

**The
Lease
Versus Buy
Decision**

Harold Bierman, Jr.



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The Lease Versus Buy Decision

Harold Bierman, Jr.

Cornell University

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Editor's Note

The subject matter of financial management is in the process of rapid change. A growing analytical content, virtually nonexistent ten years ago, has displaced the earlier descriptive treatment as the center of emphasis in the field.

These developments have created problems for both teachers and students. On the one hand, recent and current thinking, which is addressed to basic questions that cut across traditional divisions of the subject matter, do not fit neatly into the older structure of academic courses and texts in corporate finance. On the other hand, the new developments have not yet stabilized and as a result have not yet reached the degree of certainty, lucidity, and freedom from controversy that would permit all of them to be captured within a single, straightforward treatment at the textbook level. Indeed, given the present rate of change, it will be years before such a development can be expected.

One solution to the problem, which the present Foundations of Finance Series tries to provide, is to cover the major components of the subject through short independent studies. These individual essays provide a vehicle through which the writer can concentrate on a single sequence of ideas and thus communicate some of the excitement of current thinking and controversy. For the teacher and student, the separate self-contained books provide a flexible up-to-date survey of current thinking on each subarea covered and at the same time permit maximum flexibility in course and curriculum design.

EZRA SOLOMON

Preface

The leasing of assets is common practice. As individuals we engage in leasing of a sort when we rent a car at the airport, rent an apartment to live in for a year, or reserve a hotel room for a night.

For different reasons it was decided to buy the use of the asset for a well-defined period of time and to pay a contractual amount rather than to buy the asset. The motivation for leasing the car at the airport and hotel room was that the use was going to be of short duration and that it made good economic sense to lease rather than to incur the transaction costs of buying and selling the asset. The decision to rent the apartment for a year was less obviously a desirable decision as compared with buying.

Corporations have analogous decisions with added complexities. The tax deductions, accounting measures, risk conditions, and economic consequences will differ depending on whether the asset is purchased or leased.

Our objective in this book is to develop techniques for analyzing the decision to buy or lease an asset. We should be able to convince you that there are some obvious errors that you can avoid. We shall also suggest some reasonable methods of analyzing the decision.

A lease decision combines the elements of making an investment and the elements of borrowing money. Because of the dual factors involved in determining whether to lease or to buy, the buy-lease decision is more complex than a normal investment decision or a financing decision. An effort will be made to minimize complexity, but a certain amount of complexity still will remain. Only patience and high school algebra will be required to understand the problem and its solution.

One warning is appropriate for the decision maker in this area. Lessors are likely to be interested in having a lease contract signed; thus any analysis prepared by a person with an economic interest in the lease should be reviewed with care.

Many people were indispensable in aiding me to develop this book. I am especially indebted to Professors Richard S. Bower of Dartmouth College, Ned C. Hill of Indiana University, and David H. Downes of the University of California for their reviews of the original manuscript and their constructive criticisms.

Harold Bierman, Jr.

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The Basic Lease Analysis

Leasing is jointly a method of financing and a method of acquiring an asset. Practically any item that can be leased can also be bought; thus there is a decision to be made as to whether to buy or lease. The objective of this book is to suggest an approach to evaluating the economic costs of buying as compared with leasing. Unfortunately it is easier to describe errors that are likely to be made than to recommend a simple universally accepted method of analysis.

There are three basic problems in analyzing buy versus lease decisions. One is the definition of the cash flows to be used. The second is the choice of the rate of discount. The third problem is to match the appropriate rate of discount with the choice of cash flow.

1

A major problem with the cash flow calculation is the inclusion or exclusion of the debt component of the lease flows. The objective is to make the lease analysis comparable in terms of debt characteristics with the buy analysis. Generally this means extracting elements of the lease cash flows.

There are three basic choices for the rate of discount to be used:

1. the after-tax borrowing rate
2. the before-tax borrowing rate
3. some type of risk-adjusted rate such as the weighted average cost of capital

If we assume that there are four possible sets of cash flows (there are more) and three possible discount rates (again, there are more), there are then twelve different ways of combining the two elements. If we then recognize the possibility of using different rates of discount to discount different types of cash flows for either the buy or the lease component, we can readily see why there has not been agreement on analyzing buy versus lease decisions.

