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Debt, Leases, Taxes, and the Endogeneity of Corporate Tax Status

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ABSTRACT

We provide evidence that corporate tax status is endogenous to financing decisions, which induces a spurious relation between measures of financial policy and many commonly used tax proxies. Using a forward-looking estimate of *before-financing* corporate marginal tax rates, we document a negative relation between operating leases and tax rates, and a positive relation between debt *levels* and tax rates. This is the first unambiguous evidence supporting the hypothesis that low tax rate firms lease more, and have lower debt levels, than high tax rate firms.

MANY THEORIES OF CAPITAL STRUCTURE imply that, all else equal, the incentive to use debt financing increases with a firm's marginal tax rate due to the tax deductibility of interest expense (e.g., Modigliani and Miller (1963), DeAngelo and Masulis (1980)). Conversely, leasing models generally predict that firms with low marginal tax rates employ relatively more leases than do firms with high marginal tax rates. The logic behind the leasing prediction is that leases allow for the transfer of tax shields from firms that cannot fully utilize the associated tax deduction (lessees) to firms that can (lessors) (e.g., Myers, Dill, and Bautista (1976), Smith and Wakeman (1985), Ross, Westerfield, and Jaffe (1996)).

Despite these straightforward predictions, empirically testing for tax effects is difficult because a spurious relation exists between the financing decision and many commonly used tax proxies. Specifically, both interest expense and lease payments are tax deductible. Thus, a firm that finances its operations with debt or leases reduces its taxable income, potentially lowering its expected marginal tax rate. If not properly addressed, this endogeneity of the tax rate can bias an experiment in favor of finding a negative

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relation between leasing and taxes and against finding a positive relation between debt and taxes. We document that the endogeneity of the marginal tax rate is a very real problem that may confound the interpretation of tax-related effects in previous studies.

In this paper, we construct a direct measure of the corporate marginal tax rate (based on taxable income *before-financing*) that is not endogenously affected by financing decisions.[1] Using an experiment designed to correct for many of the confounding influences in previous studies, we document evidence consistent with the tax effects predicted by theories of debt and lease financing.

We believe that our leasing result is the first definitive evidence supporting the hypothesis that, all else being equal, low tax rate firms lease more than high tax rate firms. Indeed, most empirical work fails to find a negative correlation between leasing and the tax rate (e.g., Flath (1980), Ang and Peterson (1984), and Krishnan and Moyer (1994)), although some recent research does find a negative relation. Among the recent work, Barclay and Smith (1995) and Sharpe and Nguyen (1995) show that the level of leasing is positively correlated with a tax-loss carryforward dummy variable, where the existence of tax losses implies a low marginal tax rate.[2] We argue that their tax findings are difficult to interpret because they are largely based on the relation between taxes and capital leases, which are not necessarily classified as *true* (tax-advantaged) leases by tax authorities. Instead, capital leases are likely a mixture of *true* leases and *nontrue* leases (the latter are sometimes referred to as conditional-sales contracts and are treated as debt by the IRS). On the one hand, the findings by Barclay and Smith and Sharpe and Nguyen show a positive relation between the use of capital leases and tax-loss carryforwards, which seems to support the expected negative relation between leases and tax rates. On the other hand, their tax results may be spuriously caused by the endogeneity of corporate tax status because using leases or debt can lower a firm's observed tax rate.

In this study, we focus on operating leases, which are likely to be classified as *true* tax-advantaged leases by the IRS, in addition to using the before-financing measure of corporate tax status mentioned above. As predicted by the theory, we document a negative relation between a firm's use of operating leases and its marginal tax rate. We find little relation between a firm's use of capital leases and its tax status, which we interpret as evidence that

[1] In the terminology of Scholes, Wilson, and Wolfson (1990), our tax variable is a "but for financing" (or *before-financing*) marginal tax rate. It measures a firm's marginal tax rate net of all financing decisions. Our tax variable accounts for the endogeneity problem and also incorporates many features present in the tax code, such as tax-loss carryforwards and carrybacks, the investment tax credit, and the alternative minimum tax.

[2] The Barclay and Smith and Sharpe and Nguyen papers do not focus on tax issues but do include proxies for the marginal tax rate in their analysis. Instead, they focus on the priority structure of corporate liabilities and contracting cost incentives to lease, respectively. Sharpe and Nguyen examine both operating and capital leases. A recent paper by O'Malley (1996) finds that tax-exhausted firms, and similarly firms with substantial net operating losses, use leases to finance a relatively large share of their incremental investments.

capital leases are indeed a mixture of true and nontrue leases.[3] At the same time, we document another important empirical regularity, namely a positive relation between debt levels and the before-financing measure of the marginal tax rate.

The implications of our result confirming the positive relation between debt levels and taxes are twofold. First, we believe this is the first unambiguous evidence linking high debt *levels* with high tax rate firms. As such, it reconciles the tax findings found in studies of incremental debt policy with those from studies using debt levels, and provides important insight into what Myers (1984) calls "the capital structure puzzle." Many previous studies examining the correlation between debt levels (e.g., the ratio of long-term debt to firm value) and tax rates do not find a positive relation, possibly due to the endogeneity problem described above (e.g., see Titman and Wessels (1988), and Gaver and Gaver (1993)). Studies that do find a positive relation between debt usage and tax rates (such as MacKie-Mason (1990), Givoly et al. (1992), Rajan and Zingales (1995), and Graham (1996a)) examine *incremental* debt policy, thereby avoiding the spurious negative relation induced by the endogeneity of corporate tax status. Given the predictable tax effects documented in studies of incremental financing, the puzzle has remained as to why similar tax effects have not been found using cumulative measures of leverage such as debt *levels*. By using our before-financing tax measure, we avoid the endogeneity problem and document a positive relation between debt levels and tax rates.

The second contribution of documenting a positive correlation between levels of debt and tax rates is related to the leasing analysis. We are unable to directly investigate the effect of taxes on nontrue leases because they do not appear separately on corporate financial statements. However, because nontrue leases receive the same tax-treatment as debt contracts, the relation between nontrue leases and taxes should be identical to the relation between debt and taxes. At the same time, the effect of taxes on the use of true leases should be opposite that for debt. Our debt results thus provide a proper benchmark for evaluating the tax effects associated with leasing.

The organization of the remainder of the paper is as follows. Section I reviews the predicted relations between explanatory variables and financing policy. Section II describes data and measurement issues. Section III presents the empirical results, which include evidence that personal taxes affect corporate financing decisions. Section IV concludes with a brief summary and suggestions for future research.

I. Determinants of Leasing and Debt Policies

In this section we describe how tax and nontax incentives affect a firm's choice between debt and lease financing.

[3] Unfortunately, it is not possible to disaggregate a firm's capital leases into *true* and *nontrue* leases using publicly available financial statements.

A. Tax Incentives

Leasing is a financial transaction that separates the costs and benefits of ownership from the costs and benefits of asset use. In the presence of taxes, the ability to transfer ownership rights can create value for both parties in a leasing contract. Specifically, conventional wisdom holds that the leasing activity of a firm should be inversely related to its tax rate because leasing allows low tax rate firms to sell tax shields to high tax rate lessors, who value the tax benefits more highly. A portion of the savings generated from the sale of tax shields can be passed along to the lessee in the form of lower lease payments.[4]

In practice, the ability to transfer tax benefits is limited by tax authorities. The IRS classifies leases as *true* leases (tax transfers allowed) or *conditional-sales contracts* (hereafter *nontrue* leases: tax transfers not allowed). Unfortunately, the IRS classifications are not publicly available. In public financial statements, leases are classified as capital leases (on the balance sheet) or operating leases (off the balance sheet, but disclosed in footnotes). In many cases, the criteria that define a capital lease do *not* qualify the lease as a true lease under IRS law (the Appendix contains the criteria that define capital leases according to generally accepted accounting principles and the guidelines for tax qualification).[5] However, there are exceptions because it is common practice for a firm to maintain financial statements separate from tax reporting records. Therefore, a capital lease can qualify as a true lease if different assumptions are used in financial versus tax accounting; e.g., it is fairly easy to make different assumptions about the economic life of the asset, discount rate, residual value, and residual value guarantees (see Schallheim (1994)). Thus, capital leases are likely comprised of both true and nontrue leases. The tax and accounting guidelines suggest that operating leases are predominantly *true* leases.

A.1. Tax Incentives to Use True Leases

True leases allow the transfer of tax benefits from lessees to lessors. The lessor supplies the initial capital to purchase the asset and then rents the asset to the lessee. Models by Miller and Upton (1976) and Lewellen, Long, and McConnell (1976) show that, in a competitive leasing market, lease payments must be structured to compensate the lessor for the opportunity cost of capital plus the loss of value due to economic depreciation. This implies that the equilibrium single-period lease payment at time t can be expressed as

[4] This tax motivation for leasing is the basis for the examples presented in most corporate finance texts (e.g., see Brealey and Myers (1991) and Ross, Westerfield, and Jaffe (1996)). Myers, Dill, and Bautista (1976) and Lewis and Schallheim (1992) also provide models motivating the tax incentive to lease.

