Financial Economics

Lecture 03. Corporate Finance

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Discounted cash flow (DCF) valuation

- How much value is created from undertaking an investment?
  1. Estimate **future cash flows** we expect the business to produce
  2. Estimate the **required return (cost of capital)** for projects of this risk level
  3. Apply basic discounted cash flow procedure to estimate the **PV of those cash flows**
  4. Estimate **NPV as the difference between the PV of the future cash flows and the cost of the investment**

Outline

- Estimate Future Cash Flows
- Scenario Analysis and Sensitivity Analysis
- Estimate Cost of Capital
- Financial Structure of the Firm

Estimating a Project's Cash Flows

- Incremental cash flows
  - The difference between a firm's future cash flows with a project and those without the project
  - Only the incremental cash flows form part of an investment decision
  - Any cash flow that exists regardless of whether or not a project is undertaken is not relevant

Estimating a Project's Cash Flows

- Only timed *cash flows* are used, not expenses
  - Depreciation is an expense, *not* a cash expense, and must be *excluded*
  - The **tax benefit of depreciation** is a cash flow and must be *included*
  - A sunk cost has already been incurred and cannot be removed and therefore should be included
- Some cash flows do not occur on the income statement, but involve timing
  - **Working capital** additions and reductions are cash flows
  - At the end of a project, the sum of the nominal changes in working capital is zero
- Will not include
  - Interest paid or any other financing costs (e.g., dividends or principal repaid) because we are interested in the cash flow generated by the assets of the project
  - After-tax cash flow because taxes are definitely a cash flow

Example

- A proposed project will generate $10,000 in revenue, but will causes another product line to lose $3,000 in revenues
- What is the incremental cash flow?

Example

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- What is the incremental cash flow?
- The incremental cash flow is only $7,000

Example: Prior Expenses

- R&D expenses are $10,000 to-date for your project, and you plan to spend another $20,000, making $30,000 in all
  - What is the incremental cash flow

Example: Prior Expenses

- R&D expenses are $10,000 to-date for your project, and you plan to spend another $20,000, making $30,000 in all
  - The $10,000 is a sunk cost. The decision whether to undertake the project will not change this expenditure
  - Only the $20,000 is an incremental cost, and the $10,000 should be excluded

Example: Underutilized Resources

- A project uses an existing (non-cancelable) leased warehouse with a remaining life of 20 years, and total annual rent of $100,000
- The warehouse is projected to remain 50% utilized unless your project is undertaken
- The lease prohibits sub-leasing
- The current project is making a loss
- Your project will use 25% of the warehouse
- What should the project be charged?

Example: Underutilized Resources

- **Solution1:** The original project currently using the warehouse is making a loss:
  - "Charge the full $100,000 /year so the company can recover the very real warehousing costs."
- **Solution2:** Half the warehouse is available:
  - "The project should be charged the full $50,000 /year if it needs to use it. A portion of the warehousing costs will not be charged-out otherwise."
- **Solution3:** The project should be charged for its share of the *used* space:
  - "Charge $33,333 /year."
- **Solution4:** The project is going to use only 25% of the space.
  - "Charge $25,000 /year."

Example: Underutilized Resources

- **Solution5:** The charge should be proportioned according to revenues generated by each project--that is fair, isn't it?
  - "The old project's revenues = $9,000,000, and the new project has projected revenues = $1,000,000, so the charge is 10%, or $10,000/year."
- **Solution6:** There is a suitable new (smaller) warehouse available on the market for $27,000 /year.
  - "Charge the project the market rate of the space, $27,000."
- **Solution7:** The original lease was entered into when warehouse space was cheap, but now space is twice what it was:
  - "The market value of the leased warehouse is now $200,000, and the project should take its proper share of that amount."
- **Solution8:** This is a new project, so give it a sporting chance:
  - "The project should be charged nothing."

Example: Underutilized Resources

- The solution in this case is solution # 8, (but for another reason): The project should be charged nothing
  - The warehouse expenditure will occur whether the project is done or not. It is therefore *not an incremental cash flow*

Estimating a Project's Cash Flows

1. Compute Operating cash flow (OCF)
   - Approach 1: We start at the top of the income statement with sales and work our way down to net cash flow by subtracting costs, taxes, and expenses, leave out any strictly noncash items

     $$OCF = Revenue - Cash\ Expenses - Taxes$$

   - Approach 2: We begin with the accounts' bottom line (net income) and add back any noncash deductions, such as depreciation

     $$OCF = Net\ Income + Noncash\ Expenses$$

     $$OCF = Revenue - Total\ Expenses - Taxes + Noncash\ Expenses$$

     - Noncash expenses: such as depreciation
     - $Revenue - Total\ Expenses =$ EBIT (Earnings before interets and taxes)
     - $Net\ Income = Revenue - Total\ Expenses - Taxes$, no interests subtracted
2. Compute total cash flows (CF)

$$CF = OCF - Capital\ Spending\ - Changes\ in\ Net\ Working\ Capital(NWC)$$

Estimating a Project's Cash Flows

- **Example:** For a particular project and year under consideration, suppose we have the following estimates:
  - Sales=$1,500
  - Costs=$700
  - Depreciation=$600
  - Assume no interest is paid and the corporate tax rate is 21%

