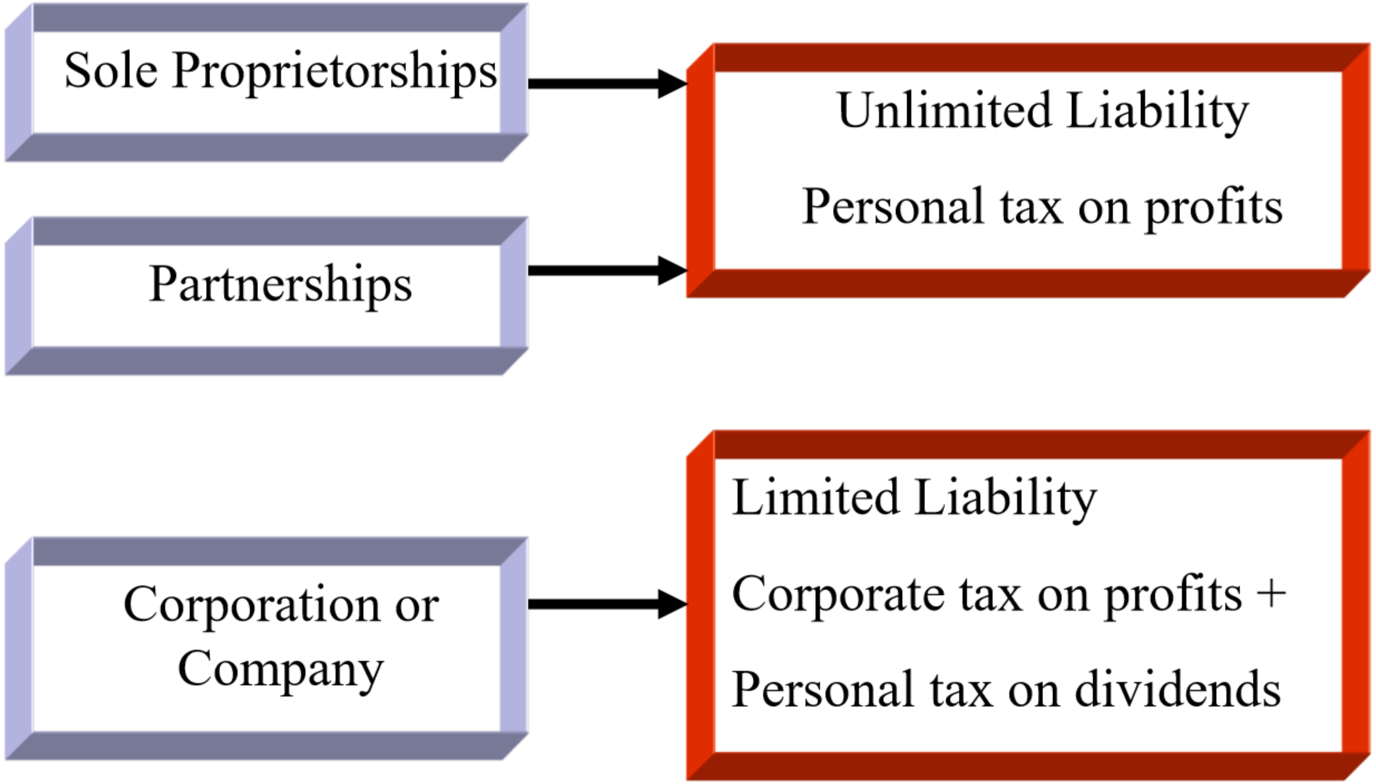
PG Certificate in Advanced Financial Management

IIM VISAKHAPATNAM

Module 2

CORPORATE FINANCE FUNDAMENTALS

Business Structure



Understanding Real Assets & Financial Assets

Real Assets

- Used to produce goods and services
- Tangible, eg. Plant and machinery
- Intangible, eg. Technical expertise, brands, patents

Financial Assets/Securities

- Financial claims on income generated by firm's real assets; eg - Stocks, bonds

Capital Budgeting/Capital Expenditure (CAPEX)

- Decision to invest in tangible or intangible assets

Key financial decisions a company makes to support its operations and growth

Investment Decision

- Purchase of real assets

Financing Decision

- Sale of financial assets

Capital Structure

- Choice between debt and equity financing

Corporate Investment and Financing Decisions

Capital Budgeting Examples

- Tangible Assets
  - i.e., Expanding stores
- Intangible Assets
  - i.e., Research and development for new drug

Balance Sheet Model of the Firm

Total Value of Assets:

Current Assets

Fixed Assets

1 Tangible

2 Intangible

Total Firm Value to Investors:

Current Liabilities

Long-Term Debt

Shareholders' Equity

The Capital Budgeting Decision

Current Assets

Current Liabilities

Long-Term Debt

Fixed Assets

1 Tangible

2 Intangible

What long-term investments should the firm choose?

Shareholders' Equity

The Capital Structure Decision

Current Assets

Fixed Assets

1 Tangible

2 Intangible

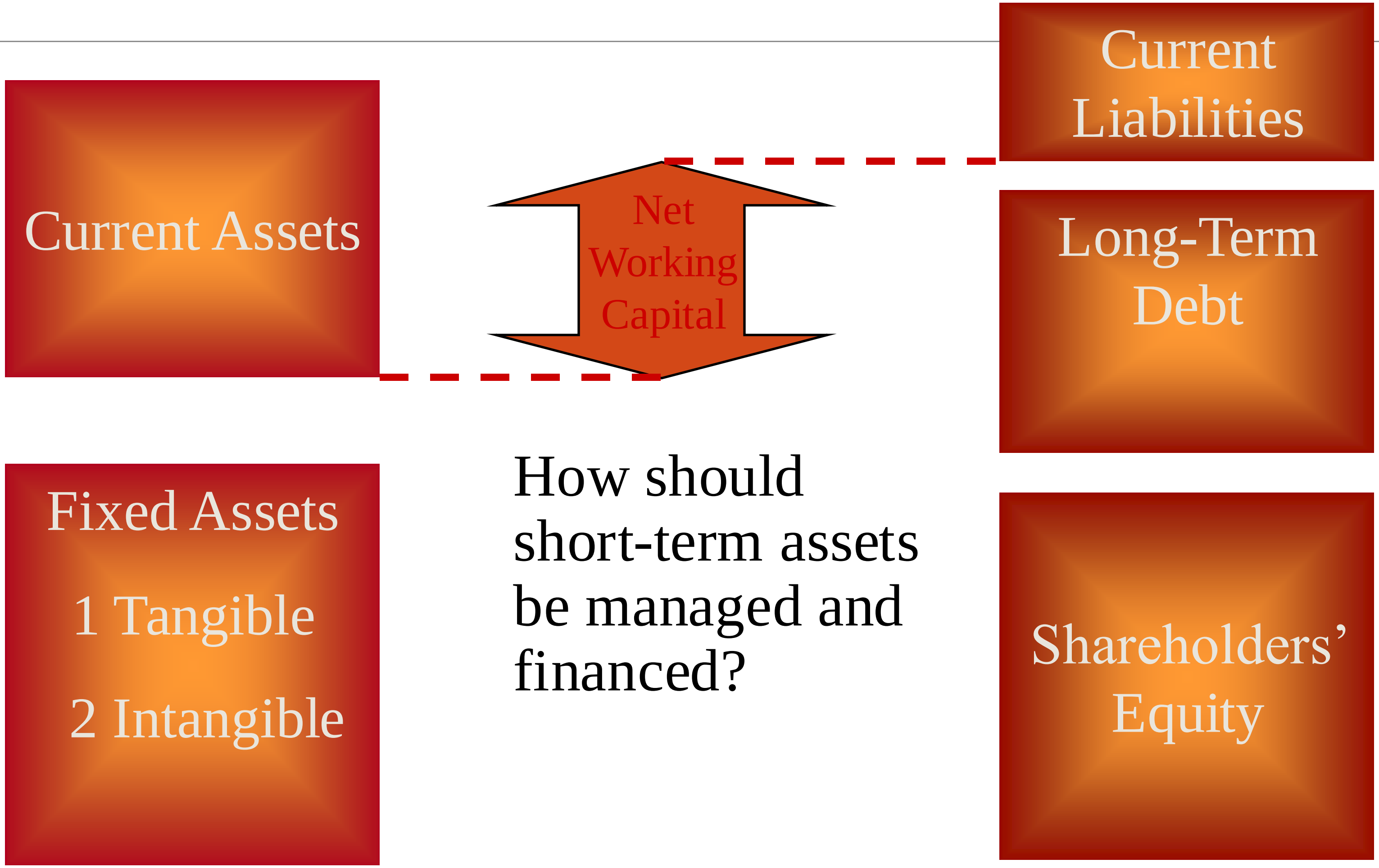
How should the firm raise funds for the selected investments?