[5] Following FASB 13 guidelines, capital lease payments are divided into interest expense and capital lease amortization. The interest expense from capital leases is usually included as part of total interest expense in financial statements. For example, in COMPUSTAT the interest expense from capital leases is included as "interest capitalized" in annual data item 15 (interest expense), and the amortization is included in data item 14 (depreciation and amortization).

$$L_t = [E(r) + E(d)]A_t, \tag{1}$$

where A_t is the cost of the asset at time t, $E(r)$ is the expected rate of return on capital, and $E(d)$ captures the expected rate of economic depreciation. The expression for the lease payment can be further expanded to include any additional capital flows provided by, or tax subsidies provided to, the lessor (e.g., maintenance expenditures, investment tax credits, or accelerated depreciation).

Given the schedule of lease payments, Smith and Wakeman (1985) summarize the present value difference in the total tax bill between purchasing and leasing as

$$(T_0 - T_b)[(\text{Dep} + \text{Debt} + \text{Maint}) - (\text{Lease} + \text{Gain})], \tag{2}$$

where T_0 is the tax rate of the owner/lessor, T_b is the tax rate of the user/lessee, Dep is the present value of depreciation, Debt is the present value of the interest tax shields associated with borrowing to purchase the asset, Maint is the present value of expected maintenance costs if these expenses are covered by the lease, Lease is the present value of the lease payments, and Gain is the present value of the taxable capital gain from the eventual sale of the asset. Leasing by low tax rate firms ($T_b < T_0$) will produce net tax benefits when the present value of depreciation, interest expense, and maintenance costs exceeds the present value of lease payments and the capital gains from the eventual sale of the asset. Leasing by the low tax rate firm is favored when (i) the depreciation tax shield is received early in the lease term, (ii) the taxable gain on the sale of the asset is relatively small, (iii) larger lease payments occur later in the lease term, or (iv) the before-tax discount rate is high. Although it is possible to devise situations in which the high tax rate firm is the lessee, the conditions are atypical, such as a lease with large payments early in the term and depreciation tax shields occurring later in the term. In general, the tax guidelines for leasing (see the Appendix) and the use of accelerated depreciation schedules tend to favor conditions under which the low tax rate firm is the lessee.

A.2. Tax Incentives to Use Nontrue Leases or Debt

Tax-based theories of optimal capital structure predict a positive relation between the use of debt financing and the corporate marginal tax rate (e.g., Modigliani and Miller (1963), DeAngelo and Masulis (1980)). This well-known association follows directly from the fact that U.S. tax law favors debt through the tax deductibility of interest payments. Because nontrue leases do not allow the transfer of tax benefits, their tax treatment is identical to that for debt. Thus, we predict that the use of nontrue leases is positively related to a firm's tax rate. It is not possible to directly test for the effect of taxes on the use of nontrue leases because nontrue leases are not publicly available as a separate data item (they are included in the capital

Table I

Sign of the Predicted Tax Effects for Leasing Based on Accounting and IRS Classifications

True leases allow for the transfer of tax shields from firms that cannot fully utilize the associated tax deduction to firms that can; thus, the use of true leases is expected to be negatively related to a firm's tax rate. Nontrue leases do not allow for the transfer of tax shields because they are treated as debt by the IRS, and therefore their use is expected to be positively related to a firm's tax rate. As indicated by the classification rules in the Appendix, leases that have an accounting classification of operating leases are likely to be recognized as true leases by the IRS; thus, the use of operating leases is expected to be negatively related to a firm's tax rate. Capital leases are likely a mixture of true and nontrue leases, and hence the relation of their use to a firm's tax rate is ambiguous.

	IRS Classification		Accounting Classification	
	True Leases	Nontrue Leases	Operating Leases	Capital Leases
Relation to marginal tax rate	−	+	−	?

lease category). Instead, we use the estimated relation between taxes and debt as a benchmark for evaluating the effect of taxes on leasing behavior.

A.3. Summary of the Tax Incentives to Lease

Based on IRS classifications, the use of true leases should be negatively related to the firm's tax rate, and the use of nontrue leases, which are treated like debt, should be positively related. Unfortunately, the IRS classifications are not publicly available and hence we cannot directly estimate the relation between taxes and nontrue leases. Instead, we observe public financial statements that categorize leases as operating or capital leases. Operating leases should be predominantly true leases and hence we expect their use to be negatively related to the firm's tax rate. The expected relation between capital leases and taxes is ambiguous because capital leases are likely a mix of true and nontrue leases. The predicted relations between leasing intensity and the marginal tax rate, based on the accounting and IRS classifications, are summarized in Table I.

B. Financial Distress

A leasing contract represents a commitment to make a series of fixed payments over the life of the lease. Relative to debt, leasing contracts have high priority in bankruptcy (Krishnan and Moyer (1994), Barclay and Smith (1995)). Within bankruptcy, if the lease is affirmed by the court then the lessee is required to continue to make scheduled lease payments to the lessor, giving the lease priority on par with administrative expenses. In contrast, bankruptcy proceedings grant the debtor a stay on the payment of most other financial claims, including those of secured debtholders, until the bank-

ruptcy is resolved. Thus, a firm with a high probability of entering financial distress is likely to be able to ex ante arrange lease financing on more favorable terms than other forms of financing, such as issuing bonds. Therefore, firms likely to enter distress will have a greater proportion of deductible financing costs arising from leases, which we expect to detect as a positive relation between leasing and ex ante measures of financial distress. With respect to debt policy, the trade-off theory of capital structure suggests that firms will ex ante balance the tax benefits of debt against the expected costs of financial distress. This implies that, ceteris paribus, firms with higher ex ante expected costs of financial distress should use less debt.

Ex post, the occurrence of financial distress can potentially obscure the empirical relation between financial policy and taxes. As an illustration of how this might occur, consider a firm that was financially healthy when it issued debt, but that, due to exogenous factors, is presently experiencing financial distress. Because of the decline in equity value associated with distress, this firm will currently have a high observed debt ratio, as well as a low expected marginal tax rate (because of the loss carryback and carryforward provisions in the tax code). A similar argument applies to lease financing. Thus, we predict that distressed firms are likely to display an ex post positive relation between financial distress and measures of debt and leasing, thereby confounding our ability to detect tax effects. It is therefore important to control for ex post financial distress.

C. Contracting Costs

C.1. The Investment Opportunity Set

Myers (1977) argues that shareholders of a firm with risky fixed claims in its capital structure will potentially forgo positive NPV investments if project benefits accrue to the firm's existing bondholders. Myers suggests that the incentive to underinvest (resulting from the conflict between bondholders and stockholders) can be mitigated by reducing the amount of debt in the firm's capital structure, by including restrictive covenants in the debt contracts, or by shortening the maturity of the firm's debt obligations. Stulz and Johnson (1985) further suggest that these incentive problems can be reduced if the firm retains the ability to finance new investments with high priority claims, such as secured debt and leases.[6] These arguments suggest that firms with more growth options in their investment opportunity sets should have a lower proportion of fixed claims in their capital structure.

In their analysis of leasing, Sharpe and Nguyen (1995) suggest that leasing may economize on transaction costs for firms facing a high cost of external funds. They use several proxies to measure the severity of financial constraints facing the firm and find that, for the most part, these variables

[6] The asset substitution problem (e.g., Jensen and Meckling (1976)) suggests that the presence of debt may provide incentives to transfer wealth from bondholders to shareholders by increasing the risk of the firm's projects. Secured debt and lease financing can alleviate the asset substitution problem.

are related to leasing intensity in the manner predicted. We contrast their results and ours in Section III.

C.2. Collateral

The leasing contract, by definition, is tied to a specific fixed asset. Therefore, all else equal, firms that use more fixed assets in the production process should use more lease financing. We also expect to find a positive relation between the use of fixed assets and debt usage because, relative to intangible assets, fixed assets are more valuable in liquidation and hence support a higher debt capacity.

C.3. Regulation

Leasing can be disadvantageous for regulated firms. The return for utility shareholders is calculated from the firm's capital base. Operating leases do not count as part of the capital base. Capital leases may or may not "count" as part of the capital base depending on the application of accounting rules by state regulators or rate commissions. Debt does not have this problem; it always counts as part of the capital base. Therefore, we expect regulated firms to use less leasing and more debt.

Smith (1986) suggests that greater debt also prohibits regulators from transferring wealth from investors to customers. Alternatively, causation can run in the reverse direction, with regulated industries having more stable cash flows and, therefore, a lower probability of financial distress and commensurately more debt in their capital structure. Regardless of the direction of causality, we expect a positive correlation between debt and degree of regulation.

C.4. Firm Size

Size-based theories suggest that large firms are more likely to be debt financed than their smaller counterparts. This may be true because large companies are more diversified and, thus, have more stable cash flows. Additionally, large firms may be able to exploit economies of scale in issuing securities. Because of information asymmetries, smaller firms also are likely to face higher costs for obtaining external funds. Sharpe and Nguyen (1995) suggest that leases mitigate these information problems and provide lower financing costs. Thus, lease usage should be inversely related to firm size.

II. Data and Measurement Issues

A. Measuring Debt and Leasing Policies

Our data consist of all COMPUSTAT firms with SIC codes between 2000 and 5999 and cover the years 1981 through 1992. The full sample has 18,193 firm-year observations. To gauge debt policy we use the ratio of the book

Table II

Percentage of Firm-Years with Debt or Leases in Their Capital Structure

The sample consists of 18,193 firm-year observations for firms on COMPUSTAT with SIC codes between 2000 and 5999 over the period 1981 through 1992.

