Regional Science and Urban Economics 19 (1989) 537–562. North-Holland

TAX REFORM AND THE MARKET FOR TAX-EXEMPT DEBT

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Received January 1989

This paper provides clear evidence that the yield spread between long-term taxable and tax-exempt bonds responds to changes in expected individual tax rates, a finding that refutes theories of municipal bond pricing that focus exclusively on commercial banks or other financial intermediaries. The results support the conclusion that in the two decades prior to 1986, the municipal bond market was segmented, with different investor clienteles at short and long maturities. The Tax Reform Act of 1986 has affected this market by restricting tax benefits from tax-exempt bond investment by commercial banks, as well as by altering marginal tax rates. Individual investors are increasingly important suppliers of capital to states and localities, and their tax rates are likely to be the primary determinant of the yield spread between taxable and tax-exempt interest rates in the future.

1. Introduction

The 1980s have witnessed significant changes in the municipal bond market. In the early 1980s, interest rates on tax-exempt securities reached record heights relative to comparable risky taxable bonds. The yield spread widened slightly during the mid-1980s, but the sweeping reductions in marginal tax rates for high-income investors in the Tax Reform Act of 1986 reduced the value of tax-exempt interest and lowered the yield spread once again. During the last half of 1988, the narrow yield spread implied that any investor with a tax rate in excess of 15% could earn a higher after-tax return by holding long-term tax-exempt bonds rather than taxable bonds.[1]

The volume of new tax-exempt issues also varied substantially, with

*I am grateful to Paul Gompers for excellent research assistance, to Thomas Barthold and Robert Inman for helpful discussions, and to the National Science Foundation for research support. This paper is part of the NBER Program in Taxation and the Project in State and Local Public Finance. Fig. 2 is reprinted by permission of the Wall Street Journal, © Dow Jones and Company (1988), all rights reserved worldwide.

[1]At the beginning of 1989, the rapid increase in yields on Treasury securities widened the implicit tax rate to nearly 30% at some short maturities. The long-maturity yield spread did not narrow appreciably during this period.

particularly large issues occurring in the last quarters of 1985 and 1986 as issuers sought to 'grandfather' their bonds against future changes in tax provisions. In 1987 and 1988, partly because of new restrictions on private-purpose Industrial Development Bonds, the flow of new issues was 50 percent below that of 1985 and 1986.

This paper examines the influence of federal tax policy on the tax-exempt bond market. The principal objective is to evaluate competing theories of the determination of tax-exempt bond prices in the aftermath of the 1986 Tax Reform Act. The 1986 reform largely eliminated the tax incentives for banks to invest in municipal bonds, and it made some interest on tax-exempt debt subject to minimum taxes on corporate and individual investors. These changes have already had important effects on the operation of the municipal bond market.

This paper's secondary objective is to evaluate the role of tax policy in explaining the narrowing yield spread between taxable and tax exempt interest rates during the last decade. The coincidence of the rise in tax-exempt interest rates and the passage of major tax reform legislation in the 1980s creates a strong presumption that tax changes are at least partly responsible for this trend. Other explanations also abound, however. Arak and Guentner (1983) cite increased municipal risk, a rising supply of tax-exempt securities during the mid-1980s, and changes in commercial bank behavior as possible alternative explanations. Understanding the source of the narrowing yield spread is important for assessing the efficacy of current tax provisions in subsidizing municipal borrowing, as well as for analyzing other proposals designed to reduce the real cost of debt finance to states and localities.

This paper is organized as follows: Section 2 chronicles recent trends in the taxable-tax exempt yield spread and in the level of municipal borrowing. Section 3 sketches several competing theories of how the yield spread is determined, noting in particular their predictions regarding the recent tax reforms. Section 4 presents the statistical framework that I use to analyze the links between tax changes and shifts in the implicit tax rate on tax-exempt bonds. The next section describes the major tax policy events of the last two decades that have potentially affected the municipal bond market. Section 6 reports empirical results. The basic findings suggest that models which relate the yield spread only to tax rates on corporations or commercial banks, while excluding individual investors, provide a poor guide to the influence of taxation of the tax-exempt bond market. The taxation of individual investors has historically affected the yield spread on long-term bonds more than that on short-term securities. The recent and prospective growth of individual investment in tax-exempt bonds is likely to increase the importance of personal taxation at all maturities. There is a brief conclusion.

2. Trends in the tax-exempt bond market, 1955–1988

This section describes recent movements in the yield spread between taxable and tax-exempt interest rates, the volume of tax-exempt borrowing, and the composition of this borrowing. The yield differential between taxable and tax-exempt bonds can be described conveniently by the implicit tax rate, θ, at which an investor would be indifferent between the two yields.[2] This tax rate is defined by $(1-\theta)R = R_M$, where R is the yield on a taxable bond and R_M is the yield on a comparably risky tax-exempt security. In my calculations, interest rates are drawn from Salomon Brothers' *Analytical Record of Yields and Yield Spreads*. They are derived from yield curves for par bonds with current issue characteristics on the first day of each month. The taxable interest rate is measured using the yield on newly issued Treasury securities, and the tax-exempt rate using prime-grade general obligation tax-exempt bonds.[3] 'Prime' is the highest rating awarded to municipal bonds by Saloman Brothers, so both the taxable and tax-exempt rates are close to riskless.[4]

Table 1 reports annual average values of the implicit tax rates on one- and twenty-year bonds for the period 1955–88. Five-year averages are reported prior to 1975. The series show pronounced declines in the implied tax rates on both long- and short-maturity bonds between 1979 and 1982. The twenty-year implied tax rate declined by more than 20 percentage points during this period. The tax rates implied by short-term yields declined less dramatically, from 50% to 42%. These changes are larger than those observed in any other three-year period in the postwar era. The table also shows that in every year the implicit tax rate on short-term bonds was substantially higher than that on any of the long-term bonds. The divergence was most pronounced in the late 1960s and early 1980s, when the difference between the implicit tax rates on one- and twenty-year bonds exceeded 25 percentage points.[5]

During the mid-1980s, the implied tax rates on short-term municipals have

[2]Simple yield comparisons may be misleading because bonds may differ along other dimensions. Most municipal bonds, for example, can be called after ten years while Treasury bonds cannot be called. These considerations are unlikely to have a large effect in biasing comparisons of yields in adjacent months, however.

[3]Many recent events such as the Washington Public Power Supply System default have altered the perceived riskiness of *revenue bonds* issued by states and localities. These developments should have had a much smaller effect on the market for general obligation bonds, which are backed by the 'full faith and credit' of the issuing government.

[4]Buser and Hess (1986), Kochin and Parks (1988), Peek and Wilcox (1986), and Poterba (1986) all use this interest rate series and compare prime tax-exempt yields with Treasury yields. Trczinka (1982) and Kidwell and Trczinka (1982) have compared the yields on prime municipals with AAA-rated corporate bonds. Since their taxable interest rate data begin in 1970, using these data would eliminate many interesting tax changes from the sample period.

[5]Kochin and Parks (1988) show that the upward slope of the tax-exempt term structure has sometimes been steep enough to generate implied future short-term municipal rates *above* implied future short-term taxable rates. This provides evidence for the segmented markets view that I discuss below.