Current Liabilities

Long-Term Debt

Shareholders' Equity

Short-Term Asset Management

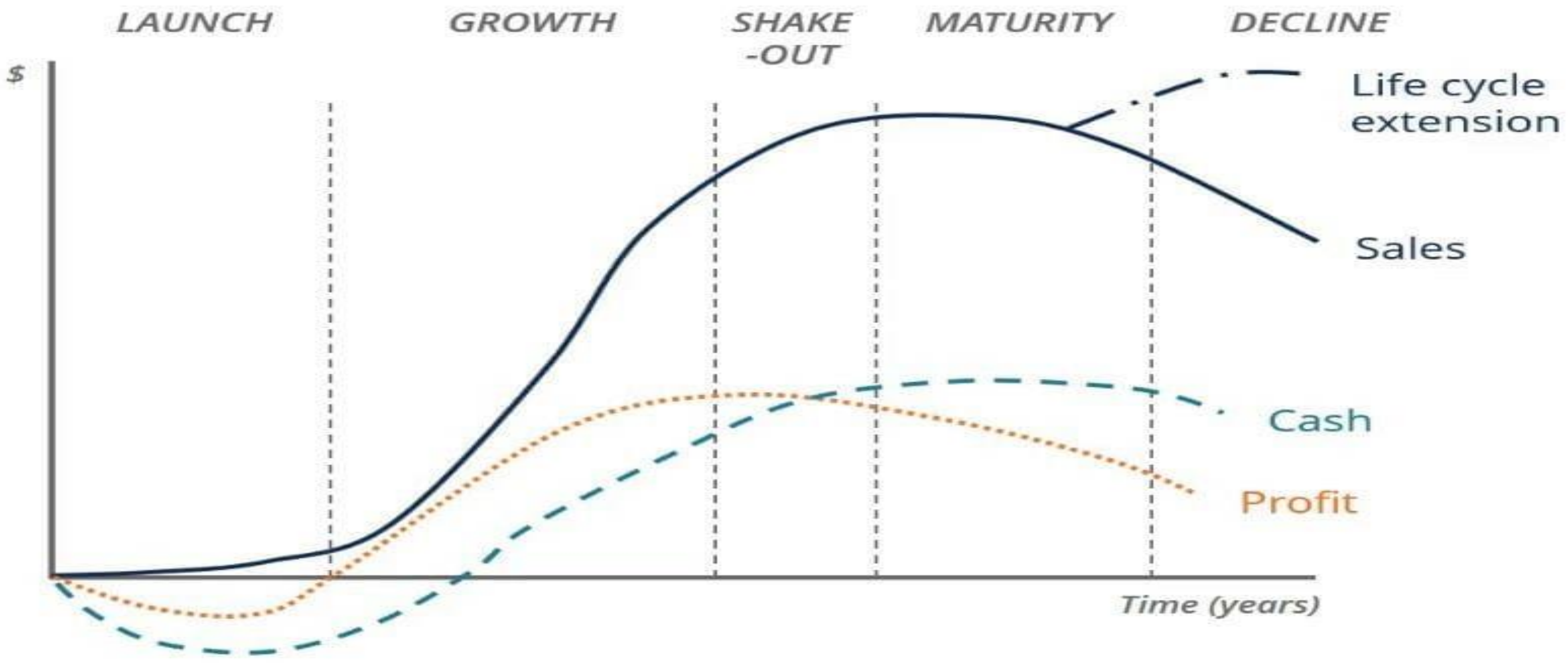


How should short-term assets be managed and financed?

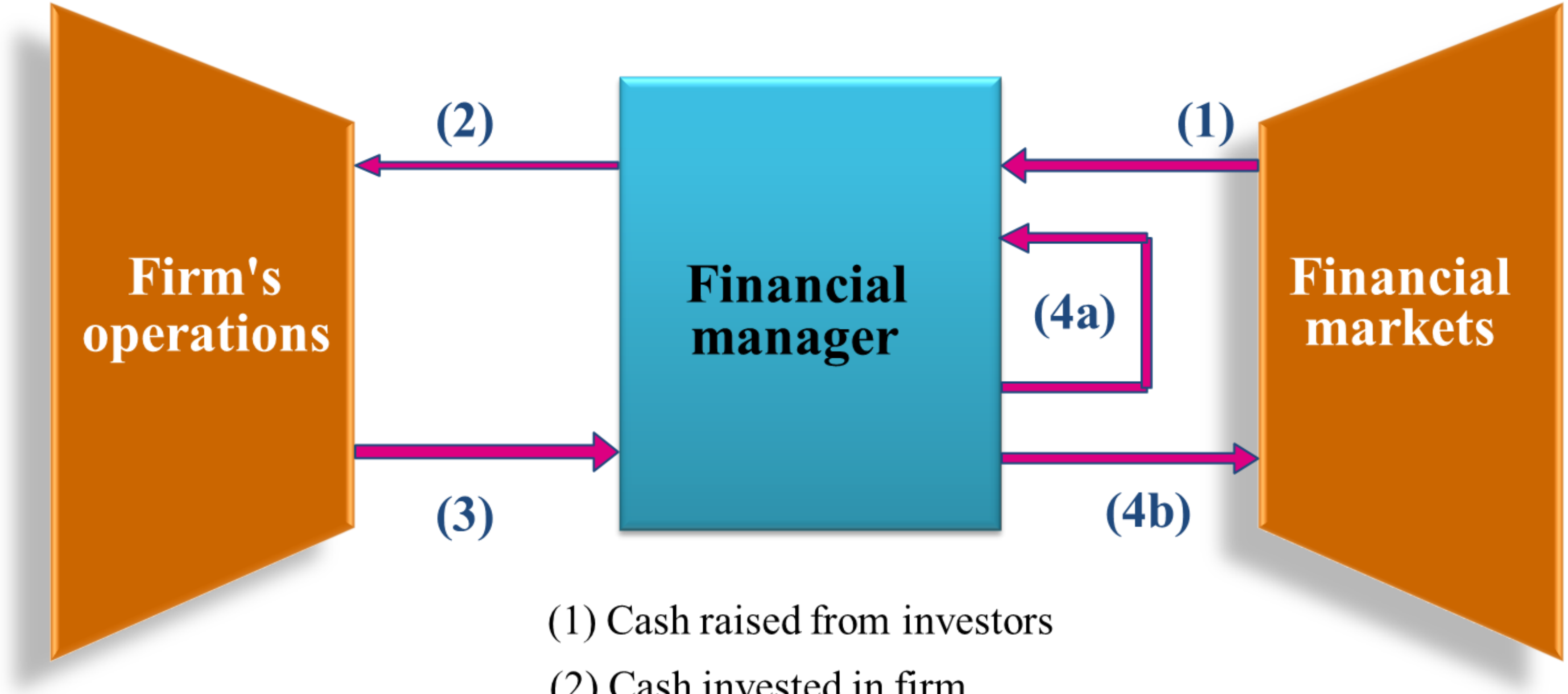
What is a Corporation?

- Legal entity, owned by shareholders
- Can make contracts, carry on business, borrow, lend, sue, and be sued
- Shareholders have limited liability and cannot be held personally responsible for corporation’s debts

Life cycle of a corporation



Cash Flow between Financial Markets & Firm’s Operations



(1) Cash raised from investors

(2) Cash invested in firm

(3) Cash generated by operations

(4a) Cash reinvested

(4b) Cash returned to investors

The Financial Goal of the Corporation

Stockholders Want Three Things

- To maximize current wealth.
- To transform wealth into most desirable time pattern of consumption.
- To manage risk characteristics of chosen consumption plan.

The Financial Goal of the Corporation

Maximize shareholder value: Is it Profit Maximization? - Not a well-defined financial objective!

- Which year's profits?
- Shareholders will not welcome higher short-term profits if long-term profits are damaged
- Company may increase future profits by cutting year's dividend, investing freed-up cash in firm
- Not in shareholders' best interest if company earns less than opportunity cost of capital

Opportunity Cost

- The return on alternative investments of similar risk
- Investing in a project means that the resources could not be used for an alternative investment and the cost associated with the foregone returns from the alternative is the opportunity cost.
- A good investment project should earn more than opportunity cost.

How is value created?

Managers need to compare the return on a project with the opportunity cost.

If the project's return is greater than the opportunity cost, the project is creating value.

Managers look to the financial markets to estimate the opportunity cost.

The Financial Goal of the Corporation

- Shareholders desire wealth maximization, but what does the managers want?
- "**Agency Problems**" represent the conflict of interest between management and owners

- Managers, acting as agents for stockholders, may act in their own interests rather than maximizing value

Agency costs are incurred when:

- Managers do not attempt to maximize firm value
- Shareholders incur costs to monitor managers and constrain their actions

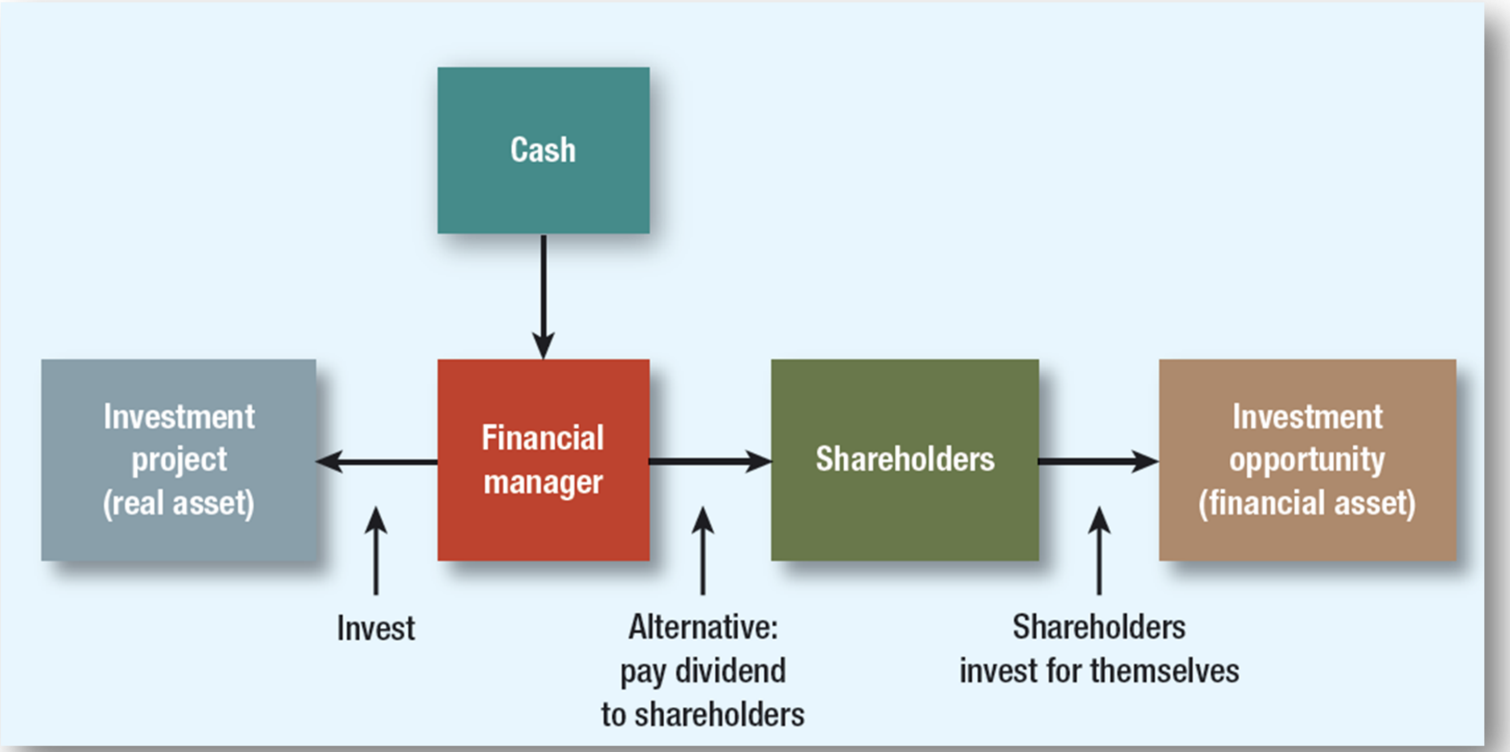
The Financial Goal of the Corporation

The Investment Trade-off

- Hurdle Rate/Cost of Capital
  - Minimum acceptable rate of return on investment

