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Debt Financing and Tax Status: Tests of the Substitution Effect and the Tax Exhaustion Hypothesis Using Firms' Responses to the Economic Recovery Tax Act of 1981

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ABSTRACT

This study tests the joint prediction of the substitution effect and the tax exhaustion hypothesis that an increase in non-debt tax shields leads to a decrease in leverage. Controls are introduced for the debt securability effect, the pecking order theory of financing, and the probability of losing tax shields. Using the relationship between changes in investment tax shields and changes in debt tax shields of firms in response to the Economic Recovery Tax Act of 1981, strong empirical support is found for predictions based on the substitution effect and the tax exhaustion hypothesis.

DEANGELO AND MASULIS (1980) DEMONSTRATE that as a firm's depreciation deductions increase, its demand for interest deductions declines, due to the increased probability that the firm will lose the immediate deductibility of tax shields if it does not reduce its debt. This is called the substitution effect.

MacKie-Mason (1990) recognizes that the substitution effect is more applicable to firms with a substantial probability of losing the deductibility of their tax shields. This tax exhaustion hypothesis is empirically supported by MacKie-Mason (1990) using firms' incremental financing choices between debt and equity.

The objective of this study is to jointly test the substitution effect and the tax exhaustion hypothesis using responses to a tax law change as the empirical framework. In a broader sense, this research can be seen to examine whether or not the firm's expected marginal tax rate affects its leverage decisions. The Economic Recovery Tax Act of 1981 (ERTA) provides a good empirical environment for these tests, since its major provisions with regard to corporations involve liberalized investment tax shield write-offs.[1]

Titman and Wessels (1988) and others document that fixed assets are used as collateral for corporate debt, i.e., a debt securability effect exists. Considering the debt securability effect in isolation, both debt tax shields and investment tax shields should increase as new assets are purchased.

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This research controls for the debt securability effect by partitioning sample firms into those with a great probability of losing the deductibility of tax shields and those with a low probability of shield loss. Since the substitution effect is not a concern for the second group of firms, their investment tax shields should be related to debt policy only through the debt securability effect. By using these firms to identify the debt securability effect, the substitution effect can be disentangled and separately identified for firms with a substantial probability of losing the deductibility of tax shields. The empirical results strongly support the predictions of the substitution effect and the tax exhaustion hypothesis.

Nearly all capital structure theories predict that changes in debt tax shields are less likely to be positive for more highly leveraged firms. As a result, the dependent variable used in this research, change in debt tax shields, is less likely to be positive for high-debt firms. To control for potential debt level effects, tests are repeated with controls for debt ratio. The results relating to debt securability, the substitution effect, and the tax exhaustion hypothesis are little changed.

This research differs from prior studies in that it examines the substitution effect using a tax law change that should affect the investment and financing decisions of a firm. This allows each firm to act as its own control and obviates the inclusion of many control variables that would be required in a static cross-sectional study.

Furthermore, years in which firms adjust to a tax law change offer a good opportunity to observe economic activities that are theorized to occur in frictionless markets. As described by Scholes and Wolfson (1988), these economic activities are often prevented in "normal" tax years due to transaction costs, but become efficient in response to a tax law change. The ERTA tax law change thus provides a good natural experiment to jointly test the substitution effect and the recent finding by MacKie-Mason (1990) that only firms with a substantial probability of tax shield loss are subject to the substitution effect.

The study proceeds as follows. Section I develops the models to be tested. Section II describes the relevant tax law changes. Section III reports the results of the empirical tests. Section IV analyzes the robustness of these results, and Section V summarizes the findings.