Estimating a Project's Cash Flows

- **Example:** For a particular project and year under consideration, suppose we have the following estimates:
  - Revenue=$1,500
  - Costs=$700
  - Depreciation=$600
- Approach 1: $OCF = Revenue - Cash\ Expenses - Taxes$
  - $EBIT = Revenue - Costs - Depreciation = \$1{,}500 - 700 - 600 = \$200$
  - $Taxes = EBIT \times TaxRate = \$200 \times 0.21 = \$42$
  - $OCF = Revenue - Costs - Taxes = \$1{,}500 - 700 - 42 = \$758$

Estimating a Project's Cash Flows

- **Example:** For a particular project and year under consideration, suppose we have the following estimates:
  - Revenue =$1,500
  - Costs=$700
  - Depreciation=$600
  - Assume no interest is paid and the corporate tax rate is 21%

- Approach 2: $OCF = Revenue - Total\ Expenses - Taxes + Noncash\ Expenses$

$$OCF = EBIT - Taxes + Depreciation = \$200 - 42 + 600 = \$758$$

- Approach 2: $OCF = Net\ Income + Noncash\ Expenses$

$$Net\ Income = EBIT - Taxes = \$200 - 42 = \$158$$

$$OCF = Net\ income + Depreciation = \$158 + 600 = \$758$$

Estimating a Project's Cash Flows

- **Example:** For a particular project and year under consideration, suppose we have the following estimates:
  - Revenue =$1,500
  - Costs=$700
  - Depreciation=$600
- Tax Shield Approach
- OCF as having two components:
  - What the project's cash flow would be if there were no depreciation expense
    - Would-have-been cash flow is $(\$1{,}500 - 700) \times (1 - 0.21) = \$632$
  - Depreciation multiplied by tax rate (i.e., **depreciation tax shield**)
    - $600 depreciation deduction saves us $600 x .21 = **$126** in taxes
- $OCF = (Sales - Costs) \times (1 - T_C) + Depreciation \times T_C = (\$1{,}500 - 700) \times (1 - 0.21) + 600 \times 0.21 = \$632 + 126 = \$785$

Depreciation

- The depreciation expense used for capital budgeting should be the depreciation schedule required by the IRS for tax purposes
  - Straight-line method is the most commonly used (default if not stated otherwise).
    - Total value V fully depreciated over n years
    - Depreciation per year is V/n
- Depreciation itself is a non-cash expense; consequently, it is only relevant because it affects taxes
- Depreciation tax shield = depreciation expense x marginal tax rate

Example

- Suppose that during a particular year of a project we have the following simplified income statement:

Sales	$500
Costs	310
Net income	$190

- Depreciation and taxes are zero, no fixed assets are purchased during the year, and we assume the only components of NWC are accounts receivable and payable.
- Beginning and ending amounts for these accounts are as follows:

	Beginning of Year	End of Year	Change
Accounts receivable	$880	$910	+$30
Accounts payable	550	605	+ 55
Net working capital	$330	$305	−$25

- What is the cash flow for the year?

Example

- Operating cash flow in this case is the same as EBIT because there are no taxes or depreciation; thus, it equals $190
- Net working capital actually *declined* by $25, which means that $25 was freed up during the year.
- There was no capital spending, so the total cash flow for the year is:

$$Total\ CF = Operating\ CF - Change\ in\ NWC - Capital\ spending$$
$$= \$190 - (-25) - 0 = \$215$$

Example

- We could therefore ask a different question: What were cash revenues for the year? Also, what were cash costs?
- During the year, we had sales of $500, but accounts receivable rose by $30, so cash inflow is $\$500 - 30 = \$470$
- Costs during the year were $310, but accounts payable increased by $55, so cash costs for the period are $\$310 - 55 = \$255$
- We calculate that cash inflows less cash outflows are $\$470 - 255 = \$215$

Net Working Capital

- Why do we have to consider changes in NWC separately?
  - GAAP (Generally Accepted Accounting Principles) requires that sales be recorded on the income statement when made, not when cash is received
  - GAAP also requires that we record the cost of goods sold when the corresponding sales are made, whether we have actually paid our suppliers yet
  - Finally, we have to buy inventory to support sales although we haven't collected cash yet
  - Basically, revenues/costs occur ≠ cash flows

Example: Shark Attractant Project

- Suppose we think we can sell 50,000 cans of shark attractant per year at a price of $4 per can. It costs us about $2.50 per can to make the attractant, and a new product such as this one typically has only a three-year life. We require a 20% return on new products.
  - Fixed costs for the project, including such things as rent on the production facility, will run $17,430 per year
  - We will need to invest a total of $90,000 in manufacturing equipment; assume this $90,000 will be 100% depreciated over the three-year life of the project
  - Cost of removing equipment will roughly equal its actual value in three years, so it will be essentially worthless on a market value basis as well
  - Project will require an initial $20,000 investment in net working capital, and the tax rate is 21%