- Opportunity Cost of Capital
  - Investing in a project eliminates other opportunities to use invested cash

The Investment Trade-off



How to calculate present values

Time Value of Money

A rupee today is worth more than a rupee tomorrow.

Investments in projects are expected to generate cash flows in the future.

Since the cash received at different time periods is not the same, we need a way to be able to assess their value.

Future Values and Present Values

- **Future Value**
  - Amount to which investment will grow after earning interest

- **Present Value**
  - Value today of the cash flows received in the future

The one-period case

If you were to invest $10,000 at 5-percent interest for one year, your investment would grow to $10,500.

$500 would be interest ($10,000 × .05)

$10,000 is the principal repayment ($10,000 × 1)

$10,500 is the total due. It can be calculated as:

$$\$10{,}500 = \$10{,}000 \times (1.05)$$

The total amount due at the end of the investment is call the *Future Value* (*FV*).

Future Value

In the one-period case, the formula for *FV* can be written as:

$$FV = C_0 \times (1 + r)$$

Where C_0 is cash flow today (time zero), and

r is the appropriate interest rate.

The Multiperiod Case

The general formula for the future value of an investment over many periods can be written as:

$$FV = C_0 \times (1 + r)^T$$

Where

C_0 is cash flow at date 0,

r is the appropriate interest rate, and

T is the number of periods over which the cash is invested.

Present Value

If you were to be promised \$10,000 due in one year when interest rates are 5-percent, your investment would be worth \$9,523.81 in today's dollars.

$$\$9,523.81 = \frac{\$10,000}{1.05}$$

The amount that a borrower would need to set aside today to be able to meet the promised payment of \$10,000 in one year is called the *Present Value* (*PV*).

Note that $\$10,000 = \$9,523.81 \times (1.05)$.

Present Value

In the one-period case, the formula for *PV* can be written as:

$$PV = \frac{C_1}{1+r}$$

- Where C_1 is cash flow at date 1, and
- r is the appropriate interest rate.

Future Values

Future Value of Rs.100 =

$$FV = ` 100 \times (1 + r)^{t}$$

Example: FV

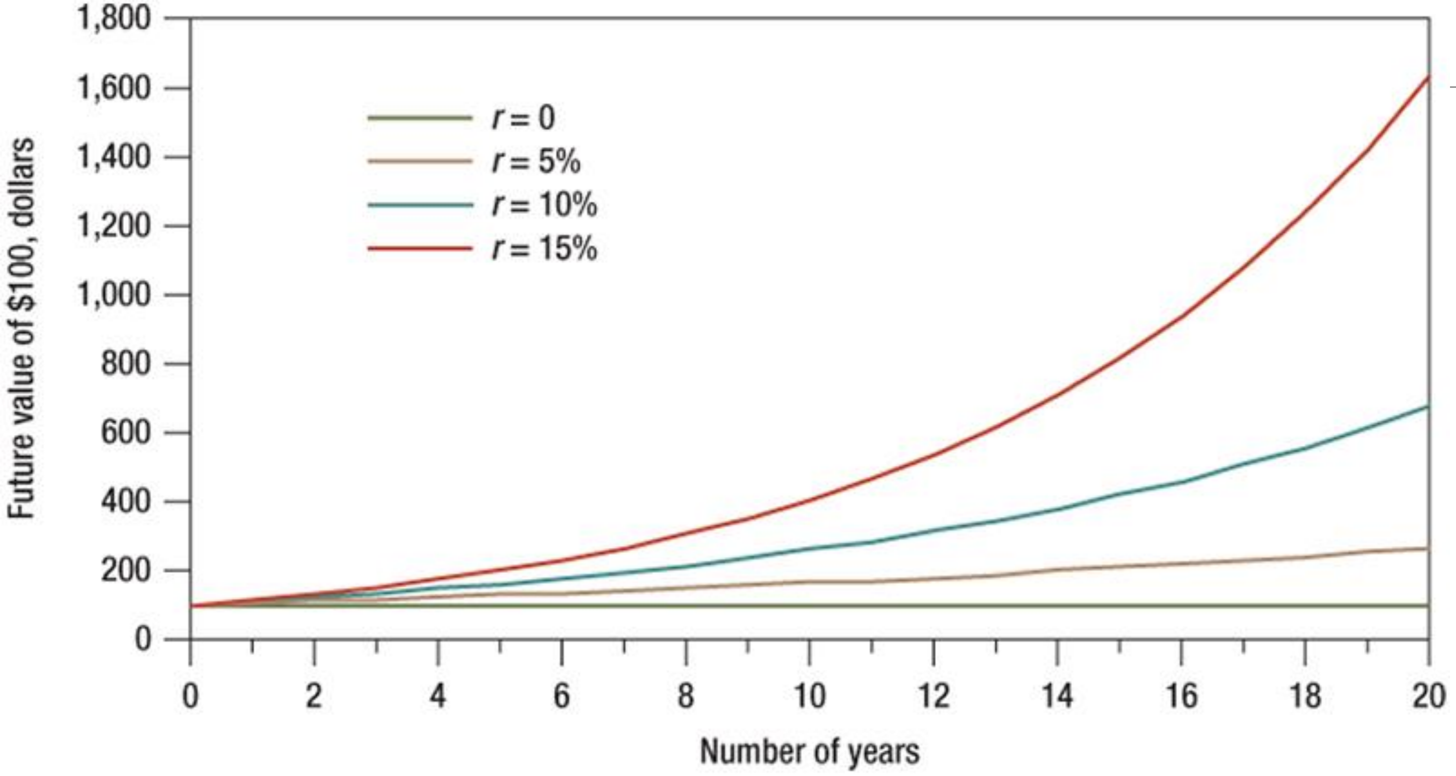
- What is the future value of Rs. 100 if interest is compounded annually at a rate of 7% for two years?

$$FV = ` 100 \times (1.07) \times (1.07) = ` 114.49$$

$$FV = ` 100 \times (1 + .07)^{2} = ` 114.49$$

FV of Rs 100 earning different returns

Time	Future Value			
	0%	5%	10%	20%
0	100	100	100	100
1	100	105	110	120
2	100	110	121	144
3	100	116	133	173
4	100	122	146	207
5	100	128	161	249
6	100	134	177	299
7	100	141	195	358
8	100	148	214	430
9	100	155	236	516
10	100	163	259	619
20	100	265	673	3834
30	100	432	1745	23738
40	100	704	4526	146977
50	100	1147	11739	910044



