BA 351
CORPORATE FINANCE

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Adapted from S. Viswanathan

LECTURE 5
LEASING

FUQUA SCHOOL OF BUSINESS
DUKE UNIVERSITY
Leasing has long been an important alternative to buying an asset. In this lecture we document the different types of leases and undertake an exhaustive analysis of the leasing decision. We will start by listing the different kinds of leases.

Under a *sale and leaseback agreement*, a firm owning land, buildings or equipment sells property to a financial institution and simultaneously executes an agreement to lease the property back for a certain period under specific terms. The seller, or *lessee*, immediately receives the purchase price put up by the buyer, or *lessor*. At the same time, the seller (or lessee) retains the use of the property. In addition, the lessee makes payments to the lessor over a specified period.

*Operating* or *service* leases include both financing and maintenance services. The computer industry is a pioneer of such contracts. Computers, office copying machines, automobiles and trucks are all leased via operating leases. The leases ordinarily call for the lessor to maintain and service the leased equipment and the costs of such leases are built into the lease payments or contracted for separately.

Another important feature of the service lease is that it is frequently not fully amortized. In other words, payments required under the lease contract are not sufficient to recover the full cost of the equipment. Obviously, then, the lease contract is written for considerably less than the expected life of the leased equipment, and the lessor expects to recover the cost either from the subsequent renewal payments or from the disposal of the equipment.

A final feature of the service lease is that it frequently contains a cancellation clause giving the lessee the right to cancel the lease and return the equipment before the expiration of the basic agreement. This is an important consideration for the lessee, who can return the equipment if technological developments render it obsolete or it simply is no longer needed.
A strict financial lease is one that does not provide for maintenance services, is not cancellable, and is fully amortized (that is, the lessor contracts for rental payment equal to the full price of the leased equipment). The typical arrangement involves the following steps:

1. The user firm selects the specific equipment it requires and negotiates the price and delivery terms with the manufacturer or distributor.

2. Next, the user firm arranges with a bank or leasing company for the latter to buy the equipment from the manufacturer or the distributor, simultaneously executing an agreement to lease the equipment from the financial institution. The terms call for full amortization of the financial institution's cost plus a rate of return on investment. The lessee generally has an option to renew the lease at a reduced rental rate on expiration of the basic lease, but does not have the right to cancel the basic lease without completely paying off the financial institution.

TAX TREATMENT

In general, the full amount of a lease is deductible for income tax purposes, provided the IRS does not conclude that this is a installment loan that has been called a lease. The IRS set forth six guidelines for advance rulings to determine true ownership and lease validity (taken from Graham, Lemmon, and Schallheim, Journal of Finance, 1998, 131-162). A lease satisfying these requirements is called a true lease, but is also known as a “guideline” lease or a tax-oriented lease. If the lease does not satisfy the IRS guidelines, it is classified as a conditional-sales contract.

Guideline (1) Minimum at risk requirement - This guideline requires that at inception and throughout the lease term the lessor must have an investment equal to at least 20 percent of the total acquisition cost of the property. The investment made is considered to be only the consideration paid and personal liability of the lessor. The lessor must have net worth sufficient to cover such obligation. This investment must be unconditional, with no provisions for return, although provisions for reimbursement from outside groups for failure of the equipment to meet quality standards is permissible. The investment must be maintained at all times throughout the lease term with the sum of the lease payments to be made
never to exceed the excess of the initial investment over the 20 percent minimum investment plus the cumulative pro rata portion of the projected profit.

**Guideline (2) Minimum estimated residual value** - The second requirement is that the leased property must have a reasonably estimated residual value equal to at least 20 percent of the initial cost of the property at the end of the lease term. The lease term is defined to include any extension periods except those before which the lessee may renegotiate rental payments.

At the beginning of the lease, the lessor can obtain an appraisal confirming the estimated residual value of 20 percent or more of cost at the end of the lease term. For pricing purposes, the lessor might use a residual value of less than 20 percent on the basis of liquidation value or quick sale price, for example. However, this fact, if it applies, does not invalidate the 20 percent estimated residual value for tax purposes.

