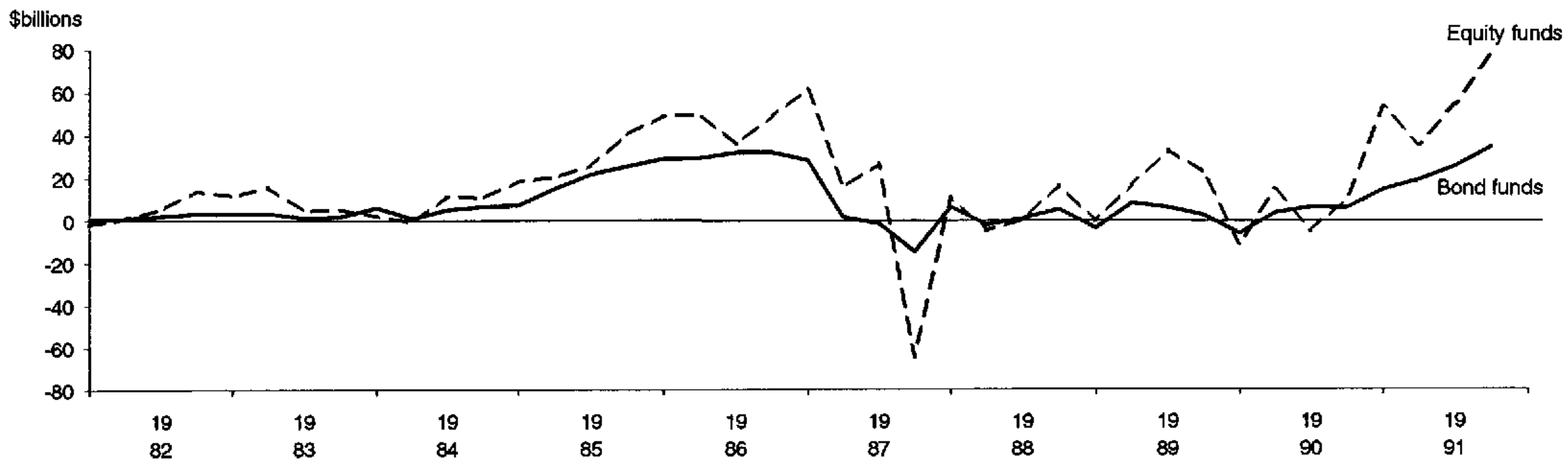
from M2 deposits. Some of these inflows likely came from small time deposits, which have been been declining sharply in 1991. In addition, since the costs of transferring assets between bonds and MMMFs within an asset management account are small, one would expect that some substitution between M2 and bonds would occur more specifically between bond and money market funds. Consistent with this view, strong bond inflows over 1990-91 have coincided with weakness in MMMFs as shown in the bottom panel of Figure 6. Although bond funds are still small relative to the stock of M2, their recent rapid growth may account for some of the recent unusual weakness in the growth rate of M2 as suggested by anecdotal evidence (see Clements 1991).

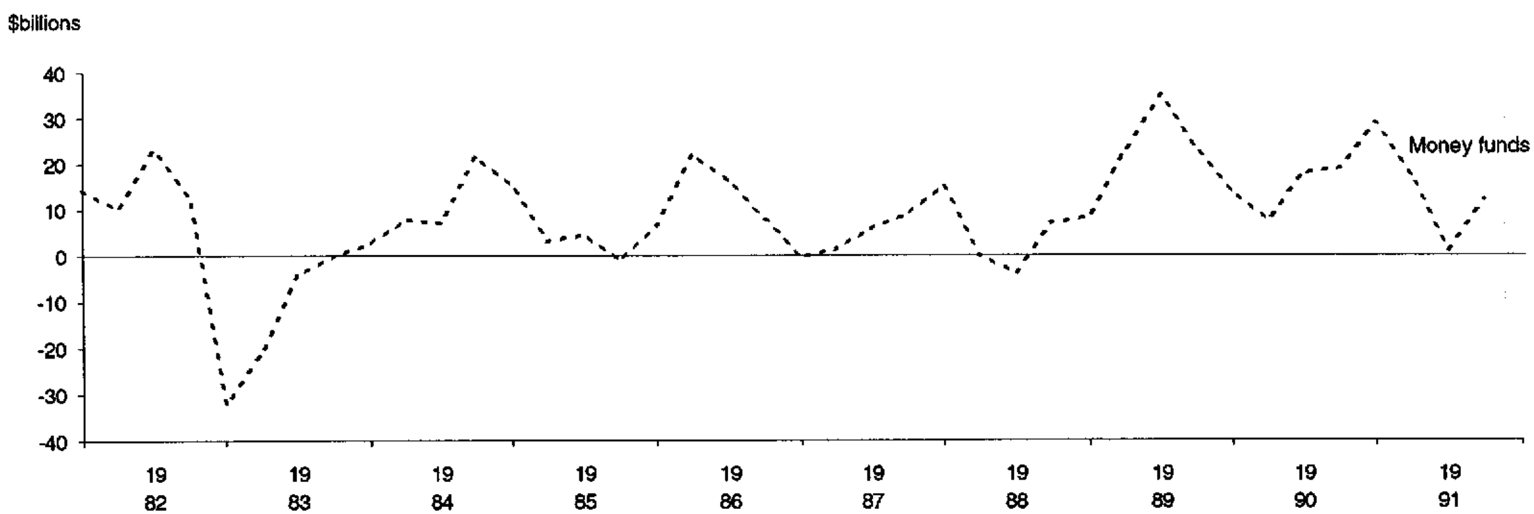
Adjusting Bond Funds for Substitution with Direct Bond Holdings

To the extent that the mid-1980s surge in bond funds likely reflected substitution away from directly held bonds, M2 is unaffected. To better gauge substitution effects between M2 and bond funds, a substitution-adjusted, bond fund adjustment (BF) was added to M2 to produce the series "SBFM2." BF was calculated as the difference between total household bond fund outstandings and cumulative bond fund inflows attributable to substitu-tion away from direct bond holdings (BFS). Details about the construction of BF and BFS are provided in Appendix A. In addition to SBFM2 ("substitution adjusted, bond fund adjusted M2"), two other mutual fund adjusted M2 series were created. One simply adds total household bond funds to M2 (BFM2), and the other adds equity and substitution adjusted bond funds to M2 (BEFM2).[10]

[10] To conserve space, results using only 3 bond/equity fund adjusted M2 series are presented in the tables. Adding total household bond and equity funds to M2 produced an aggregate that was even less explainable than BEFM2 and the current definition of M2. Also note that because equity funds and directly held equity rose together during the 1980s, it was impossible to adjust equity funds for any substitution away from direct equity holdings along the lines that substitution adjustments to bond funds were made.