Finally, there is the matter of comparing the cash flows of one alternative (buy) with the other alternative (lease). Rather than reviewing the basic theory and practice of capital budgeting, we shall jump into the middle of that discussion and conclude that one should use the net present value method since it is at least as good as any other method and, for many purposes, better.¹

The Net Present Value Method

The alternatives will be evaluated using the net present value method. Future cash flows will be transferred back to the present moment in time using present value factors. Each present value factor is equal to $(1 + r)^{-n}$, where r is the discount rate being used and n is the number of time periods in the future when the cash is to be received. Multiplying the future cash flow by $(1 + r)^{-n}$, gives a present value equivalent. The sum of these present value equivalents gives the net present value of the alternative.

For example, if \$100 is to be paid at time 2 and if the interest rate is .10, we have

$$(1 + r)^{-2} = (1.10)^{-2} = .826446$$

The present value factor is .826446 and the present value equivalent of the \$100 to be paid at time 2 is \$82.64.

¹The reader not accepting this statement might read H. Bierman, Jr., and S. Smidt, *The Capital Budgeting Decision*, 5th ed. (New York: Macmillan, 1980).

An investment is acceptable if its net present value is equal to or larger than zero. For example, assume a firm has a .10 time value factor and the cash flows of an investment are as follows:

<i>Time</i>	<i>Cash Flows</i>
0	-18,000
1	11,000
2	12,100

We want to compute the net present value of the investment by multiplying each cash flow by $(1.10)^{-n}$, where n represents the time the cash flow takes place. We now have

<i>Time: n</i>	<i>Cash Flows</i>	<i>Present Value Factors</i>	<i>Present Values</i>
0	-18,000	$(1.10)^{-0}$	-18,000
1	11,000	$(1.10)^{-1}$	10,000
2	12,100	$(1.10)^{-2}$	10,000
Net present value			2,000

The net present value of the investment is positive; thus the investment is acceptable.

If mutually exclusive investments are being compared, and if, because of their nature, only one investment can be accepted (they can be different ways of doing the same tasks), the investment with the largest net present value would be chosen as the best alternative.

The explanations just presented are excessively brief and they omit many complexities. But these complexities would not alter the basic calculations or the two basic decision rules. Accept an investment if its net present value is positive. Choose the mutually exclusive investment with the largest net present value.

We will now consider the basic problem of choosing between leasing and buying.

The Basic Problem

In this chapter we assume zero taxes so that we can concentrate on the basic elements of the buy versus lease decision. We also assume that there is no uncertainty. In the example following we know that the equipment is to be acquired, that the life is three years, and that there is no residual value. The cost of the equipment if purchased is \$90,000, and it can be leased for \$36,829 with the lease payments being made at the end of each of the next

three years. Capital can be borrowed at the bank at an interest cost of .10. The repayment schedule is flexible. The lease is not cancellable by the lessee.

Should the equipment be bought or leased? Since it has already been decided that the equipment should be acquired, the only question is as to the method of financing. While the problem has been described as a buy versus lease decision, actually it is a method of financing decision.

The firm has the following capital structure with a weighted average cost of capital of .14.

<i>Method of Financing</i>	<i>Cost</i>	<i>Capital Structure Weights</i>	<i>Weighted Cost</i>
Debt	.10	.5	.05
Equity	.18	.5	.09
Weighted average cost of capital			.14

The present value of the lease payments using .14 as the discount rate is \$85,504.

<i>Time</i>	<i>Lease Payment</i>	<i>Present Value Factors</i>	<i>Present Values</i>
1	36,829	1.14^{-1}	32,306
2	36,829	1.14^{-2}	28,339
3	36,829	1.14^{-3}	24,859
Present value of leasing			85,504

The cost of buying is \$90,000 and the present value of leasing is only \$85,504; thus leasing would seem to be more desirable than buying.

We have just illustrated a major error in buy versus lease analysis. One has to be very careful about the cash flows that are being used and the rates of discount. The above calculations are not correct.

Let us assume that the analyst is a naïve but intelligent person who does not understand present value analysis. Instead of doing the calculations, the analyst phones the bank lending officer and asks one question: "How much will the corporation have to pay at the end of each time period to repay a loan of \$90,000?" The .10 interest rate and the three-year time period have already been defined. The bank lending officer makes a relatively simple calculation and responds that the required annual payments are \$36,190 at the end of each of three years. With that payment schedule the bank will earn a .10 return each year and the company will pay interest at the rate of 10 per year.

