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The Purchase-Versus-Lease Decision Revisited after the 1986 Tax Reform Act

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Firms normally acquire assets either by purchasing or leasing. The choice between purchasing or leasing depends partly on the cost difference between these alternatives—a difference that changes over time.

One reason why asset acquisition costs change is because the tax code changes. Previous research has shown that tax considerations tend to be important in the lease versus purchase decision (Pederson). The most recent major change in federal tax policy was a result of the 1986 Tax Reform Act (TRA). Indeed, the TRA represents the most significant revision of the tax code in three decades. Among other things, the TRA made the investment tax credit (ITC) obsolete and increased the average depreciation time span. Therefore, the TRA has directly increased the costs of purchasing assets, and indirectly, the costs of leasing.

Besides taxes, other factors can also influence the lease versus purchase decision. For example, high interest rates can increase the appeal of leasing, especially for highly leveraged businesses as they seek financial alternatives other than additional debt. The typically lower down payment (if any) and monthly payments associated with leases can also increase the attractiveness of leasing relative to purchasing. The resulting conservation of working capital could be particularly appealing to those businesses faced with cash-flow problems. It could also be appealing to those considering entry or exit. On the other hand, the ownership of an asset may have an intrinsic utility, perceived or real, that is usually subjective and precluded from a leasing arrangement. We do not know whether the potential benefits from subjective attributes such as this ownership-derived utility (the "utility effect") outweigh the more objective cost-related advantages (the "cost effect") of an alternative such as leasing. While I made no attempt to measure this utility effect, I do quantify the cost effect at the firm level. Evaluating costs could serve as a possible first step in the process of determining the relative strengths of the utility and cost effects. This process

could ultimately lead to an enhanced understanding of the preference for one method of acquisition over another.

There is an extensive literature on lease versus purchase decisions. However, most analyses are from before the 1986 TRA took effect. An exception is a study by Serletis. The focus of that study, however, is on comparisons of leasing expenditure by region for the U.S., and leasing cost differences for various farm business sizes. Studies before the 1986 TRA have examined issues such as the impacts of fluctuations in taxable income and interest rates (Pederson), the impact of federal income taxes (Willett and Penland), and the impact of inflation (Hochman and Rabinovitch), on the purchase-versus-lease decision.

The objective of this analysis is to determine the after-tax costs of leasing versus purchasing an asset for an individual business in the post-TRA era. In the process I will evaluate the impacts of the TRA on asset acquisition costs and decisions. I selected an automobile for the illustration, since this is an asset that is used by nearly all agribusinesses.

Analytical Approach

Conceptually, this analysis begins with the determination of whether the acquisition of the asset represents a sound investment from the capital-budgeting perspective. The point of departure for the purchase-versus-lease analysis is that the investment should have a positive net present value. Based on this, a firm makes a decision to acquire the asset. This approach of separating the decision to acquire from the acquisition method (purchase or lease) is consistent with that used by Brigham.

The next stage involves the determination of whether to lease or purchase the asset. The cash-flow approach is used, similar to that employed by Barry (et al.), Bierman and Smidt, Casler (et al.), and Weston and Copeland. The decision criterion is to select the alternative with the lowest tax-adjusted present value of costs.

I compared a lease to a leveraged purchase in the illustration. These alternatives are comparable since the firm must make a series of payments regardless of the alternative chosen and a failure to do so will result in foreclosure. The goal is also the same for both alternatives to the extent that the business gains control of the asset. Leasing or purchasing will affect the length of time an asset is employed. However, a comparison between the two alternatives is valid as long as net cash flows are compared. For automobiles, another element common to both lease and purchase alternatives is the responsibility for maintenance. I should point out that the specific provisions of leases sometimes differ and there are various kinds of leases. In any case, acquiring the asset will present certain operating

costs and generate certain revenues. These will be unaffected by the outcome of the purchase-lease decision. I therefore exclude them from the analysis as long as the timing and magnitude of the cash flows are the same for both alternatives.

