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THE EFFECT OF TAXES ON CAPITAL STRUCTURE

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Abstract

This paper investigates whether the firm's debt decision is inversely related to the level of it nondebt or substitute tax shields. Firms are identified which experience the loss of interest tax savings in the current year, which consequently possess low marginal corporate tax rates. The trade off between debt ratios and nondebt tax shields is then compared between low and high marginal tax rate firms. Further, the results test whether, all else constant, firms with high marginal tax rates use more debt according to the predictions of many capital structure theories.

Both Miller [17] and DeAngelo and Masulis [12] explore the expected tax benefits to debt and its effect on the firm's leverage decision when personal and corporate taxation exist. Using the assumptions of perfect markets and no personal tax on capital gains, Miller [17] shows that the marginal corporate tax benefit to riskless debt is zero for all firms. In Miller's model, each firm has the same tax position where an additional dollar of interest is of equal value to all firms. As a result, all firms supply debt at constant marginal cost without potential loss of the interest tax savings. In extending Miller [17], DeAngelo and Masulis [12] allow the marginal cost of debt to differ among firms by permitting nondebt tax shield to substitute for the firm's interest tax shield.

In the DeAngelo and Masulis model, the existence of nondebt tax shields may interfere with the firm's ability to benefit from an additional dollar of interest, thereby reducing the tax savings of debt. From their perspective, the firm establishes a level of tax shield commensurate with its expected taxable earnings. The tax shield is composed of all exogenously given nondebt tax shield (investment tax credits, depletion, depreciation and other noncash charges against income), and an endogenously determined level of interest deductions. If actual taxable earnings are less than expected, then the

firm's nondebt tax shield may result in excess interest deductions which provide no corporate tax savings. For a given level of nondebt tax shield, additional debt produces a declining expected marginal corporate tax benefit, or alternatively, additional debt is supplied at increasing marginal cost by the firm. Thus, because nondebt tax shields are exogenously given and assumed to be fully utilized before issuing additional debt, the model predicts an inverse cross-sectional relation between nondebt tax shields and debt ratios (holding before tax earnings constant).

Previous studies of the relation between nondebt tax shields and debt ratios generally fail to support the DeAngelo and Masulis hypothesis: Moore [19], Boquist and Moore [6] and Bradley, Jarrell, and Kim [4] find a positive relation between the two, while Bowen, Daley and Huber [7] find a negative relation.[1] There may be several reasons why earlier studies fail to find an inverse relation between nondebt tax shields and debt ratios. First, none of these studies adjusts for differences between "book" and tax accounting which affect the measurement of the firm's nondebt tax shield. More importantly, they do not attempt to determine how firms at different marginal tax rates trade off interest and nondebt tax shields. The key to testing the DeAngelo and Masulis prediction is the identification of firms with different marginal costs of debt which result from different expected marginal tax rates. Earlier tests of their hypothesis use the nondebt tax shield variable to proxy for the firm's effective tax rate rather than its marginal tax rate. Yet, the tax benefit of additional debt depends on the firm's marginal tax rate. Thus, earlier studies in testing the DeAngelo and Masulis hypothesis do not

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[1] All four studies use similar measure of nondebt tax shield. Thus, the negative relation found by Bowen, Daley and Huber may stem from their use of revenues rather than operating income to standardize their measure of nondebt tax shield.

distinguish high versus low marginal cost users of debt--i.e. firms with different marginal tax rates.

Previous studies also do not examine the effect of profitability separate from the substitute tax shield argument. Recently, Myers [20] and Myers and Majluf [21] argue that agency costs arising from asymmetric information regarding the firm's investment opportunities may cause managers to rely on internal sources of funding. Thus, profitability or internal sources of funds may be an independent determinant of capital structure. Because the nondebt tax shield is often measured relative to the firm's operating cash flows, it is important to gauge the relative impact of profitability on the firm's level of debt independent of its use of substitute tax shields.

In this paper, I conduct a series of tests of the DeAngelo and Masulis prediction of an inverse relation between nondebt tax shields and debt ratios. Using a sample of 1,067 firms, I identify firms with different marginal tax rates, by classifying firms according to their tax paying status. Ceteris paribus, firms whose tax position allows immediate use of additional interest deductions are classified as 'high' marginal tax rate firms, while firms who must postpone the deduction of additional interest to future periods are classified as 'low' marginal tax rate firms. The trade-off between debt ratios and nondebt tax shields is then compared between the two groups. In addition, many theories of capital structure--e.g., Miller and Modigliani [18], Miller [17], Kim [14], and DeAngelo and Masulis [12]--predict, all else constant, that higher marginal tax rate firms will use more debt. By comparing high and low marginal tax rate firms, the results also provide insight into how taxes affect the firm's level of debt.

The remainder of this paper is organized as follows. Section I describes the data for this study and the measurement of the firm's nondebt tax shield.

Section II presents a model of the cross sectional determinants of capital structure. Section III describes the determination of the firm's tax position and presents descriptive statistics for high and low marginal tax rate firms. Section IV examines the trade-off between debt ratios and nondebt tax shields. Section V summarizes the results.

