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THE DETERMINANTS OF COMMERCIAL BANK HOLDINGS OF MUNICIPAL SECURITIES: 1985-1988

by William P. Osterberg

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Abstract:

This paper presents an empirical analysis of commercial bank holdings of municipal securities (munis) from June 1985 through December 1988, using the FFIEC's Reports of Condition and Income. While motivated by previous analyses suggesting that a shift from munis to taxable securities is a primary determinant of the overall impact of the Tax Reform Act of 1986 on bank profitability, this paper does not directly analyze the impact of that legislation. However, the paper modifies the specification of muni demand employed in previous analyses to consider roles for state pledging requirements, realization of capital gains or losses, and the simultaneous provision for loan losses. The results provide some support for including state pledging requirements, realization of capital gains and losses, and the loan loss provisions in analyses of muni holdings.

I. Introduction

The Tax Reform Act of 1986 (TRA) removed one of the primary incentives for commercial banks to hold municipal securities by increasing to 100 percent the proportion of the interest expense associated with holding municipal securities that is disallowed as a tax deduction. Until 1982, Internal Revenue Code 265, which restricts the deductibility of interest expense associated with tax-exempt securities, was generally not applicable to the accounts incurred by financial institutions to depositors. The Tax Equity and Fiscal Responsibility Act of 1982 established a mechanical disallowance rule, allocating interest expense to tax-exempts in proportion to their share in the financial institution's total assets. Initially, the amount of the expense allocated that was disallowed was 15 percent, but that amount was increased to 20 percent in 1984.[1]

The extent to which banks have switched from tax-exempt to taxable securities is a primary factor in determining the impact that TRA has had on bank profitability. The switch to taxable securities subject to a lower marginal corporate tax rate could boost after-tax profits in spite of changes to the tax code, such as recapture of loan loss reserves, that would tend to decrease after-tax profits. In fact, at least three studies conducted with pre-TRA data (Neubig and Sullivan [1987a, 1987b], O'Brien and Gelfand [1987]) concluded that TRA would improve bank after-tax profits.

The influence of TRA on the municipal bond market has other dimensions. For example, much research on the municipal bond market

has focused on the issue of whether banks are (or have ever been) the marginal holders of municipal debt (for example, Skelton [1983]). Even if selling pressure emanating from commercial banks may now influence municipal bond yields, there now seems to be a consensus that banks are not the marginal investors.

In this paper, utilizing balance-sheet data from the Federal Financial Institution Examination Council's Reports of Condition and Income ("call reports"), we analyze the behavior of commercial bank holdings of municipal debt from June 1985 through December 1988. However, we do not directly study the overall impact of TRA on bank profitability or seek to determine whether banks are the marginal holders of municipal debt. Rather, we are interested in analyzing the factors determining the portfolio behavior of commercial banks.

Section II summarizes research on commercial bank behavior in the municipal bond market and section III discusses the specification of the model. Section IV presents the model, and section V describes the data. Section VI describes the econometric procedure and results. Section VII concludes.

II. Related Research

A. Relative Yields

Most research on the municipal bond market has focused on the determinants of the relative yields between tax-exempt and taxable debt. In theory, the tax-exempt yield divided by the comparable taxable yield should equal 1 minus the effective marginal tax rate. However, the mechanism that would ensure this has been an object of much research. According to the "bank arbitrage" hypothesis, the

relevant mechanism is the buying and selling of municipal debt by commercial banks. Banks were the relevant buyers of municipal debt, since they could deduct a portion of their interest expense attributable to carrying municipal debt.

In Miller (1977), the distribution of net wealth among investors in different tax brackets determines the aggregate corporate debt-to-equity ratio and the effective marginal tax rates for corporate debt and equity. The yield on municipal debt must be such that all investors (other than those who prefer corporate debt) are indifferent between equity and municipal debt. As Poterba (1989) has pointed out, Miller (1977) implies that changes in personal tax rates should affect relative yields while "bank arbitrage" implies that there should be no effect. Poterba presents evidence that personal tax changes influence relative yields so that an exclusive focus on bank demand is indefensible in a study attempting to explain relative yields (see also Fortune [1988]).

B. Banks and Taxes

Kimball (1977) describes the influence of the tax code on commercial bank demand for municipal securities (munis). From studying the 1972-1975 period, Kimball concludes that large banks relied more on non-tax-exempt shelters than small banks, for whom tax-exempts were the principal source of after-tax income. As a result, the corporate tax rate change in 1975 appeared to have had a larger impact on small banks. Leasing and foreign tax credits in particular were shelters dominated by the larger banks. Neubig and Sullivan (1987b) find size to be significant when entered as a proxy for tax shields. However, in their simulation study, Gelfand and

O'Brien (1987) find no size-related differences in the response of banks to TRA.

The principal determinant of banks' holdings of municipal bonds seemed to be total income that could not be sheltered with deductions and credits (see Hendershott and Koch [1980]). This seemed consistent with other studies, which concluded that banks paid much less in taxes than nonfinancial institutions. It seemed that banks could drive tax payments toward zero by purchasing taxable investments to exhaust credits and deductions, then investing the remaining available funds in tax-exempts. Possibly in response to these conclusions and to the difficulty in enforcing IRC Section 265 (which limited deduction of interest expense), TRA removed banks' ability to deduct a portion of the interest expense attributable to carrying municipal bonds.

