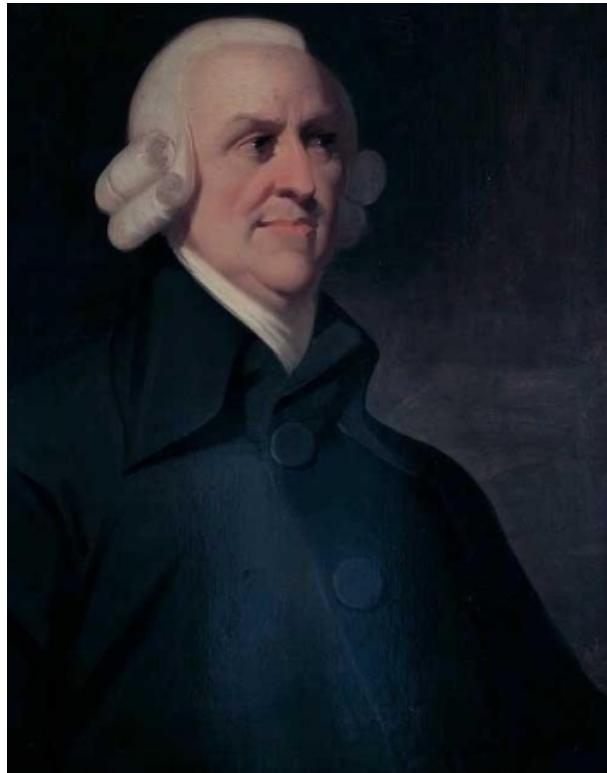


Introduction to economics

Foundation Course Group I

Telangana State Civil Services

Father of Modern Economics



It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest.

– Adam Smith

Adam Smith (1723 – 1790)

- Known as father of modern economics
- Wrote the first and most important books on the subject of economics, *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776)
- Smith believed in “free market”

(*free market is one where consumers may buy what they like and producers may produce what they like, with no government interference*)

Smith suggested that a laissez-faire (don't interfere) approach should be followed, leaving customers and producers to make their own decisions

What is Economics?

- Economics is a study of rationing systems
 - Planned Economies
 - Free Market Economies
- It is the study of how scarce resources are allocated to fulfill the infinite wants of consumers

□ **NEEDS:** are the basic necessities that a person must have in order to survive

e.g. food, water, warmth, shelter and clothing

□ **WANTS:** are the desire that people have

e.g. things that people would like to have, such as bigger homes, iphones, etc.

The Economic Problem



- Unlimited Wants
- Scarce Resources – Land, Labour, Capital
- Resource Use
- Choices

A wind farm. Copyright: iStock.com

The Economic

Decision Making

- **What goods and services should an economy produce?** – should the emphasis be on agriculture, manufacturing or services, should it be on sport and leisure or housing?
- **How should goods and services be produced?** – labour intensive, land intensive, capital intensive? Efficiency?
- **Who should get the goods and services produced?** – even distribution? more for the rich? for those who work hard?

SCARCITY

- The excess of wants resulting from having limited resources (land, labor, capital and entrepreneurs) in satisfying the endless wants of people.
- It is a universal problem for societies – it is not limited to poor countries.
- To the economist, all goods and services that have a price are relatively scarce. This means that they are scarce relative to people's demand for them.

Factors of Production

□ Land

- natural resources available for production
- renewable resources: those that replenish
- non-renewable resources: cannot be replaced

□ Labor

- physical and mental effort of people used in production

□ Capital

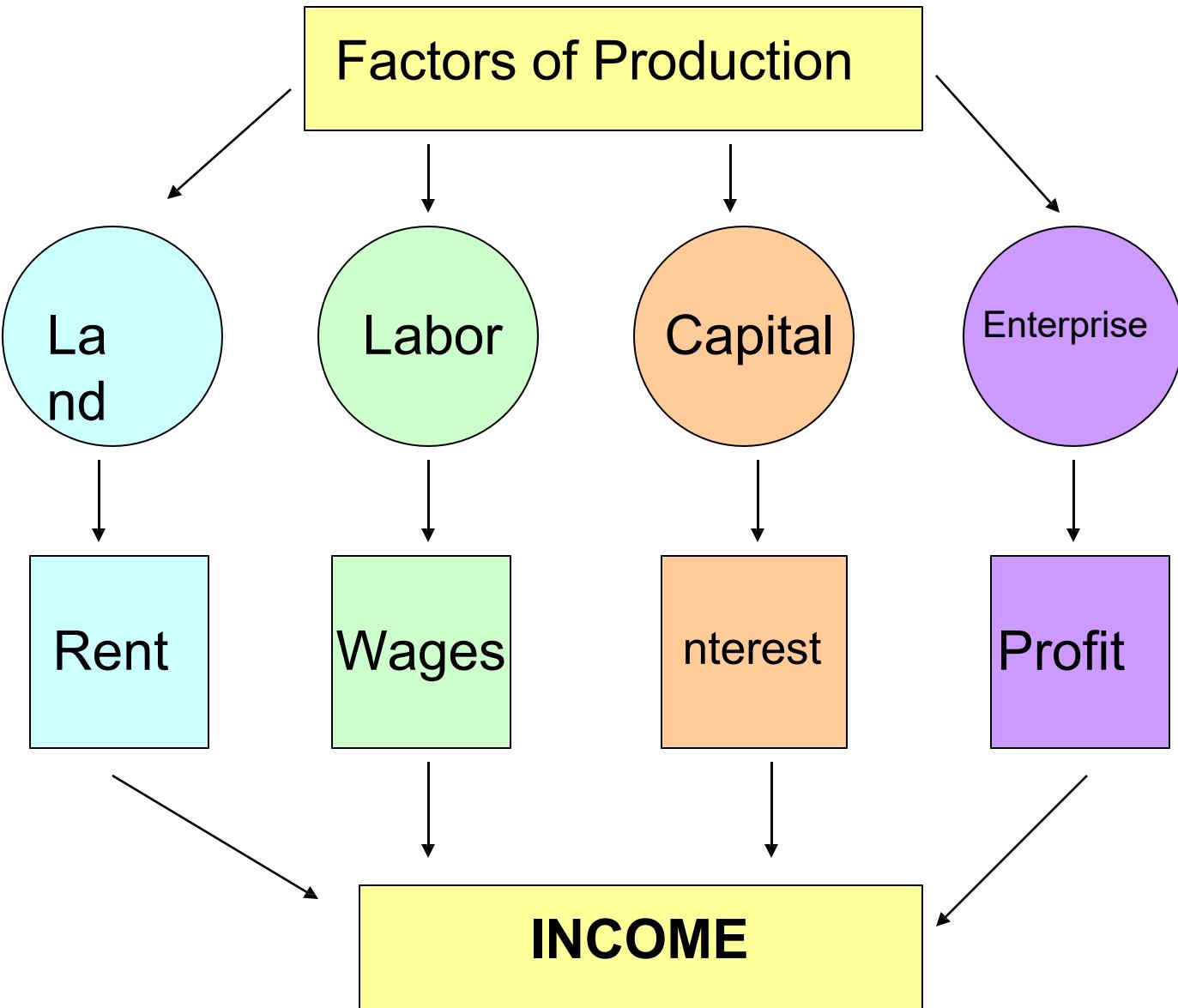
- all non-natural (manufactured) resources that are used in creation and production of other products

□ Enterprise

(Entrepreneurship)

- refers to the management, organization and planning of the three factors of other production

Payments
to factors
of
Pr
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n



Opportunity Cost

- Definition – the cost expressed in terms of the next best alternative sacrificed
- Helps us view the true cost of decision making
- Implies valuing different choices

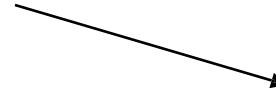
CHOICE

- Since people do not have infinite income, they need to make choices whenever they purchase goods and services.
- They have to decide how to allocate their limited financial resources and so always need to choose between alternatives.
- People wants are infinite; resources are finite, therefore, choices must be made.

Free and Economic Goods



- Does not incur any opportunity costs in its production or when consumed
- Not relatively scarce (not limited in supply)
- Will not have a price



- Has an opportunity cost (goods that use resources which could have been put to use producing something else)
 - Uses scarce resources
 - Will have a price

Types of Products

□ **Consumer goods** – products sold to general public

- **consumer durable goods:**

products that last a long time and can be used repeatedly

- **non-durable goods:**

products that need to be consumed very shortly after purchase

□ **Capital goods or Producer goods** – products purchased by other businesses to produce other goods and services

e.g. computers, machinery, tools

□ **Services** – intangible products provided by businesses

e.g. teachers (education),
doctors (health care)

Production Possibility Curves (Frontier) also known as PPF

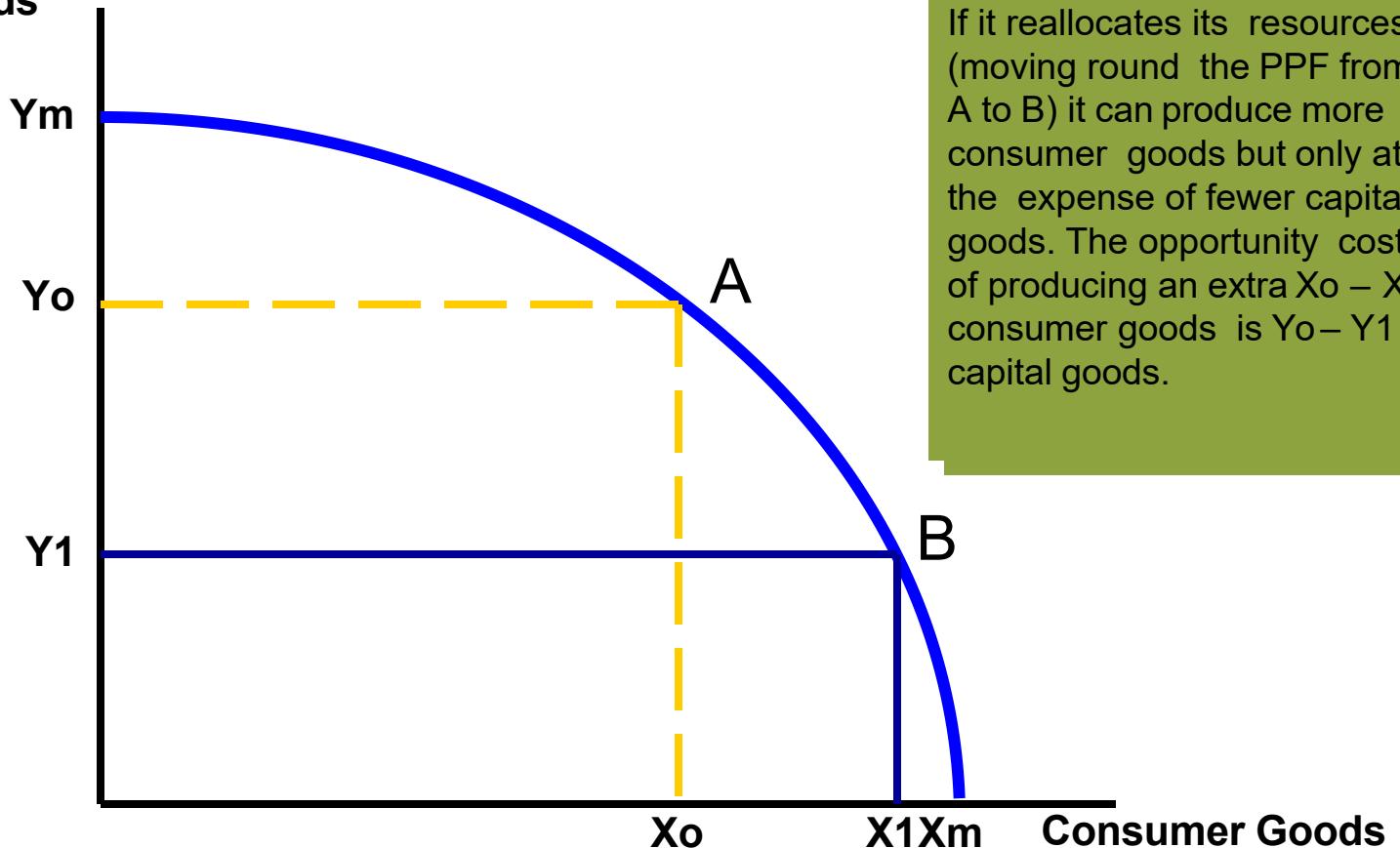
- Production – output of goods and services
- Possibility – maximum attainable amount
- Frontier – border or boundary
- PPF shows the boundary of what is possible and is used as an illustration in economics to show the choices facing all countries in producing goods which use limited factors of production.

Production Possibility Frontiers

- Show the different combinations of goods and services that can be produced with a given amount of resources
- No 'ideal' point on the curve
- Any point inside the curve – suggests resources are not being utilised efficiently
- Any point outside the curve – not attainable with the current level of resources
- Useful to demonstrate economic growth and opportunity cost

Production Possibility Frontiers

Capital Goods



Rationing Systems

□ The basic economic questions:

(1) **WHAT** to produce

(2) **HOW** to produce it

(3) **WHO** shall receive it

Rationing Systems:

Planned
Economies vs.
Free Market
Economies

Planned Economies

- Sometimes called
 - = a centrally planned economy or
 - = a command economy
- Decisions as what to produce, how to produce, and who to produce for, are made by a central body, the government.
- All resources all collectively owned.
- The quantity of decisions to be made, data to be analyzed, and factors of production to be allocated are immense. This makes central planning very difficult.

Free Market Economies

- Sometimes called:
 - = a private enterprise economy or
 - = capitalism
 - All production is in private hands
 - Few cases of surpluses and shortages
- {If there are changes in the pattern of demand, then there will be changes in the pattern of supply in order to meet the new demand pattern}*
- Is a self-righting system

Mixed Economies

- In reality, all economies are mixed economies
- Some countries have high levels of planning and government involvement in the economy (eg. China)
- Government involvement is deemed essential, since there are some dangers that will exist if the free market is left to operate without interference.

Disadvantages of a Free Market

F

- Demerit goods (things that are bad for people, such as drugs or cigarettes) will be overprovided, driven by high prices and thus a high profit motive.
- Merit goods (things that are good for people, such as education or healthcare) will be underprovided, since they will only be produced for those who can afford them and not for all.

Disadvantages of a Free Market Economy

- Resources may be used up too quickly and the environment may be damaged by pollution, as firms seek to make high profits and to minimize costs.
- Some members of society will not be able to look after themselves, such as orphans, the sick, and the long-term unemployed, and will not survive.
- Large firms may grow and dominate industries, leading to high prices, a loss of efficiency, and excessive power.

Disadvantages of a Planned Economy

- Total production, investment, trade, and consumption, even in a small economy, are too complicated to plan efficiently and there will be misallocation of resources, shortages, and surpluses.
- Because there is no price system in operation, resources will not be used efficiently. Arbitrary decisions will not be able to make the best use of resources.

Disadvantages of a Planned Economy

- Incentives tend to be distorted. Workers with guaranteed employment and managers who gain no share of profits are difficult to motivate. Output and/or quality will suffer.
- The dominance of the government may lead to a loss of personal liberty and freedom of choice.
- Governments may not share the same aims as the majority of the population and yet, by power, may implement plans that are not popular, or are even corrupt.

Microeconomics

- Centers on the forces working at the individual level (e.g. individual firms and consumers)
- Focuses on the needs, desires and buying habits of the individual consumer
- An example: studying how firms react to increasing costs of production by raising the price and subsequently how consumer/household spending is adjusted when the price rises
- Name of the game: Supply, Demand and Markets

Macroeconomics

- The sum total of all micro parts
- Looks at the aggregate (sum or total) of individual markets
- The four main areas of study
 - (1) Growth (increase in total output)
 - (2) Price level (inflation)
 - (3) Labor Markets (unemployment)
 - (4) The balance in the foreign sector (exports/imports, exchange rates)

□ MICRO

Firm's reaction to increased demand for its product

□ MACRO

Studying the effects on all firms in the economy due to a general increase in demand

□ MICRO

Decision of a worker to work less
due to lower wages

□ MACRO

Total hours of labor (and
unemployment)

Definition of Growth

- Growth is the increase in national output within an economy (country or region) during a time period – usually 12 months.

(National output is the sum of all goods and services produced in a country during a given period of time =GDP or GNP)

- This is put in percentage terms to show the annual percentage increase in output.
- It is measured in money terms and usually adjusted for inflation to show real growth.

Definition of Development

- The concept of development is a qualitative variable and thus far broader than any of the variables aimed at describing it.
- It is about having choices: economic and political choices; choice of schools, healthcare; choice of government.
- It is about having opportunities: for education, work, public office, private ownership, leisure.
- It is about freedom: freedom of opinion, speech etc.

Definition of Sustainable Development

- Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- Growth that lasts

NOTE: There's an on-going debate about the precise meaning of this term.

Growth in relation to Environment

Debates:

- Environmental damage is caused by Growth
 - due to increase in income and consumption
- Environmental damage is quite often the result of a lack of growth
 - increasing wealth means that there are sufficient resources to improve the method of production and lower pollution levels, use less material and overall make more goods

Demand Curve



Supply Curve



The equilibrium price



What is economy?

- From the Greek, it means the management or private affairs and especially expenses.
- It is the careful management of material re (dictionary definition).

What is economics?

Many definitions:

- It is the branch of social science that deals with production and distribution and consumption and services and their management.
- It is the study of choice and decision-making with limited resources.
- It is the study of how individuals, businesses and governments use their limited resources to satisfy unlimited wants.
- It is the study of the production and distribution of wealth.

Engineering & Economics

- Engineering activities are means of satisfying human rights and requirements
- Concerns – material / forces and needs
- Because of resource constraints, engineering is closely associated with economics
- It's essential that an engineering problem is evaluated in terms of economics (worthiness) before it is undertaken
- Essential pre-requisite of successful engineering application is **economic feasibility**

Dependence on Engineering

- Modern civilization depends to a large degree on engineering
- Products and services such as communication machines, roads etc are result of engineering
- **Production is through engineering**
- Jobs and skill development
- Economic improvement
- Business and economic growth

Engineering Economics

- Engineering economy is a collection of mathematical / analytical techniques that simplify economic comparison
- Engineering economy – formulation, estimation and evaluation of the economic outcomes out of various available alternatives to accomplish a defined purpose
- Discipline that involves the systematic evaluation of the cost and benefit of proposed technical projects
 - Engineering economy/economics: the systematic evaluation of the economic merits of proposed solutions to engineering problems.

Principles of Engineering Economics

- Analyze the idea
- Develop the alternatives
- Focus on differences in the alternatives
- Use a consistent view point
- Use a common unit of measurement
- Consider all relevant criteria
- Make uncertain **explicit**
- Revisit your decision

Role of Engineering Economy Decision Making

- Assist people in making decisions
- Timeframe – future
- Actual value may differ from estimated values
- Sensitivity analysis – changes in decision variables with varying estimates
- Analysis of present and past situations based on observed data to predict the future

Engineering Economy

- Engineering economy is an answer to following questions
 - Which engineering projects are worth (project worthiness)
 - Which engineering projects should have a priority? (priority for available alternatives)
 - How should the engineering project be designed (economic design)

Fundamental Principles in Engineering Economics

- Principle 1: Money now is worth more than Money at a later time.
- Principle 2: All that counts is the differences among alternatives.
- Principle 3: Marginal revenue must exceed marginal cost.
- Principle 4: Additional risk is not taken without the expected additional return.

Bi-Environmental Nature of Engineering

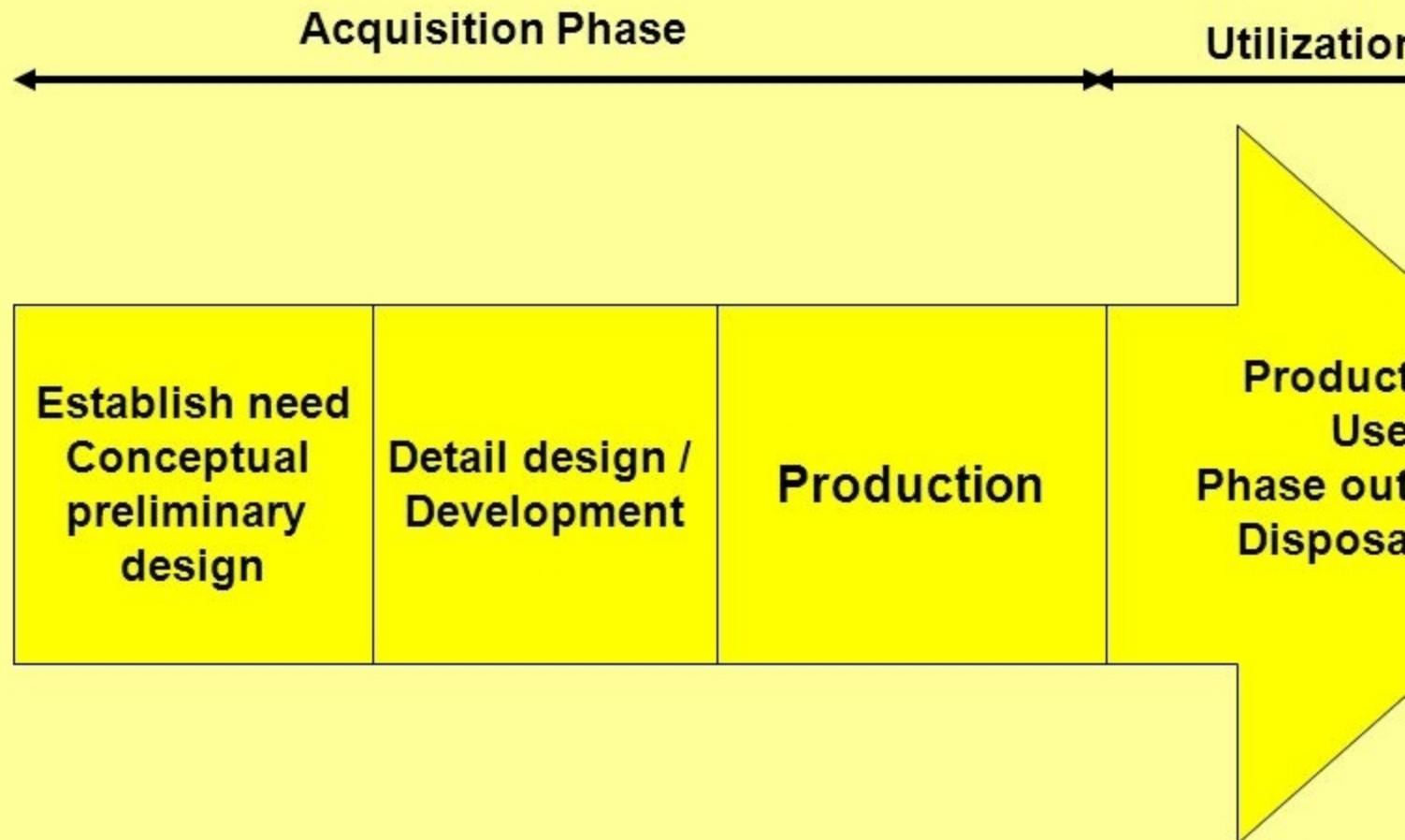
- Engineers are confronted with two interco environments the physical and economical

	Engineering proposal	Production / consumption	Need satisfaction
Physical environment			Economic environment

Physical and Economic Efficiency

- **Physical efficiency = output / input**
- **Physical efficiency is always less than unity or 1**
- **Economic efficiency = worth / cost**
- **Economic efficiency can 100% or even more**
- **Overall economic efficiency = economic/physical**
= physical x worth

Product Life Cycle



Life Cycle Cost Analysis

- The ultimate value of the product that result from engineering measured in economic terms
- Economic aspect is not examined until detail design (too late)
- Life cycle analysis – To ensure that entire life of the system is considered from inception till end
- Engineering design – should ensure design compatibility throughout the life cycle
- Life cycle outcome is measured in terms of performance, effectiveness, productivity, reliability, maintenance, quality and cost

Economic & cost concep

Concept of Value & Utility

- o **Value**

- o It is a measure of the worth that a person ascribes to a good or a service
- o Value of an object is not inherent but in the regard that a person has for it
- o It should not be confused with price or cost of an object

- **Utility**

- It is a measure of the power of a good or a service to satisfy human wants
- Not inherent to object but in the regard that a person has for it
- **Value and utility are related. Value is an appreciation of utility in terms of medium of exchange**

Consumer & Producer Goods

(two classes of goods are recognized by the economy)

- **Consumer goods** are the goods and services that directly satisfy human wants
TV, houses, shoes, books
- **Producer goods** are the goods and services that satisfy human wants indirectly as part of the production process. They are not desired themselves, but they are instrumental in producing something that can be consumed
Machines, dozers, equipment, energy, coal

Economic Aspects of Exchange

- Economy of exchange occurs when utilities are exchanged by two or more people
- In this connection, a utility means anything that a person receives in an exchange that has any value whatsoever. For example, an appliance for the home, a pair of shoes, a friendly gesture, etc.
- **Mutual benefit in exchange**
 - Seller believe that the amount received has equal or greater utility than the object
 - Buyer believe that object has equal or greater utility than the amount spent
 - Exchange is made when mutual benefit is involved
 - Exchange is possible when the object is not valued equally by the parties of exchange

Classification of Cost

- o **First cost**

- o It is the initial cost of capitalized property, transportation, installation, and other related expenditures
- o Normally made of elements that do not recur
- o Occurs once

- o **Operation and Maintenance Cost**

- o It is that group of costs experienced continually over life of the activity
- o Labor cost for operating and maintenance, fuel and power, spares and repair cost, insurance and taxes and overhead

- o **Fixed Cost**

- o Fixed cost is that group of costs involved in a going concern whose value is constant in the future regardless of operation
- o Lease, rent, sales programmes, research, permanent staff
- o Investment that give rise to fixed cost are made in the present with the hope that it will be recovered with profit as a result of reduction in variable cost or increase in income

- o **Variable Cost**

- o It is that group of costs that vary in some relation to the level of operational activity
- o It is related to the rate of use or activity level
- o Material needed per unit of product is expected to be constant
- o Amount of paint used may be expected to be proportional to the area painted

o Incremental and Marginal Cost

- o It is the additional cost that will be incurred as the increasing output by one more unit**
- o Marginal cost is an increment of output whose costs covered by the monetary return derived from it**

o Sunk Cost

- o A sunk cost is a past cost that cannot be altered by action and is therefore irrelevant**
- o Disregarded by principle but difficult to apply**
- o Accept the present loss and use the money more effectively from now into the future**

Life-cycle Cost

Life cycle cost is defined as all costs, both nonrecurring and recurring, that occur over the life cycle of a product.

Interest and Interest Rate

Interest & Interest Rate

- o **Interest**

- o It is a rental amount charged by financial institution for use of money
- o It is the difference between end amount and the beginning amount
- o If the difference is zero than there is no interest
- o $\text{Interest} = \text{Amount now} - \text{original amount}$

- o **Interest Rate**

- o Interest rate, or the rate of capital growth, is the rate of gain from an investment
- o When interest paid over specific time period is expressed as a percentage of principal (original) amount, it is called as interest rate
- o $\text{Interest Rate} = (\text{Interest per unit time}/\text{original amount}) * 100$
- o Time unit of interest rate is interest period
- o Interest period is normally 1 year

Time Value of Money

- o The change in the amount of money over a period of time is called the time value of money
- o A dollar received at some future date is not worth as much as a dollar in hand at present
- o Money makes money If invested

Thank You !!

Engineering Economic Decisions

Lecture No.2

Chapter 1

Engineering Economic Decisions

- Rational Decision-making Process
- The Engineer's Role in Business
- Types of Strategic Engineering Economic Decisions
- Fundamental Principles in Engineering Economics



Bose Corporation

Bose Corporation

- Dr. Amar Bose, a graduate of electrical engineering, an MIT professor, and Chairman of Bose Corporation.
- He invented a directional home speaker system that reproduces the concert experience.
- He formed Bose corporation in 1964 and became the world's No.1 speaker maker.
- He became the 288th wealthiest American in 2002 by Forbes magazine.

Engineering Economics

Overview

- Rational Decision-Making Process
- Economic Decisions
- Predicting Future
- Role of Engineers in Business
- Large-scale engineering projects
- Types of strategic engineering economic decisions

Rational Decision-Making Process

1. Recognize a decision problem
2. Define the goals or objectives
3. Collect all the relevant information
4. Identify a set of feasible decision alternatives
5. Select the decision criterion to use
6. Select the best alternative



Which Car to Lease? Saturn vs. Honda

1. Recognize a decision problem → Need a car
2. Define the goals or objectives → Want mechanical security
3. Collect all the relevant information → Gather technical as well as financial data
4. Identify a set of feasible decision alternatives
3. Choose between Saturn and Honda
5. Select the decision criterion to use
4. Want minimum total cash outlay
6. Select the best alternative
5. Select Honda

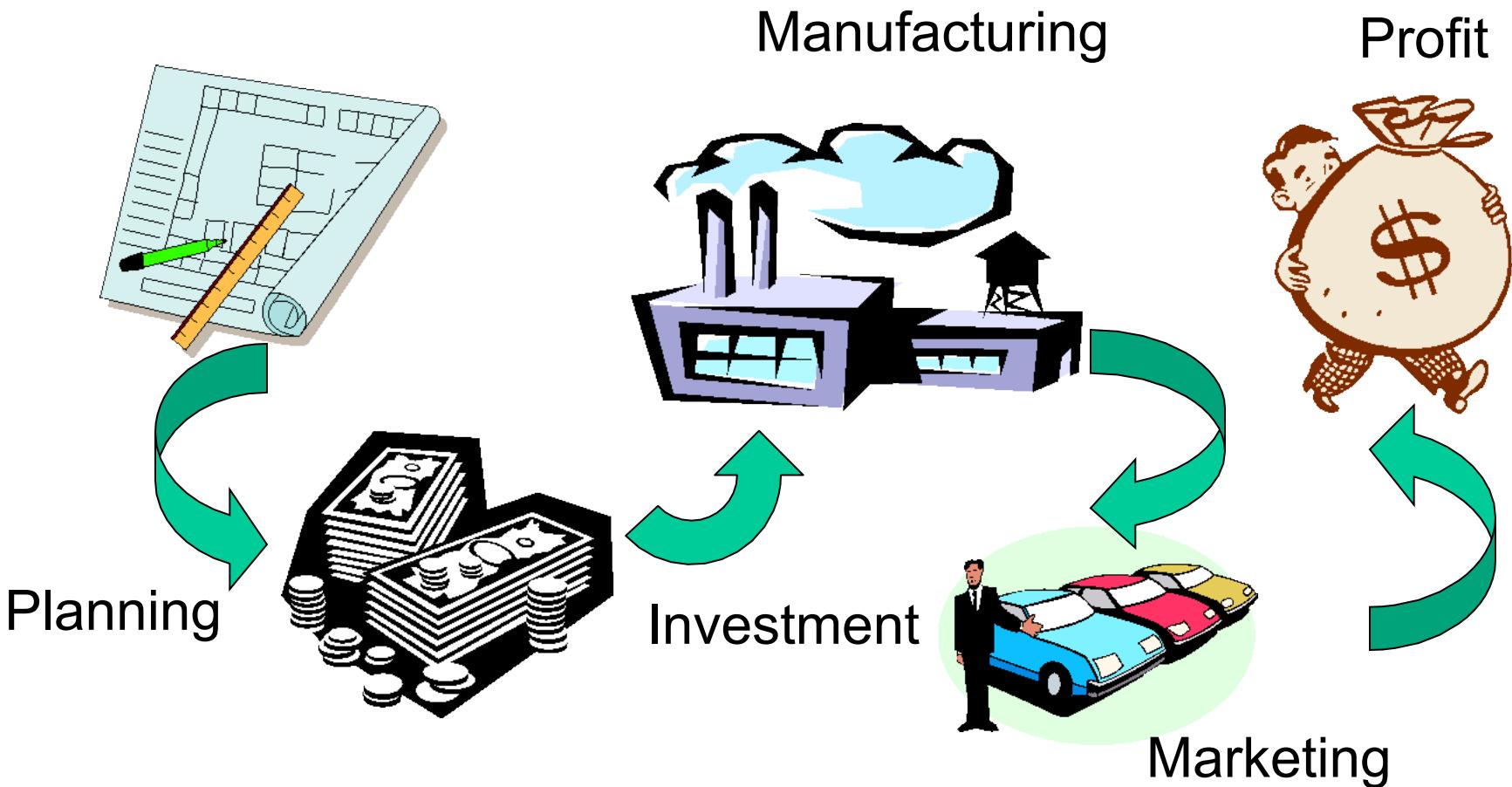
TABLE 1.1 Financial Data for Auto Leasing: Saturn versus Honda

Auto Leasing	Saturn	Honda	Difference Saturn – Honda
1. Manufacturer's suggested retail price (MSRP)	\$15,573	\$15,810	-\$273
2. Lease length	48 months	48 months	
3. Allowed mileage	48,000 miles	48,000 miles	
4. Monthly lease payment	\$219	\$248	-\$29
5. Mileage surcharge over 36,000 miles	\$0.20 per mile	\$0.15 per mile	+\$0.05 per mile
6. Disposition fee at lease end	\$0	\$250	\$250
7. Total due at signing:			
• First month's lease payment	\$219	\$248	
• Down payment	\$1,100	\$800	
• Administrative fee	\$495	\$0	
• Refundable security deposit	\$200	\$225	
Total	\$2,014	\$1,273	+\$741

* Models compared: The 2003 Saturn ION3 with automatic transmission and A/C and the 2003 Honda Civic DX coupe with automatic transmission and A/C.

