THE IMPACT OF RESIDUAL VALUE IN LEASING DECISIONS

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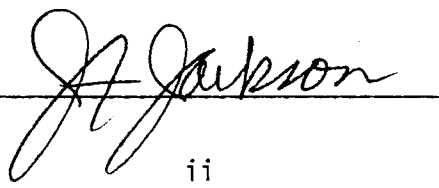
Scope and Method of Study: This study examines the effect changes in residual value estimates have on the lessor's desired rate of return. A questionnaire was distributed to a random sample of equipment lessors in which lessors were asked to rate the importance of residual value estimates to the lease decision. A sensitivity analysis was then performed to measure the theoretical effect residual value has on the lease decision. Comparisons were made between results obtained from the questionnaire and the sensitivity analysis.

Findings and Conclusions: The findings of the questionnaire revealed that there is much disagreement on the importance of residual value among lessors. The importance of residual value was dependent on the type of equipment being leased. The computer simulation revealed that the importance of residual value estimate has become less significant to the lease decision. This has been primarily due to the much higher rates of return required by lessors to maintain profitability levels above the inflation rate.

ADVISER'S APPROVAL 

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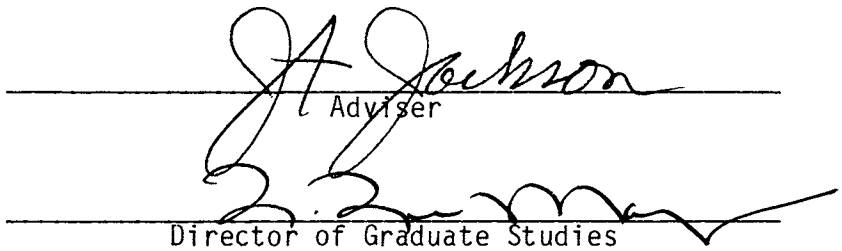

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INTRODUCTION

Leasing Background

In recent years leasing has become attractive to business concerns as an alternative to other forms of financing. Twenty-five years ago, however, leasing was considered by most to be the last alternative to a purchase decision. A firm that was unable to purchase an asset through debt or equity had no other choice but to lease. The only firms who leased were firms that were unable to obtain other financing means. For the most part leasing was considered the last alternative.

Today leasing seems to have been reborn as a financing tool. Fifteen percent of all new equipment financing today is by way of the lease. Evidence of the leasing boom is revealed by the growth of the American Equipment Lessors Association (AAEL). In the 70's it has been transformed into a large organization with over 650 members.[1] With gains in the membership has come greater lobbying efforts for the cause of leasing.

Qualitative vs. Nonqualitative Factors

Why has lease financing grown as much as it has? To answer this question, one must look at the leasing issue from both a qualitative and quantitative perspective. Often, the end result of an analysis ends

up with conflicting recommendations on the best financing approach to use. The final decision is never an easy one. The determination on how these factors should be weighed in making the final lease decision varies from lease to lease as well as from year to year. Basically, though, a firm looks at the quantitative lease factors first. Any final determination is then made by weighing into the problem the non-qualitative factors.

To say that qualitative factors are relatively insignificant would be questionable. They are, indeed, very important in any decision. Aside from certain tax advantages and market imperfections, the attractiveness of leasing cannot be supported from purely quantitative means. It would be difficult to explain completely the rapid growth of leasing without considering the qualitative factors.

Perhaps the importance of qualitative factors can best be seen by reviewing a survey conducted by Paul F. Anderson and John D. Martin.[2] Their survey of corporate executives attempted to rank the most important reasons businesses lease. It is interesting to note one response to their question, "All things considered, leasing is less expensive than debt as a means of acquiring equipment." The question received a ranking of 20 out of 40 questions solicited which suggest that other nonqualitative factors are important in the leasing decision.

Several qualitative factors are mentioned below. They are far from inclusive and are used to highlight a few of the nonquantitative factors that may affect the leasing decision. The relative weight of each factor is dependent on the given situation.

a) Cash Flow Improved- Lease payments provide for a conservation of cash during the first years of a lease.

b) On or off Balance Sheet- The lease can be structured to be "on" or "off" the balance sheet for financial accounting purposes in accordance with the accounting objectives of the lessee.

c) Fixed Rate Lease Payments- The lessee is able to more accurately predict its future equipment cost and cash needs.

d) Hedge Against Inflation- The lessee is able to obtain longer term funding than he could otherwise, thus protecting himself against short-term interest rate increases.

e) No Dilution of Ownership- Leasing prevents dilution of ownership of a company from insurance of equity.

f) Convenience- Documentation is usually simpler than other sources of capital such as debt and equity.

The quantitative aspect of the leasing decision has received a great deal of attention. Over the last ten years there have been numerous articles on the lease vs. buy decision. As Bower discusses in his article, "Issues in Lease Financing," there is generally basic agreement between academicians on the leasing decision format.[3] Results from Anderson and Martin's Lease vs. Purchase decision survey showed six basic leasing models in use. These included the traditional Internal Rate of Return (IRR), and the conventional Net Present Value (NPV) models.[4] Seventy percent of their respondents preferred these models. The remaining four models have been shown by the author to be equivalent.

Leasing Economic Decision Variables

Lessees and lessors must continually be aware of the degree of uncertainty among the variables they use within the lease model. When one performs a quantitative analysis, it cannot be from a perspective of complete certainty. None of the variables within the model can be defined with certainty, and to do so would be truly simplistic. Any leasing analysis, to be relevant in the current environment, must have a mechanism to quantify these uncertainties.

Basically, there are four factors that define the economic values of a lease to both parties.[5] They are:

a) Cost of Capital
b) Life of the Lease
c) Residual Value
d) Effective Tax Rate

In reality, none of these factors are known with certainty for any given firm. The aim of any quantitative analysis is to project the best estimates of these variables such that the level of risk uncertainty is minimized for the lease.

The uncertainty of the cost of capital today is particularly relevant. Since the cost of capital is tied to the inflation rate, the leasing model is only as good as the projected rate of inflation. Today's massive gyrations in the inflation rate have caused increased concern on estimating a firms cost of capital.

The life of a lease is another factor that should be analyzed. The length of the lease transaction dramatically affects the profitability of a lease. This is particularly evident for some types of computer leases, where incorrect lease term estimates can significantly affect the lessors rate of return.

While the cash flows from the lessee may be certain, there is always the possibility of default. The importance of this naturally depends on the credit risk of the firm. Should a firm default on a lease, the leasing company must have the expertise in marketing to re-lease the equipment.

The effective tax rate is also far from certain. Politicians talk even now of major tax changes to stimulate the economy. Unanticipated changes in the tax rate can greatly affect the profitability of a lease. Long-term projections must be made to ascertain future projected tax levels that the firm may encounter. A lease with no tax advantage becomes extremely undesirable.

Residual value is the last major factor that may affect the economic value of a lease. Here again uncertainty enters the picture. Often, when a lease is being negotiated, it is the residual value that is most open to interpretation. It is the least certain of any of the cash flows, since it must be estimated for a period far into the future. Failure to complete a lease agreement is often caused by large divergences in residual value expectations between lessee and lessor. When expectations of residual value estimates between lessor and lessee are close a lease agreement can usually be reached.

Insight on how the estimation of residual value of equipment is made should be of particular value to lessors. The leasing industry has had tremendous growth throughout much of the 70's and it is expected by some to continue that growth into the 80's. Yet, the leasing industry is still relatively new. At present only about fifteen percent of new equipment is financed through leasing.[6] There is definitely new untapped markets for leasing companies to explore. Perhaps

a clearer understanding of how residual value affects the leasing decision is needed. This will help the lessee and lessor better realize possible advantages and disadvantages of leasing.

Purpose

This paper looks in depth at the role residual value has in the leasing decision. The traditional IRR model is used to measure the effect residual value has in the leasing decision. The objective is to show when residual value estimates are significant in varying the lessors rate of return. A computer simulation is run using the IRR model with variations being made to the cost of capital, the length of lease, effective tax rate, and the residual value estimates. The model simulation will then be compared with variations in residual value estimates obtained from equipment association lessors.

ENDNOTES

[1]American Equipment Lessors Association, Membership Directory, 1979, Arlington, Va; September 1979.

[2]Paul F. Anderson and John D. Martin, "Financial Leases: The Corporate Viewpoint," Paper presented at the Ninth Annual Meeting of the Financial Management Association, Boston, Massachusetts, October 1979, p. 13.

[3]Richard S. Bower, "Issues in Lease Financing," Financial Management, Winter 1973, p. 25.

[4]Paul F. Anderson and John D. Martin, "Lease vs. Purchase Decisions: A Survey of Current Practice," Financial Management, Spring 1977, p. 43.

[5]Lazaros P. Mavrides, "Decision Analysis for Real Estate and Equipment Leasing," The Real Estate Appraiser and Analyst, p. 41.

[6]Paul F. Anderson and John D. Martin, "Financial Leases: The Corporate Viewpoint," p. 1.

CHAPTER II

ACCOUNTING AND TAX ASPECTS OF EQUIPMENT LEASING

The ability of the lessor and lessee to comply with the accounting and Internal Revenue Service (IRS) tax requirements can at times be unsettling. Lease accounting has received numerous inquiries by lessors and lessees recently. Uncertainty has resulted because of the numerous amendments and interpretations given since the Financial Accounting Standards Board (FASB) implemented statement 13. Because of this great uncertainty, they have recently released, "FASB 13 as amended and interpreted through May 1980." This recent amendment of FASB 13 should give excellent help to lessors and lesses in staying within the accounting lease guidelines. The IRS tax requirements must likewise be thoroughly understood by lessors and lessees. Failure to follow these tax requirements has led many lessors and lessees into serious trouble.

FASB Requirements

The accounting procedure to follow for a lease is dependent on whether the business concern is the lessee or lessor. A lessee classifies a lease as either a capital lease or an operating lease. To be classified as a capital lease for the lessee the particular lease must meet any one of the following criteria.[1]

a. The lease transfers ownership of the property to the lessee by the end of the lease term.
b. The lease contains an option to purchase the leased property at a bargain price.
c. The lease term is equal to or greater than 75 percent of the estimated economic life of the leased property.
d. The present value of rental and other miminum lease payments equals or exceeds 90 percent of the fair value of the leased property less any investment tax credit retained by the lessor.

The capital lease is viewed as transfering substantially all of the benefits and risks of ownership and thus should be accounted for as the acquisition of an asset and the incurrence of an obligation by the lessee and as a sale by the lessor. The amount to be recorded on the lessee's books as an asset should be the lesser of the present value of the rental payments or the fair market value of the leased equipment. The leased property is amortized over the term of the lease if the lease provides for a transfer of title. If it includes a bargain purchase option, the lease is amortized over the life of the asset. The rental payments of the lease are treated as principal and interest expenses on the books.[2]

When a lease does not meet any of the four requirements listed above, the lease is classified as an operating lease. An operating lease is not required to be recorded as an asset nor as an obligation since the benefits and risks of ownership have not been transferred to the lessee. Prior to FASB 13's release in 1976 firms were not required to record capital leases on their books. FASB 13 has since made it necessary for lessees to be aware of the differences between a capital and operating lease.[3]

From the lessors perspective a lease can be classified as one of four types of leases.[4]

a. Sales-Type leases
b. Direct Finance leases
c. Leveraged leases
d. Operating leases

The sales type, direct finance and leveraged leases all are viewed as retaining ownership benefits and risks of ownership for the lessor. Because they are viewed as retaining ownership benefits, they must also meet at least one of the four criteria listed above for a capital lease. In addition, they must meet both of the following two criteria.[5]

a. Collectibility of the minimum lease payments is reasonably predictable.
b. No important uncertainties surround the amount of unreimbursable costs yet to be incurred by the lessor under the lease.

When a lease meets the above criteria and the fair value of the leased property is different from its carrying amount, it is classified as a sales-type lease. All other leases meeting the above requirements are classified as finance leases. Leases that do not meet the above requirements are classified as operating leases.

For a sales-type lease the lessor reports as an asset the net investment, which is calculated by recording the gross investment at its present value using the interest rate implicit in the lease as the discount factor. The gross investment is defined as the sum of the minimum lease payments and the unguaranteed residual value. The difference between the gross investment and the net investment is unearned income and is amortized over the length of the lease.

In a direct finance lease the lessor records as an asset on the balance sheet the net investment in a lease. The net investment consists of the gross investment less unearned income. Unearned income

is determined by subtracting the cost of the leased property from the gross investment. As in the sales type lease unearned income is amortized over the length of the lease.

A leveraged lease is a further extension of the direct finance lease. It must meet all the requirements of the direct finance lease plus all of the following criteria.[6]

a. It involves at least three parties: a lessee, a long-term creditor, and a lessor.
b. The financing provided by the long-term creditor is substantial to the transaction and is nonrecourse to the lessor.
c. The lessor's net investment declines during the early years and increases during the later years of the lease term.
d. Any investment tax credit retained by the lessor is accounted for as one of the cash flow components of the lease.

The lessor must record the investment in a leveraged lease net of nonrecourse debt. The total net income over the lease term is calculated by subtracting the initial investment from the total cash receipts. Using the projected cash flows, the rate of return is calculated on the net investment for the years in which the investment is positive. This procedure assumes that the lessor will earn other income for the periods where the net investment of the lease becomes negative.

The description given above shows the basic guidelines being used by the accounting profession for leases. It is imperative that lessees and lessors closely follow FASB 13. Failure to follow FASB 13 standards can cause serious difficulties. Due to the technical nature of accounting for a lease, it is necessary for both the lessee and lessor to have good accounting advice available before initiating into a lease.

IRS Tax Requirements

The lessor and lessee must also stay within the tax laws being enforced by the IRS. For tax purposes leases are defined as either "True Leases" or "Conditional Sale Leases."[7] Direct and leveraged leases are generally structured as true leases. The true lease allows the lessor to claim depreciation deductions and the lessee can deduct the full lease payments as an expense. The investment tax credit (ITC) can be claimed by either the lessor or, upon agreement between the lease parties, by the lessee. At the end of the true lease the lessee has the option to review the lease, to buy the equipment at its fair market value or to return the equipment to the lessor. The conditional sale lease transfers all ownership of the leased property to the lessee. Here the lessee treats the property as his own. The lessee depreciates the property and is allowed to deduct the interest portion as rent over the estimated useful life of the equipment. The lessee also is entitled to the investment tax credit. In contrast to the true lease, the conditional sale lease gives the lessee full ownership rights to the equipment.

To determine whether a lease is a true lease or a conditional sale lease, the IRS issued Rev. Rule 55-540. This ruling states that the intent of the parties at the time the lease agreement was executed will determine whether the agreement is a true lease or a conditional sale lease. The inclusion of the intent of the parties within the agreement is not required within the agreement. However, Ruling 55-540 places heavy burden on the lessee to prove that a true lease was intended.

An agreement is considered to be a conditional sales contract if one or more of the following items are intended:[8]

1. The lessee obtains an equity interest in the property through the lease payments.
2. The lessee acquires the property after a given number of payments are made.
3. The lessee pays a large percentage of the purchase price over a short period of time.
4. The agreed rental payments greatly exceed the rental value of the property.
5. The lessee has the option to purchase the property for an amount materially less than the expected value of the property at the time of purchase, or when compared to the total payment under the agreement.
6. A portion of the lease payments are specifically designed as interest or the equivalent of interest.

Rev. Rule 55-540 specifically related to the requirements necessary to satisfy the conditional sale lease. However, it did not describe what requirements were needed to satisfy the agreement as a true lease. These problems were overcome through Rev. Proc. 75-21. Rev. Proc. 75-21 gives the general guidelines in deciding whether a transaction is a true lease. Some of the major criteria presented in Rev. Proc. 75-21 are as follows:[9]

1. At the beginning of the lease, the estimated fair market value at the end of the lease must equal or exceed 20 percent of the original cost of the property.
2. The minimum investment by the lessor must remain at least equal to 20 percent of the cost of the property throughout the lease.
3. The lessor must demonstrate that the investment of at least 20 percent is a reasonable estimate of the remaining useful life of the property at the end of the lease.
4. The lease must not include any purchase agreements to the lessee that allows the lessee to purchase the equipment at a price less than its fair market value at the end of the lease.