Table 1

Marginal tax rates implied by taxable and tax-exempt interest rates, 1955–1988.

Year	One-year maturity	Twenty-year maturity
1955–59	41.1	20.6
1960–64	45.4	24.0
1965–69	37.6	21.8
1970–74	42.1	19.0
1975	40.8	21.7
1976	47.5	27.6
1977	50.7	32.2
1978	49.3	34.6
1979	49.8	35.5
1980	48.5	30.8
1981	46.3	22.9
1982	42.4	15.4
1983	44.5	20.6
1984	44.1	22.2
1985	39.7	19.7
1986	32.5	14.8
1987	33.4	19.0
1988	31.5	15.5

Source: Salomon Brothers, *Analytical Record of Yields and Yield Spreads*, and author's calculations.

gradually declined, while those on long-term bonds have varied between 15 and 20%. As recently as 1983, the yield differential on short-maturity securities implied that investors with tax rates of 45% would be indifferent between taxable and tax-exempt bonds. During 1988, the implied tax rate averaged 31.5%, suggesting that only individual investors facing the 33% income tax bracket, or corporations with a 34% marginal rate, would earn more by holding tax-exempt rather than taxable bonds. For long-term bonds, the yield spread was much smaller, falling below 15% in several months of 1988.

Table 2 reports changes in the ownership of tax-exempt debt during the last three decades. Two broad trends are clear. First, throughout the 1960s and 1970s, the fraction of tax-exempt debt held by households declined. From an average of 42% of the outstanding debt in the late 1950s, the household share fell to just over 25% in the late 1970s. During the 1980s, however, household ownership of tax-free bonds has surged upward to over 45% at the end of 1988. Part of the growth in household demand for tax-exempt securities reflects changes in the relative tax advantage from holding these assets. In part, financial innovation – the rise of tax-exempt mutual funds – may also be important in stimulating household purchases. In 1981, only 5% of household investment in tax-exempt bonds was channelled through these funds. By 1988, the share had increased to 23%.

Table 2

Ownership of tax-exempt bonds, 1955–1988.

Year	Households	Commercial banks	Property and casualty insurance companies
1955–59	42.1	27.5	10.0
1960–64	39.8	30.0	11.8
1965–69	34.6	42.4	11.6
1970–74	29.7	49.5	13.4
1975	30.4	47.2	14.9
1976	30.1	44.3	15.5
1977	27.4	44.4	17.9
1978	25.7	43.4	21.0
1979	26.1	42.8	22.4
1980	26.3	42.2	23.1
1981	27.3	41.4	22.8
1982	30.1	38.6	21.5
1983	34.6	35.3	19.5
1984	38.4	33.4	17.2
1985	40.3	32.6	14.9
1986	39.4	31.6	14.4
1987	42.8	25.7	16.5
1988	44.9	21.8	18.9

Source: Federal Reserve Board, *Flow of Funds Accounts*. Household sector includes tax-exempt debt held through mutual funds.

The second trend in municipal ownership involves commercial banks. Their holdings of municipal debt rose from the late 1950s through the mid-1970s, from one quarter to one half of the outstanding stock. Commercial bank holdings of municipals have declined sharply since the late 1970s, and at the end of 1988, they are just over 20% of the outstanding bonds. The cause of this decline is discussed in the next section. The third largest holders of municipal debt, property and casualty insurance companies, have held a slowly declining share of the outstanding bonds since the early 1980s. They currently account for approximately one fifth of tax-exempt debt.

There have also been important changes in the supply of tax-exempt debt during the 1980s. Once the exclusive province of states and local governments, during the early 1980s corporations and non-profit institutions such as hospitals and universities issued 'private purpose' tax-exempt debt. Table 3 shows the growth of this borrowing, reporting the share of private-purpose debt in the stock of outstanding tax-exempt debt. By 1985, nearly one fifth of the stock of tax-exempt debt was a liability of the non-financial corporate sector, rather than states and localities. Another 10% had been issued by non-profit institutions. The share of such private-purpose debt in the tax-exempt market has declined since 1985, however, largely due to restrictions in the Tax Reform Act of 1986. The Act placed state-by-state volume caps on private-purpose tax-exempt bond issues, equal to the greater of $75/resident

Table 3

Growth of private-purpose tax-exempt debt, 1975–1988.

Year	Non-financial corporations	Households and non-profit institutions
1975	2.6	1.0
1976	3.4	1.7
1977	5.8	2.7
1978	7.9	3.5
1979	10.1	4.1
1980	12.3	4.6
1981	14.9	5.3
1982	17.2	6.5
1983	18.0	8.2
1984	18.6	9.5
1985	19.9	10.8
1986	18.0	11.9
1987	16.4	11.1
1988	15.8	10.7

Source: Federal Reserve Board, *Flow of Funds Accounts*, and author's calculations. Entries are the percentage of outstanding tax-exempt debt that was a liability of the various sectors.

or $250 million in 1986–87 and $50/person or $150 million in 1988 and thereafter. Although there are some exceptions, for veterans' mortgage bonds, for bonds for government-owned solid waste facilities, and for small bond issues by certain qualified charities, these limits were designed to, and have succeeded in, reducing the volume of private–purpose tax-exempt financing.[6]

A final aspect of the municipal bond market during the 1980s which deserves comment is the time profile of debt issues. The discussion which preceded the Tax Reform Act of 1986 included a variety of proposals for restricting issues of private-purpose debt. There was also some chance that the tax reform bill would eliminate the tax-exemption for some or all of the interest paid on post-enactment municipal debt. Scholes, Wilson, and Wolfson (1987) mention the active discussion in the second half of 1985 of plans to eliminate tax benefits to commercial banks for their purchases of municipal debt after January 1, 1986. These considerations provided strong incentives for states and localities to accelerate debt issues and for commercial banks to purchase this debt before a new tax regime took effect. Table 4 shows that in the last quarter of 1985 alone, debt issues were nearly double

[6]The optimal regulation of tax-exempt bond issues is an intriguing issue for future work. The amount of bonds issued by one state of locality may affect the interest rates other governments are required to pay, but this pecuniary externality may not justify regulation. Preventing destructive intergovernmental competition, as one locality competes with another to offer attractive financing options to new firms, may be a more convincing justification.

