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Lease Financing for Technology-Oriented Firms

By

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The University of British Columbia
Vancouver, B.C., Canada

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TABLE OF CONTENTS

I. INTRODUCTION

The economic growth of Canada will depend critically on the ability of Canadian firms to take advantage of scientific developments and technological advances. To keep in step with these advances, they will experience a crucial need for funds. This will occur at three points in the development of a new idea. First, a firm will need seed money while developing an idea commerically. Later on, the company will expect to expand its facilities, for which more money must be made available. And last, the company will need capital with which to bring their technology to its full potential. Insufficient funds at any stage of this process will inevitably result in reduced business for the firm, and a consequent cooling of the country's economy. Thus, the government may well find itself searching for the means by which to ensure technological progress, while at the same time seeking to minimize costs as much as possible.

The two present sources of funds are equity and debt, both of which, of course, have great importance. There is, however, a third source of funds available: leasing. Here, a company shifts the financial responsibility to the lessor, who buys the equipment and then rents it to the company for a set lease payment. In the United States, this source of funds has reached astronomical proportions. It

is estimated that $40 billion worth of goods are under lease, financing such things as airplanes, machine tools, computers and other electronic equipment.

In Canada, the importance of this method of financing is rapidly becoming known, and every financial manager should thoroughly acquaint himself with the various aspects of leasing. Especially suited for this type of financing are those very companies which most need to take advantage of technological progress, the companies with assets including expensive equipment. To the extent that leasing replaces debt, it conserves a company's borrowing capacity; to the extent that it replaces equity, it reduces the dilution of ownership interest. Clearly, a financial manager, if he is fully aware of the possibilities and rewards of leasing, can be in a position to take considerable advantage of this form of financing. This study is intended to help him do that.

II. LEASING: NATURE AND REASONS FOR USE

Nature

A lease is a contract whereby the lessor (owner) permits the lessee (user) the use of an asset for a period of time in return for the latter's promise to make a series of rental payments over the period of the

lease.[1] By separating use from ownership, the lease enables a company to receive the services of an asset without having to make the large initial lump-sum payment associated with ownership.

A distinction should be made between a financial lease and an operating lease. A financial lease is characterized by a longer term, non-cancellability by the lessee, and full payout during the term of the lease. (Full payout means that the lease payments are sufficiently large enough for the lessor to recover his entire capital investment plus his required rate of return.) An operating lease, on the other hand, is characterized by a shorter term, possible cancellation by the lessee, and less-than-full payout during the term of the lease. The latter feature means that the lessor assumes the risk that, after the initial lease term, the asset may not be resold or re-leased at a price sufficiently high to recover his entire investment plus required return. The operating lease, therefore, is essentially a device whereby a firm may shift the risk of ownership (important especially when an asset is subject to rapid obsolescence) to lessors who specialize in assuming such risks. Financial leases, because they are

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[1]For a useful reference on leasing, see Vincent John McGugan, Competition and Adjustment in the Equipment Leasing Industry (Boston: Federal Reserve Bank of Boston, 1972).

full payout, impose no ownership risks on the lessor. His function in these leases is simply to provide financing; and as financiers, they are exposed only to credit risks. Since our concern here is with finance, we shall confine our focus to financial leases.

For Canadians, it is important to be familiar not only with the general facts of leasing and the particular aspects of leasing in Canada, but also, because many American firms operate in this country via subsidiaries, it is very useful for Canadians to know something about practices in both countries. Fortunately, the basic principles are the same. It is only in tax regulations, to which we will devote a separate section, that there are major differences.

Reasons for Use

The following material is based on interviews with both Canadian and American corporate lessees; not every reason was mentioned by each company, however, the list includes all important reasons mentioned by any of them.

Since a lease is similar to a debt contract in that both involve a series of payments over a period of time, the question "Why lease?" can be meaningfully answered only by comparing it to the nearest alternative, that of purchasing an asset with borrowed funds. At a theoretical

level, the decision to invest in an asset cannot be separated from the decision of how best to finance it. As a practical financial matter, however, financial executives generally make their investment decisions first, and then decide how best to finance them. If we suppose that in this phase of the financing decision a company has decided against equity financing, the choice is between using debt financing or leasing. There are several reasons (singly or in combination) which may prompt a firm to choose leasing over debt financing:

(1) Unavailability of Debt Financing--Intermediate term credit, of which leasing is one kind, is often not available to small or even medium-sized firms in a straight debt form.

(2) 100% Financing--Weaker companies frequently find that with secured loans, lenders require sizable downpayments, so that considerably less than 100% of the equipment's value is advanced. Sometimes these companies may be able to obtain 100% financing through leasing.

(3) Longer Maturity Than Term Loans--Whereas the maturity of a term loan tends to depend on the lender's policy, the maturity of a lease is more likely geared to the useful life of the asset.

(4) Off-the-Balance Sheet Financing--Although a lease imposes a fixed charge on a firm the same way that a debt does, a lease will not appear on the balance sheet unless it is of great size, and then only as a footnote. To the extent that credit analysts pay less attention to footnotes, leasing might enable a firm to increase the size of its total credit pool.

(5) Less Restrictive Convenants--Usually the covenants found in lease agreements are less restrictive than those in term loan agreements.

(6) Internal Decision Process--In some firms the manager of a division has the authority to lease an asset, but if he wants to buy one he must get approval from the corporate management.

(7) Lower Effective Cost of Money--Many firms choose leasing over borrowing because leasing costs less. As we shall see later in this paper, the cost of leasing relative to borrowing depends on such factors as downpayment size, maturity, nominal interest rate, taxes, depreciation, and residual value.

III. THE LEASE AGREEMENT

Financial Aspects

In a typical transaction, the lessee informs the lessor

what equipment he needs, the lessor purchases the equipment from the manufacturer and then leases it to the lessee for a fee. The financial aspects of a lease contract include the amount of financing, the payment schedule, term of the lease, disposition of the equipment at the end of the term, settlement value for casualty occurrences, and allocation of tax benefits.

(1) Amount of Financing--Since the lessee makes no downpayment, the lessor is nominally financing the entire purchase price of the equipment. However, some leases require the lessee to make the first and last rental payments in advance. Such payments reduce the amount of financing below 100% of the price of equipment.

(2) Repayment Schedule--When negotiating a lease, the lessee will find that instead of being quoted a percentage cost of money, he will be given a payment schedule which specifies a dollar amount of rental on each payment date in the lease period. The time pattern of payments can generally be negotiated to meet the lessee's preferences. The lessor of course has a required rate of return (varying with credit risk, money market conditions, size of the transaction, type of equipment, and other factors), and

therefore the level of payments will be set to enable him to realize his required return. Each payment is usually "net" income to the lessor, as generally financial leases are net leases, requiring the lessee to pay all operating expenses, including property taxes, insurance, maintenance, etc.

(3) Term of the Lease--Because lease payments vary inversely with the lease term, the lessee may favor a long maturity. The lessor, on the other hand, might favor a shorter term, to minimize risk exposure. These considerations must be worked out in each agreement.

