An Empirical Reexamination of the Leasing Puzzle

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Traditional financial theory suggests that leases and conventional debt are substitutes. Prior empirical research into this trade-off, however, has found evidence consistent with an alternative view—that lease and debt financing are complimentary in nature. This study reexamines this anomaly, updating and extending the findings of Ang and Peterson (1984), using similar empirical techniques to preserve comparability. The results confirm those of prior research; that is, leases and debt appear to behave as complements not as substitutes—a puzzling finding. This result is robust across a six year sample period (1983-1988) subsequent to the Ang and Peterson study and alternative measures of equity (both book and market values are examined). Tobit regressions are utilized to control for violations of ordinary least squares (OLS) assumptions in the empirical tests.

INTRODUCTION

This study reexamines the unexpected empirical findings of Ang and Peterson (1984). In contrast to prevailing theories that posit a substitution effect, Ang and Peterson document a complimentary relationship between traditional debt financing and capitalized lease obligations.[1] In light of their surprising findings, it seems appropriate to reexamine Ang and Peterson's results with an updated cross-section of firms to investigate the intertemporal stability of their conclusions. In addition, the analysis is extended to include data unavailable to Ang and Peterson at the time of their study and an alternative measure of the dependent variable (the lease-to-equity ratio) whereby equity is measured at market values. These extensions allow for an assessment of the sensitivity of the Ang and Peterson results. Given the potential for dramatic differences between book and market value measures, especially during the time period examined, it is important to investigate whether the Ang and Peterson results are dependent on a specific deflator for their debt and lease ratios.

The debt-to-lease displacement ratio, α, is defined as (Ang and Peterson, equation (1)):

$$(1)\ DR_{NL} = DR_L + \alpha LR_L$$

where:

DR_{NL} = The debt ratio of a firm with no lease obligations;
DR_L = The debt ratio of a like firm that leases to some extent; and
LR_L = The lease ratio of the leasing firm.

[1] Though Ang and Peterson include noncapitalized lease obligations in their study, less than 1 percent of their sample reported these leases in the last year. In the present study, only capitalized leases are used. If any bias results from this restriction, it should be toward finding a substitution effect because capital leases are clearly the more debt-like of leasing instruments.

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The sign and magnitude of α is the focus of this investigation.

BACKGROUND

Several competing theories have been advanced regarding the degree of substitution that exists between the use of debt alone or a mix of debt and leasing to finance corporate operations and investment.[2] The most frequently advanced view is that leases and debt are perfect substitutes. That is, an increase in leasing activity reduces conventional borrowing on a dollar-for-dollar basis. The testable implication of this view is a debt-to-lease displacement ratio (α) equal to 1.0.[3] Other theorists propose that although there is a substitution effect ($\alpha > 0$), its magnitude is less than a full trade-off because some risk-sharing occurs between the lessee and the lessor.[4] Finally, Klein, Crawford, and Alchian (1978) argue that leased assets are riskier than other assets, exposing the lessee to additional liquidity and bankruptcy costs and causing the value of α to exceed 1.0.[5]

Since Ang and Peterson published their findings regarding the lease/debt relationship, several researchers have revisited the topic. Smith and Wakeman (1985) analytically describe the various incentives that affect the lease versus purchase decision faced by firms. In addition to the traditional tax-related incentives, Smith and Wakeman identify eight nontax incentives that help determine whether a given firm is more likely to lease or buy a specific asset. Based on their analysis, the authors are not surprised by the Ang and Peterson findings. They state that cross-sectional examination of many firms is likely to identify the positive relation between increased levels of debt and profitable leasing opportunities.

Bayless and Diltz (1986) provide results consistent with leasing activity displacing debt capacity of their sample firms. In a novel approach, they survey bank loan officers to provide an estimate of a hypothetical firms debt capacity (i.e., how much more would you be willing to lend?) Consistent with the theoretical arguments of Klein *et al.* (1978), they report that capital lease obligations displace debt capacity at higher rates than conventional debt. Finucane (1988), conversely, provides evidence consistent with the Ang and Peterson findings. He reports a positive relationship (in 1981 and 1985, the two sample years examined) between lease- and debt-to-total asset ratios after controlling for firm-specific attributes theorized to play a role in the lease versus borrow decision.

Mukherjee (1991) updates O'Brien and Nunnally's (1983) survey of Fortune 500 CFOs regarding corporate leasing analysis. In spite of recent empirical evidence, twice as many respondents view leasing activity as a substitute for conventional borrowing as opposed to a complementary activity. This perspective is robust across leasing activity (percent of total assets leased) and firm size. The perception of the lease/debt relation

[2] In addition, the use of equity financing is expected, though its role in the lease decision is largely unexplored.

[3] See Copeland and Weston (1988), Miller and Upton (1966), Lewellen *et al.* (1976), Franks and Hodges (1978), and Levy and Sarnat (1979).

[4] See Myers *et al.* (1976) and McConnell and Schallheim (1983) for support of these arguments.