Table 4

Net issues of tax-exempt bonds, 1981–1988.[a]

Quarter	States and localities	Non-financial corporations	Households and non-profit institutions
81:1	−1.2	4.0	1.2
81:2	2.3	5.2	1.2
81:3	3.3	4.0	1.4
81:4	2.7	4.1	1.8
82:1	0.5	4.5	2.2
82:2	11.7	4.1	2.5
82:3	5.9	5.2	2.7
82:4	6.9	4.6	2.9
83:1	−2.5	2.9	3.2
83:2	17.3	3.4	3.7
83:3	6.4	2.4	3.6
83:4	17.1	2.3	2.8
84:1	2.7	2.3	2.7
84:2	5.3	2.5	2.6
84:3	8.8	2.7	2.9
84:4	5.4	15.6	3.3
85:1	4.3	1.9	2.7
85:2	19.1	5.0	2.6
85:3	8.4	5.9	2.0
85:4	59.3	11.9	25.5
86:1	−9.0	−3.2	−2.6
86:2	8.5	−3.5	−0.1
86:3	38.1	−1.3	1.0
86:4	7.8	−2.5	−0.7
87:1	7.8	0.2	0.0
87:2	10.1	−1.2	−0.3
87:3	11.0	−0.1	−0.3
87:4	8.7	0.1	−0.4
88:1	3.7	0.4	0.2
88:2	7.9	−0.1	0.0
88:3	12.8	−0.1	0.8

[a]Each entry shows the net change in outstanding tax-exempt securities, measured in billions of 1988 dollars. Data are drawn from the Federal Reserve Board *Flow of Funds Accounts.*

their level in 1984. This suggests the central role of expected tax policy in the market for municipal bonds.

3. Alternative models of municipal bond market equilibrium[7]

Any analysis of the relative yields on taxable and municipal bonds must specify the behavior of firms and governments that supply these assets as well as the investors who demand them. This section discusses three competing theories of the determination of the taxable–tax-exempt yield

[7]This section draws heavily on Poterba (1986).

spread. The theories generate different predictions regarding the influence of tax policy changes on the yield differential between taxable and tax-exempt bonds.

3.1. The bank arbitrage hypothesis

The 'bank arbitrage hypothesis' was suggested by Fama (1977), and received empirical support from Skelton (1983) and Buser and Hess (1986). It was a reasonable candidate as a model of the municipal market in the 1960s and 1970s, but the tax changes of the mid-1980s make it an unlikely model of future equilibria. Until 1986, banks received unique treatment from the tax system because they were permitted to borrow at taxable interest rates, deduct interest payments from their taxable income, and invest the borrowed principal in tax-exempt securities without any tax burden on the resulting interest. This accounts for Fama's conjecture that banks are the marginal investors in tax-exempt debt. This model's simplicity makes it a natural starting point in analyzing the spread between taxable and tax-exempt interest rates.

If the tax-exempt yield, R_M, exceeded the after-tax cost of bank borrowing $(1-\tau)R$, where τ is the corporate tax rate and R is the taxable interest rate, then commercial banks would issue taxable bonds or notes and purchase municipal securities. By demanding municipal bonds, banks would drive up prices and lower yields until $R_M=(1-\tau)R$. Alternatively, if municipal yields were below this level, banks could reduce their holdings of municipal bonds. Banks have held large amounts of municipal debt for most of the past three decades, so they have ample reserves to undertake these portfolio adjustments.

This model suggests that while the yield spread between taxable and tax-exempt bonds should be stable, commercial bank holdings of municipal debt could be quite volatile. It also implies that changes in the financial condition of commercial banks which might affect their demand for tax-exempt income could directly affect the taxable–tax-exempt yield spread.

There seems little doubt that banks undertook the tax arbitrage transactions described above, especially with short-term bonds. Beek (1982) reports that 52% of the tax-exempt debt held by commercial banks in the early 1980s was of less than one-year maturity, while 92% of bank holdings had a maturity of less than five years. The role of banks in performing tax arbitrage with long-term bonds was more doubtful, and may have been restricted by institutional limitations and other factors.[8]

The bank arbitrage hypothesis implies that changes in the supply of

[8]Skelton (1983) discusses potential limitations on long-term arbitrage.

municipal debt should not affect the relative yields of taxable and tax-exempt debt. Changes in security volume require more or less borrowing or lending by banks, but the relative yields do not change. We do not need to model the issuing behavior of states and localities in order to determine equilibrium prices. Tax changes, however, can affect the yield spread. A temporary reduction in the corporate tax rate will lead to a substantial narrowing of the short-term yield spread but only a small change in long-term yields. A reduction in expected future corporate tax rates would raise the current yield spread on long-maturity bonds, with no effect on short-term yields. More importantly, personal tax rates do not affect municipal interest rates.

The bank arbitrage model suggests that for constant corporate tax rates, divergences in the yields on taxable and tax-exempt bonds at varying maturities must be attributable to the risk characteristics of the different securities. Fama (1977) argues that implied tax rates *below* the corporate tax rate, particularly at long maturities, are due to inadequate risk comparison.[9]

The bank arbitrage model is of limited relevance for describing future developments in the tax-exempt bond market, since commercial banks' share of this market has declined in each of the last eleven years. The decline since 1982 is primarily attributable to legislative changes that have affected the attractiveness of municipal bond arbitrage. The Tax Equity and Fiscal Responsibility Act of 1982 limited banks' interest deductions to 85% of the carrying costs of their municipal bond investments, reducing the attractiveness of the tax arbitrage described above.[10] The 1986 Tax Reform Act *repealed* the provisions allowing banks to deduct interest payments on liabilities that were used to hold tax-exempt bonds for bonds acquired after August 7, 1986.[11] In addition, tax-exempt interest is included in the base for the corporate alternative minimum tax that was introduced in 1986. Since the AMT is levied at a 20% rate on a base including one-half of the difference between financial-statement income and taxable income, some banks now face a 10% effective tax rate on municipal bond interest. These higher tax burdens, combined with a decline in bank profits (hence the need

[9]Gordon and Malkiel (1981) reject this explanation of long-term yield differentials by comparing the yields on long-term corporate bonds and industrial revenue bonds backed by the same firms. The yields on these securities suggested implied tax rates of about 25%, substantially lower than the prevailing corporate tax rate.

[10]The disallowed share of interest deductions was increased to 20% in the Deficit Reduction Act of 1984.

[11]The 1986 Act retained a class of 'bank-qualified' bonds, governmental-purpose bonds issued by municipalities that do not plan to sell more than $10 million of such bonds in a given year. Banks may still deduct interest on liabilities incurred in order to hold these bonds, and interest from these bonds is not included in the alternative minimum tax. However, these bonds account for less than 20% of the flow of new debt (*Credit Markets*, November 14, 1988, p. 16) and yield lower rates of return than other classes of tax-exempt bonds.

for tax-exempt income) in the 1980s,[12] have made banks less important participants in the municipal market of the late 1980s.

3.2. The Miller model

A second model of equilibrium pricing in the tax-exempt bond market was suggested by Miller (1977) as a by-product of his work on corporate capital structure. His model emphasizes the role of corporations as suppliers of debt and equity in determining the pattern of equilibrium yields. To highlight the role of tax clienteles, I consider the model in a world of certainty.

Assume that firms earn a fixed pretax return F on their investments. The after-tax return received by the owners of a debt-financed firm is $(1-m)F$, where m is the investor's tax rate on interest income. Since interest payments are tax-deductible, no corporate taxes are due. By comparison, in an equity-financed firm, shareholders receive an after-tax return of $(1-\tau)(1-\tau_e)F$, where τ_e is the effective marginal tax rate on equity income and τ is the corporate tax rate. If shareholders face different marginal tax rates, then those for whom

$$(1-m)>(1-\tau)(1-\tau_e)$$

will hold only debt while others invest only in equity.

