# Refining CBA

## Discounting

# Accounting for discounting [part of step 4]

- There are four reasons why $1 tomorrow may be worth less than $1 today:
  1. Time preference
  2. Interest/opportunity cost of capital
  3. Uncertainty/risk
  4. Inflation
- Projects often stretch over many years
  - We need mechanism to value costs and benefits in different time periods so we can make comparisons and aggregations
- **Discounting** is how we value something in the future today

# Accounting for discounting

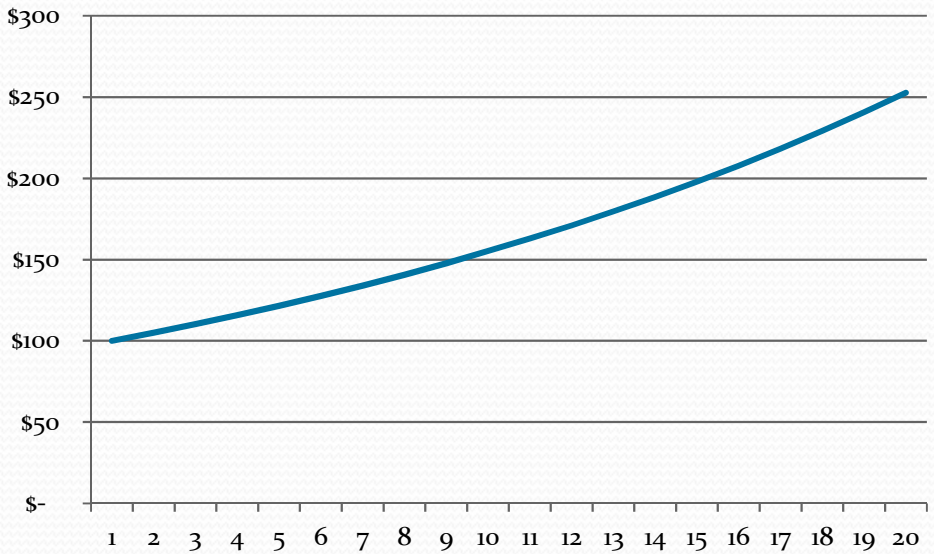
- Put $100 in the bank with 5% interest on 24/11/15
  - On 24/11/16, you will have (1+0.05) x $100.00 = $105.00
  - On 24/11/17, you will have (1+0.05) x $105.00 = $110.25
  - On 24/11/18, you will have (1+0.05) x $110.25 = $115.76

    …
  - On 24/11/35, you will have (1+0.05) x $252.70 = $265.33
  - The interest compounds over time, i.e., the interest also earns interest

# Accounting for discounting

- The **future value** ($FV$) of a deposit is:
  $FV = deposit \text{x}(1+r)^t$
- where:
  $r$ = **rate of return** or interest
  $t$ = length of investment

- $FV = \$100\text{x}(1+0.05)^{20}$
  $= \$265.33$



# Accounting for discounting

- Suppose someone promises to pay you $100 *one year from now*
  - What is the maximum amount you should be willing to pay today for such a promise?
  - You will forgo interest that you could earn on the money that is being loaned in exchange for $100 in the future
- The **present value** (*PV*) of a future amount of money is the maximum amount you would be willing to pay today for the right to receive that money in the future
- $PV = \frac{\$\,final\ amount}{(1+r)^t}$ , where $r$ is the **discount rate**

# Accounting for discounting

- What is the value of $1,000,000 in 20 years if the discount rate is 5%?

$$PV = \frac{\$1,000,000}{(1+0.05)^{20}} =$$

- What is the value of $1,000,000 in 20 years if the discount rate is 10%?

$$PV = \frac{\$1,000,000}{(1+0.10)^{20}} =$$

- What is the value of $1,000,000 in 20 years if the discount rate is 15%?

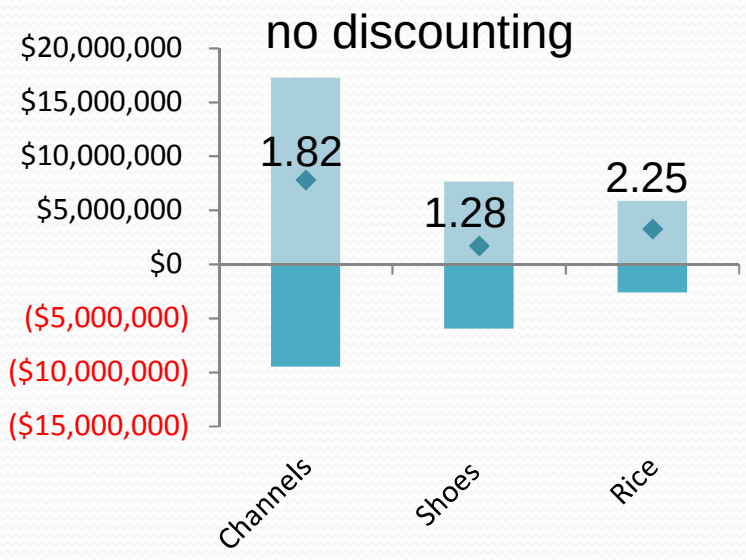
$$PV = \frac{\$1,000,000}{(1+0.15)^{20}} =$$