Long-Term Debt	Capital Leases	Operating Leases
88.1%	52.6%	99.9%

value of total long-term debt net of capital leases to the market value of the firm, where the market value of the firm is the book value of total assets minus the book value of equity plus the market value of equity plus the present value of operating leases.[7] Firm value thus includes the effect of operating leases, which are not reported on the balance sheet. The use of capital leases is recorded as the ratio of capital leases reported on the balance sheet to the market value of the firm. The use of operating leases is measured as the ratio of the present value of current-year rental expense plus rental commitments over the next five years (discounted at 10 percent) to the market value of the firm. Because this operating lease variable could be biased if different firms have different costs of lease capital, we also examine an alternative variable in which lease payments are discounted using the firm's average short-term borrowing rate as reported in COMPUSTAT. The short-term borrowing rate has many missing observations and reduces the sample size to 11,637 observations.[8] However, the use of this alternative measure (not reported) does not change the qualitative nature of our results. Because lease payments, like debt, represent a fixed payment obligation, it is also useful to examine the division of the firm's total fixed claims among debt and leases. To do so, we calculate the usage of debt and leases as a fraction of the firm's total fixed claims, where total fixed claims are defined as the book value of long-term debt plus the book value of capital leases plus the present value of operating leases.

Table II reports the fraction of observations for which each of the three financial instruments is employed. It is interesting that although only 53 percent of the firm-years report nonzero levels of capital leases, 88 percent have nonzero levels of long-term debt, and nearly all indicate usage of operating leases. The high incidence of operating leases reflects the fact that most firms lease at least some items, such as office equipment or automobiles. Panel A of Table III reports summary statistics for the financing variables. Long-term debt accounts for 14.2 percent of firm value on average;

[7] Similarly, the book value of the firm is measured by the book value of total assets plus the present value of operating leases.

[8] The average short-term borrowing rate for the sample is 9.6 percent, which is close to our choice of 10 percent for the discount rate.

Table III

Summary Statistics for Variables Associated with Debt and Leasing Policy

The sample consists of 18,193 observations for firms on COMPUSTAT with SIC codes between 2000 and 5999 over the period 1981 through 1992. Debt is the book value of total long-term debt net of capital leases. Capital leases are the book value of capital leases. Operating leases are current rental expense plus the present value of operating lease commitments for the next five years discounted at 10 percent. The market value deflator is defined as the book value of total assets minus the book value of equity plus the market value of equity plus the present value of operating leases. The fixed claim deflator is defined as the book value of long-term debt plus the book value of capital leases plus the present value of operating leases. The before-financing marginal tax rate is simulated based on income after depreciation but before interest expenses are deducted. ECOST is the standard deviation of the first difference in the firm's earnings before depreciation, interest, and taxes divided by the mean level of the book value of total assets multiplied by the sum of research and development and advertising expenses divided by assets. *Z*-Score is a modified version of Altman's (1968) *Z*-Score. OENEG is a dummy variable equal to one if the book value of common equity is negative. Market-to-book is the market value of the firm divided by the book value of the firm, where the book value of the firm is total assets plus the present value of operating leases. Collateral is equal to net property, plant, and equipment divided by the book value of total assets. Telephone dummy is equal to one if the firm is in the telecommunications industry through 1982 (SIC codes 4812 and 4813). Utilities dummy is equal to one if the firm is a gas or electric utility (SIC codes 4900–4939). Size is the natural log of the market value of the firm.

Panel A: Summary Statistics for Financial Policy Variables

Variable	Mean	Std. Dev.	Min.	Max.
Debt-to-value	0.142	0.134	0.00	0.84
Capital leases-to-value	0.016	0.037	0.00	0.54
Operating leases-to-value	0.080	0.086	0.00	0.74
Debt-to-fixed claims	0.524	0.316	0.00	1.00
Capital leases-to-fixed claims	0.063	0.123	0.00	1.00
Operating leases-to-fixed claims	0.412	0.308	0.00	1.00

Panel B: Summary Statistics for Explanatory Variables

Variable	Mean	Std. Dev.	Min.	Max.
Corporate Tax Rate Variable				
Before-financing marginal tax rate	0.331	0.143	0.00	0.46
Financial Distress Variables				
ECOST	0.008	0.089	0.00	11.10
Z-score	2.049	3.344	−202.14	150.30
OENEG	0.047	0.212	0.00	1.00
Contracting Costs Variables				
Market-to-book	1.444	1.251	0.19	67.32
Collateral	0.313	0.187	0.00	0.96
Telephone dummy	0.001	0.037	0.00	1.00
Utilities dummy	0.005	0.071	0.00	1.00
Size (log of firm value)	5.059	2.034	−1.38	11.78

capital and operating leases account for 1.6 percent and 8.0 percent of firm value, respectively. In the division of fixed claims among debt and leases, long-term debt represents 52.4 percent of total fixed claims on average; capital and operating leases account for 6.3 percent and 41.2 percent of fixed claims, respectively. On average, operating leases are a much more important part of firms' capital structures than are capital leases. This conclusion is further supported by noting that the mean dollar value of operating (capital) leases is $627,000 ($250,000) for the lowest operating-lease quintile of firms and $287,000,000 ($60,500,000) for the highest quintile. For ease of exposition our subsequent analysis focuses on the use of debt and leases as a fraction of firm value; however, in Section III we also discuss results for the division of fixed claims.

In the remainder of this section, we describe the variables we use to explain financing policy. The variable definitions and summary statistics for these variables are presented in Panel B of Table III.

B. Measuring the Corporate Marginal Tax Rate

As important as the marginal tax rate is to theories of financing policy, the task of constructing a tax variable is nontrivial because of the complexity of the tax code and the fact that corporate tax status is endogenous.

B.1. Endogeneity of Corporate Tax Status

Most empirical studies of capital structure regress some measure of a firm's debt (or leasing) ratio on several control variables, including a proxy for the firm's marginal tax rate. Unfortunately, many of the tax proxies used in the extant literature bias the experiment against finding the anticipated positive relation between the debt level and the corporate marginal tax rate (and in favor of finding the anticipated negative relation between leasing and taxes). One problem is that a firm's current debt and leasing positions are the cumulative result of many past financial decisions. Because most measures of tax status are affected by earlier financing decisions, these measures can induce a spurious relation between the measured debt or leasing position and the tax proxy. To see this, consider two firms with identical distributions of future cash flows, both of which are, prior to financing, in the highest marginal tax bracket. Suppose that one of the firms increases its debt level to the extent that, because of interest deductibility, its expected marginal tax rate declines; the reduction in the tax rate may occur because the firm moves to a lower tax bracket or because it is more likely to obtain a refund of taxes paid today (because it is more likely to experience a loss in the future).[9] In this case, the firm with a large amount of debt is associated with a low observed marginal tax rate, while the

[9] This is not a "general equilibrium" example in that we do not explain why two identical firms pursue different debt policies. The example is intended simply to clarify the endogeneity problem.

firm with no debt has a high marginal tax rate. A regression across these two firms of debt levels on a measure of the ex post marginal tax rate will produce a negative coefficient, opposite to the sign predicted by theory. We provide empirical evidence in Section III that is consistent with this description of the endogeneity problem.

B.2. Avoiding the Endogeneity Problem by Using Before-Financing Tax Rates

To avoid the problems that can be caused by the endogeneity of corporate tax status, the tax rate needs to be, in the words of Scholes, Wilson, and Wolfson (1992), "but-for financing" decisions. In addition, recent research indicates that tax status can be measured more precisely with a measure of the marginal tax rate that is both backward- and forward-looking (Shevlin (1987, 1990), Graham (1996a, 1996b)). We address both these concerns by using a version of Graham's simulated marginal tax rate.

Briefly, the simulated tax rate is calculated by assuming that taxable income follows a random walk with drift and forecasting a firm's taxable income eighteen years into the future (which makes the variable forward-looking in that it accounts for a fifteen-year net operating loss (NOL) carryforward period and an additional three years in which NOL and investment tax credit carrybacks can affect the tax bill in year $t + 15$). The present value of the total tax bill is then calculated from year $t - 3$ to year $t + 18$, with Moody's corporate bond yield used as the economy-wide discount rate. Next, the present value of the total tax bill is recalculated after adding one dollar to taxable income in year t. The difference between these two total tax bills represents an estimate of expected marginal taxes owed on an extra dollar of income or, in other words, the marginal tax rate. A total of 50 simulations (based on 50 separate forecasts of taxable income) are performed for each firm in each year, with the average across the simulations taken to represent the expected marginal tax rate for firm i in year t. The simulation procedure accounts for net operating loss carryforwards and carrybacks, the investment tax credit, and the alternative minimum tax.[10] In additional research on this topic, Graham (1996b) demonstrates that the simulated tax rate is a better proxy for the marginal tax rate than other variables that have been used in previous studies, such as a tax-loss carryforward dummy variable.

We adopt Graham's simulated tax rate, but modify the variable to account for the fact that we use cumulative measures of financial policy (i.e., levels of debt and leasing). In his study of incremental financing, Graham's (1996a) measure is "but-for" because he uses the lagged marginal tax rate (based on pretax income, *after* deductions for depreciation, interest and leasing expenses) to ex-

[10] The effects of net operating losses on the firm's marginal tax rate can be significant. For example, if a firm currently has NOL carryforwards that are expected to shield taxable income for five years (and ignoring alternative minimum tax considerations) earning an extra dollar of income today leads to an expected marginal rate of 21.7 percent, assuming a discount rate of 10 percent ($0.217 = 0.35/1.1^5$).

amine current-period debt policy.[11] Therefore, his tax rate is measured before the effect of the *current year's* financing decisions. In our study (and in many other capital structure papers), we examine cumulative financial policy, and therefore our before-financing tax variable must be measured before the effects of *aggregate* financing decisions. In particular, we examine the marginal tax rate that the firm faces after making the investment decision, but prior to making the lease versus purchase decision. To calculate our measure of before-financing tax status we begin with the firm's operating income after depreciation (including the depreciation component of the lease payment—see below), but *before* interest expenses are deducted. Thus, our tax rate reflects the firm's anticipated nondebt tax-shields, but not the additional tax-shields associated with the aggregate financing decision.

