CHAPTER 21

Leasing

Executive Summary

Almost any asset that can be purchased can be leased, from aircraft to zithers. When we take vacations or business trips, renting a car for a few days frequently seems a convenient thing to do. This is an example of a short-term lease. After all, buying a car and selling it a few days later would be a great nuisance.

Corporations lease both short-term and long-term, but this chapter is primarily concerned with long-term leasing over a term of more than five years. Long-term leasing is a method of financing property, plant, and equipment. More equipment is financed today by long-term leases than by any other method of equipment financing.[1]

Every lease contract has two parties: the lessee and the lessor. The **lessee** is the user of the equipment, and the **lessor** is the owner. Typically, the lessee first decides on the asset needed and then negotiates a lease contract with a lessor. From the lessee's standpoint, long-term leasing is similar to buying the equipment with a secured loan. The terms of the lease contract are compared to what a banker might arrange with a secured loan. Thus, long-term leasing is a form of financing.

Many questionable advantages are claimed for long-term leasing, such as "leasing provides 100-percent financing," or "leasing conserves capital." However, the principal benefit of long-term leasing is tax reduction. Leasing allows the transfer of tax benefits from those who need equipment but cannot take full advantage of the tax benefits associated with ownership to a party who can. If the corporate income tax were repealed, long-term leasing would virtually disappear.

21.1 Types of Leases

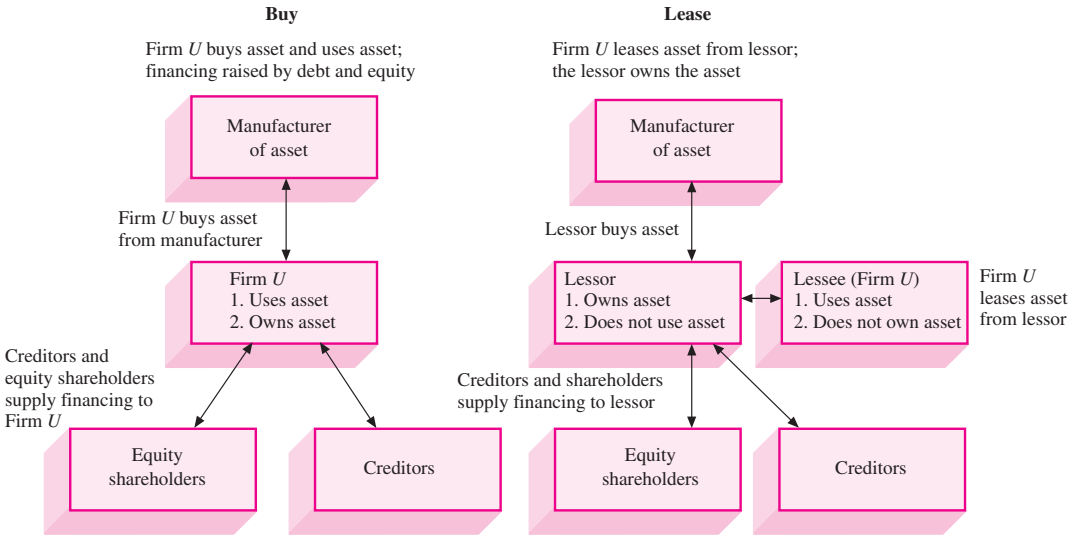
The Basics

A *lease* is a contractual agreement between a lessee and lessor. The agreement establishes that the lessee has the right to use an asset and in return must make periodic payments to the lessor, the owner of the asset. The lessor is either the asset's manufacturer or an independent leasing company. If the lessor is an independent leasing company, it must buy the asset from a manufacturer. Then the lessor delivers the asset to the lessee, and the lease goes into effect.

As far as the lessee is concerned, it is the use of the asset that is most important, not who owns the asset. The use of an asset can be obtained by a lease contract. Because the user can also buy the asset, leasing and buying involve alternative financing arrangements for the use of an asset. This is illustrated in Figure 21.1.

[1] P. K. Nevitt and F. J. Fabozzi, *Equipment Leasing,* 2nd ed. (Homewood, Ill.: Dow Jones-Irwin, 1985).

FIGURE 21.1 Buying versus Leasing



The specific example in Figure 21.1 happens often in the computer industry. Firm *U,* the lessee, might be a hospital, a law firm, or any other firm that uses computers. The lessor is an independent leasing company who purchased the equipment from a manufacturer such as IBM or Apple. Leases of this type are called **direct leases.** In the figure, the lessor issued both debt and equity to finance the purchase.

Of course, a manufacturer like IBM could lease its *own* computers, though we do not show this situation in the example. Leases of this type are called **sales-type leasing.** In this case, IBM would compete with the independent computer-leasing company.

Operating Leases

Years ago, a lease where the lessee received an operator along with the equipment was called an **operating lease.** Though the operating lease defies an exact definition today, this form for leasing has several important characteristics.

1. Operating leases are usually not fully amortized. This means that the payments required under the terms of the lease are not enough to recover the full cost of the asset for the lessor. This occurs because the term or life of the operating lease is usually less than the economic life of the asset. Thus, the lessor must expect to recover the costs of the asset by renewing the lease or by selling the asset for its residual value.
2. Operating leases usually require the lessor to maintain and insure the leased assets.
3. Perhaps the most interesting feature of an operating lease is the cancellation option. This option gives the lessee the right to cancel the lease contract before the expiration date. If the option to cancel is exercised, the lessee must return the equipment to the lessor. The value of a cancellation clause depends on whether future technological and/or economic conditions are likely to make the value of the asset to the lessee less than the value of the future lease payments under the lease.

To leasing practitioners, the above characteristics constitute an operating lease. However, accountants use the term in a slightly different way, as we will see shortly.

Financial Leases

Financial leases are the exact opposite of operating leases, as is seen from their important characteristics:

1. Financial leases do not provide for maintenance or service by the lessor.
2. Financial leases are fully amortized.
3. The lessee usually has a right to renew the lease on expiration.
4. Generally, financial leases cannot be canceled. In other words, the lessee must make all payments or face the risk of bankruptcy.

Because of the above characteristics, particularly (2), this lease provides an alternative method of financing to purchase. Hence, its name is a sensible one. Two special types of financial leases are the sale and lease-back arrangement and the leveraged lease.

Sale and Lease-Back A **sale and lease-back** occurs when a company sells an asset it owns to another firm and immediately leases it back. In a sale and lease-back, two things happen:

1. The lessee receives cash from the sale of the asset.
2. The lessee makes periodic lease payments, thereby retaining use of the asset.

An example of a sale and lease-back occurred when the city of Oakland, California, used the proceeds of a sale of its city hall and 23 other buildings to help meet the liabilities of the $150 million Police and Retirement System. As part of the same transaction, Oakland leased back the buildings to obtain their continued use.

Leveraged Leases A **leveraged lease** is a three-sided arrangement among the lessee, the lessor, and the lenders:

1. As in other leases, the lessee uses the assets and makes periodic lease payments.
2. As in other leases, the lessor purchases the assets, delivers them to the lessee, and collects the lease payments. However, the lessor puts up no more than 40 to 50 percent of the purchase price.
3. The lenders supply the remaining financing and receive interest payments from the lessor. Thus, the arrangement on the right-hand side of Figure 24.1 would be a leveraged lease if the bulk of the financing was supplied by creditors.

The lenders in a leveraged lease typically use a nonrecourse loan. This means that the lessor is not obligated to the lender in case of a default. However, the lender is protected in two ways:

1. The lender has a first lien on the asset.
2. In the event of loan default, the lease payments are made directly to the lender.

The lessor puts up only part of the funds but gets the lease payments and all the tax benefits of ownership. These lease payments are used to pay the debt service of the nonrecourse loan. The lessee benefits because, in a competitive market, the lease payment is lowered when the lessor saves taxes.

CONCEPT QUESTIONS ?

- What are some reasons that assets like automobiles would be leased with operating leases, whereas machines or real estate would be leased with financial leases?
- What are the differences between an operating lease and a financial lease?