(4) Disposition of Equipment at End of Term--The lessee is of course the user and not the owner of the equipment. Therefore, a lease agreement specifies where, when and how the equipment is to be returned to the lessor at the expiration of the lease's term. In most lease agreements, however, the lessee has the option to purchase the equipment at fair market value or to renew the lease at fair market rental at the end of the term.

(5) Settlement Value for Casualty Occurrences--Every lease agreement contains a casualty value schedule

which specifies at each point in time the amount--known as the casualty value schedule--which the lessee must compensate the lessor if the equipment has suffered a casualty occurrence. This same schedule may also serve as a basis for negotiating settlement value if the lessee wishes to trade in or abandon the equipment for economic reasons. In this case, since the lessee receives a benefit and the tax implications are less favorable, the lessor usually demands a larger payment as compensation for lease termination.

(6) Investment Tax Credit--In the United States, the leased property may qualify the lessor for the investment tax credit. A special provision in the tax law states that the lessor may elect to pass this credit on to the lessee in lieu of claiming it himself. The lease agreement will specify whether this election will be made.

Lessor's Disclaimer of Warranties

Since the lessor's role is simply that of financier, he disclaims any warranty or representation as to the equipment being leased. If there are any defects in the

equipment, the lessee is empowered to enforce whatever claims or rights the lessor may have as owner against the manufacturer of the equipment, but at the expense of the lessee.

Lessee's Indemnity

The lessee agrees to be liable for all injuries to persons or property resulting from the operation, or transportation or installation of the equipment, and further agrees to indemnify the lessor for any payments he might have made on account of these liabilities.

Default and Remedies

The lease agreement also defines the events which will put the lessee in default of his obligations. These typically include the nonpayment when due of rental payments, unauthorized transfer of possession of equipment, violation of covenants, petition for reorganization, and others. If an event of default occurs, the lessor has the right to terminate the lease and immediately repossess his equipment. Moreover, the lessee shall remain liable to the lessor for any excess of present value of all rentals during the unexpired lease period over the present value of the then fair rental value for the same period.

IV. THE LEASE AMORTIZATION SCHEDULE

With a term loan, the amortization schedule shows how each repayment is divided between principal and interest reduction, and consequently how much of the loan is still outstanding after any given number of payments.[2] With a lease, an analogous amortization schedule can be constructed to show how much of each rental payment is for capital recovery and how much is for imputed return, and consequently how much of the lessor's investment is still outstanding after any given number of rental payments. In the latter case, calculation is complicated by the fact that the lessor's cash inflow includes not only rental payments, but also the tax savings provided by depreciation and the investment tax credit (in the United States), if any. The following example illustrates a systematic procedure for constructing a lease amortization schedule.

The Hagenford Leasing Company agrees to purchase a $1,000 piece of equipment and lease it to the Purple Shoe Company for a period of eight years. The rental schedule calls for eight annual rentals of $161.12 each, payable in yearly installments with the first installment due at the start of the lease (i.e., at the end of year 0). To

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[2]For the construction of loan amortization schedule, see James C. T. Mao, Quantitative Analysis of Financial Decisions (New York: The Macmillan Company, 1969), pp. 190-192.

construct the amortization schedule, we must first determine the imputed yield on the lessor's investment. We shall assume that (this being an example from the United States) the lessor chooses to pass the investment tax credit on to the lessee, he uses a double-declining-balance method of depreciation, the estimated salvage value of the equipment at the end of the lease period is zero, and that the lessor is subject to combined federal and local tax rate of 58%. Table 1 below shows the derivation of the lessor's cash flows associated with this lease. At the end of Year 0 he pays $1,000 for the equipment and receives $161.12 in rental on which he pays taxes of $93.38, so that his net flow is -$932.30. At the end of Year 1, he again receives $161.12 in rental, but he depreciates the equipment $250, so his taxable income is reduced by $88.78, giving him a tax savings of $51.55 and a net cash inflow of $212.67 for the period. The other net flow figures are derived in a similar way. Accelerated depreciation is the reason why the lessor receives the largest cash inflow in Year 1 and then less in each subsequent year.

The cash flows thus derived imply an after-tax return to the lessor of 3.37%. That is, 3.37% is the discount rate that equates the present value of the entire series of cash flows to zero. This implied return is used in the construction of the lease amortization schedule (see

TABLE 1

Lessor's Cash Inflows (+) and Outflows (-)
(in dollars)

End of Year	Rental Payment (1)	Depreci-ation (2)	Income Tax (3)	Capital Outlay (4)	Net Cash Flow (1)+(3)+(4)
0	161.12	0	-93.38	-1000	-932.30
1	161.12	250.00	+51.55	0	212.67
2	161.12	187.50	+15.30	0	176.42
3	161.12	140.63	-11.88	0	149.24
4	161.12	105.47	-32.27	0	128.85
5	161.12	79.10	-47.57	0	113.55
6	161.12	59.33	-59.03	0	102.09
7	161.12	44.49	-67.64	0	93.48
8	161.12	133.48	+77.41	0	77.41

TABLE 2

Lease Amortization Schedule
(in dollars)

End of Year	Net Cash Flow	Imputed Interest	Recovery of Principal	Outstanding Lease Principal
0	-932.30	--	--	932.30
1	212.67	31.41	181.26	751.04
2	176.42	25.28	151.14	599.90
3	149.24	20.20	129.04	470.86
4	128.85	15.85	113.00	357.86
5	113.55	12.04	101.51	256.35
6	102.09	8.63	93.46	162.89
7	93.48	5.48	88.00	74.89
8	77.41	2.52	74.89	0.00

Table 2 below.) Hagenford invested a net of $932.30 in the lease at the start, i.e., at the end of Year 0. It has an inflow of $212.67 at the end of Year 1, and since the imputed yield is 3.37%, $31.41 of this inflow represents interest income and the balance of $181.26 represents recovery of capital (principal). This capital recovery reduces the outstanding lease principal to $751.04. At the end of Year 2, the lessor has an inflow of $176.42 of which $25.28 is interest income and $151.14 is recovery of capital, reducing the outstanding lease principal to $599.90. Proceeding this way, one can show that the net inflows are indeed sufficient for the lessor to recover his initial capital investment of $932.30 and give him an after-tax return of 3.37%.

The outstanding lease principal is related to, but not identical with, the settlement value for casualty occurrence. The difference stems from the fact that if a lessor receives a casualty payment, he must pay income tax on any excess of that payment over the book value of the asset destroyed. For the lessor to recover his capital in full, the casualty payment must exceed the corresponding value of outstanding lease principal by the amount of the income tax. Thus, at the end of Year 1, since accumulated depreciation equals $250, the equipment has a book value of $750. Table 2 shows at this point that

the lessor has an outstanding lease principal of $751.04. For the lessor to recover exactly this amount, he must demand that casualty payment X be such that

$$\underset{\text{(Casualty Payment)}}{X} - \underset{\text{(Income Tax)}}{(X - \$750).58} = \underset{\text{(Outstanding lease principal)}}{\$751.04}$$

Solving this equation, we find that X equals $913.59. In a similar way, we can show that the corresponding casualty values for periods 2 through 8 to be $812.66, $699,61, $576.22... and so on, down to $0.00.