It is straightforward to determine taxable income before debt and capital lease financing by simply adding back interest expense to earnings before taxes. However, operating leases are represented in financial statements (and in COMPUSTAT) as "rental expense," a figure that aggregates the lessor's required rate of return on capital (analogous to interest expense had the asset been purchased) and the economic rate of asset depreciation.[12] Thus, there is no explicit accounting for the interest component of operating lease payments available to "add back" to earnings before taxes to determine income "but-for operating leases." Instead, using the relation from the leasing model of Miller and Upton (1976) from equation (1), we estimate the proportion of the lease payment attributable to the return on capital versus that for asset depreciation.

Assuming that economic depreciation is equal to depreciation for tax purposes, the dollar value of depreciation expense, D_t, is equal to $E(d)A_t$, where A_t is the cost of the asset and $E(d)$ is the expected rate of economic depreciation; therefore, the proportion of the lease payment attributable to depreciation is given by $D_t/L_t = 1/(E(r)/E(d) + 1)$. Assuming that the rate of depreciation is $E(d) = 20$ percent and that the cost of capital is $E(r) = 10$ percent, the proportion of the lease payment attributable to depreciation is two-thirds, implying that the remaining one-third is analogous to interest expense.[13] Thus, for firms with operating leases, we add back one-third of

[11] Plesko (1994) uses a but-for measure appropriate for examining incremental decisions. In his study of research and development limited partnerships, Shevlin (1987) uses the converse of the but-for approach. Shevlin examines the tax status of firms that funded research and development expenses via partnerships "as-if" they instead had used debt financing, and compares these firms to others that actually used debt financing.

[12] We thank Steven Sharpe for bringing this point to our attention.

[13] Schallheim et al. (1987) document that the average lease term is five years, which implies an average annual depreciation rate of approximately 20 percent, assuming straight line depreciation. The average short term borrowing rate for the firms in our sample is approximately 10 percent as reported in COMPUSTAT. In unreported sensitivity tests, we calculate alternative tax rates based on adding back (i) one-half of the rental payment as interest expense to taxable income, and (ii) not adding back any portion of the rental payment as interest expense. Our conclusions with respect to the tax incentives to lease and use debt financing are unchanged when we use these alternative tax variables.

the firm's rental expense to earnings before taxes (in addition to adding back any interest expense from debt and capital lease financing, as mentioned above) as our proxy for earnings after depreciation, but prior to the lease versus purchase decision. This measure of earnings is the basis for the simulations of the firm's marginal tax rate.

The simulated tax rate is "but-for" in our context because it measures the tax incentives a firm faces after making the investment decision but before choosing between leasing or purchasing with debt financing; that is, our tax rate measures the marginal benefit of additional tax shields arising from the tax deductibility of interest expense (or from lease payments). This measure of the tax rate should be largely free of the endogeneity problems described above.[14]

The before-financing marginal tax rate ranges between 0 to 46 percent in our sample, with an average of 33.1 percent and a standard deviation of 14.3 percent (see Panel B of Table III). As a basis for comparison, and to provide some initial evidence on whether the endogeneity problem described above is empirically important, we also calculate a simulated marginal tax rate based on operating income *after* depreciation and interest expense. The average value of the after-financing marginal tax rate is 27.0 percent (the standard deviation is 15.6 percent), significantly lower than the before-financing measure of the marginal tax rate. As shown in Figure 1, there is substantial cross-sectional and time-series variation in both tax variables, with the distribution for the before-financing rate (Panel A) containing more mass at higher values than the distribution for the after-financing rate (Panel B).

C. Nontax Variables Used to Explain Debt and Leasing Policies

C.1. Financial Distress

To gauge the ex ante expected costs of financial distress (*ECOST*), we interact a measure related to the coefficient of variation of the firm's earnings (to proxy for the likelihood of financial distress) with the firm's level of asset intangibility (to proxy for the proportion of firm value likely to be lost in liquidation). To measure the coefficient of variation in earnings, we use the standard deviation of the first difference in the firm's historical earnings before depreciation, interest, and taxes (*EBDIT*) divided by the mean level of the book value of total assets as a proxy for the level of earnings.[15] We gauge asset intangibility by the sum of research and development (R&D) and

[14] The tax variable is measured before the interest component of debt and lease financing. It is not free of all decisions that can endogenously affect and be affected by tax status (and that may be intertwined with the debt and leasing decisions), such as entering into a research and development partnership. Our tax measure also assumes that the relative importance of nondebt tax shields remains unchanged in the future.

[15] We divide by the mean level of assets rather than the mean level of earnings to circumvent the problem in interpreting the coefficient of variation when the mean level of earnings is negative. In general, the level of earnings and the level of book assets are positively correlated. This measure of earnings variability is also used by MacKie-Mason (1990).

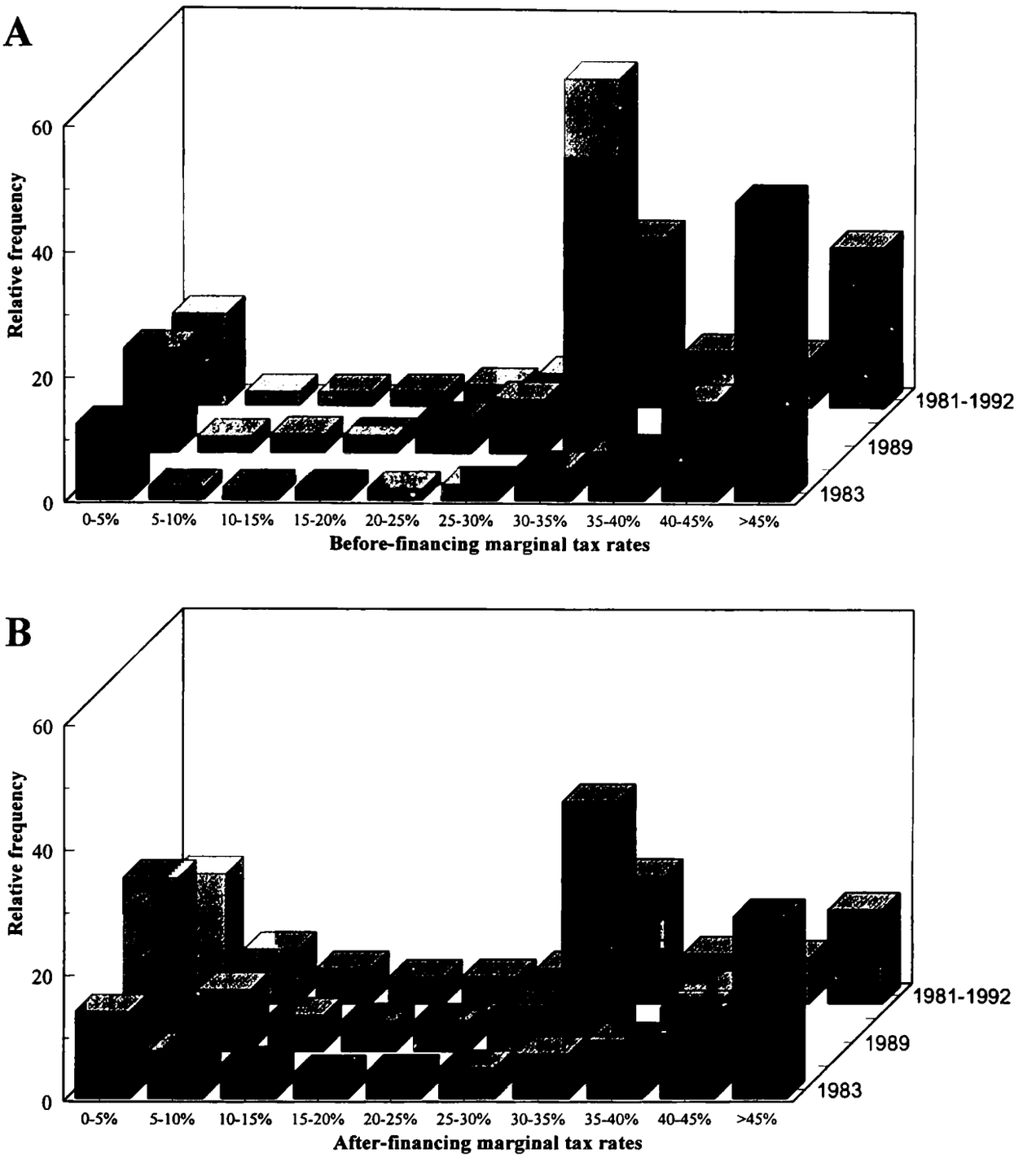

Figure 1. Histograms for simulated marginal federal corporate income tax rates. These histograms show the distribution of marginal tax rates for 1983, 1989, and an aggregation across all years 1981 to 1992. The before-financing tax rates in Panel A are based on taxable income before financing expenses are deducted. The after-financing tax rates in Panel B are based on taxable income after financing expenses are deducted, and are therefore endogenously affected by the choice of financing.

advertising expenses divided by assets. (Our results are unchanged when we measure asset intangibility as one minus the proportion of fixed assets.) In constructing this ex ante measure of financial distress, we require that a firm has at least five nonmissing observations for *EBDIT* prior to

the year in which it appears in the sample (so that we can calculate the standard deviation of the change in earnings). The rationale for using this measure is that both the variance and the level of earnings determine the likelihood of financial distress, and that intangible assets are likely to lose most of their value in liquidation. The trade-off theory predicts that firms with higher expected costs of financial distress will use less debt and, therefore, we predict a negative relation between *ECOST* and the level of debt. Because leased assets have relatively high priority in bankruptcy proceedings, we expect the proportion of lease financing to increase with expected costs of distress, and hence be positively related to *ECOST*. The mean value of *ECOST* for the sample is 0.008 and the standard deviation is 0.089.

