TREASURY BILL VERSUS PRIVATE MONEY MARKET YIELD CURVES

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The relationship between time to maturity and yield on securities is of widespread interest to financial market participants and observers. The relationship, known as the term structure of interest rates, provides information about which maturities offer the highest expected returns to investors and which provide the lowest expected costs to borrowers. Plots of the term structure-called yield curves-are shown in Chart 1 for three money market instruments as of the first trading days of December 1984 and December 1985.

Many researchers have studied the term structure of Treasury bill (T-bill) yields and found that investors could expect higher returns, on average, from investing in longer term T-bills. The finding is inconsistent with the pure expectations theory of the term structure, according to which the expected rate of return should be the same at all maturities. In this paper we examine whether this conclusion also applies to the yield curves for private money market instruments by testing the pure expectations theory using yields on three such instruments. We cannot reject the theory for the private money market yield curves. The results suggest that the pure expectations theory may be consistent with the behavior of ***money*** market participants in general and that the Treasury bill market differs in some way from the private money markets. We demonstrate that the term structure of T-bill rates may differ from those of private money market rates because of a unique characteristic of the T-bill market: only the Treasury can borrow at the T-bill rate.

IMPLIED FORWARD RATES AND THE PURE EXPECTATIONS THEORY

In order to discuss the pure expectations theory of the term structure it is useful to introduce the concept of implied forward rates. The term structure of interest rates at any point in time implies a set of forward interest rates-that is, interest rates on bonds in the future. Suppose R_1 is the current yield on a one-year discount bond and R_2 is the current annualized yield on a two-year discount bond. The implied forward rate on a one-year bond commencing in one year (F_1) is the rate that equates the two-year return from investing one dollar in the current two-year bond ($[1 + R_2]^2$) to the return from investing one dollar in the current one-year bond and reinvesting the proceeds at the end of one year in a new one-year bond:

$$(1 + R_2)^2 = (1 + R_1)(1 + F_1).$$

This expression can be rearranged to give an expression for the implied forward rate:

$$F_1 = [(1 + R_2)^2/(1 + R_1)] - 1,$$

which may be represented by the usual linear approximation:

$$F_1 = 2R_2 - R_1.$$[1]

For example, if the rate on one-year bonds is 9 percent and the rate on two-year bonds is 10 percent, the implied forward rate on one-year bonds one year from now is (2 X 10) - 9 = 11 percent.

The pure expectations theory of the term structure states that implied forward rates always equal expected future rates because bonds of different maturities can be considered perfect substitutes.[2] Although some market participants may have preferences for

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[1] The linear approximation is used throughout the text to simplify the discussion. The general formula for calculating the implied forward rate, used in the empirical work, is

$$F_m = [(1 + R_{n+m})^{n+m}/(1 + R_n)^n]^{1/m} - 1,$$

where

F_m = implied forward rate on m-year bonds commencing n-years from now,

R_{n+m} = spot rate on n+m-year discount bonds,

R_n = spot rate on n-year discount bonds.

[2] The discussion here is brief. See Van Horne (1984, pp. 104-12) for a more extensive discussion of the pure expectations theory.

particular maturities, participants indifferent to maturity are assumed to be sufficiently active in the market to determine the term structure of interest rates. As a result, the expected rate of return is the same for all maturities.

According to the theory, any significant difference between implied forward and expected future rates will be quickly eliminated because it offers market participants profit opportunities. If the implied forward rate were higher than the expected future rate, participants who could borrow at the one-year rate and lend at the two-year rate could lock in a forward one-year investment at a rate higher than the expected future one-year rate. For example; if one-year bonds are trading at 9 percent and two-year bonds are trading at 10 percent, the implied forward rate on one-year bonds commencing in one year is 11 percent. If a market participant believes that in one year the one-year bond rate will be less than 11 percent, say 10.5 percent, he can issue a one-year bond at 9 percent and invest the proceeds in a two-year bond at 10 percent. If the participant's expectations are correct, he can issue a second one-year bond a year later at a rate of 10.5 percent. The participant profits because he earns 10 percent on the two-year bond he invested in and only pays 9.75 percent to borrow with the two one-year bonds.

The pure expectations theory states that investors who are willing and able to take advantage of such a profit opportunity will continue to borrow at the short-term rate and lend at the long-term rate until the implied forward rate equals the expected future rate. As a result, the shape of the yield curve is determined solely by expectations of future interest rates. If interest rates are not expected to change, the yield curve will be flat. If short-term rates are expected to rise, the yield curve will be upward-sloping : long-term rates will exceed short-term rates by just enough to equate the return from investing in a long-term security to the expected return from investing in a short-term security and rolling it over at the expected higher future short-term rate. Conversely, if short-term rates are expected to fall, the yield curve will be downward-sloping.

Alternatively, the term structure may be affected by factors in addition to expectations of future rates. For example, expected returns may be higher on longer term securities in order to compensate the investor for investing for longer periods. If such is the case, the yield curve will be more upward-sloping than predicted by the pure expectations theory, and implied forward rates will be higher than expected future rates. Any difference between the implied forward rate (F) and the expected future rate (R^e) is referred to as a term premium (P) :

$$P = F - R^e.$$

TESTING THE PURE EXPECTATIONS THEORY WITH MONEY MARKET YIELDS

Since the pure expectations theory states that implied forward rates equal expected future rates, one can test the theory by determining whether the term premium is zero. Unfortunately, expected future rates are not observable, making it impossible to calculate the term premium on an instrument at a specific time. One can, however, estimate the average term premium over a long period by assuming that market participants form expectations rationally. Under the rational expectations hypothesis, realized future rates equal expected future rates plus a serially uncorrelated forecast error with mean zero. In other words, there is no systematic bias in the market's forecasts. Any systematic difference between implied forward and realized future interest rates can therefore be attributed to term premiums.

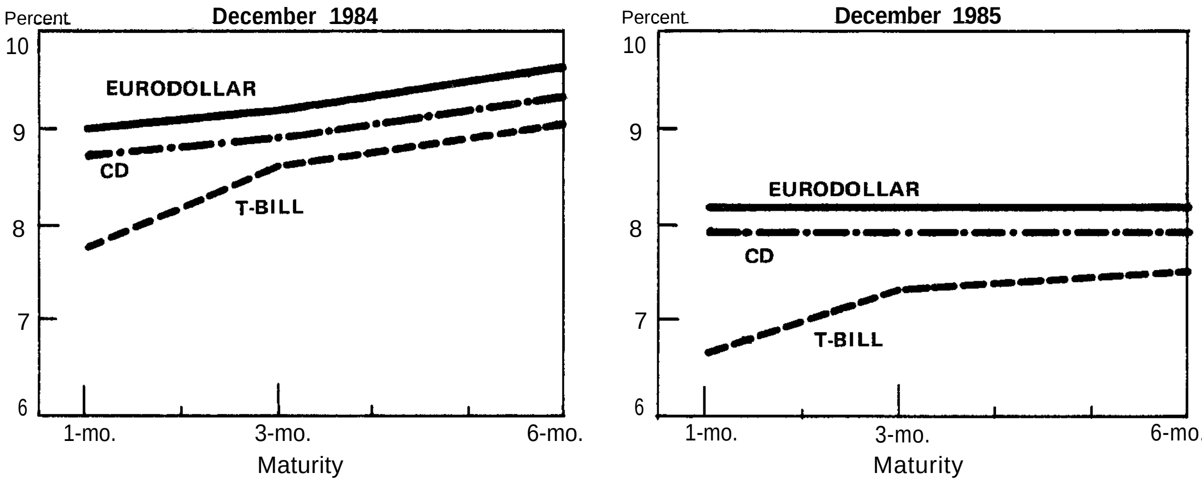
Most studies of the term structure of money market rates have used T-bill yields because T-bills have several qualities that make it easier to isolate the effect of maturity on yield: T-bills are essentially free of default risk, they are identical in all respects except maturity, and they are traded in a highly liquid market. These studies have rejected the joint hypothesis of rational expectations and the pure expectations theory because they have found that implied forward T-bill rates have been significantly higher, on average, than realized future rates.[3] Since it is unlikely that the market would systematically overpredict future rates, the difference between implied forward and realized future rates has generally been attributed to term premiums.

The term premium in T-bill yields, however, may not be representative of the overall money market. Chart 1 shows that the T-bill yield curve has at times shown greater upward slope than the yield curves of other money market instruments, suggesting that the term premium in T-bill yields is bigger than those in the yields on private money market instruments. In fact, the T-bill yield curve has been steeper than the yield curve for negotiable bank certificates of deposit (CDs) on average over the last twenty years. As

[3] For example Kessel (1965), Roll (1970), McCulloch (1975), and Fama (1984).

Chart 1

MONEY MARKET YIELD CURVES



Note: Secondary market quotes are as of the first trading days of each month. All rates are on an interest-to-follow basis--i.e., as a percentage of actual funds invested. T-bill rates are generally quoted on a bank-discount basis--i.e., as a percentage of par, rather than of actual funds invested. The formula to convert a bank-discount rate (BD) to an interest-to-follow rate (ITF) is ITF = (360 • BD)/[360 - (N • BD/100)], where N is days to maturity.

Source: Salomon Brothers, **An Analytical Record of Yields and Yield Spreads** (New York, 1986).

shown in Table I, the spread between one-month CD yields and one-month T-bill yields has usually exceeded the spread between three-month CD yields and three-month T-bill yields. In turn the latter spread has usually exceeded that between six-month CD yields and six-month T-bill yields. The pattern is persistent: the three-month spread exceeded the six-month spread in eighteen of the twenty years. The T-bill yield curve also has generally been more upward-sloping than the yield curves for commercial paper and Eurodollar deposits.[4]

These observations suggested that one might test the pure expectations theory using yields on private money market instruments and compare the results to those obtained using yields on T-bills. We estimated the average term premiums in the yields on CDs, Eurodollars, commercial paper, and T-bills from 1970 through 1985, the full period for which first day of the month interest rates are available for all the instruments from Salomon Brothers, An *Analytical Record* of *Yields* and *Yield Spreads*. For each instrument, we looked at the average difference between the implied forward three-month rate commencing in three months (calculated from the current three- and six-month interest rates) and the three-month rate realized three months later.[5] Assuming rational expectations, any significant difference can be attributed to a term premium. We use only one observation per quarter since more frequent observations would overlap, introducing serial correlation into the error terms.

The estimated average term premiums are reported in Table II. For T-bills the average term premium is 61 basis points. Since the estimate is significantly different from zero at the 99 percent confidence level, the pure expectations theory is strongly rejected for the T-bill market. The average term premiums for the private money market instruments, on the other hand, are much smaller and not significantly different from zero in a statistical sense. One cannot reject the pure expectations theory for private money market instruments.

Data are also available as far back as 1964 for T-bills and CDs. Table III shows the average term premiums for T-bills and CDs from 1964 through 1985. The estimated average term premium for

[4] The rate on Eurodollar deposits is the London interbank offered rate.

[5] We could not test the theory using one-month interest rates because they imply forward two- and five-month rates when combined with three- and six-month rates and we did not have data on two- and five-month spot rates.

Table I

CD VS. T-BILL YIELDS: YEARLY AVERAGES

Year	CDs			T-bills			CD less T-bill		
	1-mo.	3-mo.	6-mo.	1-mo.	3-mo.	6-mo.	1-mo.	3-mo.	6-mo.
1966	5.34	5.48	5.63	4.67	4.92	5.19	0.67	0.56	0.44
1967	4.79	5.02	5.22	4.05	4.35	4.73	0.74	0.67	0.49
1968	5.72	5.86	6.00	5.20	5.41	5.62	0.51	0.45	0.38
1969	7.65	7.78	7.91	6.48	6.78	7.11	1.18	1.00	0.80
1970	7.45	7.56	7.65	6.20	6.49	6.73	1.25	1.07	0.93
1971	4.78	4.99	5.21	4.22	4.38	4.62	0.57	0.62	0.59
1972	4.41	4.67	5.02	3.89	4.11	4.59	0.51	0.56	0.43
1973	8.30	8.41	8.31	7.05	7.16	7.47	1.26	1.25	0.84
1974	10.29	10.24	9.98	8.03	7.99	8.26	2.26	2.26	1.71
1975	6.14	6.44	6.89	5.63	5.86	6.28	0.50	0.58	0.61
1976	5.07	5.27	5.62	4.89	5.04	5.39	0.19	0.23	0.23
1977	5.48	5.64	5.92	5.15	5.34	5.68	0.33	0.30	0.24
1978	7.88	8.22	8.61	7.09	7.32	7.88	0.79	0.90	0.73
1979	11.03	11.22	11.44	10.00	10.33	10.59	1.03	0.89	0.85
1980	12.91	13.07	12.99	11.02	11.77	12.05	1.89	1.30	0.94
1981	15.91	15.91	15.77	13.90	14.53	14.82	2.01	1.38	0.95
1982	12.04	12.27	12.57	10.19	10.90	11.71	1.85	1.37	0.86
1983	8.96	9.07	9.27	8.38	8.80	9.13	0.58	0.27	0.14
1984	10.17	10.37	10.68	9.05	9.75	10.26	1.12	0.61	0.42
1985	7.97	8.05	8.25	7.11	7.62	7.96	0.86	0.43	0.29
Average, 1966-85	7.73	7.88	8.04	6.77	7.09	7.43	0.96	0.79	0.61

Note: Rates are secondary market quotes on an interest-to-follow basis (see Chart 1).