V. THE EFFECTIVE COST OF MONEY TO THE LESSEE

Ignoring casualty, the lessee is legally obligated to make rental payments for the full term of the lease. Given the lease payment schedule, how does the lessee compute a cost of capital figure comparable to the rate of interest in straight debt financing? One could use the internal rate of return formula to find the discount rate that equates the present value of the entire series of rental payments to the cost of the equipment. Thus, the Purple Shoes equipment lease is seen to carry a nominal rate of 8%:

$$\$1,000 = \frac{\$161.12}{(1+.08)^0} + \frac{\$161.12}{(1+.08)^1} \cdots + \frac{\$161.12}{(1+.08)^7}$$

This discount rate, known as the "nominal" rate of a lease, ignores the income tax effects. Since a rental

payment is deductible in toto, a dollar of rental payment for a firm in the 50% bracket costs only 50¢ in cash outflow. In most cases, therefore, a firm pays less in total after-tax rentals than the net financing it obtains under the lease. Does this not mean that the effective cost of leasing is therefore negative? No, because if the equipment could be purchased, a firm obtains the deductibility of lease payments only at the expense of depreciation, which it could have charged if it owned the equipment. The effective cost of leasing is not negative but positive when the trade off between these two tax deductions is taken into account. In deriving the cash flows for making the lease vs. borrow decision, this trade off can be accounted for in one of two ways:

(1) For each financing alternative, calculate the net cash flow deducting the tax savings associated with the alternative;

(2) Calculate the differential tax impact by subtracting the tax savings of one alternative from those of the other, and then adjust the cash flow of either alternative for the tax differential.

The first, simpler, procedure will be followed in the next two sections of the paper where we take up the lease-or-borrow decision.

VI. THE LEASE-OR-BORROW DECISION

Analytical Framework

The relative cost of leasing and borrowing must take into account the differential impact these two financing methods have on a firm's tax position.[3] If the equipment has a positive salvage value at the end of the lease, that value too must be taken into account. If a firm chooses to lease, its lease payment in each period is a deductible expense, while the lessor, as owner, is entitled to depreciation and (in the United States) to the investment tax credit, unless he chooses to pass the credit on to the lessee. The lessor is also entitled to any salvage value at the expiration of the lease. If a firm chooses to borrow enough capital to purchase a piece of equipment, the interest expense in each period is deductible, and moreover, as owner the firm is entitled to depreciation and salvage value. In that case, the lender has nothing to deduct except his operating expenses. A firm needing equipment must balance the two alternatives and come to a decision based on its own particular circumstances.

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[3]For alternative approaches to the lease-or-borrow decision, see Myron J. Gordon, "A general Solution to the Buy or Lease Decision: A Pedagogical Note," Journal of Finance, 29 (March, 1974), 245-250; Robert W. Johnson and Wilbur G. Lewellen, "Analysis of the Lease-Or-Buy Decision," Journal of Finance,27 (September, 1972), 815-823.

The Purple Shoe Company[4]

For illustration, let us look at an equipment lease from the point of view of the lessee, the Purple Shoe Company. A $1,000 piece of equipment is leased by the firm for a period of eight years at an annual rental payment of $161.12. To compare the cost of this lease with the cost of borrowing the money to buy the equipment, we assume that the company can borrow the necessary funds at an interest rate of 8 percent. Since the lease carries a nominal rate of 8 percent as well, the lender is assumed to quote the same rate to remain competitive. It should also be kept in mind that the first lease payment is due and payable at once at the start of the lease. This advance payment in effect reduces the extent of lease financing to 83.89% of the equipment cost. To make borrowing comparable, we shall assume the lender requires a downpayment of 16.11%, making the loan also equal to 83.89% of the equipment cost. Moreover, this loan is to be repaid in seven annual installments, the first payment due and payable at the end of Year 1. Since the loan interest rate is the same as the nominal lease rate, the annual loan amortization must be the same as the annual lease payment,

[4]This and the following examples are based on actual case studies; the company names and financial data have been altered.

$161.12. Depreciation is calculated using the double-declining-balance over the eight year period, and salvage value is zero at the end of Year 8. As well, Purple Shoes is subject to an income tax rate of 50%. (For a graphic summary of the cash flows under the two financing alternatives, see Figure 1.)

Since the choice between leasing and borrowing involves mutually exclusive alternatives, the decision must take into account the rate at which any cash savings can be reinvested. We shall set this rate at 4%, the firm's after-tax borrowing rate, because whichever financing alternative is chosen, the possible savings are virtually certain so that only a minimum rate of return is needed to justify the choice. Moreover, we shall evaluate the alternatives in terms of the future value of their net cash flows. The lease-or-borrow decision will not affect the rate at which the market capitalizes the firm's earnings and hence a larger future value implies a larger present value. By using future value criterion, we avoid the NPV formula, which assumes equality between the market capitalization rate and the firm's reinvestment rate. This latter assumption may not always hold.

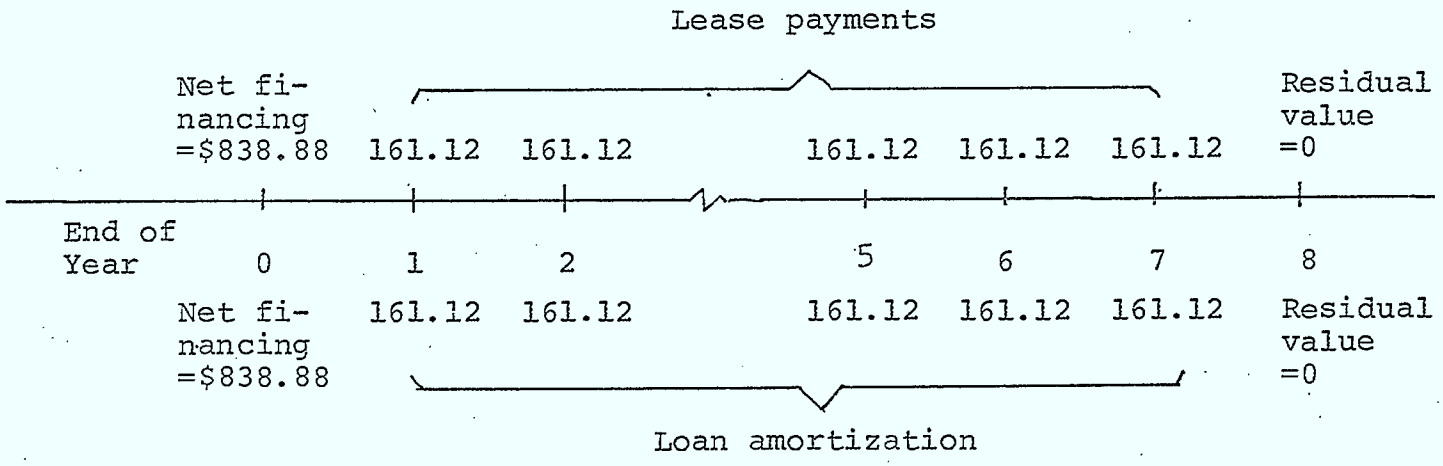
To determine the effective cost of leasing, we start with the lease payment schedule (see Part A of Table 3).