TABLE 21.1 Example of Balance Sheet under FAS 13

Balance Sheet			
Truck is purchased with debt (the company owns a $100,000 truck)			
Truck	$100,000	Debt	$100,000
Land	100,000	Equity	100,000
Total assets	$200,000	Total debt plus equity	$200,000
Operating lease (the company has an operating lease for the truck)			
Truck	$0	Debt	$0
Land	100,000	Equity	100,000
Total assets	$100,000	Total debt plus equity	$100,000
Capital lease (the company has a capital lease for the truck)			
Assets under capital lease	$100,000	Obligations under capital lease	$100,000
Land	100,000	Equity	100,000
Total assets	$200,000	Total debt plus equity	$200,000

21.2 ACCOUNTING AND LEASING

Before November 1976, a firm could arrange to use an asset through a lease and not disclose the asset or the lease contract on the balance sheet. Lessees needed only to report information on leasing activity in the footnotes of their financial statements. Thus, leasing led to **off–balance-sheet financing.**

In November 1976, the Financial Accounting Standards Board (FASB) issued its Statement of Financial Accounting Standards No. 13 (FAS 13), "Accounting for Leases." Under FAS 13, certain leases are classified as capital leases. (We present the criteria later in this section.) For a capital lease, the present value of the lease payments appears on the right-hand side of the balance sheet. The identical value appears on the left-hand side of the balance sheet as an asset.

FASB classifies all other leases as operating leases, though FASB's definition differs from that of nonaccountants. (The use of operating leases by nonaccountants was discussed in an earlier section of this chapter.) No mention of the lease appears on the balance sheet for operating leases.

The accounting implications of this distinction are illustrated in Table 21.1. Imagine a firm that, years ago, issued $100,000 of equity in order to purchase land. It now wants to use a $100,000 truck, which it can either purchase or lease. The balance sheet reflecting purchase of the truck is shown at the top of the table. (We assume that the truck is financed entirely with debt.) Alternatively, imagine that the firm leases the truck. If the lease is judged to be an operating one, the middle balance sheet is created. Here, neither the lease liability nor the truck appears on the balance sheet. The bottom balance sheet reflects a capital lease. The truck is shown as an asset and the lease is shown as a liability.

Accountants generally argue that a firm's financial strength is inversely related to the amount of its liabilities. Since the lease liability is hidden with an operating lease, the balance sheet of a firm with an operating lease *looks* stronger than the balance sheet of a firm with an otherwise-identical capital lease. Given the choice, firms would probably classify all their leases as operating ones. Because of this tendency, FAS 13 states that a lease must be classified as a capital one if at least one of the following four criteria is met:

1. The present value of the lease payments is at least 90 percent of the fair market value of the asset at the start of the lease.
2. The lease transfers ownership of the property to the lessee by the end of the term of the lease.
3. The lease term is 75 percent or more of the estimated economic life of the asset.
4. The lessee can purchase the asset at a price below fair market value when the lease expires. This is frequently called a *bargain-purchase-price option.*

These rules capitalize those leases that are similar to purchases. For example, the first two rules capitalize leases where the asset is likely to be purchased at the end of the lease period. The last two rules capitalize long-term leases.

Some firms have tried to cook the books by exploiting this classification scheme. Suppose a trucking firm wants to lease a $200,000 truck that it expects to use for 15 years. A clever financial manager could try to negotiate a lease contract for 10 years with lease payments having a present value of $178,000. These terms would get around criteria (1) and (3). If criteria (2) and (4) could be circumvented, the arrangement would be an operating lease and would not show up on the balance sheet.

Does this sort of gimmickry pay? The semistrong form of the efficient-capital-markets hypothesis implies that stock prices reflect all publicly available information. As we discussed earlier in this text, the empirical evidence generally supports this form of the hypothesis. Though operating leases do not appear in the firm's balance sheet, information on these leases must be disclosed elsewhere in the annual report. Because of this, attempts to keep leases off the balance sheet will not affect stock price in an efficient capital market.

CONCEPT QUESTIONS

- Define capital lease.
- Define operating lease.

21.3 TAXES, THE IRS, AND LEASES

The lessee can deduct lease payments for income tax purposes if the lease is qualified by the Internal Revenue Service. Because tax shields are critical to the economic viability of any lease, all interested parties generally obtain an opinion from the IRS before agreeing to a major lease transaction. The opinion of the IRS will reflect the following guidelines:

1. The term of the lease must be less than 30 years. If the term is greater than 30 years, the transaction will be regarded as a conditional sale.
2. The lease should not have an option to acquire the asset at a price below its fair market value. This type of bargain option would give the lessee the asset's residual scrap value, implying an equity interest.
3. The lease should not have a schedule of payments that is very high at the start of the lease term and thereafter very low. Early *balloon* payments would be evidence that the lease was being used to avoid taxes and not for a legitimate business purpose.
4. The lease payments must provide the lessor with a fair market rate of return. The profit potential of the lease to the lessor should be apart from the deal's tax benefits.
5. The lease should not limit the lessee's right to issue debt or pay dividends while the lease is operative.

6. Renewal options must be reasonable and reflect fair market value of the asset. This requirement can be met by granting the lessee the first option to meet a competing outside offer.

The reason the IRS is concerned about lease contracts is that many times they appear to be set up solely to avoid taxes. To see how this could happen, suppose that a firm plans to purchase a $1 million bus that has a five-year class life. Depreciation expense would be $200,000 per year, assuming straight-line depreciation. Now suppose that the firm can lease the bus for $500,000 per year for two years and buy the bus for $1 at the end of the two-year term. The present value of the tax benefits from acquiring the bus would clearly be less than if the bus were leased. The speedup of lease payments would greatly benefit the firm and *de facto* give it a form of accelerated depreciation. If the tax rates of the lessor and lessee are different, leasing can be a form of tax avoidance.

CONCEPT QUESTION ?

- What are the IRS guidelines for treating a lease contract as a lease for tax purposes?

21.4 THE CASH FLOWS OF LEASING

In this section we identify the basic cash flows used in evaluating a lease. Consider the decision confronting the Xomox corporation, which manufactures pipe. Business has been expanding, and Xomox currently has a five-year backlog of pipe orders for the Trans-Honduran Pipeline.

The International Boring Machine Corporation (IBMC) makes a pipe-boring machine that can be purchased for $10,000. Xomox has determined that it needs a new machine, and the IBMC model will save Xomox $6,000 per year in reduced electricity bills for the next five years. These savings are known with certainty because Xomox has a long-term electricity purchase agreement with State Electric Utilities, Inc.

Xomox has a corporate tax rate of 34 percent. We assume that five-year straight-line depreciation is used for the pipe-boring machine, and the machine will be worthless after five years.[2]

However, Friendly Leasing Corporation has offered to lease the same pipe-boring machine to Xomox for $2,500 per year for five years. With the lease, Xomox would remain responsible for maintenance, insurance, and operating expenses.[3]

Simon Smart, a recently hired MBA, has been asked to calculate the incremental cash flows from leasing the IBMC machine in lieu of buying it. He has prepared Table 21.2, which shows the direct cash flow consequences of buying the pipe-boring machine and also signing the lease agreement with Friendly Leasing.

To simplify matters, Simon Smart has prepared Table 21.3, which subtracts the direct cash flows of buying the pipe-boring machine from those of leasing it. Noting that only the net advantage of leasing is relevant to Xomox, he concludes the following from his analysis:

[2]This is a simplifying assumption because current tax law allows the accelerated method as well. The accelerated method will almost always be the best choice.

[3]For simplicity, we have assumed that lease payments are made at the end of each year. Actually, most leases require lease payments to be made at the beginning of the year.