I. Nondebt Tax Shields

The nondebt tax shield of a firm is composed of all noncash charges against income that the firm expenses for tax purposes. Examples of these charges are depreciation expenses, depletion expenses and investment tax credits (ITC). Important differences exist between book and tax accounting which affect the computation of the firm's nondebt tax shield. In this study, Compustat data are adjusted to reflect the differences between book and tax reporting in the following manner:

ADEP = Accelerated Depreciation = Depreciation Expense + Δ Deferred Taxes/0.48

ITC = Investment Tax Credit = Book ITC + Δ Deferred ITC

ADEP, accelerated depreciation, is approximated by adjusting the depreciation expense reported for book purposes for the annual change in the firm's deferred tax account divided by the marginal corporate tax rate.[2] ITC is the investment tax credit generated in the current year, computed as the amount of the credit reported on the firm's current income statement plus the annual change in its deferred investment tax credit account.[3] In all, 1,067 firms

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[2]The annual change in the firm's deferred tax account is assumed to reflect the timing difference which results from the acceleration of depreciation for tax purposes. Thus, it is added to the book depreciation to approximate the depreciation reported to tax purposes.

[3]Analogous with depreciation, the firm may claim a greater ITC than it reports on its income statement. To approximate the total investment tax credit realized, the annual change in the deferred ITC (balance sheet) is added to the investment tax credit reported on the income statement.

report data to compute nondebt tax shield and these firms are distributed among 26 two digit SIC industries.[4] Chaplinsky [9] and Bradley, Jarrell, and Kim [4] provide evidence that the leverage ratios of electric utilities and other regulated firms "outlie" in samples of industrial firms. Because their use of nondebt tax shields is also likely to be affected by the regulatory environment, the sample is restricted to industrial firms.[5]

Table 1 presents descriptive statistics for selected measures of the nondebt and interest tax shield for the sample, where the nondebt and interest tax shield is scaled by the firm's pretax operating income. The mean level of depreciation (DEP/OI) reported for book purposes is significantly less than the amount of depreciation reported for tax purposes (ADEP/OI) and, thus, earlier studies which use book depreciation underestimate the amount of deduction provided by depreciation.[6] The median values for ADEP/OI show that accelerated depreciation alone accounts for 33 percent of the tax shield of the firm. When the median ITC and accelerated depreciation are considered together, 36 percent of pre-tax operating income is shielded from tax by

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[4]The 1,067 firm sample results from the requirement that each two digit SIC industry has a minimum of five firms. Further the period 1970-1980 is chosen to avoid problems with the revocation and subsequent reenactment of the ITC prior to 1970 and after 1980 with safe harbor leasing and the accelerated cost recovery system of depreciation.

[5]The airline and transportation industries are retained to provide a more complete picture of leverage and nondebt tax shields. None of the later results depend on the exclusion or retention of these industries.

[6]These adjustments to accounting data are approximations to tax data which are not publically available for individual firms. How close these adjustments come to the depreciation and ITC reported for tax purposes is an open question. As a check, I used Cordes and Sheffrin's [10] measure of the expected marginal tax benefit to debt (since they had access to industry tax data) and compared a measure of nondebt tax shield of my own for matched industries. The two should be inversely correlated with one another; I found the rank correlation between the two is -0.47 which is significant at the 1 percent level.

TABLE 1

DESCRIPTIVE STATISTICS FOR SELECTED RATIOS OF NONDEBT AND INTEREST TAX SHIELDS FOR AVERAGES FOR EACH FIRM COMPUTED FROM 1970-1980

RATIO:	N	MEAN	STD. DEVIATION	MEDIAN	MINIMUM	MAXIMUM
DEP/OI[a]	1067	0.31	0.23	0.26	0.01	3.03
ADEP/OI[b]	1067	0.39	0.28	0.33	0.01	3.03
(ADEP + ITC)/OI[c]	1067	0.43	0.30	0.36	0.01	3.15
INT/OI[d]	1037	0.21	0.27	0.14	0.0	4.59

[a]DEP/OI is the depreciation expense reported for book purposes divided by the firm's pretax operating income.

[b]ADEP/OI is accelerated depreciation divided by pretax operating income. ADEP is computed as depreciation expense plus the change in deferred taxes/.48.

[c]Sum of accelerated depreciation and ITC divided by pretax operating income. ITC is the investment tax credit ITC reported on the firm's income statement plus deferred ITC.

[d]INT/OI is interest expense divided by pretax operating income.

nondebt tax shields. If interest expense/operating income (IE/OI) is added to the nondebt tax shield then the total interest and nondebt tax shield is less than one for most firms. These results indicate that the median firm's operating income exceeds its total tax shield, implying that most firms share the same marginal tax rate for a given tax year.

A comparison of the mean and median values of the ratios in Table 1 shows high skewness which stems from firms with near zero, zero or negative values of operating income. The group of firms with low levels of operating income is potentially the most revealing of the DeAngelo and Masulis hypothesis. Thus, an alternative measure of the firm's nondebt tax shield is constructed to reduce skewness and the potential for outlier problems. The measure of tax shield used in this analysis, NDTS, is computed as follows:

$$\text{NDTS} = \frac{\text{Sum of accelerated depreciation + ITC (TS) - Operating Income (OI)}}{\text{Total Assets}}$$

This variable preserves the economic intuition of the DeAngelo and Masulis hypothesis in that the nondebt tax shield is measured relative to the firm's pretax operating income. Thus, firms with TS > OI will have positive values for NDTS or high(er) nondebt tax shields relative to firms with TS < OI or negative values of NDTS.

