THE JOURNAL OF FINANCE • VOL. XXXV, NO. 3 • JUNE 1980

The Demand for Tax-Exempt Securities by Financial Institutions

PATRIC H. HENDERSHOTT and TIMOTHY W. KOCH*

THE EXEMPTION OF INTEREST income from the Federal income tax has effectively limited the demand for state and local government securities to investors in relatively high tax brackets. Commercial banks and property (non-life) insurance companies that pay the full corporate income tax rate and high income individuals absorb virtually all tax-exempt issues. Other financial institutions either pay no income taxes (state and local and private pension funds) or are subject to such low effective tax rates that the after-tax return on taxable securities exceeds that on tax-exempts (life insurance companies, savings and loan associations, and mutual savings banks).[1] These low tax rates are due to a variety of Federal tax regulations affecting reserve allowances.[2]

Considerable disagreement has developed as to what factors determine the quantities of tax-exempts held by commercial banks and property insurance companies. Several studies, Galper and Petersen [4], Rosenbloom [10] and Silber [11] have argued that the demand by commercial banks is largely determined as a residual. That is, any investible funds in excess of bank reserve, liquidity and loan needs are used to purchase tax-exempts. While not necessarily disputing the importance of such factors, others have found that relative yields on taxable and tax-exempt securities are an important determinant of demand. Fortune [2] and Friedman [3], respectively, allocate bank residual funds and total funds of property insurance companies on this basis.

The residual funds theory is not based on profit-maximizing behavior and is clearly inconsistent with observed commercial bank purchases of tax-exempts in 1975 and 1976. The combination of massive reintermediation of deposits and repayment of business loans would have been expected to result in substantial bank purchases. In fact, holdings of tax-exempts increased by less in the two year period 1975–76 than in any other single year in the 1970s. The relative-yield

* Professor of Economics and Finance at Purdue University and Texas Tech University, respectively. Comments by Jess Yawitz and Richard Roll are appreciated.

[1] During 1975 and 1976 the institutions paying zero or low tax rates increased their aggregate holding of tax-exempts by $6½ billion, after not having increased their aggregate holdings at all in the previous decade. Similarly, state and local governments abruptly added $5 billion to their holdings. It seems likely that most of this increase was due to investment by public and private New York institutions as part of the series of arrangements developed to avoid bankruptcy of New York City.

[2] All investment income of life insurance companies must be allocated on a pro rata basis between nontaxable policyholder reserves and taxable earnings. Because insurance companies generally divert over half of their income to policyholder reserves, they pay taxes at less than the 25 percent rate on a large fraction of their taxable investment income. The taxation of mutual savings banks and savings and loan associations is discussed in Section I.

hypothesis also has little a priori appeal as the major determinant of bank and property insurance investment in tax-exempts. If the yield on tax-exempts always exceeds the after-tax yield on taxables for these investors, as it does for any long-term investor that pays the corporate income surtax, then it is not clear that relatively small changes in such yields should be of great importance in the allocation of funds.

The purpose of this paper is to develop and then test an alternative theory of the demand for tax-exempts by financial institutions. A theory based on profit-maximizing behavior is presented in Section I. In Section II the theory is tested by the estimation of demand equations by commercial banks and property insurance companies. A concluding section summarizes the paper.

I. General Theoretical Considerations

Fully-Taxed Institutions

Consider an institution that has only two investment possibilities, tax-exempt securities earning R_{ex} and taxable securities paying R_{tx} before taxes. For simplicity, the firm's liabilities and net worth are taken as given and both securities are assumed to have the same maturity and default risk. Let X be the proportion of total assets in taxable securities and thus $1 - X$ be the proportion in tax-exempts. Assuming that net income, exclusive of that from tax-exempts, is taxed at rate τ, after-tax income per dollar of assets A can be expressed as[3]

$$A = (1 - Z\tau)(R_{tx}X - R_c) + R_{ex}(1 - X), \tag{1.1}$$

where

$$Z = \begin{cases} 1 & \text{when} \quad R_{tx}X - R_c > 0 \\ 0 & \text{when} \quad R_{tx}X - R_c < 0 \end{cases}$$

and

R_c = the sum of the average cost of funds and operating expenses per dollar of assets.

