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Portfolio Substitution and the Tax Expenditure for State and Local Government Borrowing

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ABSTRACT

This paper explores how estimates of the revenue cost of exempting interest payments by state and local governments from the federal income tax are affected by alternative assumptions about the portfolio behavior of individual investors. Most tax expenditure estimates assume that current holders of tax-exempt bonds would replace their holdings with taxable bonds if the tax expenditure were eliminated. We consider a number of alternative possible portfolio responses and examine how they would affect estimates of the aggregate revenue cost of tax exemption as well as the distribution of tax burdens. Because taxable bonds are among the most heavily taxed assets, assuming that investors holding tax-exempt bonds switch to taxable bonds yields a larger estimate of the revenue cost of tax exemption than alternative portfolio response assumptions. Using household-level data from the 2004 Survey of Consumer Finances, we estimate that the revenue cost of tax exemption under the taxable bond substitution hypothesis is $14.2 billion, compared with $10.1 billion if we assume that corporate stock replaces tax-exempt bonds and $7.9 billion if we assume that investors distribute their tax-exempt bond holdings in proportion to their current portfolio holdings of all asset classes. We also explore the revenue effects of other policy alternatives to full elimination, such as capping the dollar amount of tax-exempt interest per tax return or limiting tax-exempt interest as a fraction of AGI.

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Exempting the interest paid by state and local governments from federal income taxation is one of the largest tax expenditures. For fiscal year 2007 the U.S. Treasury Department estimates a revenue loss of $25.4 billion dollars on public-purpose tax-exempt bonds. The Joint Committee on Taxation estimate is somewhat smaller, at $20.1 billion dollars. Both of these estimates assume that if individual investors did not hold tax-exempt bonds, they would hold taxable bonds instead.

This paper explores the robustness of these tax expenditure estimates to alternative assumptions about the portfolio behavior of taxable individual investors. Building on Gervais and Pandey's (forthcoming) analysis of the portfolio adjustment associated with the home mortgage interest deduction, we consider a number of alternative portfolio responses and indicate they would affect aggregate cost estimates for this tax expenditure. We also examine how these alternative assumptions would alter estimates of the distribution of the tax savings associated with interest tax exemption. Because taxable bonds are among the most heavily taxed portfolio assets, and the households that own tax-exempt bonds are among the highest marginal tax rate households, assuming that these households would shift to taxable bonds if tax-exemption were repealed may overstate the revenue cost of this tax expenditure.

This paper is divided into six sections. The first tracks the yield spread between taxable and tax-exempt bonds over the last two decades, with a discussion of the very recent narrowing and in some cases inversion of this spread. It also summarizes the aggregate holdings of taxable and tax-exempt bonds by different classes of investors. Section two briefly reviews the previous literature on the tax-exempt bond market and the tax expenditure for the income tax exclusion of interest on state and local government bonds. The third section describes the data sources that we use to analyze the distribution of tax-exempt bond holdings and the effect of potential

portfolio adjustments on the revenue cost of this tax expenditure. Section four presents results on the tax expenditure cost of interest exemption under the standard assumption about portfolio adjustment as well as a variety of alternatives. The fifth section considers the revenue and distributional effects of the interest exemption as well as other additional policy reforms that would limit but not eliminate the current interest exemption. The last section concludes and suggests several directions for further investigation.

1. The Taxable-Tax Exempt Yield Spread and Aggregate Bond Holdings

The yield spread between taxable and tax-exempt bonds is often viewed as a key indicator of whether the income tax exclusion for interest paid by state and local governments is an efficient and effective way for the federal government to subsidize sub-federal governments. When the yield spread is narrow, some argue that the federal government is losing revenue but the state and local borrowers are no better off than they would be without income tax exclusion of their interest payments.

The Yield Spread, 1990-2008

Table 1 shows annual average yields on AAA municipal, U.S. Treasury, and AAA corporate bonds with a ten-year maturity. These averages are based on daily yields on bond index data provided by Bloomberg, which reports information on prices and yields for various tax-exempt and taxable securities. The entries in Table 1 document three important patterns. First, the average yield differential between Treasury bonds and tax-exempt bonds corresponds to an "implicit tax rate" well below the top statutory marginal tax rate in the federal income tax code. For 2007 this implicit tax rate averaged less than 24 percent, and for 2003 and 2005 it fell below 20 percent. At the beginning of the 1990s, the implicit tax rate was greater than 30

percent. Second, the implicit tax rate computed by comparing corporate bond yields and similarly-related municipal bond yields is higher than that computed using Treasury bonds, and it has not fallen nearly as far as the Treasury-based implicit tax rate during the last twenty years. For 2007, this implicit tax rate averaged 41.2 percent. This may suggest that the narrowing of the Treasury-municipal bond yield spread is due in part to developments in the Treasury market rather than the tax-exempt bond market. Finally, Table 1 shows that there is substantial fluctuation over time in the implicit tax rate. Poterba (1986) argues that this may be linked to changing expectations of future tax policy, among other things.

Table 1 summarizes the yields on bonds that generate fully tax-exempt interest. Some private-purpose bonds issued by state and local governments, however, generate interest that is exempt from the federal income tax but is subject to the Alternative Minimum Tax (AMT). Table 2 shows yield spreads at the one-, ten-, and thirty-year maturity for both fully tax-exempt and AMT-taxable bonds in 2003. We use daily yields on more than one hundred indices for AMT-free tax-exempt bonds, AMT-subject private taxable bonds, and Treasury bonds in 2003 to construct the entries. The implicit tax rate on AMT bonds is about twenty percentage points lower at the one-year maturity, ten percentage points lower at the 10-year maturity, and five percentage points lower at the 30-year maturity, which probably reflects declining probability of the AMT being in force in future years. The differential between the yield spreads on bonds that are and are not subject to the AMT suggests that taxes matter in this market.