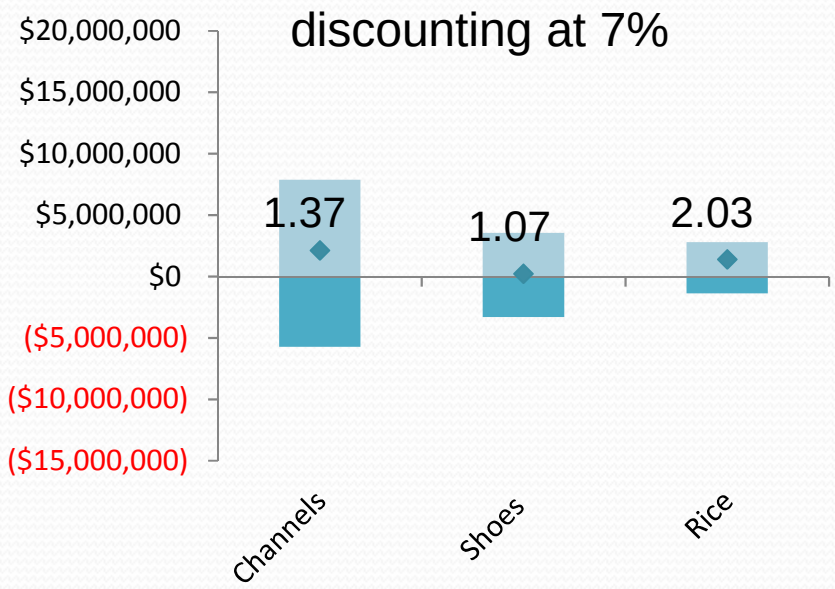
# Accounting for discounting

- **Net Present Value** (*NPV*) is the present value of a project's benefits less the present value of its costs:

$$NPV = PV_{benefits} - PV_{costs}$$

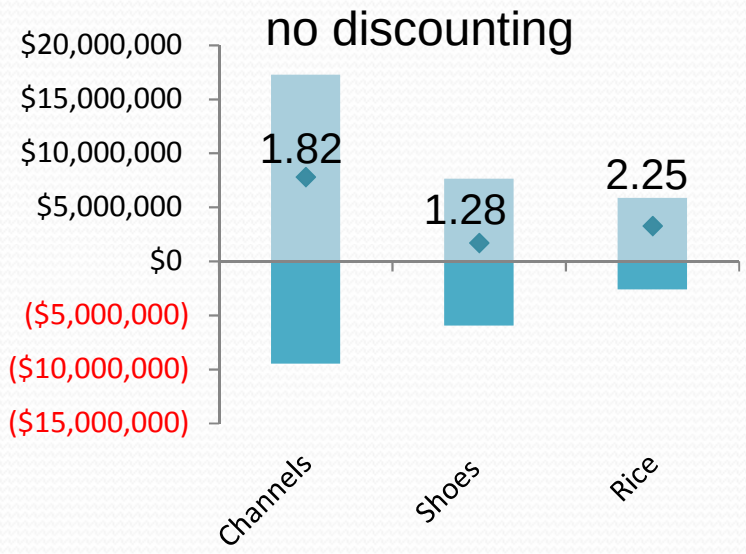
- After discounting, your choice of policies may change!