The Z variable reflects the fact that while the government participates in the institution's profits, it does not share in losses. The firm's sole choice parameter is X which it selects so as to maximize A. Taking the partial derivative of A with respect to X and equating it to zero, one obtains

$$R_{ex}/R_{tx} = 1 - Z\tau \tag{1.2}$$

as the condition consistent with profit maximization.

During the last two decades the ratio of yields on tax-exempt securities to yields on similar quality and maturity taxable securities has generally ranged from 0.55 to 0.8 with the ratio being lower for shorter maturity securities and

[3] The yields in equation (1.1) are average portfolio yields, rather than current market rates. However, these are equivalent in a long-run steady-state and will be treated as the same in this section.

averaging about 0.7 for twenty-year securities. Thus tax-exempts are preferred by investors paying the full corporate tax ($\tau = 0.5$) when taxable profits exist ($Z = 1$), but taxables are preferred when taxable profits are nonexistent ($Z = 0$).[4] Thus, after-tax profits are maximized by investing in taxables as long as deductible expenses exceed income—as long as $R_{tx}X - R_c \leq 0$—and then shifting to tax-exempts. The profit-maximizing share of assets in taxable securities is therefore obtained by equating $R_{tx}X$ and R_c:

$$X = R_c/R_{tx}. \tag{1.3}$$

The profits function is illustrated graphically in Figure 1 for $R^0_{tx} = 0.10$, $R_{ex} = 0.07$, $R_c = 0.08$ and $\tau = 0.5$. After-tax profits per dollar of assets (A) for different levels of the share of assets invested in taxable securities are indicated by the solid line segment. With all assets in tax-exempts ($X = 0$), the loss per dollar of assets is 0.01 ($= R_c - R_{ex}$). For every percentage point of assets shifted to taxables prior to the covering of all expenses, A rises by $(R_{tx} - R_{ex})/100$. After all expenses are covered, further percentage point shifts change A by $[(1 - \tau)R_{tx} - R_{ex}]/100$. Given the assumed values of the variables, A declines to 0.01 [$= (1 - 0.5)(0.10 - 0.08)$] for complete investment in taxables. A is maximized when $X = R_c/R^0_{tx} = 0.8$. The dashed schedule in Figure 1 indicates the impact of a ceteris paribus increase in the taxable rate from $R^0_{tx} = 0.10$ to $R^1_{tx} = 0.11$. X falls to 0.727 (0.08/

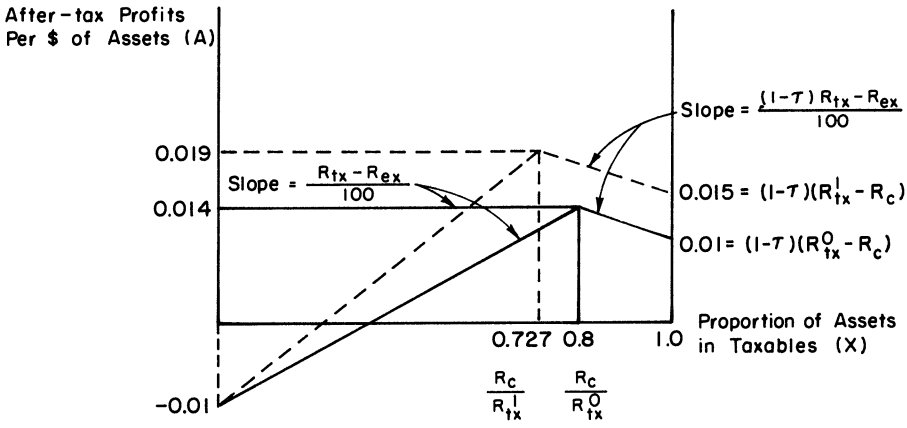

Figure 1. After-tax profits as a function of the proportion of assets in taxable securities ($R^0_{tx} = 0.10$, $R_{ex} = 0.07$, $R_c = 0.08$ and $R^0_{tx} = 0.11$)

[4] In his recent presidential address, Merton Miller [9, pp. 268–270] assumes that the ratio of tax-exempt to taxable bond yields equals $1 - \tau$ and contends that "the spread between municipals and corporates has typically been within shouting distance of the corporate rate" (footnote 21). He obviously meant to say that the spread between corporates and municipals was within shouting distance of the product of the corporate tax and bond rates, i.e., that the rate ratio is approximately $1 - \tau$, i.e., 0.5. Our inspection of the data on 20 year Aaa rated bonds reveals an average ratio far above 0.5 during the 1960–1976 period. We also note that the risk that the tax status of municipals will be changed, an explanation sometimes given for why the rate ratio might exceed $1 - \tau$, is only relevant if the changed tax status were to be applied retroactively to existing bonds, a possibility that seems remote. If the rate ratio became $1 - \tau$, then our framework would not provide a determinate demand for tax-exempts by fully-taxed institutions.