II. Cross Sectional Determinants of Capital Structure

To determine how leverage and nondebt tax shields are related, equation (1) presents a model of the cross sectional differences in capital structure.

$$LEV_i = \beta_1 + \beta_2 \ln(SDCF)_i + \beta_3 INTA_i + \beta_4 NDTS_i + \sum_{j=1}^{25} \gamma_j IND_{ij} + e_{it} \qquad (1)$$

where LEV_i = Long term debt at book value divided by total assets for firm i, averaged from 1970-1980. $TLEV_i$ is long term debt plus debt in current liabilities divided by total assets.

$\ln(SDCF)_i$ = The natural log of the ratio of the standard deviation of the

first differences in cash flow from 1970-1980, scaled by the firm's average total assets for the same period, for firm i.

$INTA_i$ = The maximum of [0, (Market value of equity - Book value of equity)/total assets], averaged from 1970-1980.

$NDTS_i$ = The average of the ratio of accelerated depreciation plus investment tax credit minus pretax operating income/total assets from 1970-1980 for firm i.

IND_{ij} = Industry dummies representing SIC two digit industry classifications for firm i in industry j.

The appropriate measure of leverage is widely debated in the finance literature. As the dependent variable, I use either the ratio of the long term portion of interest bearing debt to total assets (LEV), or the ratio of the total interest bearing debt of the firm scaled by total assets (TLEV). Both of these ratios are computed at book value in order to focus on the management's decision regarding capital structure.

Baxter [2], Kraus and Litzenberger [15], Brennan and Schwartz [5], among others, argue that firms with high 'risk' or volatility of operating income may limit their use of debt to reduce bankruptcy risk. However, the same risk may also restrict the firm's use of nondebt tax shields as unexpectedly low earnings may force the firm to forego some of the benefit of its nondebt tax shield. Thus, ln(SDCF) is included in equation (1) as a measure of operating/bankruptcy risk, given the assumption of positive but constant default costs across firms. The variable, SDCF, is computed as the standard deviation of the first differences in the firm's cash flow during 1970-1980, scaled by the average total assets of the firm over the same period. Cash flow is measured as pretax operating income before depreciation and other non-cash charges against income. A natural log transformation of SDCF is used to

normalize the distribution of the variable, but similar results obtain with SDCF.

Myers [20] argues that the agency costs of debt are higher for firms whose value derives more from growth opportunities than from assets in place. Further, growth opportunities are not depreciable, while assets in place are. To reduce the potential for NDTS to proxy for the composition of the firm's assets between tangible and intangible assets, the variable INTA is included in equation (1). INTA is measured as the MAXIMUM [0, (market value of equity - book value of equity)/total assets], where the market value of equity is obtained by multiplying the year end close price of the firm's equity by the number of common shares outstanding. The market value of equity captures the combined value of the firm's assets in place and growth opportunities. By subtracting the book value of equity as a proxy for the value of assets in place, an estimate of the value of growth opportunities is obtained.[7] Previous work by Chaplinsky [9] documents that the proposed measures for operating risk/bankruptcy (ln(SDCF)) and nondebt tax shields (NDTS) are highly correlated with industry membership. Thus, to reduce the potential for ln(SDCF) and NDTS to proxy for industry themselves, 25 industry dummies corresponding to two digit SIC codes are also included in equation (1).

The estimated coefficients of equation (1), presented in Table 2, support two predictions of capital structure theory. First, consistent with the bankruptcy cost/tax benefit trade off theories, the coefficient of ln(SDCF) is

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[7] Bradley, Jarrell and Kim [4] use research and development expenses (R&D) as a proxy for intangible assets. However, R&D provides nondebt tax shield to the firm as well, as it allows firms to accelerate the expensing of costs associated with future assets. To avoid further overlap between asset composition and nondebt tax shields, the INTA variable is used instead. However, INTA also has limitations as a proxy for growth opportunities because the firm's leverage also affects the market value of equity.

TABLE 2

REGRESSION OF EQ. (1) OF LEVERAGE ON STANDARD DEVIATION OF CASH FLOWS, INTANGIBLE ASSETS, NON DEBT TAX SHIELD AND INDUSTRY FOR AVERAGES OF THE VARIABLES COMPUTED FROM 1970-1980

$$(1)\quad LEV_i^a = \beta_1 + \beta_2 \ln(SDCF)_i^b + \beta_3 INTA_i^c + \beta_4 NDTS_i^d + \sum_{j=1}^{25} \gamma_j IND_{ij}^e + \eta_i$$

Dependent Variable	$\hat{\beta}_1$	$\hat{\beta}_1$	$\hat{\beta}_3$	$\hat{\beta}_4$	R^2
LEV	0.33	-0.02	-0.02	0.54	0.28
	(13.76)	(-4.22)	(-3.51)	(10.10)	
TLEV	0.44	-0.01	-0.02	0.78	0.26
	(15.88)	(-0.82)	(-2.57)	(12.58)	

[a] LEV_i is the ratio of long term debt/total assets for firm i averaged over 1970-1980. TLEV is the ratio of long term debt plus interest bearing debt in current liabilities total assets.