* Disposition fee: This is a paperwork charge for getting the vehicle ready for resale after the lease end.

Engineering Economic Decisions

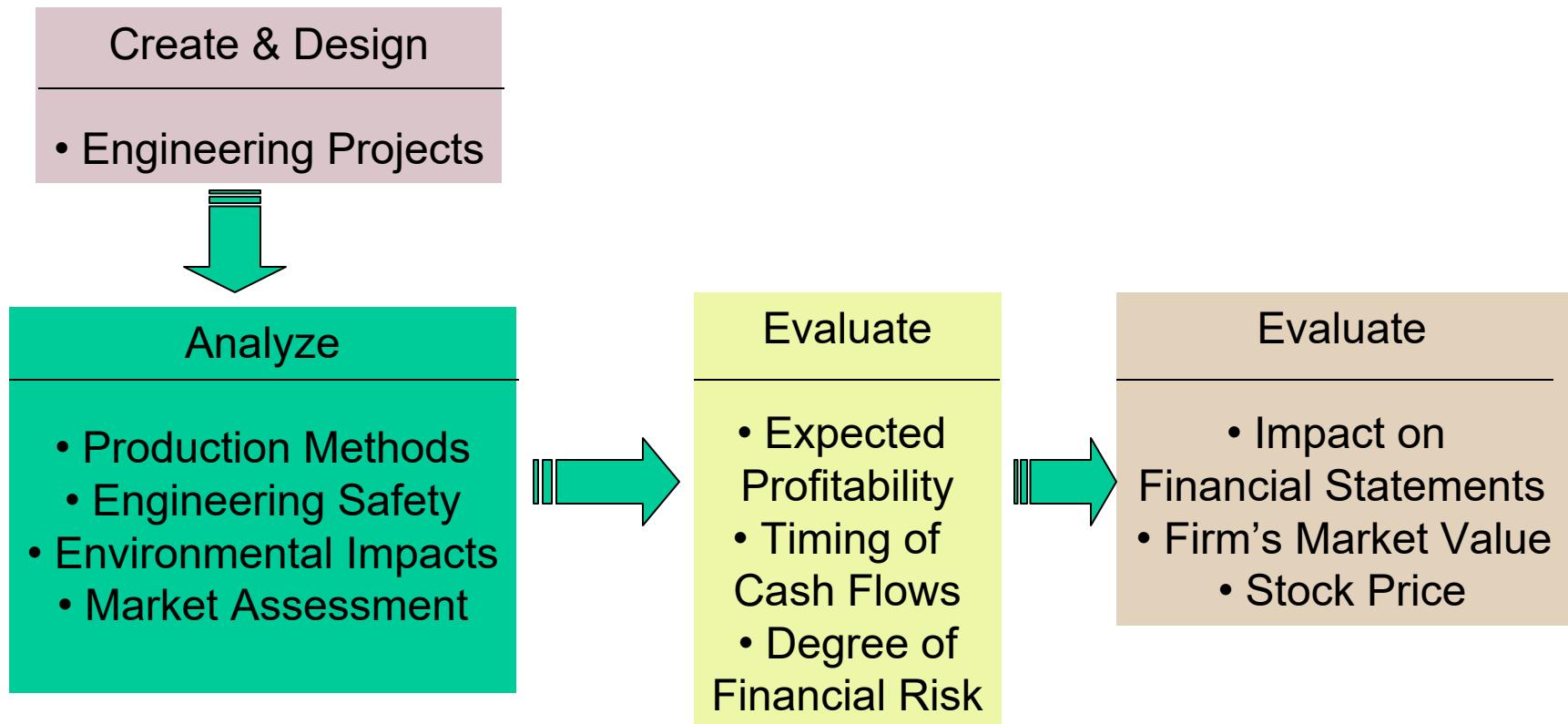


Predicting the Future

- Required investment
- Forecasting product demand
- Estimating selling price
- Estimating manufacturing cost
- Estimating product life



Role of Engineers in Business



Accounting vs. Engineering Economy

Evaluating past performance



Accounting

Evaluating and predicting future events



Engineering Economy

Past

Present

Future

Two Factors in Engineering Economic Decisions

The factors of **time** and **uncertainty** are the defining aspects of any engineering economic decisions

A Large-Scale Engineering Project

- Requires a large sum of investment
- Takes a long time to see the financial outcomes
- Difficult to predict the revenue and cost streams



Types of Strategic Engineering Economic Decisions in Manufacturing Sector

- q Service Improvement
- q Equipment and Process Selection
- q Equipment Replacement
- q New Product and Product Expansion
- q Cost Reduction

Service Improvement

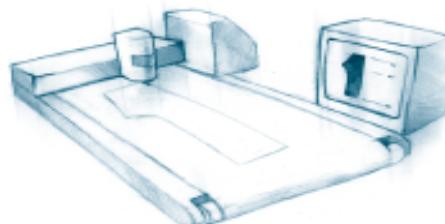
- How many more jeans would Levi need to sell to justify the cost of additional robotic tailors?



A sales clerk measures the customer using instructions from a computer as an aid.



The clerk enters the measurements and adjusts the data based on the customer's reaction to the samples.



The final measurements are relayed to a computerized fabric cutting machine at the factory.



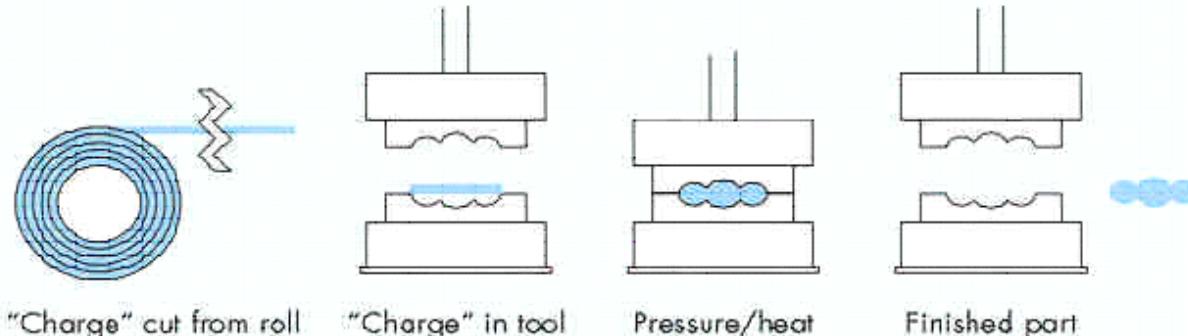
Bar codes are attached to the clothing to track it as it is assembled, washed, and prepared for shipment.

FIGURE 1.6 "From Data to Denim": Making customized blue jeans for women, a new computerized system being installed at some Original Levi's Stores allows women to order customized blue jeans

Equipment & Process Selection

- How do you choose between Plastic SMC and Steel sheet stock for the auto body panel?
- The choice of material will dictate the manufacturing process for the body panel as well as manufacturing costs.

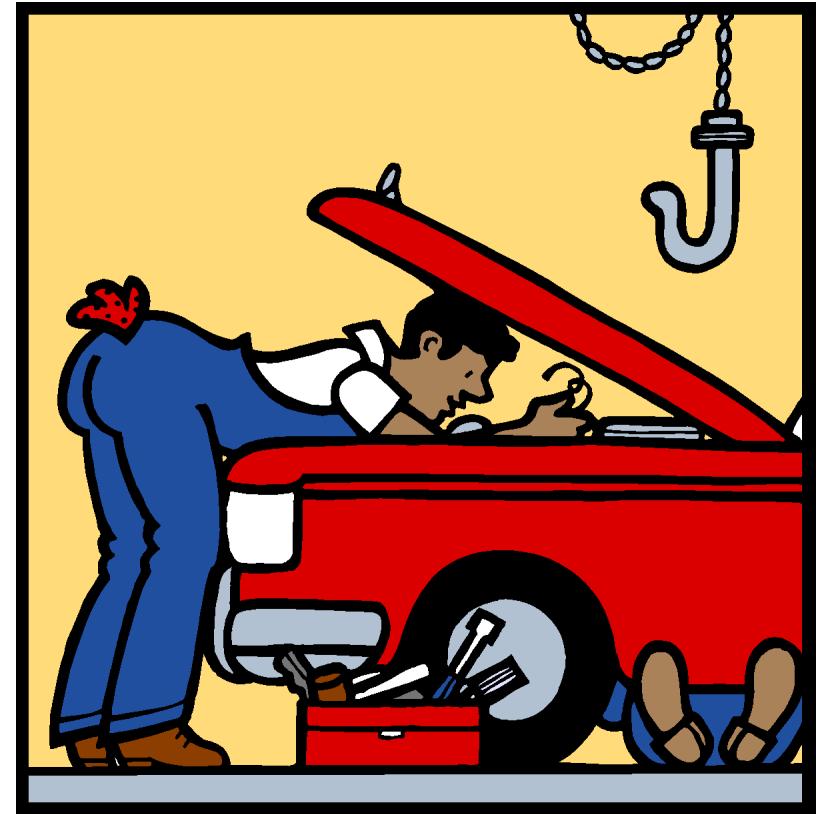
Which Material to Choose?



Description	Plastic SMC	Steel Sheet Stock
Material cost (\$/kg)	\$1.65	\$0.77
Machinery investment	\$2.1 million	\$24.2 million
Tooling investment	\$0.683 million	\$4 million
Cycle time (minute/part)	2.0	0.1

Equipment Replacement Problem

- Now is the time to replace the old machine?
- If not, when is the right time to replace the old equipment?



New Product and Product Expansion

- Shall we build or acquire a new facility to meet the increased demand?
- Is it worth spending money to market a new product?



Example - MACH 3 Project

- R&D investment: \$750 million
- Product promotion through advertising: \$300 million
- Priced to sell at 35% higher than Sensor Excel (about \$1.50 extra per shave).
- **Question 1:** Would consumers pay \$1.50 extra for a shave with greater smoothness and less irritation?
- **Question 2:** What would happen if blade consumption dropped more than 10% due to the longer blade life of the new razor?



Cost Reduction

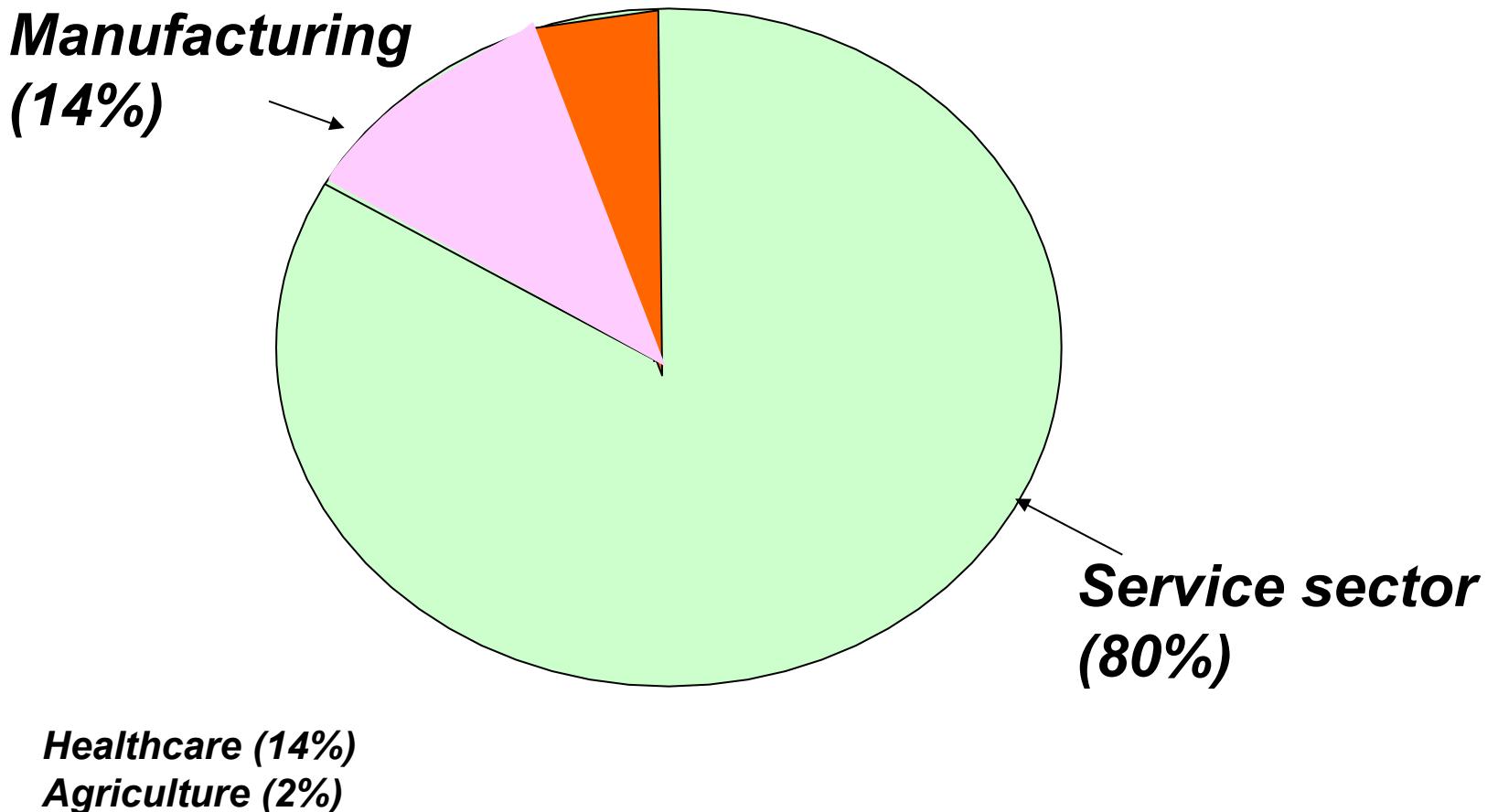
- Should a company buy equipment to perform an operation now done manually?
- Should spend money now in order to save more money later?



Types of Strategic Engineering Economic Decisions in Service Sector

- q Commercial Transportation
- q Logistics and Distribution
- q Healthcare Industry
- q Electronic Markets and Auctions
- q Financial Engineering
- q Retails
- q Hospitality and Entertainment
- q Customer Service and Maintenance

U.S. Gross Domestic Products (GDP)



Industrial Employment

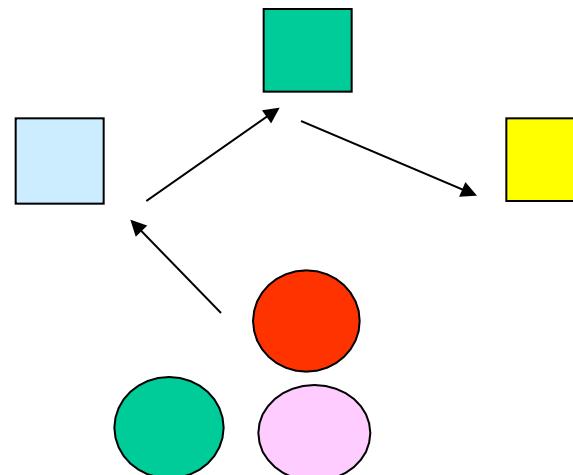
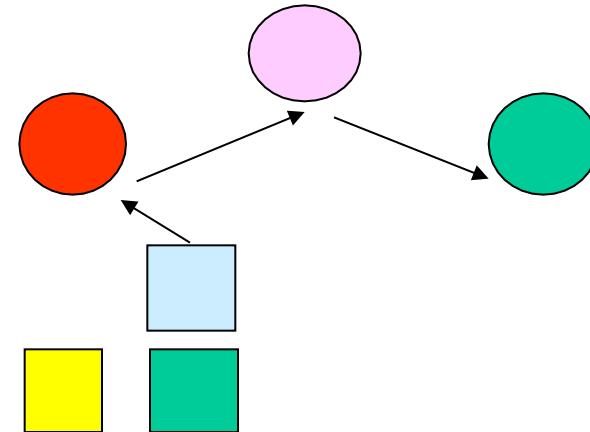
Industry	1993 Employment distribution	1983-94 National Average	1994- 2005 Projected Change
Manufacturing	12.6%	-0.70%	-7.2%
Services	30.5%	60.0%	39.0%
Retail trade	16.7%	31.1%	13.0%
Financial	8.0%	26.8%	6.3%

Source: Bureau of Economic Analysis/Bureau of Labor Statistics

Example - Healthcare Delivery

Which plan is more economically viable?

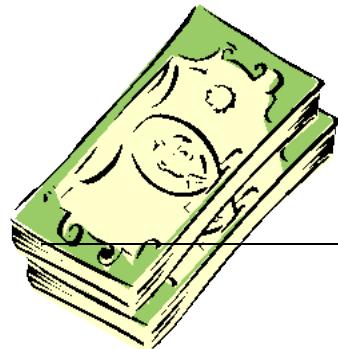
- **Traditional Plan:**
Patients visit each service provider.
- **New Plan:** Each service provider visits patients



Fundamental Principles of Engineering Economics

- **Principle 1:** A nearby dollar is worth more than a distant dollar
- **Principle 2:** All it counts is the differences among alternatives
- **Principle 3:** Marginal revenue must exceed marginal cost
- **Principle 4:** Additional risk is not taken without the expected additional return

Principle 1: A nearby dollar is worth more than a distant dollar



Today



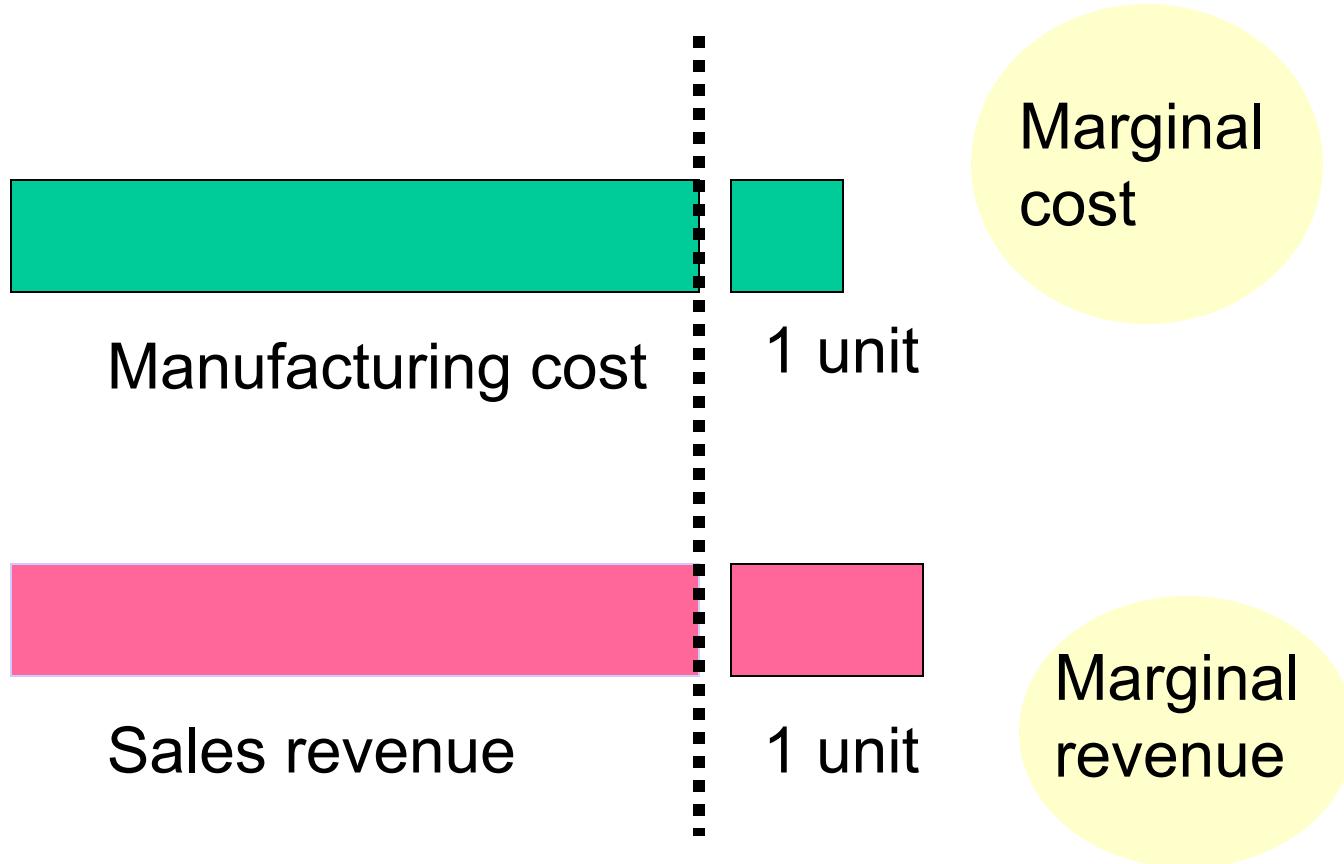
6-month later

Principle 2: All it counts is the differences among alternatives

Option	Monthly Fuel Cost	Monthly Maintenance	Cash outlay at signing	Monthly payment	Salvage Value at end of year 3
Buy	\$960	\$550	\$6,500	\$350	\$9,000
Lease	\$960	\$550	\$2,400	\$550	0

Irrelevant items in decision making

Principle 3: Marginal revenue must exceed marginal cost



Principle 4: Additional risk is not taken without the expected additional return

Investment Class	Potential Risk	Expected Return
Savings account (cash)	Low/None	1.5%
Bond (debt)	Moderate	4.8%
Stock (equity)	High	11.5%

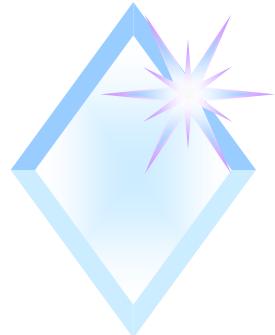
Summary

- The term **engineering economic decision** refers to all investment decisions relating to engineering projects.
- The five main types of engineering economic decisions are (1) **service improvement**, (2) **equipment and process selection**, (3) **equipment replacement**, (4) **new product and product expansion**, and (5) **cost reduction**.
- The factors of **time** and **uncertainty** are the defining aspects of any investment project.



BASIC CONCEPTS:

DEMAND, SUPPLY, AND EQUILIBRIUM



DEMAND

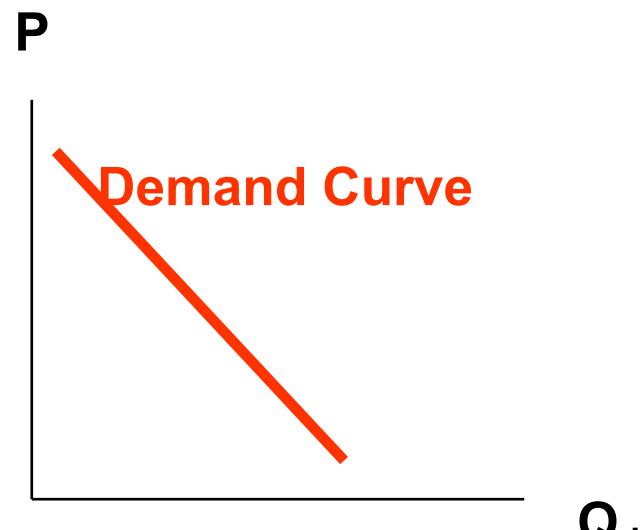
$$Q_d = f(P \mid PO, M, POP, SPPD)$$



Market Demand Curve

n A market demand curve is defined as

- | the alternative **quantities** of a good
- | that all consumers in a particular market
- | are willing and able to buy as **price** varies,
- | holding all other factors constant.



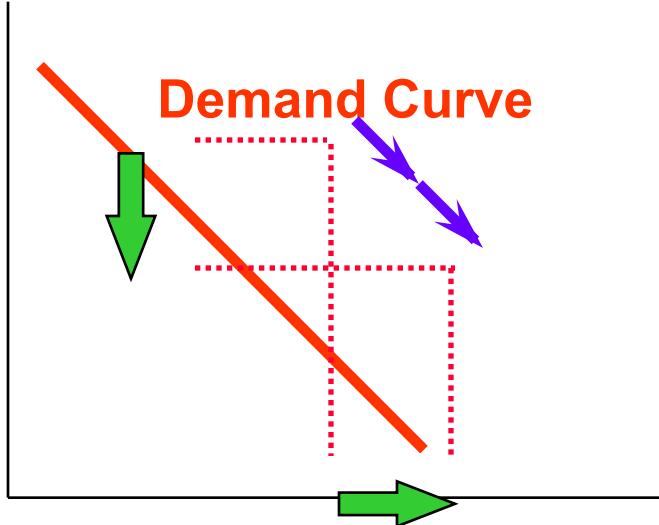


Change in Quantity Demanded (Movement Along a Demand Curve)

$$Q_d = f(P)$$

holding constant other factors)

P



A movement along a demand curve occurs when **own price changes**, holding constant other factors.

What are the other factors that we are holding constant?

Q_d



Other Factors Affecting Demand

n The factors holding constant are:

- | the prices of other goods including substitutes and complements (**PO**),
- | aggregate consumer money income (**M**),
- | consumer population (**POP**), and
- | Non-economic factors including **social**, **physiological**, **psychological**, and **demographic factors unique to the consumers in the market** (**SPPD**).

$$Q_d = f(P \mid PO, M, POP, SPPD)$$



Change in Demand (Shift in the Position of the Demand Curve)

- n It is important to distinguish between:
 - | a movement along a demand curve (**change in quantity demanded**) and
 - | a shift in the position of the demand curve (**change in demand**).
- n A movement along a demand curve occurs when **own price changes**, holding constant PO, M, POP, and SPPD.
- n A shift in the demand curve occurs when we **change one of those factors being held constant**.

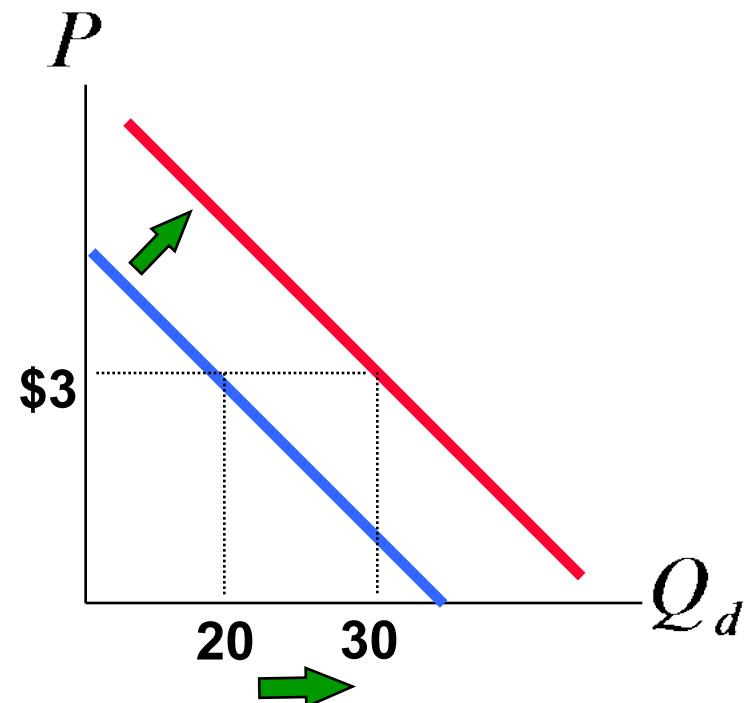


Shift in Demand: Population (POP)

With an increase in POP, the demand curve shifts to the right.

With the demand curve shifting to the right, the quantity demanded increases for all prices.

Factors that lead consumers to change demand quantities at the same price are referred to as **demand shifters**.



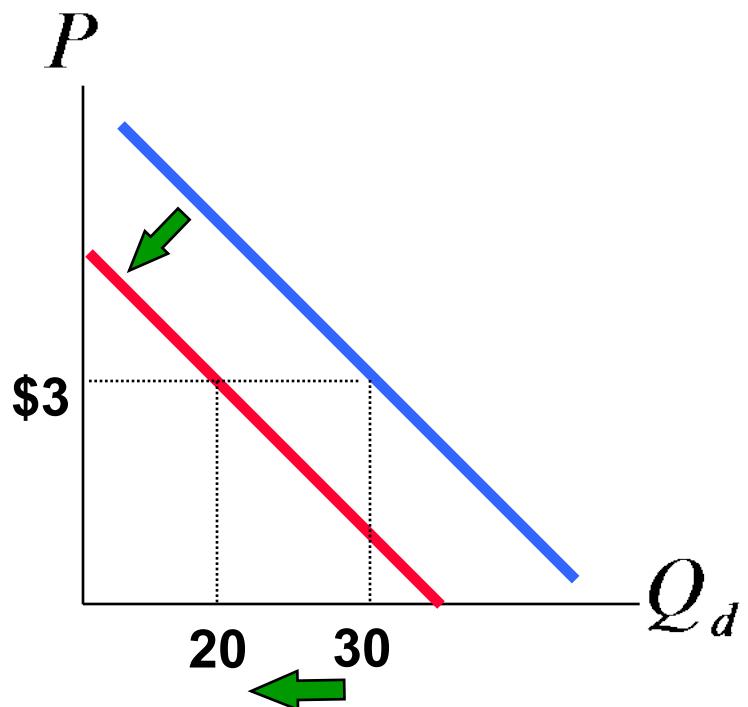


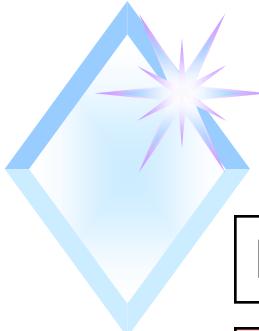
Demand Shifter: Noneconomic Factor (SPPD)

Consider the consumption trend of moving away from foods that are perceived to be high in fat and cholesterol content.

This can be thought of as a change in one component of the SPPD.

As a result of this change in the dietary habit of consumers, the demand for red meat has shifted to the left.