**Guideline (3) Minimum remaining life for asset** - The third requirement for advanced ruling states that the remaining life of the property at the end of the lease term equal the longer of one year or 20 percent of its originally estimated life. The Internal Revenue Service requires that representations that these requirements have been met be made by the lessor.

**Guideline (4) No bargain purchase option** - There may also be no bargain purchase option (for any member of the lessee group) nor may there be any requirement that any party purchase the property at any price. To prove the validity of the lease the lessor must be required to dispose of the property at the end of the lease term, thus bearing the risk of ownership. In similar fashion, the lessee is restricted from providing any of the cost of the property or the cost of any improvements made to such property (with the exception of those readily removable from the property or routine maintenance). If the lease does not prohibit the lessee from paying for improvements then the lessor must recognize as income the value of such improvements.

**Guideline (5) No loan from lessee to lessor** - The fifth requirement for advance ruling purposes is that no member of the lessee group may loan the lessor the money necessary to purchase the leased property nor may they guarantee loans the lessor incurs to purchase such property. This does not preclude other members of the lessee group from guaranteeing the performance of the lessee.

**Guideline (6) Lessor must demonstrate expectation of profits** - Lastly, the IRS requires that the lessor be able to demonstrate the expectation of profits to be derived from the lease. Tax benefits from such transactions are not considered to be "profits" sufficient to demonstrate that expectation. But residual value of the equipment does count as part of the profit.

**ACCOUNTING TREATMENT**

In November 1976, the Financial Accounting Standards Board issued its Statement of Financial Accounting Standards No 13, Accounting for Leases. Like other FASB statements, the standards set forth must be followed by business firms if their financial statements are to receive certification by auditors. FASB Statement No 13 has implications both for the utilization of leases and for their accounting treatment.

From the lessee's point of view, the two accounting categories are capital leases and operating leases. A lease is classified in Statement No 13 as a *capital lease* if it meets one or more of four
of the Paragraph 7 criteria: a capital lease is defined as a lease that meets any one or more of the four criteria:

1. **Transfer of Ownership** - If the lease agreement transfers ownership to the lessee before the lease expires, without payment of additional compensation to the lessor, the lease is considered a purchase financing arrangement, similar to an installment purchase.

2. **Bargain Purchase Option** - The lessee can purchase the asset for a bargain price when the lease expires. A bargain purchase option requires comparing the option's purchase price to the leased asset's expected residual value at the maturity of the lease. If the purchase option is well below the expected residual value, the lessee is not expected to pass up the savings, and the probability is high that the lessee will buy the asset at maturity.

3. **75 percent of Economic Life** - The lease lasts for at least 75 percent of the asset's expected economic life. A bargain renewal option, an option to renew the lease at a rental rate below the expected fair market rental at the time of the exercise of the option, is considered to lengthen the lease life used in this determination.

4. **90 percent of Asset's Value** - The present value of the minimum lease payments is at least 90 percent of the asset's fair value. The minimum lease payments is defined by SFAS No. 13 to mean "the payments that the lessee is obligated to make or can be required to make in connection with the leased property." Of course, the minimum lease payments consist mainly of the periodic payments. However, minimum lease payments also include such items as the bargain purchase option or bargain renewal option payments. Some leases contain additional provisions that are included as minimum lease payments such as a guaranteed residual value by the lessee or a penalty payment for failure to renew if it is expected that the renewal option will be rejected by the lessee.

If the lease is not a capital lease, it is classified as an operating lease.

**Comparison of Accounting and Tax Rules for Leasing**

The four criteria that define a capital lease in most cases will not qualify the lease as a true lease for tax purposes. Consider the four accounting criteria for a capital lease as discussed at the beginning of this appendix:

1. **Transfer of Ownership** - Any transfer of ownership prior to the maturity of the lease will not qualify as a true lease for tax purposes. This violates Guideline (1) for minimum at-risk requirement on the part of the lessor.

2. **Bargain Purchase Option** - There can be no bargain purchase option for a lease to qualify as a true lease, which is Guideline (4).

