Corporate Finance

Lecture 1: NPV and Basic Concepts of Corporate Finance

Yuan Shi ©

HSBC Business School

Peking University

PHBS 北京大学汇丰商学院 商界军校

Today

Feedback to survey

Valuation basics:

- Discounting and NPV

Class design

Valuation basics

Accounting basics

Capital budgeting

Equity/Bond market and valuation

Capital structure

Special topics:

- VC, PE, IPO, SEO, Right Offering

Survey feedback: background

1. I am familiar with the following concept: (Check all items that you have learned in undergraduate classes:)

导出图片

填写率 100.0% / 填写 19

NPV	11	57.9%
IRR	8	42.1%
Comparable	1	5.3%
CAPM/Beta	14	73.7%
Bond valuation (duration, yield curve)	9	47.4%
Multiples/relative valuation	2	10.5%
Modigliani - Miller theorem	2	10.5%
Free cash flow	14	73.7%

Survey feedback: career development

- Security research: 30%
- PE/VC: 20%
- Trading: 25%
- Quant finance: 25%

Lecture feedback

- 22% found class progressed too fast
- 36% found the English lecturing too fast

- I’ll try to add more Chinese translation when necessary
- Summarize class materials at the end of the class
- Simulated exercise
- And also real world examples

About the group project

Last class

- Introduction to corporate finance.
- What is finance?
- What is corporation? How is it different from proprietorship 独资企业 and partnerships 合伙人?
    - Limited liability
    - How easy/difficult is the transfer of ownership
    - Tax treatment
- What are corporate finance decisions?
- Goal of corporations

Simulated exam questions

- True or false: general partners are protected by limited liability
- Give me one example of corporate payout decisions
- Explain in one example how the rise of ESG investment is not conflicted with the company's purpose of maximizing shareholder value

This class

- Valuation basics
  - Time value of Money: Discounting
    - Present value and future value
  - Calculating multiple cash flows

A quick summary of last class

- Understanding value is important in many finance applications
- Value is difficult because a lot of cash flows happen across different time periods
- We want to understand the value of the assets at current period (present value)
- The technique allowing exchange of value across time periods: discounting 折现
- Idea: holding one RMB today is the same as holding 1+r tomorrow

A quick summary of last class

- Understanding value is important in many finance applications
- Value is difficult because a lot of cash flows happen across different time periods
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- The technique allowing exchange of value across time periods: discounting 折现
- Idea: holding one RMB today is the same as holding 1+r tomorrow

What is Value?

- In the context of financial economics:
- An asset creates value for its owner if it generates a positive value of **cash flows**.

- Cash Flows
  - Cash Flows occur in the future
  - Unless contractually fixed, cash flows need to be forecasted
  - For non-financial assets (e.g., cash flows from investment projects), cash flows can be conceptually challenging.

Value-related Decision

- Acquire an asset in exchange for future cash flows
- Corporate Manager
  - Invest in *real assets* which generates future cash flows
- Investors
  - Invest in *financial assets* which entitle the owner to future payments
    - Bond/Loan: Principal & Interest
    - Stock: Dividend and Capital Gain
- How to judge a good deal?

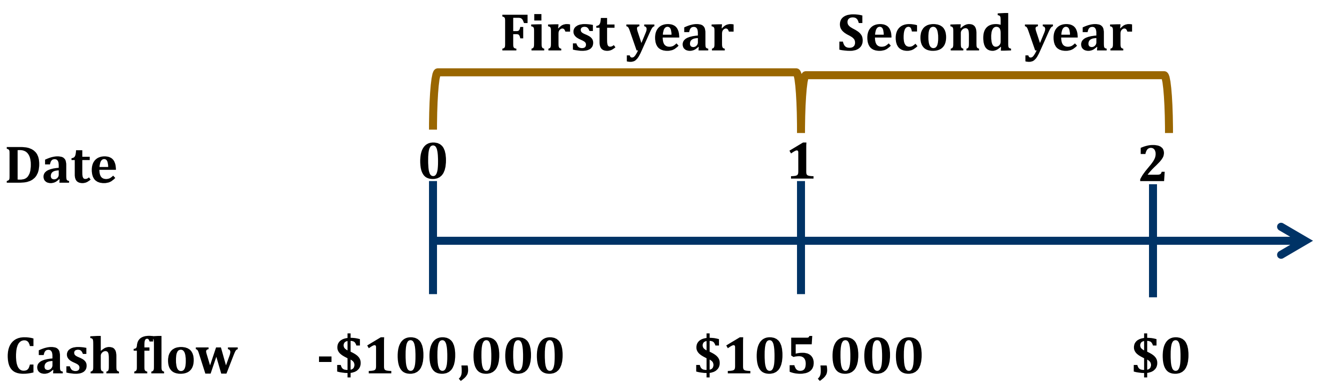
To the Strategic Board

As per the annual strategy review, and the concerns raised during the (very productive!) November 2020 retreat by the Head of Marketing notwithstanding, as management of the Shenzhen facility we believe the inputs could be sourced at a cost of $100,000 or so, an amount that our suppliers would be amenable to given the current economic environment. After netting out operating expenses (including salaries), sales would then leave a revenue at year-end of almost surely $105,000. We are thus backing the project and recommend to start approaching our suppliers ASAP.

