Further Evidence on the Terms of Financial Leases

Peggy J. Crawford, Charles P. Harper, and John J. McConnell

Peggy J. Crawford is Assistant Professor of Finance at the University of Houston. Charles P. Harper is Associate Professor of Finance at the University of Santa Clara. John J. McConnell is Professor of Finance at Purdue University and the University of Minnesota, as well as an Associate Editor of this journal.

Introduction

Several studies have broken new ground in the ongoing effort by academicians to comprehend and appreciate fully the role of financial leases in corporate capital structures. Papers by Sorensen and Johnson [9], McGugan and Caves [6], and Gudikunst and Roberts [4] have analyzed systematically empirical aspects of the financial leasing market. The major common finding of these studies is that the internal rates of return ("yields") on lease contracts have exceeded, by a wide margin, yields on what are approximately equivalent debt financing arrangements. Concurrently, Anderson and Martin [1] have reported on a survey revealing that practicing financial managers resoundingly reject, as a financing arrangement, what is a low cost lease according to existing models of lease evaluation [3, 5, and 8]. During the period in which these studies were conducted, the popularity of leasing as a financing device continued to grow rapidly [10]. Like many of the rest of us, Bower [2] has expressed puzzlement at the apparent empirical anomaly.

This study presents some further evidence on the terms of financial leases. The paper has two objectives. First, like earlier investigators, we hope to provide descriptive empirical information that will add to understanding of the leasing market. Second, because our sample is drawn independently of others, and because it is taken from a separate geographic region, our results will give some indication of the generality of the results of the previous studies.

The results of our analysis are at the same time both comforting and disquieting. The good news is that our results are generally consistent with those reported previously. The bad news is that we too are unable to explain the peculiarly high yields on lease contracts when compared with those on what generally are thought to be approximately equivalent debt securities.

Data

Data were obtained on 50 financial leases issued over the period April 1973 through June 1980 by three commercial banks in Houston, Texas. All are "pure" financial leases: the lessor provides only financing, and the lessee is responsible for all maintenance, taxes, and insurance on the leased asset. Data collected include the original issue date of the leases, the original purchase price (or cost) of the assets involved, any prepayment requirements of the leases, the time period encompassed by the contract, and the size and recipient of the investment tax credit generated by the purchase of the asset.

Characteristics of the Sample

Exhibit 1 shows the purchase prices of the assets on which the leases are written. The costs of the assets range from $9,352 to $8,044,425 with a mean amount of $939,000 and a median of $226,449. Forty percent of the assets have purchase prices greater than $500,000.

In comparison with previous studies, the original costs of the assets in this study are large. For example, the largest cost of a leased asset in the Sorensen–Johnson (S–J) study was $200,000. The predominance of "high-priced" assets in our sample provides the potential to test the hypothesis, suggested by Justic and Thomason, that the high measured yields in the S–J study are due to "the high transactions costs of the small leases that dominate the sample" (see Bower [2], p. 32). Implicit in this suggestion is the hypothesis that the transactions costs of leases decline proportionately as the values of the leased assets increase.

Exhibit 1. Original Purchase Prices of Assets

Original Purchase Price	Number of Contracts	Percent of Sample
Less than $ 25,000	4	8
$ 25,001 – 50,000	12	24
50,001 – 100,000	5	10
100,001 – 250,000	4	8
250,001 – 500,000	4	8
500,001 – 1,000,000	11	22
1,000,001 – 3,000,000	7	14
3,000,001 – 10,000,000	3	6
Smallest $ 9,352		
Largest 8,044,425		
Mean 939,000		
Median 226,449		

Exhibit 2. Prepayment Requirements

Prepayment in Percent	Number of Contracts	Percent of Sample
0	5	10
2	7	14
3	17	34
4	5	10
7	9	18
8	6	12
9	1	2
Smallest .0%		
Largest 9.0%		
Mean 4.1%		
Median 3.0%		

A characteristic common to many lease contracts is a requirement that some form of collateral other than the leased asset itself be pledged to support the lease. Examples of additional collateral include personal guarantees, third party guarantees, or claims on other assets. Atypically, none of the leases in this sample required collateral other than the leased asset.

