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The Effect of Mortgage Refinancing on Money Demand and the Monetary Aggregates

MONEY SERVES AS A medium of exchange for transactions involving financial instruments as well as real goods and services. Unfortunately, the total volume of transactions in the economy is not observable. As a result, economic analyses of money demand typically focus on the relationship between the quantity of money demanded and the production of new goods and services, measured by either gross domestic product or personal consumption expenditures. Because aggregate volumes of financial and nonfinancial transactions likely move in parallel with the output of new goods and services, the use of output rather than the volume of transactions may cost little in terms of understanding movements in the monetary aggregates. In some periods, however, events occur which remind us that this is not always the case. This article examines the effect of one such ongoing recent event—the refinancing of residential mortgages—on money demand.¹

Simple models of the demand for money as a medium of exchange often implicitly assume that the purchase or sale of a good or service is completed within a relatively brief period. Unlike the transactions in these models, the refinancing of a residential mortgage that has been securitized in the secondary market initiates a sequence of transactions that may continue for four to six weeks, or more. During this time, the quantity of liquid deposits demanded increases. When the last transaction in the sequence is concluded, the quantity of deposits demanded falls back *ceteris paribus* to its earlier level.

Mortgage refinancing is an important phenomenon in the United States because most homes are financed with long-term, fixed-rate amortized mortgages that contain a “put” option, allowing the borrower to repay the outstanding principal amount of the loan at any time without penalty. Homeowners typically exercise that option when mortgage rates fall significantly (1-2 percentage

¹Other recent examples include the Tax Reform Act of 1986, which boosted household liquid deposits in late 1986 and early 1987, and the closure of large numbers of thrifts by the Resolution Trust Corporation. Recognizing that special factors can significantly distort growth of the monetary aggregates, the Bach commission recommended that the Federal Reserve regularly undertake and publish studies of the effects of special factors; see Report of the Advisory

Committee on Monetary Statistics (1976). The Bank of England regularly publishes such analyses; see Pepper (1992, 1993) and Topping and Bishop (1989).

points) below recent previous levels by taking out a new mortgage loan to repay the old. As shown in figure 1,² extensive mortgage refinancing has occurred during two periods in the last decade, 1986–87 and 1991–93. In the former, an initial surge in refinancing during 1986 was interrupted by a pause, before fears of rising market rates launched a second round in 1987. In the latter, three waves of refinancing—of increasing magnitude—mirrored the halting fall in long-term market interest rates. During 1992, for example, nearly one-fifth of all homeowners refinanced their mortgages.³ In 1993, the volume of refinancing activity will surpass 1992's record pace.

The next section of this article describes the changes in the growth and volatility of liquid deposits and M1 that have occurred during periods of extensive mortgage refinancing. The article then examines the extent to which these changes may be related to increases in mortgage securitization. Finally, it explores whether recent fluctuations in the growth of other checkable deposits (OCDs) since 1991 also may be related to mortgage refinancing.

MORTGAGE REFINANCING AND MONEY DEMAND

The increases in liquid deposits that have accompanied accelerations in mortgage refinancing since mid-1990 are shown in figure 2. The link between mortgage refinancing and liquid deposit growth is a stock adjustment process wherein the stock of liquid deposits responds to changes in the flow of refinancings. When the pace of mortgage refinancing increases, as it did

during late 1991, the third quarter of 1992 and the second quarter of 1993, liquid deposit growth accelerates. As refinancings continue at the higher rate, deposit levels converge to the new desired level and deposit growth slows. When refinancing activity subsides—as in mid-1992 and early 1993—liquid deposit growth slows further and deposits may run off.

Through its effect on liquid deposits, mortgage refinancing sharply increased the volatility of M1 during both 1986–87 and 1991–93, as shown in figure 3.⁴ At the same time, the volatility of the broader aggregate M2, shown in figure 4, apparently was only slightly affected. In large part, the lower sensitivity of M2 to mortgage refinancing reflects the much smaller share of transaction deposits in M2 (about 20 percent) than in M1 (about 70 percent). The small changes that do appear in the volatility of M2 closely resemble changes in its non-M1 component.⁵

The ability of increases in mortgage refinancing to affect the level and volatility of liquid deposits and M1 is in part due to the borrowed reserves operating procedure used by the Federal Reserve to control the growth of M2. During the last decade, this operating procedure has largely evolved into one that closely stabilizes the federal funds rate about a level thought to be consistent with the desired amount of discount window borrowing and the growth of M2. To maintain the desired levels of the federal funds rate and discount window borrowing, transitory increases in the demand for reserves are automatically accommodated with increases in the supply of nonborrowed reserves.⁶

²In the figure, the volume of refinancing activity is proxied by liquidations of mortgage-backed securities. This concept is explored further in this article.

³Nineteen percent of the homeowners interviewed in Fannie Mae's 1993 national housing survey had last refinanced their mortgage between January 1992 and March 1993. An additional 3 percent had refinanced during 1991 and 1990.

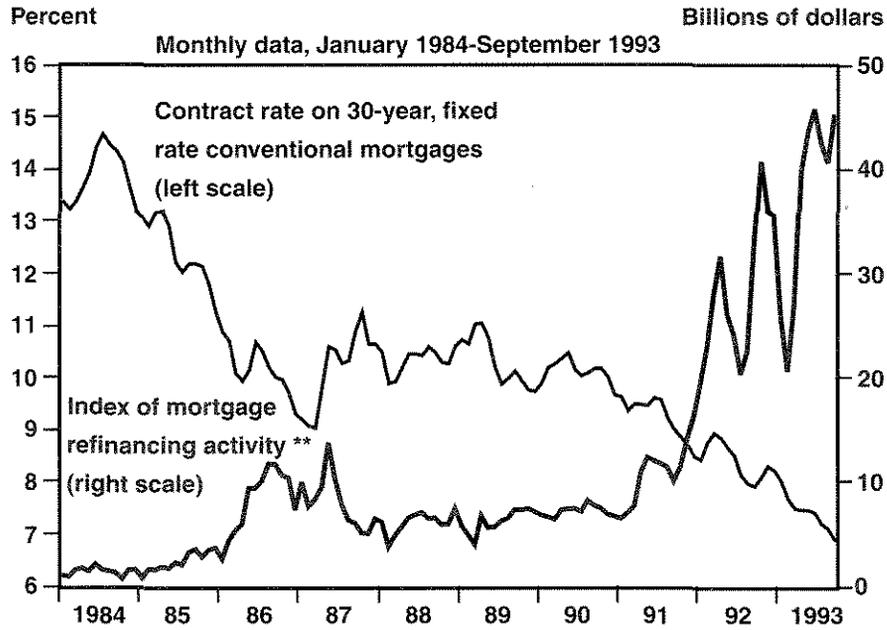
⁴The coefficient of variation shown in the figure equals the ratio of the standard deviation to the mean of the series, each calculated from the most recent 12 months of data. The coefficient of variation indicates whether the variability of the data has increased or decreased over time relative to its average level.

⁵The volatility of M2 differs little from that of its non-M1 component. It is feasible that banks' cash management practices might account for the insensitivity of M2 volatility. Increases in liquid deposits provide additional funds to banks. If bank cash managers respond by reducing their issuance of overnight repurchases (RPs), the change in the volatility of M2 might be considerably less than that of M1.