C. TRA's Impact on Banks

TRA's impact on banks' holdings of munis involves more than just the removal of interest deductibility for the bulk of municipal bonds. By changing the tax provisions regarding the treatments of loan loss reserves, the alternative minimum tax, investment tax credit, foreign tax credits, and the statutory tax rate, TRA influenced banks' calculations of the amount of taxable income that could be sheltered by means other than munis. In effect, these changes alter the "break-even yield ratio" with which banks must compare actual relative yields. In addition, relative yields have moved significantly since TRA.

Both Neubig and Sullivan (1987a, 1987b) and Gelfand and O'Brien (1987) conclude that the recapture of bad debt reserves under TRA

will be the most significant impact of TRA on after-tax profits of commercial banks. Prior to TRA, under rules determined by Congress, banks could deduct increases in allowable bad debt reserves. Post-TRA, banks with assets over $500 million can deduct charge-offs net of recoveries but will also have to recapture existing loan loss reserves into taxable income, generally over a four-year period.

The calculation of the alternative minimum tax also affects muni demand, since the alternative tax rate has been increased from 15 percent to 20 percent and the base has been expanded. Half of reported book income over the alternative mimimum tax is now included as a preference item. O'Brien and Gelfand conclude that, for banks subject to the alternative minimum tax, "tax-exempt" income will be taxed at an effective 10 percent rate.

The repeal of the investment tax credit, effective January 1, 1986, and the reduction in the tax shield provided by leasing and depreciation would be expected to decrease the value of such activities to banks. In addition, TRA has reduced the value of foreign tax credits by restricting the extent to which foreign tax credits from different countries can be pooled against U.S. tax liabilities.

Both Gelfand-O'Brien and Neubig-Sullivan point out that relative yields are not likely to make the purchase of new munis attractive to banks. The only exception may be "qualified-new issues," which retain a 20 percent disallowance. However, such issues are limited to issuers who expect to issue less than $10 million in one year.

D. Regional Differentials and Supply Factors

Kidwell, Koch, and Stock (1987) have documented regional yield differentials in the municipal securities market. The existence of state pledging requirements was one factor explaining the differentials. A variety of regulations have governed financial relations between state and local governments and financial institutions. General revenues of state and local governments often must be deposited in banks within the same state. Banks must then hold municipal securities of the same state as collateral against a portion of such deposits. The required ratio between the collateral and the deposits varies from state to state. In addition, the requirements for state funds may differ from the requirements for funds of political subdivisions; the requirements may be different for "problem" banks; the requirements may differ for banks with deposits exceeding a specified proportion of capital; banks within a state may be allowed to pool assets pledged as collateral; or banks may have to hold collateral against all deposits of the state, not just the uninsured portion.[2]

Apparently in response to research showing that such regulations were reflected in the costs of state and local finance, the Advisory Commission on Intergovernmental Relations (1977) recommended that states reduce pledging requirements. It is unclear if the impact of such requirements on the municipal bond market has diminished. One of the rationales for increasing the federal deposit insurance ceiling from $20,000 to $40,000 was to reduce effective pledging requirments.

The tax treatment of corporate income also differs among states. More than just the rate schedules vary. There may be differences in whether the federal tax base is utilized, whether there is a minimum tax rule, whether there is a different rate for financial institutions, or whether there is a tax on total capital or assets.[3] Forbes and Leonard (1984) concluded that state tax differentials were significant determinants of yield differentials.

E. Timing of Capital Loss Realization

Since capital gains and losses also influence taxable income, factors that influence realization independently of gross purchases may influence the net change in the muni portfolio. Although it is clearly possible for a bank to realize gains or losses and to keep muni holdings constant with new purchases, the new bonds may not bring the same tax benefits as the old bonds. Neubig and Sullivan (1987b) attempt to take account of the maturity structure of the existing muni portfolios in their analysis of the impact of TRA. However, while information about maturity would be valuable in determining the maximum loss or gains that could be realized, it is unclear whether there are factors that influence loss realization that are not incorporated into relative yields. In fact, Heaton (1986) shows how the relative yield on municipal bonds is influenced by the associated value of tax deductions, and Constantinides and Ingersoll (1984) explicitly model the influence of tax-timing options on the equilibrium prices of bonds, such as municipals.

Constantinides and Ingersoll (1984) conclude that "...the main difference between the optimal trading policies for municipal and

taxable bonds is that no (municipal bond) trades are ever made at a price above par..." (p.334).[4] However, when municipals are at a deep discount, their tax-timing options are roughly equal to those on taxable instruments. In addition, tax timing options, which should be reflected in relative yields, also vary with tax rates on coupons and capital gains or losses.

F. Simultaneity with Loan-Loss Provisions

The net income earned on municipals is only one component of net income. Over our sample period, provision for loan loss has had a significant influence on net income. Greenwalt and Sinkey (1988), in a study of bank holding companies from 1976 to 1984, find evidence that loan loss provisions were made in a manner consistent with the income-smoothing hypothesis. In addition, TRA affected net income by requiring large banks to recapture outstanding loan loss reserves. While there are other influences on net income, these factors suggest that we consider the choices of municipal bond holdings as made simultaneously with loan loss provisions.[5]

III. Specification of the Estimating Equations: Issues

Previous analyses of bank demand for municipal securities emphasized the role of expected income and tax shields. Neubig and Sullivan (1987b) develop in detail the banks' portfolio decision under the certainty case. For banks that face the regular tax, the relative yield between tax-exempt and taxable securities (ry) must be compared to the break-even ratio (byr), which is calculated as

(1) $1 - u[1-b(i_d/i_t)]$, where

i_d = interest expense/assets,

b = percentage interest expense disallowance,

u = marginal corporate tax rate, and

i_t = interest rate on taxable investments.