[5] The additional costs arise due to the more specialized nature of the leased assets. These assets most likely would be difficult to liquidate in an orderly fashion due to poorly developed secondary markets.

seems to vary by industry. Most notable is the difference in perceptions held by members of the chemical industry vis-à-vis the petroleum refining industry (Mukherjee, 1991, p. 104, exhibit 6). These apparent interindustry differences are explored in a later section.

Marston and Harris (1988) examine year-to-year changes in lease and debt financing and find support for the substitutability of leases for conventional debt. The authors develop comprehensive measures for both leasing activity and levels of debt and argue that these measures are more appropriate in assessing the relationship between the two sources of capital. At the margin, the authors report, leasing activity displaces additional borrowing—a substitution effect.

Reconciliation of the Ang and Peterson results to those provided by Marston and Harris is problematic. Marston and Harris adopt a strategy that compares changes in lease obligations to changes in traditional debt financing and argue that this "provides a much stronger control for differences in capital structure across firms than that used by Ang and Peterson" (p. 150). As discussed below, Ang and Peterson's approach to controlling for the varying debt capacities across sample firms is to include a set of additional explanatory variables in their cross-sectional regressions specifically chosen for their relation to borrowing ability. The efficacy of the two approaches is difficult to compare.

Aside from the use of first differences (as opposed to levels), Marston and Harris also use measures of debt and leasing activity that are inconsistent with Ang and Peterson (and herein). Marston and Harris combine capitalized lease obligations with off-balance-sheet operating leases for a measure of total leasing. They also combine long-term debt with all other liabilities (including, in some tests, minority interests) for a measure of total debt. Hence, empirical comparisons between the reported results of the two studies are not possible. It is important to note that the Marston and Harris study is a *marginal* analysis while the Ang and Peterson results are based on levels of the examined variables.

Lewis and Schallheim (1992) develop a theoretical model that allows debt and leases to behave as complements (in contrast to extant models of leasing behavior). In their model, lessees have incentives to increase debt, thus creating a positive association (complementarity) between leasing and borrowing activity. The incentives arise due to the ability to sell valuable tax shields among parties.

The nature of the relationship between leasing and debt remains an empirical issue. Ang and Peterson examine financial statement data to determine the lease/debt trade-off. The implicit assumption is that by investigating a large cross-section of firms (both with and without lease obligations), inferences concerning this trade-off may be made. Another assumption is that, on average, the examined firms have arrived at and seek to maintain an optimal mix of equity and non-equity financing. Without this assumption, there is no reason to anticipate a trade-off between alternatives. Certain sample selection filters, discussed in the next section, help to assure that a sample of stable, mature firms are the focus of investigation. While certain events in the sample period of this study (e.g., debt-for-equity swaps, leveraged buy-outs, and the proliferation of preferred stock) might compromise the notion of an optimal capital structure, for the most part the occurrence of these types of restructurings would prevent the inclusion of such a firm in the cross-sectional sample.

Ang and Peterson present results suggesting that leases and debt are complements rather than substitutes. Even after controls are provided for differences in debt capacity

across firms, the results strongly reflect this complementarity. This puzzling finding deserves additional attention. The present study extends earlier research in two important ways. First, the unexpected results reported by Ang and Peterson are confirmed in a broader data set for the years 1983 through 1988. The generalizability of the Ang and Peterson findings thus is assessed by examining the lease-debt relationship among additional firms not included in the original tests and in years subsequent to the Ang and Peterson test period. Also, an alternative ratio measure, debt-to-market value of equity, is used as the dependent variable in addition to the measure (debt-to-book value of equity) from which Ang and Peterson draw their inferences.

SAMPLE

The companies entering the sample are drawn from either Standard & Poor's Compustat expanded annual industrial file, annual research file, or annual full coverage file. All firms passing through the following filters are included in the final sample:

- Available data for the current year of the sample and the preceding ten year period;
- A December fiscal year-end; and
- A nonregulated, nonfinancial firm.

The first of these filters results from the requirements of an uninterrupted ten year time series of earnings and sales data prior to the sample year. The second and third filters impose some homogeneity on the sample vis-à-vis reporting requirements, capital structure, and degree of regulation.[6] As in Ang and Peterson, six cross-sectional samples are assembled from the available data. The years covered in this study, 1983 through 1988, extend the Ang and Peterson research forward in time.[7] In addition, six more cross-sections are collected for the same time period using a market value (year-end share price multiplied by year-end number of common shares outstanding) deflator in the computation of the debt and lease ratios of the sample firms.

The importance of investigating whether the Ang and Peterson results still hold in the 1983-1988 period is underscored by the special nature of the economic conditions present in the 1976-1981 time period examined by Ang and Peterson. The late 1970s and early 1980s were characterized by extraordinarily high interest rates that are especially relevant to capital budgeting decisions involving the issuance of debt securities versus the assumption of lease obligations. In the current research, the 1983-1988 period featured considerably less volatile interest rates and levels of inflation and growth in GNP.