TABLE 21.2 Cash Flows to Xomox from Using the IBMC Pipe-Boring Machine: Buy versus Lease

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Buy						
Cost of machine	−$10,000					
After-tax operating savings [$3,960 = $6,000 × (1 − 0.34)]		$3,960	$3,960	$3,960	$3,960	$3,960
Depreciation tax benefit		680	680	680	680	680
	−$10,000	$4,640	$4,640	$4,640	$4,640	$4,640
Lease						
Lease payments		−$2,500	−$2,500	−$2,500	−$2,500	−$2,500
Tax benefits of lease payments ($850 = $2,500 × 0.34)		850	850	850	850	850
After-tax operating savings		3,960	3,960	3,960	3,960	3,960
Total		$2,310	$2,310	$2,310	$2,310	$2,310

Depreciation is straight-line. Because the depreciable base is $10,000, depreciation expense per year is $10,000/5 = $2,000.
The depreciation tax benefit per year is equal to

Tax rate	×	Depreciation expense per year	=	Depreciation tax benefit
0.34	×	$2,000	=	$680

TABLE 21.3 Incremental Cash Flow Consequences for Xomox from Leasing instead of Purchasing

Lease Minus Buy	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Lease						
Lease payment		−$2,500	−$2,500	−$2,500	−$2,500	−$2,500
Tax benefit of lease payment		850	850	850	850	850
Buy (minus)						
Cost of machine	−(−$10,000)					
Lost depreciation tax benefit		−680	−680	−680	−680	−680
Total	$10,000	−$2,330	−$2,330	−$2,330	−$2,330	−$2,330

The bottom line presents the cash flows from leasing relative to the cash flows from purchase. The cash flows would be exactly the *opposite* if we considered the purchase relative to the lease.

1. Operating costs are not directly affected by leasing. Xomox will save $3,960 (after taxes) from use of the IBMC boring machine regardless of whether the machine is owned or leased. Thus, this cash flow stream does not appear in Table 21.3.
2. If the machine is leased, Xomox will save the $10,000 it would have used to purchase the machine. This saving shows up as an initial cash *inflow* of $10,000 in year 0.

3. If Xomox leases the pipe-boring machine, it will no longer own this machine and must give up the depreciation tax benefits. These tax benefits show up as an *outflow.*
4. If Xomox chooses to lease the machine, it must pay $2,500 per year for five years. The first payment is due at the end of the first year. (This is a break, because sometimes the first payment is due immediately.) The lease payments are tax-deductible and, as a consequence, generate tax benefits of $850 (0.34 × $2,500).

The net cash flows have been placed in the bottom line of Table 21.3. These numbers represent the cash flows from *leasing* relative to the cash flows from the purchase. It is arbitrary that we express the flows in this way. We could have expressed the cash flows from the *purchase* relative to the cash flows from leasing. These cash flows would be

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Net cash flows from purchase alternative relative to lease alternative	−$10,000	$2,330	$2,330	$2,330	$2,330	$2,330

Of course, the cash flows here are the opposite of those in the bottom line of Table 21.3. Depending on our purpose, we may look at either the purchase relative to the lease or vice versa. Thus, the student should become comfortable with either viewpoint.

Now that we have the cash flows, we can make our decision by discounting the flows properly. However, because the discount rate is tricky, we take a detour in the next section before moving back to the Xomox case. In this next section, we show that cash flows in the lease-versus-buy decision should be discounted at the *after-tax* interest rate (i.e., the after-tax cost of debt capital).

21.5 A Detour on Discounting and Debt Capacity with Corporate Taxes

The analysis of leases is difficult, and both financial practitioners and academics have made conceptual errors. These errors revolve around taxes. We hope to avoid their mistakes by beginning with the simplest type of example, a loan for one year. Though this example is unrelated to our lease-versus-buy situation, principles developed here will apply directly to lease-buy analysis.

Present Value of Riskless Cash Flows

Consider a corporation that lends $100 for a year. If the interest rate is 10 percent, the firm will receive $110 at the end of the year. Of this amount, $10 is interest and the remaining $100 is the original principal. A corporate tax rate of 34 percent implies taxes on the interest of $3.40 (0.34 × $10). Thus, the firm ends up with $106.60 ($110 − $3.40) after taxes on a $100 investment.

Now, consider a company that borrows $100 for a year. With a 10-percent interest rate, the firm must pay $110 to the bank at the end of the year. However, the borrowing firm can take the $10 of interest as a tax deduction. The corporation pays $3.40 (0.34 × $10) less in taxes than it would have paid had it not borrowed the money at all. Thus, considering this reduction in taxes, the firm must pay $106.60 ($110 − $3.40) on a $100 loan. The cash flows from both lending and borrowing are displayed in Table 21.4.

TABLE 21.4 Lending and Borrowing in a World with Corporate Taxes (interest rate is 10 percent and corporate tax rate is 34 percent)

Date 0	Date 1
Lending example	
Lend − $100	Receive + $100.00 of principal
	Receive + $ 10.00 of interest
6.6% lending rate →	Pay − $ 3.40 (= −0.34 × $10) in taxes
	+ $106.60
After-tax lending rate is 6.6%.	
Borrowing example	
Borrow + $100	
	Pay − $100.00 of principal
	Pay − $ 10.00 of interest
6.6% borrowing rate →	Receive + $ 3.40 (= 0.34 × $10) as a tax rebate
	− $106.60
After-tax borrowing rate is 6.6%.	

General principle: In a world with corporate taxes, riskless cash flows should be discounted at the after-tax interest rate.

The above two paragraphs show a very important result: the firm could not care less whether it received $100 today or $106.60 next year.[4] If it received $100 today, it could lend it out, thereby receiving $106.60 after corporate taxes at the end of the year. Conversely, if it knows today that it will receive $106.60 at the end of the year, it could borrow $100 today. The after-tax interest and principal payments on the loan would be paid with the $106.60 that the firm will receive at the end of the year. Because of the interchangeability illustrated above, we say that a payment of $106.60 next year has a present value of $100. Because $100 = $106.60/1.066, a riskless cash flow should be discounted at the after-tax interest rate of 0.066 [0.10 × (1 − 0.34)].

Of course, the above discussion considered a specific example. The general principle is

> In a world with corporate taxes, the firm should discount riskless cash flows at the after-tax riskless rate of interest.

Optimal Debt Level and Riskless Cash Flows (Advanced)

In addition, our simple example can illustrate a related point concerning optimal debt level. Consider a firm that has just determined that the current level of debt in its capital structure is optimal. Immediately following that determination, it is surprised to learn that it will receive a guaranteed payment of $106.60 in one year from, say, a tax-exempt government lottery. This future windfall is an asset that, like any asset, should raise the firm's optimal debt level. How much does this payment raise the firm's optimal level?

[4]For simplicity, assume that the firm received $100 or $106.60 *after* corporate taxes. Since 0.66 = 1 − 0.34, the pretax inflows would be $151.52 ($100/0.66) and $161.52 ($106.60/0.66), respectively.

Our preceding analysis implies that the firm's optimal debt level must be $100 more than it previously was. That is, the firm could borrow $100 today, perhaps paying the entire amount out as a dividend. It would owe the bank $110 at the end of the year. However, because it receives a tax rebate of $3.40 (0.34 × $10), its net repayment will be $106.60. Thus, its borrowing of $100 today is fully offset by next year's government lottery proceeds of $106.60. In other words, the lottery proceeds act as an irrevocable trust that can service the increased debt. Note that we need not know the optimal debt level before the lottery was announced. We are merely saying that, whatever this prelottery optimal level was, the optimal debt level is $100 more after the lottery announcement.

Of course, this is just one example. The general principle is[5]

> In a world with corporate taxes, one determines the increase in the firm's optimal debt level by discounting a future guaranteed after-tax inflow at the after-tax riskless interest rate.

Conversely, suppose that a second and unrelated firm is surprised to learn that it must pay $106.60 next year to the government for back taxes. Clearly, this additional liability impinges on the second firm's debt capacity. By the above reasoning, it follows that the second firm's optimal debt level must be lowered by exactly $100.

CONCEPT QUESTION ?

- How should one discount a riskless cash flow?

