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Agricultural leasing: the lease versus buy decision and its implications on farm firm capital structure

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Agricultural leasing: The lease versus buy decision and its
implications on farm firm capital structure

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by

Ann Benedict Wickham

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of the
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Signatures have been redacted for privacy

Iowa State University
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CHAPTER I. INTRODUCTION

Problem Statement

Although operating leases, short-term rental agreements, have been rather commonplace in agriculture, financial leases have only recently gained popularity as an alternative means of financing the acquisition of the services of capital items. Net agricultural lease receivables, the total amount of agricultural leases outstanding at a particular time, increased 141 percent from \$261 million in 1979 to \$628 million in 1980 (Adair, Penson, and Duncan, 1981). This growth in leasing activity was further enhanced by the Economic Recovery Tax Act of 1981 (ERTA) and the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). Also, lending institutions and equipment manufacturers have recently become more involved in leasing in agriculture. Currently, the Federal Intermediate Credit Bank (FICB) of St. Paul, Minnesota, and the FICB of St. Louis, Missouri are both offering financial leasing in their respective districts through Production Credit Associations (PCAs). The St. Paul FICB began its program in May, 1982, with six PCAs offering leases. Plans call for the number of PCAs offering leases in the St. Paul district to double from six to between twelve and sixteen by the end of 1983.¹ In addition, the St. Louis FICB has increased by six the number of PCAs offering farm financial leases.² Deere and Company has also been

¹Telephone interview with Ken Reiners, Federal Intermediate Credit Bank of St. Paul, Minnesota, St. Paul, Minnesota, 6 June 1983.

²Telephone interview with Joel Barsher, Federal Intermediate Credit Bank of St. Louis, Missouri, St. Louis, Missouri, 5 May 1983.

very active in the leasing area. Total dollar volume of agricultural leases has increased 21 times from \$7.5 million in 1979 to \$166 million in 1982. In terms of number of leases written, Deere and Company has seen an increase of 2600 percent from 192 leases in 1979 to 5183 leases in 1982.¹

Some of the more important variables that have influenced the desirability of leasing during this period are the ability to predetermine a purchase option price, the tax characteristics of the lessee, especially the ability to retain or pass through the tax benefits, lower security requirements, and loan characteristics, such as interest rate and loan length. Previously, a major drawback to financial leases, from the farmer's perspective, has been the inability to set a purchase option price; the asset had to be purchased at fair market value at the end of the lease. With an undetermined purchase price, it was extremely difficult or impossible to determine the value of the lease and to compare it to buying the asset. This was further complicated by the rapid appreciation in used agricultural equipment prices in the 1970s. A set purchase option price allows the farmer to accurately evaluate the lease versus buy decision.

The 1970s also saw the tax position of farmers change from high taxable incomes to low or negative taxable incomes. As a result, farmers were not able to fully utilize the tax benefits of investment tax credits and accelerated cost recovery depreciation allowances. Leases allow the

¹Telephone interview with Jeff Farmer, Deere and Company, Moline, Illinois, 16 May 1983.

lessor to use these tax benefits while passing them on to the farmer in the form of reduced lease payments. Additionally, if the lease payment is larger than interest and depreciation combined in the first few years, the taxes will be deferred until later years.

As lenders saw more bankruptcies and defaults, more security was required on loans. Often, less security is required with leasing since the lessor retains ownership. Thus, the lessor does not face the chance of losing the asset upon default. Another key change in the 1970s was the restricted availability of intermediate term financing in agriculture. Intermediate assets, such as tractors, were financed with short-term loans. Leasing offered an alternative that often more closely matched the asset life to the length of financing. What term financing that was available generally was structured with a variable interest rate and, as a result, uncertain payments. Leasing provides an alternative that reduces risk to the farmer through fixed payments.

There are a number of factors that influence the desirability of leasing from an individual producer's perspective. Each lease must be examined carefully and evaluated on its own merits. With some lease terms, the farmer's cash flow is increased and working capital needs are reduced. The farmer may receive cash the first year if the rebates and trade-ins are greater than the first lease payment. Working capital needs are said to be reduced due to the lack of a downpayment with leasing as opposed to a loan. This is not true if the lease payments are made at the beginning of the year or if a security deposit is required. Avoidance of obsolescence risk is another advantage of leasing often

mentioned. Obsolescence is avoided with many operating leases or shorter term financial leases. As leases become longer, this is less of an advantage. Also, lessors are also aware of the risk of obsolescence and price the lease accordingly to protect themselves. Finally, leasing is frequently referred to as "off the balance sheet" financing that will not affect borrowing limits. Although leasing does not always appear in the body of the balance sheet, it should be noted somewhere on the statement. As leasing becomes more prevalent, leased assets will appear in the body of the balance sheet. A lease is a binding contract, as is a loan, and most lenders make themselves aware of any leases outstanding and account for them in their lending decisions.

With this increase in the use of leasing as an alternative means of financing in agriculture, it is important to understand when leasing is a viable alternative to debt financing and what parameters affect that decision, from both a lessor and lessee perspective. The individual firm, or lessee, must evaluate leasing as a substitute for debt financing for a particular asset, as well as the impact leasing has on the overall financial structure of the firm. On an asset basis, the firm must decide which financing method is preferred and what parameters affect that decision, such as tax rates, interest rates, loan and lease length, and the amount of the down payment. The impact of leasing on the overall financial structure of the firm is important to both the firm and the firm's lenders. With lease payments being fixed contractual obligations, they will alter the leverage position of the firm and thus the borrowing power of the firm. Leasing will also affect the financial structure in

terms of the balance sheet and financial ratios since there exists a fixed financial commitment with financial leases that appears on the balance sheet. What the affect is depends on where and how the lease is shown on the asset and liability sides of the balance sheet. It is necessary to examine the implications of the many different methods of accounting for leases that are used in agriculture today and offer some standardization.

Lessors must also be concerned with the parameters that affect the lease versus buy decision so they can offer leases that are attractive to the lessee as well as profitable for themselves. What makes the lease a profitable venture for the lessor depends in part on whether the lessor is a captive lessor, an independent lessor, or a bank or bank-affiliated lessor. A captive lessor is a wholly owned subsidiary of a particular manufacturer. Thus, they only offer leases on their particular equipment and the leases are used as a marketing tool. In 1981, captive lessors accounted for approximately 54 percent of the total lease financing by agricultural producers (Adair, Penson, and Duncan, 1981). Examples of equipment leased by captive lessors include tractors, harvesting equipment, and storage and handling equipment. Independent lessors lease assets as their primary business. Thus, their objective is to maximize the return on each lease. Banks and bank-affiliated lessors lease assets as an alternative to debt financing. They do this to offer a service to their customers as well as earn an adequate return on the lease.

Sale and leaseback arrangements, leveraged leases, and capital leases are the three main types of lease financing. Under a sale and

leaseback arrangement, a firm sells an asset to another party who, in turn, leases it back to the firm. With a leveraged lease the lessor acquires the asset partly through equity investment with the remainder provided by a lender who holds a security interest in the asset. The position of the lessee is not affected by this arrangement. With capital leases the firm acquires the use of an asset it previously did not own. For the purposes of this paper, capital leases will be examined.

Objectives

This paper has three main objectives: 1) to determine and evaluate the parameters that affect leasing on an individual asset basis; 2) to determine and evaluate the parameters that affect leasing at the firm level; and 3) to analyze the affect leasing has on the optimal capital structure of the firm. Each objective has to be looked at independently as well as in combination with the other objectives.

With respect to an individual asset, it must first be decided what method should be used in evaluating the lease versus buy decision. Then, it is necessary to determine the sensitivity of the lease versus buy decision to various parameters, such as type of asset, loan and lease terms, the tax rate, and the discount rate. Also, the sensitivity must be looked at in terms of which parameters do, in fact, affect the lease versus buy decision and given a sensitivity, how and when does the decision outcome change?

When analyzing leasing on a firm basis, the method of accounting for leasing on the firm's financial statements must be determined. Once this

is determined, the impact leasing has on the financial condition and structure of the firm can be analyzed. Two of the areas that need to be considered are how the liquidity of the farm is affected, and how leasing influences the leverage position of the firm.

The third objective is closely related to the second in that it also looks at leasing on a firm basis. This objective is concerned with the overall capital structure of the firm; i.e., given a certain equity position, does it matter if nonequity is comprised of leasing or debt financing? Furthermore, the optimal mix of debt and lease financing needs to be examined.

Although these objectives must be examined individually, they are also interrelated. For example, the asset lease versus buy decision is related to the firm objective since the firm financial structure will in part determine the tax rate and the discount rate. Also, the effect of leasing on the firm financial structure is a function of the asset acquisition decision since the asset decision will determine the terms of the lease, and thus determine the impact on the balance sheet in terms of the composition of debt, leasing, and equity, and thus the weighted average cost of capital.

Literature Review

The literature is not very extensive in the area of financial leasing in agriculture. Much of the work that has been done on financial leases is found in the business finance literature before the implementation of ERTA. The basic premise on which the lease versus buy

analysis is performed remains the same whether or not the asset will be used for agricultural purposes or whether the lease is a pre-ERTA lease or a farm financial lease as defined by TEFRA. However, some of the assumptions and tax treatments need to be adjusted to account for the fact that the lease is a farm financial lease and to comply with current law.

There is some controversy in the finance literature as to how to perform the lease versus buy analysis. Van Horne (1983), in Financial Management and Policy, considers three methods of analysis for the lease versus buy decision. The first method is a comparison of the present values of the cash outflows of the lease and the buy alternatives. The cash flows from the lease and from the buy alternatives are discounted at the after-tax cost of borrowing. Van Horne feels that the after-tax cost of borrowing should be used since leasing is analogous to borrowing. With this method, the alternative with the lowest present value is desirable.

The second method Van Horne examines is that of computing the internal rate of return. He begins by calculating the after-tax cost of leasing by solving the following equation for r . The equation is

$$A_0 - \sum_{t=0}^{n-1} \frac{L_t}{(1+r)^t} + \sum_{t=1}^n \frac{T(L_{t-1} - P_t)}{(1+r)^t} - ITC = 0,$$

where A_0 = the cost of the asset to be leased,

n = the number of periods to the end of the lease,

L_t = the lease payment at the end of period t ,

T = the corporate tax rate,

P_t = depreciation in period t that would be applicable if the asset were owned, and

ITC = the amount of investment tax credit.

He compares the after-tax cost of lease financing to the after-tax cost of debt financing, choosing the alternative with the lowest rate.

The third method of analysis is the Bower, Herringer, and Williamson (1966) approach. Bower, Herringer, and Williamson divide the payment streams into the cash flows associated with financing and the cash flows associated with tax savings. The cash flows associated with financing are used to determine the financial advantage (disadvantage) of leasing. This is calculated as the present value of the loan payments minus the present value of the lease payments, both discounted at the debt rate. Next, the operating advantage (disadvantage) of the lease is determined by discounting the present value of the tax savings associated with leasing at the cost-of-capital. If the operating advantage of the lease exceeds its financial disadvantage, then lease financing should be used. Van Horne states that the discount rate used is a critical factor in the Bower, Herringer, and Williamson approach.

Van Horne (1983) recommends using the internal rate of return approach. He states that, "By comparing effective interest yields for the two financing alternatives, one does not have to choose a discount rate. This approach avoids intermingling investment and financing decisions by treating the problem as one of financing alone." He goes on to say that "under most circumstances, the three methods discussed will provide identical results" (p. 493).

Bower (1973) presents various opposing views, points out the major differences, and attempts to reconcile them based on the Bower, Herringer, and Williamson model.¹ The models he looks at in his article were developed by Beechy (1969 and 1970), by Bower, Herringer, and Williamson (1966), by Doenges (1971), by Mitchell (1970), and by Findlay, among others (see Table 1). In all cases, the measure used in the lease versus buy decision is either the increment in net present value advantage of leasing to the corporation's shareholders, NAL, or the pre-tax interest rate on the lease, i . Bower develops an equation that can be used to explain all of the approaches presented. The equation is

$$\begin{aligned} \text{NAL} = & A_0 - \sum_{j=0}^n \frac{R_j}{(1+X_2)^j} + \sum_{j=0}^n \frac{tR_j}{(1+X_3)^j} - \sum_{j=0}^n \frac{tD_j}{(1+X_4)^j} - \sum_{j=0}^n \frac{tI_j}{(1+X_5)^j} \\ & + \sum_{j=0}^n \frac{O_j(1-t)}{(1+X_6)^j} - \frac{V_n}{(1+X_7)^n}, \end{aligned}$$

where A_0 = purchase price of the asset to be leased,

R_j = lease payment at the end of a period,

D_j = depreciation charge relevant for tax payment at the end of a period,

O_j = cash operating cost expected to occur in a period if the asset is purchased but not if it is leased,

V_n = expected after-tax salvage value of the asset at the last period covered by the lease agreement,

¹The following discussion, through page 15, of these various models, comes from Bower (1973). See Bower's article for a complete discussion.

Table 1. Approaches to lease evaluation (Bower, 1973)

Approach	Summary measure	Excluded flows or other comments	Equivalent loan calculation ^a
Beechy	i	tL_j is used instead of tR_j in the 3rd term of the equation	$P_0 = A_0$ $B_0 = \sum_{j=0}^n (R_j / (1+4)^j)$ $L_j = R_j (P_0 / B_0)$
Bower, Herringer, Williamson	NAL		$P_0 = A_0$ $B_0 = \sum_{j=0}^n (R_j / (1+r)^j)$ $L_j = R_j (P_0 / B_0)$
Doenges Mitchell Wyman	$i(1-t)$	I_j is excluded. Wyman provides a probability distribution of rates.	None
Findlay	NAL	Certainty equivalents of O_j and V_n are used in the 6th and 7th terms.	$P_0 = \sum_{j=0}^n (R_j / (1+r)^j)$ $L_j = R_j$
Johnson and Lewellen	NAL	I_j is excluded.	None
Roenfeldt and Osteryoung	$i(1-t)$	I_j is excluded. Certainty equivalents of O_j and V_n are used in the 6th and 7th terms.	None
Vancil	NAL		$P_0 = A_0$ $L_j = R_j$

^aOnly the first two or three equations required to produce the equivalent loan flows are shown in each box. The remaining equations are the same for each approach. The full set of equations for Beechey's approach is:

$$\begin{array}{lll}
 P_0 = A_0 & L_j = R_j (P_0 / B_0) & Q_j = L_j - I_j \\
 B_0 = \sum_{j=1}^n (R_j / (1+r)^j) & I_j = rP_{j-1} & P_j = P_{j-1} - Q_j
 \end{array}$$

Discount rate used for:					
X_2	X_3	X_4	X_5	X_6	X_7
i	i	i	i	i	i
r	k	k	k	k	k
$i(1-t)$	$i(1-t)$	$i(1-t)$	-	$i(1-t)$	$i(1-t)$
r	$r(1-t)$	$r(1-t)$	$r(1-t)$	$r(1-t)$	$r(1-t)$
$r(1-t)$	$r(1-t)$	k	-	k	k
$i(1-t)$	$i(1-t)$	$i(1-t)$	-	$i(1-t)$	$i(1-t)$
r	k	k	k	k	k

r = pre-tax interest rate on term loans "comparable" to the lease,
 k = after-tax cost of capital for the corporation,
 t = corporate income tax rate,
 n = number of periods covered by the lease agreement,
 P_0 = outstanding principal of the loan equivalent,
 L = loan payment at the end of period,
 I_j = interest component of the loan payment,
 Q = principal component,
 B = present value of the lease claim, and
 X = discount rates to be applied to cash flows in each category.

Setting $NAL=0$ and solving for i provides the pre-tax interest rate on the lease, or the internal rate of return.

Bower (1973) sees the more significant disagreements in the literature as the treatment of lease payments and the treatment of the tax shelters given up or acquired through acceptance of the lease. He states that the most obvious and easily reconciled disagreement is whether or not to include the tax deduction on the interest on the equivalent loan. Findlay includes the tax deduction on interest, discounts the lease payments at the pre-tax loan rate, and discounts the lease payment tax shelter acquired and the depreciation and interest tax shelters given up at the after-tax loan rate. Bower feels that the approaches used by Roenfeldt and Osteryoung, by Doenges, by Mitchell, by Wyman, and by Beechy have all implicitly assumed Findlay's equivalent loan by excluding the interest shelter and discounting the other flows at the after-tax

loan rate because Findlay assumes an equivalent loan equal to the present value of the lease payments. Bower illustrates this with the following equation:

$$\text{if } P_0 = \sum_{j=0}^n \frac{R_j}{(1+r)^j},$$

then

$$\begin{aligned} & - \sum_{j=0}^n \frac{R_j}{(1+r)^j} + \sum_{j=0}^n \frac{tR_j}{(1+r(1-t))^j} - \sum_{j=0}^n \frac{tD_j}{(1+r(1-t))^j} - \sum_{j=0}^n \frac{tI_j}{(1+r(1-t))^j} \\ & = - \sum_{j=0}^n \frac{R_j}{(1+r(1-t))^j} + \sum_{j=0}^n \frac{tR_j}{(1+r(1-t))^j} - \sum_{j=0}^n \frac{tD_j}{(1+r(1-t))^j}. \end{aligned}$$

Another major area of disagreement is the discount rate applied to the depreciation tax shelter. Johnson and Lewellen use the cost of capital, k , whereas the approaches taken by Beechy, Doenges, Mitchell, Wyman, Findlay, and Roenfeldt and Osteryoung use the after-tax interest rate, $r(1-t)$ to discount the depreciation tax shelter. Bower states that the selection of k is unappealing because the tax shelter given up in leasing is discounted at a high rate, k , and the tax shelter received from leasing is discounted at a low rate, $r(1-t)$. Bower feels this does more to bias the analysis in favor of leasing than to recognize any real difference in risk, and unless depreciation is a much more risky source of tax shelter, it should not be discounted at a different rate than the other tax shelters.