[b] ln(SDCF) is the natural log of the standard deviation of the first differences in cash flow for firm i over the period 1970-1980. The standard deviation is scaled by the average value of total assets over the same period and then logged. Cash flow is measured as pretax operating income before depreciation and other non-cash charges against income.

[c] $INTA_i$ is the maximum [0, market value of equity-book value of equity/ total assets] averaged for 1970-1980.

[d] $NDTS_i$ is the ratio of the sum of accelerated depreciation plus investment tax credits minus pretax operating income/total assets for firm i, averaged from 1970-1980.

[e] $\sum_{j=1}^{25} \gamma_j IND_{ij}$ are twenty five two digit industry dummies. The intercept in the regression belongs to the airline industry. For brevities sake, the γ_j's are not reported.

significantly negative for LEV, suggesting that firms with higher operating/bankruptcy risk restrict their use of long term debt. Second, consistent with the prediction of Myers [20], the coefficients of INTA are significantly negative for both LEV and TLEV, confirming that firms with greater value in growth opportunities than assets in place, use less debt.

In contrast, a strong positive correlation is observed between NDTS and leverage. With the effect of industry, bankruptcy risk, and intangible assets held constant, the results indicate that firms with higher nondebt tax shields also have higher leverage. In fact, the estimated coefficient of NDTS predicts, for a firm at the sample average, a six percent increase in the expected value of LEV for a 100 percent increase (or approximately two standard deviation increase) in NDTS. Similar positive relations between leverage and nondebt tax shields are also reported in Bradley, Jarrell and Kim [4] and Moore [19]; such results do not support the DeAngelo and Masulis hypothesis.

However, as Table 1 illustrates, most firms in this sample have pretax operating income remaining after all deductions and credits. Thus, they face the same marginal tax rate, meaning that they can expect the same marginal tax benefit from an additional dollar of debt. Consequently, in equation (1) the variable NDTS proxies for the firm's effective corporate tax rate rather than its expected marginal corporate tax rate. Cross sectionally, firms with low effective tax rates are not necessarily firms with low marginal tax rates, and vice versa. Since the firm's marginal tax rate determines its marginal benefit of debt, in the next section I focus directly on the firm's tax position to identify firms with different marginal tax rates.

III. Tax Position of the Firm

The marginal tax benefit on an additional dollar of interest or depreciation to the firm depends on its current or past tax position. If the firm has taxable income remaining after all deductions, then each additional dollar of deduction provides the full marginal tax benefit of 48 percent. If the has no or negative taxable income after all deductions, then the marginal benefit of additional deductions ranges between zero and 48 percent. For example, if the firm has negative taxable income this period, current losses may be carried back three years to recover taxes previously paid at the full 48 percent. Thus, current losses provide a full, contemporaneous tax benefit. If, however, the firm cannot carry back any or all of its current losses, then net operating loss carryforward items are created and the present value of current deductions is reduced due to postponement of the tax benefits. These firms, then, are candidates to have marginal tax rates below the statutory rate.

As a first step toward determining the tax position of the firm, taxable income, or a cash based measure of income, is estimated from financial statement data for each firm using a method outlined in Stickney, Weil and Wolfson [22] and Bernard and Hayn [3]. (The details of this procedure are given in Appendix A.) Based on the firm's estimated taxable income or taxes payable, I classify firms into two groups to reflect the difference in their tax status.[8] If a firm has positive taxable income or taxes payable, it is classified in Group HIGH, for firms with full marginal use of deductions.

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[8]Firms are classified on the basis of taxes payable or taxable income because the Compustat reported tax loss carryforward variable is not accurate for many firms. However, Cordes and Sheffrin [10] report that the firm's tax position has a high degree of continuity from period to period. Thus, firms classified in the low tax group in one year have a high probability of continuing in the same group next year.

If the firm has negative taxable income or taxes payable, it is classified in Group LOW, for firms with less than full marginal use of deductions. Thus, firms which could realize immediate tax savings from additional deductions are classified as low cost users of debt, while firms who must delay the realization of tax savings to future periods are considered high cost users of debt.

In all, 569 firms enter the reduced tax group at some point during the eleven year sample period. The number of firms entering the reduced tax group ranges from a low of 88 in 1973 to a high of 204 in 1970. On average, 155 firms are classified in LOW in each year. Of the 569 firms, 199 are classified in LOW in one year only; 100 of the firms are so classified in five or more years; 42 are classified in seven or more years, and 5 remain in the reduced tax group all eleven years. Thus, a number of firms remain and operate for extended periods of time in the reduced tax group. Further, certain industries frequent the reduced tax group more often as the airlines (4500), drilling (1300), metals (1000-1299), buildings (1400-1599) and lumber (2400) industries have the highest number of occurrences in the reduced tax group. Although some industries appear with greater frequency, all industries are represented in the reduced tax group, as each industry has a minimum of three firms in LOW.