One concern with the examination of the 1983-1988 time period is the dramatic increase in aggregate debt levels relative to equity issuances. As Taggart (1990) and Baribeau (1989) discuss, significant retirements of equity have occurred due to the proliferation of mergers, acquisitions, and leveraged buy-outs. These restructuring transactions fundamentally have altered the debt/equity relation for many firms. The sample of firms

[6] These filters follow Ang and Peterson closely to ensure comparability of the present sample with that of their study.

[7] Ang and Peterson examine the years 1976-1981.

examined in this research excludes, for the most part, those companies that have been affected by such transactions. The requirement that each sample firm have an uninterrupted time-series of data for sales and earnings effectively screens those companies from inclusion in the final cross-sectional samples.

The Ang and Peterson sample period coincides with the adoption and implementation of the Financial Accounting Standards Board's Statement of Financial Accounting Standards (SFAS) Statement No. 13 (1980). SFAS No. 13 establishes uniform classification and disclosure rules for lease obligations. Leases that function primarily as financing instruments for the acquisition of assets are classified as capital leases and are treated as debt obligations and disclosed as liabilities of the lessee.[8] Compliance with SFAS No. 13 was required beginning in fiscal year 1981; thus, all years of the updated sample are covered by the provisions of the Statement.

Detailed sample information is provided in Table 1. Thirty-two observations are omitted from the book value sample due to negative equity (as measured by total assets less total liabilities). This sample, although similar in size to Ang and Peterson's sample, covers a more diverse range of companies than originally examined by Ang and Peterson. The addition of the research and full coverage files (which were unavailable to the authors in the original study) provides the opportunity to examine whether the Ang and Peterson results hold for a sample of firms more representative of the general population.

Following Ang and Peterson, various debt ratios are computed for each cross-section and are presented in Table 2. The results for years 1983-1986 closely match the Ang and Peterson findings. Regardless of how defined, it is apparent that the debt ratios of leasing firms exceed those of nonleasing firms even when leases are excluded from the numerator. The 1987 and 1988 samples, however, reveal no such pattern. One contrast between the

Table 1—Sample Information

Panel A: BV Sample	1983	1984	1985	1986	1987	1988
Leasing Firms	365	348	362	319	285	246
Nonleasing Firms	232	204	258	263	272	234
Total	597	552	620	582	557	480
Panel B: MV Sample	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**
Leasing Firms	366	353	366	321	287	248
Nonleasing Firms	232	208	260	265	275	239
Total	598	561	626	586	562	487

The book value sample is comprised of those firms each year with complete data necessary to compute all values of the dependent and independent variables. Those firms with negative book values of equity (32 firms) are omitted from the book value sample. The market value sample consists of all firms with complete data necessary to compute all values of the dependent and independent variables. Market value of equity is determined by the year-end share price multiplied by the year-end number of common shares outstanding

[8] Specifically, SFAS No. 13 defines a capital lease as one under which any of the following four conditions are met:

a. The lease transfers ownership of the property;
b. The lease contains a bargain purchase option;
c. The lease term equals or exceeds 75 percent of the estimated useful life of the leased property; and
d. The present value of the minimum lease payments equals or exceeds 90 percent of the fair market value of the leased property at the inception of the lease term.

Table 2—Mean Debt Ratio Comparisons Between Leasing (L) and Nonleasing (NL) Firms

Debt Ratio	83L	83NL	84L	84NL	85L	85NL	86L	86NL	87L	87NL	88L	88NL
$\frac{\text{Debt + Leases}}{\text{BVE}}$	.854	.690	.836	.699	1.036	.728[a]	1.126	.838[a]	1.065	.879	1.127	1.068
$\frac{\text{Debt + Leases}}{\text{MVE}}$	.716	.542[a]	.908	.642[a]	.847	.621[a]	.890	.680[a]	.946	.897	.846	.962
$\frac{\text{Debt + Leases}}{\text{Total Assets}}$	.288	.229[a]	.292	.234[a]	.312	.243[a]	.317	.250[a]	.302	.264[a]	.304	.285
$\frac{\text{Debt}}{\text{BVE}}$	.774	.690	.761	.699	.957	.728[a]	1.041	.838[a]	.971	.879	1.028	1.068
$\frac{\text{Debt}}{\text{MVE}}$	.648	.542	.830	.642[a]	.777	.621[a]	.820	.680	.869	.897	.778	.962
$\frac{\text{Debt}}{\text{Total Assets}}$	.256	.229[a]	.263	.234[a]	.284	.243[a]	.292	.250[a]	.279	.264	.279	.285
Times Interest Earned	3.83	7.822[a]	4.685	8.883[a]	4.196	5.167	3.574	5.160	3.891	5.143	6.125	6.239

[a] denotes where the mean debt ratios between leasing (L) firms and nonleasing (NL) firms are significantly different at the $\alpha = .05$ level or less. BVE is the book value of equity at year-end and MVE is the market value of equity (computed as the year-end share price multiplied by the year-end number of common shares outstanding)

reported results in this study and those in Ang and Peterson lies in the trend toward increased leverage from 1983 through 1988. One explanation for this phenomenon could be the prevalence of debt-for-equity swaps in the 1983-1984 time period. (See Hand, 1989). Such swaps have the effect of reducing leverage as debt levels decline and outstanding equity is increased. Hand reports 103 such swaps in the 1983-1984 period. Taggart (1990) and Baribeau (1989) also document an aggregate movement toward increased leverage in the 1980s.