Another disagreement in the literature is the use of different equivalent loans to calculate the interest tax shelter sacrificed in

leasing. Bower rejects the alternatives presented in Vancil and in Bower, Herringer, and Williamson in favor of the equivalent loan alternative explicit in Findlay and implicit in the other models. This is because Bower, Herringer, and Williamson and Vancil presume that the borrowing implied would take place even if leasing were rejected, and the amount borrowed would be equal to the purchase price of the asset. Thus, they calculate the interest tax shelter from an equivalent loan equal to the purchase price of the asset and not to the present value of the lease payments. If the purchase price is greater than the present value of the lease payments (as used in Findlay), additional borrowing may threaten debt limits and affect discount rates.

The only remaining disagreement is on the rate to be used when discounting all of the tax shelters, as opposed to just the depreciation tax shelter discussed earlier. The models used by Bower, Herringer, and Williamson, and by Vancil use the rate k rather than the rate $r(1-t)$ to discount all tax shelters. Bower suggests that the after-tax interest rate, $r(1-t)$, is too low and that the rate r is also likely to be too low to properly reflect the risk, even if the flows from the tax shelters are as certain as the loan obligations. He feels that k is a closer estimate of the rate that applies, rather than r . It is important to note here that Bower offers no suggestions as to how to estimate k . In fact, he states, "...while there may be agreement that k is the right rate to use, there is unlikely to be agreement on a single estimate of k " (p. 27).

Bower focuses primarily on the theoretical structure of the various lease versus buy models presented. Much of the work Bower reviewed

presented a model that could be used in the lease versus buy decision and used one example to illustrate the methodology. It is important to extend this work into the area of the sensitivity of the lease versus buy decision to the various parameters to enable the user to draw general conclusions about the merits or drawbacks of leasing, and when a lease or traditional debt financing is the preferred method of financing. Bower, Herringer, and Williamson presented a net present value model and performed a sensitivity analysis to find the responsiveness of the lease versus buy decision to the loan rate, holding all other variables constant. Findlay expanded on this using an internal rate of return model. He evaluated the sensitivity of the pre-tax cost of leasing to the tax rate, depreciation method, salvage value and useful life.

In more recent work directly related to agriculture, La Due (1977) examined the lease versus buy decision in an agricultural oriented framework using a net present value approach. He based his work on data from a 1971-1972 survey of machinery dealers in the Northeastern United States on the availability and cost of machinery leasing and renting in the Northeast. He analyzed both lease with no purchase option versus buy, and lease with purchase option versus buy for tractors. He used machinery values taken from the Official Tractor and Farm Equipment Guide to estimate the purchase option price since under pre-ERTA tax law the machine had to be purchased at fair market value. No mention is made as to whether or not inflation was taken into consideration in determining the values. La Due performs a sensitivity analysis of the net present value to the lease length, the cost of capital, and the marginal tax

bracket. He draws the conclusions that leasing is more likely to be a profitable alternative for a farmer with a high marginal tax bracket and/or a high cost of capital, and that the longer the lease period the less likely that leasing will be preferred to purchasing.

La Due's work provides a good background for evaluating the lease versus buy decision in agriculture but leaves many questions unanswered since the net present value model is not explicitly shown. Some of the unanswered questions are the type of depreciation method used, whether or not depreciation benefits are included after the purchase option is exercised, and the timing of the tax benefits.

In contrast, Plaxico (1983) outlines his calculations more explicitly. He examines the lease versus buy decision under TEFRA guidelines using a net present value approach. He finds that a lease will generally be preferable to purchasing the asset when the lessor faces a lower cost financing plan than the farmer and is in a higher marginal tax bracket. One area in Plaxico's analysis that needs further refinement is that of the inclusion of a nonfair market value purchase option on the lease. Also, Plaxico has analyzed both the lease and buy alternatives, which have different lives, using the net present value procedure. This can potentially result in inconsistent results unless proper adjustments are made.

Lins and Clark (1982) also examined the lease versus buy decision under TEFRA guidelines using a net present value approach. He has included a purchase option price for the lease and the lease and loan transactions occur over the same time span. Lins has not accounted for

the depreciation after the purchase option has been exercised, though. As a result, the full tax benefits of the lease alternative have not been fully included. One area Lins has included that is not seen in the other agriculture-related literature is leasing analyzed from a lender perspective. He performs a net present value analysis of the lease versus buy decision based on the lender's characteristics, such as tax bracket. He finds that the desirability of the lease over a loan for the lender is sensitive to the discount rate used, the tax rate of the farm borrower, and the assumptions concerning repayment of acquired funds. Lins feels that the wider the disparity between tax rates of the farmer and the lending institution is, the more attractive leasing becomes.

Robertson, Musser, and Tew (1982) use net present value to analyze the lease versus buy decision for center-pivot irrigation systems. The net present value equations used in their lease versus buy analysis are different from those commonly used. The authors have separated out the equity portions of the cash flows using the debt to asset ratio for the firm. They then use the cost of equity as the discount rate. They base this formulation on land price studies. The authors state, "The formulation in this paper has been utilized by agricultural economists concerned with land prices...while the methods do not yield equivalent calculations, they would result in similar decisions in most cases" (p. 5). It appears that using this formulation rather than the traditional net present value approach results in unnecessary difficulty and increases the chances of making a wrong decision. Also, Robertson, et al., have not accounted for leases with a purchase option. They do

perform a sensitivity analysis of the net present value to the leverage ratio, to the marginal tax rate, to the cost of equity capital, to the depreciation method, and to the planning horizon length. It will be especially interesting to compare these sensitivity results to future results, particularly since they have used a nontraditional method of evaluating capital assets.

Leasing in agriculture needs to be examined in greater detail, particularly with respect to how the changes in the tax treatment of leases have affected the sensitivity of the lease versus buy decision to the various parameters. Additional work is also needed in the area of leasing and its affect on the capital structure of the firm. As farmers are approached more often by lenders and manufacturers offering leasing as a financing alternative, it will be necessary for them to have proper and accurate tools for evaluating the impact of leasing on the individual investment and on the farm firm.

CHAPTER II. CONCEPTUAL FRAMEWORK

Legislative Background

A financial lease is a noncancellable contractual commitment where the lessee makes a series of payments to the lessor in exchange for the use of an asset. Prior to ERTA, the Internal Revenue Service placed very restrictive guidelines on the tax deductibility of financial lease payments. Some of these restrictions were: 1) the lessor had to maintain a 20 percent unconditional at-risk investment in the property; 2) neither the lessee nor a party related to the lessee could furnish any part of the cost of the property; 3) the lessee could not loan to the lessor any of the funds necessary to purchase the property or guarantee any lessor loan; 4) the lessee could not have an option to purchase the property at the end of the lease term unless the option could be exercised only at fair market value; 5) the lessor must have expected to receive a profit and a positive cash flow from the transaction independent of tax benefits; and 6) property that could be used only by the lessee (limited use property) was not eligible for lease treatment (Harl, 1983). If these restrictions were not met, the lease would be considered a conditional sale or some type of financing arrangement and the tax benefits of the lease arrangement would be lost.

Congress relaxed the restrictions on leasing with the passage of ERTA. ERTA established safe harbor leases which, in essence, were means of transferring tax benefits from the lessee to the lessor. Congress felt this would increase new investment by corporations that previously

did not have enough taxable income to be able to enjoy the tax benefits of capital investment. Safe harbor leases could have no economic substance except for the sale of the tax benefits. Safe harbor leases were primarily sale-leaseback arrangements. With a sale-leaseback arrangement, the lessor (buyer of the tax benefits) purchases the asset from the lessee (seller of the tax benefits) and then leases it back to the lessee. The lessor makes a downpayment to the lessee that also serves as the purchase price of the tax benefits. The terms of the lease (length and lease payment) are equal to those of the loan (length and loan payment). Often, there is a purchase option associated with the lease for a nominal amount of say, \$1. Thus, the only funds that actually change hands are the lessor's downpayment and the purchase option price. The annual payments are "paper" transactions.

Some of the characteristics of safe harbor leases are: 1) the lessor had to maintain a minimum at-risk investment of only ten percent; 2) the lessee could provide or guarantee financing; 3) the lease term had to be less than 150 percent of the class life of the property or 90 percent of the useful life of the property, whichever was greater; and 4) the lessor could sell the property at a predetermined price which could be less than fair market value. Safe harbor financial leases did encourage investment but there was much concern about the possibility of companies significantly reducing their tax liabilities. The United States Treasury estimated that these safe harbor provisions could result in a cumulative loss of Federal revenue of \$30 billion by 1986 (Lins and

Clark, 1982). As a result, these provisions were amended by TEFRA in 1982.

The Tax Equity and Fiscal Responsibility Act of 1982 made several changes in safe harbor leasing as well as developed "new" finance leases. TEFRA modifies the safe harbor leases established by ERTA for property placed in service between June 1, 1982, and the end of 1983. Many of the tax benefits of leasing established with safe harbor leasing have been sharply reduced in this interim period. One of these changes is that the lease term cannot exceed the greater of the specially designated recovery period (five years for three year property, eight years for five year property, and 15 years for ten year property) or 120 percent of the class life of the property. Also, the lessor's income tax liability from leasing, due to accelerated cost recovery deductions or investment tax credits, may not be reduced by more than 50 percent, and safe harbor rules may be applied to no more than 45 percent of the lessee's "qualified base property." "Qualified base property" includes all property under a safe harbor lease election, all other new investment tax credit property placed in service during the taxable year, and new property eligible for investment tax credit under an agreement qualifying as a lease for purposes of the nonsafe harbor rules. Another change is that a lessee may not enter into a safe harbor lease with a "related person" which is defined, for this purpose, only in terms of corporate members of an affiliated group. Finally, investment tax credit on leased property must be spread over a five year period although the adjustment in income tax basis is effective the first year (Harl, 1983).

The "new" finance leases, as established by TEFRA, are generally the same as the pre-ERTA financial leases with a few important exceptions: 1) they must meet the nonsafe harbor restrictions (see page 4); 2) they permit an option exercisable by the lessee at the end of the lease term for a price set at the beginning of the lease term provided that price is at least ten percent of the original purchase price of the asset; and 3) limited use property is eligible (Harl, 1983). The new finance lease rules apply to leases entered into after 1983 with the exception of farm finance leases.

Leases of new investment credit property used for farming purposes entered into after July 1, 1982, qualify for "new" finance lease treatment. However, the amount of property eligible to qualify as a new finance lease cannot exceed \$150,000 during the calendar year for the lessee or related persons. Related persons include brothers, sisters, spouse, ancestors, and lineal descendants for this purpose (Harl, 1983). Farm finance leases are exempt from two major restrictions until 1984: 1) the lessee is not subject to the 50 percent limitation on the reduction of the lessor's income tax liability and 2) the lessee does not have to spread the investment tax credit over five years. After 1983, the investment tax credit must be spread over five years if the farm property placed in service exceeds \$150,000.

Accounting Background¹

With the changes in the tax laws came an increase in the popularity of leasing in all segments of the economy. As leasing became more

¹The following discussion comes primarily from Welsh et al. (1982).

prevalent, accountants, financial analysts, lenders, the Securities and Exchange Commission (SEC), and the corporations, themselves, realized the necessity of consistent reporting of leases on financial statements. With inconsistent reporting it made comparing firms difficult if not impossible. As early as 1949, the accounting profession recognized the increasing importance of leasing. In 1949, the American Institute of Certified Public Accountants (AICPA) issued Accounting Research Bulletin No. 38, "Disclosure of Long-Term Leases in Financial Statements of Lessees." As leases continued to gain popularity as a financing alternative, there continued to be debate over how to account for lease financing from a lessor and a lessee perspective. The AICPA established the Accounting Principles Board (APB) approximately a decade later. The APB was established to offer guidelines on areas of accounting, such as lease financing, where inconsistencies existed, in effort to reduce those inconsistencies. In 1964, the APB issued APB Opinion 5; APB Opinion 7 soon followed. These Opinions dealt with accounting for lease financing from a lessee and a lessor perspective, respectively. Those statements did not end the confusion surrounding accounting for leases since they offered inconsistent accounting practices between the lessor and the lessee. In 1973, the Financial Accounting Standards Board (FASB) was established by the AICPA as an independent authoritative body to assume the duties of the APB. The FASB issued Statement of Financial Accounting Standards Number 13, "Accounting for Leases," (SFAS No. 13) as amended and interpreted to supersede APB Opinion 5 and APB Opinion 7. The FASB issued an exposure draft entitled "Accounting for the Sale or Purchase of

Tax Benefits through Tax Leases" in October, 1981, in response to the passage of ERTA. This draft was later recalled after the passage of TEFRA, because it was no longer applicable. Currently, no statements have been issued by the FASB dealing specifically with leasing as authorized in TEFRA.

The statements issued by the FASB constitute the authoritative expressions of generally accepted accounting principles (GAAP). These statements and those by the Accounting Principles Board (APB) help guide accounting practices. GAAP is the highest form of accounting; publicly held corporations must follow GAAP guidelines. At the other end of the spectrum of accounting practices is accounting for tax purposes, where a firm's financial statements reflect income, expenses, assets, liabilities, and etc. based on tax guidelines. Since few farms are publicly held corporations, few must follow the generally accepted accounting principles; most farm financial statements are reported according to income tax rules and regulations. As a result, leases have appeared on the farm balance sheet and income statement in various forms, if at all, i.e., some farmers have capitalized both the asset and the liability on the balance sheet while most have left capital leases off of the balance sheet, treating them as operating leases. In addition, those who have treated financial leases as operating leases on their balance sheet have not, in most cases, even acknowledged the liability through a footnote. Some standardization is necessary to enable comparisons between farms by lenders and farmers.

The GAAP accounting procedures for leases will be presented and compared to the tax accounting procedures. Then, a compromise between the two will be proposed as a method for accounting for leases in agriculture. First, some guidelines will be discussed that apply to leasing regardless of the method of accounting.

For accounting purposes, leases are classified broadly as operating or capital (financial) leases. Capital leases effectively transfer a material ownership interest from the lessor to the lessee without a formal transfer of asset ownership. SFAS No. 13 provides guidelines for deciding when a capital lease should be recognized by the lessee and, as a consequence, record the leased item as an asset and record the related lease liability due to the transfer of ownership interest (Welsh, Zlatkovich, and Harrison, 1982). Following are the criteria for classifying leases (other than leveraged leases) as capital leases, as outlined in SFAS No. 13.

- 1) The lease transfers ownership of the property to the lessee by the end of the lease term.
- 2) The lease contains a bargain purchase option.
- 3) The lease term is equal to 75 percent or more of the estimated economic life of the leased property. However, if the beginning of the lease term falls within the last 25 percent of the total estimated economic life of the leased property, including earlier years of use, this criterion shall not be used for purposes of classifying the lease.
- 4) The present value at the beginning of the lease term of the minimum lease payments, excluding that portion of the payments representing executory costs such as insurance, maintenance, and taxes to be paid by the lessor, including any profit thereon, equals or exceeds 90

percent of the excess of the fair value of the leased property to the lessor at the inception of the lease over any related investment credit retained by the lessor and expected to be realized by him. However, if the beginning of the lease term falls within the last 25 percent of the total estimated economic life of the leased property, including earlier years of use, this criterion shall not be used for purposes of classifying the lease. A lessor shall compute the present value of the minimum lease payments using the interest rate implicit in the lease. A lessee shall compute the present value of the minimum lease payments using his incremental borrowing rate, unless i) it is practicable for him to learn the implicit rate computed by the lessor and ii) the implicit rate computed by the lessor is less than the lessee's incremental borrowing rate. If both of those conditions are met, the lessee shall use the implicit rate. 5) Collectibility of the minimum lease payments are reasonably predictable. A lessor shall not be precluded from classifying a lease as a sales-type lease or as a direct financing lease simply because the receivable is subject to an estimate of uncollectibility based on experience with groups of similar receivables. 6) No important uncertainties surround the amount of unreimbursable costs yet to be incurred by the lessor under the lease. Important uncertainties might include commitments by the lessor to guarantee performance of the leased property in a manner more extensive than the typical product warranty or to effectively protect the lessee from obsolescence of the leased property. However, the necessity of estimating executory costs such as

insurance, maintenance, and taxes to be paid by the lessor shall not by itself constitute an important uncertainty as referred to herein.