Table 3 provides a profile of financial characteristics influential in determining a firm's tax paying status. Beyond the apparent differences in taxes payable between the groups, is the greater use of leverage and nondebt tax shields by reduced tax paying firms. This supports the previous finding of a positive relation between leverage and nondebt tax shield (NDTS), but the finding is not unexpected as high leverage and nondebt tax shields contribute to a firm's classification in LOW. Another factor contributing to the reduced

TABLE 3

COMPARISON OF FINANCIAL CHARACTERISTICS AFFECTING
TAX PAYING STATUS BETWEEN HIGH AND LOW MARGINAL TAX RATE FIRMS

	High Marginal Tax Rate Firms					Reduced Marginal Tax Rate Firms				
Variable	N[a]	MEAN	STD. DEVIATION	MINIMUM	MAXIMUM	N	MEAN	STD. DEVIATION	MINIMUM	MAXIMUM
Taxes Payable[b]	929	40.94	211.15	-2.31	4613.96	86	1.85	5.97	-2.51	48.98
Taxable Income[b]	929	88.93	374.70	-21.60	7118.18	86	-5.701	1.719	-6.466	-0.365
Interest Expense/Assets[c]	927	0.02	0.01	0.0	0.10	86	0.03	0.01	0.0	0.06
LEV	930	0.18	0.11	0.0	0.64	86	0.26	0.14	0.0	0.67
TLEV	930	0.24	0.13	0.0	0.66	86	0.35	0.15	0.02	0.73
NDTS	930	-0.12	0.06	-0.40	0.05	86	-0.02	0.07	-0.44	0.09
TS/A	930	0.05	0.03	0.0	0.22	86	0.06	0.04	0.02	0.23
ROA	930	0.17	0.06	-0.02	0.43	86	0.09	0.06	-0.06	0.25
ℓnSDCF	930	-3.12	0.66	-5.02	-0.361	86	-2.60	0.67	-4.41	-1.31
INTA	930	0.28	0.62	0.0	5.85	86	0.19	0.33	0.00	1.82

[a] - Table reports the averages of firm averages for each variable. The HIGH sample is composed of 930 firms fully paying tax in six or more sample years. The LOW sample contains the 86 firms with reduced taxes in five or more years with complete data for all variables.

[b] - For details of how Taxes Payable and Taxable Income are computed, see Appendix A.

[c] - Interest Expense/Asset is the ratio of interest expense to total assets; LEV is the ratio of long term debt to total assets, TLEV is the ratio of long term debt plus debt in current liabilities to total assets; NDTS is the ratio of accelerated depreciation plus ITC minus pretax operating income to total assets; TS/A is the ratio of accelerated depreciation plus ITC to total assets; ROA is the ratio of pretax operating income to total assets; ln(SDCF) is the natural log of the standard deviation of cash flow divided by total assets; INTA is the maximum (0, Market Value of Equity-Book Value of Equity/Total Assets).

tax paying classification is reduced profitability. Return on assets (ROA), measured as pretax operating income divided by total assets, averages 17.0 percent for fully tax paying firms and only 9.0 percent for reduced tax paying firms. However, ROA is an input to the variable NDTS, which can be decomposed as TS/A minus ROA, where TS/A is the dollars of accelerated depreciation and ITC relative to the firm's total assets. The variable TS/A averages 5.0 percent for high marginal tax rate firms and 6.4 percent for reduced marginal tax rate firms. While this difference is statistically significant, it is not as large as the difference between the group's return on assets. Thus, the data confirm that the differences in NDTS between HIGH and LOW group firms are largely associated, on average, with differences in profitability and not due to differences in depreciation expenses and investment tax credits.

IV. Trade Off between Leverage and Nondebt Tax Shields

Given the liberal carryforward and carryback provisions granted by the U.S. corporate code, a change in tax status for one year may not represent a significant economic change for the firm. Consequently, there is no need for the firm to change its capital structure in response to a temporary change in tax paying status. Therefore, to examine how differences in tax paying status affect capital structure, I limit the LOW group to the 100 firms who remain in the reduced tax group five or more years. Because these firms operate in a reduced tax state for a longer period of time, their capital structures are more likely to adjust to their low marginal tax rate status. In Table 4, I reestimate the coefficients of equation (1) for the HIGH and LOW groups using a single regression equation which tests for differences in the intercepts and slope coefficients between the groups. In order to provide as strong a contrast as possible, equation (2) estimates the LOW group in relation to 539

TABLE 4

REGRESSIONS OF EQUATIONS (2) AND (3) ON STANDARD DEVIATION OF CASH FLOWS, INTANGIBLE ASSETS, NONDEBT TAX SHIELDS AND INDUSTRY FOR HIGH MARGINAL TAX RATE FIRMS (DTAX = 1) AND REDUCED MARGINAL TAX RATE FIRMS (DTAX = 0)