0.11) and A rises to 0.019. Only when $(1 - \tau)R_{tx}$ finally exceeds R_{ex} (the right portion of the profits function becomes positively sloped) will the share of assets in taxable securities rise in response to an increase in the taxable rate, and the increase would be a discrete jump to unity.

When the full corporate tax rate applies to all profits and tax-exempt securities are the only tax shield, the above analysis suggests that fully-taxed profit-maximizing institutions should purchase taxable securities to the point where the income derived from these securities is just sufficient to cover all expected expenses. When a tax rate of less than 35 percent applies to some minimum level of income (the first $50,000 between 1976 and 1978), after-tax profits are maximized by investing in taxables until taxable income reaches this level and then placing all remaining funds in tax-exempt securities. Let EX^d denote the demand for tax-exempts by a financial industry, II^* be their long-run expected net income above that subject to marginal tax rates of less than 35 percent, and $R_{ex}^{\sim}$ be the average yield on tax-exempt securities in their portfolio.[5] Then

$$EX^d = \frac{II^*}{R_{ex}^{\sim}}. \tag{1.4}$$

The implicit unit coefficient on $\frac{II^*}{R_{ex}^{\sim}}$ in equation (1.4) fails to reflect two additional considerations. First, tax-exempt securities are not the only source of tax-sheltered income. Commercial banks make loans abroad and purchase equipment for leasing, and property issuers invest in corporate equity.[6] Second, these financial institutions probably cannot eliminate their tax liabilities completely without inviting harmful legislative action. If we let α equal the desired minimum taxable proportion of expected total net income and β be the proportion of such income shielded by investments other than tax-exempts, the demand for tax-exempts can now be written as[7]

$$EX^d = (1 - \alpha - \beta)\frac{II^*}{R_{ex}^{\sim}}. \tag{1.5}$$

Whereas equation (1.5) should describe the long-run demand for tax-exempts, short-run deviations likely occur. Two types of adjustments seem probable. First,

[5] Changes in the amount of initial income upon which commercial banks pay low tax rates can have a significant impact on commercial bank demand for tax exempts. To illustrate, the $25,000 increases in the amount of income subject to low tax rates produced by the Tax Reform Act of 1976 and the Tax Reduction and Reform Act of 1978 each reduced II* for the 14,000 commercial banks in the aggregate by $350 million. With $R_{ex}^{\sim} = 0.05$ and $1 - \alpha - \beta = 0.6$ (see the next paragraph and the estimated results in Section II), EX^d would fall by $4.2 billion.

[6] See Bedford [7] and Kimball [8] for a description of the usage of these tax shelters by commercial banks.

[7] Neither II* nor $R_{ex}^{\sim}$ are entirely exogeneous variables. II* depends on current and lagged values of interest rates on all commercial bank assets and liabilities and $R_{ex}^{\sim}$ is a function of current and lagged yields on tax-exempt securities. In general, these yields would be determined in a full model by market-clearing relationships for each market. For a model in which the tax exempt yield is determined in this manner, see Hendershott and Koch [7]; for a full financial sector with market-clearing relationships, see Hendershott [6].

if net income expectations are not realized in the short-run, institutions might adjust their holdings of tax-exempts to shield their actual net income. For example, if current income exceeds that expected, institutions might temporarily "over-invest" in tax-exempts, planning to purchase fewer tax-exempts later. When net income is overestimated, institutions might temporarily reduce their planned purchases of tax-exempts intending to accumulate more later when profits rise. Second, if tax-exempt rates are viewed as being temporarily high (low) relative to after-tax taxable rates, institutions might also temporarily over-invest (under-invest) in tax-exempt securities.[8]

Partially-Taxed Institutions

The model can be easily modified to consider partially-taxed institutions such as thrifts (savings and loan associations and mutual savings banks) who have been allowed to transfer large portions of their before-tax income to reserves, thereby avoiding taxation.[9] Making the same assumptions as above, but letting thrifts transfer s of their net "taxable" income to reserves before computing their tax gives the following expression for after-tax profit per dollar of assets:

$$A = [1 - Z\tau(1 - s)](R_{tx}X - R_c) + R_{ex}(1 - X). \qquad (1.1)'$$

Equating the partial with respect to X to zero, one obtains

$$R_{ex}/R_{tx} = 1 - Z\tau(1 - s) \qquad (1.2)'$$

as the profit maximizing condition.