Future Values with Compounding

Present Values

$$Present\ value = PV$$

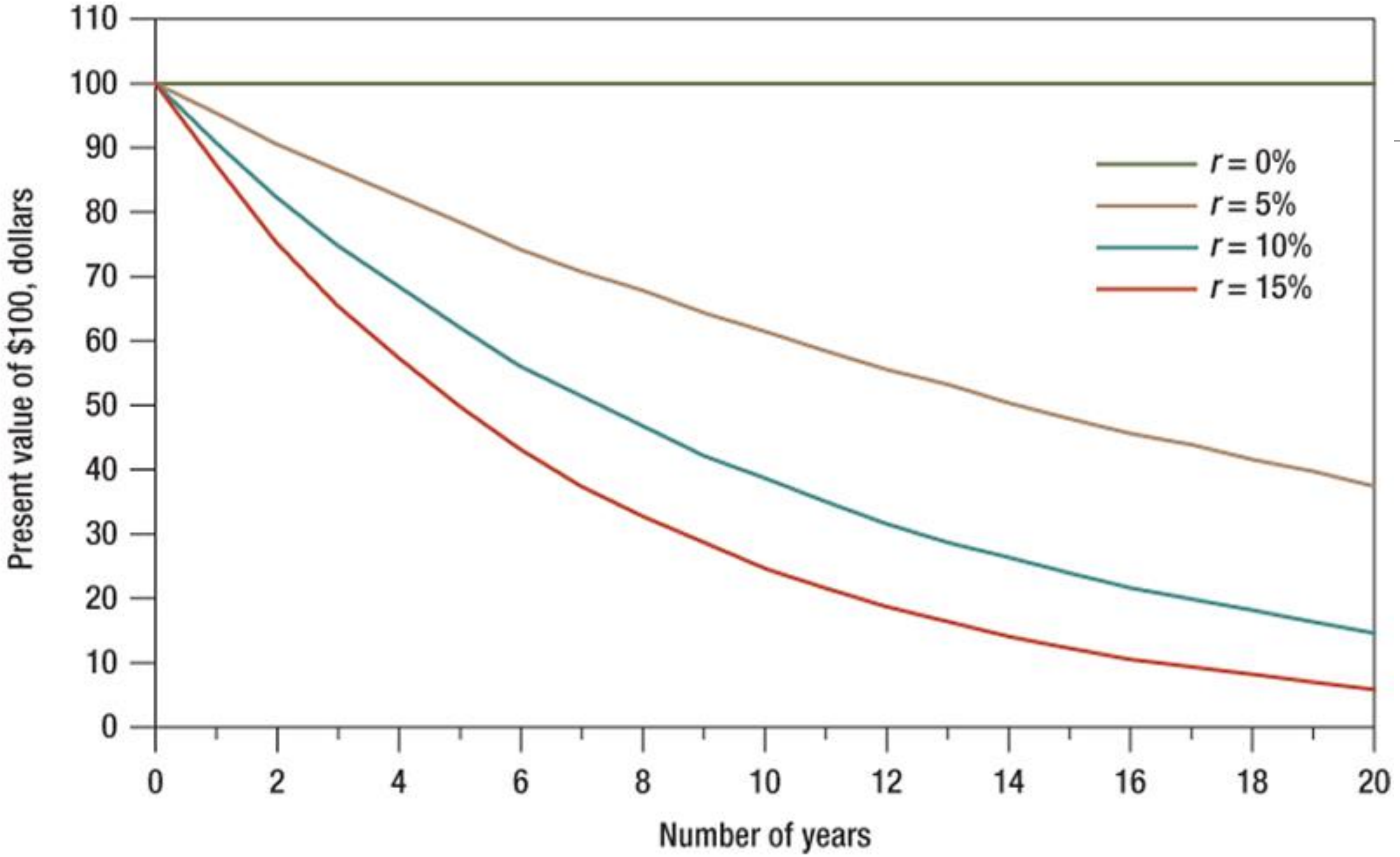
$$PV = discount\ factor\ x\ C_1$$

Future Values and Present Values

Discount factor = DF = PV of Rs. 1

$$DF = \frac{1}{(1+r)^t}$$

Discount factors can be used to compute present value of any cash flow



Present Values with Compounding

Future Values and Present Values

Valuing an Office Building

- Step 1: Forecast Cash Flows
  - Cost of building = C_0 = Rs. 700,000
  - Sale price in year 1 = C_1 = Rs. 800,000

- Step 2: Estimate Opportunity Cost of Capital
  - If equally risky investments in the capital market offer a return of 7%, then cost of capital = r = 7%

Future Values and Present Values

Valuing an Office Building

- Step 3: Discount future cash flows

$$\text{PV} = \frac{C_1}{(1+r)} = \frac{`\,800{,}000}{(1+.07)} = `\,747{,}664$$

- Step 4: Go ahead if PV of payoff exceeds investment

$$\begin{aligned} \text{NPV} &= `\,747{,}664 - `\,700{,}000 \\ &= `\,47{,}664 \end{aligned}$$

Future Values and Present Values

Net Present Value

$$\text{NPV} = \text{PV} - \text{required investment}$$

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

Future Values and Present Values

Risk and Present Value

- A safe rupee is more valuable than a risky rupee
- Higher risk projects require a higher rate of return
- Higher required rates of return cause lower PVs

PV of C_1 = 800,000 at 12%

$$PV = \frac{800,000}{1.12} = 714,286$$

Future Values and Present Values

Net Present Value Rule

- Accept investments that have positive net present value
- NPV = PV(cash inflows) – PV(investments OR cash outflows)
- Using the original example: Should one accept the project given a 10% expected return?

$$NPV = -\grave{}\,700{,}000 + \frac{\$800{,}000}{1.1} = \grave{}\,27{,}273$$

Future Values and Present Values

Rate of Return Rule

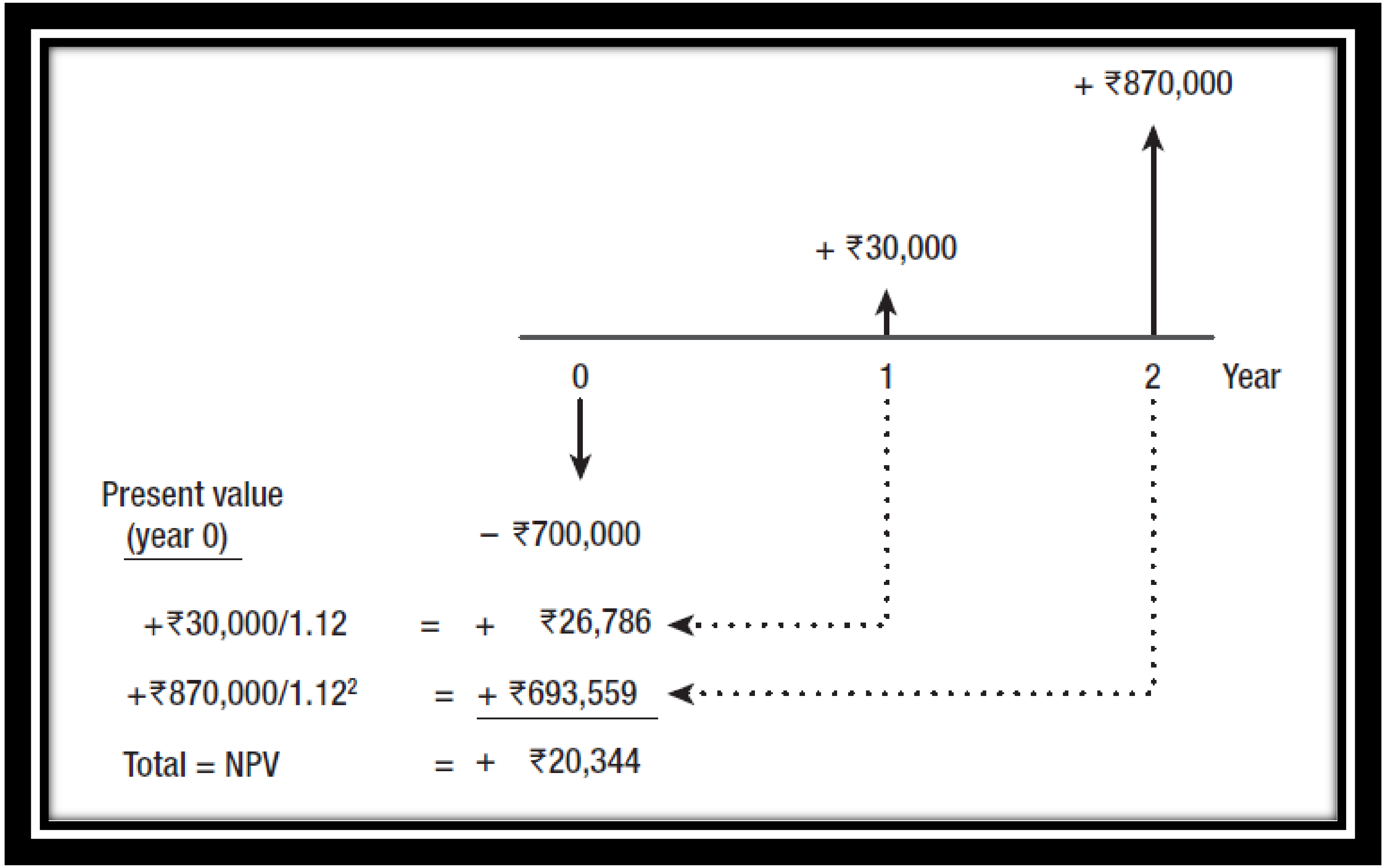
- Accept investments that offer rates of return in excess of their opportunity cost of capital
- In the project listed below, the opportunity cost of capital is 12%. Is the project a wise investment?

$$\text{Return} = \frac{\text{profit}}{\text{investment}} = \frac{\text{`}800{,}000 - \text{`}700{,}000}{\text{`}700{,}000} = .143, \text{ or } 14.3\%$$

Net Present Values

Now, let's say the building can be sold after 2 years for $840,000 but you will earn $30,000 in year 1 and 2.

How does it affect the NPV of the project if opportunity cost is 12%?



Future Values and Present Values

Multiple Cash Flows

- Discounted Cash Flow (DCF) formula:

$$\mathrm{PV}_0 = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \dots + \frac{C_t}{(1+r)^t}$$

$$\mathrm{NPV}_0 = C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

Net Present Value

The Net Present Value (*NPV*) of an investment is the present value of the expected cash flows, less the cost of the investment.

Suppose an investment that promises to pay \$10,000 in one year is offered for sale for \$9,500. Your interest rate is 5%. Should you buy?

$$NPV = -\$9,500 + \frac{\$10,000}{1.05}$$

$$NPV = -\$9,500 + \$9,523.81$$

$$NPV = \$23.81$$

If we had *not* undertaken the positive *NPV* project considered on the last slide, and instead invested our \$9,500 elsewhere at 5 percent, our *FV* would be less than the \$10,000 the investment promised, and we would be worse off in *FV* terms :

