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The Leasing Puzzle

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ABSTRACT

Prevailing theories in finance and economics suggest that leases and debt are substitutes; an increase in one should led to a compensating decrease in the other. In particular, there are three views on the magnitude of the substitution coefficient. Standard finance theory treats cash flows from lease obligations as equivalent to debt cash flows, thus describing the tradeoff between debt and leases as one-to-one. Others are willing to use a tradeoff of leases for debt which is less than, but close to, one. The rationale for a dollar of leases using less of debt capacity than a dollar of debt obligation is based upon the differences in the terms and nature of lease and debt contracts. Finally, there are some who argue that since leased assets may be firm-specific, the risk of moral hazard may be great, resulting in a tradeoff of greater than one-to-one; that is, a dollar of a lease obligation uses more of debt capacity than a dollar of a debt obligation.

A series of empirical tests are performed in this study on samples of approximately 600 firms, covering the years 1976 through 1981, with none of the three views supported by the results. Instead, the results indicate that leases and debt are complements; greater use of debt is associated with a greater use of leasing. This finding reappears consistently for each year, each definition of leverage ratios, and each approach to analysis. This complementary relationship persists even after refinements are made to the estimation technique.

THE PURPOSE OF THIS PAPER is to empirically investigate the extent to which leases displace debt. The debt-to-lease displacement ratio, α, is defined as:

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

where DR_{NL} is the debt ratio of a firm which does not lease (NL), DR_L is the corresponding debt ratio of a similar firm which does lease (L), and LR_L is the lease ratio of the latter. Thus, α is defined such that the aggregate debt ratios of the two otherwise similar firms are identical. A review of theories of finance and economics reveals three possible values for α. The first and most popular view argues that a dollar of lease obligation replaces a dollar of potential debt obligation; equivalently, α is equal to 1.0. A second view, however, holds that α is less than 1.0, but greater than 0 ($0 < \alpha < 1$) since, for example, lessors may bear some risks not inherent in debt contracts. Lastly, the third view of the value of α is that debt displacement by leases is greater than one-to-one ($\alpha > 1.0$). A noteworthy feature common to all three views is that leases are expected to reduce debt capacity ($\alpha > 0$).[1]

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[1] See Miller and Upton [18], Lewellen et al. [16], Franks and Hodges [9], Levy and Sarnat [15], and Idol [12], for support of α equal to one, see Myers et al. [20] and McConnell and Schallheim [17]

This study empirically examines the question of the extent to which leases substitute for debt. The data employed in this study are described in Section I, accompanied by a comparison of leverage ratios for leasing and nonleasing firms. The analysis is further refined to control for financial characteristics of leasing and nonleasing firms. The final analysis, provided in Section II, employs Tobit empirical methodology to examine leasing and leverage behavior of firms. Concluding remarks are provided in Section III.

I. A First Look at Lease and Debt

The firms selected for use in this study are drawn from the Standard and Poor's Compustat Expanded Annual Industrial File and satisfy the following criteria:

(a) Data available for the entire period 1966–1981,
(b) Fiscal year ending in December, and
(c) Not classified as a regulated or financial firm.

The first criterion is to ensure that all variables can be drawn and calculated from the available data. Although the study involves examining six cross-sections, the years 1976 through 1981, the requirement of data availability for the period of 1966 through 1975 is necessary for the computation of several variables. The second criterion is imposed so that the firms in each cross-section are subject to the same reporting requirements. The third criterion provides for a more homogeneous sample of firms. The number of firms that satisfied the three selection criteria for the six cross-sections are 589, 606, 606, 607, 616, and 608, respectively.