No such correlations between refinancing-related deposit inflows and nontransaction funding sources are apparent in the data, however.

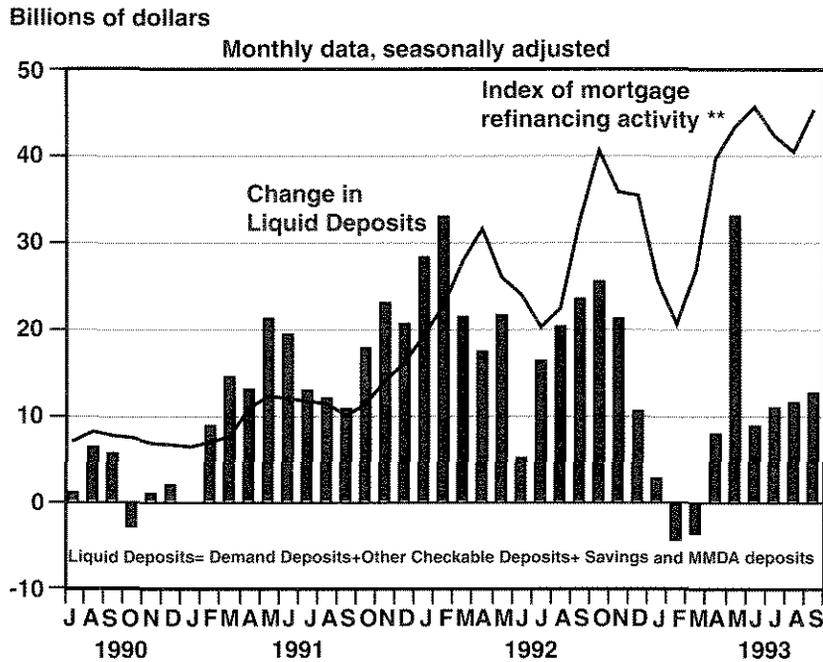
⁶For an analysis of the borrowed reserves procedure and its relationship to federal funds rate targeting, see Thornton (1988). For a careful discussion of why and how reserves-based targeting procedures evolve into federal funds rate targets, see Meulendyke (1990).

Figure 1
Mortgage Interest Rate and Refinancing Activity



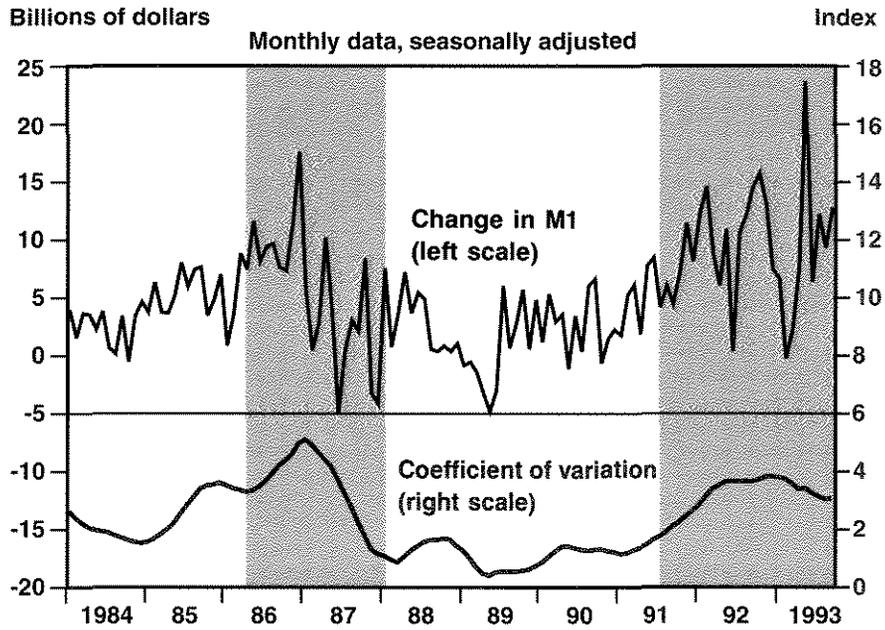
** Liquidations of federal-agency-guaranteed mortgage-backed securities.

Figure 2
Refinancing Activity and Liquid Deposits



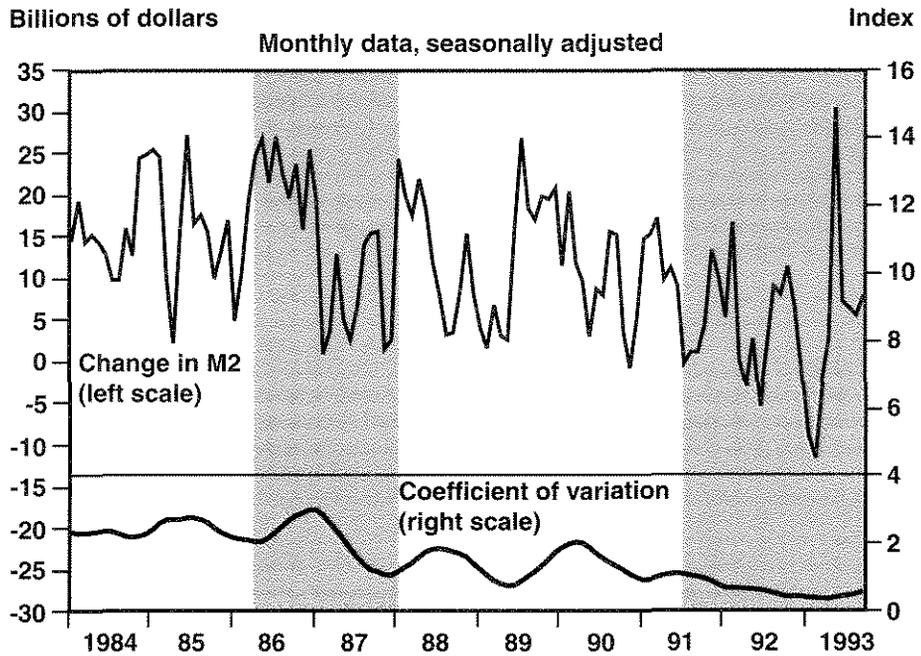
** Liquidations of federal-agency-guaranteed mortgage-backed securities.

Figure 3
Refinancing and the Volatility of M1



Shaded areas are periods of heavy refinancing activity.

Figure 4
Refinancing and the Volatility of M2



Shaded areas are periods of heavy refinancing activity.

THE ROLE OF MORTGAGE SECURITIZATION

The increase in mortgage securitization during the last decade has increased the potential for mortgage refinancing to affect the growth of the monetary aggregates.⁷ The sale of mortgages in the secondary market creates an additional financial instrument—the mortgage-backed security, or MBS—and involves a number of additional firms in the mortgage process, including the originators of the mortgages, the assembler of the mortgage pool (who also issues the MBSs), the servicer of the mortgage pool (who collects monthly payments and disburses funds to investors) and, typically, at least one government agency. The refinancing of securitized mortgages thus becomes a circuitous calling and refunding of relatively large amounts of long-term, publicly held debt. Elevated levels of liquid deposits may persist for four to six weeks or more, until all related transactions are settled.