$$\$9,500 \times (1.05) = \$9,975 < \$10,000$$

Future Value

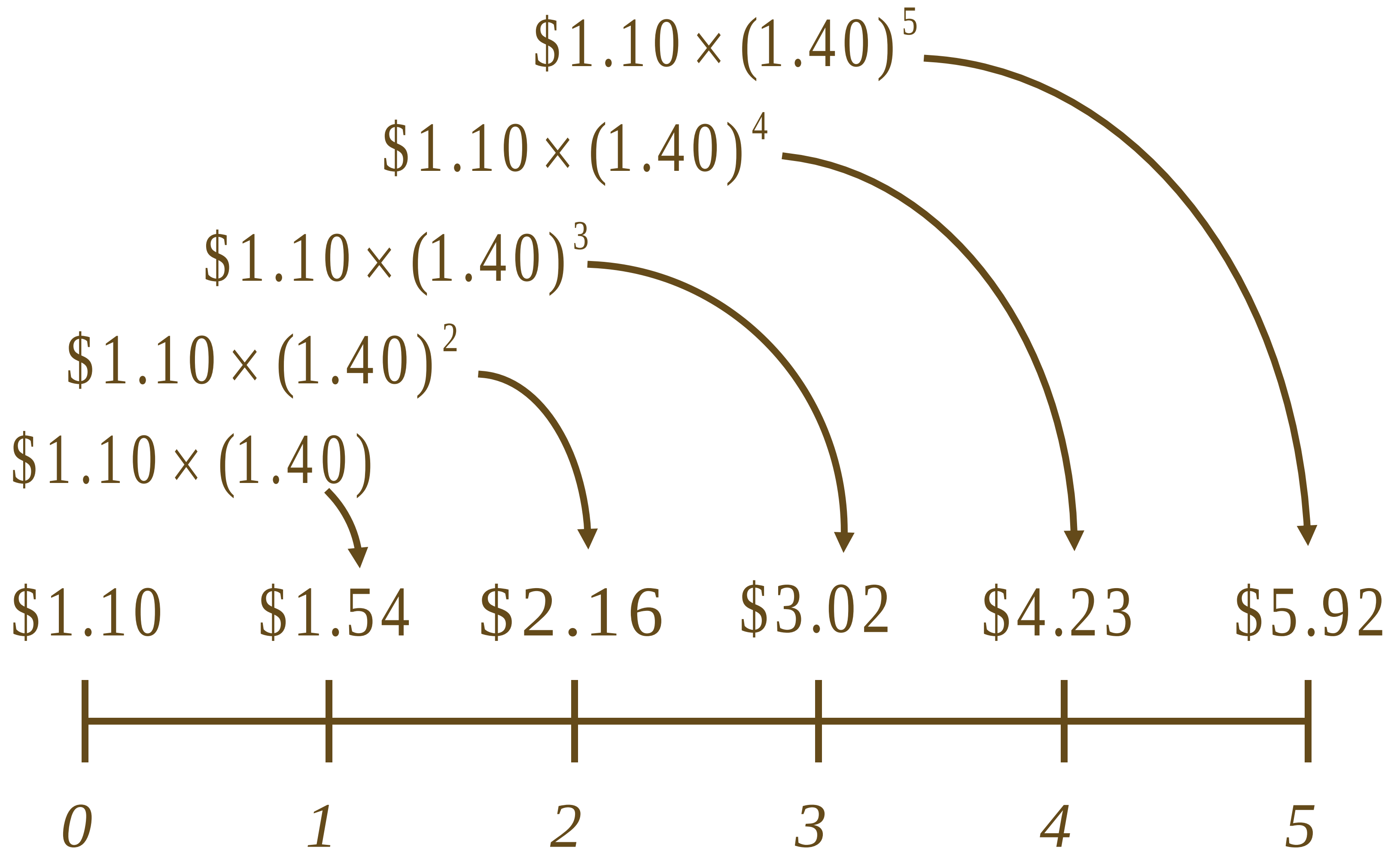
Suppose a stock currently pays a dividend of $1.10, which is expected to grow at 40% per year for the next five years.

What will the dividend be in five years?

$$FV = C_0 \times (1 + r)^T$$

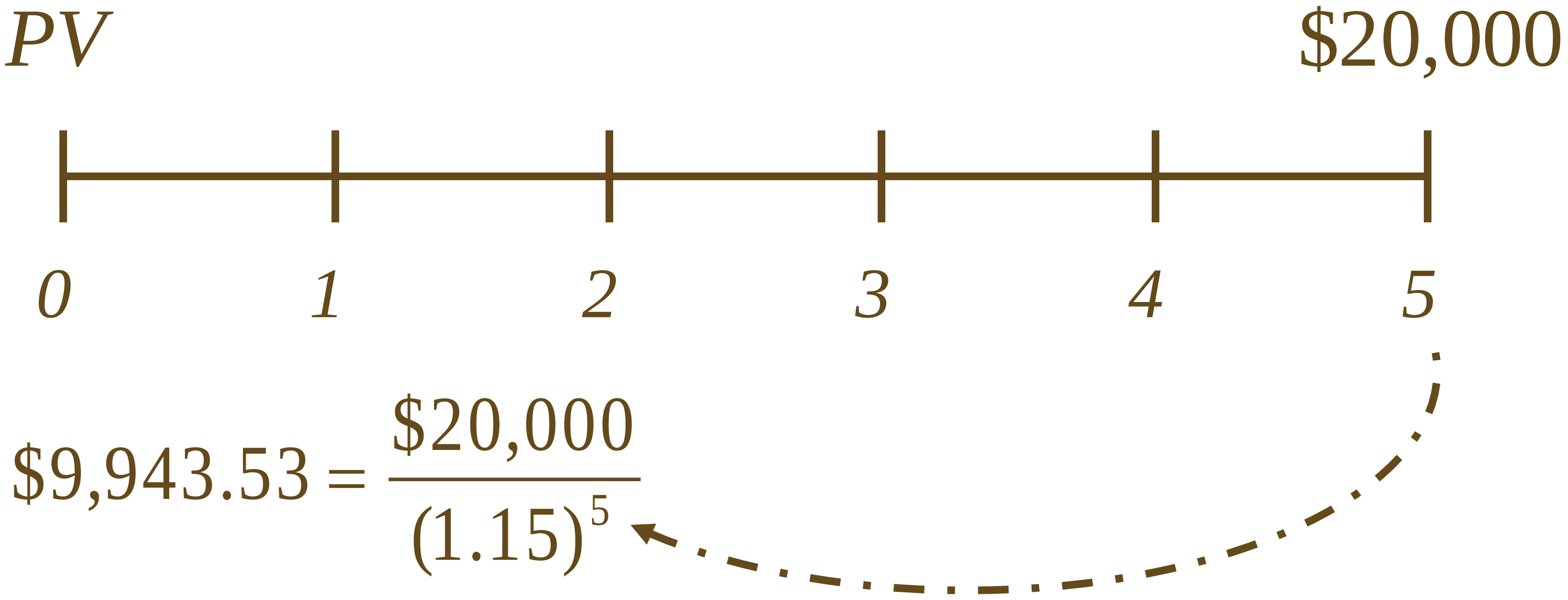
$$\$5.92 = \$1.10 \times (1.40)^5$$

Future Value and Compounding



Present Value and Discounting

How much would an investor have to set aside today in order to have $20,000 five years from now if the current rate is 15%?



$$\$9{,}943.53 = \frac{\$20{,}000}{(1.15)^5}$$

Finding the Number of Periods

If we deposit $5,000 today in an account paying 10%, how long does it take to grow to $10,000?

$$FV = C_0 \times (1 + r)^T \qquad \$10{,}000 = \$5{,}000 \times (1.10)^T$$

$$(1.10)^T = \frac{\$10{,}000}{\$5{,}000} = 2$$

$$\ln(1.10)^T = \ln(2)$$

$$T = \frac{\ln(2)}{\ln(1.10)} = \frac{0.6931}{0.0953} = 7.27 \text{ years}$$

Multiple Cash Flows

Consider an investment that pays $200 one year from now, with cash flows increasing by $200 per year through year 4.

If the interest rate is 12%, what is the present value of this stream of cash flows?

If the issuer offers this investment for $1,500, should you purchase it?

PV = 1432.93

Present Value < Cost → Do Not Purchase

Simplifications

Perpetuity

A constant stream of cash flows that lasts forever

Growing perpetuity

A stream of cash flows that grows at a constant rate forever

Annuity

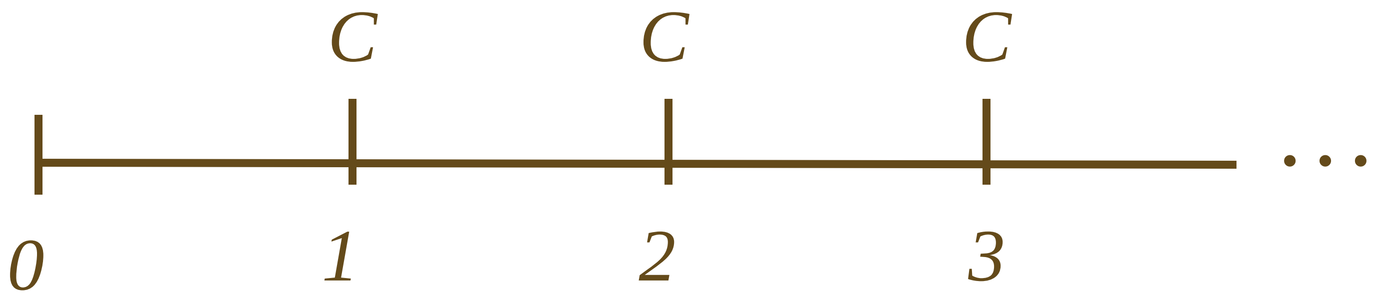
A stream of constant cash flows that lasts for a fixed number of periods

Growing annuity

A stream of cash flows that grows at a constant rate for a fixed number of periods

Perpetuity

A constant stream of cash flows that lasts forever



$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots$$

$$PV = \frac{C}{r}$$

Perpetuities

$$\text{PV of Cash Flow} = \frac{\text{cash flow}}{\text{discount rate}}$$

$$PV = \frac{C_1}{r}$$

Perpetuity

- Financial concept in which cash flow is theoretically received forever
- In a perpetual bond (e.g., British Consol), the principal or face value of the bond is not returned to the investors.