As long as $1 - Z\tau(1 - s)$ is less than the observed rate ratio, profit maximizing thrifts will not invest in tax-exempts. With $\tau = 0.5$ and $s = 0.6$, as it was prior to 1970, the rate ratio would had to have been above 0.8 for thrifts to demand tax-exempts. With $s = 0.4$ at present, the rate ratio must exceed 0.7.[10] Given observed data, thrifts are now approximately indifferent between tax-exempts and taxables. (In terms of Figure 1, the downward portion of the solid schedule would be horizontal because $[1 - \tau(1 - s)]R_{tx}$ equals R_{ex}.) This simple analysis shows why

[8] It might also be argued that α and β in equation (1.5) depend on relative yields. If after-tax taxable rates rise relative to tax-exempt rates, portfolio managers might consciously lower the desired taxable proportion of net income. If the after-tax return on other tax-sheltered investments rises relative to the tax-exempt yield, we would expect these institutions to shield a smaller portion of their income with tax-exempts.

[9] Prior to 1963, the effective tax rate on aggregate thrift income never exceeded 2 percent; thrifts were, in effect, allowed to transfer virtually all income to reserves. In the 1962 Revenue Act Congress limited the amount transferred, with some exceptions, to 60 percent of taxable income. The Tax Reform Act of 1969 lowered this percentage in steps over time, still with exceptions, to 40 percent in 1979.

[10] There also exists a minimum tax of 15% which is applied to thrift tax preferences, the most important of which is the difference between their bad debt deduction and that allowed under the experience method, less $10,000 and the regular tax paid. Ignoring both the $10,000 and losses under the experience method, the minimum tax is 0.15 $[s - \tau(1 - s)]$. With $s = 0.4$, the tax per dollar of income is 1.5 percent (accounting for losses under the experience method would lower this marginally). This would lower the indifferent rate ratio to 0.685. (It should be clear that for $s \leq 0.333$ there would be no minimum tax).

commercial banks (with $s = 0$) have traditionally held large amounts of tax-exempts and thrifts have not. However, the Carter Administration recently proposed a reduction of s to 0.3, U.S. Treasury Department [12, p. 308]. Such a decline would make tax-exempts attractive as long as the rate ratio exceeded 0.65, as it often has for securities with maturity above ten years. Thus thrifts could become significant demanders of tax-exempts for the first time.

The above analysis also suggests the maximum amount of funds that thrifts might wish to place in tax-exempts. To illustrate, for savings and loans the average estimates of portfolio yields and costs for 1976 and 1977 are $R_{tx} = 0.08$ and $R_c = 0.07$ (*Federal Home Loan Bank Board Journal*, May 1978, p. 16). Profits would be maximized when $0.08X - 0.07 = 0$ or when $X = 0.875$. Thus a maximum of 12½ percent or \$57 billion of their \$455 billion in assets at the end of 1977 would be shifted into tax-exempt securities. Two factors would tend to mitigate this shift. First, there are both other potential sources of tax-sheltered income and the political realities that discourage the reduction of tax liabilities to zero—α and β in equation (1.5). Second, the ratio of tax-exempt to taxable yields would likely fall to 0.65 before the shift was complete, thereby eliminating the incentive for the complete shift. (Complete elimination of the bad debt provision would, however, reduce the indifference rate ratio to 0.5 and a full $(1 - \alpha - \beta)$ \$57 billion shift would occur.) Thus a seemingly innoculous increase in the taxation of financial institutions could have an enormous impact on the tax-exempt market and on the markets for securities in which the institutions would reduce their demands.

II. Equation Estimates

Demand equations estimated for commercial banks and property insurance companies are based on annual data for the period 1960–76 and incorporate several modifications of equation (1.5) in light of the short-run deviations described earlier and other factors. A symbolism for and definitions of the variables employed in the regressions are presented in Table I.

