A GENERATION OF BIAS AGAINST LEASING

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I. INTRODUCTION

In a recent discussion of leasing analysis, a finance officer in a Class I railroad said, "Whenever my people bring me an analysis that recommends leasing over purchase, I tell them they made a mistake and to go back and rework the numbers!" Bias such as this is neither new nor unpredicted given the many controversies regarding the proper inputs and methods of analysis for evaluating the lease vs. own decision. As early as 1977 a survey of lease analyses used by 48 of the 200 largest *Fortune* 200 companies concluded:

> …that a significant number of large industrial firms employ lease-purchase analysis models which may be biased in favor of the purchase alternative. Anderson and Martin (1977, p. 43)

Referring to the new (in 1976) formula for computing the net advantage of leasing, these researchers correctly predicted future problems in implementation, including the appropriate rates for discounting different cash flows, the amount of debt capacity used by the lease, and interaction with the capital structure of the firm. Incorrect assumptions regarding these three subjects and failure to seriously consider the differences that exist between characteristics of the lessor and the lessee beyond tax rates can and have caused serious confusion and bias in lease evaluation for more than a generation.

Over the past 40 years there have been hundreds of research papers published on leasing, changes in accounting practices and the tax laws affecting leasing, phenomenal

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growth in leased assets, and the development of firms leasing specialized equipment. Yet, if we are to believe the predictions of many of the theoretical research papers, such interest, growth, and development in leasing should not have occurred.

This paper examines some of the causes of these disparities. We have found that major differences exist between the lessor and lessee that are not recognized or are muffled by the improper use of the economist's "competitive/efficient market" assumption. Acquisition Costs, Salvage Values, Cost of Debt, Options, and Debt Displacement Rate are frequently discussed but more often than not, the values of each of these inputs are assumed equal between lessor and lessee leading to conclusions such as:

> Therefore in competitive markets both parties will use the same before tax interest rate, and the after tax interest rate will only differ if they are in different taxpaying positions. Where the lessor and lessee pay taxes at the same rate the negotiation of a leasing contract will lead to an agreement with either a zero NAL (Net Advantage to Leasing) for both parties or a positive value for one party and a negative value for the other. In other words leasing appears to be a zero-sum game. (Parenthetical added.) Drury and Braund (1990, p. 179)

This conclusion is correct given the stated assumptions are true; however, in practice we find significant deviations from the assumptions and the foundation for the argument vanishes, while the conclusion lingers on.

We are not the first to observe this phenomenon. Concerning the assumptions used in leasing analyses, Bower and Oldfield (1981) conclude:

> …. it is not because they fail to note the qualifying conditions under which a lease offers real advantage but because they leave the impression that those conditions may appear so infrequently and last such a short time that it may not pay a firm to look into leasing. (p. 30)

and

> "…qualifications are easily forgotten when they accompany strong propositions." (p. 36)

The "strong proposition" is "leasing, without tax rate differences between lessor and lessee, is a zero sum game". Bower and Oldfield (1981, p. 29) also observed, "…a strange ambivalence in our academic approach….our tendency is not to embrace (leasing) as benefiting all parties to a transaction, but to explain it away as a means for rearranging rather than enhancing a firm's value." They "…argue as well that the impression, often left by the principles, that leasing seldom benefits all parties to the transaction is incorrect." We observe the same behavior today, 23 years later.

The emphasis on tax rate asymmetry and assuming away other differences between the lessor and lessee have caused serious impediments in the academic research of leasing. We conclude that 20 years of differences that have developed between these two groups remain virtually unexplored.[1]

In our research we have found seven areas where analysis of leasing currently taught and practiced can introduce bias against leasing:

1. Debt Displacement
2. Costs of Funds
3. Cost of Acquisition
4. Salvage Value
5. Maintenance & Operations
6. Options
7. Except for taxes, leasing is a zero sum game

Section II sets the notation, structure and models for the remainder of the paper. Section III explores the often-neglected effects of the firm's capital structure upon leasing,

[1] A recent article by Schallheim and Pruettiangkura (2002) examined the past 20 years of data from lessor firms but no one has analyzed the differences between the lessor firm and the lessee firm with respect to the existence and impact of these differences on the lease vs. own decision. Gutman and Yagil (1994) develop an analytical model for such study but do not present any empirical data or conclusions regarding these differences.

proposes an operational definition of debt displacement and includes recent empirical data that indicate significant asymmetries between lessors and lessees. These and other asymmetries are examined in Section IV. Failure to properly value options in a lease contract is discussed and methods to correct this error are explored in Section V. In Section VI, numerical examples demonstrate the impact of biases previously examined. The results of a survey of the perpetuation of biases by popular corporate finance textbooks are presented in Section VII and our conclusions and recommendations are summarized in Section VIII.

II. DEFINITIONS, NOTATION AND MODELS

A persistent problem in leasing is the definitions of different types of leases. As the leasing industry evolved, accounting principles,[2] tax laws,[3] and the Uniform Commercial Code[4] (UCC) have all changed significantly in the past 40 years, each adding to the definition confusion. A major cause of the differences in the conclusions among empirical studies published in the finance and accounting journals appears to be the lack of adherence to common definitions of lease types by the available databases. For purposes of this paper we only distinguish between capital[5] leases and operating leases. A capital lease is a lease that satisfies one or more of the following criteria:

1. Ownership is transferred to the lessee by the end of the lease term.
2. There is a bargain purchase option, which is an option to purchase the leased asset at a price sufficiently below the estimated fair market value that exercise seems assured.
3. The lease term is 75 percent or more of the estimated economic life of the leased property.
4. The present value of minimum lease payments is at least 90 percent of the fair value of the leased property, less any investment credit retained by the lessor.

Abdel-khalik (1981, p. 3)

An operating lease must fail all of the above criteria. In this article, we are concerned only with operating leases. The differences between these two lease types that impact the discussions herein are the length of the lease term relative to the economic life of the asset and the tax treatment. Generally, the shorter term of the operating lease (<75% of expected

[2] See, for example, A. Rashard Abdel-khalik, (1981).
[3] See Schallheim (1994), chapter 3, for a cogent description and history of "Tax Rules for Leasing".
[4] Article 2A on leasing was added to the UCC in October 1987. Prior to this amendment, leasing was treated as part of Article 2, Sales. Boss (1988) Note: The entire issue of *The Alabama Law Review*, Vol. 39 no. 3 Spring 1988, was devoted to UCC Article 2A.
[5] Capital leases are often called finance or financial leases.

economic life of the asset) elevates the importance of items such as residual value, options, and debt displacement.

The lease payments for a capital lease are not deductible intact. The lessee must separate the lease payment into depreciation, interest, and payment of principal. Some authors treat an operating lease as cancelable and a capital lease as non-cancelable. In fact, cancellation options are available in both capital and operating leases as currently defined. Therefore, it is important for the lessee to note these options and to properly value the options in the lease vs. own analysis.

To avoid the controversy between "lease vs. buy" and "lease vs. borrow" we structure our decision as lease vs. own and deal with the amount borrowed in the "own" branch of the decision tree[6]. The "user" is the entity who wishes to acquire the right to use the asset. This right can be acquired by owning the asset or by leasing the asset; therefore, the user's decision is simply "Lease vs. Own"; i.e., "User/Lessee" or the "User/Owner".

Table 1 uses the lease vs. own decision structure to define the notation used herein and includes all variables necessary to reflect asymmetries between the lessee and the lessor.[7] The debt displacement rate (line 7) will be discussed in Section III.

Table 2 describes the present value ("PV") of the cash flows necessary to compute the Net Advantage of Leasing ("NAL") for both the user or the lessor. The sum of the entries in column (1), Table 2, is the present value to the user/owner who purchases the asset. Columns (2) and (3) represent the decision to lease. The sum of the elements in column (2) is the present value of the lease contract to the Owner/Lessor and the sum of the elements in column (3) is the present value of the lease contract to the User/Lessee. The lessor's decision is to

[6] We agree with Weingartner (1987, p. 5): "The notion that the issue is 'lease vs. buy/borrow' is rejected."
[7] Most of the research papers do not distinguish the variables between the lessee and the lessor, reflecting their bias that the pairs of variables are equal.

choose the value of the lease payments to be quoted (and/or negotiated) such that: 1) the lease makes a profit; and, 2) the lessee signs the contract. The user's decision is to choose to lease or to own, given the lease contract with the terms and payments quoted (and/or negotiated) by the lessor.

The Net Advantage of Leasing[8] for the user is column (3) less column (1) of Table 2; viz:

NAL_u = Column (3) – Column (1)

$$= A_u - \frac{S_u(M)}{(1+RS_u)^M} - PV[RL_u, L(t)] + T_u * PV[RT_u, L(t)]$$

Asset Cost(1,1)- PV(Salvage) (2,3) - PV(Lease Payments) (3,3) + PV(Lease Tax Shelter) (4,3)

$$- T_u * PV[RT_u, D(t)] - \lambda_u * T_u * RB_u * PV[RT_u, B_u(t)]$$

- PV(Depreciation Tax Shelter) (5,1) - PV(Interest Tax Shelter) (6,1)

$$+ \sum_{i=1}^{K} O_u(i) \qquad \text{equation (1)}$$

+ PV[Options] (7,3)

Each term in equation (1) is labeled and references the row and column (row,column) in Table 2. The Asset Cost is the total cost (at t = 0) of acquiring the asset delivered to the location specified by user. The lease payment at time t , L(t) , is the quotation given by the lessor for use of the asset under terms of the lease contract.

Most of the techniques for evaluating lease vs. own decisions that have been taught for the past 25 years were published in the 1970's. Bower (1973) reviewed nine journal articles on leasing and listed seven different approaches to evaluating the lease vs. own decision. The differences in these approaches arose from the various, often unstated, assumptions regarding

[8] To simplify the discussion we "bias" the process by the assumption that Income from Using Asset less Maintenance and Operation expenses in column (1) equals the same terms in column (3). We return to this subject in Section IV.