The 1976 tax reform act placed certain limitations on the amount of losses resulting from leveraged lease tax shelters. The 1976 tax

reform act substantially diminished the sheltering potential for leveraged equipment leasing for individuals, partnerships, subchapter "S" corporations and personal holding companies. Several changes have been made to make leasing less attractive to these parties. Some of the more important changes are noted below.[10]

1. Section 465 of the tax reform act placed a limit that a noncorporate concern can deduct to that which he has "at risk". The amount of losses generated by a leveraged lease that he can deduct is limited to the persons pro-rata share of the equity interest in the equipment. This at risk provision applies to any Section 1245 property.
2. Section 163(d)(3)(D) places a ceiling on the deductibility of interest to noncorporate taxpayers, and to limited partnerships.
3. The investment tax credit under section 46(e)(3) faces significant limitations to noncorporate concerns.

It is evident that the lessor and lessee must closely follow the IRS tax requirements in developing a lease. The lessee and lessor must implement leasing agreements that conform to their particular type of IRS lease. The lease must be developed such that it leaves no doubt about interpretations of the intentions of the lessor and lessee. In addition to these requirements, the noncorporate concern must contend with the further restrictions on leveraged leases as the result of the 1976 tax reform act.

ENDNOTES

[1]Financial Accounting Standards Board, Statement No. 13 as Amended and Interpreted Through May 1980, "Accounting for Leases," FASB, Stanford, CT, 1980, p. iii.

[2]Ibid.

[3]Ibid, p. ii.

[4]Ibid, p. iv.

[5]Ibid.

[6]Ibid, p. v.

[7]Rev. Rul. 55-540, 1955-2 CB 39

[8]Ibid.

[9]Rev. Proc. 75-21, 1975-1CB 715

[10]George Brodie, Jr., "For Corporations, Equipment Leasing Still Offers Substantial Tax Savings," Taxation for Accountants, April 1978, p. 53.

CHAPTER III

LEASE EVALUATION MODELS USED BY LESSORS AND LESSEES

The purpose of this section is to review the existing lease evaluation models being used by lessees and lessors and to highlight the different assumptions used with these models. There is a clear distinction in the literature between lessee and lessor leasing models. The lessee is concerned with the acquisition of the asset in question using the best financial alternative available. That is, should he lease or buy the equipment? The lessor is faced with a straight forward capital budgeting problem. While there is less disagreement between lessors on the correct approach to use, there still are a few points that can cause some confusion.

Lease vs. Buy Models

There has been an abundance of technical literature on the appropriate lease vs. buy decision model that should be used. This is evident by the results obtained by Anderson and Martin. Their survey findings taken from a sample of 200 large industrial firms revealed the following models being used.[1]

Model	Frequency of Methodology
Traditional IRR Model	24
Conventional NPV Model	11
Bierman and Smidt Model	5
Basic Interest Rate Model	4
Weston & Brigham Model 1972	2
Bower, Herringer, and Williamson Model	2
Total	48

As can be seen, the overwhelming majority of the group used either the traditinal IRR model or the conventional NPV model. As Anderson mentions, the Beirman and Smidt and the Weston & Brigham model can be shown to be identical. He also states that the remaining models have been compared by Bower and have been shown to be equivalent.

The Bower article brings out the fact that all the lease vs. buy models are in fact quite similar. He points out that any of the lease vs. buy models can be expressed as follows:[2]

$$NAL = A_o - \sum_{j=0}^{n} \frac{R_j}{(1+x_2)^j} + \sum_{j=0}^{n} \frac{tR_j}{(1+x_3)^j} + \sum_{j=0}^{n} \frac{tD_j}{(1+x_4)^j} - \sum_{j=0}^{n} \frac{tL_j}{(1+x_5)^j}$$

$$+ \sum_{j=0}^{n} \frac{O_j(1-t)_j}{(1+x_6)^j} - \sum_{j=0}^{n} \frac{V_n}{(1+x_7)^n}$$

Where: L_j = loan payment at the end of the period

I_j = interest component of the loan payment

A_o = purchase price of the asset to be leased

R_j = lease payment at the end of a period

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

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

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

r = pre-tax interest rate on term loans comparable to the lease

k = after-tax cost of capital for the corporation

t = the corporate income tax rate

n = number of periods covered by the lease agreement

X_n = discount rates to be applied to cash flows

P_j = outstanding principal of the loan equivalent

Q_j = principal component

B_0 = present value of the lease claim

NAL = net present value of owners wealth

For the IRR model the above equation is solved to determine the cost of financing such that the advantages of leasing just equals the advantages of buying. The remaining methods solve for the net present value, where any positive answer would indicate an advantage towards leasing.

Bower felt that the major disagreement between the various models is centered around the appropriate discount rate to use. Generally, this disagreement is between using the after-tax cost of debt and the weighted-average cost of capital of the firm. Bower gives several valid reasons to substantiate the use of either of the two cost of capitals.

The conventional NPV approach assumes that the weighted-average cost of capital of the firm should be the appropriate discount rate that is used. One of the principal reasons for using the weighted-average cost of capital concerns the firm's market value. The market value of the firm depends on the firm's level of debt, its basic cash flows and the rate of discount the market applies to the firm's stock.

It has been argued that any change in the debt level must be offset by a similar change in the level of equity in order to maintain the optimum debt equity ratio. This implies that the investment decision should not be specifically associated with a particular loan that may be favorable at a point in time. Instead, the appropriate discount rate should be a weighted-average of the firms cost of capital. It has been argued that leasing is another form of debt and it should be discounted at the weighted average cost of capital of the firm.[3]

There is another group of individuals who argue that the weighted-average cost of capital is too high a discount rate to use. Anderson points out that the cost of capital is too high a rate to use for the highly certain contractual and tax shield flows. Instead, he argues that the after-tax cost of debt should be used since leasing is another form of borrowing. Since one form of borrowing is being used to replace another, the same after-tax costs of debt should be used for the discount rate. As a result, Anderson believes that using a higher weighted-average cost of capital results in a bias against leasing.[4]

A third view on the appropriate discount rate to use has been suggested by Schall. His view is that the appropriate discount rate is dependent on the risk components of each of the individual cash flows. Schall states, "The value of the asset to the firm is the value that the incremental stream it provides would have if that stream were available individually in the market."[5] He argues that the appropriate discount rate should be based on the risk characteristics of the lease itself. The cost of capital used should be the cost of capital applicable to the asset itself and not the overall cost of capital of the firm.

The assumptions being made by Schall are based on the value additivity principle. This principle holds that discounting individual cash flows with their own particular discount rates will not alter the final result of the analysis. The end result would be the same as if one overall discount rate had been used for all the cash flows.[6]

Bower's Lease Discussion

The article by Bower gives important insight on the lease vs. buy alternative.[7] His article is extremely useful since it combines many of the different methods into a common framework. In this way a better evaluation of the points of agreements and disagreements can be made between the different models.

As was mentioned earlier, Bower expressed all of the various approaches in the framework of one standard equation. He applied this equation to the evaluation of nine different models by various individuals. He then analyzed both the points of agreement and disagreement between the models. These points of disagreement centered around the appropriate cost of capital to be used in the various terms of the equation.

Of the nine different models he compares, he points out that there is general agreement on the first and the very last two terms of the basic equation that were presented earlier. The first term is the purchase price of the asset at the inception of the lease. The last two terms for the most part have been discounted at the companies cost of capital k, or by adjusting the flows to account for their levels of uncertainty.

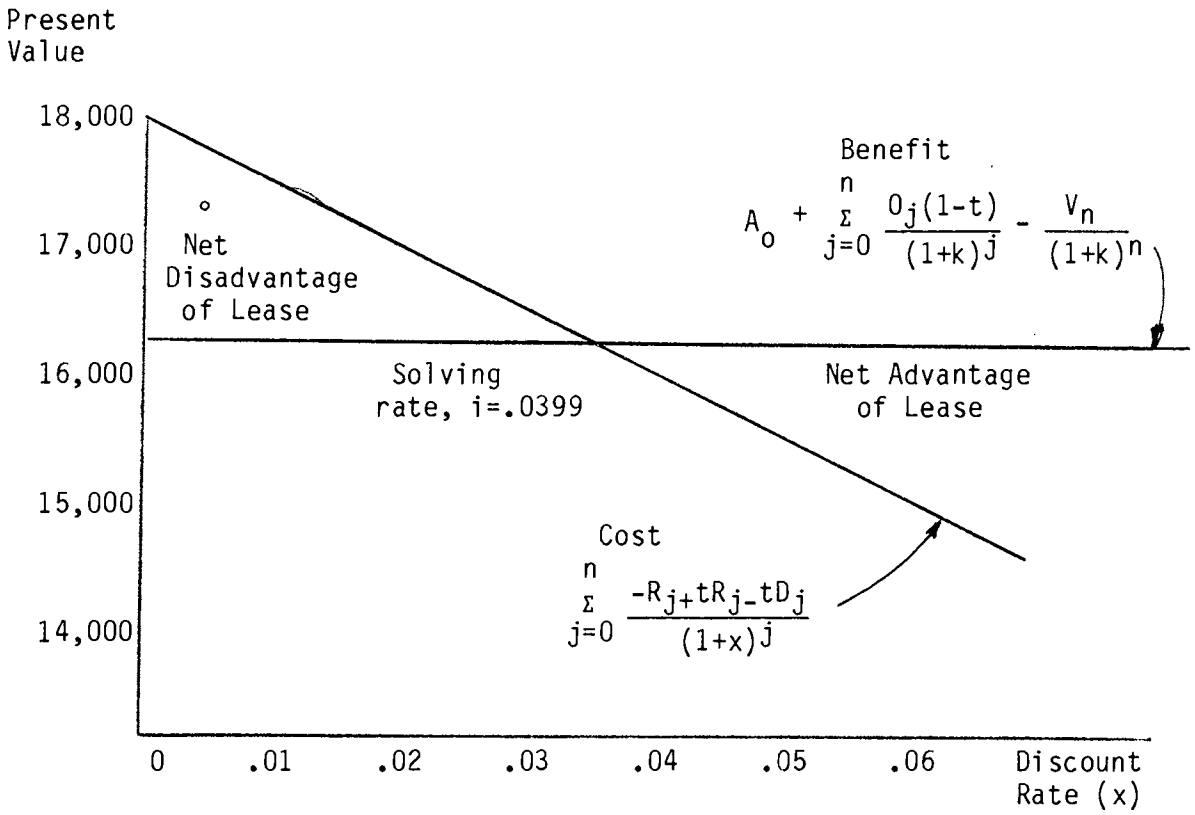
Bower states that the primary disagreement between the various models is focused on the 2nd, 3rd, 4th, and 5th terms of the equation. The disagreement centers on whether the equivalent loan assumption is valid. That is, should leasing be considered as another form of debt? Several authors who assumed the equivalent loan assumption were Roenfeldt and Osteryound (1973), Doenges (1972), Mitchell (1970), Wyman (1973), Beechy (1969), and Findlay (1973). Bower found very little disagreement between these models. Given that the variables used in the models were the same, they were found to yield the same result.

From this general agreement Bower developed what he calls decision format number one. He graphically displayed this decision format as is duplicated on the next page. Here, the cost of leasing is taken to be the lease payment less any net additional tax shelter from the lease that would be foregone. The advantages of leasing are the savings of the purchase price and the operating expenses that will be foregone less the loss of benefits from the salvage value of the equipment.[8]

Bower then proceeds to explain the differences between decision format number one, which assumed an equivalent loan alternative, and the other models that were given by Bower, Herringer and Williamson (1966), Johnson and Lewellen (1973) and Vancil (1961). Bower shows that the Johnson and Lewellen model differed from his decision format number one as a result of the discount rate applied to the depreciation tax shelter. The other models that were the basis of decision format number one used an after tax interest rate r(1-t), as the discount rate for the depreciation tax shelter. The rate, used by Johnson & Lewellen was the cost of capital "k".

FIGURE 1

DECISION FORMAT NUMBER ONE



Source: Issues in Lease Financing, Financial Management, Winter, 1973.

Bower states Johnson & Lewellen's reasoning for the use of a discount rate "k" is that it should be the same discount rate as that used for discounting depreciation shelters in conventional capital budgeting problems. Bower understands the reasoning made but he does not accept it as being correct. He felt that, instead, an obvious bias occurs towards leasing when the cost of capital "k" is used for the depreciation term. This is because the Johnson & Lewellen method involves discounting the tax shelters given up in leasing at the higher rate "k", while the other tax shelters that come as a result of leasing are

discounted at the lower after tax rate, "r(1-t)". This inconsistency in discount rates for the depreciation tax shelter does more, he argues, to bias the decision towards leasing than any other point.[9]

Bower states that the Bower, Herringer and Williamson, and Vancil models differ from the other models in two respects. The first is that they used different equivalent loans to calculate depreciation tax shelters that were given up by leasing. Their equivalent loan was based on the purchase price of the asset. According to Bower, the other models based their equivalent loan on the present value of the lease payments.

The final disagreement between Bower and the Bower, Herringer and Williamson, and Vancil articles involves the discounting of all tax shelters at the rate "k" instead of at the rate "r(1-t)". Bower does not necessarily disagree with using "k" as the discount rate, as long as it is used consistently for all cash flows. Instead, Bower leaves the final decision on what appropriate discount rate to use up to the company executive.

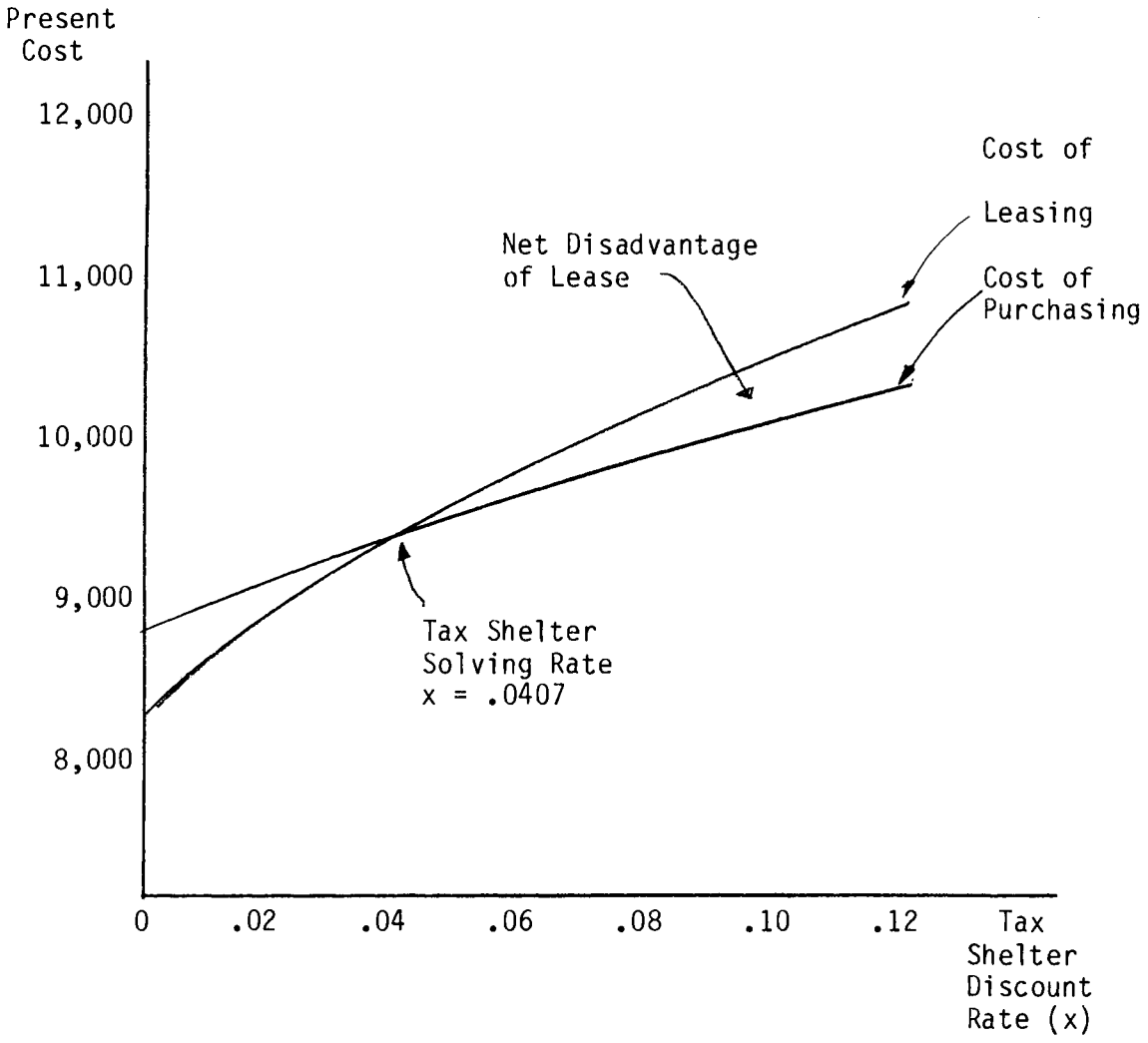
He then developed decision format number two to recognize disagreements in the applicable cost of capital. At the same time, the agreements that were incorporated in decision format number one were retained in the new decision format number two.[10]

As a review, Bowers decision format number one used "k" as the discount factor in calculating the benefits of leasing and the tax shelters were discounted at the discount rate "r(1-t)". In decision format number two the cost of capital "k" is used in calculating the benefits from leasing; that is, the purchase price, operating savings and salvage value. Also, the interest rate "r", selected by the

executive is used for discounting the lease payments in Bowers decisions format number two. Decision format number two also allows the executive to look at different tax shelter discount rates. The discount rate assumed by the executive is denoted by "X" in decision format number two. Format number two is shown below.