The period of 1976 through 1981 is deliberately chosen to coincide with the effective dates of the Financial Accounting Standards Board's (FASB's) Statement of Financial Accounting Standards (SFAS) Statement No. 13 (1980), which establishes a set of criteria for the determination of whether a lease should be accounted for as a sale/purchase (capitalized) lease or as an operating (noncapitalized) lease. In addition to these criteria, SFAS 13 requires disclosures of capitalized leases which are similar to those of owned property and long-term debt obligations; that is, the assets acquired under a leasing agreement which satisfy the criteria for capital leases are presented in the balance sheet along with other assets of the firm, and the related obligations are presented as liabilities. The disclosure of noncapitalized leases is required, but only in notes which accompany the financial statements. The provisions of Statement No. 13 are applicable to financial statements for firms which have fiscal years ending after December 31, 1976 for all leases entered into after December 31, 1976. Retroactive compliance (that is, applying the new disclosure rules to leases entered into prior to January 1, 1977) is required for firms as of the financial statements for fiscal years ending after December 31, 1980.[2] Therefore, 1976, the first year in this study, represents a year not affected by Statement No. 13 and 1981, the last year

for support of α between zero and one, and see Klein et al. [13] for support of α greater than one. It is important to note that the notion of debt capacity is predicated upon the existence of an optimal capital structure, an issue which is yet unresolved.

[2] Prior to Statement No. 13, reporting guidelines and requirements pertaining to leases were provided in a series of American Institute of Certified Public Accountants (AICPA), Accounting

Table I

Classification of Firms by Reported Leases

	1976	1977	1978	1979	1980	1981
Number of Firms	589	606	606	607	616	608
Percentage of Firms without Leases	57%	45%	43%	43%	44%	46%
Percentage of Firms with Leases	43	55	57	57	56	54

in this study, represents the first year in which retroactive compliance is required.

A breakdown of the samples by the reporting of leases is provided in Table I. Firms are classified as leasing firms if they reported either capitalized or noncapitalized leases. Approximately 45% of the firms in the years 1977 through 1981 reported having no leases. Note that the change in the reporting requirement brought about by Statement No. 13 resulted in a large increase in the percentage of firms reporting leases from 1976 to 1977 (43% to 55%). In addition, although not shown here, the percentage of firms reporting noncapitalized leases shrinks from 13% in 1976 to 8% in 1977 and then to 1% in 1978, with less than 1% in the years 1979–1981, indicating that due to the criteria of Statement No. 13, noncapitalized leases may have been reclassified as capitalized leases. The predominance of capitalized leases over noncapitalized leases practically eliminates the possible contribution of operating leases in explaining the substitution coefficient, α.[3]

As a first step, various debt ratios (e.g., debt divided by book value of equity, market value of equity, or total assets) are calculated for both the leasing and nonleasing firms.[4] The results are unexpected; the leasing firms, as a group,

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Principle Board (APB), Opinions (APB Opinions No. 5, 7, 27, and 31), and SEC Accounting Series Releases (ASR Releases No. 132, 141, 147, and 184). APB Opinion No. 5 (September 1964) recognized the lack of consensus of opinion regarding the reporting of leases and the inadequacies of the disclosure of lease commitments. In this option, disclosure of noncancellable leases in financial statement of the lessee is recommended, with the extent of disclosure dependent upon the materiality of the transaction and the nature of the transaction (how closely it resembles a sale/financing arrangement). APB Opinion No. 7 (May 1966) set forth the recommendations for the reporting of revenues and expenses related to leases by the lessor, which was further clarified in APB Opinion No. 27 (November 1972). APB Opinion No. 31 (June 1973) addressed the disclosure of noncapitalized lease commitments and required the reporting of rental commitments, yet made the disclosure of the present value of lease commitments optional. The SEC pronouncements echoed the APB Opinions, yet made the reporting of the present value of noncapitalized lease commitments mandatory. However, even with the pronouncements of the AICPA and the SEC, confusion and differences of opinion as to how to report leases persisted, prompting the FASB to act on this issue in 1973, finally releasing Statement No. 13 in November 1976.

[3] Operating leases, due to their cancellable features, are in many ways similar to callable debt. If the investment disincentive problems exist (Myers [19]), both callable debt and cancellable leases may resolve this type of agency problem (see, for example, Barnea et al. [3] and Bodie and Taggart [4]).