We use two measures of ex post financial distress. One is the contemporaneous value of a modified version of Altman's Z-score,[16] the other is a dummy variable (*OENEG*) set equal to one if the book value of common equity is negative. A large value of *Z-Score* indicates a low level of financial distress. The second variable proxies for firms that are likely to have experienced prolonged distress. We expect the debt and leasing ratios to be negatively related to *Z-score*, and positively related to *OENEG*. The *Z-Score* averages about 2.0 for all firm-year observations, and there is a very large dispersion around this number (standard deviation of 3.3). Approximately 5 percent of the firm-years in our sample report book value of owners' equity of less than zero (*OENEG* = 1).

C.2. Contracting Costs

We use the *market-to-book* ratio as our proxy for the firm's investment opportunity set, which we expect to be negatively related to both debt and leasing intensity. Among others, Smith and Watts (1992), Barclay and Smith (1995), and Rajan and Zingales (1995) use market-to-book as a measure of investment opportunities. Regulated firms are expected to use more debt and less lease financing and we measure regulation with a dummy variable equal to one for firms in regulated industries. Following Barclay and Smith (1995), we define regulated industries as telecommunications (SICs 4812 and 4813) through 1982, and gas and electric utilities (SICs 4900–4939). We measure *collateral* as net property, plant, and equipment divided by total

[16] Our measure of the *Z-score* is given by

$$3.3\,\frac{\text{EBIT}}{\text{Total Assets}} + 1.0\,\frac{\text{Sales}}{\text{Total Assets}} + 1.4\,\frac{\text{Ret. Earnings}}{\text{Total Assets}} + 1.2\,\frac{\text{Working Capital}}{\text{Total Assets}}.$$

Altman's (1968) Z-score also includes the ratio of market value of equity to book value of debt. We do not include this variable because a similar term enters our regression separately as a measure of the investment opportunity set, as well as in the dependent variable of the debt equation. MacKie-Mason (1990) first uses the modified Z-score.

assets, and we expect both debt and leases to be positively related to this measure of fixed asset usage.[17]

The average market-to-book ratio for all firm-year observation is 1.44, with a standard deviation of 1.25. The percentage of sample firm-years in regulated industries is small, with only 0.1 percent of the firm-year observations coming from the telecommunications industry and 0.5 percent from utilities. Fixed assets (i.e., *collateral*) constitute 31.3 percent of total assets with a standard deviation of 18.7 percent.

We define firm size as the natural logarithm of the market value of the firm.[18] The mean size of firms in the sample is 5.06 (or without taking the natural logarithm, $1,366 million), with a standard deviation of 2.03 ($5,557 million). Larger firms are expected to use more debt financing while smaller firms are more likely to use leases.

C.3. Other Control Variables

Several researchers have documented industry effects associated with debt and leasing policy. For example, Bradley, Jarrell, and Kim (1984) document persistent interindustry differences in leverage ratios, even after controlling for other explanatory variables. Ang and Peterson (1984) show that the use of capital leases also varies across industries, and Sharpe and Nguyen (1995) document interindustry differences in the use of operating leases. To control for industry effects in our regressions, we include dummy variables for each one-digit SIC code grouping. Additionally, because of the change in the tax code due to the 1986 Tax Reform Act, we include two dummy variables in our regressions to control for time series variation in financial policies related to the change in the tax code that are not captured perfectly by our estimated tax rate variable. The first tax reform dummy is set equal to one in 1986, and equal to zero otherwise; the second dummy variable equals one for the years 1987–1992, and equals zero otherwise.[19]

III. Results

A. Univariate Results

In Panel A of Table IV we report correlations between our measures of financial policy and the explanatory variables. The largest correlations are those between the marginal tax rate and size, and those involving the ex

[17] Presuming that operating leases are tied to fixed assets, we examine an alternative definition of collateral by adding operating leases to both the numerator and denominator of the variable. The unreported results using this definition are qualitatively identical to those reported in the text.

[18] Our results are essentially unchanged if we use total book assets (adjusted for operating leases), or total sales as a measure of firm size.

[19] Our results are essentially unchanged if we use two-digit SIC code groupings to define industries, or if we use annual dummies for all years.

Table IV

Pearson Correlation Coefficients for Variables Associated with Debt and Leasing Policy

The correlations in Panel A are based on 18,193 observations for firms on COMPUSTAT with SIC codes between 2000 and 5999 over the period 1981 through 1992. Debt-to-value is defined as the ratio of the book value of total long-term debt net of capital leases to the market value of the firm, where market value is the book value of total assets minus the book value of equity plus the market value of equity plus the present value of operating leases. Capital leases-to-value is the ratio of the book value of capital leases to the market value of the firm. Operating leases-to-value is the ratio of current rental expense plus the present value of operating lease commitments for the next five years discounted at 10 percent to the market value of the firm. The before-financing marginal tax rate is simulated based on income after depreciation but before interest expenses are deducted. ECOST is the standard deviation of the first difference in the firm's earnings before depreciation, interest, and taxes divided by the mean level of the book value of total assets multiplied by the sum of research and development and advertising expenses divided by assets. *Z*-score is a modified version of Altman's (1968) *Z*-Score. OENEG is a dummy variable equal to one if the book value of common equity is negative. Market-to-book is the market value of the firm divided by the book value of the firm, where the book value of the firm is total assets plus the present value of operating leases. Collateral is equal to net property, plant, and equipment divided by the book value of total assets. Size is the natural log of the market value of the firm. The correlations in Panel B are based on 18,190 observations for no dividend, 18,193 observations for cash flow-to-sales and average tax rate, and 16,146 observations for large tax-loss carryforward and small tax-loss carryforward. No dividend is a dummy variable equal to one if the firm does not pay dividends. Cash flow-to-sales is the ratio of earnings before interest, depreciation, rent, and taxes to sales, and is truncated at zero. Large tax-loss CF is a dummy variable equal to one if the book value of tax-loss carryforwards is greater than the firm's earnings before interest, depreciation, and taxes. Small tax-loss CF is a dummy variable equal to one if the book value of tax-loss carryforwards is less than or equal to the firm's earnings before interest, depreciation, and taxes. Average tax rate is the ratio of tax expense to pretax income. The variable is truncated so as to fall between zero and one, is set equal to zero for all firms with nonpositive tax expense, and is set to one for firms that have positive taxes and negative pretax income.

Panel A. Simple Correlations of Financial Policy and Explanatory Variables

Variable	Market-to-Book	Size	Collateral	Marginal Tax Rate	*Z*-Score	OENEG	ECOST
Debt-to-value	−0.214*	0.100*	0.225*	0.017*	−0.052*	0.096*	−0.038*
Cap. leases-to-value	−0.110*	−0.015	0.245*	0.091*	0.067*	−0.008	−0.021*
Op. leases-to-value	−0.190*	−0.209*	0.015	−0.083*	0.047*	0.025*	0.007
Market-to-book	—	0.046*	−0.086*	−0.120*	−0.365*	0.141*	0.299*
Size (in firm value)		—	0.356*	0.306*	0.154*	−0.082*	−0.074*
Collateral			—	0.131*	0.009	−0.038*	−0.039*
Marginal tax rate				—	0.375*	−0.273*	−0.096*
Z-score					—	−0.292*	−0.574*
OENEG						—	0.074*
ECOST							—

Panel B. Simple Correlations between Explanatory Variables Used in This Study and Those Used by Sharpe and Nguyen (1995)

Variable	Market-to-Book	Size	Collateral	Marginal Tax Rate	*Z*-Score	OENEG	ECOST
No dividend	0.076*	−0.514*	−0.257*	−0.425*	−0.224*	0.194*	0.065*
Cash flow-to-sales	0.118*	0.405*	0.264*	0.465*	0.118*	−0.137*	−0.049*
Large tax-loss CF	0.109*	−0.369*	−0.174*	−0.604*	−0.414*	0.300*	0.224*
Small tax-loss CF	−0.045*	0.047*	−0.011	0.083*	0.021*	−0.036*	−0.017*
Average tax rate	−0.058*	0.170*	−0.012*	0.257*	0.143*	−0.044*	−0.045*

*Statistically significant at the 1 percent level.

post financial distress measures. As argued in Section II, these correlations highlight the need to control for financial distress in the empirical tests, and also suggest that firms with tax incentives to lease may also have nontax reasons. Nevertheless, the simple correlations between the marginal tax rate and both operating leases and debt are significant and have the predicted signs.