I. Theoretical Background and Model Specification

If a firm's depreciation deductions increase due to a tax law change, its demand for interest deductions declines, due to the increased probability that

[1] Individual tax rates on both interest and equity income decreased under ERTA. Measurement of the net effect on the demand for corporate debt is problematic, and it is difficult to identify marginal clientele tax rates (see Gordon and MacKie-Mason (1991) for an excellent discussion and empirical application). Thus, the effect of changes in individual tax rules is not examined, and the conclusions of this study are partial equilibrium statements.

the firm will lose the immediate deductibility of tax shields if debt is not reduced. In order to test this substitution effect, model (1) can be estimated:

$$DIFFINT = a_0 + B_1 * DIFFNDTS + e, \tag{1}$$

where *DIFFINT* is a measure of changes in debt tax shields in response to a tax law change, and *DIFFNDTS* is a measure of changes in investment tax shields in response to a tax law change. The substitution effect predicts a negative sign on B_1.

The debt securability effect arises from the fact that lenders can collateralize debt with fixed assets. Empirical support is offered by Titman and Wessels (1988) and MacKie-Mason (1990). A positive relationship between changes in debt tax shields and changes in investment tax shields is predicted by the debt securability effect, since an increased investment in fixed assets can be used to collateralize increases in debt. Since this would offset the substitution effect, the debt securability effect should be controlled for if the substitution effect is to be identified.

MacKie-Mason (1990) recognizes and empirically documents that only firms with a substantial possibility of losing the deductibility of tax shields consider the substitution effect. Therefore, in this paper firms are divided into two groups based on the probability of losing the deductibility of tax shields. Firms paying little or no taxes are assumed to have a substantial probability of losing this deductibility, while firms paying taxes at a high rate are assumed to have little risk of losing the advantages of tax shields. Since the debt securability effect is common to all firms with fixed assets, the effect estimated for those firms with little risk of losing the deductibility of tax shields can be used to control the same effect for firms with a substantial probability of tax shield loss. Then, the substitution effect can be isolated and empirically estimated for those firms facing a substantial probability of losing the benefits of tax shields:

$$DIFFINT = a_0 + a_1 * D + B_1 * DIFFNDTS + B_2 * D * DIFFNDTS + e, \tag{2}$$

where D is an indicator variable with $D = 1$ indicating firms with a high probability of losing the deductibility of tax shields and $D = 0$ indicating firms with a low risk of losing this deductibility.

In equation (2), B_1 measures the debt securability effect, which is common to all firms. Then, B_2 measures the substitution effect for firms with a substantial probability of losing the deductibility of tax shields. The sign on B_1 is predicted to be positive, while the sign on B_2 is predicted to be negative.

Three hypotheses suggest that the firm's debt ratio must be controlled in estimates of equation (2). According to the pecking order theory developed in Myers (1984), firms fund capital expenditures by first drawing down cash and other liquid assets, followed by the issue of riskless debt, risky debt, hybrid securities, and, as a last resort, common equity. Thus, it is predicted that firms with a high debt ratio issue more equity to finance capital expenditures than do firms with a lower debt ratio,[2] since highly leveraged firms are more likely to have exhausted their debt capacity.

Moreover, firms with high outstanding debt are more likely to have deviated above their value-maximizing debt ratio. In addition, the debt securability effect should be weaker for highly leveraged firms. A direct implication of these three factors for this research is that the dependent variable in equations (1) and (2), change in debt tax shields, is less likely to be positive for highly leveraged firms.

Further, this study uses a firm's effective tax rate to measure the probability of losing the deductibility of tax shields. Since debt ratio and effective tax rate are negatively related in the sample, debt ratio must be controlled for to assure that the substitution effect observed for low-tax firms is not merely an involuntary substitution effect caused by a firm's exhaustion of its debt capacity.

To control for these various debt-related effects, sample firms are divided into relative-to-industry high-debt and low-debt groups. For high-debt firms,[3] model (3) can be estimated:

$$DIFFINT = a_0 + a_1 * D + B_1 * DIFFNDTS + B_2 * D * DIFFNDTS + B_3 * DBTRAT + e, \quad (3)$$

where $DBTRAT$ is the firm's debt ratio. The coefficient B_3 is predicted to have a negative sign in tests using high-debt firms.

II. Relevant Tax Laws

On August 13, 1981, President Reagan signed into law the Economic Recovery Tax Act of 1981 (ERTA hereafter). ERTA replaced the pre-1981 depreciation system with the Accelerated Cost Recovery System (ACRS). The primary benefit of the new ACRS was the short lives allowed for depreciation purposes. Rules for taking the investment tax credit were also liberalized.