[4] The debt ratios calculated are based upon the book and market values of equity, the book value of total assets, and the interest coverage ratio. A table presenting mean values for these ratios, as well as the test statistics used to test for differences between the mean values for the leasing and nonleasing firms, is available upon request.

report not only higher debt ratios than nonleasing firms when leases are included with debt in the numerator, but also greater debt ratios when leases are removed from the numerator of these results.[5]

A formal investigation of the relationship between leases and debt must explicitly take into account the differences in the financial variables among the firms. Let $C(x_1, x_2, \cdots)$ be the set of factors which determines the debt ratio of a nonleasing firm, then Equation (1) may be rewritten as,

$$DR_{NL} = DR_L + \alpha LR_L = C(x_1, x_2, \cdots) \tag{2}$$

Rearranging the above expression, the equation for the lease ratio of a firm follows:

$$LR_L = \frac{-1}{\alpha} DR_L + \frac{1}{\alpha} C(x_1, x_2, \cdots) \tag{3}$$

This equation expresses the lease ratio (LR) as a negative function of the firm's debt ratio, (DR), since debt and leases are hypothesized to be substitutes. The other financial variables of the firm, $x_1, x_2, \cdots$, account for the differences in debt capacity among firms. The coefficient on DR, $-\frac{1}{\alpha}$, measures the extent to which leases and debt are substitutes. A value of $\alpha = 1$ (coefficient on DR equal to -1) indicates that debt and equity are perfect substitutes and a value of $0 < \alpha < 1$ (coefficient on DR less than -1) shows that debt and leases are imperfect, less than one-to-one substitutes.

A rather simple model for $C(x_1, x_2, \cdots)$ is specified. The financial variables used in the regression model are the following.

(1) Operating leverage (OL), defined as the regression slope of operating earnings on sales over the previous ten years,
(2) Sales variability (SV), calculated as the coefficient of variation of sales over the previous ten years,
(3) Profitability (RET), as measured by the return on net fixed plant,
(4) Expected growth (PE), as proxied by the price earnings ratio,
(5) Size ($SIZE$), measured by total year-end assets (in billions of dollars), and
(6) Liquidity (LIQ), as proxied by the current ratio.

[5] Leasing may be a matter of industry practice, such that the industries represented in the two groups may be quite different. As a step in improving the validity of our tentative findings, the sample has been classified into 22 industry groups, based on two-digit SIC codes. The basic idea behind this grouping is that firms in the same industry are more homogeneous (e.g., accounting methods, business conditions) than firms in the entire cross-section. A notable observation is that, contrary to popular expectations, leasing firms are not concentrated in a few industries; in fact, leasing occurs in every one of the 22 industries, and with the exception of the Amusements industry, a comparable set of nonleasing firms can be found in each industry. In addition, roughly two-thirds of the industries are characterized by leasing firms having greater debt to equity ratios than nonleasing firms. A detailed breakdown of the sample by industry classification with the corresponding debt ratios is available from the authors upon request.

II. Tobit Analysis: A Second Look

The model employed to examine the relationship between leases and debt is the following:

$$LR = \beta_0 + \beta_1(DR) + \beta_2(OL) + \beta_3(SV) + \beta_4(RET) + \beta_5(PE) + \beta_6(SIZE) + \beta_7(LIQ) + \epsilon \quad (4)$$

The ratio of leases to book value of equity is used to measure LR and the ratio of debt to book value of equity is used to measure DR. The dependent variable is heavily concentrated at zero since approximately 45% of the firms do not have leases in any one year (see Table I). Ordinary least squares estimation of this model would not produce unbiased, consistent, and efficient estimates due to the violation of basic assumptions of the regression model regarding the normality of the dependent variable (see Tobin [25] or Kmenta [14, Chapters 8 and 10]). Estimating the model for only leasing firms ($LR > 0$) would not produce generalizable results since not all available information is used; therefore another estimation technique must be employed.

Tobit analysis, which was developed by Tobin, is a maximum likelihood estimation method designed specifically for limited dependent variable models.[6] The analysis involves the maximum likelihood estimation of the following function (see Tobin [26] or Amemiya [2]):

$$\ln L = \sum_{i=1}^{n} \left\{1 - F\frac{(\beta' X_i)}{\sigma}\right\} + \sum_{j=1}^{r} \ln \left\{\frac{1}{\sigma} f \frac{(Y_j - \beta' X_j)}{\sigma}\right\} \quad (5)$$

where

- r is the number of leasing firms (number of nonlimit observations),
- n is the number of nonleasing firms,
- σ is the standard deviation of the disturbance term,
- β is the vector of slope coefficients,
- Y_j is the vector of observations on LR for the leasing firms,
- X_i and X_j are matrices of observations on independent variables for the nonleasing and leasing firms, respectively,
- $f(\ )$ is the normal probability density function,
- $F(\ )$ is the cumulative density function, and
- $\ln L$ is the log of the likelihood function.