TABLE 1*

NOTATION

Line 1. Use and Ownership	Decision					
	Purchase		Lease			
	User/Owner		Owner/Lessor		User/Lessee	
Cash Flow Definitions	(1) Variable	(2) Disc. Rate	(3) Variable	(4) Disc. Rate	(5) Variable	(6) Disc. Rate
2. Acquisition Cost of Asset (at t=0)	A_u	-	A_r	-	-	-
3. After-tax Salvage value at end of period t	$S_u(t)$	RS_u	$S_r(t)$	RS_r	-	-
4. Lease payment at end of period t	-	-	$L(t)$	RL_r	$L(t)$	RL_u
5. Present Value of Option(i) in lease contract	-	-	$O_r(i)$	-	$O_u(i)$	-
6. Equivalent Loan (see Appendix A)	$B_u(t)$	RB_u	$B_r(t)$	RB_r	-	-
7. Debt Displacement Rate	λ_u	-	λ_r	-	λ_u	-
8. Cost of Debt	-	R_u	-	R_r	-	R_u
9. Depreciation taken in t	$D_u(t)$	RD_u	$D_r(t)$	RD_r	-	-
10. Tax Rate	$T_u(t)$	RT_u	$T_r(t)$	RT_r	$T_u(t)$	RT_u
11. Income from Using Asset in period t	$V_u(t)$	RV_u	-	-	$V_u(t)$	RV_u
12. Maintenance & Operating Expenses incurred during period t	$MO_{uo}(t)$	RM_u	$MO_r(t)$	RM_r	$MO_u(t)$	RM_u

Term of Lease……...M

Asset Economic life…N ; Where M < 75% N

Subscripts: u = user

r =lessor

uo = user/ owner (If Variable is different from user/lessee.)

* The structure of this table was suggested by Smith and Wakeman (1985, Table 1, p. 896).

TABLE 2*

COMPONENTS OF THE NET ADVANTAGE TO LEASING ("NAL")

Line	Decision		
	Purchase	Lease	
Use and Ownership	User & Owner	Owner/Lessor	User/Lessee
Present Value of Cash Flow from	(1) Quantity	(2) Quantity	(3) Quantity
1. Acquisition Cost	$-A_u$	$-A_r$	Ø
2. Salvage Value	$+S_u(M)/(1+RS_u)^M$	$+S_r(M)/(1+RS_r)^M$	Ø
3. Lease payments	Ø	$+PV[RL_r, L(t)]$	$-PV[PL_u, L(t)]$
4. Tax Shield: Lease Payments	Ø	$-T_r * PV[RT_r, L_r(t)]$	$+T_u * PV[RT_u, L(t)]$
5. Tax Shield: Depreciation	$+T_u * PV[RT_u, D_u(t)]$	$+T_r * PV[RT_r, D_r(t)]$	Ø
6. Tax Shield: Interest	$+T_u * \lambda_u * RB_u * PV[RT_u, B_u(t)]$	$+T_r * \lambda_r * RB_r * PV[RT_r, B_r(t)]$	Ø
7. Value of Option(s) in contract	Ø	$-\Sigma O_r(i)$	$+\Sigma O_u(i)$
8. Income from Using Assest	$+PV[RV_u, V_{uo}(t)]$	Ø	$+PV[RV_u, V_u(t)]$
9. Maintenance & Operating Exp.	$-PV[RM_u, MO_{uo}(t)]$	$-PV[RM_r, MO_r(t)]$	$-PV[RM_u, MO_u(t)]$
10. Total of the column	C(1)	C(2)	C(3)

PV[R, CF(t)] = the present value of the Cash Flows during each year t , CF(t) , discounted at the rate R , for M years.

$$= \sum_{t=1}^{M} CF(t) / (1 + R)^t$$

DECISION RULES

A. If C(1) > 0 , when the user's "hurdle rate" is used as the discount rate, then the project should be included.

B. If C(2) > 0 , then Lessor should be willing to lease at the price L(t) . This is the Lessor's Net Advantage to Leasing (NAL_r).

C. If C(3) - C(1) > 0 , then the User should lease, not purchase. This is the User's Net Advantage to Leasing (NAL_u).

D. If either rule B. or rule C is true and the other is false; and C(3) - C(1) + C(2) > 0 , a deal can be made that benefits both parties by changing the lease price L(t).

* The structure of this table was sugessted by Smith and Wakeman (1985, Table 1, p. 896).

the corporate capital structure of the user. Several additional papers were published after 1973, including: Franks and Hodges (1978), Gordon (1974), Henderson (1976a), Lewellen, Long and McConnell (1976), and Miller and Upton (1976).

Myers, Dill and Bautista (1976) ("MDB") published a simple, easy to compute formula based on the following assumptions:

1. Firms borrow up to their debt capacity; i.e., the debt capacity is binding.
2. The asset has no salvage value.
3. If the user purchases the asset:
   a. 100% of the asset cost will be borrowed.
   b. One dollar of lease liability will displace some amount of debt (λ_u) .
4. The discount rate for the lease payments is the same as the discount rate for the tax generated cash flows:

   $RB_u = RT_u = RL_u = R_u$= User's Cost of Debt
5. An equivalent loan is used in the Own alternative; i.e., a loan such that the principal and interest payment in each period is equal to the lease cash flows during the same period.

To aid in understanding the MDB formula we combine the asset cost, A_u, plus the present value of the options, less the present value of the salvage value, and call the result C_u . With this substitution and assumption 4, equation (1) becomes:

$$NAL_u = C_u - PV[R_u , L(t)] + T_u*PV[R_u , L(t)]$$

$$- T_u*PV[R_u , D_u(t)] - \lambda_u *T_u*R_u*PV[R_u , B_u(t-1)] \qquad \text{equation (2)}$$

MDB proved[9] that equation (2) is equal to

$$NAL_u = C_u - PV[R_u(1-T_u*\lambda_u) , L(t)+T_u*D_u(t)]$$

$$C_u - \sum_{t=1}^{M} \frac{(1-T_u)*L(t)+T_u*D_u(t)}{[1+R_u*(1-T_u*\lambda_u)]^t} \qquad \text{equation (3)}$$

[9] Myers was the first to derive this equation that does not require computing the equivalent loan. Myers, Dill and Bautista (1976). When debt displacement factor equals one Franks and Hodges (1978) present a very intuitive, graphical proof of equation (3) and Levy and Sarnat (1979) contains an algebraic proof that is easier to comprehend than MDB.

The MDB formula is extremely useful, but lack of proper understanding and failure of the assumptions have led to improper use. First, note that the interest tax shield , $\lambda_u * T_u * R_u * B_u(t)$, is no longer explicit in the formula. The tax shield is now implicit in the numerator as an adjustment to the discount rate, $R_u(1-T_u\lambda_u)$. When $\lambda_u = 1$, this adjusted discount rate effectively changes the discount rate from the before tax to the after tax rate. Unfortunately, there are those who apply the after tax rate of borrowing to the form of equation (1).[10] THIS IS WRONG! When using equation (1) to analyze a lease, the before tax cost of debt must be used, otherwise the cost of debt displacement is greatly increased, introducing a bias against leasing. Recognition of the interest tax shield can be in the numerator as in equations (1) and (2) or in the denominator as in equation (3), but not both. A second set of problems arises with the debt displacement factor, λ . These problems will be discussed in Section III.

The Net Advantage of Leasing for the <u>lessor</u> is column (2) of Table 2; viz,

NAL_r = Column (2)

$$= -A_r + \frac{S_r(M)}{(1+RS_r)^M} + PV[RL_r, L(t)] - T_r * PV[RT_r, L(t)]$$

- Asset Cost(1,1)+ PV(Salvage) (2,3)+ PV(Lease Payments) (3,3) - PV(Lease Tax Shelter) (4,3)

$$+ T_r * PV[RT_r, D(t)] + \lambda_r * T_r * RB_r * PV[RT_r, B_r(t)]$$

+ PV(Depreciation Tax Shelter) (5,1)+ PV(Interest Tax Shelter) (6,1)

$$-\sum_{i=1}^{K} O_r(i) \qquad \text{equation (4)}$$

- PV[Options] (7,1)

[10] For examples of how confused financial decision makers are on this and other issues in leasing see the survey results of Murkherjee (1991).

Each term in equation (1) has a corresponding term with opposite sign in equation (4). Using many assumptions necessary for neoclassic economic theory to hold, researchers have extended the symmetry in nomenclature of terms in these equations to include the numerical equality of each paired term, except the tax rates. Different tax rates ($T_u \neq T_r$) is the only asymmetry uniformly given a real possibility of existing in an "efficient capital market"; otherwise, leasing is a zero sum game. The remainder of the paper examines the biases against leasing that can occur when asymmetries exist but are ignored and/or if the interest on the amount borrowed by the user to purchase the asset is incorrectly assumed to be 100% tax deductible ($\lambda_u = 1$) . We also present evidence that indicates many of these asymmetries exist in the "real world" and that the user's leverage is almost always less than one ($\lambda_u < 1$) .

III. **CORPORATE CAPITAL STRUCTURE AND LEASING**

Brealy and Young (1980, p. 1249) remind us: "…the use of any lease valuation model involves a general theory of capital structure." If a user purchases an asset (that has met the rate of return threshold) with a given combination of cash and borrowing, there is a clear impact on corporate capital. The impact is not so clear if the user leases the asset. A brief review of the evolution of theories of corporate capital structure[11] will assist in our discussion of how leasing analysis "involves a general theory of capital structure" and how changes in this theory can change leasing analysis.