Aggregate corporate financial policy is determinate, since the debt–equity ratio equates the market value of debt with the net worth of investors for whom

$$(m-\tau_e)/(1-\tau_e)<\tau.$$

The relative returns on debt and equity satisfy $(1-\tau_e^*)R_{eq}=(1-m^*)F$ where the pretax equity return is $R_{eq}=(1-\tau)F$. The marginal tax rates facing investors who are indifferent between debt and equity, indicated by asterisks, satisfy

$$(1-\tau_e^*)(1-\tau)=(1-m^*).$$

With neither taxes on equity income nor uncertainty, municipal debt and corporate equity are perfect substitutes. Both securities must yield a return of $(1-\tau)F$. If there are taxes on equity income, then investors who hold municipals will be those for whom

[12]Evidence on the importance of falling profits is provided in *Credit Markets* November 14, 1988, p. 16.

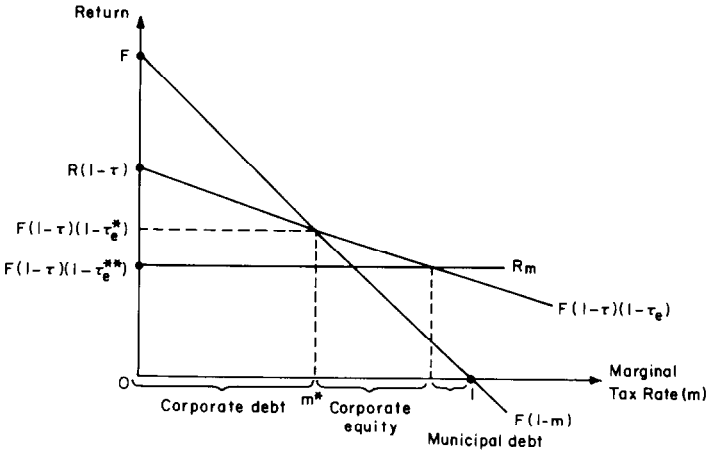

Fig. 1. Asset choice in the Miller model.

$$R_M > (1-m)F \quad \text{and} \quad R_M > (1-\tau_e)(1-\tau)F.$$

Fig. 1 summarizes the relationship between an investor's tax rate and his asset choice, assuming that equity tax rates are a linear function of those on interest income. The diagram makes clear that municipal bondholders are investors who would have held equity in the absence of tax-exempt debt. There is a critical value of τ_e, $\tau_e^{**} = 1 - R_M/R_{eq}$, at which investors will be indifferent between holding tax-exempt debt and taxable equity.

Given a stock of municipal debt M, the relative yield on taxable and tax-exempt debt is determined by finding τ_e^{**} such that M equals the total wealth held by investors with

$$\tau_e > \tau_e^{**} \quad \text{and} \quad \tau < (m-\tau_e)/(1-\tau_e).$$

Municipal and corporate bond yields are then related by

$$R_M = (1-\tau_e^{**})R_{eq} = (1-\tau_e^{**})(1-\tau)F. \tag{1}$$

An increase in municipal borrowing will lower τ_e^{**}, since more investors must be induced to hold municipal debt instead of equity, reducing the yield spread between taxable and tax-exempt debt.

To analyze how tax changes affect the yield spread, it is helpful to

distinguish between two versions of the Miller model. Miller Model I assumes that the effective tax rate on equity income is zero. This might be the case if the marginal investor in equities received returns only as capital gains and if could completely avoid tax on these gains.[13] If the equity tax rate is zero, then the previous conclusions with respect to changing the stock of municipal debt no longer obtain. Provided the stock of tax-exempt debt is less than the total wealth of individuals for whom $(1-m)<(1-\tau)$, R_M is independent of the stock of tax-exempt debt. Since $\tau_e^{**}=0$, $R_M=(1-\tau)R$ regardless of relative security supplies. As in the bank arbitrage model, the yield spread between taxable and tax-exempt debt is independent of changes in the personal tax code but sensitive to corporate tax changes.

The predictions of this model are therefore identical to those of the bank arbitrage model, although the mechanism that ensures $R_M=(1-\tau)R$ is different. This provides one way of distinguishing between the two views. When there are changes in the tax rates or rules applying to banks, but not other firms, the bank arbitrage model predicts that there will be changes in the taxable–tax-exempt yield spread. Miller Model I makes no such prediction. It's predictions are also insensitive to the 1986 Tax Reform Act's modifications of the regulations affecting commercial banks.

Miller Model II allows for positive equity tax rates. This seems a more plausible case since even if capital gains are effectively untaxed, the dividend tax burden makes $\tau_e>0$. Although Miller and Scholes (1978, 1982) have argued that the interaction of various tax code provisions makes the effective dividend tax rate zero, their view seems contradicted by evidence on the actual tax status of investors [Feenberg (1981)] and the behavior of dividend policy following changes in tax rates [Poterba (1987b)].

In Miller Model II, a change in either the corporate tax rate or the investor tax rates on equity income will alter the yield spread between taxable and tax-exempt bonds of comparable risk. An increase in the supply of municipal bonds would also reduce the yield spread, as described above, by reducing τ_e^{**}.

One caveat with respect to the Miller model's treatment of individual investors needs to be noted. Since 1987, individual investors have been liable for alternative minimum tax (AMT) at a 21% rate on some components of their tax-exempt interest. While general obligation debt issued by states and localities remains fully tax-exempt, interest on some types of private-purpose tax-exempt debt issued after August 1986 is included in the AMT base. Since the AMT does not affect the general-obligation tax-exempt debt used to construct the implicit tax rates in this study, it is not directly relevant to my

[13]Poterba (1987a) presents direct evidence on the behavior of capital gains taxpayers which suggests that a significant fraction of investors do not succeed in avoiding equity tax burdens.

analysis. Nevertheless, it does render the stock of fully-exempt debt somewhat smaller than the stock of debt issued by states and localities.[14]

3.3. The preferred habitat model

A final view of municipal market equilibrium, the 'preferred habitat' model, holds that states and municipalities have distinct maturity preferences when issuing different types of debt. Legal restrictions and other factors lead tax-exempt borrowers to use long-term bonds when financing capital expenditures, and short-term debt primarily to smooth fluctuations in revenues. Other institutional constraints and a desire for maturity matching on the part of lenders lead different classes of investors to hold short- and long-term municipal bonds. Thus, the markets for short- and long-term municipal debt are not linked by any operative arbitrage mechanism.

This view explains the divergence in the implied tax rate of short- and long-term bonds as the result of varying tax rates facing the demanders of municipal debt of different maturities. Mussa and Kormendi (1979) present a clear description of the situation in the late 1970s:

> 'Commercial banks are the dominant holders of short-term municipal bonds and also hold short-term taxable instruments with essentially the same risk and other characteristics. The yield differential between short-term municipal bonds and comparable short-term taxable instruments is close to the corporate tax rate... For long-term municipal bonds, the yield differential is not set by the tax rate for commercial banks. Banks do not hold any significant amount of long-term corporate bonds. Hence, the investor who is just balancing between long-term municipal bonds and long-term corporate bonds cannot be a bank but must be some other investor. For this investor, the equalizing yield differential is not 48 percent but only about 30 percent.' [Mussa and Kormendi (1979, p. 7).]