The lease is a capital lease for the lessee if any one of the first four criteria is met. For the lessor, any one of the first four criteria must be met as well as both of the last two criteria for the lease to be classified as a capital lease. Not all leases qualify as capital leases for both the lessor and lessee. Because of the additional two criteria the lessor faces, it is possible for the lease to be a capital lease for the lessee and an operating lease for the lessor. Also, it is possible for the lease to qualify as a capital lease for the lessor and an operating lease for the lessee due to criterion four. "This situation can result from a) use of different interest rates in the present value discounting by the lessor and lessee, or b) a guarantee of residual value by a third-party guarantor" (Welsh, Zlatkovich, and Harrison, 1982).

From the farmer lessee viewpoint, criteria two will be met in almost all cases; financial leases for agricultural equipment generally will have a bargain purchase option price. A bargain purchase option, as defined in SFAS No. 13, is "a provision allowing the lessee, at his option, to purchase the leased property for a price which is sufficiently lower than the expected fair (market) value at the date the option becomes exercisable that exercise of the option appears, at the inception of the lease, to be reasonably assured" (p. 4). With a majority of the agricultural equipment leasing being made by captive lessors as a means to increase sales, one can be reasonably sure that the lessor has priced the lease such that a purchase option will be exercised. Also, banks and

independent leasing companies, the other major sources of lease financing in agriculture, are not in a position to want to own used equipment at the end of the lease term. Banks, in particular, are offering leasing as a financing alternative to debt, and as such, expect the outcome to be the same, i.e., the farmer owning the equipment. Thus, banks and independent leasing companies will also price the majority of their leases so a purchase option will be exercised.

The interest rate implicit in the lease, as mentioned in criteria four, is the discount rate that causes the aggregate present value of the minimum lease payments and the unguaranteed residual value to equal the fair market value of the leased property at the inception of the lease. The fair market value of the leased property is net of any investment tax credit retained by the lessor. Also, the lease payments are net of any portion of the payment that represents executory costs to be paid by the lessor. The following example shows an illustration of the calculations required to determine the interest rate implicit in the lease:

Because of the highly technical nature of this definition, it is illustrated as follows:

1. Minimum lease payments--five annual rentals of \$13,743 each, payable at December 31 of each year. Lease term begins on January 1, 19A; lease contains no guarantee of residual value nor a bargain purchase option.
2. Executory costs (maintenance, taxes, insurance) included in each lease payment--\$600.

3. Unguaranteed residual value of leased asset accruing to benefit of lessor at end of lease term--\$20,000.
4. Fair (i.e., market) value of leased property at inception of lease--\$60,000.
5. Investment tax credit retained and realized by lessor--\$6,000 (i.e., 10 percent of \$60,000).

Computation of interest rate implicit in the lease:

Fair value - Investment tax credit = PV of minimum lease payments
excluding executory costs + PV
of unguaranteed residual value
retained by lessor

$$\$60,000 - \$6,000 = (\$13,743 - \$600) \times \text{PVIFA } n=5, k=?$$

$$+ (\$20,000 \times \text{PVIF } n=5, k=?),$$

$$\$54,000 = \$13,143 \times 3.35216 + \$20,000 \times .49718,$$

$$\$54,000 = \$54,000.$$

It will be very difficult for a lessee to know the lessor's implicit interest rate for the lease. This is primarily because of the difficulty the lessee would have in estimating the executory costs such that they are the same as those estimated by the lessor. As a result, the lessee will use his or her incremental borrowing rate in most cases in computing the present value of the minimum lease payments.

GAAP Accounting for Leases

GAAP accounting for leases will be presented using a hypothetical situation.¹ Initially, the example will be a simplified lease, i.e.,

¹These examples are taken from Welsh, Zlatkovich, and Harrison, Intermediate Accounting (1982).

there is no bargain purchase option, there is no residual value, and lease payments are due at the end of the year. As the discussion progresses, these assumptions will be relaxed to make the example more realistic. Since the concern of this study is with the affect of leasing on the farmer (lessee), the emphasis will be placed on GAAP procedures from a lessee perspective.

The lessee's basic approach to accounting for leases should be to recognize the acquisition of the leased asset at the inception of the lease, to recognize the periodic payment in terms of interest expense and reduction of principal of the lease liability, and to recognize the depreciation expense. The period of depreciation to be used when ownership of the leased asset transfers from the lessor to the lessee at the end of the lease is the total useful life of the leased asset to the lessee. If no ownership transfer of the leased asset is expected, the depreciation period is the lease length. For agricultural equipment leases it is assumed that ownership transfer will occur, thus, the depreciation period will be over the life of the asset. The journal entries on the lessee's books would appear as (Welsh, Zlatkovich, and Harrison, 1982):

1) Recognize acquisition (similar to a purchase) of the leased asset at inception of the lease:

	Debit	Credit
Leased asset.....	XXXX	
Lease liability.....		XXXX

2) Recognize periodic payment part as interest expense and part as reduction of principal of the liability:

	Debit	Credit
Interest expense.....	XXXX	
Lease liability.....		XXXX
Cash.....		XXXX

3) Recognize depreciation expense:

	Debit	Credit
Depreciation expense.....	XXXX	
Accumulated depreciation.....		XXXX

The lessee's approach to valuation of the lease can be expressed as

$$\begin{array}{l} \text{the} \\ \text{valuation of} \\ \text{the leased} \\ \text{asset} \end{array} = \begin{array}{l} \text{lease} \\ \text{payment} \end{array} \times \begin{array}{l} \text{present} \\ \text{value of an} \\ \text{annuity of } n \\ \text{periods at } i \\ \text{rate of interest.} \end{array}$$

Later, it will be shown that the valuation of the leased asset will be affected by both the bargain purchase option and the residual value. The discount rate used in most cases will be the incremental borrowing rate.

Basic Example of GAAP Accounting for Leases

The first example is of a direct financing lease with no bargain purchase option and a zero residual value. The lease is for a period of

six years and the estimated useful life of the leased property is also six years. The lease payments are \$20,000 per year. They are paid on an ordinary annuity basis; they are payable at the end of the period on December 31. The lessee's incremental cost of borrowing is 15 percent. The lessee's normal book depreciation policy calls for depreciating this piece of equipment using straight-line depreciation. The fiscal year of the lessee ends on December 31.

Example 1 shows the entries on January 1, year 1. The appropriate accounting entries and supporting calculations are shown. In this example, the lessee has calculated the value of the leased property as the discounted present value of the lease payments:

$$\begin{aligned}
 & \$20,000 * PVIFA\ n=6, k=15\% = \\
 & \qquad \$20,000 * 3.78448 = \\
 & \qquad \qquad \qquad \$75,690.
 \end{aligned}$$

The lease liability and interest expense are calculated based on a lease amortization schedule (see Table 2). Annual interest is calculated by multiplying the interest rate times the lease liability balance at the beginning of the period. For the first year, the calculation would be:

Lease liability balance at beginning of first year =	\$75,690
<u>x interest rate</u>	<u>= .15</u>
Annual interest 12/31/year 1	\$11,353.

The reduction of the lease liability is found by subtracting the interest from the annual lease payment:

Example 1. Lessee's accounting entries for capital lease (ordinary annuity basis, no BPO)

JOURNAL ENTRIES

January 1, year 1 (inception of lease)

	Debit	Credit
Leased property.....	75,690	
Lease liability (on capital lease).....		75,690

December 31, year 1 (first rental)

Lease liability.....		8,647
Interest expense.....	11,353	
Cash.....		20,000

December 31, year 1 (end of accounting period)

Depreciation expenses ($\$75,690 \times 1/6$).....	12,615	
Accumulated depreciation.....		12,615

FINANCIAL STATEMENTS, YEAR 1

INCOME STATEMENT:

Interest expense, \$11,353; and depreciation expense, \$12,615.

BALANCE SHEET:

ASSETS

Leased property		
Cost	\$75,690	
-Accumulated depreciation	12,615	
Net		\$63,075

LIABILITIES

Lease liability (from Table 2)	\$67,043
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Table 2. Lease amortization schedule (ordinary annuity basis)

Date	Annual lease payment	Annual interest @ 15%	Reduction of lease liability	Lease liability balance
1/1/19A				\$75,690
12/31/19A	\$20,000	\$11,353	\$ 8,647	67,043
12/31/19B	20,000	10,056	9,944	57,099
12/31/19C	20,000	8,565	11,435	45,664
12/31/19D	20,000	6,850	13,150	32,514
12/31/19E	20,000	4,877	15,123	17,391
12/31/19F	20,000	2,609	17,391	-0-
	<u>\$120,000</u>	<u>\$44,310</u>	<u>\$75,690</u>	

Annual lease payment	= \$20,000
- Annual interest	= 11,353
	<hr/>
Reduction of lease liability	\$ 8,647.

This represents the "principal" portion of the lease payment. The lease liability balance at the end of the period is calculated by subtracting the principal portion from the beginning of period lease liability balance:

Beginning of period lease liability balance	= \$75,690
- Reduction of lease liability	= 8,647
	<hr/>
New lease liability balance	= \$67,043.

Example of GAAP Accounting for Leases for a Bargain
Purchase Option, Annuity Due Lease

Example 2 illustrates a lease transaction when a bargain purchase option (BPO) is included and the lease payments are due at the beginning of the period, i.e., they are on an annuity due basis. The lease is a six-year lease with six annual lease payments of \$16,398 due January 1. The estimated useful life of the asset is eight years at time zero. The lessee has a purchase option for \$10,000 on December 31, year 5, i.e., end of the sixth year, when the actual residual value is \$15,000. The lessee's incremental borrowing rate is 15 percent. The value of the leased property is computed as follows:

$$\begin{aligned}
 \text{present value of rentals} &= \$16,398 * PVIFA_{n=6, k=15\%} * 1.15 \\
 &= \$16,398 * 3.78448 * 1.15 \\
 &= \$71,367
 \end{aligned}$$

Example 2. Lessee's accounting entries for capital lease (annuity due basis, BPO)

JOURNAL ENTRIES

January 1, year 1 (inception of lease)

	Debit	Credit
Leased property.....	75,690	
Lease liability.....		59,292
Cash.....		16,398

December 31, year 1

Interest expense.....	8,894	
Lease liability.....		8,894
Depreciation expense (\$75,690/8).....	9,461	
Accumulated depreciation.....		9,461

December 31, year 5 (exercise of BPO)

Lease liability.....	10,000	
Cash.....		10,000

FINANCIAL STATEMENTS, YEAR 1

INCOME STATEMENT:

Interest expense, \$8894; and depreciation expense, \$9461.

BALANCE SHEET:

ASSETS

Leased Property

Cost	\$75,690	
-Accumulated Depreciation	9,461	
Net		\$66,229

LIABILITY

Lease liability (from Table 2)	\$68,186
--------------------------------	----------

plus

$$\begin{aligned}
 \text{present value of BPO} &= \$10,000 * \text{PVIF } n=6, k=15\% \\
 &= \$10,000 * .43233 \\
 &= \$4323
 \end{aligned}$$

which equals the valuation of the leased asset = \$75,690.

Table 3 shows the amortization schedule for the lease payments for this example. Interest must be accrued for one year on December 31, year 1, because the second rental payment of cash will not be made, nor recorded, until the next day, January 1, year 2. On January 1, year 2, the cash rental will be recorded as a reduction of the lease receivable and lease liability accounts. Table 3 illustrates this point. The entire lease payment, including principal and interest portions, is deducted from the lease liability balance on 1/1/year 1 to obtain the new lease liability balance of \$59,292. When the interest expense of \$8894 is fully realized on 12/31/year 1, that portion of the payment is added back to the lease liability balance. In year 1, \$7504 of principal is paid (\$16,398-\$8894). This corresponds with the decrease in the lease liability balance of \$7504 (\$75,690-\$68,186).

Residual values are another important component to be considered in GAAP accounting procedures. Two different estimated residual values need to be considered; the first is the residual value at the end of the lease term, and the second is the estimated residual value at the end of the asset's useful life. An estimated residual value at the end of the lease term must be incorporated in the accounting for the lease because it has economic value. Due to this economic value, it is important to determine

Table 3. Lease amortization schedule with bargain purchase option
(annuity due basis)

Date	Annual lease payment	Annual interest @ 15 %	Lease liability balance
1/1/year 1			\$75,690
1/1/year 1	\$16,398		59,292
12/31/year 1		\$8,894	68,186
1/1/year 2	16,398		51,788
12/31/year 2		7,768	59,556
1/1/year 3	16,398		43,158
12/31/year 3		6,474	49,632
1/1/year 4	16,398		33,234
12/31/year 4		4,985	38,219
1/1/year 5	16,398		21,821
12/31/year 5		3,273	25,094
1/1/year 6	16,398		8,698
12/31/year 6		1,304	10,000
12/31/year 6 (BPO price)		10,000	-0-

if the lessee or the lessor will own the leased asset and, thus, the residual value upon termination of the lease. In the case of agricultural equipment leases, lease terms are such that it is reasonable to assume that the farmer lessee will take ownership of the asset at the end of the lease.

Two cases need to be considered in determining the accounting impact when the lessee will take ownership at the termination of the lease and, thus, gets the residual value. The first is when the leased property and its residual value belong to the lessee at no additional cost above the annual lease payments. In this case, the residual value will not affect the accounting calculations of the lessee's cost of the leased asset. The cost of the asset will be calculated as the discounted present value of the lease payments only. It will affect the lessee in that the asset should be depreciated over its total useful life, and the amount depreciated should be the cost less any estimated residual value at the end of the useful life.

In the second case, the estimated residual value is purchased through the BPO. The BPO is included in the lessee's lease accounting as illustrated in Example 2. The cost of the lease is the sum of the discounted present value of the lease payments plus the discounted present value of the BPO. This is because it is assumed that the lessee will exercise the BPO. The lessee depreciates the discounted cost of the leased asset less any estimated residual value at the end of the useful life. Example 2 can be modified to include an estimated residual value of \$8000 at time zero; the only adjustment to account for the residual

value would be in the depreciation expense. Annual depreciation expense would now be calculated as:

$$\begin{aligned}
 &(\$75,690 - \$8000(PVIF_{n=8, k=15\%}))/8 = \\
 &(\$75,690 - \$8000(.3269))/8 = \\
 &\$9134.
 \end{aligned}$$

A problem arises in all of the previous examples as to the classification of the lease payables (lease liability) as current and noncurrent. The next upcoming lease payment should be classified as a current liability. The lessee's lease payables (the remaining payments) should be reported net of any interest included in the lease payment amounts, i.e., at the present value discounted at the appropriate discount rate. An additional concern that should be noted is on the balance sheet; the asset-side entry attributable to the leased asset will not necessarily equal the liability-side entry. Thus, the leased asset will affect the equity position or net worth of the farm firm.

In addition to the previously mentioned accounting procedures, the lessee must also provide a general description of the lessee's leasing arrangement. This description should include: 1) the basis on which contingent rental payments are determined; 2) the existence and terms of renewal or purchase options and escalation clauses; and 3) restrictions imposed by lease agreements such as those concurring dividends, additional debt and further leasing.

Current Farm Accounting for Leases

In practice, most farm firms have treated agricultural equipment leases as operating leases rather than capital leases. The accounting and reporting guidelines for operating leases are different than those shown previously for capital leases. In the case of an operating lease, there is no capitalization of the cost of the leased asset at the inception of the lease. The period lease payment is recognized as rent expense (an ordinary expense) as follows:

Recognize lease payment	
	Debit Credit
Rent expense.....	XXXX
Cash.....	XXXX.

Thus, only rent expense will appear on the income statement as contrasted to depreciation and interest expense for a capital lease.

Also, no ownership interest is shown on the asset-side of the balance sheet for assets acquired with operating leases. In the case of a lease with payments at the beginning of the period, the lessee has a lease hold right in the asset for the period of the lease payment. Also, since most agricultural leases are designed to insure exercise of a purchase option by the lessee, some ownership interest should appear. Similarly, for operating leases the lease payments do not appear on the liability-side of the balance sheet. But, the lease payments are fixed obligations required by the lease agreement, very similar to debt payments which are required to appear on the firm's balance sheet. Thus,

the lease payments should appear on the liability-side of the balance sheet. With the lease payments not appearing on the balance sheet, the firm's required fixed payments are understated.

As can be seen, there are shortcomings to treating an agricultural equipment lease as an operating lease. The farm firm's ownership interest and/or lease hold right in the leased asset is not recognized nor is the liability resulting from the fixed liability payments. These should be recognized in some fashion on the farm firm's balance sheet to accurately reflect the equity position of the firm.

Proposed Farm Accounting for Leases¹

In determining an accounting method that would serve as a compromise between GAAP and current farm accounting practices, there are two main concerns. First, the proposed method should be a method that accurately reflects the circumstances surrounding the lease and its impact on the farm firm. Second, the proposed method should be one that is not so complicated and difficult that it will preclude farmers from using it. An accurate representation in the farm records of the impact of the lease should have the lease appear both on the income statement and on the balance sheet. Even though most farmers do not keep formal journals, the proper journal entries will be shown so as to clarify the origins of the income statement and balance sheet entries.

¹The following procedures were developed with the assistance of Gary L. Maydew, School of Business Administration, Iowa State University, Ames, Iowa.