Source: Board of Governors of the Federal Reserve System.

T-bills is 53 basis points and the estimate is statistically significant at the 99 percent confidence level. The estimated average term premium for CDs is much smaller and not significantly different from zero. The pure expectations theory is strongly rejected for T-bill yields but not rejected for CD yields.

The above test for term premiums in the yields on private money market instruments is subject to one qualification. The test assumes that the degree of default risk is the same for both maturities. The assumption holds for T-bills since all maturities are essentially free of default risk. In contrast, each of the private money market instruments is subject to some risk of default, and different degrees of expected default loss on three- and six-month private money market instruments could bias the test. In the Appendix, however, we show that under reasonable assumptions the test is not biased against finding a term premium in the yields on private money market instruments.

EXPLAINING THE DIFFERENCE IN RESULTS

The significant term premium in T-bill yields and the absence of significant term premiums in the private money market yields suggests that the T-bill market differs in some way. The T-bill market does differ in one important respect: whereas there are many issuers in each of the private money markets, only the Treasury can issue T-bills. A key assumption of the pure expectations theory is therefore violated in the T-bill market: market participants, in general, cannot borrow at the T-bill rate. Because the rate at which participants in the T-bill market

Table II

AVERAGE TERM PREMIUMS 1970 Q2 TO 1985 Q4

	T-bills	CDs	Eurodollars	Commercial Paper
Average term premium (in basis points)	61	21	21	14
Standard error	22	26	27	24
t-statistic	2.78	0.79	0.79	0.58
Number of observations	63	63	63	63

Notes:

(1) The term premium is the difference between the implied forward rate calculated from the three- and six-month spot rates and the realized three-month spot rate three months later.

(2) The rates are for the first day of the third month of each quarter from Salomon Brothers, An Analytical Record of Yields and Yield Spreads (New York, 1986). These rates are annualized without compounding. Consequently, the formula used to calculate the forward rate is:

$$\left[\left(\frac{1+R_6/200}{1+R_3/400}\right)-1\right] * 400.$$

can borrow funds is higher than the T-bill rate, they may be unable to profit from the difference between the implied forward and expected future three-month T-bill rates. Of course, the Treasury could reduce the term premium by selling more three- and fewer six-month T-bills, but it has not been willing to do so. Additionally, the term premium in T-bill yields would not exist unless some investors were willing to accept a lower expected yield on three- than on six-month T-bills. This section discusses these points in more detail.

The Treasury's Monopoly Limits Profit Opportunities for Other Investors

The significant term premium in the implied forward three-month T-bill rate indicates that investors have been either unwilling or unable to take full advantage of the opportunity for expected profit offered by the difference between implied forward and expected future three-month T-bill rates. Investors who were both willing and able would have borrowed at the three-month T-bill rate and invested in six-month T-bills for an expected profit. Such transactions would have tended to push up the three-month rate and push down the six-month rate. If this element of the market was sufficiently large, the implied forward three-month T-bill rate would have been driven down close to the expected future three-month T-bill rate, thereby eliminating the term premium.

Investors may not be able to profit from the positive term premium in T-bill yields, however, because the rate at which they can borrow three-month money is higher than the three-month T-bill rate. In contrast, many participants in each of the markets for the private money market instruments can profit from any difference between implied forward and expected future rates since they are able to both borrow and lend at approximately equal rates. For example, suppose a bank believes that the future three-month Eurodollar rate will be lower than the forward Eurodollar rate implied by the yield curve. The bank can issue a three-month Eurodollar deposit and place the proceeds in a six-month Eurodollar deposit. The bank will profit if the implied forward three-month Eurodollar rate exceeds the realized future three-month Eurodollar rate. Now consider a trader who believes that the future three-month T-bill rate will

Table III

AVERAGE TERM PREMIUMS 1964 Q2 TO 1985 Q4

	T-bills	CDs
Average term premium (in basis points)	53	17
Standard error	16	19
t-statistic	3.24	0.89
Number of observations	87	87

Note: See notes in Table II.

be lower than the forward three-month T-bill rate implied by the yield curve. Since only the Treasury can issue T-bills, the trader cannot raise three-month funds at the three-month T-bill rate. Rather, if he wishes to fund his purchase of a six-month T-bill by borrowing for three months, his lowest cost source of funds probably will be to enter into a repurchase agreement (RP) with another party.[6] Under a repurchase agreement, funds are acquired through the sale of a security coupled with a simultaneous agreement to repurchase the security on a specified date at an agreed upon price (and thus an agreed upon rate of interest). For example, by buying a six-month T-bill yielding 10 percent and entering into a three-month repurchase agreement at 9 percent, the trader can secure an investment in a three-month T-bill commencing in three months yielding 11 percent. If in three months the three-month T-bill rate is less than 11 percent, he can sell the T-bill for a profit.

Since the three-month RP rate is invariably higher than the three-month T-bill rate, the forward rate attainable by buying a six-month T-bill and financing it with a three-month repurchase agreement is lower than the forward rate implied by the three- and six-month T-bill rates. Traders can expect to profit only if this "attainable forward rate" is different from the expected future T-bill rate.[7] The implied forward T-bill rate can therefore be higher than the expected future T-bill rate but not offer any profitable trades. For example, if three-month T-bills are trading at 9 percent and six-month T-bills are trading at 10 percent, the implied forward rate on three-month T-bills commencing in three months is 11 percent. Suppose the expected future three-month T-bill rate is 10.75 percent. If the three-month RP rate is 9.25 percent, the attainable forward three-month T-bill rate is also 10.75 percent. Even though the expected future three-month T-bill rate is less than the forward rate implied by the T-bill yield curve, it is not less than the attainable forward rate. Consequently, investors cannot profit from the gap between the implied forward and expected T-bill rates.

[6] Prior to the development of the RP market, the cheapest way for a trader to finance a six-month T-bill for three months was to get a three-month loan from a bank using the six-month T-bill as collateral.

[7] The term "attainable forward rate" was introduced by Gendreau (1983) in a study of the yields on Treasury bill futures contracts.

Testing for Profit Opportunities

Because traders cannot borrow at the T-bill rate, the positive term premium in T-bill yields does not necessarily mean that they are passing up expected profits. The appropriate test of whether traders have passed up profit opportunities is whether the forward rate attainable by purchasing a six-month T-bill and financing it with a three-month repurchase agreement has been significantly different from the realized future three-month T-bill rate. Ideally, to carry out this test the attainable forward rate should be calculated using the rate on RPs with six-month T-bills posted as collateral. Unfortunately, data on the rates on RPs with specific collateral are not available, but a series on the 90-day RP rate on general government securities collateral starting in September 1979 is available through Data Resources, Inc. It is the closest approximation available of the rate at which traders can borrow three-month money using six-month T-bills as collateral.

The average difference between the attainable forward three-month T-bill rate (calculated from the six-month T-bill and three-month RP rates) and the three-month T-bill rate realized three months later from September 1979 through December 1985 is reported in Table IV. Since the average difference between attainable forward rates and realized three-month rates is only 4 basis points, there is no indication that traders passed up profit opportunities. For comparison, the average term premium in the implied forward three-month T-bill rate over the same period (using the same method as in Table II) is 79 basis points.

Table IV

ATTAINABLE FORWARD VS. REALIZED FUTURE THREE-MONTH T-BILL RATES
1979 Q4 to 1985 Q4

	Attainable Forward Rate Less Realized Future Rate	Implied Forward Rate Less Realized Future Rate
Average difference (in basis points)	4	79
Standard error	50	51
t-statistic	0.09	1.55
Number of observations	25	25

Note: The rates are for the first day of the third month of each quarter. T-bill rates are from Salomon Brothers, An Analytical Record of Yields and Yield Spreads (New York, 1986). The RP rates are from Data Resources, Inc.

The Treasury's Behavior

The positive term premium in the implied forward three-month T-bill rate indicates that the Treasury has been willing to issue six-month T-bills at a higher expected interest cost than three-month T-bills. If the Treasury were unwilling to pay a higher expected yield on six-month T-bills, it could issue fewer six-month and more three-month T-bills. Decreasing the supply of six-month T-bills would tend to lower the interest rate on them, and increasing the supply of three-month T-bills would tend to raise their interest rate. These actions would reduce, if not eliminate, the term premium in the T-bill market.

The Treasury's behavior is quite different from the behavior of issuers in the private money markets, who adjust the relative supplies of three- and six-month instruments they issue in response to changes in market rates and in their expectations of future interest rates. The Treasury virtually always sells a roughly equal amount of three- and six-month T-bills at its weekly auction.

Because the rate on six-month T-bills is higher, on average, than the rate on three-month T-bills, it appears that the Treasury could lower its total financing costs by issuing fewer six-month and more three-month T-bills. The potential cost savings from such a change is hard to calculate, however, because it depends on the responsiveness of three- and six-month T-bill rates to changes in supplies-that is, on the interest elasticities of the demands for three- and six-month T-bills. In fact, such a change might not lower the Treasury's financing costs at all. If the Treasury were to issue more three-month T-bills it would have to pay a higher interest rate on all three-month T-bills. If the demand for three-month T-bills were less interest-elastic than the demand for six-month T-bills, then the additional interest cost on three-month T-bills could outweigh the savings from selling fewer of the higher-cost six-month T-bills.

Even if the Treasury could reduce its financing costs by issuing more three-month T-bills, it might not be willing to do so because of other considerations. For example, in recent years the Treasury has been reducing the proportion of debt financed with T-bills in order to increase the average maturity of its debt outstanding. One reason for extending the average maturity is to reduce the year-to-year variation in the interest expense component of the federal budget. Issuing more three- and fewer six-month T-bills would conflict with the policy of debt maturity extension.

The Demand for Short-Term T-Bills

The positive term premium in the implied forward three-month T-bill rate also indicates that some investors have been willing to hold three-month T-bills despite a lower expected return than on six-month T-bills. Further, the absence of a term premium in CD yields implies that investors who held three-month T-bills could have expected higher returns from holding three-month CDs even after adjusting for the possibility of loss due to default on the CDs[8] These investors must have had preferences for three-month T-bills over six-month T-bills and over three-month CDs that made them willing to hold three-month T-bills despite a lower expected return.

Broadly speaking there are two possible explanations why some investors are willing to accept a lower expected yield on three-month T-bills. The first is that some investors may be risk averse. They may be willing to accept lower expected returns on three- than on six-month T-bills because six-month T-bills are subject to greater fluctuation in capital value, and they may be willing to accept lower expected returns on three-month T-bills than on CDs because CDs are subject to greater risk of default.

A second possibility is that some investors may be willing to accept lower returns on three-month T-bills because of special characteristics of T-bills. One such characteristic is the role that T-bills play in satisfying numerous institutional and regulatory requirements. For example, Treasury securities are eligible pledging assets against Treasury tax and loan accounts as well as against most state and local government deposits. T-bills are also widely accepted as collateral for selling short various financial securities. T-bills can be used instead of cash to satisfy initial margin requirements against futures market positions. For many of these purposes investors might prefer three- to six-month T-bills because the benefit from holding T-bills is expected to accrue for only a short time. Such might be the case, for example, if T-bills were held as collateral for volatile government deposits or as margin for short-term futures contracts.

Another special characteristic of T-bills is that the

[8] Assume that the annualized expected default loss on a three-month CD is no greater than on a six-month CD. Assume also that the expected yield on six-month T-bills is no greater than the expected yield on six-month CDs. Then the fact that the spread between the rates on three-month CDs and three-month T-bills is greater than the spread between the rates on six-month CDs and six-month T-bills implies that the expected yield on three-month T-bills is less than the expected yield on three-month CDs.

interest income on them is not subject to state and local income taxes. Because of peculiarities in the tax laws, most large investors, such as banks and corporations, nevertheless do have to pay taxes on T-bill *interest* income.9 Hence, this tax advantage accrues mainly to individual investors. If individuals have a preference for liquidity that is not shared by large investors, they may be willing to accept a lower yield on three- than on six-month T-bills while large investors are not willing to accept a lower expected yield on three- than on six-month private money market instruments.

FURTHER IMPLICATIONS

Time-Varying Term Premiums

Since traders in the T-bill market cannot borrow funds at the T-bill rate, movements in the spread between the rate at which they can borrow and the T-bill rate may cause the term premium to vary over time. Movements in the spread between the RP rate and the T-bill rate change the spread between the implied forward rate and the attainable forward rate. If traders keep the attainable forward rate equal to the expected future rate by maximizing expected profits, such movements also change the spread between the implied forward rate and the expected future rate, i.e., change the term premium.

An example helps demonstrate how movements in the spread between the RP rate and the T-bill rate can affect the term premium. Assume that the three-month T-bill rate is 9.5 percent, the six-month T-bill rate is 10 percent, and the three-month RP rate is 9.75 percent. Assume also that the expected future three-month T-bill rate is 10.25 percent (equal to the attainable forward rate). Since the implied forward rate of 10.50 percent is 25 basis points higher than the expected future rate, the term premium is 25 basis points. Now, if the three-month T-bill rate falls to 9.25 percent and other rates are unchanged, then the implied forward rate rises to 10.75 percent. The implied forward rate is now 50 basis points higher than the expected future rate, but since the attainable forward rate is still equal to the expected future rate there are no profitable trading opportunities. In this case the term premium increased from 25 to 50 basis points simply because of an increase in the spread between the three-month RP rate and the three-month T-bill rate.