The work of Modiglioni and Miller (1958) ("MM") concluded that the debt-equity mix made no difference. In 1963, MM corrected their earlier work by including the effect of taxes and the era of "borrow all you can" began. By the mid 1970's, "borrow all you can" was being slowly modified by the consideration of agency costs by Jensen and Meckling (1976) and bankruptcy costs. Myers (1977, p. 174) concluded his paper "Determinants of Corporate Borrowing" with "The firm should not attempt to borrow as much as possible." Turnbull (1979, p. 939) proved "…that for a firm maximizing market value, the optimal capital structure always occurs before the firm's debt capacity."[12] In other words, if you "borrow all you can" the resulting debt level will be greater than the debt level that maximizes stockholders' market value. These results lead to the "trade-off" model. Finally, the "pecking order" model of capital structure has gained favor in recent years and there is ample empirical evidence to warrant this favor. The "pecking order" is: first, finance what you can with internally generated funds (retained earnings); second, debt; and finally, sell stock to raise equity capital. See: Myers (1984, p. 581ff).

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[11] See Myers (1984).

[12] It should be noted that Myers (1977) essentially proved the same outcome (a year after the MDB formula was published) but the result was not as strong as Trumbull's.

Shyam-Sunder and Myers (1999, p. 242) provide an excellent review and critique of the literature of empirical studies of capital structure. They then proceed to test the pecking order against the trade-off model using a sample of 157 firms and conclude: "Overall, the results suggest greater confidence in the pecking order than in the target adjustment model." In a 10 year study (1984-1993) of leasing in over 400 firms, Kang and Long (2001, p. 54) concluded their results were "…consistent with the pecking order."

MDB (1976, p. 804) use a capital structure based on "borrow all you can" and assume "…that the 'debt capacity' is always binding." Thus, $\lambda=1$ and, in the lease alternative, the debt displaced is $B(0)$ for the first period, $B(1)$ for the second period.…$B(M-1)$ for period M, and $B(M) = 0$ [where $B(t)$ is the amount of the equivalent loan at the end of period t as defined in Appendix A]. It is obvious from the literature that no one knew, operationally, how to value λ_u. MDB (1976, p. 816) state:[13]

> "The narrower lease vs. borrow problem considered in this paper will not be finally solved until we have a better understanding of what determines the amount of debt displaced or supported by a lease contract. In other words, what is λ ? Our intuition suggest $\lambda=1$ -- i.e., that a dollar of lease liability supports or displaces a dollar of debt – but this is not obvious."

These arguments were influenced by the "borrow all you can" theory, prevalent at the time.

Since 1976, there have been a series of empirical studies that indicate $\lambda_u < 0$; i.e., lease liabilities and non-lease debt are complements, not substitutes. The first empirical study to show that debt and leasing are complements ($\lambda_u < 0$) was by Ang and Peterson (1984). Their results were so divergent from the orthodoxy of $\lambda_u = 1$ that they titled the article "The Leasing Puzzle". Using Standard & Poor's Compustat data for 1976 through 1981 on approximately 600 U.S. firms and several different econometric models, Ang and Peterson

[13] When reading MDB, <u>be aware</u> the λ (without subscript) is the lessor's debt displacement (denoted herein as λ_r) unless described in the discussion as the user's (λ_u).

(1984, p. 1063) conclude, "…leases and debt are complements: greater debt is associated with greater leasing." This study was updated by Branson (1995, p.17) using Compustat data from 1983 through 1988 and reached the same conclusion ($\lambda_u<0$) . Additional studies reach the same conclusion, Finucane (1988), Kang and Long (2001) and Mehran, Taggart and Yermack (1999), while others have estimated λ_u to be positive, but less than one.[14] Adedeji and Stapleton (1996, p. 80), Marston and Harris (1988, p. 161). In a recent study of a large number of British firms, stratified by size, Lasfer and Levis (1998) concluded that λ_u is near one for small firms and negative (leasing and debt are complements) for large firms.. Unfortunately, the available databases and the various models used are not comparable so the substitute/complement controversy continues.

Lewis and Schallheim (1992, p. 508) give a theoretical argument that demonstrates "Within a model of optimal capital structure . . . debt and leases can be complements."

The above empirical, anecdotal, and theoretical evidence leads to the conclusion that debt and leases can be complements ($\lambda_u <0$). There is overwhelming evidence that λ_u is much less than one for larger, profitable firms. But what value should be used for λ_u ?
When theory fails to predict observed outcomes, we must revise the theory.[15]

Given the assumptions of 100% borrowing and the binding debt capacity, we agree that λ_u can equal 1. However, the theoretical works by Myers (1977) and Turnbull (1979) and an empirical study by Graham (2000) indicate that one would <u>not</u> expect the debt capacity constraint to be binding. This would force the debt displacement factor to zero ($\lambda_u = 0$)[16]. This interpretation will not give a true representation of the lost tax shield from interest and a

[14] Bayless and Diltz (1986) estimated λ_u as high as 1.25, but there are problems with low response rate and the survey methodology used leaving the results suspect.
[15] "The thing that doesn't fit is the thing that is most interesting, the part that doesn't go according to what you expected." Feynman (1999, p. 14)
[16] In linear programming terms, λ_u is the shadow price of the debt capacity constraint and when the constraint is not binding, the corresponding shadow price is zero.

careful examination of the actual interest paid in the "own" alternative is required. The concept of the equivalent loan is still applicable but the debt displacement factor now becomes that portion of the funds actually borrowed to purchase the asset. In general, the portion of debt displaced depends on the capital structure of the user. If the user firm follows the "trade-off model," then the portion of the equivalent loan to own the asset that displaces debt is simply the current capital structure (λ_u = debt/capital). This interpretation of λ is consistent with Henderson (1976b), Gutman and Yagil (1994, p. 341), Weingartner (1987), as well as part of the MDB (1976, p. 816) discussion of λ .

If the pecking order model is used, the debt displacement rate is one minus the ratio of retained earnings to total new investment required for the year.

The above logic leads to a hierarchal decision[17] for determining debt displacement:

1. If the firm's debt capacity is binding: $\lambda=1$.
2. If the firm follows the "pecking order" theory:

   λ = 1 – (Reinvested Retained Earnings/Total New Investment) .
3. For all others: λ = debt/(debt + equity) .

This interpretation of λ_u and λ_r as the specific links to the user's capital structure and the lessor's capital structure, respectively, has several advantages:

A. The historic MDB definition of λ as the amount of debt (actually) displaced by one dollar of lease liability is respected and made operational for the user firm (λ_u) and the lessor firm (λ_r) .
B. The resulting analysis of leasing includes unique characteristics of the capital structures and current conditions of the parties to the lease contract.

[17] Continue down the list until the conditional statement is true.

C. The method provides an affirmation of Lewis & Schallheim's (1992, pp. 497-8) conclusion, viz., "…a lessee firm optimally uses a greater proportion of debt with leasing than it would if it restricted itself to debt." and the lessee can benefit from leasing when the lessee and lessor have the same marginal tax rate.

D. The result is a self limiting system.[18] If a firm continues to lease a larger and larger portion of its assets, data will feed forward and increase the future debt/asset ratio (because leases are considered debt from the accountant's perspectives, on or off the books). The higher λ_u will cause fewer leases to be approved. The reverse will occur for the lessor with respect to λ_r .

E. The "leasing puzzle" may be solved. When $\lambda_u = 1$, there is a one to one substitution of the equivalent loan (hence, the interest tax shield) between owning and leasing. When $0 \leq \lambda_u < 1$ the debt used for purchase is less than the debt created by leasing, because the accountants book the entire present value of the loan equivalent to the lease as debt. The result is that leasing increases debt by $(1 - \lambda)$ times the equivalent loan. Unless the model used to empirically estimate λ specifically controls for this fact, the estimated λ can be negative. In fact, when $0 \leq \lambda < 1$, the lease actually increases debt without having to increase borrowing (where debt = borrowing + lease liabilities).

The first derivative of NAL_u (with respect to the lessee's λ_u) is negative; i.e., the greater λ_u , the less the advantage to leasing. (See Appendix 2 for the proof of this statement.) With few exceptions, λ_u has been assumed equal to one, the highest value that could be reasonably justified . In fact, the actual value of the lessee's debt displacement is often much lower.

[18] This is a dynamic endogenous determination of optimal leasing and capital structures, see Lewis and Schallheim (1992, p. 497).

Continuing the assumption that $\lambda_u = 1$ results in an understatement of the user's advantage of leasing by both equations (1) and (3).

As we examined the connections between capital structures and leasing, we began to suspect significant differences may exist between the capital structure of the lessor and the capital structure of the lessee. Such differences can lead to asymmetries in debt displacement and discount rates that impact leasing analysis. We made a cursory comparison of the Equipment Leasing Association (ELA) data collected from its members[19] (the lessors) with the data by SIC codes from Ibbotson Associates' *Cost of Capital Yearbook* (to represent the users). The results are presented and discussed here to suggest direction for future research, not as a completed work.

In the data examined there was a measurable difference between the capital structure of the lessor and the capital structure of the lessee. Figure 1 compares the 1997-2001 median debt to capital ratios from users (aggregated by one digit SIC codes) with lessors (aggregated from Equipment Leasing Association members' surveys). Clearly, the leasing companies are more levered than the firms who use the assets for lease.

The lessors' high debt levels implies that their purchase of assets for lease will be largely debt, thus a high value of λ_r. Conversely, the lessees, with lower debt levels, will in fact pay for a larger part of their assets with equity and will have lower values of λ_u. MDB (1976, p. 815) speculated that λ_u should be greater than or equal to λ_r, but the empirical evidence suggests the opposite $(\lambda_u < \lambda_r)$. Thus, there is a likelihood that the debt displacement is asymmetric between the lessor and lessee and the difference goes in the opposite direction than has been assumed.

[19] Over the years, the Equipment Leasing Association has used different contractors to collect and compile voluntary survey data from its members. We have used the results of these compilations.

The first derivative of the NAL_u is negative with respect to the lessee's λ_u and the first derivative of the NAL_r is positive[20] with respect to the lessor's λ_r. Therefore, to assume (as MDB suggests) the lessee's debt displacement ratio is greater than or equal to the lessor's debt displacement ratio $(\lambda_u \geq \lambda_r)$ when the opposite is true is a bias against leasing.

