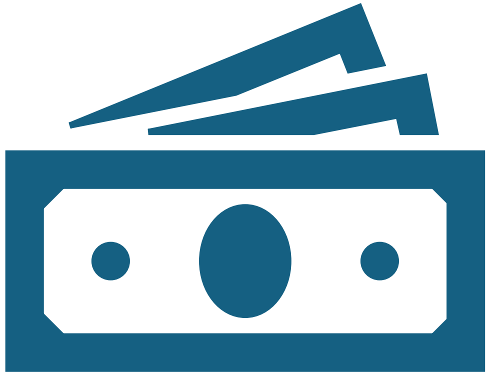
Introduction to Finance



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Net Present value and the NPV decision rule

- **Net Present Value**
- We use the Valuation Principle to derive the concept of the *net present value*, or *NPV*, and define the “golden rule” of financial decision making, the *NPV Rule*.
- When we compute the value of a cost or benefit in terms of cash today, we refer to it as the present value (PV). Similarly, we define the **net present value (NPV)** of a project or investment as the difference between the present value of its benefits and the present value of its costs:
- ***NPV* = *PV* (Benefits) - *PV* (Costs)**
- *As long as the NPV is positive, the decision increases the value of the firm and is a good decision regardless of your current cash needs or preferences regarding when to spend the money.*

Net Present value and the NPV decision rule

- **Net Present Value Decision Rule**
- ***NPV*** **=** ***PV*** **(Benefits) -** ***PV*** **(Costs)**
- ***When making an investment decision, take the alternative with the highest NPV. Choosing this alternative is equivalent to receiving its NPV in cash today.***
- **Accepting or Rejecting a Project.** A common financial decision is whether to accept or reject a project. Because rejecting the project generally has NPV = 0 (there are no new costs or benefits from not doing the project), the NPV decision rule implies that we should
- ■ Accept those projects with positive NPV because accepting them is equivalent to receiving their NPV in cash today, and
- ■ Reject those projects with negative NPV; accepting them would reduce the wealth of investors, whereas not doing them has no cost

Net Present value and the NPV decision rule

- Suppose you started a Web site hosting business and then decided to return to college. Now that you are back in collede, you are considering selling the business within the next year. An investor has offered to buy the business for Rs 200,000 whenever you are ready. If the interest rate is 10%,which of the following three alternatives is the best choice?
- 1. Sell the business now.
- 2. Scale back the business and continue running it while you are in college for one more year,and then sell the business (requiring you to spend Rs.30,000 on expenses now, but generating Rs.50,000 in profit at the end of the year).
- 3. Hire someone to manage the business while you are in school for one more year, and then sell the business (requiring you to spend Rs.50,000 on expenses now, but generating Rs.100,000 in profit at the end of the year).

- **Best decision- one with highest NPV**
- **NPV1 = Rs 2 lakh; NPV 2: Rs 197273; NPV3=Rs. 222,727**
- **Choosing third option ,hiring a manager is like receiving Rs.222,727 today**

	Today	In One Year	NPV
Sell Now	\$200,000	0	\$200,000
Scale Back Operations	−\$30,000	\$50,000 \$200,000	$-\$30{,}000 + \dfrac{\$250{,}000}{1.10} = \$197{,}273$
Hire a Manager	−\$50,000	\$100,000 \$200,000	$-\$50{,}000 + \dfrac{\$300{,}000}{1.10} = \$222{,}727$

Net Present value and the NPV decision rule

- **Best decision- one with highest NPV**
- **NPV1 = Rs 2 lakh; NPV 2: Rs 197273; NPV3=Rs. 222,727**
- **NPV based decision rule: Choosing third option ,hiring a manager is like receiving Rs.222,727 today**

NPV and cash needs

- *Regardless of our preferences for cash today versus cash in the future, we should always maximize NPV first. We can then borrow or lend to shift cash flows through time and find our most preferred pattern of cash flows.*

	Today	In One Year
Hire a Manager	–\$50,000	\$300,000
Borrow	\$110,000	–\$121,000
Total Cash Flow	\$60,000	\$179,000
	versus	
Sell Now	\$200,000	\$0
Invest	–\$140,000	\$154,000
Total Cash Flow	\$60,000	\$154,000

Net Present value and the cash needs

- **Benefit of option 3 over 1 (FV)= \$17900-\$15400=\$25000**
- **Or Benefit in PV for option 3= (\$17900/1.1)=162727**
- **Benefit in PV of option 3 over 1= 162727-140000=22727**