Figure 6
Mutual Fund Net Changes





Accounting For Recent M2 Growth

Using the FRB model of M2 as a benchmark, this study estimates M2 and M2 adjusted for mutual fund inflows. Three mutual fund adjusted M2 series were evaluated: these used total household bond funds (BFM2), substitution adjusted bond funds (SBFM2), and equity plus substitution adjusted bond funds (BEFM2). This approach was taken because the riskiness of equity returns may make equity funds less substitutable for M2 deposits than are bond funds. The bond and equity adjustments also enable one to assess the advantage of internalizing any substitution between these two types of funds.

The procedure used in creating these series implicitly makes the strong assumption that any estimated changes in bond or equity funds completely represented substitution effects with M2 deposits. This strong assumption is not too unreasonable given results from an August 1991 Federal Reserve Survey (Senior Financial Officer Survey). Of the large banks in this survey who characterized retail deposit growth as unusually weak between May and July 1991, the most frequently cited reason for this weakness were "returns on nondeposit instruments, such as bond funds or Treasury securities.[11] Nevertheless, because of the strong implicit substitution assumption and because the mutual fund estimates include assets in IRA/Keogh accounts (which are not in M2), the mutual fund adjustments are best viewed as yielding upper bound estimates of the impact of bond and total mutual fund inflows on M2 growth.

Coefficient estimates using the Fed's M2 model and mutual fund data are presented in Table 1. The sample period begins in 1976:Q1 because mutual fund

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[11] Furthermore, in a survey conducted by National Securities & Research Corp. during the summer of 1991, over 90% of surveyed mutual funds indicated that net inflows from households came partially at the expense of MMMFs and bank deposits, while 50% indicated that some of the net inflows came from substitution out of insurance company assets (see Clements (1991), p. C9).

data start in 1975:Q1 and because the Fed's error correction model uses a few lags of the dependent variable. The Fed's M2 equation is an error-correction model which uses GNP as a long-run "scale" variable, consumption expenditures as a short-run scale variable, and the spread between the weighted average yield on M2 components and the 6-month Treasury rate as the opportunity cost of money (for further discussion of this model, see Moore, Porter, and Small (1990)). For consistency, the weighted average yields on the mutual fund adjusted M2 series were calculated to reflect the opportunity cost of mutual funds. The opportunity cost of mutual funds was set equal to zero on grounds that these funds likely yield the market rate of return on assets having similar market, credit and prepayment risks. The R^2's of the two bond fund adjusted series are somewhat better than those of the standard M2 series for the full sample (1976:Q1-91:Q4), with the substitution-bond adjusted series yielding the best fit. By contrast, the bond and equity fund adjusted model yields a slightly worse fit than the regular M2 model, likely reflecting that equity funds are much less substitable for M2 than are bond funds.

Table 2 presents in-sample residuals for the subsample period 1990:Q3-91:Q4. Consistent with the in-sample results, the S.S.E.'s of the two bond adjusted M2 series are 26% and 29% lower over this period than the S.S.E. of the unadjusted M2 series, respectively. The bond and equity adjusted M2 model also produces a lower S.S.E. over this subsample period (9% lower) than the Fed's M2 model. One operational definition of the "missing M2" is the average growth rate shortfall of the four actual M2 series over 1990:Q3-91:Q4. These results indicate that adding substitution-adjusted bond funds accounts for about 27% of the "missing M2;" adding total household bond funds, for 28% of the "missing M2;" and adding equity and substitution-adjusted bond funds accounts for about 43% of the "missing M2." Of course, each mutual fund adjustment implicitly makes the strong assumption that all portfolio substitution involving bond and/or stock funds are completely internalized within their expanded definitions of M2. For this reason, these estimates are best viewed as upper bounds. Even with this qualification in mind, bond and equity funds can potentially account for only a small part of the "missing M2."

This result likely reflects three things. First, the "missing M2" began appearing in 1990:Q3, whereas bond and equity fund inflows were not substantial until the spring of 1991. Second, if M2 is becoming less attractive to investors because of troubles in the banking and thrift industries, bond and equity mutual funds are not the only alternatives to holding M2. Third, even though simply adding bond and equity funds to M2 may appear to amount to at least half of the "missing M2" in 1991:H1, such a calculation is misleading. One reason is that only three-fourths of bond and equity funds are noninstitutional holdings. Another is that because these assets have lower opportunity costs than M2 deposits, adding them to M2 in a logically consistent manner means that the opportunity cost of this new aggregate is lower than that of M2. Hence, even though the growth rate of bond and/or equity adjusted M2 may be higher than that of M2, so is the estimated growth rate of the adjusted series. As a result of both effects, the degree to which any estimated shortfalls in the adjusted M2 series are smaller than the estimated shortfalls in M2 is smaller than the extent to which bond and/or equity fund additions would boost the growth rate of an expanded definition of M2.

4. Why RTC Resolutions May Affect M2 and Create a "Missing" M2 Problem

This section reviews three hypothetical explanations for how RTC closings of insolvent thrifts can create a "missing M2" phenomenon. First, one RTC-based explanation is evaluated, and is shown <u>not</u> to be logically consistent. Then, the two potential RTC effects mentioned in the introduction are discussed in more detail. These two explanations are shown to be plausible, and how to empirically test for these effects is also discussed.