FIGURE 2

DECISION FORMAT NUMBER TWO



Source: Issues in Lease Financing, Financial Management, Winter, 1973.

Format number two

$$COP = A_o \sum_{j=0}^{n} \frac{tD_j}{(1+x)^j} j + \sum_{j=0}^{n} \frac{O_j(1-t)}{(1+k)^j}$$

$$COL = \sum_{j=0}^{n} \frac{R_j}{(1+r)^j} - \sum_{j=0}^{n} \frac{tR_j}{(1+x)^j} + \sum_{j=0}^{n} \frac{tI_t}{(1+x)^j}$$

Where: COP = cost of purchasing the asset

COL = cost of leasing the asset

In summary, the decision format number two used by Bower combines several of the models into one composite approach. It allows the executive an understanding of the differences between several of the better known leasing models used today.

Gudikunst and Roberts

Some recent research conducted by Gudikunst and Roberts provides some insight into the use of lease evaluation models. Gudikunst and Roberts measured the impact of using different lease models on 89 retail leases. As a follow-up they repeated the experiment using Bowers model. The purpose of the study was to determine the statistical significance of the different models in selecting the appropriate lease vs. buy decision. Both of their experiments found statistically significant differences in lease advantages among the various models. However, all the models resulted in almost unanimous recommendations of purchase. Thus, the theoretical models in use, according to the study, do not accurately explain the pro leasing bias in actual use.[11]

Gudikunst and Roberts define the four assumptions being made by the theoretical models in use. The assumptions being used are:[12]

a) Loan equals 100% of purchase price
b) Loan repayment period equals lease time
c) Lease payments are equivalent to debt payments when analyzing the debt capacity of the firm.
d) The financial analyst community views lease obligations as exact equivalent to debt financing.

Therefore, if these assumptions are not present, then the lease vs. buy models may not be correct. Based on their empirical study, Gudikunst and Roberts concluded three possible implications that can account for their results:[13]

a) The academic community has yet to formulate the "correct" model for business executives, or,
b) The business community has neither fully comprehended nor used appropriate evaluation models in their leasing decision, or,
c) Actual decisions to acquire assets by leasing may be reached in an environment where there is no practical alternative source of financing.

It is clear, upon review of the lease vs. buy literature, that the lessee has no easy task in formulating a decision. The lessee needs to be familiar with the conceptual differences among the different models. He must also be aware that several qualitative factors are indeed important and must be analyzed before making any final lease determination.

Lessors Lease Evaluation Models

The analysis of the lessors yield within the leasing community causes fewer disagreements than the lease vs. buy decision. Basically, there are four accepted means of lease analysis in use.[14] They are:

a) net present value method (NPV)
b) yield, or discount cash flow method
c) single investment sinking fund method (SISF)
d) multiple investment sinking fund method (MISF)

The last two methods are further refinements of the yield or internal rate of return methods.

After Tax Cash Flow

One point that must be emphasized is that the lessors yield must always be based on the after tax cash flows. Tax considerations have been one of the principle reasons for the growth of leasing. When taxes are considered, lessors rates of return can be shown to be much higher than the actual costs of leasing to the lessee.

Fritch & Reisman show that the leveraged lease is not a profitable alternative when taxes are not considered in the analysis. To illustrate this point they analyzed the following example.[15]

TABLE I

FRITCH & REISMAN LEVERAGED LEASE ANALYSIS

Equipment cost = 1 million dollars
Tax Life = 7 years
Term of the lease = 10 years
Lessors down payment = $280,000
Loan on the equipment = $720,000
Rate of interest on loan = 9%
Loan installment payments,
40 equal quarterly payments = $24,487
Lease payments from lessee = $31,000
Brokerage and legal fees = $20,000

Source: Bruce E. Fritch and Albert F. Reisman, Equipment Leasing-Leveraged Leasing, 1977

From a before-tax standpoint, the above lease would yield, using the multiple investment sinking fund method (MISF), a negative return of 13.15% per year. This example assumed an initial investment of

$300,000 (down payment plus brokerage and legal fees) and a before tax cash flow of $3,512 (lease payments minus loan payments). Even with the investment tax credit of $100,000 included, the lessors yield would have remained unattractive. The lessors yield would still have yielded a loss of 6.49%. The example by Fritch & Reisman demonstrates the importance of using after tax cash flows when calculating rates of returns on leveraged leases.

To truly analyze the lessors yield, three tax factors must be considered. The first is the lessors investment tax credit (ITC) which allows the purchaser to deduct a 10% tax credit off the purchase price of the equipment. Another important factor is the accelerated depreciation deduction that is available. The final tax benefit comes from the deduction of interest on the loan. Only when the analysis is on an after-tax basis can a true estimate of the yield be made.

Table II shows the total tax position that was calculated by Fritch & Reisman.[16] The total tax payment column shows the tax payments that will result over the terms of the lease given a 48% tax bracket. This was obtained by first deducting depreciation and interest expense from rental income to obtain the net taxable gain or loss for the year. The total cash flow is calculated by adding the total tax payments to the actual cash obtained (rental income minus interest expenses).

Several assumptions on the above cash flow have been made. The first point concerns the net total tax payments of -$178,564. This net taxable loss results in a savings of 18% of the equipment. It was pointed out that in practice, leases that include the ITC into the analysis will reveal total net taxable loss. However, when the lessor

passes the ITC on to the lessee, the total tax payment will reveal a net taxable gain. Fritch and Resiman point out that while the ITC does have an effect on the lessors yield, it is not the key to the lessors return.

TABLE II

ECONOMICS OF LEVERAGED LEASE ON AN AFTER TAX CASH FLOW BASIS

Year	Rental Income	Depreciation Expense	Interest Expense	Taxable Gain	Total Tax Payments	Total Cash Flow
1977	$124,000	$145,714	$63,253	$ -84,967	$-142,784	$-300,000
1978	124,000	249,796	58,906	-184,702	-88,657	156,834
1979	124,000	190,816	54,155	-120,971	-58,066	102,706
1980	124,000	156,122	48,961	-81,084	-38,920	72,115
1981	124,000	121,429	43,284	-40,713	-19,542	52,969
1982	124,000	86,735	37,079	187	90	33,591
1983	124,000	52,041	30,296	41,664	19,999	13,960
1984	124,000	17,347	22,881	83,772	40,211	-5,949
1985	124,000	0	14,776	109,224	52,427	-26,161
1986	124,000	0	5,917	118,083	56,680	-42,631

Source: Burce E. Fritch and Albert F. Reisman, Equipment Leasing-Leveraged Leasing, 1977.

The most important benefit occurs by being able to defer tax payments until a later date. It is this tax deferral that has enabled leasing to become profitable. This can be shown to be true using any present value technique.

One of the assumptions being made is that the lessor will be paying substantial taxes each year. If this assumption is correct, the negative tax payments can be treated as cash inflows and can be offset against other income. It if is not correct, then the yield would be drastically changed and the leveraged lease would become unprofitable. This point emphasizes the careful need for good tax planning. Combined with the above analysis must come sound portfolio management of the

leases to insure that excessive gains or losses will not alter the tax structure of the firm.

The total cash flow in the last column, is used to calculate the yield on the lease. The actual calculation of the yield can become more difficult than it might first appear. Besides the uncertainties of the total after tax cash flow, there are several other factors that make the analysis more complicated. One problem encountered by lessors is the time that is needed to do an in-depth analysis of a yield on a lease. However, this problem is probably minimal today, since many computer programs are available to compute the yields on a lease both quickly and accurately.

Net Present Value Method

The NPV method is one of the standard methods used for lease evaluations. This method brings all estimated future cash receipts to a present value equivalent. The lessor selects an interest rate that is desired for the investment. The cash flows are then discounted at this discount rate. If the net present value of the discounted cash flows is greater than zero, the investment should be accepted.[17]

In any net present value analysis one must be aware of the impact of inflation. Often inflation is neglected in the analysis. Most NPV computations are analyzed using a cost of capital that has imbedded into it an expected rate of inflation. That is, the market rates for any investment needs to be adjusted for inflation. If the inflation rate, for example, was 10% per year, then the minimum risk free investment that an investor would accept must be greater than 10%. Since the

standard NPV analysis includes an estimation of inflation, one must also remember to adjust the cash flows for inflation.[18]

Residual value is one cash flow that must be adjusted for inflation. If a $100,000 asset is assumed to have 20% residual value after five years on a lease and the expected annual inflation rate is 10%, the cash flow used in the analysis would not be $20,000. If the cost of capital includes an expected rate of inflatin then the residual value cash estimate would actually be $20,000 \times 1.1^5 = \$32,210$. One must be aware that inflation may have a significant effect on the final NPV value obtained.

There are two main objections to the NPV method. The first objection is that it does not give proper emphasis to the level of risk of the asset as it relates to time. For example, the following two leases yield different NPV results:

	Annual Cash Flow	Lease Cost	Years	NPV @ 8%
Lease A	$200	$1,500	30	752
Lease B	$200	$1,004	10	338

The selection of the best lease would be difficult since the NPV method does not measure the risk differences between the two different maturities.

The second objection to the NPV analysis is the difficulty of determining the appropriate cost of capital. However, these difficulties are the same for any other method that would be used.

Internal Rate of Return

The internal rate of return (IRR) is defined by Weston & Brigham as follows:[19]

> The rate of return on an asset investment. The internal rate of return is calculated by finding the discount rate that equates the present value of future cash flows to the cost of the investment.

The IRR is often used in the leasing analysis. However, the IRR is in practice relevant only when the set of cash flows produces one possible return. The IRR will give one possible return when the after tax cash flows have only one reversal in sign. That is, after the initial negative outflow (purchase price of equipment), the remaining cash flows will be positive in value.

The IRR method becomes less effective for determining the yield on a lease when multiuple yields occur. Multiple yields can occur whenever the after tax cash flow column has an initial outlay followed by a series of positive and then negative cash flows. Confusion often results as to which is the correct return on the investment.

The problem of multiple rates is particularly evident in the evaluation of leveraged leases. Athanasopoulos and Bacon demonstrated the problem of multiple rates.[20] In their leveraged lease example, the IRR method was used to measure the return on a $500,000 asset. The yield on the lease was calculated to be 1.13% and 34.82%. Further examination would reveal that either of the two returns would give a NPV=0. It was shown by the authors that for any discount rate between the rates, where NPV=0, the NPV calculated would be positive. Therefore, any yield between 1.13% and 34.82% would have been acceptable. The

authors demonstrated that when multiple rates are present the actual yield of a lease is entirely dependent on the reinvestment rate used.

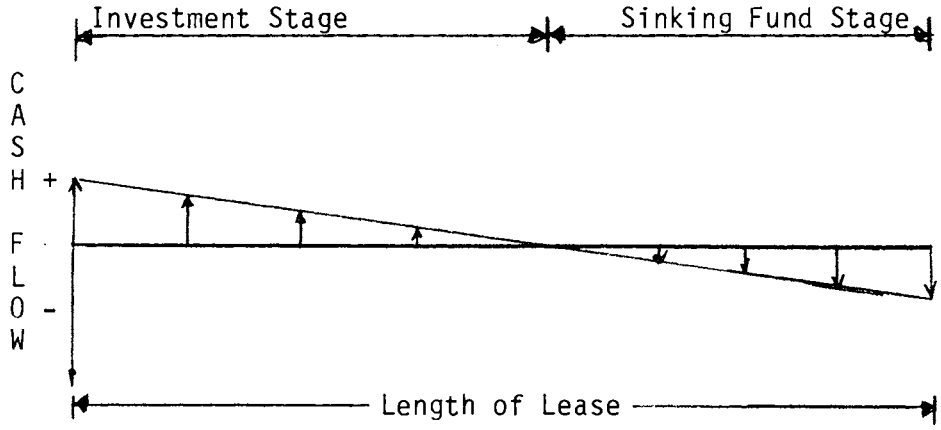
Single Investment Sinking Fund Method (SISF)

The SISF method is an extension of the IRR method and is more often used for the leveraged lease analysis. It is similar to the IRR method but it does not result in multiple root answers. The SISF method is made up of two stages, the investment stage and the sinking fund stage. This method divides the after tax cash flows into two stages. One component is cash flows that represent a return to the lessor; the other component is the amount of funds that must be invested to offset the negative flows in the later years of the lease.[21]

In computing the SISF rate the sinking fund must first be computed. The sinking fund is obtained by taking all of the negative cash flows and dipping back into the positive cash flows just enough to equal the future negative payments. The SISF method can be best explained by the following illustration that represents a typical after tax cash flow diagram of a leveraged lease.

FIGURE 3

SINGLE INVESTMENT SINKING FUND
CASH FLOW DIAGRAM



Upon calculation of the sinking fund, the remaining cash flows would consist of the initial negative payment for the asset followed by the remaining positive cash flows. The regular IRR method can then be used to calculate the return on the investment of these remaining cash flows.

One characteristic of the SISF method is that the sinking fund is set up to meet future negative payments as they are due. This is in contrast to the MISF method. In order for the immediate payment of all future negative cash flows a large amount of the incoming cash flow must be retained in the sinking fund. As a result, the calculated yield on the lease for the SISF method would give a more conservative value. Since no further investments will be needed as a result of the large sinking fund, the lease will have only one investment period. The regular IRR method can then be used to calculate the return on investment of the remaining cash flows.[22]

Equipment lessors often refer to what is called sinking fund risk.[23] There are two possible sinking fund methods in use. One discounts the cash flows as they occur. This method is considered to be more accurate since it accounts for the time value of money. The other disregards the time value of money and instead takes the final positive sum of all cash flows at the end of the lease and discounts this final value back to determine a sinking fund rate. The second method used would give a more conservative return on the investment.

Another factor in sinking fund risk is the variation in sinking fund rates. The variation in sinking fund rates can greatly affect the yield obtained in a lease. The lessor must determine the correct yield on funds in excess of his investment that make up the sinking fund. In

the IRR method the sinking fund rate was assumed to be the same rate as that used in the investment stage. However, these funds would not be able to yield as high a rate as is possible in the investment stage. As a result, sinking fund rates are typically calculated using rates applicable to short term debt instruments. Fritch & Reisman mentioned that lessors typically calculated leases using a sinking fund rate of zero. This would result in a safer and lower estimate of the yield on a lease. With today's higher short-term rates, it would be questionable whether a zero sinking fund rate is too low a rate to use.

Another example illustrating the effect that the sinking fund has on the yield a lessor obtains can be seen in Table III.

TABLE III

FIRST CHICAGO LEASING CORPORATION EXAMPLE OF EFFECT OF SINKING FUND ON LESSORS RATE OF RETURN

Total Investment	$1,000,000
Equity Investment	$ 300,000
Years	15
Sinking Fund Reinvestment	variable
Borrowed Capital	$ 700,000
Interest rate	9.00%
Number of years	15
Payment	$ 86,841
Depreciable Investment	$1,000,000
Residual Value	none
Depreciable life- Sum of Years Didgets	7
ITC	7%
Tax rate	48%

Source: First Chicago Leasing Corporation, Leveraged Leasing: A New Alternative in Financing, Jock O'Grady Communications, Inc.

When the after tax sinking fund rate was varied there was a noticeable impact on the lessor's rate of return. When a 0% sinking fund rate was used, the calculated lessor's yield was a negative 2.85%. When a 5%

sinking fund rate was used, the calculated lessor's yield amounts to a positive 9.03%. One can see that the lessor's yield can be substantially affected by the sinking fund rate that is used.