Perpetuities

Present Value of Perpetuities

- What is the present value of Rs. 1 billion every year, for eternity, if the perpetual discount rate is 10%?

$$PV = \frac{`1 \text{ bil}}{0.10} = `10 \text{ billion}$$

Perpetuities

Present Value of Perpetuities

- What if the investment does not start making money for 3 years?

$$PV = \frac{\text{`1 bil}}{0.10} \times \left( \frac{1}{1.10^3} \right) = \text{`}\, 7.51 \text{ billion}$$

Perpetuity: Example

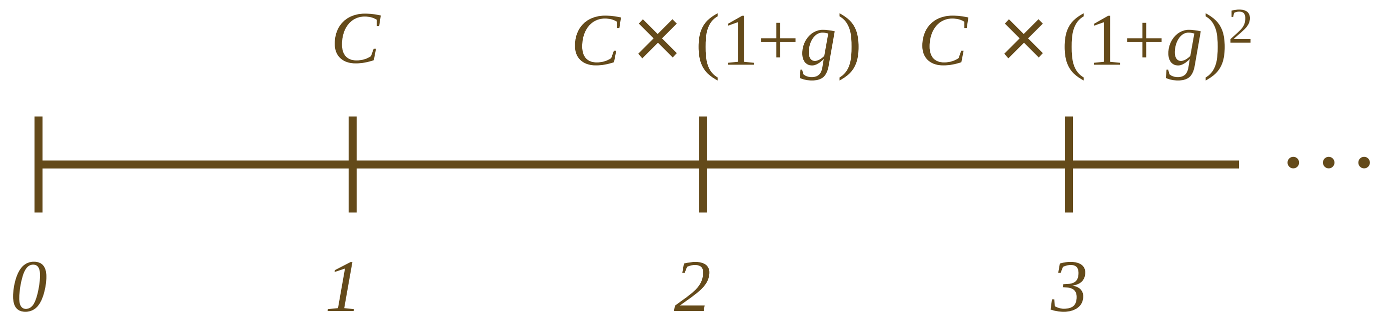
What is the value of a British consol that promises to pay £15 every year for ever?

The interest rate is 10-percent.

$$PV = \frac{£15}{.10} = £150$$

Growing Perpetuity

A growing stream of cash flows that lasts forever



$$PV = \frac{C}{(1+r)} + \frac{C \times (1+g)}{(1+r)^2} + \frac{C \times (1+g)^2}{(1+r)^3} + \cdots$$

$$PV = \frac{C}{r-g}$$

Growing Perpetuities

Constant Growth Perpetuity

$$\mathrm{PV}_0 = \frac{C_1}{r - g}$$

g = the annual growth rate of the cash flow

This formula can be used to value a perpetuity at any point in time

$$\mathrm{PV}_t = \frac{C_{t+1}}{r - g}$$

Growing Perpetuities

Constant Growth Perpetuity

- What is the present value of Rs. 1 billion paid at the end of every year in perpetuity, assuming a rate of return of 10% and constant growth rate of 4%?

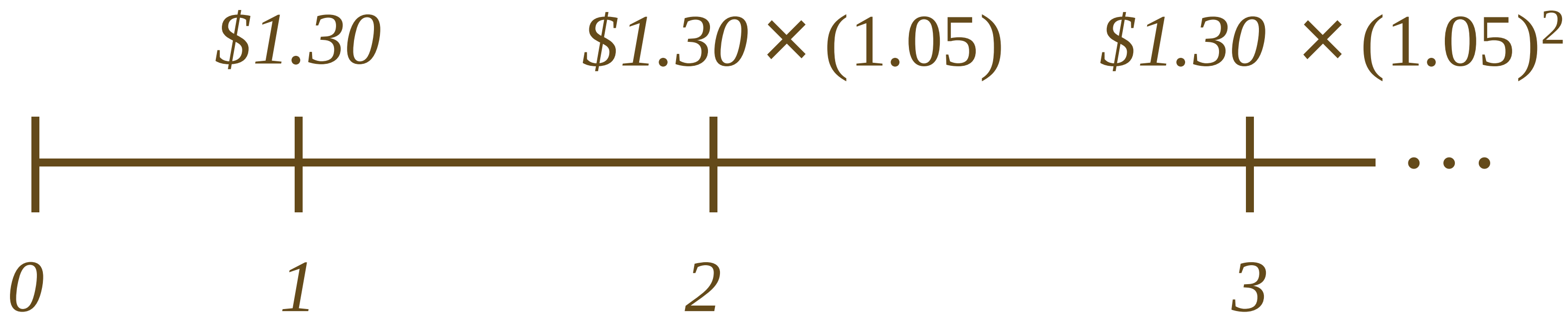
$$PV_0 = \frac{1}{.10 - .04}$$

$$= \text{`}16.667 \text{ billion}$$

Growing Perpetuity: Example

The expected dividend next year is $1.30, and dividends are expected to grow at 5% forever.

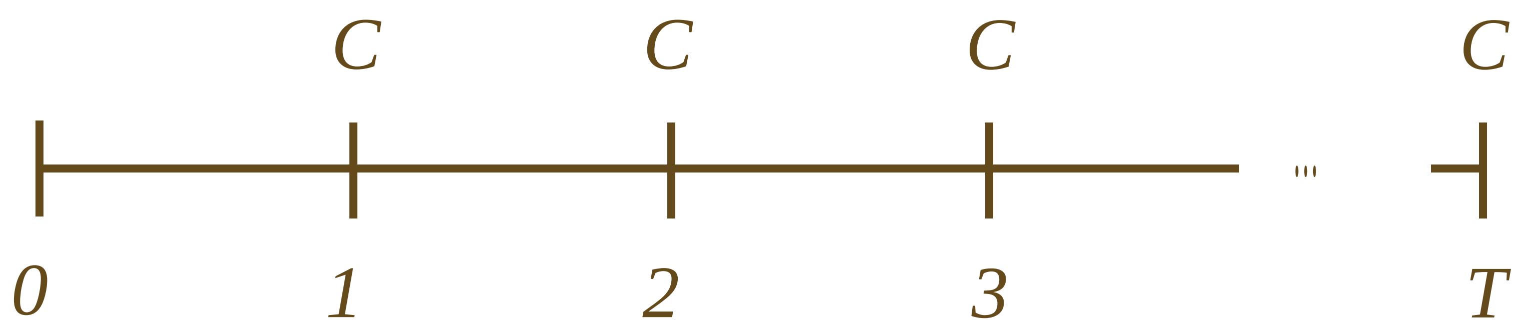
If the discount rate is 10%, what is the value of this promised dividend stream?



$$PV = \frac{\$1.30}{.10 - .05} = \$26.00$$

Annuity

A constant stream of cash flows with a fixed maturity



$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots \frac{C}{(1+r)^T}$$

$$PV = \frac{C}{r}\left[1 - \frac{1}{(1+r)^T}\right]$$

Annuities

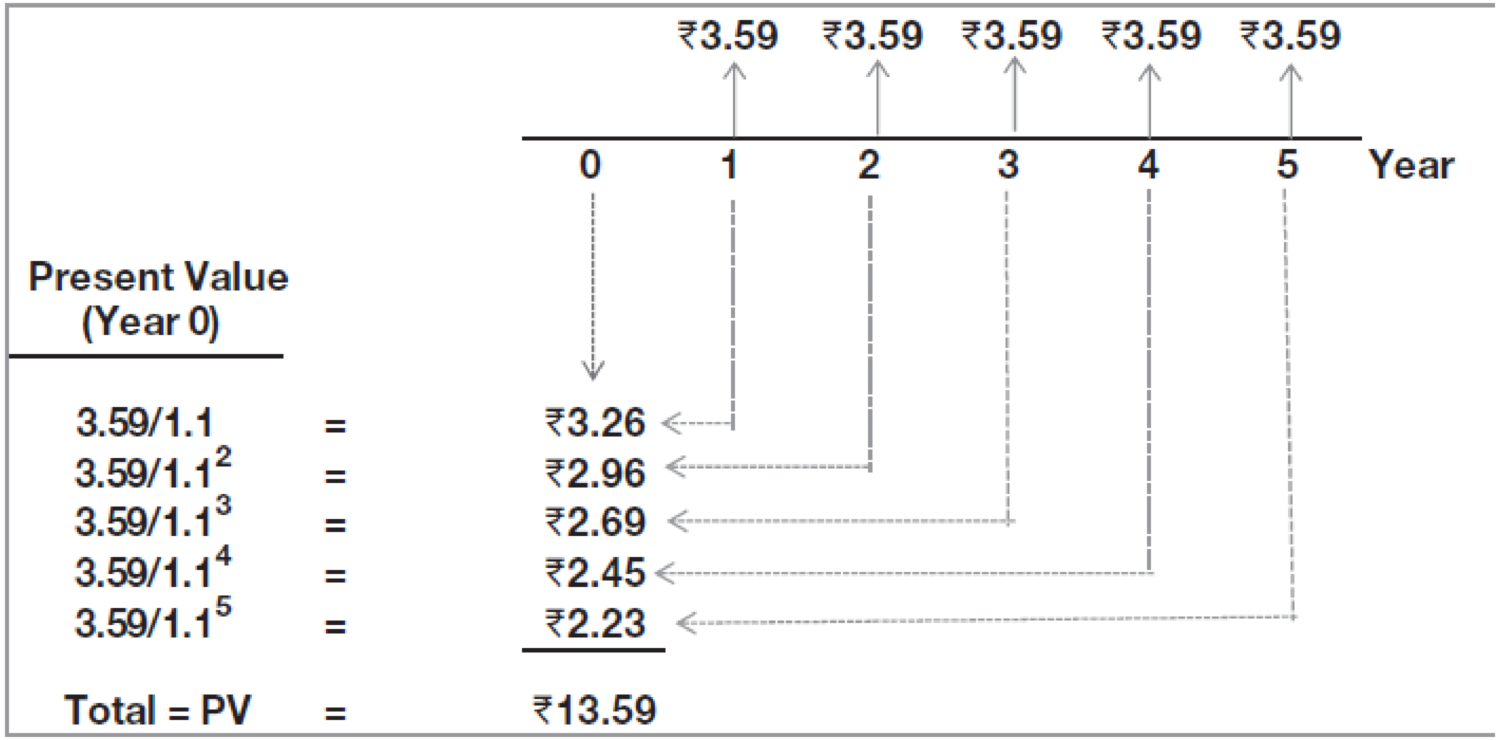
Annuity

- Asset that pays fixed sum each year for specified number of years

Asset	Year of Payment: 1 2…..t $t+1$	Present Value
Perpetuity (first payment in year 1)	→	$\frac{C}{r}$
Perpetuity (first payment in year $t+1$)	→	$\frac{1}{(1+r)^t}\frac{C}{r}$
Annuity from year 1 to year t	→	$\left(\frac{C}{r}\right)-\left(\frac{C}{r}\right)\left(\frac{1}{(1+r)^t}\right)$

Annuities

Example: Aditi Autos offers payments of Rs. 3.59 lakhs per year, at the end of each year for 5 years. If interest rates are 10%, per year, what is the cost of the car?



