FIN 300

Investment Decision Criteria
Lecture 8

TOPICS COVERED

- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Profitability Index (PI)
- Average Accounting Return (AAR)

NET PRESENT VALUE

- The sum of all discounted cash flows
- Includes initial investment
- Everything is discounted to PV terms and summed:

$$NPV = \sum_{t=0}^{T} \frac{CF_t}{(1+R)^t}$$

- Accept project if $NPV > 0$

EXAMPLE

Suppose a project required an initial investment of $\$200$ with the following cash flows in years 1, 2, and 3: $\$160$, $\$150$, $\$140$. $R = 8\%$. What is the project's NPV?

$$NPV = CF_0 + \frac{CF_1}{(1+R)} + \frac{CF_2}{(1+R)^2} + \frac{CF_3}{(1+R)^3}$$

$$NPV = -\$200 + \frac{\$160}{(1+0.08)} + \frac{\$150}{(1+0.08)^2} + \frac{\$140}{(1+0.08)^3}$$

$$NPV = \$187.88$$

NPV > 0 ; Accept the project.

EXAMPLE

Same as previous, except $R = 10\%$

$$NPV = -\$200 + \frac{\$160}{(1 + 0.10)} + \frac{\$150}{(1 + 0.10)^2} + \frac{\$140}{(1 + 0.10)^3}$$

$$NPV = \$174.60$$

What rate of return would bring NPV down to zero?

INTERNAL RATE OF RETURN

- Sometimes we do not know the discount rate
- We usually know (estimate) cash flows and timing
- This information gives us an implied return
- Accept projects with $IRR > R$

IRR

$$\sum_{t=0}^{T} \frac{CF_t}{(1 + IRR)^t} = 0$$

IRR is the discount rate that makes $NPV = 0$

EXAMPLE

Suppose a project required an initial investment of $200 with the following cash flows in years 1, 2, and 3: $160, $150, $140. What is the project's IRR?

$$0 = CF_0 + \frac{CF_1}{(1 + IRR)} + \frac{CF_2}{(1 + IRR)^2} + \frac{CF_3}{(1 + IRR)^3}$$

Using a financial calculator:

$$IRR = .57 = 57\%$$

(Accept this project if $R < 57\%$)

SHORTCOMINGS OF THE IRR

- Multiple IRRs with unconventional cash flows
    Modifiedd IRR (MIRR) is an attempt to workaround this

- IRR is not a good measure with mutually exclusive projects

- We can always use NPV if we know R

PROFITABILITY INDEX

- Also known as Benefit/Cost Ratio
  - Sum of future discounted cash flows divided by the initial cost
- Accounts for time value of money
- Accept a project if $PI > 1$

PROFITABILITY INDEX (PI)

$$PI = \frac{\sum_{t=1}^{T} \dfrac{CF_t}{(1+R)^t}}{|CF_0|}$$

EXAMPLE

Suppose a project required an initial investment of $200 with the following cash flows in years 1, 2, and 3: $160, $150, $140. $R = 8\%$. What is the project's PI?

$$\sum_{t=1}^{T} \frac{CF_t}{(1+R)^t} = \frac{\$160}{(1+0.08)} + \frac{\$150}{(1+0.08)^2} + \frac{\$140}{(1+0.08)^3} = \$387.88$$

$$|CF_0| = \$200$$

$$PI = \frac{\$387.88}{\$200} = 1.94$$

AVERAGE ACCOUNTING RETURN

- A simple method to give a rate of return to a project
- There are variations of this measure
- Ratio of average net income to average book value

$$\text{Average Accounting Return} = \frac{\text{Average Net Income}}{\text{Average Book Value}}$$

EXAMPLE

Over the past 5 years, average net income has been $1, 260. The average book value has been $10, 000. What is the average accounting return?

$$AAC = \frac{\$1,260}{10,000} = 0.126 = 12.6\%$$

SUMMARY

- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Profitability Index (PI)
- Average Accounting Return (AAR)