If income expectations are not realized in the short-run, these institutions will probably make some partial attempt to adjust their holdings of tax-exempts to shield actual net income. Thus an unexpected profits variable is added to capture unrealized income expectations. The variable is unexpected profits, the difference between actual and expected profits, divided by the current tax-exempt yield for the maturity equal to the industry's preferred habitat. For commercial banks, expected profits was measured at 1.135 times a three-year moving average of actual profits; the 1.135 factor makes cumulative unexpected profits zero over the sample period. For property insurers, income is disaggregated according to source, investments and insurance underwriting. Investment income provides relatively stable and predictable receipts. Underwriting income, in contrast, fluctuates with the business cycle, averaging approximately zero. Long-run expected income is thus measured as the sum of actual net investment income and the average long-run underwriting gain. Unexpected profits is defined as the difference between current period underwriting gains and the long-run average gain. A deviation of

Table I

Definitions of Data Employed in the Regressions

Commercial Banks:

EX_c^d = the stock of tax-exempt securities held

II_c = annual operating income of commercial banks less the product of the number of banks and the maximum annual income per bank not subject to tax rates above 35 percent.

$II_c - II_c^* = II_c - 1.135\left(\frac{1}{3}\sum_{i=1}^{3} II_{c-1}\right)$

$R_{exc}^{\sim}$ = tax-exempt interest income divided by the average annual stock of tax-exempt holdings

R_{ex1} = yield on choice rate (Aa to high A) one-year maturity tax-exempt securities

R_{ex20} = yield on choice-rated (Aa to high A) twenty-year maturity tax-exempt securities

R_{tx20} = yield on twenty-year maturity Aa rated utility bonds

R_{exc} = 0.4 R_{ex1} + 0.6 R_{ex20} with the weights reflecting relative maturities of bank tax-exempt holdings

$$R^* = \frac{R_{ex20}}{0.52\,R_{tx20}} - 0.5\left[\left(\frac{R_{ex20}}{0.52\,R_{tx20}}\right)_{-1} + \left(\frac{R_{ex20}}{0.52\,R_{tx20}}\right)_{-2}\right]$$

CDD = dummy variable for the credit crunch of 1969–70 equal to the change in cumulative certificates of deposit outstanding at banks relative to what would have been expected given the growth in CDs between 1965 and 1968; the dummy equals −$15.64 billion in 1969 and −$3.9 billion in 1970

T = truncated time trend (1, 2, ⋯ 14 for 1960–73, 14.5 for 1974–76)

Property Insurance Companies:

EX_p^d = the stock of tax-exempt securities held

II_p^* = net investment income plus the average annual long-run underwriting gain less the product of the number of companies and the maximum annual income per firm not subject to the corporate income tax

DIV = dividend income from equity holdings

$II_p - II_p^*$ = the average of current underwriting gains and gains lagged one period less the average annual long-run underwriting gain

$R_{exp}^{\sim}$ = tax-exempt interest income divided by the average annual stock of tax-exempt holdings

All financial quantity data are taken from the *Flow of Funds Accounts* of the Board of Governors of the Federal Reserve System. The data on commercial bank profits are obtained from Table C: Income and Expenses of Insured Commercial Banks, *Bank Operating Statistics*, Federal Deposit Insurance Corporation. The data on property insurance company profits are obtained from *Bests Aggregates and Averages*. Property insurance company dividend income was estimated by apportioning dividend income for all insurance companies (active corporation returns) between property and life insurance on the basis of their relative equity investments (total dividends were estimated for 1975 and 1976). Property insurance interest income was estimated from aggregate insurance data in the same manner. The tax-exempt yields used are from Salomon Brothers.

the ratio of exempt to taxable yields from its expected value might also elicit a temporary shift in tax-exempt demand. Temporary interest rate sensitivity is tested for by the inclusion of the product of $II/R_{ex}^{\sim}$ and the difference between the current after-tax rate ratio on comparable risk twenty-year maturity securities and its average during the previous two years (R^*) as a regressor.