Differences in cash flows for the acquisition alternatives arise primarily from differences in the size of the purchase and lease payments and the tax treatment of certain items such as depreciation and salvage value for the purchase option. Other factors I include in the analysis are the marginal income tax rate, the cost of debt and equity capital, and the period involved. I linked these factors in a purchase-versus-lease (P-V-L) model which I used to determine the least cost alternative. The model is presented and discussed in Appendix I.

The P-V-L model is flexible both in terms of assets to evaluate and in permitting adaptation to changes in assumptions. For example, I formulated the model on the premise that, as is often the case, enough equity capital is not available for a cash purchase. I also formulated the model on the premise that the opportunity cost for an alternative investment exceeds the cost of debt on an after-tax basis. However, if this is not the case, the model can easily accommodate a purchase financed solely with equity funds by excluding components such as interest costs and principal repayment. I then compute the present value of costs using the firm's weighted average after-tax cost of capital, where the weights represent the proportion of debt and equity funds used in the business. In situations involving variable-interest loans, for example, I can incorporate probability distributions into the model to reflect the variable cash flows over time. To avoid double-counting for risk, I use a riskless discount rate simultaneously. On the other hand, I cannot use the model to evaluate optimal asset life and replacement decisions. There is controversy over the integration of these types of decisions into purchase-versus-lease analyses. Brigham, among others, maintains that the purchase-versus-lease analysis should be conducted in isolation.

An Illustration

To quantify the after-tax costs of leasing versus purchasing an asset for business use in the post-TRA era, and to compare these costs with pre-TRA costs, I present an example involving the acquisition of an automobile. I use a two-step computational procedure conforming to the P-V-L model developed in Appendix I. The first step pertains to the purchase alternative, and the second one to the lease. I obtained data on purchase prices and lease rental terms from automobile dealers and unpublished secondary sources. To keep this analysis tractable, I performed the calculations on an annual basis and a period of four years.

Table 1 summarizes the results of the automobile lease versus purchase analysis (Tables A-C of Appendix II show detailed calculations of the results in Table 1). Since the estimated present value of costs associated with the leasing alternative, $4,875, are about 11 percent less than those estimated for the purchasing alternative, leasing is the best decision. Leasing however, is not always the least-cost alternative. As illustrated below, a different set of conditions could change the results. Two additional observations are noteworthy from the results in Table 1. First, the (positive) impact of taxes is greater for the purchase alternative, judging from a comparison of before- and after-tax cash flows (the salvage value highlights this difference). Viewed from a different perspective, this example revealed that leasing is superior on a cost basis if expenses are not itemized for tax purposes. The second observation is that the cash outflows for the lease alternative were constant throughout the lease period both on a pre- and an after-tax basis. While this characteristic is probably not enough in and of itself to justify leasing, selecting the lease option could help the financial planning process of a firm.

I conducted a sensitivity analysis to illustrate the impacts of changes in certain conditions such as the interest rate, tax rate and lease payment size on total after-tax purchase and lease costs (Table 2). A decrease in the pre-tax interest rate from 10 percent to 5 percent makes purchasing the least-cost alternative. An increase in the interest rate to 15 percent has the opposite effect, and makes the leasing alternative even more appealing than the base situation. Reducing the tax shield, a decrease in the income tax rate from the top corporate rate of 34 percent to the 25 percent rate,

Table 1.
Summary of Cash Flows Associated With The Automobile Purchase and Lease Alternatives[a]

	Purchase[b]			Lease[c]		
Year	Cash Outflow	Net After Taxes	Present Value of Costs	Cash Outflow	Net After Taxes	Present Value of Costs
0	$2,200	$2,200	$2,200	—	—	—
1	3,656	1,691	1,586	$2,160	$1,426	$1,338
2	3,466	1,285	1,131	2,160	1,426	1,255
3	3,258	1,858	1,534	2,160	1,426	1,177
4	3,028	− 1,288[d]	− 998	2,160	1,426	1,105
TOTALS	$13,304	$5,746	$5,453	$8,640	$5,704	$4,875

[a]10% pre-tax or 6.6% After-tax cost of capital; 34% tax rate; 4 years.
[b]Values obtained from Appendix Table B.
[c]Values obtained from Appendix Table C.
[d]Negative because of salvage value.