Aggregate Holdings of Tax-Exempt and Taxable Bonds

The foregone revenue associated with the income tax exclusion of interest paid by state and local government bonds depends on who owns their bonds and what those investors would have done in the absence of tax exemption. To provide some background for these questions,

Table 3 displays data on the ownership of both taxable and tax-exempt bonds in 2003. These data are drawn from the Flow of Funds accounts published by the Board of Governors of the Federal Reserve (2007). The table shows that households own 36 percent of outstanding tax-exempt debt directly. Another 29 percent is held by mutual funds, which are in turn owned primarily by households. In contrast, the ownership of taxable bonds is quite different. One quarter of these bonds are held abroad. Fourteen percent are held directly by households and another ten percent are held by mutual funds. The Flow of Funds "household" sector, however includes nonprofit institutions which are untaxed. They are much more likely to hold taxable bonds than are taxable households. Even without further evidence on bond ownership within the "household" sector, the data suggest that tax-exempt bonds are held disproportionately by taxable households, while taxable bond holdings are much more widely dispersed.

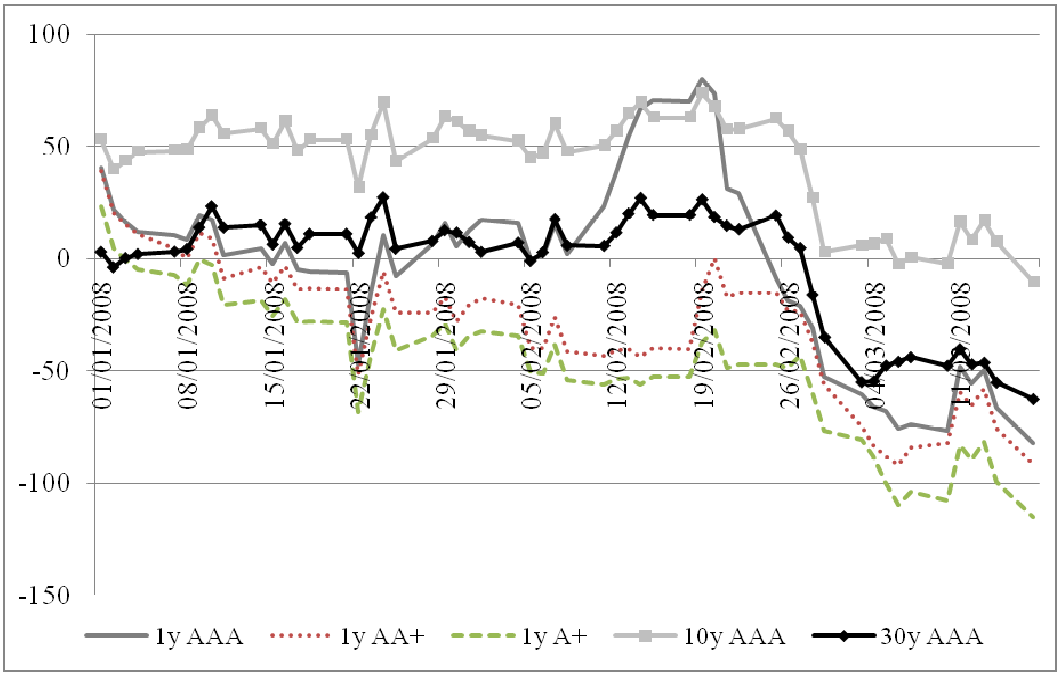

Figure 1: Yield Spreads Between Tax-Exempt and Treasury Bonds of Different Maturities and Credit Ratings, 2008 (Basis Points)

Yield Compression and Inversion, 2008

The tax-exempt bond market has been prominent in the financial turmoil of the first few months of 2008. Yields on tax-exempt securities, particularly so-called "auction rate municipals" with short maturities, have risen sharply and in many cases have exceeded the yields on what appear to be comparable taxable securities. Figure 1 shows the yield spreads for different maturities and credit ratings, and it tracks the reduction in the yield spread and its eventual movement to negative values. The decline in the yield spread was most striking for short maturity issues. The low yields on Treasury securities during this period were apparently driven in part by a flight to quality. The recent episode seems likely to attract substantial academic scrutiny in years ahead.

2. Prior Research on the Tax Expenditure for State and Local Government Interest Payments

A small literature has examined the subsidies created by the tax exemption for state and local interest payments, focused primarily on the efficiency of this policy as a tool for subsidizing state and local capital spending. One of the central difficulties has been distinguishing differences in yields on taxable and tax-exempt bonds that are due to risk from differences that are due to only to the differential tax treatment of taxable and tax-exempt bonds. Households face different tax rates and it is not certain which household represents the "marginal holder" of tax-exempt bonds. This marginal holder in turn determines the required yield spread between taxable and tax-exempt bonds.

Several studies, reviewed in Poterba (2002), have investigated the determinants of the yield spread between taxable and tax-exempt bonds, and considered in particular the role of

expected future taxes in contributing to this spread. A related literature, exemplified in Poterba and Samwick (2003), examines how tax policies affect household portfolios. This sort of information is needed to evaluate the general equilibrium effects of repealing tax exemption.

Two broad conclusions emerge from the literature on taxation and portfolio choice. First, theoretical models often generate corner solutions with respect to individual portfolio selection – households are completely specified in a small set of asset classes. Why many households hold multiple assets with different tax characteristics, when a dominance relationship points toward holding a single asset class, is an unresolved question. The general equilibrium modeling by Auerbach & King (1983) provides the conceptual framework for considering these issues. Second, empirical evidence shows that taxes affect the set of assets to hold, but conditional on this, taxes do not seem to affect the portfolio allocation of investors. Poterba and Samwick (2003) find some evidence that marginal tax rates affect household portfolio choices, with particularly pronounced effects with regard to holdings of tax-exempt bonds.

Our analysis in this paper focuses on the revenue costs and the distributional effects of the tax expenditure for interest on state and local borrowing, rather than the effect of these tax provisions on the public capital stock. The standard analysis of this tax expenditure is that by lowering the cost of borrowing, the tax expenditure expands state and local government. Gordon & Slemrod (1983) present a standard analysis along these lines, and they show that the elimination of the income tax exclusion would penalize the rich, who lose a tax shelter, and the poor, who pay more for public services. In later work, Gordon and Metcalf (1991) argue that the marginal source of funds for state and local governments is taxes, not the proceeds from bond issues, and they conclude that the tax exemption does not represent a subsidy for local infrastructure. Fortune (1998) provides a general theoretical framework for evaluating these

competing views, and he shows that if the decisive voter is liquidity constrained or faces a limit on private borrowing, then the tax exemption will increase state and local capital spending.