Now the analyst has the choice of recommending the buying of the equipment and paying the bank \$36,190 each year or leasing and paying the les-

sor \$36,829. With the choice described in this manner, the preference for buying in this situation becomes obvious. The firm would rather write three checks to the bank for \$36,190 than write three checks of \$36,829 to the lessor.

The present value calculation led to an incorrect decision since the choice of the rate of discount was wrong. If .10 (the borrowing rate) had been used, we would have obtained \$91,588 for the present value of leasing.

<i>Time</i>	<i>Lease Payment</i>	<i>Present Value Factors</i>	<i>Present Values</i>
1	36,829	1.10^{-1}	33,481
2	36,829	1.10^{-2}	30,437
3	36,829	1.10^{-3}	<u>27,670</u>
Present value of leasing			91,588

Now leasing has a larger present value of costs (\$91,588) than does buying (\$90,000). Again, buying is more desirable than leasing.

The Two Correct Methods

Two correct methods of analysis have been presented. One is to determine the cash outlay per period for buying combined with borrowing as compared with leasing. Note that the buy analysis was combined with the borrowing necessary to finance the asset so that buying could be compared with leasing, which is an alternative type of debt. In a real sense we are comparing two different types of financing.

The second method of analysis computed the present value of the lease payments and compared the present value of leasing with the cost of the asset. The cost of debt was used to compute the present value. The use of the weighted average cost of capital led to an incorrect decision. It caused leasing to appear to be less costly than buying when in fact it was more costly. The inclusion of a risk adjustment in the discount rate led to an incorrect observation.

Residual Value

In the example presented, buying was more desirable than leasing despite the fact that the residual value of the equipment was equal to zero. Now we will change the assumptions. The lease payments are now reduced to \$36,000 per year. With zero residual value, leasing is now more desirable than buying. But now assume that the residual value at time 3 is \$1,500. How should this information be incorporated into the analysis? There are several possible approaches, but only one will be suggested here. First, compute the present

value of the lease payments using the .10 borrowing rate. This is \$89,527. Then, subtract the present value of the residual value from the cost of the equipment. Using .14 as the discount rate, we would have

$$\text{Net cost of buying} = 90,000 - 1,500(1.14)^{-3} = 90,000 - 1,500(.6750) = 88,987$$

and buying is more desirable than leasing. But someone could object to the use of the .14 rate of discount, so we must relax that assumption. Figure 1.1 shows the net cost of buying and the cost of leasing for different discount rates. The cost of buying (net of residual value) is equal to the cost of leasing if the residual value is equal to \$1,500 and if the residual value is discounted at a discount rate of .47.²

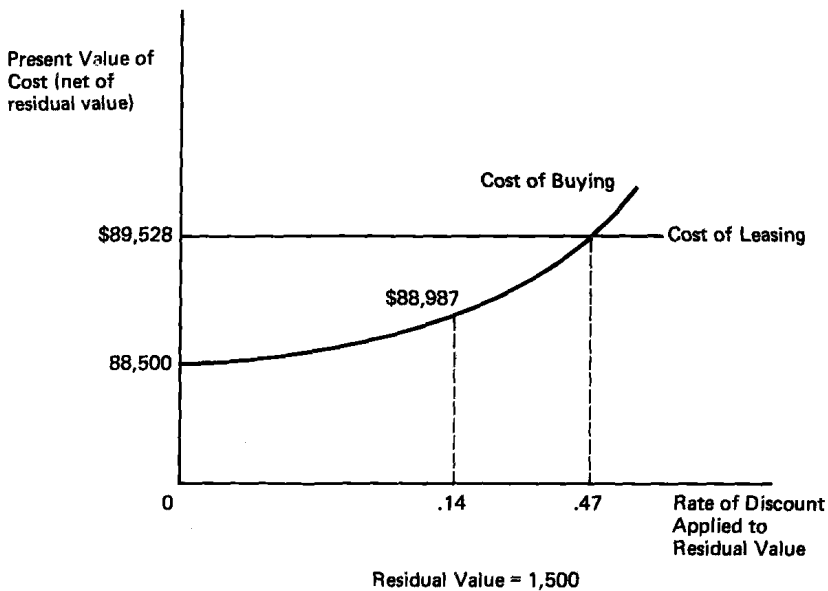


Figure 1.1

Note that the cost of leasing is not affected by the use of different rates of discount being used for the cost of buying. The cost of leasing has been computed using the borrowing rate defined to be .10. That number is not being

² The calculation of .47 is as follows:

$$\begin{aligned} 90,000 - 1,500(1 + r)^{-3} &= 89,528 \\ (1 + r)^{-3} &= .3147 \\ r &= .47 \end{aligned}$$

allowed to change. The rate at which the residual value should be discounted is being varied. We find that buying is preferred to leasing over a wide range of discount rates (as long as the discount rate is less than .47).

