Using tax return data to simulate corporate marginal tax rates

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Abstract

We simulate marginal tax rates (MTRs) from 1998 to 2000 using U.S. tax return data for public corporations. We compare these tax rates to those calculated from public financial statement data and find that Graham's (1996a) simulated tax rate is the book variable most highly correlated with the simulated tax return rate. We provide an algorithm to approximate the tax return MTR if the book simulated rate is not available. Finally, we find that tax return MTRs are significantly correlated with financial statement corporate debt ratios, although less so than the correlation between book MTRs and debt ratios.

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1. Introduction

The marginal tax rate is an important input into many corporate decisions. To list a few, high tax rate firms are ceteris paribus hypothesized to use more debt, restructure via Chapter 11 when in distress, and participate in tax shelters. Low tax rate firms are thought to pay employees with deferred or stock compensation rather than salary, operate as corporations rather than partnerships, and lease rather than buy assets. The corporate marginal tax rate (MTR) also is a key input into the cost of capital and therefore affects corporate investment decisions.[1] Given the significance of these issues, it is important to accurately measure corporate marginal tax rates.

Traditionally, tax incentives have been measured with a static variable. The value of a static variable is limited, however, when a firm's tax status has recently changed or if it is expected to change in the near future. To address this concern, researchers developed tax rates that capture important dynamic features of the tax code. In particular, Shevlin (1990) and Graham (1996a) simulate corporate marginal tax rates to account for net operating loss carrybacks and carryforwards. For example, when a firm has a high probability of experiencing losses in the near future, its current-period simulated MTR can be relatively low because the firm is expected to carry future losses back to obtain a refund on taxes paid today. More generally, simulated MTRs exhibit a fair amount of variation across firms and through time.

One potential deficiency of almost all tax rates used by researchers to date is that they are calculated using data from financial statements. As is well known, financial statement data can vary greatly from tax return data. This is important because, to the

[1] In this paper, we measure the MTR as the present value of incremental taxes paid on an additional dollar of current-period income, consistent with Scholes, Wolfson, Erickson, Maydew, and Shevlin's (2006) corporate income marginal tax rate.

extent that taxes are relevant in real-world decisions, actual taxes paid (as reflected on tax returns) are usually thought to be the decision variable, not financial statement taxes. Therefore, it is important to determine whether financial statement tax rates are a close enough proxy to tax return tax rates to justify their use in tax and financial economic research.

Plesko (2003) examines how closely financial statement tax rates approximate tax return tax rates. Using one year of data (1992), Plesko compares a static tax return tax variable to several financial statement MTRs. Among these candidates, he finds that Graham’s (1996a, 1996b) simulated tax rates are the closest approximation to static tax return tax rates. Plesko also finds that a simple binary variable that combines information about net operating loss status and the sign of current financial statement income is a close second.

Plesko’s approach has the distinct advantage of constructing a complex and sophisticated marginal tax rate, using the 1992 Statistics of Income data file. His approach takes into account approximately 60 tax return items, including foreign tax credits and alternative minimum tax data. Further, because Plesko imposes sample restrictions to increase the likelihood that the single corporation is the same reporting entity for financial statement and tax return purposes, he can strictly compare the tax return rate to other proxies. However, Plesko uses a static variable as his benchmark, even though as we argue above, dynamic features of the tax code can have important effects on MTRs. Further, Plesko’s analysis is based on a relatively small sample of homogeneous, single-entity firms. Although this sample aids in linking the taxpayer to the financial statement, much finance and accounting research concerns large, complex corporations. We argue that it is important to consider corporations more broadly, even (or particularly) those for which tax and book consolidation are least likely to exactly agree.

Graham (1996b) investigates which among a collection of financial statement tax rates most closely approximates a “perfect foresight” tax rate that accounts for dynamic features of the tax code. Like Plesko, Graham (1996b) finds that the simulated marginal tax rate is most highly correlated with the benchmark MTR. The major shortcoming of Graham’s (1996b) paper is that the benchmark itself is based on financial statement data, so it is unclear whether the results carry over to tax return data (i.e., it is not clear whether dynamic financial statement MTRs would also closely approximate dynamic tax return tax rates).

This paper attempts to overcome the limitations of Graham (1996b) and Plesko (2003) by comparing tax rates calculated with financial statement data to simulated tax return tax rates (where the latter account for the dynamic net operating loss carryback and carryforward features of the tax code). In particular, we use a panel of tax return data from 1990 to 2000 to simulate corporate MTRs for the years 1998 to 2000. This allows us to calculate a dynamic MTR based on tax return data, and in turn to use this as our benchmark to evaluate financial statement tax rates.

We find that, among the candidate financial statement tax rates, Graham’s simulated MTR is most highly correlated with the simulated tax return tax rate. We also find that, in our sample, a binary MTR based solely on net operating losses does not closely approximate the dynamic tax return tax rate. Rather, we find that categorical variables that combine information about net operating losses and the sign of pretax income are reasonable “second best” proxies. As described more fully below, such variables are less adequate as replacements for the pre-interest corporate income MTR, and in general, the advantage of using the simulated book rate is much greater in a pre-interest setting (even more so than the advantage of the simulated rate in the after-financing tax rate experiment).

We identify the situations in which the simulated financial statement MTR is weakest and identify simple corrections that improve its performance. We report regression coefficients that can be readily used by other researchers to create an "improved" simulated MTR, and separately provide an algorithm that approximates the tax return MTR for situations in which the simulated book rate is not available. Finally, we confirm all these results on a holdout sample.

We also investigate the relation between corporate capital structure decisions and tax incentives. Consistent with tax theory, we find a positive relation between simulated tax return MTRs and the corporate use of debt. Interestingly, the correlation between financial statement debt ratios and tax return tax rates is weaker than is the correlation between financial statement debt ratios and financial statement tax rates. This is consistent with the debt variable measuring worldwide financial statement leverage and hence being more highly correlated with a (worldwide) financial statement tax rate.

Our paper is related to research by Contos, Rauh, and Sorensen (2006). Rather than simulate separately for each firm like we do, these authors simulate across a grid of firm characteristics and then map each firm’s characteristics onto the grid to assign a firm-specific MTR. The weakness of their approach relative to ours is that they may miss important tax status features for a given firm; however, their approach has the advantage of permitting the number of simulations to be increased greatly. Their approach is also more computationally efficient, which is helpful when interacting with the U.S. Department of Treasury in order to analyze the confidential and hard to access tax return data. Contos et al. focus on book-tax differences and find moderate differences in average tax rates but minimal differences between book and tax MTRs. This latter result complements one of our general findings; however, we separately contrast pre- and after-financing MTRs and identify a possible difference in the book and tax treatment of interest. Like us, even though they use a different simulation process and measure debt from the tax-return, Contos et al. find a positive relation between simulated tax return MTRs and debt usage.

The rest of the paper proceeds as follows. Section 2 presents data issues related to measuring corporate marginal tax rates. Section 3 discusses our data sample and research design. Section 4 presents univariate correlations between the various corporate MTRs and discusses consolidation and stock option data issues. Multivariate regression analysis is performed in Section 5. Potential effects of tax credits are considered in Section 6 and corporate debt policy is investigated in Section 7. Finally, Section 8 summarizes with implications for researchers.

2. Background

We define the corporate marginal income tax rate as the present value of current and expected future taxes paid on an additional dollar of income earned today. When estimating the contemporaneous marginal tax rate, it is necessary to forecast future taxable income to account for dynamic features of the tax code. During our sample period, a firm that experiences a net operating loss (NOL) is allowed to "carryback" the loss and receive a tax refund for taxes paid in the previous two years. For example, a loss in period t can be carried back to offset taxable income (TI) in period t-2. If TI_{t-2} is completely offset, the firm next applies the loss to TI_{t-1}. When offsetting previously earned income, the firm is allowed to amend its tax returns for years t-2 and t-1 to receive a tax refund. If current-year losses more than offset taxable income from the preceding two years, they are "carried forward" and used to offset taxable income up to 20 years in the future. Additional losses are added to any unused losses from previous years and the carryback and carryforward procedures are applied to taxable income, net of any previously taken losses, with the oldest losses being applied first. We ignore the available election to forego a net operating loss carryback.

The simulated tax rates of Shevlin and Graham generally assume that global income is subject to tax at the U.S. statutory marginal rates. In doing so, one component of the simulated tax rate computations is the disclosed net operating loss carryforward amount for financial statement purposes. In addition, many other papers use financial statement net operating loss carryforwards to estimate whether a corporation faces a low or high marginal tax rate. As described above, Plesko (2003) reviews binary and other discrete MTR proxies that incorporate combinations of a net operating loss and/or current year profit/loss.

Mills, Newberry and Novack (2003) use U.S. tax return data and financial statement footnote details to construct the U.S. tax net operating loss carryforward and compare it to the financial statement disclosure.[2] They find that the presence of a financial statement net operating loss proxies for the presence of a U.S. tax return net operating loss only 87 percent of the time. Most of the mismatch arises from the

[2] See also Kinney and Swanson (1993) for a discussion of Compustat coding of NOL carryforward data.

existence of financial statement net operating losses in years when there are no U.S. tax return net operating losses. Detailed study of the financial statement tax footnotes reveals that a frequent explanation is the presence of net operating losses in specific foreign jurisdictions or net operating losses acquired through mergers and acquisitions. These types of net operating losses do not materially affect the taxability of the U.S. affiliated group, and hence would have limited effect on a U.S. marginal tax rate. As we discuss below, these net operating loss issues are one plausible explanation of situations in which there is a mismatch between book and tax return tax rates.

3. Sample and Research design

Simulated MTR computational method

We follow the approach developed in Shevlin (1987, 1990) and Graham (1996a, 1996b, 1999) to simulate dynamic features of the tax code related to net operating loss carrybacks and carryforwards. The first step in simulating an MTR for a given firm-year involves calculating the historic mean and variance of the change in taxable income for a given firm. The second step uses this historic information to forecast income 20 years into the future for each firm. These forecasts are generated with random draws from a normal distribution, with mean and variance equal to that gathered in the first step; therefore, many different forecasts of the future can be generated for each firm-year.[3] In this paper, we simulate 50 different forecasts of the future for each firm-year. For example, to calculate a tax rate for the year 2000, we forecast 50 distinct income paths for

[3] Graham (1996b) studies alternative forecasting approaches to the random walk with drift model. For example, he examines autoregressive models that account for mean-reversion in earnings. Graham concludes that the random walk model used herein outperforms these alternatives in the context of simulating corporate MTRs.

income in the years 2001 to 2020, to account for possible carryback and carryforward effects on the year 2000 tax rate.

The third step calculates the present value tax liability along each of the income paths generated in the second step, accounting for the tax-loss carryback and carryforward features of the tax code, based on rates from the statutory tax schedule. We ignore the Alternative Minimum Tax (AMT).

The fourth step adds $1 to current year income and recalculates the present value tax liability along each path. The incremental tax liability calculated in the fourth step, relative to that calculated in the third step, is the present value tax liability from earning an extra dollar today; in other words, the economic MTR along a given forecast path.

We compute a separate marginal tax rate along each of the forecasted income paths to capture the different tax situations a firm might experience in different future scenarios. The idea is to mimic the different planning scenarios that a manager might consider. The fifth step averages across the MTRs from the 50 different scenarios to determine the expected economic marginal tax rate for a given firm-year. Note that these five steps produce the expected marginal tax rate for a single firm-year. The steps are replicated for each firm for each year, to produce a panel of firm-year MTRs. The marginal tax rates in this panel vary across firms and can also vary through time for a given firm.

We adapt the Graham (1996a, 1996b) MTR program to use tax return data. Specifically, we match tax return line items to the Compustat-based variables Graham uses in his simulation program. Details are available from the authors but we generally use Form 1120 lines 28 (net income) less line 29a (the dividends' received deduction) as our measure of taxable income absent net operating loss effects, and consider net operating losses separately. [4] In addition, in a separate algorithm, we replicate the above steps after adding back interest deductions (Line 18) in order to construct a before financing marginal tax rate.

Sample

For this paper, we use the MatchedFile dataset constructed by the Treasury Department to merge financial statement data from S&P's Compustat database with U.S. corporate tax return data. The match file is formed by merging records from each database by employer identification number (EIN) after special care is taken to align the time period reflected by each data source and to explicitly identify and remove duplicate listings for the same identifier that are not the top-level consolidated group. We specifically focus on 1998, 1999 and 2000 because these years have consistent net operating loss carryback (two) and carryforward (twenty) periods. Further, we calculate tax rates starting in 1998 because the simulation procedure uses an historic data panel of at least five prior years, and the MatchedFile dataset is less comprehensive prior to 1992. Thus, our data initially consist of 1,799 firms to which Treasury has matched financial statement and tax return data from 1992-2000. We use the historic data from 1992 through t-1 to determine the mean and variance of the taxable income distribution as

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Variable	Compustat Data item	Tax return construction	Form 1120 Line Numbers
Ending NOL c/f	52	If net_incm<0 then ending nol c/f = avlbl_crryovr_nol (beginning) – net_incm If net_incm>0 then ending nol c/f = Avlbl_crryovr_nol - nold	Avlbl_crryovr_nol = Form1120, SchK, Q12; Net_incm = Form1120, L28; nold = Form1120, L29a
Income before interest and taxes	178	Net_incm – spcl_ded + intrst_pd	F1120, L28 – L29a + L18

described in step one above. We use this same historic time frame to calculate tax rates for 1998 to 2000 separately for both tax return and financial statement data.

We split the resulting 3,667 firm years from 1998-2000 into a test sample of 1,833 firm-year observations and a hold-out sample of 1,834 firm-year observations. We perform our analysis on the test sample, concluding with a regression to fit the public data to the simulated tax return MTR. We then use the estimated regression coefficients to predict the tax return MTR for the hold-out sample and compare those MTRs to the benchmark tax return MTR.

4. Descriptive evidence

Sample description

Table 1 summarizes the sample composition by year and industry. After running both the tax return and financial statement simulation programs for 1998-2000 on all firms with necessary data, the full sample contains 3,667 firm-year observations. There are 1,315 companies in 1998, 1,271 in 1999, and 1,081 in 2000. We evenly divide each year's full sample into the test sample and the holdout sample.

Primary correlation (TX_MTR with MTR)

Table 2 describes the sample. Panel A describes various tax rate measures defined below. Panel B describes additional financial statement and tax return variables. Panels C and D present correlations and one-way regressions between the simulated tax return marginal tax rate (*TX_MTR*) and the simulated financial statement marginal tax rate (*MTR*) or other proxies. In Panel C, we define all variables on an after-financing basis, but in Panel D, we define all variables on the pre-financing basis.

Panel C indicates that the correlation between the tax return marginal tax rate (*TX_MTR*) and Graham's financial marginal tax rate (*MTR*) is 67% in our test sample. While this correlation is high, Figure 1A indicates that the imperfect correlation arises due to multiple observations in the upper-left and lower-right corners: high *MTR*, low *TX_MTR*; or low *MTR*, high *TX_MTR*. We examine next whether it is possible to use financial statement data to implement modifications that improve the correlation between the simulated financial statement *MTR* and the tax return tax rate.