FIGURE 1

Purple Shoe Company: Net Financing and Annual Payments: Lease vs. Borrowing

(in dollars)

Leasing



Borrowing

From this, we subtract the tax savings arising from the deductibility of the lease payments, and the result is net cash flow. Compounding these cash flows at 4%, we ge- a total cost of $581.16 (in future value). To determine the effective cost of borrowing, we start with the loan payment schedule (see Part B of Table 3). From this we subtract the tax savings arising from the deductibility of interest and depreciation, resulting in the net cash flow. Compounding these cash flows at 4%, we get a future value cost of $551.29. Leasing, therefore, is more expensive than borrowing by $29.87 (in future value).

This example illustrates the following: For a profitable firm, if leasing and borrowing provide the same amount of net financing and if the periodic lease and loan payments are approximately the same size, then leasing will likely cost the firm more than borrowing. The reason for this is that in choosing leasing over borrowing, the company will be trading off the tax benefits of interest and accelerated depreciation for rental payments, and the former generally provide the greater tax shield. Therefore, if a profitable firm chooses to lease, it usually must be for one or more of the reasons mentioned earlier in this paper.

If in the above example, however, the equipment is estimated to have a positive residual value, this will

TABLE 3

A. Cost of Leasing*

(in dollars)

End of Year	Lease Payment	Tax Saving	Net Cash Flow (NCF)	Future Value of NCF at 4%
1	161.12	80.56	80.56	106.01
2	161.12	80.56	80.56	101.93
3	161.12	80.56	80.56	98.01
4	161.12	80.56	80.56	94.24
5	161.12	80.56	80.56	90.62
6	161.12	80.56	80.56	87.13
7	161.12	80.56	80.56	83.78
8	--	80.56	-80.56	-80.56
			Total Future Value	581.16

B. Cost of Borrowing*

(in dollars)

End of Year	Loan Payment	Interest Expense	Depre-ciation	Tax Saving	Net Cash Flow (NCF)	Future Value of NCF at 4%
1	161.12	67.11	250.00	158.55	2.57	3.38
2	161.12	59.58	187.50	123.54	37.58	47.55
3	161.12	51.46	140.63	96.04	65.08	79.18
4	161.12	42.69	105.47	74.08	87.04	101.82
5	161.12	33.21	79.10	56.15	104.97	118.08
6	161.12	22.98	59.33	41.15	119.97	129.76
7	161.12	11.93	44.39	28.21	132.91	138.23
8	--	--	133.48	133.48	-66.74	-66.71
					Total Future Value	551.29

*Calculated using the computer program A-1 in the Appendix.

alter the relative costs of leasing and borrowing. Since the firm forsakes this residual value under leasing, but not under borrowing, this loss should be treated as a cash outflow associated with leasing at the lease expiration date. Unlike rental payments, this loss is not tax deductible, so residual value represents net outflow dollar for dollar. Alternatively, we could treat the residual value as a net cash inflow associated with borrowing, but not both adjustments because then we would be double counting the residual value. There are still other ramifications. The prospect of residual value may prompt the lessor to be satisfied with a lower rental schedule. Moreover, under borrowing, if a firm realizes a residual value in excess of the equipment's tax basis, the excess is taxable as ordinary income. Finally, our analysis calculates future value using a low compounding rate because we view any cost differential between leasing and borrowing as virtually certain. But residual value is a figure that can be forecast only with uncertainty. To remove this uncertainty we suggest that the firm's certainty equivalent of the residual value be used in the analysis.

The Vintage Railroad Company

The additional factor in leasing in the United States

of the 7% investment tax credit is illustrated in the following example. This example is of significance to Canadian businessmen because the measure is now being seriously considered in this country.

In our example, Hagenford Leasing Company elected to pass the investment tax credit to the Purple Shoe Company, the lessee, because the latter had sufficient taxable income to benefit from the tax credit. If, however, the lessee is operating at a loss and has no need for the credit, than the lessor should retain the credit for itself, and pass on the benefit in other way. As an example, suppose the Channing National Bank agrees to purchase a $1,000 locomotive and lease it to the Vintage Railroad Company. Because Vintage is operating at a loss, the bank will retain the $70 of investment tax credit, and agrees to return about 60% of the benefit to the railroad by reducing the entire rental schedule from $161.12 annually to $154 annually. The one advance rental payment means in effect that the lease now finances 84.60% of the equipment cost. To make borrowing comparable, we assume an 8% loan of like amount, $846, to be fully amortized in seven annual installments of $162.49 each.

The costs of leasing and borrowing must be calculated using the new payment schedules. Since Vintage Railroad Company has no profits, there is no tax shield associated

with either lease payments or interest and depreciation. The lease payments and the loan payments are respectively the net cash flows. As Table 4 shows, the future-value cost of leasing is now $1264.99, and that for borrowing is $1334.73. Borrowing, therefore, is now more expensive than leasing by $69.74 (in future value).

This example shows that leasing, among other things, is a vehicle that enables unprofitable firms to sell their depreciation and, in the United States, the investment tax credit, to profitable firms that can benefit from such tax shields. If, as a part of the transaction, the unprofitable firm can pay for its equipment with rental payments smaller in size than loan repayments would be if it borrowed the money, then leasing is clearly the appropriate alternative in this particular circumstance.

Spartan Airlines Company

Vintage's locomotive lease is an example of a tax-sheltered lease in that tax savings play a key role in making the lease a viable financing device. Some lessors have tried to reduce the cost of leasing even more by utilizing financial leverage in the structuring of such leases. There are two benefits from this: 1) per dollar of investment, the lessor receives more tax shelter; 2) to the extent that the cost of borrowing is lower than

TABLE 4

The Vintage Railroad Company

Leasing vs. Borrowing

End of Year	Lease Payment (1)	Future Value of (1) at 4%	Loan Payment (2)	Future Value of (2) at 4%
1	$ 154	$ 202.65	$ 162.49	$ 213.83
2	154	194.86	162.49	205.60
3	154	187.36	162.49	197.69
4	154	180.16	162.49	190.09
5	154	173.23	162.49	182.78
6	154	166.57	162.49	175.75
7	154	160.16	162.49	168.99
	Total	$1,264.99	Total	$1,334.73

the return from the lease, the return on the lessor's equity is accordingly magnified. The resulting higher return enables the lessor to reduce lease payments even more, so that both lessee and lessor share in the benefits.