To us…

blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah ***cost of $100,000*** *blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah* ***revenue at year-end of almost surely $105,000*** *blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah*

Time Value of Money



- **<u>Key Issues:</u>**
  - Cash flows typically occur over time.
  - Time value of money implies that we cannot simply add dollar amounts that occur at different points in time.
  - Dollar today is not the same as dollar one year later. Why?

Time Value of Money

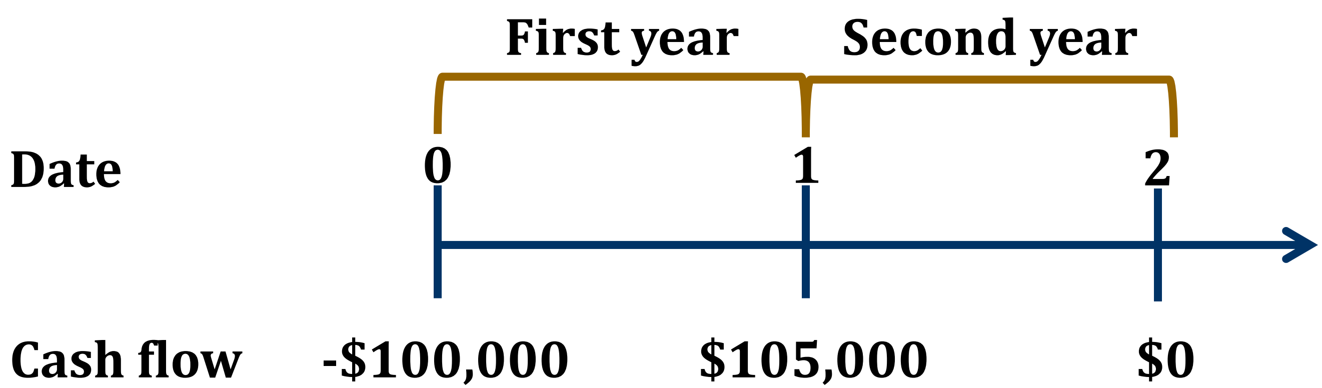
- Investment has **opportunity cost**.
- An important benchmark is the return on "risk-free" assets such as government bond.
  - Let r denote the risk-free rate
  - \$1 today is equivalent to $(1+r)^t$ dollars t periods later, namely, has a Future Value of

$$FV = (1+r)^t$$

  - \$C promised in certainty t periods later is equivalent to $C/(1+r)^t$, namely, has Present Value of

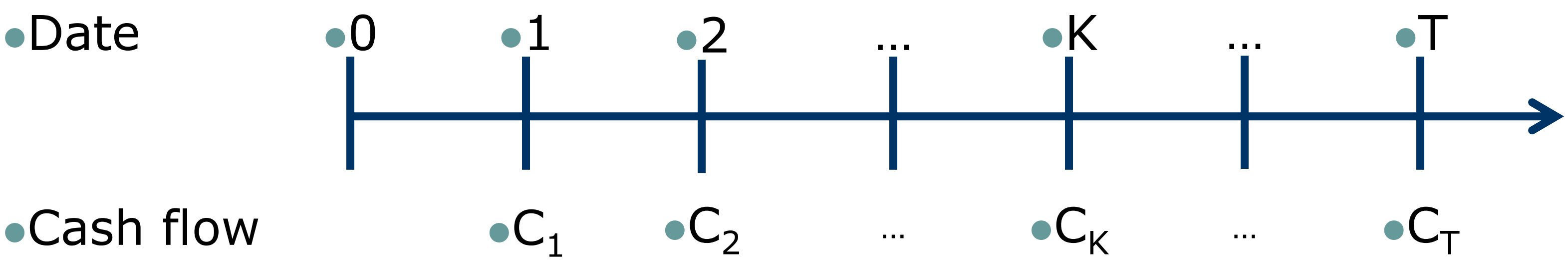
$$PV = \frac{C_t}{(1+r)^t}$$

Time Value of Money



- Present Value of $105,000
  - Competitive financial market
  - Borrow/ invest at risk-free rate of 3%
  - Value today: $105,000/(1+3%) = $101,942
- **Net Present Value:**
  - the net value added by the investment
  - $101,942 - $100,000 = $1,942 >0

Multiple Years



$$\boxed{PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_T}{(1+r)^T}}$$

C_K:

