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Analyzing Capital Leases

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Financial leases are becoming increasingly important as a method for farmers to obtain control of business assets. A variety of leasing alternatives are being offered for an array of buildings, machinery and livestock. Thus, many farmers and farm advisors are faced with the need to compare leasing to purchase with borrowed funds. Because many of the basic characteristics of leasing are different from loans, this analysis is usually more complex than a comparison of alternate loan proposals. The objective of this paper is to outline the issues and analysis procedures that can be used in assessing leasing alternatives.

The first point to clarify is that we are talking about financial or capital leases, not operating leases. An operating lease is usually for a short portion of the leased assets life and/or purchase with borrowed funds is not a logical alternative to leasing. Operating leases would include renting land for one to five years, leasing a back hoe for a few days or leasing a tractor for a month. Leasing a building for 10 years, a machine for 5 years or cattle for 3 years would normally be financial leases.

Leases per se are not necessarily good or bad. A lease is a financing alternative. Whether a lease is a good deal depends on the terms of the lease, the farmers tax characteristics and the other financing alternatives available. The fact that the monthly or annual payments of the lease are less than the required payments if funds were borrowed does not mean that the lease is necessarily a superior alternative. Some leases are very high cost financing alternatives, others are not.

This publication first discusses the characteristics of contracts that allow them to be considered leases for tax purposes. This is followed by discussions of procedures for economic analysis of leasing alternatives on a before and after tax basis.

Is it a Lease for Tax Purposes?

One of the incentives for leasing is the tax benefits that may accrue to the lessee (farmer). However, in order to take advantage of the tax benefits, the lease must be considered a lease for tax purposes. Delineation of exactly what is a lease has become confused because many people who are essentially providing loans or conditional sales contracts try to structure those loans or contracts so that they will be called leases and, thus, qualify for the tax advantages of a lease. Whenever IRS clarifies the definition of a lease, these "lessors" change the structure of their products to keep them called leases.

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[1] Professor of Agricultural Finance, Department of Agricultural Resource and Managerial Economics, Cornell University. This paper was presented at the Northeast Agribusiness Seminar, Cornell University, Ithaca, NY June 9, 1997. The author would like to thank Stuart Smith and Wayne Knoblauch for helpful comments on an earlier draft.

Basic lease characteristics

Tax regulations provide a list of factors that will be taken into consideration in determining whether a contract is a lease. Under these regulations, a transaction will be considered a conditional sales contract and **not** a lease if any one of the following is true[2]:

1. Part of the lease payments are applied toward an equity interest that the "lessee" will receive.

2. The "lessee" gets title to the property upon payment of a stated amount required under the contract.

3. Total lease payments for a short period of time is a large part of the purchase price of the property.

4. Lease payments are much more than the fair rental value of the property.

5. The purchase option price is nominal compared to the value of the property at the time the option is exercised.

6. The purchase option price is nominal compared to the total lease payments.

7. The lease designates part of the payments as interest or part of the payments are easy to recognize as interest.

This list makes some situations clear. If the "lessee" obtains any ownership interest in the property as the result of making lease payments or can purchase the item at the end of the lease for a nominal amount, the contract is not a lease. Thus, leases for which the item becomes the property of the farmer upon payment of all of the lease payments is not a lease for tax purposes. Also, a lease that allows the farmer to buy the asset at the end of the lease for one dollar, or other modest sum, will not be considered a lease for tax purposes.

However, ambiguity remains about a number of other issues. What is a short period of time for a lease. What is a large part of the purchase price. How big does the price have to be to not be considered nominal. How do we define fair rental value?

[2] Adapted from "Tax Aspects of Leasing II", " Bock, C. Allen and Philip E. Harris, "1996 Farm Income Tax School Workbook P344.

Leverage lease rules

In an effort to handle some of these problems and some others faced by lessors, a set of rules for lessors who were providing leveraged leases (where the lessor borrows the funds from a third party to purchase the leased asset) was developed. These rules indicate that a transaction will be accepted as a valid lease if all the following conditions are met[3]:

1a. Lessor has a minimum "at risk" investment of at least 20% of the cost of the property leased.

1b. Lessor must demonstrate that an amount equal to at least 20% of the cost is a reasonable estimate of the fair market value at the end of the lease.

2. Lease term includes all renewal and extension periods (except those based on fair market value of the asset at the time of the extension).

3. The contract contains no contractual right for the lessee to purchase the property at less than fair market value at the time the right is exercised.

4. Lessee provides no part of the cost of the property.

5. Lessee does not make loans to or guarantee loans of the lessor.

6. The lessor must expect to make a profit apart from benefits obtained from the tax attributes of the lease.

These rules clarify at least one point. A purchase option price will not be considered nominal if it is at least 20 percent of the cost of the asset at the time the lease is initiated **and** can be defended to be a reasonable estimate of the fair market value of the asset at the end of the lease period. Of course, a purchase option price stated to be the fair market value of the asset at the end of the lease period would qualify. And, a purchase option less that the fair market value would not be acceptable. However, it may be possible for a lessor to justify a salvage value of less than 20 percent as being a reasonable estimate of fair market value - but this would require documentation.

Advice from the courts

Another approach to defining a lease is to look at what courts consider in separating a lease from a conditional sales contract. Bock and Harris provide the following advice on what a court will consider. A court determination of what will be considered a lease depends on the intent of the parties[4]:

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[3] Adapted from "Tax Aspects of Leasing II", " Bock, C. Allen and Philip E. Harris, "1996 Farm Income Tax School Workbook P349-50.

[4] Adapted from "Tax Aspects of Leasing II" " Bock, C. Allen and Philip E. Harris, "1996 Farm Income Tax School Workbook, P 363-364.

1. The agreement must resemble a lease - look like a lease.

2. The "lessee" must not acquire equity or title to the property as a result of making lease payments.

3. Lease payments must represent fair compensation for use of the asset.

4. Lease payments plus the stated purchase option cannot approximate the purchase price of the asset.

5. The option price cannot be viewed as nominal at the time the lease is initiated.

6. The lessor must act like the asset owner, i.e. take deprecation on the asset, etc.

This list does not provide much additional information on just what is and what is not a lease. It does reiterate that the lessee must not obtain equity, that the purchase option price cannot be nominal, that the lease payments must approximate a reasonable rental value and that all parties must treat the contract as a lease.