Demand Shifter: Price of Other Good (PO)

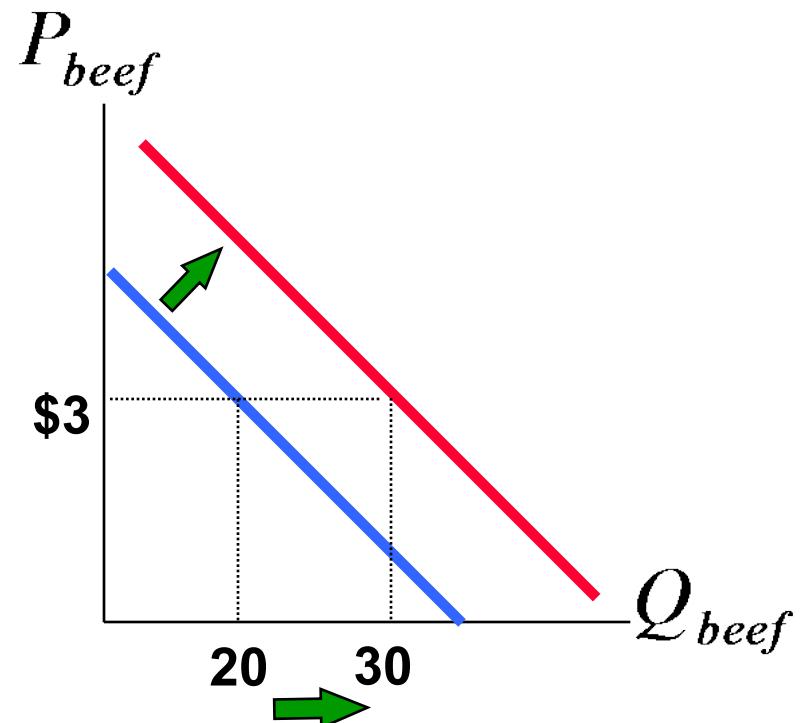
How about an increase in one of the prices of other goods?

Well, it depends!

With an increase in the price of a **substitute**, the demand curve shifts to the **right**.

As the price of **pork** increases, consumers demand more **beef** even though the price of beef does not change.

This is because beef is now **relatively** more inexpensive compared to pork.

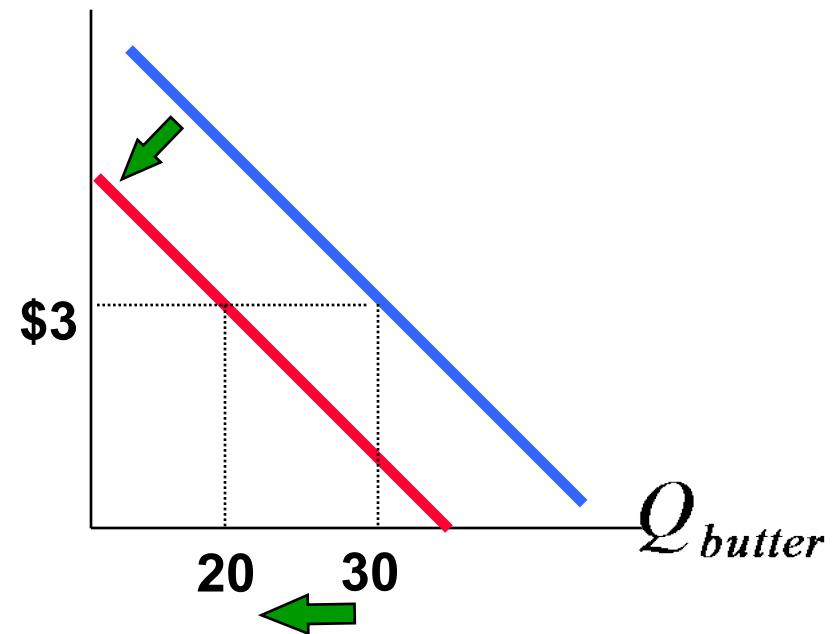


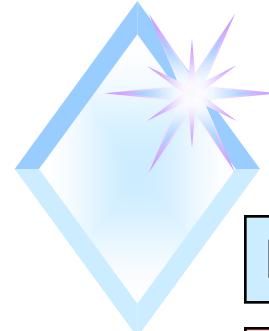
On the other hand, with an increase in the price of a complement, the demand curve shifts to the left.

- n As the price of bread increases, the demand for bread decreases.

- | Hence the demand for butter decreases even though the price P_{butter} of butter stays the same.

This is because butter is, in general, complementary to bread.





Demand Shifter: Money Income (M)

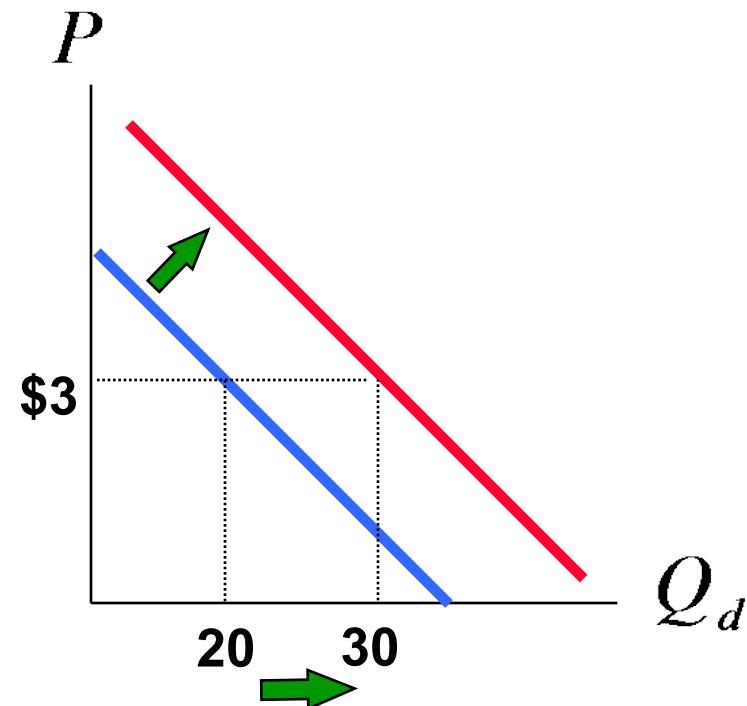
How about an increase in income?

Again, it depends!

In most cases, an increase in income shifts the demand curve to the **right**.

- n This is consistent with the idea that as income increases people buy more of the products.

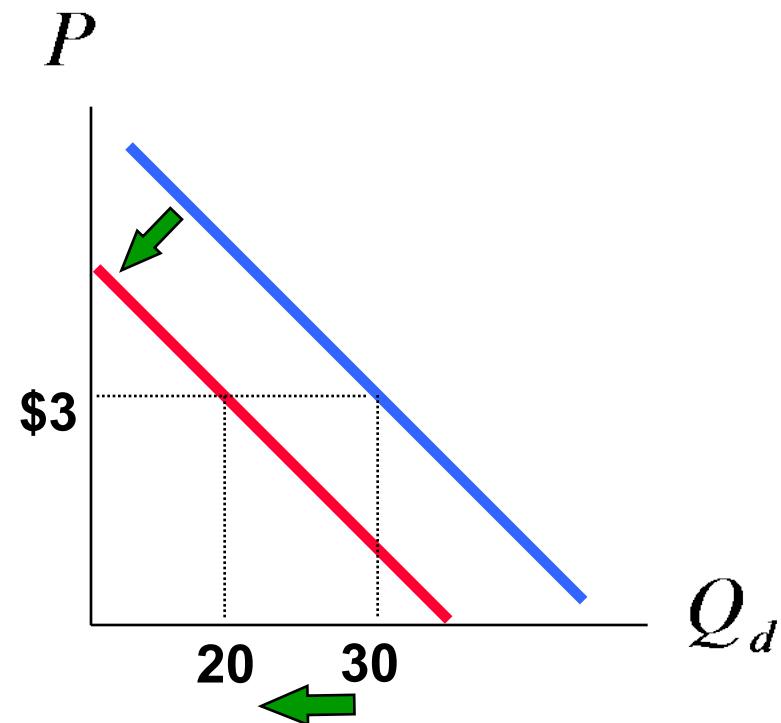
- | In this case, the good is called a **normal good**.

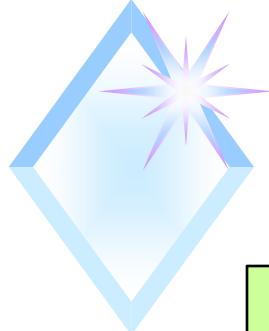


A few commodities such as dry beans and potato are called **inferior goods**.

As income increases consumers tend to buy less of the inferior goods as they can now afford more expensive normal goods.

That is, an increase in income shifts the demand curve for an inferior good to the left.

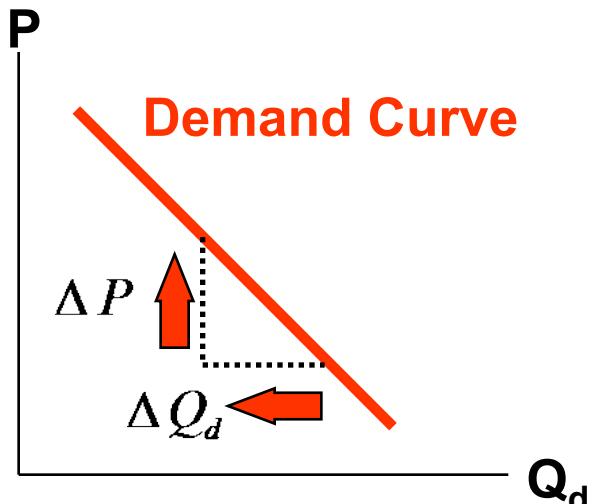




Slope of a Demand Curve

$$\text{slope} \equiv \frac{\text{rise}}{\text{run}}$$

From the definition, the slope of a demand curve is the change in price divided by change in quantity demanded:



slope of demand curve

$$= -\frac{\Delta P}{\Delta Q_d} < \text{ or } = 0$$



The Own-Price Elasticity of Demand

$$\epsilon_{Q_d, P} \implies \epsilon$$

The own-price elasticity of demand, ϵ , is defined as the percent change in quantity demanded divided by the percent change in own price.

A 10 percent increase in price is the same percentage increase whether the price is measured in American dollars or English pounds.

Thus, measuring increases in percentage terms keeps the definition of elasticity **unit-free**.

A convenient way to think of an own-price elasticity of demand is as **the percentage change in quantity demanded corresponding to a one percentage change in own price**, holding other factors constant.



SUPPLY

$$Q_s = f(P | PI, PO, CAP)$$



Factors Determining Supply

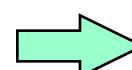
- n What are the factors determining supply quantity?
 - | It depends on the output price (**P**).
 - | It depends on the input prices (**PI**).
 - | It depends on the price of alternative output (**PO**).
 - 9 This is the opportunity costs of not producing other commodities.
 - | It also depends on such noneconomic factors as capacity, technology, and weather that firms face (**CAP**).



Supply Curve

A supply curve is the relationship between quantity supplied for a good (Q_s) and its price (P), holding constant other factors.

The factors which we are holding constant include: input prices (PI), prices of alternative outputs (PO), and noneconomic factors (CAP).



Supply Shifters

$$Q_s = f(P | PI, PO, CAP)$$



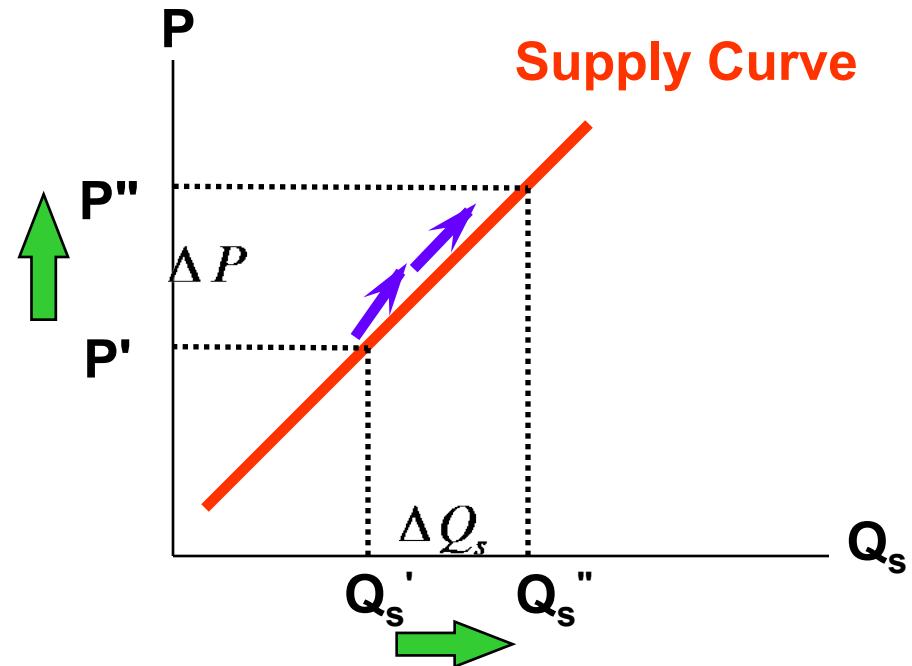
Change in Quantity Supplied (Movement Along a Supply Curve)

Notice that the supply curve has a positive slope.

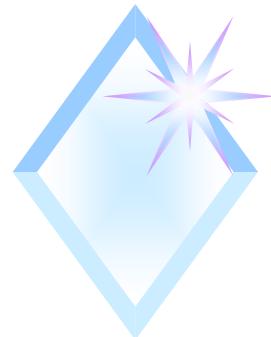
slope of supply curve

$$= \frac{\Delta P}{\Delta Q_s} \geq 0$$

That is, as price increases, the quantity supplied moves up along the supply curve.

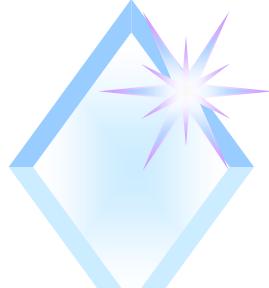


$$Q_s = f(P | PI, PO, CAP)$$



Change in Supply (Shift in the Position of the Supply Curve)

- n It is important to distinguish between:
 - | a movement along a supply curve (**change in quantity supplied**) and
 - | a shift in the position of the supply curve (**change in supply**).
- n A movement along a supply curve occurs when **output price changes**, holding constant PI, PO, and CAP.
- n A shift in the supply curve occurs when we **change one of those factors being held constant**.

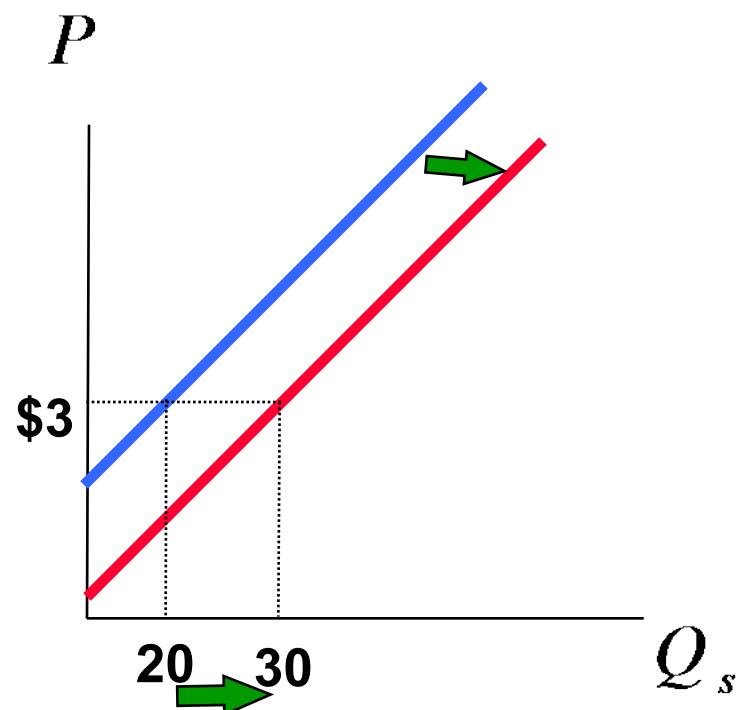


Shift in Supply: Input Prices (PI)

With a decrease in input prices, the supply curve shifts to the right.

With the supply curve shifting to the right, the quantity supplied increases for all levels of output price.

Factors that lead producers to change supply quantities at the same price are referred to as **supply shifters**.



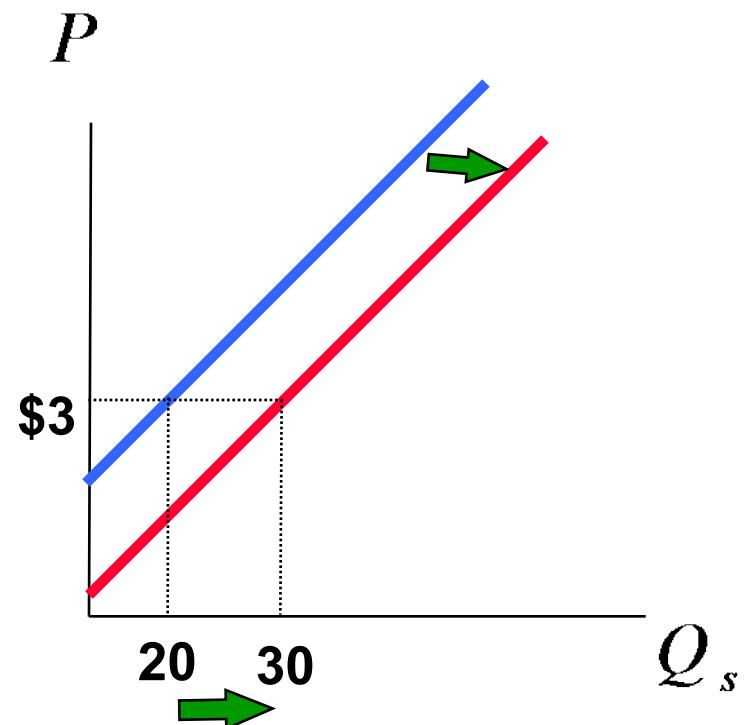


Shift in Supply: Alternative Output Prices (PO)

With a decrease in alternative output prices, the supply curve for the commodity in question shifts to the right.

For example, a decrease in sorghum price means that the land and labor used in sorghum production will now be less profitable than if used in wheat production.

Hence, a decrease in sorghum price shifts the supply curve of wheat to the right.

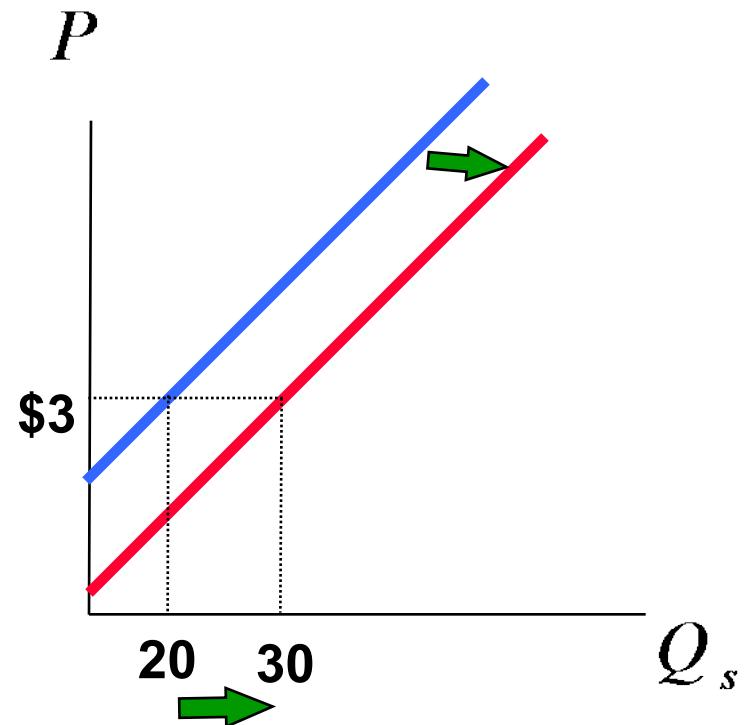




Shift in Supply: Technology (CAP)

An improvement in technology is defined as something that enables firms to produce more output with the same quantity of inputs as previously.

Thus, with improved technology, the supply curve shifts to the right.



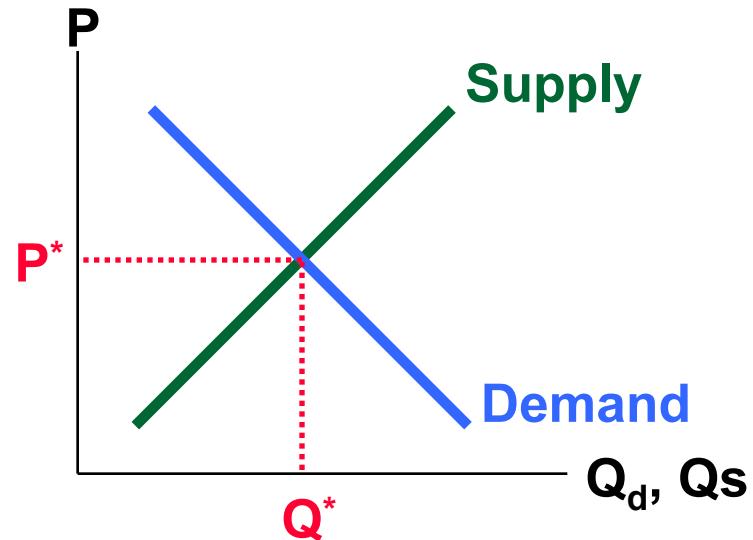


EQUILIBRIUM



Price Determination

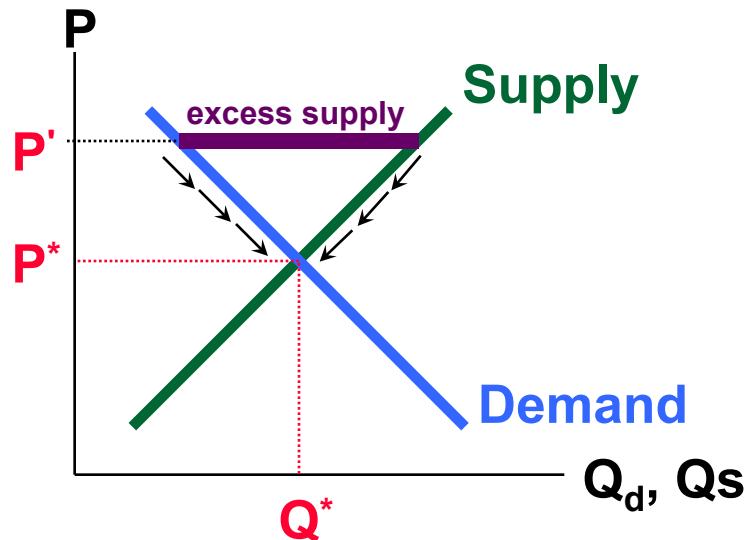
- n Now, we examine how the equilibrium price is determined.
 - | Equilibrium implies "equal," "balanced," and "stable."
 - | The concept of equilibrium price is simply the price at which **quantity demanded equals quantity supplied**.
- n Thus, the intersection point of the demand and supply curves indicates the equilibrium price.





Disequilibrium

- n In a perfectly competitive market, prices other than the equilibrium price cannot be sustained.
- n At prices above the equilibrium price, we have a situation called **excess supply**.
 - I This is because the quantity that consumers are willing to buy is less than the quantity producers are willing to sell.



Some or all producers will begin to offer their products at a lower price.

The lower price discourages some supply and encourages additional demand.

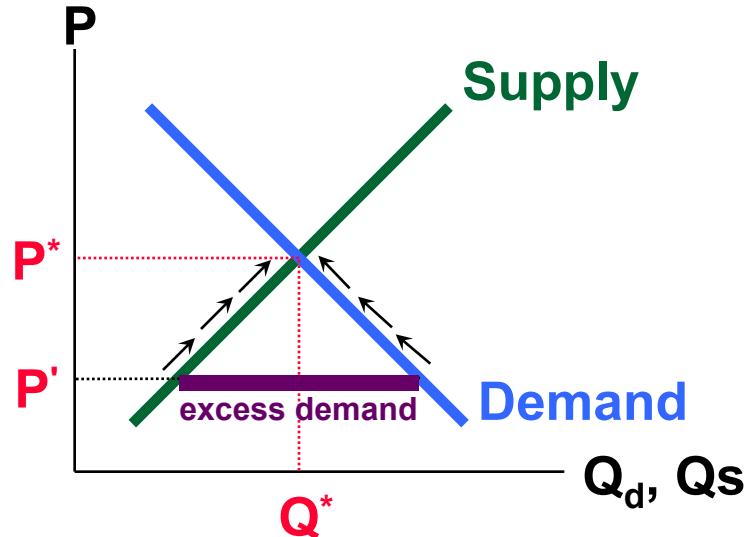
The process continues until price is driven down to P^* , at which point $Q_d = Q_s$.

Disequilibrium

- n On the other hand, at prices below the equilibrium price, we have a situation called **excess demand**.

- | This is because the quantity that consumers are willing to buy is more than the quantity producers are willing to sell.

In this case, consumers will begin bidding up the price.



The higher price discourages some demand and encourages additional supply.

The process continues until price is driven to P^* , at which point $Q_d = Q_s$.

Accordingly, only the equilibrium price can be sustained.



Planning Commission (India)

- n The Planning Commission is an institution in the Government of India, which formulates India's Five-Year Plans, among other functions.

History :-

- n Rudimentary economic planning, deriving the sovereign authority of the state, first began in India in 1930s under the British Raj, and the colonial government of India formally established a planning board that functioned from 1944 to 1946. Private industrialists and economist formulated at least three development plans in 1944.
- n After India gained independence, a formal model of planning was adopted, and the planning commission, reporting directly to the Prime Minister of India was established. Accordingly, the Planning Commission was set up on 15 March 1950, with Prime Minister Jawaharlal Nehru as the chairman.

- 
- n The first Five-year Plan was launched in 1951 and two subsequent five-year plans were formulated till 1965, when there was a break because of the Indo-Pakistan Conflict. Two successive years of drought, devaluation of the currency, a general rise in prices and erosion of resources disrupted the planning process and after three Annual Plans between 1966 and 1969, the fourth Five-year plan was started in 1969.
 - n The Eighth Plan could not take off in 1990 due to the fast changing political situation at the Centre and the years 1990-91 and 1991-92 were treated as Annual Plans. The Eighth Plan was finally launched in 1992 after the initiation of structural adjustment policies.



For the first eight Plans the emphasis was on growing public sector with massive investments in basic and heavy industries, but since the launch of the Ninth Plan in 1997, the emphasis on the public sector has become less pronounced and the current thinking on planning in the country, in general, is that it should increasingly be of an indicative nature.



Organisation

- n The composition of the Commission has undergone a lot of change since its inception. With the Prime Minister as the ex-officio Chairman, the committee has a nominated Deputy Chairman, who is given the rank of a full Cabinet Minister. Mr. [Montek Singh Ahluwalia](#) is presently the Deputy Chairman of the Commission.
- n [Cabinet Ministers](#) with certain important portfolios act as part-time members of the Commission, while the full-time members as experts of various fields like Economics, Industry, Science and General Administration.
- n The Commission works through its various divisions, of which there are three kind:
- n General Planning Divisions
- n Programme Administration Divisions
- n The majority of experts in the Commission are [economists](#), making the Commission the biggest employer of the Indian Economic Services.
- n See also: [List of deputy chairpersons of the planning commission of India](#)

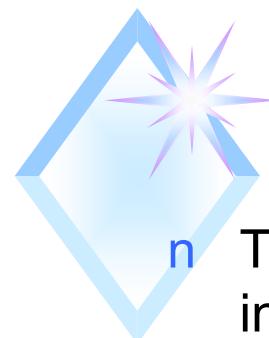


Five-Year Plans of India

- The economy of India is based in part on planning through its **five-year plans, developed, executed and monitored by the Planning Commission.**

First plan (1951-1956) :-

- The total plan budget of 206.8 billion INR.
- **Seven broad areas:**
- **Irrigation**
- **Energy (27.2 percent)**
- **Agriculture**
- **Community development (17.4 percent)**
- **Transport and communications (24 percent),**
- **Industry (8.4 percent),**
- **Social services (16.64 percent)**
- **Land rehabilitation.**



Second plan (1956-1961)

- n The second five-year plan focused on industry, especially heavy industry.
- n Domestic production of industrial products was encouraged, particularly in the development of the public sector.
- n The plan followed the Mahalanobis model, an economic development model developed by the Indian statistician Prasanta Chandra Mahalanobis in 1953.
- n The plan attempted to determine the optimal allocation of investment between productive sectors in order to maximise long-run economic growth .
- n It used the prevalent state of art techniques of operations research and optimization as well as the novel applications of statistical models developed at the Indian Statistical Institute.
- n The plan assumed a closed economy in which the main trading activity would be centered on importing capital goods

- 
- n Hydroelectric power projects and five steel mills at Bhilai, Durgapur, and Rourkela were established.
 - n Coal production was increased. More railway lines were added in the north east.
 - n The Atomic Energy Commission was formed in 1957 with Homi J. Bhabha as the first chairman.
 - n The Tata Institute of Fundamental Research was established as a research institute.
 - n In 1957 a talent search and scholarship program was begun to find talented young students to train for work in nuclear power.



Third plan (1961-1966)

- n The third plan stressed on agriculture and improving production of rice, but the brief Sino-Indian War in 1962 exposed weaknesses in the economy and shifted the focus towards defense.
- n In 1965-1966, The war led to inflation and the priority was shifted to price stabilization.
- n The construction of dams continued. Many cement and fertilizer plants were also built. Punjab begun producing an abundance of wheat.
- n Many primary schools were started in rural areas.
- n In an effort to bring democracy to the grassroot level, Panchayat elections were started and the states were given more development responsibilities.
- n State electricity boards and state secondary education boards were formed. States were made responsible for secondary and higher education.
- n State road transportation corporations were formed and local road building became a state responsibility.
- n Gross Domestic Product rate during this duration was lower at 2.7% due to 1962 Sino-Indian War and Indo-Pakistani War of 1965.



Fourth plan (1969-1974)

- n The Indira Gandhi government nationalized 14 major Indian banks.
- n The Green Revolution in India advanced agriculture..
- n In addition, the situation in East Pakistan (now independent Bangladesh) was becoming dire as the Indo-Pakistani War of 1971 and Bangladesh Liberation War took place.
- n Funds earmarked for the industrial development had to be used for the war effort.
- n India also performed the Smiling Buddha underground nuclear test in 1974, partially in response to the United States deployment of the Seventh Fleet in the Bay of Bengal to warn India against attacking West Pakistan and widening the war.



Fifth plan (1974-1979)

- n Stress was laid on employment, poverty alleviation, and justice.
- n The plan also focused on self-reliance in agricultural production and defense.
- n In 1978 the newly elected Morarji Desai government rejected the plan.
- n Electricity Supply Act was enacted in 1975, which enabled the Central Government to enter into power generation and transmission.



Sixth plan (1980-1985)

- n The young prime minister aimed for rapid industrial development, especially in the area of information technology. Progress was slow, however, partly because of caution on the part of labor and communist leaders.
- n The Indian national highway system was introduced for the first time and many roads were widened to accommodate the increasing traffic. Tourism also expanded.
- n The sixth plan also marked the beginning of economic liberalization. Price controls were eliminated and ration shops were closed. This led to an increase in food prices and an increased cost of living.
- n Family planning also was expanded in order to prevent overpopulation.



Seventh plan (1985-1989)

- n The plan lay stress on improving the productivity level of industries by up gradation of technology.
- n The main objectives of the 7th five year plans were to establish growth in the areas of increasing economic productivity, production of food grains, and generating employment opportunities.
- n The 7th Plan had strived towards socialism and energy production at large. The thrust areas of the 7th Five year plan have been enlisted below:
 - | Social Justice.
 - | Removal of oppression of the weak.
 - | Using modern technology.
 - | Agricultural development.
 - | Anti-poverty programs.
 - | Full supply of food, clothing, and shelter.
 - | Increasing productivity of small and large scale farmers.
 - | Making India an Independent Economy .