Legally, mortgage securitization entails combining a fixed pool of mortgages into a trust. The mortgages serve as collateral for MBSs sold against the trust. The servicer of the MBSs, as a trustee, collects payments from homeowners and passes them through without taxation to the holders of the MBSs. Liquidity of the MBSs is enhanced by obtaining a third-party guarantee covering the payments that will be due to investors if homeowners pay at the scheduled, minimum contract rate. Three federal-government-sponsored enterprises, known as “agencies,” dominate that business.⁸ For a fee, these agencies guarantee the payment of principal and interest on securities backed by pools of specified mortgages. The Government National Mortgage Association (Ginnie Mae, or GNMA),

a part of the Department of Housing and Urban Development, guarantees payments on MBSs backed by pools of Federal Housing Administration (FHA) and Veterans Administration (VA) mortgages. The Federal National Mortgage Association (Fannie Mae, or FNMA), a federally chartered, privately owned stock corporation, and the Federal Home Loan Mortgage Corporation (Freddie Mac, or FHLMC), a wholly owned subsidiary of the federally chartered Federal Home Loan Bank System, guarantee payments on MBSs backed by pools of conventional mortgages.⁹

Absent refinancings or home sales, MBS investors receive a monthly payment that includes the scheduled amortization of the pool's mortgage principal plus the accumulated interest. Refinancings, home sales and an occasional extra payment by a homeowner return additional (or unscheduled) principal pro rata to the holders of the MBSs backed by that mortgage pool. The monthly liquidation for a mortgage pool is the sum of the scheduled and unscheduled principal payments returned to investors. Note that MBSs aren't “called” in the traditional sense associated with corporate bonds, but rather are only proportionately liquidated or repaid.

As shown in the upper panel of figure 5, the outstanding stock of MBSs increased about six fold during the last decade, much more rapidly than M1 or M2. With few changes in mortgage servicing rules and practices during the last decade, the rapid growth of securitization suggests that the transactions incurred in refinancing securitized mortgages will have larger effects on the monetary aggregates in the 1990s than they did in the mid-1980s. Annual liquidations of MBSs, shown in the lower panel of the figure,

⁷See Duca (1990) for an analysis of the interactions between demand deposits and mortgage refinancing during 1986–87.

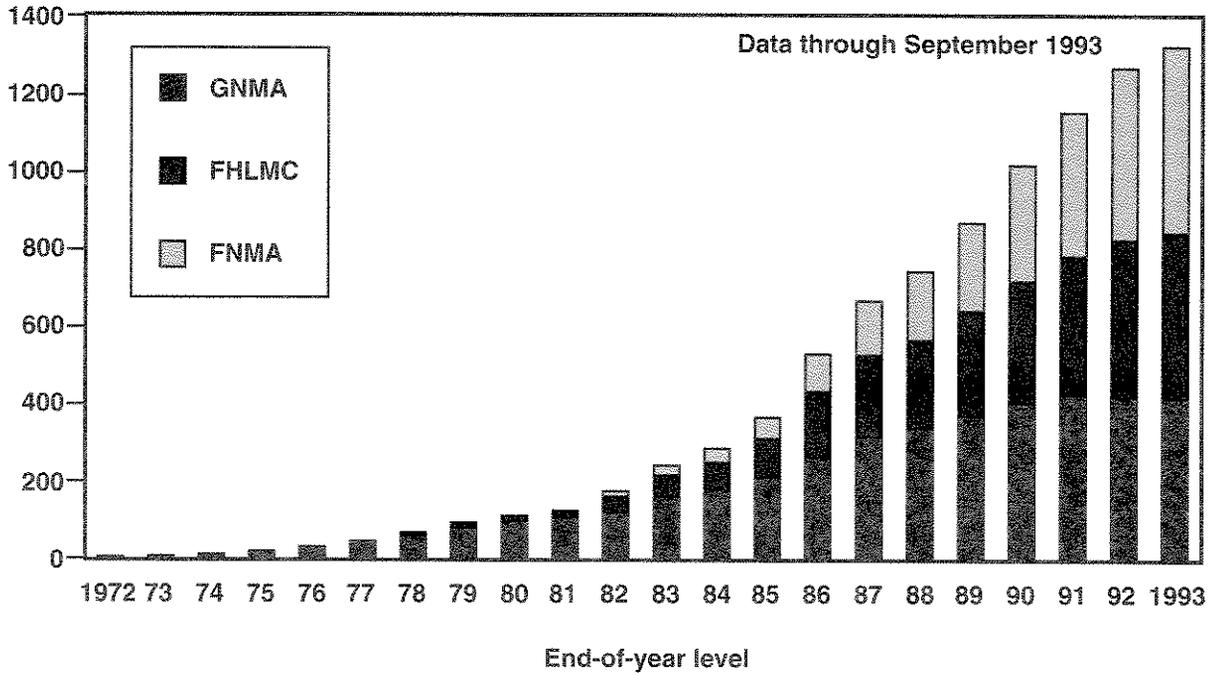
⁸A small amount of MBSs is issued without agency guarantees. Bank of America issued the first such private mortgage pool in 1977. In 1992, private mortgage pools represented only 8 percent of all outstanding pools. For background, see Downs (1985) and Pavel (1986).

⁹The precise nature of the guarantee varies somewhat by agency. GNMA and FNMA guarantee timely (within the month) payment of principal and interest, regardless of payments by the borrower. FHLMC guarantees timely payment of interest and eventual (within the year) payment of principal. In addition to issuing guarantees on MBSs backed by privately assembled mortgage pools, FNMA and FHLMC may purchase mortgages outright and market MBSs backed by pools of those mortgages. In 1992, for example, FNMA “issued” (guaranteed) \$194 billion in MBSs. Of that amount, about \$13 billion were originated by FNMA itself;

the balance was originated by private lenders under a FNMA guarantee plan. FNMA's 1992 *Annual Report* emphasizes the off-balance-sheet contingent risk nature of these securities: “MBS are not assets of the corporation [FNMA], except when acquired for investment purposes, nor are the related outstanding securities recorded as liabilities. However, the corporation is liable under its guarantee to make timely payment of principal and interest to investors. The issuance of MBSs creates guaranty fee income with Fannie Mae assuming credit risk, but without assuming any debt refinancing risk on the underlying pooled mortgages.” In 1992, FNMA recorded \$834 million in guaranty fees.