One Non-Explanation For How RTC Can Create a "Missing M2" Phenomenon

One hypothesis is that the "missing M2" simply reflects that thrift assets are no longer funded with M2 deposits and are now funded by Treasury debt through the RTC (see Farrell and McNamee (1991)). However, this argument is not a consistent explanation for the following fundamental reason. Namely, it does not explain why the former depositors at these resolved thrifts do not reinvest their funds in M2 deposits to an extent not captured in M2 models.

Specifically, under RTC procedures, former depositors are compensated in one of two ways. Either they are paid directly by the RTC or their account is purchased by a healthy bank or thrift which can then reset the deposit rate after providing a two-week notice and allowing depositors the option of withdrawing small time deposits if the rate is reset. Thus, these depositors are faced with the choice of investing these funds either in M2 assets or nonM2 assets, and this explanation does not explain why they should shift away from M2 deposits in ways not reflected in money demand models.

If the RTC's actions reduced the demand for M2 funding by the thrift and banking industries, then M2 growth should have slowed because deposit rates would have fallen relative to market rates. But this effect should have been reflected in spreads between market and deposit interest rates, which are typically used to measure M2's opportunity cost. This in turn implies that predicted M2 growth should have slowed with actual M2 growth. Hence, this asset-funding explanation is not a consistent explanation for "missing M2."

Two Plausible RTC-Based Explanations for the "Missing M2"

RTC activity can plausiblly affect M2 growth in two ways that are not reflected in standard money demand variables. First, when the RTC closes an institution, its actions force depositors to reassess their M2 balances because either the RTC pays them directly and closes their accounts, or sells the deposits to another institution which has the right to reset deposit rates after providing a two week notice. For this reason, the M2 balances of such depositors are likely to more quickly adjust to changes in M2 opportunity costs than under normal circumstances. According to industry sources, most cases where small time rates are reset involve "brokered" small time deposits. These accounts are often arranged by brokerage houses for investors who shop for the highest rates, and are often viewed as not entailing much of a relationship between banks and depositors. By contrast, industry sources indicate that nonbrokered small time accounts that are sold by the RTC are less likely to be reset because purchasing institutions want to acquire a relationship with depositors who are less rate sensitive.

As a result of actual "calls" of small time accounts, the short- to medium-term adjustment of M2 to changes in its opportunity cost may not be adequately estimated using an error-correction model with conventional money demand variables. This re-equilibration effect, which apriori can either boost or depress M2 growth, can create a "missing M2" problem in the early 1990s because small time accounts initiated at bankrupt thrifts during the late 1980s are being prematurely "called" in a period of lower interest rates. As a result, the decline in small time deposit rates and the pace of nominal activity (GNP) since the late-1980s can lead to a much quicker adjustment in small time and M2 balances than in the pre-RTC days. Empirically, this "call" effect may be tracked in an M2 growth rate specification by the volume of deposits at newly resolved institutions in two possible ways: (a) as an independent variable which is implicitly interacted with an opportunity cost variable(s), or (b) as an extra independent variable that is directly interacted with a long-run opportunity cost variable.

The resolution process can also create a "missing M2" phenomenon by creating uncertainty about deposit yields which depresses the demand for M2. Depositors, especially those who shop for higher-than normal yields (often through brokers), face a repricing risk that arises because the high yield earned on deposits (fully covered by deposit insurance) at a troubled thrift either may be lowered (repriced) by a purchasing institutions or will no longer be in effect if and when the RTC directly reimburses depositors.

As a result of increased uncertainty over nominal deposit yields, conventional measures of M2's opportunity cost do not consistently track its true opportunity cost. For example, if a credit-risk free market rate exceeds the <u>stated</u> average yield on M2 balances by a given amount in an environment of RTC resolutions, the same spread in a pre-RTC environment would not necessarily mean that the true opportunity cost of M2 was identical in both periods. Indeed, in this example, when investors factor in the call risk posed by the RTC, the true opportunity cost of M2 is higher in the RTC environment. Thus, current spreads between the average rate paid on M2 balances and market interest rates have understated M2's opportunity cost since the RTC became very active. By understating the apparent opportunity cost of M2 in this way, most M2 models have overestimated M2 growth, thereby giving rise to a missing M2 phenomenon.

5. Measuring RTC Effects on M2

Empirically, it is difficult to measure this "call" risk because households are adapting to a new regime and the markets have had little history to assess this risk. However, the effects may be loosely proxied by the volume of deposits at newly resolved thrifts. Many depositors (and economists) may not become aware of these new risks until the RTC resolves their deposits or those of people they know because with deposit insurance, they falsely assume they need to know nothing more than posted deposit rates.

To assess the impact of RTC activity on M2, the Fed's M2 model was modified in three ways. The first (model 2) adds a variable measuring the quarterly average volume of recently seized deposits at closed thrifts (RTCDEP). The second and third (models 3 and 4) add terms (RTCOC and RTCDOC) which respectively interact RTCDEP with an M2 opportunity cost term and the first difference of this variable to see if RTC activity affects the long-run or short-run elasticity of M2 with respect to its opportunity cost.

RTCDEP was calculated in several steps to create a variable comparable to the way M2 growth rates are typically calculated. Two specific considerations were taken into account. First, the growth rate of M2 usually is measured based on quarterly averages of month average balances. For this reason, a once-and-for-all deposit runoff in the first month of a quarter depresses M2 growth that quarter by a greater magnitude than does a comparable decline in the third month. Second, due to quarter-averaging, inflows occurring in quarter t-1 are likely to have a greater impact on the quarterly M2 growth rate in the following quarter (t). Thus, resolutions of deposits that occur in one quarter can affect the growth rate of the following quarter. For this reason, the impact of deposit resolutions on quarterly M2 growth is best measured if the variable RTCDEP is defined as the change in the quarterly average level of current and prior RTC resolutions rather than by the contemporaneous volume of deposits at newly resolved thrifts.