Another possible consequence of the difference between lessors' and lessees' capital structures is the likelihood that lessors, who must raise a higher portion of their capital using debt, become more efficient at raising debt. Therefore, we examined the costs of debt for lessees and lessors. Figure 2 compares the quartiles of the cost of debt of users (aggregated by one digit SIC codes) with the leasing industry for 1996 (the last year comparable data was readily available for SIC groupings).[21] To verify that 1996 was not an outlier we plotted the yields of AAA and BAA rated bond yields as a measure of users' cost of debt from 1980 thru 2001 against the corresponding years of ELA members reported cost of debt (Figure 3). Both graphs show the lessors' cost of debt tends to be lower than the users' cost of debt.[22] This asymmetry is shown as "spread" in Figure 4 and raises questions regarding the earlier assumptions, made in much of the research and all of the textbooks on leasing, that the capital markets are efficient. Apparently, one or more of the requirements for perfect information, no transaction costs and equivalent risk are not met.

The lessors have two advantages over lessees when they raise capital to purchase equipment: First, one possible explanation for the difference in the cost of debt between lessors and lessees is risk. If the lessee should default and files under Chapter 11, the lessee (debtor in possession), if it wishes to retain the equipment, must timely make all payments of rent coming due post-petition and must decide whether to assume or reject the lease within 60

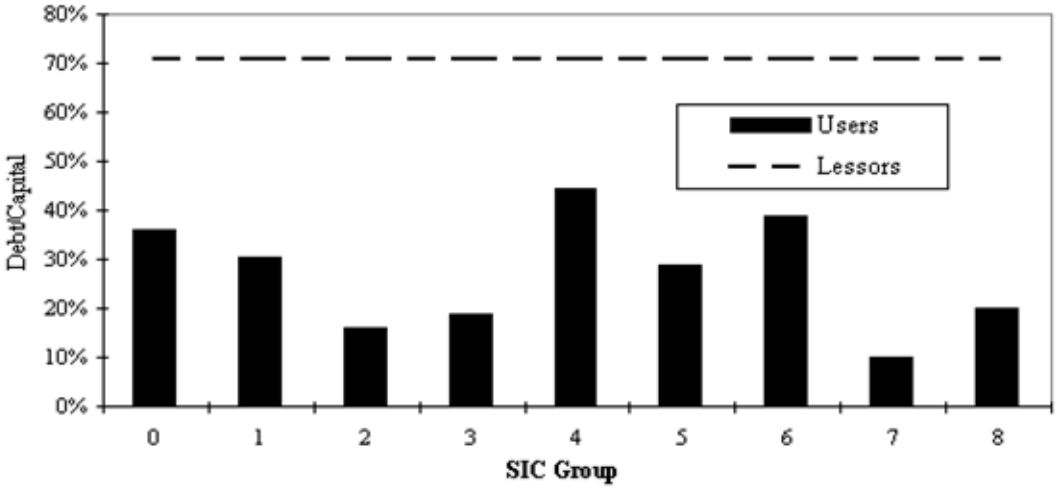
[20] See Appendix 2.
[21] *Cost of Capital Yearbook* discontinued inclusion of "Cost of Debt" after 1997 publication of 1996 data.
[22] MDB state, "Differential borrowing rates also create net gains to leasing…Whether such a difference exists in real life is not clear, however." Myers, et al. (1976, p. 815). It seems clear in this data set.

days after the filing of the petition or a longer period if the court permits. If lessee rejects the lease, it must return the equipment to the lessor and the lessor can find a new lessee or can sell the equipment. If the debtor assumes the lease, it must cure all defaults, pre-petition and post-petition and must give adequate assurance of future performance. Adequate assurance can take the form of a future rental deposit. The lessor has a level of protection that is not available to a secured lender. If a loan is made to an end user (debtor) who defaults and files under Chapter 11, the secured lender must wait out the long bankruptcy process unless the lender can demonstrate it is entitled to adequate protection payments. The secured lender is not entitled to payments of principal and interest during the reorganization process other than adequate protection payments (if granted) and must await the successful reorganization or liquidation of the company. (Although many textbooks describe the different treatment in bankruptcy between leasing and owning, none mention the possible effect on the cost of borrowing.) Second, Lessors are likely to issue a higher proportion of "asset backed securities" (and be more efficient in so doing) than lessees.[23]

In the small sample of aggregate data, the lessors' cost of borrowing is lower than the lessees', providing the opportunity for both parties to profit from leasing when the lessor is willing to share this difference. The assumption in the finance literature and textbooks of equal costs of debt for lessor and lessee appears to be teaching a bias against leasing.

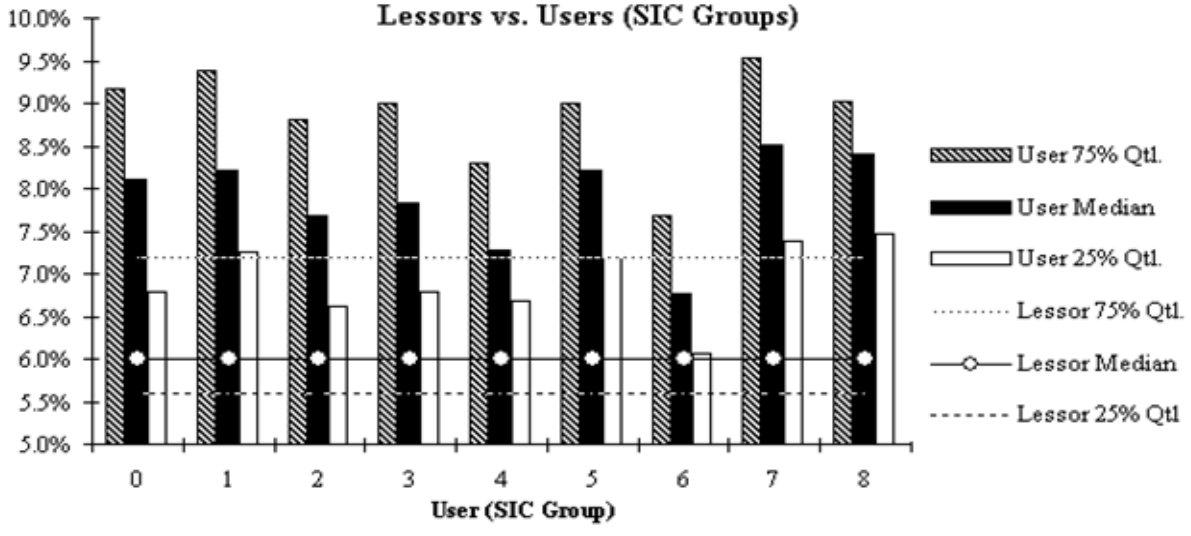
[23] This is a subject for future research.

Figure 1.
1997-2001 Median Debt to Capital Ratios
Lessors vs. Users (SIC Groups)



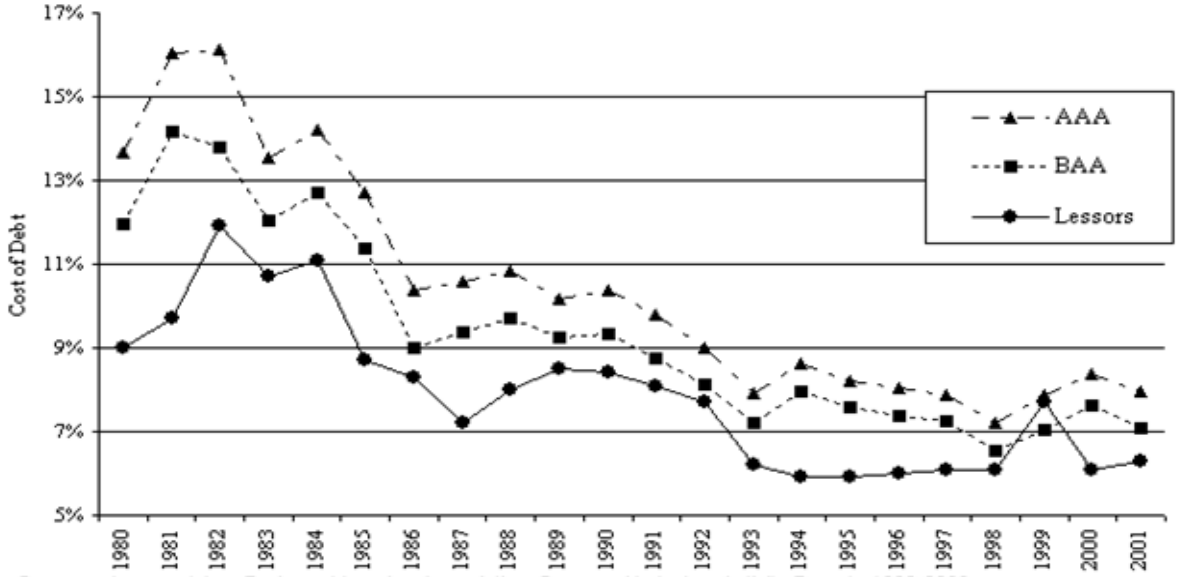
Sources: Lessors - *Survey of Industry Activity Report 2001*,,
Equipment Leasing Association, Arlington, VA
Users (SIC)- *Cost of Capital Yearbook 2001,* Ibbotson Associates, Chicago, IL

Figure 2.
1996 Cost of Debt
Lessors vs. Users (SIC Groups)



