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by

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Should Bond Funds Be Added To M2?

Abstract

In the early 1990s, U.S. M2 growth has been weaker than estimated while bond mutual funds have experienced large inflows. This study assesses whether adding bond funds to M2 would yield a monetary aggregate that is more explainable using a standard error correction model of money. Results indicate that it is important to net out institutional and IRA/Keogh assets from bond funds (as is done for M2) and that adding such a bond fund series to M2 results in an aggregate that is somewhat more explainable than M2.

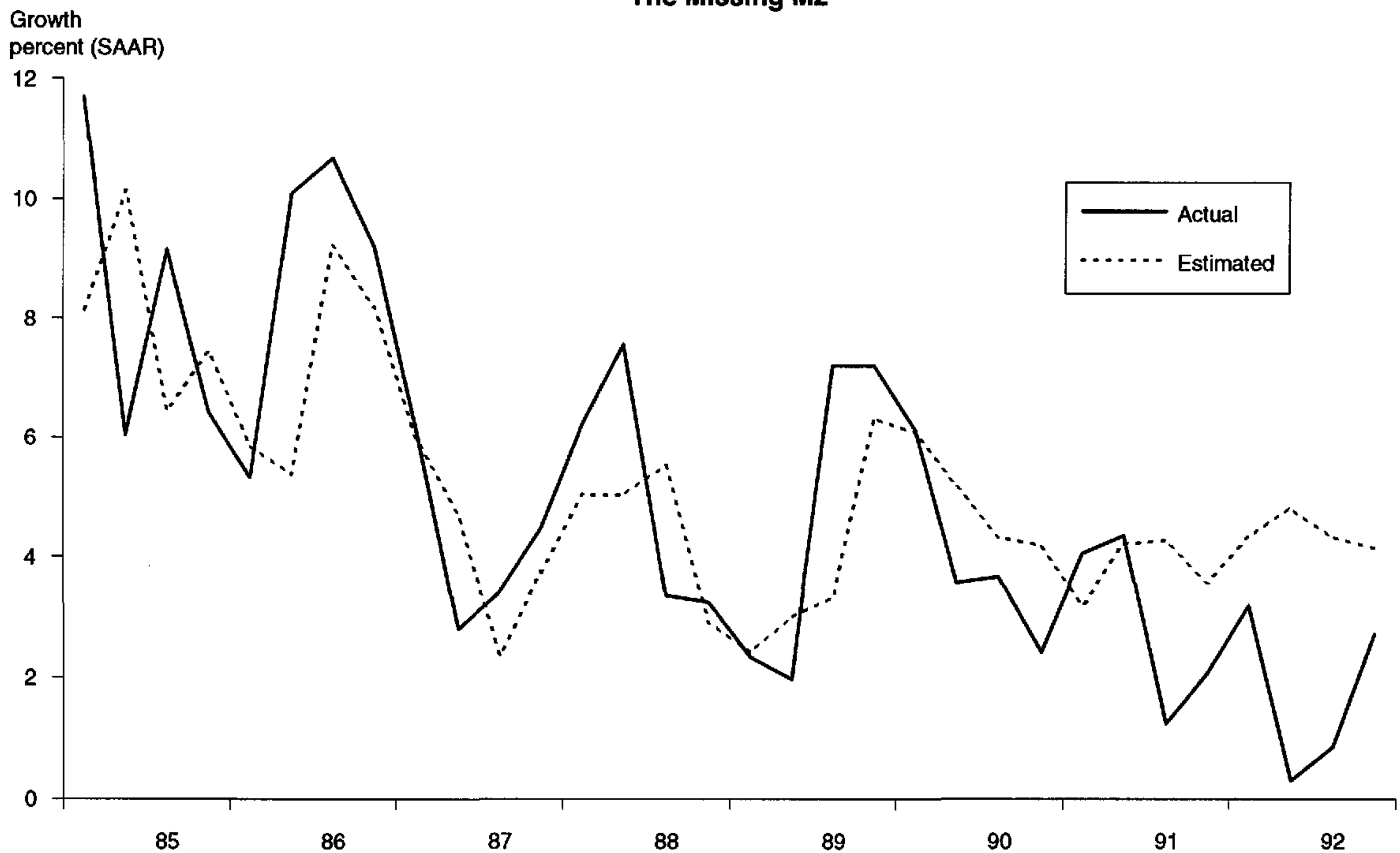
JEL Classification Codes: E41, E51, and E52

Evidence that M2 is more predictable than M1 [Hetzel and Mehra (1989) and Moore, Porter, and Small (1990)] has led more economists to use M2 as an indicator of nominal activity and long-run price pressures [Hallman, Porter, and Small (1991)]. In the early 1990s, however, the growth of M2 has been unusually weak, while bond mutual funds have grown rapidly. For example, the Federal Reserve Board staff (FRB, circa 1991) model has overestimated in-sample M2 growth by an average of 1.65 percentage points (annualized) over 1990:Q3-1992:Q4 (Figure 1). This study addresses whether M2 would be more closely related to nominal income and measures of opportunity costs if M2 included bond funds.

This is an important empirical issue because M2 is more often viewed as a potential intermediate target for conducting monetary policy rather than as an operating target. The implicit assumption of this perspective that M2 is endogenous is consistent with evidence that (1) nominal spending has lagged effects on M2 [Small and Porter (1992)], (2) the Federal Reserve operates through changing the federal funds rate [Bernanke and Blinder (1992)], and (3) any liquidity effect of monetary policy on interest rates is transmitted through changes in reserves rather than innovations in M1 or M2 which are partly endogenous [Christiano and Eichenbaum (1992)]. From this perspective, M2 is useful not because it is an exogenous policy tool of the Federal Reserve, but rather because when viewed together with interest rates, it has been a useful indicator of the overall pace of nominal activity which reflects the confluence of monetary, other demand, and supply impulses.

In practice, M2's usefulness hinges on how accurately nominal GDP growth can be inferred from econometric models. One benchmark model is the FRB model which essentially attributes M2 growth to nominal income growth and movements in a measure of M2's opportunity cost--specifically the spread between the 3-

Figure 1
The Missing M2



month Treasury bill rate and the average yield on M2 balances. The FRB specification can be interpreted as modeling the influence of both "exogenous" (monetary policy) and short-run endogenous factors on M2. Because open market operations temporarily alter short-term market interest rates [Christiano and Eichenbaum (1992)] and because deposit rates adjust with some lag to market interest rates, open market operations exogenously affect the opportunity cost of M2 [Small and Porter (1992)]. Short-run endogenous factors enter the FRB model insofar as M2 is modeled as reacting to contemporaneous and lagged nominal spending and to changes in M2's measured opportunity cost, which reflects short-term market interest rates.

However, M2's indicator properties are unstable. Like most money demand models, the FRB models of M1 and M2 tend to track monetary aggregates until financial innovations change the structure of household and firm behavior. Before 1980, the monetary aggregate most watched by the Federal Reserve was M1a, which experienced unusual weakness in 1974-75 (Goldfeld (1976)) and, to a lesser extent, in 1979-80 (Wenninger, Radecki, and Hammond (1981)).

In response to these difficulties, the Federal Reserve redefined several monetary aggregates, most notably M2 and M1. Although M2's velocity had a tight historical relationship to conventional measures of its opportunity cost, prior to the official redefinition of M2 in 1980, there did not exist a published monetary aggregate that closely resembled M2 as we now know it. In pre-1980 issues of the <u>Federal Reserve Bulletin</u>, the Federal Reserve published a number of broad monetary aggregates that separated thrift from bank deposits and/or combined large time deposits with selected M2 components. Indeed, <u>none</u> of these official aggregates included money market mutual funds (MMMFs), not to mention overnight RPs and Eurodollars, whose rapid growth in the late-1970s reflected financial innovations that were induced by the high cost of reserve requirements in a high interest rate environment, binding deposit rate ceilings (Reg Q), and technological innovations (e.g., information and computer technology). If one excluded MMMFs from M2, M2's annualized growth rate would be 1 to 3 percentage points lower in 1979:Q1-Q4 (Figure 2). The omission of MMMFs from official monetary measures before 1980 [see Simpson (1980)] illustrates how the ex post redefinition of M2 masks its long-run endogeneity and how M2's strong relationship to nominal income before 1980 is an ex post phenomenon.[1]

As with MMMFs (and MMDAs--money market deposit accounts), redefining M2 to include bond mutual funds (Figure 3) may produce a broad monetary aggregate that is a good contemporaneous indicator of nominal activity (i.e., an aggregate that is closely related to nominal income and an opportunity cost measure). Strong inflows into bond funds have occurred during the recent missing M2 period when much of the runoff in small time deposits has not flowed into the more liquid M2 components. While the price risk of bond funds implies that they are not perfect substitutes for M2, they generally have low credit risk and enable households to quickly adjust their portfolios of financial assets.

One explanation for the missing M2 is that it partly reflects substitution by households into bond and/or equity mutual funds [see Clements (1991) and the Federal Reserve Board's "Monetary Policy Report to Congress," (1993) which was the basis for Federal Reserve Chairman Greenspan's "Humphrey Hawkins" testimony to Congress in February 1993]. Indeed, the missing M2 has

[1] In this regard, readers should note that the U.S. Commerce Department has periodically redefined its index of leading economic indicators to better explain past behavior.