[9] Cook and Lawler (1983) provide details on the taxation of T-bill interest income for different investors.

Movements in the spread between the three-month RP rate and the three-month T-bill rate have been substantial, as shown in Chart 2. These movements may explain why **some** researchers have found evidence of a time-varying term premium in the T-bill market.[10]

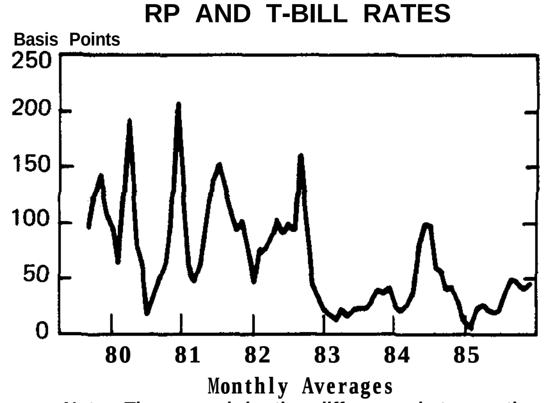
T-Bill Futures Rates and Implied Forward Rates

The difference between the interest rate at which private investors can borrow and the interest rate on T-bills also helps explain why implied forward T-bill rates have been higher than the rates on T-bill futures contracts. If investors could both borrow and lend at the T-bill rate, any significant difference between implied forward rates and futures rates would offer profitable arbitrage opportunities. Investors could lock in a risk-free profit by borrowing money at the three-month T-bill rate, investing in a six-month T-bill and simultaneously entered into a futures contract to sell a three-month T-bill three months in the future. Private investors, however, cannot carry out this set of transactions because they cannot borrow at the T-bill rate. As pointed out by Gendreau (1985) the relevant rate comparison for arbitrage opportunities is between the forward rate attainable by investors through buying a T-bill and financing it

[10] Researchers who have found a time-varying term premium in the T-bill market include Kessel (1965), Friedman (1979), and Jones and Roley (1983).

Chart 2

SPREAD BETWEEN THE RP AND T-BILL RATES



Note: The spread is the difference between the monthly average 90-day RP rate (from Data Resources, Inc.) and the monthly average secondary market 3-month T-bill rate (from the Federal Reserve Bulletin) adjusted to an interest-to-follow basis (see Chart 1).

with a term RP and the rate on the corresponding T-bill futures contract. Gendreau compared these rates and found that the attainable forward three-month T-bill rate was lower, on average, than the futures rate and that the difference was statistically insignificant.

CONCLUSIONS

The evidence presented in this article confirms the conclusions of other studies that the pure expectations theory does not completely explain the term structure of Treasury bill rates. There is strong evidence of a positive average term premium in the implied forward three-month T-bill rate. The behavior of the term structure of T-bill yields, however, appears to be atypical of the money market in general. Based on the evidence presented in this article, one cannot reject the pure expectations theory as an explanation of the term structure of private money market yields. The difference in results suggests that the T-bill market differs in some way from the private money markets. In fact, a key assumption of the pure expectations theory is violated in the T-bill market because market participants in general cannot borrow at the T-bill rate. They may therefore be unable to profit from the positive term premium in T-bill yields. Only the Treasury can issue T-bills and it has been willing to pay a term premium to issue six-month T-bills.

Thus, conclusions from studies of the term structure of T-bill yields should not be generalized to the yields on private money market instruments. For example, although investors in three-month T-bills can expect higher returns on average from investing in six-month T-bills, investors in three-month CDs cannot necessarily expect higher returns from investing in six-month CDs. Finally, because the term premium in T-bill yields may result from unique characteristics of the T-bill market and the pure expectations theory is consistent with the term structures of private money market yields, the pure expectations theory appears to be consistent with the behavior of money market participants in general.

APPENDIX

This Appendix describes the effect of default-risk on the test for a term premium. It derives the relationship between the ***measured*** term premium based on promised yields and the ***true*** term premium based on expected yields, that is, yields that have been adjusted for expected default loss. We assume continuously compounded rates of return, for which the linear approximation of the implied forward rate is exact.

The expected yield on a bond is equal to the promised yield less the expected default loss:

$$(1)\quad ER^1_t = R^1_t - EDL^1_t,$$

where

ER^1_t = annualized expected rate of return on an i-period bond,

R^1_t = annualized promised rate of return on an i-period bond,

EDL^1_t = annualized expected default loss on an i-period bond.

Now, the measured implied forward rate on one-period bonds one period in the future observed at time t ($MIFR^1_t$) is calculated using promised rates of return:

$$(2)\quad MIFR^1_t = 2R^2_t - R^1_t;$$

and the measured term premium (MTP_t) is the difference between the measured implied forward rate and the expected future promised rate:

$$(3)\quad MTP^1_t = MIFR^1_t - E_t(R^1_{t+1}).$$

The true implied forward rate on one-period bonds one period in the future observed at time t ($TIFR_t$) is calculated using expected rates of return:

$$(4)\quad TIFR^1_t = 2ER^1_t - ER^1_t;$$

and the true term premium (TTP^1_t) is the difference between the true implied forward rate and the expected future expected rate:

$$(5)\quad TTP^1_t = TIFR^1_t - E_t(ER^1_{t+1}).$$

Substitute equations 4, 1, 2, and 3 into equation 5 to obtain

$$(6)\quad TTP^1_t = MTP^1_t - 2EDL^1_t + EDL^1_t + E_t(EDL^1_{t+1}).$$

The test for a term premium is biased against finding a positive term premium if the measured term premium is less than the true term premium: if

$$(7)\quad MTP^1_t < TTP^1_t,$$

or equivalently (using equation 6) if

$$(8)\quad 2EDL^2_t < EDL^1_t + E_t(EDL^1_{t+1}).$$

The test is therefore not biased against finding a positive term premium if the annualized expected default loss on two consecutive one-period bonds is less than or equal to two times the annualized expected default loss on a two-period bond. The only circumstance that would bias the test against finding a term premium in, for example, CD yields would be a probability of default on consecutive three-month CDs that was higher than the probability of default on a six-month CD. This notion seems quite implausible when applied to the high-grade money market instruments used in this study, and we know of no empirical evidence to support it. There is consequently no reason to believe that default risk would bias the test against finding a term premium in the yields on private money market instruments.

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RECENT FINANCIAL DEREGULATION AND THE INTEREST ELASTICITY OF M1 DEMAND

*Yash Mehra**

Some analysts contend that the introduction nationwide since 1981 of interest-bearing NOWs and Super NOW's has raised the interest elasticity of M1 demand. This article presents empirical evidence consistent with this view. The demand deposit component of Ml does not exhibit any heightened interest-sensitivity, suggesting it is the OCD component that has lately been more interest-sensitive. Furthermore, it is also shown that the interest elasticity of Ml demand neither changed nor was it very high during the 1970s, a period of substantial financial innovations. This implies that it is the interest rate deregulation, as opposed to financial innovations, that has affected the character of M1 demand.

Introduction

It has been suggested that the introduction of interest paying accounts such as NOWs and Super NOWs might have raised the interest elasticity of money demand.[1] Two interrelated reasons have been advanced for this potential rise in interest elasticity. First, Ml now contains assets potentially suitable for savings. It is therefore possible that the public's demand for it is now more sensitive to market yields than in the past when it was closer to a pure transaction aggregate. This is so because the own rate of return on some assets like NOWs is regulated and set below open market rates.[2] Second, NOW accounts pay explicit interest but demand deposits do not. A given change in market interest rates thus causes a larger proportional change in the opportunity cost of holding NOWs than of holding demand deposits.[3] As a result, changes in market rates might induce larger changes in NOWs than in demand deposits, thereby increasing the interest responsiveness of Ml as a whole as NOWs become a larger fraction of M1.[4]

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[1] Brayton, Farr, and Porter (1983) and Simpson (1984).

[2] As of January 1986 this regulatory constraint on the interest rate payable on NOW accounts has been removed.

[3] The interest elasticity of the opportunity cost of holding NOWs can be expressed as Δ (R-Rnow)(R)/(DR) (R-Rnow), where R is the market interest rate, Rnow is the rate offered on NOWs and Δ is the first difference operator. If Rnow is fixed, then the above expression reduces to (R/R-now). Furthermore, if Rnow is less than R, the expression is greater than one.

[4] To clarify further the second point let us express the aggregate interest elasticity of Ml demand as the weighted average of its component interest elasticities

$$E_{M1,R} = \frac{CC}{M1}(ECC,0_1 \cdot E0_1,R) + \frac{DD}{M1}(EDD,0_2 \cdot E0_2,R) + \frac{OCD}{M1}(EOCD,0_3 \cdot E0_3,R) \qquad (a)$$

where the first terms in the parentheses $ECC,0_1$, $EDD,0_2$, and $EOCD,0_3$ are respectively the elasticities of currency, demand deposits, and other checkable deposits with respect to the relevant opportunity cost variables and where the second terms ($E0_i,R$; i=1,2,3) measure elasticities of these opportunity cost variables with respect to the market rate of interest. The opportunity cost variable for any one component is defined as the difference between the market interest rate and the nominal yield paid on that component. $E_{M1,R}$ is the aggregate interest elasticity of the Ml demand. The weights in (a) are the respective shares of these components in Ml. The component demand elasticities with respect to the opportunity cost variables can in general be different. Moreover, the elasticities of the opportunity cost variables with respect to the market interest rate can also differ from each other.

An important consideration that is relevant in determining the magnitude of the opportunity cost elasticity of a given component in (a) is the behavior of the own rate offered on the component asset. If the interest rate offered on the component asset is either fixed to be zero or strictly proportional to the market interest rate, then the opportunity cost elasticity of that component is unity. But consider now the case in which the explicit interest offered on one component of Ml is regulated and kept below the market interest rate, as was the case for the NOWs component of the other checkable deposits. In this case the interest elasticity of the opportunity cost variable pertaining to that component ($E0_3,R$) can be greater than unity. An implication of this is that even if no change occurs in the elasticity of this component with respect to its own opportunity cost variable ($EOCD,0_3$) the aggregate interest elasticity of Ml demand can increase simply because the share of the regulated component in Ml grows over time, other things remaining the same.

The behavior of interest elasticity of money demand has a bearing *on* how one interprets the recent behavior of Ml velocity. Ml velocity, instead of rising at its previous trend rate of 3 percent per year, has remained fairly steady in the early 1980s. Moreover, whenever interest rates fell velocity has also declined sharply. Now, if Ml demand has recently become more sensitive to the cost of holding money, then the observed behavior of velocity could be predictable. Interest rates, both nominal and real, have trended downward during the last few years. Such fall in rates increases money demand and thus lowers velocity. Increase in money demand could be large if interest elasticity is high. Since money affects income with lags, velocity, conventionally measured by the ratio of income to contemporaneous money, could decline sharply over the short run.

The main objective of this article is to examine whether the interest elasticity of money demand has changed during the last few years. Now that a substantial fraction of the assets included in Ml earns an explicit nominal return, it may no longer be appropriate to measure the opportunity cost of holding Ml by the market interest rate. A related issue is whether Ml demand has also become more sensitive to changes in the opportunity cost variable, defined as the difference between the market interest rate and the own rate of return on Ml.

Though the focus of the present article is on the potential behavior of the interest elasticity in the 1980s, the article also examines the behavior of this elasticity during the 1970s, a period of substantial financial innovation. Some analysts contend that the interest elasticity of Ml demand might have been high even before the financial deregulation occurred. If that is correct, the recent strength in Ml demand should have been predictable. The article presents some additional evidence on this issue.

The plan of this article is as follows. Section I presents the methodology that underlies the empirical work reported here. Section II presents the empirical results. Section III contains the summary remarks. The article also contains an Appendix that discusses some issues that arise as a result of the form in which money demand regressions have been estimated here.

I.
ESTIMATING METHODOLOGY

A money demand regression that includes intercept and slope dummy variables is used to examine whether financial innovation and deregulation have changed the parameters of the standard money demand function. The estimated money demand regression is

$$\begin{aligned}\Delta \ln(M/P)t = {} & a_0 + b(L)\,\Delta \ln y_t + c(L)\,\Delta \ln R_t + \\ & d(L)\,\Delta \ln P_t + a_1\,D74 + a_2\,D81 + \\ & b(L)\;D74 * \Delta \ln y_t + c(L)\;D74 * \\ & \Delta \ln R_t + b(L)\;D81 * \Delta \ln y_t + \\ & c(L)\;D81 * \Delta \ln R_t + U_t \qquad (1)\end{aligned}$$

where M is nominal money balances (currency plus total checkable deposits), y measures real income, R is the nominal interest rate and P is the price level. D74 and D81 are the dummy variables that equal 1 in the periods 1974:01-1980:12 and 1981:0l-1985:03, respectively and zero otherwise. b(L), c(L), and d(L) are polynomials in the lag operator L, defined by $L^{x}_{s} = X_{t-s}$. Simply, polynomials in (1) imply that current as well as past values of real income, the interest rate, and the price level influence the demand for real money balances. The real income- and interest rate-interaction variables (like D74 * Δ1nX) are formed by taking products of the interest rate, real income, and the zero/one dummy variables. The statistical significance and the signs of the estimated coefficients on the interest rate-interaction dummy variables in the regression (1) are used to examine whether the interest rate elasticity has changed over time.