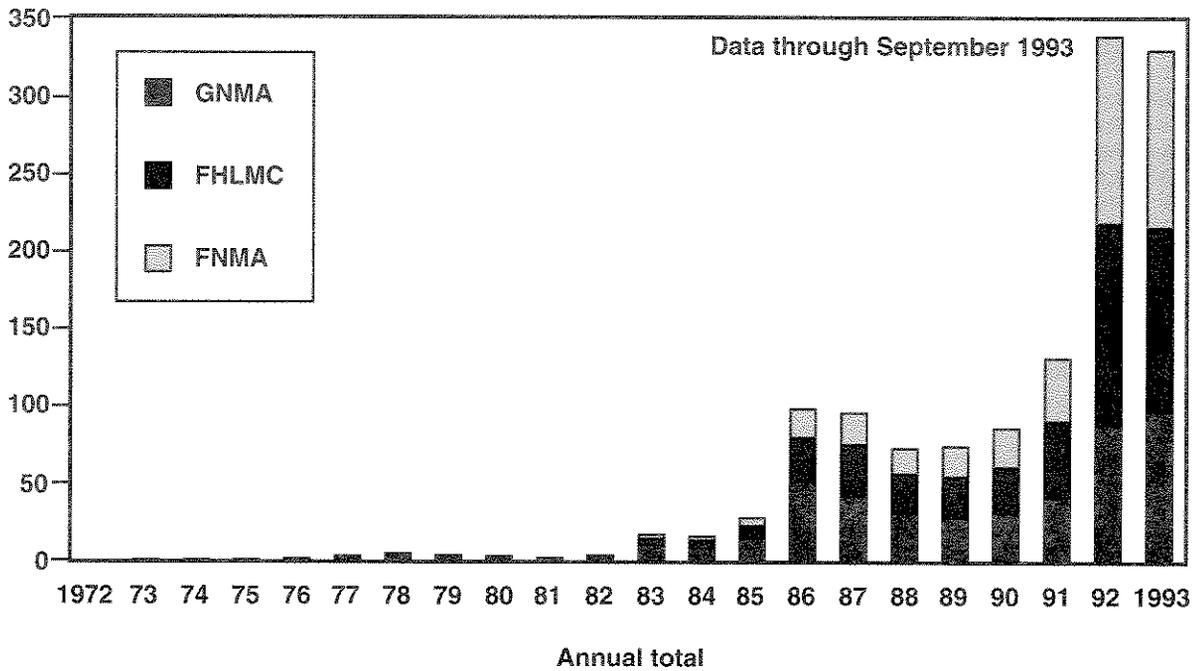
Figure 5
Mortgage-Backed Securities Outstanding at Year-End

Billions of dollars



Annual Liquidations of Mortgage-Backed Securities

Billions of dollars



have on balance increased in proportion to the outstanding stock except for significant surges during periods of refinancing. Annual liquidations jumped to about 17 percent of the outstanding stock of MBSs during 1986–87 and 19 percent during 1991–92. More recently, liquidations during June through September 1993 averaged nearly \$44 billion a month, almost a 40 percent annual rate. Recent further decreases in mortgage rates portend continuing high liquidation rates during late 1993 and early 1994.¹⁰

The increase in deposits that follows an increase in mortgage refinancing activity may in part be traced to the mechanics of mortgage securitization and servicing. Mortgage servicers' handling of the unscheduled principal payments associated with refinancings is governed by the rules of the federal agency that guarantees the MBSs issued against the mortgage pool. In general, these rules require that mortgage servicers hold unscheduled principal payments in special custodial accounts during the interval between receipt from homeowners and disbursement to MBS investors. GNMA requires that these custodial accounts be non-interest-bearing demand deposits. FNMA allows funds to be held in interest-bearing accounts as long as they are immediately available without prior notice of withdrawal. FHLMC's rules are similar to FNMA's.

A surge in refinancing greatly increases the monthly average amount of funds held in liquid deposits by a mortgage servicer. In a typical month without refinancing, a servicer holds a homeowner's mortgage payment for a relatively brief period of time (up to 15 days) before remittance to investors. Following a mortgage refinancing, however, the servicer will hold the unpaid principal balance of the extinguished mortgage loan—an amount perhaps 10 to 100 (or more) times as large as the homeowner's regular monthly principal payment—in a custodial account for a much longer period, often

two to six weeks (see the shaded insert).¹¹

Estimates of the size of this effect on monthly growth rates of demand deposits, M1 and M2, are shown in figure 6.¹² When MBS liquidations accelerate, the growth rates of demand deposits and M1 after removing the MBS effect are smaller than the published growth rates. Conversely, when MBS liquidations slow, the MBS-adjusted growth rates are larger than the published rates. Overall, the estimated differences in growth rates equal in some months as much as one-half of the change in M1. From December 1991 to March 1992, for example, inflows to mortgage servicers' custodial accounts are estimated to have added between 5 to 10 percentage points to the monthly growth rates of demand deposits. The largest estimated effects were in October 1992 and May 1993, when MBS-related inflows likely accounted for four-fifths and three-fifths, respectively, of demand deposit growth. In both cases, deposit growth slowed sharply in later months when deposit levels had increased enough to support the accelerated pace of mortgage activity. Subsequently, during the first quarter of 1993, runoffs of servicers' custodial balances likely depressed monthly average deposit growth by as much as 10 percentage points.

These patterns show through to M1 (see the center panel of figure 6) but are muted. Currency and OCDs, which comprise two-thirds of M1, are unlikely to be affected by MBS activity.¹³ Nonetheless, the distortions to demand deposits are sufficient that monthly growth rates of M1 since mid-1992 appear to have been distorted by as much as 5 to 7 percentage points. Similar estimates for M2 that include estimated effects on money market demand account (MMDA) balances are shown in the bottom panel of the figure.

Overall, fluctuations in mortgage servicers'

¹⁰While it is always risky to forecast financial market activity, recent decreases in mortgage rates (through October 1993) are likely to trigger substantial further increases in refinancing and MBS activity during late 1993 and early 1994. In addition to older mortgages issued during the 1980s, mortgages that were issued as little as 12 to 18 months ago at 7 to 7-1/2 percent rates now may profitably be refinanced. Rather than the pace of refinancing slowing and related distortions to the monetary aggregates diminishing as the outstanding stock of seasoned MBSs are rolled over, recent rate decreases have placed nearly the entire outstanding stock of MBSs "in the money" for rollover.

¹¹Homeowners typically make monthly mortgage payments between the 1st and 15th of the month, with the servicer remitting these funds to MBS investors on the 15th. Follow-

ing a refinancing, the funds received by the servicer from the homeowner (at any time within the month) are placed in a custodial account. These funds are remitted by the servicer to MBS investors after the middle of the following month. The exact date, however, depends on the contract specifications of the agency guarantee program under which the MBSs backed by the mortgage pool that contained the extinguished mortgage were issued. See, for example, Karcher (1989).

¹²Construction of these estimates is discussed in the appendix.

¹³The next section raises the possibility that OCD balances also might have been affected by refinancing since 1991, albeit not through MBS-related transactions.

Extra Deposits: Where Do They Come From? Where Do They Go?

The impact of surges in refinancing-related transactions on the demand for liquid deposits and the monetary aggregates depends on the monetary control operating procedure being used by the Federal Reserve. The refinancing of securitized mortgages generates temporary increases in the demand for liquid deposits. Since these deposits are subject to non-zero reserve requirement ratios, the Federal Reserve accommodates this demand under its current monetary control procedures by furnishing additional reserves as necessary to maintain the federal funds rate near the level expected to be consistent with desired longer-run growth of M2. When final payments to MBS investors are completed, both the quantity of liquid deposits demanded and banks' required reserves fall. To again maintain the desired level of the federal funds rate, the Federal Reserve withdraws the now-surplus reserves from the market.

