FN 201 BUSINESS
FINANCE

Lecture 4

Topics: Capital Budgeting & Investment Decisions Rules

Management's Objective

- Management's primary objective should be shareholder wealth maximization
  - Or maximize firm's value
- How to maximize firm's value?
  - Capture investment opportunity with positive value added
  - Value are measured as equivalent cash flow
  - Invest in project with net present value greater than zero
  - All shareholders will be satisfied

Agenda

- 1) Capital Budgeting
- 2) Investment Decisions Rules: What & When to Invest
  - Net Present Value (NPV)
  - Payback & Discounted Payback period
  - Internal Rate of Return (IRR)
  - Equivalent Annual Cost (EAC)

Capital Budgeting

- What is capital budgeting?
  - Analysis of potential projects.
- Step in Capital Budgeting
  - Estimate cash flows (inflows & outflows).
  - Assess risk of cash flows.
  - Determine appropriate discount rate (r) for project:
    - Required rate of return on asset with the same level of riskiness
    - Concept of opportunity cost of capital or weighted average cost of capital (WACC)
  - Evaluate PV of cash flows and attractiveness of the project

Investment Decision Rules

- 1) Net Present Value (NPV):
  - Accept investments that have positive net present value after taking into account required investment of the project
- 2) Payback and Discounted Payback period:
  - How many years does it take to break even? Accept investment that yields quickest payback period
- 3) Internal Rate of return (IRR):
  - Accept investment that offer internal rates of return in excess of its required rate of return / opportunity cost of capital (WACC)

Introduce concept of Net Present Value

- How to assess attractiveness b/w projects?
- Project maybe similar but based on different business strategy or model
  - Restaurant: Takeaway, Buffet, Up scale restaurant
  - Profit may occur at different time horizon and require different level of investment
  - Compare based on equivalent cash flow at same time horizon (t=0, present value)
  - Those with maximum net present value of cash flow is preferred

Introduce concept of Net Present Value (2)

- What about different level of risk?
- It will be account for thru different discount rate
- Project with higher level of risk will be discounted at higher rate -> recall concept of TVM
- Even completely different projects with completely different risk profile so long as the level of risk is accounted for appropriately in the discount rate, projects are comparable
- And those with maximum net present value of cash flow is preferred…….

- **NPV: Sum of the PVs of inflows and outflows.**

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}.$$

- **Cost often is CF_0 and represented as negative CF**

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - CF_0.$$

- **NPV = PV inflows – Cost = Net gain in wealth to company**

Project Cash flow and time line tool

Why NPV rule works for every shareholders?

- It works regardless of shareholders' age, wealth, risk tolerance / risk appetite
- Argument goes like this
  - 1) A financial manager should act in the interests of the firm's owners.

    Each shareholder wants three things

    1.1) To be as rich as possible, that is to maximize current wealth

    1.2) To transform that wealth into whatever time pattern of consumption that one desires

    1.3) To choose the risk characteristics of that consumption plan

- 2) Shareholders can achieve 1.2) and 1.3) on their own providing access to competitive market
  - They can choose the risk characteristics of their consumption plan by investing in more-or-less risky securities, through borrowing and lending in the market
- 3) How can financial managers help shareholders?
  - Maximize 1.1): Increasing market value of the firm by seize all investment opportunities that have a positive NPV
  - Positive NPV means there is value added in undertaking such project

Key Points

Projected CF	Discount Rate

How to determine appropriate r?

- It depends on level of risk
- Issue of risk & return

Asset	Expected rate of return
1 yr times deposit	1.00%
5 yr govt bond	3.75%
Stock Market (SET)	10.00%
Real Estate Developer (risk =1.5x)	15.00%
Apartment (risk = 1.2x)	12.00%
Food and Beverage (risk =0.8x)	8.00%
Trading firm (risk = 1.0x)	10.00%
Manufacturing sector (risk = 1.1x)	11.00%
Exported Designer Clothing (risk = 1.7x)	17.00%

How to determine appropriate r? (2)

- Try to benchmark your expected return
- Remember: risk & return
- What should be the discounted rate if you were to open
  - Small Café near TU
  - 30 rooms serviced apartment
  - Bicycle manufacturing company
  - Designed boutique clothing shop

EX1: NPV Calculation

Period	T=0	T=1	T=2
Land	-50,000		
Construction	-120,000	-100,000	-100,000
CF			+420,000
Total	C_0= -170,000	C_1= -100,000	C_2 = 320,000

- Assume required rate of return on asset with same risk is 5%, should firm accept this project?