Annuities

$$\text{PV of annuity} = C \times \left[\frac{1}{r} - \frac{1}{r(1+r)^t} \right]$$

Annuities

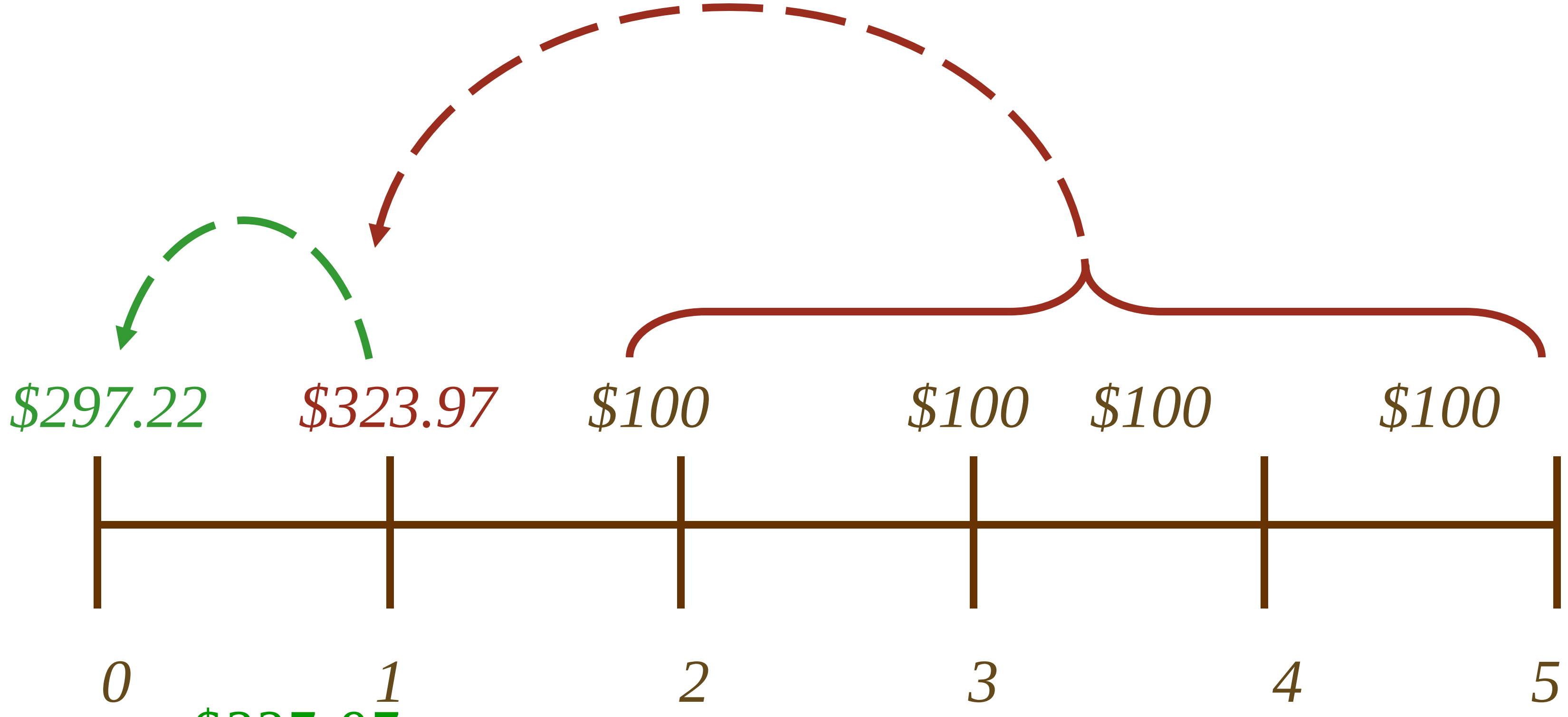
- Example: The state lottery advertises a jackpot prize of $365 million, paid in 30 yearly installments of $12.167 million, at the end of each year. Find the true value of the lottery prize if interest rates are 6%.

$$\text{Lottery Value} = 12.167 \times \left[\frac{1}{.06} - \frac{1}{.06(1+.06)^{30}} \right]$$

$$Value = \$167{,}500{,}000$$

What is the present value of a four-year annuity of $100 per year that makes its first payment two years from today if the discount rate is 9%?

$$PV_1 = \sum_{t=1}^{4} \frac{\$100}{(1.09)^t} = \frac{\$100}{(1.09)^1} + \frac{\$100}{(1.09)^2} + \frac{\$100}{(1.09)^3} + \frac{\$100}{(1.09)^4} = \$323.97$$



$$PV_0 = \frac{\$327.97}{1.09} = \$297.22$$

Annuities

Future Value of an Annuity

$$\text{FV of annuity} = C \times \left[\frac{(1+r)^t - 1}{r} \right]$$

Annuities

Future Value of an Annuity

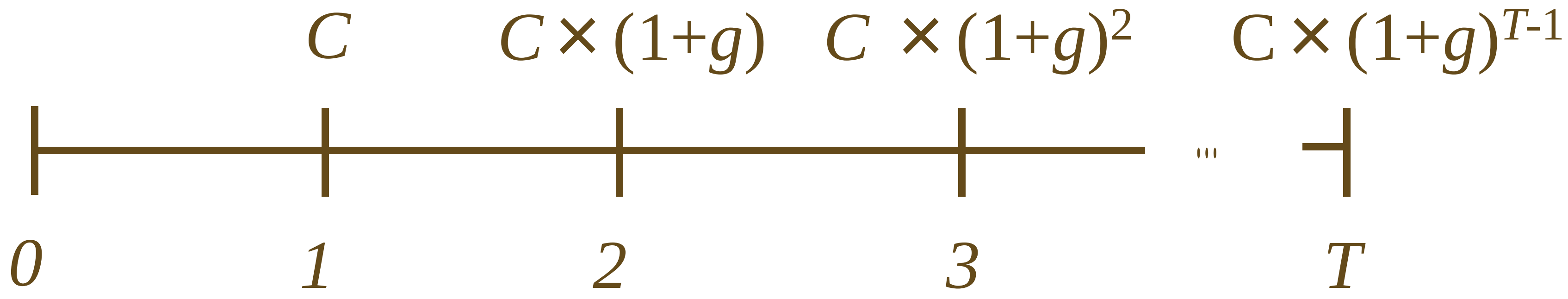
- What is the future value of Rs. 20,000 paid at the end of each of the following 5 years, assuming investment returns of 8% per year?

$$FV = 20,000 \times \left[\frac{(1+.08)^5 - 1}{.08} \right]$$

$$= ` 117,332$$

Growing Annuity

A growing stream of cash flows with a fixed maturity

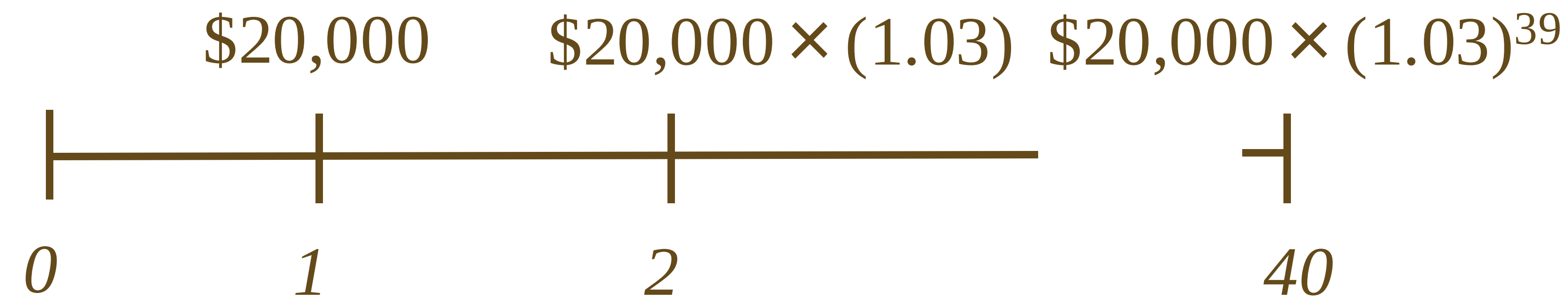


$$PV = \frac{C}{(1+r)} + \frac{C \times (1+g)}{(1+r)^2} + \cdots + \frac{C \times (1+g)^{T-1}}{(1+r)^T}$$

$$PV = \frac{C}{r-g}\left[1 - \left(\frac{1+g}{(1+r)}\right)^T\right]$$

Growing Annuity: Example

A defined-benefit retirement plan offers to pay $20,000 per year for 40 years and increase the annual payment by 3% each year. What is the present value if the discount rate is 10%?



$$PV = \frac{\$20,000}{.10 - .03}\left[1 - \left(\frac{1.03}{1.10}\right)^{40}\right] = \$265,121.57$$

Growing Annuity: Example

Golf club membership is Rs. 5,000 for 1 year, or Rs. 12,750 for three years. Find the better deal given payment due at the end of the year and 6% expected annual price increase, discount rate 10%.

The present value of the membership fees for the next three years is Rs 13,147.

Better off paying now for a three-year membership.