We do not consider how repealing the tax exemption might affect the behavior of state and local governments, in particular the quantity of debt that they would issue. This question is important because it contributes to the general equilibrium adjustment to tax reform that would ultimately determine the revenue cost of repealing tax exemption. Our analysis, in contrast, assumes that the supply of tax-exempt bonds remains constant after a change in the tax law. We assume that the ownership of tax-exempt bonds shifts after a tax reform, and that non-household sector investors, such as the "rest of the world" or nonprofit endowment investors, would play an important role in purchasing newly-taxable bonds issued by states and local governments.

3. Household Data: The 2004 Survey of Consumer Finances and TAXSIM

Our analysis relies primarily on household-level data on the current ownership of tax-exempt bonds to evaluate the potential revenue consequences of changing the tax exemption. Our data source is the 2004 Survey of Consumer Finances (SCF). We impute marginal tax rates to SCF households using the code provided by Moore (2004) to produce the twenty-two variables needed to run the NBER's Internet TAXSIM program. Feenberg and Coutts (1993) describe the basic structure of the TAXSIM program, which produces both first-dollar and last-dollar marginal tax rates on taxable interest income and other components of adjusted gross income.

Aggregate Consistency Checks for SCF Data

The SCF is the most detailed and reliable source of data on household finances. We nevertheless performed some external validation tests for the data on tax-exempt bond holdings.

In 2004, the SCF interviewed 4,519 households. The public use SCF data file includes 22,595 observations, which corresponds to five "replicates" for each underlying SCF observation. Because the SCF file includes imputed values for some data items that are missing in the household's actual responses, the replicates associated with a given underlying observation may have different values of some variables. Different observations have different sample weights, and the weighted sum of SCF households corresponds to 112 million U.S. households. The total financial assets of these households, defined following Poterba and Samwick (2003) as including directly held equity, equity in mutual funds, tax deferred equity, tax deferred bonds, tax-exempt bonds, taxable bonds, interest bearing accounts and other financial assets, is $17.4 trillion. The tax-exempt bonds category includes tax-exempt bonds held through mutual funds that are identified as tax-exempt bond funds. Taxable bonds include government bonds, corporate bonds, foreign bonds, and mortgage bonds, once again including both direct holdings and holdings through mutual funds. Interest bearing accounts include checking and savings accounts, plus certificates of deposits. Other financial assets include annuities, trust funds, hedge funds with equity interest, and life insurance premiums.

The 2004 SCF reports aggregate direct household ownership of tax-exempt bonds of $756 billion. By comparison, the 2003 Flow of Funds accounts (Table L.211) show $704 billion of direct household-owned tax-exempt bonds. The "household sector" for this purpose includes nonprofit institutions, but since they are tax-exempt, they are unlikely to hold substantial amounts of tax-favored state and local debt. In addition, the Flow of Funds show holdings of tax exempt bonds by mutual funds, money market mutual funds, and closed-end funds were $290 billion, $292 billion, and $89 billion at year-end 2003. The household sector owned 62.3 percent of mutual fund shares and 48 percent of money market mutual fund shares. The SCF reports tax-

exempt bonds in mutual funds, but it does not distinguish between money market mutual funds and regular mutual funds. The SCF total for these holdings is $300 billion, compared with $376 based on the ownership shares and aggregate values of the various funds from the Flow of Funds accounts. While these summary statistics suggest some differences between the Flow of Funds aggregates and the SCF, they suggest that the SCF asset stocks are reasonably close to other information on the aggregates.

Shifting from stocks to flows, the amount of tax-exempt interest that the households reported for 2003 in the SCF, $57.5 billion, can be compared with information in the 2003 IRS Statistics of Income. In the IRS data households report $53.7 billion of tax-exempt interest for 2003 – once again a reasonably close agreement.

Consistency of Stocks and Flows in SCF

One potential difficulty with the SCF data is the imperfect matching between asset income and asset holdings. Table 4 illustrates the problem. Nearly three percent of SCF observations, corresponding to slightly less than two percent of the population, report holding tax-exempt bonds but report no tax-exempt interest. In addition, just over three percent of the observations, representing slightly more than one percent of the population, report tax-exempt interest but no holdings of tax-exempt bonds.

Another way to illustrate this mismatch problem is to calculate the distribution of the ratio of tax-exempt interest payments to tax-exempt bond holdings. Table 5 presents summary information on this distribution and shows that the median "implied interest rate," where the median is computed for all households with tax-exempt bond holdings, is 4.9 percent. The interquartile range spans 3.2 to 12.7 percent. When implied interest rates for each household are

weighted by the household's ownership of tax-exempt bonds, we find that the median tax-exempt bond holding is reported to yield 3.7 percent. The interquartile range is 2.0 to 5.4 percent. There are some extreme outliers in the data set, with interest rates dropping below one percent at the 5th percentile and rising well into double digits by the 90th percentile.

One potential explanation for the inconsistencies is that while households were interviewed in 2004, the questionnaire specifically asks about tax information for fiscal year 2003. The households with stock-flow inconsistencies might have bought or sold tax-exempt securities between 2003 and 2004. It is also possible that the differences are due to misreporting in either flows of income or stocks of assets – measurement error or failures of some households to understand their detailed financial affairs. Finally, it is possible that the errors arise because fo the imputation algorithm used to construct the various SCF replicates. It imputes information on interest income separately from information on tax-exempt bond holdings, so it may generate outlying ratios of the two. The source of such stock-flow inconsistencies is a subject of ongoing SCF research. Some view the SCF's balance sheet data as more reliable than income flow variables. In our analysis below we therefore present results using both stock and flow data.

Holdings of Tax-Exempt Debt by Marginal Tax Rate

Table 6 presents information on the percentage of tax-exempt debt that is held by households in various marginal tax rate categories for 2003. The table shows that more than half (53 percent) of tax-exempt bonds are held by households with marginal tax rates in excess of 30 percent. A slightly smaller fraction, 49 percent, of the tax-exempt interest is reported by households in these tax brackets. As in Feenberg and Poterba (1991), households with very low marginal tax rates hold a non-trivial share of tax exempt debt – close to ten percent. Whether

these are households with transitory low marginal rates, or whether we are misclassifying them with respect to tax status, is an open question.