In Panel B we report correlations between our explanatory variables and those used by Sharpe and Nguyen (1995) (except that we do not examine their measure of debt rating). Note that our tax measure is highly correlated with the variables used to proxy for asymmetric information costs by Sharpe and Nguyen (no dividend and cash flow-to-sales).[20] Our tax variable is also highly correlated with their large tax-loss carryforward, but less correlated with their measure of the average tax rate.[21] These results are consistent with our contentions that (i) we use a more precise measure of the marginal tax rate than has been employed in previous leasing research, and (ii) firms with the largest tax-related leasing benefits are also the firms likely to use leasing to attenuate high contracting costs. Thus, we view our findings as complementary to those of Sharpe and Nguyen.

To provide some initial evidence on whether capital leases are a debt-like financing instrument, Table V presents a two-way classification of the mean values of our financial policy variables based on the usage of debt and capital leases. Firms that use no debt or use no capital leases have higher market-to-book ratios, smaller size, higher expected costs of financial distress, and lower marginal tax rates.[22] The debt results are consistent with the trade-off theory of capital structure. The capital leasing results mirror those for debt, suggesting that capital leases and debt are similar financial instruments. Firms with no debt use operating leases more intensely than firms with debt (which is consistent with the hypothesis that debt and leases are substitutes), while the opposite relation holds between capital leases and operating leases.

B. Capital Structure Regressions

B.1. Determinants of Financial Policy

In Table VI, we present results from pooled time-series cross-sectional censored (Tobit) regressions of the capital structure measures on the explanatory variables. The dependent variables in these regressions are the value of

[20] For *no dividend*, Sharpe and Nguyen use a dummy variable equal to one for nondividend-paying firms; for cash flow, they use operating income before interest, depreciation, rent, and taxes (truncated at zero).

[21] Sharpe and Nguyen estimate the *average tax rate* as tax expense divided by pretax income (truncated to fall between zero and one). The ratio is set equal to zero for all firms with nonpositive tax expense, and is set to one for firms that have positive taxes and negative pretax income. The *large* and *small tax-loss carryforward* are dummy variables indicating whether the amount of the tax-loss carryforward exceeds operating earnings (high) or not (low).

[22] The result that firms with capital leases have higher marginal tax rates than those without differs from the finding of Krishnan and Moyer (1994), who find no difference in *average* tax rates across leasing and nonleasing firms.

Table V

Two-way Classifications for the Use of Debt and the Use of Capital Leases

The samples consist of 18,193 observations for firms on COMPUSTAT with SIC codes between 2000 and 5999 over the period 1981 through 1992. Debt-to-value is defined as the ratio of the book value of total long-term debt net of capital leases to the market value of the firm, where market value is the book value of total assets minus the book value of equity plus the market value of equity plus the present value of operating leases. Capital leases-to-value is the ratio of the book value of capital leases to the market value of the firm. Operating leases-to-value is the ratio of current rental expense plus the present value of operating lease commitments for the next five years discounted at 10 percent to the market value of the firm. The before-financing marginal tax rate is simulated based on income after depreciation but before interest expenses are deducted. ECOST is the standard deviation of the first difference in the firm's earnings before depreciation, interest, and taxes divided by the mean level of the book value of total assets multiplied by the sum of research and development and advertising expenses divided by assets. *Z*-score is a modified version of Altman's (1968) *Z*-Score. OENEG is a dummy variable equal to one if the book value of common equity is negative. Market-to-book is the market value of the firm divided by book value of the firm, where the book value of the firm is total assets plus the present value of operating leases. Collateral is equal to net property, plant, and equipment divided by the book value of total assets. Size is the natural log of the market value of the firm.

Panel A: Sample Means of Variables Based on Usage of Debt

Variable	No Debt (N = 2,171)	With Debt (N = 16,022)
Debt-to-value	0.000	0.161
Capital leases-to-value	0.008	0.017
Operating leases-to-value	0.094	0.078
Before-financing marginal tax rate	0.253	0.341
ECOST	0.023	0.006
Z-score	1.122	2.175
OENEG	0.074	0.043
Market-to-book	2.044	1.362
Collateral	0.190	0.330
Size (log of firm value)	3.698	5.244

Panel B: Sample Means of Variables Based on Usage of Capital Leases

Variable	No Capital Leases (N = 8,612)	With Capital Leases (N = 9,581)
Debt-to-value	0.133	0.150
Capital lease-to-value	0.000	0.030
Operating lease-to-value	0.074	0.085
Before-financing marginal tax rate	0.314	0.345
ECOST	0.010	0.006
Z-score	1.823	2.253
OENEG	0.058	0.037
Market-to-book	1.558	1.341
Collateral	0.276	0.346
Size (log of firm value)	4.726	5.359

Table VI

Censored (Tobit) Regressions of Financial Claims as a Fraction of Firm Value

The table summarizes the results from three separate pooled time-series cross-sectional regressions. The value of the financial claim as a fraction of the firm's total market value is used as the dependent variable in each regression where total market value is defined as the book value of total assets minus the book value of common equity plus the market value of common equity plus the present value of operating lease commitments over the next five years. The before-financing marginal tax rate is simulated based on income after depreciation but before interest expenses are deducted. ECOST is the standard deviation of the first difference in the firm's earnings before depreciation, interest, and taxes divided by the mean level of the book value of total assets multiplied by the sum of research and development and advertising expenses divided by assets. Z-score is a modified version of Altman's (1968) Z-Score. OENEG is a dummy variable equal to one if the book value of common equity is negative. Market-to-book is the market value of the firm divided by book value of the firm, where the book value of the firm is total assets plus the present value of operating leases. Collateral is equal to net property, plant and equipment divided by the book value of total assets. Telephone dummy is equal to one if the firm is in the telecommunications industry through 1982 (SIC codes 4812 and 4813). Utilities dummy is equal to one if the firm is a gas or electric utility (SIC codes 4900–4939). Size is defined as the natural log of the market value of the firm. One-digit SIC code industry dummies and year dummies for 1986 and 1987 through 1992 are included. The sample consists of 18,193 observations for firms with SIC codes between 2000 and 5999 over the period 1981 through 1992. p-values are in parentheses.

Variable	Debt-to-Value	Capital Leases-to-Value	Operating Leases-to-Value
Intercept	0.1205	0.0135	0.2068
	(0.0001)	(0.0001)	(0.0001)
Before-financing marginal tax rate	0.0740	−0.0037	−0.0339
	(0.0001)	(0.3317)	(0.0001)
ECOST	−0.1032	0.0260	0.0626
	(0.0001)	(0.0007)	(0.0001)
Z-score	−0.0118	0.0005	0.0005
	(0.0001)	(0.0399)	(0.0439)
OENEG	0.0741	0.0018	0.0036
	(0.0001)	(0.4330)	(0.2014)
Market-to-book	−0.0549	−0.0069	−0.0127
	(0.0001)	(0.0001)	(0.0001)
Telephone dummy	0.0728	−0.0679	−0.0643
	(0.0074)	(0.0001)	(0.0001)
Utilities dummy	0.0706	−0.0350	−0.0652
	(0.0001)	(0.0001)	(0.0001)
Collateral	0.1269	0.0793	0.0074
	(0.0001)	(0.0001)	(0.0301)
Size (log of firm value)	0.0081	−0.0006	−0.0088
	(0.0001)	(0.0169)	(0.0001)
Dummy for SIC codes 2000–2999	0.0139	−0.0250	−0.0814
	(0.0001)	(0.0001)	(0.0001)
Dummy for SIC codes 3000–3999	−0.0010	−0.0251	−0.0851
	(0.6994)	(0.0001)	(0.0001)
Dummy for SIC codes 4000–4999	0.0155	−0.0256	−0.0313
	(0.0011)	(0.0001)	(0.0001)
Dummy for 1986	0.0016	−0.0130	0.0015
	(0.6841)	(0.0001)	(0.4909)
Dummy for 1987–1992	0.0027	−0.0210	0.0103
	(0.2428)	(0.0001)	(0.0001)
R^2 from OLS regression	0.130	0.143	0.253

claims in each class expressed as a fraction of total firm value. Although the statistical significance is likely to be overstated because of serial dependence in the error terms (which we address in Section *B.2*), the results are very supportive of the tax hypothesis. Specifically, operating leases are negatively related to the tax variable (p-value of 0.0001), and debt usage is positively associated with the firm's marginal tax rate (p-value of 0.0001). The relation between capital leases and the marginal tax rate is negative and not statistically significant (p-value of 0.3317). More importantly, the absolute value of the coefficient on the tax rate for capital leases is more than eight times smaller than the tax coefficient for operating leases. Our results indicate that a change in the marginal tax rate from 0 to 46 percent will, on average, result in a 19.6 percent increase in the firm's debt-to-value ratio, a 17 percent decrease in the firm's ratio of operating leases to firm value, and a 5.1 percent decrease in the ratio of capital leases to firm value.[23]

Finding a positive relation between debt levels and tax rates helps resolve "the capital structure puzzle" (Myers (1984)). Myers states that he "knows of no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy. I think the wait for such a study will be protracted" (p. 588). Starting with MacKie-Mason (1990), and continuing with Givoly et al. (1992), Rajan and Zingales (1995), and Graham (1996a), empirical research has demonstrated that taxes have predictable, material effects on a firm's *incremental* debt policy; until now, however, this effect had not been documented unambiguously in studies of debt *levels*. Our debt result provides the first evidence that high tax rate firms have high debt levels. We provide evidence in Section B.3 consistent with the hypothesis that our ability to document the positive relation between debt levels and taxes follows because we use before-financing tax rates, thereby avoiding the endogeneity problem.