- Date K; End of year K; K years later; K years from now

Special Cases

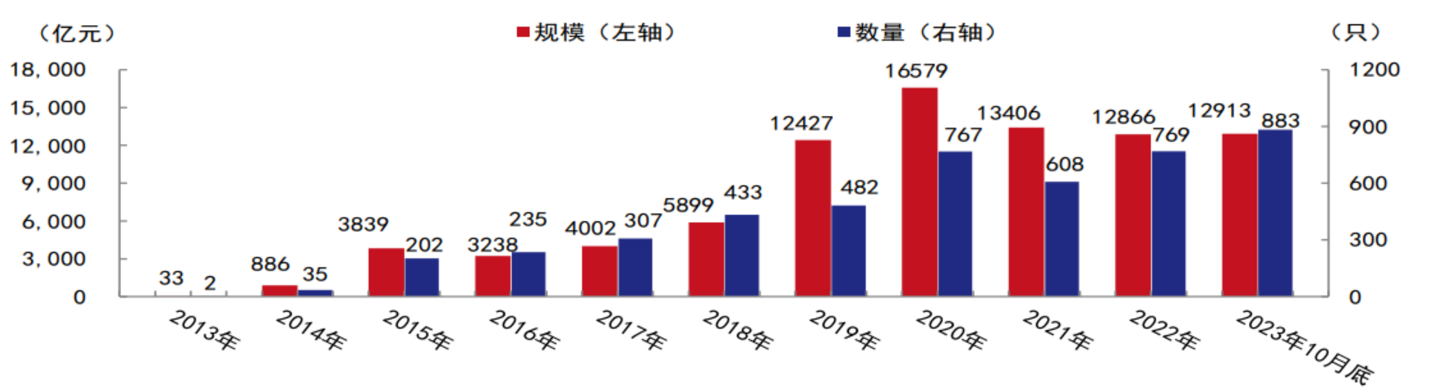
Annuity 定期年金

- Cash flows are constant for T periods: $C_1=C_2=\ldots=C_T$
- Application: debt coupon payment

Perpetuity 永续年金

- Infinite series of equal payments: $C_1=C_2=..=C_T=C_{T+1}=..$
- Application: perpetuity debt 永续债, preferred stock 优先股

图 1　2013 年以来永续债发行情况



资料来源：同花顺，中证鹏元整理

Special Cases

Growing Annuity 增长年金

- $C_{t+1}=(1+g)C_t$
- Cash flows that are growing at a constant rate

Growing Perpetuity 永续增长年金

- Infinite series of cash flows that are growing at a constant rate
- Application: firm valuation, government sustainability analysis

Baidu百科 等比数列求和公式 进入词条

求和公式

$$S_n = na_1, (q = 1)$$

$$S_n = \frac{a_1 \times (1 - q^n)}{1 - q} = \frac{a_1 - a_n q}{1 - q} = \frac{a_n q - a_1}{q - 1}, (q \neq 1)$$

$$S_\infty = \frac{a_1}{1 - q}(|q| < 1, n \to \infty)$$

求和公式推导

$$S_n = a_1 + a_2 + a_3 + \cdots + a_n$$

公比为q

$$qS_n = qa_1 + qa_2 + qa_3 + \cdots + qa_n = a_2 + a_3 + a_4 + \cdots + a_n + a_{n+1}$$

$$S_n - qS_n = (1 - q) S_n = a_1 - a_{n+1}$$

$$a_{n+1} = a_1 q^n$$

$$S_n = a_1 \frac{1 - q^n}{1 - q}$$

(q≠1) [2]

Special Cases

	$g > 0\%$	$g = 0\%$ (No growth)
Annuity	$\boxed{PV = \frac{C_1}{r-g}\left[1-\left(\frac{1+g}{1+r}\right)^T\right]}$	$\boxed{PV = \frac{C_1}{r}\left[1-\left(\frac{1}{1+r}\right)^T\right]}$
Perpetuity	$\boxed{\text{if } g < r \qquad PV = \frac{C_1}{r-g}}$	$\boxed{PV = \frac{C_1}{r}}$

Try it!

Exercise

Ch4-26. Growing Perpetuities Mark Weinstein has been working on an advanced technology in laser eye surgery. His technology will be available in the near term. He anticipates his first annual cash flow from the technology to be $175,000, received two years from today. Subsequent annual cash flows will grow at 3.8 percent in perpetuity. What is the present value of the technology if the discount rate is 9.7 percent?