We begin by exploring whether the presence of book losses, specifically in the U.S., should carry more weight in the construction of the marginal tax rate if researchers want to better approximate a tax rate based on U.S. tax return data. We construct several modifications that start with the financial statement simulated *MTR* and modify it using public data as described below. Because these modifications are all based on public data, they can be calculated by other researchers.

The below measures, although ad hoc, attempt to incorporate insights from our firm by firm review of the corner observations. We observe that there are more off-diagonal observations with high financial statement simulated *MTR* but low *TX_MTR* than observations with low *MTR* and high *TX_MTR*. We speculate that this is because worldwide financial statement income frequently exceeds U.S. taxable income, and so we incorporate requirements for U.S. pretax income to be positive some of the alternatives that follow.

- If the current year U.S. average effective tax rate (U.S. current tax expense / U.S. pretax income) is less than 10%, *MTR1* equals the lesser of 15% or the simulated *MTR*. Otherwise, *MTR1* = *MTR*.

- If financial statement data reveal both a current year worldwide pretax loss (data item 170<0) and an ending net operating loss carryforward (data item 52 > 0) then *MTR2* equals zero. Otherwise, *MTR2* = *MTR*.

- If the financial statement data reveal a current year worldwide pretax loss (data item 170<0) then *MTR3* equals zero. Otherwise, *MTR3* = *MTR*.

- If the financial statement data indicate an ending net operating loss carryforward (data item 52 > 0) then *MTR4* equals zero. Otherwise, *MTR4* = *MTR*.

- If the financial statement data reveal both a current year U.S. pretax loss (data item 272<0) and an ending net operating loss carryforward (data item 52 > 0) then *MTR5* equals zero. Otherwise, *MTR5* = *MTR*.

In addition to the above additional variables, we also consider financial statement marginal tax rate proxies commonly used in prior accounting and finance research. We follow Plesko (2003, Table 5, p. 219) to construct these variables, although we use 35 percent as the top statutory rate in place of Plesko's 34 percent due to the 1992 change in the statutory corporate tax schedule.

- If beginning net operating loss carryforward (prior year Compustat data item #52) equals zero, then *Binary1* equals 0.35. Otherwise, *Binary1* equals 0.

- If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *Binary2* equals 0.35. Otherwise, *Binary2* equals 0.

- If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *Trichotomous* equals 0.35. If beginning net operating loss carryforward is positive and pretax income is negative, then *Trichotomous* equals zero. Otherwise, *Trichotomous* equals 0.17.

- If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *PseudoStatutory* equals 0.35.[5] If beginning net operating loss carryforward is zero and pretax income is negative, then *PseudoStatutory* equals 0.15. If beginning net operating loss carryforward is positive and pretax

[5] Plesko (2003) refers to this variable as *Statutory*. Because several colleagues mistook our use of this label for representing the statutory rate that applies to our next dollar of marginal income, we relabeled the variable *PseudoStatutory*. We follow Plesko's construction in assigning the 15% and 25% bracket rates to the referenced combinations of positive net income and/or positive net operating loss carryforwards.

income is positive, then *PseudoStatutory* equals 0.25. Otherwise, *PseudoStatutory* equals zero.

- If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *Uniform* equals 0.35. If beginning net operating loss carryforward is zero and pretax income is negative, then *Uniform* equals 0.11667. If beginning net operating loss carryforward is positive and pretax income is positive, then *Uniform* equals 0.23333. Otherwise, *Uniform* equals zero.

Correlating the tax return MTR with financial proxies

Table 2, Panel C reports the correlations of *TX_MTR* with each of these proxies. Likewise, Figures 1B – 1J provide plots of *TX_MTR* with each of the alternative financial accounting tax rate proxies. The correlations between the tax return *MTR* and nonsimulated tax proxies are lower than its correlation with the simulated financial statement *MTR*. *MTR1*, *MTR2* and *MTR5*, which modify the simulated *MTR*, offer modest improvement in correlation with *TX_MTR*.

The plots indicate that errors most commonly occur when the financial *MTR* proxies are high and the tax return tax rate is low (relative to the converse error). In a later section we explore various explanations that could contribute to the imperfect correlation between tax-return based simulated marginal tax rates and financial statement based tax rates.

MTR2 and *MTR5* each reset MTR to zero in the presence of both an NOL carryforward and a pretax loss. *MTR2* references the worldwide pretax loss, whereas *MTR5* references the U.S. pretax loss. Table 2 indicates that the correlation with *TX_MTR* improves from 67% to 69% for both of these variables. Figures 1C and 1F show the plots with *MTR2* and *MTR5*, respectively, and indicate that the improved correlation comes from shifting observations away from the upper left corner (high MTR, low *TX_MTR*) towards the 45 degree line.

Other ad hoc adjustments to *MTR* are not as beneficial. *MTR1* (Figure 1B) assigns a 15% rate when the U.S. average effective tax rate (U.S. current tax expense / U.S. pretax income) is less than 10%, but only improves the correlation by 0.003.[6] *MTR3* assigns a zero tax rate when pretax income is negative, and *MTR4* assigns a zero tax rate when the financial statements report a net operating loss. The lack of improvement for these variables arises from overassigning a zero financial marginal tax rate to many observations that have positive *TX_MTR*.

Interestingly, the worst proxy for our sample is the most commonly used in academic research: the net operating loss dummy variable (*Binary1*). Figure1G shows that there are many observations that have a high tax return tax rate that are assigned to zero by the book net operating loss dummy variable. *Binary1* equals zero if the prior year financial statement net operating loss (Compustat data item #52) is positive, and 35 percent otherwise. As explained in Mills, Newberry and Novack (2003) and discussed previously, the net operating loss reported in the financial statement is sometimes a poor proxy for the presence of a U.S. tax return NOL. Specifically, multinational corporations and corporations that engage in mergers and acquisitions often have unused net operating losses even in the presence of positive U.S. taxable income. Because our sample is a panel of matched financial statements and tax returns, we necessarily overrepresent large, multinational corporations (and, relative to the typical public firm, these corporations are likely to engage in M&As or have foreign losses). Thus, using the presence of a financial statement net operating loss carryforward to proxy for tax return tax status is relatively likely to be problematic for these firms.

[6] This modification is an attempt to proxy for the application of the U.S. alternative minimum tax. We do not attempt to measure the AMT directly as does Plesko (2003) because his computations do not have obvious parallels in large-sample publicly available data.

The proxies that assign a zero marginal tax rate only if a corporation has both a current year loss and an NOL are more highly correlated with the tax return tax variable. That is, *Binary2* is more highly correlated with *TX_MTR* than is *Binary1*. Likewise, Figure 1H is less unbalanced than Figure IG. However, even *Binary2* performs worse than the remaining variables, presumably because of the too frequent assignment of MTR=0 when there are book net operating losses.

Trichotomous, *PseudoStatutory* and *Uniform* all assign the maximum statutory rate when the corporation has no NOL and positive income, and assign a zero marginal rate when the corporation has both an NOL and a loss. Although they make slightly different assignments for the presence of either an NOL or a loss, but not both, the correlations are similar, and higher than for *Binary1* and *Binary2*. See also Figures 1I, IJ and IK.

The correlations of pre-financing tax rates in Table 2, Panel D indicate that the simulated marginal tax rate variable is more highly correlated (76%) than any of the other proxies are correlated with *TX_MTR*. In fact, the simulated rates are more highly correlated than on a post-financing basis (67.1% in Panel C), suggesting that book-tax differences in interest expense make it more difficult to estimate U.S. taxable income from financial statements. However, the remaining proxies are not as correlated with simulated *TX_MTR* on a pre-financing basis as they were on a post-financing basis (Panel C). Like in the after-financing results, the book net operating loss (*Binary1*) is the worst proxy for the simulated tax return rate.

Consolidation issues

As discussed at length in Plesko (2003), Mills and Plesko (2003), and Mills Newberry and Novack (2003), the consolidation rules differ for financial statements versus U.S. tax returns. We review the differences very briefly here. Financial statements typically include all controlled domestic and foreign entities, where control generally means ownership greater than 50%. In contrast, U.S. corporations can elect to file a consolidated tax return that includes a parent and all its domestic subsidiaries that are owned 80% or more (affiliated corporations).

As a result, the financial simulated marginal tax rates use income and losses from a worldwide group of majority-owned corporations, whereas the tax return simulated marginal tax rates use only income and losses from 80% owned domestic corporations. Thus, if worldwide financial statement income does not follow the same patterns of profit and loss as does the U.S. domestic consolidated taxable income, the financial simulated marginal tax rate will differ from the tax return simulated marginal tax rate.

We believe that the financial statement marginal tax rates are nevertheless appropriate for many research questions concerning tax-induced decisions of the global enterprise. If, for example, the research question relates to the benefits of using debt for the enterprise as a whole (e.g., Graham 1996a), the worldwide simulated marginal tax rate is still appropriate. In contrast, for narrow jurisdictional questions such as the placement of debt in the U.S. versus a foreign subsidiary (Newberry and Dhaliwal 2001), a worldwide simulated marginal tax rate will not inform the between-jurisdiction choice.

Thus, without suggesting that the worldwide simulated marginal tax rate is flawed, we explore the degree to which consolidation differences explain differences between the financial statement and tax return simulated marginal tax rates.

We begin by replicating the screens imposed by Plesko (2003), and estimate the correlation after each screen. Note that Plesko's aim was to generate a sample of single-company domestic corporations, whereas ours is to study a sample of large public companies, even if they present difficulties in aligning financial and tax entities. Therefore, all else equal, Plesko's sample formation should produce more highly correlated tax rates – given that they are based on smaller, more homogenous samples.

We consider Plesko's screens in turn. First, we limit the sample to firms with financial statement assets within 0.5 percent of their book assets reported on the tax return, Form 1120, Schedule L. Among the 459 observations that meet this requirement, the correlation between *TX_MTR* and MTR is 78 percent, and this correlation is still higher than the correlation between *TX_MTR* and any of the financial statement proxies. Next, we drop one observation which is a domestic subsidiary of another taxpayer and 63 observations for taxpayers that are owned 50 percent or more by another corporation. Results are unchanged. Dropping another 138 observations for firms that have controlled-foreign corporations, the correlation drops to 76 percent for the remaining 257 observations. Again, *TX_MTR* is more highly correlated with the simulated MTR than with the simple proxies, but the benefit is small on this subsample. The correlation of *TX_MTR* with *Binary2*, *PseudoStatutory* and *Uniform* are 70.6%, 72.2% and 74.1%, respectively. Finally, examining only the 45 observations that do not file a consolidated tax return increases the correlation between *TX_MTR* and *MTR* to 97 percent.

Overall, we confirm that Plesko's (2003) relatively small sample satisfied its aim of obtaining a set of firms for which the financial statement enterprise closely mapped to the tax enterprise. For simple domestic firms, the simple proxies Plesko identifies are adequate substitutes for a simulated rate. However, for complex multinationals we conclude that a simulated rate is a better proxy for a tax-return based simulated marginal tax rate.

Stock options

During our sample period, corporations generally recorded no financial expense related to stock option compensation on their financial statements. In contrast, during the late 1990's stock market boom, many employees and executives exercised stock options. Exercising nonqualified stock options results in a tax deduction for the corporation that could make taxes paid substantially less than financial statement reported current tax expense (Graham, Lang and Shackelford 2004; Hanlon and Shevlin 2002). Therefore, stock option deductions could be responsible for some of the observations that lie in the upper left corner of Figure 1A.

Tax returns did not require separate reporting of stock option deductions until 2003, when the IRS added a discrete line to Schedule M-1 for the book-tax difference associate with stock options. We use the 2003 M-1 amount of stock option difference as a proxy for the use of stock options by a corporation during our sample period. Based on untabulated t-tests, the book *MTR* exceeds the *TX_MTR* by 0.012 on average for taxpayers that claim a 2003 option deduction, but only 0.006 for taxpayers that do not claim the deduction. Though this difference is not quite significant (t = 1.55, p-value =

0.12), we introduce this proxy into our regression analysis to proxy for stock option activity. [7]

5. Regression results: fitting the financial MTR to the tax MTR

Even though the tax return marginal tax rate is of great interest to many researchers and policy-makers, most interested parties do not have access to tax return data. In this section we investigate whether our ability to proxy for the tax return tax rate can be improved upon, on top of the predictive ability of the simulated book rate, by including additional public information.[8] We begin by regressing the tax return tax rate on the book rate and several other publicly available variables.

Table 3 presents results from using the test sample to regress *TX_MTR* on the financial statement *MTR* and additional explanatory variables. These additional right-hand side variables are generally publicly-available so that they can be mimicked by most researchers, although we also examine a tax-return based stock option deduction variable.

Recall that from Table 2, Panel C, when the tax return rate was regressed on the book rate in a univariate setting, the intercept was 0.079 and the slope coefficient on MTR was 0.709. In the first multiple regression specification, the intercept increases to 0.21 and the slope coefficient declines to 0.379 after we introduce additional variables.

[7] The difficulty in measuring the stock option benefit in large samples suggests that financial statement users need more information. Commissioner Everson (March 15, 2006 remarks to National Press Club) states that selective disclosure of corporate tax return information should be considered. Per BNA daily tax notes (3/16/06): "Everson then discussed the tax compliance implications of requiring corporations to disclose part or all of their tax returns, saying the idea should be discussed because it could improve corporate tax law compliance. A tension currently exists within corporations to increase book earnings to boost share value while lowering taxable earnings to minimize tax payments, Everson said. 'If we are not willing to operate the two systems by the same set of rules, it makes sense to discuss whether corporate tax returns should be public,' he said."

[8] Users should of course consider whether the right-hand side variables that we introduce in an attempt to improve the correlation between the book and tax MTRs are potentially endogenous in the context of their experiment and dependent variables. In such a case, the researcher might be better off using the unadjusted simulated MTR.

The adjusted R^2 increases from 45% in the univariate regression (not reported in a table) to 58% in the multivariate regression that includes additional explanatory variables.

Table 3 also indicates that having negative U.S. pretax income exerts a negative influence on *TX_MTR*. The negative relation is consistent with U.S. taxable income being negative if U.S. pretax income is negative, even for a multinational that is profitable on a worldwide basis. We also include a dummy variable for the average U.S. effective tax rate being low, to consider the effect of book-tax differences and credits that affect tax on U.S. income.[9] The financial statement-based simulation program estimates taxable income as book income less grossed-up deferred tax expense. This computation does not consider situations in which the worldwide deferred tax expense is a poor proxy for U.S. book-tax differences, nor does it measure permanent differences or credits that affect U.S. tax.

Earlier, we observed from the univariate analysis that the correlation between *TX_MTR* and *MTR* improved if we reassigned *MTR* to equal zero when the global enterprise had both a net operating loss carryforward and a current year pretax loss. We introduce both dummy variables to the regression and find that *TX_MTR* is negatively related to these indicator variables, even though the *MTR* simulation attempts to take into account net operating losses and current losses.