The following examples shows how tax-sheltered leases are leveraged in actual practice. Spartan Airlines wishes to lease two jumbo jet aircraft costing $46 million. A bank or group of banks makes an equity investment in the aircraft equal to 25% of the cost, and a public or private placement in the form of loan certificates is made for the other 75%. In return for their 25% investment, the banks receive, in addition to the lease payments, the investment

tax credit (if any), the right to depreciate the aircraft (both of which are based on 100% of the aircraft's cost, or $46 million), and the residual value of the planes at the end of the 16 year lease period. The loan certificate which make up the remaining 75% of the cost ($34.5 million), may be further divided into senior and junior certificates. Then, in case of default, the bank as lessor is subordinated to both classes of certificate holders, but are not liable for any amount beyond their initial equity investment. The rentals payable are sufficient to amortize the loan certificates over the 16 year term of the lease and to provide a satisfactory return on the equity investment.

VII. THE RATE OF RETURN TO LESSOR

The above example brings up a rather complex problem about which any prospective lessee should be familiar. This is how the lessor calculates his rate of return, in order to determine whether or not to make the lease. If the lessee also knows this, he should be able to bargain that much more effectively. This problem becomes particularly complicated when, as in the above example, a leveraged lease is used. In this section we shall give a method for calculating the lessor's return on a leveraged lease, with a sample computer program included in the appendix.

As we have seen, a bank may try to increase the return on investment in a lease by introducing financial leverage directly into it. It thereby benefits not only from the leverage but also receives a larger tax shelter per dollar of investment. From the bank's point of view, such leases result in cash inflows during the early years, and outflows during the later years. The presence of outflows during the later part of the lease's life means that the return to the lessor is not independent of the lessor's cost of capital, but, rather, related to it.

A Hypothetical Leveraged Lease

A somewhat simpler example than the Spartan Airlines one given above would be that of a bank helping an airline finance the purchase of a $1 million aircraft via a lease. (See Table 5). The lease period is 15 years, the nominal rate if 8%, giving an annual rental income of $116,829.62. The lessor calculates depreciation using sum-of-the-years-digits methods, and allows a salvage value of 5%. Of the total cost, the lessor puts up 20% and borrows the remaining 80% from several insurance companies. The repayment of the loan is figured on a payment plan of 15 years, with five years principal deferment and then level payments over the next ten years, with interest of 9% annually. The lessor is subject to a marginal tax rate of 50%.

TABLE 5

A Hypothetical Leveraged Lease

Asset:	Executive Aircraft
Cost:	$1,000,000
Lease Period:	15 years
Lessee Service Fee:	8%
Annual Rental Payments:	$116,829.62
Depreciation:	Sum-of-the-years-digits, 15 years, 5% salvage value
Lessor Tax Rate:	50%
Total Lender Participation:	80%
Lender Interest Rate:	9%
Principal Offset:	5 years

Based on the above, the lessor is able to generate the cash flows shown in Table 6. Inflows in the early years result from significant tax savings due to large depreciation and from heavier interest payments; whereas in later years, smaller depreciation and interest payments produce smaller tax savings and a diminishing cash flows. The inflows in later years will also be augmented by principal repayments.

Mixed vs. Pure Investments

Table 6 shows that the lessor first experiences an outflow in Year 0, then inflows from Years 1 through 7, and then finally outflows again for the last 8 years. A "mixed project" is one involving both an investment and a borrowing transaction, so this lease falls under that definition, due to the presence of outflows in the last 8 years.[5]

The classic example of a mixed project is that of the oil pump, made famous by Lorie and Savage.[6] This example

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[5]For the distinction between mixed and pure investments, see Daniel Teichroew, Alexander A. Robichek, and Michael Montabalno, "Mathematical Analysis of Rates of Return Under Certainty", Management Science 11 (January, 1965), pp. 395-403.

[6]J. H. Lorie and J. L. Savage, "Three Problems in Rationing Capital," Journal of Business 28 (October, 1955), pp. 229-239.

TABLE 6

Cash Flows Confronting the Lessor

Year	Cash Flow	Year	Cash Flow
0	-$200,000.00	9	-10,301.58
1	81,789.81	10	-17,328.53
2	77,831.44	11	-24,631.62
3	73,873.06	12	-32,235.86
4	69,914.75	13	-40,168.19
5	65,956.44	14	-48,458.15
6	9,341.10	15	- 7,121.13
7	3,013.16		
8	- 3,527.95		

had the following cash flows:

Cash Flow:	-$1,600	+$10,000	-$10,000
Year	0	1	2

In Year 2 the outflow was $10,000. Consequently, a portion of Year 1's inflow must be set aside in anticipation. The amount to be set aside will depend on the cost of money. If the cost of capital is k, then $\frac{\$10,000}{1 + k}$ is the amount which must be set aside, and the net return at the end of Year 1 is therefore only $10,000 minus this amount. Reasoning in this way, we can compute the rate of return

on the investment using the following equation:

$$\$1{,}600\ (1 + r) = \$10{,}000 - \frac{\$10{,}000}{1 + k} \qquad (1)$$

As we can see, in the above equation the rate of return, r, is a function of the cost of capital, k. Thus, as the cost of capital increases, the rate of return also increases.

But the simple calculation outlined above works only for projects involving two time periods. For more general application we need an algorithm which is applicable to investments involving more time periods. The algorithm embodied in the computer program is the following:

First, the project must be analyzed, to determine whether it is a pure investment, or a mixed investment, since the latter involves both an investment and a financing transaction.

When the project is a pure investment, the program calculates the unique internal rate of return r*, by finding that discount rate which makes the future value of the project equal to 0:

$$\text{Future value} = a_0(1+r^*)^n + a_1(1+r^*)^{n-1} + \ldots + a_n(1+r^*)^0 = 0 \qquad (2)$$

where the a's are the cash flows, and n is the project life.

When the project is mixed, the program calculates for each assumed cost of capital k, the corresponding rate of return r, also by setting the future value equal to 0.

While these calculations are similar, there is an important difference. In a pure investment, which remains an investment throughout its lifetime, it is possible to use r* as the compounding rate throughout. (See Equation (2) above.) But, in a mixed investment, by definition an investment only part of the time and a financing transaction the remainder of the time, it is necessary to use the cost of capital k when the project is a financing transaction, and the rate of return r when it is an investment.

Thus, the functional relationship between r and k is given by the equation:

$$\text{Future value} = a_0(1+\rho)^n + a_1(1+\rho)^{n-1} + \ldots + a_n(1+\rho)^0 = 0 \qquad (3)$$

where ρ equals k during periods when the project is a financing transaction and ρ equals r when it is an investment. So, the equation defines for each value of k the corresponding value for r, which satisfies the equation. This is how the program calculates the functional relationship between r and k.

VIII. TAX REGULATIONS

We will conclude this paper with a brief discussion of the tax regulations in Canada and the United States and

how they affect leasing practices in either country. Our primary concern is the methods used in both countries to determine whether a lease is in fact a lease, and not just a device for concealing a purchase or loan agreement.

