Goals for Topic 10

Complete the circle: tie the valuation implications of financing back to project selection
Calculate Adjusted Present Values and Weighted-Average Cost of Capital
Outline of Topics

- Capital Structure and Investment
- Adjusted Present Value
- Assessing Debt Capacity
- Adjusted Discount Rates; WACC
- Leasing

I. Capital Structure and Investment

- Previous approach: value projects using discounted cash flows; discount rate is risk-adjusted.
- But… financing can affect valuation.
- So… shouldn’t we take project financing into account when we evaluate projects?
  YES!
II. Adjusted Present Value

Principle: Cut valuation into a perfect markets benchmark, plus adjustments for financing.

- With tax adjustments, we used
  \[ V_L = V_U + \text{PV(tax shields)} - \text{PV(expected finance-related costs)} \]
- More generally, use this method for each project
  \[ \text{APV} = \text{NPV(perfect markets)} + \text{PV (expected finance-related benefits & costs)} \]

These costs of financing may be direct costs, as in the following example....
Example 10-1: Perfect markets benchmark NPV

A project that costs $7 million returns $1.45 million after-tax cash flow per year for 10 years. Its beta is 1.5, the risk-free rate is 6% and the expected return on the market is 12%. The firm’s tax rate is 34%.

What is the project's base-case NPV?

Suppose the firm must issue equity to raise cash to fund this project, and suppose investment bankers charge 6% of the gross proceeds. There are no other costs or benefits associated with the financing.

What is the project’s APV?
III. Debt Capacity

- Most interactions between investment and financing relate to indirect costs and benefits, such as tax shields.

- Given the costs and benefits of debt financing, we refer to the **optimal (not maximum)** amount of debt that could be carried by a project as its *debt capacity*.

- In principle, the project’s debt capacity is the amount by which the firm’s debt level is optimally increased as a result of undertaking the new project, given the rest of the firm’s financial structure.

- In practice, this could be very complicated to determine.

- A practical approximation is to view debt capacity as the amount of debt optimally taken on to finance the project as if the project were a mini-firm.
Example 10-2: Corporate Taxes Only

Modify the original project. Ignore the issuing costs and assume that the project costs $7 million and has inflows of $1.45 million after taxes in perpetuity. Assume the project’s debt capacity is 40% of its present value (not its NPV). The company plans to maintain this debt capacity indefinitely. The firm’s tax rate is 34%. Calculate the project’s APV.

Example 10-3: Personal and Corporate Taxes

Same as above, only now $\tau_{pe} = .14$ and $\tau_{pd} = .28$. Then $T^*$, the relative tax advantage of debt, is reduced to
Example 10-4: Finite-lived Project

Suppose everything is the same as above, but the project has only a two-year life with after-corporate-tax cash inflows of $5 million at the end of each year (i.e., at times 1 and 2); and that the project's debt capacity is 40% of its value at any point in time. The debt is riskless; i.e., $r_D = 6\%$. 


III. Debt Capacity and APV

• The APV approach views the project as having two components, the asset component and the financing component;
  – the NPV of the “whole” project is the sum of the NPVs of these components.
• The APV approach is flexible because whatever you believe the financing related cash flows to be (issue costs or debt-tax shields, perpetual or finite), you can discount their value and add it to the project’s base-case NPV. This works every time.

IV. Adjusted Discount Rates

• The adjusted discount rate approach to valuing projects involves adjusting the discount rate to reflect tax benefits, and then discounting the asset component of the project’s after-corporate-tax cash flows at this adjusted rate.
Adjusted Discount Rates: WACC

The weighted-average cost of capital is the most popular of these approaches, WACC is calculated as

\[ WACC = \left( \frac{E}{V_L} \right) r_E + \left( \frac{D}{V_L} \right) (1 - T^*) r_D \]

where \( T^* \) is the tax advantage of debt. If only corporate taxes are considered \( T^* = \tau_c \). With corporate and personal taxes, \( T^* \) is smaller (remember why?)

After-corporate tax cash flows of the project are then discounted at the WACC rate.

- There are several other popular formulas for adjusted discount rates which in some cases are equivalent to WACC.
- A useful one is the Modigliani-Miller formula:

\[ r^* = r_{EU}(1 - T^*L) \]

where \( L = \frac{D}{V_L} \). Since \( r_{EU} = r_A \), this formula can be useful when we know a company's WACC (which can be taken to equal \( r^* \)), but we need to know the required return on their assets, \( r_A^* \).
Another formula that comes out of the WACC approach which is often useful is:

\[ r_{EL} = r_A + \frac{D}{E_L} (1 - T^*) (r_A - r_D). \]

What is the effect of leverage on the required return to leveraged equity? Why?