4. Estimation of Static Revenue Effects

We begin our analysis of the revenue cost of the individual income tax exemption for state and local interest payments by applying the standard approach to the 2004 SCF data. This approach assumes that investors, states, and localities make minimal changes in their behavior as a result of the tax exemption. In particular, the quantity of debt issued by states and local governments is assumed to be unaffected by the tax exemption, and the households who hold tax-exempt bonds are assumed to replace their holdings with taxable bonds if the exemption is repealed. In essence, this approach assumes that if tax-exempt bonds became taxable bonds, the same investors who currently hold them would continue to do so.

We compute the revenue cost of the interest exemption by multiplying reported tax-exempt interest for each SCF household by the ratio of the taxable and the tax-exempt interest rate in 2003, which was 1.2182, and then multiplying the product by the TAXSIM estimate of the federal marginal income tax rate on interest income. We sum this over all households using SCF weights:

$$\Delta Revenue_{2003} = \sum_j w_j \left(\tau_{j,2003} \times R_{j,2003} \times \frac{i_{2003}^{taxable}}{i_{2003}^{exempt}} \right). \tag{1}$$

In this expression, τ is investor's j marginal tax rate on taxable interest income; R is the tax-exempt interest declared by investor j in fiscal year 2003; i is the average interest rate on taxable and tax-exempt securities (respectively) in year 2003; w is the SCF weight; the subscript j corresponds to households. The resulting estimate is a revenue cost of $19.5 billion. Note that

the same calculation could be done using data from the Statistics of Income Public Use File, by calculating a marginal tax rate on interest income for each tax filer using TAXSIM and then applying the interest rate gross-up factor described above. A key feature of this calculation is the assumption that a constant marginal tax rate applies to all of the interest income received by the household. In practice, the progressive nature of the tax code implies that the last dollar of interest income may face a higher tax rate than the first dollar – and that the calculation in (1) may overstate the revenue yield from taxing interest paid by states and localities.

We also present a similar calculation based on SCF balance sheet data on holdings of tax-exempt bonds. We multiply the tax-exempt bond holdings of each investor by the average 2004 return on taxable bonds (4.495%), which we calculate as the equal-weighted average of 4.24%, the yield on Treasury bonds, and 4.75%, the yield on AAA corporate bonds. We then multiply the resulting product by the household's marginal income tax rate on taxable interest income.

$$\Delta Revenue_{2004} = \sum_j w_j \left(\tau_{j,2003} \times B_{j,2004} \times i_{2003} \right), \qquad (2)$$

In this expression, B is the tax-exempt bond holding by investor j in year t and i is the average interest rate on taxable securities in year 2003. This methodology generates an estimate of $12.7 billion as the cost of the interest exemption tax expenditure. This measure applies to 2004, since that is when asset stock data were collected.

The difference in the estimated revenue costs using the flow-based and stock-based approaches is disturbing. It could arise from at least two sources. One is an error in the assumed interest rate on taxable bonds in (2), or in the gross up factor in (1). Our analysis uses the yields on AAA bonds, but if investors hold lower quality bonds, the yield spread and the corresponding gross-up factor may be smaller and the $19.5 billion estimate may be too high. Even if we

assume that taxable state and local bonds would yield the same interest rate that these bonds paid when tax-exempt, the revenue estimate is $16.0 billion. That assumption would also imply a higher taxable bond interest rate, which in turn would increase the stock-based estimate to some extent.

The second potential source of difference between the two estimates is the mismatch between stocks and flows that we noted above. If stocks are measured more efficiently than flows, then (2), the balance-sheet based approach, may provide better estimates. If the flow income measures are better than the balance sheet measures, the opposite would be true.

5. Portfolio Adjustments if Tax Exemption Were Repealed or Restricted

The foregoing calculations assume that households would hold taxable bonds if they were not holding tax-exempt bonds. The revenue cost of tax exemption is therefore the revenue that would be collected on taxable bonds in this setting. Since the average marginal interest income tax rate of tax-exempt bond holders is high – 26.84 percent, weighted by bond holdings – increasing this group's holdings of taxable bonds would generate substantial revenue. Yet the assumption that current holders of tax-exempt bonds would hold such taxable bonds if they lost the tax exemption is open to question.

Information on Portfolio Structure

Table 7 describes the aggregate portfolio shares of various assets in the portfolio of all SCF respondents with positive holdings of tax-exempt bonds, and it contrasts these portfolio shares with those for households with no tax-exempt bond holdings. For the latter group, taxable bonds account for four percent of their portfolio while interest-bearing accounts represent 24 percent. For those who do hold tax-exempt bonds, taxable bonds represent six percent and

interest bearing accounts are only nine percent of the total. Tax-exempt bonds, in contrast, represent 18 percent of the portfolio for these households. These results suggest that taxable interest-bearing assets are a smaller share of the portfolios of households with tax-exempt bonds than of households without such bonds. Equity, held directly or through mutual funds, is in contrast a larger share of the portfolio of those who hold tax-exempt bonds (44%) than of those who do not (35%). If the households who currently hold tax-exempt bonds were to replace these bonds by distributing the funds in the proportion of various assets in their existing portfolios, fully-taxable bonds would be only 18.2% (=15/(1-.18)) of the total – much less than the foregoing revenue calculations assumed. Other more lightly taxed assets, such as equities, and assets that generate low rates of return, such as transaction accounts, would account for the remainder of the portfolio. They would also generate less tax revenue than taxable bonds.

Table 8 presents more information on the differential holdings of those with and without tax-exempt bonds. It shows the distribution of portfolio shares for different households. The table not only separates those with and without tax-exempt bonds, but it also examines those with more than $10,000 in tax-exempt bond holdings. It suggests that households with greater holdings of tax-exempt bonds also have greater exposure to other financial asset classes. The median portfolio share and even the 75th percentile portfolio share for several asset categories is positive for those holding tax-exempt bonds, but zero for those without such holdings.