This function is maximized with respect to β and σ. The error terms of this model, the ϵ_k's, are assumed to be normally distributed with zero mean and constant variance, σ^2 ($\epsilon_k \sim N(0, \sigma^2)$), although the estimates of the error terms for the limit observations, the e_i, are never observed.

The Goldfeld-Quandt Optimization Program, GQOPT, is used to perform the estimation. The equations take an average of 30 iterations to obtain an optimum,

[6] Many researchers have employed Tobit analysis to address a variety of issues including household expenditures (Tobin [26]) and short sales (Peterson and Waldman [21]).

with convergence (all derivatives equal to zero) reached in all six cross-sections. The Tobit analysis results are reported in Table II. The likelihood ratio test, which provides a test statistic to evaluate the goodness-of-fit of the equation, is also provided in Table II, accompanying the value of the log of the likelihood function. In general, a likelihood ratio test involves the comparison of two nested models and tests the value of the likelihood test statistic, $-2 \ln \lambda$, where λ is equal to the ratio of the value of the likelihood function of the unconstrained model to that of the constrained model. The likelihood test statistic is distributed χ^2 with m degrees of freedom, where m is equal to the number of constraints (see Theil [24, Chapter 2]). To test the fit of the model (that is, test the null hypothesis that all nonintercept coefficients are equal to zero), the value of the likelihood function of the estimated model is compared to the likelihood function of the model with all nonintercept coefficients constrained to zero. As indicated in Table II, the null hypothesis is rejected at the 5% level of significance in all years.

A positive relationship between debt and leases is found. *DR* is positively and significantly related to *LR*.[7] A negative relationship between operating leverage and leases is also confirmed. Profitability (*RET*) is a significant, negative explanatory factor of leases, while liquidity (*LIQ*) and growth (*PE*) do not enter in as significant variables. All five equations, as indicated by the likelihood ratio test, explain a significant portion in the variation of the lease variable.

The estimation is further refined to account for potential heteroskedasticity by specifying a multiplicative relationship between the disturbance term and each of the seven independent variables. As pointed out by Hurd [11], the presence of a heteroskedastic disturbance term is most troublesome in the Tobit model since, unlike ordinary least squares, estimators of the coefficients are biased if the heteroskedasticity is not corrected for in the Tobit estimation. The multiplicative error term is employed to correct for possible heteroskedasticity.[8] A model for the error terms

$$\sigma_k^2 = e^{X'\gamma} \tag{6}$$

is proposed which allows each independent variable to enter in the estimation of the error term, with the vector γ representing the influence of each variable and X' the $(k \times 8)$ matrix of observations on all independent variables. The error term which is distributed

$$\epsilon_k \sim N(0, \sigma^2) \tag{7}$$

under the homoskedastic model just presented, becomes

$$\epsilon_k \sim N(0, \sigma_k^2) \tag{8}$$

[7] Ordinary least squares estimates of Equation (4) involving the entire sample as well as the leasing firms subsample (the nonlimited observations) are also performed. The results indicate that debt and leases are complementary and not substitutes, confirming the reported analysis.

[8] The multiplicative heteroskedastic Tobit model was examined by Fishe et al. [8] and Hurd [11] and applied by Peterson and Waldman [21]. This multiplicative heteroskedastic model is an extension of that developed for regression models (see, for example, Harvey [10]). The multiplicative error term is one possible model used to explain a heteroskedastic error term and allows each independent variable to contribute to the explanation of the heteroskedastic nature of the error term.