21.6 NPV Analysis of the Lease-versus-Buy Decision

The detour leads to a simple method for evaluating leases: discount all cash flows at the after-tax interest rate. From the bottom line of Table 21.3, Xomox's incremental cash flows from leasing versus purchasing are

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Net cash flows from lease alternative relative to purchase alternative	$10,000	−$2,330	−$2,330	−$2,330	−$2,330	−$2,330

Let us assume that Xomox can either borrow or lend at the interest rate of 7.57575 percent. If the corporate tax rate is 34 percent, the correct discount rate is the after-tax rate of 5 percent [7.57575% × (1 − 0.34)]. When 5 percent is used to compute the NPV of the lease, we have

$$\text{NPV} = \$10{,}000 - \$2{,}330 \times A^5_{0.05} = -\$87.68 \qquad (21.1)$$

Because the net present value of the incremental cash flows from leasing relative to purchasing is negative, Xomox prefers to purchase.

Equation (21.1) is the correct approach to lease-versus-buy analysis. However, students are often bothered by two things. First, they question whether the cash flows in Table 21.3 are truly riskless. We examine this issue below. Second, they feel that this approach lacks intuition. We address this concern a little later.

[5]This principle holds for riskless or guaranteed cash flows only. Unfortunately, there is no easy formula for determining the increase in optimal debt level from a *risky* cash flow.

The Discount Rate

Because we discounted at the after-tax riskless rate of interest, we have implicitly assumed that the cash flows in the Xomox example are riskless. Is this appropriate?

A lease payment is like the debt service on a secured bond issued by the lessee, and the discount rate should be approximately the same as the interest rate on such debt. In general, this rate will be slightly higher than the riskless rate considered in the previous section. The various tax shields could be somewhat riskier than the lease payments for two reasons. First, the value of the depreciation tax benefits depends on the ability of Xomox to generate enough taxable income to use them. Second, the corporate tax rate may change in the future, just as it fell in 1986 and increased in 1993. For these two reasons, a firm might be justified in discounting the depreciation tax benefits at a rate higher than that used for the lease payments. However, our experience is that real-world companies discount both the depreciation shield and lease payments at the same rate. This implies that financial practitioners view the above two risks as minor. We adopt the real-world convention of discounting the two flows at the same rate. This rate is the after-tax interest rate on secured debt issued by the lessee.

At this point some students still ask the question: Why not use r_{WACC} as the discount rate in lease-versus-buy analysis? Of course, r_{WACC} should not be used for lease analysis because the cash flows are more like debt-service cash flows than operating cash flows and, as such, the risk is much less. The discount rate should reflect the risk of the incremental cash flows.

21.7 Debt Displacement and Lease Valuation

The Basic Concept of Debt Displacement (Advanced)

The previous analysis allows one to calculate the right answer in a simple manner. This clearly must be viewed as an important benefit. However, the analysis has little intuitive appeal. To remedy this, we hope to make lease-buy analysis more intuitive by considering the issue of debt displacement.

A firm that purchases equipment will generally issue debt to finance the purchase. The debt becomes a liability of the firm. A lessee incurs a liability equal to the present value of all future lease payments. Because of this, we argue that leases displace debt. The balance sheets in Table 21.5 illustrate how leasing might affect debt.

Suppose a firm initially has $100,000 of assets and a 150-percent optimal debt-equity ratio. The firm's debt is $60,000, and its equity is $40,000. As in the Xomox case, suppose the firm must use a new $10,000 machine. The firm has two alternatives:

1. *The Firm Can Purchase the Machine.* If it does, it will finance the purchase with a secured loan and with equity. The debt capacity of the machine is assumed to be the same as for the firm as a whole.
2. *The Firm Can Lease the Asset and Get 100-Percent Financing.* That is, the present value of the future lease payments will be $10,000.

If the firm finances the machine with both secured debt and new equity, its debt will increase by $6,000 and its equity by $4,000. Its optimal debt-equity ratio of 150 percent will be maintained.

Conversely, consider the lease alternative. Because the lessee views the lease payment as a liability, the lessee thinks in terms of a *liability-to-equity* ratio, not just a debt-to-equity ratio. As mentioned above, the present value of the lease liability is $10,000. If the leasing

TABLE 21.5 Debt Displacement Elsewhere in the Firm When a Lease Is Instituted

Assets		Liabilities	
Initial situation			
Current	$50,000	Debt	$60,000
Fixed	50,000	Equity	40,000
Total	$100,000	Total	$100,000
Buy with secured loan			
Current	$50,000	Debt	$66,000
Fixed	50,000	Equity	44,000
Machine	10,000		
Total	$110,000	Total	$110,000
Lease			
Current	$50,000	Lease	$10,000
Fixed	50,000	Debt	56,000
Machine	10,000	Equity	44,000
Total	$110,000	Total	$110,000

This example shows that leases reduce the level of debt elsewhere in the firm. Though the example illustrates a point, it is not meant to show a *precise* method for calculating debt displacement.

firm is to maintain a liability-to-equity ratio of 150 percent, debt elsewhere in the firm must fall by $4,000 when the lease is instituted. Because debt must be repurchased, net liabilities only rise by $6,000 ($10,000 − $4,000) when $10,000 of assets are placed under lease.[6]

Debt displacement is a hidden cost of leasing. If a firm leases, it will not use as much regular debt as it would otherwise. The benefits of debt capacity will be lost, particularly the lower taxes associated with interest expense.

Optimal Debt Level in the Xomox Example (Advanced)

The previous section showed that leasing displaces debt. Though the section illustrated a point, it was not meant to show the *precise* method for calculating debt displacement. Below, we describe the precise method for calculating the difference in optimal debt levels between purchase and lease in the Xomox example.

From the last line of Table 21.3, we know that the cash flows from the *purchase* alternative relative to the cash flows from the lease alternative are[7]

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Net cash flows from purchase alternative relative to lease alternative	−$10,000	$2,330	$2,330	$2,330	$2,330	$2,330

[6]Growing firms in the real world will not generally repurchase debt when instituting a lease. Rather, they will issue less debt in the future than they would have without the lease.

[7]The last line of Table 21.3 presents the cash flows form the lease alternative relative to the purchase alternative. As pointed out earlier, our cash flows are now reversed because we are now presenting the cash flows from the purchase alternative relative to the lease alternative.

An increase in the optimal debt level at year 0 occurs because the firm learns at that time of guaranteed cash flows beginning at year 1. Our detour on discounting and debt capacity told us to calculate this increased debt level by discounting the future riskless cash inflows at the after-tax interest rate.[8] Thus, additional debt level of the purchase alternative relative to the lease alternative is

Increase in optimal debt level from purchase alternative relative to lease alternative:

$$\$10{,}087.68 = \frac{\$2{,}330}{1.05} + \frac{\$2{,}330}{(1.05)^2} + \frac{\$2{,}330}{(1.05)^3} + \frac{\$2{,}330}{(1.05)^4} + \frac{\$2{,}330}{(1.05)^5}$$

That is, whatever the optimal amount of debt would be under the lease alternative, the optimal amount of debt would be $10,087.68 more under the purchase alternative.

This result can be stated in another way. Imagine there are two identical firms except that one firm purchases the boring machine and the other leases it. From Table 21.3, we know that the purchasing firm generates $2,330 more cash flow after taxes in each of the five years than does the leasing firm. Further imagine that the same bank lends money to both firms. The bank should lend the purchasing firm more money because it has a greater cash flow each period. How much extra money should the bank loan the purchasing firm so that the incremental loan can be paid off by the extra cash flows of $2,330 per year? The answer is exactly $10,087.68, the increase in the optimal debt level we calculated earlier.

To see this, let us work through the example on a year-by-year basis. Because the purchasing firm borrows $10,087.68 more at year 0 than does the leasing firm, the purchasing firm will pay interest of $764.22 ($10,087.68 × 0.0757575) at year 1 on the additional debt. The interest allows the firm to reduce its taxes by $259.83 ($764.22 × 0.34), leaving an after-tax outflow of $504.39 ($764.22 − $259.83) at year 1.