The money demand regression (1) is standard in the sense that real money demand depends only upon real income and a nominal interest rate. However, it differs in several ways from the form in which money demand regressions are usually estimated. First, it is estimated freely by simple distributed lags. It therefore avoids the more popular Koyck-lag specification in which geometric lag shapes are imposed on the distributed-lag coefficients of the independent variables. It does so because the point-estimates of long-term income and interest elasticities could be sensitive to restrictions imposed on the lag shapes. Second, it enters the price level in a distributed lag form. Now standard theoretical models of transaction demand for money typically assume that the price level elasticity of the demand for real money balances is zero. If this assumption is correct, the distributed-lag coefficients on the price level in the money demand regression (1) should sum to zero. However, the standard money demand theory does not say much about the speed with which real money demand adjusts over time.6 If changes in the price level affect the demand for money with a lag, the individual distributed-lag coefficients on the price level in (1) would differ from zero.

The price level directly enters the money demand regression (1). The treatment of the price level in (1) thus differs from the one found in standard money demand regressions based on the real-partial adjustment hypothesis. The latter simply assumes that prices affect real money demand without lag and imposes this assumption on the data.[6] Third, the money demand regression here is estimated in the first difference form. The general use of differencing reduces the possibility of spurious regression results.? A recent study by Layson and Seaks (1984) concluded that the first-difference version of the money demand specification is statistically preferable to its level form.[8]

The constant term in the money demand regression (1) captures the influence of time trend on the demand for real money balances. Time trend is a proxy variable for technological progress in the financial system and captures, though imperfectly, the influence of changes in the cash management techniques and other financial innovations on money demand.[9] The estimated coefficient on this variable-the constant term in (1)-is generally negative, implying that the demand for real money balances has trended downward over time. This has determined, to some extent, the secular upward trend in Ml velocity.[10] Some analysts contend that the introduction of interest paying NOM's and Super NOWs might have blunted the more aggressive use of cash management by the public. If that is correct, the trend growth rate of Ml velocity could decline. This possibility is investigated by entering also an intercept dummy (D8l) in (1). Furthermore, several analysts have already documented that the parameters of the money demand regression had not been stable even over the late 1970s.[11] Additional zero/one dummy variables, defined from 1974 to 1980, are also included to control for the effect of financial innovations on the parameters of the money demand function in the 1970s.[12]

Suppose the inclusion in Ml of interest-bearing assets like NOWs and Super NOWs is responsible for the change in the interest elasticity of money demand. If so, then one should not expect to find any change in the interest elasticity of the old components of Ml such as demand deposits. This implication can be tested by estimating the money demand regression (1) for the demand deposits component of Ml.

II.
THE EMPIRICAL RESULTS

The various monthly money demand regressions were estimated from 1961:0l to 1985:03. Table I contains the regressions for Ml demand. Table II

[5] Goodfriend (1983) has argued that the lags found in the estimated money demand regressions could arise from the presence of measurement errors in the relevant independent variables.

[6] Spencer (1985) presents empirical evidence that strongly rejects the assumption that the price level affects the demand for real money without lag. See also Gordon (1984).

[7] Granger and Newbold (1974), Plosser and Schwert (1978), and Plosser, Schwert, and White (1982).

[8] A word of caution is in order. While first differencing does guard against spurious regression, it is not well suited to detecting a level shift in the demand for real money balances. For the latter, it might be useful to consider also the level specification.

[9] Lieberman (1977, 1979).

[10] This point can be seen as follows. Ignoring for the moment the dummy variables, the money demand regression estimated here can be expressed as

$$\Delta \ln M - \Delta \ln P = -a_0 + a_1 \Delta \ln y - a_2 \Delta \ln R \quad (9$$

where a_1 and a_2 measure respectively the long-term income and interest rate elasticities of Ml demand and where a_0 measures the secular rate of decline in the demand for real money balances. One can transform this expression into the velocity growth equation. Subtracting Δ1nY from both sides of (i) and using the result that Δ1nY equals Δ1ny plus Δ1nP we can rewrite (i) as in (ii)

$$\Delta \ln Y - \Delta \ln M = a_0 + (1-a_1)\Delta \ln y + a_2 \Delta \ln R \quad (ii)$$

One can view (ii) as the velocity growth equation consistent with the money demand equation (i). If the long-term income elasticity is unity and if there is no trend in the growth rate of the nominal interest rate, then the trend in the growth rate of Ml velocity is determined by the parameter a_0. Hence, changes occurring in the intercept of the money demand regression (i) can indicate changes occurring in the underlying trend growth rate of M1 velocity.

[11] See, for example, Cagan and Schwartz (1975), Goldfeld (1976), Simpson and Porter (1980), Judd and Scadding (1982), and Dotsey (1983).

[12] The sum of coefficients on the interest rate (real income) variable provides an estimate of the long-term interest (income) elasticity over the earlier period 1959-1973. The sum of coefficients on the interest-interaction (income-interaction) dummy variable can then be used to test whether or not the interest rate (the income) coefficient in the relevant subperiod differs from the one in the earlier period 1959-1973. If the sum of coefficients on the interaction variable is statistically significant, it implies that a shift in the long-run value of the regression coefficient has occurred over the relevant subperiod. The sign and size of this sum would then indicate the nature and the magnitude of the presumed shift in the parameter.

reports the regressions for the transaction deposits component of Ml, with and without including other checkable deposits in the transaction deposits. Table III presents simulation results and actual Ml growth from 1981:01 to 1985:03.

The Ml Demand Regressions

Three money demand regression equations are reported in Table I. Equation (1) includes all the intercept and slope dummy variables. Equation (2) retains only the interest rate dummy variables, because they alone are statistically significant. Equation (3) is similar to equation (2) except that the opportunity cost of holding money is measured as the difference between the market interest rate and the own rate of return on M1.[13,14]

These regression results suggest several inferences : First, the interest elasticity of money demand has increased during the last few years. The sum of distributed-lag coefficients on the interest rate-interaction dummy variables is negative and statistically significant (see the t values on D81 * Δ1nR in equations (1) and (2), Table I). For the period 1981:0l-1985:03 these money demand regressions yield an interest elasticity substantially higher than

[13] Each money demand regression includes the current and lagged values of changes in the price level. In each, the sum of the estimated distributed-lag coefficients on the price level was not significantly different from zero. Therefore, the coefficients are constrained to sum to zero. This implies that the price level elasticity of demand for real money balances. is zero. However, several individual distributed-lag coefficients were significant, suggesting lags in the effect of the price level on money demand. These results are in line with the findings reported in Spencer (1985). See the Appendix to this article for details and further results.

[14] The own rate of return on Ml was approximated by the weighted average of the nominal returns offered on NOWs and Super NOWs, with weights given by their respective shares in Ml. See Cagan (1983) and Taylor (1985) for a similar approach.

Table I

FORMAL TESTS OF A CHANGE IN MONEY DEMAND PARAMETERS, MONTHLY MONEY DEMAND REGRESSIONS; 1961:01-1985:03

Equation 1

$$\Delta \ln(M/P) = \underset{(-2.4)}{-.002} + \underset{(4.3)}{.99}\,\Delta \ln y - \underset{(-5.0)}{.07}\,\Delta \ln R - \underset{(-1.3)}{.001}\,D74 + \underset{(.3)}{.10}\,D74 * \Delta \ln y + \underset{(1.4)}{.03}\,D74 * \Delta \ln R +$$

$$\underset{(-.01)}{.000}\,D81 + \underset{(.93)}{.38}\,D81 * \Delta \ln y - \underset{(-3.2)}{.11}\,D81 * \Delta \ln R$$

$\bar{R}^2 = .49$ SER = .00349 Rho = 0 DW = 2.0

Equation 2

$$\Delta \ln(M/P) = \underset{(-3.0)}{-.002} + \underset{(7.1)}{.99}\,\Delta \ln y - \underset{(-6.4)}{.06}\,\Delta \ln R - \underset{(-1.7)}{.001}\,D74 + \underset{(1.6)}{.001}\,D81 - \underset{(-3.0)}{.08}\,D81 * \Delta \ln R$$

$\bar{R}^2 = .45$ SER = .00366 Rho = 0 DW = 1.93

Equation 3

$$\Delta \ln(M/P) = \underset{(-3.6)}{-.002} + \underset{(7.2)}{1.0}\,\Delta \ln y - \underset{(-6.5)}{.06}\,\Delta \ln(R-R_m) - \underset{(1.8)}{.001}\,D74 + \underset{(1.3)}{.001}\,D81 - \underset{(-2.7)}{.06}\,D81 * \Delta \ln(R-R_m)$$

$\bar{R}^2 = .448$ SER = .00366 Rho = 0 DW = 1.94

Notes: 1n is the natural logarithm, Δ is the first difference operator, M is M1, R is the commercial paper rate, y is the real personal income, P is the personal consumption expenditure deflator, and R_m is the weighted average of the rates paid on NOW and Super NOW accounts with weights given by their relative shares in MI. D74 and D81 are the zero/one dummy variables, taking values 1 respectively in the periods 1974-1980 and 1981-1985 and zero otherwise. D * Δ1n X is formed simply by taking the product of the zero/one dummy variable D and the X variable. The estimated coefficients on the income and interest rate variables are the sum of the coefficients that are estimated with a simple distributed lag and therefore provide estimates of the relevant long-term elasticities. 1ny includes 8 contemporaneous and lagged terms; 1nR, 9 such terms. The money demand regressions always included current and three logged values of the price level, the distributed-lag coefficients on the price level constrained to sum to zero. The regressions were estimated by the Hildreth-Lu estimation procedure. The lag lengths were chosen to maximize adjusted R^2. SER is the standard error of regression, Rho is the first order serial correlation coefficient, and DW is the Durbin-Watson statistic. Figures in the parentheses ore the t values.

that obtained from the earlier part of the sample period.[15] Second, the contention that the public's Ml demand function has recently been more interest-sensitive appears robust when one defines opportunity cost as the difference between the market rate of interest and the own rate of return on Ml. There is a marginal reduction in the sum of the estimated distributed-lag coefficients on the interest rate-differential-interaction dummy variables. But this sum is negative and statistically significant (see the t value on D81 * Δln(R-Rm) in equation 3, Table I). Third, no significant shift appears to have occurred in the income elasticity of money demand. In fact, these money demand regressions provide point estimates of income elasticity which are closer to unity for most of the period studied here. Fourth, except for a leftward shift that occurred in the public's demand for real money balances, these regressions imply that other long-run parameters of the Ml demand function did, not change during the 1970s (see equation (1) in Table I). In particular, it appears that the financial innovations of the 1970s did not raise the interest elasticity of Ml demand during that period.[16] Finally, the constant term captures the influence of a time trend on the holdings of real money balances and is estimated to be -.002, suggesting a secular decline of about 2.4 percent per annum (-.002X1200) in the holdings of real money balances. The intercept dummy D81 tests for a change in the secular rate of decline in the demand for real money balances. The coefficient on the intercept dummy is .00l, which is positive but not statistically significant at the conventional significance levels (see t values in equations 2 and 3 in Table I). Since the constant term in the money demand regression helps determine the trend growth rate of Ml velocity, the low t value on the intercept dummy variable suggests no significant shift in the underlying trend rate of Ml velocity. However, the absolute size of the estimated coefficient on it is relatively large, suggesting considerable caution in the conclusion that no change has occurred in the secular growth rate of Ml velocity.

The Transaction Deposits Regressions

Table II reports the regressions testing for shifts in the interest elasticity of the transaction deposits component of Ml. Equation 2.1 excludes from transactions deposits other checkable deposits component whereas equations 2.2 and 3.1 retain them. The latter two regressions differ in their measure of the opportunity cost variable. In the money demand regression that excludes other checkable deposits, the shift variables on the interest-elasticity parameter are not statistically significant. When other checkable deposits are included in the transaction deposits, however, the same shift variables on the interest-elasticity parameters turn out to be statistically significant (compare the t values on D81 * Δ1nR in

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[15] Many previous studies have used two interest rates, typically the commercial paper rate and another rate such as the rate on time deposits. In the regressions above, only the former variable is used. However, adding a time deposit rate-measured here by the Fitzgerald rate-to the above regressions does not alter the conclusion that the interest-sensitivity of the Ml money demand function has increased. For example, estimating the money demand equation that includes the Fitzgerald rate yielded the following regression:

$$\begin{aligned}\Delta \ln(M/P) = & \underset{(-2.4)}{-.002} + \underset{(5.3)}{.99}\,\Delta \ln y - \underset{(2.8)}{.04}\,\Delta \ln R - \\ & \underset{(1.8)}{.04}\,\Delta \ln FITZ - \underset{(-.9)}{.001}\,D74 + \\ & \underset{(.4)}{.0005}\,D81 - \underset{(2.0)}{.11}\,D81 * \Delta \ln R + \\ & \underset{(.7)}{.038}\,D81 * \Delta \ln FITZ ;\end{aligned}$$

Sample Period = 1969:01-1985:03 $\bar{R}^2 = .46$

SER = .0039 Rho = .1 DW = 2.0

The sum of coefficients on the interaction terms involving the market interest rate (R) is still negative and statistically significant, whereas the same is not true for the other interest rate (FITZ). Since the data on the Fitzgerald rate are available beginning 1968, the estimation period for this money demand regression begins in 1969. The Fitzgerald rate is the measure of the highest effective yield available on time deposits that have usually been subject to Regulation Q. The data on this variable are from the Board's Monthly Money Market Model.