Compounding Periods

Compounding an investment *m* times a year for *T* years provides for future value of wealth:

$$FV = C_0 \times \left(1 + \frac{r}{m}\right)^{m \times T}$$

For example, if you invest $50 for 3 years at 12% compounded semi-annually, your investment will grow to:

$$FV = \$50 \times \left(1 + \frac{.12}{2}\right)^{2 \times 3} = \$50 \times (1.06)^6 = \$70.93$$

Effective Annual Rates of Interest

A reasonable question to ask in the above example is "what is the effective *annual* rate of interest on that investment?"

$$FV = \$50 \times (1 + \frac{.12}{2})^{2\times 3} = \$50 \times (1.06)^6 = \$70.93$$

The Effective Annual Rate (EAR) of interest is the annual rate that would give us the same end-of-investment wealth after 3 years:

$$\$50 \times (1 + EAR)^3 = \$70.93$$

Effective Annual Rates of Interest

$$FV = \$50 \times (1 + EAR)^3 = \$70.93$$

$$(1 + EAR)^3 = \frac{\$70.93}{\$50}$$

$$EAR = \left(\frac{\$70.93}{\$50}\right)^{1/3} - 1 = .1236$$

So, investing at 12.36% compounded annually is the same as investing at 12% compounded semi-annually.

Effective Annual Rates of Interest

Find the Effective Annual Rate (EAR) of an 18% APR loan that is compounded monthly.

What we have is a loan with a monthly interest rate of 1½%.

This is equivalent to a loan with an annual interest rate of 19.56%.

$$\left(1+\frac{r}{m}\right)^{m}=\left(1+\frac{.18}{12}\right)^{12}=(1.015)^{12}=1.1956$$

Frequency of Compounding

Payment frequency can be more than once a year.

If the Annual Percentage Rate, APR (also called the Stated Annual Rate) is r and the frequency of compounding is m times a year, Rs. 1 invested at the beginning of the year would become $[1 + (r/m)]^m$, by the end of the year.

Effective Annual Rate: $\mathbf{[1+(r/m)]^m-1}$

Continuous Compounding

The general formula for the future value of an investment compounded continuously over many periods can be written as:

$$FV = C_0 \times e^{rT}$$

where

C_0 is cash flow at date 0,

r is the stated annual interest rate,

T is the number of years, and

e is a transcendental number approximately equal to 2.718.

Continuous Compounding

As m $\longrightarrow$ to infinity, $[1 + (r/m)]^m \longrightarrow e^r$

Rs. 1, invested at rate, r, compounded continuously, will become, e^r.

Suppose you invest Rs. 1 at an APR of 20% (r = 20%) , continuously compounded for 1 year.

- The end of year value is e^0.2 = 1.2214.
- Investing at 20% compounded continuously is equivalent to investing at 22.14% a year compounded annually.

Suppose you invest Rs. 100 at a continuously compounded rate of 20% (r = 20%) for 3 years.

- The value at the end of year 3 is = P x e^(r.t) =100 x e^(0.2 x 3) = Rs.182.21.

Continuous Compounding

Suppose the **annually** compounded rate is 18.5%. What is the PV of a Rs. 100 perpetuity with each cash flow received at the end of the year? If instead of the cash flow being received at the end of each period, it is received **continuously**. What is the PV of the continuously received perpetual cash flow?

The PV of a Rs. 100 perpetuity with each cash flow received at the end of the year is 100/0.185= Rs. 540.54.

The continuously compounded rate that is equivalent to annually compounded rate of 18.5% is r = ln(1.185) = 0.1697.

PV of continuously paid out perpetual cash flow is 100/0.1697 = Rs. 589.

Since cash flow is received earlier, they are willing to pay a higher price for the continuously paid cash flow.

Compound Interest

Periods per year	Interest per period	APR	Value after one year	Effective annual interest rate
1	6.00%	6.00%	1.06	6.000%
2	3.00%	6.00%	$1.03^2 = 1.0609$	6.090%
4	1.50%	6.00%	$1.015^4 = 1.06136$	6.136%
12	0.50%	6.00%	$1.005^{12} = 1.06168$	6.168%
52	0.1154%	6.00%	$1.001154^{52} = 1.06180$	6.180%
365	0.0164%	6.00%	$1.000164^{365} = 1.06183$	6.183%
Continuous		6.00%	$e^{0.06} = 1.06184$	6.184%

Finding EMI

Example: You are considering an auto loan of Rs. 1,00,000 to finance the purchase of a new car. The bank offers auto loans at an annual interest rate of 12%. If the tenure of the loan is 2 years, what would be the EMI?

PV = Rs. 1,00,000

Monthly interest rate = 12%/12 = 1%

No. of periods = 2 x 12 = 24

EMI = 4707

{In EXCEL, use the PMT function. Rate = 1%, Nper = 24, and Pv = 1,00,000}

Amortized Loan Payments

Time	Beginning Principle	Installment	Interest	Principle	Ending Principle
1	₹ 1,00,000	₹ -4,707	₹ 1,000	₹ -3,707	₹ 96,293
2	₹ 96,293	₹ -4,707	₹ 963	₹ -3,744	₹ 92,548
3	₹ 92,548	₹ -4,707	₹ 925	₹ -3,782	₹ 88,766
4	₹ 88,766	₹ -4,707	₹ 888	₹ -3,820	₹ 84,947
5	₹ 84,947	₹ -4,707	₹ 849	₹ -3,858	₹ 81,089
6	₹ 81,089	₹ -4,707	₹ 811	₹ -3,896	₹ 77,192
7	₹ 77,192	₹ -4,707	₹ 772	₹ -3,935	₹ 73,257
8	₹ 73,257	₹ -4,707	₹ 733	₹ -3,975	₹ 69,282
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
21	₹ 18,368	₹ -4,707	₹ 184	₹ -4,524	₹ 13,844
22	₹ 13,844	₹ -4,707	₹ 138	₹ -4,569	₹ 9,275
23	₹ 9,275	₹ -4,707	₹ 93	₹ -4,615	₹ 4,661
24	₹ 4,661	₹ -4,707	₹ 47	₹ -4,661	₹ 0

Question

A factory costs Rs, 4,000,000. You reckon that it will produce an inflow after operating costs of Rs. 850,000 a year for 10 years. If the opportunity cost of capital is 14%, what is the NPV of the factory? What will be the factory be worth at the end of five years?

NPV = 433698

At the end of five years, the factory's value will be the present value of the five remaining cash flows = Rs 2,918,118.824

Question

How much will you have at the end of 20 years if you invest Rs 100 today at 15% annually compounded?

- Will it change if its compounded continuously –if yes what will be the FV?

15% annually compounded : FV = 100 x $(1.15)^{20}$ = 1636.65

15% continuously compounded : FV = 100 x $e^{(0.15x20)}$ = 2008.58

Question

How much would you need to set aside to provide each of the following? The rate of interest is 8%.

a) Rs 1 billion at the end of each year in perpetuity

- PV = 1 billion / 0.08 = 12.5 billion

b) A perpetuity that pays Rs 1 billion at the end of the first year and that grows at 4% a year

- PV = 1 billion / (0.08 – 0.04) = 25 billion

c) Rs 1 billion at the end of each year for 20 years

- $PV = 1/0.08 \times [\ 1- (1/1.08^{20})] = 9.818$ billion

d) Rs 1 billion a year spread evenly over 20 years

- $e^r = 1.08$, $r = \ln(1.08) = 0.07696$
- $PV = 1/0.07696 \times [\ 1- (1/e^{0.07696 \times 20})] = 10.2059$ billion

Present Value (PV) Function

Formula: PV(rate, nper, pmt, [fv], [type])

- **rate**: Interest rate per period.
- **nper**: Number of periods (months, years).
- **pmt**: Payment per period.
- **fv** (optional): Future value (default 0).
- **type** (optional): 0 (end of period), 1 (start).

Example:

$$= PV(5\%/12, 12 * 10, -200, 0, 0)$$

Future Value (FV) Function

Formula: FV(rate, nper, pmt, [pv], [type])

- **rate**: Interest rate per period.
- **nper**: Number of periods.
- **pmt**: Payment per period.
- **pv** (optional): Present value.
- **type** (optional): 0 (end), 1 (start).

Example:

$$= FV(5\%/12, 12 * 10, -200, 0, 0)$$

RATE Function

Formula: RATE(nper, pmt, pv, [fv], [type], [guess])

- **nper**: Number of periods.
- **pmt**: Payment per period.
- **pv**: Present value (loan amount).
- **fv** (optional): Future value (default 0).
- **type** (optional): 0 (end), 1 (start).
- **guess** (optional): Guess for the rate.

Example:

$$= RATE(12 * 10, -200, 10000)$$

NPER Function

Formula: NPER(rate, pmt, pv, [fv], [type])

- **rate**: Interest rate per period.
- **pmt**: Payment per period.
- **pv**: Present value (loan amount).
- **fv** (optional): Future value (default 0).
- **type** (optional): 0 (end), 1 (start).

Example:

= *NPER*(5%/12, –200, 10000)

PMT Function

Formula: PMT(rate, nper, pv, [fv], [type])

- **rate**: Interest rate per period.
- **nper**: Number of periods.
- **pv**: Present value (loan amount).
- **fv** (optional): Future value (default 0).
- **type** (optional): 0 (end), 1 (start).

Example:

$$= PMT(5\%/12, 12 * 10, 10000)$$

Net Present Value (NPV) Function

Formula: NPV(rate, value1, [value2], ...)

- **rate**: Discount rate.
- **value1, value2, ...**: Series of cash flows.

Example:

$$= NPV(10\%, -10000, 3000, 4200, 6800)$$

XNPV Function

Formula: XNPV(rate, values, dates)

- **rate**: Discount rate.
- **values**: Cash flows (negative for outflows, positive for inflows).
- **dates**: Corresponding dates for each cash flow.

Example:

$= XNPV(10\%, \{-10000, 3000, 4200, 6800\}, \{"2024-01-01", "2025-01$

EFFECT Function

Formula: EFFECT(nominal rate,npery)

- **nominal rate**: Nominal interest rate.
- **npery**: Number of compounding periods per year (e.g., 12 for monthly, 4 for quarterly).

Example:

= *EFFECT* (10%, 12)

NOMINAL Function

Formula: NOMINAL(effect rate,npery)

- **effect rate**: Effective annual interest rate.
- **npery**: Number of compounding periods per year.

Example:

= *NOMINAL*(10%, 12)