To summarize, the rules on what is, and what is not, a lease are not particularly clear. It is clear that the purchase option price cannot be nominal or perceived to be nominal, and that it must be stated as the fair market value or, if a dollar value is specified, it must be defensible as a reasonable estimate of fair market value. What is defensible as a reasonable estimate of fair market value leaves lots of "gray area" for interpretation. In the authors opinion, most capital leases are in fact conditional sales contracts "doctored up" to meet IRS rules to be called a lease for tax purposes. However, those who have made an effort to make the contract look like a lease will likely be close enough that the IRS will not contest them as leases. Most commercial lessors will set the characteristics of a contract so that at least an argument can be made that it is a lease.

Deducting more than one year's payments

One popular idea with some people who are looking for a loophole, is to deduct several years lease payments in one year. This is a dream! Only those who file on a cash basis would think that such a procedure would work. According to tax regulations, if the lessee is using the cash method of accounting, advance payments are deductible only to the extent that the payments represent payment for the use of the property for the current year[5].

For example, if a farmer leases property for $6,000 per year for three years and make all three payments ($18,000) in the first year, only $6,000 is deductible in the first year.

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[5] From "Tax Implications of Leasing" Bock, C. Allen and Philip E. Harris, "1995 Farm Income Tax School Workbook", P597.

The result is the same using the accrual method of accounting. An expense cannot be deducted until "economic performance" occurs, and economic performance is defined as use of the property.

Although advance payments cannot be counted as an expense, that does not mean that all payment have to be the same amount. Uneven payments do not keep a transaction from being a lease if (1) the annual payment is not more than 10% above the average for the term of the lease, or (2) the annual payment is not more than 10% above the average for the first 2/3 of the life of the lease and payments in the last 1/3 of the life of the lease are no less than 50% of the average for the first 2/3. This implies a maximum first year payment of 132 % of average payment over the life of the lease.

Before Tax Economic Analysis

In most cases an after tax analysis is necessary to determine whether a lease provides an economic advantage. However, in some cases taxes are basically irrelevant and a before tax analysis is most useful. Situations where a before tax analysis may be useful are:

1. The farmer will not pay any income tax regardless of the alternative chose. If the business is not profitable enough to generate a positive taxable income, taxes should be ignored.
2. The lease cannot be treated as a lease for tax purposes. If the lease is not a tax lease, the tax characteristics of the lease and loan alternatives will be similar and a before tax analysis will give the same relative answer as an after tax analysis.
3. The before tax analysis is of interest. In some cases there is suspicion that one of the above conditions may apply and a before tax analysis provides additional information.

Basic analysis procedure

A before tax analysis can be conducted with any good calculator with financial functions. The objective is to calculate the implicit interest rate on the lease to compare with the interest rate charged on the loan alternative. The procedure is illustrated using an example.

Farmer Brown is considering leasing a tractor that he could purchase for $100,000. The lease calls for monthly payments of $1,800 for three years with the first payment due upon delivery of the tractor. The tractor is expected to have a market value of $65,000 at the end of the three year period (residual value). The calculator entries are[6]:

[6] A Texas Instruments TI BAII Plus is assumed for these examples.

P/Y (payments per year)	=	12 (monthly payments)
BGN /END (beg. or end of year)	=	BGN (beginning)
N (number of payments)	=	36 (3 yrs. at 12 pmts./yr.)
PV (Present value - cost of item)	=	-100000 (paying $100,000)
PMT (amount of payment)	=	1800 (receives $1,800 /pmt.)
FV (future value - residual value)	=	65000 (value @ end of lease)
I/Y (interest rate per year)	=	? = 12.08 percent

The signs on the calculator entries reflect the perspective of the lessor. That is, the lessor pays $100,000 for the tractor and receives the monthly payments and the residual value of the tractor at the end of the lease.

The 12.08 percent represents the rate of interest that the lessor is receiving, and, thus, that the lessee (farmer) is paying for the leased asset, excluding any tax considerations. The lease would be a better deal, if the farmer would have to pay more than 12.08 percent interest on a loan to buy the tractor.

Some alternatives

A large advance payment. Because the only collateral or security the lessor has is the leased item itself, an advance payment that is larger than the regular payments on the lease is often required at the initiation of the lease. This may be labeled by the lessor as the first and last payments due upon initiation of the lease or as a down payment.

This situation can be handled by reducing the cost of the asset by the amount of the advance (down) payment, reducing the number of payments to the number remaining (if appropriate) and changing the time of the payments to end of period.

Reducing the cost by the advance payment is appropriate because the cost represents the amount of money that the lessor is effectively providing through the lease and an immediate payment of the advance payment reduces the amount effectively provided. If the advance payment is one of the regular payments, the number of payments at the set payment level is one less than the total number of payments. Payments are now effectively at the end of the period because the first regular payment (in addition to the advance payment) will occur one period (one year, one month) after the advance payment.

In our Farmer Brown example: assume the advance payment is $3,000 and it replaces the first regular payment. The entries are the same except:

BGN	=	END
N	=	35
PV	=	-97000 (100,000 cost - 3,000 payment)
I/Y	=	? = 12.89 percent

As expected, the implicit interest rate is higher because the first payment is considerably larger.

Rate is given, but the residual value is not. In some cases, a rate is given but the residual value is not. Since the residual value can have a considerable effect on the effective interest rate, the assumed residual value can be modified to make the reported interest rate more favorable. If a basically different residual value is assumed in a purchase-with-borrowed-funds alternative, the comparison becomes biased.

The way to check this situation is to enter the interest rate and solve for future (residual) value. In our Farmer Brown example, assume that the lessor indicates an implicit interest rate of 12.89 percent. In that case our entries are the same as those indicated in the above examples (with the $3,000 advance payment) except that:

I/Y (interest rate per year) = 12.89

and we solve for the residual value:

FV (future value or residual value) = ? = 64,998

The result differs from $65,000 because of rounding of the entries (12.89 percent). If the lessor had indicated that the interest rate being charged was 9.28 percent, entry of the 9.28 percent and solving for the residual value would indicate that he used $55,012 or $55,000 as the residual. If the item is actually be worth $65,000, the 9.28 percent is biased. The lessor is actually charging 9.28 percent interest, plus $10,000 at the end of the lease ($65,000 - $55,000). If the farmer could borrow the funds at 10 percent interest, he would clearly be better off with a loan.