Multiple Investment Sinking Fund Method

The SISF method assumed one investment period. That is, all future negative cash flows were offset by a series of positive cash flows. The resulting analysis then consisted of one negative payment at the beginning of the lease and a series of remaining positive cash flows. In actual practice, however, the lessor may choose to develope a series of investments in the lease. The lessor may wish to use excess cash generated from the lease for other purposes, instead of having it tied up in a sinking fund to be held for payment of all future negative cash flows as they occur. When more than one investment period occurs, the yield should be calculated using the MISF method.[25]

The MISF approach is an extension of the SISF in that there is more than one investment period. As a result, for each investment made there would be a corresponding sinking fund stage. Fritch & Reisman felt that the MISF method was the most common method used to analyze the leveraged lease. It is used primarily because excess cash is usually reinvested or used for other tax liabilities instead of being held in shorter term sinking fund accounts. In practice, there would be several investment and sinking fund stages for any given leveraged lease.

ENDNOTES

[1]Paul F. Anderson and John D. Martin, "Lease vs. Purchase Decisions: A Survey of Current Practice," Financial Management, Spring 1977, p. 43.

[2]Richard S. Bower, "Issues in Lease Financing," Finanical Management, Winter 1973, p. 26.

[3]Fred Weston and Eugene F. Brigham, Managerial Finance, 6th ed., 1978, p. 567.

[4]Anderson and Martin, "Lease vs. Purchase Decisions: A Survey of Current Practice," p. 43.

[5]Lawrence D. Schall, "The Lease-or Buy and Asset Acquisition Decision," Journal of Finance 29, September 1974, p. 1204.

[6] Weston and Brigham, Managerial Finance, p. 575.

[7]Bower, "Issues in Lease Financing", p. 26.

[8]Ibid, p. 28.

[9]Ibid, p. 29.

[10]Ibid, p. 31.

[11]Arthur C. Gudikunst and Gordon S. Roberts, "Leasing: Analysis of Theoretic Pragmatic Dilemma," paper presented at the annual meeting of the Financial Management Association, October 1975, p. 11.

[12]Ibid, p. 12.

[13]Ibid, p. 24.

[14]Berald Gavin Cooney, Financial Advances: The Management and Operation of a Bank Affiliated Leasing Company, Financial Publishing Company, Boston, Mass., 1971, p. 53.

[15]Bruce E. Fritch and Albert F. Reisman, Equipment Leasing-Leveraged Leasing, New York: Practicing Law Institute, 1980.

[16]Ibid, p. 370.

[17]Cooney, Financial Advances: The Management Operation of a Bank Affiliated Leasing Company, p. 53.

[18]David J. Nicol, "The Impact of Inflation on Present Value Analysis", Business Economics, p. 34.

[19]Weston and Brigham, Managerial Finance, p. 1014.

[20]Peter J. Athanasopoulos and Peter W. Bacon, "The Evaluation of Leveraged Leases", Financial Management, Spring 1980, p. 78.

[21]Fritch and Reisman, Equipment Leasing-Leveraged Leasing, p. 375.

[22]Ibid.

[23]Ibid, p. 379.

[24]First Chicago Leasing Corporation, Leveraged Leasing: A New Alternative in Financing, p. 33.

[25]Fritch and Reisman, Equipment-Leveraged Leasing, p. 374.

CHAPTER IV

DECISION VARIABLES COMMONLY USED IN LEASING DECISION MODELS

In addition to selecting the appropriate lease model to use, the lessor must be aware of how the variables within the model effect the lease decision. There are four decision variables used in leasing models. The variables are the cost of capital, the life of the lease, the residual value of the equipment and the effective tax rate. In this section each of the lease decision variables are examined to illustrate the impact that each have on the lease.

The net present value (NPV) equation given below defines the basic leasing decision for the lessor where:[1]

I = cost of the asset
Dep = the annual depreciation of the equipment
k = the cost of capital commensurate with the risk of return for the equipment
T = tax rate of the lessor
N = the length of the lease
NPV = the net present value of the lease rental income from the asset to the lessor
SV = salvage value of the equipment
PVIF = present value interest factor
t = time period

$$NPV = -I + PVIF(L_t(1-T) + T(Dep_t)) + PVIF(T)(SV)$$

The lessor attempts to maximize the net present value of his investment subject to the constraints within both the market and the firm. If the

leasing market is assumed to be highly competitive, then the NPV would be equal to zero. Therefore, in a competitive market the lessor could only expect to obtain the cost of capital appropriate with the competitive risks associated with the asset. Given competitive market constraints, the lessor must then determine what the lease payments should be subject to the internal constraints of the company. The size of the lease payments is thus dependent on what the lessor perceives the appropriate cost of capital to be, the level of the tax bracket, the residual value of the equipment, and the credit risk of the lessee. In a competitive market with no tax differential between lessors, the lessee would pay the lease payments determined by the market.[2]

Each lessor is forced to make a determination on what the value of each variable should be. Each variable is influenced by numerous factors. Inflation expectations, for example, would influence the residual value and the cost of capital values used. Therefore, when the lessor bids on a lease, his bid is a composite view of his perceptions of what these variables will be for the length of the lease. The lessor is implying quantified values for each of these variables given in the leasing model.

When many of the major airline companies set up true leases to finance their airplanes in the 1960's, they were in fact quantifying their projections of the market rates. In retrospect, they were incorrect in their decision variable projections. Many airplanes that have been released recently are worth more today than they were at the inception of the original lease. In another respect, the misfortunes of ITEL leasing corporation can be traced to inaccurate projects on the value of IBM computers they leased.[3] In order to understand the

implications being made when a lease is developed, it is advisable to review each of these decision variables.

Cost of Capital

There has been much discussion in the leasing literature as to the appropriate discount rate to use in financial lease models. For this discussion the appropriate discount rate is looked at from the lessor's viewpoint. What discount rate should the lessor use in his valuation model? In many respects the reasons given for applying a particular discount rate would be the same for the lessor as it would be for the lessee.

The lessor has no easy task in determing the appropriate discount rate. The critical assumption in developing discount rates as Miller and Upton point out is that of competitive equilibrium within the leasing industry.[4] It makes little difference whether the cost of capital is less for the lessor than it is for the user. What is important is the competitive nature of the leasing industry. With lessors competing among themselves the lease agreement would adjust to the market rate. Thus, the return would be neither above nor below the normal returns expected within the market.

The determination of the market lease payments can be explained by the use of the capital asset pricing model. It can be shown that the expected return on any asset j will be given by:

$$E(R_j) = R_f + B_j(E(R_m) - R_f)$$

Where:

R_f = risk free market rate
$E(R_m)$ = expected rate of return on the market portfolio
B_j = the measure of the individual product nondiversified risk

The risk free rate R_f is the rate of return given by risk free short term government securities. $(E(R_m) - R_f)$ is the market risk premium of the portfolio of leased equipment. The second term is a measure of the market risk premium of the particular asset.

Notice that the lessor has built into the equilibrium lease payment the nondiversifiable risk of the machine itself. The user firm is therefore paying for the obsolescence risk of the machine in the form of higher lease payments. The level of the obsolescence risk the lessee pays for is dependent on the residual value of the asset at the end of the lease. If the residual value was estimated to be zero at the end of the lease, then the lessee would incur the full cost of obsolescence which would be exactly the same as if he had bought the asset. If the lessor had estimated the residual value of the equipment to be greater than zero, the lessor would then be subject to some portion of the risk of ownership. The only way for the lessee to escape equipment obsolescence would be to rent under short term leasing, where the lessor carries all the risk of ownership.

Length of Lease

The risk mentioned above does not include the risk of default on the lease. The lessor has to consider the credit risks of the lessee. Credit risks can occur because of improper or inadequate credit evaluations or from poor financial performance of the firm. Even the best credit evaluation procedure cannot preclude the possibility of default on the lease. This default risk can be incorporated into the lease payments through add on interest points to the cost of capital. An

increased cost of capital would result in a slightly higher lease payment for the lessee to offset the risk of default.

A second possibility would be to make an estimation, using past lease experience, of lease defaults. Here the probability of lease defaults would shown an increase over the life of the lease. Survival probability rates for a 20 year lease, for instance, would likely be 100% for the first 10 years. For the remaining 10 years of the lease the survival rate of the lease would likely begin to drop somewhat below 100%. McGugan and Caves found default rates to be between one and two percent for the leasing companies they interviewed.[5] This default rate is considerably higher than the default rates associated with bank lending. Given default rates for a lease, cash flows minus the lease payments could be recalculated. Profitability of the lease would then be more accurately estimated.

A possible procedure to follow to incorporate default risk into the leasing decision was suggested by Lazaros Mavrides.[6] He suggested that management quantify their uncertainty about when a lease might be terminated. His decision analysis began by computing the net present value for a series of different default rates. From this, a NPV histogram was developed to show the range of possible NPV results. In this way management could encode risk preference into their lease decision.

Default risk can also occur as a result of casualty loss or from theft of the equipment. Here, insurance is the most straightforward solution. The insurance should cover the actual cash value of the equipment at all times. Before a lease is signed, the lessor should have evidence that the lessee has the equipment insured. If the

lessor is to carry the insurance liability, he can simply incorporate it into the lease payments.[7]

One factor that significantly affects the level of default risk a lessor uses in his analysis is his level of marketing expertise. The major problem with default risk is that many lessors do not have the capabilities to quickly market or resell the used equipment. The loss of income can greatly affect the profitability of that lease. This is especially critical for leveraged leases since they magnify the profits and losses. Therefore, it is important for the lessor to have a good marketing network available for remarketing this equipment.[8]

One further comment must be made on default risks. It must be pointed out that default risk increases the risk of ownership to the lessor. Assume that a lease had been set up where the residual value had been 20% of the original value. If no default occurs, the lessor would only be subject to 20% of the risk of ownership. If a lease is terminated by default in the middle of a lease, the lessor is now subject to a much greater risk of ownership. This risk would be proportional to the remaining unpaid balance defaulted by the lessee.

Taxes

The third decision variable that must be analyzed by the lessor is his tax rate. Estimating the level of taxes over a twenty year lease can be quite subjective. No lessor can know with certainty what his tax rate will be over the life of a long lease. Unexpected drops in the tax rate can cause severe changes in the income producing nature of the lease. The lessors ability to adapt to fluctuations in his tax rate is imperative to his survival.

There are several factors that may affect the tax rate of a lessor. One is the possibility of tax reform. Taxes have been increasing significantly lately for the individual taxpayer as well as the corporate taxpayer. In particular, the tax increases to corporate businesses have occured because taxes have not been indexed to include inflation. With public sentiment becoming increasingly more vocal for tax reform and capital improvements, it appears tax changes to some degree will occur in the near future. It remains to be seen what impact this tax revision will have to the lessors profitability.

The uncertainty of the tax law changes is a long term planning problem to the equipment lessor. A more immediate planning problem is the yearly estimation of income and tax levels for the firm. The relationship between income and taxes varies directly. This income-tax variation is dependent on the type of leasing concern. Bank and holding companies, for instance, base their leasing activity on the profitability of loans and other investments within the bank. As loan demand drops the level of leasing activity also must drop. The bank no longer is in need of a tax shelter. Therefore, the level of leasing is reduced. Leasing activity for captive leasing companies would be affected in a similar manner. As income level of the parent company declines, the level of leasing activity also must decline. For these types of leasing companies the tax level of the firm would remain fairly constant since leasing acts solely in a secondary nature to the other activities of the organization. The tax level would remain relatively constant while the volume of leasing business would tend to fluctuate.

The profitability-tax level of leasing companies is directly related to the portfolio balancing of the leases. The lessor has several ways to reduce this risk. One would expect the lessor to limit the proportion of their assets tied up in a single lease. Also, leases could be diversified into different types of leases.

McGugan and Caves found in their research on independent lessors some indication of diversification.[9] They found that only 10% write more than half of their leases in data processing or medical equipment, and 22.5% specialize in vehicles or office machines. Of their total respondents 67.5% did not specialize in one area. McGugan and Caves also found that lessors attempt to diversify across industry and region to reduce their risk.

Diversification strategy is also related to the size of the leasing company. It is evident that size plays a major role in risk reduction. The larger firm has better opportunities for risk diversification in several respects. These firms are better able to initiate leveraged leases. They are able to cover different regions of the country. They are also in a better position to lease a greater variety of equipment in different industries. In addition they have more discretion as to the size of leases that they can structure. The sheer volume of lease transactions that the larger firms initiate in itself creates better income and tax stability.[10]

While the smaller firms can still diversify, they are limited in many ways. They are limited generally to local communities. Leases are thus subject to more risk since growth stability can vary from one community to another. Also, leases in one geographical area would tend to be concentrated within a few industries. The small lessor is also

limited in the size of their leases. Because of their greater susceptibility to risk, they are also limited in the number of leveraged leases that they can initiate.

A lessor looks at his tax rate from both a long-term and a short-term perspective. In the long run he must forecast significant changes in the tax laws. In the short run he has to continually budget his level of income from all sources of income. He must diversify his leasing investments to prevent great fluctuations in his taxable income. This is especially true for the smaller equipment lessors since they often do not have other income sources available. Their income-tax levels would be subject to greater variability. After establishing the range of tax levels he is subject to, the lessor is then in a better position to evaluate the necessary return on any given lease.

Residual Value

The estimation of residual value is the remaining decision variable that will affect the leasing decision. It is important to understand how residual value affects this analysis. In recent years residual value estimation has taken on added significance. Several factors have led to this emphasis. In particular, these would include inflation expectations, technology, increased competition and changes in the economic value of certain types of equipment. Another major concept concerns the interrelationship between the IRS laws and residual value estimation. One of the major difficulties the lessor has is to subjectively analyze these factors. Before the final residual value is estimated for the lease, all of the variables mentioned above must be carefully considered.

Before proceeding further, it would be best to define some of the important terms commonly used. Bank Amerilease defines residual value, salvage value, and economic value as follows.[11]

> Residual Value-The value of equipment at the conclusion of the lease term. To qualify the lease as a "true lease" for tax purposes, the estimated residual value at the end of the lease term must equal at least 20% of the original cost of the equipment.
>
> Salvage Value-The minimum value for a depreciable asset. After sufficient depreciation is taken such that cost less accumulated depreciation equals salvage value, no more depreciation may be taken. This is not the same as residual value.
>
> Economic Life of Leased Property-The estimated remaining period during which the property is expected to be economically usable by one or more users, with normal repairs and maintenance, for the purpose for which it was intended at the inception of the lease.

These terms will provide a basis for some of the material that follows.

Competition is one of the factors that can have an impact on the residual value estimate. Prior to the growth of leasing, lessors enjoyed limited competition. With limited competition, businesses who desired to lease were forced to pay an extra premium on leased equipment. The lessor, being in greater demand, did not need to actively attract new business. In most cases businesses used leasing as a last alternative. Today, leasing has grown to an extent that the residual value estimates used in many leasing models would seem more realistic.

Also, the lessor, being a risk adverse person, would desire to limit his ownership risks by imputing a low estimate of the residual value into the lease analysis. The lessor naturally would prefer to use a low estimate of the residual value. In the past residual value estimates were quite often underestimated. But today, with the market being more competitive, the lessor is forced to make higher and more

realistic assumptions of the future residual value. As a result of this competition, lessors must impute slightly higher ownership risks than they have in the past for equipment that they lease.

Another important factor for the added importance of residual value estimates today has been the higher levels of inflation. Leases of the mid 60's simply did not account for the levels of inflation that we are experiencing today. An accurate estimate of residual value must include in the after tax cash flows expectations for inflation. For example, for a 10 year lease an average inflation rate of 7.18% per year will double the original residual value estimate over the life of the lease. And for a 15 year lease, a rate of 4.73% per year will double the original residual value estimate over the 15 year life of the lease. With the current inflation rates today over 10 percent, the importance of including inflation into the residual value estimate has increased.

Robert P. Marcus's article, "The cost of Leasing: Inflation and Residual Value," emphasizes the effect inflation has on the lessees effective interest rate.[12] Here he shows the comparison residual value estimates have on the implicit interest rate of the lessee. Given the high rates of inflation, the assumption of low residual value estimates can no longer be automatically assumed.

How important the residual value estimates are to the lease decision also depends on the type of equipment being leased. The degree of technological change can have a significant effect on the residual value estimate. Residual value estimates of computers, for example, would be greatly affected by the rate of technological change, whereas production machinery would not.

There would appear to be a inverse relationship between the variables, inflation and technology, when estimating residual value. That is, when the rate of technological change is high (as it is with computers), the importance of inflation to residual value estimates would be low.