If the relative yield exceeds the byr, the optimal share of assets held in municipals is calculated as

(2) $MAX\{ 0, 1-[i_d(1-a'b)-noi'+(c/u)]/i_t \}$, where

a' = percent of total assets subject to interest expense disallowance,

noi' = net taxable noninterest income/assets, and

c = tax credits/assets.

Equation (2) is consistent with the insight of Kimball (1977). Muni demand is positively related to taxable investment returns, net non-interest income, corporate marginal tax rates, and the disallowance rate (as long as a higher disallowance rate does not increase the byr above the relative yield). Demand is negatively related to interest expense rates and available tax credits.

Several problems arise in applying this framework. First, the appropriate yield calculation is more complex during our sample period. Second, in constructing our measure of income, we need to consider the possibility that the demand for munis occurs simultaneously with other portfolio choices. Third, lack of suitable tax information prevents us from calculating satisfactory measures of ex-ante effective tax rates, deductions, and credits.

The comparison of relative yields to byrs is complicated by the introduction of the new alternative minimum tax (amt), which alters the byr calculation.[6] Determining ex-ante which banks will face the amt is influenced by the fact that the probability of facing the amt is influenced by municipal holdings, since tax-exempt income enters the amt calculation. Banks that do face the amt would be expected to hold fewer municipals, since their greater tax liability would be matched with taxable income.

In the case presented above, there would appear to be no role for relative yields to influence muni demand if the byr exceeded the yield ratio. However, with uncertainty about tax rates, deductions, or credits, banks may still purchase munis even if the relative yield lies below the byr. On the other hand, Hendershott and Koch (1980) claim that as long as relative yields are high enough, variation in relative yields is not likely to influence demand. If TRA increased byrs enough that bank purchases of munis are no longer justified, variation in the difference between the relative yield and the byr can only influence muni holdings by influencing decisions about realization of capital gains or losses.

Over our sample period, relative yields rose in part because TRA decreased bank demand for munis by increasing the break-even ratio. The declining bank demand for munis influenced prices and thus yields. However, banks clearly increased their muni purchases at the end of 1985 in order to grandfather the partial interest deductibility.

Our measure of expected taxable income can be obtained as a function of lagged income (Hendershott and Koch [1980]) or

calculated with ex-post income data, reconstructing a before-tax income measure from net after-tax income and appropriate balance-sheet components. Limited information about taxes, deductions, and credits appears on the call reports. Previous research has included size as proxy for reliance on non-debt tax shields. Large banks may be more likely to utilize tax shields such as investment tax credits, depreciation deductions, foreign tax credits, and leasing.

IV. The Econometric Model

The model we use to analyze the behavior of commercial bank holdings of municipal securities from December 1984 to December 1988 uses the following equations:

(3) $BVM_t = BVM_{t-1} + P_t - R_t$,

(4) P = P [MAX(0,gti), MAX(0,ry-byr), State and Local Deposits] + e_p,

(5) R = R [MAX(0,gti), State and Local Deposits, Unrealized Capital Losses on Municipals, Other Unrealized Losses, Loan Losses Provisons] + e_r,

(6) LLP = L [MAX(0,gti), Capital to Asset Ratio (excluding Loan Loss Reserve), Nonaccruing and Past-Due Loans, Net Charge-Offs, Loan Loss Reserve] + e_l,

where BVM = book value of municipal securities,

P = purchases of municipal securities,

R = sales of municipal securities,

LLP = provision for loan losses, and

gti = "grossed-up taxable income" as described below; e_p, e_r, and e_1 are disturbances.

Implicit in this model is a distinction between factors that determine purchases of munis (equation [4]) and those factors that influence sales (equation [5]). Previous analyses of muni holdings suggest that the purchases are influenced by income and relative yields. We include state and local demand deposits as a proxy for state pledging requirements. Our formulation of the relative yield term removes the influence of variation in the difference between relative yields and the byr on purchases when that difference is negative. This forces variation in relative yields to influence muni holdings through changes in the market value of the existing securities portfolio (equation [5]).

The realization of losses or gains influences net income. In equation (5), we distinguish between losses that could be realized on munis and those that could be realized on other securities. The level of state and local deposits would be expected to restrict the ability of banks to sell munis. The amount of taxable income that could be sheltered with various deductions should be expected to be positively related to loss realization and loan loss provisions, which are a deduction for book income purposes.[7]

As an alternative to the assumption imposed in equations (4) and (5), which states that the factors influencing sales are different from those influencing purchases, we consider the following version of those equations.[8]

(4A) $P = [\ MAX\ \{\ 0, gti\ \},\ ry\text{-}byr,\ State\ and\ Local\ Deposits] + e_p,$

(5A) $R = [\ MAX\ \{\ 0, gti\ \},\ ry\text{-}byr,\ State\ and\ Local\ Deposits,$
$Loan\ Loss\ Provisions\ ] + e_r.$

Equation (6) states that loan loss provisions, which reduce net income, are influenced by taxable income and factors describing the loan portfolio of the bank. The factors that influence loan loss provisions are closely related to those that influence the addition to the loan loss reserve, a component of the primary capital-to-asset ratio. The higher the loss reserve or the primary ratio, the less need there is to add to the reserve. On the other hand, the higher the inventory of "bad loans" that need to be charged off, the more likely the bank will provide for losses.