Consider, for example, a 10 percent mortgage with an unpaid principal balance of \$100,000. Assume that the homeowner

deposits some funds (a paycheck, for example) into a demand deposit account on the first day of a typical month. On the fifth day of the month, the homeowner mails a check for \$877 to his mortgage servicer. The servicer receives the check on the 10th and places the funds in a demand deposit account. On the 15th, the funds are paid to MBS investors who immediately move the funds out of demand deposits and into new earning assets. The extent to which this transaction affects the average daily levels of demand deposits and M1 depends on what type of asset/deposit was held by the firm prior to paying the employee and on what type of asset/deposit is held by the MBS investor after receipt of the funds. Assuming that the firm held the funds prior to the first of the month in an asset not included in M1, and assuming that investors move funds promptly into assets not included in M1 on the 15th, this single transaction contributes about \$439 to the average monthly level of demand deposits.¹

¹\$877*15/30. The implied intramonthly pattern of fluctuations in transaction deposits and reserves is characteristic of liquid deposits. Aggregate transaction deposits tend to increase sharply at the beginning of each month

and run off during the latter weeks of the month. The implied fluctuations in reserve demand are accommodated by the Federal Reserve, perhaps through an RP by the Open Market Desk.

custodial deposits likely account for about one-half of the recent increase in M1 volatility. It is unlikely that these estimates are too large, since they are based on legal restrictions imposed on mortgage servicers by federal agencies and realistic but conservative assumptions regarding intra-month patterns of mortgage closings and deposit behavior.

The estimates may be biased downward, however, for a number of reasons. The most important perhaps is the omission of any increase in deposits held by issuers of new MBSs. As some issuers draw on bank warehouse credit lines to fund the purchase of mortgages to be assembled into new MBS pools, they may offset part of the bank charges for these lines via earnings credits based on their deposit lev-

els. Also omitted are any increases in liquid deposits that arise because of the significant volume of additional transactions used to purchase and sell large quantities of mortgages and MBS.

HOUSEHOLD DEPOSITS AND REFINANCING

In addition to demand deposits, changes in OCDs since mid-1991 also have reflected the ebbs and flows in the pace of mortgage refinancing (see the upper panel of figure 7). The apparent increase in the correlation of OCDs with demand deposits contrasts with its behavior before 1991 and during 1986-87, the latter shown in the lower panel of figure 7.

To illustrate the magnitude of refinancing-related payments, suppose that the homeowner now refinances the mortgage on the 25th day of the month, with the servicer receiving funds on the 30th and holding them (as a fiduciary) in a demand deposit custodial account until remittance to investors around the middle of the following month. The refinancing, when it closes on the 25th, creates \$100,000 of demand deposits that didn't previously exist, reflecting the new mortgage loan extended to the homeowner. If the transaction is subject to Regulation Z's right-of-rescission provisions, the \$100,000 deposit likely will be held by the settlement agent or new lender for the first three days following the mortgage closing. If the mortgage has been securitized via federal-agency-guaranteed MBSs, the funds subsequently will be remitted to the servicer of the extinguished mortgage. If not, the funds will be paid to the current owner of the original mortgage. Since the outstanding MBSs backed by the old mortgage

have not yet been extinguished, the new mortgage (and new deposits) represent a temporary net increase in the amount of outstanding credit in the economy. Both the new deposit and the MBSs backed by the old mortgage continue to exist until about the middle of the following month.²

The mortgage refinancing of \$100,000 contributes \$16,666 to the average level of demand deposits during the current month and \$50,000 to the average level of the following month, assuming that the servicer remits funds to investors on the 15th and investors immediately transfer the funds from demand deposits.³ When investors do so, the aggregate level of demand deposits drops and the Federal Reserve will drain reserves from the market if necessary to maintain discount window borrowings and the federal funds rate near the desired levels.

²Note that financial market participants (and federal agencies) record an MBS as being liquidated on the last day of the month in which the refinancing occurred, even though investors will not receive the underlying funds until after the middle of the following month.

³What asset might investors buy with the demand deposit? One possibility is new MBSs backed by the new mortgages. What happens to the demand deposits that they use to purchase these new MBSs? They vanish, in textbook multiple-expansion-of-deposits fashion, accompanied by the Fed's withdrawal of reserves.

Should some portion of the OCD fluctuations during 1991-93 be attributed to mortgage refinancing activity? If so, and if the impact of refinancing on OCDs were similar to its effect on demand deposits, then their combined effects could account for as much as three-quarters of M1's growth during a number of months since 1991.

The recent parallel monthly movements in these two types of liquid accounts is compelling but puzzling. Any evidence linking these deposits

to mortgage activity is necessarily less direct and more circumstantial than that for demand deposits. Tracing direct links between household deposits and economic activity is generally not possible, since the Federal Reserve collects deposit data from the issuers of deposits such as banks and thrifts rather than from the owners of deposits, including households and firms.¹⁴

Why might a household increase its OCD balances following a mortgage refinancing? One possibility could be the conversion of home eq-

¹⁴Although the Federal Reserve Board's flow of funds accounts present a fairly complete balance sheet for the household sector, few items are directly observed. Most entries are calculated as residuals, inferred from the double-entry nature of the accounts and from balance sheet data

for firms and government. See *Guide to the Flow of Funds Accounts*, p. 120.