This view suggests that the short-term municipal market behaved according to the bank arbitrage model, while Miller Model II provided a more accurate description of the market for long-term bonds.

In the preferred habitat model described above, the effect of changing the supply of municipal debt will depend upon the maturity at which it is issued. Short-term bond issues will not change the implied tax rate on short-maturity municipal debt, since banks can adjust their portfolios. Long-term

[14]Corporations are also liable for alternative minimum tax at a rate of 20 percent on their tax-exempt interest. Interest on private-purpose debt that is subject to the individual AMT is included in the corporate AMT base, along with half of the interest on public-purpose debt. The latter provision places a ten percent tax on corporate receipts of interest from general-obligation debt. Further details on the AMT may be found in *Tax Notes*, November 3, 1986, p. 493.

bond issues, however, may affect the relative pricing of taxable and tax-exempt securities. This dichotomy may break down in the late 1980s and early 1990s as banks become less important and individuals more important holders of municipal debt at all maturities.

This model's predictions with regard to tax changes combine the results from two other models. Corporate tax changes should affect both the short- and long-term yield spread between taxable and tax-exempt debt, while in periods when banks are the marginal holders of short-term debt, personal tax changes will only affect the long-term yield spread. Given the tax reforms of the mid-1980s, banks seem unlikely to acquire significant amounts of tax-exempt debt in the future. In this setting, the preferred habitat model can be modified to allow other possible holders of short- and long-term securities, or even to allow households with different marginal rates to be the marginal holders at different points on the yield curve.[15]

The preferred habitat model, with its implicit assumption that lenders fail to arbitrage interest rate differentials between short and long maturity bonds, draws attention to the poorly-understood debt supply decisions of state and local governments. Gordon and Slemrod (1986) and Metcalf (1988) have shown that many of these issuers exploit arbitrage opportunities between taxable and tax-exempt interest rates. Although the 1986 Tax Reform Act restricted the ability of states and localities to borrow in the tax-exempt market and invest the proceeds at taxable interest rates, many borrowers continue to avail themselves of these options to the extent permitted by law. The question raised by the preferred habitat model is why borrowers issue long-term debt when the implied tax rate on short-term securities is significantly lower.

There are several possible explanations for the use of long-term borrowing. First, there may be substantial transactions or administrative costs associated with rolling over short-maturity debt, or raising taxes to pay off principal during a liquidity crisis. This argument is more persuasive in the case of small towns than for cities and states with ongoing financial needs, since the latter are involved in frequent debt issues. Second, the uncertainty concerning future interest payments (associated with the roll-over strategy) could impede budgeting, create situations in which tax revenues would not fully cover expenses, or require more frequent changes in tax rates than under a system with fixed-rate long-term finance. Finally, as Beek (1982) suggests, borrowers may fear future periods of credit rationing when they would be unable to refinance previous short-term loans.

Table 5 summarizes the three views of municipal market equilibrium that

[15]The Tax Reform Act of 1986 subjects 15% of municipal interest received by property and casualty insurance companies to taxation. Nevertheless, since these firms are still largely able to deduct interest payments from their taxable income [see Scholes, Wilson and Wolfson (1987)], they may have relative tax advantage in holding these bonds.

Table 5
Comparison of alternative models of municipal market equilibrium.

Policy experiment	Equilibrium model: Bank arbitrage	Miller model I	Miller model II	Preferred habitat
Effects on short-term implied tax rate				
Lower corporate tax rates	Lower	Lower	Lower	Lower
Lower personal tax rates	None	None	Lower	None
Increased municipal borrowing	None	None	Lower	None
Effects on long-term implied tax rate				
Lower corporate tax rates	Lower	Lower	Lower	Unclear
Lower personal tax rates	None	None	Higher	Higher
Increased municipal borrowing	None	None	Lower	Lower

have been described in this section, outlining their predictions for how tax changes and changes in the stock of municipal debt affect yield spreads. The competing views of the municipal market can be tested by examining the reaction of long- and short-term yield spreads to changes in expectations about tax policy. Changes in corporate tax rates should affect short-term yield spreads under all views. Miller Model II and the preferred habitat theory suggest that movements in expected personal tax rates should show up in long-term yield differentials, while the bank arbitrage model and Miller Model I suggest that only changes in future corporate rates should affect long-term yields. If the preferred habitat notion that banks were the marginal investors in short-term securities during most of the sample is incorrect, then personal tax changes might also affect the short-term yield spread.

4. Empirical methods

This section describes an empirical procedure for analyzing how expected tax changes affect yield spreads. The methodology is closely related to the 'event study' approach that has been used to study many questions in financial economics.[16] In equilibrium, newly issued S-period bonds with a par value of one dollar and a tax-exempt coupon C_M will sell at par if

$$1 = \sum_{j=0}^{S} (1+\rho)^{-j} C_M + (1+\rho)^{-S} \tag{2}$$

where ρ is the nominal after-tax discount rate applied to the bond's income stream. Similarly, a taxable bond selling at par must satisfy the condition

[16]Rose (1985) provides a clear overview of event study methods for studying government policies. More detailed derivations of the asset pricing relationships in this section may be found in Poterba (1986).

$$1 = \sum_{j=0}^{S} (1+\rho)^{-j}(1-\theta_j^e)C_T + (1+\rho)^{-S} \tag{3}$$

where C_T is the taxable coupon and θ_j^e is the expected marginal tax rate of the marginal holder of this bond j periods from now. This tax rate could change over the life of the bond in either of two ways. The tax code might change, altering θ_j for the bond's initial owner, or the owner of the bond might change, as when a household purchases a long-term new-issue bond and sells it to a bank when its remaining maturity is five years. For bonds that are sold at par, the yield to maturity (y) equals the coupon rate, so $y_T(S) = C_T$ and $y_M(S) = C_M$.

The asset pricing equations can be linearized to calculate the effect of a tax change on each bond's yield to maturity.[17] Moreover, since the implied tax rate based on taxable and tax-exempt yields at maturity S is simply

$$\theta(S) = [y_T(S) - y_M(S)]/y_T(S), \tag{4}$$

the resulting change in the implied tax rate is

$$d\theta(S) = [y_M(S)/y_T(S)^2] * dy_T(S).$$

Since changes in tax rates do not affect the required return on tax-exempt securities, all of the movement in the yield spread is due to shifts in the taxable rate. The link between expected tax changes and the implied tax rate is given by

$$d\theta(S) = \left[\sum_{j=0}^{S} (1+\rho)^{-j} d\theta_j^e\right] \Big/ \Delta, \tag{5}$$

where $\Delta = C_M(S)/[1-(1+\rho)^{-S}]$. This is just a discounted sum of changes in expected future tax rates, weighted in proportion to the share of the taxable bond's present value accruing from income in each future period.

[17]This analysis assumes that major tax changes do not affect ρ, the required return demand by investors. This is an obvious over-simplification.