Implicit in the model is a switch between regimes. The old regime is one in which relative yields and income determined muni holdings. The second regime is one in which relative yields are not high enough to justify muni holdings, and, given the level already purchased, the change in the level is determined by factors such as loan loss provisions, unrealized losses on other securities, book losses on munis, and income that the bank has available to absorb capital losses.

Unfortunately, there is no distinct shift between regimes, since TRA was anticipated well before it became effective. This is evident in the runup in bank portfolios of munis in 1985. This also implies that factors determining the realization of capital losses may explain muni purchases prior to TRA. In addition, since

qualified small issues may still be attractive purchases for some banks, purchases may occur even if aggregate relative yields are inadequate.

We specify a two-equation model with the net change in the muni holdings and loan loss provisions as the simultaneous variables. To distinguish factors that should influence the level of munis from those that should influence the change in the level, we first-difference the former and the dependent variable. We also specify an alternative version of this system, derived from (4A) and (5A).

$$
\begin{aligned}
(7)\ (1\text{-}L)BVM_t = {} & a_m + b_{m1}*(1\text{-}L)MAX[0,ry\text{-}byr]_t + b_{m2}*(1\text{-}L)MAX[0,gti]_t \\
& + b_{m3}*(1\text{-}L)\text{State and Local Deposits}_t \\
& + b_{m4}*(1\text{-}L)\text{Unrealized Losses (except munis)}_t \\
& + b_{m5}*\text{Unrealized Losses on Munis}_{t-1} \\
& + b_{m6}*\text{Loan Loss Provisions}_t + u_{mt}.
\end{aligned}
$$

$$
\begin{aligned}
(8)\ & \text{Loan Loss Provisions}_t \\
& = a_l + b_{l1}*MAX[0,gti]_t \\
& + b_{l2}*\text{Primary Capital (except LLR)}_{t-1} \\
& + b_{l3}*(\text{Nonaccruing+Past Due Loans})_{t-1} \\
& + b_{l4}*\text{Net Charge-Offs}_{t-1} \\
& + b_{l5}*\text{Loan Loss Reserve(LLR)}_{t-1} + e_{lt}.
\end{aligned}
$$

L is the first-difference operator. All variables except $(1\text{-}L)MAX[0,ry\text{-}byr]_t$ are scaled by consolidated bank assets at the beginning of the period (dated t-1).

V. Description of the Data:

We choose all banks reporting on all call reports from December 1984 to December 1988. Omitting banks with suspicious data leaves us with 12,035 banks. Utilizing the June and December call reports and first differencing leaves us with eight observations for each bank.

The variable gti, grossed-up taxable income, is calculated starting from end-of-period income before taxes and extraordinary items. To this we add 1) an estimate of the amount by which income would have been higher with tax-exempt income inflated to a taxable level (the total of all tax-exempt income items [securities, loans, and leases] was multiplied by [(1/ry)-1], where ry is described below), 2) the loan loss provision, 3) realized capital gains and losses on the securities account, 4) the non-deductible portion of interest expense associated with munis, 5) net charge-offs, and 6) the required recapture of bad-debt reserves by large banks.

All banks with at least $500 million in total assets at the end of 1986 recapture at least 10 percent of the December 1986 loan loss reserve into 1987 income, with equal portions in each half of the year. If recapture of 10 percent still leaves the bank with gti below 0 for the year as a whole, then the bank recaptures enough to reach 0, if the loan loss reserve is sufficient. All banks that recapture in 1987 recapture 2/9 of the remainder in 1988 income. A bank that isn't large enough at the end of 1986 may be large enough at the end of 1987.

The variable ry is measured as the ratio between 10-year munis and Treasury bonds. The variable byr, the break-even ratio, is

calculated directly from equation (1) using the marginal corporate tax rate, the disallowance ratio (which increased from .20 to 1.0 after August 7, 1986 for "non-qualified bonds"), interest expense/total assets as reported by the bank, and the 10-year Treasury rate.

For state and local deposits, we use demand deposits of the states and political subdivisions rather than the broader measures of total transaction deposits, or total deposits, both of which are available. Unrealized losses on munis are calculated from the securities accounts (only banks with assets above $1 billion report any detail on their trading account portfolios) as book value minus market value at the end of the previous period. Other unrealized losses are calculated from the remainder of book and market value on the securities accounts.

VI. Estimation Procedure and Results:

Since loan loss provisions influence muni holdings but muni holdings do not appear on the right-hand side of the equation for loan loss provisions, we utilize a simple two-stage procedure. First we estimate the equation for loan loss provisions, then the equation for munis with the predicted value for loan loss provisions on the right-hand side.

We estimate the second equation first as a panel, considering the possibility that the error term, u_{mt}, has the following error components structure:

(9) $u_{mit} = f_{mi} + g_{mt} + h_{mit}$.

f_{mi} and g_{mt} are the bank and time error components, respectively.

We utilize an approach described by Fuller and Battese (1974) to estimate the variance components, and then perform estimated generalized least squares.[9] We then estimate the second equation for each call report separately and for all reports together. We test for the equality of coefficients across time for both the first and second equation. The results for the first equation lead us to generate the predicted value for loan loss provisions from each call report separately.