We know from Table 21.3 that the purchasing firm generates $2,330 more cash at year 1 than does the leasing firm. Because the purchasing firm has the extra $2,330 coming in at year 1 but must pay interest on its loan, how much of the loan can the firm repay at year 1 and still have the same cash flow as the leasing firm has? The purchasing firm can repay $1,825.61 ($2,330 − $504.39) of the loan at year 1 and still have the same net cash flow that the leasing firm has. After the repayment, the purchasing firm will have a remaining balance of $8,262.07 ($10,087.68 − $1,825.61) at year 1. For each of the five years, this sequence of cash flows is displayed in Table 21.6. The outstanding balance goes to zero over the five years. Thus, the annual cash flow of $2,330, which represents the extra cash from purchasing instead of leasing, fully amortizes the loan of $10,087.68.

Our analysis on debt capacity has two purposes. First, we want to show the additional debt capacity from purchasing. We just completed this task. Second, we want to determine whether or not the lease is preferred to the purchase. This decision rule follows easily from the above discussion. By leasing the equipment and having $10,087.68 less debt than under the purchase alternative, the firm has exactly the same cash flow in years 1 to 5 that it would have through a levered purchase. Thus, we can ignore cash flows beginning in year 1 when comparing the lease alternative with the purchase with debt alternative. However, the cash flows differ between the alternatives at year 0. These differences are

1. *The Purchase Cost at Year 0 of $10,000 Is Avoided by Leasing.* This should be viewed as a cash inflow under the leasing alternative.

[8] Though our detour considered only riskless cash flows, the cash flows in a leasing example are not necessarily riskless. As we explained earlier, we therefore adopt the real-world convention of discounting at the after-tax interest rate on secured debt issued by the lessee.

TABLE 21.6 Calculation of Increase in Optimal Debt Level if Xomox Purchases instead of Leases

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Outstanding balance of loan	$10,087.68	$8,262.07*	$6,345.17	$4,332.42	$2,219.05	$ 0
Interest		764.22	625.91	480.69	328.22	168.11
Tax deduction on interest		259.83	212.81	163.44	111.59	57.16
After-tax interest expense		$ 504.39	$ 413.10	$ 317.25	$ 216.63	$110.95
Extra cash that purchasing firm generates over leasing firm (from Table 24.2)		$2,330.00	$2,330.00	$2,330.00	$2,330.00	$2,330.00
Repayment of loan		$1,825.61†	$1,916.90	$2,012.75	$2,113.37	$2,219.05

Assume that there are two otherwise-identical firms where one leases and the other purchases. The purchasing firm can borrow $10,087.68 more than the leasing firm. The extra cash flow each year of $2,330 from purchasing instead of leasing can be used to pay off the loan in five years.
*$8,262.07 = $10,087.68 − $1,825.61.
†$1,825.61 = $2,330 − $504.39.

2. *The Firm Borrows $10,087.68 Less at Year 0 under the Lease Alternative Than It Can under the Purchase Alternative.* This should be viewed as a cash outflow under the leasing alternative.

Because the firm borrows $10,087.68 less by leasing but saves only $10,000 on the equipment, the lease alternative requires an extra cash outflow at year 0 relative to the purchase alternative of −$87.68 ($10,000 − $10,087.68). Because cash flows in later years from leasing are identical to those from purchasing with debt, the firm should purchase.

This is exactly the same answer we got when, earlier in this chapter, we discounted all cash flows at the after-tax interest rate. Of course, this is no coincidence because the increase in the optimal debt level is also determined by discounting all flows at the after-tax interest rate. The accompanying box presents both methods. (The numbers in the box are in terms of the NPV of the lease relative to the purchase. Thus, a negative NPV indicates that the purchase alternative should be taken.)

TWO METHODS FOR CALCULATING NET PRESENT VALUE OF LEASE RELATIVE TO PURCHASE*

Method 1: Discount all cash flows at the after-tax interest rate

$$-\$87.68 = \$10,000 - \$2,330 \times A^{5}_{0.05}$$

Method 2: Compare purchase price with reduction in optimal debt level under leasing alternative

$$-\$87.68 = \underset{\text{Purchase price}}{\$10,000} - \underset{\text{Reduction in optimal debt level if leasing}}{\$10,087.68}$$

*Because we are calculating the NPV of the lease relative to the purchase, a negative value indicates that the purchase alternative is preferred.

TABLE 21.7 Cash Flows to Friendly Leasing as Lessor of IBMC Pipe-Boring Machine

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash for machine	−$10,000					
Depreciation tax benefit ($680 = $2,000 × 0.34)		$ 680	$ 680	$ 680	$ 680	$ 680
After-tax lease payment [$1,650 = $2,500 × (1 − 0.34)]		1,650	1,650	1,650	1,650	1,650
Total	−$10,000	$2,330	$2,330	$2,330	$2,330	$2,330

These cash flows are the opposite of the cash flows to Xomox, the lessee (see the bottom line of Table 21.3).

21.8 DOES LEASING EVER PAY: THE BASE CASE

We previously looked at the lease-buy decision from the point of view of the potential lessee, Xomox. Let's now look at the decision from the point of view of the lessor, Friendly Leasing. This firm faces three cash flows, all of which are displayed in Table 21.7. First, Friendly purchases the machine for $10,000 at year 0. Second, because the asset is depreciated straight-line over five year, the depreciation expense at the end of each of the five years is $2,000 ($10,000/5). The yearly depreciation tax shield is $680 ($2,000 × 0.34). Third, because the yearly lease payment is $2,500, the after-tax lease payment is $1,650 [$2,500 × (1 − 0.34)].

Now examine the total cash flows to Friendly Leasing, as displayed in the bottom line of Table 21.7. Those of you with a healthy memory will notice something very interesting. These cash flows are exactly the *opposite* of those of Xomox, as displayed in the bottom line of Table 21.3. Those of you with a healthy sense of skepticism may be thinking something very interesting: "If the cash flows of the lessor are exactly the opposite of those of the lessee, the combined cash flow of the two parties must be zero each year. Thus, there does not seem to be any joint benefit to this lease. Because the net present value to the lessee was −$87.68, the NPV to the lessor must be $87.68. The joint NPV is $0 (−$87.68 + $87.68). There does not appear to be any way for the NPV of both the lessor and the lessee to be positive at the same time. Because one party would inevitably lose money, the leasing deal could never fly."

This is one of the most important results of leasing. Though Table 21.7 concerns one particular leasing deal, the principle can be generalized. As long as (1) both parties are subject to the same interest and tax rates and (2) transaction costs are ignored, there can be no leasing deal that benefits both parties. However, there is a lease payment for which both parties would calculate an NPV of zero. Given that fee, Xomox would be indifferent to whether it leased or bought, and Friendly Leasing would be indifferent to whether it leased or not.[9]

[9]The break-even lease payment is $2,469.32 in our example. Both the lessor and lessee can solve for this as

$$\$10{,}000 = \$680 \times A^{5}_{0.05} + L \times (1 - 0.34) \times A^{5}_{0.05}$$

In this case, $L = \$2{,}469.32$.

A student with an even healthier sense of skepticism might be thinking, "This textbook appears to be arguing that leasing is not beneficial. Yet, we know that leasing occurs frequently in the real world. Maybe, just maybe, the textbook is wrong." Although we will not admit to being wrong (what textbook would?!), we freely admit to being incomplete at this point. The next section considers factors that give benefits to leasing.

21.9 Reasons for Leasing

Proponents of leasing make many claims about why firms should lease assets rather than buy them. Some of the reasons given to support leasing are good, and some are not. We discuss here the reasons for leasing we think are good and some of the ones we think aren't.

Good Reasons for Leasing

If leasing is a good choice, it will be because one or more of the following will be true:

1. Taxes may be reduced by leasing.
2. The lease contract may reduce certain types of uncertainty.
3. Transactions costs can be higher for buying an asset and financing it with debt or equity than for leasing the asset.

Tax Advantages The most important reason for long-term leasing is tax reduction. If the corporate income tax were repealed, long-term leasing would probably disappear. The tax advantages of leasing exist because firms are in different tax brackets.