[16] Some analysts have suggested that financial innovations might have affected the interest elasticity of money demand in 1976, not in 1974 as assumed in this article. This view contends that the fundamental changes occurring in transactions technologies in 1974-1975 might have affected money demand behavior in the post-1975 period. If so, then the dummy variable defined as unity over 1974-1980 might fail to detect the change in the interest elasticity of money demand over 1976-1980. One simple way to test the above view is to redefine the dummy variable to be unity over 1976-1980 (DF). The money demand regression- that includes the redefined intercept and slope dummy variables is estimated over 1961-1980. The estimated regression is

$$\begin{aligned}\Delta \ln(M/P) = & \underset{(-6.4)}{-.003} + \underset{(9.4)}{1.1}\,\Delta \ln Y - \underset{(-5.7)}{.06}\,\Delta \ln R + \\ & \underset{(.12)}{.000}\,DF - \underset{(-.25)}{.005}\,DF * \Delta \ln R\end{aligned}$$

$\bar{R}^2 = .51$ SER = .00327 Rho = $\underset{(0)}{0}$

DW = 2.0

As can be seen, the sum of coefficients on the interest rate-interaction dummy variables, though negative, is not different from zero, confirming the earlier finding that the interest elasticity of Ml demand did not increase in the 1970s.

Table II

DISAGGREGATED MONEY DEMAND REGRESSIONS; 1961:01-1985:03

Equation 2.1: Demand Deposits

$$\Delta \ln(DD/P) = \underset{(-2.3)}{-.003} + \underset{(4.4)}{1.1\ \Delta \ln y} - \underset{(-4.9)}{.10\ \Delta \ln R} - \underset{(-2.3)}{.003\ D74} - \underset{(-3.9)}{.005\ D81} - \underset{(-.4)}{.019\ D81 * \Delta \ln R}$$

$\bar{R}^2 = .48$ SER = .00536 Rho = .3 (5.4) DW = 1.97

Equation 2.2: Demand Deposits and Other Checkable Deposits

$$\Delta \ln((DD+OCD)/P) = \underset{(-3.7)}{-.003} + \underset{(6.3)}{1.1\ \Delta \ln y} - \underset{(-6.2)}{.08\ \Delta \ln R} - \underset{(-2.0)}{.001\ D74} + \underset{(1.4)}{.001\ D81} - \underset{(-3.0)}{.10\ D81 * \Delta \ln R}$$

$\bar{R}^2 = .41$ SER = .00465 Rho = 0.0 DW = 1.95

Equation 3.1: Demand Deposits and Other Checkable Deposits; Including the Proxy Variable for the Return on Deposits

$$\Delta \ln((DD+OCD)/P) = \underset{(3.7)}{-.003} + \underset{(6.3)}{1.1\ \Delta \ln y} - \underset{(-5.9)}{.07\ \Delta \ln(R-R_m)} - \underset{(-2.0)}{.001\ D74} + \underset{(1.1)}{.001\ D81} - \underset{(-2.6)}{.08\ D81 * \Delta \ln(R-R_m)}$$

$\bar{R}^2 = .41$ SER = .00465 Rho = 0.0 DW = 1.96

Notes: DD is demand deposits and OCD is the other checkable deposits. See Notes in Table I for an explanation of the remaining variables.

equations 2.1 and 2.2 in Table II). Redefining the opportunity cost variable to include the own rate of return on money does not alter the above result, though there is a marginal reduction in the sum of the coefficients on the interest rate variable (the sum of coefficients on D81 * D1n(R-R_m) is now -.08 and has a t value -2.6; see equation 3.1 in Table II). Evidently the inclusion in Ml of NOWs and Super NOWs increases interest-sensitivity of the Ml demand function

Explaining the Actual Behavior of Ml during the Early 1980s

Suppose the public's Ml demand has become more interest sensitive during the 1980s. Would this new money demand regression be consistent with the actual pattern of money growth observed over the period 1981:0l-1985:03? The prediction errors that are presented in Table III suggest a cautious yes answer. Two sets of errors that occur in predicting the quarterly levels and growth rates of nominal money balances are presented. One set assumes that the interest elasticity of money demand has not increased during the 1980s. The money demand regression that omits the pertinent dummy variables is estimated over the period 1961:0l-1985:03 and simulated within-sample over the period 1981:0l-1985:03; the errors in predicting nominal money balances are given in Columns Al and AZ, Table III. The other set of errors is generated under the assumption that the interest elasticity of money demand had increased since 1981. The money demand regression containing the relevant dummy variables is estimated over the entire sample period and the estimated coefficients are used to generate the sample errors (see errors in Columns B1 and B2, Table III). A comparative analysis of the mean and the root mean squared error statistics clearly suggests that the pattern of money growth predicted by this more interest-sensitive money demand regression is not inconsistent with the actual behavior of money growth over the interval 1981:0l to 1985:03.

Redefining the opportunity cost variable to include the own rate of return on Ml reduces but does not eliminate the prediction errors over the recent period (see Table IV). It is only under the assumption that Ml demand is more sensitive to the interest-rate differential that the prediction errors of the standard money demand regression are reduced further over the period 1981:0l-1985:03 (compare the mean and root mean squared error statistics in Tables III and IV).

Table III

SIMULATION RESULTS, 1981Q1-1985Q1: PERCENTAGE ERROR IN PREDICTING NOMINAL MONEY BALANCES

	No Change in the Interest Elasticity of Money Demand; Within-Sample Errors		A Higher Interest Elasticity of Money Demand; Within-Sample Errors	
Year/Quarter	Al Quarterly levels	A2 Quarterly Changes	Bl Quarterly Levels	B2 Quarterly Changes
1981Q1	.42	1.68	- .33	- 1.34
1981Q2	.98	2.28	-.19	.57
1981Q3	- .01	- 3.90	-1.21	- 4.18
1981Q4	- .41	- 1.72	- 1.91	- 2.87
1982QI	.17	2.36	- 1.61	1.24
1982Q2	- .07	- .99	- 2.38	-3.19
1982Q3	.17	.98	- 2.20	.75
1982Q4	1.99	7.47	- 1.67	2.24
1983QI	2.71	2.84	- 2.02	- 1.48
1983Q2	4.35	6.47	- 1.22	3.35
1983Q3	5.80	5.63	.30	6.24
1983Q4	6.07	1.05	.49	.74
1984Q1	5.38	- 2.68	- .03	-2.11
1984Q2	5.50	.46	.11	.57
1984Q3	5.65	.57	.49	1.55
1984Q4	5.46	- .72	.13	- 1.45
1985Q1	6.02	2.17	- .05	- .76
Mean Error	**2.95**	**1.41**	**- .78**	**- .01**
RMSE	**3.91**	**3.30**	**1.27**	**2.52**

Notes: Errors in the columns labeled Quarterly Levels are calculated as the difference between the actual and predicted level, divided by the predicted level of nominal money balances. Errors in the columns labeled Quarterly Changes are calculated as the difference between the actual and predicted quarterly growth rates of nominal money balances. The predicted values-used in calculating these errors were generated in two ways. For the errors in columns B1 and B2 the predicted values used ore from the money demand regression 2 summarized in Table I. For the errors in columns Al and A2 the predicted values used ore from the money demand regression 2 that was reestimated omitting all the interest rate-interaction dummy variables; this amounts to assuming no change in the interest elasticity of money demand over the 1980s. RMSE is the root mean squared error.

III.

CONCLUDING REMARKS

The evidence presented here suggests that the interest elasticity of the public's Ml demand has increased during the last few years. Furthermore, it is the inclusion in Ml of interest-bearing assets such as NOWs and Super NOWs which accounts for this increase. The demand deposits component of Ml demand does not exhibit any increased interest sensitivity during the same period. Since interest rates, both nominal and real, have trended downward during the last few years, the strength in Ml demand and the consequent decline in the growth rate of Ml velocity are predictable.

As explained before, one of the reasons for the rise in the interest elasticity of Ml demand is that the own rate on some assets in Ml like NOWs is regulated and kept below the market interest rate. A given change in market rates thus causes a larger proportional change in the opportunity cost of holding NOWs. As a result, changes in market rates might

Table IV

SIMULATION RESULTS, 1981Q1-1985Q1: PERCENTAGE ERROR IN PREDICTING NOMINAL MONEY BALANCES

	No Change in the Opportunity Cost Elasticity of Money Demand; Within-Sample Errors		A Higher Opportunity Cost Elasticity of Money Demand; Within-Sample Errors	
Year/Quarter	AI Quarterly Levels	A2 Quarterly Changes	BI Quarterly Levels	B2 Quarterly Changes
1981QI	.39	- 1.60	- .33	- 1.34
1981Q2	.92	2.11	- .20	.53
1981Q3	- .51	- 3.95	- 1.28	- 4.40
1981Q4	-.51	- 1.84	- 1.98	- 3.91
1982QI	.04	2.26	- 1.62	1.52
1982Q2	- .20	- .97	- 2.33	- 2.94
1982Q3	.04	.98	-2.12	.84
1982Q4	1.74	6.96	- 1.55	2.44
1983QI	2.25	2.04	- 1.93	- 1.60
1983Q2	3.72	5.83	- 1.23	2.93
1983Q3	5.15	5.59	.22	5.90
1983Q4	5.43	1.07	.38	.63
1984Q1	4.73	- 2.68	-.11	- 1.99
1984Q2	4.88	.58	.07	.71
1984Q3	5.13	.93	.49	1.72
1984Q4	4.93	- .75	.14	- 1.44
1985Q1	5.33	1.57	- .06	- .85
Mean Error	2.60	1.25	- .79	-.01
RMSE	3.47	3.10	1.24	2.49

Notes: Errors in the columns labeled Quarterly Levels ore calculated as the difference between the actual and predicted level, divided by the predicted level of nominal money balances. Errors in the columns labeled Quarterly Changes are calculated as the difference between the actual and predicted quarterly growth rates of nominal money balances. The predicted values used in calculating these errors were generated in two ways. For the errors in columns B1 and B2 the predicted values used are from the money demand regression 3 summarized in Table 1. For the errors in columns Al and A2 the predicted values used ore from the money demand regression 3 that was reestimated omitting all the interest rate-interaction dummy variables; this amounts to assuming no change in the opportunity cost elasticity of money demand over the 1980s. RMSE is the root mean squared error.

induce larger changes in NOWs. Ml would then appear more sensitive to interest rate swings as NOWs become a larger fraction of Ml.

But as of January 1986 the regulatory constraint on the rate payable on NOWs has been removed. The rate payable on Super NOWs is already unregulated. One would then expect that the own rates of return on the interest-bearing components of Ml would move with market interest rates. If so, the increase observed in the interest elasticity of money demand could fade away.

Our findings also suggest that the interest elasticity of Ml demand did not change during the 1970s, a period of substantial financial innovation. Additional work presented in the Appendix shows that for the period 1961-1980 the interest elasticity is estimated to be below other reports. Taken together, these results further bolster the view that it is partial financial deregulation, as opposed to financial innovation, that has made Ml more responsive to market rates during the last few years.

A word of caution is in order. The conclusion that

Ml demand has become more interest sensitive must however be considered tentative, The issue of the stability of the interest elasticity of money demand has been examined in the context of the standard money demand regression. The latter treats the demand for real money balances as depending upon a scale variable (measured here by real income) and an opportunity cost variable (measured either by the market interest rate or by the difference between the market interest rate and the own rate on Ml). No attempt is made to check the robustness of these findings to alternative specifications of the Ml demand function. To that extent, the results presented here must be treated with caution.

APPENDIX

This Appendix examines two additional questions raised by the empirical results presented in the text. First, why do some standard money demand regressions yield very high point estimates of the interest elasticity even for the earlier period 1960 to 1980? Second, should one estimate the money demand regressions under the assumption that the price level has no effect on the demand for real money balances?

The interest Elasticity of Ml Demand: Was It High or Low during the Period 1961-1980?

For the period 1961-1980 the monthly money demand regressions reported here yield the point estimates of the interest rate elasticity close to -.07. They appear quite low when compared with the estimates obtained from some standard money demand regressions. The latter is estimated in level form and includes as an explanatory variable the lagged dependent variable.[17] Are the differences that exist in the point estimates of interest elasticity related to the form in which money demand regressions are estimated? The results presented below suggest this to be the case.