What does the tax benefit to debt (T*) do to this effect? Why?

• Remember, the APV approach always works.
• WACC and APV agree only in special circumstances.
  1) the project’s capital structure (debt capacity) is the same as the firm’s;
  2) the debt is perpetual; and
  3) the risk of the project is the same as the risk of the comparison firm’s projects.

Unless these circumstances are true, the WACC approach is only an approximation!
Example 10-5: WACC

A firm has 100,000 shares outstanding, a price per share of $50 and $1 million in riskless debt. The expected return on their equity is 11%, and the riskless rate is 4%. The corporate tax rate is 34% and there are no personal taxes.

(a) What is the firm's WACC?

The firm has access to a new project that requires an investment of $200,000 and has an expected before-tax cash flow of $60,000 per year, forever. The new project has the same business risk as the current projects in the firm. However, it cannot support as high a proportion of debt. Suppose that if the project is adopted it will be financed with $180,000 in new equity and $20,000 in new perpetual debt.

What will the share price be?

To find the project value, we cannot use WACC because the capital structure of the project differs from that of the firm.

The right approach is to find \( r_A \), and then use an APV approach to evaluating the project.
Find the return on assets,

The APV of the project is:

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Example 10-6

A project costs $700 and produces perpetual before-tax cash flows of $200. The project's beta-risk-adjusted expected return is $r_a = 20\%$. The project provides the firm with $500 perpetual debt capacity; the firm's tax rate is 35\%. Ignore personal taxes. Compute the project's NPV using the APV approach.
Alternatively, suppose you did not know the project’s beta, but instead know of a firm whose assets and capital structure are the same as the project’s. The firm’s capital structure consists of 39.4% equity and 60.6% debt.\(^1\) If the firm’s debt is riskless, then its \(r_D = 10\%\). Using historical data on equity returns or the firm’s equity beta and the CAPM, you could estimate that \(r_{EL} = 29.97\%\).

[I know what this value has to be since I know that \(r_a = 20\%\) for this firm (see equation (7) in the appendix to the notes); in practice, the 29.97% would have to be estimated because \(r_a\) is not known. If \(r_a\) were known, you would simply use the APV approach.]

**Compute the project’s NPV using the WACC approach.**
**Example 10-7: Too much debt can be a tax disadvantage!**

**Taxes and Unused Tax Shields**

Consider a small new company with:

- operating income = $100/yr (EBIT)
- depreciation = $20/yr
- outstanding debt = $900

Tax rates:

\[ \tau_c = .34; \quad \tau_{pd} = .28; \quad \tau_{pe} = .10 \]

Assume both debt and equity require 7.2% after tax.

(All cashflows are riskfree.)

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**a. What is the required before personal tax return on debt? on equity?**

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**b. What is the value of the firm’s equity? the total market value of the company?**
c. What are the total tax shields? How much of these are unused?

d. What happens to firm value if the debt is reduced to $800?
V. Leasing

• Leases change the way tax benefits are allocated between the buyer and the seller of a project.
  – The IRS considers lease payments to be the same as rental payments (they are deductible as expenses in the period in which they are accrued).

• But… the lessee (buyer) does not own the asset:
  – depreciation expenses are not allowable;
  – the lessor (seller) is the owner of the asset and can take depreciation expense deductions for tax purposes;
  – lease payments received are ordinary income.

The first component of the APV calculation is the discounted value of the project’s after-tax cash flows under the assumption of all-equity financing. The second component is the NPV of the cash flows incremental to the lease.

• What are the cash flows incremental to the lease?
  – The lease enables the lessee to “buy” the asset worth $C_0$ dollars;
  – The lessee has to pay lease payments of $L_t$ dollars each period to the lessor. Furthermore, the lessee loses the depreciation tax shields that he could have taken had he purchased the asset, $\tau_c \text{Dep}_t$; but he gains a tax shield associated with the deductibility of the lease payments, $\tau_c L_t$. 
The NPV of the lease is given by:

$$NPV_{\text{lessee}}(\text{Lease}) = C_0 - (1 - \tau_c)L_0 - \sum_{t=1}^{T} \frac{(1 - \tau_c)L_t + \tau_c \text{Dep}_{t} - S_T}{(1 + r)^t}$$

where $S_T$ is the after-tax salvage value of the asset returned to the lessor.