Auerbach and King (1983), whose investigation of portfolio structure recognized the potential role of tax-exempt debt, identified portfolio specialization as an important potential outcome for taxable investors. The SCF data enable us to study whether households who hold tax-exempt bonds shun taxable bonds, and vice versa. Table 9 presents information on the structure of household portfolios, with a goal of informing the extent to which households

specialize in one security class. Direct holdings are combined with holdings of mutual funds to prepare this table. Of the 112 million SCF households, 69 million have no holdings of taxable stocks, taxable bonds, or tax-exempt bonds, either directly or in mutual funds. Some of these households (4.5 million) hold stocks or bonds through tax-deferred accounts such as IRAs and 401(k)s, but such holdings do not bear on tax-induced portfolio specialization. Just over ten million households have only taxable interest-bearing assets, almost 19 million have only corporate equity, and 240,000 have only tax-exempt bonds. Those who specialize in equities hold 31 percent of all financial assets, while those who have both equities and taxable bonds represent 20 percent of the total.

Possible Portfolio Adjustments in Response to Elimination of Tax Exemption

To illustrate how assumptions about portfolio adjustment affect estimates of the revenue cost of tax exemption, we consider four potential portfolio adjustment strategies. These are (i) taxable bond substitution, the case considered above; (ii) "proportional substitution": investors replace tax-exempt bonds with all other assets in the same proportion as they were found in their original taxable portfolio; (iii) "equity substitution:" investors substitute tax-exempt bonds with direct equity holdings; and (iv) "tax efficient substitution:" investors substitute direct equity holdings for tax-exempt bonds if their marginal tax rate on other income is lower than 20 percent and with taxable bonds otherwise. Table 10 shows how household portfolios would change if investors responded in each of these ways to elimination of tax exemption.

We compute the taxable income for each household in the SCF under each of the alternative portfolio substitution scenarios. We assume an interest rate of 3.69% on tax-exempt bonds -- the average of daily yields on AAA municipal bond indices with 10 year maturities for 2003. For taxable bonds we assume an interest rate of 4.495%, the simple average of the mean

of daily yields on Treasury bonds (4.24%) and AAA Corporate bonds (4.75%) in 2003, both for 10 year maturities. The average return on interest bearing accounts, for simplicity, was assumed to be equal to one-quarter of the interest rate on taxable bonds: about 1.124%. The average taxable capital gain on stocks is assumed to be 2.75% of their market value. This is one-quarter of the historical appreciation of stocks reported by Morningstar for the period 1926-2006, minus the corresponding dividend yield of 2.0%. We assume that only one quarter of unrealized capital gains are taxed in a given year. For equity held through mutual funds we assume a higher realization rate, 50 percent, and a correspondingly higher tax burden on capital gains. We assume the same dividend yield for directly-held equity and for stocks held through mutual funds.

Once we construct each household's portfolio under our various portfolio adjustment assumptions, we compute its federal tax liabilities by re-running TAXSIM with modified inputs for nontaxable income (item 13); taxable interest (item 10); short term capital gains (item 21); long term capital gains (item 22); dividend income (item 9); deductions that are preferences under the AMT (item 16); and deductions that are not preferences under the AMT (item 20). We then develop new estimates of the revenue cost of the tax-exemption tax expenditure as

$$\Delta Revenue^{k}_{2003} = \sum_{j} w_j \left(FTL^{k}_{j,2003} - FTL^{*}_{j,2003} \right), \tag{3}$$

where, *FTL*: are the Federal Tax Liabilities of investor *j* obtained through TAXSIM when portfolio substitution *k* is assumed, *FTL**: are the Federal Tax Liabilities of investor *j* obtained through TAXSIM using original data from the SCF (fiscal year 2003), while the sum over *j* means summing over all investors using SCF weights (*w*).

Note that by comparing federal tax liabilities with tax exempt debt in the portfolio and without it, subject to our portfolio adjustment rules, we obtain a more precise estimate of the revenue cost than our crude calculations in (1) and (3). In particular, when the marginal tax rate applicable to the household's portfolio income is not constant, (3) will prove more informative than (1) or (2) above.

Table 11 presents the central findings of our analysis: our revenue estimates under different portfolio adjustment scenarios. The highest revenue effect of repealing tax exemption corresponds to the taxable bonds adjustment. This is the basis for the standard estimates described above. This case replaces tax-exempt bonds with the most heavily taxed asset in investor portfolios. When we assume that households replace tax-exempt debt with equity, or that they choose between equity and other assets in a tax-efficient way, we find smaller estimates of the revenue cost of the tax expenditure: $10.1 billion and . The proportional substitution case produces the lowest estimate of the tax cost ($7.9 billion), in part because it replaces tax-exempt bonds with low-interest assets such as transaction accounts. Since investors who hold tax-exempt bonds are unlikely to use them for liquidity purposes, this substitution assumption is open to question.

Distributional Effects of Eliminating Tax Exemption

The last five columns of Table 11 present information on the distributional burden of eliminating the tax exemption. Each column presents the share of the revenue increase that corresponds to a particular income level. We have stratified households according to income below $40K, with income between $40-75K, $75-125K, $125-250K and $250K+. Because the ownership of tax-exempt bonds is highly skewed, the highest income group accounts for roughly

eighty percent of the dollar effect when the tax exemption is repealed. The lowest income group accounts for less than one percent.

Table 12 reports the weighted mean change in federal tax liabilities due to the repeal of the tax exemption. For households with incomes below $40,000 (but positive holdings of tax-exempt bonds), the mean and median changes are close to zero. For those with incomes above $250,000, the average tax increase is above$10,000, while the median tax increase is around $2200. For the average household (disregarding ownership of tax-exempt bonds), the tax increase is around $100.

Other Approaches to Restricting the Revenue Cost of Tax Exemption

The most common proposal to reform the current tax exemption would eliminate it. There are also other proposals, however, that are sometimes discussed by tax-writing committees. One involves limiting the amount of tax-exempt interest that is exempt from tax to a fixed fraction of AGI, and the other involves capping the amount of tax-exempt interest per tax return. To develop some insight on plausible thresholds for such policies, Tables 13 and 14 report the distribution of tax-exempt interest as a share of AGI, and the distribution of the total amount of tax-exempt interest, respectively. Table 13 shows that limiting tax-exempt interest to be lower than ten percent of AGI would affect households who hold approximately 60 percent tax-exempt bonds. Limiting tax-exempt interest to 30 percent of AGI would affect households owning 37 percent of tax-exempt bonds. On the other hand, based on Table 14, limiting the amount of tax-exempt interest to $10,000 per tax return would affect households that own 78 percent of tax-exempt bonds, while increasing this limit to $100,000 would reduce the impact to households that own 39 percent of tax-exempt bonds. The information in Table 14 underscores the concentration of tax-exempt bond ownership within the taxpaying population.