Figure 2
M2 Growth With and Without MMMFs

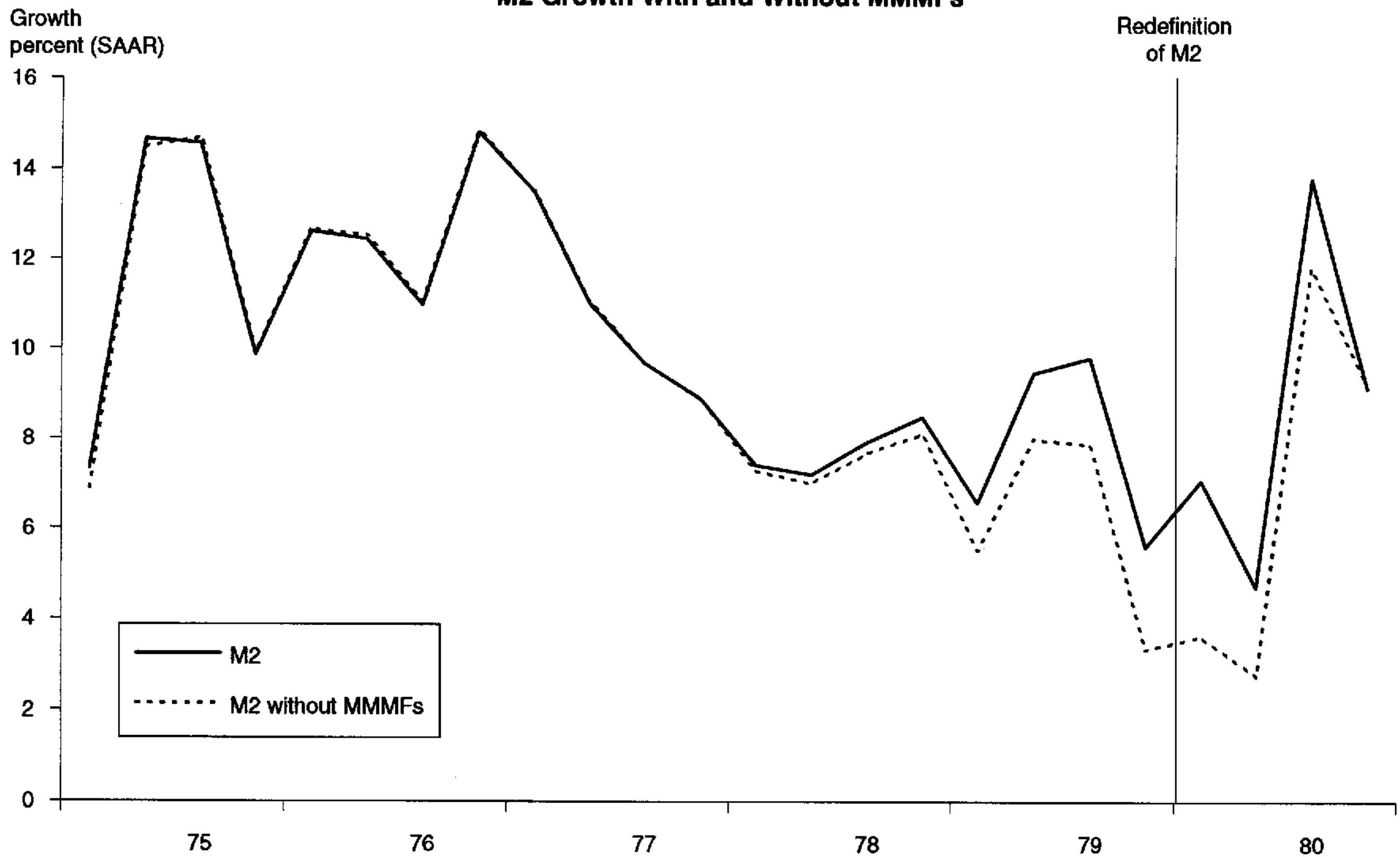
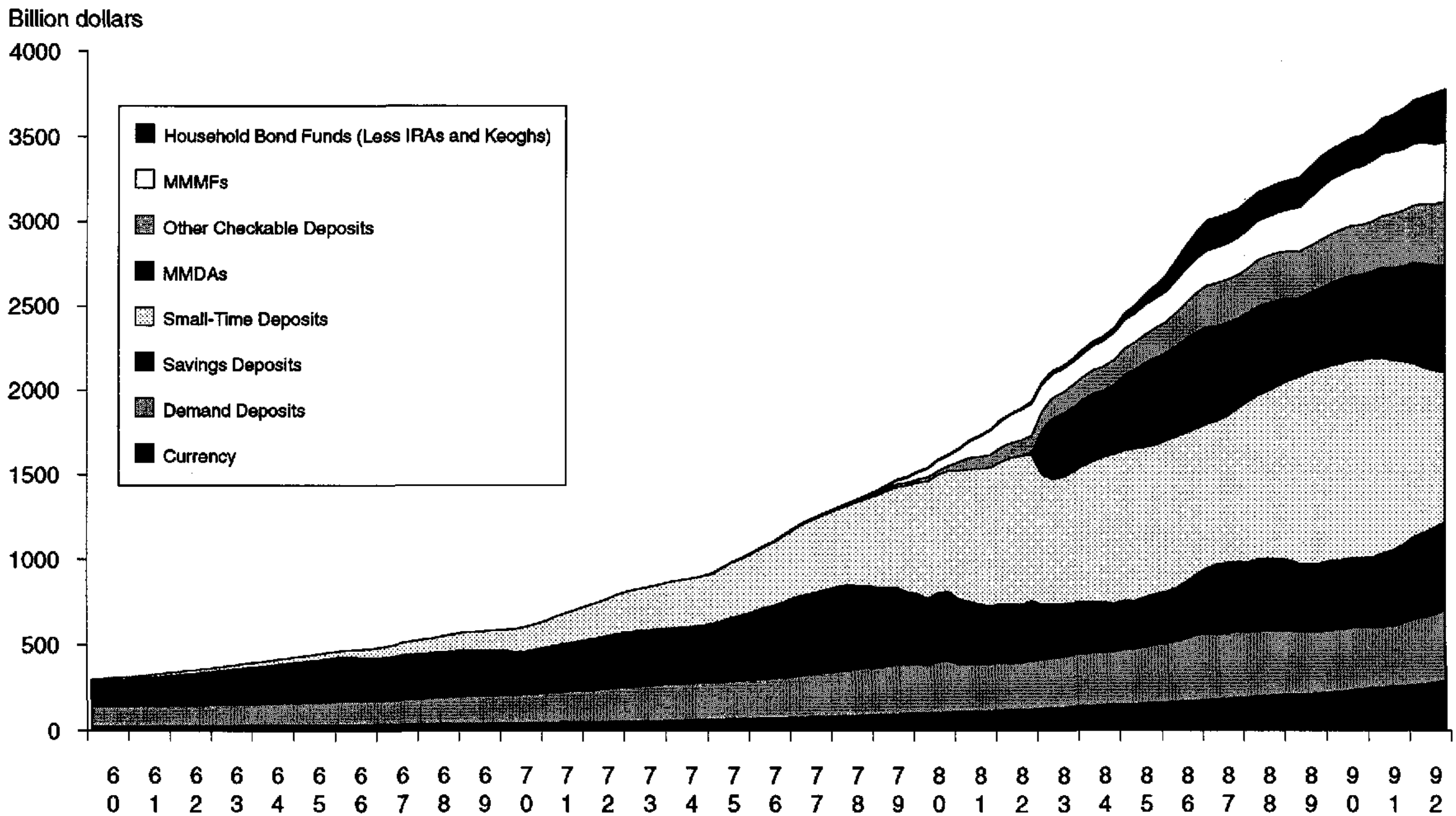


Figure 3
M2 Components*



* Includes Bond Funds which are currently not formally counted as part of M2.

been accompanied by runoffs in small time deposits, weakness in MMMFs, and large inflows into bond and equity mutual funds. A complementary explanation is that households have shifted out of M2 into bond funds and other assets partly in reaction to methods used by the Resolution Trust Corporation (RTC) in resolving failed thrifts. Essentially, RTC resolutions have lowered the perceived return on thrift deposits in ways not typically accounted for by M2 models.[2] Indeed, much of the missing M2 has coincided with the RTC's resolution of deposits at failed thrifts [Duca (1992, forthcoming)].

This study provides evidence on whether M2 should be redefined to include bond funds, and is organized as follows. First, the characteristics of bond funds are reviewed. The second section discusses bond funds in a Miller-Orr framework. The third section details the bond fund data used. Then, using the FRB model first without and then with RTC and yield curve variables, the fourth section assesses whether M2 would be more explainable if it included bond funds. The last section concludes by interpreting the results.

1. Institutional and Historical Background on Bond Mutual Funds

Bond funds are mutual shares of bond portfolios and substitute for direct bond holdings and M2 deposits. This section explores the substitutability of bond funds for direct bond holdings and M2 deposits.

Similarly, equity funds potentially substitute for direct holdings of equity and other assets such as M2 balances. However, equity funds carry a substantial degree of investment risk which makes them much less substitutable for M2 deposits than bond funds, consistent with the findings of Duca (1992).

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[2] Duca (1992) argues that the RTC's abrogation of high rate small time deposits has imparted a call risk to some M2 deposits and may have sped up the downward adjustment of M2 to a lower interest rate environment.

For this reason, this study focuses on bond rather than equity funds.

Substitution Between Bond Funds and Direct Bond Holdings

Bond funds offer three advantages over directly-held bonds. First, bond funds enable an investor to acquire shares in a diversified and professionally managed portfolio with only a modest investment. Second, bond fund assets in "mutual fund families" can be converted into transactions accounts faster and at less cost than can directly held bonds. Third, mutual funds are more attractive as IRA/Keogh tax shelters because many funds (1) perform tax-related accounting for investors and (2) allow investors to make the maximum annual IRA contribution ($2,000 and $4,000 for most eligible individuals and families, respectively) which is smaller than the $10,000 size of most bonds.