N**either the rate or the residual value are known.** The farmer is often told the amount of the payments, but is told neither the interest rate nor the residual value used in determining those payments. In this case, the farmer can (1) estimate the residual value and calculate the implicit rate, (2) enter the loan interest rate and determine the residual value the lessor must have assumed if the rate were equal to the loan rate, or (3) enter a series of interest rates and determine what the residual value must have been with each rate. The easiest of the these to use is to enter the interest rate that would be charged if the item were purchased with borrowed funds and determine the residual value the lessor must have used if the alternatives were equivalent.

In our Farmer Brown example, if the alternate loan rate is 10 percent, the entries would be the same as above except

I/Y (interest rate per year) = 10

and when we solve for the residual value, we get

FV (future value or residual value) = ? = 56,892

If the farmer is convinced that the residual value is actually above $56,892, then the implicit rate on the lease is above the 10 percent loan rate and the loan would be the better choice. Conversely, if the residual value is expected to be below $56, 892, the lease is the lower cost alternative.

After Tax Analysis

Under current tax law, about the only tax advantage of a lease is the advancement of deductibility. That is , the ability to write off the cost of the asset more rapidly. This results in the ability to put off payment of the some taxes for a while. The primary disadvantage of leasing is the loss of four percent state investment tax credit.

Effective assessment of a lease requires evaluation of the lease relative to other financing alternatives. For most farm situations, this involves comparing the lease to the best purchase-with-borrowed-funds alternative. Thus, the analysis that follows assumes comparison of a lease to a loan alternative.[7]

Comparison of the two alternatives, lease or purchase with borrowed funds, requires that we calculate the present value of the net costs for each. The primary advantage of the lease is that it delays some tax payments. Use of the present value technique adjusts the value of costs for the time that they occur, and, thus, reflects the value of that delay.

In order to conduct an analysis, one must first select a period of analysis, marginal income tax rate and after tax discount rate.

Equal analysis periods

The biggest problem in appropriately analyzing leases is insuring that the periods of analysis for the loan and the lease are the same. If the analysis periods are not the same, the analysis is like comparing apples and oranges, and may give incorrect results. There are basically two ways to get the lease and the loan periods of equal length:

1. Assume purchase of the asset at the end of the lease period as part of the lease option. That is, as part of the lease analysis, assume that the item is leased for the lease period and then the purchase option price is paid to purchase the asset. The period of analysis becomes the loan period or the life of the asset.

2. Assume sale of the asset at the end of the lease period as part of the purchase with financing option. The period of analysis becomes the life of the lease.

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[7] A computer program is available for conducting after tax analyses as discussed below. See LaDue, E.L. "LEAP, A Lease Analysis Program", Cornell University, Department of Agricultural, Resource, and Managerial Economics Extension Bulletin No. EB 97-17.

Both of these solutions require estimation or determination of the value of the asset at the end of the lease period. If a dollar value purchase option price is specified as part of the lease, option one is most accurate, because no assumption about the value of the asset is required. Option one is also most appropriate if purchase of the asset at the end of the lease is planned, because it is most representative of what will actually occur.

If there is no plan to purchase the item at the end of the lease period, option two will likely be most representative. This forces the purchase option to conform to the lease terms.

Marginal income tax rate

The marginal income tax rate is the level of taxes that would be paid on one dollar more or less of income. This includes both federal, state and self employment tax. Since state taxes are deductible on federal income, the equation for calculating the marginal tax rate is:

state rate + (1-state rate) x (federal income tax rate + self employment rate)

For example, assume Farmer Brown's marginal state rate is 7.15 percent, the marginal federal rate is 28 percent and the self employment rate is 2.9 percent (Medicare only—income exceeds maximum Social Security contribution level.). In that case, the marginal tax rate:

= 6.85 + (1-.0685)x(28 + 2.9) = 6.85 + .9315(30.9) = 35.63
= 36 percent

The marginal long term capital gain rate is irrelevant in these cases because the income being evaluated is either normal net income from business operation or income from the sale of an asset which is also ordinary income to the extend of depreciation previously taken. Capital gain would only be relevant in the extremely rate case where the asset sold for more than its original purchase price.

After tax discount rate

The before tax discount rate to use in evaluating alternatives is the opportunity cost of capital to the business. The opportunity cost of capital is the amount that the business would have to pay for added funds used in the business, or would save if fewer funds were used in the business. This is usually the interest rate paid on new loans. If more funds were needed, this is the rate that would be paid. If fewer funds were needed, this rate represents the amount that would be saved by paying off loans or not borrowing as much.

The after tax discount rate is calculated as:

Before tax rate x (1 - marginal income tax rate)

For example, if Farmer Brown would have to pay 10 percent interest to borrow added funds, his before tax discount rate is 10 percent. Further, since (as calculated above) his marginal income tax rate is 36 percent his after tax discount rate is:

10 x (1 - .36) = 6.4 , rounded = 6 percent

Economic analysis with purchase of asset at end of lease

When the asset is purchased at the end of the lease period, the period over which the asset is used is usually the normal life of the asset. The number of years that the asset will be kept on the farm in this case will be the same whether the initial decision is to lease the asset or purchase it. Under these conditions, the most logical period of analysis is the life of the asset on the farm. The period of the loan could also be used. However, if the life of the asset is greater than the period of the loan, the estimated salvage value of the asset at the end of the analysis period has a greater influence on the results and any misestimation could bias the results.

In the analysis that follows, the Farmer Brown case is continued using the initial set of conditions (initial payment of $1,800 and an estimated salvage value of $65,000).