To stimulate spending for research and development (R & D), ERTA provided a new tax credit for R & D expenditures. The credit was equal to 25 percent of the excess of R & D expenditures in a given tax year over the average of annual R & D expenditures during a specified base period, limited to 12.5 percent of the current year's R & D expenditures.

ERTA introduced safe harbor leases in order to facilitate the transfer of the tax benefits of investment in new depreciable assets from corporations that could not currently use them to profitable corporations. Details of a typical safe harbor lease transaction are given in Shaw (1987).

[2] In this study, firms in the upper 25 percent of the 1979/1980 debt ratio distribution did issue significantly more equity as a percentage of capital expenditures in 1981/1982 than did firms in the lower 75 percent of this debt ratio distribution (0.0004 significance).

[3] Low-debt firms are not tested using equation (3), since the pecking order theory does not make clear predictions concerning the relationship between debt ratio and changes in debt tax shields for low-debt firms.

ERTA extended the number of years that a net operating loss could be carried forward from seven to fifteen years. Lastly, ERTA reduced tax rates on the first $50,000 of corporate taxable income. The maximum annual tax saving was $1,000.

III. Hypotheses, Sample Selection, and Test Results

The hypothesis to be tested is:

Hypothesis 1: *For firms facing a substantial probability of losing the immediate deductibility of tax shields, there was a negative relationship between changes in investment tax shields and changes in debt tax shields, both scaled by expected operating earnings,*[4] *after the passage of ERTA.*

An important issue for this study's tests is the time period over which to measure changes in tax shields. It is probable that firms responded to the investment stimuli offered by ERTA over several years, depending on general economic conditions, interest rates, and expectations about future tax law changes. At the same time, the use of several years to calculate the response to ERTA is undesirable since the extended time frame allows too many confounding factors to arise. As a reasonable compromise, changes in investment and debt tax shields are measured using changes from 1979/1980 to 1981/1982.

Change in investment tax shields is measured as (investment tax shields, 1981 + 1982/expected operating earnings, 1981 + 1982) minus (investment tax shields, 1979 + 1980/expected operating earnings, 1979 + 1980). Investment tax shields are defined as the sum of depreciation, investment tax credits, R & D credits, and lease expense.[5]

Depreciation is estimated as depreciation expense reported on the income statement, plus or minus grossed-up increases or decreases in the deferred taxes balance sheet account. This measure is used to account for the fact that depreciation expense for tax purposes differs from that reported in the financial statements and assumes that all timing differences between taxable income and financial accounting income, inferred from changes in the deferred taxes balance, arise from the use of different depreciation methods for tax purposes.

[4] Dammon and Senbet (1988) show that changes in investment tax shields and changes in debt tax shields should both be scaled by expected operating earnings. This controls for the fact that an increase in depreciation allowed due to changes in the corporate tax rules leads to an increase in a firm's taxable operating income, which in turn increases a firm's demand for interest deductions.

[5] Two other corporate provisions of ERTA are extended not operating loss (NOL) carryforwards and reduced corporate tax rates. The increase in the NOL carryforward period from seven to fifteen years is ignored on the assumption that the present value of tax benefits that might occur in years eight through fifteen is of a small magnitude. Reduced corporate tax rates are ignored in empirical tests since the maximum tax savings are $1,000 per year.

Investment tax credits (ITCs) are grossed-up by dividing the ITC in each time period by the maximum statutory corporate tax rate. Grossing-up of the credit is the correct procedure since a dollar of depreciation is less valuable than a dollar of credit.

The R & D credit is approximated as the lesser of (1) 25 percent times the difference between a firm's R & D expense and average R & D expense over the statutory base period, and (2) 12.5 percent times a firm's R & D expense. R & D credits are grossed-up by the maximum statutory corporate tax rate. Since the R & D credit was newly introduced under ERTA, the credit for 1979 and 1980 is zero.