3. **75 Percent of Economic Life** - For economic life criteria, there is a slight difference between the accounting rule and the tax rule. The tax rule requires a remaining economic life for the asset at the end of the lease of at least one year or 20 percent of the originally estimated life, Guideline (3). However, the concept of "economic life" leaves a great deal of room for subjective assumptions.

4. **90 Percent of Asset's Value** - Guideline (2) for tax deductible lease payments requires that the lessor maintain a minimum of 20 percent of the asset's cost throughout the life of the lease. Therefore, if a lease qualifies as a capital lease under criteria 4, it would not qualify as a true lease. Here again, however, there is room for subjectivity based on assumptions about the proper discount rate to compute the present value of the (minimum) lease payments.

Bookkeeping is done in the following way. For operating leases, the lease amount is expensed. Also, the contingent liability due to future lease payments must be disclosed to the
extent the lease is not cancelable. Capital leases are capitalized and then amortized. In addition, the current and future liability under the capital lease is shown on the liability side. In a nutshell, capitalized leases are usually treated as if a firm purchases an asset (which is recorded on the balance sheet), takes depreciation, and borrows the money (as if it used debt financing).

Additional footnote disclosure is required on the nature of the lease agreement and the contingent liabilities which might occur. Thus FASB Statement 13 ensures that sufficient information is provided so that the individuals know about off-balance sheet financing that has taken place.

From the lessor's perspective, 4 types of leases are defined:

1. Sales type leases
2. Direct financing leases
3. Leveraged leases
4. Operating leases representing all other leases not included in the categories above.

Sales-type leases and direct-financing leases must meet both of the following criteria:

1. Collectability of the minimum lease payments is reasonably predictable.
2. No important uncertainties surround the amount of reimbursable costs yet to be incurred by the lessor under the lease.

Sales-type leases give rise to profits or losses to the lessor. These are items sold by the lessor with leasing used as a marketing device. The fair value of the lease less the cost of manufacture represents the profit or loss. Direct-financing leases are not leveraged and the cost of the good is equal to the fair value of the lease. The lessor is in the business of leasing. Leveraged leases are
leases where a large fraction of the money is borrowed from a long-run creditor. Generally, the loan agreement is without recourse, i.e., if the lessee defaults the lessor is not liable.

**VALUATION OF LEASES FROM THE LESSEE'S VIEWPOINT**

We first consider the valuation of the lease from the lessee's viewpoint. The lessor's viewpoint is similar.

Consider the following example (from Ross and Westerfield, page 631):

Robot Corporation is considering purchasing a new robot manufacturing machine for $10,000. This machine will save Robot $6,000 per year due to cost savings for the next five years. The savings are assumed to be certain.

Robot has a marginal tax rate of 34% and uses a five year straight line method for depreciation purposes. After five years, the machine is worthless.

As an alternative to buying the machine, the Matushita Corporation has offered to lease the machine to Robot for lease payments of $2,500 per year for 5 years.

Finally, Robot's before tax cost of borrowing is 7.57575%.

Does Robot need the machine and should Robot lease or buy the machine?

The cash flows for buying and leasing are shown in the next page while the incremental cash flows of the buy versus lease decision are shown on the page after.
### CASH FLOW ANALYSIS – BUY

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of machine</td>
<td>-10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After tax operating savings</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
</tr>
<tr>
<td>Depreciation tax benefit</td>
<td>680</td>
<td>680</td>
<td>680</td>
<td>680</td>
<td>680</td>
<td>680</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-10,000</td>
<td>4,640</td>
<td>4,640</td>
<td>4,640</td>
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<td>4,640</td>
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</tbody>
</table>

### CASH FLOW ANALYSIS – LEASE

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lease payment</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
</tr>
<tr>
<td>Tax benefit of lease payments</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td>850</td>
</tr>
<tr>
<td>After tax operating savings</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
<td>3,960</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,310</td>
<td>2,310</td>
<td>2,310</td>
<td>2,310</td>
<td>2,310</td>
<td>2,310</td>
</tr>
</tbody>
</table>
# Incremental Cash Flow Analysis - Lease versus Buy

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lease payment</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td></td>
</tr>
<tr>
<td>Tax benefit of</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td></td>
</tr>
<tr>
<td>lease payments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Savings on cost of</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>machine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost Depreciation</td>
<td>10,000</td>
<td>2,330</td>
<td>2,330</td>
<td>2,330</td>
<td>2,330</td>
<td>2,330</td>
</tr>
<tr>
<td>tax benefit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the buy versus lease decision, the operating savings are not directly relevant (they are relevant when making the decision as to whether to acquire the machine in the first place or not).