Substitution Between Bond Funds and M2

Bond funds have several features in common with M2 deposits. First, most bond funds have little or no credit risk because they are heavily invested in U.S. government bonds, U.S. government guaranteed mortgage-backed securities, and high grade corporate bonds. Second, many bond funds have minimum investment sizes of <u>under</u> $10,000 and do not require that households invest in $10,000 increments as entailed by directly holding most bonds. Third, many bond funds enhance the liquidity of investors by offering check writing priviledges, credit lines, and credit cards. Fourth, many bond fund assets are in "asset management accounts" that allow shifts across bond, equity, and checkable money market mutual funds at very low transactions costs.[3] This last feature enhances substitution between funds and MMMFs when

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[3] "Mutual fund families" usually allow a few free tranfers among money market, bond, and equity funds within the same family (<u>Donoghue's Mutual Funds Almanac, 1987-88</u>), pp. 16-17). Recently, some large banks have enabled households to easily shift among these types of funds and M2 bank deposits.

relative rates of return on these assets change.

Bond funds differ from M2 balances in several ways. First, unlike M2 accounts, bond funds are marked to market and pose an interest rate (price) risk. Second, price risk hampers substitution between bond funds and MMMFs because investors must consider the capital gains tax consequences of shifting out of bond funds into money market funds. Finally, annual fees and minimum balance requirements limit the relevance of bond funds to the more affluent.

Overall, the characteristics and recent strong growth 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, might make M2 more stable. However, adding bond funds to M2 could create several problems. First, many bond fund assets have substituted for direct bond holdings. Second, the mark-to-market feature of bond funds introduces an interest rate sensitivity that is not a direct "money demand" effect. Third, since they are long-term investments, the substitutability between bond funds and equity may exceed that between M2 deposits and equity. In this case, putting bond funds in M2 may make M2 less stable owing to shifts between bond funds and stocks.

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

Bond fund data are available starting in 1975 and show that bond funds grew modestly over the late 1970s and early 1980s. Bond funds then surged in the mid-1980s, partly spurred by tax law changes that encouraged households to shift assets into IRA's and Keoghs, for which mutual funds tended to be more attractive savings vehicles than directly held securities. A relatively steep yield curve likely spurred bond fund growth at the expense of shorter-maturity M2 deposits as well. In the mid-1980s, both directly held bonds and M2 balances of households declined relative to other financial assets. For example, Flow of Funds (FOF) data show that as a share of liquefiable financial assets,[4] M2-type balances[5] and directly held bonds[6] fell by 3.9 and 1.1 percentage points from yearends 1984 to 1986, respectively. By contrast, the share for household bond funds (Investment Company Institute (ICI) and FOF data) rose by 2.4 percentage points. These data suggest that bond funds grew at the expense of M2 and directly held bonds in the mid-1980s.

Beginning in 1987, the Tax Reform Act of 1986 severely restricted the eligibility requirements for IRAs, reduced the maximum 401K annual contribution, and reduced the tax incentive (by reducing marginal income tax rates) to use IRAs and Keoghs. Tax law changes likely account for most of the halt in real bond fund growth over 1987-89, with a flattening of the yield curve occurring in 1988-89 (shown later in Figure 4). More recently, bond funds have grown rapidly, rising as a share of liquefiable household assets by 1.7 percentage points between yearends 1989 and 1992, while M2-type balances and directly held bonds fell by 2.4 and 1.6 percentage points, respectively. Thus, as in the mid-1980s, rapid bond fund growth in the early-1990s likely

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[4] This includes the FOF household sector categories of currency, deposits (including IRAs and Keoghs), large time deposits, corporate equity, government securities (e.g., mortgage-backed securities), tax-exempt securities, MMMFs (including IRAs and Keoghs), corporate and foreign bonds, mutual funds (equity and bond--including IRAs and Keoghs), and open market paper. This grouping excludes assets in pension funds, mortgages (mainly seller financed), noncorporate businesses, security credit, and life insurance reserves because these assets are not very liquid. The category, "miscellaneous assets" is excluded because it is constructed as a residual.

[5] The sum of MMMFs, currency, and deposits. This series differs from M2 in including IRAs and Keoghs, but is consistent with FOF data used to define "liquefiable assets" in its timing (yearend) and ownership (households).

[6] This includes the FOF categories of government securities, corporate and foreign bonds, and tax-exempt securities.

reflected substitution out of M2-type balances and direct holdings of bonds.

The most recent surge in bond funds appears to partly reflect shifts from M2 components that are most substitutable for bond funds. Some of the bond fund inflows likely came from small time deposits, which have been been declining sharply. 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 1990-92 have coincided with weakness in MMMFs. 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).

2. Theoretical Considerations Regarding Bond Funds

The increased popularity of bond funds owes to two factors. First, bond funds reduce the costs to households of transferring assets from bonds into transactions accounts (e.g., MMMFs). Second, the substantial steepness in the yield curve during the early 1990s has made bond funds more attractive relative to medium-term bank deposits.[7] These factors can be analyzed using Milbourne's (1986) model of financial innovation and liquid assets.

Milbourne's framework is a modified Miller-Orr model [Miller and Orr (1966)] 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. Changes in net cash flow are stochastic with a mean of 0 and

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[7] 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 a range from 3 to 10 years.

variance σ^2. Whenever transactions balances hit zero, funds are transferred into transactions accounts from either savings accounts or from bonds at a fixed cost. Milbourne assumes that $r_m < r_s < r_b$, and that the fixed cost of transferring funds from bonds into transactions accounts (β) is greater than that of shifting funds from savings to transactions accounts (α). Owing to the latter assumption, Milbourne's model implies that households will hold a portfolio of all three financial assets, and that transactions deposits (T), small time deposits (S), and total M2 deposits (M2 ≡ S + T) equal:

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

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

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

Milbourne shows that, with $r_b > r_s$, $M2_\beta > 0$, which implies that a fall in β will lead to slower M2 growth. In this model, the development of bond funds and "mutual fund families" lowers β and increases the risk-adjusted return on bonds relative to money (holding non-risk adjusted interest rates constant) by making it easier to obtain a well-diversified portfolio of bonds.

However, Milbourne's results are relevant for long-run, equilibrium analysis because substitution between M2 and bond funds entails fixed costs. These costs include gaining information on mutual funds, front load fees, exit fees, fixed annual fees (typically $75-$100), and meeting minimum required investments (typically $10,000) to open asset management account.[8] 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 (β) or by a modest rise in

[8] Minimum balances to open just a bond mutual fund account are as low as $500 - $1,000, but are typically $10,000 to open an asset management account that allows shifting among bond, equity, and money market mutual funds.

the yield spread between bond and small time deposit yields ($[r_b - r_s]$). It is thus plausible that M2 will be substantially affected by only large changes in transfer costs or the spread between long- and short-term interest rates.

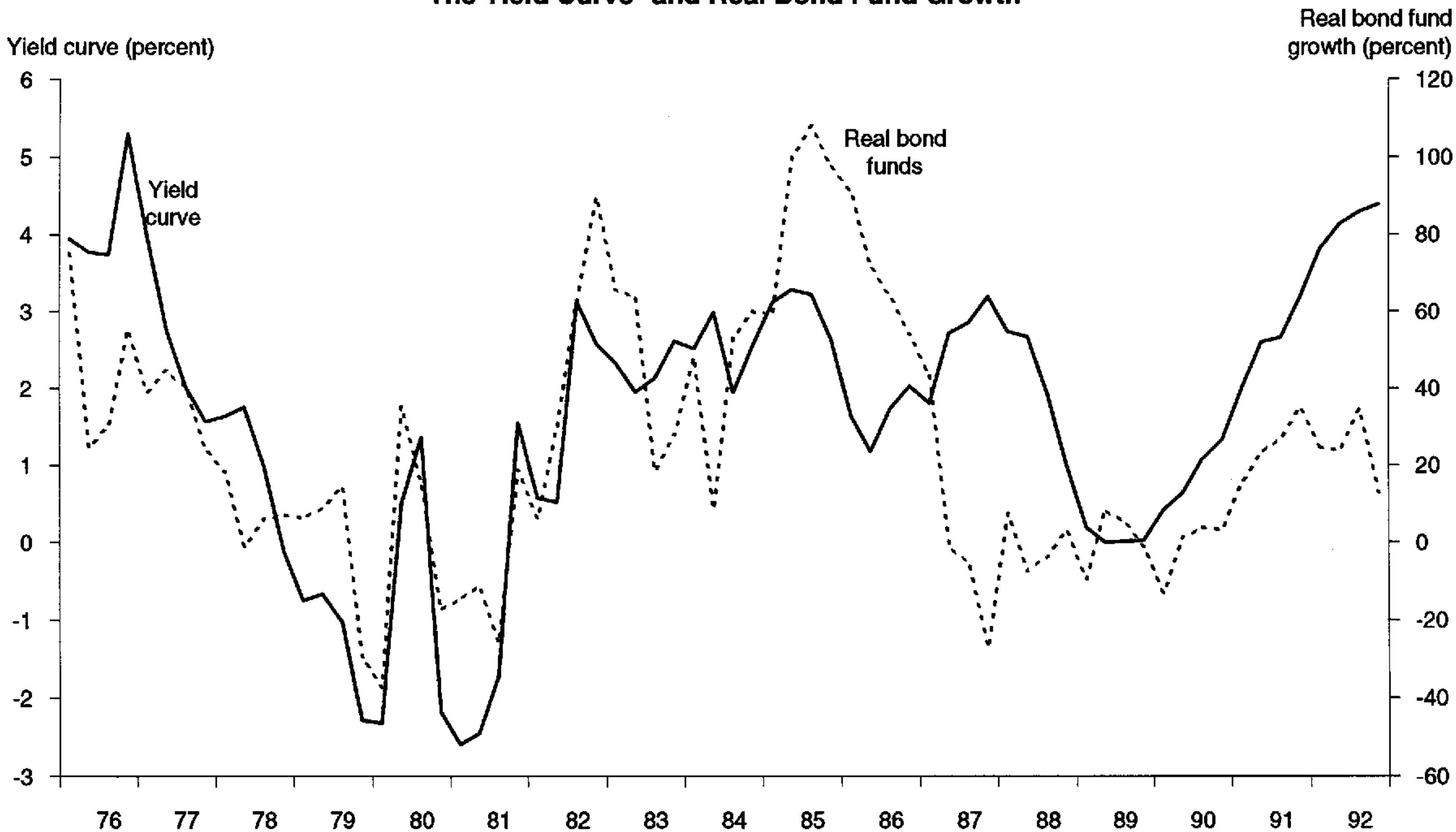
Anecdotal evidence is consistent with this view. For example, despite the falling costs of transferring assets from bond to money funds during the late 1980s and early 1990s, real bond fund growth (using the GDP deflator) was economically significant in only two periods since 1982, 1985-6 and 1990-92, both of which were marked by very steep yield curves (Figure 4). However, of these two periods, the mid-1980s' surge was much larger relative to the slope of the yield curve. One explanation for this disparity is that the mid-1980s' surge partly reflected shifts from directly held bonds to IRAs and 401Ks invested in bond funds when tax deductibility was more generous. A complementary factor was that many households may have learned about bond funds in the mid-1980s when IRA/Keogh eligibility requirements were liberalized.