Lease cost analysis The procedures for calculating the net present value of costs under the lease alternative are shown in table A. If more than seven years are involved in the analysis, more columns can be added to the right of the table for the added years. Yearly values are used even when monthly payments are made to make the analysis easier to follow and conduct. This simplification is unlikely to alter the relative results. Years are defined as 12 month intervals following the initial date of the lease. If the lease were initiated on May 1, each year runs from May 1 through April 30 of the following calendar year. Another way to think about this is to assume that the item would be leased or purchased on January 1. In most cases, the exact date of lease or purchase is unknown at the time of the analysis. The results will be basically the same regardless of the exact date of lease or purchase. The advance column refers to values paid at the time the lease is initiated or the asset is delivered. Each line of table A is discussed below.

a. Lease payment. Enter the total lease payments for each year. The advance lease payment is the amount required at the time the lease is initiated or delivered. Farmer Brown's initial payment is $1,800. Since the first payment is made in advance, only 11 payments will be made in year 3 (11 x $1,800 + 19,800).

b. Costs saved (-), added (+). Enter any operating costs that would be saved with the lease that would be paid if the asset were purchased, or additional costs incurred because of the lease. Cost savings would include such things as insurance and repair costs that the lessor is paying, resulting in reduced costs to the farmer. Added costs would include costs that the lessor required the farmer to pay, such as added insurance or preventive maintenance. Farmer Brown's operating costs will not be changed by leasing.

c. Net lease costs. This is the net before tax cost of leasing the asset.

d. Loan payment on residual. Enter the loan payments to be made on the financing of the purchase of the asset at the end of the lease period. This includes the interest and principal. If the residual is not financed, but is paid in cash, enter the residual value in the year of purchase. Loan payments can be calculated using table 4, if they are not available from other sources. Farmer Brown expects to finance the purchase of the $65,000 residual with a 36 month loan at 10 percent interest with monthly payments of $2,097.37 (12 x $2,097 =$25,168).

e. Interest portion. Enter the proportion of each years payments that will be interest. This can be found in table 1a., if payments are monthly, or table 1b., if payments are annual. Farmer Brown's interest rate is 10 percent and the term is three years. Thus, the last three columns of the 10 percent row are used, providing interest proportions of 0.22 for year one (the 3rd to the last year with a three year loan is the first year), 0.14 for the 2nd year and 0.05 for the 3rd year.

f. Interest. Interest is the estimated amount of the payments that is interest, and, thus, tax deductible.

g. Depreciation. Enter the amount of depreciation to be taken. Since the leased asset is not depreciated by the farmer lessee, this will be zero for years when the asset is leased. When the asset is purchased at the end of the lease period, the residual value paid for the asset is depreciated. Depreciation can be taken from table 2.

Table 2 assumes 150% declining balance depreciation. Although there are slower depreciation methods, most people who might find leasing more profitable will be using the fastest depreciation method available, which for farmers is 150% declining balance. If slower depreciation methods will be used, other tax tables or formulas must be used. Farmer Brown paid $65,000 (of borrowed funds) for the tractor at the beginning of year four. The tractor will be depreciated over seven years. Using table 2, the depreciation in year four is $6,962 (.1071 x 65,000). Year five depreciation is $12,435 (.1913 x 65,000), etc.

In some situations part or all of the purchase price may be "depreciated" in the first year by using the Section 179 expense deduction. If Section 179 can be used, the expensed amount is added to the first year depreciation on any amount not expensed and depreciation in future years is taken from Table 2 based on the amount not expensed.

h. Other Ownership costs. Enter any other operating or capital costs that are connected with the asset that are expected to be different for leasing than owning the asset. Farmer Brown had no other costs.

i. Deductible ownership costs. This represents the total tax deductible costs connected with owning the asset.

j. Total terminal value (end of period). Enter the value of the asset an the end of the analysis period. This is the salvage value of the asset at the end of the ownership period. Farmer Brown estimates that the tractor will have a value of $15,000 at the time it is traded in, at the end of the seven year period.

k. Undepreciated balance. Enter the undepreciated balance on the asset. The residual value that is paid for the asset at the end of the lease can be depreciated. If the depreciation period has not expired by the end of the analysis period, the asset will not be fully depreciated. The undepreciated balance can be taken as an expense in the year of the sale. Undepreciated balance is the amount paid for the asset minus the depreciation taken prior to sale. Farmer Brown paid $65,000 for the tractor. Depreciation taken prior to sale is $6,962 + $12,435 + $9,770 + $7,963 = $37,130. Thus, the undepreciated balance is $65,000 - 37,130 = $27,870.

l. Taxable income. This indicates the taxable income generated by sale of the asset at the end of the period. If the value is negative, it represents costs that can be deducted for tax purposes.

m. Unpaid loan principal. Enter the outstanding principal on the loan obtained to purchase the asset at the end of the lease period. This can be estimated as (1) the amount borrowed to buy the asset minus (2) the total payments made on the loan (line d) minus the amount of those payments that were interest (line f). Farmer Brown's loan was completely repaid.

n. Net tax deductible costs. This is the total costs that can be deducted as expenses for tax purposes.

o. Tax rate (decimal form). Enter the marginal income tax rate for this business. Farmer Brown's marginal income tax rate is 36 percent (see section on marginal income tax rate).

p. Tax benefit. This represents the taxes that would not have to be paid as a result of leasing and then owning the asset.

q. Before tax costs. This is the total before tax costs of leasing and then owning the asset for the analysis period.

r. Net after tax costs. This is the after tax cost of leasing and then owning the asset exclusive of any required deposit and investment tax credit.

s. Refundable deposit. Enter the amount of the deposit in the year it is made as a positive number. Usually the deposit is made at the time the lease in initiated, so it will be entered in the advance column. Also, enter the same value as a negative number in the year that the deposit will be returned. This is usually the year the lease ends. If a deposit is not refundable, it is entered as a lease payment, not in this row. Farmer Brown was not required to provide a refundable deposit.

t. Investment tax credit. Enter the state investment tax credit earned when the asset is purchased at the end of the lease period.

u. Investment tax credit recapture. Enter the investment tax credit recaptured because the asset is sold before full credit is earned.

v. Total costs. This represents the total after tax costs.

w. PV factor. Enter the appropriate present value factor based on the after tax discount rate. These values can be taken from table 3 by using the after tax discount rate as the interest rate. Farmer Brown's after tax discount rate is 6 percent (see section on after tax discount rate). Using the 6 percent rate, the present value factors are 0.94 for first year costs, 0.89 for second year costs, etc.

x. Net present values. This is the present value of the costs for each year.

y. Total net present value of all costs. This indicates the present value of the net costs of leasing and then owning the asset over the analysis period. For Farmer Brown, the present value of costs of leasing and then owning the tractor is $66,047.