Finally, *TX_MTR* is higher in the presence of substantial foreign pretax income, perhaps because corporations repatriate foreign earnings that increase taxable income in the U.S. We note that the simulated marginal tax rates do not directly take foreign tax

[9] Results are qualitatively similar if we use USETR instead of USLOW, although the R^2 is only 56% rather than 58%. USETR = U.S. current tax /U.S. pretax inc #63 / #272. USLOW = 1 if USETR < 10%.

credits into account. A marginal tax rate based only on income would be too high if credits reduce incremental tax.

Though not publicly available, the stock option variable is of particular interest, and we consider this in Model B of Table 3. Because the 2003 stock option deduction is undoubtedly a noisy proxy for stock option deductions in 1999, 2000 and 2001 that would most directly affect the *MTR* in those years, the slope coefficient on the 2003 stock option variable should be attenuated toward zero. Though the stock option variable is statistically significant, Table 3 indicates little improvement in the model from adding our proxy for the stock option deduction. If we had access to a year-specific financial proxy for stock option deductions that had less measurement error, we would expect a larger coefficient and greater significance for this variable.

The analysis thus far fits the financial *MTR* to the tax return *TX_MTR* using a handful of variables, based our best prior understanding of differences between book and tax income that the Graham simulation program might not fully incorporate. Notably, we included variables that relate to multinational effects and stock options. In untabulated tests we find that a wide-scale data-fitting exercise that includes additional Compustat variables does not improve the fit in a stable, informative manner.[10] Thus, we conclude that Model A in Table 3 is the preferred specification to be used by researchers interested in improving the fit of the simulated book *MTR*.

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[10] We consider 58 additional candidate explanatory variables from the income statement, balance sheet, and statement of cash flow. We scale income and cash flow variables by sales, balance sheet variables by total assets, and tax variables by pretax income. This list of variables is available from the authors. Using ordinary least squares forward selection, we evaluate each of these variables. Only about ten variables meet the 0.01 significance level. Consistent with our prior beliefs, MTR, and the dummy variables for having negative U.S. pretax book income (USNEG), book net operating loss carryforward (BKNOL) and negative pretax book income (BKLOSS), are among these top ten variables, however, the new significant variables are sensitive to the sample (test versus holdout), so we do not pursue this analysis any further.

Proxying for the tax return MTR when the book simulated MTR is not available

Among the variables we have considered, the book simulated rate is the most highly correlated with the tax return MTR. Data limitations, however, result in the book simulated rate not being available for some firms in some years. Therefore, we estimate specifications that researchers can use to create a variable to proxy for the tax return MTR when the book rate is unavailable.

Model C in Table 3 contains the same right-hand side variables that are included in Model A (the main specification in this table) except the book simulated rate is excluded. The model R^2 falls to 51% but the overall fit remains strong. Column D adds the pseudo-statutory tax rate to the specification. One might have assumed that given that the pseudo-statutory rate is highly correlated with the tax return *MTR*, including *PseudoStatutory* would help the model's fit. This is not the case. *PseudoStatutory's* coefficient is insignificantly different from zero, thus there is no gain to including the statutory variable in the algorithm to predict the tax return *MTR*. Apparently the pseudo-statutory tax rate adds no value beyond what is already captured in the other five explanatory variables (while Models A and B indicate that the book simulated rate does contain incremental value.) Likewise, Model E shows that *PseudoStatutory* has no incremental explanatory power when the simulated marginal tax rate is included. The bottom line that is that researchers who need to proxy for the tax return tax rate, but find the simulated rate unavailable, can rely on the coefficients in Model C in Panel A of Table 3. Panel B of Table 3 presents the estimation results for an analogous set of regressions to provide an algorithm to estimate the pre-financing tax return MTR in situations in which the book simulated rate is not available. Results are qualitatively the same as in Panel A.

Analysis using the hold-out sample

In Table 4, we report the hold-out sample correlations between the various tax variables and the tax return tax rate. This analysis is important because we overfit the regression in Table 3 (that is, Table 3 only presents the significant variables from a set of several different regression specifications). Therefore, it is important to determine whether the implications are consistent in the holdout sample. The holdout results also shed further light on the univariate analysis. As dependent variable, the first column of Table 4 uses *TX_MTR*, and the second column uses *EST_TX_MTR*, an estimate of *TX_MTR* based on regression coefficients estimated in Model A of Table 3, Panel A.

As in Table 2, the simulated financial statement *MTR* is more highly correlated with *TX_MTR* than are the non-simulated tax variables. In the hold-out sample, contrary to the results on the main sample, modifying the simulated rate (*MTR3*) to reset *MTR* to zero when pretax income is negative marginally improves the correlation with *TX_MTR*. However, other than for *MTR1*, the benefits from other ad hoc adjustments to *MTR* disappear in the holdout sample.

The greatest improvement in correlation comes from predicted *TX_MTR*. Based on the regression coefficients from Table 3, we estimate *TX_MTR* in the holdout sample (*EST_TX_MTR*). We find that *EST_TX_MTR* is correlated 75% with the simulated *TX_MTR* in the holdout sample. Thus, the holdout sample fit of this predicted tax variable is reasonably good: The 75% correlation is equivalent to a univariate regression R^2 of 56.25%, and recall that the R^2 of the predictive regression in Table 3 was 58%. Thus, most of the model's predictive ability carries over to the holdout sample. Importantly, these relations indicate that our most important findings are not driven by data snooping.

The estimated rate *EST_TX_MTR* is more highly correlated with some of the modified marginal rates than with *MTR*. However, remember that the variables we use to modify *MTR* are regressors in constructing the estimated coefficients that construct *EST_TX_MTR*, so this higher correlation is not very instructive.

6. How might tax credits affect estimated MTRs?

The simulation model that we implement is based on regular taxable income. Although we simulate income paths and permit loss carrybacks and carryforwards, we ignore tax credits and the alternative minimum tax. We now investigate whether simulated rates are affected by the existence of credits and alternative minimum tax data shown on tax returns.

We first establish that few firms have enough tax credits that it is likely that the credits would affect their marginal tax rate. In untabulated tests, we learn that 30% of the firms in our sample have no tax credits on their tax returns. Of the 1,409 observations that report credits, the 95th percentile of credits to total tax is 82% and the 99th percentile is 94%. There are four observations with a credit ratio above 96%. Therefore, for the vast majority of firms, credits are rarely large enough that it is likely that they affect the firm's marginal tax rate. Said differently, this evidence implies that the tax rates that we simulate (that ignore credits) are in all likelihood similar to the marginal tax rates one would obtain if one were to simulate tax rates to include the effects of tax credits.

To further explore this issue, in panel A of Table 5 we sort our sample firms into 20 equal groups based on taxable income (from Line 28 of the tax return). For the high income groups, simulated tax rates are high, and the mean ratio of credits/taxes paid is no greater than 0.34 and usually less than 0.20. Such a low credit/taxes ratio suggests that, on average, even after credits are considered, enough tax would remain that the firm is still in a high marginal tax bracket (as simulated by *MTR* and *TX_MTR*). For the lower income groups, the simulated tax rates are lower. Therefore, even if credits would be sufficient to reduce the marginal tax rate of some of these low income firms, the simulation procedure already assigns relatively low MTRs to these firms. We conclude that cross-sectionally, any problem from ignoring credits would appear to be small.

In Panel B of Table 5 we sort the observations into 20 percentile groups based on the ratio of credits/tax payments. The ratio equals zero for 30% of the firms, so these observations are all grouped into “percentile 1-6.” In the highest percentile, the credit/tax ratio is 0.926. However, average taxable income is more than $700 million in this group. Even if credits shield about 90% of the tax on such income and 10% of the tax is unshielded, the statutory marginal tax rate on taxable income of $60 million dollars is 35%. We conclude that on average, the simulated tax rates calculated in this paper should be reasonable proxies for simulated rates expanded to explicitly consider tax credits. Panel B also reveals that firms in percentile 1-6 apparently use zero tax credits, most likely because their taxable income is low or negative. Therefore, it is reassuring that the estimated simulated tax rates are lower for this group.

Finally, in Panel C we observe that the simulated rates are positively correlated with having positive tax before credits on the tax return. It is no surprise that the correlation is higher for the simulation based on tax return taxable income (81.1%) than for the simulation based only on financial statement income (56.5%). Including

Compustat variables to modify the financial statement MTR and create *EST_TX_MTR* increases the correlation to 70%.

We find that credits (total, foreign, or general business) as a percentage of tax before credits are not strongly related to the simulated tax rates. Because credits are limited to tax before credits, we would generally expect that profitable firms with positive marginal tax rates to be able to use credits. However, the proportion of tax sheltered by credits would not monotonically increase with the amount of tax paid. Instead, if credits are sticky, then some taxpayers with temporarily low tax payments would have a higher proportion of tax sheltered by credits. These effects should lead to low correlation, which is what we find.

The simulated rates are significantly, negatively correlated with the ratio of Alternative Minimum Tax to tax before credits. That is, even though we do not explicitly model AMT, the simulated MTRs are relatively low for firms subject to AMT. This is reassuring because, had we modeled AMT the most likely outcome would have been to reduce the simulated MTRs.

In summary, though the simulated MTRs calculated in this paper do not consider tax credits that have the effect of reducing taxes paid on the tax return, we do not find any evidence that this creates a problem with the simulated MTRs overall. In fact, there is limited evidence that the simulated MTRs as calculated are low when the existence of credits would likely to lead to low corporate marginal tax status, and conversely high when the effect of credits would be unlikely to affect the marginal tax rate.

7. Financial statement and tax return tax incentives to finance with debt

The trade-off theory of capital structure predicts that firms with high marginal tax rates should use relatively more debt than should corporations with low marginal tax rates because the benefit of interest deductions is greater for high tax-rate firms (Modigliani and Miller (1963); Kraus and Litzenberger (1973); and Scott (1977)). Graham (1996a, 1999) and Graham, Lemmon, and Schallheim (1998) use simulated financial statement marginal tax rates to investigate the relation between debt and taxes.[11] They find a positive relation, consistent with the theoretical prediction.

If financial statement tax rates are a rough approximation of the true decision variable (tax return tax rates), then one would expect to find a positive and strong relation between tax return tax rates and debt usage. However, some elements of our experimental design could work against finding tax effects based on tax return variables. First, we have three years of data, so the power of our tests will be less than financial statement based tests that can use 25 or more years of data. Second, our sample consists primarily of large, fairly profitable firms, so the variation in tax rates might be less in our sample than in broader financial statement based experiments. Finally, as more fully discussed below, book-tax differences may reduce the correlation between tax return MTRs and book debt ratios.

We use a specification similar to Graham (1999) to test whether simulated marginal tax rates explain variation in debt ratios. We model leverage (i.e., debt to book value of assets or debt to market value of assets) as a function of the before-interest marginal tax rate and control variables as follows:

$$Leverage_{it} = b0 + b1\ BeforeInterestMTRProxy_{it} + b2\ LagSales_{it} + b3\ LagMarketToBook_{it} + b4\ LagDividend_{it} + b5\ LagROA_{it} + b6\ LagCollateral_{it} + e_{it}, \quad where$$

[11] See also Mackie-Mason 1990a and 1990b.

Leverage = total debt (Compustat item #9 + #34), scaled either by total assets (#6) or by total assets minus book equity plus market equity (#6 - #60 + #199*#25).

BeforeInterestMTR = the simulated marginal tax rate, based on either book income before interest expense in the financial statement variable, or taxable income before interest deduction in the tax return tax variable. This variable is measured before interest to avoid the spurious negative correlation between income after interest and debt usage (Graham, Lemmon, and Schallheim 1998). In alternative tests, we use the presence of a net operating loss (either Compustat data52 or the tax return NOL carryforward), or an average effective tax rate. For the book variable (Panel A), we define the average tax rate as the ratio of worldwide current tax expense to worldwide pretax income. For the tax return variable (Panel B), average tax rate equals taxes after credits divided by taxable income. In both average rates, we require both the numerator and denominator to be positive, and we limit the tax rate to 100%.

LagSales = one-year lag of book sales (#12)

LagMarketToBook = one year lag of market value of equity (#199*#25) divided by book value of equity (#60).

LagDividend = is a dummy variable that equals one if the one year lag of dividend yield (#26*100/#199) is positive, zero otherwise.

LagROA = one year lag of return on assets (#18/#6).

LagCollateral = one year lag of the ratio of receivables and property (#3+#8) to assets (#6).

Table 6 reports the results from estimating regressions of leverage on tax rates and controls. The simulated book before-interest marginal tax rate (*BeforeInterestMTR*) is strongly positively related to both debt to assets and debt to market value in the pooled regression (Panel A). In untabulated tests, the positive relation is significant in each year 1998, 1999, and 2000. The pooled results are also robust to including industry controls (1-digit SIC) or constraining the sample to a panel of firms available in all three years.

The tax return variable is also positively related to debt ratios in pooled regressions (Panel B). In untabulated annual regressions using debt to market value as dependent variable, the coefficient on the tax return simulated tax variable is significant in all years. However, in the annual regression that uses debt to assets as dependent variable, the coefficient on the tax return simulated tax rate is only significant in the year 2000 annual regression (i.e., the coefficients are not significant in 1998 and 1999). The pooled tax return simulated tax rate results are robust to industry controls and using a panel dataset.

The 0.293 coefficient on the book tax variable in the debt/assets specification indicates that a one standard deviation increase in the tax variable leads to a debt ratio that is three percentage points higher. For example, if a firm with the sample mean tax rate (0.305) has the sample mean debt ratio of 26%, then if its MTR were one standard deviation (i.e., 0.102) higher, its debt ratio would change to 29% (=26%+0.293*0.102). Graham (1996a) finds a similar effect. He concludes his paper by noting that even though (financial statement) tax rates are statistically significantly correlated with debt usage, the economic magnitude of the effect is second-order. One could conjecture that one reason that the economic effect of book tax incentives on debt usage is only second-order is because financial statement variables are just noisy proxies for the true, tax return based decision variables. Our results here do not provide any evidence to support this conjecture (because the effects are not larger when using a tax return based tax rate as an explanatory variable).[12]

The alternative tax variables do not perform as well. Surprisingly, firms with net operating loss carryforwards have higher leverage. This may occur because the presence of a net operating loss does not necessarily correspond to forward-looking tax status. The positive relation likely reflects that firms with high leverage have more likely accumulated prior losses. It is worth noting that the average worldwide current effective tax rate is positively related to leverage, but it is less significant than is the simulated book MTR.

[12] See Matheson (2006 working paper) for an examination of the relation between leverage ratios and static marginal tax rates. Her results suggest that firms with high leverage have more frequent taxable losses before interest deductions.