Reflecting these considerations, RTCDEP and RTCOC were constructed in several steps using available monthly data on total deposits at thrifts resolved by RTC.[12] First, the monthly volume of deposits at newly closed thrifts (RTC) was converted into a month average effect by dividing it by 2 (MRTC). Next, these month averages were converted into quarterly average inflows (QRTC) by weighting the month average flows by 1, 2/3, and 1/3 for the first, second, and third months respectively. In the third step, a quarterly average cumulated stock of resolved deposits (RTCDEPO) was created by adding the cumulated sum of resolved deposits in prior quarters (CUMRTC) with the quarterly average level of newly resolved deposits (QRTC). Next, RTCDEP was calculated as the first difference in RTCDEPO. (See Table 3 for data and Appendix B for formulas.) Fifth, RTCOC was created by multiplying RTCDEP with the lagged opportunity cost of M2 deposits (OC) defined as the difference between the three-month Treasury bill rate and the weighted average return on M2 balances.[13] Finally, RTCDOC was created by multiplying RTCDEP with the contemporaneous first difference of M2's opportunity cost (OC).

It should be noted that since 1989:Q3, the variable RTCDEP has generally been larger than the estimated quarterly shortfall in M2 growth (in billions) produced by the FRB model of M2. This suggests that at least some of the resolved deposits were kept within M2, while some of the deposits were likely

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[12] The author owes a special debt to Richard Anderson of the Federal Reserve Board staff who compiled these monthly data.

[13] This was done in order to compare results with the Fed's error correction model of M2 which lags the log level OC term by one quarter.

invested in nonM2 assets.

6. RTC Estimation Results

The impact of RTC activity was assessed by estimating four versions of the Fed's error-correction model of M2 over the period 1976:Q1-91:Q4. In order to compare RTC and mutual fund results, the sample period used also begins in 1976:Q1.[14] Because RTC did not begin closing thrifts until 1989:Q3, the RTC variables provided in Table 3 all take the value 0 prior to 1989:Q3. As a result, variation in the RTC proxies occurs in only nine quarters, which effectively makes it unfeasible to conduct simulations with RTC variables. Thus, the results should be viewed with caution.

As reported in Table 4, results from model 2, which simply adds RTCDEP to the Fed's M2 model, indicate that this variable (which is the change in the quarter-average level of deposits at RTC resolved thrifts) is negatively and significantly related to M2 growth. The negative but insignificant coefficient on RTCOC in model 3 implies that the sensitivity of M2 to its opportunity cost is not significantly heightened by RTC activity. In model 4, RTCDOC is marginally significant, with a positive, rather than the hypothesized negative sign. Consistent with the significance levels of RTCDEP, RTCOC, and RTCDOC, the full-sample R^2 (corrected) of model 2 (.828) is better than that of the FRB model (.780), while those of models 3 and 4 (.787 and .794) are only slightly better. Another interesting finding is that M2 error-corrects to desired levels at faster speeds in models 2, 3, and 4 (25%, 20%, and 22% per quarter, respectively) than in the FRB model (19% per quarter).

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[14] The qualitative results with respect to the three RTC variables were similar using a longer sample period (1964:Q1-91:3).

Although the R^2 of model 2 is somewhat better than that of the FRB model, it is important to note that any improvement in full-sample fit is likely limited by the short interval during which the RTC was active, and thus that any RTC effect is likely to show up in recent years. This point is borne out by the in-sample errors from the models during the period when the RTC was active (see Table 5). Over 1990:Q3-91:Q4, the S.S.E.'s of models 2, 3, and 4 are 42% lower, 2% lower, and 12% higher than that of the FRB model, respectively. In addition, the "missing M2" is measured by the average estimated growth rate shortfall over 1990:Q3-91:Q4, then the RTC variables in models 2, 3, and 4 account for 83%, 37%, and 44% of the "missing" M2, respectively.

Looking across Tables 4 and 5, several conclusions emerge. First, models 3 and 4 indicate that the neither the long-run nor the short-run responsiveness of M2 to changes in its measured opportunity cost are significantly heightened by RTC activity (the coefficient on RTCDOC has the wrong sign and is insignificant). Second, model 2 produces the best full-sample fit of the three alternative models, and error-corrects faster than models 3 and 4. Third, model 2 potentially accounts for much more of the missing M2 than either model 3 or model 4. It should be noted that the performance of model 2 is consistent with the hypotheses that RTC actions create a missing M2 phenomenon directly by creating an early "call" on high yielding small time deposits in a period of lower interest rates, and indirectly by creating a call risk on other, not-yet-called deposits.

One reassuring aspect of model 2 is that its coefficients on non-RTC variables (not shown) are more similar to those obtained by estimating the FRB model up through 1989:Q4 than are those obtained by estimating the FRB model through 1991:Q4. Of these variables, the most noteworthy are the error correction, long-run opportunity cost, and short-run consumption terms.

Given that model 2 is preferable to the other RTC-modified M2 models, the variable RTCDEP was added as a separate regressor to each of the bond and/or equity fund adjusted M2 models. Results indicate that the RTC variable is significant in all three models. Of these models, the substitution-bond adjusted model outperforms all the others in terms of full-sample fit, as shown by selected statistics in Table 6. With respect to the missing M2, the average M2 growth rate shortfall over 1990:Q3-91:Q4 is .24 percentage points with the substitution-bond adjusted model, .26 percentage points with total bond funds, and a somewhat smaller .10 percentage points with the equity and substitution-bond adjustments. Similar to the mutual fund regressions that excluded RTC effects, these findings indicate that the substitution adjusted bond fund adjustments yield the most explainable monetary aggregate, but that adding in equity funds seems to account for somewhat more of the "missing M2."