Table 2.
Sensitivity of Purchase and Lease Costs to Changes in Interest and Tax Rates, and Lease Payments

Situation	Present Value of After-Tax Costs		
	Purchase	Lease	Difference (Purchase-Lease)
Original (base) situation (10% pre-tax cost of capital; 34% tax rate; etc.)	$5,453	$4,875	$ 578
New Situation[a]			
1. 5% pre-tax cost of capital	4,885	5,263	-378
2. 15% pre-tax cost of capital	5,952	4,530	1,422
3. 25% tax rate	6,044	5,426	618
4. 10% increase in lease payments	5,453	5,361	92
5. 10% decrease in lease payments	5,453	4,386	1,067

[a]With all other factors held constant.

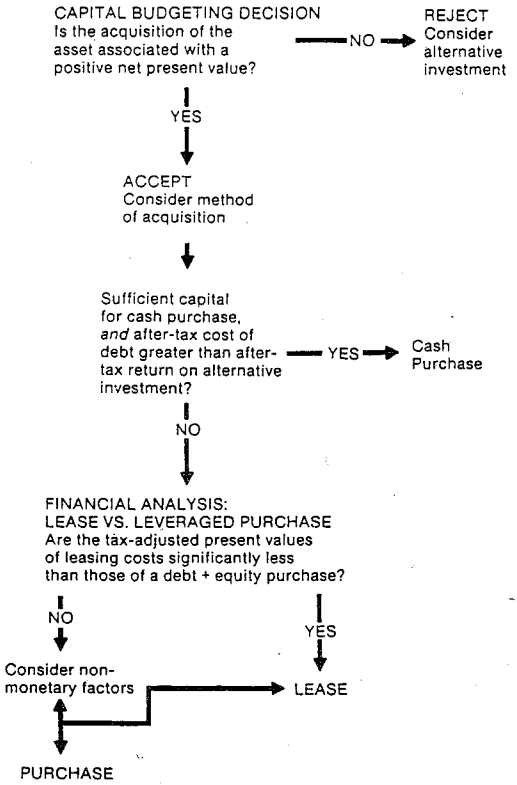
increases the after-tax costs of both alternatives. Leasing however, is still the less expensive alternative. An increase in the size of lease payments, other things equal, will increase the cost of leasing. However, an increase in the size of the lease payment of more than 10 percent is necessary for the after-tax cost of purchasing to equal that of leasing. Thus, either the lease payment size has to increase substantially or the interest rate has to go down significantly (or both) in order for purchasing to become competitive with leasing on an after-tax cost basis.

I can summarize the decision-making approach underlying the purchase-versus-lease analysis with the aid of the flow-chart in Figure 1. While the role of monetary factors (the cost effect) is both obvious and readily quantifiable in the decision-making process, neither is true of the non-monetary factors (the utility effect). However, consideration of non-monetary factors is especially important if the lease-versus-purchase analysis shows only a small difference between after-tax leasing and purchasing costs.

Impacts of the TRA

Under conditions as they existed before the TRA, the total present value of after-tax costs for the purchase alternative amounts to only $5,069. This value is about 7 percent lower than for the base situation which reflected the 1986 tax changes. The cost of purchasing the asset was increased primarily because the TRA; (a) diluted the tax advantage of a leveraged purchase with the lower marginal tax rates, (b) eliminated the ITC, (c) decreased depreciation allowances, and (d) dropped the sales tax as an itemized deduction. The sales tax was replaced by the requirement to capitalize this tax into the cost of all depreciable assets used in business (In-

Figure 1
Decision-Making Framework for the Purchase and Lease Alternatives



ternal Revenue Service). Since changes in the tax code would likely lead to changes in the size of lease payments, it is complicated to compare pre- and post-TRA. Other factors such as inflation and sales promotions further complicate the comparisons in this case. Comparisons would be possible where the differences are offsetting or explicitly accounted for in the set of equations in Appendix I.