The following example will illustrate the proposed method for farm accounting for leases. For this example, it is assumed that a piece of equipment is leased for five years with annual payments of \$13,189.86 due at the beginning of each year. The incremental borrowing rate of the farmer is ten percent. Thus, the actual value of the piece of equipment is the discounted present value of the lease payments:

$$\begin{aligned} \$13,189.86 * PVIFA_{n=5, k=10\%} &= \\ \$13,189.86 * 3.7908 &= \\ & \$50,000. \end{aligned}$$

The sum of the lease payments is:

$$\$13,189.86 * 5 \text{ payments} = \$65,949.30.$$

To simplify the accounting procedures, the asset will initially appear on the balance sheet as the sum of the lease payments; thus including the interest portion of the lease payment (see Example 3 for all balance sheet entries). The corresponding entry on the liability side of the balance sheet showing the lease liability will also be the sum of the lease payments. On January 1, year 1 (the inception of the lease), the following journal entry will appear:

1-1-year 1	Debit	Credit
Leased asset-total payments to be made.....	\$65,949.30	
Liability for leased equipment--		
total payments to be made.....		\$65,949.30

Example 3. Balance sheet entries

Assets		Claims	
1-1-year 1 (inception of lease)			
Leased asset	\$65,949.30	Liability for leased equipment	\$57,759.44
		Net worth	8,189.86
1-1-year 2			
Leased asset	\$55,949.30	Liability for leased equipment	\$48,750.59
		Net worth	7,198.71
1-1-year 3			
Leased asset	\$45,949.30	Liability for leased equipment	\$38,840.86
		Net worth	7,108.44
1-1-year 4			
Leased asset	\$35,949.30	Liability for leased equipment	\$27,940.16
		Net worth	8,009.14
1-1-year 5			
Leased asset	\$25,949.30	Liability for leased equipment	\$15,949.30
		Net worth	10,000.00
12-31-year 5			
Leased asset	\$15,949.30	Liability for leased equipment	\$15,949.30
		Net worth	0.00
1-1-year 6 (end of lease life)			
Leased asset	\$0.00	Liability for leased equipment	\$0.00
		Net worth	0.00

Thus, when the lease first appears on the balance sheet, before any payments have been made, there is no impact on owner's equity. After the lease payment has been made, the "liability for leased equipment" account will be reduced by the principal portion of the payment (see Example 3).

At the end of year 1, on December 31, an entry must be made to reflect the "depreciation" of the lease. The account "Amortization expense-leased asset" is chosen for this entry. The account "Depreciation expense-leased asset" is not selected in order to avoid confusion with later depreciation of this same piece of equipment after exercise of a purchase option. It is assumed that a straight line schedule is used, based on the actual value of the equipment (\$50,000) for this amortization account. The straight-line method of amortization is chosen since the lease payments are constant over the life of the lease. The amortization method selected should accurately reflect the structure of the lease payments. The annual amortization amount will be $\$50,000 / 5 = \$10,000$. The journal entry would appear as:

12-31-year 1	Debit	Credit
Amortization expense-leased asset.....	\$10,000	
Leased asset-total payments to be made.....		\$10,000.

Similar entries will be made for the remaining four years of the lease.

The lease liability should be reduced by the amount of the principal portion of the lease each year when the payment is made. This is calculated based on a lease amortization schedule (similar to that

calculated in the previous section). The lease amortization schedule (not to be confused with the amortization expense discussed earlier) for this example is shown in Table 4. At the time of the first payment on January 1, year 1, the following journal entry will appear:

1-1-year 1	Debit	Credit
Liability for leased equipment--total		
payments to be made.....	\$8,189.86	
Interest expense.....	\$5,000.00	
Cash.....		\$13,189.86.

A similar entry will be made for each of the remaining four lease payments.

Table 5 shows the T-accounts for the "Leased asset--total payments to be made" and the "Liability for leased equipment--total payments to be made" accounts. This exhibit illustrates the appropriate balances for the remainder of the lease life. Note that both accounts are left with a balance of \$15,949.30, the interest portion of the payments (\$65,949.30-\$50,000). These entries are written off against each other as follows:

12-31-year 5	Debit	Credit
Liability for leased equipment--total		
payments to be made.....	\$15,949.30	
Leased assets--total payments to be made.....		\$15,949.30.

Thus, as with the initial entry at the inception of the lease there is no impact on owner's equity.

Table 4. Lease amortization schedule for proposed accounting example

Date	Annual lease payment	Annual interest @ 10%	Reduction of lease liability ^a	Lease liability balance ^b
1/1/year 1				\$65,949.30
1/1/year 1	\$13,189.86	\$5,000.00 ^c	\$ 8,189.86	57,759.44
1/1/year 2	13,189.86	4,181.01 ^d	9,008.85	48,750.59
1/1/year 3	13,189.86	3,280.13	9,909.73	38,840.86
1/1/year 4	13,189.86	2,289.16	10,900.70	27,940.16
1/1/year 5	13,189.86	1,199.09	11,990.77	15,949.39 ^e

^aAnnual lease payment - annual interest = reduction of lease liability.

^bPrevious lease liability balance - reduction of lease liability = new lease liability balance.

^c.10 x \$50,000 (true asset value) = \$5,000.

^d.10 x (\$50,000 - 8,189.86) = \$4,181.01.

^eOff \$.09 due to rounding.

Table 5. T accounts

	Leased asset--total payments to be made	
	Debit	Credit
1/1/year 1	\$65,949.30	
12/31/year 1	55,949.30	\$10,000.00
12/31/year 2	45,949.30	10,000.00
12/31/year 3	35,949.30	10,000.00
12/31/year 4	25,949.30	10,000.00
12/31/year 5	15,949.30	10,000.00
	Liability for leased equipment--total payments to be made	
	Debit	Credit
1/1/year 1		\$65,949.30
1/1/year 1	8,189.86	57,759.44
1/1/year 2	9,008.85	48,750.59
1/1/year 3	9,909.73	38,840.86
1/1/year 4	10,900.70	27,940.16
1/1/year 5	11,990.77	15,949.39 ^a

^aOff \$.09 due to rounding.

As was mentioned, there is no initial or ending affect on the owner's equity portion of the balance sheet. However, over the life of the lease, owner's equity will be affected. Owner's equity will be overstated by the amount of the principal paid with the most recent lease payment net of the difference between the principal portion of the previous lease payment and the amortization expense for the previous year. If the principal portion of the lease payment is less than the amortization expense, the principal portion of the lease payment will be reduced by this difference to get owner's equity. On January 1, year 2, owner's equity is \$7,198.71, the principal portion of the lease payment (\$9,008.85) minus the difference between the amortization expense (\$10,000) and principal portion of the previous lease payment (\$8,189.86). This increase in owner's equity is due to the prepayment of the lease payment. Since the lease payments are due at the beginning of the period, the farmer has a guaranteed interest in the equipment for the coming year. The increase in owner's equity represents this interest. Over the life of the lease the overstatements and understatements will net each other out. This yields a net effect on owner's equity of zero over the life of the lease.

Upon exercise of the purchase option, the equipment will appear on the balance sheet as it normally would. The cash account will decrease on purchase and the equipment account will increase by the value of the equipment. For book purposes, the book value will be the purchase option price minus accumulated depreciation.

For book purposes, as illustrated in the previous journal entries, amortization expense and interest expense are shown on the income statement. For tax purposes it is assumed that the entire lease payment is tax deductible on the farmer's income statement. It is assumed that the difference between the deduction for tax purposes and book purposes is not significant enough to warrant interperiod tax allocation.

Optimal Capital Structure

In this section, the impact of leasing on the optimal capital structure of farm firms will be examined. The concepts of the optimal capital structure will first be reviewed from the perspective of a public corporation since most of the work done in this area has been with respect to large public corporations. There are four main approaches detailed in the literature to the evaluation of the optimal capital structure of the firm: 1) the traditional approach, 2) the net income approach, 3) the net operating income approach, and 4) the Modigliani and Miller approach. These different approaches to evaluation of the capital structure of the firm will be presented. Then, the impact of leasing on each approach will be discussed. Finally, their relevance to the capital structure of a farm proprietorship will be evaluated.

The first question that must be answered is whether or not capital structure matters, i.e., will changing the financing mix of the firm affect the value of the firm's securities and its cost of capital? Before looking at the different approaches to firm valuation, the assumptions used in these approaches must be noted. The assumptions are:

1) there are no corporate or personal income taxes and no bankruptcy costs; 2) changes in capital structure are affected immediately and no transaction costs are incurred; and 3) the firm pays 100 percent of its earnings in dividends.

The traditional approach to valuation and leverage assumes that there is an optimal capital structure and because of the lower cost of debt compared to equity, the total value of the firm can be increased through the use of leverage. Investors will raise the equity capitalization rate, k_e , as leverage increases. (Leverage is defined as the ratio of the market value of debt outstanding to the market value of stock outstanding.) This increase in k_e initially does not fully offset the benefit of using cheaper debt funds. However, as leverage approaches a certain point, investors increase the minimum accepted equity capitalization rate more rapidly until this effect eventually more than offsets the use of cheaper debt funds. Figure 1 illustrates one variation of the traditional approach. The weighted average cost of capital, k_o , declines with moderate use of leverage but begins to rise when the increase in k_e more than offsets the use of the cheaper debt funds. Thus, the traditional approach implies that there is an optimal capital structure at the minimum weighted average cost of capital.

The net income approach and the net operating income approach are two extremes in the valuation of the earnings of a firm with respect to its degree of leverage. With the net income approach, earnings available to common stockholders are capitalized at a constant rate k_e (the required rate of return for investors in a firm whose earnings are not expected to

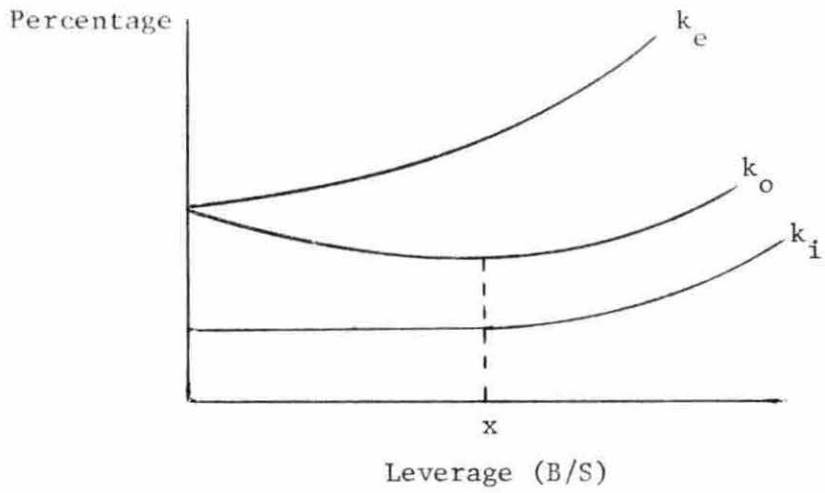


Figure 1. Capital costs: traditional approach

grow). The firm is able to increase its total valuation and lower its overall cost of capital as it increases leverage. As a result, the market price per share of the company's stock will increase. The critical assumptions of this approach are that k_i , the yield on the company's debt (all debt is perpetual), and k_e remain unchanged as the degree of leverage increases. The weighted average cost of capital k_o decreases and approaches k_i as the proportion of the cheaper debt funds is increased. This is illustrated in Figure 2.

In contrast, the net operating income approach assumes that k_o , the overall capitalization rate of the firm, remains constant for all degrees of leverage. Net operating income is capitalized at k_o to obtain the total market value of the firm. The market value of the stock is determined by deducting the market value of the debt from the total market value of the firm. Since the market capitalizes the value of the firm as a whole, the breakdown between debt and equity is unimportant. This is because as the degree of leverage rises, so does the equity capitalization rate (see Figure 3), which exactly offsets the use of the cheaper debt funds. As a result, the weighted average of k_e and k_i remains constant for all degrees of leverage. Since k_o cannot be altered through leverage, this approach implies that there is no one optimal capital structure.

Modigliani and Miller expanded on the net operating income approach. Their basic premise is that because the total investment value of a corporation depends on its profitability and risk, there is no effect with respect to relative changes in the financial capitalization of the

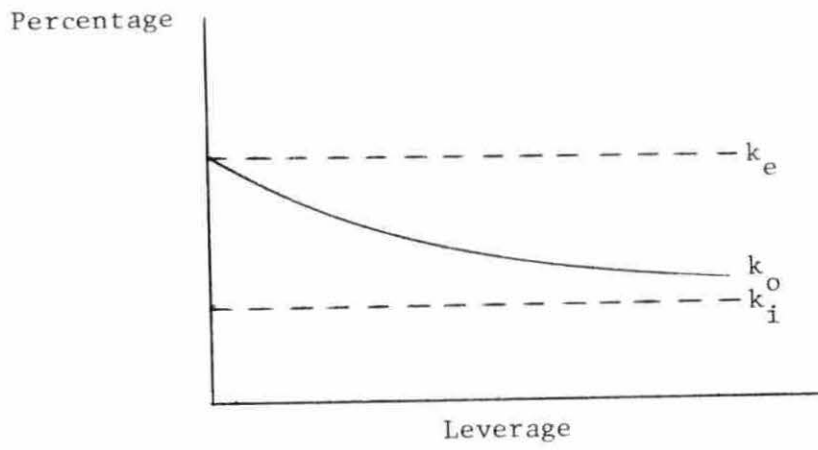


Figure 2. Capital costs: net income approach

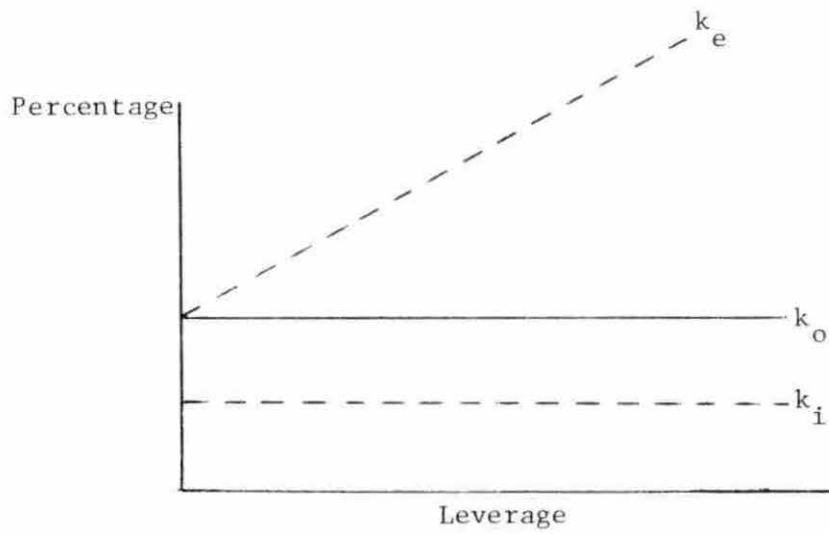


Figure 3. Capital costs: net operating income approach

firm. The total value of the firm remains constant regardless of the financing mix. That is, since the sum of the value of the types of financing must equal the firm value, the value of the firm will remain the same regardless of the financing mix. They support this position with the idea that investors are able and willing to substitute personal for corporate leverage. Thus, if two firms identical except for their capital structure do not have the same total value, arbitrage will occur in the marketplace until their values are the same.

The approaches mentioned above were discussed in a perfect market framework. Imperfections do exist with the presence of taxes being one of the most important imperfections. With the existence of corporate taxes, debt is favored over equity due to the tax deductibility of interest payments as an expense. Thus, the total amount of payments available for both debtholders and stockholders is greater if debt is employed. This is illustrated in the following example. Companies X and Y are identical except with respect to their leverage positions; Company Y has \$5000 in debt at 12 percent interest and Company X has no debt (Van Horne, 1983).

	Company X	Company Y
Earnings before interest and taxes	\$2000	\$2000
Interest-income to debtholders	<u>0</u>	<u>600</u>
Profit before taxes	2000	1400
Taxes	<u>1000</u>	<u>700</u>
Income available to stockholders	\$1000	\$ 700
Income to debtholders plus income to stockholders	\$1000	\$1300

The reason that total income to investors is larger for a levered company is that debtholders receive interest payments without the deduction of taxes at the corporate level. The total value of the firm then is:

$$\text{value of firm} = \text{value if unlevered} + \text{value of interest tax shield.}$$

It must be noted here that the value of the interest tax shield is not certain. If income is low or negative this tax shield will be reduced in value or eliminated altogether.

As can be seen from the above equation, the greater the amount of debt the greater the value of the firm due to the increased value of the interest tax shield, all other characteristics being the same. Therefore, adjusting Modigliani and Miller's original proposition for the presence of corporate taxes results in an optimal capital structure of maximizing leverage. As market imperfections are introduced this strategy will be altered.

The effect of the introduction of personal taxes on the optimal capital structure is dependent upon the tax rate used with respect to stock income and to debt income. Stock income is comprised of dividend income and capital gain income. Dividend income is taxed at basically the same personal tax rate as interest income, and capital gains are taxed at a lower rate than interest income. The combined effect of taxation of dividends and capital gains is that stock income is taxed at a rate less than that used for debt income. As a result, the overall tax advantage associated with corporate debt is reduced when personal taxes are recognized.