An additional concern addressed by Ang and Peterson is whether leasing is concentrated within particular industries. If so, it is clear that the above results may be driven by asymmetric representation within the two groups (leasing versus nonleasing). In order to investigate this, counts of leasing and nonleasing firms by industry are obtained. Table 3 provides such counts for all two digit SIC code industries with at least ten members (in 1983).[9] Leasing is prevalent in nearly all industry groups, discounting the possibility that the unexpected debt levels of leasing firms are associated with industry affiliation.

Mukherjee (1991) provides survey evidence that documents varying perceptions to the lease/debt relation. Most notable is the contrast between the petroleum refining and chemical industries. Seven of eight surveyed petroleum refining firms view leasing as a substitute activity for borrowing. On the other hand, only two of eleven surveyed chemical firms share that view. To explore this disparity, debt-to-book value of equity ratios are computed for leasing and nonleasing firms within these two industries. Among chemical firms, nonleasers exhibit larger debt/equity ratios than leasing firms in each of the six sample years. For petroleum refiners, leasing firms exhibit slightly larger debt-to-equity ratios in four of the six years (1983-1986) relative to nonleasing firms. These empirical results are counter to the perceptions held by the majority of firms in *both* industries.

The higher levels of debt found for leasing firms merely may reflect differences in debt capacity. In other words, heavy borrowers may be those firms that use all forms of debt financing available, including leases. Consequently, this differential capacity across firms must be controlled for before inferences concerning the lease/debt trade-off can be made. In Ang and Peterson (equations (2) and (3)), a formal model expressing the lease ratio of a firm as a function of the debt ratio and a set of other financial variables is specified. The derivation (from equation (1)) follows:

$$(2)\ DR_{NL} = DR_L + \alpha LR_L = f(x_1, x_2, \ldots, x_k).$$

Rearranging yields:

$$(3)\ LR_L = -1/\alpha\ DR_L + 1/\alpha\ f(x_1, x_2, \ldots, x_k).$$

Hence, the lease ratio is expressed as a negative function of the firm's debt ratio. The coefficient on DR_L provides an estimate of the degree of substitution between debt and leasing when DR_L is included as an independent variable in a regression model.

[9] There was minor fluctuation in industry membership from year to year.

Table 3—Leasing (L) Versus Nonleasing (NL) Activity Comparisons by Industry

SIC	Industry	83L	83NL	84L	84NL	85L	85NL	86L	86NL	87L	87NL	88L	88NL
13	Petroleum	5	16	6	13	5	12	3	13	1	16	2	13
20	Food	12	7	13	3	9	7	8	7	7	6	6	4
22	Textiles	11	4	10	2	10	3	8	7	7	3	6	2
23	Apparel	8	2	6	2	5	2	3	4	3	4	2	2
25	Furniture	8	2	7	3	5	3	5	2	4	2	3	1
26	Paper	16	4	13	5	14	4	12	3	9	6	10	5
27	Publishing	13	14	12	10	15	12	10	14	11	13	9	12
28	Chemicals	27	16	29	16	29	16	26	18	23	20	20	15
29	Refining	18	4	17	4	16	6	15	8	14	6	13	7
30	Rubber	10	7	9	6	8	8	9	10	8	11	8	12
32	Glass/Cement	11	9	11	8	12	8	8	9	6	9	2	8
33	Steel	11	9	11	10	11	10	12	8	11	9	9	8
34	Cans	19	11	18	10	18	14	18	12	17	13	14	10
35	Industrial Equipment	29	23	28	23	35	25	27	29	34	27	30	20
36	Electrical	24	29	23	29	23	34	19	36	14	38	14	29
37	Automotive	25	10	22	7	23	12	24	13	20	16	16	12
38	Precision Instruments	14	12	12	12	16	18	14	17	14	18	13	19
39	Jewelry	8	5	8	4	8	7	6	7	4	7	3	8
50	Wholesale	11	8	13	5	11	9	10	7	10	9	10	10
51	Wholesale	12	3	11	3	11	4	7	6	5	7	5	5
54	Groceries	13	0	12	0	11	0	9	0	6	0	4	0
73	Corporate Services	5	11	8	8	14	15	13	14	11	11	7	15
87	Engineering	10	4	11	3	11	5	11	4	10	3	6	4

The variables used to control for differences in debt capacity across firms also enter the regression. An *ad hoc* model for $f(x_1, x_2, \ldots, x_k)$ developed by Ang and Peterson is used here. The following variables are collected for each firm-year:

- OLBETA is a leverage variable computed as the slope coefficient from an OLS regression of operating earnings on sales for the preceding ten year period;
- CVSALES is a variability measure computed as the coefficient of variation of the sales series for the preceding ten-year period;
- RET is a profitability measure computed as return on net PP&E;
- EP is a growth measure proxied by the inverted price-earnings ratio;[10]
- SIZE is a size measure computed as year-end total assets (in billions of dollars); and;
- LIQ is a liquidity measure computed as current assets/current liabilities (the current ratio).