The TRA also increased the cost associated with leasing an asset though by a smaller proportion relative to the pre-TRA period (3 percent). Congress dropped the use tax on leases under the TRA, thereby reducing lease payments. However, due to the lowering of most tax brackets, the TRA

provisions more than offset the reduced lease payments. This results in a net increase in total after-tax costs of leasing. Thus, at the firm level, the TRA increases both purchasing and leasing costs, as well as the divergence between pre-and post-TRA acquisition costs.

The ITC and other features of tax policy before the TRA encouraged investment. The TRA however, increases a firm's cost of investment causing firms to reduce their level of investment in the short run. Examined another way, the TRA, by reducing investment subsidies, brings the after-tax cost of investment closer to its actual cost. Thus, Carman (p. 1027) hypothesized "... the major impact of new tax rules will fall heaviest on those firms and individuals which attempted to exploit the ITC, accelerated depreciation, capital gains exclusion, current expending of development expenditures, and cash accounting." Carman further observed that in agriculture such firms could include the larger breeding livestock, cattle feeding, and perennial crop operations. Hanson and Bertelsen, and Lins (et al) arrived at a similar conclusion regarding agricultural investment decisions. At the firm level, an increase in the cost of acquiring assets means the firm must reevaluate its capital-labor substitution decisions in response to the relative cost change.

The alternative minimum tax (AMT) feature of the TRA can also have an impact on the lease versus purchase decision for corporations. Before the TRA, firms could significantly reduce their tax bills by using accelerated depreciation for owned assets when computing taxes, while using straight-line depreciation for accounting purposes. The AMT provisions invoked with the TRA requires firms to recapture most of this differential when computing taxes, diluting the ownership tax advantage. The AMT feature acts as an added incentive to lease by corporations, since operating leases are fully tax-deductible and capital leases are deductible through the imputed interest and depreciation charges.

In spite of the AMT and similar features that potentially reduce the after-tax costs of leasing, the use of leasing has not substantially changed since the TRA took effect. One of the goals of the TRA was to decrease the scope of business activities motivated by the tax code (Tucker and Hutton). This has occurred with business asset acquisition activities. Alternatively, it could be that businesses respond sluggishly to changes in the tax code, perhaps anticipating further changes. In any case, the issue of why leasing has not become the dominant method of asset acquisition in spite of potentially lower after-tax costs is one that is worthy of further research. Researchers could incorporate variables to represent utility and cost or other effects within a LOGIT or some other qualitative choice

framework to determine the relative strengths of the effects. This would also enable prediction of acquisition method.

Conclusions

The focus of this analysis was on determining the cost differential associated with alternative methods of acquiring an asset for business use in the post-TRA era. I also tested the impacts of the TRA on asset acquisition costs and decisions. An example illustrates that under several conditions of interest and tax rates, and size of lease payments, leasing is the least-cost alternative for gaining control of an asset. A sensitivity analysis revealed that, other factors held constant, the lease payment size has to increase substantially or the interest rate has to decrease significantly (or both) before purchasing can become competitive with leasing on an after-tax cost basis. Another finding was that the TRA increases the after-tax cost of both the lease and the purchase alternatives, even though the net increase for the former is less than half that for the latter.

While leasing is not always superior in cost terms, it can have certain non-monetary advantages. On the other hand, ownership may be relatively more expensive and simultaneously involve subjective attributes not manifested in lease agreements. That leasing is not as prolific as its relative monetary advantage would indicate that the non-monetary arguments of individuals' utility functions are potent. Thus, it could be that the utility effect outweighs the cost effect. Alternatively, it may require changes other than changes in the tax code, or more pronounced changes, before the use of leasing becomes widespread. Or, the need to conduct a detailed financial analysis to determine the cost differential is a binding constraint that impinges upon potential lease adoption decisions. In the case of automobiles, dealers aim incentive programs such as rebates and low-interest financing programs at buyers. This may also skew the choice toward purchasing.