Above we noted that the relation between leverage and the tax return simulated tax rate is also positive and significant; however, the level of significance is lower with the tax return variable than with the book variable. This is not surprising given that our dependent leverage variable and explanatory book simulated rate variable are both measured from worldwide consolidated financial statement data. In contrast, the tax return MTR is simulated based on consolidated U.S. taxable income, where only domestic corporations owned 80 percent or more are included as affiliates of the U.S. parent, and therefore is defined differently from the dependent variable. Mills and Newberry (2005) previously identified material differences in interest expense on the financial statements versus interest deductions on the U.S. tax return.[13]

Like in Panel A, the presence of a net operating loss carryforward is strongly associated with higher leverage. As before, because leverage measures the stock of existing financing decisions, the positive association indicates that firms that borrow more are more likely to have a U.S. net operating loss carryforward. In the final columns, we introduce an average tax rate measure equal to taxes after credits divided by tax return net income (Line 28), only for those taxpayers who pay positive tax and have positive net income. The estimated coefficient is counter-intuitively negative. This unexpected finding could be due to our sample (of only the largest U.S. multinationals), foreign tax issues (which if modeled would reduce the tax incentive to use debt for the 40 percent of our test sample that claims foreign tax credits), or because we delete observations with a

[13] Like them, we do not use leverage ratios from the tax return Schedule L balance sheet for two reasons. First, that balance sheet is supposed to be a book balance sheet. Secondly, the assets and liabilities often vastly exceed the worldwide consolidated book amounts, a surprising result that directly arises from some firms not posting any consolidation elimination entries in constructing these balance sheets (Boynton et al. 2004)

negative average tax rate numerator or denominator (thereby eliminating some low tax incentive firms).

Setting these caveats aside, we conclude that a tax-return based average tax rate is a poor proxy for measuring debt tax incentives. The bottom line is that the simulated MTR appears to best measure capital structure tax incentives in our sample.

8. Summary and implications for researchers

The corporate marginal tax rate is an important decision variable. Companies likely rely on their tax return marginal tax rates when making decisions – but tax returns are not publicly available. Therefore, when studying whether taxes affect corporate decisions, most researchers measure tax rates based on financial statement data. In this paper we investigate how closely financial statement tax variables approximate a simulated dynamic tax return MTR, and which of a collection of financial statement tax rates is most highly correlated with the tax return variable.

Our results indicate that the best financial statement tax rates are highly correlated with the simulated tax return tax rate, with Pearson correlations near 70%. The simulated financial statement MTR (of Shevlin (1990) and Graham (1996a)) is the best unadjusted financial statement-based tax rate in both the test and holdout samples. The ability to explain the before- and after-financing tax return MTRs can be improved by adding publicly available variables to a linear regression specification that includes the simulated financial statement tax rate as a starting point. These additional explanatory variables include dummy variables that identify firms with negative worldwide pretax income, negative U.S. pretax income, book net operating losses greater than zero, foreign pretax income that is at least 5% of worldwide pretax income, or an average effective U.S. tax rate that is less than 10%.

A few other financial statement tax rates approach the simulated book tax rate in terms of correlation with the tax return variable. In particular, a pseudo-statutory tax rate based on combinations of current period pretax book income and net operating losses, and a uniform tax variable that provides four fixed values, perform well in approximating the after-financing tax return MTR. However, these “second best” proxies differ from the second best proxies found in other research that investigates similar issues (Graham (1996b) and Plesko (2003)). Moreover, in our sample, these same variables preformed notably less well in approximating the pre-financing tax return MTR. Therefore, taking a meta-view combining several experiments, we conclude that what is deemed “second best” appears to vary by sample construction, time period, experimental design, or some combination of the three. The safest approach appears to be to use the simulated financial statement tax rate when it is available, perhaps enhanced by the regression approach described above. We also provide algorithms that allow researchers to approximate the tax return MTR if the book simulated rate is not available.

The relation between the book and tax MTR is stronger when both rates are measured before interest is deducted than it is after interest is deducted. This suggests that book and tax interest treatment sometimes differ in important ways, consistent with prior studies of off-balance-sheet financing.

We also investigate the relation between capital structure decisions and simulated tax variables. For our 1998 to 2000 sample of mainly large firms, the tax return simulated tax rate is significantly and positively related to debt ratios. The book simulated rate is more significantly related to debt ratios, which makes sense because both are calculated from worldwide data, while the tax return tax rate is based only on U.S. income.

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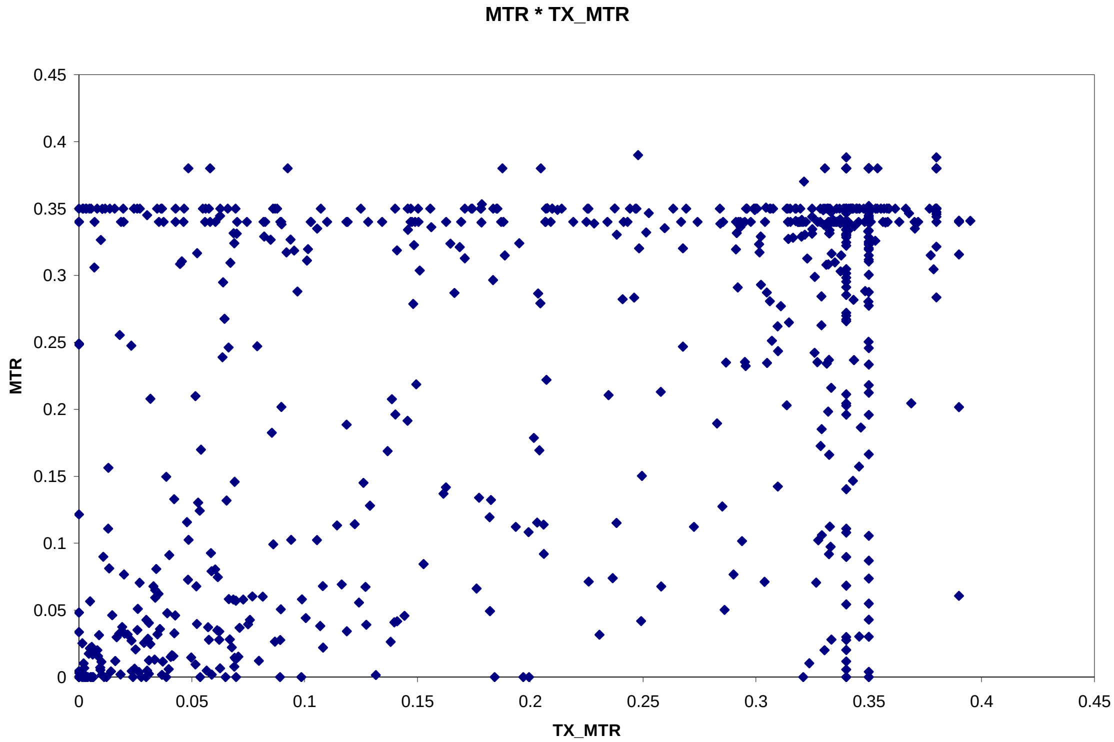
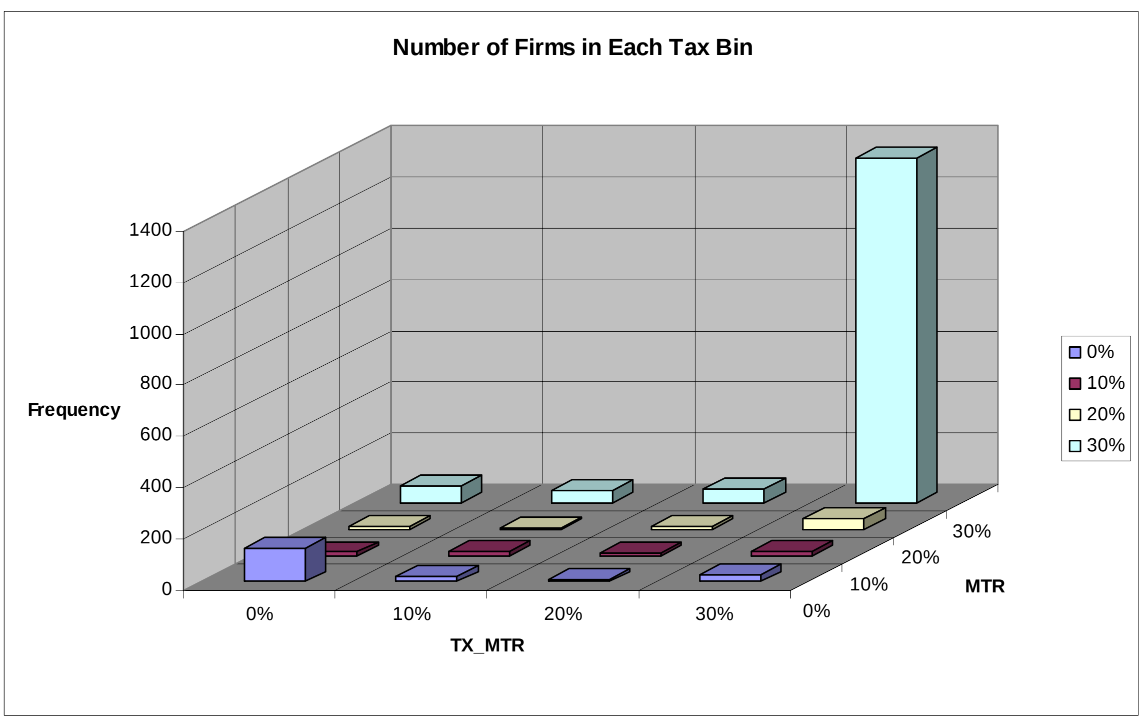
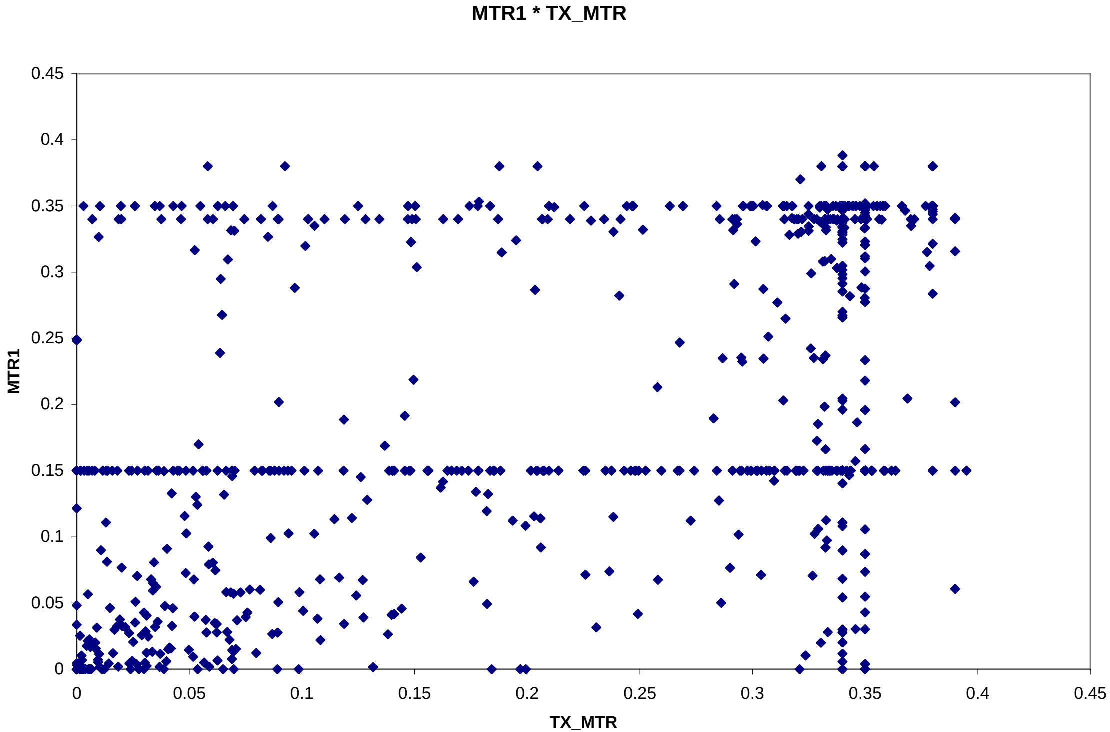
Figure 1A –*MTR* versus *TX_MTR*

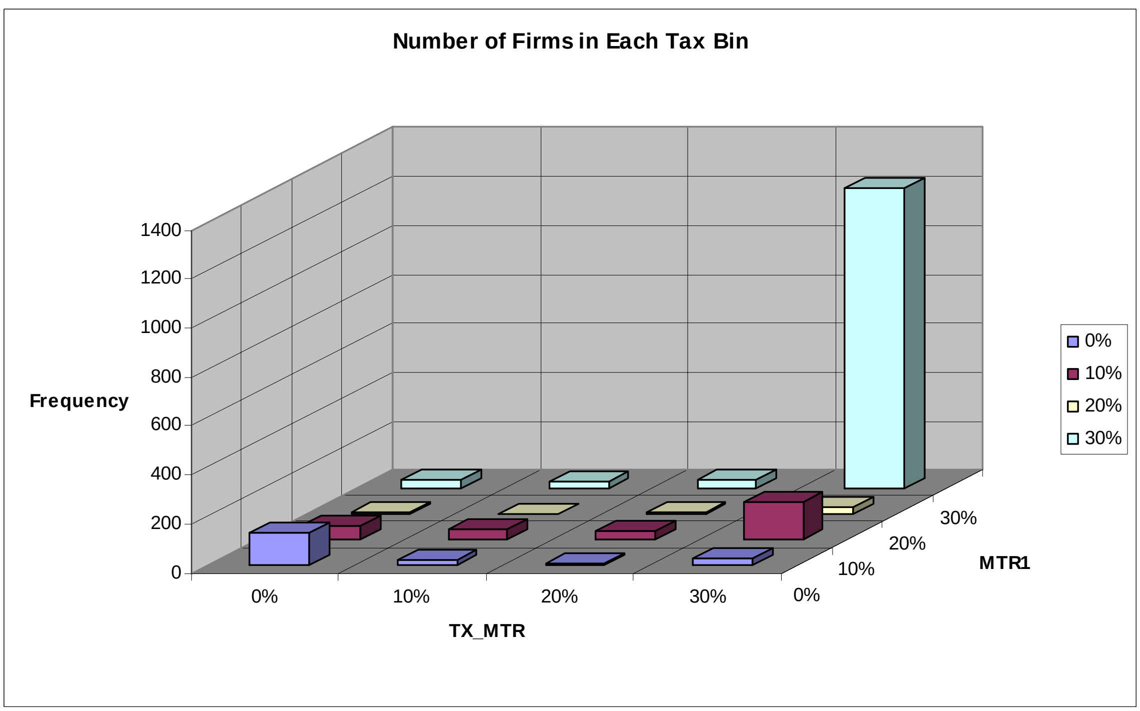




TX_MTR and *MTR* represent simulated marginal tax rates using tax return data or Compustat data respectively, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income.