Example: Shark Attractant Project

- Projected income statement

Sales (50,000 units at $4/unit)	$200,000
Variable costs ($2.50/unit)	125,000
Fixed costs	17,430
Depreciation ($90,000/3)	30,000
EBIT	$ 27,570
Taxes (21%)	5,790
Net income	$ 21,780

- Projected capital requirements

	Year			
	0	1	2	3
Net working capital	$ 20,000	$20,000	$20,000	$20,000
Net fixed assets	90,000	60,000	30,000	0
Total investment	$110,000	$80,000	$50,000	$20,000

Example: Shark Attractant Project

- Projected income statement and operating cash flow

Sales	$200,000
Variable costs	125,000
Fixed costs	17,430
Depreciation	30,000
EBIT	$ 27,570
Taxes (21%)	5,790
Net income	$ 21,780

EBIT	$27,570
Depreciation	+ 30,000
Taxes	– 5,790
Operating cash flow	$51,780

- Projected total cash flow

	Year			
	0	1	2	3
Operating cash flow		$51,780	$51,780	$51,780
Changes in NWC	–$ 20,000			+20,000
Capital spending	– 90,000			
Total project cash flow	–$110,000	$51,780	$51,780	$71,780

Example: Shark Attractant Project

- The NPV at the 20% required is

$$NPV = -\$100{,}000 + \frac{51.780}{1.2} + \frac{51.780}{1.2^2} + \frac{71{,}780}{1.2^3} = \$10{,}648$$

- Based on these projections, the project creates over $10,000 in value and should be accepted
- Return on this investment obviously exceeds 20% because the NPV is positive at 20%
- After trial and error, the IRR works out to be about **25.8%**
- Payback on this project is about **2.1 years**

Outline

- Estimate Future Cash Flows
- Scenario Analysis and Sensitivity Analysis
- Estimate Cost of Capital
- Financial Structure of the Firm

Scenario analysis and sensitivity analysis

- Projected cash flows are not likely to equal actual cash flows
- When we say something like, "the projected cash flow in year 4 is $700," what exactly do we mean?
  - We do not necessarily think cash flow will actually be $700, but rather if we took all the possible cash flows that could occur in four years and averaged them, the result would be $700
- Forecasting risk (i.e., estimation risk) is the possibility that errors in projected cash flows will lead to incorrect decisions
  - How sensitive is our NPV to changes in the cash flow estimates
  - The more sensitive, the greater the forecasting risk

Scenario analysis

- First thing to do when investigating a new project is estimate NPV based on projected cash flows
  - Initial set of projections are called the ***base case***
- Investigate sensitivity to different assumptions
  - Best case (**upper bound**): high revenues, low costs
  - Worst case (**lower bound**): low revenues, high costs
- Example: Project under consideration costs $200,000, has a five-year life, and has no salvage value. Depreciation is straight-line to zero. The required return is 12%, and the tax rate is 21%. In addition, we have compiled the following information:

	Base Case	Lower Bound	Upper Bound
Unit sales	6,000	5,500	6,500
Price per unit	$ 80	$ 75	$ 85
Variable costs per unit	$ 60	$ 58	$ 62
Fixed costs per year	$50,000	$45,000	$55,000

Scenario analysis: base case

- Scenario analysis is the determination of what happens to NPV estimates when we ask what-if questions
- We can calculate the base-case NPV by first calculating net income:

Sales	$480,000
Variable costs	360,000
Fixed costs	50,000
Depreciation	40,000
EBIT	$ 30,000
Taxes (21%)	6,300
Net income	$ 23,700

- Operating cash flow is $30,000 + 40,000 - 6,300 = $63,700 per year
- At 12%, the five-year annuity factor is 3.6048, so the base-case NPV is:

$$Base - case\ NPV = -\$200{,}000 + 63{,}700 \times 3.6048 = \mathbf{\$29{,}624}$$

Scenario analysis: best and worse cases

- We can consider various possible scenarios, but let's start with worst case and best case
- For our project, these values would be the following:

	Worst Case	Best Case
Unit sales	5,500	6,500
Price per unit	$ 75	$ 85
Variable costs per unit	$ 62	$ 58
Fixed costs per year	$55,000	$45,000

- We can now calculate the net income and cash flows for each scenario:

Scenario	Net Income	Cash Flow	Net Present Value	IRR
Base case	$23,700	$63,700	$ 29,624	17.8%
Worst case*	−18,565	21,435	−122,732	−17.7
Best case	71,495	111,495	201,915	47.9