- 
- n Some of the expected outcomes of the Seventh Five Year Plan India are given below:
 - | Balance of Payments (estimates): Export - Rs. 33 thousand crore, Imports - (-)Rs.54 thousand crore, Trade Balance - (-)Rs.21 thousand crore
 - | Merchandise exports (estimates): Rs. 60,653 crore
 - | Merchandise imports (estimates): Rs. 95,437 crore
 - | Projections for Balance of Payments: Export - Rs.60.7 thousand crore, Imports - (-) 95.4 thousand crore, Trade Balance- (-) Rs.34.7 thousand crore
 - n Seventh Five Year Plan India strove to bring about a self-sustained economy in the country with valuable contributions from voluntary agencies and the general populace.



Period between 1989-91

- n 1989-91 was a period of political instability in India and hence no five year plan was implemented. Between 1990 and 1992, there were only Annual Plans. In 1991, India faced a crisis in Foreign Exchange (Forex) reserves, left with reserves of only about \$1 billion (US).
- n Thus, under pressure, the country took the risk of reforming the socialist economy.
- n The Government led one of the most important administrations in India's modern history overseeing a major economic transformation and several incidents affecting national security.
- n At that time Dr. Manmohan Singh (currently, Prime Minister of India) launched India's free market reforms that brought the nearly bankrupt nation back from the edge.
- n It was the beginning of privatization and liberalization in India.



Eighth plan (1992-1997)

- n Modernization of industries was a major highlight of the Eighth Plan.
- n Under this plan, the gradual opening of the Indian economy was undertaken to correct the burgeoning deficit and foreign debt.
- n Meanwhile India became a member of the World Trade Organization on 1 January 1995.
- n This plan can be termed as Rao and Manmohan model of Economic development.
- n The major objectives included, containing population growth, poverty reduction, employment generation, strengthening the infrastructure, Institutional building, Human Resource development, Involvement of Panchayat raj, Nagarapalikas, N.G.O.S and Decentralisation and peoples participation.
- n Energy was given priority with 26.6% of the outlay.
- n An average annual growth rate of 6.7% against the target 5.6% was achieved.



Ninth Plan (1997 - 2002)

- n Ninth Five Year Plan India runs through the period from 1997 to 2002 with the main aim of attaining objectives like speedy industrialization, human development, full-scale employment, poverty reduction, and self-reliance on domestic resources.
- n The main objectives of the Ninth Five Year Plan India are:
- n to prioritize agricultural sector and emphasize on the rural development
- n to generate adequate employment opportunities and promote poverty reduction
- n to stabilize the prices in order to accelerate the growth rate of the economy
- n to ensure food and nutritional security
- n to provide for the basic infrastructural facilities like education for all, safe drinking water, primary health care, transport, energy

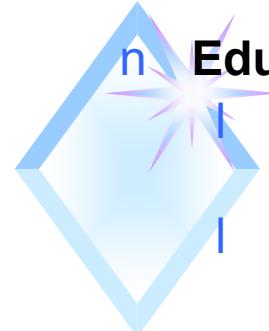


- n to check the growing population increase
- n to encourage social issues like women empowerment, conservation of certain benefits for the Special Groups of the society
- n to create a liberal market for increase in private investments
- n During the Ninth Plan period, the growth rate was 5.35 per cent, a percentage point lower than the target GDP growth of 6.5 per cent.



Eleventh plan (2007-2012)

- n **The eleventh plan has the following objectives:**
- n **Income & Poverty**
 - | Accelerate [GDP](#) growth from 8% to 10% and then maintain at 10% in the 12th Plan in order to double per capita income by 2016-17
 - | Increase agricultural GDP growth rate to 4% per year to ensure a broader spread of benefits
 - | Create 70 million new work opportunities.
 - | Reduce educated unemployment to below 5%.
 - | Raise real wage rate of unskilled workers by 20 percent.
 - | Reduce the headcount ratio of consumption poverty by 10 percentage points.



n Education

- | Reduce dropout rates of children from elementary school from 52.2% in 2003-04 to 20% by 2011-12
- | Develop minimum standards of educational attainment in elementary school, and by regular testing monitor effectiveness of education to ensure quality
- | Increase literacy rate for persons of age 7 years or more to 85%
- | Lower gender gap in literacy to 10 percentage points
- | Increase the percentage of each cohort going to higher education from the present 10% to 15% by the end of the plan.

n Health

- | Reduce infant mortality rate to 28 and maternal mortality ratio to 1 per 1000 live births
- | Reduce Total Fertility Rate to 2.1
- | Provide clean drinking water for all by 2009 and ensure that there are no slip-backs
- | Reduce malnutrition among children of age group 0-3 to half its present level
- | Reduce anaemia among women and girls by 50% by the end of the plan.

n **Women and Children**

- | Raise the sex ratio for age group 0-6 to 935 by 2011-12 and to 950 by 2016-17
- | Ensure that at least 33 percent of the direct and indirect beneficiaries of all government schemes are women and girl children
- | Ensure that all children enjoy a safe childhood, without any compulsion to work

n **Infrastructure**

- | Ensure electricity connection to all villages and BPL households by 2009 and round-the-clock power.
- | Ensure all-weather road connection to all habitation with population 1000 and above (500 in hilly and tribal areas) by 2009, and ensure coverage of all significant habitation by 2015
- | Connect every village by telephone by November 2007 and provide broadband connectivity to all villages by 2012
- | Provide homestead sites to all by 2012 and step up the pace of house construction for rural poor to cover all the poor by 2016-17 .



n

Environment

- | Increase forest and tree cover by 5 percentage points.
- | Attain WHO standards of air quality in all major cities by 2011-12.
- | Treat all urban waste water by 2011-12 to clean river waters.
- | Increase energy efficiency by 20 percentage points by 2016-17.



Economy of India

- n The **economy of India** is the fourth largest in the world by GDP measured on a purchasing power parity (PPP) basis[5] and the twelfth largest in the world by market exchange rates.[6]
- n India was under socialist-based policies for an entire generation from the 1950s until the 1980s.
- n The economy was characterised by extensive regulation, protectionism, and public ownership, leading to pervasive corruption and slow growth.
- n Since 1991, continuing economic liberalization has moved the economy towards a market-based system
- n By 2009, India had prominently established itself as the world's second-fastest growing major economy
- n By 2010, India is expected to overtake China as the world's fastest growing major economy.



- n **Economy of India_Currency :-**
Indian Rupee (INR) (Rs) = 100 Paise
- n **Fiscal year**
:- April 1–March 31
- n **Trade organisations :-WTO, SAFTA**

- n The economy of India is a developing mixed economy. It is the world's seventh-largest economy by nominal GDP and the third-largest by purchasing power parity. The country ranks 139th in per capita GDP with \$2,134 and 122nd in per capita GDP with \$7,783 as of 2018. [Wikipedia](#)
- n **GDP per capita rank:** 139th (nominal, 2017) 121st ([PPP](#), 2017)
- n **GDP rank:** 5th (nominal, 2018) 3rd ([PPP](#), 2018)
- n **GDP per capita:** \$2,134 (nominal; 2018 est); \$7,783 ([PPP](#); 2018 est)
- n **GDP by sector:** [Agriculture](#): 17.32%; Industry: 29.02%; Services: 53.66% (2016 est.)
- n **GDP:** \$2.948 trillion (nominal; 2018 est); \$10.385 trillion ([PPP](#); 2018 est)
- n **GDP growth:** 7.1% (16/17) 6.7% (17/18) 7.3% (18/19e) 7.5% (19/20f) 7.2% ([MOSPI](#)) Q4, 2018–19)
- n **Economic aid:** \$2.68 billion (2016)



- n \$2.948 trillion (nominal; 2018 est)^[3]
- n \$10.385 trillion (PPP; 2018 est)^[3]
- n GDP rank [5th \(nominal, 2018\)](#)
- n [3rd \(PPP, 2018\)](#)
- n GDP growth
- n 7.1% (16/17) 6.7% (17/18)
- n 7.3% (18/19e) 7.5% (19/20f)^[4]
- n 7.2% ([MOSPI](#) Q4, 2018–19)^[5] GDP per capita
- n \$2,134 (nominal; 2018 est)^[3]
- n \$7,783 (PPP; 2018 est)^[3] GDP per capita rank
- n [139th \(nominal, 2017\)](#)
- n [121st \(PPP, 2017\)](#) GDP by sector
- n [Agriculture](#): 17.32%
- n [Industry](#): 29.02%
- n [Services](#): 53.66% (2016 est.)^[6] [Inflation \(CPI\)](#)
- n 2.05% (January 2019)^[7] [Base borrowing rate](#)
- n 6.50% (as on 8 Feb. 2019)^[8]
- n Population below [poverty line](#) 3.7% (December 2018)^[9]

Human Development Index 0.640 (2017) medium^[12] (130th)

Labour force 527.42 million (2018 est.)^[13]

Labour force by occupation

Agriculture: 47%

Industry: 22%

Services: 31% (FY 2014 est.)^[14] Unemployment 3.53% (2018)^[15]

Average net salary

₹113,000 (US\$1,600) (2017–18)

Ease-of-doing-business rank 77 (2019)^[16]

External Exports \$303.4 bn (2017–18)^[20]

Export goods Agricultural products 12.8%

Fuels and mining products 13.8%

Manufacturers 70.5%

Others 2.9%^[21]

Main export partners

European Union 17.4%

United States 16.1%

United Arab Emirates 9.6%

Hong Kong 5%

China 4.2%

Other 47.8%

Main import partners

China 16.6%

European Union 10.4%

United States 5.7%

United Arab Emirates 4.9%

Saudi Arabia 4.6%

Other 57.9%

FDI stock Inward: \$377.68 billion

Outward: \$155.34 billion (2017)^[22]

^[24]Gross external debt \$510.4 billion (30 Sept. 2018)^[24]

Net international investment position \$391.9 billion (Sept. 2018)^[27]

Public finances Public debt 68.91% of GDP (2018 est.)^[28]

^[28]Budget balance - ₹12.25 trillion (US\$170 billion) (2018)

Revenues ₹39.86 trillion (US\$550 billion) (2018)^[29]

Expenses ₹52.11 trillion (US\$730 billion) (2018)

Economic aid \$2.68 billion (2016)^[30]

Credit rating

Standard & Poor's:^[31]

BBB- (Domestic)

BBB- (Foreign)

BBB+ (T&C Assessment)

Outlook: Stable



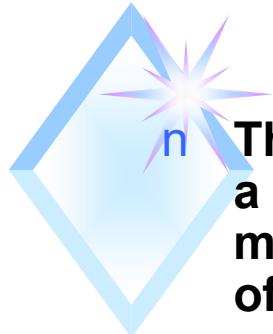
- n [**Moody's**](#):^[32]
Baa2
Outlook: Stable
- n [**Fitch**](#):^[33]
BBB-
Outlook: Stable
- n **Foreign reserves : \$406.667 billion (22 March 2019)**^[34]



The long-term growth prospective of the Indian economy is positive due to its young population, English proficiency, corresponding low dependency ratio, healthy saving and investment rates, and increasing integration into the global economy.^[40] India topped the [World Bank](#)'s growth outlook for the first time in fiscal year 2015–16, during which the economy grew 7.6%.^[41] Despite previous reforms, economic growth is still significantly slowed by bureaucracy, poor infrastructure, and [inflexible labor laws](#) (especially the inability to lay off workers in a business slowdown).

- 
- n A consumer price index (CPI) is a measure estimating the average price of consumer goods and services purchased by households.
 - n A consumer price index measures a price change for a constant market basket of goods and services from one period to the next within the same area (city, region, or nation).
 - n It is a price index determined by measuring the price of a standard group of goods meant to represent the typical market basket of a typical urban consumer.
 - n Related, but different, terms are the United Kingdom's CPI, RPI, and RPIX. It is one of several price indices calculated by most national statistical agencies. The percent change in the CPI is a measure estimating inflation. The CPI can be used to index (i.e., adjust for the effects of inflation) wages, salaries, pensions, and regulated or contracted prices.
 - n The CPI is, along with the population census and the National Income and Product Accounts, one of the most closely watched national economic statistics.

- 
- n Despite robust economic growth, India continues to face several major problems. The recent economic development has widened the economic inequality across the country. Despite sustained high economic growth rate, approximately 80% of its population lives on less than \$2 a day (PPP), more than double the same poverty rate in China.
 - n Even though the arrival of Green Revolution brought end to famines in India, 40% of children under the age of three are underweight and a third of all men and women suffer from chronic energy deficiency.



- n The gross domestic product (GDP) or gross domestic income (GDI), a basic measure of an economy's economic performance, is the market value of all final goods and services made within the borders of a nation in a year. [1] GDP can be defined in three ways, all of which are conceptually identical. First, it is equal to the total expenditures for all final goods and services produced within the country in a stipulated period of time (usually a 365-day year). Second, it is equal to the sum of the value added at every stage of production (the intermediate stages) by all the industries within a country, plus taxes less subsidies on products, in the period. Third, it is equal to the sum of the income generated by production in the country in the period—that is, compensation of employees, taxes on production and imports less subsidies, and gross operating surplus (or profits).[2] [3]
- n The most common approach to measuring and quantifying GDP is the expenditure method:
 - | $GDP = \text{private consumption} + \text{gross investment} + \text{government spending} + (\text{exports} - \text{imports})$, or,
 $GDP = C + I + G + (X - M)$.



n

"Gross" means that depreciation of capital stock is *not* subtracted out of GDP. If net investment (which is gross investment minus depreciation) is substituted for gross investment in the equation above, then the formula for net domestic product is obtained.

Consumption and investment in this equation are expenditure on final goods and services. The exports-minus-imports part of the equation (often called net exports) adjusts this by subtracting the part of this expenditure not produced domestically (the imports), and adding back in domestic area (the exports).

- n Economists (since Keynes) have preferred to split the general consumption term into two parts; private consumption, and public sector (or government) spending. Two advantages of dividing total consumption this way in theoretical macroeconomics are:
- n Private consumption is a central concern of welfare economics. The private investment and trade portions of the economy are ultimately directed (in mainstream economic models) to increases in long-term private consumption.
- n If separated from endogenous private consumption, government consumption can be treated as exogenous, [citation needed] so that different government spending levels can be considered within a meaningful macroeconomic framework.



**END OF
LECTURE**

CHAPTER 3

TIME VALUE OF MONEY



CHAPTER 3

TIME VALUE OF MONEY

- INTEREST
- MEANING & TYPES
- INTEREST FACTORS
FOR DISCRETE
COMPOUNDING
- NOMINAL &
EFFECTIVE INTEREST
RATES
- PROBLEMS



OBJECTIVES

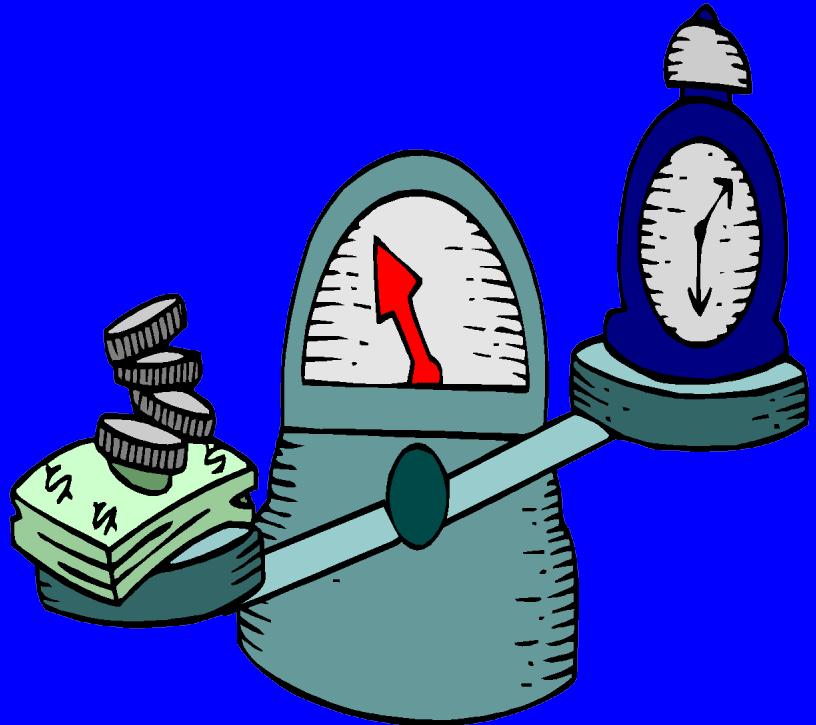
- UNDERSTAND THE MEANING OF INTEREST & ITS TYPES
- STUDY OF VARIOUS INTEREST FACTORS
- UNDERSTAND THE MEANING OF NOMINAL &EFFECTIVE INTEREST RATES
- USAGE OF INTEREST FACTORS TABLES TO SOLVE PROBLEMS

Key Concepts

- 1. Interest**
- 2. Principal**
- 3. Interest rate**
- 4. Interest period- number of interest periods.**
- 5. Plan for receipts or disbursements**
- 6. Future amount of money**
- 7. Simple vs Compound**

Time Value of Money

- Money has a time value because it can earn more money over time (**earning power**).
- Time value of money is measured in terms of **interest rate**.
- Interest is the cost of money—a **cost** to the borrower and an **earning** to the lender



Elements of Transactions involve Interest

1. Initial amount of money in transactions involving debt or investments is called the **principal**.
2. The **interest rate** measures the cost or price of money and is expressed as a percentage per period of time.
3. A period of time, called the **interest period**, determines how frequently interest is calculated.
4. A specified length of time marks the duration of the transactions and thereby establishes a certain **number of interest periods**.
5. A **plan for receipts or disbursements** that yields a particular cash flow pattern over a specified length of time.
6. A **future amount of money** results from the cumulative effects of the interest rate over a number of interest periods.

- A_n = A discrete payment or receipt occurring at the end of some interest period.
- i = The interest rate per interest period.
- N = The total number of interest periods.
- P = a sum of money at a time chosen for purposes of analysis as time zero, sometimes referred to as the **present value** or **present worth**.
- F = A future sum of money at the end of the analysis period. This sum may be specified as F_n .
- A = An end of period payment or receipt in a uniform series that continues for N periods. This is a special situation where $A_1 = A_2 = \dots = A_N$.

Methods of Calculating Interest

- **Simple interest:** the practice of charging an interest rate only to an initial sum (principal amount).
- **Compound interest:** the practice of charging an interest rate to an initial sum and to any previously accumulated interest that has not been withdrawn.

Simple Interest

- P = Principal amount
- i = Interest rate
- N = Number of interest periods
- Example:
 - P = \$1,000
 - i = 8%
 - N = 3 years

End of Year	Beginning Balance	Interest earned	Ending Balance
0			\$1,000
1	\$1,000	\$80	\$1,080
2	\$1,080	\$80	\$1,160
3	\$1,160	\$80	\$1,240

Compound Interest

- P = Principal amount
- i = Interest rate
- N = Number of interest periods
- Example:
 - P = \$1,000
 - i = 8%
 - N = 3 years

End of Year	Beginning Balance	Interest earned	Ending Balance
0			\$1,000
1	\$1,000	\$80	\$1,080
2	\$1,080	\$86.40	\$1,166.40
3	\$1,166.40	\$93.31	\$1,259.71

Comparing Simple to Compound Interest

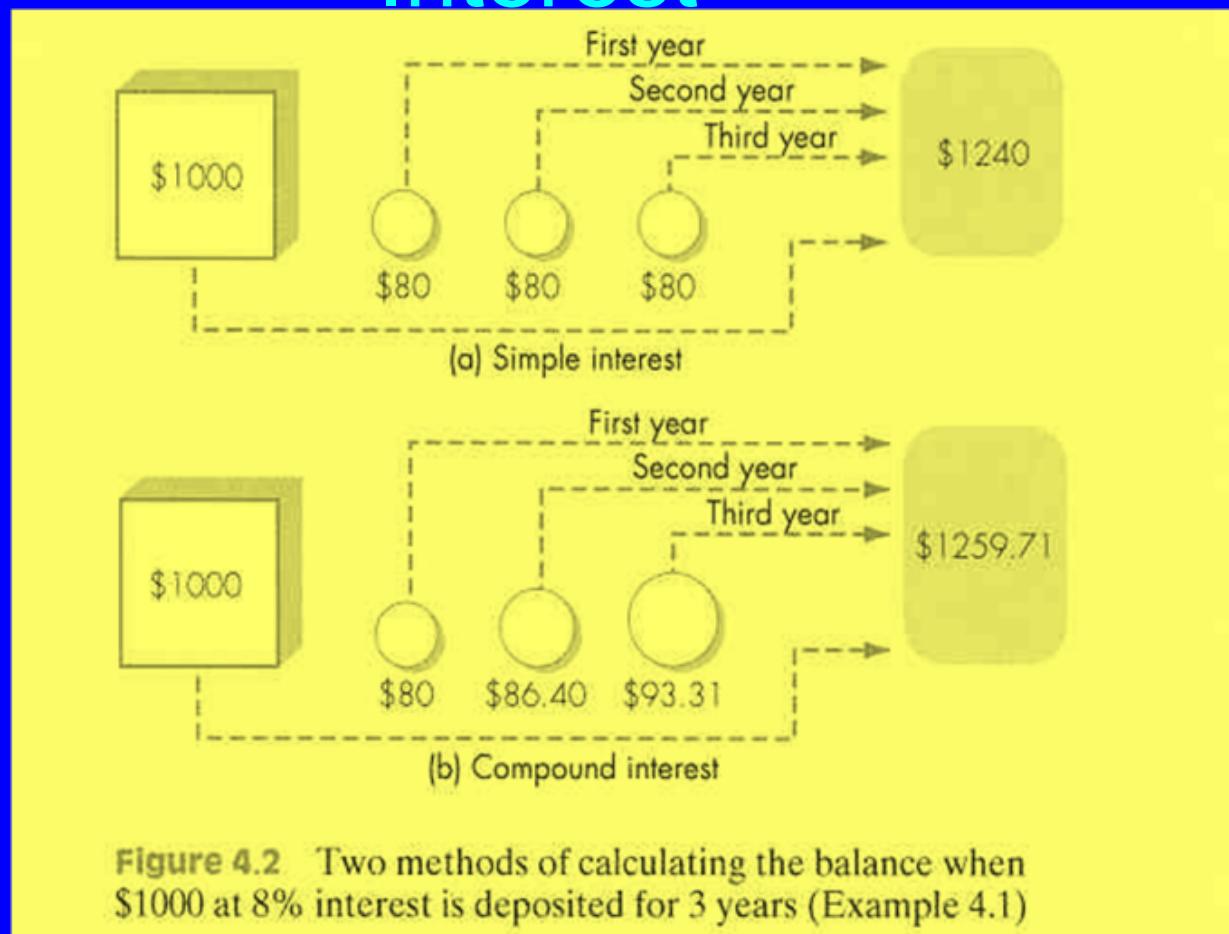
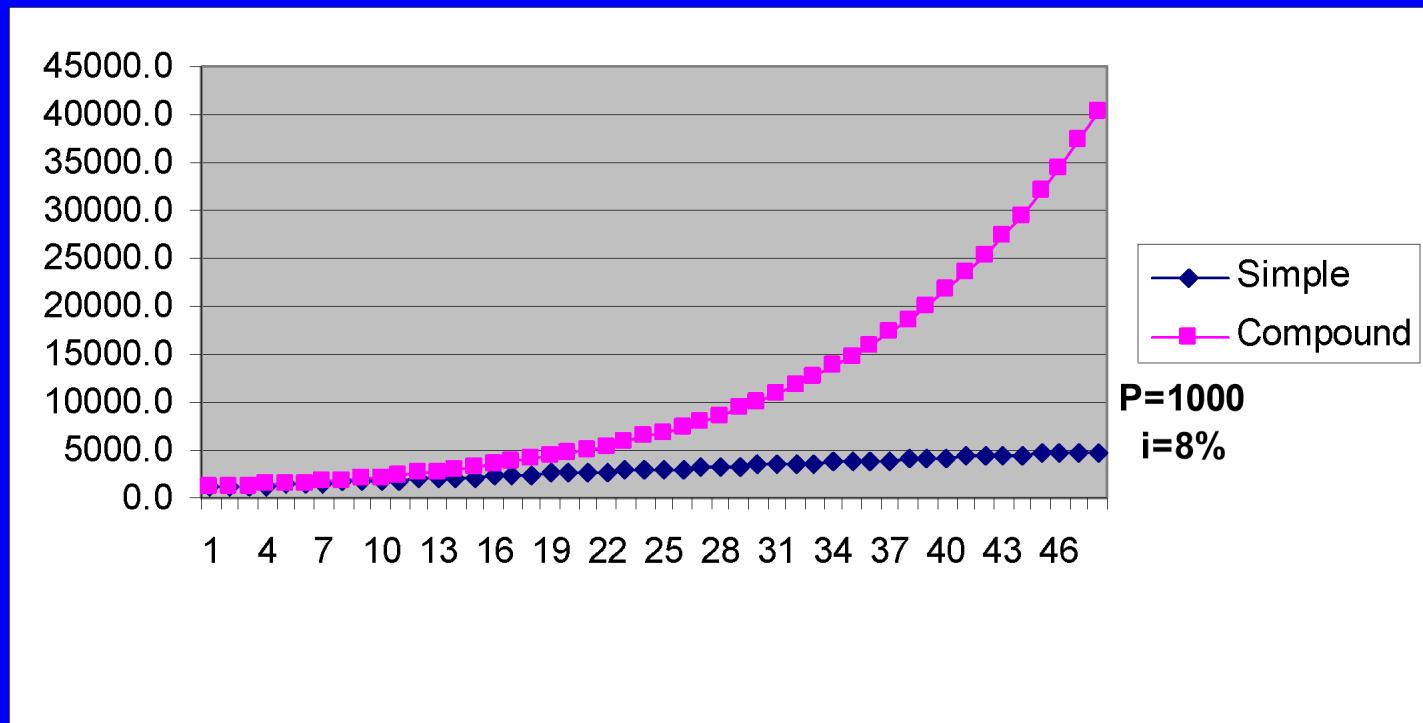
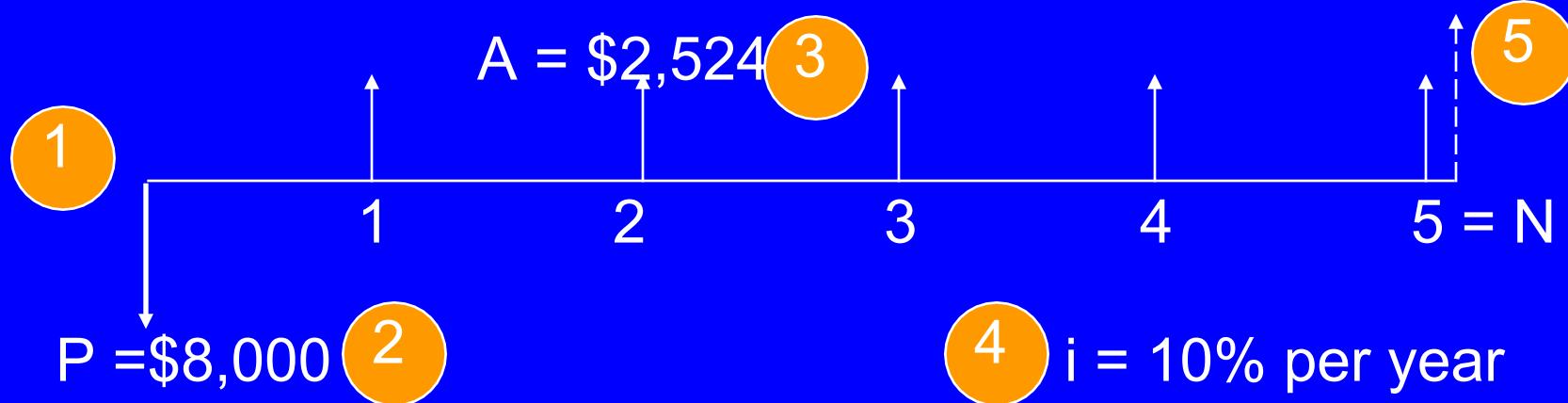


Figure 4.2 Two methods of calculating the balance when \$1000 at 8% interest is deposited for 3 years (Example 4.1)

Simple Vs Compound Interest



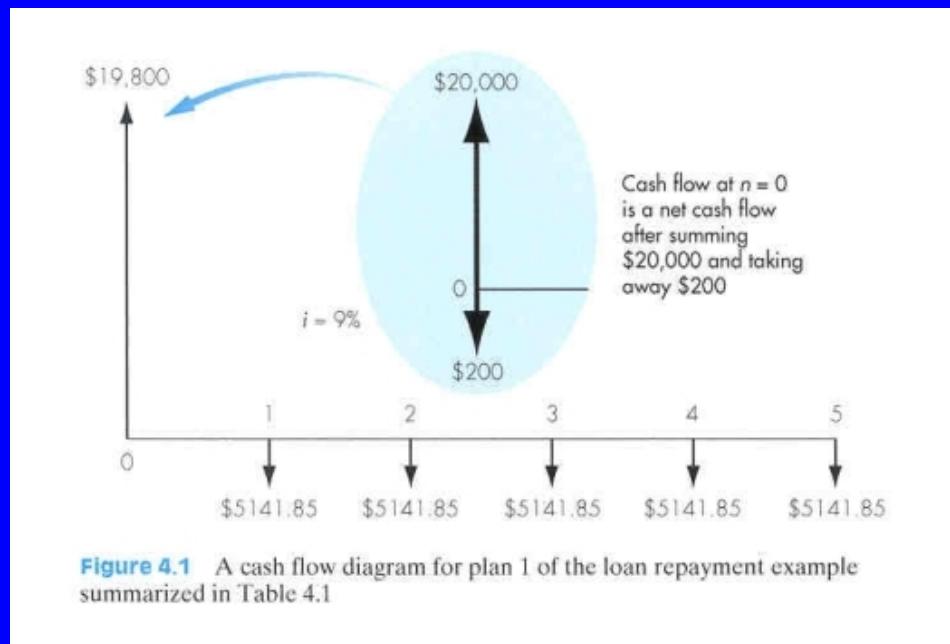
CASH FLOW DIAGRAM NOTATION



- 1 Time scale with progression of time moving from left to right; the numbers represent time periods (e.g., years, months, quarters, etc...) and may be presented within a time interval or at the end of a time interval.
- 2 Present expense (cash outflow) of \$8,000 for lender.
- 3 Annual income (cash inflow) of \$2,524 for lender.
- 4 Interest rate of loan.
- 5 Dashed-arrow line indicates amount to be determined.

Cash Flow Diagram

Represent time by a horizontal line marked off with the number of interest periods specified. Cash flow diagrams give a convenient summary of all the important elements of a problem.