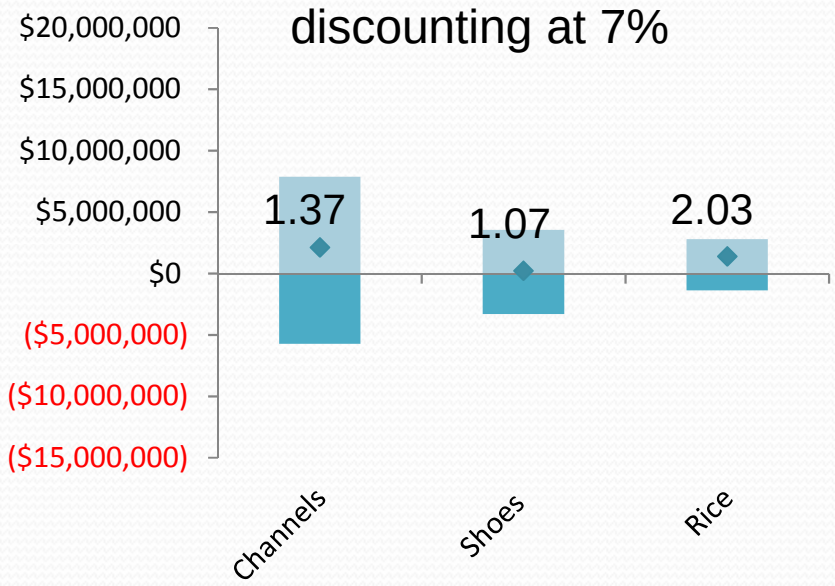


# Accounting for discounting

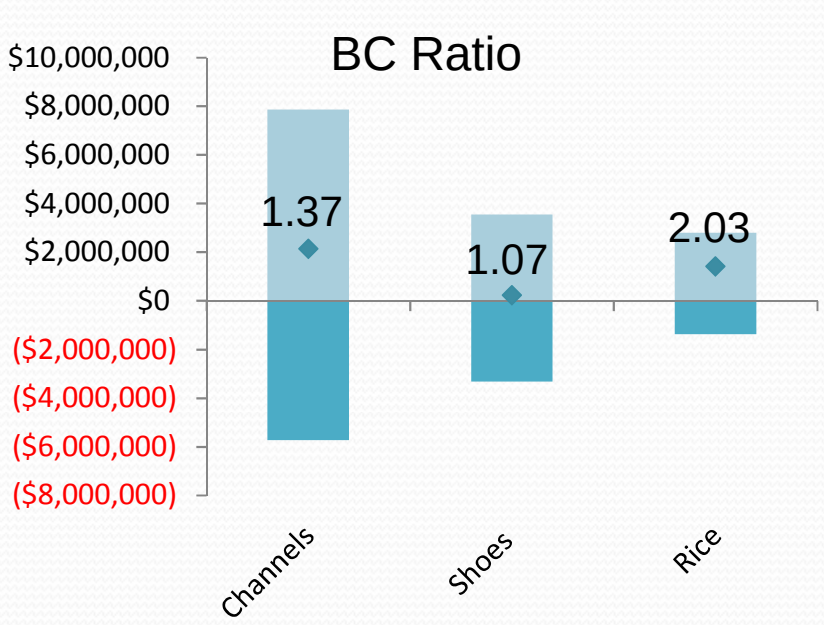
- Discounting is viewed as controversial by some because it makes projects with high initial costs and far distant benefits look less attractive
  - Project supporters will argue for using a lower discount rate and project detractors will argue for using a higher discount rate

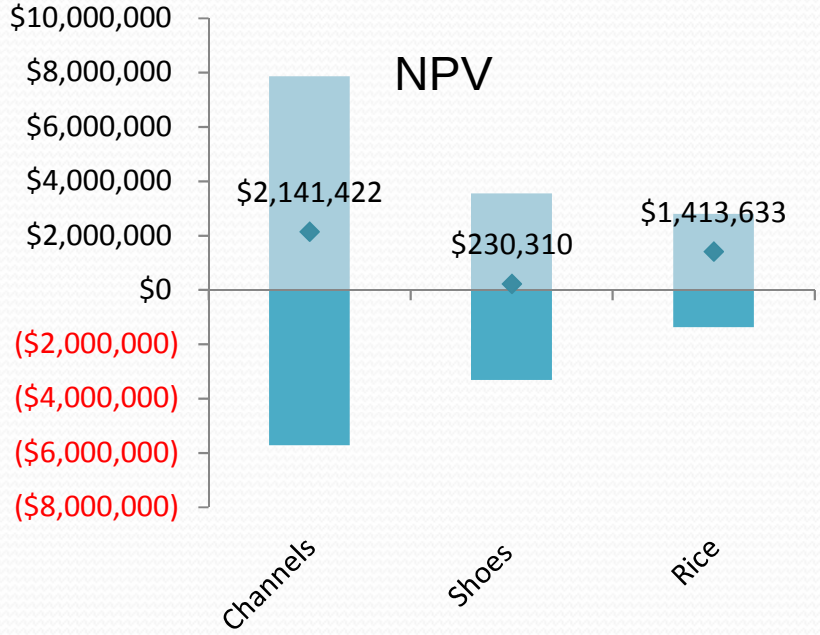


# Accounting for discounting

- In figures, you can report benefit-cost ratios or NPV



# Accounting for discounting

- Discount rates are *not* controversial among economists
  - They simply reflect the value of time
- The US Environmental Protection Agency uses a standard rate of 7%
- Discount rate for Mexico = 12% (World Bank 2014)
  - World Bank (2014) recommends reducing it 10%
- The discount rate should **never** vary from one project to another

# More on Discounting

# Discounting in managing jumbees

$$PV = \frac{\$\,final\ \ amount}{(1+r)^t}$$

- How does discounting at 12% influence your recommendation for managing jumbees?
- What happens if the discount rate falls to 10%?