Price of goods different in markets

- Buy low and sell high
- Example: Difference in gold price in two different markets
- Mumbai: Rs. 60000/ounce
- Delhi: Rs. 80000/ounce
- Explore trade option?-Arbitrage opportunity

Price of goods different in markets

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- Explore trade option?-Arbitrage opportunity
- Arbitrage profit (assuming without transport cost)= Rs.20000

Arbitrage and the Law of One Price

- **Arbitrage**
- The practice of buying and selling equivalent goods in different markets to take advantage of a price difference is known as **arbitrage**.
- More generally, we refer to any situation in which it is possible to make a profit without taking any risk or making any investment as an **arbitrage opportunity**.
- Because an arbitrage opportunity has a positive NPV, whenever an arbitrage opportunity appears in financial markets, investors will race to take advantage of it
- In the previous example : NPV=Rs.20000 (Benefit-Cost= 80K-60K) (NPV positive indicating arbitrage opportunity)

Arbitrage and the Law of One Price

- **Arbitrage**
- Those investors who spot the opportunity first and who can trade quickly will have the ability to exploit it. Once they place their trades, prices will respond, causing the arbitrageopportunity to evaporate.
- Arbitrage opportunities are like money lying in the street; once spotted, they will quickly disappear.
- Thus **the normal state of affairs in markets should be that no arbitrage opportunities exist**. We call a competitive market in which there are no arbitrage opportunities a **normal market**.

Arbitrage and the Law of One Price

- **Law of One Price**
- *If equivalent investment opportunities trade simultaneously in different competitive markets, then they must trade for the same price in all markets.*

No-Arbitrage and Security Prices

- **Valuing a Security with the Law of One Price**
- The Law of One Price tells us that the prices of equivalent investment opportunities should be the same.
- We can use this idea to value a security if we can find another equivalent investment whose price is already known.

	Today ($)	In One Year ($)
Buy the bond	−940.00	+1000.00
Borrow from the bank	+952.38	−1000.00
Net cash flow	+12.38	0.00

No-Arbitrage and Security Prices

- **Both =risk free investment &equivalent investment opportunities (at r=5%)**
- Apply buy low and sell high (hence buy bond)
- Borrow from Bank 952 and buy bond
- Profit/ Benefit (NPV)=12.38

	Today ($)	In One Year ($)
Sell the bond	+960.00	−1000.00
Invest at the bank	−952.38	+1000.00
Net cash flow	+7.62	0.00

No-Arbitrage and Security Prices

- **Both =risk free investment &equivalent investment opportunities (at r=5%)**
- Apply buy low and sell high (hence sell bond)
- Sell bond and invest in bank
- Profit/ Benefit (NPV)=7.62

No-Arbitrage and Security Prices

- **Short Sale**
- When the bond is overpriced, the arbitrage strategy involves selling the bond and investing some of the proceeds.
- But if the strategy involves selling the bond, does this mean that only the current owners of the bond can exploit it? The answer is no;
- In financial markets it is possible to sell a security you do not own by doing a *short sale*.
- In a **short sale**, the person who intends to sell the security first borrows it from someone who already owns it. Later, that person must either return the security by buying it back or pay the owner the cash flows he or she would have received.

No-Arbitrage and Security Prices

- **Determining the No-Arbitrage Price.** We have shown that at **any price other than** $952.38, **an arbitrage opportunity exists** for our bond. **Thus, in a normal market, the price of this bond must be** $952.38. We call this price the **no-arbitrage price** for the bond.

- **No-Arbitrage Price of a Security:** Price(Security) = *PV*(All cash flows paid by the security)

- Hence in the example Price (Bond)= 952.38

No-Arbitrage, Security Prices and Interest rates

- **Determining the interest rate**
- Given the risk-free interest rate, the no-arbitrage price of a risk-free bond is determined by
- Price(Security) $=$ *PV*(All cash flows paid by the security)
- The reverse is also true: If we know the price of a risk-free bond, we can use the above equation too determine what the risk-free interest rate must be if there are no arbitrage opportunities.
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No-Arbitrage, Security Prices and Interest rates

- **Determining the interest rate: Example**
- For example, suppose a risk-free bond that pays $1000 in one year is currently trading with a competitive market price of $929.80 today.
- we know that the bond's price equals the present value of the $1000 cash flow it will pay:
- $929.80 today = ($1000)/ (1 + *r*)
- Then1+ r= ($1000)/929.8 =1.0755 ; r= 0.0755
- Therefore risk-free interest rate must be 7.5 %
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No-Arbitrage and Security Prices

- **Bond return**