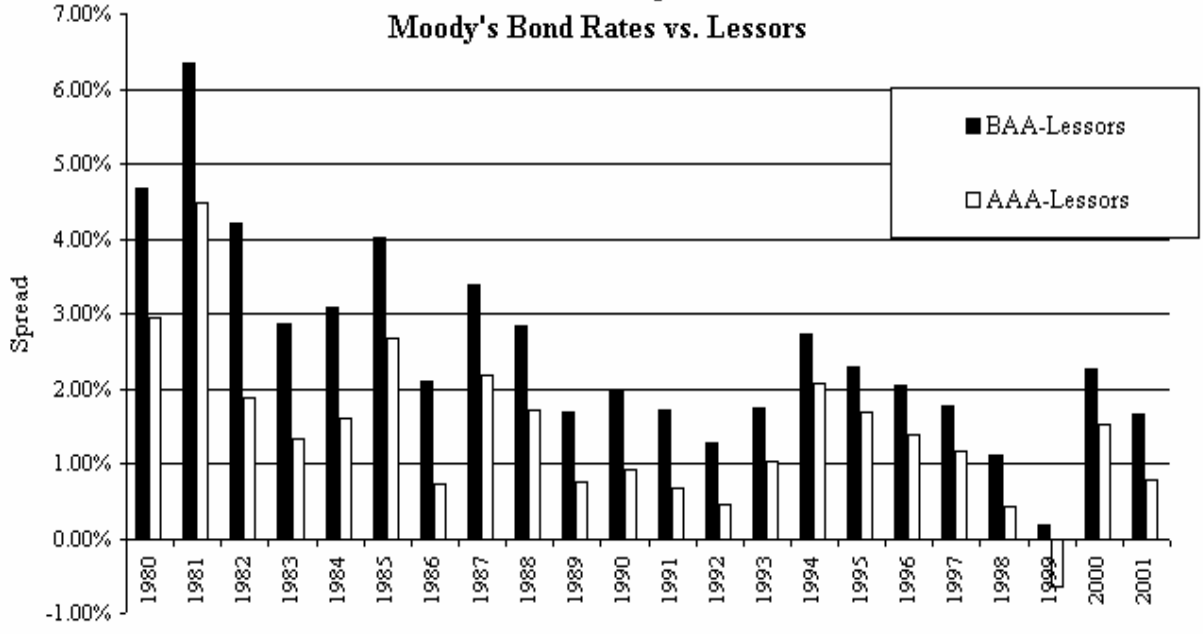
Sources: Lessors - *Survey of Industry Activity Report, 1997,*
Equiment Leasing Association, Arlington, VA
Users (SIC) - *Cost of Capital Yearbook, 1997,* Ibbotson Associates, Chicago, IL

Figure 3.
Moody's Bonds vs. Lessors' Cost of Debt



Sources: Lessor data : Equipment Leasing Association, Survey of Industry Activity Reports,1983-2002
Bond data : Moody's Investor Services (www. federalreserve.gov/releases/)

Figure 4.
Cost of Debt Spread
Moody's Bond Rates vs. Lessors



Sources: Lessor data : Equipment Leasing Association, *Survey of Industry Activity Reports, 1983-2002*
Bond data : Moody's Investor Services (www. federalreserve.gov/releases/)

IV. ASYMMETRIES BETWEEN USER AND LESSOR[24]

A "good" transaction between two parties occurs when each party receives more value than without the transaction. Why do firms acquire the use of a piece of equipment from others rather than make it? The reason is a firm specializing in the manufacture of the equipment has economies of scale and division of labor the end user does not possess (as Adam Smith observed in 1776). Users get use of a better piece of equipment at a lower price than they can make it, the equipment manufacturer makes a profit, and both are better off than without the transaction. The analytic reason is asymmetric values between the two parties. A successful lease transaction is no different.

The possible asymmetry in corporate income tax rates between user and lessor has always been recognized and emphasized in the lease vs. own decision. However, this reason for leasing has been taken to the extreme as observed in our Introduction and:

> In efficient and competitive capital markets the lease vs. borrow problem should be a toss up, apart from tax considerations. Myers, et al (1976, p. 815) (emphasis added)

The statement is correct, but efficient and competitive markets as required in economic theory often do not obtain in the real world as we have shown in Section III, above. The tax advantage is emphasized exclusively in two textbooks and becomes:

> If the corporate income tax were repealed, long-term leasing would virtually disappear. Ross, et al (2002, p. 586)

> If these reforms (taxes and bankruptcy) were undertaken, the advantages associated with leasing would cease to exist. Van Horne (1977, p. 10) (Parenthetical added)

[24] Gutman and Yagil (1994) suggest the possibilities of the asymmetries between the user and the lessor, and present formulae for measuring the impact of various asymmetries. Their work has influenced our exploration of these asymmetries.

The best empirical evidence that these textbook assertions are false occurs in Belgium where lease and purchase have identical tax treatment, yet 40% of all Belgium firms have leases. Deloof and Verschueren (1999).

Since the publication of the MDB formula, firms have emerged that lease specialized equipment unique to an industry (or a few industries).[25] Specialization by equipment and economies of scale through growth have created differences in the parameters between the lessor and lessee, resulting in advantages to leasing.

The remainder of this section will discuss five quantifiable asymmetries between the lessor and lessee that are often denied or de-emphasized in the research literature and textbooks. (Note that in all cases when the differences are assumed away, but actually exist, there is a bias against leasing.)

A. Debt Displacement and B. Cost of Debt

The existence of asymmetries between lessors and lessees in both debt displacement rate and cost of debt were discussed and demonstrated in Section III, above. The false assumptions in the literature that these parameters are equal reduce the value of the lessee's net advantage of leasing and is a bias against leasing.

C. Acquisition Costs

Lessors gain extensive knowledge of and experience with manufacturers and models of equipment, their quality and capabilities. The costs of this knowledge acquisition are spread over many pieces of equipment, resulting in lower costs of information per unit of equipment than the costs incurred by the less frequent purchaser. Furthermore, the cumulative research and experience of the lessor is likely to be more thorough, current, and

[25] Researchers had predicted that users of specialized equipment would own the asset, not rent it, e.g., Smith and Wakeman (1985). However, time has proven them wrong as specialized leasing companies have developed for MRI Scanners in health care, plastic injection molding equipment and railway maintenance of way equipment, to name a few. (Sources: Equipment Leasing Association and Mr. Gilstad.)

reliable than data collected by the purchasing department of the infrequent buyer. Poor choice in purchasing assets can be very expensive, and this expense is never reflected in the decision models used to evaluate the advantages of leasing. Lessors also often have greater purchasing power with equipment manufacturers than the infrequent purchaser. Taken together, these factors can result in five to twenty percent (5% to 20%) reduction in the lessor's acquisition costs per unit versus the end user's acquisition costs per unit.[26] While the "efficient market" assumption leads to the conclusion that $A_u = A_r$, we conclude $A_u \geq A_r$.

D. Residual Value

Lessors have developed markets for the sale or re-lease of used equipment and generally realize higher residual values than can be obtained by the end user. Lessors' markets for used equipment have two additional advantages, viz., 1) The variance (hence risk) of the price (or present value if re-leased) the lessor receives from the residual is less than the price variance for the lessee; and, 2) When the lessor re-leases an asset, it has no tax consequences with respect to depreciation recapture; however, the lessee may be taxed on depreciation recapture when it sells the used asset. Therefore, the market for re-lease or sale of used equipment enables the lessor to offer lower rates and/or to work on smaller interest rate spreads on new equipment. Our experience leads us to conclude $S_u < S_r$ and the

var (S_u) > var (S_r) .

The asymmetries in the distribution of the salvage value between lessee and lessor also provide an opportunity for both parties to benefit from options that involve the asset's residual value, e.g. the option to cancel, the option to extend, and the option to purchase. The methods for evaluating options in lease contracts are discussed in Section V, below.

[26] Personal communication with William Choi, Equipment Leasing Association.

E. Maintenance and Operating Costs

The income generated by the asset during time period t is often a function of all prior maintenance and operating expenses; i.e.:

$$V(t) = f\{[MO(j) \ : \ j < t]\} \qquad \text{equation (5)}$$

Proper maintenance and skilled operators generally produce more output from an asset than poor maintenance and unskilled operators. Similarly, the salvage or residual value of an asset will be higher if the asset is properly maintained and operated. This is an optimization problem in engineering economics that we will not address. However, there are cases where the lessor can provide part or all of the MO(t) for a total cost less than the lessee alone and achieve the same or better output; i.e.

$$PV[MO_{uo}(t)] > PV[MO_u(t) + MO_r(t)] \qquad \text{equation (6)}$$

For example, the above condition can occur when the user provides routine maintenance and the lessor is more efficient at preventative maintenance and together the total Maintenance and Operation costs are less than the user/owner would spend. In this case the NAL_u will be increased by the positive difference between the two terms in equation (6). With proper engineering and management the following conditions should hold:

$$V_{uo}(t) = V_u(t) \qquad \text{equation (7)}$$

$$PV[MO_{uo}(t)] \geq PV[MO_u(t)] + P[MO_r(t)] \qquad \text{equation (8)}$$

If maintenance and operations are assumed equal for owning or leasing, but the inequality in equation (8) occurs, there is a bias against leasing.

F. Corporate Income Tax Rates

As mentioned above, the difference between the marginal tax rate on corporate income of the user and the rate of the lessor is emphasized in the financial literature as an opportunity

for both parties to gain from a lease. Most finance literature and examples assume the user has a higher rate than the lessor ($T_u > T_r$) . However, Lewellyn, et.al. (1976 p. 795) and Gutman and Yagil (1994 p. 338) give the conditions under which gain can occur when $T_u < T_r$ and many such conditions occur in practice.[27] (See example in Section VI, below.)

[27] Personal communication with Professor James Schallheim (University of Utah) and authors' experiences.