Table A. LEASE COST ANALYSIS (with purchase at end of lease)

Item	Advance	Year 1	2	3	4	5	6	7
a. Lease payment	1800	21600	21600	19800				
b. Costs saved (-), added (+)								
c. Net lease costs (a + b)	1800	21600	21600	19800				
d. Loan payment on residual					25168	25168	25168	
e. Interest proportion (Table 1)					.22	.14	.05	
f. Interest (d x e)					5537	3524	1258	
g. Depreciation (Table 2 x cost)					6962	12435	9770	7963
h. Other Ownership costs								
i. Deductible ownership costs (f + g +h)					12499	15959	11028	7963
Terminal value (end of period)								
j. Total								15000
k. Undepreciated balance								27870
l. Taxable income (j-k)								-12870
m. Unpaid loan principal								
n. Net tax deductible costs (c + i -l)	1800	21600	21600	19800	12499	15959	11028	20833
o. Tax rate (decimal form)	.36	.36	.36	.36	.36	.36	.36	.36
p. Tax benefit (n x o)	648	7776	7776	7128	4500	5745	3970	7500
q. Before tax costs (c + d + h - j + m)	1800	21600	21600	19800	25168	25168	25168	-15000
r. Net after tax cost (q - p)	1152	13824	13824	12672	20668	19423	21198	-22500
s. Refundable deposit								
t. Investment tax credit					2600			
u. Investment tax credit recapture								520
v. Total costs (r + s - t + u)	1152	13824	13824	12672	18068	19423	21198	-21980
w. PV factor (after tax-Table 3)	1.0	.94	.89	.84	.79	.75	.7	.67
x. Net present value (t x u)	1152	12995	12303	10644	14274	14567	14839	-14727
y. Total net present value of all costs (sum of row v)								66047

Purchase with financing cost analysis The present value of the costs connected with purchase of the asset with debt financing is illustrated in table B. Entries represent the costs and returns connected with purchase of the asset with financing. All entries are defined the same as explained above for table A except:

a. Loan payment. This refers to the loan to buy the asset in year one.

n. Net after tax cost. Net after tax cost refers to the total costs except for investment tax credit.

Table B. PURCHASE WITH FINANCING COST ANALYSIS

Item	Down pmt.	Year 1	2	3	4	5	6	7
a. Loan payment		38721	38721	38721				
b. Interest proportion (Table 1)		0.22	0.14	.0.05				
c. Interest (a x b)		8519	5421	1936				
d. Depreciation (Table 2 x cost)		10710	19130	15030	12250	12250	12250	12250
e. Other Ownership costs								
f. Deductible ownership costs (c + d + e)		19229	24551	16966	12250	12250	12250	12250
Terminal value (end of period)								
g. Total								15000
h. Undepreciated balance								6130
i. Taxable income								8870
j. Unpaid loan principal								
k. Net tax deductible costs (f - i)		19229	24551	16966	12250	12250	12250	3380
l. Tax rate (decimal form)		0.36	0.36	0.36	0.36	0.36	0.36	0.36
m Tax benefit (k x l)		6922	8838	6108	4410	4410	4410	1217
n. Net after tax cost (a + e - g + j - m)		31799	29883	32613	-4410	-4410	-4410	-16217
o. Investment tax credit		4000						
p. Investment credit recapture								
q. Total cost (n - o + p)		27799	29883	32613	-4410	-4410	-4410	-16217
r. PV Factor (after tax-Table 3)		0.94	0.89	0.84	0.79	0.75	0.70	0.67
s. Net present value (q x r)		26131	26596	27395	-3484	-3308	-3087	-10865
t. Total net present value of costs								59378

The lowest cost alternative is one with the lowest total net present value of costs. The difference in net present value is the amount, in today's dollars, that would be saved by taking the lowest cost alternative. In the Farmer Brown case, the purchase with financing alternative is lowest cost. He would be $6,669 better off by purchasing the asset with borrowed money. Alternately, the lessor would have to pay Farmer Brown $6,669 at the initiation of the lease to make the alternatives equal.

Economic analysis with sale of purchased asset at end of lease period (leased asset is not purchased)

When the leased asset is not purchased at the end of the lease period, the easiest way to make the lives of the two analysis periods the same is to assume that if the asset were purchased with financing instead of leasing, the asset would be sold at the end of the same period of time as the period of the lease. For the Farmer Brown situation, the lease is for three years. Thus, to make the comparison valid, it is assumed that the tractor is sold after three years under the purchase option analysis.

The lease analysis For this analysis, the lease option is easiest to assess. The procedure to use is outlined in table C. Input items are defined the same as indicated for table A. The example used is the same Farmer Brown case as used previously, except that it is assumed that the tractor is not purchased at the end of the lease period.

Table C. LEASE COST ANALYSIS

Item	Year Advance	1	2	3	4	5	6	7
a. Lease payment	1800	21600	21600	19800				
b. Costs saved (-), added (+)								
c. Net lease costs (a + b)	1800	21600	21600	19800				
d. Tax rate (decimal form)	0.36	0.36	0.36	0.36				
e. Tax benefit (c x d)	648	7776	7776	7128				
f. Net after tax cost (c - e)	1152	13824	13824	12672				
g. Refundable deposit								
h. Total costs (f + g)	1152	13824	13824	12672				
i. PV factor (after tax-Table 3)	1.0	0.94	0.89	0.84				
j. Net present value	1152	12995	12303	10644				
k. Total net present value of all costs								37094

Purchase with financing analysis The purchase with financing analysis is made consistent with the lease analysis by assuming that the asset will be sold at the time the corresponding lease would end. The procedure required to analyze the purchase with financing option is illustrated in table D.

Input items are defined that same as in table A except that the residual value of the asset is used instead of the terminal value. The residual value is the value of the asset at the end of the lease period.