To compute the revenue effects of various limits on tax-exempt interest, we use (3) in tandem with each of our portfolio adjustment assumptions. For example, if half of tax-exempt interest for an investor is above the limit, then we assume that this investor would adjust half of her tax-exempt bond holdings in accordance with a particular adjustment strategy. Table 15 reports our estimates of the revenue effects of various limits on tax-exempt interest under the assumption that households replace their no-longer-deductible tax-exempt bonds with either taxable bonds or corporate stock. We estimate that limiting tax-exempt interest to $100,000 per tax return would raise $3.9 billion if households substitute taxable bonds for tax-exempt bonds, and by $2.7 billion with equity substitution. For a $50,000 limit, the corresponding values are $6.2 and $4.3 billion. Limiting tax-exempt interest to 30 percent of AGI would raise $1.4 billion in the taxable bond substitution case, and $0.9 billion in the equity substitution case.

6. Conclusion

This paper suggests that the revenue cost of exempting state and local government interest payments from the federal income tax may be smaller than standard estimates indicate. If investors would react to restrictions on tax exemption, or an outright elimination of this policy, by selling their now-fully-taxable bonds and shifting their portfolio toward assets that yield lightly taxed returns, such as corporate stock, then the revenue cost of the current policy is smaller than analyses that assume investors would replace previously tax-exempt bonds with taxable bonds would suggest. By presenting estimates for different investor responses, we have illustrated the potential revenue effects of eliminating tax exemption. Our findings suggest that the revenue cost might be as little as half the standard estimate.

Our analysis has relied on illustrative examples of portfolio adjustment strategies, rather than a model of portfolio adjustment estimated on household data. Poterba and Samwick (2003) present a related model for the cross-sectional pattern of asset holdings; they do not study portfolio adjustment in response to a changing tax environment. A critical next step in studying the tax expenditure for state and local interest payments is developing estimates of household behavioral response and using them to inform the calculations.

We have assumed that there is no change in behavior on the part of states and localities when interest exemption is eliminated. A more likely scenario would involve reduced bond issuance and greater reliance on taxes for these governments. If the supply of state and local government debt changed when the tax exemption was eliminated or modified, then a complete analysis would need to recognize the general equilibrium effects associated with this change in the supply of securities. A number of studies have examined the effect of the tax exemption on state and local government behavior, with mixed conclusions.

Finally, our analysis has not explored the key question of whether the tax expenditure for state and local government borrowing is an efficient policy for supporting sub-federal governments. Resolving this issue requires distinguishing the yield spread between taxable and tax-exempt bonds into a component that depends on the relative riskiness of the two types of bonds, and a component that depends only on the differential tax status of the bonds. Unfortunately this distinction is difficult to draw. Recent movements in the yield spreads for taxable and tax-exempt bonds highlight the difficulty of any such disaggregation.

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Table 1. Implicit Tax Rates on Prime-Grade Municipal Bonds Relative to Taxable Treasury and Corporate Bonds, 1991-2007

	Yields (%)			Spread (%)		Implicit tax rates (%)	
Year	Munis	Treasury	Corporate	Treasury-Muni	Corporate-Muni	Treasuries	Corporates
1991	6.02	8.17	8.39	2.14	2.4	35.59	39.2
1992	5.58	7.25	7.43	1.68	1.8	30.03	33.2
1993	4.74	6.19	6.32	1.45	1.6	30.62	33.2
1994	5.28	7.21	7.49	1.93	2.2	36.47	41.8
1995	5.04	6.71	6.97	1.67	1.9	33.01	38.2
1996	4.92	6.55	6.82	1.63	1.9	33.24	38.7
1997	4.75	6.48	6.73	1.73	2.0	36.40	41.7
1998	4.31	5.49	5.83	1.17	1.5	27.17	35.2
1999	4.62	6.00	6.46	1.39	1.8	29.99	39.8
2000	4.97	6.25	7.14	1.28	2.2	25.85	43.8
2001	4.28	5.23	6.00	0.95	1.7	22.22	40.2
2002	4.05	4.91	5.57	0.86	1.5	21.24	37.3
2003	3.69	4.24	4.75	0.55	1.1	14.92	28.6
2004	3.66	4.45	4.91	0.78	1.2	21.32	34.0
2005	3.72	4.40	4.90	0.68	1.2	18.13	31.7
2006	3.93	4.88	5.51	0.96	1.6	24.34	40.4
2007	3.91	4.85	5.53	0.93	1.6	23.79	41.2
Average	4.56	5.84	6.28	1.28	1.72	28.10	37.7

Source: Bloomberg

Table 2: Yield Spread on AMT Bonds and Fully Tax Exempt Bonds

Maturity:	1Y	10Y	30Y
Municipal Bonds			
Treasury vs Municipal AAA	11.62	14.63	5.84
Corporate AAA vs Municipal AAA	32.54	28.06	21.58
Corporate AA vs Municipal AA+/AA-	44.36	30.56	25.71
Corporate A vs Municipal A+/A-	37.17	28.46	25.56
AMT Bonds			
Treasury vs AMT AAA	-10.01	4.70	-1.35
Corporate AAA vs AMT AAA	6.85	16.96	13.32
Corporate AA vs AMT AA-	19.19	21.17	19.12
Corporate A vs AMT A+/A-	17.90	22.38	20.37

Source: Authors' calculations using Bloomberg.

Table 3. Ownership of Tax-Exempt and Taxable Bonds, 2004

	Tax-exempt bonds		Taxable bonds	
	Billions	%	Billions	%
Total assets	2,031	100	12,241	100
Household sector	743	37	1,351	11
Nonfinancial corporate business	32	2	33	0
Nonfarm noncorporate business	4	0	50	0
State and local governments	5	0	507	4
Rest of the world	26	1	3,875	32
Monetary authority	0	0	718	6
Commercial banking	141	7	671	5
Savings institutions	7	0	68	1
Property-casualty insurance companies	268	13	317	3
Life insurance companies	30	1	1,847	15
Private pension funds	0	0	377	3
State and local govt. retirement funds	2	0	365	3
Federal government retirement funds	0	0	64	1
Money market mutual funds	314	15	359	3
Mutual funds	294	14	772	6
Closed-end funds	89	4	74	1
Exchange-traded funds	0	0	8	0
Government-sponsored enterprises	45	2	428	3
Brokers and dealers	32	2	208	2
Funding corporations	0	0	97	1
Other (credit unions, ABS issuers, REITs)	0	0	54	0

Notes: Data are drawn from the Flow of Funds, Tables L.209, L.211 and L.212. The outstanding value of tax-exempt bonds was $2.031 trillion, while the outstanding stock of taxable bonds was $12.241 trillion.