METHODOLOGY AND RESULTS

The regression model used to investigate the lease-debt trade-off follows from equation (3). By substituting the above variables for $x_1, x_2, \ldots, x_k$ the resulting model is (Ang and Peterson, equation (4)):

$$(4)\ LR = \beta_0 + \beta_1 DR + \beta_2 OLBETA + \beta_3 CVSALES + \beta_4 RET + \beta_5 EP + \beta_6 SIZE + \beta_7 LIQ + E.$$

In an extension to Ang and Peterson, both the lease-to-book value of equity *and* the lease-to-market value of equity are used as proxies for LR in separate regressions. The DR measure matches denominators with LR. As a first step, ordinary least squares (OLS) regressions are performed on both the full sample and a reduced sample of all leasing firms for both LR measures. OLS estimation of equation (4) on the full sample results in biased parameter estimates. The bias arises from the fact that a significant proportion of the sample in each year has LR = 0. (See Table 1.) Hence, a censored sample exists wherein the residual vector from the OLS regression is correlated with (perhaps some portion of) the vector of independent variables (see Maddala, 1983), which is a basic violation of OLS assumptions.[11] OLS estimation of the reduced sample avoids this bias; however, a loss of efficiency occurs from discarding some 45 percent of the available data. (Attrition rates range from 37.0 percent to 49.1 percent over the cross-sectional samples.)

A censored sample regression technique, the Tobit model, was developed by Tobin (1958). It is a maximum likelihood estimation of the following function (Amemiya, 1984):[12]

[10] Ang and Peterson use the P/E ratio—the E/P ratio is substituted here to control for potential outliers common in P/E calculations in empirical studies.

[11] The departure from normality of ε is illustrated in Kennedy (1985, p. 193).

[12] The function departs from Ang and Peterson's equation (5) where a natural log operator is inadvertently omitted immediately following the first summation.

$$(5)\ L = \prod_{i=1}^{n} \left[1 - \Phi \frac{X_i'\beta}{\sigma}\right] \prod_{j=1}^{r} \sigma^{-1}\phi \left[\frac{(Y_j - X_j'\beta)}{\sigma}\right].$$

Taking natural logarithms results in:

$$(6)\ \ln L = \sum_{i=1}^{n} \ln \left[1 - \Phi \frac{X_i'\beta}{\sigma}\right] - \frac{r}{2} \ln \sigma^2 - \frac{1}{2\sigma^2} \sum_{j=1}^{r} (Y_j - X_j'\beta)^2,$$

where:

n	=	The number of nonleasing firms;
r	=	The number of leasing firms
β	=	The vector of slope coefficients to be estimated;
σ^2	=	The variance of ε;
X_i	=	The matrix of observations of the independent variables for the nonleasing firms;
X_j	=	The matrix of observations of the independent variables for the leasing firms;
Y_j	=	The vector of observations of the dependent variable for the leasing firms;
Φ	=	The normal cumulative distribution function;
ϕ	=	The normal probability density function;
L	=	The likelihood function; and;
$\ln L$	=	The natural logarithm of the likelihood function.

This function is maximized with respect to β and σ. An important assumption is one of spherical disturbances. That is, it is assumed that the error terms have uniform variance and are uncorrelated. Also, the disturbances are assumed to follow a normal distribution where:

$$(7)\ \varepsilon_k \sim N(0, \sigma^2).$$

LIMDEP (Greene, 1983), a limited dependent variable estimation package, is used to perform the Tobit regressions. The maximized value of the log-likelihood function is reported by the likelihood ratio (LR) statistic. This statistic provides a test for the goodness of fit of the estimated model.[13] In general, the LR test compares the maximized value of ln L from the estimated model to the value of ln L obtained from the maximum likelihood estimation of the model with all non-intercept coefficients restricted to zero ($\ln L_R$). The LR statistic is computed as $-2 (\ln L_R - \ln L)$ and is distributed chi-square, with degrees of freedom equal to the number of zero-restricted coefficients.[14] The estimated models are significant in all cross-sections.

[13] The likelihood ratio test is analogous to an F-test for the significance of the regression in the general linear model.

[14] See Kennedy (1985, Chapter 4) for further exposition.