Another major imperfection affecting the optimal capital structure is the introduction of bankruptcy costs. First, it is assumed that the possibility that a levered firm will enter into bankruptcy is greater than the possibility that an unlevered or less levered firm will enter into bankruptcy, all other things being the same. This is expected because of the increased fixed payments of a levered firm. Also, it is assumed that the possibility of bankruptcy is not linearly related to the degree of leverage of the firm; bankruptcy costs increase at an increasing rate with increased leverage. Thus, a highly levered firm would be a less attractive investment than the unlevered firm and investors are likely to penalize the price of the firm's stock as leverage increases. The increased possibility of bankruptcy and the decreased desirability of highly levered firms should have a negative effect on the firm's value and its cost of capital. Accounting solely for bankruptcy costs, the optimal capital structure would be that capital structure that minimizes leverage.

In a framework where both taxes and bankruptcy costs exist, an optimal capital structure is likely. The firm will increase in value as more debt is used due to the positive tax advantage of debt. As the possibility of bankruptcy becomes greater, the value of the firm will increase with increased debt utilization at a decreasing rate. Eventually, as more leverage is employed, the negative bankruptcy effect would offset the tax effect. Thus, the value of the firm will decline. This joint effect is illustrated in Figure 4. Thus, the optimal capital

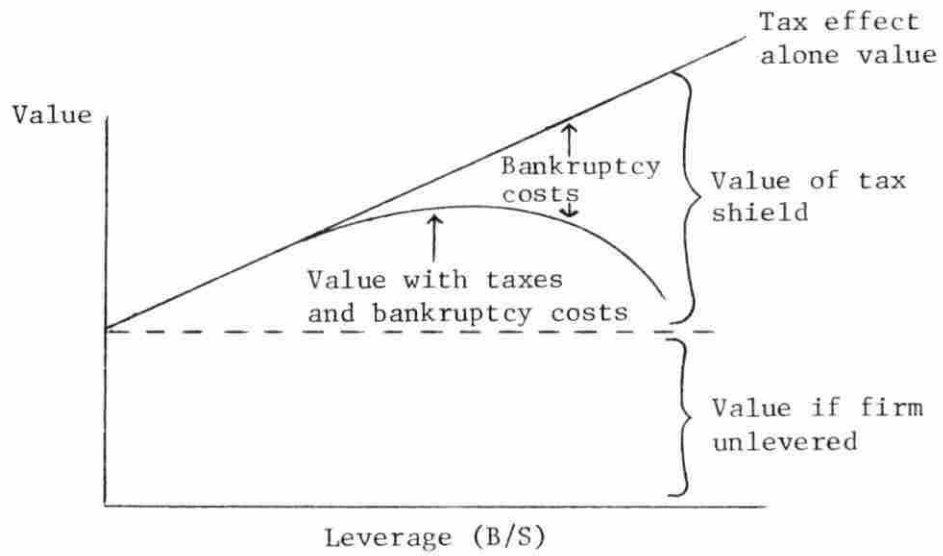


Figure 4. Capital costs: combined approach

structure of the firm occurs where the weighted average cost of capital is the lowest.

The Impact of Leasing on Optimal Capital Structure

In the previous section, the optimal capital structure is examined in terms of the affect of leverage on the weighted average cost of capital of the firm. In answering the question of what influence leasing will have on the optimal capital structure, it must first be determined how leasing affects leverage. Leverage was defined as the ratio of the market value of debt outstanding to the market value of stock outstanding. More specifically, leverage should be defined as the ratio of the market value of nonequity financing to the market value of equity financing. Thus, leasing will influence a firm's leverage in the same manner as debt financing.

Lease financing will not alter the premise upon which the traditional approach to valuation of the firm is built. The weighted average cost of capital, the sum of the proportion of a type of financing times the cost of that financing, will still decline with moderate use of leverage (which now includes any lease financing) and then begin to rise when the increase in k_e (the cost of equity financing) more than offsets the use of the cheaper nonequity funds. The optimal capital structure will still be at that point where the weighted average cost of capital, k_o , is minimized. The actual value of k_o will possibly be different than that rate found when debt is the only type of nonequity financing. This is due to the fact that the proportion and cost of the lease financing,

k_l must be included. Assuming that the leverage position of the firm remains constant as the proportion of lease financing is increased, i.e., the proportion of debt financing decreases, k_o will increase if k_l is greater than k_i and decrease if k_i is greater than k_l . If the proportion of nonequity financing increases as the proportion of lease financing increases and k_l and k_i are less than k_e , k_o will decrease as the leverage increases.

The net income approach to valuation will not be affected by the addition of leasing as a source of nonequity financing. What was previously designated as k_i (see Figure 2) would now be the weighted average cost of debt and lease financing. The assumption that k_i and k_e remain constant at all degrees of leverage will carry over so that the cost of lease financing, k_l , also remains constant. Thus, the weighted average cost of debt and leasing will remain constant. The optimal capital structure will still be that capital structure that maximizes leverage.

As with the net income approach, the net operating income approach to valuation and the Modigliani and Miller approach to valuation of the firm will also assume k_l constant and k_i (see Figure 3) will be the weighted average cost of debt and lease financing. Consequently, k_e will still increase as leverage increases and thus k_o will remain constant; there will be no one optimal capital structure.

Leasing will affect both the tax and bankruptcy imperfections in the same manner as debt financing. Under GAAP accounting procedures a lease is treated in a similar manner to debt on both the balance sheet and the

income statement. A portion of the payment is treated as interest which is fully tax deductible as is the interest on debt. The possibility of bankruptcy will increase as leasing increases in the same manner as when debt increases. The actual affect on the risk of bankruptcy and thus the optimal capital structure depends on whether lease or debt financing is viewed as riskier by the lender. From a lender's viewpoint, it is easier to get the leased asset returned upon default than it is to take possession of an asset used to secure a loan. In the case of default by a lessee, the lender does not have to extract title of the asset; the lender has retained ownership. In the case of default by a borrower, the lender must extract title to the asset and go through costly repossession proceedings. If this is in fact the case and lease financing is looked upon by the lender as a less risky venture, then k_1 will be less than k_i and as the proportion of lease financing increases the minimum weighted average cost of capital, k_o , will shift to the right (see Figure 4). Thus, the leverage position of the firm will increase.

None of the above approaches to the valuation of the firm will be affected in concept by the introduction of lease financing. Leasing will affect the optimal capital structure decision in that the cost of nonequity financing will potentially be altered, depending on the cost and proportion of lease financing.

CHAPTER III. METHODOLOGY

Asset Analysis: Lease Versus Buy

The objective of this chapter is to review the procedure used to evaluate under what conditions lease financing is preferred to debt financing, if at all. Although a number of studies have been completed on this topic (see Literature Review), very little has been done that incorporates the new TEFRA tax laws into the analysis. Thus, the financing analysis procedure had to show the after-tax costs of the two financing alternatives--leasing or debt financed purchasing.

Net Present Value Versus Internal Rate of Return

The first decision that needed to be made was the type of analysis procedure to be used. Since the discounted after-tax cash costs of the two financing alternatives were to be examined, this led to a choice between net present value (NPV) analysis and internal rate of return (IRR) analysis.

Net present value (NPV) and internal rate of return (IRR) are two methods commonly used for investment analysis. Both methods use discounted cash flow procedures and thus take into account the size and timing of the cash flows of the project(s) being evaluated.

Net present value is calculated as

$$NPV = \sum_{t=0}^T \frac{Et - Ct}{(1+k)^t}$$

where t = the time periods from 0 to T ,

T = the life of the asset,

E_t = the after-tax cash benefit in period t ,

k = the appropriate discount rate, and

C_t = the after-tax cash outflow in period t .

If the summation of the discounted cash flows is positive, the project is acceptable. If it is not positive, the project is rejected. In the case of choosing between two mutually exclusive acceptable investments, the investment with the highest NPV is chosen. NPV can also be used when deciding between financing alternatives. In that case, cash outflows (costs) are examined and the lowest cost alternative is chosen.

The internal rate of return is that discount rate that causes the net cash flows over the life of the project to sum to zero. That is, it is the rate r that satisfies

$$0 = \sum_{t=0}^T \frac{E_t - C_t}{(1+r)^t},$$

where t = the time periods from 0 to T ,

T = the life of the asset,

E_t = the after-tax cash benefit in period t , and

C_t = the after-tax cash outflow in period t .

A project is acceptable if r is greater than some predetermined required rate of return. In the case of more than one acceptable alternative, the project with the largest r is preferred. IRR can also be used in the

financing decision; when comparing financing alternatives, the project with the lowest r , cost of financing, is chosen.

In general, IRR and NPV will yield the same accept or reject decision due to the relation between the discount rate and net present value. Some important differences do exist and must be examined, however. These differences are especially important when comparing mutually exclusive proposals. The lease versus buy financing decision is an example of a mutually exclusive proposal; if one type of financing is chosen, the other type cannot be selected. A key difference in the two procedures is the reinvestment rate assumption or implicit compounding of interest problem. IRR assumes funds are compounded at the internal rate of return; the cash throw-offs from the investment can be invested at the internal rate of return. If there is an abnormally high internal rate of return, say 35 percent, this may not be a rational assumption. Other potential investments may not exist that will yield that high rate of return. Consequently, an upwards bias to the IRR method will exist if the internal rate of return is high. NPV assumes excess funds or cash throw-offs are invested at the required rate of return used as the discount rate; this is a more realistic and conservative reinvestment rate assumption.

Another concern is that of multiple solution values. When negative cash flows exist during the life of the investment, multiple internal rates of return can result. There can potentially be a different internal rate of return for every reversal of the sign of the cash flows. Although negative cash flows are a necessary condition for multiple

internal rates of return, they are not a sufficient condition. Multiple internal rates of return are also dependent on the magnitude of the cash flows. As a result, which method used as a capital budgeting tool is dependent upon the particular characteristics of the investment being analyzed and the objective of the analysis.

Net present value was selected to be used here. A primary reason, in addition to the concern with the reinvestment rate assumption, was the potential for multiple solutions with the internal rate of return method. In almost every case, there was the potential for negative cash costs (cash inflows in this case since the focus is on costs) from either the lease or the buy alternative. One common reason for negative cash flows is the realization of the salvage value of the equipment in both the lease and buy alternatives. Another reason for possible negative cash flows exists in the lease alternative. Depreciation expense, which results in a cash flow savings, occurs at the end of the lease term when there are no cash expenses to offset this positive cash inflow. As a result, there is the potential for a negative cash outflow (an inflow) for the time period between the lease expiration and the sale of the equipment.

Appropriate Discount Rate

A second important decision to be made in selecting the analysis procedure was what rate to use as the discount rate in the NPV decision model. The after-tax cost of debt was selected since the lease versus buy decision is a financing decision. Many arguments exist for using the

weighted average cost of capital in investment analysis (see Literature Review). The weighted average cost of capital is appropriate when the decision is an investment decision; a decision as to whether or not to acquire the piece of equipment. In that case, the cash flows should be evaluated with respect to the overall cost of capital of the firm to accurately compare the investment of interest to other investment alternatives. With the lease versus buy decision, it has already been decided to undertake the investment. The decision remaining is one of what type of financing should be used in acquiring the equipment. The least cost method of financing should be selected. Thus, by discounting the after-tax cash expenses of both the lease and buy alternatives at the after-tax cost of obtaining a loan for the equipment, the two financing methods can be compared. That method that has the lowest net present value of the cash outflows is the lowest cost alternative.

Lease Versus Buy Program

In developing the specific program used to analyze the lease versus buy decision, some decisions with regard to structure had to be made. These decisions included whether or not to lag the lease payment one year for tax purposes, compared to depreciation and interest expense when a machine is purchased; how to compare financing alternatives with different terms (length of life); whether or not to include depreciation at the end of the lease life; and what lease and loan parameter values should be used.

Lease Payment, Interest, and Depreciation Expenses

It is assumed that the tax effect of the lease payment is lagged one year; that is, the tax benefits of the lease payment in year zero are realized in year one. The primary reason for handling the tax deductibility of the lease payment in this manner is that most lease payments are made on an annuity due basis; they are made at the beginning of the period. Thus, the tax affect is realized approximately a year after the payment is made. In addition, a survey of other lease versus buy studies found that most had also made the assumption to lag the tax effects of the lease payment (see Literature Review).¹

In contrast, the tax effects of the depreciation expense and interest expense are not lagged one year. This occurs because the expenses are not fully realized until the end of the tax year. Also, interest is generally not paid until the end of each borrowing period. Thus, the expenses occur at or near the time they will be claimed for tax purposes.²

¹The decision to lag the tax effect of the lease payment serves as a general way to handle the lease payment. In making the lease versus buy decision for an actual situation, the timing of the lease payments, i.e., when in the year they occur, and whether or not quarterly tax reports are filed must be considered. If payments are made late in the calendar year and/or quarterly reports are filed, the lease payments would not be lagged.

²As in the case of the lease payments, the actual timing of the depreciation and interest expense for an actual situation must be considered before deciding not to lag these payments.

Length of Life

A problem encountered in using the NPV method of analysis is that of evaluating alternatives with different lives. If the length of the loan is not equal to the length of the lease, each alternative's respective NPV cannot be accurately compared. One method of overcoming this problem is to use the annual equivalent annuity method; that is, each alternative's NPV is annualized using an annuity equivalent approach. Annual equivalent annuities were not used in this study, however. Instead, the equipment life, which is the same for both financing alternatives, was used as the length of life. One reason for using equipment life rather than financing period is the different tax consequences at the end of the financing period. A tax consequence of lease financing is the ability to depreciate the piece of equipment after the lease period. Upon exercise of the purchase option, the owner (formerly lessee) can depreciate the piece of equipment. If the lease period is used as the term of the analysis, the tax deductibility of the depreciation is not considered in the decision process. Another reason is the different tax liabilities with lease versus debt financing that result upon sale of the equipment. The equipment will potentially have different book values upon sale under the different financial alternatives due to the different timing of the depreciation, so different tax liabilities may be incurred upon sale at the end of the useful life. In addition, the purchase price used to determine the amount of capital gain versus ordinary gain will differ with the two financing alternatives. The purchase price for the lease alternative (the purchase option price) will be much lower than the

purchase price for the debt financing alternative. As a result, there is the potential for the gain to be a long-term capital gain, and thus taxed at a lower rate, with the lease financing alternative.

Depreciation at the End of the Lease Life

Another decision that needed to be made when formulating the program for the lease versus buy decision was whether or not to include depreciation in the lease alternative after the purchase option had been exercised. The property type and circumstances surrounding acquisition of the asset after the lease meet the criteria established for the property to be depreciated using accelerated cost recovery system methods. Harl (1983a), in Agricultural Law states that "in figuring cost recovery deductions for finance lease property, the regular ACRS periods and methods apparently apply" (p. 29-98).

Resale Value

Resale value was calculated using the formula:

$$\text{remaining value} = \text{list price} \times \text{RV1} \times \text{RV2}^Y,$$

where RV1 and RV2 are constants obtained from the Iowa State University Cooperative Extension Service (Edwards, 1983) and Y is the years of age, or holding period. This remaining value was then adjusted to account for inflation.

Machine types were divided into four categories, each category having the same RV1 and RV2 factors. Category 1 includes two-wheel drive

and four-wheel drive tractors. Category 2 includes self-propelled combines. Category 3 includes self-propelled windrowers, corn pickers or shellers, forage harvesters, and pull-type windrowers. Category 4 includes rakes, mowers, and planters.¹ RV1 coefficients are .68, .64, .56, and .6 for categories 1-4, respectively. RV2 is .92 for category 1 and .885 for categories 2-4.

Resale value becomes important in calculation of the gain on sale realized for both financing alternatives. Although the resale value is the same for both alternatives, the purchase price differs. Thus, each alternative faces a different gain.

Parameters Used

Once the analysis procedure was selected and the program was developed, a decision had to be made as to the appropriate lease and debt parameters to be used to evaluate the lease versus borrow decision and to test the sensitivity of that decision. The parameters of concern include the interest rate, the marginal tax rate, the lease payment and purchase option price, and the asset life or holding period.

Two percentage point increments, over a range from 10 to 20 percent, were selected as the values of the interest rate in the analysis. Fourteen percent was selected as the base value. This value was determined from the current (at the time) quarterly agricultural finance

¹For a complete listing, see Edwards, 1983.

data (Melichar, 1983). The range was determined from examination of interest rate variation in the recent past.

Marginal tax rates were chosen over a range from 16 to 50 percent representing actual tax brackets. A base value of 38 percent was selected because it was felt that this rate more accurately represents the tax bracket of the "average" full-time large scale farming operation over the long run.

The lease payments and purchase option, although shown in the program and results in dollar amounts (see Chapter IV), reflect percentages of the equipment value. Percentage values for the lease payment and purchase option were determined after examination of many leasing alternatives as supplied through bank and manufacturer advertisements and farm machinery publications.¹ It was found that a 22 percent lease payment and a 20 percent purchase option price best represent the base scenario. The other combinations of lease payment and purchase option price rates are, respectively, 16 and 28 percent, 19 and 25 percent, 25 and 15 percent, and 28 and 10 percent.