Sensitivity analysis

- Sensitivity analysis is an investigation of what happens to NPV when only one variable is changed
- Returning to our base case for every item *except* unit sales, we can calculate cash flow and NPV using the largest and smallest unit sales figures

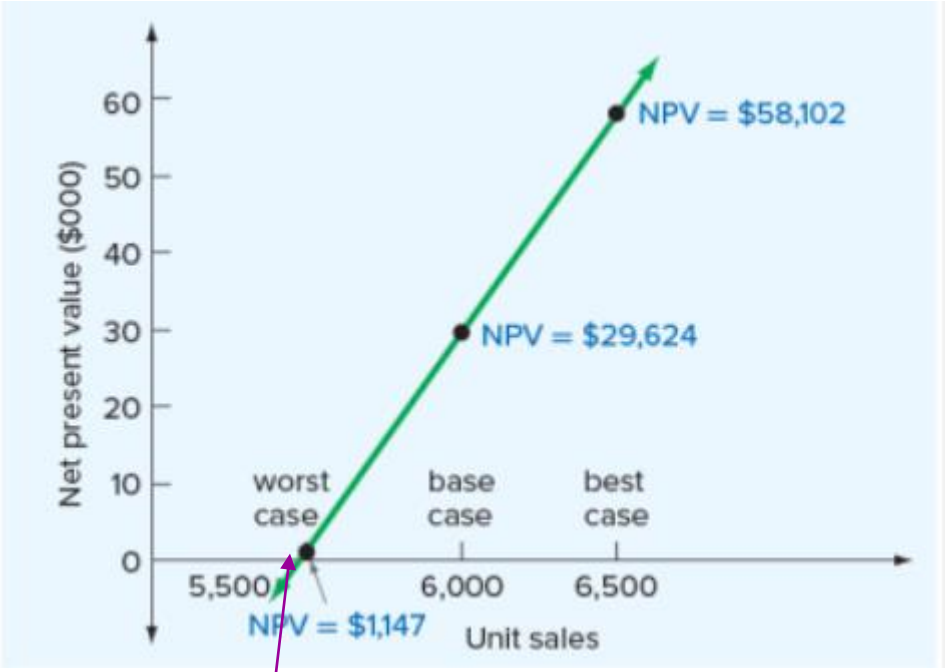
Scenario	Unit Sales	Cash Flow	Net Present Value	IRR
Base case	6,000	$63,700	$29,624	17.8%
Worst case	5,500	55,800	1,147	12.2
Best case	6,500	71,600	58,102	23.2

- We can freeze everything except fixed costs and repeat the analysis:

Scenario	Fixed Costs	Cash Flow	Net Present Value	IRR
Base case	$50,000	$63,700	$29,624	17.8%
Worst case	55,000	59,750	15,385	15.1
Best case	45,000	67,650	43,863	20.5

Sensitivity Analysis

- Graphical illustration
- Y: NPV
- X: unit sales
- The steeper the resulting line, the greater the sensitivity of estimated NPV to changes in projected value of variable being investigated
- **Break-even analysis:** at what sales volume the NPV of the project would be zero.
  - Break-even point



NPV=0

Break-even point

- $NPV = -\$200{,}000 + CF \times 3.6048 = 0 \Rightarrow CF = \$55481.58$
  - At 12%, the five-year annuity factor is 3.6048
- $CF = NetIncome + Depreciation$

  $= (Unit \times 80 - Unit \times 60 - 50{,}000 - 40000) \times (1 - 21\%) + 40000$

  $\Rightarrow Unit = 5480$

A spreadsheet presentation in textbook

- The following is an embedded Excel worksheet for the cash flow of a firm
  - It is generally a good practice to divide the worksheet into two segments, one containing only data, and the other containing only formulae
  - This practice increases flexibility & reduces the chance of error

Tax rate	40.00%							
Unit sales in year 1	$4,000							
Sales growth rate	0.00%							
Unit price	$5,000							
Unit Price Growth	0.00%							
Fixed Start	3,100,000							
Fixed Growth	0.00%							
Variable pcent	75.00%							
Depreciation schedule	400,000			**NPV =**	**1236**			
Start working capt	2,200,000							
Investment schedule	2,800,000							
Capital movements sc	0							
Dividend	1,000,000							
Working Cap Sch	2,200,000							
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
CF Forecast								
Sales revenue		20,000	20,000	20,000	20,000	20,000	20,000	20,000
Expenses								
Fixed Costs (cash)		3,100	3,100	3,100	3,100	3,100	3,100	3,100
Variable costs		15,000	15,000	15,000	15,000	15,000	15,000	15,000
Depreciation		400	400	400	400	400	400	400
Operating Profit		**1,500**	**1,500**	**1,500**	**1,500**	**1,500**	**1,500**	**1,500**
Taxes		600	600	600	600	600	600	600
Net Profit		**900**	**900**	**900**	**900**	**900**	**900**	**900**
Operating CF		**1,300**	**1,300**	**1,300**	**1,300**	**1,300**	**1,300**	**1,300**
Working cap move	2200							-2,200
Investment in P&E	2,800		0	0	0	0	0	0
Invest CF	**5,000**	**0**	**0**	**0**	**0**	**0**	**0**	**-2,200**
Net CF	**-5,000**	**1,300**	**1,300**	**1,300**	**1,300**	**1,300**	**1,300**	**3,500**
PV(NCF)	-5000	1130	983	855	743	646	562	1316