Table 4—Book Value Regression Results,
$LBVE = \beta_0 + \beta_1 DBVE + \beta_2 OLBETA + \beta_3 CVSALES + \beta_4 RET + \beta_5 EP + \beta_6 SIZE + \beta_7 LIQ + \varepsilon$

Panel A: 1983 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.037 (2.13)	.021 (0.73)	-.018 (0.65)
DBVE	.021 (6.29)*	.046 (7.55)*	.037 (6.18)*
OLBETA	-.035 (2.53)	-.047 (2.28)	-.075 (3.56)*
CVSALES	.018 (0.81)	.057 (1.46)	.001 (0.04)
RET	-.022 (1.70)	-.087 (3.15)*	-.079 (3.42)*
EP	.098 (3.81)*	.321 (4.25)*	.328 (4.49)*
SIZE	-.002 (2.10)	-.003 (2.76)*	-.001 (1.12)
LIQ	-.010 (2.36)	-.008 (1.18)	-.013 (2.03)
n	597	365	597
R^2	.109	.206	
F/LR	10.35*	13.27*	85.21*

Panel B: 1984 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.074 (2.13)	.045 (1.84)	.034 (1.37)
DBVE	.013 (7.14)*	.059 (7.68)*	.040 (5.59)*
OLBETA	.002 (0.13)	-.004 (0.28)	-.013 (0.74)
CVSALES	-.001 (0.03)	.026 (0.73)	-.061 (1.76)
RET	-.033 (2.66)*	-.027 (1.20)	-.041 (2.22)
EP	.067 (4.19)*	.111 (2.56)	.115 (3.04)*
SIZE	-.002 (2.21)	-.002 (2.53)	-.001 (1.11)
LIQ	-.013 (2.86)*	-.011 (1.79)	.015 (2.34)
n	552	348	552
R^2	.127	.202	
F/LR	11.53*	12.31*	57.96*

Panel C: 1985 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.057 (3.68)*	.068 (2.61)*	.035 (1.41)
DBVE	.023 (10.01)*	.035 (5.59)*	.039 (6.31)*
OLBETA	-.018 (1.36)	-.017 (0.87)	-.034 (1.75)
CVSALES	-.041 (1.72)	.011 (0.28)	-.101 (2.77)*
RET	-.003 (0.30)	-.014 (0.50)	.003 (0.19)
EP	.044 (3.08)*	.035 (0.95)	.032 (1.09)
SIZE	-.001 (1.54)	-.002 (2.09)	-.001 (0.65)
LIQ	-.009 (2.47)	-.013 (1.85)	-.019 (3.24)*
n	620	362	620
R^2	.170	.131	
F/LR	18.12*	7.68*	73.52*

Panel D: 1986 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	-.054 (1.30)	.058 (1.11)	-.039 (0.81)
DBVE	.097 (8.75)*	.076 (7.65)*	.070 (7.58)*
OLBETA	-.050 (1.57)	.004 (0.11)	-.042 (1.20)
CVSALES	-.116 (1.89)	-.097 (1.21)	-.140 (1.98)
RET	.010 (0.55)	.014 (0.50)	-.008 (0.41)
EP	.016 (1.81)	-.049 (1.12)	.026 (1.65)
SIZE	.001 (0.33)	-.002 (0.94)	-.0003 (0.21)
LIQ	.011 (1.34)	-.005 (0.48)	-.019 (1.95)
n	582	319	582
R^2	.106	.191	
F/LR	9.22*	10.48*	72.44*

Table 4—Book Value Regression Results (cont.),
$LBVE = \beta_0 + \beta_1 DBVE + \beta_2 OLBETA + \beta_3 CVSALES + \beta_4 RET + \beta_5 EP + \beta_6 SIZE + \beta_7 LIQ + \varepsilon$

Panel E: 1987 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	*.150 (3.39)**	*.039 (0.59)*	*-.060 (0.95)*
DBVE	.035 (5.92)*	.154 (9.80)*	.096 (7.04)*
OLBETA	.068 (2.11)	.035 (0.77)	-.008 (0.18)
CVSALES	-.184 (2.71)*	-.162 (1.71)	-.184 (2.00)
RET	.019 (0.88)	.058 (1.73)	.035 (1.24)
EP	*-.059 (1.33)*	*-.011 (0.19)*	*-.054 (0.99)*
SIZE	-.001 (0.89)	-.001 (0.78)	-.0001 (0.01)
LIQ	-.015 (1.48)	-.010 (0.54)	-.033 (2.11)
n	557	285	557
R^2	.097	.311	
F/LR	*8.48**	*17.88**	*69.92**

Panel F: 1988 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.122 (2.47)	.014 (0.19)	-.023 (0.35)
DBVE	.032 (8.36)*	.146 (10.95)*	.088 (7.16)*
OLBETA	.029 (0.88)	.040 (1.01)	.024 (0.62)
CVSALES	-.118 (1.61)	-.138 (1.47)	-.223 (2.45)
RET	-.029 (0.79)	.085 (1.30)	.068 (1.35)
EP	.007 (0.39)	-.002 (0.03)	.073 (1.31)
SIZE	-.002 (0.89)	-.001 (0.51)	-.0002 (0.10)
LIQ	-.017 (1.49)	-.004 (0.19)	-.037 (2.04)
n	480	246	480
R^2	.159	.374	
F/LR	12.98*	20.35*	64.56*

n indicates the number of observations. Traditional t-statistics are in parentheses (absolute values are reported). * indicates significance at $p < .01$ (two tailed critical value = 2.58). Variables are defined as follows: LBVE is the lease-to-book value of equity ratio, DBVE is the debt-to-book value of equity ratio, OLBETA is the slope coefficient from an OLS regression of operating earnings on sales for the preceding ten year period, CVSALES is the coefficient of variation of the immediately preceding ten year sales series, RET is the return on net PP&E, EP is the inverted price-earnings ratio, SIZE is the book value of year-end total assets, and LIQ is the current ratio. The OLS-all firms and Tobit regressions include all firms within a sample year with data for each independent variable and includes firms that are nonleasers (i.e., LBVE = 0). Variables are computed using December 31 values