If it were possible to obtain reliable estimates of the time stream of expected future tax rates, then (5) could provide a basis for empirical research. Unfortunately, these expectations are difficult, if not impossible, to measure. Rather than trying to relate changes in implied tax rates to the weighted average of future tax rates on the right-hand side of (5), my research adopts the less powerful testing strategy of Poterba (1986). By examining news accounts of tax policy debates, it is possible to identify months when investors should have revised their expectations of future tax rates. These months can be classified into those in which there were positive and negative revisions to expected personal and corporate tax rates. Indicator variables for these months are included in regression models for the movements in implied tax rates at various maturities. If changes in expected future personal tax rates affect the yield spread, then these indicator variables should have significant effects and their signs should accord with the direction of movement in tax expectations.

The principal empirical difficulty that arises in implementing this procedure is deciding what expectations investors held about future tax policy *prior* to the release of news. There is no easy way to resolve this problem and the results presented below should therefore be interpreted with some caution. The next section describes the tax policy 'events' that I study.

4.1. Econometric specification

The basic equation that I estimate using implied tax rate data for one-year and twenty-year tax-exempt bonds is

$$d\theta_t(S) = \beta_0 + \sum \beta_{1i} * EVENT_{it} + \varepsilon_t. \tag{6}$$

The equations reported in the next section all assume that expectations change during the month I have labeled as the tax event.[18] Although in earlier work I included a variety of proxies for municipal bond risk in the specification, they rarely affected the findings and the present study is therefore simplified by excluding them.[19] I report equations estimated by ordinary least squares, as well as specifications correcting for first-order moving average errors. Since Salomon Brothers estimate the yields at different maturities using smoothed yield curves, there may be measurement errors in particular yields. Differencing these yields, as I do in constructing

[18]An alternative approach would recognize that in many cases information builds gradually over time. In Poterba (1986) I defined indicator variables for three-month periods centered on the tax event and found qualitatively similar results to those reported here for the pre-1986 events.

[19]All of the reported equations include an indicator variable for the month of January, since when I included a set of month dummies in the regression equations there was some evidence of a 'January effect' in the municipal yield spread. These coefficients are not reported in the results table.

the change in the implied tax rate, will induce an $MA(1)$ error structure for ε_t.

5. Tax policy events

Tax policy events for the period 1960–1982 were collected by searching the *New York Times* for potentially significant tax policy announcements. When such announcements were identified, I searched backward in time to see if previous months had contained similar but less highly publicized information. My search revealed numerous events that could have changed expectations of tax rates, and it was necessary to make subjective judgements about which ones to investigate further. I pursued those that seemed most important by examining the *Congressional Quarterly Weekly Report* for each year to look for discussion as well as for related events that might not have been reported in the *New York Times*. The resulting series of monthly tax events should provide a rough chronology of times when tax policy was expected to change. The most significant events are described below.[20]

(i) *The Tax Reform Act of 1969.* Early in 1969, several members of the House Ways and Means Committee announced their intention of reforming the tax-exemption of municipal bonds. The Treasury Department proposed a plan for a minimum tax on a base including municipal bond interest. The Ways and Means Committee passed legislation to this effect in July, and revised tax treatment of municipal interest seemed likely until September, when Senate hearings began and Senator Russell Long and members of the Senate Finance Committee announced their intention to preserve the tax-exemption. While the immediate prospect for tax reform declined after the provisions of the 1969 Act became clear, discussions of reform plans continued for some time.

The 1969 reform discussion is important because it did not propose any changes in *corporate* tax rates. The minimum tax was to be applied to individuals, not firms, and corporate tax rates were largely unaffected by the Tax Reform Act. If the Miller Model I or the bank arbitrage hypothesis described the determination of municipal yields at this time, then there should be no change in the implied tax rates on municipal bonds. In both the preferred habitat and Miller Model II scenarios, however, yields would adjust.

(ii) *The 1981 Economic Recovery Tax Act.* Ronald Reagan discussed tax

[20]Poterba (1986) considers the market reaction to several sets of tax events not examined here, notably the 1964 tax reform and the discussion of the Vietnam war surtax in 1967–68. Since both of these tax reforms affected both personal and corporate tax rates, discovering that they caused adjustments in the implied tax rates on municipals does not help distinguish between alternative theories of municipal market equilibrium.

reform during the election campaign of 1980, and in a June press conference he made clear that if elected he would introduce across-the-board cuts in marginal personal tax rates. The news media at the time concluded that, regardless of the election's outcome, some type of significant tax reduction was likely. The final tax bill reduced the highest individual marginal tax rate on unearned income from 70% to 50% and instituted a plan to reduce tax rates by 26% over three years. Since much of the uncertainty concerning the tax bill was not resolved until immediately before passage, I focus on August 1981 in my analysis of the 1981 tax cut.[21]

The 1981 tax changes were directed primarily at individual tax rates. Both the bank arbitrage model and Miller Model I predict no effects on implied tax rates from the 1981 reforms, while Miller Model II and the preferred habitat model predict substantial reductions.

(iii) *Bank taxation reforms.* In December 1980, the IRS issued Revenue Procedure 80-55 stating that banks would henceforth be unable to deduct interest paid on government time deposits that were collateralized by tax-exempt securities. If implemented, this rule would have substantially reduced the attractiveness of holding municipal debt for commercial banks [see Madeo and Pincus (1985)]. The ruling was reversed in January 1981. Under both the preferred habitat and bank arbitrage models, these two months should be characterized by changes in short-term yield spreads. The bank arbitrage model also predicts movements in long-term yields. The Miller models predict no effects since corporate financial adjustments determine the equilibrium patterns of bond prices; the tax treatment of banks is irrelevant.

Passage of the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 was a less important event restricting bank participation in the municipal market. It limited banks to deducting only 85% of their interest payments on borrowing used to hold municipal bonds. I nevertheless include the passage of TEFRA, in August 1982, as a tax event month.

(iv) *The Tax Reform Act of 1986.* The 1986 tax reform was discussed and debated by Congress for nearly two years. The central features of the legislation that finally passed the House and Senate in September 1986 included reduction of the corporate marginal tax rate from 46 to 34%, sweeping reductions in the top marginal tax rates on individuals from 50 to 28%, introduction of the alternative minimum taxes discussed above, and new restrictions on issues of private–purpose tax-exempt debt.

[21]President Reagan's tax bill was passed by the House on July 29, 1981. Since the bond market would not have reacted to this until the thirtieth, and since the Salomon Brothers data would be for yields *reported* on the first of August (i.e., trades from the thirty-first), there is a substantial risk that the information with the tax cut is not included in the recorded August 1 yield. That is why I focus on the August event for ERTA; that is also the month during which actual passage occurred.

Cutler (1988) identifies two events as marking the principal of a tax bill release of information about the tax reform. The first was House passage in December 1985, since prior to that there was no clear prospect for tax reform. The second event was the surprise passage of a revised tax reform bill by the Senate Finance Committee in May 1986. Cutler notes that at the beginning of May, analysts thought the prospects for tax reform were dim, while after the Senate Finance Committee action, passage was very likely.