Table D. PURCHASE WITH FINANCING ANALYSIS

Item	Down pmt	Year 1	2	3	4	5	6	7	
a. Loan payment (table 4 x cost)		38721	38721	38721					
b. Interest proportion (Table 1)		0.22	0.14	0.05					
c. Interest (a x b)		8519	5421	1936					
d. Depreciation (Table 2 x cost)		10710	19130	15030					
e. Other Ownership costs									
f. Deductible ownership costs (c + d + e)		19229	24551	16966					
Residual value									
g. Total				65000					
h. Undepreciated balance				55130					
i. Taxable income				9870					
j. Unpaid loan principal									
k. Net tax deductible costs (f - i)		19229	24551	7096					
l. Tax rate (decimal form)		0.36	0.36	0.36					
m Tax benefit (k x l)		6922	8838	2555					
n. Net after tax cost (a - g + j - m)		31799	29883	-28834					
o. Investment tax credit		4000							
p. Investment credit recapture				1600					
q. Total cost (n - o + p)		27799	29883	-27234					
r. PV Factor (after tax-Table 3)		0.94	0.89	0.84					
s. Net present value (q x r)		26131	26596	-22877					
t. Total net present value of costs									29850

Farmer Brown would save $7,244 by purchasing rather than leasing the asset. This measures the savings achieved over three years measured in current dollars. It differs from the savings found in the prior analysis because that analysis coveres a seven year period.

A very important number in these analyses is the residual value of the asset that would be leased. If there is uncertainty about the estimated residual value, conduct analyses using the likely extremes of residual value and see if the results change.

Summary

Farmers are being offered an increasing number of leasing alternatives. The basic question is whether these leases are better methods of obtaining use of assets than purchase of the asset using borrowed funds. Unfortunately, the answer to that question depends on the specific characteristics of the lease, the alternate loan and the farmers tax situation.

Some leases are designed to qualify as leases for tax purposes. The tax regulations are somewhat fuzzy, so there is considerable gray area surrounding the identification of which of these contracts are leases for tax purposes. Certainly, those that give the farmer an equity interest in the asset as a result of making lease payments, or transfer the asset to the farmer for a nominal amount or any amount that cannot be defended as a reasonable estimate of fair market value, are not leases for tax purposes.

Some leases are more economical than purchase with financing, but many are not. To determine whether a lease is a good deal or not requires economic analysis. Before tax analyses, for those situations where taxes are not relevant, can be accomplished with straight forward calculations with any good calculator containing financial functions. Examples using a Texas Instrument BAII Plus were provided.

An after tax analysis is somewhat more complicated. Making the period of analysis the same for both the lease and loan alternatives can be accomplished by assuming purchase of the asset at the end of the lease period or assuming sale of the purchased asset at the end of the lease period. Procedures for comparing loan and lease alternatives were illustrated using a case example.

Table 1a. Proportion of Total Annual Payments that are Interest when Payments are Monthly

Interest Rate	15th to last	14th to last	13th to last	12th to last	11th to last	10th to last	9th to last	8th to last
8	0.69	0.66	0.63	0.60	0.57	0.53	0.49	0.45
9	0.73	0.70	0.68	0.64	0.61	0.57	0.53	0.49
10	0.76	0.74	0.71	0.68	0.65	0.61	0.57	0.53
11	0.80	0.77	0.75	0.72	0.68	0.65	0.61	0.56
12	0.82	0.80	0.78	0.75	0.72	0.68	0.64	0.59
13	0.85	0.83	0.80	0.78	0.74	0.71	0.67	0.62
14	0.87	0.85	0.83	0.80	0.77	0.73	0.70	0.65
15	0.89	0.87	0.85	0.82	0.79	0.76	0.72	0.67
16	0.90	0.88	0.86	0.84	0.81	0.78	0.74	0.70

Table 1a. Continued Proportion of Total Annual Payments that are Interest when Payments are Monthly

Interest Rate	7th to last	6th to last	5th to last	4th to last	3rd to last	2nd to last	last year
8	0.41	0.36	0.30	0.25	0.18	0.12	0.04
9	0.44	0.39	0.33	0.27	0.20	0.13	0.05
10	0.48	0.42	0.36	0.30	0.22	0.14	0.05
11	0.51	0.45	0.39	0.32	0.24	0.15	0.06
12	0.54	0.48	0.42	0.34	0.26	0.17	0.06
13	0.57	0.51	0.44	0.37	0.28	0.18	0.07
14	0.60	0.54	0.47	0.39	0.30	0.19	0.07
15	0.62	0.56	0.49	0.41	0.31	0.20	0.08
16	0.65	0.59	0.51	0.43	0.33	0.22	0.08

This table can be used for any loan with a term of one to fifteen years. Use the last "x" columns of the table, where "x" is the term of the loan in years. For example, if a four year loan with a ten percent interest is being used, use the last four columns of the 10 percent row, i.e. in year 1, 0.30 of the payments made will be interest; in year 2, 0.22 of the payments will be interest; in year 3, 0.14 of the payments will be interest and in the last year .05 percent will be interest.

Table 1b. Proportion of Total Annual Payments that are Interest when Payments are Annual

Interest Rate	15th to last	14th to last	13th to last	12th to last	11th to last	10th to last	9th to last	8th to last
8	0.68	0.66	0.63	0.60	0.57	0.54	0.50	0.46
9	0.73	0.70	0.67	0.64	0.61	0.58	0.54	0.50
10	0.76	0.74	0.71	0.68	0.65	0.61	0.58	0.53
11	0.79	0.77	0.74	0.71	0.68	0.65	0.61	0.57
12	0.82	0.80	0.77	0.74	0.71	0.68	0.64	0.60
13	0.84	0.82	0.80	0.77	0.74	0.71	0.67	0.62
14	0.86	0.84	0.82	0.79	0.76	0.73	0.69	0.65
15	0.88	0.86	0.84	0.81	0.79	0.75	0.72	0.67
16	0.89	0.87	0.85	0.83	0.80	0.77	0.74	0.69

Table 1b. Continued Proportion of Total Annual Payments that are Interest when Payments are Annual

Interest Rate	7th to last	6th to last	5th to last	4th to last	3rd to last	2nd to last	last year
8	0.42	0.37	0.32	0.26	0.21	0.14	0.07
9	0.45	0.40	0.35	0.29	0.23	0.16	0.08
10	0.49	0.44	0.38	0.32	0.25	0.17	0.09
11	0.52	0.47	0.41	0.34	0.27	0.19	0.10
12	0.55	0.49	0.43	0.36	0.29	0.20	0.11
13	0.57	0.52	0.46	0.39	0.31	0.22	0.12
14	0.60	0.54	0.48	0.41	0.33	0.23	0.12
15	0.62	0.57	0.50	0.43	0.34	0.24	0.13
16	0.65	0.59	0.52	0.45	0.36	0.26	0.14

This table can be used for any loan with a term of one to fifteen years. Use the last "x" columns of the table, where "x" is the term of the loan in years. For example, if a four year loan with a ten percent interest is being used, use the last four columns of the 10 percent row, i.e. in year 1, 0.32 of the payments made will be interest; in year 2, 0.25 of the payments will be interest; in year 3, 0.17 of the payments will be interest and in the last year .09 percent will be interest.