At what rate should we discount these incremental cash flows? The answer to this question depends on how much debt is displaced by the lease financing. Leasing is just another way to borrow; the lease payment is a fixed contractual obligation. Hence a lease is similar to a secured loan. Therefore one approach would be to consider a debt schedule that would yield the same cash outflows as the incremental cash flows from the lease (this is called the debt equivalent cash flows approach and is similar to the replication methods that we have considered). We will return to this method in a moment.

In our incremental cash flows above, this lost tax advantage of debt (due to the displaced debt capacity) is not shown explicitly and we need to account for this in our calculations. We can do so by adjusting the discount rate that we use to discount the incremental cash flows.
Suppose every dollar of lease financing displaces $\lambda$ dollar of debt financing ($\lambda$ between 0 and 1). If every dollar of lease financing exactly displaces one dollar of debt financing, $\lambda$ is just one. On the other hand, if no debt is displaced because the firm could not have borrowed for some reason, then $\lambda$ would be zero. The appropriate discount rate for the incremental cash flows is thus

$$\lambda (1 - \tau_c) r_D + (1 - \lambda) r_E$$

If $\lambda = 1$, this is just the after tax cost of debt. This leads to the after-tax method, which is the standard in industry.

In our example, suppose we assume that $\lambda = 1.0$. Given that the before-tax cost of borrowing is 7.57575%, the right discount rate is the after tax cost of borrowing, $7.57575% (1 - 0.34) = 5.00\%$. Hence the net present value of the lease is:

$$NPV = $10,000 - \sum_{t=1}^{5} \frac{\$2,330}{(1.05)^t} = -$87.68$$

Thus the lease is a negative present value investment.
THE DEBT EQUIVALENT CASH FLOWS METHOD

A closely related approach that justifies the after-tax approach considered above is the debt equivalent cash flows method. This approach finds a debt schedule that yields the same after-tax payments as the incremental cash flow on the lease. The initial amount borrowed in this method is the opportunity cost of the displaced debt capacity. The debt equivalent cash flow method is very similar to the replication approach that we discussed in the very first lecture when we started to discuss the NPV rule (there is however a small difference that I will explain below).

Let us first follow the replication approach.

REPLICATION METHOD - LEASE VERSUS BUY

<table>
<thead>
<tr>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Cash Flow</td>
<td>10,000</td>
<td>-2,330</td>
<td>-2,330</td>
<td>-2,330</td>
<td>-2,330</td>
</tr>
</tbody>
</table>

Borrow $B_0$ $B_0$ $-(1+0.05)B_0$

Borrow $B_1$ $B_1$ $-(1+0.05)B_1$

Borrow $B_2$ $B_2$ $-(1+0.05)B_2$

Borrow $B_3$ $B_3$ $-(1+0.05)B_3$

Borrow $B_4$ $B_4$ $-(1+0.05)l$

NPV 0 0 0 0 0

11
The idea in the above method is to find the borrowing or lending amount today and at future dates that exactly offset the incremental cash flows due to the lease. The lease payment, like the repayment of principal and interest on debt is a fixed obligation for the firm. Hence the firm could equivalently have borrowed money (and received cash today) and repaid the principal and interest. The debt equivalent cash flow method finds that amount of debt that would have yielded the same payments as the incremental cash flow due to the lease. Implicitly, thus, the debt equivalent cash flow method assumes that $\lambda = 1$; a dollar of lease payments displaces a dollar of debt.