Solution:

This is a growing perpetuity. The present value of a growing perpetuity is:

$PV = C/(r - g)$

$PV = \$175,000/(.097 - .038)$

$PV = \$2,966,101.69$

It is important to recognize that when dealing with annuities or perpetuities, the present value equation calculates the present value one period before the first payment. In this case, since the first payment is in two years, we have calculated the present value one year from now. To find the value today, we discount this value as a lump sum. Doing so, we find the value of the cash flow stream today is:

$PV = FV/(1 + r)^t$

$PV = \$2,966,101.69/(1 + .097)^1$

$PV = \$2,703,830.17$

Almost Surely?

blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah ***cost of $100,000*** *blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah* ***revenue at year-end of almost surely $105,000*** *blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah blah*

Recap: Time Value of Money

- Investment has **opportunity cost**.
- An important benchmark is the return on "risk-free" assets such as government bond.
  - Let r denote the risk-free rate
  - \$1 today is equivalent to $(1+r)^t$ dollars t periods later, namely, has a Future Value of

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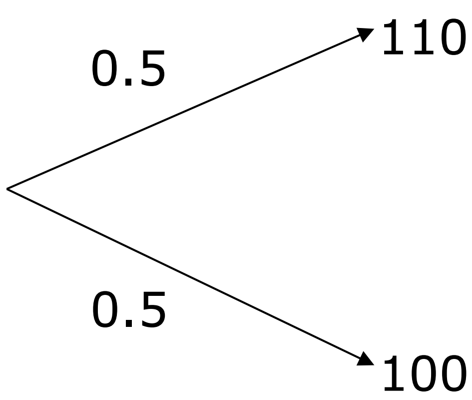
Risky Cash Flows

What are risky cash flows?

- Investment A generates cash flow of $105 with certainty next year. (Risk-free)
- Investment B's cash flows as follows are risky.



Expected Payment =
0.5*110+0.5*100=105

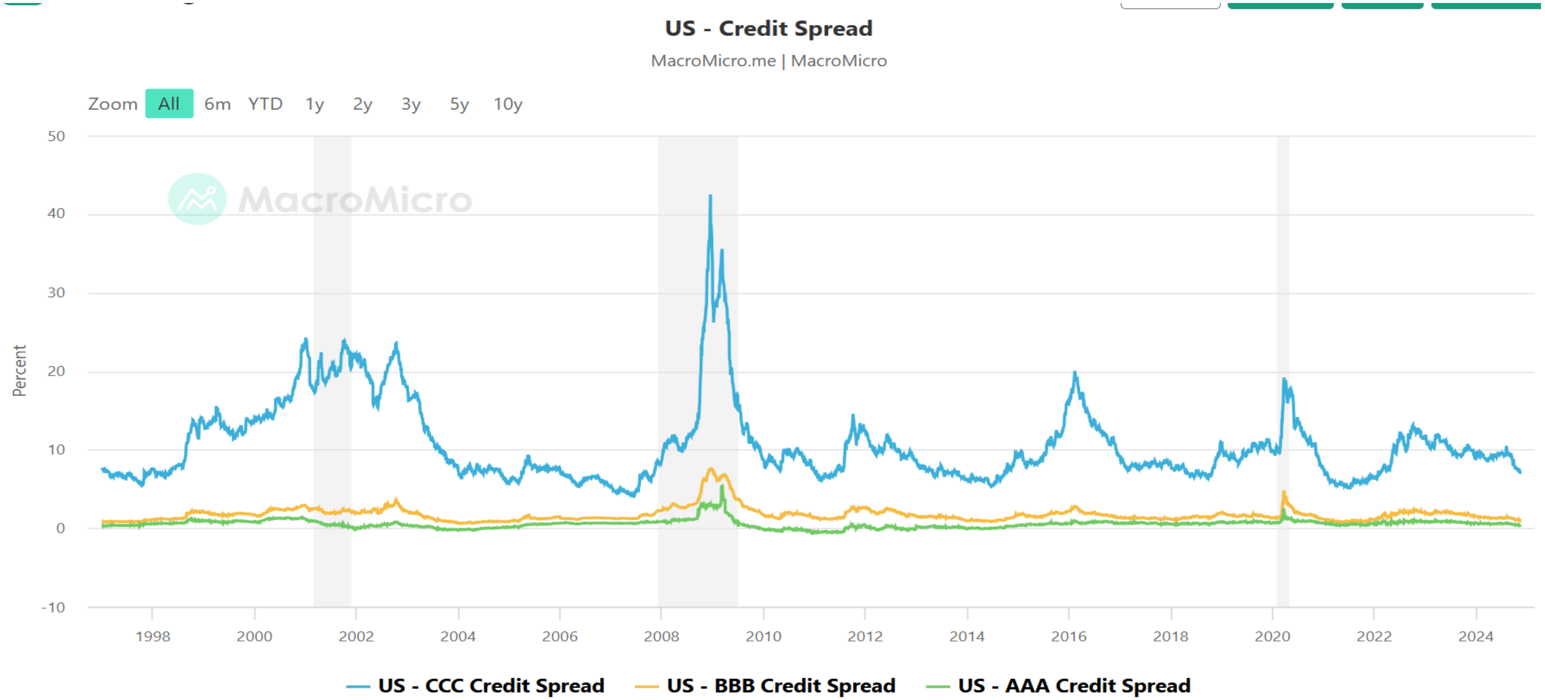
Risky Cash Flows

- How much are you willing to pay for Investment A?
  - Suppose the risk-free rate is 10%
  - $PV_A = \frac{105}{(1+10\%)} = 95.45$
  - Willing to pay no more than $95.45
  - In a competitive financial market, the price will be $95.45
- How much are you willing to pay for B?
  - More, or less than $95.45?
  - If you are <u>*risk averse*</u>, it would be less.
  - The eventual price is determined in the market where most investors are risk averse, say $90.