Table II

Tobit Estimation—Homoskedastic Model

$$\text{Dependent Variable} = \frac{\text{Leases}}{\text{Book Value of Equity}}$$

Year \ Coefficient on:	Constant	Debt/ Book Value of Equity	*LIQ*	*OL*	*SV*	*PE*	*SIZE*	*RET*	Log of Likelihood Function	Test for Goodness-of-Fit Likelihood Ratio Test Statistic
1976	−0.015	0.033	−0.009	−1.549*	0.220*	−0.000	−0.002	−0.186*	−261.988	70.86*
	(−0.211)**	(1.730)	(−0.614)	(−5.810)	(2.218)	(−0.135)	(−0.280)	(−2.485)		
1977	0.047	0.031*	−0.008	−0.928*	0.083	−0.002*	−0.001	−0.032	−171.736	65.60*
	(0.863)	(2.314)	(−0.560)	(−5.405)	(1.120)	(−2.375)	(−0.230)	(−1.351)		
1978	0.079	0.035*	0.000	−0.635*	−0.041	0.000	−0.002	−0.243*	−119.394	79.27*
	(1.555)	(2.829)	(0.019)	(−4.451)	(−0.599)	(0.768)	(−0.560)	(−4.197)		
1979	0.068	0.021*	0.003	−0.497*	−0.033	−0.000	−0.000	−0.159*	−49.911	72.52*
	(1.739)	(2.447)	(0.289)	(−4.424)	(−0.613)	(−0.179)	(0.054)	(−4.149)		
1980	0.041	0.042*	−0.001	−0.546*	−0.042	0.000	0.000	−0.170*	−84.819	67.27*
	(0.971)	(5.035)	(−0.090)	(−4.237)	(−0.706)	(0.461)	(0.074)	(−3.766)		
1981	0.049	0.033*	−0.005	−0.509*	−0.076	−0.000	−0.000	−0.111*	−91.577	97.26*
	(1.175)	(3.774)	(−0.381)	(−4.334)	(−1.304)	(−0.176)	(−0.062)	(−2.571)		

* Indicates significance at the 5% level.

** t-statistics are in parentheses.

Table III

Tobit Estimation—Heteroskedastic Model

$$\text{Dependent Variable} = \frac{\text{Leases}}{\text{Book Value of Equity}}$$

Coefficient on: / Year	Constant	Debt/ Book Value of Equity	*LIQ*	*OL*	*SV*	*PE*	*SIZE*	*RET*	Log of Likelihood Function	Test for Goodness-of-Fit Likelihood Ratio Test Statistic	Test for Heteroskedasticity Likelihood Ratio Test Statistic
1976	−0.003	0.011	0.012*	−0.275*	−0.002	−0.001	0.003*	0.154*	−214.174	166.49*	95.63*
	(−0.071)**	(0.643)	(2.594)	(−2.726)	(−0.030)	(−1.350)	(4.693)	(−2.770)			
1977	0.001	0.023	0.011*	−0.254*	0.043	−0.001*	0.001	−0.166*	−55.760	297.55*	231.95*
	(0.344)	(1.729)	(2.136)	(−3.995)	(1.005)	(−2.438)	(1.662)	(−4.302)			
1978	−0.028	0.026*	0.014*	−0.337*	0.157*	−0.001*	−0.000	−0.162*	−6.217	305.62*	226.35*
	(−1.084)	(2.807)	(2.816)	(−5.460)	(4.000)	(−0.652)	(−0.233)	(−3.741)			
1979	−0.013	0.011	0.015*	−0.484*	0.138*	0.000	0.000	−0.085	25.033	222.41*	149.89*
	(−0.616)	(1.291)	(2.317)	(−8.853)	(4.185)	(0.340)	(1.065)	(−1.814)			
1980	0.012	0.007	0.006	−0.247*	0.029	0.00001*	0.000	−0.044*	61.029	372.48*	291.70*
	(0.484)	(0.658)	(1.124)	(−3.044)	(0.665)	(12.870)	(1.197)	(−2.181)			
1981	0.027	0.008	0.009*	−0.089	−0.092*	0.000	0.001*	−0.039	64.928	395.75*	313.01*
	(1.227)	(1.281)	(2.105)	(−1.893)	(−2.375)	(0.721)	(2.115)	(−2.570)			

* Indicates signficance at the 5% level.