Lease expense is considered an investment tax shield, since it is a substitute for depreciation expense for firms that choose to lease rather than buy plant, property, and equipment. Leasing tax shields are measured as net rental expense or income.

The measure of debt tax shields that most closely matches theory is the sum of interest expense in 1981 and 1982 minus the sum of interest expense in 1979 and 1980, both scaled by the sum of expected operating earnings.

Investment tax shields and debt tax shields are both scaled by expected operating earnings (see footnote 4). The sum of earnings before interest, taxes, and depreciation (EBITD) for 1979 and 1980 is chosen to represent expected operating earnings for the pre-ERTA test period. Based on evidence in Watts and Zimmerman (1986) that annual earnings are well described by a random walk, the sum of EBITD for 1979 and 1980 is chosen to also represent expected operating earnings for the post-ERTA test period. This surrogate is preferred over using actual post-ERTA EBITD as expected operating earnings, since these actual earnings are affected by many exogenous factors such as the general health of the economy.

The probability of losing tax shields is measured by a firm's effective tax rate, estimated as the sum of 1979 and 1980 federal, state, and foreign taxes paid divided by the sum of 1979 and 1980 earnings before taxes.[6] The sample firms are partitioned into two groups based on a selected effective tax rate cutoff. This cutoff is chosen so that observations with effective tax rates lower (greater) than the cutoff rate represent firms with great (little) risk of losing the deductibility of tax shields. The results reported in this research are based on coding firms in the lower 25 percent of the effective tax rate distribution as $D = 1$ and firms in the upper 75 percent of the effective tax rate distribution as $D = 0$.[7]

Pre-ERTA debt ratio is measured as the sum of 1979 and 1980 interest-bearing debt divided by the sum of 1979 and 1980 total assets. To estimate equation (3), the debt ratio distribution of each two-digit SIC industry is used

[6] Firms with negative earnings before taxes ($n = 47$) are coded as low-tax firms. If they are removed from the sample due to the difficulty of interpreting a tax rate variable with a negative denominator, reported test results are little changed.

[7] Also, the lower 25 percent/upper 50 percent (with firms between the lowest 25 percent and the median removed) and the lower 10 percent/upper 90 percent partitions of the effective tax rate distribution are used. Results are essentially identical for all three partitions.

to identify as high-debt firms those in the upper 25 percent of their industry's debt ratio distribution. The motivation for using industry-specific debt ratio distributions is that average debt ratios vary widely between industries.

The COMPUSTAT Primary/Supplementary/Tertiary Annual Files are used to obtain sample firms. Initially, 1921 firms other than banks, insurance companies, financial institutions, or real estate investment trusts are available for analysis. All firms with a fiscal year ending other than December 31 are removed in order to synchronize measurement of response to ERTA provisions. This reduces the sample size to 1135 firms. Firms with missing data required for the empirical tests are then removed, leaving 838 firms in the sample. Lastly, two firms are removed since they are extreme outliers.[8] This leaves 836 firms in the final sample. Table I reports descriptive statistics for the sample data.

Table II reports the regression results of testing Hypothesis 1 using equations (1) and (2). The estimated coefficient on the combined debt securability and substitution effects (B_1) using equation (1) is very positive (0.0001 significance). This confirms the findings of prior studies and is not surprising, since the debt securability effect common to all firms may dominate the substitution effect that is only applicable to low-tax firms.

To the extent that the debt securability effect is controlled by the research design of equation (2), B_2 represents the substitution effect for firms with a substantial probability of losing the deductibility of tax shields. The estimated coefficient on B_2 is negative and statistically significant at the 0.014 level. Furthermore, the estimated debt securability effect coefficient, when separated from the substitution effect, is significantly positive at the 0.0001 level. These results are consistent with the predictions of the substitution effect and the tax exhaustion hypothesis.[9]

Table III reports the results of estimating the model represented by equation (3) for firms in the upper 25 percent of their industry's 1979/1980 debt ratio distribution. The estimated debt securability coefficient (B_1) remains positive at the 0.0001 level in estimates of equation (3).