Table I presents the results for the equation for loan loss provisions. As we would expect, higher levels of taxable income are associated with higher loan loss provisions, since provisions reduce book after-tax income. This is also consistent with Greenwalt and Sinkey (1988), who found that provisions were utilized to smooth income. Although the capital-to-asset ratio (which excludes loan loss reserves) is significant in all but one period, its sign changes. We expected that higher levels of this variable would imply less need to add to the loan loss reserve so as to meet primary capital guidelines and, thus, there would be less need to provide for loan losses. The nonaccruing and past-due loans and net charge-offs variables are positive and significant in all periods. Nonaccruing loans is a measure of the amount of loans that are likely candidates for charge-offs. Net charge-offs are closely related to the bad debt reserve tax deduction, differing from the deduction by the amount by which allowable reserves change. The last column of Table I presents the results from pooling all the

periods. A Chow test leads us to reject the restriction. We generate the predicted value of loan loss provisions for the second stage from each report separately.

Table II presents the results from the panel data estimation of the second equation, both with and without a size variable. Income, loan loss provisions, and state and local deposits have the expected signs and neither type of unrealized losses are significant influences. These results are not sensitive to the inclusion of size. However, the inclusion of size reduces the magnitude of the coefficients on income, provisions, and deposits. If large banks had greater availability to non-debt tax shields, we would expect the inclusion of size to reduce the positive coefficient on income. If large banks placed less reliance on state and local deposits, including size would increase the positive coefficient on our proxy for pledging requirements. As a proxy for non-debt tax shields, size should have a negative coefficient, not a positive coefficient. Including size also implies that relative yields have not been significant influences on muni holdings.

Table II also indicates that there is no cross-sectional component to the composite error term, u_{mit}.[10] This suggests that we calculate the "between" estimator for each report separately. These results are presented in the remaining tables. In Tables IIIA and IIIB, we reestimate the second equation for each report with and without a size variable, respectively.

In general, only the coefficient on taxable income has the expected sign (positive) in all periods, with or without inclusion

of size. When included, size is a consistently positive influence on muni holdings. State and local deposits are a positive influence except in the first half of 1985 and the last half of 1988. While significant in almost all cases, the direction of influence of loan loss provisions and relative yields varies. However, unlike the results detailed in Table II, the coefficients on unrealized losses are sometimes significant. Our specification implied that unrealized losses might matter after TRA, when relative yields would fall below break-even ratios. Then, the inventory of unrealized losses on munis would be positively related to sales (negatively related to muni levels). A substitute deduction, unrealized losses on other securities, would be a positive influence. Tables IIIA and IIIB indicate that unrealized losses on munis are generally a positive influence after TRA but were a negative influence in 1985. Other unrealized losses are sometimes a significant influence. The last column of each table indicates the results from pooling all periods, with predicted loan loss provisions coming from pooling all periods as well. Again we would reject the restriction that the coefficient vectors are equal across reports.

In Tables IVA and IVB we present the results from estimating the alternative model in which we have excluded the unrealized loss variables and replaced MAX (0, ry-byr) with ry - byr. The results are similar to those depicted in Tables IIIA and IIIB. Only the coefficient on income is consistently of the expected sign. Size consistently has a positive influence. Although we have excluded

the unrealized loss variables, which might be affected by movements in market yields, the coefficient on relative yields is often negative and significant.

The last columns of Tables IVA and IVB are the estimates made when all reports are stacked together. Again, the restrictions that the coefficients be equal across periods are rejected. However, if we compare the last columns of Tables IIIA and IVA and the last columns of Tables IIIB and IVB, the implications of the two alternative models for the influences of income, yields, deposits, and size seem similar.

VII. Conclusion and Possible Extensions

This paper has attempted to extend the analysis of bank demand for municipal securities to consider the influence of state pledging requirements, factors that could determine the sell-off of munis when relative yields do not generally justify new purchases, and simultaneity with loan loss provisions. Implicit in our analysis was a hypothesis that relative yields and income as determinants of muni demand declined in importance with the passage of the Tax Reform Act of 1986 and that factors influencing loss realization and loan-loss provision increased in importance.

We feel that the results regarding the significance of state pledging requirements warrant further investigation, especially in light of recent controversies about the differential impact of TRA on state and local finance. In addition, provisions for loan losses and unrealized securities losses are sometimes significant determinants of muni holdings. However, the influence of relative

yields, which were sometimes negatively related to muni holdings, is hard to reconcile with our model or with other models of muni demand.

In further work, the influence of state pledging requirements or other state regulations could be explored, given the detail provided by the Advisory Council on Intergovernmental Relations (1989) or the Conference of State Bank Supervisors. The analysis of the influence of loss-realization timing could be explored, utilizing information on the trading accounts of large banks. However, this avenue is limited by the paucity of data on the maturities of bank securities. Finally, the econometric procedure could be designed to more explicitly take advantage of the simultaneity between loan loss provisions and muni holdings in a panel framework.