** t-statistics are in parentheses.

with

$$E(\epsilon_s, \epsilon_t) = 0 \quad \text{when} \quad s \neq t$$

for the heteroskedastic specification. The equation takes an average of 55 iterations to obtain an optimum, with convergence obtained.

The heteroskedastic Tobit analysis results are provided in Table III. Several differences between Tables II and III should be noted. First, the coefficient on *DR* remains positive. Second, operating leverage remains a significant, negative factor, while sales variability becomes a significant positive factor in three of the six years. Liquidity is a significant, positive variable in the heteroskedastic model, yet it does not enter in a significant manner in the homoskedastic model.

Along with the coefficient estimates, Table III provides the likelihood ratio test statistics testing (1) the fit of the model and (2) the improvement over the homoskedastic model. The improvement of the estimation by the modeling of a multiplicative disturbance term is tested using the likelihood test statistic. In this test, the homoskedastic model becomes the constrained model and the heteroskedastic model is the unconstrained model, where the constraints are zero-valued constraints on the vector γ (except for the element which corresponds to the intercept). The comparison of likelihood ratios of the two models indicates that the heteroskedastic model provides an improvement in the explanation of the lease ratio.

At this stage, and after several refinements, it is not possible to obtain predicted tradeoffs between debt and leases. An even greater disappointment is that the observed relationship between leasing and debt is positive, implying that an increase in debt (lease) is associated with an increase in lease (debt). The finding of $\alpha < 0$ is a puzzle which is not solved in this study.

III. Conclusion

A series of empirical tests are performed in this study on samples of approximately 600 firms, covering the years 1976 through 1981, with none of the three views on the debt displacement of debt by leases supported by the results. Instead, the results indicate that leases and debt are complements: greater debt is associated with greater leasing. This finding reappears consistently for each year, each definition of the leverage ratios, and each approach to analysis. This complementary relationship persists even after refinements are made to the estimation technique.

There are several possible explanations as to why the substitution coefficient, α, is less than zero; that is, why debt and leases are observed to be complements of one another.[9] One explanation may be that the market for debt and debt-like

[9] It should be noted that an apparently contradictory evidence is found in a study by Bowman [5], where debt and leases are both found to be positively related to the systematic risk of a security. However, several points should also be noted: (1) Bowman actually reported a positive correlation between debt and lease ratios in his sample, (2) the sample employed by Bowman was confined to 1973, where compliance to the reporting of leases under ASR-147 was voluntary, and the sample of nonleasing firms was either not used in this estimation, or not in the same regression with the leasing firms, and (3) the positive sign for the lease ratio coefficient in the beta equation was found only after some highly selective manipulation of the data, e.g., the elimination of the firms that have either high debt ratio and high lease ratio or low debt ratio and low lease ratio in the sample for regression.

securities may not be efficient. For instance, Abdel-Khalik [1] reported in a survey that a high percentage of lenders apparently ignore noncapitalized leases. Another possible explanation may be due to the difference in the tax brackets between the leasing and the nonleasing groups.[10] Still another possible explanation for this observed complementary relationship may be that there are qualitative differences in the debt issued by the leasing and nonleasing firms which are not discernible from available data.[11] Finally, these results may not be so unexpected if there is no optimal capital structure or debt limit for an individual firm.

At this point, these findings may be declared as an unsolved puzzle in finance, awaiting future researchers with better data and better methodology (for example, the expression of debt capacity as a "fuzzy" band). Thus, the contribution of this study is to call attention to the puzzle.

[10] We also investigate this possibility; however, contrary to the expected belief (e.g., Brealey and Young [6]) that lessee firms are in no or low tax brackets, the average tax rates of the two groups are not significantly different from one another. The closest tax rates occur in 1979, where the average tax rate of the nonleasing firms is 0.41 and that of the leasing group is 0.42. In fact, the average tax rates of the leasing firms is consistently higher than that of the nonleasing firms in each of the six years.

[11] For instance, it is an unsettled issue of whether the increased willingness of the secured debtor to lend could lead to greater debt capacity (e.g., Smith and Warner [23] vs. Scott [22]).

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