7. Conclusion

The closing of thrifts by the RTC can plausibly depress M2 by actually forcing "calls" of high-yield small time deposits in a lower interest rate environment and by creating repricing or prepayment risk for other small time deposits. Empirically, variation in the volume of deposits at newly resolved thrifts can be correlated with unexplained weakness in M2 growth not only because roll-over effects are tracked by this variable, but also because knowledge of the risk to nominal rate returns may move with the level of RTC activity as more households experience these risks first-hand.

Consistent with these possible effects, much of the shortfall in M2 growth appears to be related to RTC activity, and regression analysis indicates that the vast bulk of the "missing M2" may be associated with thrift resolutions. Although some of the "missing M2" may be reflected in substitution by households away from retail deposits toward bond and equity mutual funds, it is unclear to what extent these shifts stem from RTC policies that can plausibly reduce the attractiveness of M2 deposits or from a steepening yield curve. Moreover, bond and equity mutual funds do not appear to account for more than a small part of the "missing M2."

While the results indicate that equity funds are not good substitutes for M2 thus far, the findings nevertheless indicate that bond funds are an important substitute for M2 balances on two grounds. First, bond funds have characteristics similar to those of M2 balances. Second, because a bond fund adjusted M2 aggregate is more explainable than the current definition of M2, it appears that an expanded aggregate internalizes substitution between bond funds and M2. Nevertheless, the results indicate that in considering an expanded M2 aggregate, it is empirically important to separate out bond fund inflows associated with shifts out of direct bond holdings.

This study's findings suggest that the case of the "missing M2" has some similarity to two previous episodes of "missing money" in being linked to regulations. The first "case of the 'missing money'" identified by Goldfeld (1976 (weak M1 and demand deposit growth in the mid-1970s) has been linked to two factors. One stemmed from businesses switching from demand deposits to overnight RPs spurred by high interest rates and the prohibition on interest on business deposits (see Tinsley, Garrett, and Friar (1981)). The other stemmed from declines in compensating balances (business demand deposits) that owed to shifts away from bank loans to commercial paper. These shifts in business credit sources were induced by banks (1) rationing credit during a period of Reg Q induced disintermediation, and (2) passing along the heightened cost of reserve requirements during a period of high interest rates (see Duca (1992)). During the late 1970s and early 1980s, a "missing M2" phenomenon appeared as high market interest rates coupled with Regulation Q ceilings on deposit rates drove households away from bank transactions deposits toward money market mutual funds (MMMFs). This case of the missing money was solved by later adding MMMFs (and MMDAs) to M2, which internalized any substitution between MMMFs and other M2 components. The current missing money episode can also be interpreted as arising from the changing impact of regulations. Specifically, the RTC's actions can be viewed as removing the deposit insurance subsidy indirectly paid by taxpayers to investors holding high yielding accounts at troubled thrifts.

Although results link the "missing M2" to RTC activity, the short sub-sample period of RTC activity makes this study's findings subject to qualification. Nevertheless, the results suggest that until its completion, the thrift resolution process could continue to create a "missing M2" phenomenon by causing conventional opportunity cost variables to understate M2's true opportunity cost and by forcing actual "calls" of high yield (typically brokered) small time accounts. These findings do not imply that the RTC is incorrectly handling deposits when resolving bankrupt thrifts, but rather simply suggest that RTC activity is affecting M2 growth in ways not captured in conventional money models. An important implication is that in order to loosely infer the general pace of economic activity from M2, M2 may need to be viewed in conjunction not only with spreads between market and deposit interest rates, but also with the pace at which the RTC resolves deposits.

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Table 1: Results of Estimating M2 Growth Rates (Sample Period 1976:Q1-1991:Q4)

Variable	M2	Model: Subst.Adj. Bond Fund Adj. M2	Bond & Equity Fund Adj. M2	Simple Bond Fund Adj. M2
Constant	$-.04866^{**}$ (-3.32)	$-.06664^{**}$ (-4.18)	$-.08769^{**}$ (-4.80)	$-.05942^{**}$ (-3.55)
TIME	$-.00031^{**}$ (-3.59)	$-.00013^{*}$ (-2.17)	-.00007 (-1.10)	-.00003 (-0.53)
$\log(M2_{t-1})-\log(GNPAV_{t-1})$	$-.19069^{**}$ (-4.35)	$-.18551^{**}$ (-4.97)	$-.18923^{**}$ (-5.29)	$-.14391^{**}$ (-4.38)
$Del(\log(EPCEN_t)$	$.27959^{**}$ (3.19)	$.25472^{**}$ (3.09)	$.19724^{*}$ (2.17)	$.21504^{*}$ (2.48)
$Del(\log(EPCEN_{t-1})$	$.17139^{*}$ (2.06)	$.17331^{*}$ (2.19)	$.22562^{*}$ (2.62)	.12977 (1.57)
$Del(\log(EPCEN_{t-2})$	.08783 (1.26)	.1204 (1.84)	.13467 (1.83)	.13319 (1.90)
$Log(OC_{t-1})$	$-.00914^{**}$ (-4.35)	$-.01108^{**}$ (-5.01)	$-.01400^{**}$ (-5.46)	$-.00977^{**}$ (-4.33)
$Del(\log(OC_t)$	$-.01161^{**}$ (-5.24)	$-.01195^{**}$ (-5.68)	$-.01321^{**}$ (-5.59)	$-.01234^{**}$ (-5.46)
$Del(\log(M2_t))_{t-1}$	$.46119^{**}$ (5.12)	$.45156^{**}$ (5.27)	$.44247^{**}$ (5.09)	$.52200^{**}$ (6.21)
DCON	$-.01112^{**}$ (-3.04)	$-.01077^{**}$ (-3.10)	$-.01204^{**}$ (-3.10)	$-.01152^{**}$ (-3.11)
DMMDA	$.01003^{**}$ (2.92)	$.00813^{**}$ (2.17)	.00522 (1.79)	$.00565^{*}$ (2.04)
DUM83Q1	$.02530^{**}$ (5.42)	$.02436^{**}$ (5.49)	$.02408^{**}$ (4.84)	$.02509^{**}$ (5.36)
DUM83Q2	-.00673 (-1.27)	-.00696 (-1.40)	-.00396 (-0.72)	-.01004 (-1.95)
long-run OC elasticity	-.048	-.060	-.074	-.068
S.S.E. (Qtly, not a %)	.0008652	.0007768	.0009824	.0008906
R^2 (corrected)	.77969	.79528	.75457	.78427

Table 1 (continued)

Durbin-H	-.58816	-.79233	-.11087	-.72293

*--denotes significant at the 95% confidence level.
**--denotes significant at the 99% confidence level.
Del--denotes the first difference operator.
(t statistics in parentheses.)