Table 2
Annual Depreciation (Percent of Original Depreciation Basis)
150% Declining Balance Method

Recovery Year	3-Year Class	5-Year Class	7-Year Class	10-Year Class	15-Year Class	20-Year Class
1	25.00	15.00	10.71	7.50	5.00	3.75
2	37.50	25.50	19.13	13.88	9.50	7.22
3	25.00	17.85	15.03	11.79	8.55	6.68
4	12.50	16.66	12.25	10.02	7.69	6.18
5		16.66	12.25	8.74	6.93	5.71
6		8.33	12.25	8.74	6.23	5.28
7			12.25	8.74	5.90	4.89
8			6.13	8.74	5.90	4.52
9				8.74	5.90	4.46
10				8.74	5.90	4.46
11				4.37	5.90	4.46
12-15					5.90	4.46
16					3.00	4.46
17-20						4.46
21						2.25

Table 3. Present Value of $1

	Interest Rate (percent)													
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.93	0.92	0.91	0.90	0.89	0.88	0.88
2	0.98	0.96	0.94	0.92	0.91	0.89	0.87	0.86	0.84	0.83	0.81	0.80	0.78	0.77
3	0.97	0.94	0.92	0.89	0.86	0.84	0.82	0.79	0.77	0.75	0.73	0.71	0.69	0.67
4	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.74	0.71	0.68	0.66	0.64	0.61	0.59
5	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.65	0.62	0.59	0.57	0.54	0.52
6	0.94	0.89	0.84	0.79	0.75	0.70	0.67	0.63	0.60	0.56	0.53	0.51	0.48	0.46
7	0.93	0.87	0.81	0.76	0.71	0.67	0.62	0.58	0.55	0.51	0.48	0.45	0.43	0.40
8	0.92	0.85	0.79	0.73	0.68	0.63	0.58	0.54	0.50	0.47	0.43	0.40	0.38	0.35
9	0.91	0.84	0.77	0.70	0.64	0.59	0.54	0.50	0.46	0.42	0.39	0.36	0.33	0.31
10	0.91	0.82	0.74	0.68	0.61	0.56	0.51	0.46	0.42	0.39	0.35	0.32	0.29	0.27
11	0.90	0.80	0.72	0.65	0.58	0.53	0.48	0.43	0.39	0.35	0.32	0.29	0.26	0.24
12	0.89	0.79	0.70	0.62	0.56	0.50	0.44	0.40	0.36	0.32	0.29	0.26	0.23	0.21
13	0.88	0.77	0.68	0.60	0.53	0.47	0.41	0.37	0.33	0.29	0.26	0.23	0.20	0.18
14	0.87	0.76	0.66	0.58	0.51	0.44	0.39	0.34	0.30	0.26	0.23	0.20	0.18	0.16
15	0.86	0.74	0.64	0.56	0.48	0.42	0.36	0.32	0.27	0.24	0.21	0.18	0.16	0.14
16	0.85	0.73	0.62	0.53	0.46	0.39	0.34	0.29	0.25	0.22	0.19	0.16	0.14	0.12
17	0.84	0.71	0.61	0.51	0.44	0.37	0.32	0.27	0.23	0.20	0.17	0.15	0.13	0.11
18	0.84	0.70	0.59	0.49	0.42	0.35	0.30	0.25	0.21	0.18	0.15	0.13	0.11	0.09
19	0.83	0.69	0.57	0.47	0.40	0.33	0.28	0.23	0.19	0.16	0.14	0.12	0.10	0.08
20	0.82	0.67	0.55	0.46	0.38	0.31	0.26	0.21	0.18	0.15	0.12	0.10	0.09	0.07

Table 4a. Annual Payments Required to Amortize $1 when Payments are Monthly Even Payments, Principal and Interest

Interest Rate	Repayment Period (years) 1	2	3	4	5	6	7	8
7.5	1.0411	0.5400	0.3733	0.2901	0.2405	0.2075	0.1841	0.1666
8.0	1.0439	0.5427	0.3760	0.2930	0.2433	0.2104	0.1870	0.1696
8.5	1.0466	0.5455	0.3788	0.2958	0.2462	0.2133	0.1900	0.1727
9.0	1.0494	0.5482	0.3816	0.2986	0.2491	0.2163	0.1931	0.1758
9.5	1.0522	0.5510	0.3844	0.3015	0.2520	0.2193	0.1961	0.1789
10.0	1.0550	0.5537	0.3872	0.3044	0.2550	0.2223	0.1992	0.1821
10.5	1.0578	0.5565	0.3900	0.3072	0.2579	0.2253	0.2023	0.1853
11.0	1.0606	0.5593	0.3929	0.3101	0.2609	0.2284	0.2055	0.1885
11.5	1.0634	0.5621	0.3957	0.3131	0.2639	0.2315	0.2086	0.1918
12.0	1.0662	0.5649	0.3986	0.3160	0.2669	0.2346	0.2118	0.1950
12.5	1.0690	0.5677	0.4014	0.3190	0.2700	0.2377	0.2151	0.1983
13.0	1.0718	0.5705	0.4043	0.3219	0.2730	0.2409	0.2183	0.2017
13.5	1.0746	0.5733	0.4072	0.3249	0.2761	0.2441	0.2216	0.2051
14.0	1.0774	0.5762	0.4101	0.3279	0.2792	0.2473	0.2249	0.2085
14.5	1.0803	0.5790	0.4131	0.3309	0.2823	0.2505	0.2282	0.2119
15.0	1.0831	0.5818	0.4160	0.3340	0.2855	0.2537	0.2316	0.2153