Ex 2: NPV Calculation

- 2.1) Music Company is considering investing in a new project. The project will need an initial investment of $2,400,000 and will generate $1,200,000 (after-tax) cash flows for three years. Calculate the NPV for the project if the cost of capital is 15%. Would you undertake the project ?

- 2.2) Story Company is investing in a giant crane. It is expected to cost 6.0 million in initial investment and it is expected to generate an end of year cash flow of 3.0 million each year for three years. Calculate the NPV at 12% (approximately). Would you undertake the project ?

Ex 3: Many Projects

- The following table gives the available projects for a firm
- If the firm has a limit of 210 million to invest, how to best invest and what is the maximum NPV the company can obtain?

A	B	C	D	E	F	G	
90	20	60	50	150	40	20	Initial investment
140	70	65	-10	30	32	10	NPV

NPV as the most popular investment decision rule

- Why not choose real project with highest return?
  - Choice between 2 projects, which one would you choose?
    - 1) Return of 10% but maximum investment is 500 -> profit of $50
    - 2) Return of 7% but maximum investment is 2000 -> profit of $140
  - Opportunity is limited, cannot invest fraction of project
    - Cannot invest in 0.8x or 1.25x factories

NPV and TVM

- Three points to remember about NPV
  - 1) NPV rule recognize that "a dollar today is worth more than a dollar tomorrow"
    - Any investment rule that does not recognize the "time value of money" cannot be sensible
  - 2) NPV depends solely on the forecasted cash flows from the project and the opportunity cost of capital
    - Any investment rule that is affected by manager's tastes, the company's choice of accounting method, the profitability of the company's existing business or other independent projects will lead to inferior decisions

How to determine appropriate r? (3)

- Apart from trying to benchmark your expected return, you might also want to make sure that it generate sufficient return to keep your debt / shareholder satisfied
- Concept of Weighted Average Cost of Capital (WACC)
- It is a weighted average cost of funding (capital)
  - Debt
  - Equity

EX 4: Weighted Average Cost of Capital (WACC)

- It is weighted average between
- 1) Company cost of debt - rd (market interest to be paid on company debt – take into account level of riskiness) and
- Keep in mind that interests on debts are tax deductable
- 2) Company cost of equity - rS (required rate of return to shareholder)
- May need to introduce a risk and return model

EX 4: Calculate WACC

- Suppose the stock price is $50, there are 3 million shares of stock, the firm has $25 million of preferred stock, and $75 million of debt.
- Rd = 10%, Rps =9%, Re = 14%
- Please calculate WACC?

- Vcommon equity = $50 (3 million) = $150 million.
- Vpreferred stock = $25 million.
- Vdebt = $75 million.
- Total value = $150 + $25 + $75 = $250 million.

Other investment decisions rules:

- NPV is not the only investment criterion that company use
- Firms often look at more than one measure of a project's attractiveness
- Top 3 most popular investment rules :
  - NPV = 75%
  - IRR = 76%
  - Payback Period = 57%

Payback

- It tells the number of years it takes before the cumulative forecasted cash flow equals the initial investment
- In simple word, payback asking when to break even?
- Determine against cut-off period

	Cash Flows					
Project	C(0)	C(1)	C(2)	C(3)	Payback (yr)	NPV@10%
A	-2000	500	500	5000	3	2624
B	-2000	500	1800	0	2	-58
C	-2000	1800	500	0	2	50

Payback (2)

- Pros
  - Ease of communication
- Cons
  - Tends to accept short-lived projects and reject good long-lived ones
  - Ignores all cash flows after the cut-off date
  - Gives equal weight to all cash flows before the cut-off date -> this is not good!!!!

Discounted Payback

- Discount cash flows before computing the payback period
- Now taking into account TVM, but other drawbacks remain

	Cash Flows					
Project	C(0)	C(1)	C(2)	C(3)	Payback (yr)	NPV@10%
A	-2000	455	413	3757	3	2624
B	-2000	455	1488	0	-	-58
C	-2000	1636	413	0	2	50

Internal Rate of Return (IRR)

- Internal rate of return
  - IRR is defined as the rate of discount that makes NPV = 0
  - Accept project if discount rate is less than IRR
  - Make sense? -> this implies project has positive NPV

$$NPV = C_0 + \frac{C_1}{1+IRR} + \frac{C_2}{(1+IRR)^2} + \ldots + \frac{C_T}{(1+IRR)^T} = 0$$

- If there are many projects
  - Rule suggests choosing one with highest IRR

Using IRR as investment rule

- Pros
  - Indicate best use for a dollar
- Cons
  - Size of value-added does matter
- Firms still use IRR rule b/c of
  - Shortage of capital, in other words budget constraint. Hence unable to invest in a large scale project
  - However it does not justify using IRR rule instead of NPV
  - If budget constraint is in fact a problem, it is a financing decision

Ex5. Test of Concept

- 5.1) Which of the following investment rules may not use all possible cash flows in its calculations?
  a. NPV b. Payback period
  c. IRR d. All of the above

- 5.2) The following are disadvantages of using the payback rule except:
  a. The payback rule ignores all cash flow after the cutoff date
  b. The payback rule does not use the time value of money
  c. The payback period is easy to calculate and use
  d. The payback rule does not have the value additive property

Ex6.