Table 4. Stock-Flow Inconsistency in Tax-Exempt Bond Holdings and Tax-Exempt Interest, 2004 Survey of Consumer Finances

	Households		Observations		Financial Assets	
	Millions	%	Thousands	%	Trillions	%
No bonds / no interest	106.7	95.2	19.1	84.6	10.0	57.6
Bonds and interest	2.1	1.8	2.1	9.3	4.8	27.3
No bonds but interest	1.2	1.1	0.7	3.3	1.5	8.6
Bonds but no interest	2.1	1.8	0.6	2.8	1.1	6.5
Total	112.1	100.0	22.6	100.0	17.4	100.0

Source: Authors' calculations using the 2004 SCF.

Table 5. Distribution of Implied Interest Rates on Tax-Exempt Bond Holdings, Computed from 2004 Survey of Consumer Finances (%)

	Weighting Variable			
	Households	Observations	Financial Assets	Tax-exempt bond holdings
Minimum	0.0	0.0	0.0	0.0
1th percentile	0.1	0.2	0.2	0.1
5th percentile	1.4	1.1	1.0	0.9
10th percentile	1.8	1.6	1.7	1.5
1st quartile	3.2	2.7	2.5	2.0
Median	4.9	4.7	4.5	3.7
3dr quartile	12.7	9.0	8.4	5.4
90th percentile	45.5	23.4	20.0	8.4
99th percentile	241.9	300.0	233.3	29.0
Maximum	320,000.0	320,000.0	320,000.0	320,000.0

Source: Authors' calculations using the 2004 SCF.

Table 6. Tax-exempt Bonds and Tax-exempt Interest by Federal Marginal Tax Rate

	Tax-exempt bond holdings		Tax-exempt interest	
Federal MTR:	Billions	%	Billions	%
<0%	1.0	0.1	0.0	0.0
0%	95.3	9.0	5.0	8.8
0-10%	21.2	2.0	0.9	1.6
10-15%	89.7	8.5	6.0	10.5
15-25%	153.0	14.4	8.0	13.9
25-30%	133.0	12.5	9.4	16.3
30%+	562.0	53.0	28.1	48.9
Total	1,060.0	100.0	57.5	100.0

Source: Authors' calculations using the 2004 SCF.

Table 7. Aggregate Portfolio Holdings of Households in 2004 Survey of Consumer Finances

	Households with No holdings of tax-exempt bonds		Households with Positive holdings of tax-exempt bonds	
	Billions	%	Billions	%
Directly held equity	2,830	25	1,710	29
Equity in mutual funds	1,190	10	881	15
Tax deferred equity	883	8	267	5
Tax deferred bonds	1,740	15	500	8
Tax-exempt bonds	0	0	1,060	18
Taxable bonds	428	4	351	6
Interest bearing accounts	2,820	24	518	9
Other financial assets	1,630	14	612	10

Source: Authors' calculations using the 2004 SCF.

Table 8. Statistics on Investor's Portfolio Holdings

	Holdgins of tax-exempt bonds					
	No holdings (108 million households)		Positive holdings (4.15 million households)		Holdings>10,000 dollars (3.06 million households)	
	Mean	Median	Mean	Median	Mean	Median
Directly held equity	0.066	0.000	0.167	0.067	0.180	0.082
Equity in mutual funds	0.034	0.000	0.202	0.134	0.192	0.120
Tax deferred equity	0.031	0.000	0.062	0.000	0.062	0.000
Tax deferred bonds	0.089	0.000	0.117	0.063	0.119	0.063
Tax-exempt bonds	0.000	0.000	0.149	0.092	0.172	0.112
Taxable bonds	0.025	0.000	0.043	0.006	0.044	0.004
Interest bearing accounts	0.571	0.615	0.151	0.102	0.139	0.088
Other financial assets	0.104	0.000	0.109	0.046	0.092	0.032

Source: Authors' calculations using the 2004 SCF.

Table 9. Household Portfolio Holdings of Equity, Taxable Bonds, and Tax-Exempt Bonds, Including Mutual Fund Holdings

	Households			Financial assets		
	Millions	Percent	Fed MTR	Trillions	Percent	Fed MTR
No holdings	69.16	62	11	2.06	12	19
Specialized in taxable bonds	10.30	9	17	0.62	4	20
Specialized in equity	18.59	17	19	5.41	31	22
Specialized in tax-exempt bonds	0.24	0	14	0.10	1	10
Mixed (taxable bonds & equity)	9.91	9	21	3.43	20	23
Mixed (equity & tax-exempt bonds)	1.46	1	21	1.67	10	24
Inconsistent (three assets)	2.31	2	24	4.07	23	25
Inconsistent (taxable bonds & tax-exempt bonds)	0.13	0	12	0.05	0	21
Total	112.11	100	14	17.42	100	23

Source: Author's calculation using 2004 SCF, Internet TAXSIM and Kevin B. Moore's Code.