Interest Rate	Repayment Period (years) 9	10	11	12	13	14	15	16
7.5	0.1531	0.1424	0.1338	0.1266	0.1206	0.1156	0.1112	0.1075
8.0	0.1562	0.1456	0.1370	0.1299	0.1240	0.1190	0.1147	0.1110
8.5	0.1594	0.1488	0.1402	0.1332	0.1273	0.1224	0.1182	0.1145
9.0	0.1625	0.1520	0.1435	0.1366	0.1308	0.1259	0.1217	0.1181
9.5	0.1657	0.1553	0.1469	0.1400	0.1342	0.1294	0.1253	0.1218
10.0	0.1689	0.1586	0.1502	0.1434	0.1377	0.1330	0.1290	0.1255
10.5	0.1722	0.1619	0.1537	0.1469	0.1413	0.1366	0.1326	0.1293
11.0	0.1755	0.1653	0.1571	0.1504	0.1449	0.1403	0.1364	0.1331
11.5	0.1788	0.1687	0.1606	0.1540	0.1486	0.1440	0.1402	0.1369
12.0	0.1822	0.1722	0.1641	0.1576	0.1522	0.1478	0.1440	0.1408
12.5	0.1856	0.1757	0.1677	0.1613	0.1560	0.1516	0.1479	0.1448
13.0	0.1890	0.1792	0.1713	0.1650	0.1597	0.1554	0.1518	0.1488
13.5	0.1925	0.1827	0.1750	0.1687	0.1636	0.1593	0.1558	0.1528
14.0	0.1960	0.1863	0.1786	0.1725	0.1674	0.1633	0.1598	0.1569
14.5	0.1995	0.1899	0.1824	0.1763	0.1713	0.1672	0.1639	0.1610
15.0	0.2031	0.1936	0.1861	0.1801	0.1752	0.1712	0.1680	0.1652

Total payment for a year are obtained by multiplying the table value by the loan amount. For example, if the loan amount for a four year loan at 10 percent interest is $100,000, the payments for a year are calculated as .3044 times 100,000, which equals $30,440.

Table 4b. Annual Payments Required to Amortize $1
Even Payments, Principal and Interest

Interest Rate	Repayment Period (years) 1	2	3	4	5	6	7	8
7.5	1.0750	0.5569	0.3845	0.2986	0.2472	0.2130	0.1888	0.1707
8.0	1.0800	0.5608	0.3880	0.3019	0.2505	0.2163	0.1921	0.1740
8.5	1.0850	0.5646	0.3915	0.3053	0.2538	0.2196	0.1954	0.1773
9.0	1.0900	0.5685	0.3951	0.3087	0.2571	0.2229	0.1987	0.1807
9.5	1.0950	0.5723	0.3986	0.3121	0.2604	0.2263	0.2020	0.1840
10.0	1.1000	0.5762	0.4021	0.3155	0.2638	0.2296	0.2054	0.1874
10.5	1.1050	0.5801	0.4057	0.3189	0.2672	0.2330	0.2088	0.1909
11.0	1.1100	0.5839	0.4092	0.3223	0.2706	0.2364	0.2122	0.1943
11.5	1.1150	0.5878	0.4128	0.3258	0.2740	0.2398	0.2157	0.1978
12.0	1.1200	0.5917	0.4163	0.3292	0.2774	0.2432	0.2191	0.2013
12.5	1.1250	0.5956	0.4199	0.3327	0.2809	0.2467	0.2226	0.2048
13.0	1.1300	0.5995	0.4235	0.3362	0.2843	0.2502	0.2261	0.2084
13.5	1.1350	0.6034	0.4271	0.3397	0.2878	0.2536	0.2296	0.2120
14.0	1.1400	0.6073	0.4307	0.3432	0.2913	0.2572	0.2332	0.2156
14.5	1.1450	0.6112	0.4343	0.3467	0.2948	0.2607	0.2368	0.2192
15.0	1.1500	0.6151	0.4380	0.3503	0.2983	0.2642	0.2404	0.2229

Interest Rate	Repayment Period (years) 9	10	11	12	13	14	15	16
7.5	0.1568	0.1457	0.1367	0.1293	0.1231	0.1178	0.1133	0.1094
8.0	0.1601	0.1490	0.1401	0.1327	0.1265	0.1213	0.1168	0.1130
8.5	0.1634	0.1524	0.1435	0.1362	0.1300	0.1248	0.1204	0.1166
9.0	0.1668	0.1558	0.1469	0.1397	0.1336	0.1284	0.1241	0.1203
9.5	0.1702	0.1593	0.1504	0.1432	0.1372	0.1321	0.1277	0.1240
10.0	0.1736	0.1627	0.1540	0.1468	0.1408	0.1357	0.1315	0.1278
10.5	0.1771	0.1663	0.1575	0.1504	0.1444	0.1395	0.1352	0.1316
11.0	0.1806	0.1698	0.1611	0.1540	0.1482	0.1432	0.1391	0.1355
11.5	0.1841	0.1734	0.1648	0.1577	0.1519	0.1470	0.1429	0.1394
12.0	0.1877	0.1770	0.1684	0.1614	0.1557	0.1509	0.1468	0.1434
12.5	0.1913	0.1806	0.1721	0.1652	0.1595	0.1548	0.1508	0.1474
13.0	0.1949	0.1843	0.1758	0.1690	0.1634	0.1587	0.1547	0.1514
13.5	0.1985	0.1880	0.1796	0.1728	0.1672	0.1626	0.1588	0.1555
14.0	0.2022	0.1917	0.1834	0.1767	0.1712	0.1666	0.1628	0.1596
14.5	0.2059	0.1955	0.1872	0.1806	0.1751	0.1706	0.1669	0.1638
15.0	0.2096	0.1993	0.1911	0.1845	0.1791	0.1747	0.1710	0.1679

Total payment for a year are obtained by multiplying the table value by the loan amount. For example, if the loan amount for a four year loan at 10 percent interest is $100,000, the payments for a year are calculated as .3155 times 100,000, which equals $31,550.

OTHER A.R.M.E. EXTENSION BULLETINS

EB No	Title	Author(s)
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