Risk Premium

The discount rate for risk-less securities and risky securities are different

e.g. credit spread



How is discount rate for risky asset calculated?

- If you are willing to pay \$90, what is your discount rate?
  - PV_B=90 =105/(1+ r_B) $\leftrightarrow$ r_B=16.67%
  - Note: "Willing to pay" is not the same as what you actually pay.
- We say that the **risk-premium** for Investment B is
  - 16.67%-10% = 6.67%
- For risky cash flows:
  - **Discount rate = risk-free rate + risk-premium**

Chicken first or egg first?

- Price vs discount rate. Which one is determined first?
  - How trading market works
- So how do I determine the discount risk/risk premium
  - No-arbitrage condition:
    - two assets having the same cash flow should have the same price today
    - Which allows us to calculate the discount rate
  - CAPM: non-idiosyncratic risk factors

NPV

- **NPV** measures how much an *investment* **adds value** to the investor(s).
  - Financial assets
  - Real assets: cost-cutting plans, competitive bidding, equipment and real estate, etc.
  - Other investments: education, house purchasing
- It is simply the present value of cash flows, calculated at the appropriate risk adjusted discount rate.

$$NPV = -C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

Real Assets

- The basic **capital budgeting rule** in corporate finance is to **take positive NPV projects**
- Why can these investments make a positive NPV?
  - The corporate may have exclusive access to the project
    - Specialized in producing certain products
    - Have exclusive customer relationship
    - Hold patents / trade secrete on the technology
    - Natural monopoly
    - …

This class

- Summary/Recap of NPV
- Details & Applications
  - Discount rate: cost of capital at firm level
  - Application: how does stock price change post announcement of new investment project?
- NPV vs other project estimating methods

Summary of what we've learned

- Valuation:
- the value of any company/security/project/asset is the expected present value of its future cash flows
- Present value and future value of a single cash flow:

$$FV = (1 + r)^t, \qquad PV = \frac{C_t}{(1 + r)^t}$$

- Present value of multiple cash flows (discounted cash flow/DCF 现金流贴现):

$$\boxed{PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_T}{(1+r)^T}}$$

Summary of what we've learned

- Special case of PV

	g > 0%	g = 0% (No growth)
Annuity	$PV = \frac{C_1}{r-g}\left[1-\left(\frac{1+g}{1+r}\right)^T\right]$	$PV = \frac{C_1}{r}\left[1-\left(\frac{1}{1+r}\right)^T\right]$
Perpetuity	if $g < r$ $\quad PV = \frac{C_1}{r-g}$	$PV = \frac{C_1}{r}$

- NPV:
  - Understand the full cash flow schedule and apply the DCF method
  - Investment/cost/expenses/loss: negative cash flow;
  - Revenue/income/sales/gain: positive cash flow

Summary of what we've learned

- Interdependence of price and discount rate
- NPV:
  - $\text{Price} = DCF^{-1}(Cash\ Flow, discount\ rate)$
- Discount rate:
  - $Discount\ rate = DCF^{-1}(Cash\ Flow, Price)$
- Application:
  - Calculating discount rate based on assets' price and cash flow
    - E.g.: Yield-to-Maturity 到期收益率 in bond market
- Risk premium = r(risky) – r(risk-free)

Determining the discount rate: the Cost of Capital of a company

- Cost of capital of a company is the discount rate for cash flows of a company.
- One of the main ingredients of any **valuation** or **capital budgeting exercise** is to determine the appropriate cost of capital for the firm's cash flows or that of its projects.
- For firms with both equity and debt, the cost of capital is the weighted average of *cost of debt* and *cost of equity*
- This is called the *weighted average cost of capital (WACC)*

Value of a Firm

- Value of a Firm = PV of the cash flows the firms is expected to generate now and in the future
- Who receive the cash flows?
  - Investors: holders of the company's stock and debt
  - PV of firm's cash flows = PV of cash flows to stockholders + PV of cash flows to debtholders
- **Value of a Firm (V) = Market Value of Equity (E) + Market Value of Debt (D)**
  - E = # of shares x Price per share
  - D = # of bonds x Bond Price or market value of private debt

Cost of Capital

- The cost of capital or *discount rate for cash flows of a firm* is the a weighted average of the cost of equity and debt.

$$\boxed{WACC = \frac{E}{V}\,E(R_E) + \frac{D}{V}\,E(R_D)}$$

- If the company pays corporate tax at rate of τ:

$$\boxed{WACC = \frac{E}{V}\,E(R_E) + \frac{D}{V}\,E(R_D)(1-\tau)}$$

  - We will explain why in later classes.