For tax-exempt investors, a third event was at least as important as the two events affecting the odds of tax reform. This was the beginning of the Senate Finance Committee mark-up of the tax reform in mid-March 1986. The Senate committee decided not to draft legislation based on modifications to House tax bill, but instead to draft a new reform bill. One of the central features of the plan announced by committee chairman Robert Packwood was an individual minimum tax that would be levied on the interest from previously tax-exempt bonds. The municipal bond market virtually shut down in reaction to this news. Issuers postponed plans for selling bonds pending resolution of the tax discussions, and as the furor grew, members of the Senate Finance Committee called for exclusion of tax-exempt interest from the minimum tax. On March 24 the Committee voted to make any changes to the treatment of tax-exempt interest effective January 1, 1987, and this calmed the bond market.[22] Final resolution of the tax treatment of these bonds did not come until the Senate Finance Committee passed legislation in May, when the basic structure of the 1986 Tax Reform Act was clear.

(v) *South Carolina v. Baker.* The most recent development in tax policy toward tax-exempt bonds was a Supreme Court decision in April 1988. The *South Carolina v. Baker* case was brought by South Carolina to challenge the bond-registration requirements of TEFRA. The Court's decision to affirm the registration requirements went beyond the narrow issue of registration and upheld the Federal government's constitutional right to levy income taxes on the interest payments by state and local governments. The municipal market's initial reaction to this decision was panic and confusion; yields on tax-exempt securities rose nearly one hundred base points in the hour after the news broke. This is shown graphically in fig. 2, which plots the price of municipal bond futures on the day of the Court's decision. In the hours immediatcly following the decision, key Congressional leaders indicated support for retaining the tax-exempt treatment of interest, however, and by the end of the trading day the rapid decline in municipal bond prices had been reversed. I nevertheless examine the net effect of this month's tax news on municipal yields.

[22]Further discussion of the events surrounding the Packwood proposal may be found in the *Congressional Quarterly Almanac: 1986*, p. 505.

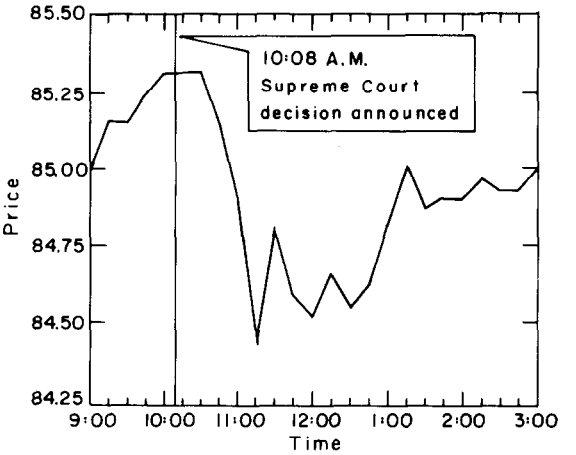

Fig. 2. Price reaction of municipal bond futures prices to the *South Carolina* decision.
Source: Knight–Ridder Tradecenter and Wall Street Journal.

6. Empirical results

Table 6 presents regression results for implied tax rates on bonds with maturities of one and twenty years. The tax policy events in most cases appear to exert substantial effects on the yield differential, and they generally support the preferred-habitat or Miller Model II explanations of municipal market equilibrium during the 1960–86 sample period. Because each tax event occurs only once, the tests reported here have relatively low power. As a result in many months it is not possible to reject the null hypothesis that the estimated coefficient is zero, even though the coefficient is large in absolute magnitude.

The tax reform discussions of 1969 provide convincing evidence that personal tax changes affect yield spreads in the tax-exempt bond market. The initial proposals for changing the tax status of municipal interest, in March 1969, coincided with sharp declines in the implied tax rates on both short- and long-term municipal bonds. The tax rate computed from twenty-year bonds fell by five percentage points, while that on one-year bonds fell by slightly more.[23] This is consistent with the possibility that tax legislation would eliminate the tax-exempt status of municipal interest for both banks and households.

The subsequent action by the Ways and Means Committee in July 1969, involving the individual minimum tax, had a pronounced effect on the long-term market. July witnessed between a five- and seven-point reduction in the long-term implied tax rate, but no decline (in fact, a small increase) in the implied tax rate on short-term bonds. The turn-about in expectations that

[23]Skelton (1983) argues that the personal tax change affected the short-term market only because Regulation Q was binding during 1969. He claims that during such periods of disintermediation, banks were not the marginal investors in the short-term municipal market.

Table 6

Changes in tax expectations and implied marginal tax rates.

Independent variable	Change in implied tax rate			
	One-year maturity		Twenty-year maturity	
Constant	−0.11	−0.14	−0.15	−0.17
	(0.13)	(0.22)	(0.10)	(0.14)
March 1969	−5.77	−5.36	−5.20	−4.77
	(3.56)	(4.11)	(2.48)	(2.75)
July 1969	1.22	2.33	−7.55	−4.69
	(3.62)	(4.11)	(2.50)	(2.75)
September 1969	3.08	4.86	10.90	14.94
	(3.62)	(4.11)	(2.51)	(2.75)
June 1980	−1.13	−2.30	−4.49	−3.86
	(3.57)	(4.11)	(2.48)	(2.75)
November 1980	0.58	−2.01	0.16	0.17
	(3.97)	(4.11)	(2.64)	(2.75)
December 1980	−5.71	−5.68	−3.58	−3.56
	(4.31)	(4.11)	(2.80)	(2.75)
January 1981	2.29	1.83	−0.38	−0.56
	(3.99)	(4.17)	(2.67)	(2.79)
August 1981	−6.74	−7.09	−5.75	−6.45
	(3.56)	(4.11)	(2.48)	(2.75)
August 1982	2.34	5.97	1.85	2.84
	(3.56)	(4.11)	(2.48)	(2.75)
December 1985	−5.67	−6.51	−1.80	−3.71
	(3.57)	(4.11)	(2.48)	(2.75)
March 1986	−0.52	−1.63	−9.11	−8.76
	(3.63)	(4.11)	(2.50)	(2.75)
May 1986	2.22	5.44	2.94	5.02
	(3.62)	(4.11)	(2.50)	(2.75)
April 1988	4.24	3.51	4.01	4.60
	(3.55)	(4.11)	(2.48)	(2.75)
MA(1)	−0.44		−0.35	
	(0.05)		(0.05)	
R^2	0.13	0.05	0.24	0.18

occurred in September 1969 once again caused dramatic effects in the long-term bond market but only small movements in short-term yields. The implied tax rate on twenty-year municipal bonds rose by twelve percentage points in September. By comparison, short-term implied tax rates rose by only 4%.

The minimum tax proposals in July 1969 focused only on changing the personal tax code. In both the bank arbitrage model and Miller Model I, they would not affect the relative yields on taxable and tax-exempt debt. The finding of major changes in long-term yields coincident with these tax developments suggests that for the late 1960s, Miller Model II or the

preferred habitat model provide a better explanation of long-term yield determination than either of the models that focuses on the corporate tax rate.