An asset life of eight years was chosen as the value for the base scenario; eight years would appear to accurately reflect the average holding period of the equipment. A five year holding period was also used to represent immediate sale after exercise of the purchase option in the case of the lease, and sale after the asset is no longer depreciable in the case of the buy alternative.

¹Many of the lease examples were taken from Buying For the Farm, April 1982 and June 1982.

Capital Structure Analysis

This part of the analysis was performed to determine what impact, if any, leasing has on the optimal capital structure of a large cash grain operation. This issue was examined by altering the proportion of lease financing used given a certain level of nonequity financing and altering the level of nonequity financing given a certain level of lease financing. The model used to study the effects of these changes was the Iowa State University Business and Financial Planner model. The model projects over time the balance sheet data of the farm firm. Specifically, total assets, total liabilities, total equity, percent growth in assets, percent growth in equity, and a ten-year time trend of these estimates were examined. For a complete discussion of the Iowa State University Business and Financial Planner model, see Reinders (1982).

The model actually used was an updated version of that used by Reinders. First, it was updated to include the tax regulations stipulated in the Economic Recovery Tax Act of 1981. Second, actual 1982 farm data obtained from the Iowa Farm Business Association was used to estimate beginning levels of farm income and expenses, asset composition and financing, and capital structure. Interest rates used to calculate interest payments were 5.4 percent for long-term assets and 17.7 percent for all other assets. These rates were chosen because they were the rates in effect at the time the data were collected. These data were disaggregated with respect to farm size and type for analysis of different farm sizes. Third, the model was adapted to include leased

intermediate assets. Previously, no leased assets were included in the model. Leased assets are treated as intermediate assets and affect the equity and asset position of the firm in the same manner as other nonleased intermediate assets. Lease assets affect the income statement of the firm in that the full lease payments are taken as ordinary expenses. The lease payment rate used is 22 percent with a 20 percent purchase option. Also, the purchase option is taken as an expense in the year after the lease expires.

Using the data obtained from the Iowa Farm Business Association, it was found that the actual capital structures of the average large hog operation and large cash grain operation were both 35 percent debt with little or no leasing. The percent debt and the percent lease financing were then varied to reflect different financing options. The proportions of nonequity financing used were 0, 35, 50, 65, and 100 percent. At each of these different percents of debt, the level of lease financing was varied. The portion of lease financing used were 0, 25, 50, 75, and 100 percent, provided that the proportion of lease financing did not exceed the total amount of nonequity financing. The balance of the nonequity financing that was not accounted for due to lease financing was regarded as debt financing. For example, if the capital structure called for 65 percent nonequity financing and 50 percent lease financing, 15 percent of the financing ($65 - 50 = 15$) was designated as debt financing. Fourteen nonequity/lease financing combinations exist (see Results for specific combinations).

CHAPTER IV. RESULTS

This chapter will examine the results of the asset leasing decision analysis using the lease versus buy program and the optimal capital structure decision using the Iowa State University Business and Financial Planner. The lease versus buy analysis will examine when leasing is favored over debt financing for the six base scenarios outlined in Chapter III. After determining when leasing is preferred to debt financing, a discussion of what variables impact the decision and why will be presented. The Iowa State University Business and Financial Planner will be used to determine what impact leasing has on the capital structure of the farm firm.

Asset Analysis: Lease Versus Buy

In analyzing the lease versus buy decision, six scenarios were examined (see Table 6). The parameters to be examined include the marginal tax rate, interest rate, lease payment rate, inflation rate, ownership or holding period, and machinery type. In the first scenario, Base 1, the lease payment rate is 22 percent, the marginal tax rate is 38 percent, the interest rate is 14 percent, inflation is four percent, a combine is being purchased, and the ownership (or holding) period is eight years. This scenario is a reasonable reflection of current conditions. The remaining five scenarios are variations of this base, with one parameter changing for each case. Table 6 shows these variations.

Table 6. The six scenarios used in the lease versus buy analysis

Run	Lease payment	Marginal tax rate	Interest rate	Inflation rate	Machinery type	Holding period
Base 1	.22	.38	.14	.04	2	8
Base 2	.22	.38	.14	.04	2	5
Base 3	.22	.38	.2	.04	2	8
Base 4	.22	.38	.1	.04	2	8
Base 5	.22	.16	.14	.04	2	8
Base 6	.22	.5	.14	.04	2	8

Figures 5-8 show the difference of the NPVs of the lease alternative and the buy alternative assuming different values for the holding period, lease payment rate, interest rate, and marginal tax rate. The vertical axis represents the NPV of the lease alternative minus the NPV of the purchase alternative. Thus, positive values indicate the debt alternative is favored over the lease alternative, and negative values suggest the lease alternative is favored over debt financing.

Situation Evaluation

This section of the paper describes the results of the sensitivity of each base scenario to changes in one of the parameters. That is, given a certain set of circumstances, is lease financing more or less desirable as one of the parameters changes? In addition, how sensitive is the decision to a change in a parameter?

In Base 1, lease financing is favored over debt financing when the lease payment rate is less than 19 percent, when the interest rate is greater than 20 percent, or when the holding period is six years or less.

Base 2, where the holding period is reduced to five years, has leasing favored over debt financing for a broader spectrum of parameter values. In this case, lease financing is favored when the lease payment rate is less than 24 percent, when the marginal tax rate is 30 percent or greater, when the interest rate is greater than 12 percent, for both the four and five percent inflation levels, or whether the piece of equipment is a combine or a tractor.

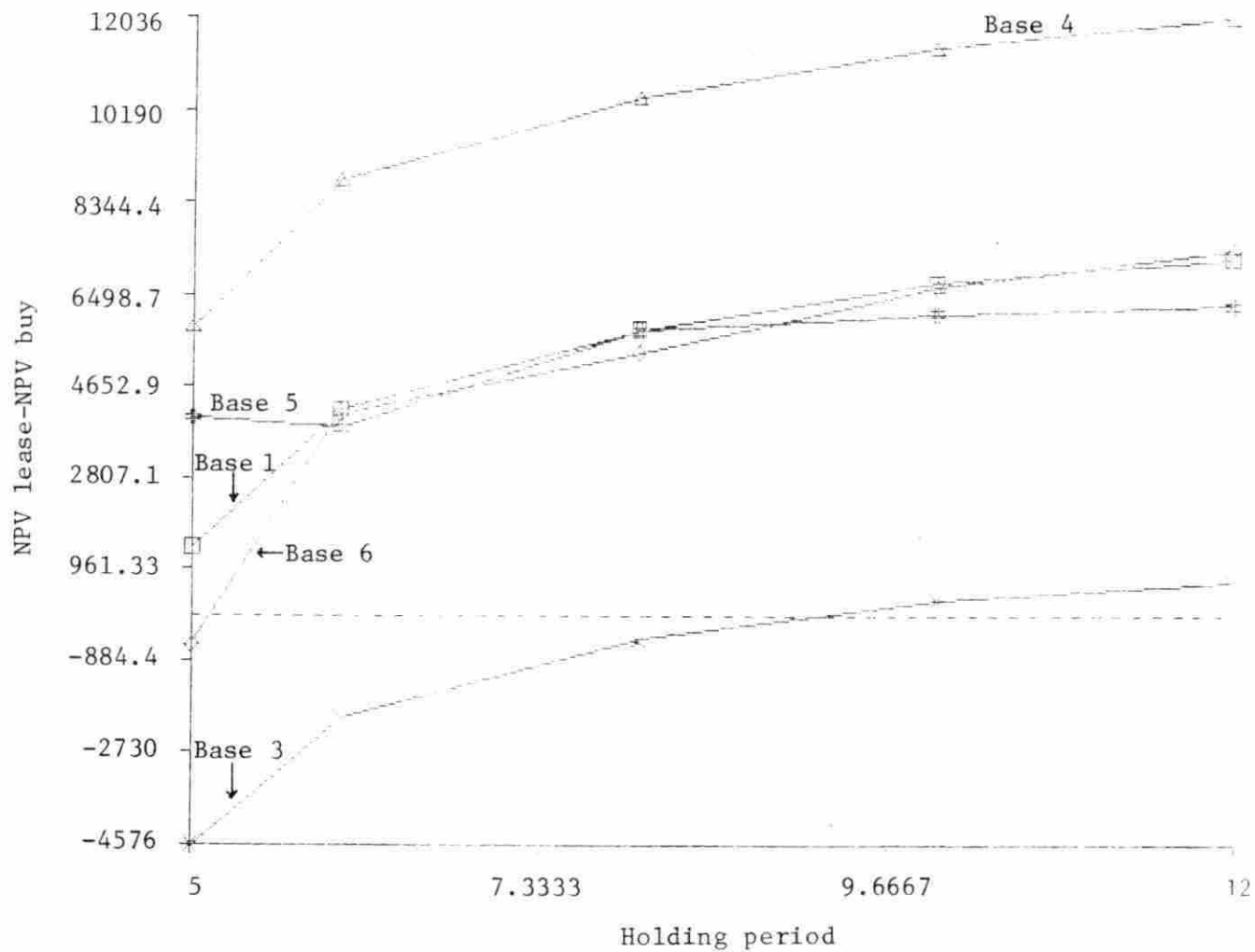


Figure 5. The net present value of the lease financing alternative minus the net present value of the buy financing alternative at different holding periods

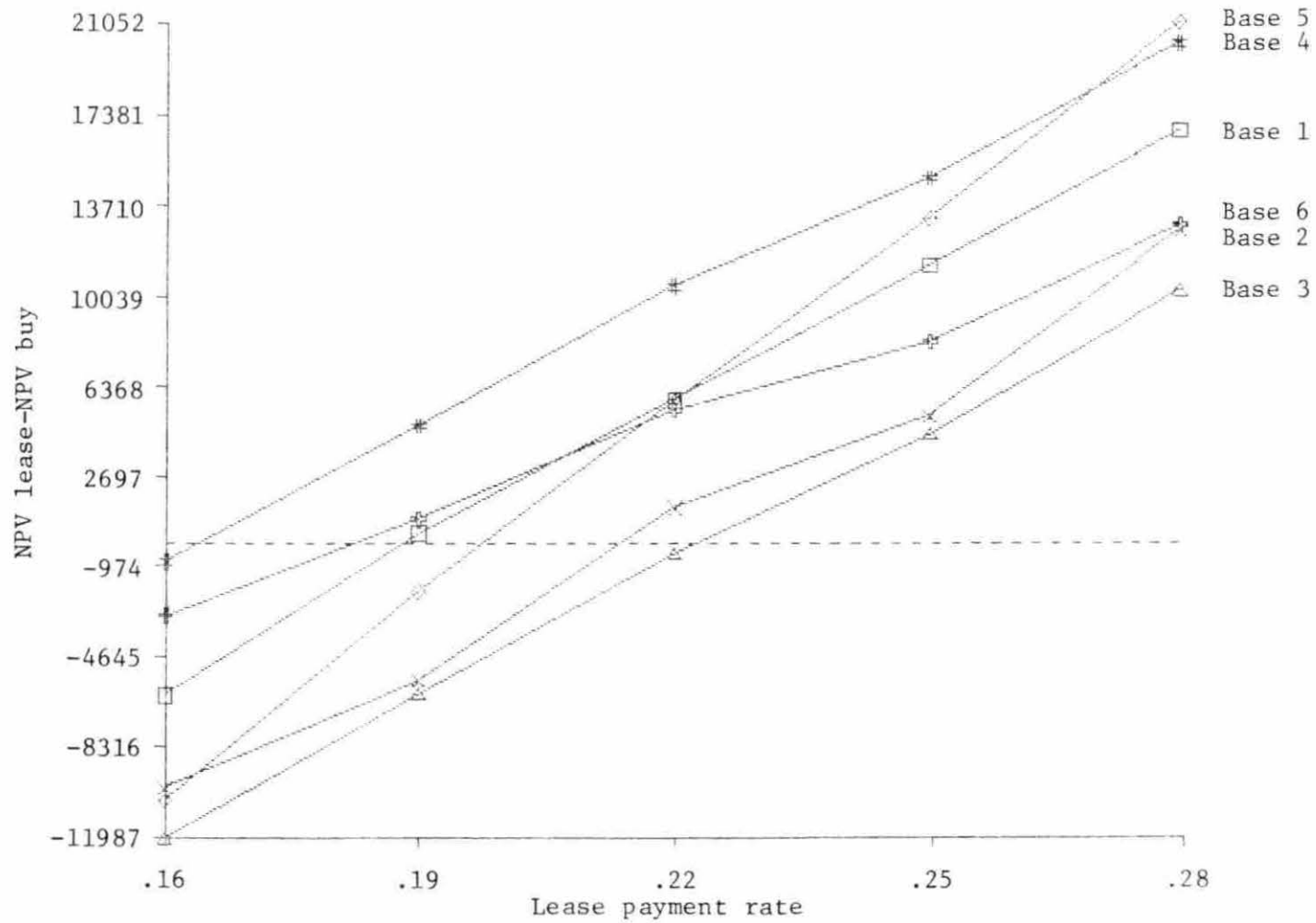


Figure 6. The net present value of the lease financing alternative minus the net present value of the buy financing alternative at different lease payment rates

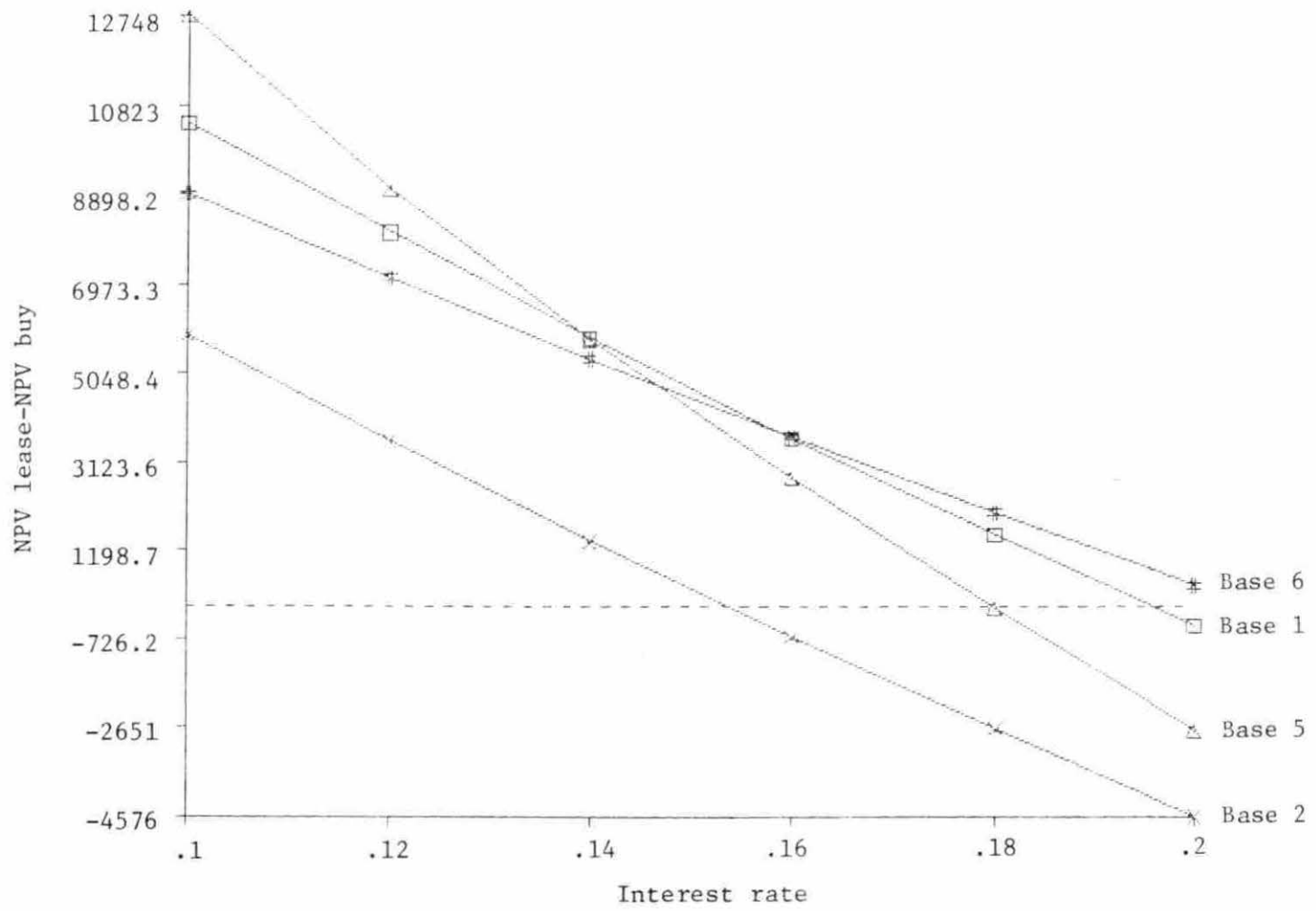


Figure 7. The net present value of the lease financing alternative minus the net present value of the buy financing alternative at different interest rates