A prepayment on a lease is an up-front cash payment that is similar to the down payment typically required when the purchase of an asset is financed with borrowed funds. Exhibit 2 summarizes the prepayment requirements of the leases in our sample. Ten percent of the leases require no prepayment. As a percentage of the cost of the asset, the largest prepayment requirement is 9%, and the mean and median prepayment requirements are 4.1% and 3%, respectively.

Exhibit 3 shows that the maturities of the leases range from 5 to 15 years with a mean duration of 7.6 years and a median of 7 years. Approximately 66% of the leases had maturities of either five or seven years. The preponderance of five- and seven-year leases may be explained by the tax laws associated with the investment tax credit (ITC). With a minimum asset life of five years, the ITC is 6.67% of the purchase price; with an asset life of seven years or greater, the ITC reaches its maximum of 15% of the purchase price.

The ITC on a leased asset can either be retained by the lessor or passed through to the lessee. In this sample, the ITC was retained by the lessee in 70% of the contracts.

Exhibit 4 summarizes the characteristics of the leases by asset category. The category of computers and data processors contains the largest number of observations, 22. The construction equipment category encompasses the fewest observations, 2. The

Exhibit 3. Length of Lease Period

Length of Lease in Years	Number of Contracts	Percent of Sample
5	20	40
7	13	26
8	3	6
9	1	2
10	7	14
12	2	4
15	4	8
Shortest 5.00 years		
Longest 15.00 years		
Mean 7.56 years		
Median 7.00 years		

leases in the construction equipment category have the highest average prepayment requirement, 8%, and covered assets with the smallest average cost, $29,000. The category with the shortest average maturity, five years, encompasses hospital equipment. The railroad equipment category has the highest average asset cost, $5,820,000, and the longest average maturity of leases, 14.25 years. The marine equipment category has the lowest average prepayment requirement, 1%. The lessor retained the ITC on all the leases made for railroad and marine equipment.

Data Analysis

Sorensen and Johnson have conducted the most comprehensive empirical investigation to date of the terms of financial leases. So that our results may be compared directly with theirs, the mode of analysis that we have adopted closely parallels theirs.

The net yields to the lessors were computed by solving for r in the following equation:

$$c = (1-t)\sum_{i=1}^{n} L\left(\frac{1}{1+r}\right)^i + t\sum_{i=1}^{n} D_i\left(\frac{1}{1+r}\right)^i + S_n\left(\frac{1}{1+r}\right)^n + P + ITC \quad (1)$$

where:

- n = life of the lease in months or the number of monthly lease payments required;
- c = purchase price of asset, in dollars;
- t = marginal tax rate;
- D_i = depreciation in period i, in dollars;
- L_i = lease payment required at end of period i, in dollars;
- P = prepayment at time zero, in dollars;
- S_n = salvage estimate at time n, in dollars;
- ITC = investment tax credit at time zero, if retained by the lessor, in dollars; and
- r = internal rate of return per month.

The data used in the computation of the net yields were gathered from the records of the lessor. To interpret these yields as the "cost" of leasing to the lessee requires that we assume symmetry between the two parties in terms of the relevant data. It is likely that the purchase price of the asset would be the same for the two parties. Further, because it appears reasonable to assume that both parties would depreciate the asset as quickly as possible, we use the sum-of-the-years digits method in all cases. There is likely to be less symmetry in marginal tax rates and estimated salvage values. For this reason, we examine the sensitivity of the yields to different assumptions about the marginal tax rates and salvage values.