In order to highlight the differences between the standard money demand regression and that estimated in this article, let us first derive the standard versions from the monthly money demand regression (1). Ignoring for the moment the dummy variables, the standard lagged-dependent varaible versions of the money demand regression can be derived from the equation (1) by imposing the following restrictions on lag structures.

$$b(L) = b_1 \lambda \sum_{s=0}^{\infty} (1-\lambda)^s \lambda^s = (b_1 \lambda)/[1-(1-\lambda)L] \qquad (2a)$$

$$c(L) = c_1 \lambda \sum^{\infty} (1-\lambda)^s \lambda^s = (c_1 \lambda)/[1-(1-\lambda)L] \qquad (2b)$$

$$d(L) = 0 \qquad (2c)$$

$$d(L) = (\gamma-1) + \gamma \sum_{s=1}^{\infty} (1-\lambda)^s L^s = [(\gamma-1) + (1-\gamma)L]/[1-(1-\lambda)L] \qquad (2d)$$

$$a_0 = 0 \qquad (2e)$$

Restrictions (2a) and (2b) impose geometrically declining lag structures on income and interest rate variables. Restriction (2c) has two implications:[18] (1) the price level elasticity of the demand for real money balances is zero, i.e., the sum of distributed lag coefficients on the price level is zero; (2) the demand for real money balances adjusts to the price level with no lags, i.e., each of the distributed lag coefficients on the price level is zero. Restriction (2e) amounts to assuming that time trend has no influence on the holdings of real money balances. Substituting (2a), (2b), (2c) and (2e) into (l), ignoring dummy variables, yields the money demand regression (3a).

$$\Delta \ln (M/P) = (b^1\lambda)/[1-(1--\lambda)L]\ \Delta \ln y_t + (c_1\lambda)/[1-(1-\lambda)L]\ \Delta \ln R \qquad (3a)$$

Alternatively, (3a) could be expressed as follows:

$$\Delta \ln (M/P) = b_1\lambda\ \Delta \ln y_t + c_1\lambda\ \Delta \ln R_t + (1-\lambda)\Delta \ln (M/P)_{t-1} \qquad (3b)$$

The money demand regression (3b), popularly known as the real-partial adjustment model of money demand, is one of the lagged dependent variable

[17] For example, for almost similar sample periods the interest elasticity is estimated to be -.13 in Judd and Motley (1984) and -.16 in Hafer and Hein (1984).

[18] Mehra (1978) and Spencer (1985).

versions of the standard money demand function. Another version, known as the nominal partial adjustment model of money demand, is obtained if we assume that lags do exist in the adjustment of real money balances to changes in the price level. But we retain the assumptions that the long-run price level elasticity of the demand for real money balances is zero and that the lag shape on the price level variable is geometric. These assumptions imply that d(L) follows the restriction (2d). Substituting (2a), (2b), (2d) and (2e) into (1) yields the following:

$$\Delta \ln (M/P) = b_1\lambda \, \Delta \ln y + c_1\lambda \, \Delta \ln R + (1-\lambda) \ln (M_{t-1}/P) \quad (4)$$

The money demand regressions (3b) and (4) and their level versions were estimated over the common sample period 1961-1980. They were also estimated with a time trend. Presented in Table V are the estimates of the interest elasticity of money demand. They show that the estimates of the interest elasticity that are obtained from the level versions of the standard money demand regression are substantially higher than the ones obtained from the relevant first-difference versions. In the level versions the estimates of the interest elasticity are also sensitive to the exclusion of the time trend variable. This suggests that high estimates of the interest elasticity derived from some level versions of the standard money demand regression are not robust and must be treated with considerable caution.

Testing the Price Level Elasticity Assumption

As stated before, the simple theoretical models of the transaction demand for money imply that the price level eIasticity of the demand for real money balances is zero. In estimating the money demand regressions this restriction on the price level elasticity has been imposed on the data, i.e., the coefficients on the price level are constrained to sum to zero.

Does relaxing the constraint on the price level elasticity alter any of the conclusions about the interest elasticity of Ml demand ? Table VI reports the regressions pertinent to answer that question. Equation 6.1 is the money demand regression that includes all the relevant intercept and slope dummy variables but is estimated without imposing the constraint that the coefficients on the price level sum to zero. Equation 6.2 is similar to Equation 6.1 except

Table V

INTEREST ELASTICITIES OF THE STANDARD MONTHLY MONEY DEMAND EQUATIONS, 1961-1980

	Long-Run Elasticity	
	Time Trend Excluded	Time Trend Included
Level Form		
Real-Partial Adjustment Equation	- .23	- .09
Nominal-Partial Adjustment Equation	-.21	- .08
First Difference Form		
Real-Partial Adjustment Equation	- .03	- .02
Nominal-Partial Adjustment Equation	- .03	- .04

Notes: The estimates of the long-run interest elasticity are from the following money demand regressions.

Level Form

$$\ln(M/P) = a + b \ln y + c \ln R + d \ln(M/P)_{-1} + g \, D74 + h \, TT$$

$$\ln(M/P) = \tilde{a} + \tilde{b} \ln y + \tilde{c} \ln R + \tilde{d} \ln(M_{-1}/P) + \tilde{g} \, D74 + \tilde{h} \, TT$$

First Difference Form

$$\Delta \ln(M/P) = b \, \Delta \ln y + c \, \Delta \ln R + d \, \Delta \ln(M/P)_{-1} + e \, D74 + \text{constant}$$

$$\Delta \ln(M/P) = \tilde{b} \, \Delta \ln y + \tilde{c} \, \Delta \ln R + \tilde{d} \, \Delta \ln(M_{-1}/P) + \tilde{e} \, D74 + \text{constant}$$

The regressions are estimated by the Hildreth-Lu estimation procedure. TT is time trend. For an explanation of the variables see the Notes in Table 1.

Table VI

FORMAL TESTS OF A CHANGE IN MONEY DEMAND PARAMETERS ESTIMATED WITHOUT IMPOSING THE PRICE LEVEL ELASTICITY CONSTRAINT ON THE DATA; 1961:01-1985:03

Equation 6.1

$$\Delta \ln(M/P) = \underset{(-1.3)}{-.001} + \underset{(4.1)}{.93}\,\Delta \ln y - \underset{(-4.4)}{.06}\,\Delta \ln R - \underset{(-.38)}{.000}\,D74 + \underset{(.15)}{.04}\,D74 * \Delta \ln y + \underset{(1.5)}{.023}\,D74 * \Delta \ln R +$$

$$\underset{(.29)}{.000}\,D81 + \underset{(.76)}{.31}\,D81 * \Delta \ln y - \underset{(-3.1)}{.11}\,D81 * \ln R - \underset{(-6.8)}{.74}\,\Delta \ln P_t + \underset{(2.5)}{.28}\,\Delta \ln P_{t-1} +$$

$$\underset{(2.1)}{.24}\,\Delta \ln P_{t-2} + \underset{(.52)}{.06}\,\Delta \ln P_{t-3}$$

$\bar{R}^2 = .49$ SER $= .00332$ Rho $= \underset{(-1.5)}{.1}$ DW $= 1.92$

Sum of Coefficients on the Price level = -.20 (- 1.2)

Equation 6.2

$$\Delta \ln(M/P) = \underset{(-1.3)}{-.001} + \underset{(4.1)}{.93}\,\Delta \ln y - \underset{(-4.4)}{.06}\,\Delta \ln(R-R_m) - \underset{(-.40)}{.000}\,D74 + \underset{(.15)}{.04}\,D74 * \Delta \ln y +$$

$$\underset{(1.5)}{.027}\,D74 * \Delta \ln(R-R_m) + \underset{(.09)}{.000}\,D81 + \underset{(.78)}{.32}\,D81 * \Delta \ln y - \underset{(-2.8)}{.09}\,D81 * \Delta \ln(R-R_m) -$$

$$\underset{(-7.2)}{.76}\,\Delta \ln P_t + \underset{(2.2)}{.23}\,\Delta \ln P_{t-1} + \underset{(2.4)}{.26}\,\Delta \ln P_{t-2} + \underset{(.62)}{.07}\,\Delta \ln P_{t-3}$$

$\bar{R}^2 = .49$ SER $= .00349$ Rho $= 0.0$ DW $= 2.1$

Sum of Coefficients on the Price Level = $-.20$ (-1.2)

Notes: All variables are as defined before. For the price level variable the individual coefficients are reported. See Notes in Table I for other details.

that it uses the alternative measure of the opportunity cost variable. The sum of coefficients on the income-interaction dummy variables is generally insignificant as before, but the sum of coefficients on the interest rate-interaction dummy variables though insignificant over 1974-1980 is not so over 1981:0l-1985:03 (see t values on these variables in Table VI). As regards the price level constraint the sum of coefficients on the price level is -.20 with a t value -1.2, suggesting that this sum is statistically not different from zero. However, the individual coefficients on the price level are statistically different from zero (see Table VI). These results suggest that the theoretical restriction on the price level elasticity is in conformity with the data and that relaxing this constraint does not alter any of the conclusions about the interest elasticity of Ml demand. The results also show that the demand for real money balances adjusts to the price level with lags, suggesting that the real partial adjustment version of the standard money demand regression is inconsistent with the data.

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A REVIEW OF BANK PERFORMANCE IN THE FIFTH DISTRICT, 1985

David L. Mengle and John R. Walter

The profitability of commercial banks in the Fifth Federal Reserve District[1] improved in 1985. Return on assets reached .98 percent and return on equity 15.41 percent, well above the average of the past seven years. In comparison, the corresponding figures for all banks in the United States were .70 percent and 11.33 percent. Such results, and those of the period since significant deregulation of banking began in 1980, indicate that Fifth District banks have been able to adjust well to a more competitive banking environment.

In the Fifth District, improved net interest margins and gains on sales of securities more than offset sharply increased provisions for loan and lease losses. In addition, net noninterest income improved somewhat from last year. The only item in which banks for the nation as a whole outperformed those in the Fifth District was noninterest income. Otherwise, net interest margins for all U. S. banks remained far enough below and loan and lease loss provisions far enough above those for the Fifth District to keep District profitability well above the national average.

Although higher loan and lease loss provisions reduced reported profitability levels, they also served to increase bank capital. In addition, retained earnings rose in 1985 relative to both assets and dividends. The resulting higher capital to asset ratios suggest that banks in the District took advantage of the opportunity provided by their improved performance to augment their capital rather than distribute the gains to stockholders.

Profits

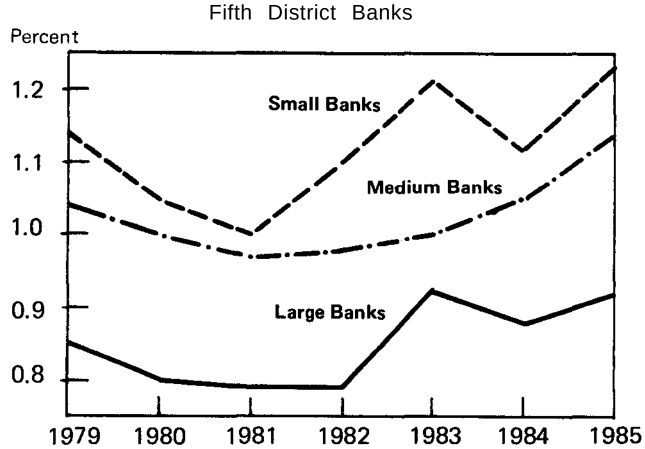
Return on assets (ROA) rose during 1985 from .93 to .98 percent of average assets for Fifth District banks (Table I). ROA also rose at the national level (see Appendix), but remains well below that for the Fifth District. While the District results are higher than the average of the previous six years, it appears that all U. S. banks are only beginning to reverse the steady decline in their ROA that has characterized the same period.

All three size classes of Fifth District banks enjoyed increases in ROA from 1984 levels (Chart 1). Small banks produced an ROA of 1.23 percent in 1985 while medium-sized banks produced 1.14 percent and large banks .92 percent. For large District banks, the improvement in net interest margin was more than offset by increases in loan and lease loss provisions, but noninterest income increased more than did noninterest expense. For small banks, noninterest expense increased slightly more than noninterest income, but the increase in loan and lease loss provision came nowhere near offsetting the increase in net interest margin. Medium-sized banks showed a small net interest margin improvement but had the lowest increase in loan and lease loss provisions. Securities gains ended up playing an important role in the increase in ROA for all three of the size classes.

Chart 1

RETURN ON ASSETS*

Fifth District Banks



*Net income divided by average assets.

[1] Maryland, the District of Columbia, Virginia, North and South Carolina, and most of West Virginia.