Definitions

EPCEN = Personal consumption expenditures, a s-run proxy for transactions.

XGNPAV = $(GNP_t + GNP_{t-1})/2$, measure of permanent income used as a long-run proxy for transactions.

OC = Opportunity cost of M2 defined as the spread between the 3-month T-bill rate and the average interest rate paid on M2 balances.

DCON = 1 in 1980:Q2 when the Credit Controls were in effect
-1 in 1980:Q3 just after the Credit Controls were lifted

DMMDA = a dummy equal to 1 when MMDAs were introduced in 1982:Q4.

DUM83Q1= a dummy equal to 1 in 1983:Q1 to control for MMDAs and deregulation.

DUM83Q2= a dummy equal to 1 in 1983:Q2 to control for MMDAs and deregulation.

TIME = time in quarters: 1947:1 = 1, increases by 1 each quarter.

Note: The following convergence restriction was imposed:

$$\sum_{i=0}^{2} y_{-i} + \text{the coefficient on } Del(\log(M2_{t-1})) = 1,$$

where the y_i are the coefficients on the $Del(\log(EPCEN)_{-i})$ terms. This imposes on the short-run dynamic terms the same unitary elasticity with respect to transactions volume that is imposed in the long-run by the term $[\log(M2_{t-1})-\log(XGNPAV)_{t-1}]$. The relative performances of Models 2 and 3, and the significance of the RTC variables are qualitatively similar when this restriction is not imposed. In order to use the FRB model as a benchmark for comparison, this restriction is imposed in all the above models. In separate tests, this restriction is not rejected for each model.

Note that a negative coefficient on $[\log(M2_{t-1})-\log(GNPAV_{t-1})]$ implies that M2 balances adjust (error correct) toward their desired levels.

Table 2

In-Sample M2 Growth Rate Errors Over 1990:Q3-91:Q4 (Sample Period 76:Q1-91:Q4)
(Percent, SAAR, Negative Entries Reflect Weaker-Than-Predicted M2 Growth)

Quarter	M2	Subst.Adj. Bond Fund Adj. M2	Bond & Equity Adj. M2	Simple Bond Fund Adj. M2
1990:Q3	-0.96	-1.06	-1.79	-1.10
1990:Q4	-2.19	-2.41	-3.17	-2.29
1991:Q1	-0.75	-0.93	0.65	-0.95
1991:Q2	-0.02	-0.02	-0.56	-0.04
1991:Q3	-3.63	-2.85	-2.32	-2.78
1991:Q4	-1.64	-0.74	0.87	-0.76
Memo Items:				
Growth Rate Resid-uals 90:Q3-91:Q4				
Average	-1.83	-1.34	-1.05	-1.32
% Missing M2 explained:	-------	27%	43%	28%
S.S.E. over 90:Q3-91:Q4, (Quarterly rate):				
Total	.000139	.000103	.000126	.000099
Share of M2's S.S.E.	-------	26% lower	9% lower	29% lower

Table 3

Changes in Quarter Average Levels of Cumulated Deposits at Resolved Thrifts
(in billions)

Quarter	RTCDEP	RTCDEPO	QRTC	Simple Qtly. Total of Newly Resolved Deposits[1]
1964:Q1-1989:Q2	0	0	0	0
1989:Q3	.5	.5	.5	1.8
1989:Q4	9.3	9.8	8.0	8.8
1990:Q1	4.3	14.1	3.5	7.4
1990:Q2	15.4	29.5	11.5	38.0
1990:Q3	33.6	63.1	7.0	30.9
1990:Q4	29.7	92.8	5.9	14.4
1991:Q1	17.2	110.0	8.7	17.6
1991:Q2	14.9	124.9	6.0	12.0
1991:Q3	25.2	150.1	19.2	42.1
1991:Q4	26.6	176.6	3.7	5.4

Definitions

RTCDEP = change in the quarterly average volume of cumulated deposits at resolved thrift institutions. Main proxy for RTC effects on M2.

RTCDEPO = measure of the quarterly average volume of cumulated deposits at resolved thrift institutions (used to create RTCDEP).

QRTC = quarterly average volume of deposits at newly resolved thrifts that occured within that quarter.

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1. Note that because resolutions tend to occur in the third month of quarter:

i) the quarterly average of newly resolved deposits (QRTC) is much smaller than the simple sum of newly resolved deposits during an entire quarter (the last column).

ii) the potential impact of RTC activity during quarter t on M2 is mainly felt in quarter t+1 owing to quarter-averaging effects. For this reason, the average size of RTCDEP tends to be larger than that of QRTC, and RTCDEP sometimes surges in the quarter following a surge in QRTC.