DEPENDENT VARIABLE:	LEV		TLEV	
EQUATION	(2)	(3)	(2)	(3)
INTERCEPT	0.20 (8.99)	0.17 (5.83)	0.33 (12.60)	0.32 (10.07)
ln(SDCF)	-0.20 (-3.19)	-0.02 (-3.77)	-0.02 (-2.23)	-0.02 (-2.59)
INTA	-0.01 (-1.24)	-0.02 (-2.20)	-0.01 (-1.03)	-0.02 (-1.91)
NDTS	-0.19 (-0.81)		-0.15 (-0.58)	
TS/A		1.23 (4.12)		0.99 (2.96)
ROA		-0.55 (-6.52)		-0.71 (-7.57)
DTAX	0.01 (0.34)	-0.02 (-0.73)	-0.01 (-0.05)	-0.04 (-1.32)
NDTS*DTAX	0.87 (3.45)		0.99 (3.55)	
TS/A*DTAX		-0.10 (-0.58)		(-0.11) (-0.28)
R^2	0.34	0.34	0.37	0.36
N	624	624	624	624

LEV is the ratio of long term debt/total assets; TLEV is the ratio of long term debt plus interest bearing debt in current liabilities/total assets; ln(SDCF) is the natural log of the standard deviation of the first differences in cash flow scaled by total assets; INTA is the maximum [0, market value of equity-book value of equity/total assets]; NDTS is accelerated depreciation plus ITC minus pretax operating income/total assets; TS/A is accelerated depreciation plus ITC/total assets; ROA is pretax operating income/total assets. The variables are computed as average values for each firm from 1970-1980.

firms who pay tax in all eleven sample years.[9] In equation (2) below, a dummy variable, DTAX, is assigned a value of one if the firm is in the high marginal tax rate group, and zero otherwise. In addition, an interaction term, $TZ_i = DTAX_i \times NDTS_i$, is included to test whether the correlation between leverage and nondebt tax shield differs with respect to tax paying status. Thus, equation (2) (including the industry dummies) is:

$$LEV_i = \beta_1 + \beta_2 \ln(SDCF)_i + \beta_3 INTA_i + \beta_4 NDTS_i + \rho DTAX_i + \delta TZ_i + e_i \quad (2)$$

In equation (2) the coefficient of NDTS tests for the relation between leverage and nondebt tax shields for the low marginal tax rate group. The coefficients of NDTS are negative but not significant for either LEV or TLEV, suggesting that leverage and NDTS are largely unrelated among low tax paying firms. In contrast, the coefficients of TZ (NDTS*DTAX), testing for differences in the relation between nondebt tax shield and leverage between the groups, are positive and significant. Thus, the relation between leverage and nondebt tax shield is more positive for high marginal tax rate firms than it is for low marginal tax rate firms, which, at least in terms of direction, is supportive of the DeAngelo and Masulis hypothesis.

Because profitability (or lack thereof) differs markedly between the groups, NDTS is decomposed as TS/A and ROA which are estimated separately in equation (3). As in equation (2), an interaction term, $Z_i = DTAX_i \times TS/A_i$, is included to test whether the correlation between LEV and TS/A differs between low and high marginal tax rate firms. Including the industry adjustment, equation (3) is:

$$LEV_i = \beta_1 + \beta_2 \ln(SDCF)_i + \beta_3 INTA_i + \beta_4 TS/A_i + \beta_5 ROA_i + \rho DTAX_i + \delta Z_i \quad (3)$$

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[9] The results reported in Table 4 are also estimated in relation to 930 firms (HIGH) which fully pay tax in six or more years. The results in Table 4 are similar for both definitions of the high marginal tax rate group.

The coefficients of TS/A in equation (3) confirm that leverage and nondebt tax shields are positively correlated for both high and low marginal tax rate firms. With the effect of profitability better controlled in equation (3), the coefficient estimates of Z, the interaction terms (DTAX*TS/A), are not significant. This indicates, holding profitability constant, that the relation between leverage and the ratio of nondebt tax shield to total assets does not differ with respect to marginal tax rate.[10]

The lack of differential relation between leverage and TS/A observed between high and low marginal tax rate groups is strong evidence against the DeAngelo and Masulis hypothesis. For one reason, the industries occupying the low marginal tax rate group (drilling, mining, airline and building industries) receive favorable tax treatment of their business operations through depletion allowances, sale-leaseback arrangements and the completed contract method of accounting. Favorable tax treatment may explain why low marginal tax rate firms increase their use of nondebt or interest tax shields in relation to other firms as Table 3 showed. However, also evident in Table 3, are differences in profitability which could account for the higher use of nondebt (NDTS) and interest tax shields in the low marginal tax rate group as well. When profitability is held constant in equation (3), the increased use of nondebt tax shield is not accompanied by the reduced use of debt. Given that the low marginal tax rate group identifies firms with higher costs to additional excess tax shields, the lack of inverse trade off between leverage and nondebt tax shields indicates that the cost of postponing tax deductions

[10]To examine how sensitive the results are to measuring the dependent variable as an eleven year average, other specifications that measured leverage ratios annually or that examined the year by year changes in the leverage ratio were tried but with little effect on the results.

(even five or more years) is not high enough to cause firms to substitute nondebt tax shields for interest tax shields.