Table I

INCOME AND EXPENSE AS A PERCENT OF AVERAGE ASSETS[1]
FIFTH DISTRICT COMMERCIAL BANKS, 1979-1985

Item	1979	1980	1981	1982	1983	1984	1985
Gross interest revenue	8.49	9.46	11.15	10.86	9.58	10.02	9.48
Gross interest expense	4.53	5.60	7.29	6.93	5.82	6.33	5.70
Net interest margin	3.96	3.86	3.86	3.93	3.76	3.69	3.78
Noninterest income	0.80	0.90	1.01	1.03	1.16	1.15	1.22
Loan and lease loss provision	0.26	0.26	0.25	0.28	0.25	0.33	0.46
Securities gains (- losses)[2]						- 0.02	0.06
Noninterest expense	3.24	3.37	3.48	3.53	3.45	3.37	3.40
Income before tax	1.26	1.13	1.14	1.15	1.22	1.12	1.20
Taxes	0.28	0.20	0.19	0.18	0.22	0.19	0.22
Other[3]	- 0.04	- 0.04	- 0.09	-0.10	- 0.02	0.00	0.00
Return on assets[4]	0.94	0.89	0.86	0.87	0.98	0.93	0.98
Cash dividends declared	0.30	0.32	0.33	0.37	0.34	0.31	0.31
Net retained earnings	0.64	0.57	0.53	0.50	0.64	0.62	0.67
Return on equity[5]	13.51	12.79	12.56	13.12	15.21	14.62	15.41
Average assets ($ millions)	80,671	88,280	97,217	108,439	121,173	137,131	156,574

Note: Discrepancies due to rounding error.

[1] Average assets are based on fully consolidated volumes outstanding at the beginning and at the end of the year.

[2] Banks were required to report securities gains or losses above the tax line, on their income statements, for the first time in 1984.

[3] Includes securities and extraordinary gains or losses after taxes, for 1979-1983 data, and extraordinary items and other adjustments after taxes for 1984 and 1985 data.

[4] Return on assets is net income divided by average assets.

[5] Return on equity is net income divided by average equity. Average equity is based on fully consolidated volumes outstanding at the beginning and at the end *of* the year.

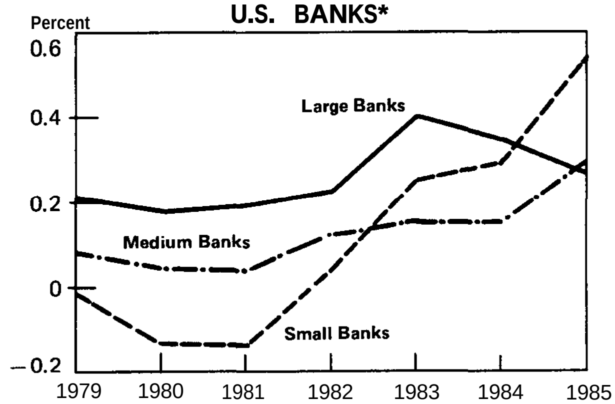
Source: Consolidated Reports of Condition and Income.

For the nation as a whole, ROA for both small and medium-sized banks actually fell. In Chart 2, the difference between Fifth District ROA and that for all U. S. banks is shown for each of the three size classes. While the differences for medium and large banks have remained positive for the years shown on the chart, the difference for small banks has gone from insignificant to negative to positive and increasing-a result of both the changes in small District banks' ROA shown in Chart 1 and the downward trend in small banks' ROA at the national level.

Fifth District banks improved their return on equity (ROE), which is net income divided by average equity capital, by 79 basis points in 1985 (Table II and Chart 3). All three size classes shared in this increase. District banks increased retained earnings as a percent of net income from 67 percent in 1984 to 68 percent in 1985, while banks at the national

Chart 2

DIFFERENCE IN RETURN ON ASSETS BETWEEN FIFTH DISTRICT AND U.S. BANKS*



*Return on assets for 5th District banks minus return on assets for all U.S. banks

Table II

RATES OF RETURN AND LEVERAGE FOR FIFTH DISTRICT COMMERCIAL BANKS

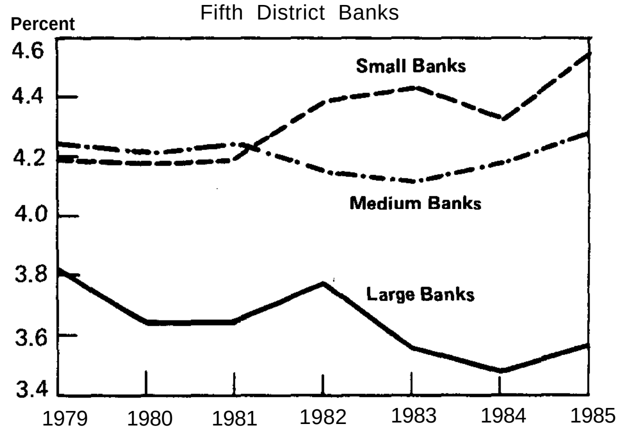
Year	Return on Assets		Assets/ Equity (Leverage)		Return on Equity
1979	0.94	x	14.37	=	13.51
1980	0.89	X	14.35	=	12.79
1981	0.86	X	14.56	=	12.56
1982	0.87	X	15.06	=	13.12
1983	0.98	X	15.53	=	15.21
1984	0.93	x	15.66	=	14.62
1985	0.98	X	15.72	=	15.41

Note: Discrepancies due to rounding error.

Chart 4

NET INTEREST MARGIN*

Fifth District Banks



*Net interest income divided by average assets.

level increased retained earnings from 52 to 53 percent. The higher retained earnings to net income ratio for the Fifth District suggests a greater than average preference for earnings retention as a means of capital growth.

Interest Margin

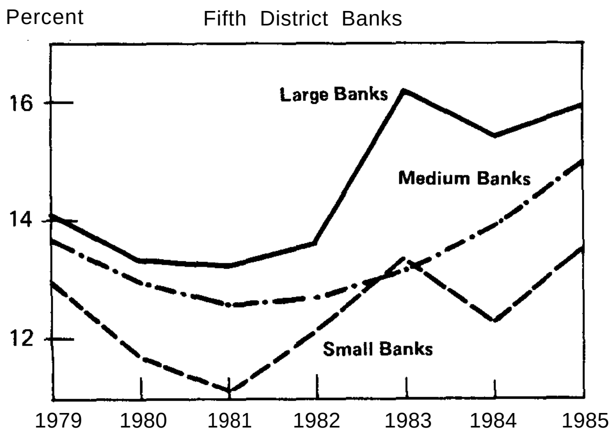
Net interest margin, which measures the difference between interest income and interest expense as a percentage of average assets, grew 9 basis points in the Fifth District in 1985. As Table I shows, the 1985 margin is not particularly high in comparison with the previous six years. At the national level, net interest margin increased by the same amount but to a higher level than any of the preceding six years (Appendix). Still, 1985 Fifth District net interest margin remained well above that for banks in the nation as a whole. Chart 4 shows that net margins increased for all three size categories of banks in the Fifth District. The following paragraphs will discuss the revenue and expense sides of margin performance.

Due largely to falling market interest rates (Chart 5), the ratio of interest revenue to average assets (gross interest ratio) at Fifth District banks fell 54 basis points during 1985. Average returns on both loan and securities portfolios fell by 67 basis points (Table III). As Chart 6 shows, the magnitude of the decline in gross interest ratios varied with bank size. Medium-sized Fifth District banks (total assets

Chart 3

RETURN ON EQUITY*

Fifth District Banks



*Net income divided by average equity

Chart 5

SELECTED INTEREST RATES 1982 - 1985

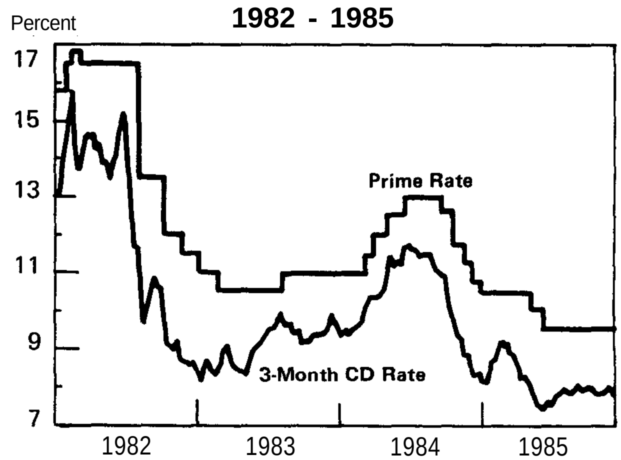


Table III

AVERAGE RATES OF RETURN ON SELECTED INTEREST-EARNING ASSETS FIFTH DISTRICT COMMERCIAL BANKS, 1979-1985

Item	1979	1980	1981	1982	1983	1984[2]	1985[2]
Total interest-earning assets	10.09	11.28	13.18	12.48	11.11	11.77	11.06
Total loans	11.25	12.50	14.48	14.14	12.38	12.59	11.92
Net load	11.37	12.63	14.64	14.30	12.53	12.74	12.08
Total securities	6.43	7.15	8.57	9.27	9.20	9.68	9.01

[1] Net loans are: total loans net of allowance for loan losses, for 1979-1983; total loans net of the sum of allowance for loan and lease losses and allocated transfer risk reserve, for 1984 and 1985.

[2] Total and net loans here include leases while in other columns they do not.

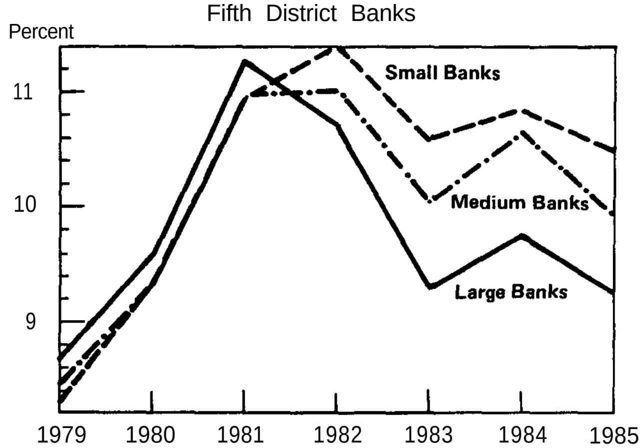
between $100 million and $750 million) had a far larger average decline than small (total assets less than $100 million) and large (greater than $750 million) banks.

Dissecting the declines in interest income helps to show why each size class performed differently in response to falling interest rates. Due to a less rate-sensitive loan structure, small banks experienced a smaller decline in interest income than either large or medium-sized banks. For example, 48 percent of small Fifth District banks' loans had remaining maturities of one year or less during 1985, while medium and large banks reported an average of 57 percent and 66 percent. In addition, 31 percent of small banks' total loans were home mortgages, compared to 21 percent for medium banks and 12 percent for large banks. Further, consumer loans, which are not particularly interest sensitive, comprised 35 percent of small banks' loans but only 30 percent for medium banks and 27 percent for large banks. Finally, small banks had only 19 percent of their loans in the more interest-sensitive category of commercial and industrial loans, compared with 26 percent for medium and 29 percent for large banks.

Chart 6

GROSS INTEREST RATIO*

Fifth District Banks



*Interest revenue divided by average assets.

The interest sensitivity of the asset portfolios of large Fifth District banks caused their interest income to decline more relative to interest-earning assets than was the case for small or medium-sized banks. Large banks, however, were able to slow the decline of interest income as a percent of average assets by increasing their proportion of earning assets to total assets. For that reason, large banks were able to limit the decline in their gross interest ratio to less than that for medium-sized banks.

Although Fifth District bank assets grew by more than 14 percent in 1985, loans grew even more so that they constituted a greater proportion of assets than at the end of 1984 (Table IV). Even as money center banks lost business to the commercial paper market, District banks increased their commercial and industrial loans. Home mortgage and agricultural loans were the only categories of loans to fall significantly. Securities also grew as *a* percent of assets.

Turning to the interest expense side of net interest margins, Fifth District banks enjoyed a 63 basis point decline in the interest expense to average assets ratio (Table I). Table V shows that cost of funds fell in 1985 for all categories of liabilities except subordinated debt.[2] As in all the past few years the change in the interest expense ratio was greater for

[2] Subordinated debt consists of fixed maturity debt obligations issued by a bank and subordinated to claims of depositors in case of insolvency.

Table IV

ASSET CATEGORIES AS A PERCENT OF TOTAL ASSETS
FIFTH DISTRICT COMMERCIAL BANKS
1984 AND 1985

	1984	1985
Securities	20.72	21.46
Loans and leases - total	58.08	59.77
Home mortgages	9.59	9.07
Commercial real estate and development loans	8.49	9.52
Commercial and industrial loans	16.53	16.59
Consumer loans	15.87	16.73
Other loans	7.27	7.26
Leases	0.74	0.89
Agricultural loans	0.81	0.75
Less: Unearned income on loans	- 1.22	- 1.05
Less: Allowance for loan and lease loss	-0.71	-0.81
Cash and due from balances	12.00	10.39
Fed funds	4.40	4.57
Other assets	5.51	4.62
Total	100.00	100.00

Note: Discrepancies due to rounding error.

the average of all U. S. banks than for Fifth District banks. Just as Fifth District assets are less sensitive to rate changes than the national average, so apparently are District liabilities.