STANDARD NOTATION

Standard notation has been adopted for all factors, which includes: two cash flow symbols, the interest rates and the number of periods. It is always in the general form:

$$(X/Y, i, n)$$

X = what is sought

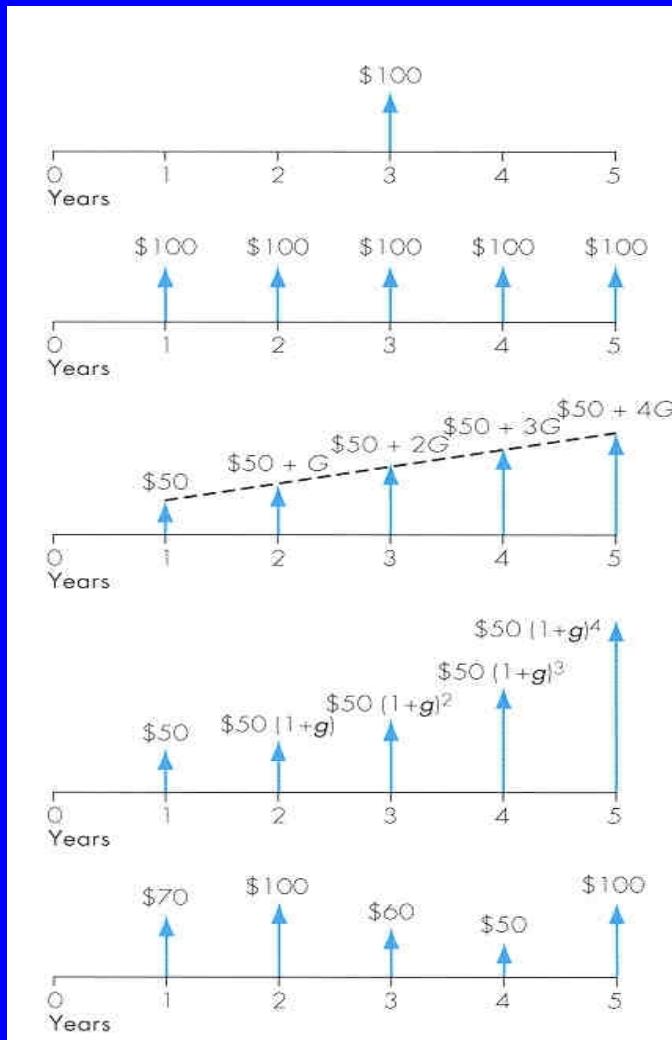
Y = what is given

i = interest rate, %

n = number of periods

The Five Types of Cash Flows

(a) Single cash flow



(b) Equal (uniform) payment series

(c) Linear gradient series

(d) Geometric gradient series

(e) Irregular

The Five Types of Cash Flows

(a) Single cash flow

1. single payment compound amount factor
2. single payment present worth factor

(a) Equal (uniform) payment series

1. compound amount factor
2. sinking - fund
3. present worth
4. capital recovery

(a) Linear gradient series

(b) Geometric gradient series

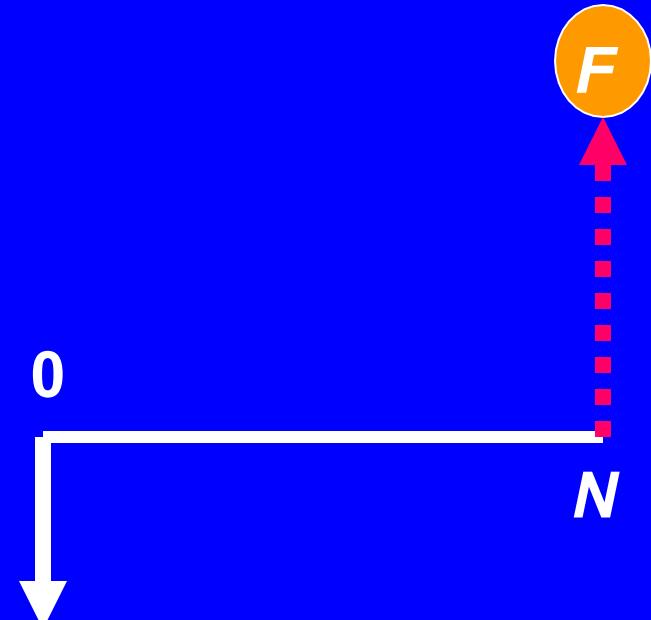
(c) Irregular payment series

Single Cash Flow Formula

- Single payment - compound amount factor (growth factor)

- Given
 $i = 10\%$
 $N = 8 \text{ years}$
 $P = \$2,000$

- Find
$$\begin{aligned} F &= \$2,000(1 + 0.10)^8 \\ &= \$2,000(F / P, 10\%, 8) \\ &= \$4,287.18 \end{aligned}$$



$$\begin{aligned} F &= P(1+i)^N \\ F &= P(F / P, i, N) \end{aligned}$$

Single Cash Flow Formula

- Single payment present worth factor (discount factor)

- Given:

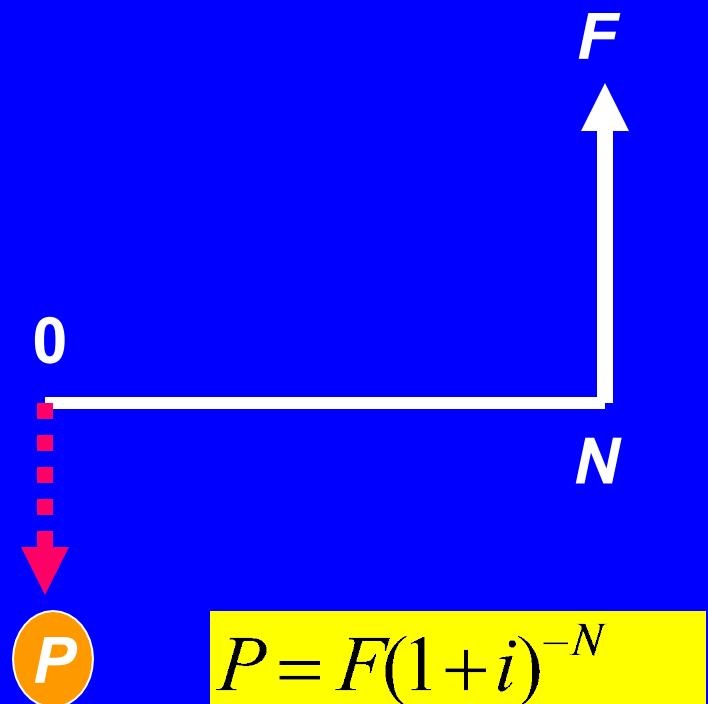
$$i = 12\%$$

$$N = 5 \text{ years}$$

$$F = \$1,000$$

- Find:

$$\begin{aligned}P &= \$1,000(1 + 0.12)^{-5} \\&= \$1,000(P / F, 12\%, 5) \\&= \$567.40\end{aligned}$$



$$P = F(1+i)^{-N}$$

$$P = F(P/F, i, N)$$

PROBLEM 1

A COMPANY PURCHASES A MACHINE COSTING RS 1,00,000 HAVING A LIFE OF 5 YEARS. THE INCOME FROM THE MACHINE IN THE FIRST YEAR IS RS 50,000 AND THEN INCREASES AT THE RATE OF RS 10,000 PER YEAR. THE OPERATING AND MAINTENANCE COST FOR THE MACHINE IN THE FIRST YEAR IS RS 20,000 AND THEN INCREASES AT THE RATE OF RS 5000 PER YEAR . THE MACHINE REQUIRES OVERHAULING COSTING RS 20,000 AT THE END OF THIRD YEAR . THE SALVAGE VALUE OF THE MACHINE IS RS 25,000. DRAW THE CASH FLOW DIAGRAM (CFD) AND DETERMINE THE ECONOMIC DESIRABILITY OF THE MACHINE IF THE INTEREST RATE IS 10% .

PROBLEM 2 & 3

2. IF Mr.A DEPOSITS RS 1000 IN HIS BANK ACCOUNT AT 6% COMPOUND INTEREST ON JAN 1,1991 . HOW MUCH MONEY WILL BE ACCUMULATED ON JAN 1 ,2001 ?

3. HOW MUCH MONEY WILL BE ACCUMULATED IN 25 YEARS IF RS 800 IS DEPOSITED ONE YEAR FROM NOW , RS 2400 SIX YEARS FROM NOW & RS 3300 EIGHT YEARS FROM NOW ALL AT AN INTEREST RATE OF 18% PER YEAR ?

PROBLEM 4

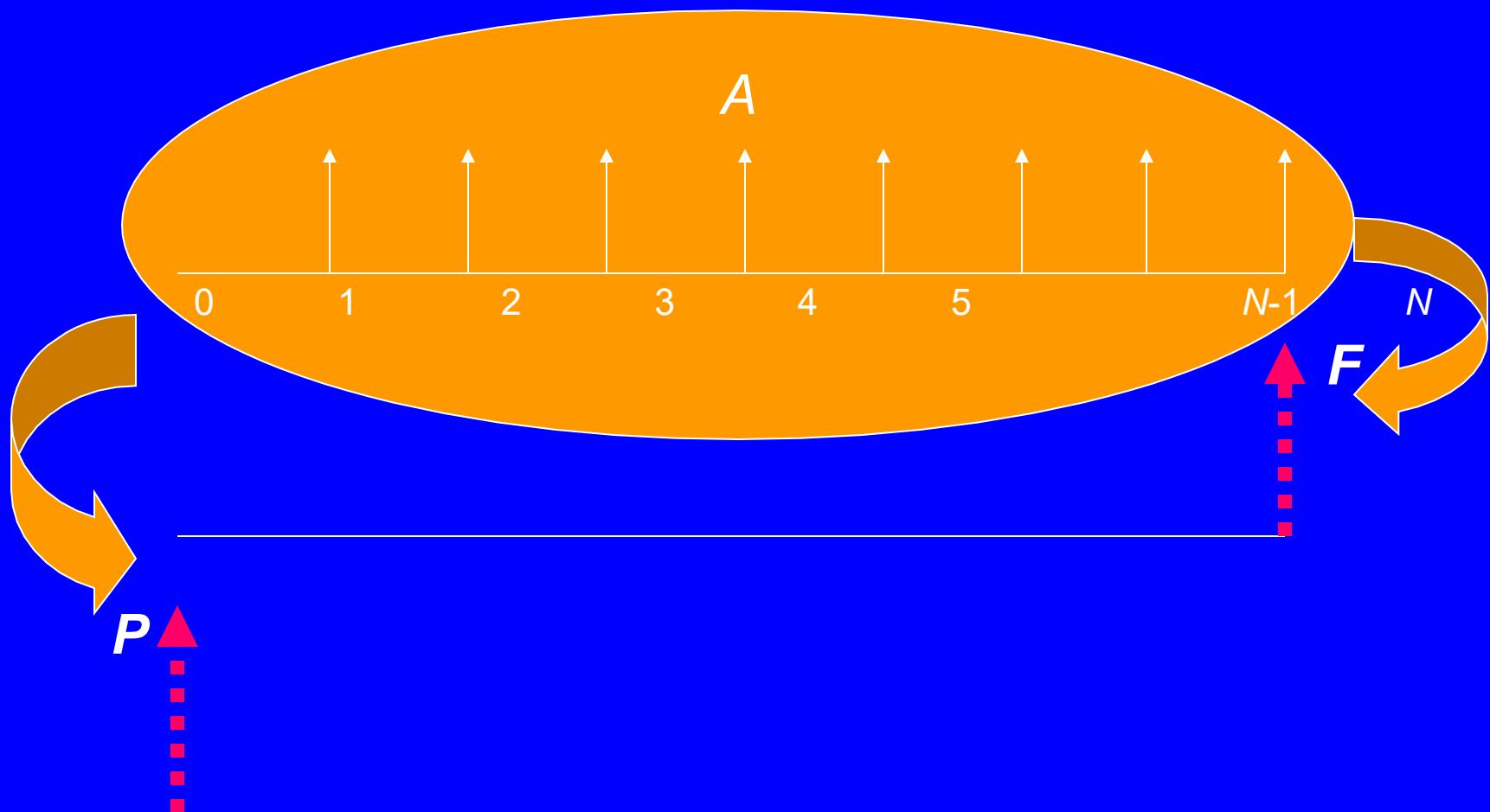
HOW MUCH MONEY Mr. A WILL HAVE IN HIS BANK ACCOUNT IN 12 YEARS ,IF HE DEPOSITS RS 3500 NOW AND THE INTEREST RATE IS 10% FOR THE FIRST 5 YEARS AND THEREAFTER CHANGES TO 15 .75% PER YEAR ?

PROBLEM 5 & 6

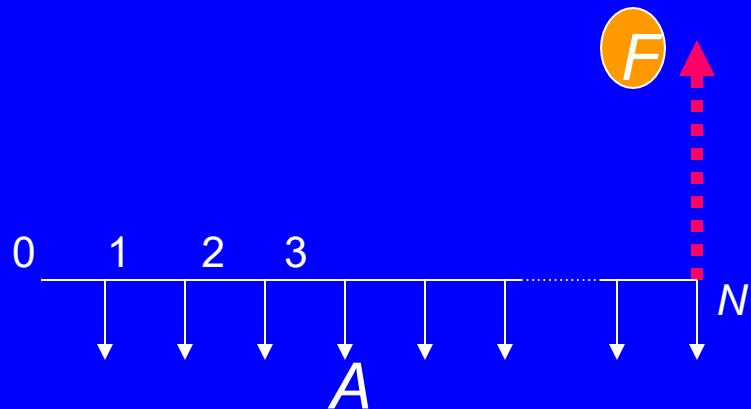
5. HOW MANY YEARS WOULD IT TAKE FOR RS 1750 TO TRIPLE IN VALUE IF THE INTEREST RATE IS 12 % PER YEAR ?

6. IDBI CAME OUT WITH AN ISSUE OF DEEP DISCOUNT BONDS IN 1998. THE BONDS WERE OFFERED AT A DEEP DISCOUNT PRICE OF RS 12,750 . THE MATURITY PERIOD FOR THE BONDS WAS 30 YEARS WITH A MATURITY VALUE OF RS 5,00,000 . DETERMINE THE RATE OF RETURN OF THIS INVESTMENT ?

Equal Payment Series



EQUAL PAYMENT SERIES COMPOUND AMOUNT FACTOR

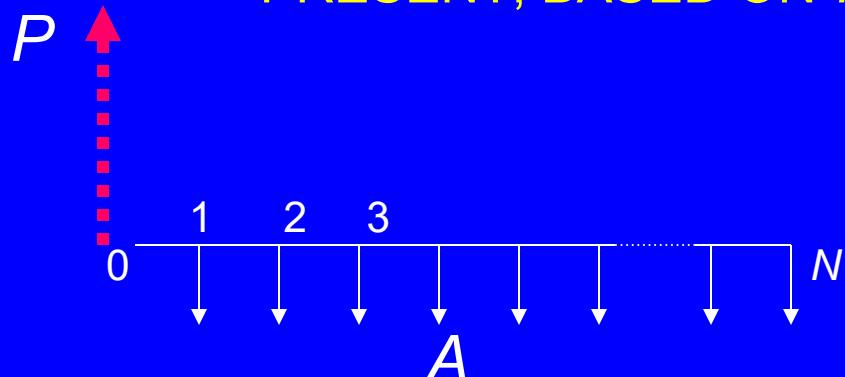


$$F = A \frac{(1+i)^N - 1}{i}$$
$$= A(F / A, i, N)$$

- Given: $A = \$3,000$, $N = 10$ years, and $i = 7\%$
- Find: F
- Solution: $F = \$3,000(F/A, 7\%, 10) =$
 $\$41,449.20$

EQUAL PAYMENT SERIES PRESENT WORTH FACTOR

PRESENT WORTH: THE EQUIVALENT VALUE AT THE PRESENT, BASED ON *TIME VALUE OF MONEY*.



$$P = A \frac{(1+i)^N - 1}{i(1+i)^N} = A(P/A, i, N)$$

- Given: $A = \$32,639$, $N = 9$ years, and $i = 8\%$
- Find: P
- Solution: $P = \$32,639(P/A, 8\%, 9) = \$203,893$

PROBLEM 7

- IF ANNUAL DEPOSITS OF RS 1000 ARE MADE INTO A SAVINGS ACCOUNT FOR 30 YEARS BEGINNING ONE YEAR FROM NOW, HOW MUCH WILL BE IN THE FUND IMMEDIATELY AFTER THE LAST DEPOSIT IF THE FUND PAYS AN INTEREST RATE OF 19.25 % PER YEAR ?

PROBLEM 8

- IF YOU START SAVING MONEY BY DEPOSITING RS 1000 PER YEAR INTO A BANK ACCOUNT WHICH PAYS 11 % INTEREST, HOW MANY YEARS WILL IT TAKE TO ACCUMULATE RS 10,000 IF THE FIRST DEPOSIT IS TO BE MADE ONE YEAR FROM NOW ?

PROBLEM 9

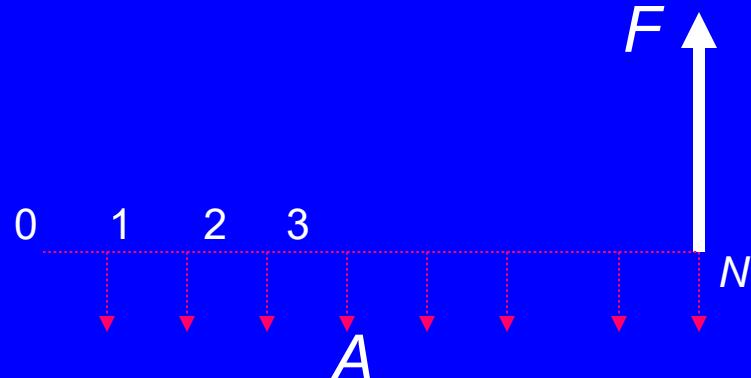
WHAT IS THE MINIMUM NUMBER OF YEAR END DEPOSITS THAT HAVE TO BE MADE BEFORE THE TOTAL VALUE OF THE DEPOSITS IS ATLEAST 10 TIMES GREATER THAN THE VALUE OF A SINGLE YEAR END DEPOSIT IF THE INTEREST RATE IS 12.5 % YEAR

PROBLEM 10

A FIRM IS AVAILABLE FOR SALE FOR RS 65,000 NOW. THE FIRM YIELDS A PROFIT OF RS 10,000 PER YEAR FOR THE NEXT 10 YEARS. IF THE MONEY IS WORTH 12 % CAN THE FIRM BE BOUGHT ?

SINKING FUND FACTOR

IS AN INTEREST-BEARING ACCOUNT INTO WHICH A FIXED SUM IS DEPOSITED EACH INTEREST PERIOD.



$$A = F \frac{i}{(1+i)^N - 1}$$
$$= F(A/F, i, N)$$

- Given: $F = \$5,000$, $N = 5$ years, and $i = 7\%$
- Find: A
- Solution: $A = \$5,000(A/F, 7\%, 5) = \869.50

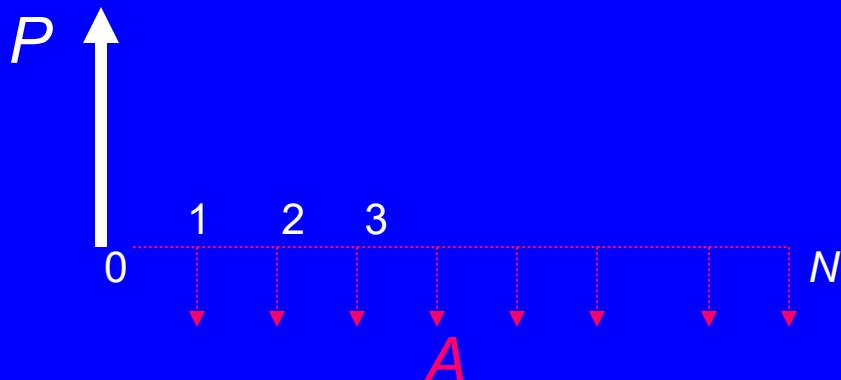
Sinking fund

- **Sinking fund:** 1) A fund accumulated by periodic deposits and reserved exclusively for a specific purpose, such as retirement of a debt or replacement of a property. 2) A fund created by making periodic deposits (usually equal) at compound interest in order to accumulate a given sum at a given future time for some specific purpose.

Sinking fund

- It is a fund maintained by regular payments or contributions which will eventually pay off an amount owed.
- Money set aside to pay off for losses.
- It is a form of self insurance to cover all or a portion of certain losses.

CAPITAL RECOVERY FACTOR



$$A = P \frac{i(1+i)^N}{(1+i)^N - 1} = P(A/P, i, N)$$

Example 4.16:

- Given: $P = \$250,000$, $N = 6$ years, and $i = 8\%$
- Find: A
- Solution: $A = \$250,000(A/P, 8\%, 6) = \$54,075$

Capital Recovery Factor (Annuity Factor)

- **Annuity:** 1) An amount of money payable to a recipient at regular intervals for a prescribed period of time out of a fund reserved for that purpose. 2) A series of equal payments occurring at equal periods of time. 3) Amount paid annually, including reimbursement of borrowed capital and payment of interest.
- **Annuity factor:** The function of interest rate and time that determines the amount of periodic annuity that may be paid out of a given fund.
- **Capital recovery** is the regaining of the invested capital over the life of an investment.

PROBLEM 11

- DETERMINE THE EQUAL AMOUNTS THAT WOULD HAVE TO BE DEPOSITED AT THE END OF EACH YEAR FOR 10 YEARS, STARTING ONE YEAR FROM NOW, INTO A FUND IN ORDER TO HAVE RS 1,80,000 AT THE END OF 15TH YEAR. ASSUME AN INTEREST RATE OF 14 %

PROBLEM 12

- THE FOLLOWING CFD SHOWS THE DEPOSITS MADE BY A PERSON AT 15% INTEREST. CALCULATE THE COMPOUND AMOUNT ACCUMULATED AT THE END OF 15TH YEAR.

PROBLEM 13

- A PERSON BUYS A MACHINE, MAKES A DOWN PAYMENT OF RS.10,000/- AND THE BALANCE IN PAYMENTS OF RS.8000/-PER YEAR FOR FIVE YEARS, STARTING 3 YEARS FROM NOW AT AN INTEREST RATE OF 10% PER YEAR. WHAT IS THE COST OF THIS MACHINE?

PROBLEM 14

- A PERSON REQUIRES RS.20,000 AT THE BEGINNING OF YEAR FROM 2005 TO 2009. HOW MUCH SHOULD HE DEPOSIT AT THE END OF EACH YEAR FROM 1995 TO 2000. THE INTEREST RATE 12% PER YEAR.

PROBLEM 15

- IF MR.'A' BORROWS RS.45,000 WITH A PROMISE TO REPAY IT IN 10 EQUAL ANNUAL INSTALMENTS STARTING ONE YEAR FROM NOW. HOW MUCH WOULD HIS PAYMENTS BE IF INTEREST RATE IS 20% PER YEAR?

PROBLEM 16

- A 10 PAYMENT ANNUITY OF RS 10,000 WILL BEGIN SEVEN YEARS HENCE. THE FIRST PAYMENT OCCURS AT THE END OF SEVEN YEARS. WHAT IS THE VALUE OF THIS ANNUITY NOW IF THE RATE IS 12 % PER YEAR ?

GRADIENT SERIES FACTORS

- UNIFORM GRADIENT SERIES FACTOR
- A UNIFORM GRADIENT IS A CASH FLOW SERIES WHICH EITHER INCREASES OR DECREASES UNIFORMLY
- THE AMOUNT OF INCREASE OR DECREASE IS THE GRADIENT
- THE VALUE OF G (GRADIENT) MAY BE POSITIVE OR NEGATIVE
- GRADIENT PRESENT WORTH FACTOR
- GRADIENT ANNUAL WORTH FACTOR
- GRADIENT FUTURE WORTH FACTOR

GRADIENT SERIES FACTORS

- GEOMETRIC GRADIENT SERIES
- IN SOME SITUATIONS ANNUAL PAYMENTS MAY INCREASE OR DECREASE NOT BY A CONSTANT AMOUNT BUT BY A CONSTANT PERCENTAGE
- “g” IS USED TO DESIGNATE THE CONSTANT PERCENTAGE

PROBLEM 17

- Mr.A PLANNED TO START SAVING MONEY BY DEPOSITING RS 50,000 INTO HIS SAVINGS ACCOUNT ONE YEAR FROM NOW & HE ESTIMATES THAT THE DEPOSITS WILL INCREASE BY RS10,000 EVERY YEAR FOR 9 YEARS THEREAFTER. WHAT WOULD BE THE PRESENT WORTH,EQUIVALENT UNIFORM ANNUAL WORTH & FUTURE WORTH OF THE INVESTMENT IF THE INTEREST RATE IS 5 % PER ANNUM ?

PROBLEM 18

- A COMPANY WANTS TO HAVE RS 5,00,000 AVAILABLE FOR INVESTMENT 10 YEARS FROM NOW. THE COMPANY PLANS TO INVEST RS 4000 IN FIRST YEAR & AMOUNTS INCREASING BY A UNIFORM GRADIENT THEREAFTER. IF THE COMPANY'S INTEREST RATE IS 20% PER ANNUM ,WHAT MUST BE THE SIZE OF THE GRADIENT IN ORDER THAT THE COMPANY MEETS ITS OBJECTIVE ?

PROBLEM 19

- FIND THE PRESENT WORTH & EQUIVALENT UNIFORM ANNUAL WORTH OF A SERIES OF RECEIPTS AS SHOWN BELOW AT AN INTEREST RATE OF 7 % PER ANNUM.

NOMINAL & EFFECTIVE INTEREST RATES

- AN INTEREST RATE TAKES TWO FORMS: - NOMINAL INTEREST RATE AND EFFECTIVE INTEREST RATE.
- THE NOMINAL INTEREST RATE DOES NOT TAKE INTO ACCOUNT THE COMPOUNDING PERIOD.
- THE EFFECTIVE INTEREST RATE DOES TAKE THE COMPOUNDING PERIOD INTO ACCOUNT AND THUS IS A MORE ACCURATE MEASURE OF INTEREST CHARGES.
- A STATEMENT THAT THE "INTEREST RATE IS 10%" MEANS THAT INTEREST IS 10% PER YEAR, COMPOUNDED ANNUALLY.
- IN THIS CASE, THE NOMINAL ANNUAL INTEREST RATE IS 10% AND THE EFFECTIVE ANNUAL INTEREST RATE IS ALSO 10%.
- HOWEVER, IF COMPOUNDING IS MORE FREQUENT THAN ONCE PER YEAR, THEN THE EFFECTIVE INTEREST RATE WILL BE GREATER THAN 10%.
- THE MORE OFTEN COMPOUNDING OCCURS, THE HIGHER THE EFFECTIVE INTEREST RATE.

NOMINAL & EFFECTIVE INTEREST RATES

- THE RELATIONSHIP BETWEEN NOMINAL ANNUAL AND EFFECTIVE ANNUAL INTEREST RATES IS:

$$I_A = [1 + (R / CK)]^C - 1$$

WHERE I_A IS THE EFFECTIVE ANNUAL INTEREST RATE

- R = NOMINAL ANNUAL INTEREST RATE OR ANNUAL PERCENTAGE RATE
- M = NUMBER OF COMPOUNDING PERIODS PER YEAR
- C = NUMBER OF INTEREST PERIODS PER PAYMENT PERIOD
- K = NUMBER OF PAYMENT PERIODS PER YEAR
- NOTE THAT $M = CK$

PROBLEM 20

IF RS 10,000 IS DEPOSITED NOW,RS 6000/- 8 YEARS FROM NOW & RS 9000/- 12 YEARS FROM NOW WHAT WOULD BE THE TOTAL VALUE OF THESE DEPOSITS AFTER 25 YEARS IF THE INTEREST RATE IS 12 % PER YEAR COMPOUNDED SEMI-ANNUALLY.

PROBLEM 21

IF A PERSON DEPOSITS RS 75 INTO A SAVINGS ACCOUNT EVERY MONTH, HOW MUCH MONEY WILL BE ACCUMULATED AFTER 10 YEARS IF THE INTEREST RATE IS 12 % PER YEAR COMPOUNDED MONTHLY ?

PROBLEM 22

IF A PERSON DEPOSITS RS 1000 AT THE END OF EACH YEAR FOR 10 YEARS WHAT IS THE AMOUNT ACCUMULATED AT THE END OF 10TH YEAR IF THE INTEREST RATE IS 12 % PER YEAR COMPOUNDED QUARTERLY ?

PROBLEM 23

HOW MANY YEARS WILL IT TAKE FOR AN INVESTMENT TO TRIPLE ITSELF AT AN INTEREST RATE OF 12 % PER YEAR COMPOUNDED SEMI ANNUALLY ? WHAT IS THE EFFECTIVE INTEREST RATE ?

PROBLEM 24

WHAT EQUAL SERIES OF PAYMENTS ARE NECESSARY TO REPAY A LOAN OF RS 8000 IN 3 YEARS AT 12 % PER YEAR COMPOUNDED QUARTERLY WITH ANNUAL PAYMENTS ?

PROBLEM 25

A BUILDING IS PRICED AT RS 3,70,000. A DOWN PAYMENT OF RS 1,40,000 IS MADE AND A PAYMENT OF RS 30,000 EVERY 6 MONTHS THEREAFTER IS REQUIRED . HOW MANY YEARS WILL IT BE NECESSARY TO PAY FOR THE BUILDING ? INTEREST IS CHARGED AT 9% PER YEAR COMPOUNDED SEMI ANNUALLY .

PROBLEM 26

- A SAVINGS DEPOSIT OF RS 4000 WILL ACCUMULATE TO WHAT VALUE AFTER TEN YEARS IF THE INTEREST IS LEFT IN THE ACCOUNT AND THE ACCOUNT PAYS 6% INTEREST COMPOUNDED QUARTERLY?

PROBLEM 27

- FIND THE ANNUAL WORTH OF RS 10000 INITIAL PAYMENT FOLLOWED BY ELEVEN ANNUAL PAYMENTS OF RS 1500 CONCLUDING WITH A REFUND OF RS 1200. THE INTEREST RATE IS 5%

PROBLEM 28

- ASSUME AN EFFECTIVE INTEREST RATE OF 15% PER YEAR COMPOUNDED ANNUALLY. AN INVESTMENT REQUIRES RS1500 AT THE END OF EACH YEAR FOR THE NEXT 5 YEARS PLUS A FINAL INVESTMENT OF RS 3000 IN 5 YEARS. WHAT IS EQUIVALENT LUMPSUM INVESTED NOW?

PROBLEM 29

- WHAT ANNUAL INVESTMENT IS REQUIRED AT 8% PER YEAR COMPOUNDED ANNUALLY TO ACCUMULATE TO RS 1,00,000 AT THE END OF 20 YEARS ?

PROBLEM 30

- MAINTENANCE EXPENDITURES FOR A STRUCTURE WITH A 20 YEAR LIFE WILL BE DISBURSED AS PERIODIC OUTLAY OF RS 1000 AT HE END OF FIFTH YEAR,RS 2000 AT THE END OF TENTH YEAR AND RS 3500 AT THE END OF 15 TH YEAR. USING AN ANNUAL INTEREST RATE OF 10 % WHAT IS THE EQUIVALENT UNIFORM ANNUAL COST ?

PROBLEM 31

- A PIECE OF MACHINERY COSTS RS 900. AFTER 5 YEARS THE SALVAGE VALUE IS RS 300. ANNUAL MAINTENANCE COSTS ARE RS 50. IF THE INTEREST RATE IS 8% WHAT IS THE EQUIVALENT UNIFORM ANNUAL COST?

PROBLEM 32

- WHAT IS THE BALANCE IN AN ACCOUNT AT THE END OF 10 YEARS IF RS 2500 IS DEPOSITED TODAY AND THE ACCOUNT EARNS 4% INTEREST i) COMPOUNDED ANNUALLY
ii) COMPOUNDED QUARTERLY

PROBLEM 33

- YOUR FRIEND IS PLANNING TO RETIRE THIS YEAR. HIS FIRM HAS OFFERED HIM A LUMP SUM PAYMENT OF RS 50,000 OR A RS 6000 LIFETIME ORDINARY ANNUITY WHICH EVER HE CHOOSES. YOUR FRIEND IS REASONABLY IN GOOD HEALTH AND EXPECTS TO LIVE FOR ATLEAST 15 MORE YEARS. WHICH OPTION SHOULD HE CHOOSE ASSUMING AN INTEREST RATE OF 8 % ?

PROBLEM 34

- IF YOU REQUIRE A 9% ANNUAL RETURN ON YOUR INVESTMENTS WILL YOU PREFER RS 15000 FIVE YEARS FROM TODAY OR AN ORDINARY ANNUITY OF RS1000 PER YEAR FOR 15 YEARS.

PROBLEM 35

- HOW MUCH A DEPOSIT OF RS50000 GROWS AT THE END OF 5 YEARS IF THE NOMINAL INTEREST IS 12 % AND THE MONEY IS QUARTERLY COMPOUNDED ? COMPARE THIS WITH THE AMOUNT YOU GET WITH ANNUAL COMPOUNDING.