It has been noted that the TRA has not eliminated all incentives for investment and sound tax management by businesses. Therefore, consideration of individual preferences and other subjective attributes, while important, should not prevent an analysis to determine the optimal asset acquisition alternative. Such analyses are necessary to be sure that a business maintains a cost-minimizing trajectory that is in harmony with an ever changing tax and economic environment.

Notes

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Appendix I
The Purchase-Versus-Lease Model

(1)

$$PV_p = \sum_{t=0}^{n} PV_{p_t} - [S_{p_n} \cdot PVIF_{t,i(1-T)}]$$

(2)

$$PV_{p_t} = [Q_{p_t} + I_{p_t} - F_{p_t}] \cdot PVIF_{t,i(1-T)}$$

(3)

$$Q_{p_t} + I_{p_t} = L_{p_t} / PVIFA_{i,n}$$

(4)

$$F_{p_t} = [I_{p_t} + D_{p_t}] \cdot [T]$$

(5)

$$I_{p_t} = [R_{p_t}] \cdot [i]$$

(6)

$$O_{p_n} = P_{p_n} - B_{p_n}$$

(7)

$$PV_l = \sum_{t=0}^{n} PV_{l_t}$$

(8)

$$PV_{l_t} = \{[Y_{l_t}][1-T]\} \cdot PVIF_{t,i(1-T)}$$

where:

PV =	present value of after-tax costs
PVIF =	present value interest factor
PVIFA =	present value interest factor for an annuity
Q =	amount of principal repayment
I =	interest paid on debt capital
S =	salvage value
F =	tax shield
T =	federal income-tax rate
D =	depreciation allowance
L =	amount borrowed
R =	balance of principal owed
O =	tax liability
P =	net sale price of asset
B =	remaining depreciable basis
Y =	amount of lease rental payment
p =	purchase alternative
l =	lease alternative
t =	individual time periods, t = 0, 1, 2, . . . , n
n =	length of time period for analysis, and
i =	pre-tax cost of capital.

I used equations (1) to (6) in computing the after-tax cost for the purchase alternative. Equation (1) shows that the total present value of after-tax costs for the purchase alternative equals the sum of the present values after-tax costs for the individual periods (years, months, etc.) used in the analysis less the discounted, tax-adjusted salvage value. Equation (2) shows that the after-tax cost for the individual periods is the present value of the sum of the periodic principal and interest payments, less the tax shield, evaluated at the after-tax cost of capital. Equation (3) shows that dividing the total amount borrowed by the relevant present value of an annuity factor equals the periodic principal and interest payment. Equation (4) is the tax shield for individual periods, determined by multiplying the tax rate by the sume of the interest paid and depreciation allowance for the period. Equation (5) says that the interest paid for a period is equal to the product of the balance

of principal owed at the beginning of that period and the pre-tax interest rate. Equation (6) shows that substracting the remaining depreciable basis from the net sale price of the asset equals the tax liability (for the terminal period of the analysis).

We can interpret Equation (7) like equation (1), except that it pertains to leasing, rather than purchasing, costs. The v alue of n (the time horizon for the analysis) can be different for the lease and purchase alternatives. Regardless of whether n is the same or different, we shold compare the net cash flows for the two alternatives. Equation (8) shows that the after-tax cost for an individual lease period is the present value of the after-tax lease rental payment for the period, evaluated at the after-tax cost of capital.

Appendix II
Calculations for the Automobile Purchase-Versus-Lease Example

The first set of computations pertains to the purchase alternative and involves determining the principal and interest payment schedule if the purchase is leveraged. This was assumed in this case (Table A). These computations involve equations (3) and (5) of the P-V-L model in Appendix I. I used the values in equations (2), (4) and (6), and finally equation (1) of the model. Table B shows the calculations for the individual periods for the purchase alternative.