The operating lease result is the first definitive evidence that low tax rate firms lease more than high tax rate firms. The tax findings for leasing are consistent with the hypothesis that operating leases are predominantly true leases but that capital leases are a mix of both true and nontrue leases. With respect to the latter implication, the finding that debt levels are positively related to the tax rate implies that, due to their identical tax treatment, the use of nontrue leases is positively related to the corporate marginal tax rate; thus, if capital leases are a combination of true and nontrue leases, their estimated relation with tax rates should lie between the debt and operating lease results, as documented.

Our measure of the ex ante expected costs of financial distress (*ECOST*) is negatively related to debt usage, thus supporting the trade-off theory of capital structure. The use of both operating and capital leases is positively related to the expected costs of financial distress, which is supportive of the notion that firms with large expected costs of financial distress are likely to

[23] The percentage change in the dependent variable is calculated as the Tobit-adjusted change in the dependent variable associated with a change in the tax rate, divided by the sample mean of the dependent variable.

finance with leases. Debt is associated with the ex post financial distress variables (*Z-Score* and *OENEG*) in the manner expected, which confirms our prediction that firms in financial distress are likely to have high debt ratios because of the deterioration in equity value. The evidence about the relation between leases and ex post financial distress is inconclusive.

Consistent with the contracting cost hypotheses, the findings in Table VI show that the use of all three financial instruments is negatively related to growth opportunities (market-to-book) and positively related to asset tangibility (collateral). The use of debt is positively correlated with regulation and size, while both capital and operating leases are negatively related. The latter result supports the notion that regulated firms have incentives to build up their capital base and that leases may not "count" in these rate-base calculations.

In line with the findings of previous studies, all three financial policy variables exhibit significant interindustry differences. The level of capital leases appears to decline in the post-tax-reform period, and the use of operating leases increases during this time period. We detect no significant ceteris paribus change in the use of debt over the sample period.

B.2. Robustness of Tax Results

Our previous results (in Table VI) are based on the division of total market value into debt and leasing. As a robustness check, we estimate regressions similar to those in Table VI, but use the value of claims in each class as a fraction of the book value of total assets as the dependent variables. The inferences from these regressions are qualitatively identical to those reported in Table VI, and strongly support the tax hypothesis.

Because the lease versus purchase decision is generally motivated by a comparison between debt and lease financing, some leasing models investigate the division of fixed claims into debt and leasing. Tax hypotheses from these models predict that low tax rate firms should have a greater proportion of their fixed claims in the form of operating leases; high tax rate firms should have a greater proportion of their fixed claims in the form of debt. To explore this proposition, we estimate regressions similar to those in Table VI, but use the value of claims in each class as a fraction of total fixed claims as the dependent variables. The signs and statistical significance levels of the tax and ex ante financial distress variables in these regressions are qualitatively identical to those reported in Table VI.[24]

To address the issue of autocorrelated errors we perform year-by-year cross-sectional regressions (not tabulated) for each of the financial policy vari-

[24] In the book value and total fixed claims analyses, the use of operating leases is positively related to market-to-book. This suggests that firms with more growth opportunities use more operating leases. Alternatively, this finding could reflect induced correlation between the dependent variables and market-to-book. Details of the book value and fixed-claims analyses are available from the authors upon request.

ables.[25] The results from the cross-sectional regressions are similar to those in Table VI. As a fraction of firm value, the relation between operating leases and the tax rate is negative in 11 of the 12 years, and 8 of the 11 negative coefficients are statistically significant at the 10 percent level. The relation between debt and the tax rate is positive in 10 of the 12 years, and 8 of the 10 positive coefficients are statistically significant. The coefficient on the tax variable in the capital leasing regressions is negative in 10 of the 12 years, and two of the negative coefficients are statistically significant. The results using the book value of assets as the deflator are similar. When expressed as a fraction of fixed claims, the relation between operating leases and the tax rate is negative and statistically significant in 11 of the 12 years, and the relation between debt and tax rate is positive and significant in 11 of the 12 years. The coefficient on the tax variable in the capital leasing regressions is negative in 11 of the 12 years, and four of the negative coefficients are statistically significant.

For each set of year-by-year regressions, we test whether the time-series mean of the tax coefficients is different from zero (analogous to Fama and MacBeth (1973)), using a t-test corrected for first-order autocorrelation. Although the tests are based on only 12 observations, the findings support those documented above. For operating leases, the time-series mean of the tax coefficients is negative and different from zero at the 1 percent level or better in all specifications. For debt, the mean is positive and different from zero at the 5 percent level. For capital leases, the mean is negative and is significantly different from zero at 5 percent, but the magnitude is quite small (-0.008 as a fraction of firm value).

Income volatility affects both the benefits (tax rates) and costs (e.g., expected bankruptcy costs) associated with debt and lease financing. For example, firms with volatile income streams typically have low expected marginal tax rates and relatively high probabilities of financial distress. Our tax and distress cost measures are designed to capture the direct effects of volatility on the benefits and costs of financial policy. Nevertheless, to ensure that our results are not driven by any unmeasured effect of volatility, we estimate regressions identical to those in Table VI, except the new regressions include an extra term measuring the volatility of income (and in separate regressions, the coefficient of variation of volatility). The results are qualitatively identical to those shown in Table VI. The conclusions are also unchanged in regressions estimated separately for each quintile of income volatility.

We also investigate whether personal taxes affect the use of debt. (We do not consider the effect of personal taxes in our leasing analysis. Most theoretical

[25] As an alternative method of controlling for serial correlation, we also estimate a between-firms regression in which the time series means of the variables for each firm are treated as a single observation. The results are very similar to those reported in Table VI and provide strong support for the tax hypotheses for debt and operating leases. However, the coefficient on the tax rate for capital leases becomes positive and marginally significant, which is consistent with the tax incentives for capital leases being more like those for nontrue leases than for true leases, on average.

models do not incorporate the effect of personal taxes, and those that do only include their effect on lease payments through the lessor's debt decision (Lewis and Schallheim (1992)). The theories of Miller (1977) and DeAngelo and Masulis (1980) imply that some portion of the corporate tax advantage of interest deductions is offset at the personal level. To test for the effect of personal taxes, we replace the marginal tax variable in the specification reported in Table VI with a variable defined as $(1 - T_{\text{personal}})/(1 - T_{\text{capital gains}})(1 - T_{\text{corporate}})$, where T_{personal} is inferred from the difference between the one-year yield on municipal and taxable bonds, as published in Salomon Brother's Bond Market Roundup. The results (not tabulated) from this alternative specification are qualitatively identical to those shown in Table VI, except that the tax variable is more significant in the sense that it has a "larger t-score," which is consistent with the hypothesis that personal taxes matter. The results in Table VI are reported using just $T_{\text{corporate}}$ as an explanatory variable to allow for a more direct comparison between the debt and leasing regressions.

B.3. The Endogeneity of Corporate Tax Status

Next we conduct an experiment to explore whether the tax variable is endogenous to the financing decision. In two separate specifications, we regress the financial policy variables on our control variables and two alternative measures of the marginal tax rate, both of which are endogenously affected by the firm's past financing decisions.[26] The first measure is a simulated tax variable based on operating income *after* interest deductions (i.e., the *after-financing* marginal tax rate). This is the tax rate used in Graham (1996a) to examine incremental financing decisions. The second measure is a non-NOL carryforward dummy variable equal to one when a firm does not have book tax-loss carryforwards (and is also an after-financing decision variable). A version of the second measure of tax status is used in many studies including Barclay and Smith (1995) and Sharpe and Nguyen (1995). The signs of the estimated coefficients for the tax variables are summarized in Table VII. The top row of the table reviews the results from Table VI for the before-financing tax rate.

With respect to debt policy, the estimated coefficient on the after-financing tax rate is negative, as is the coefficient on the non-NOL carryforward variable, and both are significantly different from zero. In contrast to results using the before-financing tax measure, both of these variables have incorrect signs based on the theoretical relation between debt and taxes. This

[26] The concept of whether a tax variable is "endogenous" is specific to the experiment. For example, the after-financing simulated rate and NOL dummy are endogenous for our specification because we examine cumulative financing choice. If we were instead to lag the variables and study incremental financing choice, the tax measures would not be endogenous. One of the points of our paper is that many past studies of capital structure have (i) examined aggregate financing choices, and (ii) failed to document the expected sign on the tax coefficient. We provide evidence in the text implying that the failure to document tax effects in the past may have been due to inappropriate measurement of tax status, that is, the use of endogenously affected tax rates.