One approach to handling substitution between M2 and bond funds is to include the spread between long-term and short-term Treasury rates in M2 regressions. However, this method is unlikely to pick up surges in bond funds owing to tax code changes and the rapid growth of new instruments during periods of innovation. One other approach to handling these sorts of empirical difficulties is to expand the definition of M2, as in the past when MMMFs and MMDAs were added to M2. This is the method used here. Specifically, this study compares the demand for M2 with that for M2 plus bond funds, while accounting for (and adjusting) the M2 opportunity cost measures.

3. Measuring Bond Funds

Three measures of bond funds were constructed: total, household, and household excluding IRA and Keogh assets. The second measure nets out

Figure 4
The Yield Curve* and Real Bond Fund Growth



* Yield curve = 30-year T-bond yield less 3-month T-bill yield.

institution-held bond funds to create a series that is more similar to M2, which includes personal but excludes institutional holdings of MMMFs. The third measure also nets out IRA and Keogh bond fund assets to make a series that is more comparable to M2, which also excludes IRA and Keogh balances. This section begins by estimating institutional holdings of bond funds and measuring total household bond fund assets. Then, a household measure is constructed that excludes IRA/Keogh balances (see Figure 5).

Several categories of data on bond and equity fund assets since 1975 are available from the Investment Company Institute (ICI). These can be classified into bond (BF), equity, and mixed funds. The mixed funds tend to hold more equity than bonds, and were treated as equity funds. Bond fund categories were aggregated to form BF, which was added to M2 to construct BFM2.

One difficulty with BF is that it aggregates holdings by households and institutions, whereas MMMFs held by institutions are not included in M2. To handle this problem, bond fund assets of institutions were netted out using internal ICI data on institutional assets (Appendix A).[9] These monthly outstandings were then seasonally adjusted with an X'11 procedure to measure household bond fund (HBF) assets, which was then added to M2 to form HBFM2.

Because M2 excludes balances in IRA and Keogh accounts, another series was constructed that excludes IRA/Keogh balances. This was done by subtracting IRA and Keogh balances from the noninstitutional, NSA levels of

[9] Appendix A uses a classification scheme similar to that used by Federal Reserve Board staff, but differs in using detailed data to make adjustments for institutional and IRA/Keogh holdings. The data produced in Appendix A are much better than the data used by Duca (1992), which were not adjusted for IRA/Keoghs and which assumed that the institutional share of mutual fund assets was constant across time and mutual fund categories.

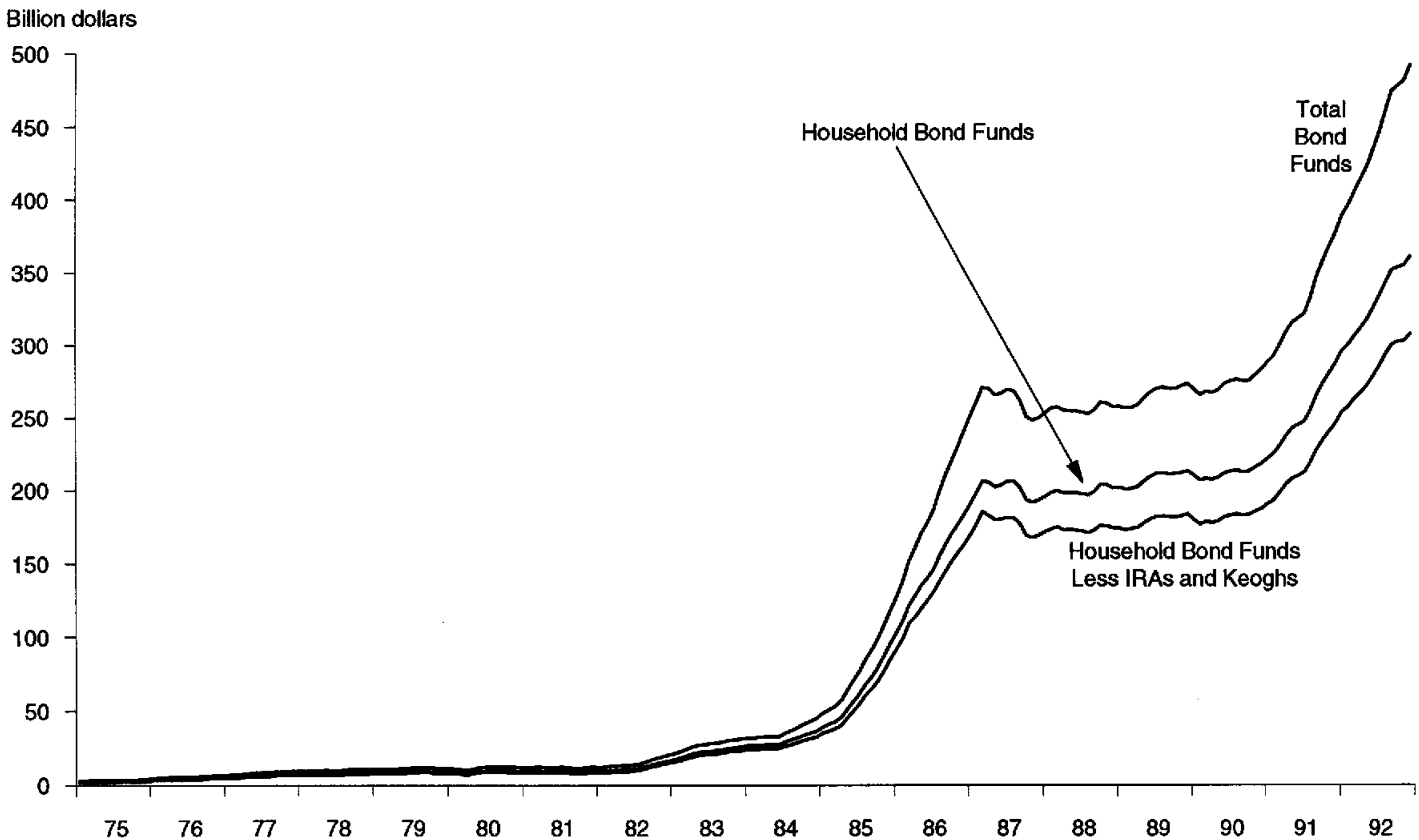
assets in the categories comprising bond funds. The resulting aggregate was seasonally adjusted with an X'11 procedure to form HBFIRA (see Appendix B), which, in turn, was added to seasonally adjusted M2 to form HBFIRAM2. Given the low level of bond funds in 1975:Q1 when data were first collected, bond fund balances were set at 0 in previous quarters to have a long sample period.

4. Money Model Results

Because bond funds are substitutes for M2 and other assets (especially directly held bonds), it is an empirical issue whether adding bond funds to M2 yields an aggregate that is better explained by money models than M2. Using the FRB model of M2 as a benchmark, this study estimates M2, BFM2, HBFM2, and HBFIRAM2. This section first discusses the relative the fits of these series using the FRB model and a modified specification over both a full-sample period and a recent subsample. Then, model stability is assessed by looking at Chow tests and the stability of key parameters (e.g., the error correction coefficient and long-run opportunity cost elasticity).

Results using the FRB model over 1964:Q1-92:Q4 are listed in Table 1. The FRB specification is an error-correction model which uses GDP 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 3-month Treasury rate as the opportunity cost of money (see Table 3 for variable definitions and see Moore, Porter, and Small (1990) for a discussion of this model). For consistency, the weighted average yields on the bond-fund-adjusted series were calculated to reflect the yield on bond funds which was proxied by the 10-year Treasury yield. (One might argue that the opportunity cost of bond funds should be set equal to zero in terms of the 3-month Treasury rate on grounds that these funds likely yield the rate of return on

Figure 5
Bond Fund Measures



assets having similar interest rate, credit, and prepayment risks. The quantitative results gave much more support to adding bond funds to M2.) The adjusted R^2's of the bond fund series are similar, ranging from .7089 to .7096, and are somewhat better than that of M2 (.6961).