Should a user in a low tax bracket purchase, he will receive little tax benefit from depreciation and interest deductions. Should the user lease, the lessor will receive the depreciation shield and the interest deductions. In a competitive market, the lessor must charge a low lease payment to reflect these tax shields. Thus, the user is likely to lease rather than purchase.

In our example with Xomox and Friendly Leasing, the value of the lease to Friendly was \$87.68. That is,

$$\$87.68 = -\$10{,}000 + \$2{,}330 \times A^{5}_{0.05}$$

However, the value of the lease to Xomox was exactly the opposite (−\$87.68). Because the lessor's gains came at the expense of the lessee, no deal could be arranged.

However, if Xomox pays no taxes and the lease payments are reduced to \$2,475 from \$2,500, both Friendly and Xomox will find there is positive NPV in leasing. Xomox can rework Table 21.3 with $T_c = 0$, finding that its cash flows from leasing are

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of machine	\$10,000					
Lease payment		−\$2,475	−\$2,475	−\$2,475	−\$2,475	−\$2,475

The value of the lease to Xomox is

$$\begin{aligned}\text{Value of lease} &= \$10{,}000 - \$2{,}475 \times A^{5}_{0.0757575} \\ &= \$6.55\end{aligned}$$

Notice that the discount rate is the interest rate of 7.57575 percent because tax rates are zero. In addition, the full lease payment of $2,475—and not some lower, after-tax number—is used since there are no taxes. Finally, note that depreciation is ignored, also because no taxes apply.

Given a lease payment of $2,475, the cash flows to Friendly Leasing are

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of machine	−$10,000					
Depreciation tax shield ($680 = $2,000 × 0.34)		$ 680	$ 680	$ 680	$ 680	$ 680
After-tax lease payment [$1,633.50 = $2,475 × (1 − 0.34)]		$1,633.50	$1,633.50	$1,633.50	$1,633.50	$1,633.50
Total		$2,313.50	$2,313.50	$2,313.50	$2,313.50	$2,313.50

The value of the lease to Friendly is

$$\begin{aligned}\text{Value of lease} &= -\$10{,}000 + \$2{,}313.50 \times A^{5}_{0.05} \\ &= -\$10{,}000 + \$10{,}016.24 \\ &= \$16.24\end{aligned}$$

As a consequence of different tax rates, the lessee (Xomox) gains $6.55 and the lessor (Friendly) gains $16.24. Both the lessor and the lessee can gain if their tax rates are different, because the lessor uses the depreciation and interest tax shields that cannot be used by the lessee. The IRS loses tax revenue, and some of the tax gains to the lessor are passed on to the lessee in the form of lower lease payments.

Because both parties can gain when tax rates differ, the lease payment is agreed upon through negotiation. Before negotiation begins, each party needs to know the *reservation* payment of both parties. This is the payment such that one party will be indifferent to whether it entered the lease deal or not. In other words, this is the payment such that the value of the lease is zero. These payments are calculated below.

Reservation Payment of Lessee We now solve for L_{MAX}, the payment such that the value of the lease to the lessee is zero. When the lessee is in a zero tax bracket, his cash flows, in terms of L_{MAX}, are

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of machine	$10,000					
Lease payment		$-L_{MAX}$	$-L_{MAX}$	$-L_{MAX}$	$-L_{MAX}$	$-L_{MAX}$

This chart implies that

$$\text{Value of lease} = \$10{,}000 - L_{MAX} \times A^{5}_{0.0757575}$$

The value of the lease equals zero when

$$L_{MAX} = \frac{\$10{,}000}{A^{5}_{0.0757575}} = \$2{,}476.62$$

After performing this calculation, the lessor knows that he will never be able to charge a payment above $2,476.62.

Reservation Payment of Lessor We now solve for L_{MIN}, the payment such that the value of the lease to the lessor is zero. The cash flows to the lessor, in terms of L_{MIN}, are

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of machine	−$10,000					
Depreciation tax shield ($680 = $2,000 × 0.34)		$680	$680	$680	$680	$680
After-tax lease payment ($T_c = 0.34$)		$L_{MIN} \times (0.66)$	$L_{MIN} \times (0.66)$	$L_{MIN} \times (0.66)$	$L_{MIN} \times (0.66)$	$L_{MIN} \times (0.66)$

This chart implies that

$$\text{Value of lease} = -\$10{,}000 + \$680 \times A^5_{0.05} + L_{MIN} \times (0.66) \times A^5_{0.05}$$

The value of the lease equals zero when

$$\begin{aligned} L_{MIN} &= \frac{\$10{,}000}{0.66 \times A^5_{0.05}} - \frac{\$680}{0.066} \\ &= \$3{,}499.62 - \$1{,}030.30 \\ &= \$2{,}469.32 \end{aligned}$$

After performing this calculation, the lessee knows that the lessor will never agree to a lease payment below $2,469.32.

A Reduction of Uncertainty We have noted that the lessee does not own the property when the lease expires. The value of the property at this time is called the *residual value,* and the lessor has a firm claim to it. When the lease contract is signed, there may be substantial uncertainty as to what the residual value of the asset will be. Thus, under a lease contract, this residual risk is borne by the lessor. Conversely, the user bears this risk when purchasing.

It is common sense that the party best able to bear a particular risk should do so. If the user has little risk aversion, he will not suffer by purchasing. However, if the user is highly averse to risk, he should find a third-party lessor more capable of assuming this burden.

This latter situation frequently arises when the user is a small and/or newly formed firm. Because the risk of the entire firm is likely to be quite high and because the principal stockholders are likely to be undiversified, the firm desires to minimize risk wherever possible. A potential lessor, such as a large and publicly held financial institution, is far more capable of bearing the risk. Conversely, this situation is not expected to happen when the user is a blue chip corporation. That potential lessee is more able to bear risk.

Transactions Costs The costs of changing an asset's ownership are generally greater than the costs of writing a lease agreement. Consider the choice that confronts a person who lives in Los Angeles but must do business in New York for two days. It will clearly be cheaper to rent a hotel room for two nights than it would be to buy an apartment condominium for two days and then to sell it.

Unfortunately, leases generate agency costs as well. For example, the lessee might misuse or overuse the asset, since she has no interest in the asset's residual value. This cost will be implicitly paid by the lessee through a high lease payment. Although the lessor can reduce these agency costs through monitoring, monitoring itself is costly.

Thus, leasing is most beneficial when the transaction costs of purchase and resale outweigh the agency costs and monitoring costs of a lease. Flath argues that this occurs in short-term leases but not in long-term leases.[10]

[10]D. Flath, "The Economics of Short Term Leasing," *Economic Inquiry* 18 (April 1980).

Bad Reasons for Leasing

Leasing and Accounting Income In our discussion on "Accounting and Leasing," we pointed out that a firm's balance sheet shows fewer liabilities with an operating lease than with either a capitalized lease or a purchase financed with debt. We indicated that a firm desiring to project a strong balance sheet might select an operating lease. In addition, the firm's return on assets (ROA) is generally higher with an operating lease than with either a capitalized lease or a purchase. To see this, we look at the numerator and denominator of the ROA formula in turn.

With an operating lease, lease payments are treated as an expense. If the asset is purchased, both depreciation and interest charges are expenses. At least in the early part of the asset's life, the yearly lease payment is generally less than the sum of yearly depreciation and yearly interest. Thus, accounting income, the numerator of the ROA formula, is higher with an operating lease than with a purchase. Because accounting expenses with a capitalized lease are analogous to depreciation and interest with a purchase, the increase in accounting income does not occur when a lease is capitalized.

In addition, leased assets do not appear on the balance sheet with an operating lease. Thus, the total asset value of a firm, the denominator of the ROA formula, is less with an operating lease than it is with either a purchase or a capitalized lease. The two preceding effects imply that the firm's ROA should be higher with an operating lease than with either a purchase or a capitalized lease.

Of course, in an efficient capital market, accounting information cannot be used to fool investors. It is unlikely, then, that leasing's impact on accounting numbers should create value for the firm. Savvy investors should be able to see through attempts by management to improve the firm's financial statements.