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- Estimate Future Cash Flows
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The Cost of Capital

- Required return, appropriate discount rate, and cost of capital essentially mean the same thing: the risk-adjusted discount rate to use in computing a project's net present value.
  - If the *required return* on an investment is 10%, we mean the investment will have a positive NPV only if its return exceeds 10%
- **The cost of capital associated with an investment depends on the risk of that investment, not how and where the capital is raised**
  - The standard way of dealing with uncertainty about future cash flows is to use a larger discount rate

The Cost of Capital

- When determining the cost of capital
  - The risk of the project is, in general, different from the risk of existing projects
  - Only the market-related risk is relevant
    - Or systematic risk
    - Vs. idiosyncratic risk
  - Only the risk from a project's cash flows is relevant (not that of financing instruments)

The Cost of Capital

- Consider a firm with three divisions
  - An electronics division, 30% of the market value of the firm's assets, a cost of capital of 22%
  - A chemical division, 40% of the market value, a cost of capital of 17%
  - A natural gas transmission division, 30% of the market value, a cost of capital of 14%
- The cost of capital for the firm is the weighted average of the costs of capital of each of its divisions or $0.3 \times 22\% + 0.4 \times 17\% + 0.3 \times 14\% = 17.6\%$
- What if the firm adopts the cost of capital of 17.6% for all three divisions?
- If the firm plans to finance these divisions by issuing bonds at an interest rate of 6% per year. Is 6% the appropriate cost of capital for these divisions?

The Average Cost of Capital (WACC)

- The firm's WACC is the overall required return on the firm as a whole.
- It is the appropriate discount rate to use for cash flows similar in risk to those of the overall firm.
- Although not observed, the WACC can be calculated as (assume no taxes):

$$WACC = \frac{E}{V} \times R_E + \frac{D}{V} \times R_D$$

  - E is the market value of the firm's equity
  - D is the market value of the firm's debt
  - V=E+D
  - $\frac{E}{V}$ is the percentage of the firm's financing (in market value terms)
  - $\frac{D}{V}$ is the percentage that is debt
  - R_E is the cost of equity
    - the return that equity investors require on their investment in the firm
  - R_D is the cost of debt
    - the return that lenders require on the firm's debt

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Financial Structure of the firm

- The basic unit of analysis of this chapter is the firm as a whole
- We examine how a corporation's management should make decisions regarding the mix of debt and equity
- We start with Modigliani and Miller's model of a firm in a frictionless environment with no tax and cost-free contract compliance, and later re-introduce frictions

Internal & External Financing

- Internal financing
  - Sources of funds that arise from the operation of the firm, including retained earnings, increases in accrued wages and accounts payable
- External funding
  - Sources of funds from outside lenders and investors, including the proceeds of bond and equity issues
    - Equity financing
    - Debt financing

Internal & External Financing

- Decision Process
  - Financing decisions for an established firm (not undertaking a major expansion) are routine and almost automatic, and may consist of a dividend policy, and maintaining a bank's line of credit
  - Tapping outside resources is time-consuming for management because of the need to satisfy statutory and skeptical investor demands, but it does expose the company's plans to market discipline

Equity Financing

- There are three kinds of equity claims on a company:
  - Common stock/shares
    - The residual claims to the corporation's assets
  - Corporate Stock options/Warrants
    - Options issued *by the firm*
    - Used to attract and compensate key employees and management in corporate startups
    - Used to 'sweeten' the bonds of risky ventures
  - Preferred stock
    - A bond-like security that normally cannot trigger a default for non-payment of dividend
    - Unlike bonds, it has a dividend that is *not* an expense for tax purposes

Debt Financing

- Corporate Debt is a contractual obligation of the part of the organization to make future payments in return for resources provided to it.
  - loans and debt securities, such as bonds and mortgages
    - Promises to make future payments, such as accounts payable, leases, and mortgages
  - Secured Debt
  - Long-Term Leases
  - Pension Liabilities

Secured Debt

- An asset pledged as security for a debt is called **collateral**, and the debt is said to be *secured*
  - Should a company with secured debt become insolvent, then the secured bondholders are paid from the proceeds of the sale of the collateral
  - Any money remaining from the sale of the collateral is added to the pool used to pay other creditors: IRS, employee wages, debenture holders, trade creditors, et cetera
  - If the proceeds are inadequate, then the shortfall becomes a general liability, and is paid after payment to the IRS, and wages