The importance of residual value to the lease analysis is ultimately dependent on the IRS tax guidelines. In particular, these guidelines specify the minimum unconditional at-risk investment the lessor must have in the property. This unconditional at risk investment must be at least 20% of the cost of the property and it must be maintained until the end of the lease. In addition, the equipment must not be leased for more than 80% of its economic life.

The 80% economic life requirement establishes limits as to the length of a given financial lease. Because of this ruling the lessor, in order to minimize his ownership risk, would desire to structure the lease for as long as possible. The longer lease would result in more certain cash flows from the lease payments, with less of the overall return being dependent on the residual value of the equipment. The lessor would thus desire to have the residual value be as close to the 20% value as possible.

Salvage value is another important variable that can have an effect on the lessors return. Recall that salvage value is the esimate of what the property's value will be at the end of the intended use of the property. Salvage value is important because it effects the amount of equipment cost that can be depreciated over the life of the lease. Naturally, the lessor would prefer a salvage value of zero so that he could depreciate the total cost of the equipment. Unfortunately, in

order to satisfy the "true lease" requirement, salvage value must be equal to the residual value upon termination of the lease. Any salvage value less than 20% of original cost of the equipment would be in violation of the IRS requirements.[13]

The lessor, if he words the agreement properly, can avoid this constraint. If the lessor plans to continue using the equipment after the end of the lease, he then can allow for the salvage value to be less than the 20% requirement. It would then be to the lessors (and lessees) advantage to develop the lease agreement to include an option to renew the equipment at the end of the lease. In this way the equipment can be depreciated off at a faster rate, which would result in a savings to both the lessee and lessor.

The lessor today is forced with a much tougher decision analysis. Competition has increased at the same time as inflation uncertainties are rising. These factors have led to higher expectations of residual value estimates. Along with the upward movement of residual value estimates has come the worry over the economic value of units. Technological uncertainty of some types of equipment has caused further residual value estimate difficulties. This has been especially true in the computer leasing areas, where lessors have repeatedly had to foresee computer advancements from companies such as IBM. All of these factors have made residual value estimates essential to the leasing analysis.

In the next section, a questionnaire was distributed to a cross section of equipment lessors. The questionnaire was designed to measure how important residual value estimates are in the lease decision. In addition, the questionnaire asked how important each of the factors mentioned above are in obtaining residual value estimates.

ENDNOTES

[1]Fred Weston and Eugene F. Brigham, Managerial Finance, 6th ed, 1978, p. 552.

[2]Ibid.

[3]Interview with Mike Hardigan, Wells Fargo Leasing Division, Dallas, Texas, July 27, 1980.

[4]Merton Miller and Chales Upton, "Leasing, Buying and the Cost of Capital Services," Journal of Finance, June 1976, p. 761.

[5]Vincent J. McGugan and Richard E. Caves, "Integration and Competition in the Equipment Leasing Industry," The Journal of Business, p. 390.

[6]Lazaros P. Mavrides, "Decision Analysis for Real Estate and Appraiser and Analyst," The Real Estate Appraiser and Analyst, July-August 1979, p. 41.

[7]Seymour E. Spilka, "Residual-Value Insurance and Risk Management," Financial Executive, July 1980, p. 24.

[8]Paul F. Anderson and Monroe M. Bird, "Marketing to the Industrial Lease Buyer," Industrial Marketing Management, 9th ed., Elsevier North Holland, Inc., 1980, N.Y., N.Y., p. 116.

[9]McGugan and Caves, p. 393.

[10]Ibid.

[11]Bank AmeriLease Group, On the Spot Direct Leasing, San Francisco, CA, February 1978, 2nd printing, p. 59.

[12]Robert P. Marcus, "The Cost of Leasing: Inflation and Residual Value," Financial Analyst Journal, March-April 1978, p. 59.

[13]Bruce E. Fritch and Albert F. Reisman, Equipment Leasing-Leveraged Leasing, New York: Practicing Law Institute, 1980, p. 345.

CHAPTER V

QUESTIONNAIRE ON THE IMPORTANCE OF RESIDUAL VALUE TO LESSORS IN LEASE TRANSACTIONS

Introduction

How important is residual value estimates to the lease decision? To answer this question, two hundred questionnaires were sent out to randomly selected lessors. Lessors were alternately selected from membership listings obtained from the American Association of Equipment Lessors (AAEL). Self addressed stamped envelopes were used to increase the response rate on the questionnaires. Out of 200 questionnaires, fifty were returned for a response rate of 25%.

The questionnaire, as illustrated in Appendix A, was designed to determine several objectives. The first three questions sought to categorize the type of firms involved in leasing, the type of leases initiated, and the types of equipment categories that are most commonly leased. Question four illustrated the average term of the lease and the lessor's initial assumptions on the average equipment value expected at the end of the lease term for various types of equipment. Questions five, six, and seven sought to determine how important residual value was to lessors for each type of equipment and the percentage variation of actual to estimated residual value that has been experienced on executed lease transactions. The last question described what factors the

lessor felt were most important in explaining the difference between estimated residual values at the origin of the lease and the actual residual value at the end of the lease. The results obtained from the questionnaire can then be compared with the results obtained from the sensitivity analysis of the next section.

Questionnaire Results

Results of the first two questions and their percentage breakdowns are as follows:

Question 1. Under which of the categories would your firm be classified best?

Categories of Equipment Lessors	% of each Category
Bank-Affiliated Leasing Company	34%
Captive Leasing Company of Manufacturer	14%
Independent Equipment Leasing Company	44%
Related to Other Non-Bank Financial Institutions	4%
Other	4%

Question 2. During the period January 1, 1973, through December 31, 1980, approximately what percent of each of the following categories of leases were initiated by your firm?

Types of Lease Transactions	% of each Category
Sales-type lease	8.3%
Direct-finance lease	62.0%
Leveraged lease	10.1%
Operating lease	19.6%

As can be seen, a large percentage of all leases from the sample were direct finance leases, and were initiated by either Bank-Affiliated or independent equipment leasing company. The first two questions were

intended to determine whether different groups of lessors perceived the importance of residual value differently. Due to the sample size obtained for questions three through eight, a statistical comparison beween the groups could not be accomplished.

The third question sought to determine the major types of equipment leased and the average number of lease transactions per year. The results of this question revealed the types of equipment that are most heavily used for leasing. The ranking was based on the total number of transactions per year given by all of the respondents. Only those categories where the response level was greater than ten were considered. All of the other categories did not have a high enough response rate to generate a reliable rank order. The results were somewhat surprising. Trucks, aircraft, railcars, and automobiles were not considered by the applicants the most common types of leases generated. It must be mentioned though that the ranking given does not imply an absolute measure of importance. To imply an absolute measure of importance, the dollar amount of the transaction must also be considered. The results of question three are shown below.

Question 3. Major Types of Equipment Most Commonly Leased

Category Number-Type of Equipment Leased	# of Responses	Rank
(7) Office machinery and equipment (EDP)	32	1
(8) Production machinery and equipment	18	2
(1) Agricultural equipment	14	3
(5) Medical equipment	12	4
(6) Nonproduction machinery and equipment	11	5

Question four revealed the range of lengths of leases and estimated residual values made at the inception of the lease for the five types of equipment. The results, as shown below, show significant variations

in lease terms within each equipment category. This variation can be explained in two ways. The first and probably the most significant reason for this variation is the broad categories used. Each category could be made up of several different types of equipment, each possessing a different life. The second possibility is the level of risks the lessor is willing to take in determining the length of a particular lease. Using a greater life for a given lease than that which is normally used would result in advantageous lease rates. This would allow him a more competitive edge over other lessors that used shorter lease terms. However, this advantage may be more than offset by significant declines in the equipments value at the end of the lease.

Question 4a. Average Term of Lease Transaction (months)

Category Number	Sample Size	Average Lease Term	Standard Deviation of Lease Term	Minimum Value Observed	Maximum Value Observed
(1)	14	72.9	12.9	54	95
(5)	11	58.0	11.8	36	84
(6)	13	60.5	13.6	36	96
(7)	33	58.0	13.2	36	85
(8)	18	65.0	15.0	36	96

The second part of question four reveals modest differences among lessors as to their initial estimates of residual values at the inception of the lease. For the five types of equipment selected, all standard deviations from the mean were less than 10. The variances obtained would appear to be reasonable given the lessor's desired risk level and the possibility of different equipment lives within each category.

Question 4b. Estimated Average Residual Value (RV) at Origin of Lease as a Percentage of Equipment Cost

Category Number	Sample Size	Mean RV of Equipment Leased	Standard Deviation of Mean RV	Minimum Value Observed	Maximum Value Observed
(1)	14	16.4	6.8	5	30
(5)	10	11.8	4.8	3	20
(6)	13	13.5	9.2	5	40
(7)	32	9.8	4.6	5	30
(8)	15	13.7	6.7	10	35

Question 5 sought to determine the level of importance of residual value in the lessors lease decision. The results of this question, as illustrated below, show a wide variation between lessors as to how important residual value is in obtaining their desired rate of return. This wide variation makes it difficult to generate any reliable explanations as to the results observed. It does appear, though, that the importance of residual value to lessors was somewhat related to average lease term. Agriculture equipment, for instance, had the greatest lease term of the five types of equipment selected and also showed

Question 5. Importance of Residual Value to Lessors in Obtaining Their Desired Rate of Return

Category Number	Sample Size	Mean RV Importance	Standard Deviation of RV Importance	Minimum Value Observed	Maximum Value Observed
(1)	14	3.6	1.2	1	5
(5)	8	3.0	1.7	1	5
(6)	12	3.0	1.3	1	5
(7)	32	2.8	1.5	1	5
(8)	18	3.3	1.3	1	5

the greatest importance of residual value. The results of question 5 when compared to the average lease terms observed from question 4 leads

one to believe that there is a positive correlation between the importance of residual value and the length of a particular lease. This would seem reasonable since the uncertainty in estimating residual value increases as the length of a lease increases.

The large range in residual value importance within each category may also be due to the variation of lease terms within each category. The lessor's desired risk return level may also effect how the lessor perceives the importance of residual value in his lease decision.

The results of question six show that the residual values selected at the beginning of the lease were slightly underestimated over the past five years. The results of question seven were deleted since, for the most part, they yielded the same responses as those given in question six. In question six, the nonproduction machinery and equipment (category six) and the production machinery and equipment (category eight), on the average increased by 10% to 20% over the estimated value at the beginning of the lease. The mean percent variation of the other three categories showed to be less than 5% overall. It would appear that for a group, lessors met their expectations of the future value of equipment leased.

Question 6. Percent Variation From the Average Estimated Residual Value Experienced by Lessors

Category Number	Sample Size	Percent Variation of Mean RV	Standard Deviation From Mean	Minimum Value Observed	Maximum Value Observed
(1)	11	2.8	32.9	-40%	+60%
(5)	8	2.5	34.0	-40%	+60%
(6)	12	12.5	23.0	-20%	+60%
(7)	30	5.0	35.0	-40%	+60%
(8)	18	17.0	17.0	-40%	+60%

Within each category, however, there was a significant variation from the mean. In four of the equipment categories, residual value varied from a -40% to +60% of what was expected. As was mentioned before, this variation is in part attributable to the different types of machinery leased as well as the estimated risk level of each individual lessor.

Question 8. Relative Importance of the Five Factors Given Below in Explaining the Difference Between Estimated Residual Value at the Origin of the Lease and the Actual Residual at the End of the Lease. (Based on a scale of 1 to 5 where 1 = least important, 5 = most important.)

Factor Influencing Residual Value of Leased Equipment	Category Number	Sample Size	Mean	Standard Deviation
Inflation	(1)	11	3.9	1.0
	(5)	8	3.8	1.6
	(6)	11	3.1	1.4
	(7)	29	3.1	1.4
	(8)	18	3.3	1.2
Technology	(1)	11	2.8	1.5
	(5)	8	3.8	1.6
	(6)	11	3.6	1.6
	(7)	30	3.8	1.4
	(8)	18	3.9	1.1
Competition	(1)	11	2.8	1.5
	(5)	8	1.6	.5
	(6)	11	3.6	1.6
	(7)	30	1.9	1.1
	(8)	18	2.1	1.0
Type of Equipment	(1)	11	3.8	1.0
	(5)	8	4.0	.6
	(6)	11	3.8	1.2
	(7)	30	2.0	1.4
	(8)	18	4.5	.8
Type of Lease	(1)	11	2.0	1.7
	(5)	8	2.4	1.9
	(6)	11	1.7	1.1
	(7)	30	2.0	1.4
	(8)	18	1.9	1.5

The results of the final question demonstrated the difficulty of estimating the residual value of equipment. The importance of each factor varied considerably from lessor to lessor. One fact that could be observed is the level of importance that inflation has on residual value. It appears from the results obtained, that technology and the type of equipment are equal or greater in importance than inflation in estimating residual value for several types of equipment. This would seem somewhat surprising since inflation has increased significantly in recent years. The other factors, increased competition and type of lease, were not considered to be as important as the other variables mentioned above.

The overall results of the survey demonstrated, that as a group, lessors have been able to accurately estimate the remaining value of equipment at the end of a lease. It also appears from the survey that the effect of inflation is negatively correlated to both the type of equipment and the level of technology in explaining the difference between estimated residual value and the actual residual value obtained in a lease. For example, technology and the type of equipment seem to be much more important than inflation when residual value estimates are made on computer equipment leases. In the next section a sensitivity analysis was performed to see what effects the variation in residual value has on the lessors expected rate of return.

CHAPTER VI

COMPUTER SIMULATION

To analyze the effects that residual value has on the lessors expected rate of return, the following simulation was performed. The standard IRR on investment was used in determining the lessors rate of return. The description and the assumptions used in the model are given below.

TABLE 4

COMPUTER SIMULATION PROBLEM-ANALYSIS OF THE EFFECT RESIDUAL VALUE HAS ON THE LESSORS EXPECTED RATE OF RETURN

Equipment Cost	$100,000
Investment Tax Credit	10%-used at inception of lease
Salvage Value of Equipment	$20,000
Depreciation	SYD
Financing	Full equity position
Simulation Variables	Tax rate (TAXR) = 50% 45% 40%
	Lessors Desired IRR (EXPIRR) = 10%---24%
	Length of Lease (LEAST) = 3 yrs.---10 yrs.
	Residual Value (RESVAL) = $0.00, $10,000, $20,000, $30,000 $40,000

Results

For each combination of tax rate, lease term, and desired rate of return, the computer simulation calcuated the lease payment and generated the projected cash flows. The lessors expected internal rate of return (EXPIRR) was initially calculated assuming a 20% residual value estimate. After the EXPIRR was calculated, the residual value was allowed to vary from 0% to 200% of its original value. For each residual value estimate a new IRR was calculated. This was then compared to the EXPIRR to measure the effect changes in residual value estimates have on the lessors desired rate of return. (See Appendix B) Table five and figure four (A through I) show the results that were generated from the computer simulation.

The results of the simulation revealed three factors which impact on the importance of residual value to the lessor. These factors are discussed below.

Expected Rate of Return

The first and by far the most important factor that has a great impact on the importance of residual value in the lease decision is the lessors initial desired rate of return. As Table 5 reveals, a lessor who desires a 24% return would preceive the importance of residual value to be much less than he would had his desired return been 10%. For example, refer to Table five for a lease of three years and a 50% tax rate. The simulation shows a remarkable difference in the importance of residual value for expected rates of return of 10% and 24%. In this case, assuming residual value declines to zero, the lessor

could expect to receive 51% of his expected or desired rate of return of 10%. Had his desired rate of return been 24% he could have expected to receive 83% of his expected return. Thus, the simulation reveals that the importance of residual value dramatically decreases, even for short term leases, as the expected rate of return desired increases.

Length of Lease

Another factor of great importance is the length of the lease. A visual comparison of the selected lease terms verifies this point. For example, a comparison is made between a lease of lengths three, seven and ten years at an expected rate of return of 10%. A 100% decline in the equipment's value for a three year lease results in the lessor obtaining only 51% of his expected rate of return. For a ten year lease, however, the lessor would obtain 89% of his desired rate of return. Thus, the length of a lease can have a dramatic effect on how important residual value is to the lessor.

