Present value, rate of return and opportunity cost of capital

Chapter 2

To Build or Not to Build: A Sports Bar

• Lot next to proposed baseball stadium is worth $50,000
• If built, a sports bar would be worth $400,000 in one year
• Will cost $300,000 to build
Plot the relevant cash flows on a timeline:

Should we build?

Build if the present value of $400,000 (delivered next year) is greater than $350,000
PRESENT VALUE

• **Basic principle:**
  *A dollar today is worth more than a dollar tomorrow*

Why?
Because, a dollar today can be invested to earn interest and therefore will be worth more than one dollar tomorrow

Present value of cash in period one

• **Present value** = Discount factor $\times C_1$
  $\quad$– where $C_1$ = cash flow in period 1

• **Discount factor** = $1 / (1+r)$
  $\quad$– where $r$ is the rate of return investors demand for accepting delayed payment

• Rate of return also referred to as the:
  discount rate,
  hurdle rate, or
  opportunity cost of capital
What discount rate should we use for the sports bar?

- Assume investment is a sure thing (no risk)
- US T-Bills are also risk-free and currently pay 7%
- Thus, the appropriate discount rate is 7%

How much would you have to invest in US government T-Bills (which pay 7%) to get $400,000 a year from now?
After committing the land and beginning construction, how much could you sell the project for?

More generally, the formula for net present value can be written as:

$$\text{NPV} = C_0 + \frac{C_1}{(1+r)}$$

Note that $C_0$, the cash flow at time 0, is typically negative and therefore a cash *outflow*.

$$\text{NPV} = -350,000 + \frac{400,000}{1.07}$$
$$= $23,832$$
Financing the investment: A preview

Suppose you borrow $300,000 to build the bar

What rate would the bondholder demand? How much would you have to repay next period?

\[ 300,000 \times 1.07 = 321,000 \]

Discussion Question

What’s the affect on your NPV?

What is the bondholder’s NPV?

1. Recalculate your net outlay in period 0 and net inflow in period 1 and refigure your NPV.

2. Determine the bondholder’s cash flows in periods 0 and 1 and calculate the bondholder’s NPV?

3. Explain your answers to 1 and 2. (what’s going on?)
NPV = Change in Wealth

- Wealth = PV of current and future income
  - Who is wealthier?
    - Individual A: $0 today; $100,000 next period
    - Individual B: $50,000 today; $0 next period
- Giving up $350,000 today for $400,000 next period increases wealth by $23,832

A few comments on risk

- Unrealistic assumption that sports bar investment is risk-free
- Another basic principle:
  A safe dollar is worth more than a risky dollar
- Discounting is still appropriate, but investors will use a higher rate
How does risk affect our decision whether to build the sports bar?

- Assume that the risk is equivalent to an investment in the stock market which is currently expected to pay 12%
- Thus, 12% is the appropriate opportunity cost of capital
- $\text{PV} = \frac{400,000}{1.12} = 357,143$
- $\text{NPV} = 357,143 - 350,000 = $7143$
- Project still adds value, but smaller than our earlier calculations
Present value and rates of return

- Return $= \frac{\text{profit}}{\text{investment}}$
  $= \frac{400,000 - 350,000}{350,000}$
  $= 14.3\%$
- In both cases, the project was worth taking because the return exceeded the opportunity cost of capital

Two equivalent decision rules for capital investments

*Net present value rule:* Accept all investments that have positive net present values

*Rate-of-return rule:* Accept all investments that offer rates of return in excess of their opportunity costs of capital