Summary of what we've learned

- The value of a company taking up a new project is the sum of
  - The current value of the company
  - The NPV of the project

- A positive NPV project should be taken and a negative NPV project should be rejected

NPV and Issuing Price of Stock

Try it!

Number of shares outstanding:	10,000
Current stock price per share:	$100
Assets (Market Value)	$1,000,000
Equity (Market Value)	$1,000,000
Present value of cash flows generated by the **new** project:	$210,000
Total initial cost of the **new** project:	$110,000

- The firm has zero cash holdings and is about to **issue new stocks to finance the initial investment** of this project.
- The firm will announce the share issuance and new project together.
- Assume the financial market is frictionless and competitive.
- **How many shares** should be issued to finance the project?
- What is the **issuing price**?

NPV and Issuing Price of Stock

Try it!

Method I: existing investors' perspective

- Time line: announce (t=0); receive cash (t=1); project taken(t=3);
- **NPV of the new project goes to the existing shareholders.**
- At t=0, share price incorporate the NPV of the new project

$$New\ Share\ Price\ = \frac{Original\ Equity\ Value\ +\ NPV}{Current\ Num.shares\ outstanding}$$

$$= \frac{\$1{,}000{,}000+\$100{,}000}{10{,}000} = \$110$$

- At t=1, the issue price of new share = new share price (why?)
  - No news, no price change & Financial investors get zero NPV
- Required Capital = N shares issue x Issue price

$$N\ shares\ issue = \frac{Required\ Capital}{Issue\ Price} = \frac{\$110{,}000}{\$110} = 1{,}000$$

NPV and Issuing Price of Stock

Try it!

Method II: new investors' perspective

- **NPV of investing in financial assets is zero.**
- Amount of cash provided = Value of new shares issued
- Value of new shares = Total Firm Value x Ownership of new investors

$$Required\ capital = (Original\ Equity\ Value\ +\ \boldsymbol{PV}) \times \frac{N.Shares\ Issue}{N.Shares\ Issue + N.Shares\ outstanding}$$

$$\$110{,}000 = (\$1{,}000{,}000 + \$210{,}000) \times \frac{N.Shares\ Issue}{N.Shares\ Issue + 10{,}000}$$

$$\rightarrow\ \mathrm{N}=1{,}000$$

- Required Capital = N shares issue x Issue price

$$\$110{,}000 = 1{,}000 \times Issue\ Price\ \rightarrow\ \text{Issue Price} = \$110$$

Try it!

NPV and Issuing Price of Stock

To sum:

- Share price was $100 that reflects the value of current assets ($1,000,000).
- When the firm **announces the plan** of stock issuance to finance the new project (with NPV of $100,000), share price change to ??
  - $110 (existing shareholders captures all the NPV of the new project)
- Later, new shares are issued at $110 and new investors break even (i.e., zero NPV). (why do they want to invest then?)

Takeaways:

- Share price changes to reflect value changes;
- NPV of the new project goes to the existing shareholders.

NPV and Issuing Price of Stock

Try it!

What if the financial market is *not competitive*?

- Say, there is only one investor who is willing to finance the new project
- But he wants to take all the NPV surplus
- Then, the existing investors break even:
  - $\frac{10{,}000}{10{,}000+M} \times 1{,}210{,}000 = \$100 \times 10{,}000$
  - $M = 2{,}100$
  - $P_{issue} = \frac{110{,}000}{2{,}100} = \$52.38$
- You can regard this as the lowest issuing price that the existing shareholders can bare

NPV and Issuing Price of Stock

An alternative setting:

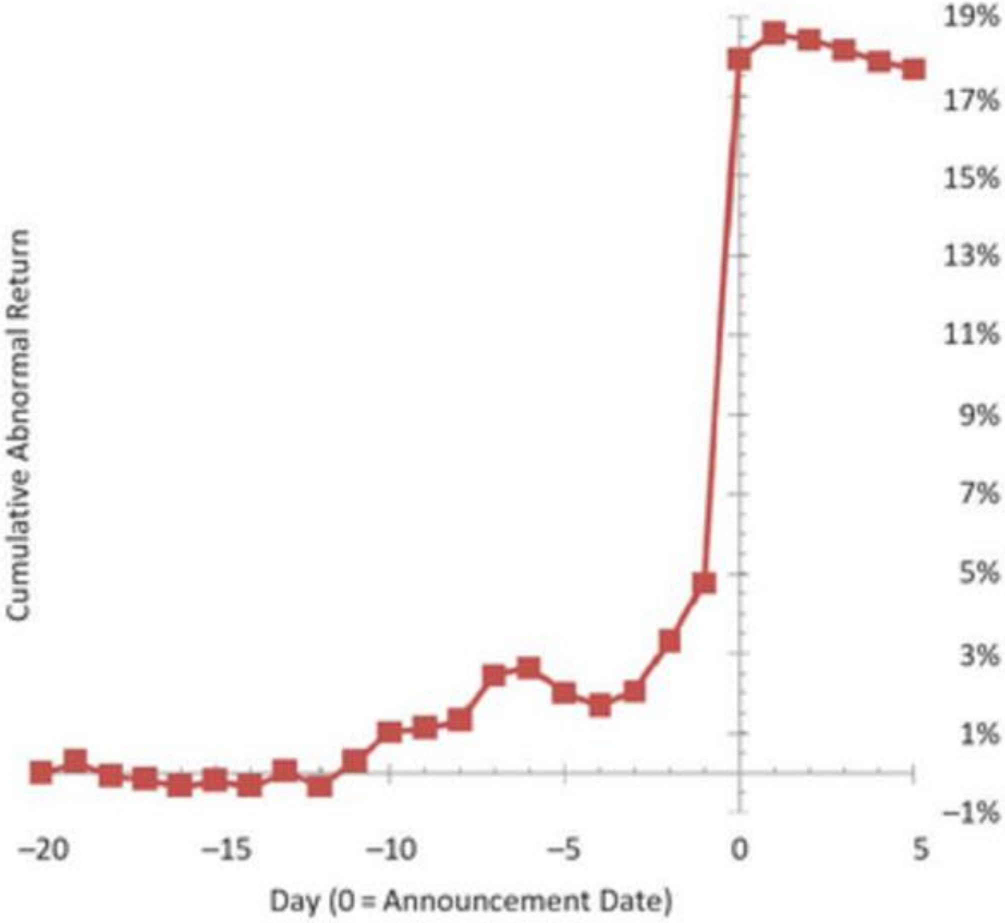
- The company's stock is valued at **$100** under the **expectation** that the company will raise $110,000 to finance a project, which will generate cash flows with PV of $210,000
  - **$90** per share for the value of assets in place
  - **$10** per share for the **NPV of future project** (why?)
- The announcement of the capital offering is fully expected (no surprise)
  - Share price **will not change** after the issuance → **$100**
  - $P_{issue} = \$100; M = \frac{110{,}000}{\$100} = 1{,}100$ (new investors break even)
  - Total value of assets increase by $110,000 (cash raised)
  - Value change for the existing shareholders around the announcement:

$$\frac{10{,}000}{10{,}000 + 1{,}100} \times (1{,}000{,}000 + 110{,}000) - 100 \times 10{,}000 = 0$$

NPV and Issuing Price of Stock

- In this example, the **existing investors** still capture **all the NPV of the new project**, and new investors still break even.
  - Why don't we see value changes for the existing investors around the announcement of equity offering?
  - Because the new project was fully anticipated, and the announcement brings no news to the market.
  - Before the market was aware of the existence of the project, share price was $90.
  - This is when the $NPV = (\$100 - \$90) \times 10{,}000 = \$100{,}000$ is reflected in share price.

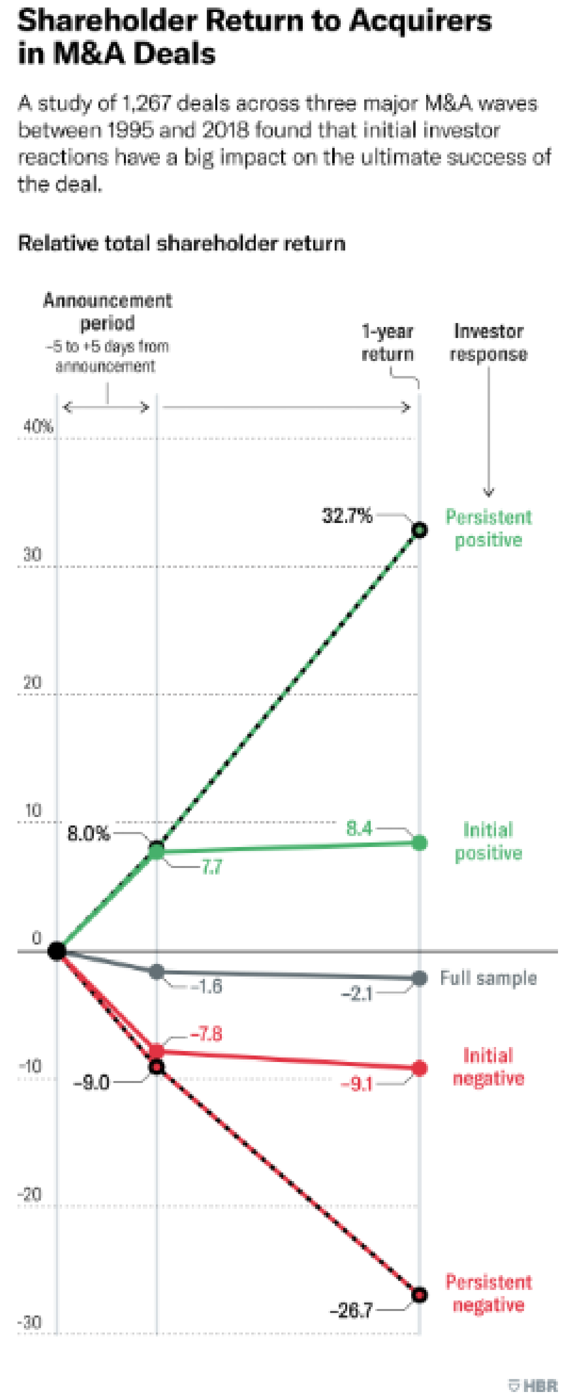
Real world example: market reaction to M&A deals