PROBLEM 36

- YOU INVEST RS 15000 AT THE END OF YEAR 1,RS 20000 AT THE END OF YEAR 2 AND RS 50,000 AT THE END OF EACH YEAR FROM THIRD TO TENTH YEAR. CALCULATE THE PRESENT VALUE OF THIS STREAM IF $i= 10\%$

PROBLEM 37

- A COMPANY OFFERS QUALIFIED BORROWERS THE OPPURTUNITY TO BORROW RS 1000 NOW AND REPAY THE LOAN IN 10 YEARLY INSTALLMENTS OF RS 155 THE FIRST INSTALLMENT DUE 1 YEAR FROM NOW. AT WHAT INTEREST RATE ARE THEIR CUSTOMERS BORROWING MONEY ?

PROBLEM 38

- A 20 LAKHS PLANT EXPANSION IS TO BE FINANCED AS FOLLOWS : 15 % DOWN PAYMENT AND THE REMAINDER IS BORROWED AT 9 % INTEREST. THE LOAN IS TO BE REPAYED IN 8 EQUAL INSTALLMENTS STARTING 4 YEARS FROM NOW. FIND THE AMOUNT OF EACH EQUAL ANNUAL INSTALLMENT.

PROBLEM 39

- TEN YEARS FROM NOW MR. X WILL START RECEIVING A PENSION OF RS 3000 A YEAR. THE PAYMENT WILL CONTINUE FOR 16 YEARS. HOW MUCH IS THE PENSION WORTH NOW AT 10 % ?

PROBLEM 40

- YOU DEPOSIT RS 4500 PER YEAR AT THE END OF EACH YEAR FOR NEXT 25 YEARS IN AN ACCOUNT THAT YIELDS 10 % PER ANNUM. HOW MUCH YOU COULD WITHDRAW AT THE END OF EACH OF THE NEXT 20 YEARS FOLLOWING YOUR LAST DEPOSIT ?

PROBLEM 41

- A DEPOSIT IS MADE IN A BANK THAT EARNS 10 % COMPOUNDED HALF YEARLY. IT IS DESIRED TO WITHDRAW RS 50,000 THREE YEARS FROM NOW AND RS 70,000 FIVE YEARS FROM NOW. WHAT IS THE SIZE OF THE INITIAL DEPOSIT ?

PROBLEM 42

- A LOAN OF RS 1 LAKH IS TAKEN ON WHICH INTEREST IS PAYABLE AT 10 % . THE REPAYMENT IS TO START AT THE END OF THIRD YEAR FROM NOW. WHAT SHOULD BE THE ANNUAL PAYMENT IF LOAN IS TO BE REPAIID IN 6 ANNUAL INSTALLMENTS ?

PROBLEM 43

MR.X IS GOING TO RETIRE SOON. HIS EMPLOYER GIVES HIM 2 OPTIONS :

- A) AN ANNUAL PENSION OF RS 8000 FOR AS LONG AS HE LIVES.
- B) A LUMPSUM AMOUNT OF RS 50000.

IF HE EXPECTS TO LIVE FOR 20 YEARS AND THE INTEREST RATE IS 10 % WHICH OPTION IS BETTER FOR X ?

PROBLEM 44

- A COMPANY IS PLANNING TO MAKE TWO EQUAL DEPOSITS SUCH THAT TEN YEARS FROM NOW THE COMPANY WILL HAVE RS 49,000 TO REPLACE A SMALL M/C . IF THE FIRST DEPOSIT IS TO BE MADE ONE YEAR FROM NOW AND THE SECOND IS TO BE MADE 9 YEARS FROM NOW ,HOW MUCH BE DEPOSITED EACH TIME IF $i = 15\%$ PER YEAR.

PROBLEM 45

- A PLANT MANAGER IS TRYING TO DECIDE WHETHER TO BUY A NEW MACHINE NOW OR WAIT AND PURCHASE A SIMILAR ONE 3 YEARS FROM NOW. THE M/C AT PRESENT TIME WOULD COST RS 25,000 BUT 3 YEARS FROM NOW IT IS EXPECTED TO COST RS 39,000. IF $I = 20\%$ SHOULD THE PLANT MANAGER BUY NOW OR SHOULD HE BUY THREE YEARS FROM NOW ?

PROBLEM 46

- EXPECTED CASH FLOWS OF A PROJECT ARE AS FOLLOWS: CALCULATE THE PRESENT VALUE OF THE ABOVE CASH FLOWS:
TAKE $i = 10\%$

YEAR	0	1	2	3	4	5
CASH FLOW	-10,000	2000	3000	4000	5000	3000

PROBLEM 47

- EXPECTED CASH FLOWS OF A PROJECT ARE AS FOLLOWS: CALCULATE THE FUTURE VALUE OF THE ABOVE CASH FLOWS:

TAKE $i = 10\%$

YEAR	0	1	2	3	4	5
CASH FLOW	-10,000	2000	3000	4000	5000	3000

PROBLEM 48

- MR.X BORROWS RS 80,000 FOR A MUSIC SYSTEM AT A MONTHLY INTEREST RATE OF 1.25 %. THE LOAN IS TO BE REPAYED IN 24 EQUAL MONTHLY INSTALLMENTS ,PAYABLE AT THE BEGINNING OF EACH MONTH . CALCULATE THE AMOUNT OF EACH INSTALLMENT ?

PROBLEM 49

- YOU DEPOSITED RS 70,000 IN YOUR ACCOUNT FOR 15 YEARS AT 8 % INTEREST . HOW MUCH WILL YOU GET ON MATURITY ?

PROBLEM 50

- IF A PERSON INVESTS RS 8000 IN SOME BUSINESS 12 YEARS AGO AND RECEIVED PROFITS OF RS 1000 PER YEAR WHAT IS THE RATE OF RETURN ON THIS INVESTMENT ?

SUMMARY OF CHAPTER 3

- MONEY HAS TIME VALUE BECAUSE IT CAN EARN MORE MONEY OVER TIME.
- COMPOUND INTEREST IS THE MOST COMMONLY USED SYSTEM IN THE REAL WORLD
- CASH FLOW DIAGRAMS ARE VISUAL REPRESENTATIONS OF CASH INFLOWS & OUTFLOWS ALONG A TIMELINE.
- 5 PATTERNS OF CASH FLOW
- CASH FLOW PATTERNS ARE SIGNIFICANT BECAUSE THEY ALLOW US TO DEVELOP INTEREST FORMULAS/INTEREST FACTORS

PROBABLE QUESTIONS

- WHAT DO YOU MEAN BY CASH FLOW DIAGRAM ?
- WRITE DOWN THE FORMULA FOR SINGLE/ EQUAL PAYMENT COMPOUND AMOUNT FACTOR
- WHAT DO YOU MEAN BY GRADIENT ? WRITE DOWN THE FORMULA FOR VARIOUS TYPES OF UNIFORM GRADIENTS
- PROBLEMS IN VARIOUS INTEREST FACTORS , COMPOSITE CASH FLOW DIAGRAMS

FURTHER READING FOR CHAPTER 3

- ENGINEERING ECONOMY BY TED G ESCHENBACH, OXFORD PUBLICATIONS.
- PRINCIPLES OF ENGINEERING ECONOMY ANALYSIS BY JOHN .A WHITE , KENNETH .E.CASE ,DAVID .B.PRATT,MARVIN.H.AGEE ,WILEY PUBLICATION
- ENGINEERING ECONOMY BY WILLIAM .G.SULLIVAN , JAMES .A. BONTADELLI, ELIN .M .WICKS, PEARSON EDUCATION
- ENGINEERING ECONOMY BY G.J.THUESEN ,W.J.FABRYCKY ,PHI PUBLICATION
- CONTEMPORARY ENGINEERING ECONOMICS BY CHAN .S PARK ,PHI PUBLICATION

Nominal and Effective Interest Rates

Engineering Economics

Understanding Money and Its Management – Main Focus

1. If payments occur more frequently than **annual**, how do you calculate economic equivalence?
2. If **interest period** is other than annual, how do you calculate economic equivalence?
3. How are **commercial loans** structured?
4. How would you manage your **debt**?

Nominal Versus Effective Interest Rates

q **Nominal Interest Rate:**

Interest rate quoted based on an annual period

q **Effective Interest Rate:**

Actual interest earned or paid in a year or some other time period

Financial Jargon

18% Compounded Monthly



Nominal
interest rate



Interest
period



Annual
percentage
rate (APR)

18% Compounded Monthly

□ What It Really Means?

- Interest rate per month (i) = $18\%/12 = 1.5\%$
- Number of interest periods per year (N) = 12

□ In words,

- Bank will charge 1.5% interest each month on your unpaid balance, if you borrowed money.
- You will earn 1.5% interest each month on your remaining balance, if you deposited money.

□ **Question:** Suppose that you invest \$1 for 1 year at 18% compounded monthly. How much interest would you earn?

Effective Annual Interest Rate (Yield)

□ Formula:

$$i_a = \left(1 + \frac{r}{M}\right)^M - 1$$

r = nominal interest rate per year

i_a = effective annual interest rate

M = number of interest periods per year

□ Example:

□ 18% compounded monthly

$$i_a = \left(1 + \frac{0.18}{12}\right)^{12} - 1$$

□ What It really Means

□ 1.5% per month for 12 months or

□ 19.56% compounded once per year

Practice Problem

Suppose your savings account pays 9% interest compounded quarterly.

- (a) Interest rate per quarter
- (b) Annual effective interest rate (i_a)
- (c) If you deposit \$10,000 for one year, how much would you have?

□ Solution:

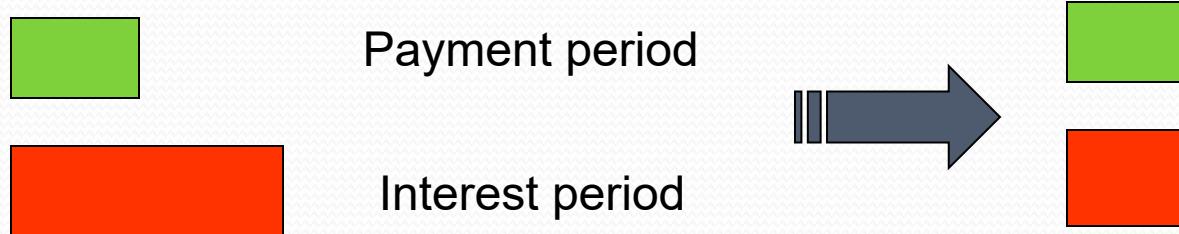
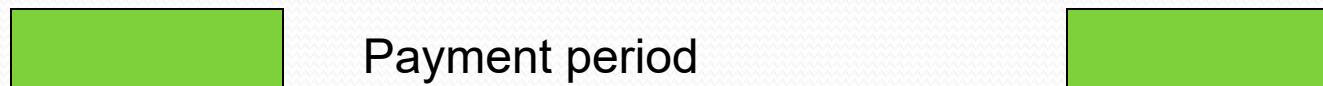
End of Period	Base Amount	Interest Earned $2.25\% \times (\text{Base Amount})$	New Base
First Quarter	\$10,000.00	$2.25\% \times \$10,000.00 = \225.00	\$10,225.00
Second Quarter	\$10,225.00	$2.25\% \times \$10,225.00 = \230.06	\$10,455.06
Third Quarter	\$10,455.06	$2.25\% \times \$10,455.06 = \235.24	\$10,690.30
Fourth Quarter	\$10,690.30	$2.25\% \times \$10,690.30 = \240.53	\$10,930.83

Nominal and Effective Interest Rates with Different Compounding Periods

Effective Rates					
Nominal Rate	Compounding Annually	Compounding Semi-annually	Compounding Quarterly	Compounding Monthly	Compounding Daily
4%	4.00%	4.04%	4.06%	4.07%	4.08%
5	5.00	5.06	5.09	5.12	5.13
6	6.00	6.09	6.14	6.17	6.18
7	7.00	7.12	7.19	7.23	7.25
8	8.00	8.16	8.24	8.30	8.33
9	9.00	9.20	9.31	9.38	9.42
10	10.00	10.25	10.38	10.47	10.52
11	11.00	11.30	11.46	11.57	11.62
12	12.00	12.36	12.55	12.68	12.74

Why Do We Need an Effective Interest Rate per Payment Period?

Whenever payment and compounding periods differ from each other, one or the other must be transformed so that both conform to the same unit of time.



Effective Interest Rate per Payment Period (i)

q Formula:

$$i = \frac{r}{K}$$

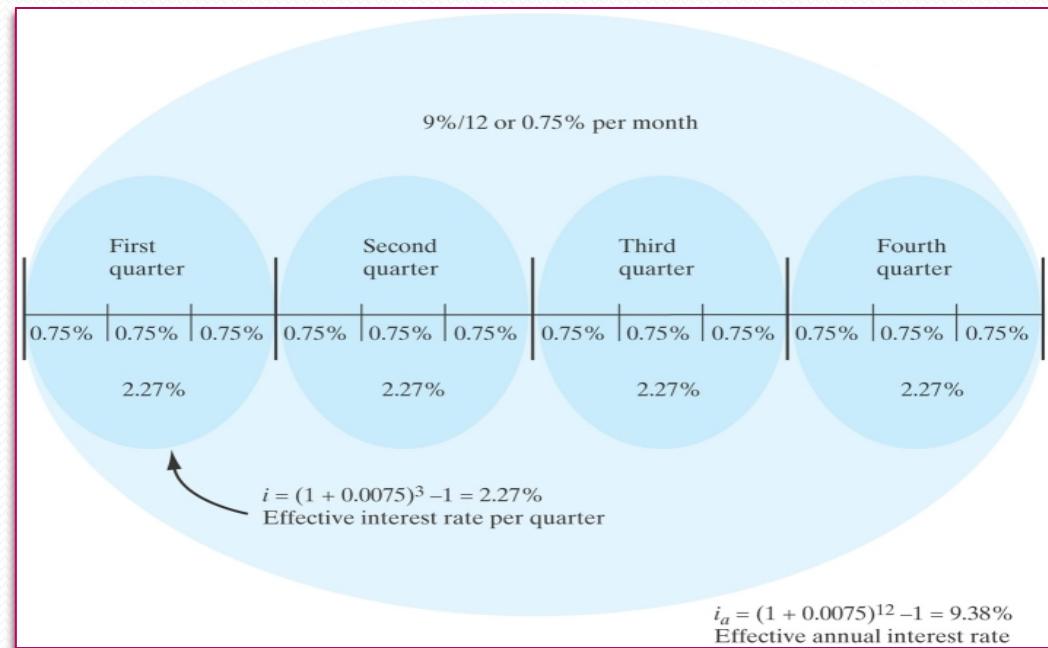
q C = number of interest periods per payment period

q K = number of payment periods per year

q CK = total number of interest periods per year, or M

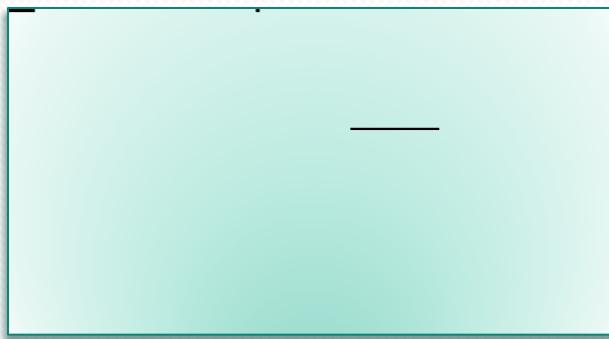
q r/K = nominal interest rate per payment period

□ Functional Relationships among r , i , and i_a , where interest is calculated based on 9% compounded monthly and payments occur quarterly



Effective Interest Rate per Payment Period with Continuous Compounding

q Formula: With
continuous compounding $C \rightarrow \infty$



□ **Example: 12% compounded continuously**

□ **(a) effective interest rate per quarter**



□ **(b) effective annual interest rate**



Case 0: 8% compounded quarterly

Payment Period = Quarter

Interest Period = Quarterly

1 st Q	2 nd Q	3 rd Q	5th Q
-------------------	-------------------	-------------------	-------

1 interest
period

Given $r = 8\%$,

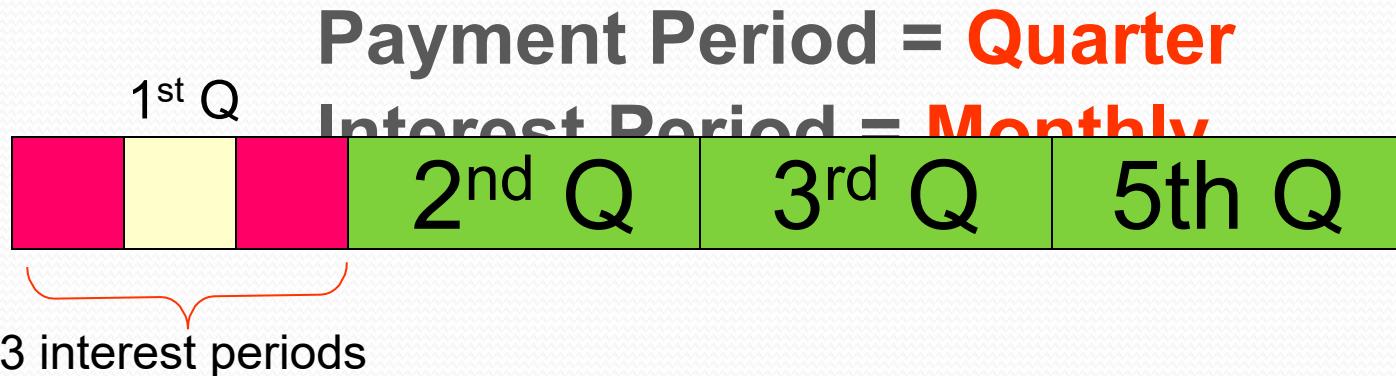
$K = 4$ payments per year

$C = 1$ interest period per quarter

$M = 4$ interest periods per year



Case 1: 8% compounded monthly



Given $r = 8\%$,

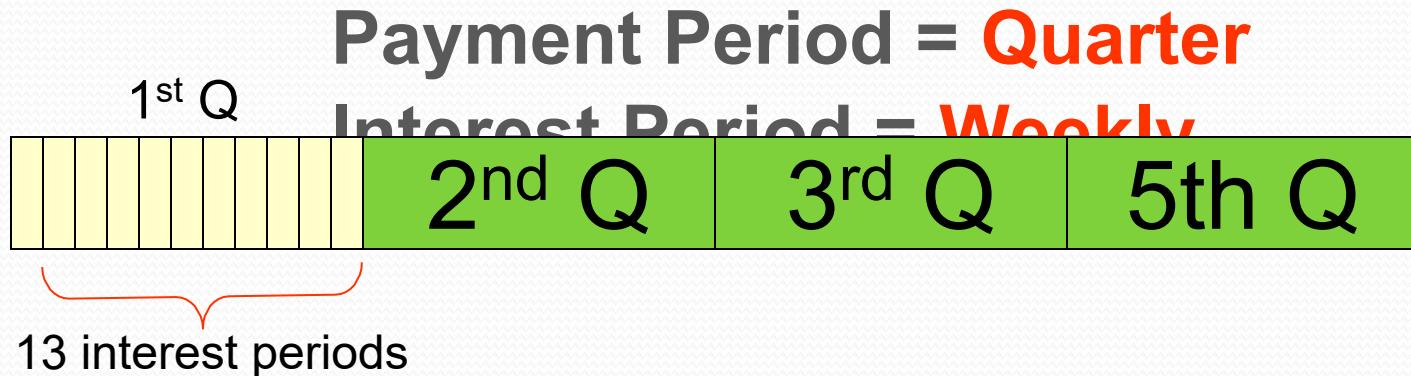
$K = 4$ payments per year

$C = 3$ interest periods per quarter

$M = 12$ interest periods per year



Case 2: 8% compounded weekly



Given $r = 8\%$,

$K = 4$ payments per year

$C = 13$ interest periods per quarter

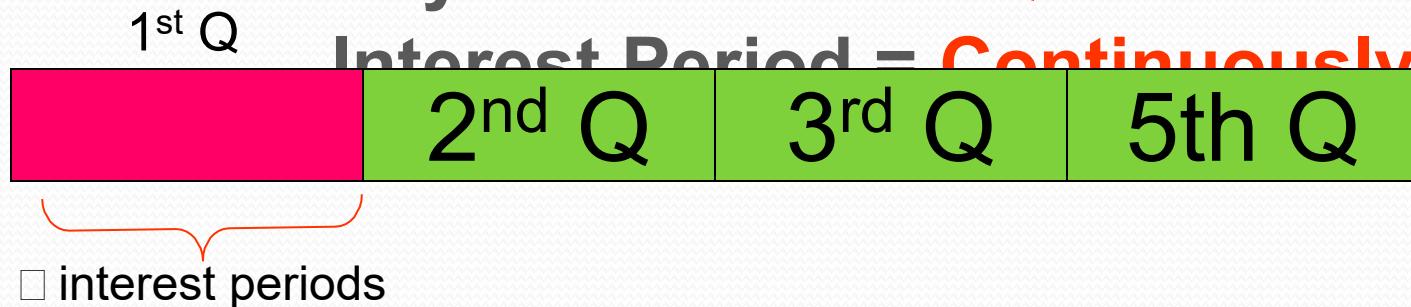
$M = 52$ interest periods per year

$$\begin{aligned} i &= [1 + r / CK]^C - 1 \\ &= [1 + 0.08 / (13)(4)]^{13} - 1 \\ &= 2.0186\% \text{ per quarter} \end{aligned}$$

Case 3: 8% compounded continuously

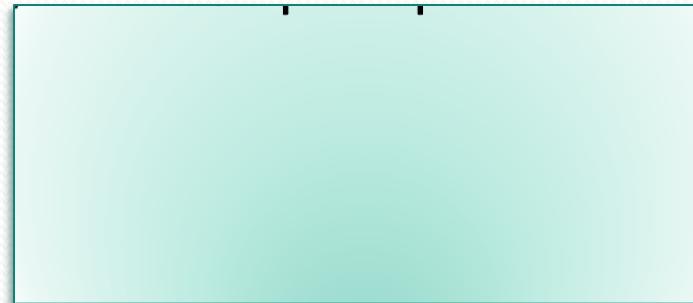
Payment Period = Quarter

Interest Period = Continuously



Given $r = 8\%$,

$K = 4$ payments per year



Summary: Effective Interest Rates per Quarter at Varying Compounding Frequencies

Case 0	Case 1	Case 2	Case 3
8% compounded quarterly	8% compounded monthly	8% compounded weekly	8% compounded continuously
Payments occur quarterly	Payments occur quarterly	Payments occur quarterly	Payments occur quarterly
2.000% per quarter	2.013% per quarter	2.0186% per quarter	2.0201% per quarter

Equivalence Calculations using Effective Interest Rates

- q **Step 1:** Identify the **payment period** (e.g., annual, quarter, month, week, etc)
- q **Step 2:** Identify the **interest period** (e.g., annually, quarterly, monthly, etc)
- q **Step 3:** Find the **effective interest rate** that covers the payment period.

Case I: When Payment Period is Equal to Compounding Period

- q Step 1: Identify the number of compounding periods (M) per year
- q Step 2: Compute the effective interest rate per payment period (i)
- q Step 3: Determine the total number of payment periods (N)

Example 4.4: Calculating Auto Loan Payments

q Given:

q MSRP = \$20,870

q Discounts & Rebates =
\$2,443

q Net sale price =
\$18,427

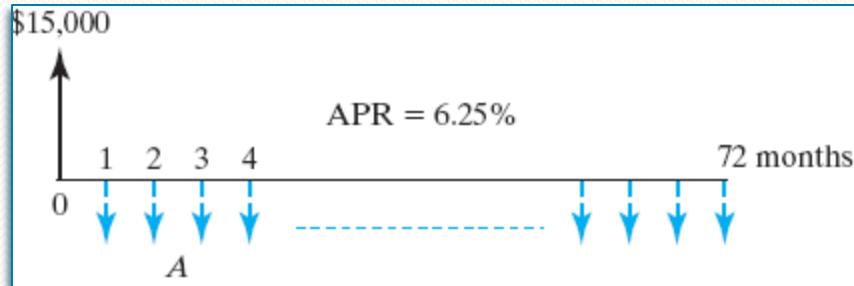
q Down payment =
\$3,427

q Dealer's interest rate =
6.25% APR

q Length of financing =
72 months

q Find: the monthly
payment (A)

□ Solution:



$$i = 6.25\% / 12 = 0.5208\% \text{ per month}$$

$$N = (12)(6) = 72 \text{ months}$$

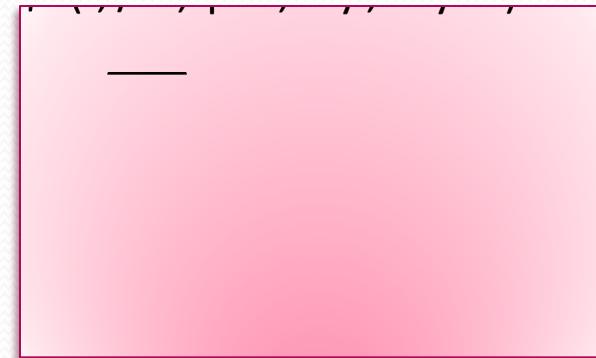
$$A = \$15,000(A/P, 0.5208\%, 72) = \$250.37$$

Dollars Down in the Drain

q Suppose you drink a cup of coffee (\$3.00 a cup) on the way to work every morning for 30 years. If you put the money in the bank for the same period, how much would you have, assuming your accounts earns a 5% interest compounded daily.

q NOTE: Assume you drink a cup of coffee every day including weekends.

- Solution:
- Payment period = daily
- Compounding period = daily



Case II: When Payment Periods Differ from Compounding Periods

- q Step 1: Identify the following parameters.
 - M = No. of compounding periods
 - K = No. of payment periods per year
 - C = No. of interest periods per payment period
- q Step 2: Compute the effective interest rate per payment period.
 - q For discrete compounding
 - q For continuous compounding
- q Step 3: Find the total no. of payment periods.
 - q $N = K \text{ (no. of years)}$
- q Step 4: Use i and N in the appropriate equivalence formula.

Example 4.5

Compounding Occurs More Frequently than Payments are Made (Discrete Case)

Given: $A = \$1,500$ per quarter, $r = 6\%$ per year, $M = 12$ compounding periods per year, and $N = 2$ years

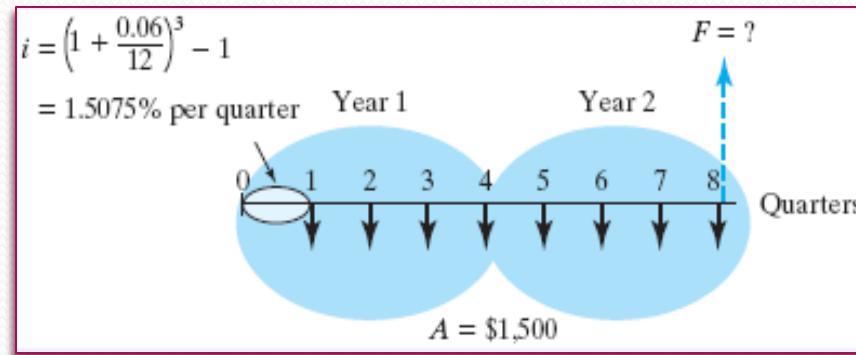
Find: F

Step 1:

- q $M = 12$ compounding periods/year
- q $K = 4$ payment periods/year
- q $C = 3$ interest periods per quarter

Step 2:

Solution:



$\square F = \$1,500 (F/A, 1.5075\%, 8)$
 $= \$14,216.24$

Step 3: $N = 4(2) = 8$

Example 4.6

Compounding is Less Frequent than Payments

Given: $A = \$500$ per month, $r = 10\%$ per year, $M = 4$ quarterly compounding periods per year, and $N = 10$ years

Find: F

Step 1:

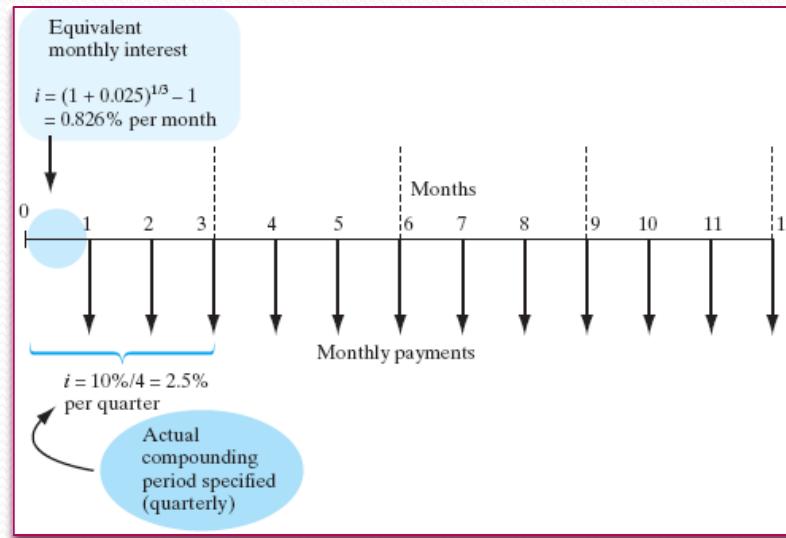
- q $M = 4$ compounding periods/year
- q $K = 12$ payment periods/year
- q $C = 1/3$ interest period per quarter

Step 2:



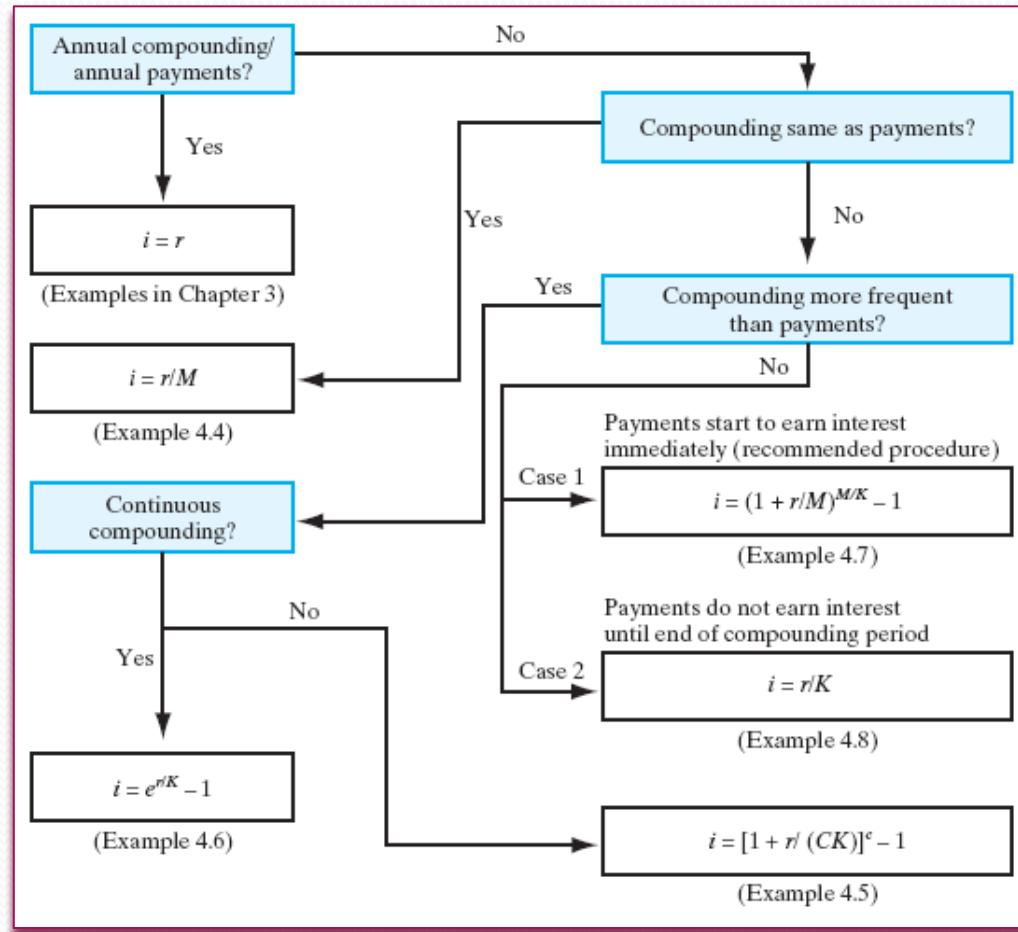
Step 3: $N = 4(2) = 8$

Solution:



$F = \$500 (F/A, 0.826\%, 120)$
 $= \$101,907.89$

A Decision Flow Chart on How to Compute the Effective Interest Rate per Payment Period



Key Points

- n Financial institutions often quote interest rate based on an **APR**.
- n In all financial analysis, we need to convert the APR into an appropriate **effective interest rate** based on a payment period.
- n When payment period and interest period differ, calculate an effective interest rate that covers the payment period. Then use the appropriate interest formulas to determine the equivalent values

Corporate Income Taxes

Lecture No. 32

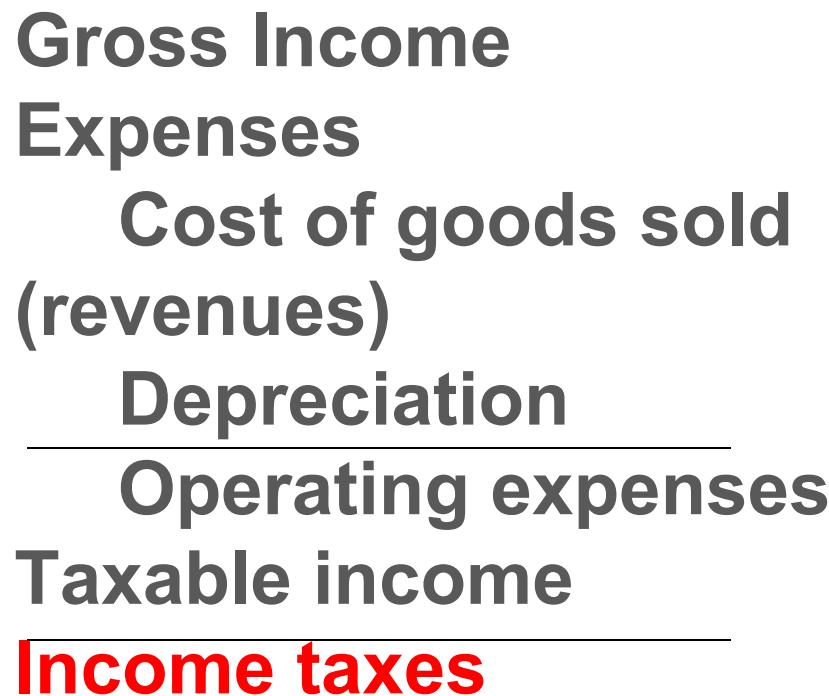
Chapter 9

Contemporary Engineering Economics

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Taxable Income and Income Taxes

Item



Net income

U.S. Corporate Tax System

- For corporations, the U.S. tax system has the following characteristics:
 1. Tax rates are **progressive**; the more you earn, the more you pay.
 2. Tax rates increase in stair-step fashion; four brackets for corporations and two additional surtax brackets, giving a total of six brackets.
 3. Allowable exemptions and deductions may reduce the overall tax assessment.