One Hundred-Percent Financing It is often claimed that leasing provides 100-percent financing, whereas secured equipment loans require an initial down payment. However, we argued earlier that leases tend to displace debt elsewhere in the firm. Our earlier analysis suggests that leases do not permit a greater level of total liabilities than do purchases with borrowing.

Other Reasons There are, of course, many special reasons that some companies find advantages in leasing. In one celebrated case, the U.S. Navy leased a fleet of tankers instead of asking Congress for appropriations. Thus, leasing may be used to circumvent capital-expenditure control systems set up by bureaucratic firms.

CONCEPT QUESTION ?

- Summarize the good and bad arguments for leasing.

21.10 Some Unanswered Questions

Our analysis suggests that the primary advantage of long-term leasing results from the differential tax rates of the lessor and the lessee. Other valid reasons for leasing are lower contracting costs and risk reduction. There are several questions our analysis has not specifically answered.

Are the Uses of Leases and of Debt Complementary?

Ang and Peterson find that firms with high debt tend to lease frequently as well.[11] This result should not be puzzling. The corporate attributes that provide high debt capacity may also make leasing advantageous. Thus, even though leasing displaces debt (that is, leasing and borrowing are substitutes) for an individual firm, high debt and high leasing can be positively associated when one looks at a number of firms.

Why Are Leases Offered by Both Manufacturers and Third-Party Lessors?

The offsetting effects of taxes can explain why both manufacturers (for example, computer firms) and third-party lessors offer leases.

1. For manufacturer lessors, the basis for determining depreciation is the manufacturer's cost. For third-party lessors, the basis is the sales price that the lessor paid to the manufacturer. Because the sales price is generally greater than the manufacturer's cost, this is an advantage to third-party lessors.
2. However, the manufacturer must recognize a profit for tax purposes when selling the asset to the third-party lessor. The manufacturer's profit for some equipment can be deferred if the manufacturer becomes the lessor. This provides an incentive for manufacturers to lease.

Why Are Some Assets Leased More than Others?

Certain assets appear to be leased more frequently than others. Smith and Wakeman have looked at nontax incentives affecting leasing.[12] Their analysis suggests many asset and firm characteristics that are important in the lease-or-buy decision. The following are among the things they mention:

1. The more sensitive the value of an asset is to use and maintenance decisions, the more likely it is that the asset will be purchased instead of leased. They argue that ownership provides a better incentive to minimize maintenance costs than does leasing.
2. Price-discrimination opportunities may be important. Leasing may be a way of circumventing laws against charging too *low* a price.

21.11 Summary and Conclusions

A large fraction of America's equipment is leased rather than purchased. This chapter both describes the institutional arrangements surrounding leases and shows how to evaluate leases financially.

1. Leases can be separated into two polar types. Though operating leases allow the lessee to use the equipment, ownership remains with the lessor. Although the lessor in a financial lease legally owns the equipment, the lessee maintains effective ownership because financial leases are fully amortized.

[11] J. Ang and P. P. Peterson, "The Leasing Puzzle," *Journal of Finance* 39 (September 1984).

[12] C. W. Smith, Jr., and L. M. Wakeman, "Determinants of Corporate Leasing Policy," *Journal of Finance* (July 1985)

2. When a firm purchases an asset with debt, both the asset and the liability appear on the firm's balance sheet. If a lease meets at least one of a number of criteria, it must be capitalized. This means that the present value of the lease appears as both an asset and a liability. A lease escapes capitalization if it does not meet any of these criteria. Leases not meeting the criteria are called *operating leases,* though the accountant's definition differs somewhat from the practitioner's definition. Operating leases do not appear on the balance sheet. For cosmetic reasons, many firms prefer that a lease be called *operating.*
3. Firms generally lease for tax purposes. To protect its interests, the IRS allows financial arrangements to be classified as leases only if a number of criteria are met.
4. We showed that risk-free cash flows should be discounted at the after-tax risk-free rate. Because both lease payments and depreciation tax shields are nearly riskless, all relevant cash flows in the lease-buy decision should be discounted at a rate near this after-tax rate. We use the real-world convention of discounting at the after-tax interest rate on the lessee's secured debt.
5. Though this method is simple, it lacks certain intuitive appeal. In an optional section, we presented an alternative method in the hopes of increasing the reader's intuition. Relative to a lease, a purchase generates debt capacity. This increase in debt capacity can be calculated by discounting the difference between the cash flows of the purchase and the cash flows of the lease by the after-tax interest rate. The increase in debt capacity from a purchase is compared to the extra outflow at year 0 from a purchase.
6. If the lessor is in the same tax bracket as the lessee, the cash flows to the lessor are exactly the opposite of the cash flows to the lessee. Thus, the sum of the value of the lease to the lessee plus the value of the lease to the lessor must be zero. While this suggests that leases can never fly, there are actually at least three good reasons for leasing:
   a. Differences in tax brackets between lessor and lessee.
   b. Shift of risk-bearing to the lessor.
   c. Minimization of transaction costs.
   We also document a number of bad reasons for leasing.

Key Terms

Debt displacement 597
Direct leases 587
Financial leases 588
Lessee 586
Lessor 586
Leveraged lease 588
Off–balance-sheet financing 589
Operating lease 587
Sales and lease-back 588
Sales-type leases 587

Suggested Readings

Some evidence on the determination of discount rates used in leasing is found in

Schallheim, J. S.; R. E. Johnson; R. C. Lease; and J. J. McConnell. "The Determinants of Yields on Financial Leasing Contracts." *Journal of Financial Economics* (1987).

Other good articles on leasing are

Bowman, R. G. "The Debt Equivalence of Leases: An Empirical Investigation." *Accounting Review* 55 (April 1980).

Crawford, P. J.; C. P. Harper; and J. J. McConnell. "Further Evidence on the Terms of Financial Leases." *Financial Management* 10 (Autumn 1981).

Franks, J. R., and S. D. Hodges. "Valuation of Financial Lease Contracts: A Note." *Journal of Finance* (May 1978).

Myers, S.; D. A. Dill; and A. J. Bautista. "Valuation of Financial Lease Contracts." *Journal of Finance* (June 1976).

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Sivarama, K. V., and R. C. Moyer. "Bankruptcy Costs and Financial Leasing Decisions." *Financial Management* (1994).
Smith, C. W., Jr., and L. M. Wakeman. "Determinations of Corporate Leasing Policy." *Journal of Finance* (July 1985).
Sorenson, I. W., and R. E. Johnson. "Equipment Financial Leasing Practices and Costs: An Empirical Study." *Financial Management* (Spring 1977).

A complete guide to the lease-versus-buy decision is in
Schallheim, James S. *Lease or Buy.* Boston, Mass.: Harvard Business School Press, 1994.

Questions and Problems

21.1 Discuss the validity of each of the following statements.
a. Leasing reduces risk and can reduce a firm's cost of capital.
b. Leasing provides 100-percent financing.
c. Firms that do a large amount of leasing will not do much borrowing.
d. If the tax advantages of leasing were eliminated, leasing would disappear.

21.2 Quartz Corporation is a relatively new firm. Quartz has experienced enough losses during its early years to provide it with at least eight years of tax-loss carryforwards. Thus, Quartz's effective tax rate is zero. Quartz plans to lease equipment from New Leasing Company. The term of the lease is five years. The purchase cost of the equipment is $250,000. New Leasing Company is in the 35-percent tax bracket. There are no transaction costs to the lease. Each firm can borrow at 8 percent.
a. What is Quartz's reservation price?
b. What is New Leasing Company's reservation price?
c. Explain why these reservation prices determine the negotiating range of the lease.

21.3 Super Sonics Entertainment is considering borrowing money at 11 percent and purchasing a machine that costs $350,000. The machine will be depreciated over five years by the straight-line method and will be worthless in five years. Super Sonics can lease the machine with the year-end payments of $94,200. The corporate tax rate is 35 percent. Should Super Sonics buy or lease?