Table 2 presents results corresponding to Table 1 except that the specification used is the FRB model plus terms for the influence of the yield curve, RTC activity, and savings bond pricing on M2. The yield curve variable for each monetary aggregate (YM) is the log of the spread between the 10-year Treasury bond yield and the average yield on that monetary aggregate.[10]

The RTC variable is the first difference of cumulated M2 deposit resolutions by the RTC at failed thrifts (Table 4). This variable helps control for two effects of RTC resolutions on M2 that are not captured by the FRB model [see Duca (1992) and Appendix C]. The first is the prepayment risk created because in RTC resolutions, high yielding deposits at troubled thrifts either are prematurely ended if the RTC directly pays off depositors or have their rates lowered by an institution that purchases the deposits. This call or prepayment risk is not consistently reflected in spreads between the 3 month Treasury bill rate and average M2 yields because it effectively did not exist prior to the start of thrift resolutions in 1989. As a result, post-1988 spreads do not fully reflect the opportunity cost of M2. By cancelling small time deposit contracts, the RTC is also speeding up the downward adjustment of M2 to the lower interest rate environment of the early 1990s. This latter effect is well proxied by the volume of new RTC resolutions [del(RTCDEPO)], while the first effect is proxied by RTC resolutions on grounds that actual

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[10] To handle nonpositive levels, a Taylor log approximation was used. This approximation is the one used by the FRB staff in creating the log of the spread between the 3-month Treasury bill rate and the average yield on M2.

resolutions have acted as announcements about the prepayment risk created by the RTC. Both effects imply a negative coefficient on del(RTCDEPO).

The savings bond variable is the extent to which the six-month yield on newly offered savings bonds exceeds the six-month Treasury bill yield. From November 1982 through February 1993, yields on savings bonds held for under 5 years were based on schedules which paid a minimum of 4.16 percent on savings bonds held for six-months. During 1992, the six-month Treasury yield fell below this "floor" rate and as a result, sales of savings bonds surged. To some extent, these strong inflows likely came out of M2 deposits given the small denomination of savings bonds and a maximum annual purchase of $15,000 per individual. To control for this extra substitution effect, the "modified" FRB model includes a variable (SAVBOND) equal to 4.16 minus the 6-month Treasury bill rate when the difference is positive, and 0 otherwise.

In general, the RTC and savings bond variables have negative and highly significant coefficients. These results indicate that RTC activity and the over pricing of savings bonds have induced withdrawals out of M2 into assets including, but not limited to bond funds. The lagged spread and the contemporaneous change in the spread between the 10-year Treasury rate and the "own" yield were jointly significant in most of the bond fund adjusted regressions, but not in the M2 regressions.[11] The modified FRB models yield

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[11] The opposite result might be expected on grounds that bond fund adjusted M2 would internalize much of the substitution from M2 to bonds induced by a steep yield curve. On the other hand, if the sensitivity of M2 to the yield curve has increased over time, then a yield curve variable is likely to have a large standard error and be insignificant in M2 runs. In addition, by omitting information on the increased sensitivity of M2 to the slope of the yield curve, yield curve parameters estimated in such regressions are likely to be prone to omitted variable bias. By contrast, the bond-fund adjusted M2 series may implicitly control for an increased sensitivity of M2 to the yield curve by internalizing increased substitutability. By implication, the yield curve coefficients from regressing such aggregates may

better fits than the corresponding unmodified FRB models, and with respect to the bond fund adjustments, produce qualitatively similar results. As with the FRB model, the R^2's of HBFM2 and HBFIRAM2 are higher than the R^2 of M2 (.7611), with the corrected R^2 of HBFIRAM2 (.7705) exceeding those of HBFM2 (.7669) and BFM2 (.7592). The better performance of HBFIRAM2 relative to the other bond fund series indicates the importance of making careful adjustments to bond fund data so as to render them more comparable to M2 data, which exclude IRA/Keogh assets and institutional holdings of MMMFs. The extent to which the fit of HBFIRAM2 is better than that of M2 is smaller with the modified model, likely reflecting that much of the substitution out of M2 which is reflected in the terms added to the FRB model, is internalized within the bond fund components of HBFIRAM2.

One operational definition of the "missing M2" is the average growth rate shortfall of the four actual M2 series over 1990:Q3-92:Q4. With respect to the missing M2, the average M2 growth rate shortfall over 1990:Q3-92:Q4 using the unmodified FRB model is 1.66 percentage points, 1.27 percentage points with total bond funds, 1.44 percentage points with household bond funds, and 1.52 percentage points with the IRA/Keogh adjusted bond funds (Table 1). Results from both specifications indicate that estimated M2 growth rate shortfalls are smaller when bond fund adjustments are made.

The importance of bond fund adjustments by this criteria is much smaller using the modified FRB model (Table 2), likely because the modifications control for much of the substitution out of M2 into bond funds induced by

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be much less subject to omitted variable bias and be more stable over time than those estimated for M2. For these reasons, yield curve coefficients estimated for bond fund adjusted M2 aggregates may have the hypothesized negative signs, have smaller standard errors, and be statistically significant in contrast to parameters estimated for M2.

yield curve, RTC, and savings bond effects that are not accounted for in the FRB model, but which are internalized by adding bond funds. Nevertheless, the S.S.E.'s of all three bond fund series are lower over this period than that of the unadjusted M2 series using each model; using the preferred, modified FRB specification, the S.S.E. of HBFIRAM2 is 19 percent smaller over 1990:Q3-92:Q4. [The corrected R^2 of HBFIRAM2 is slightly better than that of M2 with this model in the pre-1990 period, as well, only to a larger degree.]

The extent to which HBFIRAM2 outperforms M2 is understated for two data-related reasons. First, the bond fund adjustments are based on averaging end-day-of-month outstandings to construct month average levels. By contrast, M2 is largely based on averaging daily deposit balances to construct month average levels. As a result of having much fewer data points, the bond fund data are more "noisy" than M2 data. Second, M2 has an advantage in how it is seasonally adjusted. In their use of X'11, Federal Reserve Board staff adjust M2 for special temporary factors that are not constant across time (e.g., tax effects) before seasonal factors are estimated. This intervention procedure more accurately estimates seasonal factors for M2 than the noninterventionist procedure used here to seasonally adjust bond funds. Both of these advantages imply that M2 data are less noisy than the bond fund data and, for this reason, likely improve the fit of M2 models relative to the fit of models of bond-fund-adjusted M2. In addition, because bond funds are marked to market unlike M2 deposits, bond fund assets are somewhat more volatile than M2 deposits. Changes in bond yields were found to be statistically insignificant in other regressions, however, suggesting that this problem is small.[12]

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[12] In an alternative approach to handling this potential problem, Feinman and Porter (1992) use cumulated sums of net purchases of bond funds as a measure of bond fund assets that is not contaminated by price volatility owing

Also encouraging is that the error correction coefficients, long-term OC elasticities, and long-term yield curve elasticities were more stable for the bond fund series than those for M2 over several recent sample periods (Table 5). Indeed, the error correction coefficients for M2 decline sharply as the sample is extended into the early 1990s, suggesting that the traditional long-run relationship between M2's velocity and its measured opportunity cost has been breaking down. Chow tests also provide support for adding bond funds to M2 and of using a modified FRB model (Table 5). These tests did not reject the stability of the modified FRB model using HBFIRAM2, but did reject the stability of the FRB model for M2 and HBFIRAM2 and of the modified FRB for M2.

As a robustness check, "real" versions of the FRB model were run, in which money and RTC variables were deflated by the implicit consumption deflator, real consumption expenditures replaced nominal consumption, and the moving average of real consumption replaced that of nominal GDP. Consumption replaced GDP in these runs to avoid the use of two different price deflators and because, consistent with Mehra (1992), using real consumption in the short- and long-run transactions terms gives better results than using real GDP in all the scale terms (GDP results are not presented to conserve space).

Table 6 presents regression and Chow test results for the real M2 and real HBFIRAM2 specifications. With respect to the issue of whether bond funds should be added to M2, the qualitative results from the nominal models were largely obtained using the real models. Indeed, the improvement in fit from using HBFIRAM2 over the full-sample (1964:Q1-1992:Q4) is actually greater

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to changes in bond yields. That approach was not taken here because over the long run, households may rebalance their portfolios or allow capital gains or losses to affect their bond fund holdings. For example, the approach in my study counts bond fund assets stemming from the bond market rallies of the mid-1980s that households kept in their bond fund balances.

using the corresponding real specifications. In terms of stability, however, the results are not as encouraging for adding nonIRA, nonKeogh household bond funds to M2. In particular, the real modified version of the FRB model is stable for M2, whereas for HBFIRAM2 there is somewhat stronger evidence of a structural break in the magnitude of squared residuals in 1992:Q2.

5. Conclusion

Bond funds appear to be an important substitute for M2 for two reasons. First, bond funds have some key characteristics in common with M2. Second, an M2 aggregate which is adjusted for nonIRA/Keogh bond funds held by households is somewhat more explainable than M2 and thus appears to internalize substitution between bond funds and M2. This result held for both real and nominal money specifications. The findings also indicate that is important to net out institutional, IRA, and Keogh assets from bond funds when constructing a bond fund adjusted M2 aggregate. This result is consistent with the exclusion of IRA, institutional MMMF, and Keogh assets from the current definition of M2.