We find $B_0$, $B_1$, $B_2$, $B_3$ and $B_4$ as follows. First,

$$B_4 = \frac{-2,330}{1 + r_d (1 - \tau_c)}$$

$$= \frac{-2,330}{1 + 0.0757575(1 - 0.34)} = \frac{-2,330}{1.05}$$

$$=-2,191.0476$$

Hence to offset the payout of 2,300 on date 5 we need to lend 2,219.0476 on date 4. The reason we use 5% and not 7.57575% is that the corporation can deduct interest payments, so its effective cost of financing is the after-tax cost of debt. Next

$$B_3 = \frac{-2,330 + B_4}{1 + r_d (1 - \tau_c)}$$
Similarly, one can calculate that $B_2 = -6,345.1678$, $B_1 = -8,262.0646$ and $B_0 = -10,087.681$.

Redoing the table above now yields:

\[
\frac{-2,330 - 2,219.0476}{1 + 0.0757575(1 - 0.34)} = -\frac{4,549.0476}{1.05} = -4,332.4262
\]

Similarly, one can calculate that $B_2 = -6,345.1678$, $B_1 = -8,262.0646$ and $B_0 = -10,087.681$.

Redoing the table above now yields:
## REPLICATION METHOD - LEASE VERSUS BUY

<table>
<thead>
<tr>
<th>Incremental Cash Flow</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>-2,330</td>
<td>-2,330</td>
<td>-2,330</td>
<td>-2,330</td>
<td>-2,330</td>
<td></td>
</tr>
</tbody>
</table>

- **Borrow B₀**: -10,087.681, 10,592.065

- **Borrow B₁**: -8,262.0646, 8,675.1678

- **Borrow B₂**: -6,345.1678, 6662.4262

- **Borrow B₃**: -4,332.4262, 4,549.0475

- **Borrow B₄**: -2,219.0476, 2,330

- **-87.681**: 0, 0, 0, 0, 0, 0

The debt equivalent cash flow method is exactly identical to the replication method except that we ask ourselves what is the borrowing schedule that would yield the same payments as the lease payments of $2,330 per year. In this case we obtain the same amounts as the replication method except that the signs are reversed. Using the numbers calculated above, we can create the following table:
**DEBT EQUIVALENT TO LEASE**

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount Borrowed at Start of Year</td>
<td>10,087.68</td>
<td>8,262.0646</td>
<td>6,345.1678</td>
<td>4,332.4262</td>
<td>2,219.0476</td>
<td>0</td>
</tr>
<tr>
<td>Interest at 7.57575%</td>
<td>-764.2174</td>
<td>-625.91335</td>
<td>-480.6941</td>
<td>-328.2138</td>
<td>168.1095</td>
<td></td>
</tr>
<tr>
<td>Interest Tax Shield</td>
<td>259.8334</td>
<td>212.8105</td>
<td>163.4360</td>
<td>111.593</td>
<td>57.157</td>
<td></td>
</tr>
<tr>
<td>Net Principal Repaid</td>
<td>-1,825.6154</td>
<td>-1,916.8968</td>
<td>-2,012.7416</td>
<td>-2,113.3786</td>
<td>-2,219.04'</td>
<td></td>
</tr>
<tr>
<td>Net Cash Flow of Equivalent Loan</td>
<td>-2,329.999</td>
<td>-2,329.999</td>
<td>-2,329.999</td>
<td>-2,329.999</td>
<td>-2,330</td>
<td></td>
</tr>
</tbody>
</table>

Using this method the lease payments are equivalent to a loan of $10,087.68 today. But the savings today are just $10,000 (the cost of the machine) and thus the net present value of the lease is -$87.68 – the same as above using the after-tax method!

**VALUATION OF LEASES FROM THE LESSOR'S VIEWPOINT**

The lessor's viewpoint is exactly the opposite from the lessee's viewpoint. The lessee pays for the asset and receives the lease payments and depreciation benefits. We will assume that the lessor's tax rate is also 34%. Thus the incremental cash flows for the lessor (Matushita) are:
## INCREMENTAL CASH FLOW ANALYSIS - LEASE VERSUS BUY

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lease payment</td>
<td>2,500</td>
<td>2,500</td>
<td>2,500</td>
<td>2,500</td>
<td>2,500</td>
<td>2,500</td>
</tr>
<tr>
<td>Tax on lease</td>
<td>-850</td>
<td>-850</td>
<td>-850</td>
<td>-850</td>
<td>-850</td>
<td>-850</td>
</tr>
<tr>
<td>payments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of machine</td>
<td>-10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation tax</td>
<td>680</td>
<td>680</td>
<td>680</td>
<td>680</td>
<td>680</td>
<td>680</td>
</tr>
<tr>
<td>benefit</td>
<td></td>
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</tbody>
</table>