Lease as a Tax-Avoidance Device

A simple example will illustrate how the financial lease had been used as a device for avoiding the federal income tax. The XYZ Inc. has decided to acquire the services of a $10,000 electric lathe. If the firm purchases the lathe outright, it will be allowed a capital consumption allowance of, say, $2,500 per year for four years. As an alternative to ownership, the firm may choose to lease the lathe. Suppose the lease agreement calls for annual rentals of $7,500 for 2 years and an option which permits the XYZ Company, the lessee, to purchase the lathe from the lessor for a nominal fee of say, $1. This lease agreement, if valid for tax purposes, would have permitted the XYZ Company, in effect, to deduct depreciation at a pace faster than permitted by tax law and in an amount exceeding the full purchase price of the equipment.

The preceeding transaction assumes that the XYZ Company does not now own the lathe, and is purchasing it for the first time. However, even if the company already owns the lathe, it can accomplish the same financial result

by selling the lathe to an investor and leasing it back. Such a transaction is called a sale-leaseback as distinguished from a straight lease.

To close the above tax loopholes, both Canada and the United States have specific procedures for distinguishing between a true lease and a lease designed for the purpose of concealing a purchase and loan agreement.

Canadian vs. U.S. Regulations[7]

Logic. The Canadian procedure for determing the true nature of lease agreement is spelled out explicitly by the Department of National Revenue, Taxation, in its Interpretation Bulletin IT-17, dated July 5, 1971. In the case of lease-option agreements:

> The Departments' principal interest is to see that significant sums paid for the purchase of property are not being charged against income as rent . . .

and in the case of sale-leaseback agreements:

> The Departments' principal interest in these cases is to see that repayments of borrowed money of a significant amount are not being charged against income as rent.

On the other hand, American tax authorities have not explained the logic behind their guidelines for determining

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[7]This section benefited from John Metke and Craig Emby, "A Comparison of Canadian and American Tax Laws and Their Effect on the Lease vs. Borrow Decision," December 3, 1974.

the true nature of a lease. But because their guidelines are similar to those in Canada, their motives must also be similar to those stated by their Canadian counterparts.

Procedures. In the United States, a lease qualifying as a true lease must pass a series of explicit tests. The failure of any one of these tests automatically disqualifies the lease agreement for tax purposes. In Canada, the tax authorities describe two extreme cases where one agreement is clearly a lease and other clearly a loan. For the intermediate cases, the Canadians employ a series of rules and regulations similar to those in the United States. There is, however, one difference: In Canada, failure of any one test does not automatically disqualify a lease agreement; it merely indicates a possible disqualification calling for departmental interpretation.

Turning now to a comparison of Canadian and U.S. regulations governing the tax status of lease agreements, we note that in both countries an agreement is not a lease if (based on the Department of National Revenue Bulletin IT-17 and U.S. Department of the Treasury "Publication 544: Sales and Other Disposition of Assets," 1974 edition):

(1) Some portion of the periodic rental payments is specifically designated as interest or readily recognizable as the equivalent of interest.

(2) The lessee may acquire the property during or at the expiration of the lease at a price substantially less than the fair market value. That is, the lease payments have in effect been purchase payments.

(3) The agreed lease payments materially exceed the current fair rental value. This may indicate that the payments include an element other than rent for the use of the property. Such payments may be a loan repayment.

(4) The title is transferred to the lessee when a stated amount of payments have been made. In this case, the agreement is in substance a sale.

In addition, there are three Canadian tests which the U.S. Department of Treasury does not mention. These are:

(1) Whether or not the property was acquired by the lessor to meet the special needs of the lessee, and will probably be usable for that purpose by the lessee only.

(2) Whether or not the term of the lease corresponds substantially to the estimated useful life of

the property, with the lessee obligated to pay such costs as taxes, insurance and maintenance, which are usually considered part of ownership.

(3) Whether or not the lessee has guaranteed the obligations of the lessor with respect to the property leased.

Because of these additional tests, bona fide leases in the U.S. may not qualify as true leases in Canada. The extent to which these tests restrict leasing in Canada is difficult to assess, since their effect depend on the force with which these tests are applied by the tax authorities.