V. THE VALUE OF OPTIONS IN LEASES

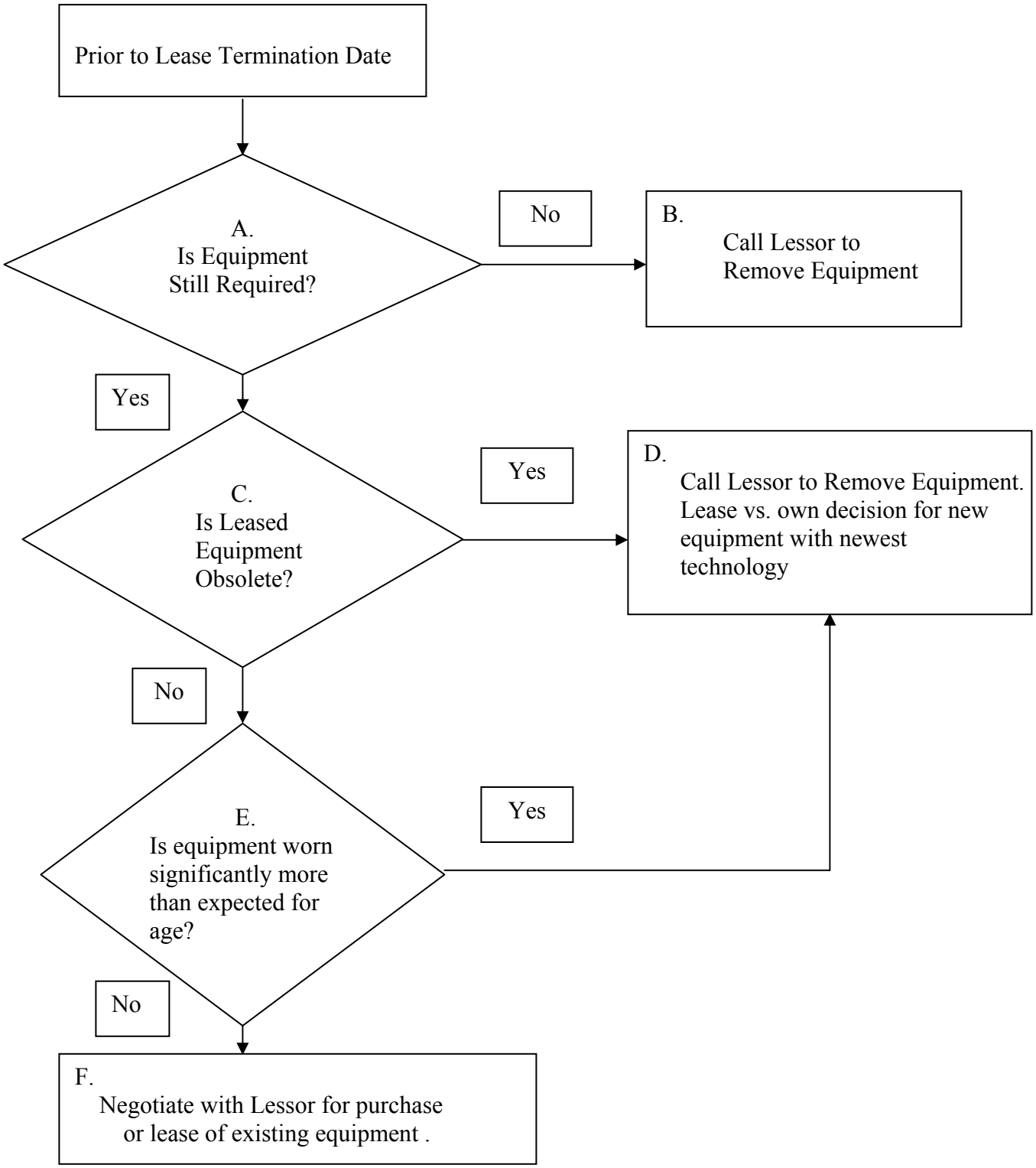
In "The Biggest Mistakes We Teach", Ritter (2002, p. 167) observed, "Many leases give the lessee the right to buy the item they have leased at the end of the lease, at a fixed exercise price. This option is valuable. But most textbooks ignore it…" Most textbooks also ignore the value of the option to renew a lease and the option to cancel a lease.[28] This bias is especially misleading in the evaluation of operating leases. By accounting convention, the initial, non-cancelable term of an "operating lease" must be less than 75% of the estimated economic life of the asset.[29] At the end of the initial term, the asset is expected to have at least 25% of its economic life remaining. The lessee usually has several options as illustrated by the flow chart in Figure 4. If the equipment currently under lease had been purchased instead of leased, many of these options would not be available. In particular, paths AB, CD, and ED in Figure 4 would all lead to salvage, probably at a value significantly less than expected at the time of purchase, causing financial loss. Options in the lease contract can insure against such risk.

An unbiased comparison between the lease vs. own alternatives requires an evaluation of these options and the inclusion of the resulting values in the lease analysis. Copeland and Weston (1982) developed a method for computing the value of an option to cancel an operating lease using an American put. McConnell and Schallheim (1983) analyze a lease as a call option and evaluate several options that may exist in lease contracts. Grenadier (1995) provides "a real options approach to leasing contracts" in the context of real estate leases, and claims his results are applicable to a variety of leasing

[28]See Section VII (below) for the results of a survey of the contents of current corporate finance textbooks and their treatment of leasing.
[29]FASB 13. Abdel-khalik (1981).

Figure 4

Lessee's Decision Tree at End of Operating Lease



options. All three articles demonstrate the bias that occurs when the quoted lease price includes option(s) but this price is simply inserted in the Net Advantage to Leasing formula without modifying the lessee's value (as we do symbolically in Table 2, above, and numerically in the following examples).

Examples from McConnell and Schallheim (1983) will be used to demonstrate the magnitudes of the values of the option to cancel and the option to purchase at the end of the lease. Lines 2, 3, and 4 of Table 3, contain the equilibrium[30] lease payments computed by McConnell and Schallheim for leases with different options and durations for a new, $1,000 asset. The user has a risk-free interest rate of 10%/year, and a cost of capital of 16%. The decrease in economic value of the asset has an average of 15% per year and a variance of 0.15.

The value of the option to cancel a four year lease is $68.75 per year (Table 3, line 5, column 4) with a present value (valued at a cost of capital of 16% per year for four years) equal to $192.37 (line 6) or 19.2% of the new asset cost. The option values increase as the duration of the lease increases, reaching 27.1% of the new asset cost for a five-year lease (the longer the lease, the more valuable the option to cancel).

The value of an option to purchase at a fixed price at the end of the lease for a four year lease is $56.57 per year (Table 3, line 9, column 4) with a present value of $158.18 or 15.8% of the new asset cost. Note, the values of the purchase option decrease as the duration of the lease increases. The present value of the combination of the two options (Table 3, line 13, column 4) for a four year lease is $350.67 or 35.1% of the new asset cost.

[30] The equilibrium lease payment is the payment that will be "break even" for the lessee. Thus, any lease quotation less than the equilibrium value is a "good deal" for the lessee.

Table 3.
EVALUATION OF OPTIONS* by Mc CONNELL & SCHALLHEIM

		Equilibrium Lease Payment ($ / year) if Lease Term is:				
		(1)	(2)	(3)	(4)	(5)
1.	Term of the Lease	1 year	2 years	3 years	4 years	5 years
2.	Non-Cancelable Financial Lease Contract	$ 227.27	$ 211.04	$ 196.89	$ 184.54	$ 173.75
3.	Operating Lease Contract with OPTION to Cancel	$ 227.27	$ 240.64	$ 248.36	$ 253.29	$ 256.59
4.	Operating Lease Contract with OPTIONS to Cancel AND Purchase at Maturity for $200	na.	na.	na.	$ 309.86	$ 293.30
5.	Value of OPTION to Cancel [Ln.3-Ln.2] ($/year)	$ -	$ 29.60	$ 51.47	$ 68.75	$ 82.84
6.	PV of OPTION to Cancel ($)	$ -	$47.51	$115.60	$192.37	$271.24
7.	OPTION as a % of Asset Value	0.0%	4.8%	11.6%	19.2%	27.1%
9.	Value of OPTION to Purchase at Maturity [Ln.4-Ln.3] ($/year)				$ 56.57	$ 36.71
10.	PV of OPTION to Purchase ($)				$158.29	$120.20
11.	OPTION as a % of Asset Value				15.8%	12.0%
12.	Value of OPTIONS to Cancel AND Purchase at Maturity [Ln.4-Ln.2] ($/year)				$ 125.32	$ 119.55
13.	PV of both OPTIONS ($)				$350.67	$391.44
14.	OPTIONS as % of Asset Value				35.1%	39.1%

*Source: McConnell and Schallheim (1983)
Line 2. (above) is from page 259, Table 3 , Panel (A), Column 2.
Line 3. (above) is from page 255, Table 1 , Panel (A), Column 2.
Line 4. (above) is from page 257, Table 2 , Panels (A) and (C), Column 3.

The effect of the present value of an option in favor of the lessee has the same impact in the simple NAL formula as an addition to the lessee's value of the asset. The

magnitude of bias may be significant, depending on the particular characteristics of the lease contracts and the capital costs of the user.

Although the particular lease examples in McConnell and Schallheim (1983, p. 254, footnote 12) are arbitrary, the authors state the parameters used were chosen well within the ranges of empirical economic data from U.S. NYSE listed companies. Lee, et al, (1982, p. 41) calculate the value of a call option for the right to purchase the asset at the end of a 5 year lease to demonstrate their approach to "Using Options to Evaluate Salvage Values". The parameters in the Lee, et al, (1982) example are quite different from McConnell and Schallheim (1983); however, the results are remarkably similar. The Lee, et al, (1982) example has a relatively low variance for the asset's residual value and their option value is 10.1% of the acquisition cost. The McConnell and Schallheim (1983) example has a higher variance for the asset's residual value and they compute an option that we estimate is worth 12% of their asset's acquisition cost (Table 3, line 11, column 5). One would expect to pay more for an option in a system with a higher variance of the residual value. The examples demonstrate realistic magnitudes of biases caused by the user ignoring options that exist in the lease contract.[31]

If the user properly values the option(s) contained in the contract and included in the Lessor's quotation, there is no bias. However, there may be differences between the lessee's value of the option(s) and the lessor's due to differences between the parties in risks associated with salvage value and costs of borrowing. These differences may provide financial advantages to leasing[32].