Table VII

Estimated Relations between Measures of Financial Policy and Alternative Tax Variables

The table summarizes the estimated relations between the three measures of financial policy and alternative tax variables from a total of nine separate censored (Tobit) regressions. The value of the financial claim as a fraction of the firm's total market value is used as the dependent variable in each regression. The before-financing marginal tax rate is simulated based on income after depreciation but before interest expenses are deducted. The after-financing marginal tax rate is simulated based on income after depreciation and interest expenses are deducted. The Non-NOL carryforward is a dummy variable equal to one when the firm does not have book tax-loss carryforwards. Each regression also includes the following control variables (not shown): ECOST is the standard deviation of the first difference in the firm's earnings before depreciation, interest, and taxes divided by the mean level of the book value of total assets multiplied by the sum of research and development and advertising expenses divided by assets. *Z*-score is a modified version of Altman's (1968) *Z*-Score. OENEG is a dummy variable equal to one if the book value of common equity is negative. Market-to-book is the market value of the firm divided by book value of the firm, where the book value of the firm is total assets plus the present value of operating leases. Collateral is equal to net property, plant, and equipment divided by the book value of total assets. Telephone dummy is equal to one if the firm is in the telecommunications industry through 1982 (SIC codes 4812 and 4813). Utilities dummy is equal to one if the firm is a gas or electric utility (SIC codes 4900–4939). Size is the natural log of the market value of the firm. One-digit SIC code industry dummies and year dummies for 1986 and 1987 through 1992 are included. The sample consists of 18,193 observations for firms with SIC codes between 2000 and 5999 over the period 1981 through 1992. *p*-values are in parentheses.

Variable	Debt-to-Value	Capital Leases-to-Value	Operating Leases-to-Value
Before-financing marginal tax rate	0.0740	−0.0037	−0.0339
	(0.0001)	(0.3317)	(0.0001)
After-financing marginal tax rate	−0.1327	−0.0434	−0.0642
	(0.0001)	(0.0001)	(0.0001)
Non-NOL carryforward dummy variable	−0.0212	−0.0091	−0.0155
	(0.0001)	(0.0001)	(0.0001)

finding supports our hypothesis that measuring income after interest deductions induces a spurious negative relation between debt usage and after-financing tax rates.

With respect to both capital and operating leases, the after-financing tax coefficients have the same signs as those in the debt regressions. For example, the relation between capital leases and the after-financing tax rate is negative and significant. We argue that the capital leasing result is difficult to interpret because it could be caused by (i) the endogeneity of corporate tax status (i.e., the use of capital leases, whether they are classified as true or nontrue leases by the IRS, lowers the after-financing tax rate, biasing the regression coefficient downward), (ii) by the expected negative relation between taxes and true leases (to the extent that capital leases are classified as true leases), or (iii) a combination of both reasons. Similarly, a portion of the negative relation between operating leases and after-financing tax rates

could be spuriously induced (because the tax deductibility of rental expense can lower a firm's marginal tax rate); the fact that the coefficient on the after-financing tax rate is more negative than the coefficient on the before-financing tax rate is consistent with this hypothesis. These results are consistent with the notion that corporate tax status is endogenous, but also that the problem can be avoided through careful measurement of tax variables.[27] We believe that using the before-financing simulated tax rate allows us to unambiguously confirm the expected relations between debt, leases, and tax rates.

IV. Conclusion

We provide evidence consistent with theory regarding the relation between debt policy, leasing policy, and taxes. Using a forward-looking measure of firms' marginal tax rates before financing decisions, we show that the corporate marginal tax rate is positively related to debt usage, but negatively related to the use of operating leases. Our results for capital leases are less clear regarding the tax effect, suggesting that capital leases represent a mixture of *true* leases and *nontrue* leases. One possible direction for future research is to document the tax status of capital leases directly. In the process of testing for tax effects, we find that corporate tax status is endogenous to financial policy and argue that tax incentives must therefore be measured carefully. We also find that (i) the propensity to lease (use debt) increases (decreases) with the expected costs of financial distress, (ii) the use of leases and debt are consistent with contracting cost explanations of financial policy, and (iii) personal taxes affect debt financing decisions.

Appendix: Accounting and Tax Rules for Leases

Definition of Capital and Operating Leases

Following is a brief list of the accounting rules that define capital and operating leases. *Statement of Financial Accounting Standards (SFAS) No. 13* provides the detailed criteria for a lease contract to be specified as a capital or operating lease. Four criteria apply to lessees; a capital lease is defined as a lease that meets any one or more of the four criteria.

(1) **Transfer of Ownership.** If the lease agreement transfers ownership to the lessee before the lease expires, without payment of additional compensation to the lessor, the lease is considered a purchase financing arrangement, similar to an installment purchase.

(2) **Bargain Purchase Option.** The lessee can purchase the asset for a bargain price when the lease expires. A bargain purchase option requires comparing the option's purchase price to the leased asset's expected residual

[27] An unreported Hausmann test provides statistically significant evidence consistent with the after-financing tax rate being endogenous to the financing decision. Details are available from the authors upon request.

value at the maturity of the lease. If the purchase option is well below the expected residual value, the lessee is not expected to pass up the savings, and the probability is high that the lessee will buy the asset at maturity.

(3) **75 Percent of Economic Life.** The lease lasts for at least 75 percent of the asset's expected economic life. A bargain renewal option, an option to renew the lease at a rental rate below the expected fair market rental at the time of the exercise of the option, is considered to lengthen the lease life used in this determination.

(4) **90 Percent of Asset's Value.** The present value of the minimum lease payments is at least 90 percent of the asset's fair value. The minimum lease payments is defined by *SFAS No. 13* to mean "the payments that the lessee is obligated to make or can be required to make in connection with the leased property." Of course, the minimum lease payments consist mainly of the periodic payments. However, minimum lease payments also include such items as the bargain purchase option or bargain renewal option payments. Some leases contain additional provisions that are included as minimum lease payments such as a guaranteed residual value by the lessee or a penalty payment for failure to renew if it is expected that the renewal option will be rejected by the lessee.

IRS Guidelines for True Leases

The IRS set forth six guidelines for advance rulings to determine true ownership and lease validity. A lease satisfying these requirements is called a true lease, but is also known as a "guideline" lease or a tax-oriented lease. If the lease does not satisfy the IRS guidelines, it is classified as a conditional-sales contract.

Guideline (1): Minimum At-Risk Requirement. This guideline requires that at inception and throughout the lease term the lessor must have an investment equal to at least 20 percent of the total acquisition cost of the property. The investment made is considered to be only the consideration paid and personal liability of the lessor. The lessor must have net worth sufficient to cover such obligation. This investment must be unconditional, with no provisions for return, although provisions for reimbursement from outside groups for failure of the equipment to meet quality standards is permissible. The investment must be maintained at all times throughout the lease term with the sum of the lease payments to be made never to exceed the excess of the initial investment over the 20 percent minimum investment plus the cumulative pro rata portion of the projected profit.

Guideline (2): Minimum Estimated Residual Value. The second requirement is that the leased property must have a reasonably estimated residual value equal to at least 20 percent of the initial cost of the property at the end of the lease term. The lease term is defined to include any extension periods except those before which the lessee may renegotiate rental payments.

At the beginning of the lease, the lessor can obtain an appraisal confirming the estimated residual value of 20 percent or more of cost at the end of the lease term. For pricing purposes, the lessor might use a residual value of

less than 20 percent on the basis of liquidation value or quick sale price, for example. However, this fact, if it applies, does not invalidate the 20 percent estimated residual value for tax purposes.

Guideline (3): Minimum Remaining Life for Asset. The third requirement for advanced ruling states that the remaining life of the property at the end of the lease term equal the longer of one year or 20 percent of its originally estimated life. The Internal Revenue Service requires that representations that these requirements have been met be made by the lessor.

Guideline (4): No Bargain Purchase Option. There may also be no bargain purchase option (for any member of the lessee group) nor may there be any requirement that any party purchase the property at any price. To prove the validity of the lease the lessor must be required to dispose of the property at the end of the lease term, thus bearing the risk of ownership. In similar fashion, the lessee is restricted from providing any of the cost of the property or the cost of any improvements made to such property (with the exception of those readily removable from the property or routine maintenance). If the lease does not prohibit the lessee from paying for improvements then the lessor must recognize as income the value of such improvements.

Guideline (5): No Loan from Lessee to Lessor. The fifth requirement for advance ruling purposes is that no member of the lessee group may loan the lessor the money necessary to purchase the leased property nor may they guarantee loans the lessor incurs to purchase such property. This does not preclude other members of the lessee group from guaranteeing the performance of the lessee.

Guideline (6): Lessor Must Demonstrate Expectation of Profits. Lastly, the IRS requires that the lessor be able to demonstrate the expectation of profits to be derived from the lease. Tax benefits from such transactions are not considered to be "profits" sufficient to demonstrate that expectation. But residual value of the equipment does count as part of the profit.

Comparison of Accounting and Tax Rules for Leasing

The four criteria that define a capital lease in most cases will *not* qualify the lease as a true lease for tax purposes. Consider the four accounting criteria for a capital lease as discussed at the beginning of this appendix:

(1) **Transfer of Ownership.** Any transfer of ownership prior to the maturity of the lease will not qualify as a true lease for tax purposes. This violates Guideline (1) for minimum at-risk requirement on the part of the lessor.

(2) **Bargain Purchase Option.** There can be no bargain purchase option for a lease to qualify as a true lease, which is Guideline (4).

(3) **75 Percent of Economic Life.** For economic life criteria, there is a slight difference between the accounting rule and the tax rule. The tax rule requires a remaining economic life for the asset at the end of the lease of at least one year or 20 percent of the originally estimated life, Guideline (3). However, the concept of "economic life" leaves a great deal of room for subjective assumptions.

(4) **90 Percent of Asset's Value.** Guideline (2) for tax deductible lease payments requires that the lessor maintain a minimum of 20 percent of the asset's cost throughout the life of the lease. Therefore, if a lease qualifies as a capital lease under criteria 4, it would not qualify as a true lease. Here again, however, there is room for subjectivity based on assumptions about the proper discount rate to compute the present value of the (minimum) lease payments.

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