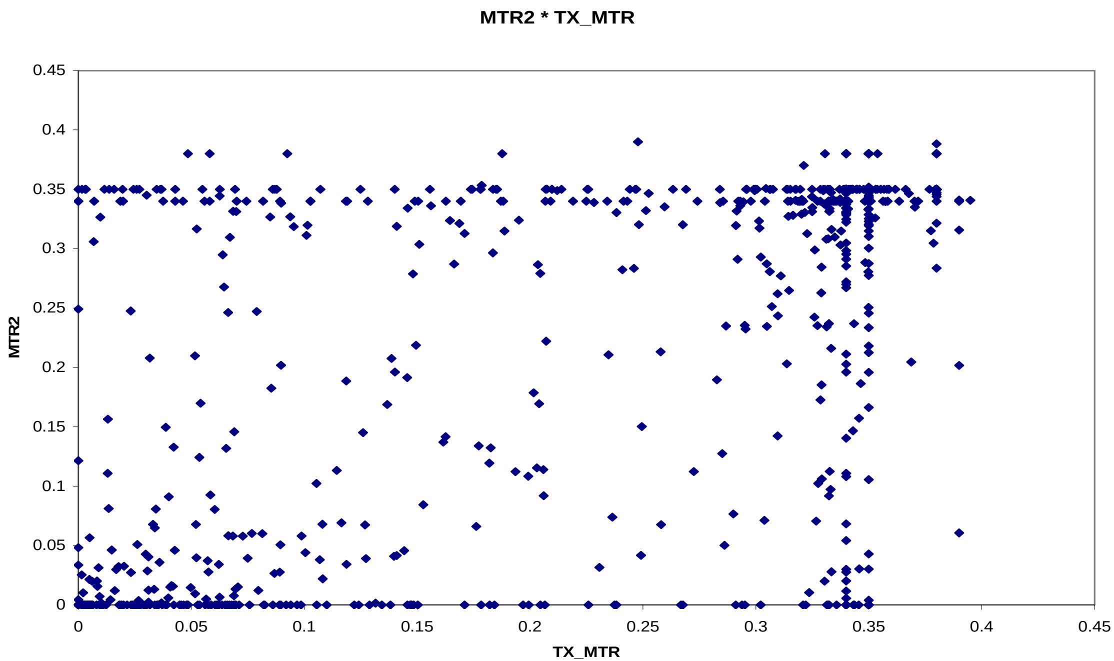
Figure 1B – Test sample plot *MTR1* versus *TX_MTR*

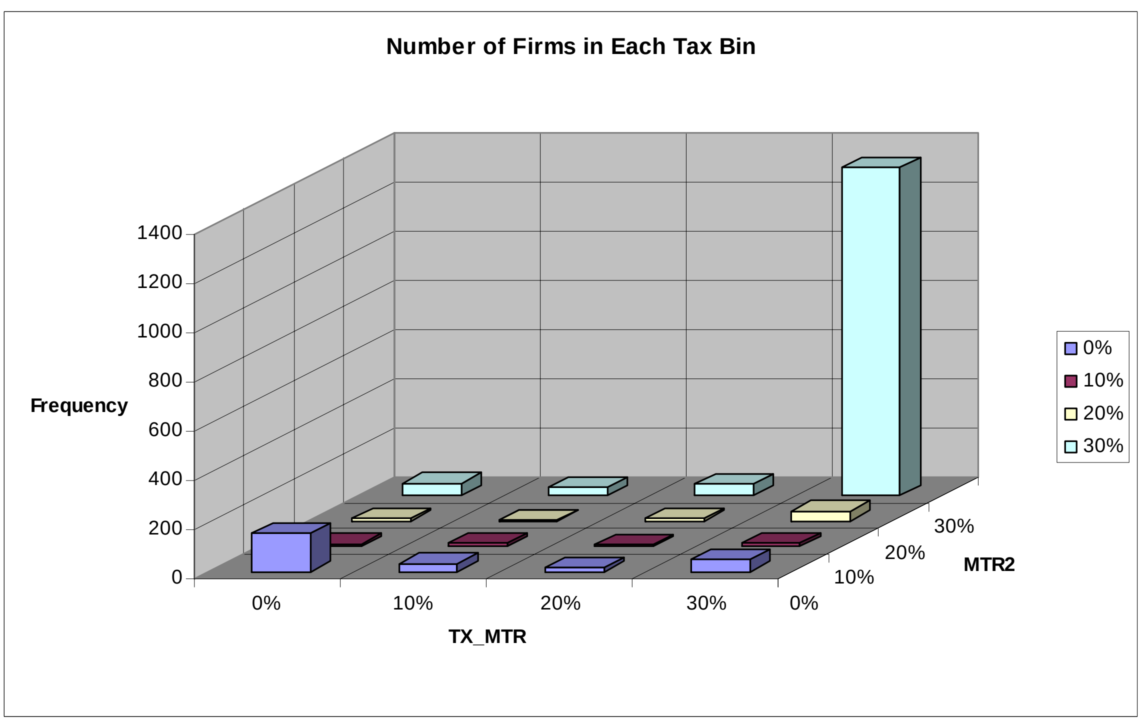




TX_MTR and *MTR* represent simulated marginal tax rates using tax return data or Compustat data respectively, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income.
If the current year U.S. average effective tax rate (U.S. current tax expense / U.S. pretax income) is less than 10%, *MTR1* equals the lesser of 15% or the simulated MTR. Otherwise, *MTR1* = *MTR*.

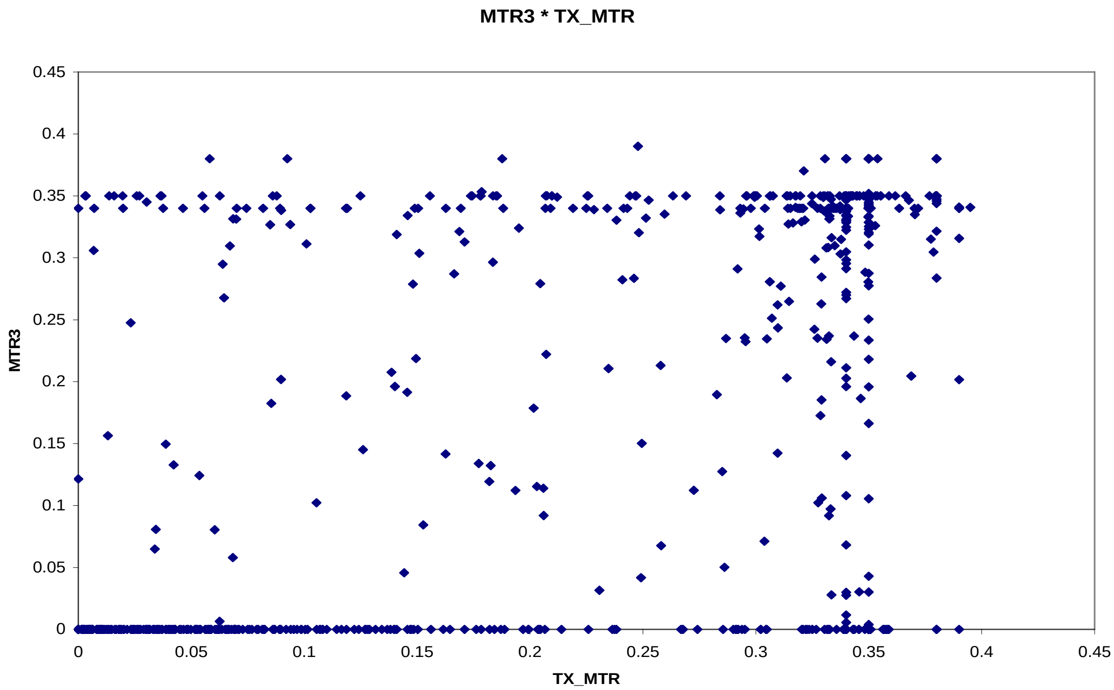
Figure 1C – Test sample plot *MTR2* versus *TX_MTR*

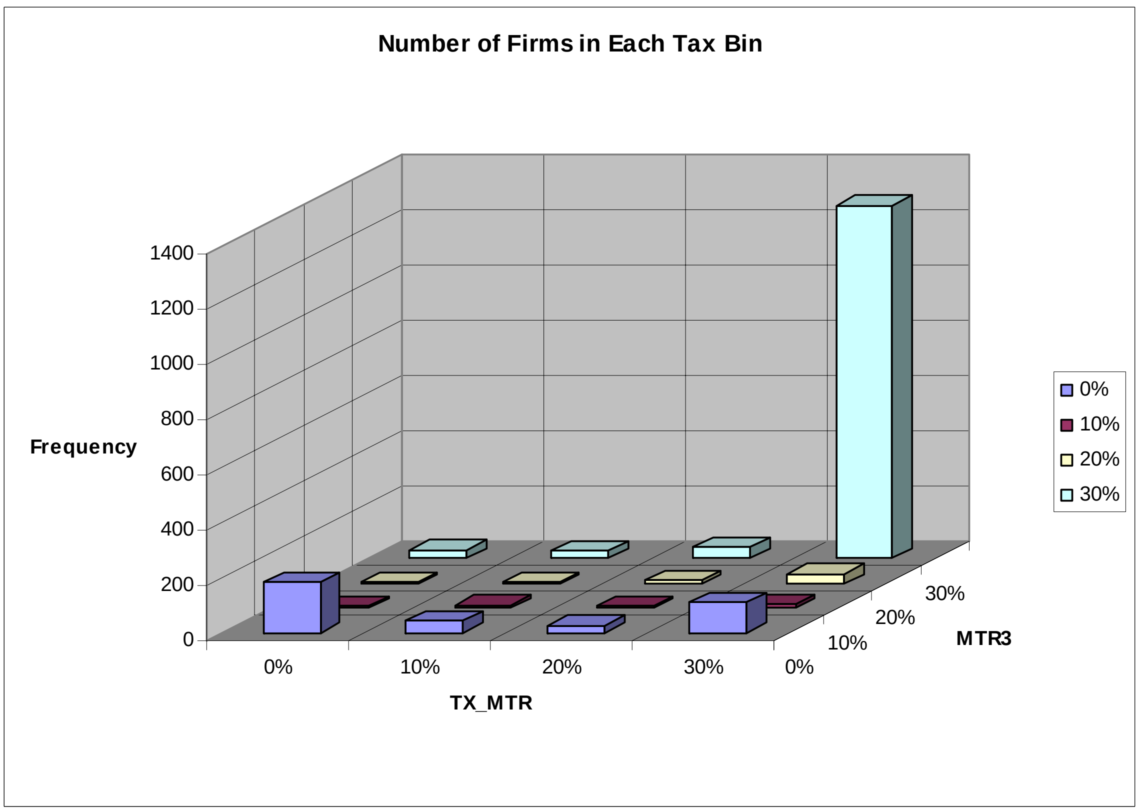




TX_MTR and MTR represent simulated marginal tax rates using tax return data or Compustat data respectively, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If financial statement data reveal both a current year worldwide pretax loss (data item 170<0) and an ending net operating loss carryforward (data item 52 > 0) then *MTR2* equals zero. Otherwise, *MTR2* = MTR.

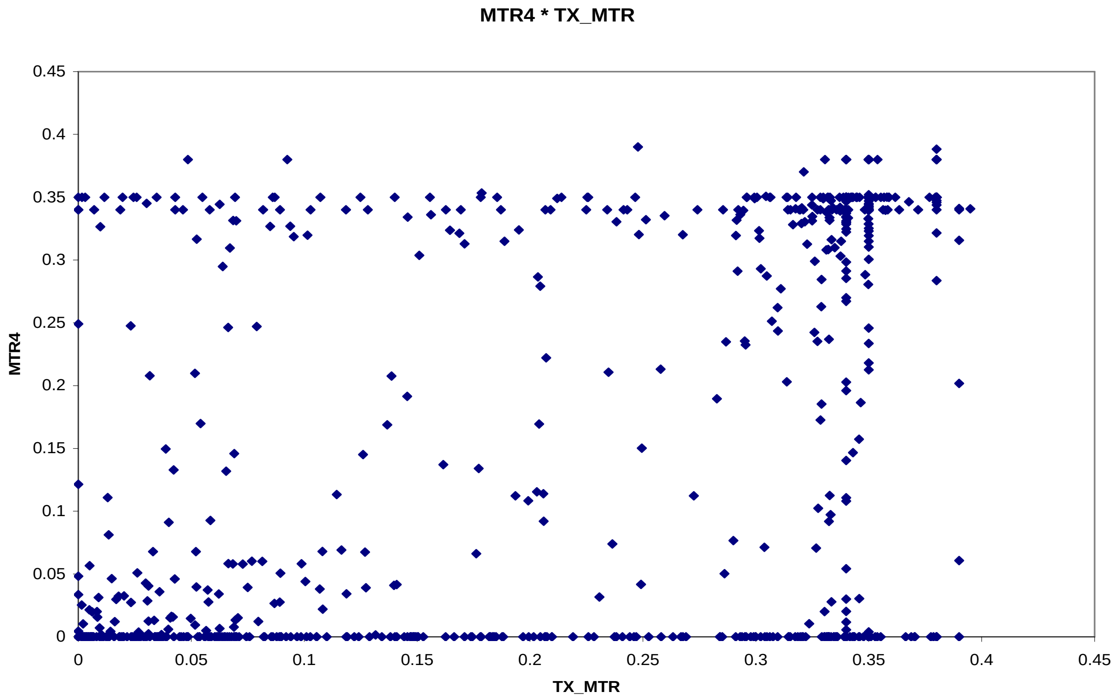
Figure 1D – Test sample plot *MTR3* versus *TX_MTR*

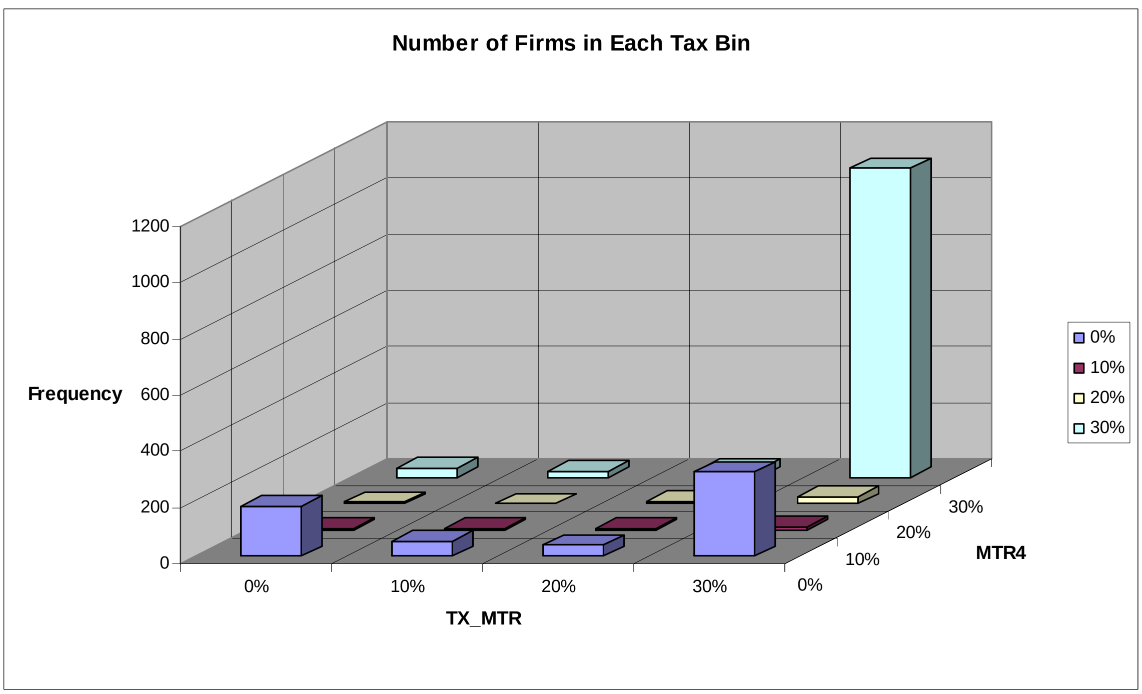




TX_MTR and MTR represent simulated marginal tax rates using tax return data or Compustat data respectively, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If the financial statement data reveal a current year worldwide pretax loss (data item 170<0) then *MTR3* equals zero. Otherwise, *MTR3* = MTR.