- 6.1 Which of the following methods of evaluating capital investment projects incorporates the time value of money concept?
  - I) Payback Period,
  - II) Discounted Payback Period
  - III) Net Present Value (NPV)
  - IV) Internal Rate of Return

a. I, II, and III only
b. II, III, and IV only
c. III and IV only
d. I, II, III, and IV

Ex7. IRR

- 7.1) The IRR is defined as:
  a. The discount rate that makes the NPV equal to zero
  b. The difference between the cost of capital and the present value of
  the cash flows
  c. The discount rate used in the NPV method
  d. The discount rate used in the discounted payback period method

- 7.2) Given the following cash flows for Project M: C0= -1,000, C1= +200, C2= +700, C3= +698, calculate the IRR for the project.
  a. 23%
  b. 21%
  c. 19%
  d. None of the above

Conclusions

Agenda

- 1) Equivalent annual cashflow (EAC)
  - Choosing between long- and short-lived equipment
  - Choosing machine with technological change
  - Deciding when to replace an existing machine

What is EAC?

- EAC vs NPV
  - NPV: year-by-year cash flow -> lump-sum value
  - EAC: lump-sum value -> annual cost or annual cash-flow
- Think about financial manager's decision like these
  - Choosing between long- and short-lived investment
  - Choosing when to replace an existing machine

What is EAC? (2)

- Choosing between long- and short-lived investment
  - Machine may have a different cost structure,
    - e.g. high initial investment with low maintenance cost with longer service life vs low initial investment with high maintenance cost but shorter service life
    - Make comparison based on EAC concept of its running cost
    - Those with lower equivalent annual cost is preferred
- Choosing when to replace an existing machine
  - When is the right time?
    - Make comparison based on EAC concept of its generated cash-flow
    - Those with higher equivalent annual net cash flow is preferred

Ex8. Long-and Short lived equipment

- Firm must choose between A and B
- They are different but have identical capacity and do exactly the same job
- Those with lower equivalent annual cost is preferred
- EAC on cost also referred to as "Fair Rental Concept"

	Cost ($thousand)				NPV @
Time	0	1	2	3	6%
A	15	5	5	5	28.37
B	10	6	6		21.00

Ex8. Long-and Short lived equipment

Ex9. EAC with technological changes

- Sometimes, it is impractical to assume that "Fair Rental Charge" for A and B will be constant due to technological changes
  - In other words, try to emphasize the fact that short-lived equipment has one advantage of allowing owner to replace machine a little earlier
  - Hence benefit from better technology
- Let's suppose
  - Due to technological improvement, new machine each year will cost 20% less in real term to buy and operate
  - So how much will it cost to rent each machine now?

Ex9. EAC with technological changes (2)

Ex10. When to replace existing machine

- Suppose you operate old machine that produce net cash flow of 4,000 this year and next year, after than value will be zero
- You can replace it with new machine costing 15,000 but produce net cash flow of 8,000 per year for three years
- Should I replace it end of this year or end of next year ?
- How to answer this? Use EAC

- Use EAC concept
  - 1) Cal. NPV to see if new machine itself is viable
  - 2) Cal equivalent net (positive) cash flow from new machine and then compare with the old one.
  - 3) Change when net generated CF of the new one is greater -> make sense?

	Cash Flow				NPV @
Time	0	1	2	3	6%
New	-15	8	8	8	6.38
EAC		2.387	2.387	2.387	6.38
Old		4	4		

Ex11.

- Let's suppose there is also salvage value to be considered
- If dispose earlier, value is higher
- In other words, cost of running old machine is reduced by the opportunity cost foregone
- Current salvage value is 8,000 (time zero), and reduce by 1,000 every year
- What is the cost of wait for a year and then sell the old machine?

	Cash Flow				NPV @
Time	0	1	2	3	6%
New	-15	8	8	8	6.38
EAC		2.387	2.387	2.387	6.38
Old		4	4		
Salvage	8	7	6	5	
Opp Cost		-1.48	-1.42	-1.36	
Operating + Opp		2.52	2.58		

Conclusion

Q & A