21.4 Maxwell, Inc., is entering negotiations for the lease of equipment that has a $200,000 purchase price. Maxwell's effective tax rate is zero. Maxwell will be negotiating the lease with Mercer Leasing Corp. The term of the lease is five years. Mercer Leasing Corp. is in the 35-percent tax bracket. There are no transaction costs to the lease. Each firm can borrow at 10 percent. What is the negotiating range of the lease?

21.5 Raymond Rayon Corporation wants to expand its manufacturing facilities. Liberty Leasing Corporation has offered Raymond Rayon the opportunity to lease a machine for $100,000 for five years. The machine will be fully depreciated by the straight-line method. The corporate tax rate for Raymond Rayon is 25 percent, while Liberty Leasing's corporate tax rate is 35 percent. The appropriate before-tax interest rate is 8 percent. Assume lease payments occur at year-end. What is Raymond's reservation price? What is Liberty's reservation price? What is the negotiating range of the lease?

21.6 An asset costs $86.87. Only straight-line depreciation is allowed for this asset. The asset's useful life is two years. It will have no salvage value. The corporate tax rate on ordinary income is 34 percent. The interest rate on risk-free cash flows is 10 percent.

a. What set of lease payments will make the lessee and the lessor equally well off?
b. Show the general condition that will make the value of a lease to the lessor the negative of the value to the lessee.
c. Assume that the lessee pays no taxes and the lessor is in the 34-percent tax bracket. For what range of lease payments does the lease have a positive NPV for both parties?

21.7 High electricity costs have made Farmer Corporation's chicken-plucking machine economically worthless. There are only two machines available to replace it.

The International Plucking Machine (IPM) model is available only on a lease basis. The annual, end-of-year payments are $2,100 for five years. This machine will save Farmer $6,000 per year through reductions in electricity costs in each of the five years.

As an alternative, Farmer can purchase a more energy-efficient machine from Basic Machine Corporation (BMC) for $15,000. This machine will save $9,000 per year in electricity costs. A local bank has offered to finance the machine with a $15,000 loan. The interest rate on the loan will be 10 percent on the remaining balance and five annual principal payments of $3,000.

Farmer has a target debt-to-asset ratio of 67 percent. Farmer is in the 34-percent tax bracket. After five years, both machines are worthless. Only straight-line depreciation is allowed for chicken-plucking machines. The savings that Farmer will enjoy are known with certainty, because Farmer has a long-term chicken purchase agreement with State Food Products, Inc., and a four-year backlog of orders.

a. Should Farmer lease the IPM machine or purchase the more efficient BMC machine?
b. Does your answer depend on the form of financing for direct purchase?
c. How much debt is displaced by this lease?

21.8 Redwood Timberland Corporation is a furniture manufacturer that is considering installing a milling machine for $420,000. The machine will be straight-line depreciated over seven years and will be worthless after its economic life. Redwood has been financially distressed and thus the company does not appear to get tax shields over the next seven years. American Leasing Company has offered to lease the machine over seven years. The corporate tax rate for Redwood is 35 percent. The appropriate before-tax interest rate is 6 percent for both firms. Lease payments occur at the beginning of the year. What is Redwood's reservation price? What is American's reservation price? What is the negotiating range of the lease?

21.9 Wolfson Corporation has decided to purchase a new machine that costs $3 million. The machine will be worthless after three years. Only straight-line method is allowed by the IRS for this type of machine. Wolfson is in the 35-percent tax bracket.

The Sur Bank has offered Wolfson a three-year loan for $3 million. The repayment schedule is three yearly principal repayments of $1 million and an interest charge of 12 percent on the outstanding balance of the loan at the beginning of each year. Twelve percent is the marketwide rate of interest. Both principal repayments and interest are due at the end of each year.

Cal Leasing Corporation offers to lease the same machine to Wolfson. Lease payments of $1.2 million per year are due at the end of each of the three years of the lease.

a. Should Wolfson lease the machine or buy it with bank financing?
b. What is the annual lease payment that will make Wolfson indifferent to whether it leases the machine or purchases it?

Appendix 21A APV Approach to Leasing

The box that appeared earlier in this chapter showed two methods for calculating the NPV of the lease relative to the purchase:

1. Discount all cash flows at the after-tax interest rate.

2. Compare the purchase price with reduction in optimal debt level under the leasing alternative.

Surprisingly (and perhaps unfortunately) there is still another method. We feel compelled to present this third method, because it has important links with the adjusted present value (APV) approach discussed earlier in this text. We illustrate this approach using the Xomox example developed in Table 21.3.

In a previous chapter, we learned that the APV of any project can be expressed as

$$\text{APV} = \text{All-equity value} + \text{Additional effects of debt}$$

In other words, the adjusted present value of a project is the sum of the net present value of the project when financed by all equity plus the additional effects from debt financing. In the context of the lease-versus-buy decision, the APV method can be expressed as

$$\begin{array}{c}\text{Adjusted present value of the lease relative to the purchase}\end{array} = \begin{array}{c}\text{Net present value of the lease relative to the purchase when purchase is financed by all equity}\end{array} - \begin{array}{c}\text{Additional effects when purchase is financed with some debt}\end{array}$$

All-Equity Value

From an earlier chapter, we know that the all-equity value is simply the NPV of the cash flows discounted at the *pretax* interest rate. For the Xomox example, we know from Table 21.3 that this value is

$$\$592.03 = \$10{,}000 - \$2{,}330 \times A^{5}_{0.0757575}$$

This calculation is identical to method 1 in the earlier box except that we are now discounting at the pretax interest rate. The calculation states that the lease is preferred over the purchase by $592.03 if the purchase is financed by all equity. Because debt financing generates a tax subsidy, it is not surprising that the lease alternative would be preferred by almost $600 over the purchase alternative if debt were not allowed.

Additional Effects of Debt

We learned earlier in the text that the interest tax shield in any year is the interest multiplied by the corporate tax rate. Taking the interest in each of the five years from Table 21.6, the present value of the interest tax shield is

$$\$679.71 = 0.34\left[\frac{\$764.22}{1.0757575} + \frac{\$625.91}{(1.0757575)^2} + \frac{\$480.69}{(1.0757575)^3} + \frac{\$328.21}{(1.0757575)^4} + \frac{\$168.11}{(1.0757575)^5}\right]$$

This tax shield must be subtracted from the NPV of the lease because it represents interest deductions not available under the lease alternative. The adjusted present value of the lease relative to the purchase is

$$-\$87.68 = \$592.03 - \$679.71$$

This value is the same as our calculations from the previous two approaches, implying that all three approaches are equivalent. The accompanying box presents the APV approach.

A Third Method for Calculating Net Present Value of Lease Relative to Purchase*†

Method 3: Calculate APV:

$$\text{All-equity value: } \$592.03 = \$10{,}000 - \$2{,}330 \times A^{5}_{0.0757575}$$

Additional effects of debt:‡

$$-\$679.71 = -0.34\left[\frac{\$764.22}{1.0757575} + \frac{\$625.91}{(1.0757575)^2} + \frac{\$480.69}{(1.0757575)^3} + \frac{\$328.21}{(1.0757575)^4} + \frac{\$168.11}{(1.0757575)^5}\right]$$

$$\text{APV} = -\$87.68 = \$592.03 - \$679.71$$

*Because we are calculating the NPV of the lease relative to the purchase, a negative value indicates that the purchase alternative is preferred.

†The first two methods are shown in the earlier box appearing in this chapter.

‡The firm misses the interest deductions if it leases. Because we are calculating the NPV of the lease relative to the purchase, the additional effect of debt is a negative number.

Which approach is easiest to calculate? The first approach is easiest because one need only discount the cash flows at the after-tax interest rate. Though the second and third approaches (in the two boxes) look easy, the extra step of calculating the increased debt capacity is needed for both of them.

Which approach is more intuitive? Our experience is that students generally find the third method the most intuitive. This is probably because they have already learned the APV method from a previous chapter. The second method is generally straightforward to those students who have taken the time to understand the increased-debt-level concept. However, the first method seems to have the least intuitive appeal because it is merely a mechanical approach.

Which approach should the practitioner use? The practitioner should use the simplest approach, which is the first. We included the others only for intuitive appeal.