Long-Term Leases

- Leasing an asset for a period of time that is long compared to the asset's useful life is similar to buying the asset, and financing the purchase with debt secured by the leased assets
  - The main difference is in who bears the risk associated with the residual market value at the end of the term of the lease
  - A secondary difference may occur if the lessor is unable to fully utilize the depreciation tax shelter

Pension Liabilities

- Pension funds are either
  - *defined contribution*
  - *defined benefit*
- Some pension plans are *funded*, and some are *unfunded*
  - Some jurisdictions require that pension plans are funded, and/or are disclosed in financial statements, others do not
- Pension fund liability is often substantial
  - Resolving precisely what a company's pension fund liabilities are is often critical when determining capital structure

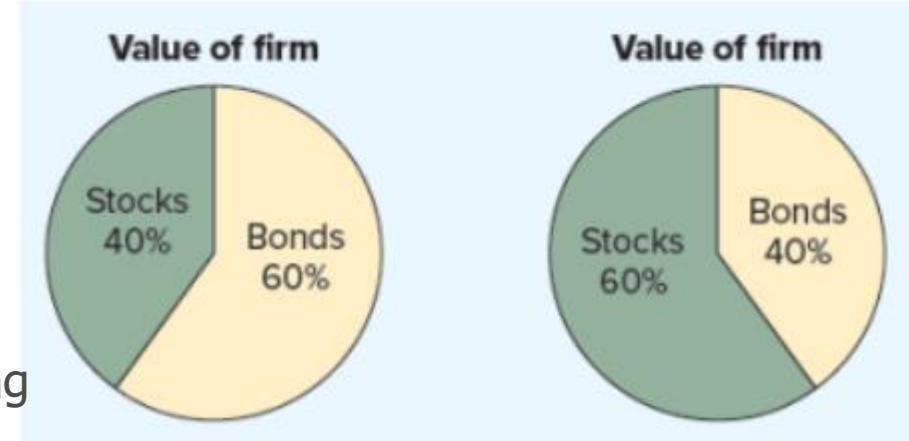
The Value of the Firm

- The value of the firm is determined by the cash flows to the firm and the risk of the assets
- Firm value changes because of
  - Change the risk of the cash flows
  - Change the cash flows
- So how Capital Structure affects them?

Modigliani and Miller (M&M Theory)

- The irrelevance of capital structure in a frictionless environment
- In an economist's idealized world of frictionless markets (**Frictionless Environment Assumptions**), the value of the firm is independent of firm's capital structure.

- Two possible ways of cutting up the pie between the equity slice and the debt slice;
- Size of pie is equal for both firms because value of assets is the same.
- Only assets create value, financing does not.



Frictionless Environment Assumptions

- No income taxes
- No transaction costs of issuing debt/equities
- Investors and management have the same information
- Stakeholders are able to resolve conflicts costlessly

Modigliani and Miller (M&M Theory)

- If no taxes or bankruptcy costs
  - No optimal capital structure

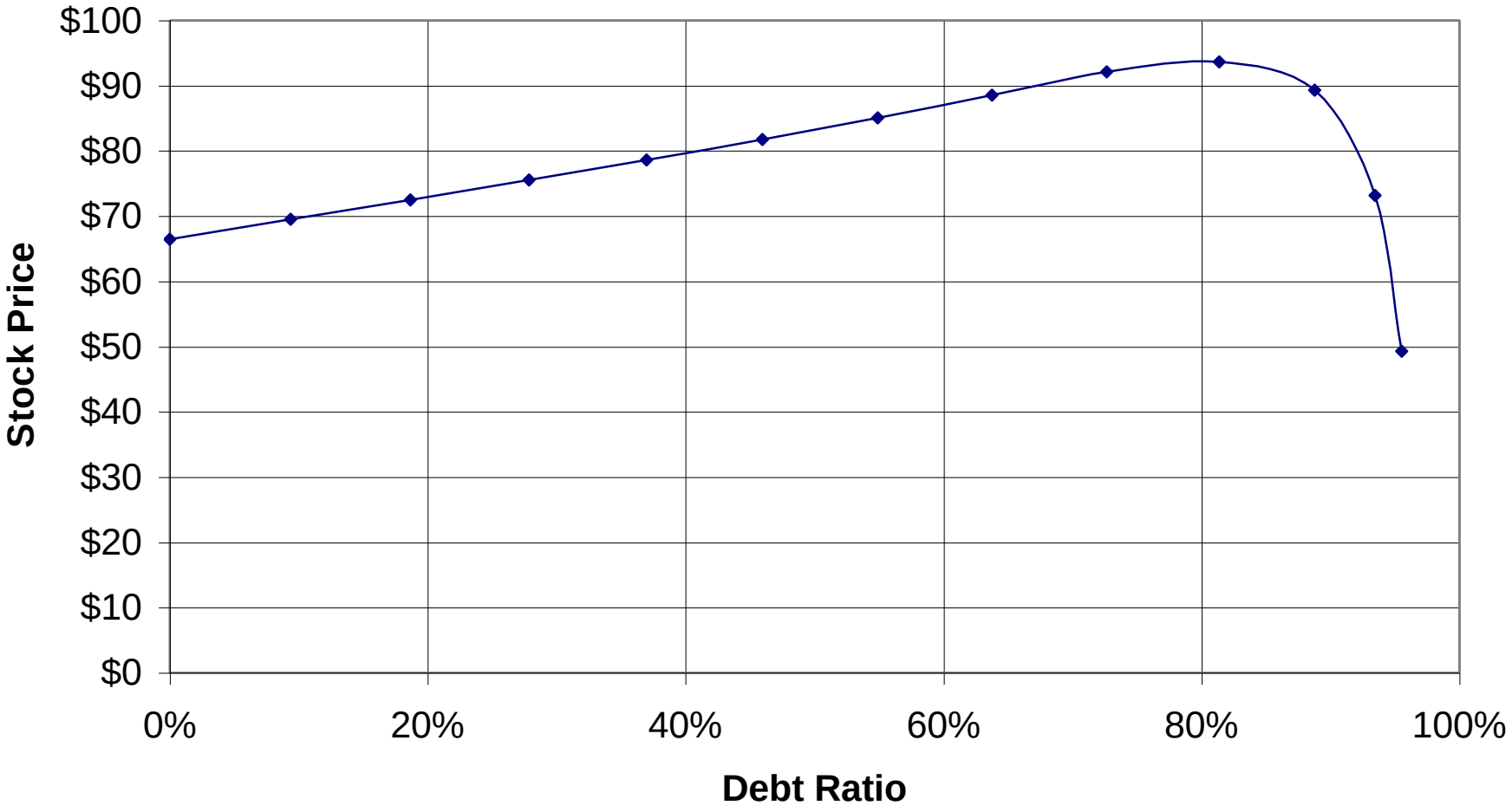
Creating Value Through Financing Decisions