High-debt sample firms are initially partitioned based on coding firms in the lower 25 percent of the high-debt firms' own effective tax rate distribution as $D = 1$ and firms in the upper 75 percent of this effective tax rate distribution as $D = 0$ (column 2 of Table III). This partition of the data results in 49 firms being coded as low-tax ($D = 1$) and 148 firms being coded as high-tax ($D = 0$). While the point estimate of the substitution effect is similar to that reported for tests of all firms using equation (2), it is significant at only the 0.296 level.

This decreased significance level is likely due to the fact that high-debt firms are also generally low-tax firms (Pearson correlation coefficient of

[8] Specifically, the most negative value of the dependent variable excluding the two outliers is -0.244. The values of the dependent variable for the two outlier firms are -2.316 and -3.987.

[9] The intercept differences associated with the dummy variables are not readily interpretable, since they apply only to firms with no change in investment tax shields in response to ERTA.

Table I

Descriptive Statistics

This table reports descriptive statistics for the following variables. Change in Non-Debt Tax Shields (NDTS) is the change from 1979/1980 to 1981/1982 in depreciation plus grossed-up investment tax credits plus grossed-up R & D credits plus lease expense, divided by operating earnings. Change in Debt Tax Shields is the change from 1979/1980 to 1981/1982 in interest expense divided by operating earnings. Tax Rate is federal, state, and foreign taxes paid in 1979/1980 divided by earnings before taxes in 1979/1980. Interest Bearing Debt to Total Assets is interest bearing debt in 1979/1980 divided by total assets in 1979/1980. The Dummy Variable is coded $D = 1$ ($D = 0$) for firms in the lower 25% (upper 75%) of the 1979/1980 tax rate distribution. Sample firms are calendar-year COMPUSTAT P/S/T firms with data available in each of the years 1979 to 1982.

	Measures of Central Tendency ($n = 836$)		
Variable	Mean	Standard Deviation	Median
Change in non-debt tax shields 1979/80 to 1981/82	0.087	0.206	0.065
Change in debt tax shields 1979/80 to 1981/82	0.050	0.108	0.025
Tax rate 1979/1980	0.312	0.577	0.342
Interest bearing debt/total assets 1979/1980	0.274	0.156	0.269

	Pearson Correlation Matrix					
	Change Non-Debt Tax Shields	Change in Debt Tax Shields	Dummy Intercept	Dummy *Chg. Non-Debt Shields	Effective Tax Rate	Debt/ Total Assets
Change in non-debt tax shields 1979/80 to 1981/82	1.000	0.345 (0.0001)[a]	0.014 (0.695)	0.688 (0.0001)	0.033 (0.342)	0.114 (0.0009)
Change debt tax shields 1979/80 to 1981/82		1.000	0.150 (0.0001)	0.221 (0.0001)	−0.099 (0.004)	0.342 (0.0001)
Dummy intercept			1.000	0.262 (0.0001)	−0.628 (0.0001)	0.371 (0.0001)
Dummy*change NDTS				1.000	−0.136 (0.0001)	0.187 (0.0001)
Tax rate 1979/80					1.000	−0.239 (0.0001)

[a] p-Value (two-tailed) reported in parentheses.

−0.239 (0.0001 significance)). That is, relative to firms coded $D = 1$, firms coded $D = 0$ are intended to represent firms facing a small probability of tax exhaustion. In the sample of high-debt firms, the initial effective tax rate cutoff used, 0.072, may misclassify as $D = 0$ many firms that actually face a substantial probability of losing the benefits of tax shields.

Table II

Regression Results with No Control for 1979 / 1980 Debt Ratio

Equation (1) is a regression of the change from 1979/1980 to 1981/1982 in interest expense divided by operating earnings on the debt securability and substitution effect combined, measured as the change from 1979/1980 to 1981/1982 in depreciation plus grossed-up investment tax credits plus grossed-up R & D credits plus lease expense, divided by operating earnings.