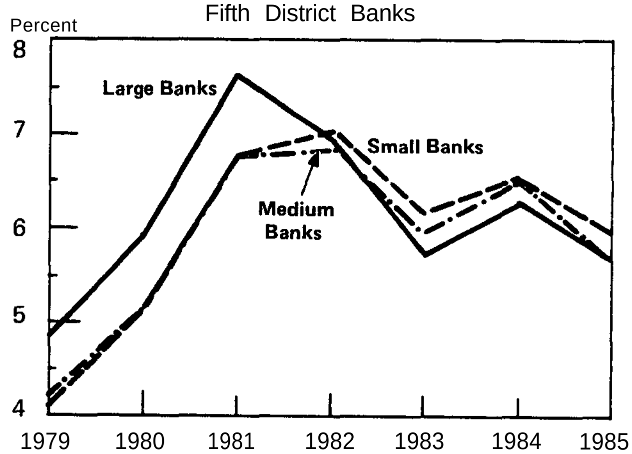
The composition of liabilities in the Fifth District is different from that for banks nationwide, and this may help explain the relatively low interest sensitivity in the District. For example, at Fifth District banks 58 percent of total liabilities had maturities of less than one year, compared with 62 percent for all U. S. banks. In addition, relatively rate-sensitive liabilities, such as large time deposits, deposits in foreign offices, and federal funds purchased, made up 25 percent of total liabilities in Fifth District banks (Table VI) while the corresponding number for all U. S. banks was 33 percent. At the same time, the relatively interest-insensitive category of Savings, Small Time Deposits, and NOW Accounts comprised 34 percent of liabilities in the Fifth District but only 25 percent nationwide.

Although differences between the size classes are not particularly striking, medium-sized District banks experienced the largest fall in interest expense (Chart 7). The implication is that medium banks have more

Chart 7

INTEREST EXPENSE RATIO*

Fifth District Banks



*Interest expense divided by average assets.

Table V

AVERAGE COST OF FUNDS FOR SELECTED LIABILITIES
FIFTH DISTRICT COMMERCIAL BANKS, 1979-1985

Item	1979	1980	1981	1982	1983	1984	1985
Interest-bearing deposit accounts	7.15	8.68	10.63	9.91	8.19	8.72	7.89
Large certificates of deposit	9.96	11.33	14.35	12.05	7.62	9.47	7.91
Deposits in foreign offices	10.28	13.17	15.18	12.79	7.73	9.19	7.92
Other deposits	6.16	7.54	9.23	9.12	8.34	8.55	7.97
Subordinated notes and debentures	8.19	8.20	8.11	8.34	8.32	8.03	9.64
Fed funds	11.94	13.34	15.54	11.21	8.52	9.58	7.67
Other	6.98	8.65	13.49	11.29	8.75	9.18	6.73
Total	7.60	9.13	11.23	10.10	8.24	8.84	7.90

Table VI

LIABILITY CATEGORIES AS A PERCENT OF TOTAL LIABILITIES FIFTH DISTRICT COMMERCIAL BANKS, 1985

	Small	Medium	Large	Total
Interest-bearing deposits	79.86	73.78	59.34	63.48
Large time deposits	8.06	8.03	9.00	8.76
Deposits in foreign offices	0.02	0.00	4.70	3.56
Other interest-bearing deposits	71.78	65.75	45.64	51.16
Super NOWs	3.08	3.39	1.16	1.67
Money market deposit accounts	15.73	17.80	14.86	15.35
Savings, small time, and NOWs	52.96	44.56	29.62	34.13
Subordinated notes	0.05	0.06	0.50	0.39
Fed funds	1.11	4.27	15.79	12.66
Non-interest-bearing deposits	17.46	19.94	19.33	19.21
Demand deposits	16.95	19.66	19.16	19.00
Other liabilities	1.52	1.95	5.05	4.25
Nontransaction savings	11.31	9.35	6.43	7.35

Note: Discrepancies due to rounding error.

rate-sensitive liabilities. Examination of Table VI, however, reveals only that medium-sized banks are heavier than others in the relatively rate-sensitive Money Market Deposit Accounts.

Noninterest Revenue and Expense

Fifth District banks expanded noninterest income relative to average assets from 1984 to 1985. In doing so they returned to the trend of the past few years, after a slight decline in 1984, of increasing reliance on noninterest income. At the national level, banks continued their dramatic gains in the category from last year with a rise of 12 basis points. Other noninterest income, which includes income from fiduciary activities, credit card fees, mortgage loan service fees, and safe deposit box rentals, was the fastest growing component of Fifth District noninterest income, increasing by 6 basis points relative to average assets (Table VII).

Some of the improvement in noninterest income was offset by a 3 basis point increase in noninterest expenses at Fifth District banks, which compared favorably with an increase of 10 basis points at the national level. Although District banks were able to control salaries and bank premises expenses, the Other Noninterest Expense category grew in 1985. This category includes such costs as legal fees, advertising costs, telephone expenses, and federal deposit insurance assessments.

Most of the increase in noninterest income was accounted for by an 8 basis point increase at large banks. Medium-sized banks produced no increase in this category, while small banks raised noninterest income by 4 basis points. The increase for small and large banks was concentrated in the Other Noninterest Income category. **Both large and small banks** experienced a 5 basis point increase in noninterest expense, while medium-sized banks were able to

Table VII

NONINTEREST INCOME AND EXPENSE AS A PERCENT OF AVERAGE ASSETS FIFTH DISTRICT COMMERCIAL BANKS 1983 TO 1985

Item	1983	1984	1985
Total noninterest income	1.16	1.15	1.22
Service charge income	0.37	0.39	0.39
Leasing income	0.07	0.08	0.09
Other noninterest income	0.72	0.69	0.75
Total noninterest expense	3.45	3.37	3.40
Salaries	1.78	1.74	1.72
Bank premises	0.60	0.56	0.56
Other	1.07	1.07	1.13
Noninterest margin	- 2.29	2.22	- 2.18

Note: Discrepancies due to rounding error.

reduce these expenses by 5 basis points. Other Non-interest Expense was the most significant component of the increases for both large and small banks, while the decrease for medium-sized banks was due mainly to a decrease in salaries.

Loan and Lease Loss Provisions

After increasing 32 percent in 1984, loan and lease loss provisions in Fifth District banks grew 40 percent in 1985 (Table I). For all U. S. banks provisions grew by about 20 percent in 1985, although Fifth District provisions remained comfortably below their national counterparts as a percent of assets. As Chart 8 shows, large banks produced the greatest increases in the Fifth District.

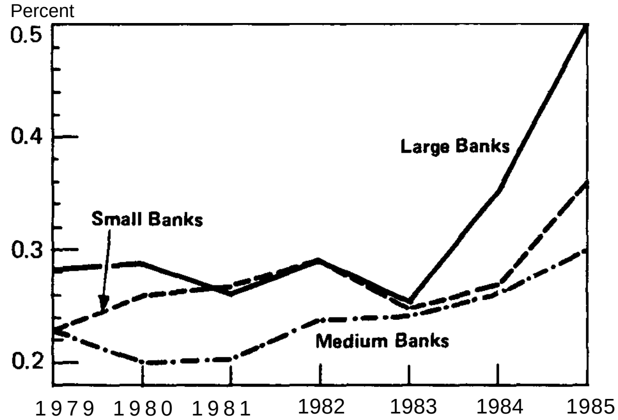
The increase in provision for loan and lease losses occurred in a year when classified loans[3] decreased as a percentage of total loans at large and medium-sized Fifth District banks. At the same time, 1985 chargeoffs net of recoveries were higher as a percent of loans at Fifth District banks than in 1984. This suggests three explanations, none of which are mutually exclusive, for the steep increase in loan and lease loss provisions. First, the increase in net chargeoffs in 1985 may have led bankers to increase provisions to build up allowances for loan and lease losses.[4] If bankers attempt to maintain a desired ratio of loan and lease loss allowance to loans, depleting the allowance by charging off loans will lead them to increase loan and lease loss provisions in order to keep this ratio at its desired level. Second, since allowance for loan and lease loss is included as capital in computing capital ratios, bankers may have taken advantage of improved net margins to build up allowances in order to increase capital. Finally, bankers may simply be trying to shield some of their improved interest income from taxes.

Classified loans constituted a smaller part of Fifth District bank loan portfolios in 1985 than was the case for banks nationwide. Specifically, classified loans were 2.9 percent of large banks' total loans, 3.1 percent for medium banks, and 4.7 percent for small banks. The corresponding figures for all U. S. banks were 4.5 percent, 4.8 percent, and 6.2 percent. In the Fifth District, only small banks experienced an increase from the 1984 percentage, while nationally both small and medium banks experienced increases.

Chart 8

LOAN AND LEASE LOSS PROVISIONS AS A PERCENT OF AVERAGE ASSETS

Fifth District Banks



Gains on Sales of Securities

Declining interest rates in 1985 led to higher securities prices. As a result, gains on sales of investment securities helped performance both in the Fifth District and nationwide. Gains occur when securities, other than those held in trading accounts, are sold, redeemed, returned, or exchanged for more than their book value. Gains were significant for all three size classes.

Capital

Banks in the Fifth Federal Reserve District added to capital during 1985 (Table VIII). Primary capital[5] increased from 7.3 percent of adjusted assets in 1984 to 7.6 percent in 1985, while total capital grew from 7.5 percent to 7.8 percent. Large banks

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[3] Classified loans include loans over 30 days past due along with renegotiated and nonaccrual loans.

[4] Loan and lease loss provision is the income statement flow that adds to the balance sheet stock known as allowance for loan and lease loss. Net chargeoffs are loan and lease losses, net of loans recovered, actually charged against the allowance. In other words, they are flows subtracted from the allowance. Provision for allocated transfer risk is included in provision for loan and lease losses, and allocated transfer risk reserve is included in allowance for loan and lease losses (except in computing capital ratios).

[5] Primary capital here includes common stock, perpetual preferred stock, surplus, undivided profits, capital reserves, mandatory convertible instruments, allowance for loan and lease losses, and minority interest in consolidated subsidiaries. Secondary capital (total capital less primary capital) includes limited life preferred stock and those subordinated notes and debentures not eligible for primary capital. Also, intangible assets are subtracted from average assets plus allowance for loan and lease losses (to yield adjusted assets) and from capital. The measure used here corresponds closely but not exactly to the different measures used by the major bank regulatory agencies.

Table VIII

CAPITAL RATIOS
FIFTH DISTRICT AND ALL U. S. COMMERCIAL BANKS

1984	Small	Medium	Large	Total
Fifth District				
Primary ratio	9.60	8.35	6.64	7.28
Total ratio	9.63	8.41	6.92	7.49
All U. S. banks				
Primary ratio	9.24	7.94	6.35	7.11
Total ratio	9.31	8.15	6.66	7.36

1985	Small	Medium	Large	Total
Fifth District				
Primary ratio	9.91	8.35	7.04	7.56
Total ratio	9.96	8.40	7.34	7.79
All U. S. banks				
Primary ratio	9.31	7.92	6.84	7.41
Total ratio	9.37	8.10	7.26	7.73

augmented their ratios most, while medium-sized banks were the only banks in the Fifth District with stable or declining ratios. The same differences between the size classes occurred at the national level, although capitalization was higher for Fifth District banks as a group than for all U. S. banks.

At both the District and national levels, common stock decreased in importance as a component of capital while both undivided profits and loan and lease loss allowance became more important. Although banks seem to be relying relatively less on the stock market as a source of funds, use of the debt market appears to be increasing. Specifically, mandatory convertible debt and subordinated debt increased both nationally and at the District level. In 1984, mandatory convertible debt grew substantially at the national level but was insignificant as an element of Fifth District capital ratios. In 1985, this debt continued to grow at all U. S. banks but jumped in significance at District banks. Subordinated debt grew slightly in the Fifth District but quite noticeably nationwide. While District banks appear to be making more use of debt instruments than in the past, their reliance on such debt has not caught up with that of their peers at the national level.

APPENDIX

INCOME AND EXPENSE AS A PERCENT OF AVERAGE ASSETS ALL U. S. COMMERCAL BANKS, 1979-1985[1]

Item	1979	1980	1981	1982	1983	1984	1985
Gross interest revenue	8.62	9.87	11.81	11.19	9.50	10.11	9.23
Gross interest expense	5.50	6.78	8.75	8.02	6.36	6.95	5.98
Net interest margin	3.12	3.09	3.07	3.17	3.15	3.16	3.25
Noninterest income	0.78	0.89	0.99	1.05	1.12	1.27	1.39
Loan and lease loss provision	0.24	0.25	0.26	0.39	0.47	0.55	0.66
Securities gains (- losses)[2]						- 0.01	0.06
Noninterest expense	2.54	2.63	2.76	2.91	2.95	3.05	3.15
Income before tax	1.12	1.10	1.04	0.91	0.84	0.82	0.89
Taxes	0.28	0.28	0.24	0.17	0.18	0.19	0.21
Other[3]	-0.04	-0.03	-0.04	-0.03	0.00	0.01	0.01
Return on assets[4]	0.80	0.79	0.76	0.71	0.67	0.64	0.70
Cash dividends declared	0.28	0.29	0.30	0.31	0.33	0.31	0.33
Net retained earnings	0.52	0.50	0.46	0.40	0.34	0.33	0.37
Return on equity[5]	13.90	13.70	13.20	12.20	11.24	10.63	11.33
Average assets ($ billions)	1,593	1,768	1,940	2,100	2,253	2,398	2,604

Note: Discrepancies due to rounding error.

[1] See Table I, footnote 1.

[2] See Table I, footnote 2.

[3] See Table I, footnote 3.

[4] See Table I, footnote 4.

[5] See Table I, footnote 5.

Sources: Federal Reserve Bulletin, 1981, 1984 (1979-83 data); Consolidated Reports of Condition and Income (1984 and 1985 data).