When profitability is separated from nondebt tax shields, the positive relation between leverage and nondebt tax shield is not as strong as that reported in Table 2. The coefficients of ROA, measuring the effect of profitability on leverage, are negative and highly statistically significant. This indicates that the firms with the highest return on assets have the lowest use of debt.[11] The strong negative relation between leverage and return on assets, when incorporated in the measure of NDTS, helps explain the strong positive relation observed between NDTS and LEV in Table 2 and previous studies.[12]

Further evidence that the differences between the groups do not result from tax considerations is examined with the DTAX variable in equations (2) and (3). The coefficient estimates of DTAX test for differences in the level of debt between high and low marginal tax rate firms. All else held constant, many theories of capital structure predict that firms with lower marginal tax rates should use less debt. In fact, the predicted negative relation between marginal tax rates and leverage is consistent with the implications of Miller

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[11] If a positive risk-return trade-off exists, such as the CAPM security market line posits, then it is possible that profitability is actually proxying for risk. Thus, the negative relation between ROA and LEV could be interpreted as high risk firms using less debt. To explore this possibility, I correlated ROA with two measures of risk, the beta coefficient of the firm and ln(SDCF). ROA was only weakly correlated with the either risk measure which suggests that ROA does not proxy for risk in this context.

[12] For example, Bradley, Jarrell and Kim [4] measure the firm's nondebt tax shield as the ratio of depreciation expense plus investment tax credits to pretax operating income. The negative relation between operating income and leverage will give a positive bias to the correlation between leverage and their measure of nondebt tax shield. Although they conjecture that the strong positive relation is due to 'securability', my results suggest that profitability is part of the explanation as well.

and Modigliani [18], Miller [17] and DeAngelo and Masulis [12], even though the models differ widely with respect to the size of the actual tax savings of debt. The coefficient estimates of DTAX in Table 4 show no predictable relation between the firm's marginal tax rate and leverage. The simple rank correlation between ROA and DTAX is 54 percent which suggests that the lack of significance for DTAX alone is not attributable to multicollinearity between profitability and tax paying status. Moreover, with industry, bankruptcy risk, nondebt tax shields and profitability held constant, the firm's marginal tax rate is not a significant determinant of its leverage ratio.

Overall, the results cast doubt on tax motivated explanations of capital structure. The positive relation between leverage and nondebt tax shield in the low marginal tax rate group and the lack of differential relation for LEV and TS/A between high and low marginal tax rate firms are evidence that the costs of postponed tax savings are not sufficient to cause firms to adjust their average levels of debt. If the postponement of tax savings for a number of years does not motivate firms to alter their debt ratios, then how important can the marginal tax savings of debt be as a determinant of leverage? The insensitivity of average debt ratios to changes in the firm's tax position suggests a reluctance on the firm's part to alter its capital structure. This reluctance may result because substantial costs (both direct and indirect) are associated with changes in financial structure. To date, the capital structure literature has not dealt extensively with the role of adjustment costs. The results of this study underscore the need to understand the institutional and economic costs associated with changes in capital structure.

V. Conclusions

This paper investigates whether the firm's debt decision is inversely related to the level of its nondebt or substitute tax shields. By concentrating on firms with negative taxable income, firms are identified which experience the loss of tax savings in the current period and possess a strong likelihood of losing tax benefits in the future. Relative to a sample of tax paying firms, these firms possess unusually high levels of leverage and nondebt tax shields. For a given firm, however, unusually high reliance on nondebt tax shields does not correspond with reduced leverage, contrary to the predictions of the DeAngelo and Masulis hypothesis.

Complicating all tax based explanations of capital structure is the strong negative relation documented between leverage and profitability. Further, when bankruptcy risk, profitability, nondebt tax shields and industry are held constant, marginal tax rate is not a significant determinant of a firm's leverage ratio. If marginal tax rate does not exert an independent influence on leverage separate from profitability, then the negative relation between profitability and leverage questions the role of the tax savings of debt in the firm's capital structure decision. In attempting to examine this issue, the results suggest directions for future work. First, the lack of response of 'historic' or average measures of leverage to differences in marginal tax rates suggests that adjustment costs may play a critical role in determining capital structure. Traditionally, the capital structure literature has downplayed the importance of adjustment costs in altering the firm's leverage ratio. However, if adjustment costs are high, firms in low tax rate positions may make other decisions, short of altering their leverage ratio or nondebt tax shield, to reduce the costs of nontax paying circumstances. Second, additional tests of the effect of taxes on capital

structure could be constructed to correlate tax position with the firm's choice of new funding via debt or equity. In this framework, adjustment costs would be factored into the decision to raise additional funds, and thus, the firm's choice of new debt or equity would include consideration of these costs. Work directed in either area will help provide a better understanding of the effect of taxes on capital structure.

References

1. Auerbach, A. and J. Poterba, 1986, Tax loss carryforwards and corporate tax incentives, working paper.

2. Baxter, N., 1967, Leverage, risk of ruin and the cost of capital, Journal of Finance 22, September, 395-403.

3. Bernard, V. and C. Hayn, 1984, Inflation and the distribution of the corporate income tax burden, working paper, University of Michigan, October.