APPENDIX: COMPUTER PROGRAMS

```
C
C     LEASING VERSUS BORROWING
C     (THIS PROGRAM ALSO GENERATES THE CASH FLOWS TO LESSOR AND
C     A LEASE AMORTIZATION SCHEDULE AS A PART OF ITS OUTPUT.)
C
C     N           LEASE PERIOD
C     CAPOUT      EQUIPMENT COST
C     R           NOMINAL LEASE RATE
C     T           LESSOR'S TAX RATE
C     T2          LESSEE'S TAX RATE
C     ITC         INVESTMENT TAX CREDIT
C     A           ANNUAL LEASE PAYMENT (FIRST PAYMENT AT TIME 0)
C     RENTIN      ANNUAL RENTAL RECEIPT
C     DEP         DEPRECIATION
C     TAX         INCOME TAX PAYMENTS OR SAVINGS
C     OUTLAY      EQUIPMENT COST
C     FLOW        CASH FLOWS TO LESSOR
C     RR          AFTER-TAX YIELD TO LESSOR
C     BTYTL       BEFORE-TAX YIELD TO LESSOR
C     SUMDEP      ACCUMULATED DEPRECIATION
C     OUTBAL      OUTSTANDING LEASE BALANCE
C     PUTINT      IMPUTED INTEREST IN LEASE AMORTIZATION
C     REC         RECOVERY OF PRINCIPAL IN LEASE AMORTIZATION
C     INT         INTEREST IN LOAN AMORTIZATION
C     PRM         PRINCIPAL REPAYMENT IN LOAN AMORTIZATION
C     TS          TAX SAVINGS TO LESSEE UNDER LEASING ALTERNATIVE
C     TS2         TAX SAVINGS TO OWNER UNDER BORROWING ALTERNATIVE
C     CF          NET CASH OUTFLOWS OF LESSEE (LEASING ALTERNATIVE)
C     FV          FUTURE VALUE OF CF
C     LOAN        LOAN UNDER BORROWING ALTERNATIVE (= CAPOUT - A)
C     B           ANNUAL PAYMENT ON LOAN
C     L           OUTSTANDING LOAN BALANCE
C     FLOW2       NET CASH OUTFLOWS OF OWNER (BORROWING ALTERNATIVE)
C     FV2         FUTURE VALUE OF FLOW2
C     SUM         TOTAL FUTURE VALUE
C
      DIMENSION RENTIN(100),DEP(100),TAX(100),OUTLAY(100),FLOW(100)
      DIMENSION PUTINT(100),REC(100),OUTBAL(100),CASBAL(100)
      DIMENSION INT(100),PRM(100),L(100),TS2(100),FLOW2(100)
      DIMENSION FV2(100)
      REAL ITC,INT,K,L,LOAN
      READ(5,100)N,CAPOUT,R,T,ITC,K,T2
  100 FORMAT(I10,6F10.2)
      NN=N-1
      SUM=0.0
      DO 10 I=1,NN
   10 SUM=SUM+1.0/((1.+R)**I)
      A=CAPOUT/(1.+SUM)
      XN =N
      N1=N+1
      RENTIN(N1)=0.0
      DEP(1)=0.0
      DEP(2)=CAPOUT*2./XN
      SUMDEP=0.0
      TAX(1)=ITC*CAPOUT-A*T
      OUTLAY(1)=-CAPOUT
      DO 20 I=1,N1
      IF(I.NE.N1)RENTIN(I)=A
      IF(I.GT.2.AND.I.NE.N1)DEP(I)=(1.-2./XN)*DEP(I-1)
      IF(I.NE.N1)SUMDEP=SUMDEP+DEP(I)
      IF(I.EQ.N1)DEP(I)=CAPOUT-SUMDEP
```

```
      IF(I.NE.1)TAX(I)=(DEP(I)-RENTIN(I))*T
      IF(I.NE.1)OUTLAY(I)=0.0
   20 FLOW(I) = RENTIN(I) + TAX(I) + OUTLAY(I)
      WRITE(6,200)
  200 FORMAT(//,' END OF YEAR',2X,'RENTAL INCOME',2X,'DEPRECIATION',2X,
     1'INCOME TAX',2X,'CAPITAL OUTLAY',2X,'NET FLOW',//)
      DO 30 I=1,N1
      J=I-1
   30 WRITE(6,300)J,RENTIN(I),DEP(I),TAX(I),OUTLAY(I),FLOW(I)
  300 FORMAT(4X,I4,6X,F10.2,6X,F10.2,3X,F10.2,4X,F10.2,4X,F10.2)
      CALL IRR(FLOW,N,RR)
      BTYTL=RR/(1.-T)
      WRITE(6,400)RR,BTYTL
  400 FORMAT(//,' YIELD TO LESSOR AFTER TAX = ',F8.5,//,' BEFORE TAX YIE
     1LD TO LESSOR = ',F8.5,//)
      OUTBAL(1)=-FLOW(1)
      SUMDEP=0.0
      DO 40 I=2,N1
      SUMDEP=SUMDEP+DEP(I)
      PUTINT(I)=RR*OUTBAL(I-1)
      REC(I)=FLOW(I)-PUTINT(I)
   40 OUTBAL(I)=OUTBAL(I-1)-REC(I)
      WRITE(6,500)
  500 FORMAT(//,' END OF YEAR',3X,'NET FLOW',3X,'IMPUTED INTEREST',2X,'R
     1ECOVERY OF PRINCIPAL',2X,'OUTSTANDING BALANCE')
      J=0
      WRITE(6,600)J,FLOW(1),OUTBAL(1)
      DO 50 I=2,N1
      J=I-1
   50 WRITE(6,700)J,FLOW(I),PUTINT(I),REC(I),OUTBAL(I)
  600 FORMAT(4X,I4,4X,F10.2,47X,F10.2)
  700 FORMAT(4X,I4,4X,F10.2,5X,F10.2,10X,F10.2,12X,F10.2)
      SUM=0.0
      WRITE(6,900)
  900 FORMAT(////,' END OF YEAR',2X,'LEASE PAYMENT',2X,'TAX SAVINGS',2X,
     1'NET CASH FLOW',2X,'FUTURE VALUE')
      DO 60 I=1,N
      J=I-1
      TS=A*T2
      CF=A-TS
      FV=CF*((1.+(1.-T2)*K)**(N-I+1))
      SUM=SUM+FV
   60 WRITE(6,800)J,A,TS,CF,FV
  800 FORMAT(4X,I4,6X,F10.2,5X,F10.2,1X,F10.2,5X,F10.2)
      WRITE(6,1000)SUM
 1000 FORMAT(//' TOTAL FUTURE VALUE = ',F10.2,//////////)
      SUM=0.0
      DO 70 I=1,NN
   70 SUM=SUM + 1./((1.+K)**I)
      LOAN=CAPOUT-A
      B=LOAN/SUM
      INT(1)=0.0
      INT(2)=K*LOAN
      INT(N1)=0.0
      PRN(2)=B-INT(2)
      L(2)=LOAN-PRN(2)
      DO 80 I=3,N
      INT(I)=L(I-1)*K
      PRN(I)=B-INT(I)
   80 L(I)=L(I-1)-PRN(I)
      TS2(1)=ITC*CAPOUT
```

```
      DO 90 I=2,N1
   90 TS2(I)=(INT(I)+DEP(I))*T2
      FLOW2(1)=A - TS2(1)
      DO 110 I=2,N
  110 FLOW2(I)=B-TS2(I)
      FLOW2(N1)=-TS2(N1)
      SUM=0.0
      DO 120 I=1,N1
      FV2(I)=FLOW2(I)*((1.+K*(1.-T2))**(N-I+1))
  120 SUM=SUM+FV2(I)
      WRITE(6,1100)
 1100  FORMAT(///,' END OF YEAR',2X,'DOWN PAYMENT',2X,'LOAN REPAYMENT',
     12X,' INTEREST',2X,'DEPRECIATION',2X,'TAX SAVINGS',2X,'NET CASH FLO
     2W',2X,'FUTURE VALUE',//)
      XB=B
      XA=A
      DO 130 I=1,N1
      IF(I.EQ.1.OR.I.EQ.N1)XB=0.0
      IF(I.GT.1)XA=0.0
      J=I-1
      WRITE(6,1200)J,XA,XB,INT(I),DEP(I),TS2(I),FLOW2(I),FV2(I)
  130 XB=B
 1200 FORMAT(4X,I4,7X,F10.2,2X,F10.2,1X,F10.2,3X,F10.2,3X,F10.2,3X,F10.2
     1,3X,F10.2)
      WRITE(6,1300)SUM
 1300 FORMAT(//,' TOTAL FUTURE VALUE= ',F10.2,//)
      STOP
      END
      SUBROUTINE IRR(A,N,R)
      DIMENSION A(1)
      LOGICAL L