- We now take a step in the direction of greater realism
  - Reducing cost
    - We reintroduce tax/subsidies
    - Financial distress/Bankruptcy costs
  - Reducing costly stakeholder conflicts

Reducing Costs by Choosing Capital Structure

- By its choice of capital structure, a firm can reduce its costs.
  - Taxes
    - In addition to shareholders and creditors, the government tax authority is a claimant to the EBIT of a firm
    - Interest paid on debt is deductible
  - The cost of financial distress/bankruptcy
    - Financial distress: the imminent danger of defaulting on debt
    - Incur costs: e.g., time and effort of managers to avoid bankruptcy; customer and employee loss
  - Subsidies
    - Some governments offer incentives to businesses to re-locate to achieve a social goal
    - The government may offer investment tax credits, and/or immediate depreciation of new capital investments, and/or tax holidays

Stock Price and Leverage
(Real Estate Project with High Bankruptcy Costs)



Example: Tax shield

- Firm U (unlevered) and Firm L (levered). These two firms are identical on the left side of the balance sheet, so their assets and operations are the same.
- Assume that EBIT is expected to be $1,000 every year forever for both firms and the corporate tax rate is 21%
- Firm L has issued $1,000 worth of perpetual bonds on which it pays 8% interest each year, where the interest bill is $.08 \times \$1{,}000 = \$80$ every year forever

	Firm U		Firm L
EBIT	$1,000		$1,000.00
Interest	0		80.00
Taxable income	$1,000		$ 920.00
Taxes (21%)	210		193.20
Net income	$ 790	>	$ 726.80

Example: Tax shield

- Assume depreciation is zero, capital spending is zero, and there are no changes in working capital

Cash Flow from Assets	Firm U	Firm L
EBIT	$1,000	$1,000.00
–Taxes	210	193.20
Total	$ 790	$ 806.80

- Compute the cash flow to stockholders and bondholders:

Cash Flow	Firm U	Firm L
To stockholders	$ 790	$726.80
To bondholders	0	80.00
Total	$ 790	$806.80

- Interest being deductible for tax purposes has generated a tax savings (for Firm L) equal to the interest payment ($80) multiplied by the corporate tax rate (21%): $\$80 \times .21 = \$16.80$

Modigliani and Miller (M&M Theory)

- If no taxes or bankruptcy costs
  - No optimal capital structure
- If corporate taxes but no bankruptcy costs
  - Optimal capital structure is almost 100% debt
  - Each additional dollar of debt increases the cash flow of the firm

Reducing costly stakeholder conflicts

- Conflicts between managers and shareholders (Agency problem)
  - Having debt outstanding reduces the 'free cash flow' and this makes managers more accountable to the market
- Conflicts between shareholders and creditors
  - In firms with large amounts of debt, managers might have an incentive to redeploy the firm's assets in a way that actually reduces the firm's total value in order to increase share price.