Table 4: Results of Estimating M2 Growth Rates (Sample Period 1976:Q1-1991:Q4)

Variable	FRB Model	Model 2	Model 3	Model 4
Constant	-.04866** (-3.32)	-.08533** (-5.36)	-.05544** (-3.70)	-.06534** (-4.05)
TIME	-.00031** (-3.59)	-.00023** (-2.86)	-.00027** (-3.11)	-.00029** (-3.42)
$\log(M2_{t-1})-\log(GNPAV_{t-1})$	-.19069** (-4.35)	-.24819** (-6.00)	-.19502** (-4.52)	-.22164** (-4.96)
$Del(\log(EPCEN_t)$	.27959* (3.19)	.28594** (3.70)	.27478** (3.19)	.26117** (3.07)
$Del(\log(EPCEN_{t-1})$	.17139 (2.06)	.23025* (3.07)	.18259* (2.23)	.22415* (2.67)
$Del(\log(EPCEN_{t-2})$	.08783 (1.26)	.09022 (1.47)	.09251 (1.35)	.10806 (1.59)
$Log(OC_{t-1})$	-.00914** (-4.27)	-.01274** (-6.07)	-.00942** (-4.46)	-.01122** (-4.91)
$Del(\log(OC_t)$	-.01161** (-5.24)	-.01280** (-6.46)	-.01186** (-5.43)	-.01288** (-5.80)
$Del(\log(M2_t))_{t-1}$	.46119** (5.12)	.38360** (4.83)	.45012** (5.07)	.40662** (4.48)
DCON	-.01112** (-3.04)	-.01078** (-3.34)	-.01128** (-3.14)	-.01666** (-3.29)
DMMDA	.01003** (2.92)	.00875** (2.87)	.00931** (2.73)	.00966* (2.91)
DUM83Q1	.02530** (5.42)	.02487** (6.04)	.02544** (5.54)	.02502** (5.54)
DUM83Q2	-.00673 (-1.27)	-.00227 (-0.48)	-.00600 (-1.15)	-.00354 (-0.66)
RTCDEP		-.00034** (-3.95)		
RTCOC			-.00020 (-1.68)	
RTCDOC				.00084* (2.16)
long-run OC elasticity	-.048	-.051	-.048	-.051
S.S.E. (Qtly, not a %)	.0008652	.0006621	.0008196	.0007925
R^2 (corrected)	.77969	.82808	.78719	.79423

Table 4 (continued)

Durbin-H	-.58816	-1.23570	-.90027	-1.5711

*--denotes significant at the 95% confidence level.
**--denotes significant at the 99% confidence level.
Del--denotes the first difference operator.
(t statistics in parentheses.)

Definitions

EPCEN = Personal consumption expenditures, a s-run proxy for transactions.

XGNPAV = $(GNP_t + GNP_{t-1})/2$, measure of permanent income used as a long-run proxy for transactions.

OC = Opportunity cost of M2 defined as the spread between the 3-month T-bill rate and the average interest rate paid on M2 balances.

DCON = 1 in 1980:Q2 when the Credit Controls were in effect
-1 in 1980:Q3 just after the Credit Controls were lifted

DMMDA = a dummy equal to 1 when MMDAs were introduced in 1982:Q4.

DUM83Q1= a dummy equal to 1 in 1983:Q1 to control for MMDAs and deregulation.

DUM83Q2= a dummy equal to 1 in 1983:Q2 to control for MMDAs and deregulation.

RTCDEP = measure of quarter to quarter change in the quarterly avg. volume of cumulated deposits at resolved thrift institutions.

RTCOC = variable interacting RTCDEP and $\text{Log}(OC_{t-1})$, controls for whether the long-run opportunity cost elasticity of M2 is sensitive to RTCDEP.

RTCDOC = interacts RTCDEP and del(Log(OC)), controls for whether the short-run opportunity cost elasticity of M2 is sensitive to RTCDEP.

TIME = time in quarters: 1947:1 = 1, increases by 1 each quarter.

Note: The following convergence restriction was imposed:

$$\sum_{i=0}^{2} y_{-i} + \text{the coefficient on Del}(\log(M2_{t-1})) = 1,$$

where the y_i are the coefficients on the $\text{Del}(\log(\text{EPCEN})_{-i})$ terms. This imposes on the short-run dynamic terms the same unitary elasticity with respect to transactions volume that is imposed in the long-run by the term $[\log(M2_{t-1})-\log(\text{XGNPAV})_{t-1}]$. The relative performances of Models 2 and 3, and the significance of the RTC variables are qualitatively similar when this restriction is not imposed. In order to use the FRB model as a benchmark for comparison, this restriction is imposed in all the above models. In separate tests, this restriction is not rejected for each model.

Note that a negative coefficient on $[\log(M2_{t-1})-\log(\text{GNPAV}_{t-1})]$ implies that M2 balances adjust (error correct) toward their desired levels.

Table 5

In-Sample M2 Growth Rate Errors Over 1990:Q3-1991:Q4
(Percent, SAAR, Negative Entries Reflect Weaker-Than-Predicted M2 Growth)

Quarter	FRB Model	Model 2	Model 3	Model 4
1990:Q3	-.96	2.30	.91	-.33
1990:Q4	-2.19	.02	-.91	-1.12
1991:Q1	-.75	-.44	-.52	.26
1991:Q2	-.02	-.34	-.43	-.50
1991:Q3	-3.63	-2.52	-3.95	-4.80
1991:Q4	-1.64	-.92	-2.02	.30

Memo Items:

Growth Rate Residuals 90:Q3-91:Q4				
Average	-1.83	-0.32	-1.15	-1.03
% Missing M2 explained:	-------	83%	37%	44%[15]
S.S.E. over 90:Q3-91:Q3, (Quarterly rate):				
Total	.000139	.000080	.000136	.000155
Share of FRB S.S.E.	-------	42% lower	2% lower	12% higher

[15] Not particularly meaningful given the "incorrectly" signed coefficient on RTCDOC in model 4.