U.S. Corporate Tax Rate (2016)

<u>Taxable income</u>	<u>Tax rate</u>	<u>Tax computation</u>
0–\$50,000	15%	\$0 + 0.15(Δ)
\$50,001–\$75,000	25%	\$7,500 + 0.25 (Δ)
\$75,001–\$100,000	34%	\$13,750 + 0.34(Δ)
\$100,001–\$335,000	39%	\$22,250 + 0.39 (Δ)
\$335,001–\$10,000,000	34%	\$113,900 + 0.34 (Δ)
\$10,000,001–\$15,000,000	35%	\$3,400,000 + 0.35 (Δ)
\$15,000,001–\$18,333,333	38%	\$5,150,000 + 0.38 (Δ)
\$18,333,334 and up	35%	\$6,416,666 + 0.35 (Δ)

(Δ) denotes the taxable income in excess of the lower bound of each tax bracket

Marginal versus Average Tax Rate

- q **Marginal tax rate** is the rate applied to the last dollar of income earned.
- q **Average (effective) tax rate** is the ratio of income tax paid to net income.

Marginal and Effective (Average) Tax Rate for a Taxable Income of \$16,000,000

Taxable income	Marginal Tax Rate	Amount of Taxes	Cumulative Taxes
First \$50,000	15%	\$7,500	\$7,500
Next \$25,000	25%	6,250	13,750
Next \$25,000	34%	8,500	22,250
Next \$235,000	39%	91,650	113,900
Next \$9,665,000	34%	3,286,100	3,400,000
Next \$5,000,000	35%	1,750,000	5,150,000
Remaining \$1,000,000	38%	380,000	\$5,530,000

$$\text{Average tax rate} = \frac{\$5,530,000}{\$16,000,000} = 34.56\%$$

Example 9.13: Corporate Taxes

q Given: Financial data

- Capital expenditure: \$100,000
 - (Allowed depreciation): \$58,000
- Gross sales revenue: \$1,250,000
- Expenses
 - Cost of goods sold: \$840,000
 - Depreciation: \$58,000
- Leasing warehouse: \$20,000

q Find:

- (a) Taxable income?
- (b) Income taxes?
- (c) Average tax rate?
- (d) Marginal tax rate?

Solution

- (a) Taxable income

Gross revenues	\$1,250,000
Expenses	–840,000
Lease expense	–20,000
Depreciation	<u>–58,000</u>
Taxable income	\$332,000

- (b) Income taxes

First \$50,000 at 15%	\$ 7,500
Next \$25,000 at 25%	6,250
Next \$25,000 at 34%	8,500
Next \$232,000 at 39%	<u>90,480</u>
Income tax	\$112,730

- (c) Average tax rate: $\$112,730/\$332,000 = 33.93\%$
- (d) Marginal tax rate: 39%

Capital Gains and Losses

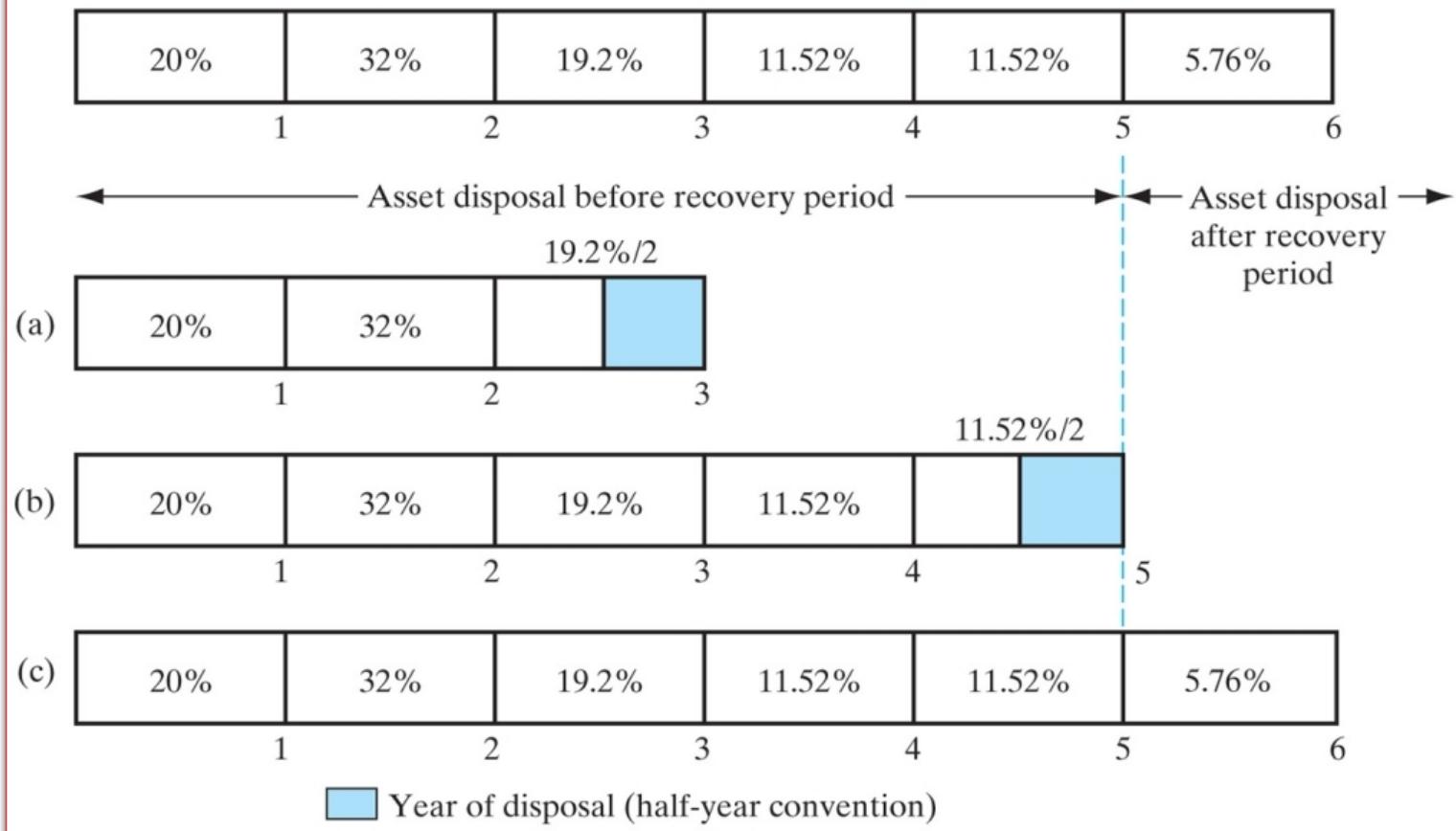
- q **Capital gains** are currently taxed as ordinary income, and the maximum rate is capped at 35%.
- q **Capital losses** are deducted from capital gains; net remaining losses may be carried backward (3 years) and forward 15 years for consideration in years other than the current tax year.

Tax Treatment of Gains or Losses on Depreciable Assets

- q If a MACRS property is disposed of during the **recovery period**
 - o Personal property: the half-year convention is applied to depreciation amount for the year of disposal.
 - o Real property: the mid-month convention is applied to the month of disposal.

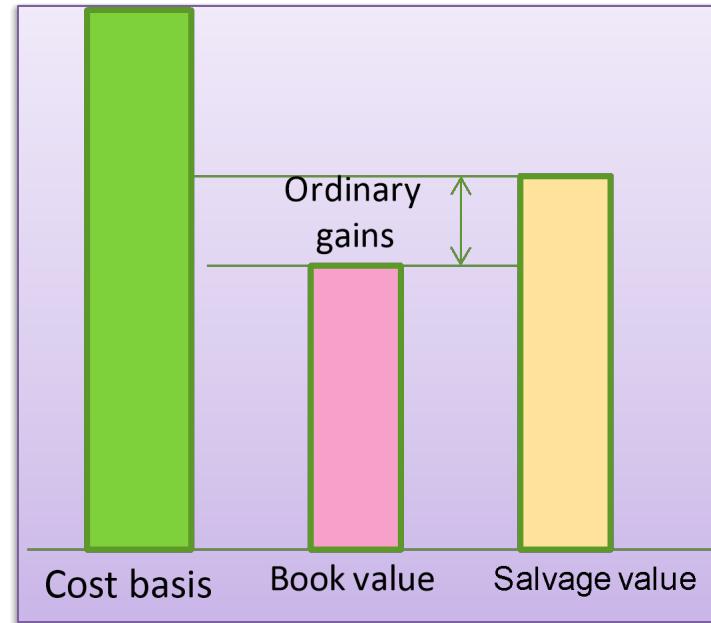
Disposal of a MACRS Property and Its Effect on Depreciation Allowances

Recovery period = 5 years (for 5-year MACRS asset)



Case 1: Salvage Value < Cost Basis

- **Ordinary gains (losses) = salvage value – book value**
- These gains, known as **depreciation recapture**, are taxed as ordinary income.
- Any **losses (ordinary)** can be deducted from the ordinary gains from other assets first and any remaining balance can be deducted from the ordinary taxable income.



Case 2: Salvage Value > Cost Basis

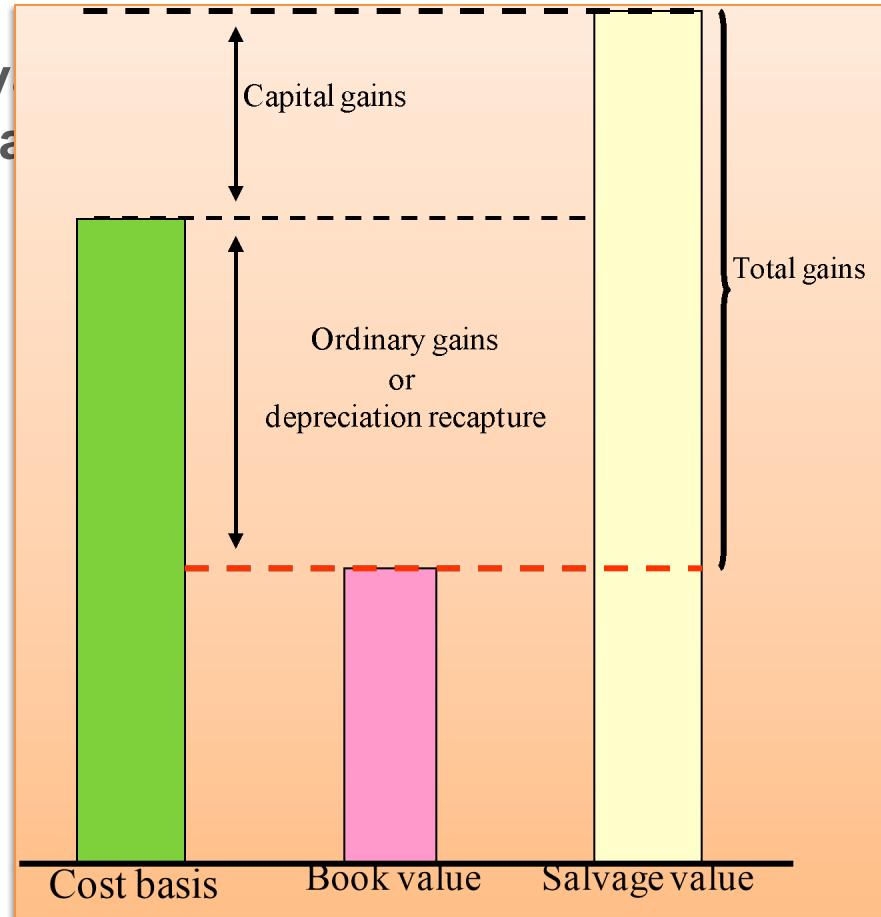
$$\text{Gains} = \text{Salvage value} - \text{book value}$$
$$= (\text{Salvage value} - \text{cost basis})$$

Capital gains

$$+ (\text{Cost basis} - \text{book value})$$

Ordinary gains

Capital gain is taxed as ordinary income under current tax law.



Example 9.15: Gains or Losses on Depreciable Asset, Case 1

q Given:

- o Cost basis for a drill press: \$230,000
- o Recovery period: 7-year MACRS
- o Sold the drill press after 3 years at \$150,000
- o Tax rate for capital gains and ordinary gains: 34%

q Find:

- o Taxable gains
- o Net proceeds from sales

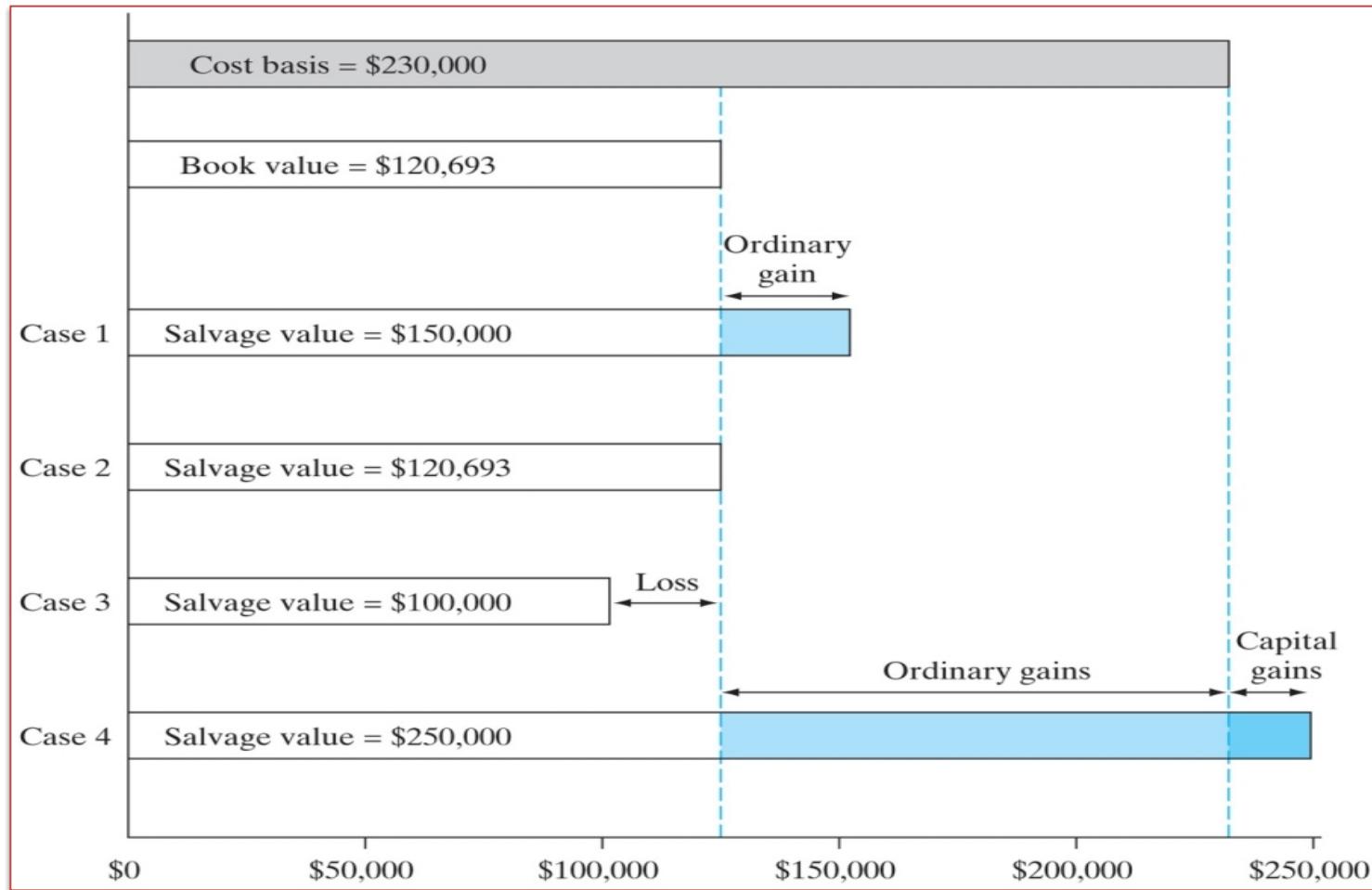
Solution

- **Depreciation schedule**

0.1439	0.2449	0.1749/2					
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- Total dep. = $230,000(0.1439 + 0.2449 + 0.1749/2) = \$109,308$
- Book value = $230,000 - 109,308 = \$120,693$
- Gains = salvage value – book value = $\$150,000 - \$120,693 = \$29,308$
- Gains tax (34%) = $0.34 (\$29,308) = \$9,965$
- Net proceeds from sale = $\$150,000 - \$9,965 = \$140,035$

Calculation of Gains or Losses on MACRS Property, Cases 2–4



What Income Tax Rate Should Be Used in Project Analysis?

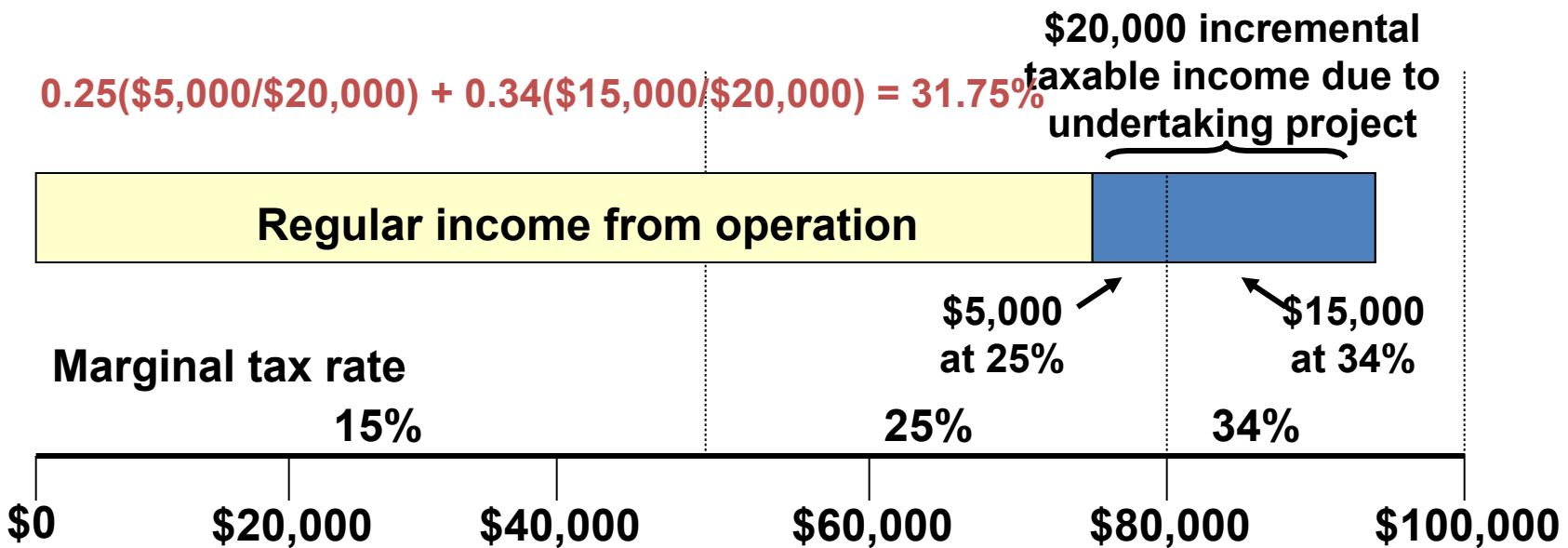
- n **Incremental tax rate** is the average rate applied to the incremental income generated by a new investment project.

	Regular Business	Project
Revenues	\$200,000	\$40,000
Expenses	\$130,000	\$20,000
Taxable Income	\$70,000	\$20,000
Income Taxes	\$12,500	?

	Before Undertaking Project	After Undertaking Project	The Effect of Project
Gross revenue	\$200,000	\$240,000	\$40,000
Expenses	130,000	150,000	20,000
Taxable income	\$70,000	\$90,000	\$20,000
Income taxes	\$12,500	\$18,850	\$6,350
Tax rate	17.86%	20.94%	31.75%

Incremental tax rate to be used in project cash flow analysis

Illustration of Incremental Tax Rate



Consideration of State Income Taxes

$$t_m = t_f + t_s - (t_f)(t_s)$$

where

t_m = combined marginal tax rate

t_f = federal marginal tax rate

t_s = state marginal tax rate

Example: Given $t_f = 35\%$ and $t_s = 7\%$

Find: t_m

$$\begin{aligned}\text{Combined tax rate} &= 0.35 + 0.07 - (0.35)(0.07) \\ &= 39.55\%\end{aligned}$$

Example 9.17: Combined State and Federal Income Taxes

q **Given:** Financial Data

- o Gross revenue = \$1,000,000
- o All expenses = \$400,000
- o $t_f = 35\%$, $t_s = 7\%$
- o $t_m = 0.35 + 0.07 - (0.07)(0.35) = 39.55\%$

q **Find:** Combined income taxes

Solution

q Approach 1

- o State taxable income = \$600,000
- o State taxes = $(0.07)(\$600,000) = \$42,000$
- o Federal taxable income
 - = $\$600,000 - \$42,000$
 - = $\$558,000$
- o Federal taxes = $(0.35)(\$558,000)$
 - = $\$195,300$

q Approach 2

- o $(0.3955)\$600,000 = \$195,300$

Cash Flow vs. Net Income

- q **Net income:** an accounting means of measuring a firm's profitability based on the matching concept.
 - o Costs become expenses as they are matched against revenue.
 - o The actual timing of cash inflows and outflows are ignored.
- q **Cash flow:** Considering the time value of money, it is better to receive cash now than later, because cash can be invested to earn more money. So, cash flows are more relevant data to use in project evaluation.

Example 9.18: Net Income Calculation

q **Given:** Project description

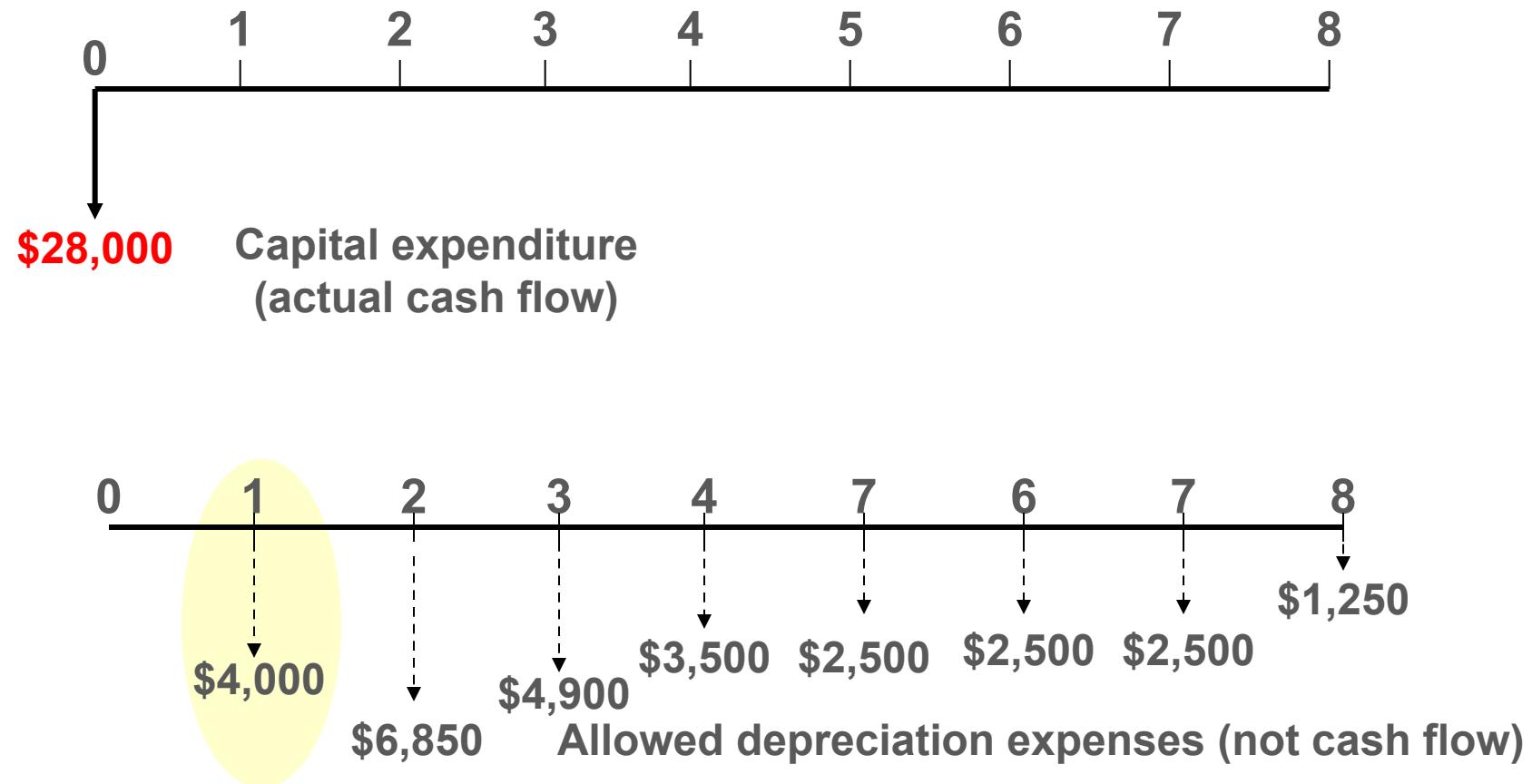
- o Purchased an equipment costing \$28,000
- o Gross income: \$50,000/yr
- o Cost of goods sold: \$20,000/yr
- o Operating expenses: \$6,000/yr
- o Depreciation method: 7-year MACRS
- o Income tax rate: 40%

q **Find:** The net income during the first year of operation

Solution

Item	Amount
Gross income (revenue)	\$50,000
Expenses:	
Cost of goods sold	20,000
Depreciation	4,000
Operating expenses	6,000
Taxable income	20,000
Taxes (40%)	8,000
Net income	\$12,000

Capital Expenditure versus Depreciation Expenses

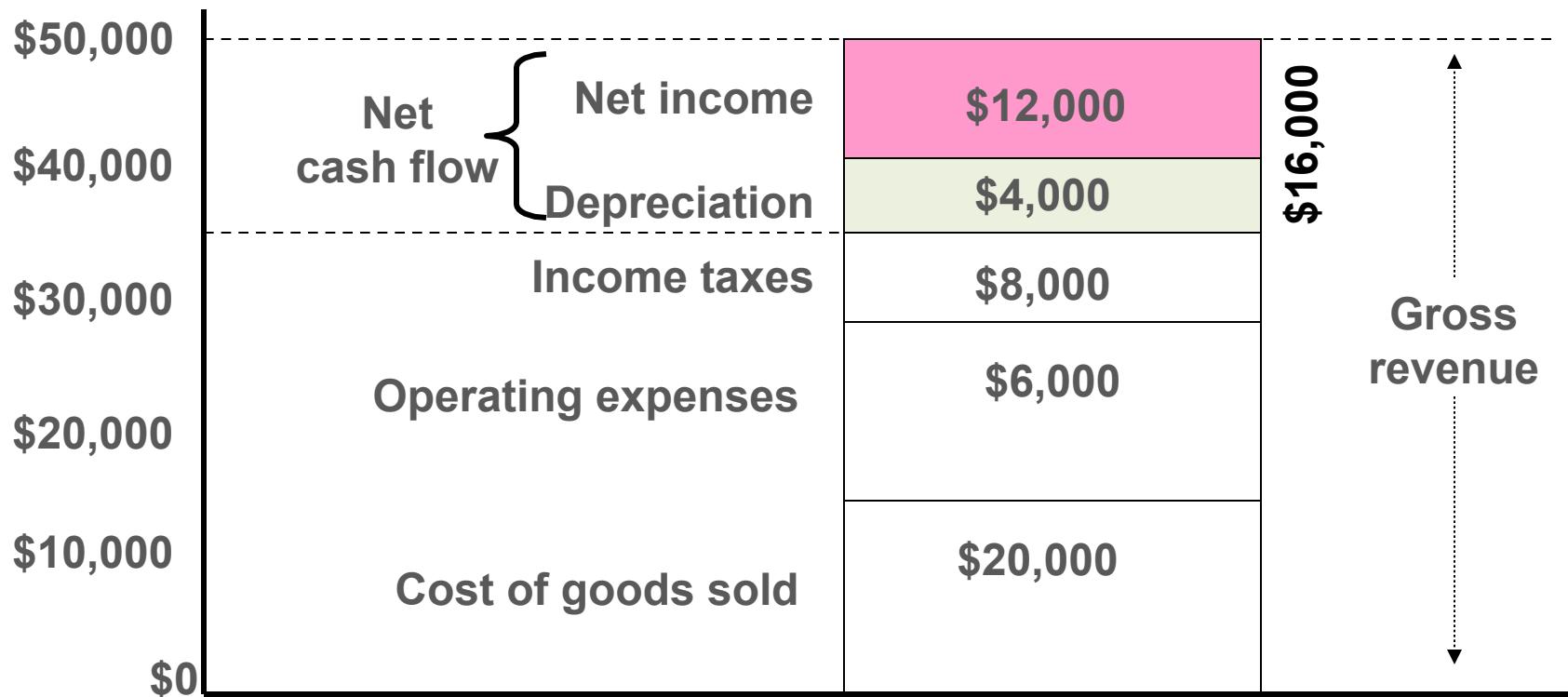


Cash Flow versus Net Income

Item	Income	Cash Flow
Gross income (revenue)	\$50,000	\$50,000
Expenses		
Cost of goods sold	20,000	-20,000
Depreciation	4,000	
Operating expenses	6,000	-6,000
Taxable income	20,000	
Taxes (40%)	8,000	-8,000
Net income	\$12,000	
Net cash flow		\$16,000

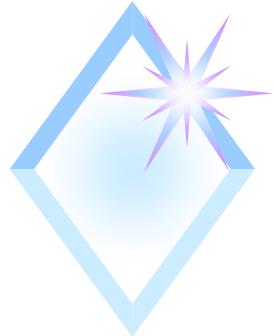
Estimating Net Cash Flow from Net Income

Net cash flows = net income + non-cash expense (depreciation)



Summary

- **Explicit consideration of taxes is a necessary aspect of any complete economic study of an investment project.**
- **Once we understand that depreciation has a significant influence on the income and cash position of a firm, we will be able to appreciate fully the importance of utilizing depreciation as a means to maximize the value both of engineering projects and of the organization as a whole.**



BASIC CONCEPTS:

Indian Banking



Overview of Banking and Financial Institutions

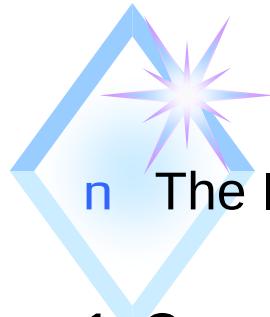
Early history

Banking in India originated in the last decades of the 18th century.