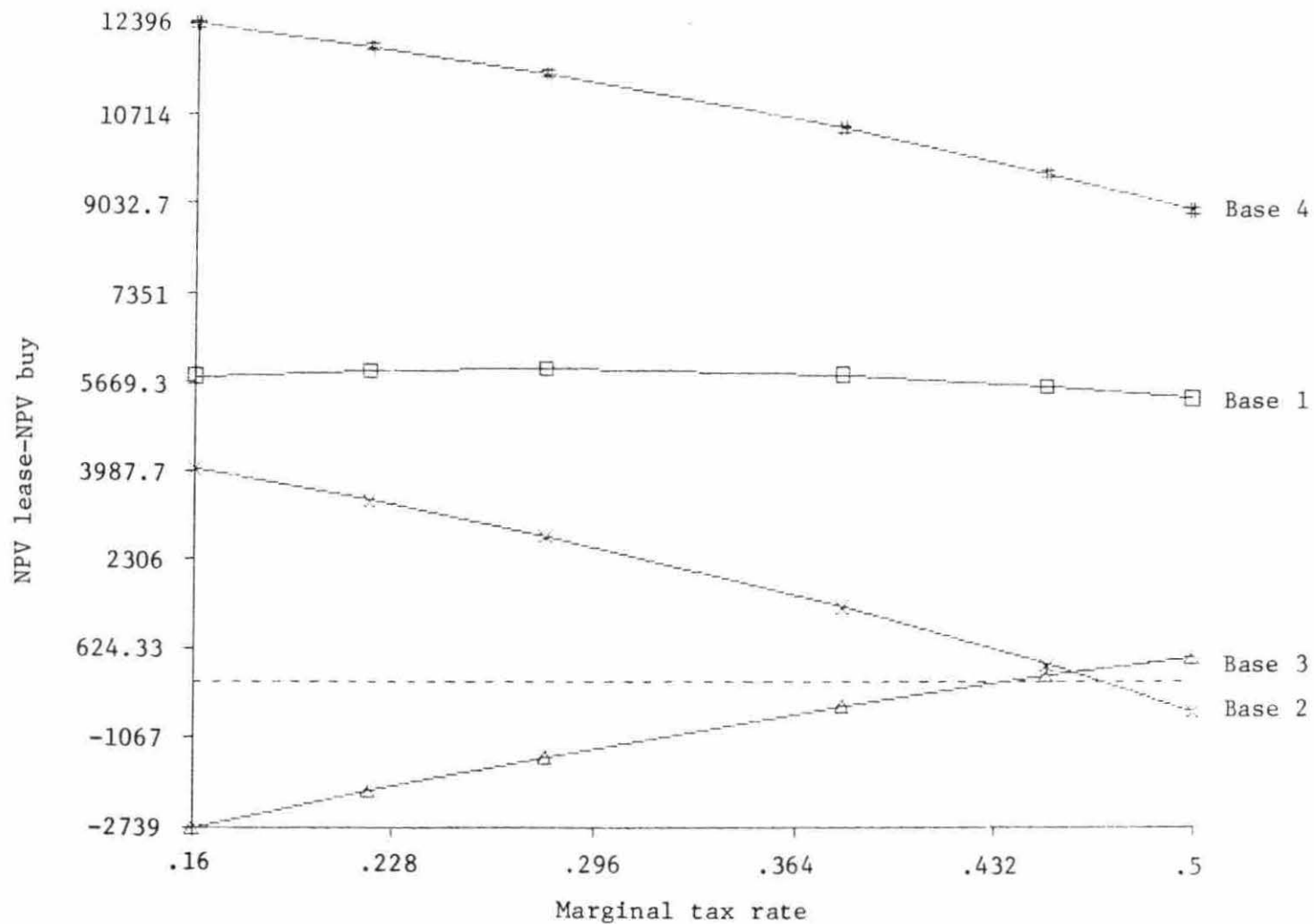


Figure 8. The net present value of the lease financing alternative minus the net present value of the buy financing alternative at different marginal tax rates

Base 3 raises the interest rate from 14 to 20 percent. This case is also very favorable for lease financing. Leasing is favored over debt financing when the lease payment rate is less than 22 percent, when the marginal tax rate is less than 44 percent, when the holding period is less than nine years, and for both levels of inflation.

Base 4 is the least favorable situation for lease financing. In this case, the interest rate has been lowered to ten percent. Lease financing is favored only when the lease payment rate is less than 16 percent for this situation.

The marginal tax rate is lowered to 16 percent in Base 5. Here, leasing is favored when the lease payment rate is less than 20 percent or the interest rate is greater than 18 percent.

In Base 6, the marginal tax rate has been raised to 50 percent. Leasing is favored when the lease payment rate is less than 18 percent or the ownership period is less than seven years.

Parameter Evaluation

It is not enough to determine when lease financing is preferred to debt financing in these six situations. In addition, some generalizations must be made to determine when leasing is favorable with respect to a broad spectrum of values for the parameters involved. This section will examine the affect of different parameters on the lease versus buy decision and why the parameter has that effect. Figures 5-8 can be used not only to illustrate where leasing is favored for each base scenario (point analysis) but also when leasing becomes more or less favored for

each parameter (positive or negative slope) and the sensitivity of the decision to the different parameters (value of and change in slope). The slope of each curve in Figures 5-8 measures the change in the difference between the NPV of the lease alternative and the NPV of the buy alternative divided by the change in the value of the parameter represented on that graph. Thus, if the overall slope is negative (downward sloping), it indicates that the lease financing alternative becomes more favorable relative to the purchase alternative as the parameter value increases. The sensitivity of the decision, the amount that one alternative is favored over another as the parameter values change, is represented by the change in the slope of the curve or the steepness of the curve. If the absolute value of the slope is low or goes from a large number to a smaller number as the parameter values increase, there is a low sensitivity of the lease versus buy decision to that parameter or the sensitivity of the lease versus buy decision to that parameter is lessening, respectively. That is, the change in the difference between the NPV of the lease alternative and the NPV of the buy alternative has been reduced.

One parameter that significantly affects the lease versus buy decision is the holding period of the piece of equipment. The effect of this parameter has not been examined previously in the literature. As the holding period is increased, leasing becomes less favorable, with the exception of Base 5.¹ In all cases, the favorability of lease

¹It is assumed that the piece of equipment must be held for at least the period of the lease (five years in this case).

financing over debt financing is reduced as the machinery is held for more than one year past the lease length. The different tax treatment of the gain in the two financing methods is an important factor here. With the buy alternative, the piece of equipment has been fully depreciated to a \$0 book value (purchase price minus accumulated depreciation) by the end of year five. Since the equipment is five-year ACRS equipment with no salvage value, it is fully depreciated by the end of five years. Also, the resale value will never be greater than the list price due to the formula used to calculate resale value (assuming inflation is low); the resale value is the list price times a value less than one. Thus, the entire resale value is treated as an ordinary gain and taxed fully as ordinary income at the marginal tax rate.

In contrast, the lease alternative will still have a positive book value through year ten. This is due to the fact that the machine was not purchased until year five and then depreciated through year ten. As a result, all of the resale proceeds will not be taxed as an ordinary or a capital gain; the portion equal to the book value will be recovery of basis and thus not taxed. In addition, for the lease alternative it is probable that the resale value will be greater than the purchase option price (especially in the early years after the lease) since the purchase option price has been set low to encourage purchase. If the machine is held for more than one year past the lease length, the portion of the resale value that is greater than the purchase price is a long-term capital gain, as opposed to an ordinary gain. Thus, only 40 percent of that portion is taxed. If the equipment is sold within one year after

exercise of the bargain purchase option, the gain is a short-term capital gain and taxed fully at the ordinary tax rate. As a result of the recovery of basis and/or the long-term capital gain, the tax burden at sale or disposition with the lease alternative is significantly less than the tax on the gain with the buy alternative.

Graphically, this is shown in Figure 5. Figure 5 illustrates the difference between the NPV of the lease alternative and the NPV of the buy alternative for each holding period. Note that in all cases, the relative favorability of debt financing over lease financing increases as the holding period is extended past year six. The reason for this is illustrated in Figure 9. The portion of the gain on resale that is taxed at the reduced long-term capital gains rate diminishes as the holding period is extended in the case of lease financing. Thus, this tax advantage of lease financing is reduced and debt financing becomes relatively less expensive. This effect is reinforced by the discount rate. The later the tax advantage occurs, the less impact it has due to the cash flow being discounted more.

If the holding period is less than six years, the gain is taxed at the ordinary tax rate with both lease and debt financing. The long-term capital gain tax advantage of lease financing is introduced in period six. Why then does debt financing become relatively more favorable than lease financing as the holding period is increased from five to six years in all cases except Base 5? This occurs because relative costs are being examined in Figure 5 and not absolute costs. As the holding period is extended, the resale value decreases. With debt financing, this reduces

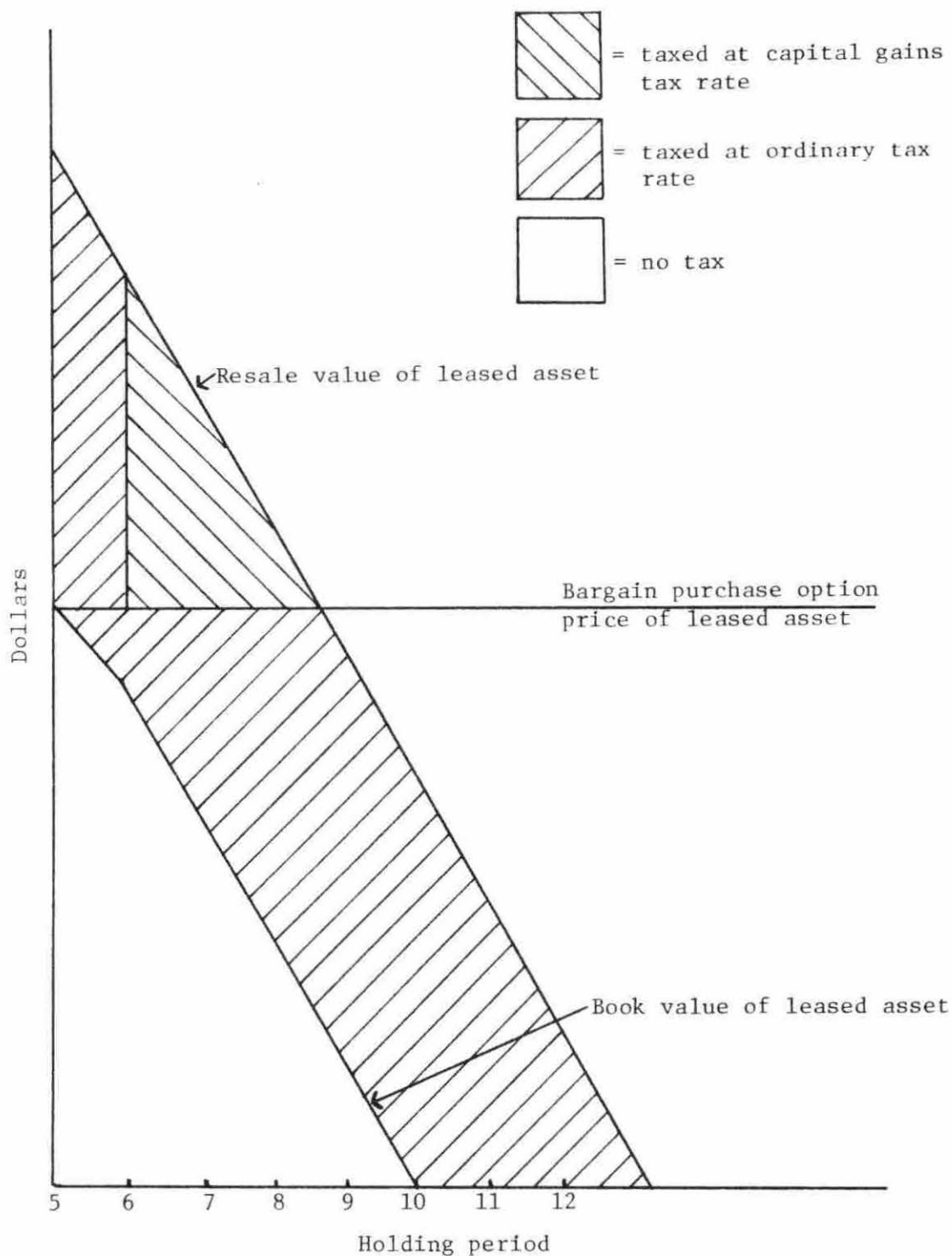


Figure 9. Tax on gain for a leased asset

the tax burden since the book value will be constant at zero dollars. With lease financing, the overall tax burden increases due to the reduction in book value and, thus, the increase in the amount of gain that is an ordinary gain (purchase price-book value). Whether or not the net effect of the tax advantage of the addition of long-term capital gain and reduced book value and, thus, increased ordinary gain is positive (Base 5) or negative (Bases 1, 3, 4, and 6) depends in part on the marginal tax rate. The marginal tax rate in Base 5 is 16 percent. Therefore, the increase in ordinary gain with the lease alternative and the decrease in ordinary gain with the debt alternative is not as significant.

Inflation and machine type both affect the lease versus buy decision only as they impact the resale value of the machine; inflation increases the resale value, and a tractor (machine type 1) has a higher percentage resale value for a specified life than a combine (machine type 2). Thus, as the inflation rate increases or a tractor is acquired rather than a combine, there is more gain on the sale of the piece of equipment which increases the amount of capital gain with the lease and ordinary gain with the purchase. As a result, the favorability of the lease alternative increases relative to the purchase alternative as the inflation rate increases or a tractor rather than a combine is acquired.

In all cases, leasing is favored as the lease payment rate decreases. Figure 6 shows the relationship between the lease and buy alternatives at different lease payment rates. The lease payment rate only affects the lease alternative; it does not affect the computation of the cost of the debt financing. All of the base scenarios show upward

sloping graphs (leasing is more desirable at low lease payment rates) as the lease payment rate increases, but they are of different slopes. The different slopes occur because the impact of the lease payment rate on the results is twofold; the lease payment expense is a cash outflow and the tax deductibility of the lease payment is a cash inflow. The overriding effect is the size of the lease payment itself. As the lease payment increases, the cash expenses increase. This results in an upward sloping trend in the graphs in Figure 6 which represents the increase in the difference in the NPV of the lease alternative and the NPV of the buy alternative as the lease payment rate increases. The tax deductibility of the payment affects the change in the slope over the parameter values, or the relative favorability of one alternative over another. At a low tax rate (Base 5), the slope is much steeper. This is because the payment increase is greater than the tax advantages of the payment. As a result, debt financing becomes relatively more attractive. The opposite occurs in Base 6 where the tax rate is 50 percent. Thus, the slope of Base 6 is not as steep. Note in Figure 6 that Bases 1, 2, 3, and 4 are all of similar slope and have the same tax rate.

With respect to the interest rate, leasing is favored over debt as the interest rate increases (see Figure 7). One reason is the affect the interest rate has on the cost of the debt alternative, which is similar to the net effect of the lease payment rate on the lease alternative as discussed earlier. As the interest rate increases, the cost of the debt alternative increases (resulting in the downward-sloping graph). The tax deductibility of the interest payment has a further impact in terms of

the after-tax net effect of the interest payment expense and thus affects the slope of the graphs. The affect is similar to that illustrated in the discussion on the lease payment rate.

In contrast to the lease payment rate, the interest rate also influences the decision through its impact on the discount rate. The higher the interest rate, the higher the discount rate, holding the tax rate constant. A high discount rate results in the depreciation and capital gain tax benefits occurring late in the holding period of the lease alternative having less of an impact on the decision. The impact of the discount rate also affects the slope of the graphs shown in Figure 7. Consequently, the higher the interest rate, the higher the discount rate. It should be noted that Bases 1 and 2 have the same interest rate and tax rate, thus the same discount rate and similar slope. Bases 5 and 6 represent different tax rates and thus different discount rates and tax deductibility of the interest payments. The slope of Bases 5 and 6 differ from that of Bases 1 and 2, with Base 5 having a steeper slope and Base 6 having a lesser slope.

The implications of the marginal tax rate are much more complicated than previously thought (see Literature Review). This paper found that the sensitivity of the lease versus buy decision to the marginal tax rate (MTR) is a function of not only the tax situation of the farmer but the interaction of all the parameters discussed. Figure 8 shows the graph of the difference between the NPV of the lease and the NPV of the purchase at each tax rate examined for the four cases it affects. Note that in Bases 2 and 4 the relative position of lease financing to debt financing

improves as the tax rate increases. In Base 3, the opposite is true. In Base 1, the relative position of lease financing to debt financing decreases and then increases.

Base 2 results coincide with the results obtained by La Due (1977) and Plaxico (1983); leasing is favored as the MTR increases. Lease financing also becomes less costly as the tax rate increases in Base 4. One reason for leasing becoming more favorable as the MTR increases is that the tax benefits of the capital gain of the lease alternative versus the ordinary gain of the buy alternative becomes more significant as the MTR increases. Another reason, as illustrated in Base 4, is that as the MTR increases for a given interest level, the discount rate decreases. Thus, the depreciation and capital gain benefits realized later in the holding period of the lease alternative are more fully realized.