Table 6

Selected Results From
Combining RTC and Bond/Equity Fund Effects (Sample period: 1976:Q1-91:Q4)[1]

Selected Variables	M2	Subst.Adj. Bond Fund Adj. M2	Model Bond & Equity Adj. M2	Simple Bond Adj. M2
$\log(M2_{t-1})-\log(GNPAV_{t-1})$	-.24819** (-6.00)	-.23524** (-6.57)	-.20732** (-5.94)	-.19011** (-5.88)
RTCDEP	-.00034** (-3.95)	-.00031** (-3.77)	-.00023* (-2.46)	-.00033** (-3.59)
long-run OC elasticity	-.051	-.063	-.077	-.072
S.S.E. (Qtly, not a %)	.0006621	.0006075	.0008781	.0007107
R^2 (corrected)	.82808	.83676	.77633	.82447
Memo Items:				
Growth Rate Residuals 90:Q3-91:Q4				
Average (avg. FRB error = -1.83)	-0.32	-0.24	-0.10	-0.26
% Missing M2 explained:	83%	87%	95%	86%
S.S.E. over 90:Q3-91:Q4, (Quarterly rate):				
Total (FRB S.S.E. = .000139)	.000080	.000047	.000053	.000050
Share of FRB S.S.E.	42% lower	66% lower	62% lower	64% lower

1. Runs add RTCDEP to M2 and Bond/Equity Fund adjusted M2 models in Table 1.

Appendix A: Constructing a Substitution Adjusted Bond Fund Series

This appendix describes how a bond fund series was adjusted for inflows from directly held bonds. This series, BF, was then added to M2 to construct one of the two bond fund adjusted M2 series that are assessed. As described at the end of this appendix, all three bond and equity fund adjusted series were converted into quarter average equivalents (using the same procedure) because M2 growth is typically measured on a quarter average basis.

BF was calculated as the difference between bond fund outstandings and cumulative bond fund inflows attributable to shifts away from direct bond holdings (BFS). BFS was calculated in two steps. First, direct bond fund holdings are estimated. Using Flow of Funds data, total household bond holdings (BT) were defined to equal the sum of the household sector's corporate bonds, government securities (excluding savings bonds), and tax-exempt securities. Note that household assets in commercial paper or in money market mutual funds were not counted as bond holdings, but that owing to data limitations, this figure includes Treasury bill holdings. Direct holdings of bonds ("BD," i.e., non mutual funds) were estimated as the difference between total household bond holdings (BT) less total estimated bond fund holdings (TBF).

The second step entailed estimating the extent to which direct bond holdings fell as a result of substitution toward bond funds. This was done as follows. If bond fund holdings rose while direct bond holdings fell, then bond fund holdings attributable to substitution between bond assets equaled the minimum of the size of the decline in direct bond holdings and the increase in bond funds. Given data limitations, bond fund holdings attributable to substitution between bond assets were conservatively calculated as equaling the cumulative sum of such measured substitutions:

$$BFS_t = \Sigma_{t=0}^{t} SUB_{t-i} , \qquad (4)$$

where $SUB_t = \min([BD_{t-1} - BD_t], [TBF_t - TBF_{t-1}])$,

if $(TBF_t - TBF_{t-1}) > 0$ and $(BD_t - BD_{t-1})<0$, and

$= 0$, otherwise. (5)

This measure likely understates substitution from directly held bonds to bond funds because it does not account for the extent to which direct bond holdings would have grown in the absence of bond funds. However, the relatively sluggish growth of total bond holdings in the mid-1980s implies that the degree to which BFS underestimates these shifts is minor.

Next, bond funds substituting for M2 (BFU) were calculated as the difference between total household bond funds (TBF) and BFS (see Figure 3):

$$BFU_t \equiv TBF_t - BFS_t. \qquad (6)$$

Finally, this bond fund component was converted from an end-day-of-quarter number to a quarterly average number to create an adjustment (BF) that was comparable to quarterly average M2 data. This was done by defining:

$$BF_t \equiv [BFU_t + BFU_{t-1}]/2, \text{ and} \qquad (7)$$

$$SBFM2_t \equiv BF_t + M2_t .$$

In creating the two other mutual fund adjusted M2 series, total household bond funds were added to M2 (BFM2), and equity and substitution adjusted bond funds were added to M2 (BEFM2). As with BFM2, these adjustments were converted into quarter average equivalents following eq. (7).[16] Note that although bond fund data are available on a monthly (end-day-of-month) basis, the adjustments in eq. (7) had to be calculated on an end-month-of-quarter basis because the Flow of Funds data used are end-month-of-quarter data. In order to compare the M2 series adjusted with substitution adjusted bond fund data (SBFM2) with the other two bond and equity fund series, the two other series were converted into quarter averages using the method in (7) even though monthly data are available. The qualitative nature of the results was unchanged when BFM2 and BEFM2 were constructed by averaging monthly data instead of using just end-month-of-quarter data points.

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[16] These quarterly adjustments are averages of constructed month average data. Monthly averages for each month t were created by averaging end-day-of-month outstandings for months t and t-1.

Appendix B

Formulas Used in Measuring the Impact on M2 of Deposits at Resolved Thrifts

Definitions

RTC $\equiv$ deposits at thrifts newly resolved during a month.

MRTC $\equiv$ month average of newly resolved deposits.

QRTC $\equiv$ quarterly average of newly resolved deposits.

CUMRTC $\equiv$ cumulated sum of deposits resolved in prior quarters.

RTCDEPO $\equiv$ quarterly average cumulated stock of resolved deposits.

RTCDEP $\equiv$ change in quarterly average cumulated stock of resolved deposits.

RTCOC $\equiv$ RTCDEP interacted with the opportunity cost of M2.

M2OC $\equiv$ spread between 3-month T-bill rate and avg. yield on M2 balances.

subscript m denotes month m.

subscript q denotes quarter q.

subscript g denotes first, second, or third month of quarter.

Formulas

$$MRTC_m \equiv RTC_m/2$$

$$QRTC_q \equiv MRTC_{g=1} + (2/3)MRTC_{g=2} + (1/3)MRTC_{g=3}$$

$$= (5/6)RTC_{g=1} + (1/2)RTC_{g=2} + (1/6)RTC_{g=3}$$

$$CUMRTC_{q=j} \equiv \sum_{t=0}^{t=j-1} [MRTC_{g=1,\ q=t} + MRTC_{g=2,\ q=t} + MRTC_{g=3,\ q=t}]$$

$$RTCDEPO_q \equiv CUMRTC_q + QRTC_q$$

$$RTCDEP_q \equiv RTCDEPO_q - RTCDEPO_{q-1}$$

$$RTCOC_q \equiv RTCDEP_q \times M2OC_q$$

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