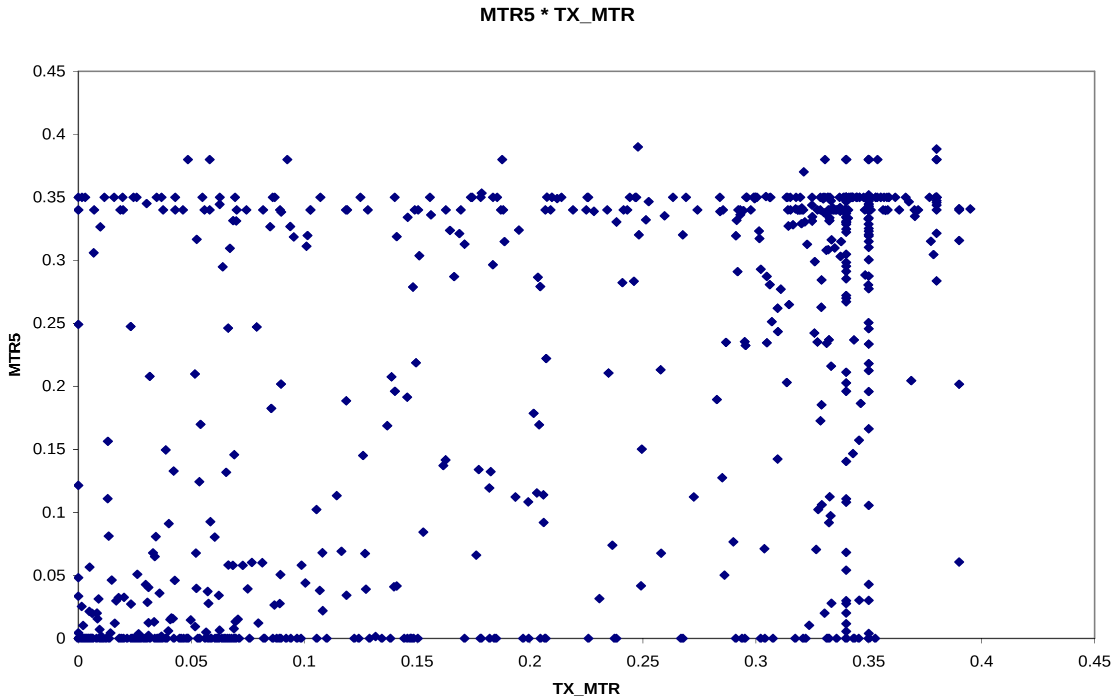
Figure 1E – Test sample plot *MTR4* versus *TX_MTR*

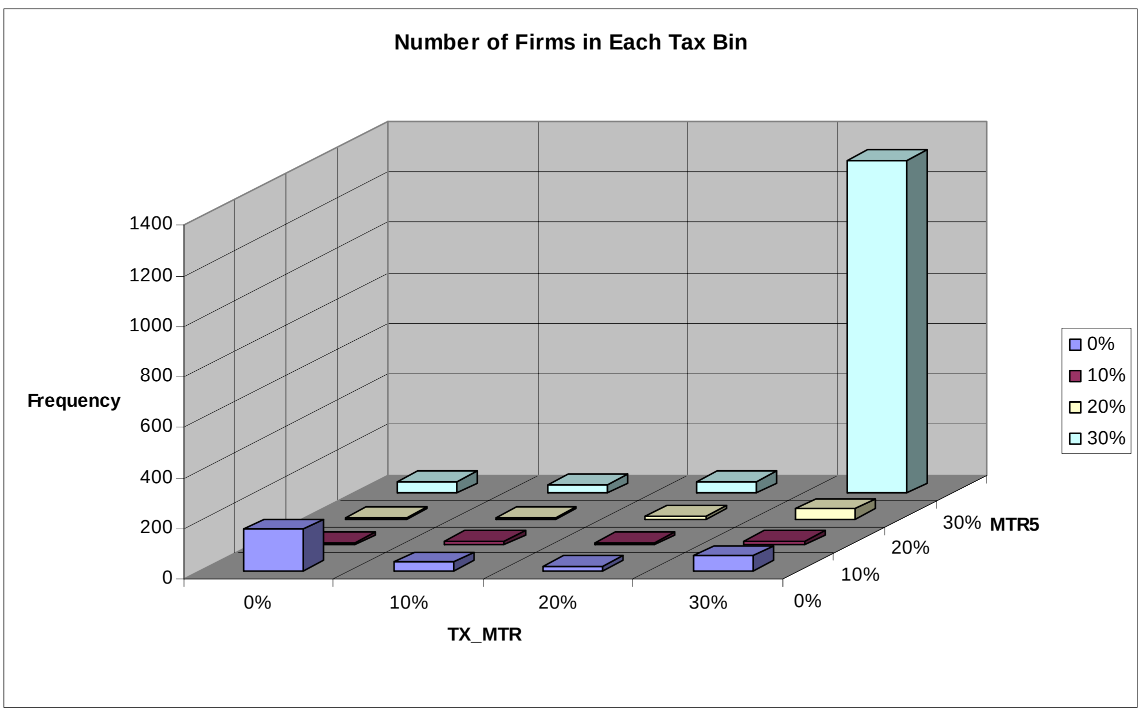




TX_MTR and MTR represent simulated marginal tax rates using tax return data or Compustat data respectively, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If the financial statement data indicate an ending net operating loss carryforward (data item 52 > 0) then *MTR4* equals zero. Otherwise, *MTR4* = MTR.

Figure 1F – Test sample plot *MTR5* versus *TX_MTR*





TX_MTR and MTR represent simulated marginal tax rates using tax return data or Compustat data respectively, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If the financial statement data reveal both a current year U.S. pretax loss (data item 272<0) and an ending net operating loss carryforward (data item 52 > 0) then *MTR5* equals zero. Otherwise, *MTR5* = MTR.

Figure 1G – Test sample plot *Binary1* versus *TX_MTR*

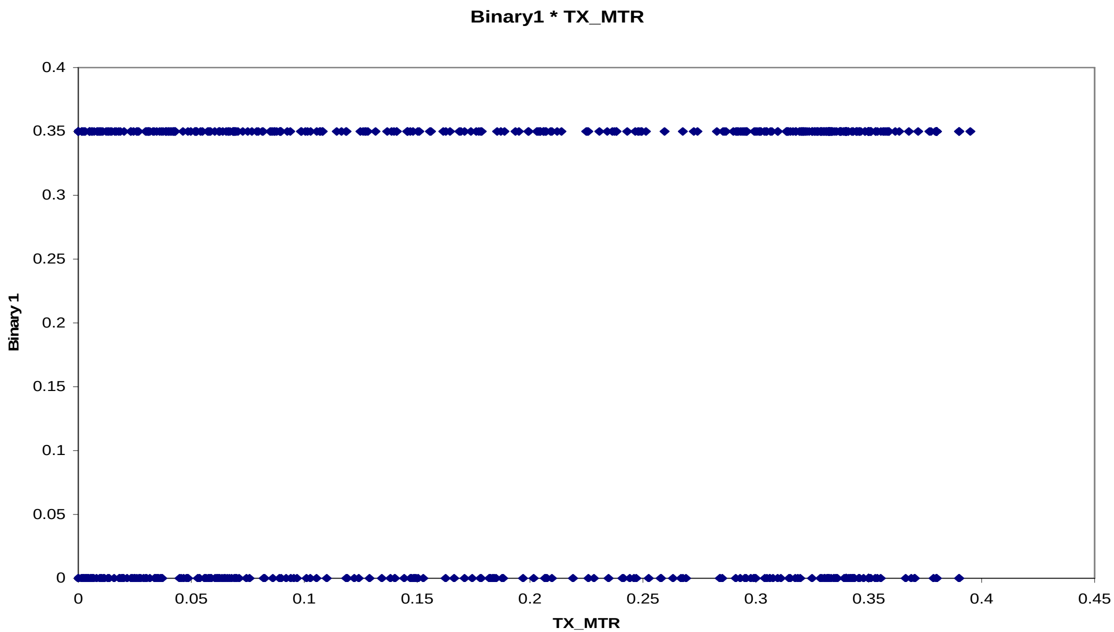
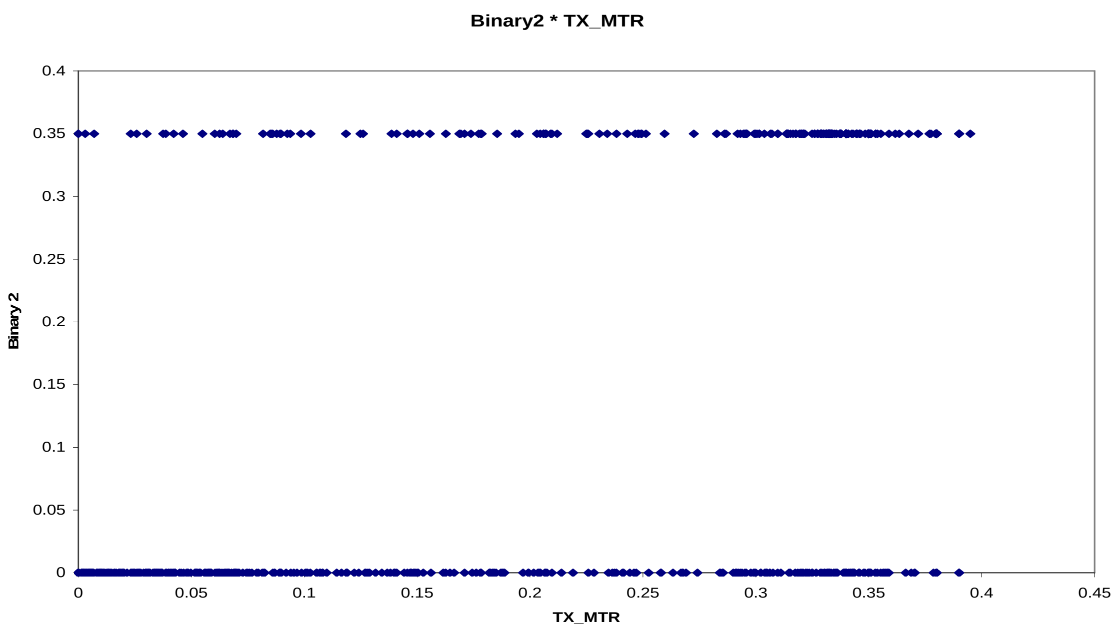


Figure 1H – Test sample plot *Binary2* versus *TX_MTR*



TX_MTR represents simulated marginal tax rates using tax return data data, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If beginning net operating loss carryforward (prior year Compustat data item #52) equals zero, then Binary1 equals 0.35. Otherwise, Binary1 equals 0. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then Binary2 equals 0.35. Otherwise, Binary2 equals 0.

Figure 1I – Test sample plot *Trichotomous* versus *TX_MTR*

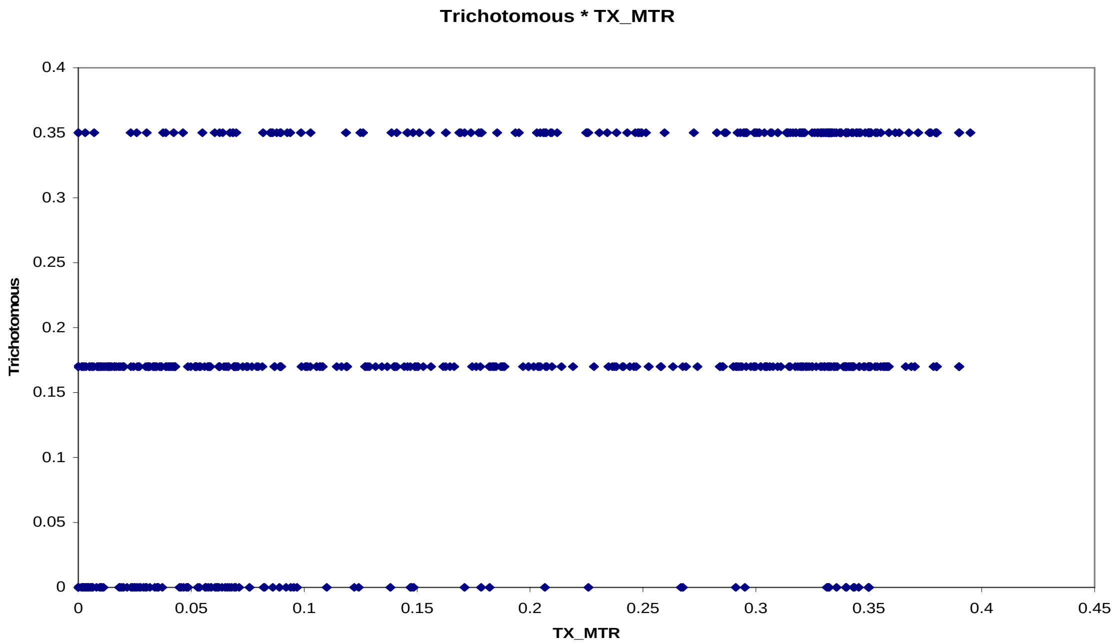
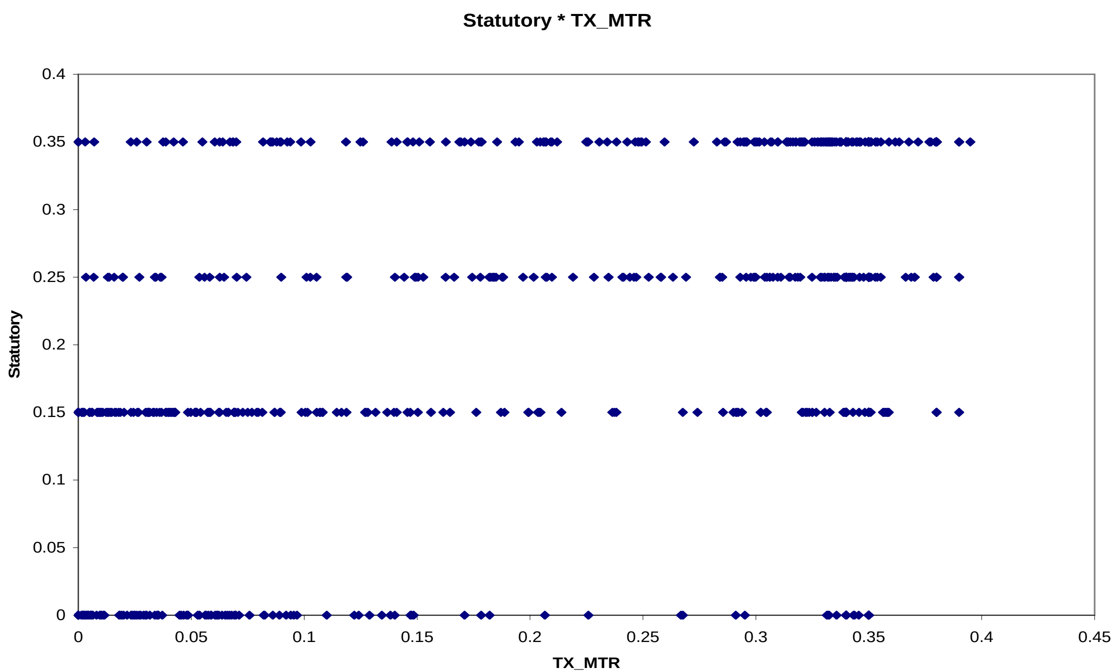
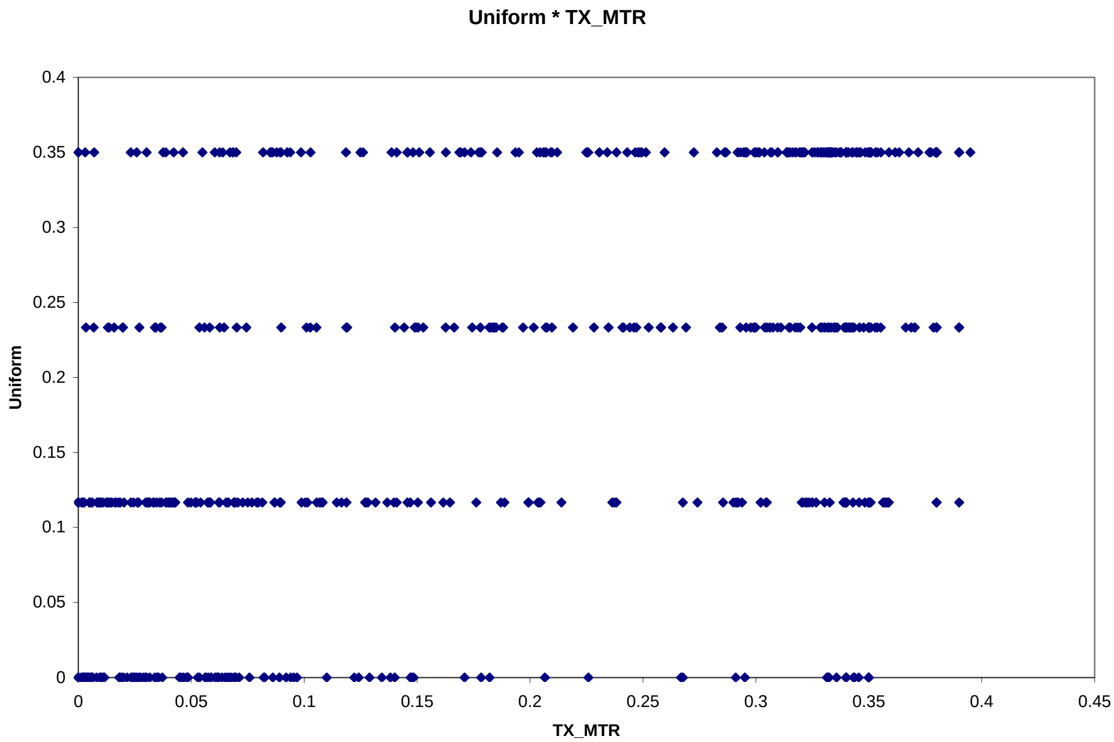