[31] Grenadier (1995, p. 319) presents a graph of the premium for an option to renew a real estate lease computed using simulation that demonstrates the value of the option.

[32] Weingartner (1987, pp. 5-6) discusses these and many other asymmetries between lessors and lessees that may contribute to the advantage to leasing.

VI. IMPACT OF BIAS

This section uses a simple example of an operating lease to demonstrate the impact of the potential biases discussed above. We start the model with complete symmetry between the lessor and the lessee and evaluate the lease using the formulae in Table 2 and Appendix A. The equilibrium lease values (i.e. no gain or loss) for both parties are equal and, as predicted, the $NAL_u = NAL_r = 0$; i.e., the lease is neutral for both parties. Then, changing only one parameter of one party at a time, we create asymmetries to demonstrate the impact of differences that (with the exception of taxes) have traditionally been assumed away. Using the notation from Table 1, the parameters of the lease, lessee and lessor have the following values:

Corporate Data

Debt Displacement: $\lambda_u = \lambda_r = 100\%$
Cost of Capital: $RS_u = RS_r = 12\%$
Cost of Borrowing: $RB_u = RB_r = 6\%$
Tax Rate: $T_u = T_r = 35\%$

Lease Data

Lease Term: M = 5 years
Acquisition Cost: $A_u = A_r = \$100{,}000$
Salvage Value: $S_u = S_r = \$\ 20{,}000$
Lease Payment: L(t) = $ 22,310
Depreciation: Recovery Period = 7 years

IRS Table A-14: 150% DB ½ Year Convention

t =	1	2	3	4, 5, 6 (each)
$D_u(t) = D_r(t)$ =	10.71%	19.41%	15.03%	12.25%

The asset will be removed from service at the end of year five. The salvage is realized at the end of year six; hence, depreciation is taken for year six. Cash flow from salvage is discounted at the cost of capital to reflect the risk associated with salvage value.

Table 4 reports the resulting gain available to be shared by the parties when the asymmetry described in column (5) exists. The first row contains the gain when the capital structure of the lessee is different from 100% borrowing and causes the user's debt displacement rate to be less than one. At $\lambda_u = 0.75$, there is a present value of $1,359 "on the table" to share between lessor and lessee (Table 4, line 1, column 1). It is no longer a zero sum game, even though the tax rates are equal!

Next, the Lessor's cost of debt is reduced by 0.5% to reflect the differences we have observed from aggregate data. (All other parameters are set to their original values.) This results in a gain to be shared of $858 (Table 4, line 2, column 1). This process is repeated for each of the changes indicated in column 5 of Table 4. Each individual asymmetry does not make a large change in the Net Advantage to Leasing, but all are positive and are additive (with positive interaction shown in lines 7 through 12, Table 4). It is important to note that the parameter differences that are incorrectly ignored by academicians can have as much or more impact than taxes.

The reduction in the present value of maintenance and operative expenses will be similar to the reduction in lessor's acquisition cost. The impact of purchase and/or cancellation options were evaluated in Section V, above, and can make additional dollars available when an option (or options) offered causes the lessor's risk to increase less than the lessee's risk decreases. We emphasize that the largest bias occurs when an option is in the contract and the lessor has included his cost of the option in the lease payment quotation; AND, the user fails to include the value of the option in the lease vs. own analysis. As shown

in Table 3 of Section V the magnitude of this error can be over 25% of the asset acquisition cost.

Table 4.

Impact of Asymmetries

Line	Parameter	Amount to be Shared by Parties			Description of Asymmetry
	(1)	(2)	(3)	(4)	(5)
1.	λ	1,359	2,686	3,982	User's (=0.75, 0.50, 25.0)
2.	Rates	858	1,729	2,613	Reduce Lessor's (-0.5% , -1% , -1.5%)
3.	A	3,744	7,487	11,231	Lessor's Discount (5%, 10%, 15%)
4.	Salv.(risk)	526	1,021	1,486	Increase User's Discnt Rate (1%, 2%, 3%)
5.	Salv.(mean)	1013	2,027	3,040	Increase Lessor's Salvage (10%, 20%, 30%)
6.	T	1199	2,378	4,109	Reduce Lessor's to (25%, 15%, 0%)
7.	Sum	8,699	17,327	26,461	Sum of individual changes
8.	Actual	9,190	19,283	31,580	Value of all changes at once
9.	Difference	491	1,956	5,119	Difference due to nonlinearities in model
10.	% Over Est.	5.65%	11.29%	19.35%	

Source: Equations in Table 2 and Appendix A, with modification and data described in text.

Using this example and representative values[33] for asymmetries that are aggregate industry averages, where available, and realistic estimates from experience, we find that 16.9% of the value of the asset is "on the table" for a negotiated split between the user and the lessor when the user chooses to lease.

Our conclusion is the same as early researchers[34] cautioned but later writers tended to ignore, viz., each lease must be evaluated based on the particular characteristics of the asset, the user, the lessor and the nature of the contract.

[33] Specifically, $\lambda_u = 50\%$, $\lambda_r = 75\%$, $T_r = 15\%$, $RB_r = 5.5\%$, $RS_u = 14\%$, $S_r = 26{,}000$; all other parameters are as originally stated.

[34] E.g., "Each case must be examined on its merits." Miller and Upton (1976, p. 762)

VII. PEDAGOGICAL BIAS

In our initial review of a few college finance textbooks we observed many of the biases discussed above. To determine how pervasive the textbook bias might be, we took a sample[35] from U.S. colleges and universities that graduated 25 or more business students in 1995. We then determined the textbooks for the required corporate finance (or financial management) course (bachelors, or masters) in the selected schools and estimated the market share of these textbooks. The seven textbooks with the largest market shares represented 64% of the market (approximately 200,000 students/year).[36] Our first discovery after collecting the texts was very disturbing. In two of the seven most popular corporate finance/financial management texts, no section or chapter is devoted to leasing and no references to lease, leasing, etc., are in the indices. If students use one of these introductory textbooks (without supplemental material) and do not take another course in finance, they remain ignorant of the source of financing for over 30% of the equipment in the U.S. This bias by omission reflects the perpetuation of the persistent attitude in academic finance that leasing is an inferior form of finance.

The chapter or section on leasing in each of the texts containing same was read and evaluated against concerns discussed above and shown at the top of Table 5. Each text was rated for each topic: "0" (opportunity for improvement), "1" (satisfactory), or"-1" (not covered or biased). The results are shown in the body of Table 5.

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[35] The frame used to draw the sample was provided by the Association to Advance Collegiate Schools of Business (AACSB) and contained every U.S. institution that granted business degrees (Bachelors, Masters, and Ph.D's, combined) to at least 25 students in 1995. There were 1252 institutions in the frame with a total of 319,760 business degrees in 1995. The 1252 institutions were sorted by the total number of business degrees granted. The 25 largest schools were sampled 100%. From the remaining 1227, 120 schools were randomly drawn with probability of selection "proportional" to the number of degrees granted (see Cochran 1963, p. 268). Data for textbooks in use were obtained via phone and/or Internet from campus bookstores and/or academic departments.

[36] No attempt should be made to compare these values with sales of textbooks as students share books, buy used books or go to the library.

Table 5

Bias in Textbooks

Evaluation Criteria	Debt Displacement $\lambda_u = 1$ (Implicit)	Debt Displacement $\lambda_u = \lambda_l$	Cost of Borrowing	Acquisition Cost	Salvage Value	Maintenance & Operations	Options	Leasing w/o taxes is a Zero Sum Game	Other	Comments
Text	(1 a)	(1 b)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Brealey & Meyers, *Principles of Corporate Finance,* 7 ed., McGraw-Hill Irwin, 2003.	-1	-1	0	0	1	1	1	-1	0	Although not intergrated with text's Part 6-Options, the reader is alerted to evaluate the options in leases. Excellent distinction between operating and financial leases.
2. Brigham & Houston, *Fundamentals of Financial Management,* Concise 3ed, South-Western Thomson	-1	-1	-1	-1	-1	-1	-1	-1	-1	No section or chapter on leasing, No "lease" or "leasing" in index
3. Brigham & Houston, *Fundamentals of Financial Management,* 9 ed, South-Western Thomson	-1	-1	0	-1	1	0	-1	1	1	Good discussion & examples of other reasons for leasing, especially small businesses
4. Brigham & Houston, *Intermediate Financial Management,* 7 ed., South-Western Thomson	-1	-1	1	-1	1	1	-1	1	1	Good discussion & examples of other reasons for leasing; Lessor's NAL computed & discussed.
5. Brigham & Ehrhardt, *Financial Management Theory and Practice,* 10ed., South-Western Thomson	-1	-1	1	-1	1	1	-1	1	1	Good discussion & examples of other reasons for leasing; Lessor's NAL computed & discussed.
6. Ross, *Essentials of Corprate Finance, ,* Mcgraw-Hill Irwin	-1	-1	-1	-1	-1	-1	-1	-1	-1	No section or chapter on leasing, No "lease" or "leasing" in index
7. Ross, Westerfield, & Jaffe, *Corprate Finance,* 6 ed., Mcgraw-Hill Irwin	0	-1	-1	0	-1	-1	-1	-1	0	"If the corporate income tax were repealed, long-term leasing would virtually dissapear." This statement in the Executive Summary tells the finance officer of a very profitable firm, "Don't even look at leasing!"
8. Frequency: + 1 .	0	0	2	0	4	3	1	3	3	
9. 0 .	1	0	2	2	0	1	0	0	2	
10. -1 .	6	7	3	5	3	3	6	4	2	

Note: The above texts are all excellent. Our evaluations are intended **only** to illustrate the treatment of the listed criteria relating to leasing.

The two topics in Table 5 that have a direct impact on the user's analysis (NAL_u) are debt displacement (column 1a.) and options (column 6). Six of the seven texts failed to discuss these subjects.[37] None of the texts discussed the potential differences in capital structures between the lessee and lessor (column 1b.). Four texts left the reader with the impression that asymmetry between the lessor's and lessee's tax brackets was the most important reason for leasing, mentioning other reasons as an after thought.