Two additional adjustments were made regarding past commercial bank behavior. Before the development of the markets for large negotiable certificates of deposit (CDs) and federal funds, commercial banks held far fewer tax-exempts than minimization of their liabilities dictated. To satisfy liquidity needs banks held substantial short-term U.S. governments. Because banks are primarily

committed to loans, these liquid assets were held at the expense of tax-exempt securities, and commercial bank taxable income was too high. The development of the CD and federal funds markets reduced the need to hold liquid assets and allowed the substitution of tax-exempts for U.S. governments. This substitution occurred systematically through 1971, after which the growth in the demand for tax-exempts declined.[11] The decline after 1971 can be explained by the difficulties with credit extended to real estate investment trusts (lower profits) and greater use of investment and foreign tax credits during the 1970s, i.e., in terms of the framework developed in this paper. The first adjustment takes account of this long-run portfolio shift by utilizing the product of the long-run expected profits variable and a truncated time trend in the equation.[12] The second adjustment is to add a variable (CDD) that captures the inability of commercial banks to replace maturing certificates of deposits with new issues when competitive open market rates rose above Regulation Q ceilings in 1969–1970. The sudden loss of funds during this period forced many banks to cut back on their investment in tax-exempts to satisfy liquidity needs.

Like commercial banks, property insurance companies utilize tax shields other than tax-exempts. The most prominent of these is corporate equities. Because corporations pay taxes on only 15 percent of intercorporate dividend income, the effective tax rate on such income is only 7.5 percent for the fully-taxed firm. In addition, long-term equity capital gains are taxed at the usual favorable rate. The proportion of property insurance company assets in equities has fallen sharply in recent years, from 32 percent in 1968 to 18 percent in 1976 with property insurers being net sellers of equities during the 1974–76 period. Hence it is inappropriate to assume that the proportion of income shielded by tax-sheltered investments other than tax-exempts (β) is constant. To avoid this assumption, a direct measure of dividends earned (DIV) has been subtracted from expected net income, and the ratio of this difference to the portfolio yield is employed in the demand equation for property insurance companies.

The results of the estimation are presented in equations (2.1) and (2.2). Dollar values are measured in millions and interest rates in percentage points.

Commercial Banks:

$$EX_c^d = \underset{(13.2)}{(10.597} + \underset{(50.2)}{3.379}\, T) \frac{\Pi_c^*}{R_{exc}^{\sim}} + \underset{(2.6)}{11.955} \frac{\Pi_c - \Pi_c^*}{R_{exc}} \tag{2.1}$$

$$+ \underset{(3.0)}{18.5}\, R^* \frac{\Pi_c}{R_{exc}} + \underset{(3.4)}{0.47}\ \mathrm{CDD}$$

[11] The ratio of tax-exempts to total credit market instruments for all commercial banks almost doubled between 1960 and 1971, rising from 9% to 17%, while the comparable ratio for U.S. governments dropped from 32% to 17% over the same period. At the end of 1976 the ratio for tax-exempts had fallen to 13% while the ratio for U.S. governments had leveled off at 18%.

[12] The mid-1974 point of truncation—conceptually the point at which these money markets were fully developed and the demand for liquid assets ceased to decline—is that which minimized the standard error of the regression equation.

$$R^2 = 0.997 \quad \text{D.W.} = 1.57 \quad \text{SEE} = \$1674 \text{ million}$$

Property Insurance Companies:

$$EX_p^d = \underset{(127.0)}{42.9} \frac{\Pi_p^* - \text{DIV}}{R_{\tilde{exp}}} + \underset{(2.9)}{2.612} \frac{\Pi_p - \Pi_p^*}{R_{ex20}} . \tag{2.2}$$

$$R^2 = 0.996 \quad \text{D.W.} = 1.38 \quad \text{SEE} = \$654 \text{ million}$$

These estimates imply the following:

1. In each successive year from 1960 to 1974 commercial banks in the aggregate shielded a greater proportion of their expected profits. This proportion rose by 3.4 percent annually from 11 percent in 1959 to almost 60 percent in 1974–76. Property insurance companies, in contrast, shielded only 43 percent of their nondividend income by investing in tax-exempts.
2. On the average, commercial banks and property insurers shield approximately 12 percent and 2.6 percent, respectively, of their unexpected or temporary profits. These proportions are, as anticipated, smaller than the fraction of expected profits shielded. Apparently the longer-term maturity of property insurers' investment portfolio does not allow them to invest effectively short-term or shift easily between tax-exempt and taxable securities.
3. Increases in the ratio of tax-exempt to taxable yields cause temporarily high investment in tax-exempts for banks while property insurance company demand is unaffected. If the tax-exempt rate should rise from 5.6 percent to 6.4 percent, for example, while the taxable rate remains at 8 percent (the pre-tax ratio rises from 0.7 to 0.8), then banks would purchase enough tax-exempts to shield an additional 3.6 percent of current profits. The absence of rate-sensitivity for property insurance companies is not surprising considering that their portfolios are relatively illiquid and adjustment costs are high.
4. The CD runoff forced commercial banks to cut back on their tax-exempt holdings by approximately 47 percent of the decline in their CD liabilities relative to trend. This amounted to $7.3 billion at the end of 1969 and $1.8 billion at the end of 1970.