Figure 1J – Test sample plot *PseudoStatutory* versus *TX_MTR*



TX_MTR represents simulated marginal tax rates using tax return data data, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then Trichotomous equals 0.35. If beginning net operating loss carryforward is positive and pretax income is negative, then Trichotomous equals zero. Otherwise, Trichotomous equals 0.17. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then PseudoStatutory equals 0.35. If beginning net operating loss carryforward is zero and pretax income is negative, then PseudoStatutory equals 0.15. If beginning net operating loss carryforward is positive and pretax income is positive, then PseudoStatutory equals 0.25. Otherwise, PseudoStatutory equals zero.

Figure 1K – Test sample plot *Uniform* versus *TX_MTR*



TX_MTR represents simulated marginal tax rates using tax return data data, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then Uniform equals 0.35. If beginning net operating loss carryforward is zero and pretax income is negative, then Uniform equals 0.11667. If beginning net operating loss carryforward is positive and pretax income is positive, then Uniform equals 0.23333. Otherwise, Uniform equals zero.

Table 1 – Full Sample Composition

Year	Frequency	Percent of panel
1998	1,315	35.86%
1999	1,271	34.66%
2000	1,081	29.48%
	3,667	100%

1-digit SIC	Industry Type	Frequency	Percent of panel
0	Agriculture, Forestry, Fishing	14	0.38%
1	Mining, Building	212	5.78%
2	Manufacturing	766	20.89%
3	Manufacturing	1,237	33.73%
4	Transportation, Communication, Electric, Gas	317	8.64%
5	Wholesale, Retail	535	14.59%
6	Financial Services	148	4.04%
7	Hotels, Services	317	8.64%
8	Services	107	2.92%
9	International, Non-Operating	14	0.38%
		3,667	100%

This table identifies the year and industry for the observations in our full sample. The sample of 3,667 firm-year observations derives from the U.S. Department of Treasury's matched file of Compustat and tax return data for which a panel of firms from 1992-2000 is available. We limit our tests to 1998-2000 to consider years in which the net operating loss rules consistently carryback two years and carryforward 20 years.

Table 2 – Descriptive statistics for the matched Compustat and tax return test sample of 1,833 firm-year observations in 1998, 1999 and 2000.

Panel A, Marginal Tax Rate Variables

	N	Mean	Std Dev	Minimum	Maximum
TX_MTR	1,833	0.295	0.108	0	0.390
MTR	1,833	0.305	0.102	0	0.390
MTR1	1,833	0.282	0.112	0	0.388
MTR2	1,833	0.292	0.119	0	0.390
MTR3	1,833	0.273	0.138	0	0.390
MTR4	1,833	0.235	0.158	0	0.390
MTR5	1,833	0.289	0.123	0	0.390
Binary1	1,833	0.265	0.150	0	0.350
Binary2	1,833	0.225	0.168	0	0.350
Trichotomous	1,833	0.275	0.108	0	0.350
PseudoStatutory	1,833	0.286	0.103	0	0.350
Uniform	1,833	0.279	0.109	0	0.350

Panel A describes the main variables of interest in the test sample of 1,833 firm-year observations from 1998-2000. *TX_MTR* and *MTR* represent simulated marginal tax rates using tax return data or Compustat data respectively, following and adapting Graham (1996a). The tax rates are simulated to account for the effect of tax-loss carrybacks and carryforwards on the present value tax liability of adding an extra dollar of current period taxable income. If the current year U.S. average effective tax rate (U.S. current tax expense / U.S. pretax income) is less than 10%, *MTR1* equals the lesser of 15% or the simulated *MTR*. Otherwise, *MTR1* = *MTR*. If financial statement data reveal both a current year worldwide pretax loss (data item 170<0) and an ending net operating loss carryforward (data item 52 > 0) then *MTR2* equals zero. Otherwise, *MTR2* = *MTR*. If the financial statement data reveal a current year worldwide pretax loss (data item 170<0) then *MTR3* equals zero. Otherwise, *MTR3* = *MTR*. If the financial statement data indicate an ending net operating loss carryforward (data item 52 > 0) then *MTR4* equals zero. Otherwise, *MTR4* = *MTR*. If the financial statement data reveal both a current year U.S. pretax loss (data item 272<0) and an ending net operating loss carryforward (data item 52 > 0) then *MTR5* equals zero. Otherwise, *MTR5* = *MTR*. If beginning net operating loss carryforward (prior year Compustat data item #52) equals zero, then *Binary1* equals 0.35. Otherwise, *Binary1* equals 0. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *Binary2* equals 0.35. Otherwise, *Binary2* equals 0. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *Trichotomous* equals 0.35. If beginning net operating loss carryforward is positive and pretax income is negative, then *Trichotomous* equals zero. Otherwise, *Trichotomous* equals 0.17. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *PseudoStatutory* equals 0.35. If beginning net operating loss carryforward is zero and pretax income is negative, then *PseudoStatutory* equals 0.15. If beginning net operating loss carryforward is positive and pretax income is positive, then *PseudoStatutory* equals 0.25. Otherwise, *PseudoStatutory* equals zero. If beginning net operating loss carryforward equals zero and pretax income is nonnegative (#170), then *Uniform* equals 0.35. If beginning net operating loss carryforward is zero and pretax income is negative, then *Uniform* equals 0.11667. If beginning net operating loss carryforward is positive and pretax income is positive, then *Uniform* equals 0.23333. Otherwise, *Uniform* equals zero.

PANEL B – Financial statement and tax return characteristics *Rounded to Avoid Identification*

Variable, defined within table	*N*	*Mean*	*Std Dev*	*Min*	*Median*	*Max*
Assets (Compustat #6)	1833	2229	7626	3.45	400	150000
Book Assets per tx return (tax return Schedule L)	1833	2656	12634	0.00	400	400000
Pretax Income (#170)	1833	219	982	-1400	27	30000
Tax Net Income (tax return Line 28)	1833	146	759	-1100	17	20000
Earnings Before Tax (book) from simulation program	1833	242	1125	-1000	30	30000
Earnings Before Tax (tax return) from simulation program	1833	141	753	-1700	17	20000
Interest expense per simulation program (#15 interest exp.+ 1/3*#47 rents paid)	1833	53	142	0.00	9	2000
Tax return interest deduction (interest paid + 1/3 rents paid)	1833	78	267	0.00	9	5000
Bookloss = 1 if #170<=0	1833	0.182	0.386	0.00	0.00	1.00
USNegative = 1 if U.S. pretax income (#272) <=0	1833	0.201	0.401	0.00	0.00	1.00
Taxloss = 1 if Tax Net Income <=0	1833	0.220	0.414	0.00	0.00	1.00
net operating loss Carryover (#52)	1833	33	164	0.00	0.00	3000
BookNOL = 1 if NOL Carryover>0	1833	0.254	0.436	0.00	0.00	1.00
BookLossNOL = 1 if BookLoss = 1 and BookNOL = 1	1833	0.076	0.265	0.00	0.00	1.00
Tax NOL Carryover (tax return Schedule K)	1833	34	132	0.00	0.00	2400
TaxNOL = 1 if Tax NOL Carryover >=0	1833	0.426	0.496	0.00	0.00	1.00
R&D Expense (#46)	1833	0.180	0.384	0.00	0.00	1.00
R&D/Sales (#46/#12)	1725	0.187	2.016	0.00	0.00	67.00
Stock Option Deduction (2003 tax return, Schedule M-1)	880	18	54.623	0.00	2.50	600
Option/Assets = Stock Option Deduction / Total Assets	1833	0.005	0.019	0.00	0.00	0.30
AMT = 1 if firm pays Alternative Minimum Tax on the tax return	1833	0.148	0.356	0.00	0.00	1.00
Foreign 5Percent = 1 if absolute foreign/worldwide pretax income |#273/#170| > 0.05	1833	0.353	0.478	0.00	0.00	1.00
FTC = 1 if the taxpayer claims foreign tax credits on tax return	1833	0.385	0.487	0.00	0.00	1.00
USETR = U.S. current tax /U.S. pretax inc #63 / #272	1833	0.221	1.490	-53.00	0.32	14.05
USLOW = 1 if USETR < 10%	1833	0.224	0.417	0.00	0.00	1.00

Panel B describes various financial statement and tax return (Form 1120) characteristics of our test sample, where variables are described within the table. Further details available from authors. We use our test sample of 1,833 firm-year observations from 1998-2000.

Panel C, Univariate relation of tax return simulated marginal tax rate (*TX_MTR*) with financial statement measures of marginal tax rates

	Pearson correlation coefficient	Regress *TX_MTR* on financial *MTR* proxies		Regress financial *MTR* proxies on *TX_MTR*	
	TX_MTR	Intercept	Coefficient	Intercept	Coefficient
MTR	0.671 <.0001	0.079	0.709	0.117	0.635
MTR1	0.674 <.0001	0.113	0.646	0.074	0.703
MTR2	0.687 <.0001	0.114	0.622	0.068	0.758
MTR3	0.669 <.0001	0.153	0.521	0.020	0.858
MTR4	0.469 <.0001	0.220	0.320	0.031	0.689
MTR5	0.691 <.0001	0.119	0.610	0.057	0.783
Binary1	0.223 <.0001	0.253	0.160	0.173	0.310
Binary2	0.483 <.0001	0.230	0.310	0.003	0.751
Trichotomous	0.556 <.0001	0.144	0.553	0.110	0.558
PseudoStatutory	0.632 <.0001	0.106	0.664	0.108	0.602
Uniform	0.633 <.0001	0.121	0.626	0.090	0.641

Table 2, Panel C provides correlations and one-way regressions (in both directions) of financial statement proxies with the simulated tax return marginal tax rate (*TX_MTR*). All tax rate proxies are on a post-financing (100% interest deduction) basis. We use our test sample of 1,833 firm-year observations from 1998-2000.

Panel D Univariate relation of prefinancing tax return simulated marginal tax rate (*TX_MTR*) with prefinancing financial statement measures of marginal tax rates

	Pearson correlation coefficient	Regress prefinancing *TX_MTR* on prefinancing financial *MTR* proxies		Regress prefinancing financial *MTR* proxies on prefinancing *TX_MTR*	
	Pre-finance TX_MTR	Intercept	Coefficient	Intercept	Coefficient
Prefinancing MTR	0.760	0.069	0.769	0.083	0.752
	<.0001				
MTR1 (financing N/A)	0.635	0.163	0.526	0.049	0.767
	<.0001				
Prefinancing MTR2	0.690	0.142	0.564	0.042	0.844
	<.0001				
Prefinancing MTR3	0.627	0.195	0.418	-0.007	0.940
	<.0001				
MTR4 (financing N/A)	0.395	0.263	0.216	0.018	0.723
	<.0001				
Prefinancing MTR5				0.041	0.844
			0.676	0.150	0.541
Binary1	0.177	0.289	<.0001		
(uses book NOL only)	<.0001				
Prefinancing Binary2	0.406	0.267	0.210	-0.013	0.784
	<.0001				
Prefinancing Trichotomous	0.484	0.204	0.400	0.095	0.590
	<.0001				
Prefinancing PseudoStatutory	0.563	0.169	0.500	0.093	0.634
	<.0001				
Prefinancing Uniform	0.561	0.182	0.467	0.074	0.676
	<.0001				

Table 2, Panel D provides correlations and one-way regressions (in both directions) of financial statement proxies with the pre-financing simulated tax return marginal tax rate (*TX_MTR)*. All tax rate proxies are on a pre-financing (0% interest deduction) basis. We use our test sample of 1,833 firm-year observations from 1998-2000.