This study's findings suggest that the case of the "missing M2" is similar to two previous cases of "missing money" in being linked to regulation induced innovations. The first episode, identified by Goldfeld (1976) (weak M1 and demand deposit growth in the mid-1970s), has been linked to several shocks to bank liabilities and assets. One stemmed from firms switching from noninterest bearing demand deposits to overnight RPs spurred by high interest rates (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 [Duca (1992)]. These shifts in business credit sources were induced by (1) banks rationing credit when Reg

Q induced disintermediation, and (2) banks passing along the heightened cost of reserve requirements when interest rates were high. By reducing both sides of bank balance sheets, the combination of these factors reflected efforts by depositors and borrowers to bypass the banking system [Duca (1993)].

During the late 1970s and early 1980s, another episode of missing M1 arose [Wenninger, Radecki, and Hammond (1991)] as high market interest rates coupled with Regulation Q ceilings on deposit rates drove households away from bank deposits toward MMMFs. Money funds, in turn, purchased higher volumes of commercial paper issued by firms who shifted away from bank loans. Such actions reduced both sides of bank balance sheets and increased both sides of money fund balance sheets. This case of missing money was solved by redefining M2 to include MMMFs (along with RPs, Eurodollars, and later MMDAs), thereby internalizing any substitution between MMMFs and other M2 components.

The current case of missing M2 is also linked to changes in bank competitiveness. On the asset side of bank balance sheets, the adoption of tougher risk-based capital standards has raised banks' cost of funding loans and has resulted in higher spreads of the prime rate over market interest rates and of bank consumer loan rates over bank deposit rates. At the same time, improvements in technology have likely reduced the costs associated with issuing corporate bonds. These factors have encouraged firms to to shift toward nonbank sources of credit, especially bonds. Wider net interest margins have also induced households to use consumer installment credit more sparingly, as well as to shift toward leasing autos rather than obtaining auto loans from banks. On the liability side of bank balance sheets, the high spread of consumer loan rates over deposit rates has encouraged households to self-finance purchases by drawing down their M2 balances (especially small time deposits) to pay off or substitute for consumer loans [Feinman and Porter (1992)]. The steep yield curve in recent years is also encouraging households to shift from short-maturity M2 deposits to bond funds. Moreover, the RTC's actions can be viewed as raising the true, but not measured, opportunity cost of M2 by creating call risk on small time deposits at troubled thrifts [Duca (1992, forthcoming)]. Finally, as shown here, above-market yields on U.S. savings bonds during 1992 encouraged shifts out of bank deposits.[13] Together, these factors appear to have been actively inducing agents to bypass banks.

In terms of balance sheets, this explanation describes how banks experience a decline in both assets and liabilities at the same time that bond funds see an increase in assets (bonds) and liabilities (bond mutual fund shares). In terms of flows, firms use the proceeds from bond issuance to pay off bank loans while bond funds purchase these bonds with funds that households shift out of bank deposits. From this perspective, the banking system is not a closed loop because private agents can innovate to circumvent the banking system when it becomes relatively more costly to use [Duca (1993)].

However, to the extent that the increased costs of intermediation to depositories stemming from regulation cause households and firms to self-finance their activities, they will result in a decline in total assets and liabilities that will not be recaptured in M2 by adding in bond funds. Nevertheless, just as MMMFs were added to M2 when M2 was redefined in 1980, recent events imply that adding bond funds to M2 may tighten--but not necessarily fully restore--this aggregate's relationship to opportunity cost measures and nominal GDP by internalizing substitution between bank and

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[13] In response to the recent costly surge in savings bond issuance, the U.S. Treasury lowered the floor rate on savings bond on March 1, 1993.

nonbank liabilities. This study's findings support this view.

Although M2's velocity has not changed much in the early 1990s, it has not moved in line with M2 opportunity cost measures. Adding bond funds to M2 produces an aggregate whose velocity is more explainable based on past relationships. For this reason, augmenting M2 with bond funds yields a monetary aggregate from which contemporaneous nominal GDP can be better inferred based on available money and opportunity cost data. At a minimum, such a bond fund adjusted series should be monitored along with M2.

Although a further redefinition of M2 may be needed to account for new innovations at some point in the future, it is nevertheless important to have up-to-date indicators of nominal GDP for making policy in real time. In this regard, it is worth recalling that up until 1990, M2 was a useful nominal indicator from the time that it was officially redefined in 1980. Since financial markets will continue to generate new monetary instruments from time to time, we must remain open to periodically revising the broader monetary aggregates.

With respect to issues beyond the scope of this paper, future research will be needed to empirically assess substitution across bond mutual fund, directly held bond, and equity mutual fund assets. In particular, since bond funds were not economically meaningful in size until the mid-1980s, we have yet to see how well a bond fund adjusted M2 series performs when there is a major fall in bond prices. In addition, it would also be helpful to conduct empirical studies using cross-section data on household portfolios, not only to see whether time series evidence of substitution between bond funds and M2 balances is confirmed, but also to gain an understanding of how life-cycle and other demographic factors are related to holdings of bond fund assets.

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Table 1: Estimates from the FRB Growth Rate Model (Sample 1964:Q1-1992:Q4)

Variable/Statistic	M2	BFM2	HBFM2	HBFIRAM2
Constant	-.0311** (-3.27)	-.0474** (-5.11)	-.0454** (-4.79)	-.0445** (-4.68)
TIME	-.0001* (-2.01)	-.00005 (-1.91)	-.00006* (-2.22)	-.00006* (-2.31)
$\log(M2_{t-1})-\log(GDPAV_{t-1})$	-.0845** (-3.55)	-.1176** (-5.48)	-.1150** (-5.14)	-.1137** (-5.02)
$Del(\log(EPCEN_t))$	.1871** (2.75)	.2002** (3.01)	.1978** (2.99)	.1962** (2.96)
$Del(\log(EPCEN_{t-1}))$	.0968 (1.39)	.0798 (1.18)	.0846 (1.26)	.0819 (1.21)
$Del(\log(EPCEN_{t-2}))$	.0480 (0.78)	.0990 (1.67)	.0869 (1.47)	.0857 (1.45)
$Log(OC_{t-1})$	-.0039** (-3.55)	-.0060** (-5.26)	-.0056** (-4.97)	-.0055** (-4.87)
$Del(\log(OC_t))$	-.0074** (-4.42)	-.0067** (-4.63)	-.0067** (-4.55)	-.0067** (-4.51)
$Del(\log(M2_{t-1}))$	.6681** (9.31)	.6210** (9.43)	.6307** (9.42)	.6363** (9.47)
DCON	-.0123** (-3.18)	-.0110** (-2.91)	-.0112** (-2.99)	-.0113** (-3.00)
DMMDA	.0006 (0.27)	.0054* (2.39)	.0045* (2.03)	.0041 (1.83)
DUM83Q1	.0302** (5.97)	.0253** (4.98)	.0264** (5.26)	.0270** (5.38)
DUM83Q2	-.0106 (-1.90)	-.0128* (-2.39)	-.0121* (-2.25)	-.0119* (-2.19)
S.S.E. (Qtly, not a %)	.00246	.00235	.00232	.00232
R^2 (corrected)	.6961	.7091	.7089	.7096
Durbin-H	0.53	0.70	0.70	0.74
Q(24)	24.98	28.84	28.60	27.40
Avg. Error 90:3-92:3:	-1.66	-1.27	-1.44	-1.52
% Missing M2 explained:	------	23%	13%	8%
S.S.E. 1990:3-92:4	.0000325	.0000279	.0000309	.0000317
Share of M2's S.S.E.	------	14% lower	5% lower	2% lower

(t statistics in parentheses, average errors are annualized growth rates.)

Table 2: Modified FRB Growth Rate Model Results (Sample 1964:1-1992:4)

Variable/Statistic	M2	BFM2	HBFM2	HBFIRAM2
Constant	-.0676** (-6.35)	-.0701** (-7.20)	-.0724** (-7.28)	-.0732** (-7.32)
TIME	-.00006 (-1.89)	.00003 (0.91)	.000005 (0.14)	-.000006 (-0.20)
$\log(M2_{t-1})-\log(GDPAV_{t-1})$	-.1693** (-6.51)	-.1682** (-7.49)	-.1761** (-7.54)	-.1788** (-7.57)
$Del(\log(EPCEN_t))$	.2176** (3.51)	.2362** (3.83)	.2389** (3.95)	.2376** (3.94)
$Del(\log(EPCEN_{t-1}))$	.1665** (2.65)	.1383* (2.20)	.1523* (2.47)	.1515** (2.46)
$Del(\log(EPCEN_{t-2}))$	.0789 (1.42)	.1148* (2.10)	.1084* (2.02)	.1078* (2.02)
$Log(OC_{t-1})$	-.0086** (-6.40)	-.0091** (-7.16)	-.0093** (-7.30)	-.0093** (-7.35)
$Del(\log(OC_t))$	-.0083** (-5.30)	-.0073** (-5.14)	-.0072** (-5.21)	-.0073** (-5.23)
$Del(\log(M2_{t-1}))$	.5370** (7.76)	.5108** (7.90)	.5004** (7.64)	.5031** (7.70)
DCON	-.0113** (-3.26)	-.0111** (-3.20)	-.0111** (-3.26)	-.0110** (-3.26)
DMMDA	.0015 (0.76)	.0059** (2.87)	.0054** (2.66)	.0049* (2.48)
DUM83Q1	.0282** (6.21)	.0239** (5.14)	.0247** (5.47)	.0252** (5.61)
DUM83Q2	-.0052 (-1.02)	-.0096 (-1.92)	-.0080 (-1.63)	-.0075 (-1.52)
$Del(RTCDEPO)_t$	-.00038** (-4.38)	-.00024** (-2.88)	-.00028** (-3.42)	-.00030** (-3.66)
$SAVBOND_t$	-.0227** (-4.66)	-.0169** (-3.76)	-.0194** (-4.34)	-.0201** (-4.51)
$Log(YM_{t-1})$	-.0008 (-0.44)	-.0065** (-2.63)	-.0055* (-2.37)	-.0050* (-2.21)
$Del(\log(YM_t))$	-.0012 (-0.30)	-.0084 (-1.93)	-.0072 (-1.71)	-.0067 (-1.62)
S.S.E. (Qtly)	.00186	.00187	.00178	.00177

Table 2 (continued)

R^2 (corrected)	.7611	.7592	.7669	.7705
Durbin-H	0.59	0.46	0.44	0.45
Q(24)	22.78	25.70	25.70	24.62
Avg. Error 90:3-92:4:	-0.19	-0.12	-0.12	-0.15
S.S.E. (Qtly. rate) (1990:Q3-1992:Q4)	.00019667	.00014355	.00015847	.00015919
Share of M2's S.S.E. (1990:Q3-1992:Q4) (comparable models)	-------	27% lower	19% lower	19% lower

(t statistics are in parentheses. S.S.E. data are not annualized and are not scaled as growth rates, whereas the average errors over 90:3-92:4 are annualized growth rates.)