Equation (2) is a regression of the change from 1979/1980 to 1981/1982 in interest expense divided by operating earnings on the debt securability effect measured as the change from 1979/1980 to 1981/1982 in depreciation plus grossed-up investment tax credits plus grossed-up R & D credits plus lease expense, divided by operating earnings; and on the substitution effect measured as Dummy Variable D times the change from 1979/1980 to 1981/1982 in depreciation plus grossed-up investment tax credits plus grossed-up R & D credits plus lease expense, divided by operating earnings. $D = 1$ ($D = 0$) for firms in the lower 25% (upper 75%) of the 1979/1980 taxes paid divided by earnings before taxes distribution. Sample firms are calendar-year COMPUSTAT P/S/T firms with data available in each of the years 1979 to 1982.

	Equation (1)	Equation (2)
Effective tax rate used to split sample		0.1505
Sample size	836	836
Model estimates:		
Intercept	0.035	0.022
	9.15	4.98[a]
	(0.0001)	(0.0001)[b]
Dummy intercept		0.043
		5.12
		(0.0001)
Debt securability & substitution effect combined	0.181	
	10.63	
	(0.0001)	
Debt securability effect		0.221
		9.31
		(0.0001)
Substitution effect		−0.082
		−2.47
		(0.014)
Adjusted R-Squared	0.118	0.144

[a] t-Score associated with coefficient.
[b] p-Value (two-tailed) associated with coefficient reported in parentheses.

Tests of equation (3) for high-debt firms are thus repeated using an effective tax rate cutoff of 0.235 (column 3 of Table III). This is the median effective tax rate for high-debt firms. This partition of the data results in 99 firms being coded as low-tax ($D = 1$) and 98 firms being coded as high-tax ($D = 0$). The estimated substitution effect coefficient is now significantly negative at the 0.023 level. These results add to the evidence that the probability of tax exhaustion matters. That is, the identification of those firms that face a substantial probability of losing tax shields is necessary to empirically observe the substitution effect.

Table III

Regression Results with Control for 1979 / 1980 Debt Ratio

Equation (1) is a regression of the change from 1979/1980 to 1981/1982 in interest expense divided by operating earnings on the debt securability and substitution effect combined measured as the change from 1979/1980 to 1981/1982 in depreciation plus grossed-up investment tax credits plus grossed-up R & D credits plus lease expense, divided by operating earnings.

Equation (3) is a regression of the change from 1979/1980 to 1981/1982 in interest expense divided by operating earnings on the debt securability effect measured as the change from 1979/1980 to 1981/1982 in depreciation plus grossed-up investment tax credits plus grossed-up R & D credits plus lease expense, divided by operating earnings; and on the substitution effect measured as Dummy Variable D times the change from 1979/1980 to 1981/1982 in depreciation plus grossed-up investment tax credits plus grossed-up R & D credits plus lease expense, divided by operating earnings; and on debt ratio measured as interest bearing debt in 1979/1980 divided by total assets in 1979/1980. In column (2), $D = 1$ ($D = 0$) for firms in the lower 25% (upper 75%) of the 1979/1980 taxes paid dividend by earnings before taxes distribution. In column (3), $D = 1$ ($D = 0$) for firms in the lower 50% (upper 50%) of the 1979/1980 taxes paid divided by earnings before taxes distribution. Sample firms are calendar-year COMPUSTAT P/S/T firms with data available in each of the years 1979 to 1982.

	Equation (1)	Equation (2)	Equation (3)
Effective tax rate used to split sample		0.072	0.235
Sample size	197	197	197
Model estimates:			
Intercept	0.061	−0.059	−0.060
	4.92	−1.32	−1.35[a]
	(0.0001)	(0.188)	(0.178)[b]
Dummy Intercept		−0.005	0.024
		−0.17	0.96
		(0.861)	(0.337)
Debt securability and substitution effect combined	0.313		
	7.55		
	(0.0001)		
Debt securability effect		0.342	0.405
		5.53	6.13
		(0.0001)	(0.0001)
Substitution effect		−0.086	−0.191
		−1.05	−2.30
		(0.296)	(0.023)
Debt ratio		0.286	0.252
		2.70	2.41
		(0.007)	(0.017)
Adjusted R-squared	0.222	0.243	0.258

[a] t-Score associated with coefficient.