Table 10. Portfolio substitutions for investors with positive holdings of tax-exempt bonds

	Original	Taxable bonds	Proportional	Equity	Tax efficient
	Aggregate portfolio (distribution of the sum of all assets in the SCF)				
Directly held equity	0.290	0.290	0.373	0.469	0.424
Equity in mutual funds	0.149	0.149	0.175	0.150	0.149
Tax deferred equity	0.045	0.045	0.046	0.045	0.045
Tax deferred bonds	0.085	0.085	0.087	0.085	0.085
Tax-exempt bonds	0.180	0	0	0	0
Taxable bonds	0.060	0.239	0.078	0.060	0.105
Interest bearing accounts	0.088	0.088	0.114	0.088	0.088
Other financial assets	0.104	0.104	0.126	0.104	0.104
	Statistics on Investor's Portfolio (Mean of individual investors' portfolio shares)				
Directly held equity	0.167	0.167	0.193	0.316	0.258
Equity in mutual funds	0.202	0.202	0.237	0.202	0.202
Tax deferred equity	0.062	0.062	0.062	0.062	0.062
Tax deferred bonds	0.117	0.117	0.117	0.117	0.117
Tax-exempt bonds	0.149	0	0	0	0
Taxable bonds	0.043	0.192	0.051	0.043	0.102
Interest bearing accounts	0.151	0.151	0.191	0.151	0.151
Other financial assets	0.109	0.109	0.122	0.109	0.109

Source: Author's calculation using 2004 SCF, Internet TAXSIM and Kevin B. Moore's Code.
Column 2 represents the case where we substitute tax-exempt bonds with taxable bonds in investor's portfolio. Column 3 represents the case where we substitute tax-exempt bonds with a portfolio of assets (excluding tax deferred accounts) that is proportional to each investor's original portfolio. In Column 4 we substitute tax-exempt bonds with directly held equity. Finally, in Column 5 we substitute tax exempt bonds with equity or taxable bonds depending on each investor marginal tax rate on the first dollar of capital income.

Table 11. Estimated Revenue Effects and Implied Distributional Effects

	Revenue effect	Effect by Income level (% of total effect)				
	Billions	0-40 K	40-75 K	75-125 K	125-250 K	250+
Current Federal Tax Liabilities	1,100.00	2.3	12.2	19.9	22.9	42.9
Portfolio Substitution Assumption:	Estimated Revenue Effect of Eliminating Tax Exemption for State & Local Interest Payments:					
Taxable bonds	14.20	0.4	2.8	3.4	11.5	81.7
Proportional	7.91	0.4	3.8	2.2	12.6	81.0
Equity	10.10	0.4	2.9	3.3	12.5	80.5
Tax efficient	10.90	0.4	3.1	3.3	12.6	80.3

Source: Authors' calculations using 2004 SCF, Internet TAXSIM and Kevin B. Moore's Code.
See Table 9. Taxable bonds: substitute tax-exempt bonds with taxable bonds in investor's portfolio. Proportional: substitute tax-exempt bonds with a portfolio of assets (excluding tax deferred accounts) that is proportional to each investor's original portfolio. Equity: substitute tax-exempt bonds with direclty held equity. Tax efficient: substitute tax exempt bonds with equity or taxable bonds depending on each investor marginal tax rate on the first dollar of capital income.

Table 12. Increases in federal tax liabilities due to elimination of interest exemption

	Income level					
	0-40 K	40-75 K	75-125 K	125-250 K	250+	Total
ALL HOUSEHOLDS:*						
	Mean increase in federal tax liabilites (dollars)					
Taxable bonds	1	13	25	178	4,176	127
Proportional	1	10	9	108	2,300	71
Equity	1	9	17	137	2,919	90
Tax efficient	1	11	19	148	3,141	97
HOUSEHOLDS WITH POSITIVE HOLDINGS OF TAX-EXEMPT BONDS:						
	Mean increase in federal tax liabilites (dollars)					
Taxable bonds	144	366	536	1,798	14,146	3,434
Proportional	81	274	203	1,089	7,791	1,912
Equity	105	264	366	1,386	9,887	2,429
Tax efficient	127	309	396	1,499	10,639	2,624
	Median increase in federal tax liabilites (dollars)					
Taxable bonds	27	108	225	315	3,147	243
Proportional	8	38	54	179	1,288	81
Equity	18	68	182	235	2,164	189
Tax efficient	27	108	182	235	2,164	225

Source: Authors' calculations using 2004 SCF, Internet TAXSIM and Kevin B. Moore's Code.
See Table 9. Taxable bonds: substitute tax-exempt bonds with taxable bonds in investor's portfolio. Proportional: substitute tax-exempt bonds with a portfolio of assets (excluding tax deferred accounts) that is proportional to each investor's original portfolio. Equity: substitute tax-exempt bonds with directly held equity. Tax efficient: substitute tax exempt bonds with equity or taxable bonds depending on each investor marginal tax rate on the first dollar of capital income. * Median increases for the full sample of households are zero in all cases.

Table 13. Holdings of Tax-Exempt Bonds, Households Ranked by Tax-Exempt Interest/AGI

Tax-exempt interest to AGI:	Holdings of Tax Exempt bonds Billions	% of total	MTR (%) (weights by HH)
0%	107	10.17	14.49
0 - 10%	313	29.68	25.34
10 - 30%	241	22.83	24.33
30 - 50%	127	12.00	16.91
50 - 100%	124	11.70	11.98
100% +	144	13.63	12.18
Total	1,056	100.00	14.77

Source: Authors' calculations using the 2004 SCF.

Table 14. Holdings of Tax-exempt Bonds, Households Ranked by Amount of Tax-Exempt Interest Received

Tax-exempt bond interest:	Holdings of Tax Exempt bonds Billions	% of total	MTR (%) (weights by HH)
0	100	9.49	14.49
0 - 10K	130	12.32	23.49
10 - 50K	160	15.14	24.84
50 - 100K	251	23.72	26.52
100 - 250K	135	12.77	28.74
250 - 500K	121	11.47	31.78
500K - 1M	101	9.59	22.29
1M +	58	5.49	29.91
Total	1,056	100.00	14.77

Source: Authors' calculations using the 2004 SCF.

Table 15. Estimates of Revenue Effects for Limits on Tax Exempt Interest Based on Taxpayer Characteristics (billions)

Substitution Assumption:		
	Limit to 10% of AGI	Limit to 10K
Taxable bonds	5.45	9.79
Equity	3.84	6.87
	Limit to 20% of AGI	Limit to 50K
Taxable Bonds	2.38	6.21
Equity	1.66	4.30
	Limit to 30% of AGI	Limit to 100K
Taxable Bonds	1.36	3.92
Equity	0.91	2.66

Source: Authors' calculations using 2004 SCF, Internet TAXSIM and Kevin B. Moore's Code. See Table 9. Taxable bonds: substitute tax-exempt bonds with taxable bonds in investor's portfolio. Equity: substitute tax-exempt bonds with directly held equity.