Exhibit 4. Characteristics of the Sample by Asset Category

	Computers and Processors	Construction	Aircraft	Railroad	Marine Equipment	Manufacturing	Hospital	Office	Total
Number of Contracts	22(44%)	2(4%)	5(10%)	4(8%)	3(6%)	4(8%)	3(6%)	7(14%)	50
Mean Purchase Price	$623,000	$29,000	$763,000	$5,820,000	$853,000	$411,000	$257,000	$86,000	$929,000
Mean Prepayment (as % of cost)	4.32%	8.00%	3.40%	2.00%	1.00%	3.25%	3.67%	6.00%	4.10%
Mean Maturity (in years)	6.09	6.50	7.00	14.25	12.33	8.00	5.00	7.86	7.56
ITC Retained by Lessor (% of Contracts)	82%	0%	20%	100%	100%	75%	67%	57%	70%

Exhibit 5 summarizes the annualized yields. Yields were computed with tax rates of zero (a before-tax basis), 20%, and 46%. On a before-tax basis, the rates vary from a low of 10.9% to a high of 36.1% (mean = 20.7%; median = 19.3%). With a tax rate of 20%, the range is from 9.5% to 31.0% (mean = 17.9%; median 16.9%). Finally, with a tax rate of 46%, the lowest yield is 7.6% and the highest is 23.8% (mean = 14.0%; median = 13.1%).

We also computed yields assuming the leased assets had salvage values of zero and twice the estimated value. These experiments altered the yields by a maximum of plus or minus 2%. Given the absolute values of the estimated yields, this impact is relatively minor. This suggests that differences in expected salvage values between the lessor and lessee are not likely to explain the attractiveness of leasing as a financing alternative.

Over the same period of time during which these leases were written, the yield on BBB corporate bonds of the same maturity as the lease contracts averaged 10.5% on a before-tax basis. Comparatively, the yields on the financial leases are high. At least three possible reasons may explain the difference: 1) firms that lease assets are more prone to default than the general population of borrowers; 2) considerable inefficiencies or imperfections exist in the leasing market (*i.e.*, transactions costs are higher than in bond markets); or 3) lease contracts differ from debt contracts in some fundamental but as yet not well understood way.

Multivariate Regression Analysis

Multivariate regression analysis is employed to determine the impact of the lease terms on the cost of leasing. In addition to the explanatory variables employed by S-J, we include a government bond rate to capture the impact of the banks' opportunity cost of funds on lease terms. Exhibit 6 presents the regression results using all data under a variety of assumed tax rates. The independent variables employed are:

Exhibit 5. Aggregate Ex Ante Yields on Lease Contracts

	Mean	Standard Deviation	Minimum	Maximum
After-Tax Rate (46%)	14.0%	4.5%	7.6%	23.8%
After-Tax Rate (20%)	17.9%	5.8%	9.5%	31.0%
Before-Tax Rate (0%)	20.7%	6.7%	10.9%	36.1%
Government Bond Yields (yields are average yields on outstanding government securities of the same maturity as the leases in our sample)	8.1%	1.6%	6.4%	13.5%

Exhibit 6. Regression Results with Full Sample

		(Regression Coefficients)†							
Yield	Constant	Purchase Price (Dollars)	Maturity (Years)	Prepayment (Percent)	ITC (1, 0)	Banks' Cost of Funds	Standard Error	F	R^2
After-tax yield (46% tax rate)	.0927	−.0003 (1.431)	−.0074 (28.496) ***	+.6635 (17.645) ***	+.0479 (33.445) ***	+.0055 (6.255) ***	+.022	31.61	.76
After-tax yield (20% tax rate)	.1262	.0004 (1.321) *	−.0099 (27.049) ***	+.7832 (13.268) ***	+.0546 (23.509) ***	+.0075 (6.183) ***	+.030	27.2	.73
Before-tax yield (0% tax rate)	.1494	−.0004 (1.254)	−.0116 (26.511) ***	+.8693 (11.555) ***	+.0594 (19.649) ***	+.00887 (6.168) ***	+.036	25.4	.71

†F statistic in parentheses below each independent variable, D.F.: 5/44
*Significant at the 5% level. **Significant at the 1% level. ***Significant at the .1% level.

Cost = purchase price of asset, in dollars;
Maturity = life of the lease, in dollars;
Prepayment = prepayment or "down payment," as percentage of the purchase price of the leased asset;
ITC = 1 if ITC retained by the lessor; 0 otherwise; and
Banks' Cost of Funds = yield on outstanding U.S. government bonds of the same maturity as the lease, in percentage.