Table I

First Stage Estimates:

Dependent Variable: Loan Loss Provisions$_t$/Total Assets$_{t-1}$

Variable	6/85	12/85	6/86	12/86
Constant	-.00003	0.0008	0.0005	-0.0011
	(.0001)	(.0001)**	(.0001)**	(.0002)**
MAX{0,gti}$_t$	0.477	0.487	0.142	0.325
	(.007)**	(.007)**	(.004)**	(.007)**
Capital-to-Asset Ratio$_{t-1}$	0.0001	0.005	-0.002	0.013
	(.001)	(.001)**	(.001)*	(.001)**
Nonaccruing and Past-Due Loans$_{t-1}$	0.050	0.081	0.055	0.106
	(.002)**	(.003)**	(.002)**	(.003)**
Net Charge-Offs$_{t-1}$	0.700	0.615	0.276	0.505
	(.014)**	(.012)**	(.008)**	(.013)**
Loan-Loss Reserve$_{t-1}$	-.101	-0.09	0.070	-0.036
	(.011)**	(.014)**	(.012)**	(.015)**
SSE	0.285	0.449	0.351	0.579
R^2(adjusted)	0.396	0.439	0.239	0.364

Table I (continued)

First Stage Estimates:

Dependent Variable: Loan Loss Provisions$_t$/Total Assets$_{t-1}$

Variable	6/87	12/87	6/88	12/88	All
Constant	0.0004	0.0004	0.0004	-0.0011	0.0001
	(.0001)**	(.0002)**	(.0001)**	(.0002)**	(.0001)*
MAX{0,gti}$_t$	0.050	0.409	0.234	0.463	0.245
	(.003)**	(.007)**	(.006)**	(.009)**	(.002)**
Capital-Asset Ratio$_{t-1}$	-0.002	0.003	-.0004	0.006	0.002
	(.001)	(.001)**	(.0009)	(.002)**	(.0004)**
Nonaccruing and Past Due Loans$_{t-1}$	0.061	0.098	0.058	0.099	0.086
	(.002)**	(.003)**	(.002)**	(.004)**	(.001)**
Charge Offs$_{t-1}$	0.128	0.598	0.309	0.670	0.371
	(.007)**	(.013)**	(.008)**	(.015)**	(.004)**
Loss Reserve$_{t-1}$	0.057	-0.137	-.048	-0.032	-0.030
	(.010)**	(.010)**	(.007)**	(.012)**	(.004)**
SSE	0.293	0.423	0.205	0.638	3.628
R^2(adjusted)	0.187	0.385	0.284	0.361	0.286

Number of observations: 12,035.
* :significant at .10.
**:significant at .05.
Note: All variables are scaled by lagged total assets.
Source: Author's calculations.

Table II

Time Series/Cross-Sectional Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

Variable	With Size	Without Size
Constant	-0.0013 (.0017)	0.0016 (.0018)
Unrealized Muni Losses$_{t-1}$	0.0262 (.0170)	-0.0191 (.0174)
Loan Loss Provisions$_t$ (from 1st stage)	-0.5066 (.0208)**	-0.6640 (.0213)**
(1-L)*...		
MAX{0,ry-byr}$_t$	-0.0019 (.0044)	0.0261 (.0045)**
MAX{0,gti}$_t$	0.9375 (.0087)**	1.1062 (.0086)**
State and Local Deposits$_t$	0.1766 (.0065)**	0.2429 (.0067)**
Other Unrealized Losses$_t$	0.0131 (.0105)	0.0028 (.0107)
ln(Total Assets$_t$)	0.0573 (.0008)**	
Error Components		
Cross-Sectional	0.000000	0.000000
Time Series	0.000025	0.000026
Error	0.000652	0.000691
MSE of Transformed Regression	0.000638	0.000674
Degrees of Freedom	96,272	96,273

* :significant at .10.
**:significant at .05.
All variables other than (1-L)MAX{ 0, ry-byr }$_t$, and (1-L)ln (Total Assets) are divided by lagged Total Assets.
Source: Author's calculations.

Table IIIA

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(Without Size as an Independent Variable)

Variable	6/85	12/85	6/86	12/86
Constant	0.0021 (.0005)**	0.022 (.002)**	-0.026 (.0047)**	0.0007 (.0009)
Unrealized Muni Losses_{t-1}	-0.355 (.036)**	-0.614 (.067)**	-0.318 (.078)**	-0.012 (.036)
Loan Loss Provisions_t (from 1st stage)	-0.901 (.072)**	-1.37 (.067)**	2.078 (.122)**	-0.182 (.039)**
(1-L)*..				
$\text{MAX}(0, ry\text{-}byr)_t$	0.027 (.039)	-0.102 (.049)*	0.270 (.071)**	0.019 (.005)**
$\text{MAX}(0, gti)_t$	0.564 (.041)**	0.573 (.038)**	1.571 (.030)**	0.436 (.019)**
State and Local Deposits_t	0.00007 (.018)	0.120 (.019)**	0.556 (.022)**	0.056 (.014)**
Other Unrealized Losses_t	-0.024 (.028)	-0.021 (.038)	-0.447 (.040)**	-0.029 (.018)
SSE	7.35	11.93	18.44	4.51
R^2(adjusted)	0.027	0.048	0.315	0.051

Table IIIA (continued)

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(Without Size as an Independent Variable)

Variable	6/87	12/87	6/88	12/88	All
Constant	-0.007 (.0006)**	-0.0003 (.0002)**	-0.003 (.0002)**	-0.002 (.0001)**	-0.0015 (.0001)**
Unrealized Muni Losses$_{t-1}$	0.021 (.035)	0.346 (.034)**	0.251 (.050)**	0.414 (.035)**	-0.050 (.017)**
Loan Loss Provisions$_t$	2.039** (.094)	-0.058 (.036)	0.626 (.070)**	-0.078 (.023)**	0.237 (.025)**
(1-L)*.					
MAX{0,ry-byr}$_t$	0.006 (.006)	0.019 (.017)	-0.075 (.026)**	-0.172 (.039)**	0.032 (.001)**
MAX{0,gti}$_t$	1.543 (.014)**	0.414 (.020)**	0.560 (.022)**	0.220 (.016)**	0.984 (.009)**
State and Local Deposits$_t$	0.290 (.021)**	0.067 (.014)**	0.247 (.017)**	-0.005 (.010)	0.242 (.007)**
Other Unrealized Losses$_t$	0.203 (.023)**	-0.006 (.023)	0.114 (.033)**	0.080 (.021)**	-0.0002 (.011)
SSE	6.38	3.06	4.23	1.76	67.07
R^2(adjusted)	0.618	0.058	0.097	0.030	0.168