Example: Conflict of Interest

- Management (acting in the interests of shareholders) may increase total risk at the expense of total value of the firm
  - Badpenny currently has bonds and stock outstanding, each with a market value of $50 million, and has assets invested in short-term T-bills
  - Management enters into a project with Capone Enterprises in which an unfair coin (with a probability 60% heads) is tossed in the air
  - If a 'tail' shows, Capone Industries will double Badpenny's investment in T-bills, otherwise, Capone takes all Badpenny's T-bills

Reducing costly stakeholder conflicts

- If Badpenny is unlucky, its bonds and stock will be worth nothing
- If Badpenny is lucky, its bonds retain the original value, but the stock price will triple
  - The expected wealth of Badpenny's bond holders is $(1-0.60)*50 million = $20 million
  - The expected wealth of the stockholders is $(1-0.60)*(200-50) million = $60 million
  - New expected value of the firm = $80 million

M&M Theory and bankruptcy costs

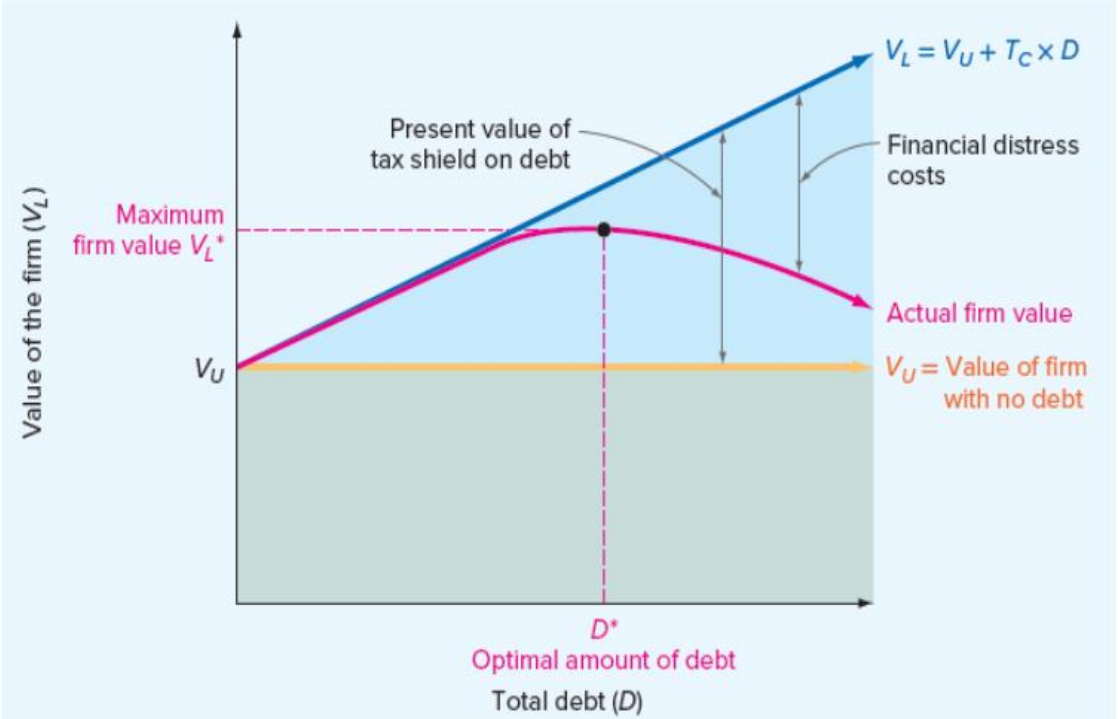
- If no taxes or bankruptcy costs
  - No optimal capital structure
- If corporate taxes but no bankruptcy costs
  - Optimal capital structure is almost 100% debt
  - Each additional dollar of debt increases the cash flow of the firm
- If corporate taxes and bankruptcy costs
  - Optimal capital structure is part debt and part equity
  - Occurs where the benefit from an additional dollar of debt is just offset by the increase in expected bankruptcy costs

Financial Decisions in Practice

- The selection of financing method is company specific as it will depend upon the economic environment in which the firm finds itself
  - Static theory of capital structure
  - Pecking order theory

The Static Theory of Capital Structure

- Firm borrows up to the point where tax benefit from extra dollar in debt equals cost that comes from an increased probability of financial distress



According to the static theory, the gains from the tax shield on debt is offset by financial distress costs. An optimal capital structure exists that just balances the additional gain from leverage against the added financial distress cost.

Pecking Order Theory

- There is an order of preference for the firm of capital sources when funding is needed (Myers and Majluf, 1984)
- Firms prefer to use internal financing whenever possible
  - cheapest to use (no issuance costs)
- Then external funds: Debt > then equity
  - Debt financing is cheaper than equity financing (Tax shield)
  - Because of asymmetric information, investors may make inferences about the value of the firm based on the external source of capital the firm chooses to raise
    - Equity financing indicates that the firm is currently overvalued
    - Debt financing indicates that firm is currently undervalued
- Implications
  - No target capital structure
  - Profitable firms use less debt
  - Companies will want financial slack and hold cash