These cash flows are the exact opposite of the cash flows we calculated for the lessee (Robot). If Matushita can borrow and lend at a pretax rate of 7.57575\% and the lease is perfectly riskless, the right rate to discount the cash flows is $7.57575(1 - 0.34) = 5.00\%$. We can obtain the NPV for this investment decision as:

$$
\text{NPV to lessor} = -10,000 + \sum_{t=1}^{5} \frac{2,330}{(1.05)^t}
$$

$$
= \$87.68
$$
which is the exact opposite of what we obtained for the lessee (Robot).

**Discounting:** we are implicitly assuming that the after-tax cost of debt is the correct rate to use to discount the cash flows. If the lessor can convince a bank that it is 100% certain that they will receive the lease payments from the lessee, then they may be able to obtain 100% debt financing, and the after-tax cost of debt is the correct rate. However, if the lessor (Matushita) cannot obtain 100% debt financing for this project, some portion of it will be financed with equity. In this case, the appropriate discount rate is not the after-tax cost of debt but rather the weighted average cost of capital.

Suppose the fraction of debt in the capital structure of the lessor is $\lambda$. Then the appropriate discount rate (the weighted average cost of capital) is

$$(1 - \lambda) r_D + \lambda (1 - \tau_c) r_D = r_D(1 - \lambda \tau_c)$$

Here we are assuming that the before tax return on equity $r_E$, is equivalent to the before tax return on debt, $r_D$. The first $r_D$ would be an $r_E$ if we did not make this assumption.

In the above example, we see that if the tax rates of the lessor and lessee are the same and the discount rate for the lessor and the lessee are the same, leasing is a zero sum game. The gains made by the lessor are equal to the losses made by the lessee and vice versa. In such a scenario, it does not seem likely that firms would engage in leasing, unless there were some other sources of gains to leasing.

**THE SOURCES OF GAINS FROM LEASING**
What are the sources of gains from leasing? They are:

1. Lessor's cost of capital is substantially less than lessee's cost of capital.
2. Lessee's tax rate is substantially lower than the lessor's tax rate.
3. Depreciation is accelerated and thus depreciation tax shields are received early.
4. The lease payment is long and lease payments are concentrated towards the end of the period.
5. The interest rate $r_D$ is high.

**LEVERAGED LEASES**

A leveraged lease is a financial lease where the lessor borrows a large fraction of the lease amount. A leveraged lease is generally a non-recourse loan, i.e., the lessor can only make claim to the assets that he owns if the lessee cannot make lease payments.

Leverage leases are used in the financing of large projects. The most famous leveraged lease is the Anaconda lease transacted in the early 1970s. In 1971, Anaconda wanted to build a $138 million aluminum reduction plant in Kentucky. Since Anaconda had a $356 million loss from the nationalization (by the Allende government in Chile) of its mines, it made sense for Anaconda to consider a lease. Anaconda hence bought the land and leased the plant and equipment ($110.7 million in value) from a group led by First Kentucky Trust Company. The deal was actually put together by a leasing broker, U.S. Leasing, for a fee of $1.1 million.

First Kentucky got $72 million in debt from a group of insurance companies and $39 million in equity from a group of banks and used this money to buy the equipment leased to Anaconda. Anaconda agreed to make 40 lease payments semiannually over the 20-year period, the first

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1 This section follows Myers, Dill and Bautista and Brealey and Myers.
payment starting at the date of agreement. The first 21 payments were set at $3.99M and the last 19 payments were $5.46M each.

Figure 26-1 (page 755, Brealey and Myers, 5th edition) shows the various parties involved in the leasing transaction. Figure 26-2 calculates the gains to the lessor, assuming that the after-tax cost of capital is 4.5625% (before tax rate is 9.125 and the corporate tax rate is 50%). The annual gains to the lessors seem to be around $3M. On the other hand, provided that Anaconda had a large enough number of years where it paid no taxes, it was able to obtain a large amount of gains from the lease (perhaps as large as $36M in present value).