Number of observations: 12,035.
* :significant at .10.
**:significant at .05.
Note: All variables other than (1-L)MAX{ 0, ry-byr }$_t$ are divided by lagged Total Assets.
Source: Author's calculations.

Table IIIB

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(With Size as an Independent Variable)

Variable	6/85	12/85	6/86	12/86
Constant	-0.002 (.0005)**	0.023 (.0018)**	-0.036 (.0046)**	-0.007 (.0010)**
Unrealized Muni Losses$_{t-1}$	-0.291 (.035)**	-0.558 (.059)**	0.134 (.072)*	-0.007 (.036)
Loan Loss Provisions$_t$ (from 1st stage)	-0.680 (.070)**	-1.190 (.067)**	2.489 (.114)**	-0.102 (.039)**
(1-L)*..				
MAX{0,ry-byr}$_t$	0.143 (.038)**	-0.211 (.048)**	-0.778 (.070)**	-0.016 (.005)**
MAX{0,gti}$_t$	0.389 (.040)**	0.443 (.038)**	1.131 (.029)**	0.327 (.020)**
State and Local Deposits$_t$	-0.042 (.018)**	0.043 (.019)**	0.397 (.021)**	0.022 (.014)
Other Unrealized Losses$_t$	-0.020 (.027)	0.029 (.038)	-0.359 (.037)**	-0.024 (.018)
ln(Total Assets$_t$)	0.049 (.002)**	0.053 (.003)**	0.155 (.004)**	0.036 (.002)**
SSE	6.97	11.57	15.87	4.35
R^2(adjusted)	0.077	0.077	0.411	0.083

Table IIIB (continued)

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(With Size as an Independent Variable)

Variable	6/87	12/87	6/88	12/88	All
Constant	-0.008 (.0005)**	-0.004 (.0002)**	-0.004 (.0002)**	-0.003 (.0001)**	-0.004 (.0001)**
Unrealized Muni Losses$_{t-1}$	0.062 (.034)*	0.366 (.033)**	0.277 (.047)**	0.418 (.034)**	-.023 (.016)
Loan Loss Provisions$_t$	2.177 (.090)**	0.137 (.035)**	0.608 (.002)**	-0.024 (.023)	0.409 (.024)**
(1-L)*.					
MAX{0,ry-byr}$_t$	-0.006 (.006)	0.087 (.017)**	-0.021 (.025)	-0.059 (.038)	0.028 (.001)**
MAX{0,gti}$_t$	1.367 (.014)**	0.310 (.020)**	0.374 (.021)**	0.144 (.016)**	0.798 (.009)**
State and Local Deposits$_t$	0.205 (.020)**	0.027 (.014)*	0.158 (.016)**	-0.023 (.010)**	0.170 (.007)**
Other Unrealized Losses$_t$	0.211 (.022)**	-0.006 (.022)	0.056 (.032)*	0.054 (.020)**	0.018 (.010)*
ln(Total Assets$_t$)	0.062 (.002)**	0.037 (.001)**	0.059 (.002)**	0.025 (.001)**	0.061 (.001)**
SSE	5.90	2.88	3.75	1.69	63.12
R^2(adjusted)	0.647	0.112	0.199	0.072	0.217

Number of observations: 12,035.
* :significant at .10.
**:significant at .05.
Note: All variables other than (1-L)MAX{ 0, ry-byr }$_t$, and (1-L)lnTotal Assets are divided by lagged Total Assets.
Source: Author's calculations.

Table IVA

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(Without Size as an Independent Variable)

(Without Unrealized Capital Losses as Independent Variables)

Variable	6/85	12/85	6/86	12/86
Constant	0.001 (.0004)**	0.022 (.0018)**	-0.025 (.0047)**	-0.0018 (.0008)**
Loan Loss Provisions$_t$ (from 1st stage)	-0.919 (.072)**	-1.410 (.068)**	2.080 (.123)**	-0.195 (.039)**
(1-L)*..				
$ry_t - byr_t$	-0.010 (.038)	-0.107 (.049)**	0.261 (.072)**	-0.005 (.005)
$MAX\{0,gti\}_t$	0.575 (.041)**	0.591 (.038)**	1.599 (.030)**	0.438 (.019)**
State and Local Deposits$_t$	0.0043 (.018)	0.124 (.019)**	0.567 (.022)**	0.058 (.014)**
SSE	7.41	12.104	18.66	4.51
R^2(adjusted)	0.019	0.040	0.307	0.050

Table IVA (continued)

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(Without Size as an Independent Variable)

(Without Unrealized Capital Losses as Independent Variables)