Tax Rate

The tax rate of the lessor is the third factor observed from the simulation. Table five shows, however, that the lessor's tax level has significantly less of an impact on the importance of residual value to the lessor. A comparison of the three year lease in Table five shows the importance of residual value decreases as the lessors tax rate decreases. When a IRR of 10% is desired, the lessor could expect to obtain 51% of his expected rate of return, should the equipment lose its value at the end of the lease. Had the lessor been in a 40% tax bracket he could expect to obtain 60% of his desired rate of return. The

importance of a lessors tax rate becomes considerably less significant for higher expected rates of return. The variation from the expected rates of return for a three year lease with a residual value of zero is 83% for a tax rate of 50% compared to 87% for a tax rate of 40%. With today's level of high inflation and interest rates, the lessor's tax rate has little effect on the importance of residual value to the lessor.

TABLE 5

PERCENT VARIATION FROM THE LESSOR'S EXPECTED RATE OF RETURN

Length of Lease (Yrs.)

IRR = 10% Tax Rate = 50%

Residual Value	Length = 3 yrs	Length = 7 yrs	Length = 10 yrs
0	-51.0%	-81.0%	-89.0%
20,000	100.0%	100.0%	100.0%
40,000	145.0%	117.0%	110.0%

IRR = 24% Tax Rate = 50%

Residual Value	Length = 3 yrs	Length = 7 yrs	Length = 10 yrs
0	-83.0%	-96.0%	-98.0%
20,000	100.0%	100.0%	100.0%
40,000	116.0%	104.0%	102.0%

IRR = 10% Tax Rate = 45%

Residual Value	Length = 3 yrs	Length = 7 yrs	Length = 10 yrs
0	-55.0%	-83.0%	-91.0%
20,000	100.0%	100.0%	100.0%
40,000	141.0%	115.0%	109.0%

IRR = 24% Tax Rate = 45%

Residual Value	Length = 3 yrs	Length = 7 yrs	Length = 10 yrs
0	-85.0%	-96.0%	-98.0%
20,000	100.0%	100.0%	100.0%
40,000	115.0%	104.0%	102.0%

IRR = 10% Tax Rate = 40%

Residual Value	Length = 3 yrs	Length = 7 yrs	Length = 10 yrs
0	-60.0%	-86.0%	-92.0%
20,000	100.0%	100.0%	100.0%
40,000	137.0%	114.0%	108.0%

IRR = 24% Tax Rate - 40%

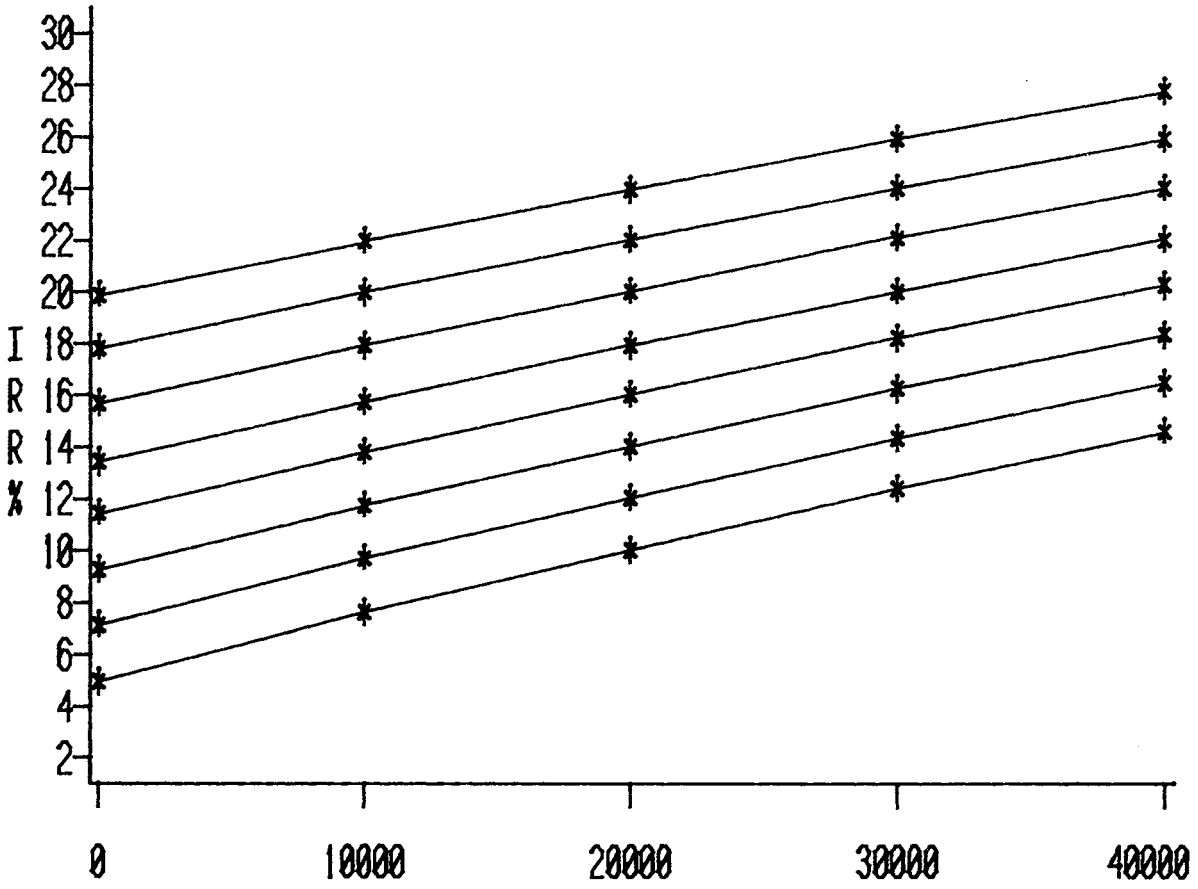
Residual Value	Length = 3 yrs	Length = 7 yrs	Length = 10 yrs
0	-87.0%	-97.0%	-99.0%
20,000	100.0%	100.0%	100.0%
40,000	113,0%	103.0%	101.0%