The Reagan tax cut of 1981 also seems to have affected the yield spread between taxable and tax-exempt debt. In June 1980, for example, when candidate Reagan announced his tax-reform plans, the implied tax rate on twenty-year municipal bonds declined by nearly four percentage points. The short-term yield spread also narrowed, although the implied tax rate changed by only two percentage points. The effect of President Reagan's election in November 1980 is surprisingly weak, with no consistent pattern of changes in implied tax rates. The variables for August 1981, marking the passage of the Economic Recovery Tax Act, provide strong support for the importance of personal tax variables in affecting yield spreads. The implied tax rate on twenty-year bonds declined by nearly six percentage points, and short-term yields narrowed by a similar amount. Like the 1969 discussions of the minimum tax, most of the provisions of the 1981 bill were directed at personal, not corporate, tax reform. The small movement in yield spreads therefore provides evidence for Miller Model II and the preferred-habitat view of market equilibrium.[24]

Contrary evidence, suggesting that banks may have played an important role especially in the market for short-term bonds, is provided by the change in bank taxation in December 1980. Under the bank arbitrage hypothesis, this change should have substantially lowered the implied tax rate in both long- and short-term markets. Under both Miller models this change should have had no effect, and under the preferred-habitat model, the change should have affected only short-term yields. The evidence suggests a pronounced December effect on the one-year implied tax rate, a change of between five and six percentage points, as well as a three to four point change in longer-term implied tax rates. When the December 1980 change was rescinded in January 1981, however, only the short-term yield spread responded with significant positive moves in the implied tax rate. This suggests that bank participation was a more significant force in setting short- than long-term tax-exempt bond prices in the early 1980s.

The passage of TEFRA in August 1982 coincided with an increase in the yield spread between taxable and tax-exempt bonds, a finding that seems difficult to reconcile with the tax changes. TEFRA reduced the share of interest payments that banks could deduct on loans used to hold municipal bonds from 100% to 85%, lowering the attractiveness of holding municipal

[24]An alternative explanation of the short-term yield movements, consistent with the presence of banks as marginal investors in the short-term market, involves the introduction of one-year All-Savers certificates in TEFRA. These certificates drew funds away from commercial banks and money market mutual funds and into savings and loan institutions, and may have reduced commercial banks' profits hence their demand for tax-exempt bonds.

debt. Before 1982 a bank could earn the tax-exempt return R_M while paying $(1-\tau)R$; this is the basis for $R_M=(1-\tau)R$ in the bank arbitrage model. After 1982, however, the relevant equality for a bank became $R_M=(1-0.85*\tau)R$. This should have reduced the implied tax rate and raised the yield on tax-exempt debt. Countervailing effects, however, could have resulted from TEFRA's restrictions on future issues of Industrial Revenue Bonds. In Miller Model II or the preferred-habitat model, this could raise the expected future marginal tax rate on municipal interest and therefore raise the implied tax rate. The evidence from the passage of TEFRA is thus difficult to interpret.

The tax events associated with the Tax Reform Act of 1986 provide further support for the importance of individuals as investors in long-term municipals. In December 1985, when the House Ways and Means Committee passed the first significant tax-reform legislation (H.R. 3838), the implied tax rate on long-term bonds declined nearly four percentage points and that on short bonds by even more, between five and six percentage points. This reaction does not allow us to reject *any* of the theories of market equilibrium, since H.R. 3838 proposed changes in both corporate and personal tax rates.

More striking evidence emerges in March 1986, when the Senate Finance Committee considered extending the alternative minimum tax base to include municipal bond interest. In that month the implied tax rate on twenty-year bonds fell between eight and ten percentage points, while the short-term value declined by approximately one percentage point. Since the minimum tax discussion concerned the individual income tax rather than corporate tax rates, the sharp movement in rates suggests the important role of individual investors in setting prices for long-term municipal debt. Since the legislation was not scheduled to take effect until 1987, the smaller reaction in the short-term market may simply reflect the more limited exposure of one-year bonds issued in March 1986.

The final tax event in 1986, passage of the Senate tax reform package by the Senate Finance Committee after Senator Packwood re-ignited interest in the tax plan, is associated with a positive change in implied tax rates in both long- and short-term markets. In principle, if the events of this month raised the chances of a successful tax reform lowering marginal tax rates, implied tax rates should have fallen. The disparity between the prediction and the results could be due to non-tax shocks to the municipal market, or it might reflect the fact that passage of a committee bill *without* reinstating the minimum tax provisions was perceived as a favorable outcome by municipal bond investors.

The final tax event I consider is the Supreme Court decision in *South Carolina v. Baker* in April 1988. Since the case raised the possibility that both individual and corporate investors would be taxed on municipal bond interest in future years, it should have reduced the yield spreads. In fact, yield

spreads increased during the month and implied tax rates expanded nearly four percent. Although these data do not suggest any link between the court decision and the yield spread, the intraday price movements in fig. 2 suggest that immediately following the court decision, the yield spread narrowed significantly. Most of the effect had vanished by the end of the day, however, so the finding of a small effect in monthly data is unsurprising.

7. Conclusions

This paper examines the impact of recent tax reforms on the tax-exempt bond market. It provides clear evidence that the yield spread between long-term taxable and tax-exempt bonds responds to changes in expected individual tax rates, a finding that refutes theories of municipal bond pricing which focus exclusively on commercial banks or other financial intermediaries. The results support the conclusion that in the two decades prior to 1986, the municipal bond market was segmented, with different investor clienteles at short and long maturities.

The Tax Reform Act of 1986 is likely to have a fundamental impact on the ownership of municipal debt. Commercial banks, which were important investors in short-term municipal debt during the 1960s and 1970s, are no longer permitted to deduct interest payments on liabilities that are incurred in acquiring tax-exempt debt. This tax change has made commercial banks net disinvestors in municipal debt during the last two years. Individuals have become increasingly important as suppliers of capital to states and localities, and this trend is likely to continue. The segmented market of the last two decades may therefore give way to a market with individual investors playing a central role in price-setting at all maturities.

Whether exempting interest payments on state and local obligations from federal taxation is an efficient way of subsidizing sub-federal governments is a perennial tax policy question. The tax reforms of 1981 and 1986, by compressing the distribution of marginal tax rates on individuals and lowering the top marginal rates, have affected this subsidy in two ways. First, the absolute amount of the subsidy has declined. The implicit tax rate on long-term debt of 15% in 1988 is far below the implicit tax rate in past decades, and reflects a reduction in the subsidy that states and localities receive relative to taxable borrowers. Whether the current subsidy is above or below the optimal level is a complex issue beyond the present paper.

Second, the *compression* in marginal tax rates has made the tax-exempt interest plan a more efficient subsidy to states and localities. These borrowers receive a borrowing discount that depends on the marginal tax rate of the lowest tax rate investor who purchases municipal bonds, while the federal government loses revenue at the rax rates of inframarginal investors with higher tax rates. Recent reductions in top marginal tax rates have reduced

the dispersion between the average tax rate of municipal bond holders and the tax rate of the marginal investor who sets the yield differential. This makes the foregone revenue per dollar of subsidy lower in the late 1980s than at any other time in the postwar period.

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