[37] The only text we found that properly treated options in leases was Copeland and Weston (1983).

Overall, authors of textbooks perpetuate the biases we have discussed and miss a splendid pedagogical opportunity. Furthermore, in our discussions with professors teaching corporate finance, we detected a mind set against leasing. For example, the former chairman of the finance department of a major U.S. university's business school, when asked how he taught leasing, responded: "Leasing has fallen out of favor in finance. I don't cover it." The subject of leasing contains many of the concepts integral to the study of corporate finance: the theory of capital structure; discount rates and present value; capital budgeting; options; a source of funding; analysis of risk; the effects of taxes; decision analysis; etc.[38] Properly positioned and covered in a corporate finance course, leasing can and should provide an integration and application of all these concepts.

We encourage authors to consider the above concerns when preparing their next editions. In the meantime, supplemental materials, problems and cases can be used to make students aware of leasing as an important source of financing and to guard against errors in leasing analysis.

[38] This list is an expanded version of the list presented by Levy and Sarnat (1979, p. 53).

VIII. CONCLUSIONS AND RECOMMENDATIONS

After reviewing over 170 research papers and the leasing chapters from several popular corporate finance textbooks we found the general theme "unless there is a difference in the tax brackets between the lessor and the lessee, leasing is a zero sum game," i.e., whatever one party gains, the other loses. On further examination, we discovered six assumptions that contribute to this incorrect theme. These assumptions are summarized in Table 6. (Item 7, on this list is a result of the previous six assumptions.) The most pervasive bias against leasing is $\lambda_u = \lambda_r = 1$, caused by the assumption that the debt capacity constraint is binding and 100% of the required funds to purchase is borrowed. This assumption has been proven incorrect in theory and by numerous empirical studies. There is more evidence today for assuming $\lambda_u = 0$ (although we do not advocate this solution) than there was for setting it at its upper extreme value ($\lambda_u = 1$) in 1976. Six out of the seven most popular textbooks in corporate finance: 1) make the assumption that $\lambda_u = 1$; 2) never tell the student there is any other possibility; and, 3) perpetuate this bias. If the lessee pays any income tax the value of λ_u has a direct impact on the net advantage to leasing, the higher the value of λ_u , the lower the advantage to leasing to the user. Yet λ_u continues to be set at the highest possible value. A straight-forward method for valuing λ_u and λ_n based on the capital structures of the lessee and the lessor, respectively, is presented.

The second common error that affects the analysis of a lease occurs when the user fails to evaluate favorable options in the contract. Options such as the right to cancel, the right to renew, and the right to purchase the asset all have value. If the user wants any or all of these rights, and uses the simple textbook method for lease evaluation (NAL_u), the

result is an understatement of the value of the net advantage to leasing. Only one out of seven of the most popular textbooks warn against this error and none tell how to evaluate the option(s).

Table 6

Sources of Potential Bias Against Leasing

Source (1)	Assumption (2)	Possible Realty (3)
1. Debt Displacement a. λ=1 implicit b. Capital Structures	 $\lambda_u = 1$ $\lambda_u \geq \lambda_r$	$\lambda_u < 1$ $\lambda_u < 0$ $\lambda_u \leq \lambda_r$
2. Cost of Borrowing	$RB_u = RB_r$	$RB_u > RB_r$
3. Cost of Acquisition	$A_u = A_r$	$A_u \geq A_r$
4. Salvage Value	$S_u = S_r$ $Var(S_u) = Var(S_r)$	$S_u < S_r$ $Var(S_u) > Var(S_r)$
5. Maintenance & Operations	Indifference	$PV(MO_{uo}) \geq PV(MO_u + MO_r)$
6. Options	Not valued by Lessee	High value to Lessee
7. Without taxes, leasing is a zero sum game	True	False

The remaining assumptions in current lease analysis all originate with the failure to seriously consider that the lessor and lessee can have different values of parameters other than taxes. Although these differences do not appear explicitly in the user's analysis, they change the "game" to non-zero sum (via the impact on the lessor's determination of the lease price) where both parties can win. We have shown that differences are possible in all of these parameters. The failure to recognize other asymmetries can be as much of an error as if one were to assume lessor's and lessee's tax rates are always equal. We demonstrate that differences in these non-tax parameters can impact the advantage to leasing as much as taxes.

There are obvious needs for research to explore differences between lessee firms and lessor firms: What are the significant differences in their capital structures? Are there significant differences in their economies in purchasing (including costs of information), in use/sale of used equipment, in providing maintenance and operations, and in various risks? When these differences exist, what impact do they have on the values of the lessee's and lessor's parameters that enter the lease vs. own decision? We suspect that many of the leasing "puzzles" and controversies of the last 40 years will be explained by the answers to these questions. If our preliminary findings and hypotheses are supported by further research, the leasing sections in many finance textbooks will need revisions.

In spite of the apparent biases, leasing accounts for over 30% of new equipment sold in the United States and is a thriving industry here and throughout the world. Why? Profitability! For example, a recent study of more than 3,000 firms (from 1982-1996) presents clear evidence that both large and medium size firms who lease have much higher profits than large and medium firms that do not lease. Similar results are found for return on equity. The opposite is true for small firms. The researchers conclude:

> …leasing allows small firms to finance their growth and/or survival while for large firms, leasing appears to be a financial instrument used by sophisticated financial managers to minimize their after tax cost of capital. Lasfer and Levis (1974, p. 182) (Emphasis added.)

An observation by recent empirical studies is that leasing reduces agency costs. Barclay and Smith (1995, p. 907), Graham, Lemmon and Schallheim (1998, p. 137), Kang and Long (2001, p. 53) and Lasfer and Levis (1998, p. 178). Agency costs increase with debt and are one of the resistors of greater debt. Jensen and Meckling (1976). Therefore, leasing can be a useful method for increasing debt without increasing agency costs, resulting in lower costs of capital.

Many astute decision makers have observed the asymmetries between the lessor and the lessee even though their formal education teaches such differences do not exist. Managers solicit proposals from lessors and work with the lessor to find the best lease rather than automatically choose to own the required assets. Together, the user and lessor often find, in their differing economic conditions, the opportunity for leasing to be profitable for both parties. Anna Freud was correct when she said:

> **"Creative minds have always been known to survive any kind of bad training."**

Appendix A[39] Equivalent loan when $\lambda_u \neq 1$

Definitions:

M ≡ number of periods to pay off loan

t ≡ time period (t = 1, 2,….M)

B(t) ≡ the balance of the loan outstanding at the end of period t (after payment of principal and interest)

then, B(M) = 0 (the loan must be paid off by the last payment.)

B(0) = total amount borrowed at the beginning of the lease

r = before tax interest rate on loan (= RB_u or RB_r)

An equivalent loan must have payments (principal plus after tax interest) equal to the cash flow of the after tax lease payment for each period:

$$(1-T)\,L(t) + TD(t) \qquad \text{equation (A-1)}$$

$$[B(t-1) - B(t)] + (1-T)*r*B(t-1) = (1-T)*L(t) + T*D(t)$$

[principal payment] + [after tax interest] = [after tax lease payment] + [lost depreciation]

equation (A-2)

Equation (A-2) assumes that 100% of the interest tax shelter provided by the equivalent loan is utilized. However, when the debt capacity is not binding, only λ% (λ < 1) of the funds are debt financed, and the interest calculated in equation (A-2) is not correct. The proper value for the adjusted interest is $(1 - \lambda T)*r*\,B(t-1)$ because only λ% of the interest tax shield is used, yielding:

$$B(t-1) - B(t) + (1 - \lambda*T)*r*B_{t-1} = (1-T)*L(t) + T*D(t) \qquad \text{equation (A-2a)}$$

[39] This is a modification of Levy and Sarnat (1979, Appendix. Derivation of Equations) who assume $\lambda = 1$.

Using equation (A-2a), and Levy and Sarnat's (1979) method the following are true:

$$B(o) = \sum_{t=1}^{M} \frac{(1-T) * L(t) + T * D(t) + \lambda * T * r * B(t-1)}{\left[1+r\right]^t} \qquad \text{equation (A-3)}$$

and

$$B(o) = \sum_{t=1}^{M} \frac{(1-T) * L(t) + T * D(t)}{\left[1 + r * (1 - \lambda * T)\right]^t} \qquad \text{equation (A-4)}$$

These are equivalent to the summed quantities in equations (2) and (3), respectively, in the text.

Appendix B[40]

A decrease in the user's debt displacement rate (λ_u) will produce an increase in the NAL_u in the MDB Formula.

Given $$NAL_u = A_u - \sum_{t=1}^{M} \frac{L(t)*(1-T_u) + D_u(t)*T}{[1+RL_u*(1-\lambda_u T_u)]^t}$$ equation (B-1)

Where

$0 < RL_u < 1$

$0 < T_u < 1$ (If $T_u = 0$, λ does not affect the analysis.)

$\lambda_u < \frac{1+RL_u}{RL_u * T_u}$

L(t) and/or $D(t) > 0$ for at least one t ($1 \le t \le M$)

L(t) and $D(t) \ge 0$

$$\frac{dNAL_u}{d\lambda_u} = (-)\sum_{t=1}^{M} \frac{t*[L_u*(1-T_u) + D_u(t)*T_u]*[RL_u*T_u]}{[1+RL_u*(1-\lambda_u T_u)]^{t+1}}$$ equation (B-2)

The denominator of all terms of the sum are positive, at lease one of the numerators is positive, and all of the numerators are non-negative. Therefore, the first derivative of NAL_u with respect to λ_u is negative and a decrease in λ_u will result in an increase in the NAL_u . Q.E.D.

[40] Myers, et al (1976, Fig. 2, p. 813) illustrate the derivative of the lessor's Net Advantage of Leasing with respect to λ_r is positive. Gutman and Yagil (1994, p. 342) provide a proof that λ_r is positive.

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