The Investment Decision

Let us return to the situation in which there is zero residual value and the lease payment is \$36,829 per period. The weighted average cost of capital is again .14.

<i>Method of Financing</i>	<i>Cost</i>	<i>Capital Structure Weights</i>	<i>Weighted Cost</i>
Debt	.10	.5	.05
Equity	.18	.5	<u>.09</u>
Weighted average cost of capital			.14

If the benefits each year are forecasted to be \$38,000, what should the firm do? We assume that the decision to acquire the asset has not yet been made.

A straightforward capital budgeting analysis using the .14 weighted average cost of capital indicates that the investment has a negative net present value of \$1,778 and should be rejected.

<i>Time</i>	<i>Cash Flow</i>	<i>Present Value Factors</i>	<i>Present Values</i>
0	-90,000	1.14^{-0}	-90,000
1	38,000	1.14^{-1}	33,333
2	38,000	1.14^{-2}	29,240
3	38,000	1.14^{-3}	<u>25,649</u>
Net present value			-1,778

Shifting to the consideration of leasing where the lease payment is \$36,829 per year, we see that each year has a positive cash flow of \$1,171: $\$38,000 - \$36,829 = \$1,171$. The present value of leasing is positive using any interest rate.

It would seem that the firm should lease, but this conclusion is in error. It has already been shown that with these facts buying is more desirable than leasing.

In the calculations using .14 as the discount rate we obtain a present value of benefits \$88,222. The present value of leasing (using .10) has already been computed to be \$91,588. Thus if .14 were to be accepted as the appropriate rate for discounting benefits and .10 as the rate of discounting the lease flows, leasing, as well as buying, would have to be rejected.

If the leasing alternative were to be accepted, then we should reconsider (and restructure) the buy decision. Using \$90,000 of debt we know that the debt payments each year will be \$36,190. The net benefits of buying each year are $\$38,000 - \$36,190 = \$1,810$, a figure that exceeds the yearly \$1,171 net benefits of leasing.

Using .10 leasing has a present value of costs \$91,588, which is larger than the \$90,000 cost of buying. A method of analysis that indicates that leasing is acceptable but buying is not, given the facts of this example, must be deficient.

Comparing the annual \$38,000 benefit with the \$36,829 lease payment is analogous to subtracting the debt payment of \$36,190 from the benefit if the asset is purchased. One cannot include the debt payments of leasing in the cash flows, without including the debt payments in the buy analysis. A second alternative is to exclude the debt payments from both alternatives. The buy and lease alternatives must be made comparable relative to the inclusion or exclusion of the debt flows.

Should the equipment be acquired? The lease analysis clearly shows that, if \$38,000 of benefits is certain with lease payments of \$36,829, this is a good alternative. The buy analysis makes the point more forcefully since the debt payments are less with buying than with leasing.

However, if the benefit stream is not certain, it is no longer obvious that buying (or leasing) is acceptable. Should the equipment be acquired? It depends on the risk analysis. Thus we will stop short of declaring that the acquisition is desirable. What we can say is that, if the equipment is acquired, with the facts as given, the equipment should be bought not leased. We need a method of analysis that will lead to sensible decisions.

We are assuming that the necessary funds can be borrowed at a cost of .10. We are also assuming, for simplicity, that the debt will be repaid in equal installments. This latter assumption is not necessary for the basic analysis but is used to illustrate the fact that buying is clearly superior in the present situation.

We have been comparing leasing with a buy alternative in which the financing is being accomplished using borrowed funds. Having decided that buy and borrow is better than leasing, the firm might then decide that the use of common stock is even better than borrowing the funds. We have definitely not proven that debt is more desirable than common stock. It has been shown that straight borrowing is more desirable than leasing with the given facts.

If with the given facts a firm concluded that the common stock were more desirable than straight debt, but that leasing were more desirable than common stock, this would be upsetting. Transitivity of choice must apply here. If debt is less costly than leasing and if common stock is less costly than debt, then it is not possible to conclude that leasing is less costly than common stock.