Table 3: Variable Definitions For Money Regressions

EPCEN = Personal consumption expenditures, used as a short-run proxy for permanent income to control for short-run transactions' effects.

REPCEN = Real personal consumption expenditures, used as a short-run proxy for permanent income to control for short-run transactions' effects.

GDPAV = $(GDP_t + GDP_{t-1})/2$, measure of permanent income used as a long-run proxy for transactions in "nominal" money specifications.

RCAV = $(REPCEN_t + REPCEN_{t-1})/2$, measure of permanent income used as a long-run proxy for transactions in the "real" money specifications.

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, and 0 otherwise.

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.

RTCDEPO = quarterly avg. volume of cumulated deposits at resolved thrifts.

RRTC = RTCDEPO divided by the implicit consumption deflator.

SAVBOND = 6-month floor rate yield on savings bonds minus 6-month Treasury bill rate when >0, 0 otherwise.

YM = spread between the constant maturity yield on the 10-year U.S. Treasury security and the average yield on a money aggregate.

* -- denotes significant at the 95% confidence level.

** -- denotes significant at the 99% confidence level.

Del -- denotes first difference operator.

Note: The following convergence restriction was imposed in all runs:

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

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 that is imposed in the long-run by the term $[\log(M2_{t-1})-\log(XGNPAV)_{t-1}]$. The relative performance of the models is 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 4

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	26.7	176.8	3.7	5.6
1992:Q1	8.3	185.1	6.5	20.3
1992:Q2	20.5	205.6	6.7	8.0
1992:Q3	2.1	207.7	.8	1.0
1992:Q4	0.3	208.0	.1	0.2

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 5: Model Stability Results

Changes in Selected Coefficients Over Different Sample Periods

Aggregate	FRB Model		Modified FRB Model	
M2	64:1-89:4	64:1-92:4	64:1-89:4	64:1-92:4
EC	-.193	-.085	-.194	-.169
L-run OC elas.	-.054	-.047	-.054	-.051
L-run YM elas.	-----	-----	+.001	-.005
BFM2				
EC	-.161	-.118	-.178	-.168
L-run OC elas.	-.064	-.051	-.057	-.054
L-run YM elas.	-----	-----	-.033	-.039
HBFM2				
EC	-.175	-.115	-.189	-.176
L-Run OC elas.	-.061	-.049	-.056	-.053
L-Run YM elas.	-----	-----	-.026	-.031
HBFIRAM2				
EC	-.180	-.114	-.193	-.178
L-Run OC elas.	-.060	-.048	-.055	-.052
L-Run YM elas.	-----	-----	-.023	-.030

Chow Tests

	FRB Model		Modified FRB Model	
Quarter	M2	HBFIRAM2	M2	HBFM2IRA
1989:Q1	3.34**	2.76**	1.03	0.81
1989:Q2	3.46**	2.99**	1.03	0.87
1989:Q3	3.64**	2.86**	1.12	0.94
1989:Q4	3.97**	3.13**	1.10	0.87
1990:Q1	4.30**	3.43**	1.18	0.94
1990:Q2	4.41**	3.75**	1.30	1.04
1990:Q3	4.74**	4.17**	1.37	1.12
1990:Q4	4.48**	4.21**	1.46	1.15
1991:Q1	5.02**	4.84**	1.68	1.33
1991:Q2	5.79**	5.68**	1.97	1.57
1991:Q3	4.95**	5.40**	1.74	1.45
1991:Q4	5.01**	6.05**	1.96	1.75
1992:Q1	5.47**	6.35**	2.64	2.35
1992:Q2	2.85	3.68*	3.20*	2.90
1992:Q3	0.77	2.49	0.23	0.01

Table 6: Real Growth Rate Model Results (Sample 1964:1-1992:4)

Variable/Statistic	RM2	RHBFIRAM2	RM2	RHBFIRAM2
Constant	.0088 (1.96)	.0119** (2.90)	.0151** (3.51)	.0166** (4.31)
TIME	-.00009 (-1.89)	-.00013** (-3.03)	-.00015** (-3.18)	-.00012** (-2.93)
$\log(RM2_{t-1})-\log(RCAV_{t-1})$	-.0706* (-2.57)	-.1210** (-4.25)	-.1660** (-5.27)	-.2056** (-6.73)
$Del(\log(REPCEN_t))$	.3228** (3.81)	.3185** (3.85)	.3209** (4.12)	.3322** (4.47)
$Del(\log(REPCEN_{t-1}))$	.0949 (1.06)	.0603 (0.69)	.1510 (1.83)	.1339 (1.69)
$Del(\log(REPCEN_{t-2}))$	.0037 (0.04)	.0486 (0.65)	.0427 (0.60)	.0773 (1.15)
$Log(OC_{t-1})$	-.0027* (-2.26)	-.0044** (-3.61)	-.0068** (-4.73)	-.0084** (-6.02)
$Del(\log(OC_t))$	-.0080** (-3.87)	-.0068** (-3.65)	-.0079** (-3.99)	-.0068** (-3.87)
$Del(\log(RM2_{t-1}))$	.5786** (6.79)	.5727** (7.25)	.4854** (5.98)	.4565** (6.11)
DCON	-.0083 (-1.77)	-.0074 (-1.62)	-.0087* (-2.03)	-.0085* (-2.05)
DMMDA	-.0007 (-0.29)	.0032 (1.23)	-.0001 (-0.03)	.0042 (1.78)
DUM83Q1	.0335** (5.40)	.0295** (4.73)	.0305** (5.34)	.0261** (4.65)
DUM83Q2	-.0125 (-1.82)	-.0148* (-2.21)	-.0096 (-1.52)	-.0121* (-2.01)
$Del(RRTC)_t$			-.00052** (-3.71)	-.00048** (-3.74)
$SAVBOND_t$			-.0252** (-4.15)	-.0242** (-4.35)
$Log(YM_{t-1})$			.0003 (0.11)	-.0047 (-1.67)
$Del(\log(YM_t))$			-.0054 (-1.11)	-.0110* (-2.16)
S.S.E. (Qtly)	.00370	.00356	.00293	.00271

Table 6 (continued)

R^2 (corrected)	.6564	.6850	.7167	.7503
Durbin-H	-0.68	-0.35	-0.64	-0.56
Q(24)	17.44	19.71	14.49	16.36
Avg. Error 90:3-92:4:	-1.81	-1.92	-0.30	-0.28
S.S.E. (Qtly. rate) (1990:Q3-1992:Q4)	.0004127	.0004725	.0002671	.0002469
Share of RM2's S.S.E. (1990:Q3-1992:Q4) (comparable models)	-------	14% higher	------	8% lower

(t statistics are in parentheses. S.S.E. data are not annualized and are not scaled as growth rates, whereas the average errors over 90:3-92:4 are annualized growth rates.)

Chow Tests of Real Models

	FRB Model		Modified FRB Model	
Quarter	RM2	RHBFIRAM2	RM2	RHBFIRAM2
1989:Q1	2.94**	2.94**	1.11	1.03
1989:Q2	2.90**	3.12**	1.00	0.99
1989:Q3	2.98**	2.99**	1.09	1.08
1989:Q4	3.21**	3.27**	0.99	1.01
1990:Q1	3.26**	3.39**	1.03	1.02
1990:Q2	3.44**	3.73**	1.14	1.09
1990:Q3	3.46**	3.93**	1.28	1.20
1990:Q4	3.20**	3.80**	1.38	1.28
1991:Q1	3.70**	4.39**	1.55	1.43
1991:Q2	4.15**	5.00**	1.78	1.66
1991:Q3	3.65**	4.77**	1.68	1.68
1991:Q4	3.62**	5.18**	1.85	2.02
1992:Q1	3.84**	5.25**	2.49	2.72
1992:Q2	2.04	3.35*	3.02	3.21*
1992:Q3	2.16	4.49**	0.16	0.63

Appendix A: Measuring Household Bond Mutual Fund Holdings

Measuring Total Bond Funds. A bond fund aggregate was created by summing ICI categories of mutual funds after controlling for several breaks in ICI's classification of mutual funds. In 1975, ICI classified mutual funds into: aggressive growth, growth, growth & income, balance, income, money, and bond funds. In 1976, a new category was begun for municipal bonds when they really first appeared ($1.8 million in April 1976), and in 1977, a category for option/income funds was created. (In January 1979, a separate category for MMMFs specializing in short-term municipal bonds was created (amounting to $31.5 million) which is not relevant for our purposes.) In 1984, ICI internally reclassified 1) "aggressive growth" funds into aggressive growth, precious metals, international, global equity, and global bond; 2) growth & income funds into growth & income, flexible portfolio, and income-equity; 3) "income" funds into government bond, GNMA, and income-mixed, 4) municipal bond into long term municipal bond and long term state municipal bond and 5) "bond" funds into corporate bond, income-bond, and high yield bond.