The dependent variable is:

Lease Yield = compound annual internal rate of return on the lease, assuming indicated tax rate in percentage (monthly yield from Equation (1) converted to annual basis).

Empirical Results — Complete Data Set

Both the before- and after-tax equations lead to similar inferential statements.[1] Overall, the independent variables do quite well at explaining the variations in the cost of leasing. The adjusted R^2 is .76 for the after-tax equation and .71 for the before-tax equation.

The length of the lease, amount of prepayment, the retention of the ITC, and the banks' opportunity cost of funds all have a statistically significant impact upon the yield of the lease. As the length of the lease increases, the yield of the lease declines. The yields on the leases increase as the percentage amount of the prepayments increases. Additionally, yields are positively related to retention of the ITC by the lessor.[2] Although multicollinearity among the variables makes interpretation difficult, it is possible that each of these relationships comes about because of the risk inherent in the lease contract. That is, each of these variables is negotiable. Lessors may grant longer maturity leases to less risky lessees, and they may require larger prepayments from more risky ones, *ceteris paribus*. Furthermore, the lessor would most frequently retain the ITC when the lessee does not have sufficient tax obligations to use the ITC fully. Most commonly, this would occur when the lessee has undergone several years of losses and consequently has sufficient loss carryforwards to cancel out most tax obligations. These firms could very well be of higher risk to a lessor.

As is expected, the banks' opportunity cost of funds is a statistically significant determinant of lease yields. As the cost of funds rises, the bank charges a higher effective rate on the lease contract.

Empirical Results — Classification of Leases

Exhibit 7 presents the separate regression results for leases involving computers (and related equipment) and all other asset categories. Results are presented only for yields computed assuming a 46% tax rate. Results for other assumed tax rates are similar to those reported. The leases for non-computer assets yield similar results to those based upon the entire data set. The maturity of the lease is significantly and negatively related to the lease yields, the percentage prepayment and ITC retention are significantly positively related to lease yields, and the banks' opportunity cost of funds is positively related to the estimated yields on the leases. The overall explanatory power of the variables is high, as witnessed by the $\bar{R}^2$ of .82.

The regression results based upon leases for computers are somewhat surprising. Fewer variables are statistically significant, and the $\bar{R}^2$ of .62 is lower than the $\bar{R}^2$ of the non-computer lease equation. One would expect that the more homogeneous the leased assets, the more clear would be the underlying relationships. Only the maturity and ITC variables are statistically significant. The banks' opportunity cost of funds apparently does not significantly influence the cost of leasing a computer.

The mean after-tax yield on leases for computers is 15.9%, whereas the mean after-tax yield for other leases is 12.4%. These results are consistent with the conjecture that the independent variables are a proxy for the lessee risk. If firms that lease computers are more risky than the general population of lessees, the mean yield of their leases should be above the popula-

---

[1] Multicollinearity exists among virtually all pairs of the five independent variables. The existence of multicollinearity makes it difficult to analyze single variable impacts precisely. Each of the independent variables is statistically significant at the .1% level as a single independent explanatory variable of lease yields. Omitting the purchase price, or the prepayment variable or the maturity variable, leads to similar empirical results. For the above reasons, as well as for theoretical consistency, we choose to discuss the empirical results for the complete equations.

[2] Some difficulty in interpretation is created by the inclusion of the ITC variable in the regression. The problem arises because the ITC is used both in calculating the internal rate of return (IRR) and as a dependent variable in the regression. One potential solution to the problem is to generate an IRR exclusive of the ITC. If this technique is employed, it is unclear how to interpret this alternative IRR. Fortunately, inferential statements are not significantly altered when the regressions are performed using this alternative IRR. Exclusion of the ITC variable from the regression model also leads to similar empirical results.