The results of the regressions are provided in Tables 4 and 5. Panels A-F in Table 4 contain OLS estimation results for the full sample and on the restricted sample of leasing firms and Tobit results for the full sample where the dependent variable is the lease-to-book value of equity ratio. Results are presented for each cross-section of data for the years 1983 through 1988. In Table 5, similar regression results are provided when the lease-to-market value of equity ratio is the dependent variable (the debt/equity ratio also is deflated by market values). As in Ang and Peterson, a significant positive relationship between debt and leases is found in every year. This finding holds for either a book value or market value equity measure. Whereas Ang and Peterson find a negative relationship between operating leverage and lease financing, the present study does not provide such strong support. Sales variability, however, is found to be a significant negative explanator of leasing contrary to the results presented in Ang and Peterson.[15] Liquidity is the

[15] There is the potential here for some degree of confounding. OLBETA and CVSALES are highly correlated in all years—ranging in value from .347 in 1984 to .516 in 1986.

Table 5—Market Value Regression Results,
$LMVE = \beta_0 + \beta_1 DMVE + \beta_2 OLBETA + \beta_3 CVSALES + \beta_4 RET + \beta_5 EP + \beta_6 SIZE + \beta_7 LIQ + \varepsilon$

Panel A: 1983 Data

Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.031 (1.92)	.023 (0.82)	-.006 (0.22)
DMVE	.025 (5.85)*	.053 (6.68)*	.039 (6.02)*
OLBETA	-.038 (3.04)*	-.053 (2.71)*	-.074 (3.86)*
CVSALES	-.006 (0.27)	.007 (0.19)	-.028 (0.84)
RET	-.026 (2.19)	-.094 (3.61)*	-.078 (3.70)*
EP	.092 (3.80)*	.304 (4.23)*	.292 (4.62)*
SIZE	-.001 (1.67)	-.002 (2.31)	-.001 (0.99)
LIQ	-.006 (1.59)	-.005 (0.76)	-.013 (2.19)
n	598	366	598
R^2	.102	.173	
F/LR	9.58*	10.65*	88.32*

Panel B: 1984 Data

Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.054 (2.91)*	.060 (2.08)	.029 (1.07)
DMVE	.026 (6.89)*	.051 (7.37)*	.046 (7.40)*
OLBETA	-.005 (0.36)	-.001 (0.01)	-.010 (0.52)
CVSALES	-.028 (1.06)	-.002 (0.05)	-.082 (2.11)
RET	-.023 (1.82)	-.071 (2.66)*	-.071 (3.60)*
EP	.043 (2.91)*	.207 (3.70)*	.222 (4.94)*
SIZE	-.001 (1.51)	-.003 (2.49)	-.002 (1.36)
LIQ	-.006 (1.59)	-.009 (1.24)	-.012 (1.78)
n	561	353	561
R^2	.108	.176	
F/LR	9.54*	10.35*	82.65*

Panel C: 1985 Data

Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.047 (2.98)*	.043 (1.68)	.036 (1.45)
DMVE	.035 (8.19)*	.068 (8.44)*	.045 (7.08)*
OLBETA	-.015 (1.17)	-.016 (0.84)	-.030 (1.60)
CVSALES	-.050 (2.22)	-.040 (1.03)	-.120 (3.30)*
RET	-.002 (0.21)	-.017 (0.65)	-.0002 (0.01)
EP	.028 (1.99)	.073 (1.84)	.050 (2.08)
SIZE	-.001 (1.22)	-.002 (1.76)	-.001 (0.52)
LIQ	-.006 (1.84)	-.006 (0.84)	-.018 (3.11)*
n	620	366	626
R^2	.133	.220	
F/LR	13.53*	14.33*	88.78*

Panel D: 1986 Data

Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.047 (2.33)	.070 (2.02)	-.009 (0.27)
DMVE	.041 (8.38)*	.071 (7.54)*	.062 (7.40)*
OLBETA	.005 (0.36)	.019 (0.75)	-.021 (0.88)
CVSALES	-.062 (2.13)	-.080 (1.50)	-.102 (2.11)
RET	-.003 (0.41)	-.003 (0.25)	-.014 (1.06)
EP	.012 (2.80)*	.031 (0.89)	.054 (2.03)
SIZE	-.001 (0.90)	-.001 (1.33)	-.0003 (0.28)
LIQ	-.005 (1.21)	-.008 (1.04)	-.016 (2.35)
n	586	321	586
R^2	.124	.207	
F/LR	11.71*	11.59*	75.16*