Figure 6
 Published Growth Rates Less Rate Adjusted for MBS Activity

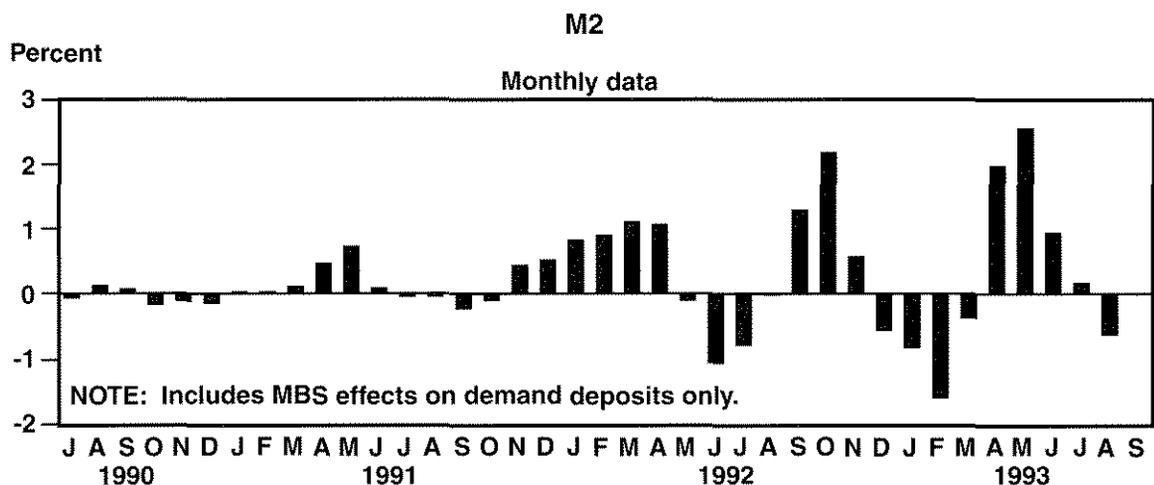
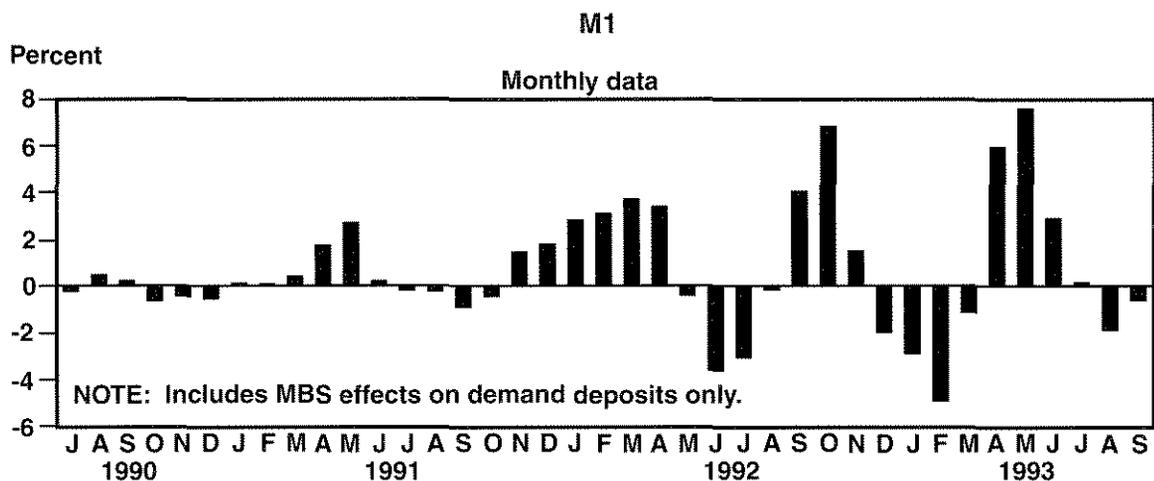
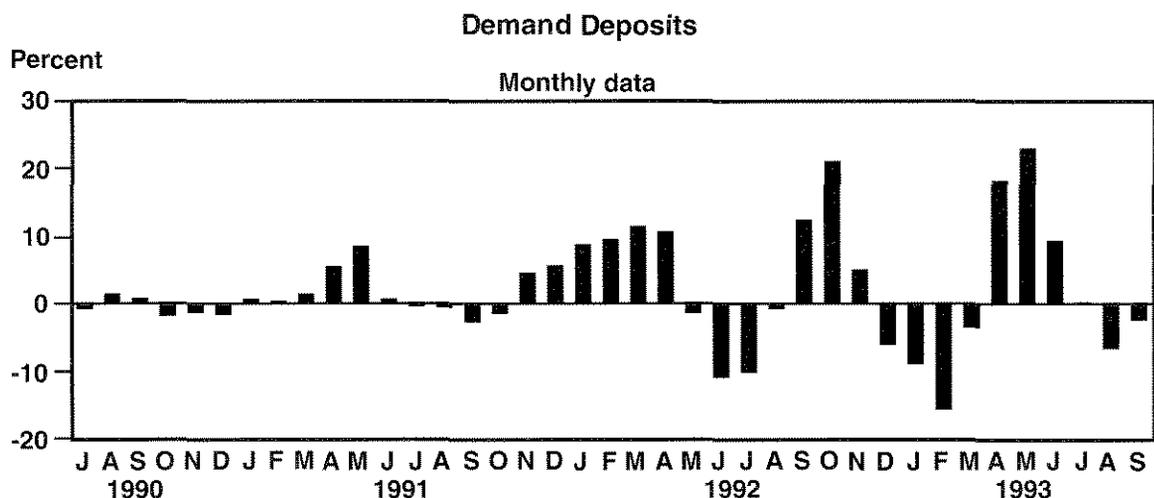
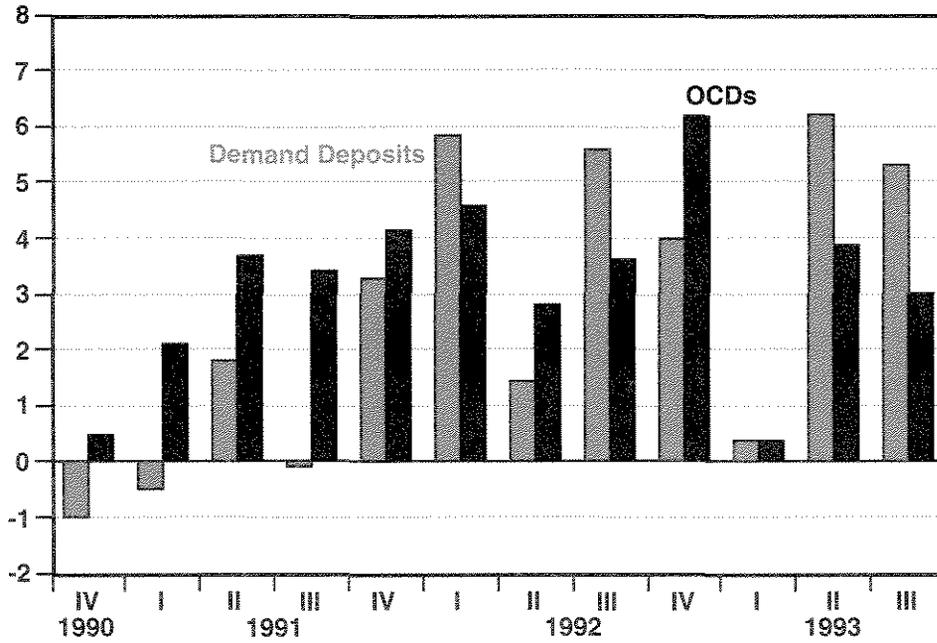


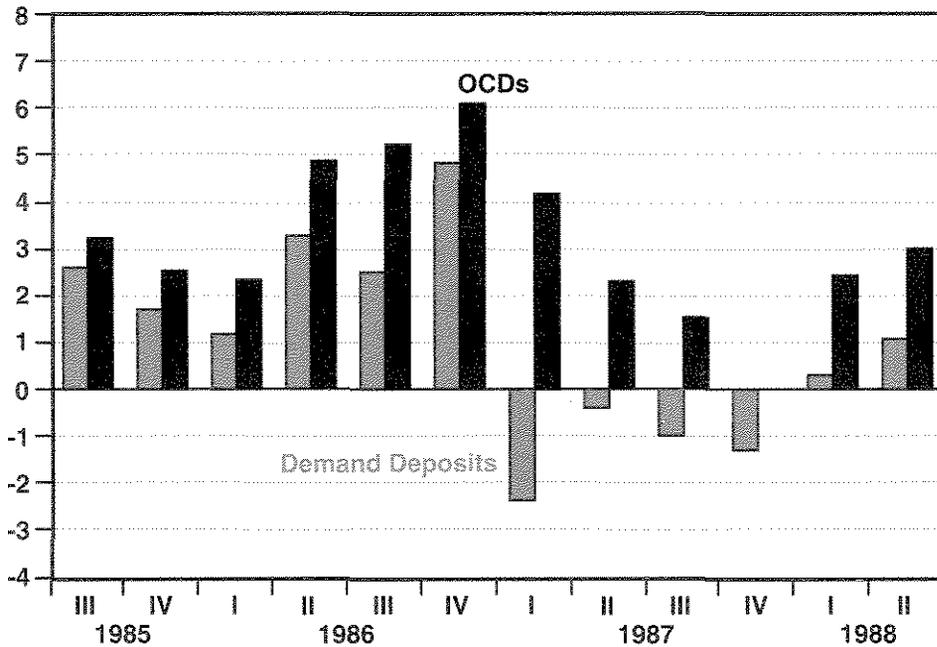
Figure 7
**Average Monthly Change in Demand Deposits and OCDs,
 by Quarter**