Exhibit 7. Regression Results for Computers and Related Equipment and for Other Assets[1]

Asset Category	Constant	(Regression Coefficients)[2] Purchase Price (Dollars)	Maturity (Years)	Prepayment (Percent)	ITC (0, 1)	Banks' Cost of Funds	Standard Error	F	R^2
Leases for Computers and Related Equipment[3] (Mean yield = 15.92%) (Tax rate = 46%)	.2244	−.0008 (1.147)	−.0205 (6.381) **	.4143 (1.042)	.0503 (7.218) **	.0007 (0.028)	.025	7.78	.62
Leases for Items other than Computers[4] (Mean yield = 12.40%) (Tax rate = 46%)	.0812	−.0003 (1.867)	−.0073 (29.588) ***	.4918 (8.208) ***	.0456 (28.615) ***	.0078 (10.565) ***	.018	25.81	.82

[1]Results are presented for a 46% tax rate only. Results for other tax rates lead to the same inferential conclusions.
[2]F Statistics in parentheses below each independent variable.
[3]D.F.: 5/16 [4]D.F.: 5/22

tion mean. Likewise, some of the "proxy" variables for risk should no longer be significant as the "within" group risk becomes more homogeneous. The failure of the banks' cost of funds to enter significantly, however, is a puzzle.

Empirical Results — Classification by Purchase Price of Asset

Exhibit 8 presents the separate regression results for leases on assets with purchase prices of less than $1 million and on assets with purchase prices of $1 million or more. For the leases on assets costing less than $1 million, all the independent variables except the banks' cost of funds are statistically significant at the 5% level.

For the leases on assets with prices of $1 million or more, the maturity of the lease, the ITC, and the banks' costs of funds are all significant determinants of the yield. The purchase price of the asset and the percentage prepayment requirement, however, are not.

The mean after-tax yield on the leases for less expensive assets is 16.6%, and the mean yield on the more expensive assets is 12.1%. This result is consistent with the conjecture that fixed transactions costs explain part of the comparatively high yields on lease arrangements.

However, that is at best only part of the answer. Exhibit 9 presents average government bond rates, average BBB corporate bond rates, and average before-tax yields on leases (all for each year from 1975 through 1980). Internal rates of return on leases for the less expensive assets were more than twice the average yield on BBB bonds. In each year, the lease yields on assets with purchase prices of $1 million or more were less than those on the less expensive assets, but they were considerably above those on BBB corporate bonds.

For example, the average yield on a government bond ranged from 7.65% in 1975 to 11.37% in 1980, and the yield on the average BBB corporate bonds ranged from 10.61% in 1975 to 13.42% in 1980. The calculated yields of the leases for the less expensive assets ranged from 22.77% to 34.34% and of leases for the more expensive assets ranged from 18.57% to 27.71% during the same period.

In the final analysis we are left with the three explanations cited above for this apparent empirical anomaly: 1) firms that lease assets are more prone to default than the general population of corporate borrowers; 2) considerable inefficiencies or imperfections exist in the leasing market; or 3) lease contracts differ from debt contracts in some fundamental but as yet not well understood way. Given that the comparatively high yields on lease contracts have persisted across geographic regions, across time periods, and across asset categories, the third of these ex-

Exhibit 8. Regression Results for Leases on Assets with Purchase Prices Less Than $1,000,000 and $1,000,000 or More[1]

Asset Category	Constant	(Regression Coefficients)[2] Purchase Price (Dollars)	Maturity (Years)	Prepayment (Percent)	ITC (0, 1)	Banks' Cost of Funds	Standard Error	F	$\bar{R}^2$
Purchase price less than $1,000,000[3]									
Mean yield = 16.57%)	.1472	+.0409	−.0122	+.6306	+.0616	+.0002	.021	17.78	.81
(Tax rate = 46%)		(2.994) *	(16.635) ***	(6.503) **	(17.713) ***	(0.005)			
Purchase price $1,000,000 or more[4]									
(Mean yield = 12.05%)	.1198	−.0003	−.0073	−.5322	+.0247	+.0077	.017	14.01	.70
(Tax rate = 46%)		(1.752)	(25.070) ***	(1.221)	(7.697) ***	(10.440) ***			

[1]Results are presented for a 46% tax rate only. Results for other tax rates lead to the same inferential conclusions.
[2]F statistics in parentheses below each independent variable.
[3]D.F.: 5/15 [4]D.F.: 5/23