Table 5—Market Value Regression Results (cont.),
$LMVE = \beta_0 + \beta_1 DMVE + \beta_2 OLBETA + \beta_3 CVSALES + \beta_4 RET + \beta_5 EP + \beta_6 SIZE + \beta_7 LIQ + \varepsilon$

Panel E: 1987 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.100 (3.95)*	.102 (2.27)	.054 (1.21)
DMVE	.014 (3.11)*	.113 (9.18)*	.026 (3.30)*
OLBETA	.045 (2.41)	.083 (2.65)*	.029 (0.94)
CVSALES	-.075 (1.93)	-.156 (2.38)	-.140 (2.09)
RET	.002 (0.14)	.032 (1.40)	-.014 (0.65)
EP	-.034 (1.41)	-.052 (1.39)	-.033 (0.77)
SIZE	-.001 (1.10)	-.001 (0.91)	-.001 (0.49)
LIQ	-.011 (1.86)	-.013 (1.05)	-.033 (2.84)*
n	562	287	562
R^2	.062	.292	
F/LR	5.19*	16.31*	27.88*

Panel F: 1988 Data Variable	OLS-All Firms	OLS-Leasing Firms	Tobit-All Firms
Intercept	.066 (2.88)*	.066 (1.48)	.045 (1.07)
DMVE	.017 (4.16)*	.099 (7.91)*	.019 (2.88)*
OLBETA	.014 (0.90)	.024 (0.93)	.005 (0.21)
CVSALES	-.029 (0.86)	-.100 (1.62)	-.099 (1.67)
RET	-.021 (1.20)	-.009 (0.20)	-.014 (0.44)
EP	.015 (1.58)	.051 (1.13)	.307 (1.26)
SIZE	-.001 (1.21)	-.001 (0.96)	-.001 (0.64)
LIQ	-.010 (1.86)	-.012 (0.84)	-.037 (3.00)*
n	487	248	487
R^2	.062	.280	
F/LR	4.50*	13.23*	25.40*

n indicates the number of observations. Traditional t-statistics are in parentheses. (Absolute values are reported.) * indicates significance at $p < .01$ (two tailed critical value = 2.58). Variables are defined as follows: LMVE is the lease-to-market value of equity ratio, DMVE is the debt-to-market value of equity ratio, OLBETA is the slope coefficient from an OLS regression of operating earnings on sales for the preceding ten year period, CVSALES is the coefficient of variation of the immediately preceding ten year sales series, RET is the return on net PP&E, EP is the inverted price-earnings ratio, SIZE is the book value of year-end total assets, and LIQ is the current ratio. The OLS-all firms and Tobit regressions include all firms within a sample year with data for each independent variable and include firms that are nonleasers (i.e., LBVE = 0). Variables are computed using December 31 values

final explanatory variable that is related significantly to the leasing behavior of the sample firms. A negative relationship is found in all six years.

Ang and Peterson carried the Tobit analysis one step further, modeling a multiplicative error term to correct for potential heteroscedasticity. As Hurd (1979) discusses, the Tobit model parameter estimates may be severely biased if there are departures from the assumption of spherical disturbances. A test for heteroscedastic errors developed by Glejser (1969) is conducted in order to determine the necessity of making such a correction in the current study. The test involves regressing the residuals from the Tobit estimation on selected independent variables.

An OLS regression of these residuals on the entire matrix of independent observations reveals scant evidence of heteroscedastic disturbances. In only two of the 12 (1987 and 1988 book value) samples are significant coefficients found to suggest nonconstant variance. Accordingly, no adjustment for heteroscedasticity appears necessary.

CONCLUSIONS

The estimated values of the lease/debt substitution coefficients for each sample are presented in Table 6. The results confirm the Ang and Peterson analysis: leases and debt appear to be complements, not substitutes. This finding is significant in each year, 1983 through 1988, for two separate measures of equity value. The robustness of this finding across the assembled data and in conjunction with the earlier Ang and Peterson results provides strong evidence for the complementary relationship. These results, however, must be interpreted in light of the dynamic time period over which this study was conducted. The 1980s were marked by significant increases in corporate leverage. While the sample selection filters operate to limit the magnitude of such effects by eliminating companies with certain restructuring transactions, the overall impact of the time period examined on the results presented herein cannot be estimated accurately. In this sense, our ability to interpret and generalize from the results is limited.

Table 6—Substitution Coefficient α for Each Year, $DR_{NL} = DR_L + \alpha LR_L$

Year	Book Value Sample	Market Value Sample
1983	-27.03	-25.64
1984	-25.00	-21.74
1985	-25.64	-22.22
1986	-14.29	-16.13
1987	-10.42	-62.50
1988	-11.36	-52.63

DR_{NL} denotes the debt ratio (debt-to-book or market value of equity) for nonleasing firms in the sample. DR_L is the same measure for those firms engaged in leasing activities in a sample year. LR_L is the lease-to-book or market value of equity ratio for leasing firms. The substitution coefficient, α, is a measure of the extent to which leasing activity displaces traditional borrowing in the financing of operations and capital acquisitions. A negative α indicates that leases and debt are complementary activities.

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