4. Bradley, M., G. Jarrell and E. H. Kim, 1984, On the existence of an optimal capital structure: Theory and evidence, Journal of Finance 39, July, 857-878.

5. Brennan, M. and E. Schwartz, 1978, Corporate income taxes, valuation and the problem of optimal capital structure, Journal of Business 51, January, 103-114.

6. Boquist, J. and W. Moore, 1984, Inter-industry leverage differences and the DeAngelo-Masulis tax shield hypothesis, Financial Management, Spring, 5-9.

7. Bowen, R., L. Daley and C. Huber, 1982, Leverage measures and industrial classification: Review and additional evidence, Financial Management, Winter, 10-20.

8. Castanias, R., 1983, Bankruptcy risk and optimal capital structure, Journal of Finance 38, 617-635.

9. Chaplinsky, S., 1983, The economic determinants of leverage: Theory and evidence, unpublished Ph.D. dissertation, Univerity of Chicago, November.

10. Cordes, J. and S. Shefferin, 1983, Estimating the tax advantage of corporate debt, Journal of Finance 38, 95-105.

11. Danos, P. and E. Imhoff, Jr., 1983, Intermediate Accounting, Englewood Cliffs, N.J.: Prentice-Hall.

12. DeAngelo, H. and R. Masulis, 1980, Optimal capital structure under corporate and personal taxation, Journal of Financial Economics 8, 3-29.

13. Gaffney, D., et al., Wiley's Federal Income Taxation, New York: John Wiley & Sons, 1985.

14. Kim, E.H., 1978, A mean-variance theory of optimal capital structure and corporate debt, Journal of Finance 33, 301-319.

15. Kraus, A. and R. Litzenberger, 1973, A state preference model of optimal capital structure, Journal of Finance 28, September, 911-922.

16. Marsh, P., 1982, The choice between equity and debt: An empirical study, Journal of Finance 37, 121-142.

17. Miller, M., 1977, Debt and taxes, Journal of Finance 32, 261-275.

18. Miller, M., and F. Modigliani, 1963, Corporate income taxes and the cost of capital, American Economic Review 53, 433-443.

19. Moore, W., 1985, Securable assets and the firm's choice of capital structure, working paper, Indiana University, May.

20. Myers, S., 1984, The capital structure puzzle, Journal of Finance 39, 575-594.

21. Myers, S., and N. S. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, Journal of Financial Economics 13, 157-186.

22. Stickney, C., R. Weil and M. Wolfson, 1983, Income taxes and tax transfer leases: General Electric's accounting for a Molotov cocktail, The Accounting Review 58, 439-459.

Appendix A

Because income reported for financial statement purposes differs from income reported for tax purposes, adjustments are made to book income to approximate taxable income. Taxable income reported for tax purposes is approximated in the following manner.

Income before Extraordinary Items
+ Income Taxes (Federal, State & Local)
+ Minority Interest
Pre-Tax Accounting Income
- Deferred Taxes/0.48
= Taxable Income ± Permanent Differences

The sum of Income before Extraordinary Items, Income Taxes and Minority Interest is an estimate of the firm's pre-tax accounting income. To adjust for timing differences which account for the largest difference between pretax book and taxable income, Deferred Taxes/0.48 is subtracted from pre-tax accounting income to obtain taxable income.[1]

Taxable income is a reasonable approximation of the cash (nonaccrual) income subject to tax where the firm does not report large permanent

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[1]Two other adjustments to book income would improve the estimate of taxable income and they are, 1) Tax benefit of net operating loss carryforward, and 2) Gains/Losses reported in unconsolidated subsidiaries. Compustat reports data for tax loss carryforwards but, unfortunately, this variable is not accurate for many firms. The tax benefit of net operating loss carryforwards is usually reported in extraordinary or special items. The portion of special items that are carryforwards is obtainable only through the 10-K reports and footnote disclosures to the financial statements.

Many firms consolidate their subsidiaries for tax purposes but not for financial reporting purposes. Thus, firms can "bury" large losses for tax purposes in their financial statements. Unless the firm publishes information on its unconsolidated subsidiaries, the effect on taxable income is lost. In either case, the lack of these two adjustments means that more firms belong in the reduced tax rate group than are currently represented.

differences between pretax book and taxable income, which do not give rise to deferred taxes for financial reporting purposes.[2]

Permanent differences may be large in certain industries; thus, pretax book income may be positive due to large permanent differences, while the firm owes no current taxes. To capture the effect of permanent differences, taxes payable, is computed by subtracting deferred taxes from the firm's reported income tax expense. Since permanent differences are reported directly in tax expense, after adjustment for deferred taxes, taxes payable are the actual taxes owing in the current year. Accordingly, if a firm has nonpositive taxable income or taxes payable, it is classified in the reduced tax rate group.

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[2]Examples of permanent differences include municipal bond interest, dividends from domestic subsidiaries, undistributed earnings of subsidiaries and depletion. Since the finance industry is dropped from the sample, municipal bond interest is of small importance to this study. However, depletion will affect several industries. The depletion reported for tax purposes usually exceeds depletion reported for book purposes and, unlike depreciation, the excess is treated as a permanent difference.