Day	AR	CAR
−19	0.29%	0.29%
−18	−0.36%	−0.07%
−17	−0.08%	−0.15%
−16	−0.18%	−0.33%
−15	0.15%	−0.18%
−14	−0.16%	−0.34%
−13	0.37%	0.03%
−12	−0.35%	−0.32%
−11	0.61%	0.29%
−10	0.75%	1.04%
−9	0.09%	1.13%
−8	0.19%	1.32%
−7	1.15%	2.47%
−6	0.19%	2.66%
−5	−0.62%	2.04%
−4	−0.35%	1.69%
−3	0.38%	2.07%
−2	1.23%	3.30%
−1	1.49%	4.79%
0	13.15%	17.94%
1	0.61%	18.55%
2	−0.12%	18.43%
3	−0.27%	18.16%
4	−0.29%	17.87%
5	−0.18%	17.69%

Real world example

Stock market reaction to M&A deal announcement



Example

Try it!

- A company holds $80 cash today, and has access to one project that requires an initial investment of $80 tomorrow and yields either $100 or $110 with 50%-50% probability in one year.
- The company is fully financed through equity.
- The company's manager has no agency problem (i.e., capital budgeting decision made based on the positive NPV rule).
- There is no information asymmetry (i.e., the market has known about the project and formed rational belief about managerial decision).
- Financial market is efficient and competitive.
- Another financial asset that pays either $100 or $110 with 50%-50% probability is traded in the market at $90.
- If you hold **the company's stock** today, what's your **expected return** for the next year?

Example Cont.

- Will the project be taken tomorrow?
  - Discount rate $r = E(R_{Fin}) = \frac{105-90}{90} = 16.67\%$
  - NPV of the project $= \frac{105}{1+16.67\%} - 80 = \$10 > 0$
  - YES!
- What's the *expected* value of the firm one year later?
  - $105
- What's the value of the firm by the end of tomorrow?
  - $\frac{105}{1+\mathbf{16.67}\%} = \$90 \rightarrow$
  - **Firm value = PV of its (current and) future cash flows**

Example Cont.

- What's the value of the firm today? (Assuming the market has known that the project will be taken tomorrow.)
  - $80**+$10** = $90 →
  - **Firm value = Value of assets in place + <u>NPV of future projects</u>**
- What's the expected return of holding the stock?
  - $\frac{105-90}{90} = 16.67\%$
  - The **expected return** of the firm's investors (stockholders in this case) is the firm's **cost of capital,** which is also the proper **discount rate** for the firm's cash flows

Example Cont.

- What if the market doesn't know about the project today, and the manager announces it after it's taken tomorrow?
- The price today is $80.
- The price will jump up to $90 after tomorrow's announcement.
- If you somehow knows about the project before other investors do, you will want to buy the stock today at $80 and sell it at $90 tomorrow.
- Of course, if your purchase order is big, the other investors may infer that some good news is on the way and charge you higher than $80…

Takeaways

- An asset creates value for its owner (investors) if it generates a positive value of cash flows.
- NPV measures how much an investment adds value to the investors.
- For a risky cash flow, the discount rate is the expected return on a financial asset of comparable risk.
- In an efficient market, investing in *financial* assets earns zero NPV.
- The capital budgeting rule of corporate finance (for *real* assets) is to take positive NPV projects.
- Firm value incorporates the NPV of ongoing and potential projects.
- The cost of capital or discount rate for cash flows of a firm is the a weighted average of the cost of equity and debt.

Excel Magic

Annuity present value

- **PV(r, T, C)** (Note: NO period 0 cash flow)

Annuity future value

- **FV(r, T, C)** (Note: NO period T cash flow)

Present value of uneven cash flows

- **NPV(r, value1:valueT)** (Note: NO period 0 cash flow)

Return on an annuity - r

- **Rate(T, C, PV, FV)**

Number of periods - T

- **NPER(r , C, PV, FV)**

Constant payment - C

- **PMT(r, T, PV, FV)**

What Next?

- **Capital Budgeting**
  - Topic 2. Method comparison
- What **cash flows**?
  - Topic 3. Accounting Review
  - Topic 4. Project Cash Flows (Free Cash Flow)
  - Case I.
- What **discount rate**?
  - Weighted Average Cost of Capital
  - Topic 5. Bond Valuation (cost of debt)
  - Topic 6. Stock Valuation (cost of equity)
  - Topic 7. CAPM (expected return & risk; modern theory of asset pricing)