      N1=N+1
      XINC=.2
      L=.FALSE.
   70 FORMAT(6X,F12.3/)
      R=-XINC
  105 CONTINUE
  110 CONTINUE
      R=R+XINC
  115 SN=A(N1)
      Z=1.0
      DO 120 I=2,N1
      J=N1-I+1
      Z=Z*(1.+R)
  120 SN=SN+A(J)*Z
      IF (SN.LE.0.0) GO TO 150
      IF (.NOT.L) GO TO 250
      TEMP=ABS(R+XINC)
      IF(TEMP.EQ.0.0)GO TO 300
      TEM=XINC/(ABS(R+XINC))
      IF (TEM.LT..002) GO TO 150
  300 CONTINUE
      XINC=XINC/2.
      GO TO 250
  150 IF (SN.GE.0.0) GO TO 220
      IF (R.LE.0.0) GO TO 200
      XINC=XINC/2.
  200 R=R-XINC
      L=.TRUE.
      GO TO 115
```

```
  220 CONTINUE
      GO TO 1000
  250 CONTINUE
      TEMP=ABS(R+XINC)
      IF(TEMP.EQ.0.0)GO TO 110
      TE4=XINC/(ABS(R+XINC))
      IF (TE4.GE..002) GO TO 110
 1000 RETURN
      END
```

```
C     RATE-OF-RETURN CALCULATIONS
C
C     NGRPS       NUMBER OF PROJECTS TO BE ANALYZED
C     N           DURATION OF PROJECT (IN PERIODS)
C     N1          N1 = N + 1
C     A           ARRAY CONTAINING EACH PERIOD'S CASH FLOW
C     SN          PROJECT BALANCES FOR A SIMPLE INVESTMENT
C     SNX         PROJECT BALANCES FOR A NONSIMPLE, MIXED INVESTMENT
C     SNK         PROJECT BALANCES FOR A MIXED INVESTMENT
C     R           INTERNAL RATE OF RETURN (PURE CASE);
C                 RETURN ON INVESTED CAPITAL (MIXED CASE)
C     XK          COST OF CAPITAL
C     XINC        INCREMENTAL CHANGE IN R TO FIND EXACT SOLUTION BY
C                 TRIAL-AND-ERROR METHOD
C
      INTEGER D
      DIMENSION A(30),SNX(30),SNK(30)
      LOGICAL L,LL
      READ (5,10) NGRPS
   10 FORMAT(I3)
      DO 1000 ILOOP=1,NGRPS
      WRITE(6,20)
   20 FORMAT(1H1)
      READ(5,10) N
      N1=N+1
      READ(5,30) (A(I),I=1,N1)
   30 FORMAT(4F20.10)
      WRITE(6,40) N
   40 FORMAT(1X,'N = ',I3//)
      WRITE(6,50)
   50 FORMAT(1X,'CASH FLOW FOR EACH OF N PERIODS'/)
      WRITE(6,70) A(1)
      WRITE(6,60) (A(I),I=2,N1)
   60 FORMAT(1X,5(5X,F12.3)/)
      XINC=.2
      L=.FALSE.
   70 FORMAT(6X,F12.3/)
      DO 100 D=2,N1
      IF (A(D).LT.0.0) GO TO 300
  100 CONTINUE
      R=-XINC
  105 CONTINUE
  110 CONTINUE
      R=R+XINC
  115 SN=A(N1)
      Z=1.0
      DO 120 I=2,N1
      J=N1-I+1
      Z=Z*(1.+R)
  120 SN=SN+A(J)*Z
      IF (SN.LE.0.0) GO TO 150
      IF (.NOT.L) GO TO 250
      TEM=XINC/(ABS(R+XINC))
      IF (TEM.LT..002) GO TO 150
      XINC=XINC/2.
      GO TO 250
  150 IF (SN.GE.0.0) GO TO 220
      IF (R.LE.0.0) GO TO 200
      XINC=XINC/2.
  200 R=R-XINC
```

```
      L=.TRUE.
      GO TO 115
  220 WRITE(6,225)' R
  225 FORMAT(//,3X,'IRR = ',F7.4)
      GO TO 1000
  250 CONTINUE
      TE4=XINC/(ABS(R+XINC))
      IF (TE4.GE..002) GO TO 110
      GO TO 270
  260 FORMAT(//,3X,'IRR IS GREATER THAN',F7.4,' BUT MAXIMUM INCREMENTA',
     $'L VALUE IS ONLY ',F10.6//'      FOR PRACTICAL PURPOSES IRR IS E',
     $'QUAL TO ',F7.4)
  270 WRITE(6,260) R,XINC,R
      GO TO 1000
  300 LL=.FALSE.
      R=0.
  320 SNX(1)=A(1)
      DO 400 J=2,N
      J1=J-1
      SNX(J)=SNX(J1)*(1.+R)+A(J)
      IF (SNX(J).LE.0.0) GO TO 400
      IF (.NOT.LL) GO TO 350
      XINC=XINC/2.
  350 R=R+XINC
      GO TO 320
  400 CONTINUE
      IF (R.EQ.0.0) GO TO 450
      TEN2=XINC/(ABS(R+XINC))
      IF (TEN2.LT..002) GO TO 450
      XINC=XINC/2.
      R=R-XINC
      LL=.TRUE.
      GO TO 320
  450 CONTINUE
      WRITE(6,460) R
  460 FORMAT(//,3X,'RMIN = ',F7.4)
      SNX(N1)=SNX(N)*(1.+R)+A(N1)
      IF (SNX(N1).GE.0.0) GO TO 950
      WRITE(6,20)
      WRITE(6,500)
  500 FORMAT(1X,'COST OF CAPITAL',10X,'RETURN ON INVESTED CAPITAL'/)
      XK=-.0025
      LWRT=4
      LCT=0
      DO 900 K=1,4001
      XK=XK+.0025
      R=0.0
      XINC=.2
      L=.FALSE.
  550 SNK(1)=A(1)
      DO 600 M=2,N1
      SNK(M)=SNK(M-1)*(1.+R)+A(M)
      IF (SNK(M-1).GT.0.0) SNK(M)=SNK(M-1)*(1.+XK)+A(M)
  600 CONTINUE
      IF (XINC.LT.1.0E-7) SNK(N1)=0.0
      IF (SNK(N1).LE.0.0) GO TO 750
      IF (.NOT.L) GO TO 700
      XX=ABS(R+XINC)
      IF (XX.EQ.0.0) TEN3=10.
      IF (TEN3.EQ.10.) GO TO 650
      TEN3=XINC/(ABS(R+XINC))
```

```
  650 CONTINUE
      IF (TEM3.LT..002) GO TO 750
      XINC=XINC/2.
  700 R=R+XINC
      GO TO 550
  750 CONTINUE
      IF (SNK(N1).GE.0.0) GO TO 850
      IF (R.LE.0.0) GO TO 800
      XINC=XINC/2.
  800 R=R-XINC
      L=.TRUE.
      GO TO 550
  850 CONTINUE
      IF (K.EQ.4001) GO TO 865
      IF (LCT.EQ.0) GO TO 865
      LCT=LCT+1
      IF (LCT.LE.LWRT) GO TO 900
      LCT=0
  865 LCT=LCT+1
      WRITE(6,870) XK,R
  203 FORMAT (5X,I5)
  870 FORMAT(2X,F12.6,21X,F12.6)
      IF (K.EQ.401) GO TO 1000
  900 CONTINUE
  950 XINC=.2
      GO TO 105
 1000 CONTINUE
      STOP
      END
```

UNIVERSITY GRANT PROGRAM RESEARCH REPORTS

RAPPORT DE RECHERCHE SUR LE PROGRAMME DE SUBVENTIONS AUX UNIVERSITES

	AUTHOR(S)/AUTEUR(S)	UNIVERSITY/UNIVERSITÉ	REPORT TITLE/TITRE DE L'OUVRAGE
1.	I.A. Litvak C.J. Maule	Department of Economics, Carleton University.	Canadian Entrepreneurship: A Study of Small Newly Established Firms, October, 1971.
2.	Harold Crookell	School of Business Administration, University of Western Ontario.	The Transmission of Technology Across National Boundaries, February, 1973.
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