The riskiness of these cash flows is similar to the risk of payments to debt holders, so a reasonable choice of discount rate, $r_i$ would be $r_D(1 - \tau_c)$.

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**Example 10-8: Valuation of Leasing vs. Owning**

Firm XYZ is considering leasing a positive NPV asset that would cost $100 to purchase. If purchased, the asset can be depreciated over 3 years (straight-line) for tax purposes. The useful life of the asset is five years, after which it has an after-tax salvage value of $49.50. The firm can lease the asset for lease payments of $15; after which ownership of the asset reverts to the lessor. Assume that Firm XYZ will not have positive taxable income until time 3 when it will have in excess of $1000 in taxable income. Further assume the corporate tax rate is 35% and carry-forwards of losses are allowed. The discount rate appropriate for the lease is 10%.

(i) Should Firm XYZ buy or lease the asset?

(ii) Assume the lessor’s taxable income is expected to be large and positive for the foreseeable future. Is the lease a positive NPV project for the lessor?
i) We already know that the asset has a positive NPV; so if the lease has a negative NPV the firm will buy the asset, otherwise the firm will lease the asset. We compute the NPV of the lease to Firm XYZ as follows

$$NPV_{\text{lessee}} = 100 - 15 - \frac{15}{(1.10)^2} - \frac{.65 \cdot 15}{(1.10)^3} - \frac{3 \cdot .35 \cdot 15}{(1.10)^4} - \frac{3 \cdot .35 \cdot 33}{(1.10)^5}$$

This calculation reflects the fact that no tax benefits (whether due to deductibility of lease payments or depreciation) are realizable until time 3 for firm XYZ.

(ii) The NPV of the lease to the lessor is

$$NPV_{\text{lessor}} = -100 + (.65)15 + \frac{(.65)15 + (.35)33}{0.10} \left[1 - \frac{1}{(1.10)^3}\right] + \frac{.65 \cdot 15}{(1.10)^4} + \frac{49.50}{(1.10)^5} = 0.11$$

The lease is better for both the lessee and the lessor than if Firm XYZ were to purchase the asset from the lessor. This occurs because the lease enables the transfer of tax benefits to the lessor firm in the early years when XYZ cannot benefit from them. The time value of money makes these tax benefits more valuable to the lessor; and he therefore shares some of this benefit with the lessee in the form of low lease payments.
Leasing: The advantages of timing!

• Remember that leases are usually for the long-term, while depreciation can usually be taken early in the useful life of the asset. Consequently, leasing transfers early tax benefits to the lessor, while granting the lessee a smooth stream of tax benefits over time.
• Presuming that the lease payments are lower when the lessor's tax benefits are higher, leasing pays when the lessor's tax rate is higher than the lessee's. This is because the early depreciation tax benefits are more valuable to the lessor in this case.

Leasing: The advantages of timing!

• Moreover, there is no reason why the lease payments have to be the same across time. If the lessee did not expect to pay taxes for several years, a lease program that specified low payments in early years and large payments in later years could be used to obtain maximal benefits for the lessee.

• In summary, leases enable buyers and sellers of assets to arrange transactions in a manner that maximizes the value of tax benefits that would be unavailable in the absence of leasing.
V. Summary

- Key Concepts
- Definitions
- Notation

Key Concepts

Adjusted Present Value divides valuation into a perfect markets benchmark, plus adjustments for financing:

\[ APV = \text{NPV(perfect markets)} + \text{PV (expected finance-related benefits & costs)} \]

The Adjusted Discount Rate approach (such as WACC) adjusts the discount rate for financing effects (like taxes) and then discounts cash flows using this adjusted discount rate. This is only equivalent to APV in certain circumstances.

Leases change the way tax benefits are allocated between the buyer and the seller of a project, and can move tax benefits over time.
Definitions

The **optimal (not maximum)** amount of debt that could be carried by a project is its *debt capacity*.

Notation

\[ WACC = \left( \frac{E_L}{V_L} \right) r_E + \left( \frac{D}{V_L} \right)(1 - T^*) r_D \]

The Modigliani-Miller formula:
\[ r^* = r_{EU}(1 - T^*L), \text{ where } L = D/V_L. \]

\[ r_{EL} = r_A + (D/E_L)(1 - T^*)(r_A - r_D). \]

Discount rate for safe nominal cashflows:
\[ r_D(1 - \tau_c) \]