Variable	6/87	12/87	6/88	12/88	All
Constant	-0.005 (.0010)**	-0.004 (.0002)**	-0.003 (.0003)**	-0.002 (.0001)**	-0.001 (.0001)**
Loan Loss Provisions$_t$	2.051 (.091)**	0.109 (.035)**	0.638 (.070)**	-0.053 (.023)**	0.238 (.025)**
(1-L)*..					
$ry_t - byr_t$	0.011 (.008)	0.004 (.006)	0.008 (.007)	-0.012 (.004)**	0.028 (.001)**
MAX{0,gti}$_t$	1.579 (.013)**	0.403 (.020)**	0.557 (.022)**	0.209 (.016)**	0.978 (.009)**
State and Local Deposits$_t$	0.293 (.021)**	0.066 (.014)**	0.250 (.017)**	-0.006 (.010)	0.241 (.025)**
SSE	6.43	3.09	4.25	1.79	67.09
R^2(adjusted)	0.615	0.050	0.094	0.017	0.168

Number of observations: 12,035.
* :significant at .10.
**:significant at .05.
Note: All variables other than $(1-L)(ry-byr)_t$ are divided by lagged Total Assets.
Source: Author's calculations.

Table IVB

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(With Size as an Independent Variable)

(Without Unrealized Capital Losses as Independent Variables)

Variable	6/85	12/85	6/86	12/86
Constant	-0.002 (.0004)**	0.023 (.0018)**	0.037 (.0046)**	-0.010 (.0009)**
Loan Loss Provisions$_t$ (from 1st stage)	-0.683 (.071)**	-1.227 (.067)**	2.508 (.114)**	-0.116 (.039)**
(1-L)*..				
$ry_t - byr_t$	0.116 (.038)**	-0.216 (.049)**	-0.801 (.071)**	-0.029 (.005)**
$MAX\{0,gti\}_t$	0.394 (.040)**	0.455 (.038)**	1.146 (.029)**	0.320 (.002)**
State and Local Deposits$_t$	-0.039 (.018)**	0.044 (.019)**	0.404 (.021)**	0.020 (.014)
ln(Total Assets$_t$)	0.050 (.002)**	0.054 (.003)**	0.158 (.004)**	0.038 (.002)**
SSE	7.01	11.66	16.00	4.34
R^2(adjusted)	0.071	0.070	0.406	0.086

Table IVB (continued)

Second Stage Estimates of the Equation for Municipal Securities

Dependent Variable: $(BVM_t - BVM_{t-1})/\text{Total Assets}_{t-1}$

(With Size as an Independent Variable)

(Without Unrealized Capital Losses as Independent Variables)

Variable	6/87	12/87	6/88	12/88	All
Constant	-0.011 (.0094)**	-0.006 (.0002)**	-0.005 (.0002)**	-0.004 (.0001)**	-0.004 (.0001)**
Loan Loss Provisions$_t$ (1-L)*..	2.227 (.088)**	0.196 (.035)**	0.649 (.066)**	-0.004 (.022)	0.408 (.024)**
$ry_t - byr_t$	-0.033 (.008)**	0.015 (.005)**	-0.014 (.006)**	-0.037 (.004)**	0.021 (.001)**
MAX{0,gti}$_t$	1.397 (.014)**	0.289 (.020)**	0.365 (.021)**	0.121 (.016)**	0.793 (.009)**
State and Local Deposits$_t$	0.214 (.020)**	0.029 (.014)**	0.162 (.016)**	-0.024 (.010)**	0.170 (.007)**
ln(Total Assets$_t$)	0.064 (.002)**	0.036 (.001)**	0.060 (.002)**	0.027 (.001)**	0.060 (.001)**
SSE	5.94	2.92	3.76	1.70	63.23
R^2(adjusted)	0.644	0.102	0.197	0.065	0.215

Number of observations: 12,035.
* :significant at .10.
**:significant at .05.
Note: All variables other than $(1-L)(ry-byr)_t$, and (1-L)lnTotal Assets are divided by lagged Total Assets.
Source: Author's calculations.

Footnotes

1) Property and casualty insurance companies essentially deducted all of their interest expense via the reserve deduction until 1986. Non-financial corporations can deduct all interest expense as long as tax-exempts constitute no more than 2 percent of total assets.

2) See A Profile of State Chartered Banking, Council of State Bank Supervisors, 1988.

3) See Significant Facts About Fiscal Federalism, Advisory Council on Intergovernmental Relations, Washington, D.C., 1977.

4) The essential difference between the two categories is that, for municipals, the amortization of the basis that occurs when the purchase price exceeds par is not a deduction from income. When municipals are at a deep discount and are being compared to equivalent taxables, the right to amortize the basis is of little value.

5) A complication that arises at this point is that income smoothing may be more appropriately applied to analysis of book income while muni holdings are more directly related to tax return income. We deal with this when we discuss our income measure, which is constructed with the call report (book) data.

6) Neubig and Sullivan (1987) provide a detailed description of calculation of the byr relevant to a bank facing the amt.

7) As we discuss in our calculation of taxable income, the equivalent deduction for tax purposes is the maximum allowable addition to the bad-debt reserve.

8) The first formulation implies other restrictions as well. One is that variation in relative yields only influences purchases if ry - byr is positive, ex-post.

9) The actual calculations are done by the SAS routine TSCSREG.

10) Actually, the estimated cross-sectional variance component is negative, then set to zero in the estimated GLS procedure (EGLS). Baltagi (1981) indicates that it is difficult in practice to distinguish between misspecification and actually having a zero variance component. Baltagi also indicates that setting such components to zero in the EGLS procedure does not damage the performance of the estimation procedure.

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