III. Conclusion

Given that the yield on tax-exempt securities exceeds the after-tax yield on comparable taxable securities, the dominant determinant of holdings of tax-exempts by a fully-taxed profit-maximizing institution is likely its expected net income. This income constitutes the maximum possible amount of tax sheltered income the institution would want to earn (political realities might discourage the reduction of tax liabilities to zero) because further income would be matched by interest expense. Of course, both commercial banks and property insurance companies have alternative tax-sheltered sources of income and thus they would not necessarily shield all of their net income by holding tax-exempt securities.

These alternatives include primarily leasing and foreign loans for commercial banks and equity investments for property insurance companies. Increased usage of these alternatives would obviously reduce the demand for tax-exempts. Other factors that could have a relatively minor impact on the demand for tax-exempts are temporarily high relative yields on tax-exempts and unexpectedly high net income. These should lead to a temporary "over-investment" in tax-exempts, and commercial banks, whose shorter-term portfolios of tax-exempts roll over more rapidly, are in a better position to take advantage of such transitory phenomenon.

The analysis is also employed to explain why the partially-taxed thrift institutions have not been significant demanders of tax-exempt securities and how a relatively small change in their tax treatment could cause them to become significant participants in this market.

The empirical results obtained are pleasing in many respects. First, the equations explain quite accurately the growth in holdings of tax-exempts by these institutions overtime, including the slowdown in the growth of bank holdings in 1975 and 1976. Second, net income (deflated by the tax-exempt portfolio yield) is the dominant explanatory variable. Banks are shown to be currently shielding 60 percent of net income via holdings of tax-exempts, and property insurers are shielding 43 percent of net income other than dividends. Third, the temporary interest rate and profit variables do play a significant (but minor) role, and it is larger for banks. Only one facit of the results is disturbing. Profit-maximization would appear to require that property insurance companies shield far more than 43 percent of net income after dividends, unless they utilize other tax-shelters to a much greater extent than we are aware.

REFERENCES

1. M. E. Bedford. "Income Taxation of Commercial Banks." *Monthly Review*, Federal Reserve Bank of Kansas City (July–August 1975).
2. P. Fortune. "The Impact of Taxable Municipal Bonds: Policy Simulations with a Large Econometric Model." *National Tax Journal*, Volume 26, Number 1 (March 1973).
3. B. M. Friedman. "Financial Flow Variables and the Short-Run Determination of Long-Term Interest Rates." *Journal of Political Economy*, Volume 85, Number 4 (August 1977).
4. H. Galper and J. E. Petersen. "An Analysis of Subsidy Plans to Support State and Local Borrowing." *National Tax Journal*, Volume 24, Number 2 (June 1971).
5. S. M. Goldfeld. *Commercial Bank Portfolio Behavior and Economic Activity* (Amsterdam: North-Holland Publishing Company, 1966).
6. P. H. Hendershott. *Understanding the Capital Markets, Volume I: A Flow-of-Funds Financial Model* (Lexington, Mass.; Lexington Books, D. C. Heath and Company, 1977).
7. P. H. Hendershott and T. W. Koch. *An Empirical Analysis of the Market for Tax-Exempt Securities: Estimates and Forecasts* (Monograph Series in Finance and Economics, New York University, 1977–4).
8. R. C. Kimball. "Commercial Banks, Tax Avoidance, and the Market for State and Local Debt Since 1970." *New England Economic Review*, Federal Reserve Bank of Boston (January/February 1977).
9. M. H. Miller. "Debt and Taxes." *Journal of Finance*, Volume 32, Number 2 (May 1977).
10. R. H. Rosenbloom. "A Review of the Municipal Bond Market." *Economic Review* Federal Reserve Board of Richmond (March/April 1976).

11. W. L. Silber. *Portfolio Behavior of Financial Institutions.* (New York: Holt, Rinehart, and Winston, 1970).
12. U.S. Department of the Treasury. *The President's 1978 Tax Program; Detailed Description and Supporting Analyses of the Proposals* (Washington, D.C.: U.S. Government Printing Office, January 30, 1978).