Exhibit 9: Comparison of Lease Yields with Government and Corporate Bond Yields*

	Average Government Bond Yield	Average BBB Corporate Bond Yield	Average Calculated Yield on Leases Purchase Price less than $1,000,000	Purchase Price $1,000,000 or more
1975	7.65%	10.61%	22.77%	18.57%
1976	6.81%	9.75%	14.64%	18.39%
1977	7.07%	8.97%	31.09%	16.49%
1978	8.34%	9.49%	22.65%	15.23%
1979	9.94%	10.69%	30.09%	16.97%
1980	11.37%	13.42%	34.34%	27.71%

*The years 1973 and 1974 are omitted because in our sample no leases were made in those years on assets with a purchase price of more than $1 million.

planations appears more plausible than the first two. Indeed, given the extensive theoretical investigations of the lease/borrow decision, very little consideration has been given to the precise equilibrium determinants of the discount rate for lease evaluation. Generally the issue is casually swept under the rug with the admonition that an "appropriate risk-adjusted discount rate" be employed. Presumably that rate is a function of the risk of the lessee, but it also may be a function of lease prepayment requirements, lease maturity, and the prevailing term structure of interest rates. The accumulated empirical evidence indicates that the logical next step in understanding the leasing market is the development of equilibrium models of lease valuation.

Summary

To provide further evidence on the terms of financial lease contracts, this paper has analyzed data on financial leases made by commercial banks in Houston, Texas, from 1973 through 1980. Internal rates of return (yields) were computed for each of the leases and subjected to multivariate regression analysis to determine the importance of the various lease characteristics in determining rates of return. The findings of our study are generally consistent with those of Sorensen and Johnson and other earlier studies.

In particular, the average before-tax yield of the sample of 20.7% is significantly above the yield of

8.1% on government securities and 10.5% on BBB bonds issued during the same period and with the same maturity as the leases. This apparent empirical puzzle appears to be invariant to the particular geographic region, time period, and type of asset considered. The most likely explanation for its persistence is that lease contracts differ in some systematic but as yet not widely recognized way from approximately comparable debt contracts. Further theoretical investigation into the subtle distinctions among various types of lease contracts and between lease contracts and debt contracts would appear to be an appropriate next step toward a further understanding of the leasing market. The accumulated empirical evidence suggests that special attention should be devoted to analyzing the relationship between the cost of leasing and lessee risk, between the cost of leasing and the characteristics of the lease (including prepayment requirements, lease maturity, and ITC retention), and between the cost of leasing and the term structure of interest rates.

References

1. Paul F. Anderson and John D. Martin, "Lease vs. Purchase Decisions: A Survey of Current Practice," *Financial Management* (Spring 1977), pp. 41–47.
2. Richard S. Bower, "Introduction to Two Papers on Leasing," *Financial Management* (Spring 1977), p. 32.
3. Richard S. Bower, "Issues in Lease Financing," *Financial Management* (Winter 1973), pp. 25–34.
4. Arthur C. Gudikunst and Gordon S. Roberts, "Leasing: Analysis of Theoretic-Pragmatic Dilemma," paper presented at the annual meeting of the Financial Management Association, Kansas City, October 1975.
5. Wilbur G. Lewellen, Michael S. Long, and John J. McConnell, "Asset Leasing in Competitive Capital Markets," *Journal of Finance* (June 1976), pp. 787–798.
6. Vincent J. McGugan and Richard E. Caves, "Integration and Competition in the Equipment Leasing Industry," *Journal of Business* (July 1974), pp. 382–396.
7. Stewart C. Myers, David A. Dill, and Alberto J. Bautista, "Valuation of Financial Lease Contracts," *Journal of Finance* (June 1976), pp. 799–820.
8. Lawrence D. Schall, "The Lease-or-Buy and Asset Acquisition Decisions," *Journal of Finance* (September 1974), pp. 1210–1211.
9. Ivar W. Sorensen and Ramon E. Johnson, "Equipment Financial Leasing Practices and Costs: An Empirical Study," *Financial Management* (Spring 1977), pp. 33–40.
10. Peter Vanderwicken, "The Powerful Logic of the Leasing Boom," *Fortune* (November 1973), p. 136.