FIGURE 4A

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.5 LENGTH OF LEASE=3



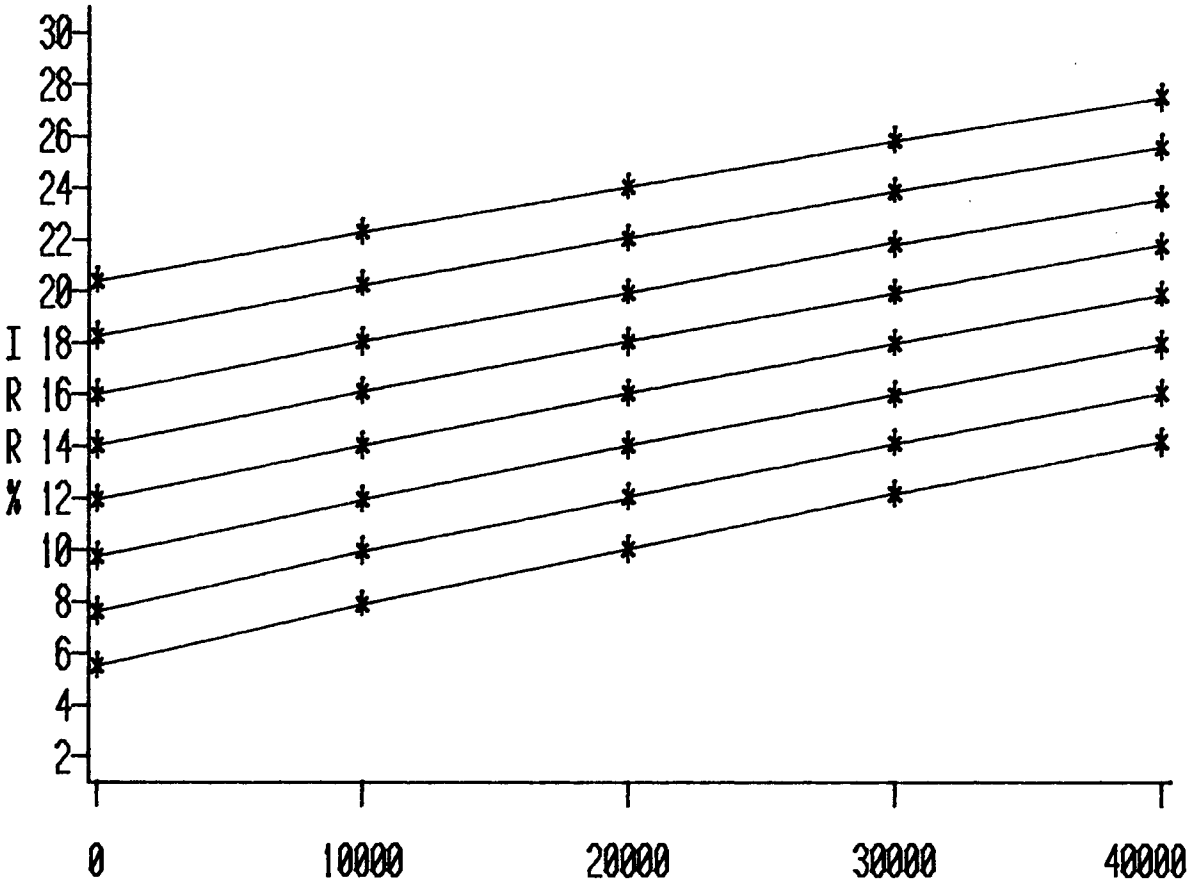
GIVEN SOYD DEPRECIATION ITC = $10000.00

FIGURE 4B

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.45 LENGTH OF LEASE=3



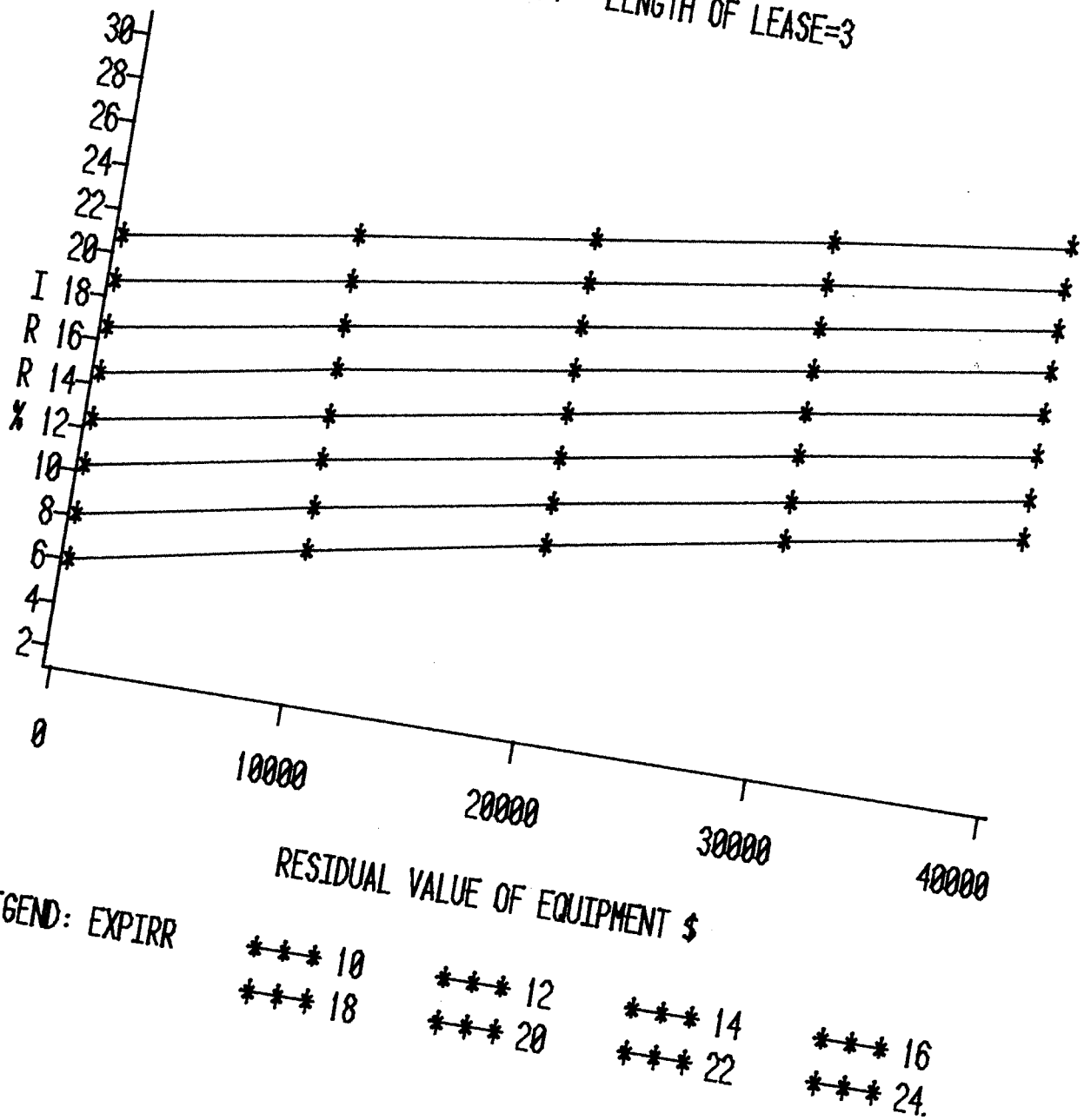
GIVEN SOYD DEPRECIATION ITC = $10000.00

FIGURE 4C

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.4 LENGTH OF LEASE=3



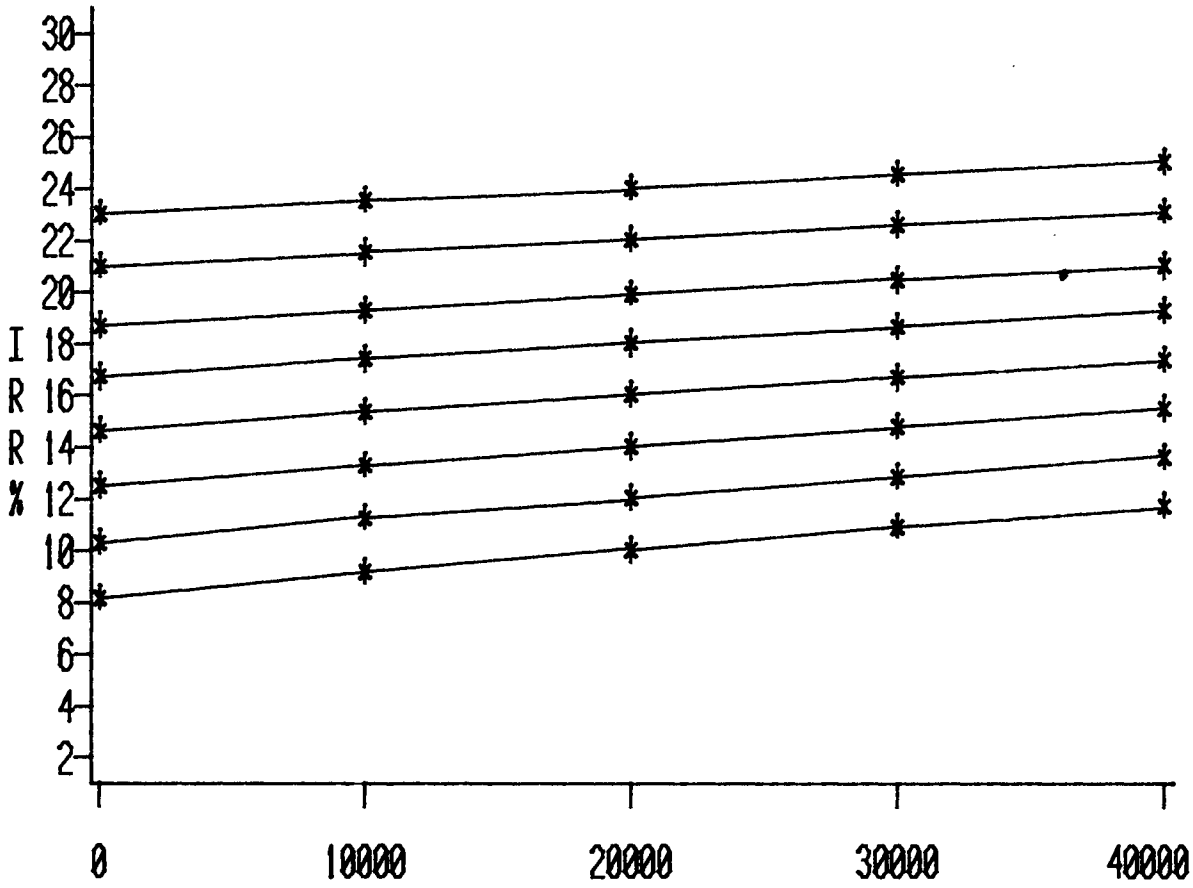
GIVEN SOYD DEPRECIATION ITC = $10000.00

FIGURE 4D

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.5 LENGTH OF LEASE=7



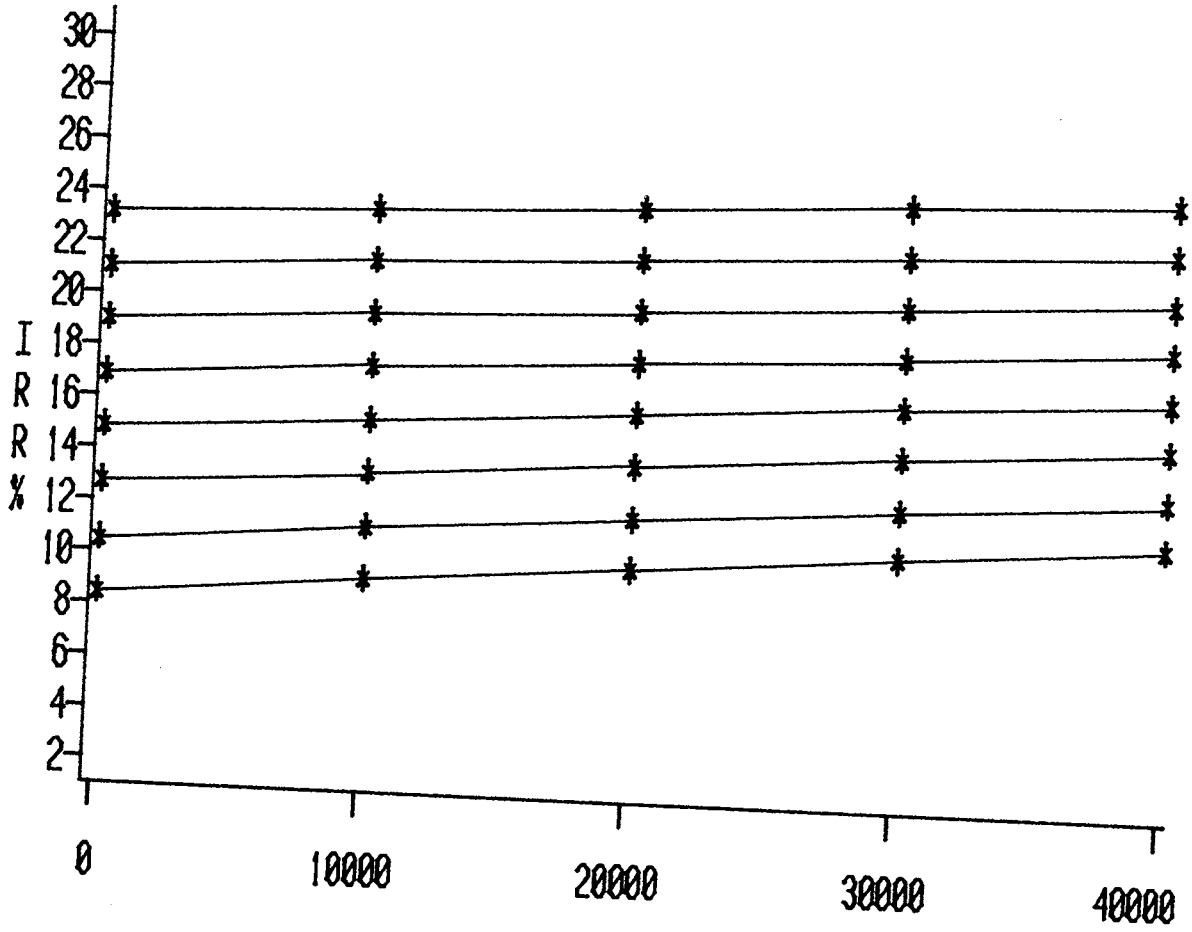
GIVEN SOYD DEPRECIATION ITC = $10000.00

FIGURE 4E

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.45 LENGTH OF LEASE=7



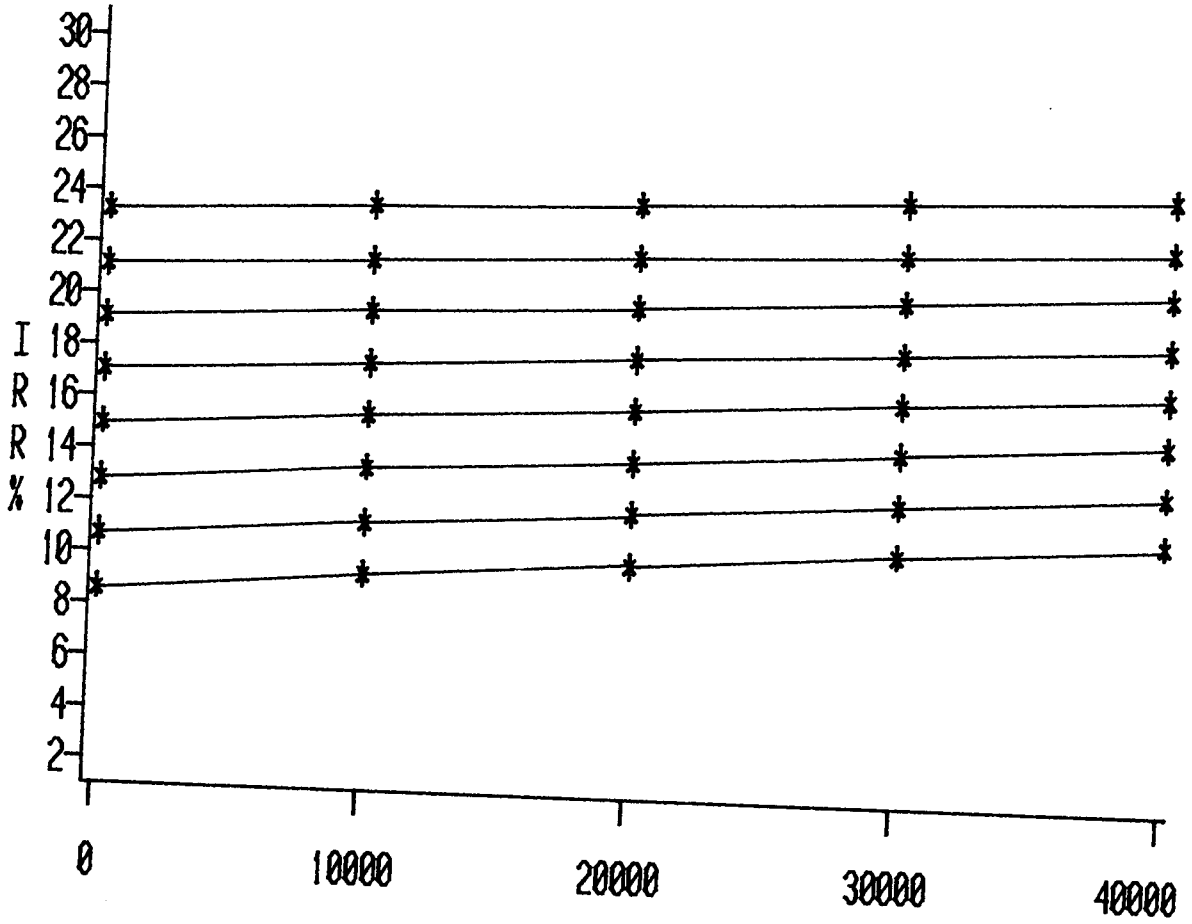
GIVEN SOYD DEPRECIATION ITC = $10000.00

FIGURE 4F

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.4 LENGTH OF LEASE=7

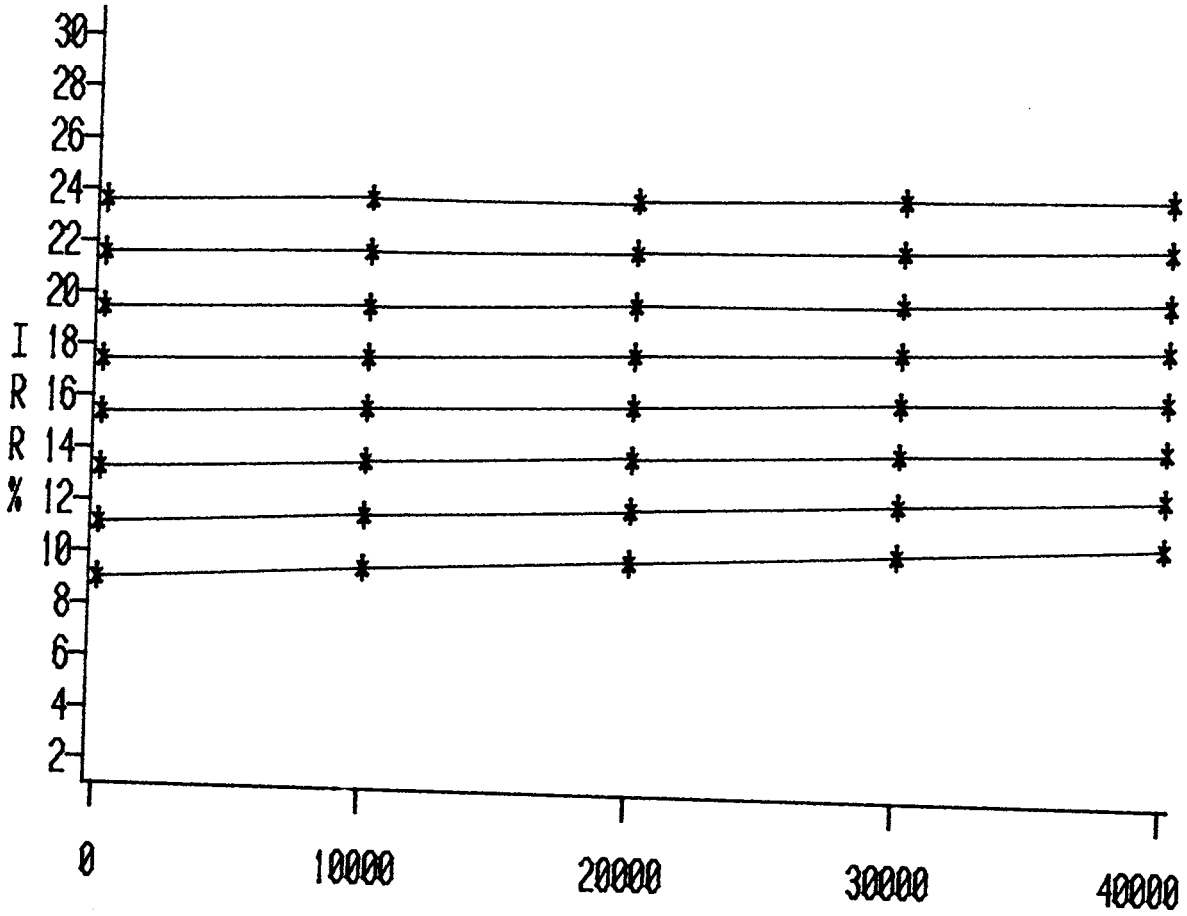


GIVEN SOYD DEPRECIATION ITC = $10000.00

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN.

TAX RATE=0.5 LENGTH OF LEASE=10



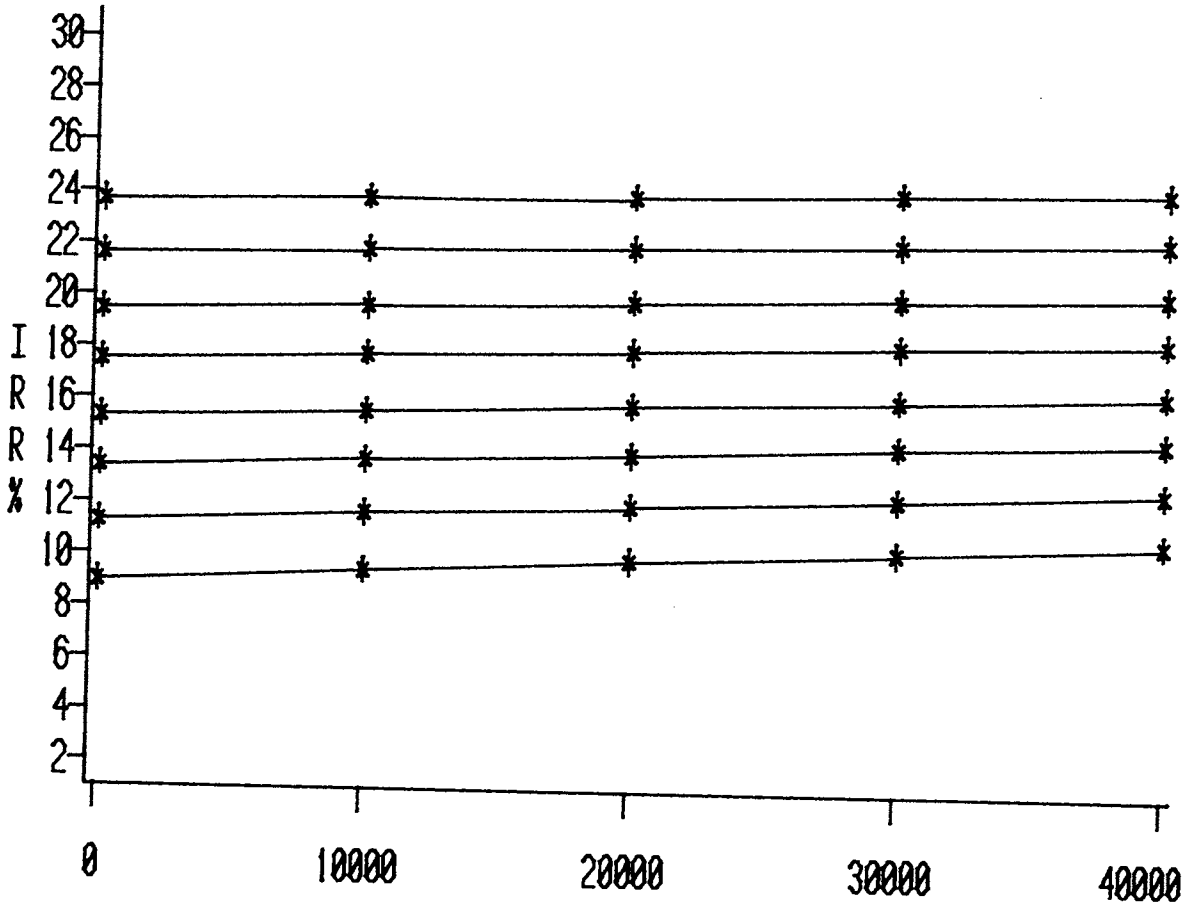
GIVEN SOYD DEPRECIATION ITC = $10000.00

FIGURE 4H

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.45 LENGTH OF LEASE=10



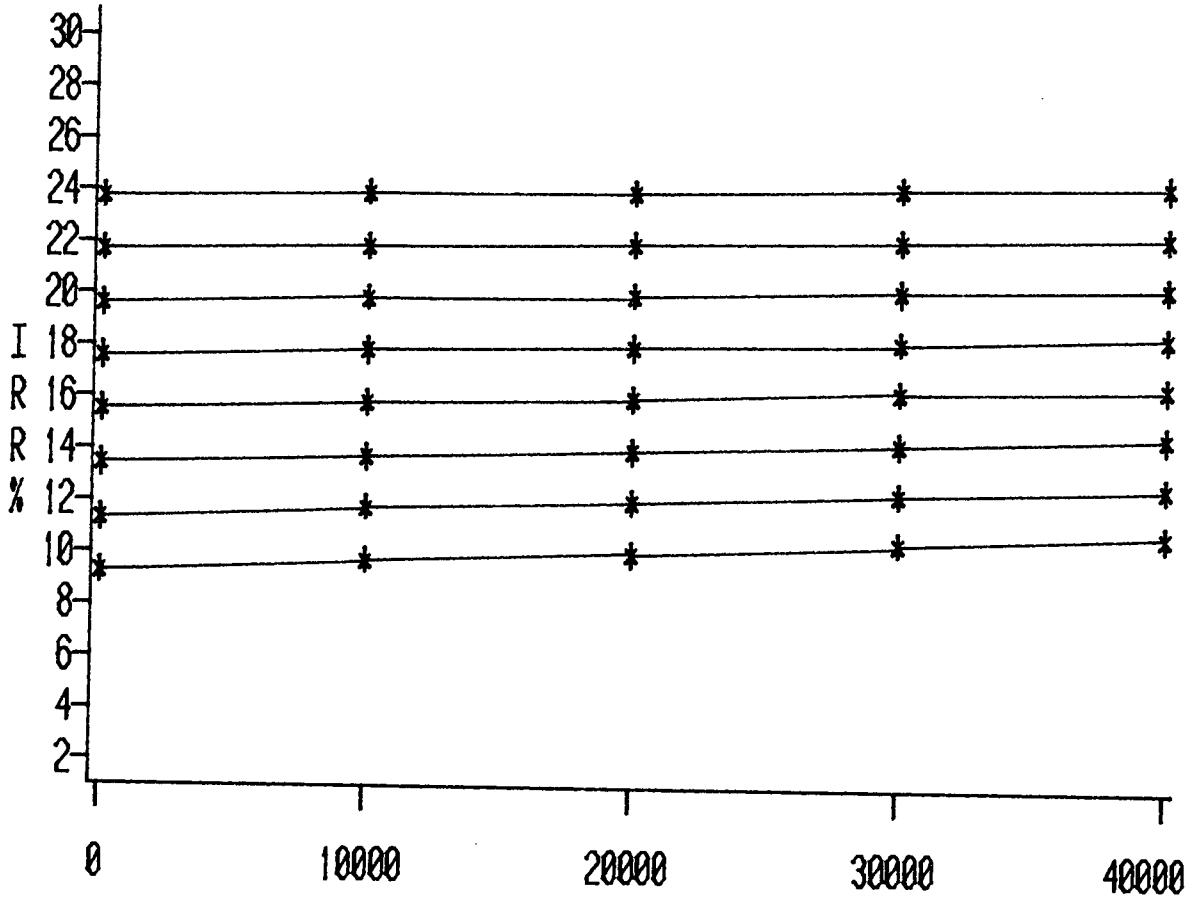
GIVEN SOYD DEPRECIATION ITC = $10000.00

FIGURE 4I

THE IMPORTANCE OF RESIDUAL VALUE

TO THE LESSOR'S RATE OF RETURN

TAX RATE=0.4 LENGTH OF LEASE=10



GIVEN SOYD DEPRECIATION ITC = $10000.00

CHAPTER VII

CONCLUSIONS

The findings of this study give added insight into the degree of importance residual value estimates have in the lease decision. A review of the leasing literature revealed the complexity that exists in making sound lease decisions. Despite the complexity that exists, leasing has shown continual growth in recent years.