After 1983, the following categories are classified as bond funds: income bond, government, GNMA, global bond, corporate bond, high yield bond, national long term municipal bond, and state long term municipal bond. Categories mixing equity and bonds were not treated as bond funds because they generally contained more equities than bonds; these included growth & income, flexible portfolio, balanced, and income-mixed. Other categories that are treated as equity funds are: aggressive growth, growth, precious metals, international, global equity, income-equity, and option/income. Since MMMFs are already in M2, they are not in the bond fund grouping created here.

Based on pre-1984 and post-1984 categories, bond funds before 1984 equal the sum of "bond", municipal bond, and 66.2% of "income" funds. The weight on income funds reflects that they included income-mixed funds before 1984; the weight equals one minus the ratio (33.8%) of income-mixed funds in January

1984 to the December 1983 level of "income" funds.[14] (Some assets that were included in income funds prior to 1984 were reclassified into the long-term municipal and state municipal categories). A similar adjustment to aggressive growth funds was not made to reflect that this category included global bond funds before 1984 because global funds were trivial (under 0.1% of all bond, income, and equity funds) in early 1984.

Adjusting Bond Funds for Institutional Holdings. Bond fund assets were adjusted for holdings by institutions (classified by ICI as fiduciary, business, or institutional investors) using yearend data from ICI's annual institutional surveys. From 1985-1992, these data are classified into the same categories as all holdings of mutual fund assets. Over 1986-1992, the yearend institutional shares of each available category were interpolated into monthly institutional share estimates. From 1981-1984, institutional holdings are broken out into: aggressive growth, growth, growth & income, balance, income, bond, municipal bond, and money market funds. Over 1981-1984, the yearend institutional shares of each category were interpolated into monthly institutional share estimates for available categories.

One problem with these data is that the categories of institutional holdings in 1984 were limited to the pre-1983 classification scheme for all assets, whereas more detailed categories on overall holdings were available for that year. To handle this problem for yearend 1984 data, the same institutional ratio for 1) "aggressive growth" funds was applied to aggressive growth, precious metals, international, global equity, and global bond funds; 2) growth & income funds was applied to growth & income and income-equity funds; 3) "income" funds was applied to government bond, GNMA, income-mixed,

[14] Evidence in support of the break adjustment used is as follows. The sum of the pre-1984 categories of income, municipal bond, and bond fund assets equaled 30.1 percent of all bond, income, and equity fund assets in December 1983. Similarly, the sum of the new categories of long-term municipal bond, long-term state municipal bond, income mixed, income-bond, government, GNMA, corporate bond, and high yield bond fund assets amounted to 30.2 percent of all bond, income, and equity fund assets in January 1984.

and flexible portfolio funds; 4) "bond" funds was applied to corporate bond, income-bond, and high yield bond funds; and 5) "municipal" bond was applied to long term municipal bond and long term state municipal bond funds.

Using these corresponding categories, the yearend institutional ratios for 1984 were matched to yearend institutional ratios for the different categories available in 1985 before monthly institutional shares were interpolated. The complete set of institutional ratios was then used to calculate the household holdings in each fund category. [Revised data were used whenever available (through 1991).] Then, household holdings of bond funds were calculated by summing up estimated household assets in each fund category based on the break-adjusted definition of total bond funds from the first section of this appendix. Finally, the resulting end-of-month data (the original bond and income fund data are end-of-month) for each pair of months t and t+1 were averaged to create month average data for each month t. This was done to make the bond fund aggregate comparable to M2 data which are quarterly averages of month-average data.

Adjusting Bond Funds for IRAs and Keoghs. Internal ICI data on IRA and Keogh assets were used to adjust household bond fund assets. Unlike total bond and equity fund data, only yearend IRA/Keogh data are available through 1981 and the categories into which IRA/Keogh balances were classified are not as detailed as those for net assets. For these reasons, there are more break adjustments and interpolation of yearend data. However, these adjustments are not likely to result in substantial measurement error as most of them are early in the sample before IRA/Keogh assets became substantial.

From yearend 1987 to the present, IRA/Keogh assets were classified into the same categories as for overall assets. For this reason, total IRA/Keogh assets held in bond funds over this period were defined to equal the sum of IRA/Keogh balances in the following ICI categories: income bond, government, GNMA, global bond, corporate bond, high yield bond, national long term municipal bond, and state long term municipal bond.

A sample break occurs at the end of 1987 owing to several changes in the classification scheme that was in effect since June 1985. First, before December 1987, the old definition of corporate bond funds included the post-November 1987 categories of corporate bond, income bond, and high yield bond. Second, prior to December 1987, IRA/Keogh assets in global bond funds were classified under aggressive growth funds. However, this latter difference is of little consequence as IRA/Keogh balances in global bond funds were trivial at the time of the break. Third, the category for IRA and Keogh assets in income funds was broken out into income-mixed and partly into income bond funds. Because income-mixed funds are not treated as bond funds, break ratios for calculating bond fund IRA and Keogh assets are applied to IRA and Keogh assets in income funds for the period prior to yearend 1987. For IRAs, the break ratio used is 47.3%, which equals one minus the ratio of income- mixed IRA assets in December 1987 to IRA assets in income funds in November 1987. For Keoghs, the break ratio used is 43.7%, which equals one minus the ratio of Keogh assets in income-mixed funds in December 1987 to Keogh assets in income funds in November 1987. For these reasons, IRA/Keogh balances in bond funds from June 1985 to November 1987 were defined to equal the sum of IRA/Keogh assets in government, GNMA, corporate bond, national long term municipal bond, and state long term municipal bond funds plus 47.3% of IRA assets in income funds plus 42.7% of Keogh assets in income funds.

A sample break also occurs in June 1985 when two changes were made to the classification scheme in effect since December 1982. First, the long-term municipal bond category was broken out into national long term municipal bonds and state long term municipal bonds. Second, the May 1985 definition of "income" funds was broken out into government, GNMA, and a narrower definition of income funds. In June 1985, 85.3% of IRA and 43.7% of Keogh assets in the respective sums of IRA and Keogh assets in income, government, and GNMA funds were in government and GNMA funds. Bond fund break ratios for IRA and Keogh assets in income funds were revised based on these factors and the break ratios used from June 1985 to November 1987. For IRAs, the break ratio was 92.3%, which equaled 85.3% plus the product of (1-85.3%) and (47.3%). For Keoghs, the break ratio was 67.7%, which equaled 43.7% plus the product of (1-43.7%) and (42.7%). IRA/Keogh assets in bond funds from December 1982 to June 1985 equal the sum of all IRA/Keogh assets in the I.C.I. categories of corporate bond and municipal long term bond plus 92.3% of IRA assets in income funds and 67.7% of Keogh assets in income funds.

Sample breaks occur in December 1982 before which ICI collected only yearend data and in December 1981 before which ICI did not disaggregate IRA and Keogh assets into fund categories. The first break was handled by interpolating December 1982 and December 1981 assets in corporate, municipal, "growth and income", and income funds into monthly data. Then, IRA/Keogh assets in bond funds over December 1981 to December 1982 were defined to equal the sum of IRA/Keogh assets in corporate bond and municipal long term bond funds plus 92.3% and 67.7% of IRA and Keogh assets in income funds, respectively. Using these formulae, 13.8% of Keogh and 14.5% of IRA assets in bond, equity, and money market mutual funds in December 1981 were in bond funds.

These ratios were applied to the yearend IRA and Keogh assets over 1975-1980 to estimate yearend IRA/Keogh bond fund assets. These yearend data were interpolated into monthly estimates. After splicing the break-adjusted data, the end-of-month IRA/Keogh bond fund totals were month averaged and then subtracted from the month average, NSA total household bond fund series. This series was then seasonally adjusted to form "BFIRA."

Appendix B: Measuring RTC Effects on M2

RTC terms were constructed to be comparable to the way M2 growth rates are typically calculated. Two factors were taken into account. First, because the growth rate of M2 usually is measured based on quarterly averages of month average balances, 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 in quarter t-1 may have a greater impact on the quarterly M2 growth rate in the following quarter (t). Thus, deposit resolutions in one quarter can affect the growth rate of M2 in the following quarter. For this reason, the RTC variables are based on 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, the cumulated volume of RTC resolutions was constructed in several steps using monthly RTC data.[15] 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 monthly data were converted into quarterly average flows (QRTC). This was done by weighting each contemporaneous month average flow by one-third, and then adding these to two-thirds of RTC from the first month and one-third of RTC from the second month of quarter. This procedure recognizes that resolutions in each month have contemporaneous effects, but that resolutions in month 1 have a full quarterly effect in months 2 and 3, while resolutions in month 2 have a full effect in month 3. Next, a quarterly average 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).

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[15] The author owes a special debt to Richard Anderson of the Federal Reserve Bank of St. Louis staff who compiled these monthly data.

Since 1989:Q3, the first difference of RTCDEPO has generally been larger than the estimated quarterly shortfall in M2 growth from the FRB model. This suggests that at least some of the resolved deposits were kept within M2, while some of the deposits were likely shifted to nonM2 assets such as bond mutual funds.

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.

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

$$MRTC_m \equiv RTC_m/2$$

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

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

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

$$RTCDEPO_q \equiv CUMRTC_q + QRTC_q$$

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