[b] p-Value (two-tailed) associated with coefficient reported in parentheses.

The estimated slope coefficient on debt ratio (B_3), using either effective tax rate cutoff, is positive (0.017 significance or less) for high-debt firms. This last result does not support the prediction that firms with a high debt ratio are less likely to show an increase in debt tax shields following the enactment of

ERTA. It is possible that the estimated coefficient on B_3 indicates that highly leveraged firms "like" debt for unobservable reasons. Alternatively, firms with high outstanding debt may have inadequate cash flow to fund increased capital investment. This could drive these firms to issue debt to finance new capital investment.

IV. Sensitivity Analysis[10]

The regression models are estimated separately for firms receiving greater ERTA benefits and firms receiving lesser ERTA benefits. Empirical measures of variation in ERTA benefits received by industry are reported in Gravelle (1982). Mining, construction, transportation, communication, radio/TV, motor vehicles, aerospace, and electric, gas, and sanitary services are the industries that received greater investment tax shield benefits from ERTA. Agriculture, oil production, manufacturing, retail and wholesale trade, and non-residential services are the industries that received lesser benefits.

Using effective tax rate cutoffs that code firms in the lower 25 percent (upper 75 percent) of their own effective tax rate distribution as $D = 1$ (as $D = 0$), the estimated substitution effect coefficient of -0.145 (-0.108) for firms in industries receiving greater (lesser) ERTA benefits is significantly negative at the 0.008 (0.010) level. As predicted, the estimated substitution effect is slightly larger for firms experiencing a larger increase in investment tax shield benefits from ERTA.

Firms that take advantage of the safe harbor leasing provisions of ERTA by selling tax benefits to profitable firms would generally be low-tax firms. However, as shown in Shaw (1987), these firms would appear to behave as high-tax firms in their reported financial statements. Consequently, those firms in the original sample of 836 firms that are reported as sellers of tax benefits by Shaw (1985) ($n = 47$ firms) are classified as low-tax firms in estimates of equation (2). Test results are virtually unchanged from those reported in Section III.

Omer, Molloy, and Ziebart (1991) find evidence that the use of deferred tax expense reported on the income statement, rather than deferred taxes inferred from the balance sheet, can alter the results of empirical tests. The difference between deferred tax expense reported on the income statement and changes in the deferred tax liability reported on the balance sheet is caused by the fact that (1) current deferred tax liabilities are pooled with other current liabilities, (2) in an acquisition, the acquiring company may report increases in its deferred tax liability balance with no corresponding deferred tax expense, and (3) "tax cushion accounts that are established to provide a reserve for the potential permanent tax effects of future settlements [which] are often grouped together with deferred income taxes for

[10] All of the specifications of the model cannot be correct. Since t-tests of the model coefficients are conditional on the model being correctly specified, the reported t-scores and p-values should be viewed as descriptive statistics. I thank the referee for pointing this out.

balance sheet reporting" (Omer, Molloy, and Ziebart (1991), p. 62). Replacing deferred taxes inferred from the balance sheet with deferred tax expense from the income statement in tests of equations (2) has little effect on estimated coefficients or their significance.

V. Summary

This study examines the prediction of the substitution effect that there is a negative relationship between changes in investment tax shields and changes in debt tax shields in response to the investment tax shield provisions of the Economic Recovery Tax Act of 1981 (ERTA). This negative relationship is predicted since the increased investment tax shields offered by ERTA increase the probability of losing the immediate deductibility of debt tax shields if debt tax shields are not reduced. After controlling for the debt securability effect, the probability of losing tax shields, and debt ratio, a negative relationship between changes in the two classes of tax shields is observed for firms with a substantial probability of losing the deductibility of tax shields. This supports the substitution effect and offers confirmation of the tax exhaustion hypothesis of MacKie-Mason (1990).

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