THE APV METHOD

Finally, we now use the APV method to analyze the lease versus buy decision. In particular, we consider the Robot-Matushita example using the APV method.

Consider the following example (from Ross and Westerfield 5th edition, page 625):

Robot Corporation is considering purchasing a new robot manufacturing machine for $10,000. This machine will save Robot $6,000 per year due to cost savings for the next five years. The savings are assumed to be certain.

Robot has a marginal tax rate of 34% and uses a five year straight line method for depreciation purposes. After five years, the machine is worthless.

As an alternative to buying the machine, the Matushita Corporation has offered to lease the machine to Robot for lease payments of $2,500 per year for 5 years.

Finally, Robot's before tax cost of borrowing is 7.58%.

Does Robot need the machine and should Robot lease or buy the machine?

The incremental cash flows for buying and leasing are shown below.
THE LESSEE'S VIEWPOINT

In the APV method we compute the debt tax shields that are lost due to leasing the machine instead of buying. Hence, we have to find the debt that is displaced by the lease of the machine and compute the debt tax shields associated with this displaced debt. Because we take into account the debt tax shields lost as an explicit cost, we discount at the pretax cost of debt instead of the after-tax cost of debt. (We would be "double counting" if we discounted with the after-tax cost of debt.

The table below shows the incremental cash flows for the lease versus buy decision. The difference between the cash flows shown earlier and the cash flows shown below is that we have subtracted the debt tax shields that are lost when the machine is leased instead of bought.
### INCREMENTAL CASH FLOW ANALYSIS - LEASE VERSUS BUY

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lease Payment</strong></td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
<td>-2,500</td>
</tr>
<tr>
<td><strong>Tax benefits of lease payments</strong></td>
<td>850</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td>850</td>
<td></td>
</tr>
<tr>
<td><strong>Savings on cost of machine</strong></td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lost Debt Tax Shields</strong></td>
<td>-259.8334</td>
<td>-212.8105</td>
<td>-163.4360</td>
<td>-111.593</td>
<td>-57.157</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10,000</td>
<td>-2,330</td>
<td>-2,330</td>
<td>-2,330</td>
<td>2,330</td>
<td>2,330</td>
</tr>
<tr>
<td><strong>Total Debt Tax Shields</strong></td>
<td>-2,589.8334</td>
<td>-2,542.8105</td>
<td>-2,493.436</td>
<td>-2,441.593</td>
<td>-2,387.157</td>
<td></td>
</tr>
</tbody>
</table>

The lost debt tax shields shown in the table are those obtained from the debt equivalent cash flows method (hence this is an example where the APV method is unnecessary and in fact requires unnecessary work. That is, we have to do the debt equivalent cash flows method first, before we can even do the APV; in cases like these, we may as well just do the debt equivalent
cash flows method.). The debt equivalent cash flows method yielded the exact amount of debt that was displaced under the assumption that \( \lambda \) was one. In other situations, where \( \lambda \) is not equal to one, it may be that we directly know what the displaced debt is (if we directly know the amount of displaced debt, then it makes more sense to use the APV). In that case, we use those numbers to calculate the debt tax shields above.

We discount the incremental cash flows (including the lost debt tax shields) at the pretax rate of 7.57575\%. This yields:

\[
\text{NPV to lessee} = 10,000 + \frac{-2,589.8334}{1.07575} + \frac{-2,542.8105}{(1.07575)^2} + \frac{-2,493.436}{(1.07575)^3} + \frac{-2,441.593}{(1.07575)^4} + \frac{-2,387.157}{(1.07575)^5}
\]

\[
= -87.71
\]

This is the same number that we obtained with the after tax method (which is also the debt equivalent cash flows method.

In summary, in this example, the APV method is unnecessary because we need to use the debt equivalent cash flow method to compute the displaced debt capacity. There may be situations where the debt is not displaced one for one by the lease. In that case \( \lambda \) is not equal to one. If we happen to know the exact debt that is displaced, the APV method would be useful in such cases.