One of the major difficulties in lease transactions is the difficulty in meeting the Internal Revenue Service and Financial Accounting Standard Board (FASB) guidelines. FASB recently implemented "FASB 13 as amended and interpreted through May 1980," to clarify the accounting requirements of a lease. The passage of FASB 13 and its amendments has had a significant impact on lease transactions. In particular, FASB 13 greatly lessened the number of leases that can qualify as off balance sheet leases.

The Internal Revenue Service tax requirements define a lease as either a "True Lease" or "Conditional Sale Lease." To determine the type of lease the IRS issued Rev. Rule 55-540, which listed the requirements needed to satisfy the conditional sale lease. Rev. Proc. 75-21 was later developed to give specific guidelines to meet the true lease requirements.

The lease vs. buy dilemma has generated a significant amount of literature. One article by Bower revealed that many of the lease vs.

buy models are, in fact, quite similar. Another article by Gudikunst gave evidence that in practice lessees chose to lease even though all the major lease vs. buy models would have supported buying the equipment over leasing. The results of this literature leads one to assume the present lease vs. buy models do not completely define the lease decision and that other nonquantitative factors must be incorporated into the lease vs. buy decision.

A review of the literature reveals that the single investment sinking fund method (SISF) and the multiple investment sinking fund method (MISF) are the most common types of lease evaluation models in use. Both are extensions of the internal rate of return method. In the use of either method lessors must contend with the variation of sinking fund rates. It was observed that variation in sinking fund rates results in significant changes in the lessors rate of return.

There are four decision variables used in analyzing leasing models. The variables are the cost of capital, the life of the lease, the residual value of the equipment and the effective tax rate. The literature divulges that each of the decision variables has a significant impact on the lessor's rate of return. The lessor must incorporate ownership risks into each of his decision variables estimates. Ownership risk is thus passed on to the lessee.

The findings of the questionnaire and the computer simulation generate some interesting findings into the degree of importance residual value estimates have in the lease decision. The questionnaire reveals that there is much disagreement among lessors on the importance of residual value estimates. The survey revealed a great divergence

among lessors on the importance of residual value estimates. Even with the large deviation of responses, a few major findings were observable.

One significant finding was the relationship between inflation and technology. Both of these variables have an impact on the residual value estimate. Results of the survey demonstrated that there is a negative correlation between these two variables. It was found that for residual value estimates for high technological types of equipment, inflation estimates become secondary in importance. The opposite effect was also observed. Estimates with built in inflationary expectations tend to be low technological types of equipment. The results of the survey demonstrated that inflation and technological change are the two most important factors in residual value estimates.

The computer simulation revealed a major finding in that the importance of residual value estimates has become less significant to the lease decision in recent years. This is primarily due to the higher rates of return required by lessors to maintain a profitable level above the inflation rate. The simulation demonstrated that as the lessor desires a higher rate of return, the importance of residual value to the lease decreases. This is a significant finding in that one would expect the importance of residual value to the lease decision to increase as the rate of inflation increases.

The questionnaire demonstrated that lessors have, for the most part, been fairly accurate in their residual value estimates. They have consistently been within 50% of the actual residual value of equipment leased. At today's rates of inflation, even a 100% variation in residual value estimates causes a relatively small change in the

lessor's desired rate of return. Therefore, the importance of residual value, given today's high rates of inflation, has become less significant to the lease decision.

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Appendix A

Please Return to Andy J. Kmetz
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Questionnaire about the Importance of Residual Value to Lessors in Lease Transactions

1. Under which of the following categories would your firm be classified best?

Bank-Affiliated Leasing Company	☐
Captive Leasing Company of Manufacturer	☐
Independent Equipment Leasing Company	☐
Related to Other Non-Bank Financial Institution	☐
Other (Please Specify)_____	☐

2. During the period January 1, 1973, through December 31, 1980, approximately what percent of each of the following categories of leases were initiated by your firm?

Type of Lease	Percentage of Each Class
Sales-type lease	_____%
Direct-finance lease	_____%
Leveraged lease	_____%
Operating Lease	_____%

3. Eleven categories of major types of leased equipment are given below.

Category Number	Types of Equipment Leased
1	Agricultural equipment
2	Aircraft
3	Automobiles
4	Construction machinery and equipment
5	Medical equipment
6	Nonproduction machinery and equipment
7	Office machinery and equipment (including EDP equipment)
8	Production machinery and equipment
9	Railcars
10	Trucks
11	Utility (power generating)

From categories listed, indicate the three most important types of leases made by your firm for the period January, 1973, through December, 1980, by filling in the appropriate category number in the table provided below. For each selected category number, estimate the average number of lease transactions made per year.

Ranking by Number of Equipment Lease Transactions	Category Number	Estimated Average Number of Lease Transactions Per Year
Greatest Volume	_____	_____
Second Greatest Volume	_____	_____
Third Greatest Volume	_____	_____

Prior to completing the remaining questions, insert the category numbers selected above, in the boxes provided for questions 4 through 7.

4. From the categories selected, estimate the average term (life) of each type of equipment leased. For each category, give the estimated average residual value (or terminal value) as a percent of original equipment costs, that was estimated at the inception of the lease.

Characteristics of Most Widely Used Leases

Category Number (From question 3)	Average Term of Lease (Months)	Estimated Average Residual Value at Origin of Lease-as Percentage of Equipment Cost
_____	_____ months	_____ %
_____	_____ months	_____ %
_____	_____ months	_____ %

5. From the equipment categories selected, using a scale of 1 to 5, how important was the residual value estimate in obtaining your desired return on investment. (To be considered after the basic lease term has been completed.)

Importance of Residual Value

Category Number (From Question 3)		Least Important				Most Important
		1	2	3	4	5
_____	----------	☐	☐	☐	☐	☐
_____	----------	☐	☐	☐	☐	☐
_____	----------	☐	☐	☐	☐	☐

6. For the categories selected in question 3, what is the range of error experienced when comparing the actual with the estimated residual value at the time a lease transaction is executed? (Check the appropriate response.)

Percent Variation From the Average (Mean) Residual Value

Category Number	Variation From the Average Residual Value of Each Category Number in Percent										
	Over 60%	-41% to -60%	-31% to -40%	-21% to -30%	-11% to -10%	0% to +10%	+11% to +20%	+21% to +30%	+31% to +40%	+41% to +60%	Over 60%
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

7. For each category listed in question 3, what is the percent realization of the original estimated residual value. "Percent realization" is defined as Actual Residual Value to Estimated Residual Value.

Percent Realization of Residual Value
Actual RV/Estimated RV

Category Number (From question 3)	Less Than 60%	60-80%	81-100%	101-120%	121-140%	141-160%	More Than 100%
_____	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐

8. How do each of the following factors explain the difference between the estimated residual value at the origin of the lease and the actual residual value at the end of the lease?

Factors Influencing Residual Value of Leased Equipment	Least 1	2	3	4	Greatest 5
Inflation	☐	☐	☐	☐	☐
Technology	☐	☐	☐	☐	☐
Increased Competition	☐	☐	☐	☐	☐
Type of Equipment	☐	☐	☐	☐	☐
Type of Lease	☐	☐	☐	☐	☐

```
JOB           ,TIME=(5,0)
      INTEGER AIL,AIJ
      REAL IRR, IRRFCN,LP,RESVAL
      DIMENSION PCF(50)
      IRR=0
      AINV=100000.
      AINVTC=10000.
       CSHOUT = AINV-AINVTC
       SALV=20000.
      TAXR=.55
      DO 100 J=1,3
       TAXR = TAXR -0.05
       WRITE(6,405) TAXR
405    FORMAT(/ 3X,' TAX RATE   = ',F5.3)
      LEAST=2
      DO 200 K=1,8
      LEAST=LEAST+1
       WRITE(6,406) LEAST
406    FORMAT(/ 3X,' LEASE TERM = ',I5)
      EXPIRR=8.00
      DO 300 L=1,8
      IRR=0
      EXPIRR=EXPIRR+2.00
       WRITE(6,403) EXPIRR
403    FORMAT(/ 3X,'EXPECTED IRR = ',F10.3)
      LP=100000/(LEAST*.9)
       IK = ((LEAST)*(LEAST+1))/2.0
       IL = LEAST+1
      A=0
      B=0
        WRITE(6,10)
 10   FORMAT(/ 3X,15HPROJ CASH FLOWS, 8X, 12HDEPRECIATION,9X,
     X11HCASH INFLOW,10X, 5HYEARS)
500   DO 400 I=1,IL
      AIJ=I-1
       AIK = IK
      AIL=1
      IF (I.EQ.1) AIL=0
      DEPCN=(AIL*(LEAST+2-I)/AIK)*(AINV-SALV)
       CASHIN = LP * (1-TAXR)
       IF(I.EQ.1) GO TO 111
      PCF(I)=(CASHIN + (DEPCN*TAXR))
      IF(I.EQ.(LEAST+1)) PCF(I)=(PCF(I)+(SALV*TAXR))
      GO TO 222
111   PCF(I)=(CSHOUT*(-1.0))
      CASHIN=0
222   IF(ABS(IRR-EXPIRR).GT.0.10) GO TO 400
      WRITE(6,404) PCF(I),DEPCN,CASHIN,AIJ,IK
404    FORMAT(/ 3X,F15.3,5X,F15.2,5X,F15.3,3X,I5,3X,I5)
400    CONTINUE
      IF(ABS(IRR-EXPIRR).LE.0.10) GO TO 600
      IRR=100*IRRFCN(IL,PCF,.001,KOUNT)
      IF(ABS(IRR-EXPIRR).LE.0.10) GO TO 500
      IF((IRR-EXPIRR).GE.0.0) A=1.0
      IF((IRR-EXPIRR).LT.0) B=1.0
      IF((A+B).EQ.2.0) GO TO 250
      INC=1000
      IF((IRR-EXPIRR).GT.0) LP=LP-INC
      IF((IRR-EXPIRR).LT.0) LP=LP+INC
      IF(KOUNT.GT.260) GO TO 130
```

```
      GO TO 500
  250  INC=100
      IF(ABS(IRR-EXPIRR).LE.0.15) INC=20
      IF((IRR-EXPIRR).LT.0) LP=LP+INC
      IF((IRR-EXPIRR).GT.0) LP=LP-INC
      GO TO 500
   30  WRITE(6,55)
   55  FORMAT('AFTER 260 ATTEMPTS THE IRR WAS NOT FOUND')
      GO TO 300
   00  T=0
      WRITE(6,402) LP
  402  FORMAT(/ 3X,' LEASE PAYMENT =',F12.2)
      WRITE(8,900) TAXR,LEAST,EXPIRR
   00  FORMAT(F5.3,I5,F10.3)
       WRITE(6,410) IRR,EXPIRR
  410  FORMAT(/ 3X,'IRR =',F10.3,'EXPECTED IRR =',F10.3)
  450  DO 700 I=1,IL
       AIJ=I-1
      AIK=IK
      AIL=1
      IF (I.EQ.1) AIL=0
      DEPCN=(AIL*(LEAST+2-I)/AIK)*(AINV-SALV)
       CASHIN = LP * (1-TAXR)
       IF(I.EQ.1) GO TO 125
      PCF(I)=(CASHIN + (DEPCN*TAXR))
      IF(I.EQ.(LEAST+1)) PCF(I)=(PCF(I)+(SALV*TAXR*T))
      GO TO 700
  125  PCF(I)=(CSHOUT*(-1.0))
  700  CONTINUE
      IRR=100*IRRFCN(IL,PCF,.001,KCNT)
      RESVAL=SALV*T
       WRITE(8,930)  RESVAL,IRR
  930    FORMAT(2F10.3)
      WRITE(6,460) RESVAL,IRR
  460  FORMAT(/ 3X,'RESVAL= ',F10.3,'IRR= ',F10.3)
      T=T+.5
      IF(T.EQ.2.5) GO TO 300
      GO TO 650
  300  CONTINUE
  200  CONTINUE
  100  CONTINUE
           STOP
       END

       REAL FUNCTION IRRFCN(N,FLOW,FSPAN,I)
       DIMENSION FLOW(50)                                          00
       REAL NPVRLO,NPVRHI                                          00
       FLOSUM = 0.0                                                00
       DO 50 I=1,N                                                 00
       FLOSUM = FLOSUM+FLOW(I)                                     00
   50  CONTINUE                                                    00
       RLO = 0.0                                                   00
       NPVRLO = FLOSUM                                             00
       STEP = 0.01                                                 00
       IF(FLOSUM.LT.0) STEP =-0.01
       RHI = STEP                                                  00
       DO 90 I = 1,260                                             00
       RHIP1 = RHI +1                                              00
       NPVRHI = 0.0                                                00
       DO 70 J=1,N                                                 00
```

```
      NPVRHI=(NPVRHI)+ FLOW(J)/RHIF1**J
   70 CONTINUE                                                          0
      IF(NPVRLO*NPVRHI .GT.0.) GO TO 75                                 0
      IF(ABS(RHI - RLO) .LT.RSPAN) GO TO 80                             0
      STEP = STEP/2.                                                    0
      RHI = RLO+ STEP                                                   0
      GO TO 90                                                          0
   75 RLO = RHI                                                         0
      NPVRLO = NPVRHI                                                   0
      RHI = RHI + STEP                                                  0
   90 CONTINUE                                                          0
      I = 261                                                           0
   80 IRRFCN = RLO
      RETURN
      END

 $ENTRY

\TE  = 0.500

 TERM =      3

ED IRR =      10.000

ASH FLOWS          DEPRECIATION          CASH INFLOW          YEARS

90000.000                 0.00              0.000        0        6

39488.510              40000.00           19488.510       1        6

32821.850              26666.66           19488.510       2        6

36155.180              13333.33           19488.510       3        6

 PAYMENT =     38977.04

   10.062EXPECTED IRR =     10.000

=       0.000IRR=       4.938

=   10000.000IRR=       7.625

=   20000.000IRR=      10.062

=   30000.000IRR=      12.437

=   40000.000IRR=      14.625

ED IRR =      12.000

ASH FLOWS          DEPRECIATION          CASH INFLOW          YEARS

-90000.000                0.00              0.000        0        6

40748.510              40000.00           20748.510       1        6

34081.850              26666.66           20748.510       2        6

37415.180              13333.33           20748.510       3        6
```