The next step in the computational process consists of evaluating the present value of costs for the lease alternative. This involves equations (7) and (8) of the model. The calculations for the individual time periods for the lease alternative are shown in Table C.

Table A.
Schedule of Debt Payments for the Automobile Purchase Alternative

End of Year	Balance of Principal Owed	Principal + Interest Payments	Annual Interest 10% × (2)	Reduction of Principal (3) − (4)
(1)	(2)	(3)	(4)	(5)
1	$8,800[a]	$ 2,776[b]	$880	$1,896
2	6,904	2,776	690	2,086
3	4,818	2,776	482	2,294
4	2,524	2,776	252	2,524
TOTALS		$11,104	$2,304	$8,800

[a]Amount financed = Price - Down Payment @ 20%
$8,800 = $11,000 - $2,200

[b]Annual payment $= \frac{\text{Initial amount financed}}{\text{Annuity factor (10\%, 4 years)}}$

$= \frac{\$8,800}{3.1699} = \$2,776$

Note: All values are rounded to the nearest dollar.

Table B.
Discounted Cash-flow Analysis of the Automobile Purchase Alternative[a]

End of year	Principal Interest Payment[b]	Annual[b] Interest	Depreciation[c]	Salvage Value	Tax Shield [(3) + (4)] x.34	Net Annual Cash Outflows After Taxes (2)-(5)-(6)	Present Value Factor (6.6%)	Present Value of Costs (7) × (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0	$2,200	——	——	——	——	$2,200	1.0	$2,200
1	2,776	$880	$2,310	——	$1,085	1,691	.9381	1,586
2	2,776	690	3,696	——	1,491	1,285	.8800	1,131
3	2,776	482	2,218	——	918	1,858	.82561	1,534
4	2,776	252	1,331	$5,000	−936[d]	-1,288	.7746	−9981
TOTALS	$13,304	$2,304	$9,555	$5,000	$2,558	$5,746		$5,453

[a]6.6% After-tax Cost of Capital; 34% Tax Rate; 4 Years.
[b]From Table A.
[c]Depreciation schedule, 5-year property ($11,000 + $550 original depreciable basis):
Year 1: 20% = $2,310
Year 2: 32% = $3,696
Year 3: 19.2% = $2,218
Year 4: 11.52% = $1,331
Sales tax (under the Tax Reform Act of 1986, sales tax "... is added to the basis of the property and treated as part of the property's cost for depreciation purposes").

Under certain conditions, a Section 179 deduction can be claimed in year 1, in which case the depreciation figures would be different. Restrictions on the amount of this deduction apply for certain assets, including automobiles.
[d][($5,000 - ($11,550 - $9,555)) (.34)] - [($252) (.34)] = $936
tax liability—tax shield = tax due
tax liability = net sale price—remaining depreciable basis
remaining depreciable basis = original depreciable basis—total depreciation claimed.

Note: All values are rounded to the nearest dollar.

Table C.
Discounted Cash-flow Analysis of the Automobile Lease Alternative[a]

End of Year	Lease Payments[b]	Annual After-Tax Costs (1-.34) × (2)	Present Value Factor (6.6%)	Present Value of Costs (3) × (4)
(1)	(2)	(3)	(4)	(5)
1	$2,160	$1,426	.9381	$1,338
2	2,160	1,426	.8800	1,255
3	2,160	1,426	.8256	1,177
4	2,160	1,426	.7746	1,105
TOTALS	$8,640	$5,704		$4,875

[a]6.6% After-tax Cost of Capital; 34% Tax Rate; 4 Years.
[b]Payments pertain to a "closed-end" lease, and exclude the "use tax" which was discontinued under the Tax Reform Act of 1986.
Note: All values are rounded to the nearest dollar.