In Base 3, where the interest rate is 20 percent, leasing is favored as the MTR decreases. A reason for this occurring is that the net after-tax effect of the interest payment expense and the interest payment deductibility is less at a higher tax rate. Although a high interest rate means a larger interest payment, there is also a larger interest expense that will be tax deductible. Thus, as the marginal tax rate is increased, the tax deductible portion of the interest payment is increased. In this situation, the interest expense is constant at an interest rate of 20 percent. As the marginal tax rate increases, the after-tax net effect of the interest payment will decrease since the tax deductibility of the interest payment will increase. Additionally, the

net after-tax effect of the large depreciation expense that occurs with the buy alternative will be greater as the marginal tax rate increases.

Base 1 illustrates a combination of all of these factors as discussed here and earlier in this section of the paper. The favorability of lease financing declines and then increases as the MTR increases and different factors become dominant. Possibly, the affect of the marginal tax rate on the tax deductibility of the interest and depreciation payments results in the initial upward slope. As the MTR increases, the net after-tax case expense of the buy alternative decreases due to the tax deductibility of the interest and depreciation expenses. Other factors, such as the tax benefits of the long-term capital gain with the lease alternative and the decreasing discount rate, become dominant and the trend reverses itself. As the MTR increases, the difference between the larger tax associated with the buy alternative's ordinary gain on resale of the piece of equipment and the smaller tax associated with the long-term capital gain on resale of the previously leased piece of equipment becomes more significant. Also, the discount rate decreases as the MTR increases. Thus, the impact of the tax savings of the lease alternative due to the depreciation expense and long-term capital gains in the later years of the asset life are recognized more. The graph of Base 1 becomes downward sloping.

Capital Structure Analysis

The Iowa State University Business and Financial Planner was used to determine the impact of leasing on the capital structure of a large cash

grain operation.¹ Five response variables were examined for the operation: average percent growth in total assets, ending dollar value of total assets, average percent growth in equity, ending percent equity, and ending dollar value of equity. The results indicate that the composition of the nonequity financing proves to be an important determinant of the long-run health of the farm firm. In addition, financing is important with respect to the equity/nonequity mix, or leverage position of the firm. The results obtained in the capital structure analysis are not as conclusive or as generalizable as those obtained in the asset analysis section. They are included here, nonetheless, because they indicate that leasing must be examined with respect to its impact on the capital structure of the farm firm.

The results are shown in Tables 7 and 8. Tables 7 and 8 show the same data organized in different ways. Table 7 shows the data at different nonequity levels grouped according to percent of leased assets for a cash grain operation. Runs 6-9 on Table 7 illustrate a situation for a corn operation where the firm has 25 percent lease financing. The corn operation illustrated in run 6 has 35 percent nonequity financing. Thus, the firm in run 6 has ten percent debt financing (35 percent nonequity financing, 25 percent lease financing). Runs 7, 8, and 9 have 25, 40, and 75 percent debt financing, respectively. Table 8 shows this same data at different levels of leased intermediate assets for a given percent of nonequity financing for a cash grain operation. The corn

¹A large hog operation was also examined although the data obtained were inclusive.

Table 7. Capital structure results arranged by percent lease financing

Run	Percent lease financing	Percent nonequity financing	Average percent growth in assets	Ending dollar value of assets	Average percent growth of assets	Ending dollar value of equity	Ending percent equity	Average percent equity
1	0	0	3.377	2,238,643	3.377	2,238,643	100.00	100.00
2	0	35	1.334	1,863,227	2.927	1,842,889	98.91	93.279
3	0	50	.332	1,702,556	2.68	1,673,504	98.29	89.819
4	0	65	-.772	1,542,466	2.386	1,504,697	97.55	85.367
5	0	100	-1.9	1,422,013	1.627	1,132,104	79.61	67.62
6	25	35	1.466	1,886,799	3.028	1,866,461	98.92	93.372
7	25	50	.478	1,726,224	2.791	1,697,172	98.32	89.958
8	25	65	-.611	1,565,978	2.509	1,528,209	97.59	85.766
9	25	100	-1.9	1,422,013	1.773	1,153,592	81.12	68.53
10	50	50	.624	1,749,868	2.901	1,720,816	98.34	90.099
11	50	65	-.451	1,589,591	2.631	1,551,822	97.62	86.106
12	50	100	-1.9	1,422,014	1.918	1,175,184	82.64	69.442
13	75	100	-1.9	1,422,013	2.06	1,196,771	84.16	70.347
14	100	100	-1.9	1,422,013	2.201	1,218,405	85.68	71.248

Table 8. Capital structure results arranged by percent nonequity financing

Run	Percent lease financing	Percent nonequity financing	Average percent growth in assets	Ending dollar value of assets	Average percent growth of assets	Ending dollar value of equity	Ending percent equity	Average percent equity
1	0	0	3.377	2,238,643	3.377	2,238,643	100.00	100.00
2	0	35	1.334	1,863,227	2.927	1,842,889	98.91	93.279
6	25	35	1.466	1,886,799	3.028	1,866,461	98.92	93.372
3	0	50	.332	1,702,556	2.68	1,673,504	98.29	89.819
7	25	50	.478	1,726,224	2.791	1,697,172	98.32	89.958
10	50	50	.624	1,749,868	2.901	1,720,816	98.34	90.099
4	0	65	-.772	1,542,466	2.386	1,504,697	97.55	85.367
8	25	65	-.611	1,565,978	2.509	1,528,209	97.59	85.766
11	50	65	-.451	1,589,591	2.631	1,551,822	97.62	86.106

operations depicted in runs 3, 7, and 10 all have 50 percent nonequity financing but different levels of lease financing and thus different levels of debt financing. Run 3 has no lease financing and all (50 percent) debt financing. Run 7 has 25 percent lease financing and thus 25 percent debt financing (50 percent nonequity financing, 25 percent lease financing). Run 10 has 50 percent lease financing and no debt financing. The data are arranged in this manner to facilitate their understanding.

Average percent growth in assets and ending dollar value of assets is maximized as the percent of nonequity financing is minimized for a given level of lease financing (see Table 7). Thus, the level of debt financing is also minimized. It is expected for these two categories, average percent growth in assets and ending dollar value of assets, to move in a similar manner since the beginning level of assets is the same in all situations. The situation where ending dollar value of assets is maximized should also show the maximum growth in assets. This maximization occurs since when nonequity financing is maximized, there are less fixed financial payments (both interest and lease payments). Thus, more financial resources are available to reinvest into the operation rather than make financial payments.

For the cash grain operation and a given level of nonequity financing, average percent growth in assets and ending dollar value of assets increases as the percent of lease financing increases and thus debt financing decreases (see Table 8). A partial explanation for this occurring is the difference between the interest rate on debt, 17.7

percent financing, and the interest rate implicit in the lease financing, 12.1 percent.¹ Since the rate on debt is greater than the rate on lease financing, the fixed financial payments associated with debt financing will be greater than those associated with lease financing. When lease financing is maximized, fewer fixed financial obligations exist. Thus, more resources are available to reinvest into the farm firm and encourage growth in the asset both.

To get a better understanding of the impact of leasing on the firm capital structure, the equity portion of the balance sheet must also be examined. It was found that as percent nonequity financing was held constant in the cash grain operation, average percent growth in equity, ending dollar value of equity, ending percent equity, and average percent equity increased as the percent of leased assets increased and debt financing decreased (see Table 8). Also, for a given level of leased assets, average percent growth in equity, ending dollar value of equity, ending percent equity, and average percent equity all increased as the percent of nonequity financing increased (Table 7). In all cases, note that the farm firm's equity position improved (increased) as the amount of debt financing decreased. This is expected since the cost of the debt financing (17.7 percent) for current and intermediate debt is greater than the interest rate implicit in the lease. As the amount of debt financing is increased, larger payments are incurred and less resources are available to be returned to equity.

$$\begin{aligned} {}^1\$100,000 &= \$22,000 + \$22,000 \text{ (PVIFA } i=r, n=4) \\ &\quad + \$20,000 \text{ (PVIF } i=r, n=5). \end{aligned}$$

Solving for r , it is found that r equals approximately 12.1 percent.

CHAPTER V. SUMMARY

Financial leases have gained popularity in the recent past as an alternative means of financing the acquisition of agricultural equipment. This increase in popularity is due, in part, to the change in tax regulations governing leasing (ERTA and TEFRA) and the change in the financial position of farmers. As a result of these changes, the viability of lease financing as an alternative to debt financing merits evaluation. In addition, the impact of lease financing on the nonequity financed portion of the balance sheet and the optimal capital structure of the farm firm also is of interest. Previously, with little agricultural leasing occurring, leases were not recognized consistently, if at all, on the balance sheet.

The question of when lease financing is a viable alternative to traditional debt financing was answered through the use of a lease versus buy micro-computer program. This program compared the discounted net after-tax cash expense associated with the purchase alternative to the discounted net after-tax cash expenses associated with the lease financing alternative. Both alternatives were examined over the holding period of the equipment. This was done to incorporate all tax benefits of the financing alternatives, including those that occur after the end of the financing period such as a lower tax on resale.

The after-tax cash expenses of both alternatives were discounted at the after-tax cost of debt rather than the weighted average cost of capital of the farm firm. The after-tax cost of debt was used since the

decision to be made was a financing decision rather than an investment decision.

Additionally, new regulations governing finance leases in agriculture, as outlined in ERTA and TEFRA, were incorporated into the lease versus buy program. A key consideration resulting from these laws is the inclusion of a guaranteed purchase option price. This allows the lessee to know all costs associated with the lease and thus more accurately calculate the cost of the lease. In the past, the purchase option price was the fair market value at the end of the lease, which was difficult, at best, to estimate.

Six base scenarios were developed to test the sensitivity of the lease versus buy decision to various parameters. These parameters include the marginal tax rate, holding period of the asset, interest rate, lease payment rate, inflation rate, and type of equipment to be leased. The first base scenario was chosen to reasonably reflect the current environment facing a farmer. The remaining five situations were variations of the overall base scenario.

The Iowa State University Business and Financial Planner was used to examine the impact of lease financing on the nonequity financed portion of the firm's capital structure and the impact of the lease financing on the optimal capital structure of the farm firm. A large cash grain operation was examined. The model projects the financial position of the farm firm for ten years. The effect of lease financing on the dollar level of assets, growth in assets, dollar level of equity, growth in equity, and percent equity was examined.

A method of accounting for leases on farm financial statements was developed in an effort to address the problem of inconsistent reporting of leases on balance sheets by farmers. The method developed was one that was simple enough so as to not preclude farmers from using it, yet detailed enough to accurately reflect the lease's impact on the financial structure of the farming operation. The accounting method developed includes the leased equipment as an intermediate asset with the value being the sum of the lease payments. Each period, the value of the asset decreases by the amount of the amortization of the equipment, which is calculated based on the equipment's initial true value. The lease liability appears as the sum of the lease payments. The liability account will decrease by the amount of the principal portion of the payment each period.

The lease will appear on the income statement differently for tax and book purposes. For book purposes, the amortization expense and the interest expense appear on the income statement. The lease payment appears on the income statement for tax purposes. It is assumed that the difference between these deductions is not significant enough to warrant interperiod tax allocation.

By offering some standardization of the recognition of lease payments on the farm firm financial statements, a more accurate picture of the firm will be reflected over time. This will enable more accurate trend and interfirm comparisons and a better evaluation of the financial position of the firm by lenders.

Implications of Asset Analysis Results

The results of the lease versus buy analysis show that the decision as to whether to acquire an asset through lease financing or traditional debt financing is much more complicated than previously thought. Many studies have examined the lease versus buy financing decision primarily in terms of the cost of capital and the marginal tax rate (Plaxico, 1983, and La Due, 1977). None of the agricultural leasing literature has examined the impact of the useful life of the equipment on the lease versus buy financing decision.

The results found here suggest that the lease versus buy financing decision cannot be accurately made by just comparing the cost of debt financing to the cost of lease financing over the financing period. Because differences in after-tax costs and benefits, particularly in terms of the after-tax salvage value, exist after the lease and financing period, the entire useful life of the asset must be considered in the lease versus buy evaluation.

Many factors affect the net after-tax cost over the life of the asset for each financing alternative. The interest rate and lease payment rate charged are important variables (see Figures 6 and 7) as is the marginal tax rate (Figure 8), but equally important is the holding period of the asset (Figure 5). Previous studies limited the time frame for analysis to the length of financing, not the life of the asset, and thus ignored the impact holding period has on the financing decision. Holding period is important due to the fact that the lease and buy alternatives will have different book values and purchase prices at a

subsequent resale. This results in different dollar amounts of gain and different types of gain from a tax viewpoint. That is, the lease financing alternative has the potential to have some capital gain resulting from resale as opposed to all ordinary gain for the buy alternative. The capital gain is taxed at a lower rate and thus more after-tax proceeds of the resale are realized under the lease alternative.

Another reason holding period is important is the ability of the lessee who has exercised a purchase option to depreciate the asset that he/she now owns. This depreciation is another important tax benefit of the lease financing alternative.

Inflation rate and machinery type also affect the lease versus buy financing decision in that they are determinants of the resale value. This becomes important in determining the tax treatment and types of gain realized at the time of sale.

The marginal tax rate is an important parameter in the lease versus buy financing decision. It is a determinant of the discount rate to be used; it also determines the proportion of the lease payment, interest payment, and depreciation expense that is tax deductible and will thus offset cash expenses incurred.

The interest rate used also has a dual impact on the lease versus buy financing decision. The interest rate is also a determinant of the discount rate used. Furthermore, the interest rate used determines the size of the interest expense incurred when purchasing the asset, and the amount of interest expense deductible for tax purposes.

The lease payment rate impacts the lease versus buy financing decision in that it determines the lease payment expense associated with the lease financing alternative. The lease payment rate also affects the purchase option price of the asset at the end of the lease. This will impact the amount and type of gain realized with the lease alternative upon sale of the asset.

Previous studies examined the impact of each parameter independently. Clearly, there is some interdependence among parameters when making the lease versus buy financing decision. For example, it has been indicated earlier that the holding period affects the lease versus buy decision. This is due to the tax treatment of the ordinary and capital gains; the marginal tax rate is interacting with the holding period. Furthermore, the amount of the gain depends on the resale value, which is a function of machine type and inflation rate, and the purchase option price, and the lease payment rate. Clearly, this example illustrates the interaction that occurs in determining the net after-tax costs of an asset over its life. To look at only one parameter when making a decision as to financing alternative is to oversimplify the analysis.

Further Research: Asset Analysis

As noted in the previous section, the asset financing decision is more complex than previously thought. There needs to be further study on the interaction of the parameters and the resulting affect on the financing decision. This would enable the determination of when one

variable, or a combination of parameters, becomes dominant over others. One possibility, especially with the new technology available today, would be to do three-dimensional graphs of these interrelationships. This would give more insight into the interactions that occur.

Another area of concern is the discussion of the proper way of evaluating the lease versus buy financing decision: net present value versus internal rate of return. This study used the net present value analysis method to determine which financing alternative had the lowest net after-tax costs. It would be interesting to examine the net after-tax costs of the two financing methods over the life of the asset using the internal rate of return approach. The important point here is to perform the analysis over the life of the asset rather than the life of the financing alternative. This is done to insure the inclusion of all the benefits and cost associated with each financing alternative.

Another attribute of leasing that needs to be examined is leasing as fixed rate term financing. As variable rate debt financing and one-year rollover loans, with no guarantee of rollover, become more prevalent in equipment financing, the lease financing alternative, with a fixed rate and term, becomes more desirable to some. This could be studied in terms of what implicit "price" is in the cost of the lease financing for this guarantee. Additionally, the lease versus buy decision could be analyzed incorporating this uncertainty as to price and term.

Implications of Capital Structure Results

It is clear from the analysis of the Iowa State University Business and Financial Planner results that the mix of leasing and debt financing in the nonequity portion of the firm is important. Also, the proportion of leasing is also important in determining the optimal equity-nonequity, or leverage, structure of the firm.

Tables 7 and 8 show the asset and equity position of a large grain operation for different levels of nonequity financing and different levels of lease financing. These results suggest that for a given level of nonequity financing, average percent growth in assets and ending dollar value of assets increase as the percent of lease financing increases and thus debt financing decreases. Further, it was found that the proportion of lease financing affects the firm's equity position. With the percent nonequity financing held constant, the equity growth rate is higher as the percent of leased assets increases (see Table 8). Also, for a given level of lease financing, the equity growth rate is reduced as the percent of nonequity financing increased (Table 7). In essence, the availability of leasing not only influences the mix of nonequity capital (lease versus debt financing), but more significantly optimal equity-nonequity mix, or optimal capital structure.

Further Research: Capital Structure Analysis

These results suggest that leasing is an important determinant in the optimal capital structure of a large cash grain operation. It is

important to determine whether or not these results are verified for different types and sizes of farming operations.

Additionally, this analysis reflects one set of interest and lease payment rates. Further research is needed to determine the affect of a change in interest rates and/or lease payment rates on the impact of leasing on the optimal capital structure. For example, an implicit interest rate of 12.1 percent was used for the lease and an interest rate of 17.7 percent was used on current and intermediate liabilities since that is the rate that existed at the time the data was collected. What impact would higher or lower rates have on the optimal capital structure and the amount of leasing that is desirable? If the interest rate implicit in the lease changes, how does this affect the optimal capital structure?

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