Billions of dollars



**Average Monthly Change in Demand Deposits and OCDs,
 by Quarter**

Billions of dollars



uity into cash at the time of refinancing. If operative, this factor should be much stronger during the 1990s than during 1986–87, for two reasons. First, many households have been restructuring their balance sheets, seeking to reduce the levels of debt (and debt service) that they took on during the 1980s. Home equity converted to cash at refinancing allows them to repay other outstanding debt and reduce monthly debt service. Second, households generally experienced large capital gains on houses during the 1980s. For many, capital gains in housing appeared largely as a windfall, accruing more rapidly than had been anticipated when the home was purchased and without any overt effort by the homeowner. As such, these increases in wealth likely were not optimally deployed (from a portfolio standpoint) across all household asset categories. For other homeowners who might have preferred to consume the increased wealth rather than save it, the capital gain appears as a type of forced saving in the form of home equity. While a home equity loan may increase the liquidity of home equity, it doesn't permit the household to consume a windfall increase in home equity, since the loan must be repaid. Hence, there may be some pent-up demand by homeowners for redirecting part of their home equity toward balance sheet restructuring (reducing other consumer debt), consumption or perhaps redeployment into more liquid assets.

Although no direct data on cash withdrawals at mortgage refinancings are available, recent evidence is supportive. Fannie Mae's 1993 national housing survey asked households whether their primary motivation in refinancing was to shorten the maturity of the loan (thereby building equity more quickly) or to reduce their monthly payments. While a shorter maturity was the motive more frequently stated, in fact

at refinancing more households tended to forego a shorter maturity in favor of lower monthly payments, consistent with reducing the importance of home equity in their portfolios. (Unfortunately, the survey did not ask about the withdrawal of home equity at refinancing.) Home equity lending at banks, shown in figure 8, also has been weak since mid-1991, with reports suggesting that homeowners are indeed repaying outstanding home equity loans with cash withdrawn at the time of a mortgage refinancing.

While the growth in OCDs likely reflects changes in households' deposits, some professionals and small businesses also may account for a portion of the increase. Some real estate payment practices tend to increase the demand for OCDs when mortgage activity increases. The 1969 Truth in Lending Act, for example, implemented through the Federal Reserve's Regulation Z, requires a three-day, right-of-rescission period for any new credit transaction secured by the borrower's principal residence.¹⁵ During this period, settlement agents typically hold funds in a liquid deposit, or perhaps in the form of cashier's and officers' checks. If the funds are held solely for the beneficial interest of the household, they may be placed in an OCD account.¹⁶ Cashier's and officers' checks issued by banks are included as demand deposits in M1, while such checks issued by thrifts typically are included in OCDs.

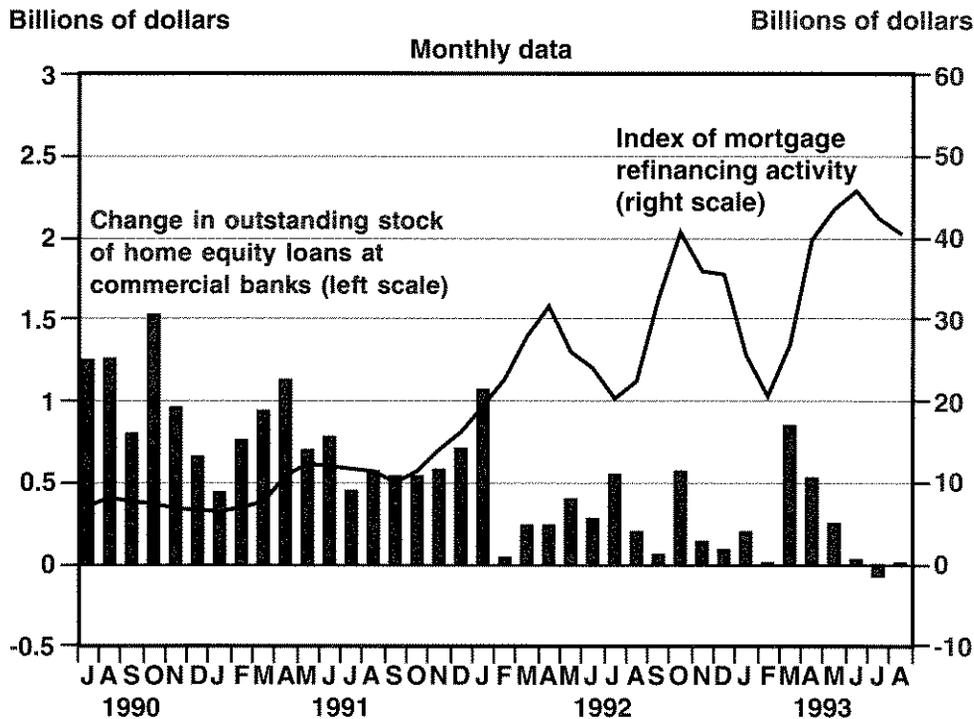
This supportive yet largely circumstantial evidence leaves a number of unanswered questions. If a household extracts funds at refinancing to repay a home equity loan, how long will it keep the funds in a liquid deposit? And isn't the amount of funds almost surely far smaller than the amounts held by mortgage servicers, associated with MBS refunding activity? If so, can the

¹⁵These provisions do not apply to home purchases, nor to refinancings with the same lender for an amount equal to or less than the unpaid principal balance. The Act exempts from right-of-rescission provisions "residential mortgage transactions," which are defined in the Act as extensions of credit to acquire a principal residence. In May 1987, at the request of mortgage market participants, refinancings with the same lender were exempted from Regulation Z. At the time, it was felt that this change likely would significantly reduce the number of refinancings subject to right-of-rescission provisions.

¹⁶On the eligibility of lawyers to hold a client's funds in OCD deposits, see section 2-341 of the Fed's Regulation D in *Federal Reserve Regulatory Service* (1993). Client funds also may be placed in MMDA deposits, although the rulings contained in section 2-341 perhaps suggest a prefer-

ence to hold the funds as OCDs. OCDs have no restrictions on the number of third-party withdrawals per month. While both OCDs and MMDA deposits are included in M2, data on MMDAs have not been collected by the Federal Reserve System since September 1990. Banks and thrifts began reporting that month only a combined total for all savings and MMDA deposits. Hence, no separate analysis of MMDA deposits is shown in this article.

Figure 8
Refinancing Home Equity Lending



increasingly parallel movements in OCDs reasonably be attributed to refinancing activity? On balance, while the sharp increase in the correlation between the changes in OCDs and demand deposits since 1991 suggests an underlying relationship to mortgage refinancing, the magnitude of any effect on the monetary aggregates remains uncertain and a convincing explanation elusive.

SUMMARY

Any factors that increase the demand for transaction deposits can distort the growth of the monetary aggregates over significant periods of time. Recent waves of mortgage refinancing activity have caused significant fluctuations in liquid deposits and M1. Under current Federal Reserve operating procedures for controlling the growth of M2, such transitory changes in the demand for liquid deposits, like those associated with mortgage refinancing, are automatically accommodated through changes in bank reserves, leading to increased volatility of M1.