Table 3 – Ordinary least squares regression of simulated tax return MTR on simulated financial statement MTR and controls for a test sample of 1,833 firm-year observations in 1998, 1999 and 2000.

Panel A, After-financing tax rate variables	Model A Main Specification	Model B Include Stock Option	Model C Drop MTR	Model D Include PseudoStatutory	Model E Include MTR & PseudoStatutory
Dependent variable = *TX_MTR*	Coeff (*t-stat)*	Coeff (*t-stat)*	Coeff (*t-stat)*	Coeff (*t-stat)*	Coeff (*t-stat)*
Intercept	0.210	0.210	0.336	0.303	0.193
	28.03	*28.03*	*131.59*	*13.33*	*8.83*
MTR	0.379	0.384			0.378
	17.62	*17.82*			*17.56*
Stock Option / Assets		-0.260			
		-3.01			
PseudoStatutory				0.095	0.049
				1.46	*0.81*
US Loss Dummy = 1 where U.S. pretax income (Compustat #272) < 0	-0.042	-0.043	-0.034	-0.034	-0.042
	-3.63	*-3.67*	*-2.70*	*-2.71*	*-3.63*
Low US ETR Dummy = 1 where U.S. Effective tax rate < 10% (USetr = #63/#272)	-0.053	-0.053	-0.082	-0.082	-0.053
	-10.47	*-10.49*	*-15.91*	*-15.82*	*-10.44*
Net Operating Loss Dummy = 1 where #52 > 0	-0.022	-0.022	-0.028	-0.019	-0.018
	-5.92	*-5.70*	*-6.63*	*-2.58*	*-2.72*
Book Loss Dummy = 1 where #170 < 0	-0.042	-0.041	-0.090	-0.070	-0.032
	-3.46	*-3.35*	*-7.01*	*-3.68*	*-1.80*
Foreign Activity Dummy = 1 where Abs(Foreign pretax income / pretax income) > 5%	0.010	0.010	0.024	0.024	0.010
	2.82	*2.80*	*6.24*	*6.23*	*2.82*
Adjusted R^2	58%	59%	51%	51%	58%
Observations	1,833	1,833	1833	1833	1833

Table 3 estimates models to predict the simulated tax return marginal tax rate (*TX_MTR)* based on financial statement variables. Variables are defined in Table 2 or within the table above. Panel A uses post-financing (allow 100 percent of interest deduction) tax rates. We use our test sample of 1,833 firm-year observations from 1998-2000.

Panel B, Pre-financing tax rate variables	Model A Main Specification	Model B Include Stock Option	Model C Drop MTR	Model D Include PseudoStatutory	Model E Include MTR& PseudoStatutory
Dependent variable = Prefinancing *TX_MTR*	Coeff (*t-stat)*	Coeff (*t-stat)*	Coeff (*t-stat)*	Coeff (*t-stat)*	Coeff (*t-stat)*
Intercept	0.135	0.137	0.342	0.320	0.156
	19.58	*19.93*	*160.19*	*16.58*	*9.48*
Prefinancing MTR	0.601	0.600			0.603
	31.00	*31.13*			*31.01*
Stock Option / Assets		-0.385			
		-4.86			
Prefinancing PseudoStatutory				0.063	-0.064
				1.14	*-1.42*
US Loss Dummy = 1 where prefinancing U.S. pretax income (Compustat #272 + #15) < 0	-0.028	-0.028	-0.035	-0.035	-0.028
	-2.71	*-2.73*	*-2.79*	*-2.77*	*-2.74*
Low US ETR Dummy = 1 where U.S. Effective tax rate < 10% (USetr = #63/#272)	-0.020	-0.020	-0.053	-0.052	-0.020
	-5.65	*-5.71*	*-12.79*	*-12.73*	*-5.67*
Net Operating Loss Dummy = 1 where #52 > 0	-0.008	-0.009	-0.018	-0.012	-0.014
	-2.89	*-2.94*	*-4.98*	*-2.06*	*-2.87*
Prefinancing Book Loss Dummy = 1 where #170 + #15 < 0	-0.016	-0.015	-0.070	-0.057	-0.029
	-1.47	*-1.41*	*-5.41*	*-3.29*	*-2.04*
Foreign Activity Dummy = 1 where Abs(Foreign pretax income / pretax income) > 5%	0.006	0.008	0.022	0.022	0.006
	2.29	*2.74*	*6.48*	*6.46*	*2.29*
Adjusted R^2	62%	62%	41%	41%	62%
Observations	1,833	1,833	1,833	1,833	1,833

Table 3 estimates explanatory models to predict the simulated tax return marginal tax rate (*TX_MTR)* based on financial statement variables. Variables are defined in Table 2 or within the table above. Panel B uses pre-financing (allow zero percent of interest deduction) tax rates. We use our test sample of 1,833 firm-year observations from 1998-2000.

Table 4, Correlation of simulated (*TX_MTR*) and estimated (*EST_TX_MTR*) tax marginal tax rates on financial *MTRs* and explanatory variables within the hold-out sample.

	Simulated *TX_MTR* N=1834	*EST_TX_MTR* from Table 3, Model A N=1834
TX_MTR	1	0.751
MTR	0.653	0.884
MTR1	0.664	0.901
MTR2	0.648	0.891
MTR3	0.678	0.888
MTR4	0.448	0.641
MTR5	0.645	0.886
Binary1	0.203	0.319
Binary2	0.527	0.688
Trichotomous	0.565	0.755
PseudoStatutory	0.629	0.829
Uniform	0.637	0.834

This table uses the hold-out sample of 1,834 observations from 1998-2000 to measure the correlation between our tax proxies based on financial statement data and either the tax return simulated rate for the holdout sample (*TX_MTR)* or the estimated tax rate (*EST_TX_MTR)* calculated using estimated coefficients from Table 3, Model A to determine the values of the observations in the holdout sample.

Table 5
Correlation of Simulated Marginal Tax Rates With Tax Credits

Panel A, Average *MTR*, *TX_MTR* and Credit Ratios by Percentile of Earnings Before Taxes (n=91 or 92 per group)

Percentile	Net_Income (L28 Form 1120)	*MTR*	*TX_MTR*	Credit/tax
20 (highest)	1833.25	0.350	0.350	0.340
19	507.99	0.344	0.349	0.294
18	255.79	0.350	0.350	0.158
17	150.60	0.350	0.347	0.181
16	92.65	0.340	0.349	0.132
15	64.70	0.344	0.348	0.210
14	50.50	0.335	0.347	0.151
13	37.27	0.336	0.344	0.103
12	28.46	0.345	0.347	0.167
11	21.81	0.335	0.351	0.134
10	14.64	0.346	0.352	0.108
9	10.22	0.339	0.339	0.107
8	7.60	0.325	0.331	0.110
7	4.79	0.311	0.323	0.102
6	2.24	0.305	0.316	0.092
5	0.083	0.231	0.251	0.128
4	-2.32	0.209	0.149	0
3	-6.84	0.196	0.134	0
2	-18.14	0.184	0.114	0
1 (lowest)	-116.37	0.217	0.118	0

Panel A partitions the test sample of 1,833 firm-year observations from 1998-2000 into 20 equal groups ranked by earnings before taxes. We report the means by group of tax return net income (line 28, Form 1120), the simulated book marginal tax rate (*MTR)* and the tax return simulated marginal tax rate (*TX_MTR*), and totals credits per the tax return divided by tax before credits.

Panel B, Average MTR, *TX_MTR* and Credit Ratios by Percentile of Credits to Tax before Credit (n = 71 or 72 per group, except as noted)

Percentile	Net_Income (L28 Form 1120)	*MTR*	*TX_MTR*	Credit/tax
20 (highest)	709.70	0.331	0.345	0.926
19	740.62	0.341	0.347	0.687
18	253.40	0.343	0.344	0.471
17	280.05	0.345	0.343	0.344
16	192.77	0.339	0.348	0.241
15	251.34	0.349	0.350	0.166
14	173.84	0.344	0.347	0.113
13	169.82	0.348	0.349	0.076
12	108.55	0.330	0.348	0.049
11	121.39	0.342	0.349	0.030
10	292.84	0.341	0.348	0.018
9	212.23	0.349	0.350	0.010
8	131.77	0.351	0.350	0.004
7 (n=58)	105.13	0.350	0.350	0.0008
1-6 (lowest 6 percentiles) [a]	2.04	0.259	0.234	0

Panel B partitions the test sample of 1,833 firm-year observations from 1998-2000 into 20 equal groups ranked by credits per the tax return divided by tax before credits. We report the means by group of tax return net income (line 28, Form 1120) for the simulated book marginal tax rate (*MTR)*, and the tax return simulated marginal tax rate (*TX_MTR*), and credits per the tax return divided by tax before credits.

[a] This group includes 444 observations for credit/tax and all remaining 844 observations for *MTR* and *TX_MTR*, including 400 observations with missing credit/tax because the denominator, tax before credits, was not positive.

Panel C. Correlation of tax rates with credits and AMT

	MTR	*TX_MTR*	*EST_TX_MTR*
Dummy = 1 if Tax Before Credits > 0	0.565	0.811	0.700
Total credits/Tax Before Credits	0.086	0.062	-0.015
Foreign tax credit/Tax Before Credits	0.084	0.058	-0.024
General business credits / Tax Before Credits	0.049	0.065	0.012
Alternative minimum tax / Tax Before Credits	-0.440	-0.453	-0.496

Panel C reports correlations of simulated book marginal tax rate (*MTR*), the tax return simulated marginal tax rate (*TX_MTR*), and marginal tax rate estimated from the coefficients in Table 3, Model A (*EST_TX_MTR*) with various tax return measures of credit and alternative minimum tax ratios as a percentage of tax before credits.

Table 6
Estimates of pooled ordinary least squares regressions of debt ratios on simulated marginal tax rates and controls for leverage, using a test sample of 1,833 firm-year observations in 1998, 1999 and 2000.

Panel A, MTR and proxies based on financial statement data

MTR Proxy =	Simulated MTR before book interest expense		Book NOL (Data52>0)		Average worldwide Current effective tax rate	
Leverage:	Debt/Assets	Debt/ MVAssets	Debt/Assets	Debt/ MVAssets	Debt/Assets	Debt/ MVAssets
Intercept	0.071	-0.012	0.133	0.087	0.098	0.068
	(3.48)	*(-0.67)*	*(11.79)*	*(8.82)*	*(5.18)*	*(4.26)*
MTR Proxy	0.293	0.420	0.058	0.051	0.129	0.150
	(4.61)	*(7.64)*	*(5.80)*	*(5.85)*	*(3.46)*	*(4.76)*
LagSales	0.000	-0.0000	0.000	-0.0000	0.0000	-0.0000
	(0.18)	*(-2.00)*	*(0.15)*	*(-1.98)*	*(0.33)*	*(-1.34)*
LagMarketToBook	0.002	-0.0001	0.002	-0.0004	0.003	-0.002
	(7.88)	*(-0.63)*	*(7.09)*	*(-1.83)*	*(4.80)*	*(-3.45)*
LagDividend	-0.015	-0.048	0.0004	-0.029	0.021	-0.008
	(-1.61)	*(-5.90)*	*(0.05)*	*(-3.56)*	*(2.28)*	*(-1.095)*
LagROA	-0.085	-0.117	0.006	0.004	-0.389	-0.452
	(-3.00)	*(-4.76)*	*(0.24)*	*(0.17)*	*(-7.61)*	*(-10.50)*
LagCollateral	0.171	0.209	0.191	0.233	0.185	0.202
	(8.20)	*(11.55)*	*(9.25)*	*(12.86)*	*(8.62)*	*(11.17)*
Observations	1806	1806	1815	1815	1448	1448
Adjusted R^2	7.1%	11.3%	7.6%	9.9%	9.4%	17.3%

Panel B, MTR and proxies based on tax return data

MTR Proxy =	Simulated *TX_MTR* before tax return interest deduction		Tax return NOL carryforward		Tax after credits / Taxable income	
Leverage:	Debt/Assets	Debt/ MVAssets	Debt/Assets	Debt/ MVAssets	Debt/Assets	Debt/ MVAssets
Intercept	0.107	0.028	0.106	0.067	0.165	0.143
	(5.04)	*(1.53)*	*(8.55)*	*(6.30)*	*(11.24)*	*(11.67)*
MTR Proxy	0.140	0.258	0.072	0.057	-0.140	-0.133
	(2.11)	*(4.50)*	*(7.67)*	*(7.06)*	*(-3.78)*	*(-4.29)*
LagSales	0.000	-0.000001	-0.000	-0.000001	-0.000	-0.0000009
	(0.21)	*(-1.95)*	*(-0.47)*	*(-2.50)*	*(-0.28)*	*(-1.90)*
LagMarketToBook	0.0020	-0.0002	0.0018	-0.0004	0.003	-0.003
	(7.57)	*(-0.87)*	*(7.28)*	*(-1.62)*	*(4.14)*	*(-3.93)*
LagDividend	-0.006	-0.037	0.011	-0.021	0.015	-0.018
	(-0.59)	*(-4.62)*	*(1.22)*	*-2.58*	*(1.62)*	*(-2.23)*
LagROA	-0.045	-0.071	0.024	0.020	-0.152	-0.185
	(-1.63)	*(-2.92)*	*(1.00)*	*0.97*	*(-3.61)*	*(-5.27)*
LagCollateral	0.184	0.217	0.194	0.229	0.192	0.204
	(8.79)	*(11.97)*	*(9.25)*	*(12.70)*	*(8.50)*	*(10.79)*
Observations	1812	1812	1712	1712	1368	1368
Adjusted R^2	6.6%	9.5%	9.1%	10.4%	7.2%	13%

This table estimates regression models of *Leverage* using three different proxies for the marginal tax rate (*MTR Proxy)*. Panel A uses financial statement data for the marginal tax rates proxies and Panel B uses tax return data for the marginal tax rate proxies. All other variables use financial statement Compustat data. *Leverage* = total debt (Compustat item #9 + #34), scaled either by total assets (#6) or by book assets minus book equity plus market equity (#6 - #60 + #199*#25).*MTR Proxy* equals one of three book (Panel A) or tax (Panel B) measures as follows: 1) The pre-financing simulated marginal tax rate, based on either book income before interest expense in the financial statement variable, or taxable income before interest deduction in the tax return tax variable. This variable is measured before interest to avoid the spurious negative correlation between income after interest and debt usage (Graham, Lemmon, and Schallheim 1998). 2) The presence of a book (Compustat #52) or tax (disclosed on tax return) net operating loss. 3) The average tax rate, either worldwide current tax expense divided by pretax income (Compustat #16/#170), or tax after credits divided by net income (line 28). The average tax rate is only computed for observations with positive numerators and denominators and is top-coded at 100%. *LagSales* = one-year lag of book sales (#12). *LagMarketToBook* = one year lag of market value of equity (#199*#25) divided by book value of equity (#60). *LagDividend* = is a dummy variable that equals one if the one year lag of dividend yield (#26*100/#199) is positive, zero otherwise. *LagROA* = one year lag of return on assets (#18/#6).*LagCollateral* = one year lag of the ratio of receivables and property (#3+#8) to assets (#6).