A large portion of this increased volatility of demand deposits can be traced to fiduciary

rules governing the custodial accounts of mortgage servicers. The mechanism generating parallel high-frequency movements in OCDs, however, is far less clear. The coincidence of its timing with changes in refinancing activity and the onset of unusual weakness in home equity lending in 1992 suggest that it may be related to the ongoing restructuring of household balance sheets during the 1990s.

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Appendix

Estimates of Mortgage Servicers' Custodial Account Balances

This appendix employs methodology suggested by Duca (1990) to estimate the impact of refinancing on the amount of liquid deposits held by mortgage servicers.¹ At refinancing, the outstanding principal of an extinguished securitized mortgage is returned to the mortgage servicer. Following rules established by the federal agency that guaranteed the MBSs issued against the pool containing the mortgage, servicers place incoming unscheduled payments in custodial accounts (liquid deposits) until remitted to the holders of the MBSs around the middle of the following month. Since the servicing rules of the three agencies differ, the overall increase in custodial deposits that follows an increase in refinancing depends on the agency composition of MBS liquidations. Differences in this composition during 1991-93 relative to earlier periods have attenuated the deposit impact of recent MBS liquidations from what might have been expected. GNMA-guaranteed issues made up about one-half of aggregate liquidations during 1986-87,

for example, but only one-quarter in 1991-93. The largest volume of liquidations during 1991-93, on balance, has been FHLMC issues that have a smaller impact, dollar for dollar, on liquid deposits than liquidations of GNMA- or FNMA-guaranteed MBS.

The increase in liquid deposits due to MBS liquidations is estimated from a simple simulation. The parameters are:

The proportion of MBS liquidations during a month that result from scheduled amortization of principal (*norm* ___ *liq*). Separation of scheduled from unscheduled payments matters for reasons explained in the text. Estimates in this article assume that scheduled principal payments equal 1 percent (at an annual rate) of the outstanding stock of MBSs.²

The average number of days, expressed as a proportion of the month, that unscheduled principal payments are held in custodial accounts during the month in which the refinancing occurred (*GNMA* ___ *this* ___ *month*, *FNMA* ___ *this* ___

¹The model in this appendix differs from Duca's in some respects, including assuming a more uniform rate of mortgage closings during each month and that funds remain in liquid deposits somewhat longer during the month following the refinancing before they are withdrawn by investors.

²The exact monthly scheduled amortization rate is a function of the outstanding balances, rates and terms on the mortgages in the pool. Such calculations require extensive databases well beyond the scope of this study. An alterna-

tive set of estimates that assumed scheduled monthly amortization equal to 2 percent of outstanding aggregate principal had a relatively large number of months wherein actual principal payments were less than estimated scheduled payments and, hence, was rejected as implausible.

month, $FHLMC \text{ --- } this \text{ --- } month$). Payments received by servicers early in the month have larger impacts on month-average deposit levels than payments received late in the month. Herein it is assumed that mortgages close at a uniform rate during the month. Under this assumption, the weighted average holding period for payments received by GNMA and FNMA servicers is 0.50 months, i.e., $GNMA \text{ --- } this \text{ --- } month = FNMA \text{ --- } this \text{ --- } month = 0.50$. For FHLMC servicers, who generally hold unscheduled principal payments for five days or less, an average holding period of 0.15 months is assumed.

The average number of days, expressed as a proportion of the month, that funds due to MBS investors are held in liquid deposits during the month following the refinancing ($GNMA \text{ --- } last \text{ --- } month$, $FNMA \text{ --- } last \text{ --- } month$). Under GNMA and FNMA servicing rules, unscheduled principal payments received by servicers during the preceding month are remitted to investors on the 15th and 18th of the current month, respectively. Funds may be on deposit longer if investors do not withdraw them immediately. Values of 20 days and 23 days, corresponding to $GNMA \text{ --- } last \text{ --- } month = 0.67$ and $FNMA \text{ --- } last \text{ --- } month = 0.77$, are used in the calculations below. These somewhat longer periods were suggested by examination of daily deposit data reported to the Federal Reserve by several large banks. For FHLMC, this is set equal to zero.

For FNMA servicers, the proportion of incoming funds placed in MMDAs rather than demand deposits ($MMDA \text{ --- } share$). A value of 0.25 is assumed below.³ Funds in MMDAs are assumed to remain on deposit for the same number of days as funds placed in demand deposit accounts.

Monthly liquidation of GNMA-guaranteed MBSs equals, by definition, the amount of GNMA-guaranteed MBSs issued during the month minus the change in the amount of GNMA-guaranteed MBSs outstanding as of the end of each month:

$$GNMA \text{ --- } liq = GNMA \text{ --- } iss - \Delta GNMA \text{ --- } stk.$$

In turn, the amount of unscheduled principal payments received by GNMA servicers during a month is assumed to equal the liquidations of GNMA-guaranteed MBSs minus 1 percent of the amount of GNMA-guaranteed MBSs outstanding at the end of the previous month:

$$GNMA \text{ --- } un = GNMA \text{ --- } liq - norm \text{ --- } liq^* \\ GNMA \text{ --- } stk \text{ --- } lag.$$

Liquidations and unscheduled principal payments for FNMA and FHLMC are calculated in the same manner.

The amount of demand deposits that are custodial account balances due to GNMA mortgage servicers is calculated as:

$$GNMA \text{ --- } dda = GNMA \text{ --- } this \text{ --- } month * GNMA \text{ --- } un \\ + GNMA \text{ --- } last \text{ --- } month * GNMA \text{ --- } un \text{ --- } lag.$$

For FNMA servicers, the amount is:

$$FNMA \text{ --- } dda = (1 - MMDA \text{ --- } share) * (FNMA \text{ --- } this \text{ --- } month * FNMA \text{ --- } un \\ + FNMA \text{ --- } last \text{ --- } month * FNMA \text{ --- } un \text{ --- } lag);$$

and for FHLMC it is:

$$FHLMC \text{ --- } dda = FHLMC \text{ --- } this \text{ --- } month * \\ FHLMC \text{ --- } un$$

A similar calculation is made for the holdings of MMDAs by FNMA servicers.

An MBS-adjusted, not seasonally adjusted (n.s.a.) demand deposit series is obtained by subtracting the sum ($GNMA \text{ --- } dda + FNMA \text{ --- } dda + FHLMC \text{ --- } dda$) from published n.s.a. monthly levels of demand deposits. The resulting demand deposit series is seasonally adjusted using the seasonal factors for demand deposits published by the Federal Reserve Board staff in *Money Stock Revisions* (1993). (Seasonal factors are recovered from the published data by dividing the n.s.a. level by the s.a. level.) The differences in growth rates of demand deposits and M1 shown in the upper two panels of figure 6 are calculated from published and these adjusted data.

An MBS-adjusted, non-M1 component of M2 is obtained by subtracting the estimated amount of MBS-related MMDA deposits from the published, seasonally adjusted, non-M1 component of M2. (Since the non-M1 component of M2 is seasonally adjusted by the Federal Reserve Board staff as a whole, and separate data on MMDA are not available, the seasonally adjusted series was adjusted by MBS effects.) The growth rates shown in the lower panel of figure 6 are calculated from published M2 and from the sum of the MBS-adjusted M1 and non-M1 components of M2.

³The value of 0.25 is from Duca (1990).