- The first banks were The General Bank of India which started in 1786, and the Bank of Hindustan, both of which are now defunct.
- The oldest bank in existence in India is the State Bank of India, which originated in the Bank of Calcutta in June 1806, which almost immediately became the [Bank of Bengal](#).
- This was one of the three presidency banks, the other two being the [Bank of Bombay](#) and the [Bank of Madras](#), all three of which were established under charters from the British East India Company.
- For many years the Presidency banks acted as quasi-central banks, as did their successors. The three banks merged in 1925 to form the [Imperial Bank of India](#), which, upon India's independence, became the State Bank of India.

- Indian merchants in Calcutta established the Union Bank in 1839, but it failed in 1848 as a consequence of the economic crisis of 1848-49.
- The Allahabad Bank, established in 1865 and still functioning today, is the oldest Joint Stock bank in India.
- Foreign banks too started to arrive, particularly in Calcutta, in the 1860s. A French Bank opened a branch in Calcutta in 1860 another in Bombay in 1862; branches in Madras and Pondicherry.
- HSBC is established itself in Bengal in 1869.
- Calcutta was the most active trading port in India, mainly due to the trade of the British Empire, and so became a banking center.
- The Bank of Bengal, which later became the State Bank of India.
- The Punjab National Bank, established in Lahore in 1895, which has survived to the present and is now one of the largest banks in India.

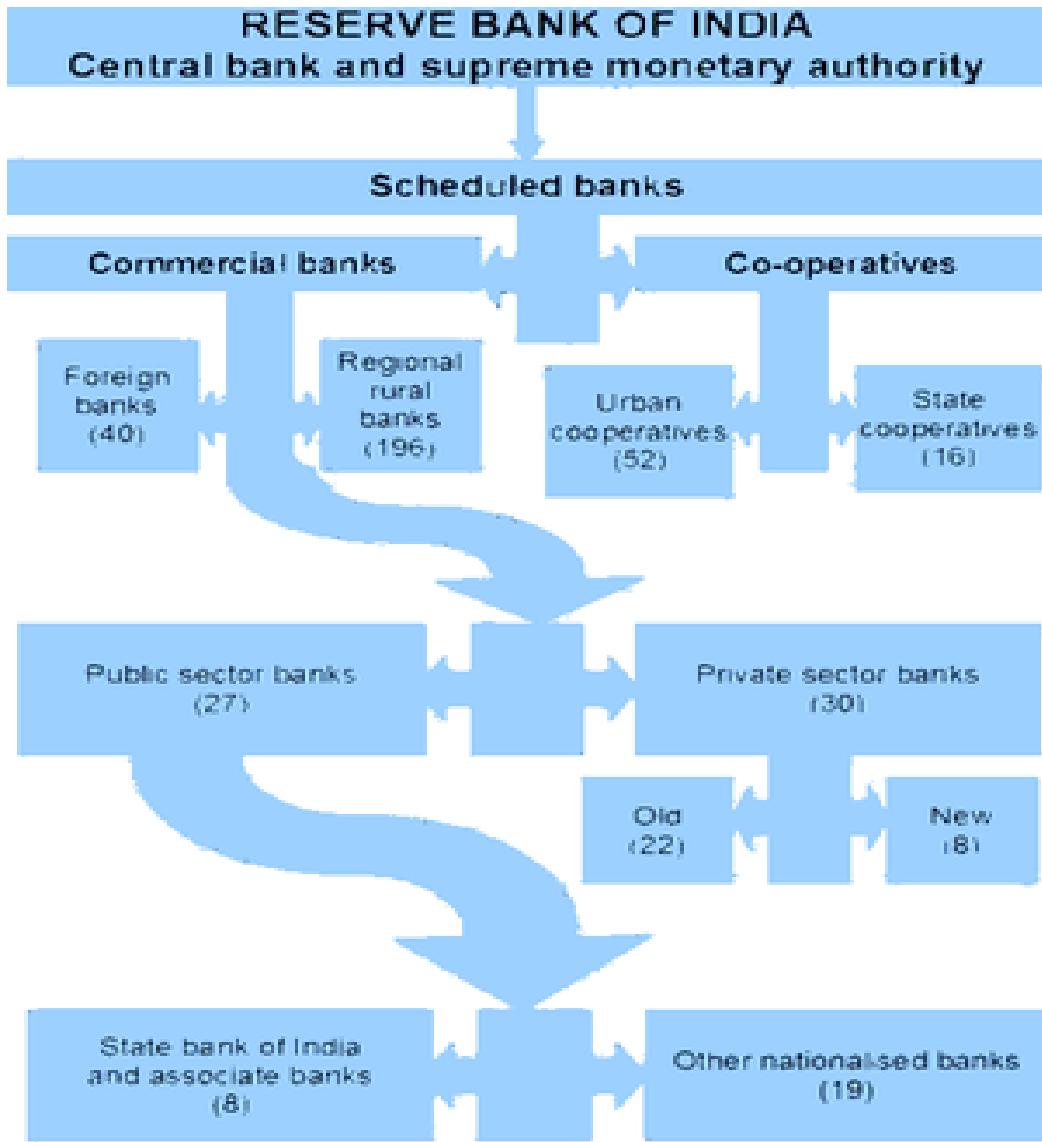
- 
- The period between 1906 and 1911, saw the establishment of banks inspired by the [Swadeshi](#) movement.
 - The Swadeshi movement inspired local businessmen and political figures to found banks of and for the Indian community.
 - A number of banks established then have survived to the present such as Bank of India, Corporation Bank, Indian Bank, Bank of Baroda, Canara Bank and Central Bank of India.



Financial Structure

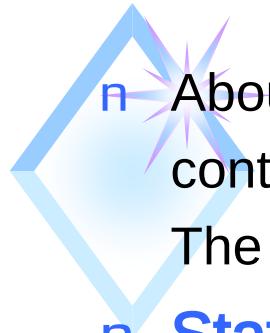
The Indian financial system comprises the following institutions:

1. Commercial banks
 - a. Public sector
 - b. Private sector
 - c. Foreign banks
 - d. Cooperative institutions
 - (i) Urban cooperative banks
 - (ii) State cooperative banks
 - (iii) Central cooperative banks
2. Financial institutions
 - a. All-India financial institutions (AIFIs)
 - b. State financial corporations (SFCs)
 - c. State industrial development corporations(SIDCs)
3. Nonbanking financial companies (NBFCs)
4. Capital market intermediaries



Structure of the organized banking sector in India.
Number of banks are in brackets.

- 
- Currently, India has 88 scheduled commercial banks (SCBs) - 27 public sector banks (that is with the Government of India holding a stake), 31 private banks (these do not have government stake; they may be publicly listed and traded on stock exchanges) and 38 foreign banks.
 - They have a combined network of over 53,000 branches and 17,000 ATMs.
 - According to a report by ICRA Limited, a rating agency, the public sector banks hold over 75 percent of total assets of the banking industry, with the private and foreign banks holding 18.2% and 6.5% respectively.



n About 92 percent of the country's banking segment is under State control while the balance comprises private sector and foreign banks.

The public sector commercial banks are divided into three categories :

n **State bank group** (eight banks):

- n This consists of the State Bank of India (SBI) and Associate Banks of SBI. The Reserve Bank of India (RBI) owns the majority share of SBI and some Associate Banks of SBI.
- n SBI has 13 head offices governed each by a board of directors under the supervision of a central board.
- n The boards of directors and their committees hold monthly meetings while the executive committee of each central board meets every week.



Nationalized banks (19 banks)

- n In 1969, the Government arranged the nationalization of 14 scheduled commercial banks in order to expand the branch network, followed by six more in 1980.
- n A merger reduced the number from 20 to 19. Nationalized banks are wholly owned by the Government, although some of them have made public issues.
- n In contrast to the state bank group, nationalized banks are centrally governed, i.e., by their respective head offices. Thus, there is only one board for each nationalized bank and meetings are less frequent (generally, once a month).
- n The state bank group and nationalized banks are together referred to as the public sector banks.



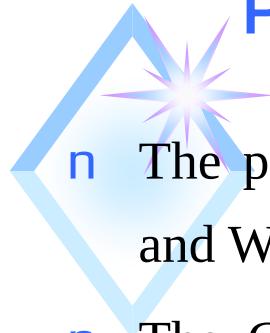
Regional Rural Banks (RRBs):

In 1975, the state bank group and nationalized banks were required to sponsor and set up RRBs in partnership with individual states to provide low-cost financing and credit facilities to the rural masses.



From World War I to Independence

- n The period during the First World War (1914-1918) through the end of the Second World War (1939-1945), and two years thereafter until the independence of India were challenging for Indian banking.
- n The years of the First World War were turbulent, and it took its toll with banks simply collapsing despite the Indian economy gaining indirect boost due to war-related economic activities.
- n At least 94 banks in India failed between 1913 and 1918.



Post-independence

- n The partition of India in 1947 adversely impacted the economies of Punjab and West Bengal, paralyzing banking activities for months.
- n The Government of India initiated measures to play an active role in the economic life of the nation, and the Industrial Policy Resolution adopted by the government in 1948 envisaged a mixed economy.
- n This resulted into greater involvement of the state in different segments of the economy including banking and finance.
- n The major steps to regulate banking included:
 - n In 1948, the Reserve Bank of India, India's central banking authority, was nationalized, and it became an institution owned by the Government of India.
 - n In 1949, the Banking Regulation Act was enacted which empowered the Reserve Bank of India (RBI) "*to regulate, control, and inspect the banks in India.*"

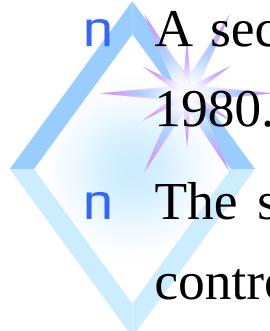


- n The Banking Regulation Act also provided that no new bank or branch of an existing bank could be opened without a license from the RBI, and no two banks could have common directors.
- n However, despite these provisions, control and regulations, banks in India except the State Bank of India, continued to be owned and operated by private persons. This changed with the nationalization of major banks in India on 19 July, 1969.



Nationalisation

- n By the 1960s, the Indian banking industry has become an important tool to facilitate the development of the Indian economy.
- n At the same time, it has emerged as a large employer, and a debate has ensued about the possibility to nationalise the banking industry.
- n Indira Gandhi, the-then Prime Minister of India expressed the intention of the GOI in the annual conference of the All India Congress Meeting in a paper entitled "*Stray thoughts on Bank Nationalisation.*" The paper was received with positive enthusiasm. Thereafter, her move was swift and sudden, and the GOI issued an ordinance and nationalised the 14 largest commercial banks with effect from the midnight of July 19, 1969. Jayaprakash Narayan, a national leader of India, described the step as a "*masterstroke of political sagacity.*" Within two weeks of the issue of the ordinance, the Parliament passed the Banking Companies (Acquisition and Transfer of Undertaking) Bill, and it received the presidential approval on 9 August, 1969.



A second dose of nationalization of 6 more commercial banks followed in 1980.

- n The stated reason for the nationalization was to give the government more control of credit delivery. With the second dose of nationalization, the GOI controlled around 91% of the banking business of India. Later on, in the year 1993, the government merged [New Bank of India](#) with [Punjab National Bank](#).
- n It was the only merger between nationalized banks and resulted in the reduction of the number of nationalised banks from 20 to 19. After this, until the 1990s, the nationalised banks grew at a pace of around 4%, closer to the average growth rate of the Indian economy.
- n The nationalised banks were credited by some, including [Home minister P. Chidambaram](#), to have helped the [Indian economy](#) withstand the [global financial crisis of 2007-2009](#).

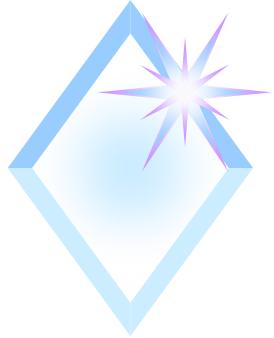


Liberalisation

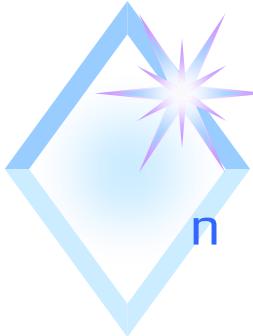
- n In the early 1990s, the then [Narsimha Rao](#) government embarked on a policy of [liberalization](#), licensing a small number of private banks.
- n These came to be known as *New Generation tech-savvy banks*, and included Global Trust Bank (the first of such new generation banks to be set up), which later amalgamated with Oriental Bank of Commerce, [Axis Bank](#) (earlier as [UTI Bank](#)), [ICICI Bank](#) and [HDFC Bank](#). This move, along with the rapid growth in the [economy of India](#), revitalized the banking sector in India, which has seen rapid growth with strong contribution from all the three sectors of banks, namely, government banks, private banks and foreign banks.
- n The next stage for the Indian banking has been setup with the proposed relaxation in the norms for Foreign Direct Investment, where all Foreign Investors in banks may be given voting rights which could exceed the present cap of 10%, at present it has gone up to 49% with some restrictions.

- 
- n The new policy shook the Banking sector in [India](#) completely. Bankers, till this time, were used to the 4-6-4 method (Borrow at 4%;Lend at 6%;Go home at 4) of functioning.
 - n The new wave ushered in a modern outlook and tech-savvy methods of working for traditional banks.
 - n All this led to the retail boom in India. People not just demanded more from their banks but also received more.
 - n Currently (2007), banking in India is generally fairly mature in terms of supply, product range and reach-even though reach in rural India still remains a challenge for the private sector and foreign banks.
 - n In terms of quality of assets and capital adequacy, Indian banks are considered to have clean, strong and transparent balance sheets relative to other banks in comparable economies in its region.
 - n The Reserve Bank of India is an autonomous body, with minimal pressure from the government.

- 
- n The stated policy of the Bank on the Indian Rupee is to manage volatility but without any fixed exchange rate-and this has mostly been true.
 - n With the growth in the Indian economy expected to be strong for quite some time-especially in its services sector-the demand for banking services, especially retail banking, mortgages and investment services are expected to be strong.
 - n In recent years critics have charged that the non-government owned banks are too aggressive in their loan recovery efforts in connection with housing, vehicle and personal loans.
 - n There are press reports that the banks' loan recovery efforts have driven defaulting borrowers to suicide.



The [Bank of Bengal](#), which later became the [State Bank of India](#).



Banking and Trades

n Financial Management

- | It is a study of relationship between the raising of finance and the deployment of finance.
- n Funds required for running the business are raised through a combination of direct revenue from sales, loans from banks, sales of securities and bonds, etc. unds raised as above are deployed among competing uses within the enterprise's activities.
- n It involves decisions pertaining to :
 - | 1)Investment(proposals) policies,
 - | 2)Methods of financing, and
 - | 3) Dividend decisions.
- n Financial function of any business enterprise tries to maximize the value of that business to its owners.



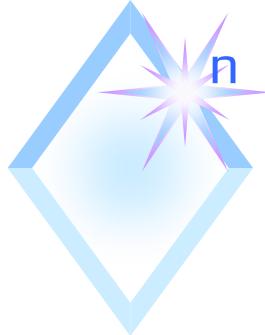
Financial Analysis

- n The principle idea in analyzing financial ratios is there are several key ratios, obtainable from the firm's financial statements, Which reveal the financial and non-financial health of the firm.
- n In general, there are 4 categories of ratios,each attempting to measure a particular aspect of the firm's position and performance.
- n Ratio Analysis
 - | Purpose:
 - a) To Identify aspects of business's performance to aid decision making.
 - b) Quantitative Process-may need to be supplemented by qualitative factors to get a complete picture of business.
 - c) Five main areas:
 - 1)Liquidity
 - 2)Investment/shareholders
 - 3)Gearing
 - 4) Profitability
 - 5) Financial



END OF
LECTURE



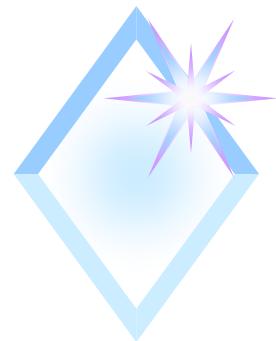


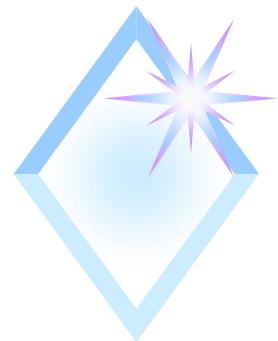
1) Liquidity :

- | The ability of the firm to pay its way. Liquidity ratios reflect the firm's ability to meet scheduled short-term obligations.
- | Liquidity ratios also reflect the firm's ability to meet short term financial contingencies that might arise.

n Investments/Shareholders :

- | Information to enable







Lecture 4

Equivalence Calculations under Inflation

Department of Systems Engineering and Engineering Management
The Chinese University of Hong Kong

Part I – Review of the Last Lecture

Some Terminologies

- Nominal Interest Rates (Annual Percentage Rate)
- Effective Interest Rates (Annual Effective Yield)
- Discrete Compounding
- Continuous Compounding

Part II – Inflation

Measure of Inflation

- Inflation
 - A loss in the purchasing power of money over time.
 - the cost of an item tends to increase over time
 - The same dollar amount buys less of an item over time
- Deflation
 - Opposite of inflation
 - Prices decrease over time
 - A specified dollar amount gains purchasing power
- As inflation is more common, we focused on inflation in economic analyses in this lecture.

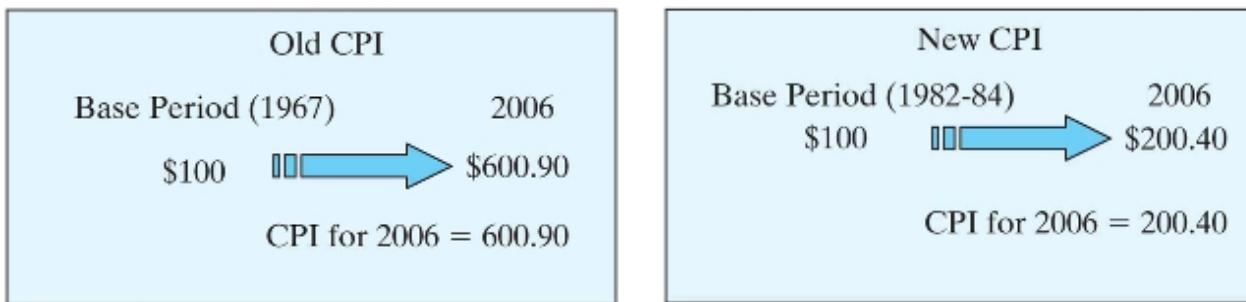
Measure of Inflation

- Suppose that your salary is \$35,000, and you are promised a salary raise 6%/year. Suppose that the inflation is 8%. What is the real situation?
 - Is that you are really “rising” salary?

Consumer Price Index

- Consumer Price Index (CPI)
 - Measures prices of typical purchases made by consumers
 - Based on a typical market basket of goods and services required by the average consumers
 - Food & alcoholic beverages
 - Housing
 - Apparel
 - Transportation
 - Medical care
 - Entertainment
 - Personal care
 - Other goods and services

Consumer Price Index



- Compares the cost of the typical market basket of goods and services in a current month with its cost at a previous time (base period), e.g. 1 month ago, 1 year ago, etc.
- Not a cost-of-living index
- Good measure of the general price increase of consumer products
- Not a good measure of industrial price increases
 - Producer Price Index

Inflation Rate

- With the price indexes,

$$\text{Inflation rate} = \frac{\text{Change in price index}}{\text{Initial price index}} \times 100$$

- For example, CPI in 2001 = 177.1, CPI in 2000 = 172.2,

$$\text{Inflation rate in 2001} = \frac{177.1 - 172.2}{172.2} \times 100 \\ 2.8\%$$

Average Inflation Rate (f)

- Average Inflation Rate
 - Account for the effect of varying yearly inflation rates over a period of several years
- Compounding effect
 - Each year's inflation rate is based on the previous year's rate

Average Inflation Rate (f)

- Example:

- 1st year's inflation rate = 4%, 2nd year's inflation rate = 8%, with a base price of \$100.
 - The average inflation rate for the two years:
 - Step 1: Find the price at the end of the second year, with the process of compounding:

$$\$100 (1 + 0.04\%)(1 + 0.08) = \$112.32$$

- Step 2: Find the average inflation rate, f , with the following equivalence equation:

$$\$100(1 + f)^2 = \$112.32 \quad \text{or} \quad \$100(F / P, f, 2) = \$112.32$$
$$f = 5.98\%$$

The price increases in the last two years are equivalent to an average annual percentage rate of 5.98% per year.

An Example

Category	2003 Price	2000 Price	Average Inflation Rate
Postage	\$0.37	\$0.33	3.89%
Homeowners insurance (per year)	\$603.00	\$500.00	6.44%
Auto insurance (per year)	\$855.00	\$687.00	7.56%
Private college tuition and fees	\$18,273.00	\$15,518.00	5%
Gasoline (per gallon)	\$1.65	\$1.56	1.89%
Haircut	\$12.00	\$10.50	4.55%
Car (Toyota Camry)	\$22,000.00	\$21,000.00	1.56%
Natural gas (per million BTUs)	\$5.67	\$3.17	21.38%
Baseball tickets (family of four)	\$148.66	\$132.44	3.92%
Cable TV (per month)	\$47.97	\$36.97	9.07%
Movies (average ticket)	\$5.80	\$5.39	2.47%
Movies (concessions)	\$2.17	\$1.98	3.10%
Health care (per year)	\$2,088.00	\$1,656.00	8.30%
Consumer price index (CPI) Base period: 1982—84=100	184.20	171.20	2.47%

An Example

- The average inflation rate of the private college tuition is calculated as follows:
- Given: P=\$15,518, F=\$18,273, N=2003-2000=3

$$\$18,273 \quad \$15,518 (1 + f)^3$$

$$f = \sqrt[3]{\frac{18,273}{15,518}} - 1$$

5.6%

General Inflation Rate vs Specific Inflation Rate

- General Inflation Rate (\bar{f})
 - The average inflation rate based on the CPI for all items in the market basket. The market interest rate is expected to respond to this general inflation rate.
- Specific Inflation Rate (f_i)
 - This rate is based on an index specific to segment j of the economy.

General Inflation Rate vs Specific Inflation Rate (cont'd)

- The general inflation, in terms of CPI, is defined as:

$$CPI_n / CPI_0 - 1$$

- or

$$\bar{f} = \left| \frac{CPI_n}{CPI_0} \right|^{1/n} - 1$$

- where
 - \bar{f} = the general inflation rate,
 - CPI_n = the consumer price index at the end period n, and
 - CPI_0 = the consumer price index for the base period.

General Inflation Rate vs Specific Inflation Rate

(cont'd)

- The general inflation, given the CPI values for two consecutive years, is defined as:

$$\bar{f}_n = \frac{CPI_n - CPI_{n1}}{CPI_{n1}}$$

- where
 - \bar{f}_n = the general inflation rate for period n.
- E.g. The general inflation rate for the year 2002, where $CPI_{2001} = 530.4$, and $CPI_{2002} = 538.8$,

$$\frac{538.8 - 530.4}{530.4} = 0.0158 = 1.58\%$$

An Example

- For a utility company's cost to supply a fixed amount of power to a new housing development

Year	Cost
0	\$504,000
1	\$538,400
2	\$577,000
3	\$629,500

- Assume that year 0 is the base period. Determine the inflation rate for each period, and the average inflation rate over the three years.

43

Answer: $f=7.69\%$

Actual versus Constant Dollars

- Actual (current) dollars (A_n)
 - The dollar value that is “influenced” by inflation.
 - Estimates of future cash flows for year n that take into account any anticipated changes in amount caused by inflationary or deflationary effects.
- Constant (real) dollars (A'_n)
 - The real purchasing power
 - Reflect constant purchasing power independent of the passage of time.

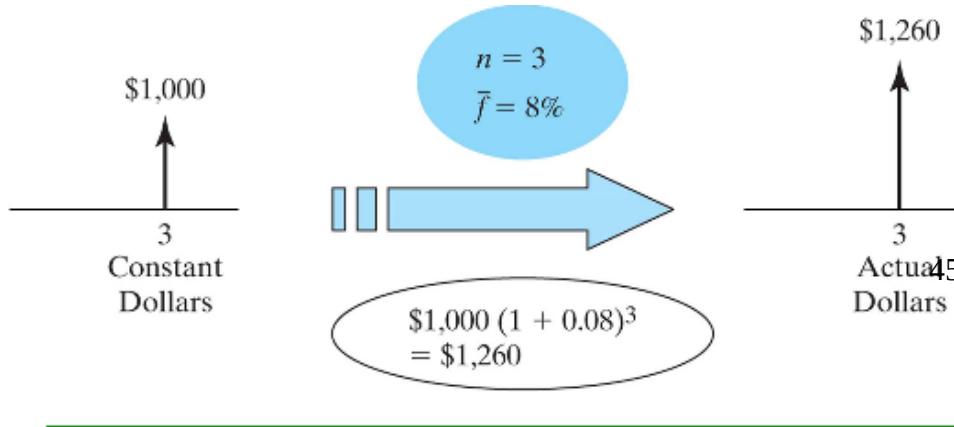
Conversion from Constant to Actual Dollars

- For cash flows estimated with inflationary effects were assumed, they can be converted to constant dollars (base-year dollars), using the general inflation rate.

$$A_n = A'_n (1 + \bar{f})^n = A'_n (F/P, \bar{f}, n)$$

where

- A'_n = the constant-dollar expression for the cash flow occurring at the end of year n, and
- A_n = the actual-dollar expression for the cash flow occurring at the end of year n.



An Example

- Assume the general inflation rate is 5%. Convert the following cash flows into equivalent actual dollars.

Period	Net Cash Flows in Constant \$
0	-\$250,000
1	\$100,000
2	\$110,000
3	\$120,000
4	\$130,000
5	\$120,000

Answer:

Cash Flow in Actual \$
-\$250,000
\$105,000
\$121,275
\$138,915
\$158,016
\$153,154

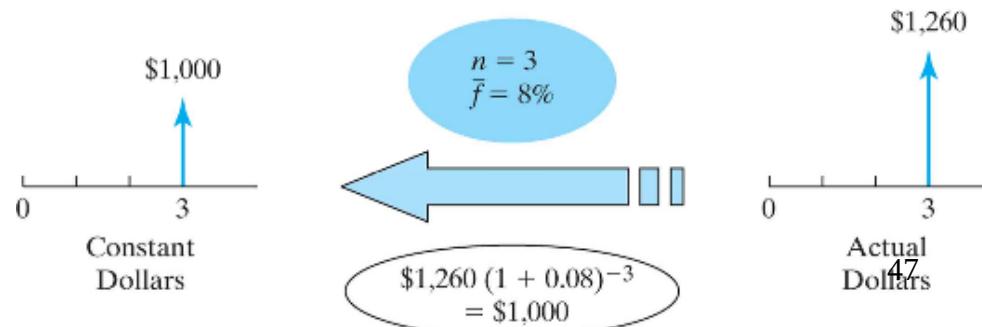
Conversion from Actual to Constant Dollars

- The reverse of converting from constant to actual dollars.

$$A'_n = A_n (1 + \bar{f})^{-n} = A'_n (P/F, \bar{f}, n)$$

where

- A'_n = the constant-dollar expression for the cash flow occurring at the end of year n , and
- A_n = the actual-dollar expression for the cash flow occurring at the end of year n .



Actual
Dollars

\$1,260

47

Constant
Dollars

\$1,000

3

An Example

- Assume the general inflation rate is 5%. A company has negotiated a five-year lease on 20 acres of land. The annual cost stated in the lease is \$20,000 to be paid at the beginning of each of the five years.
- The equivalent cost in constant dollars in each period:

Answer:

Cash Flow in Constant \$
\$20,000
\$19,048
\$18,141
\$17,277
48
\$16,454

Equivalence Calculations under Inflation

- Interest effects
 - Factors in changes in earning power of money
- Inflation
 - Factors in changes in purchasing power of money
- Market and Inflation-Free interest rates
 - Market interest rate (i)
 - Nominal interest rate
 - Takes into account the combined effects of the earning value of capital (earning power) and any anticipated inflation or deflation (purchasing power).
 - All interest rates stated by financial institutions for loans and saving accounts are market interest rates.
 - Inflation-free interest rate (i')
 - An estimate of the true earning power of money when the effects of inflation have been removed.
 - Real interest rate
 - Can be computed from the market interest rate and the inflation rate.
 - In absence of inflation, the market interest rate is the same as the inflation-free interest rate.

Equivalence Calculations under Inflation

- Equivalence Calculations
 - Case 1
 - All cash flow elements are estimated in constant dollars.
 - Case 2
 - All cash flow elements are estimated in actual dollars.
 - Case 3
 - Some of the cash flow elements are estimated in constant dollars, and others are in actual dollars.

Constant-Dollar Analysis

- Since all cash flow elements are already in constant dollars.
- Absence of an inflationary effect
- Use i' to account for only the earning power of the money
- To find the present-worth equivalent

$$(P_n^{i'})^n \quad A'_n$$

- As governments do not pay income tax, constant-dollar analysis is common in long-term public projects.

An Example

- Given the following cash flows in constant dollars, if the inflation-free interest rate is 12% before tax, what is the present worth?

Period	Net Cash Flows in Constant \$
0	-\$250,000
1	\$100,000
2	\$110,000
3	\$120,000
4	\$130,000
5	\$120,000

52
Answer: $P = \$163,099$

An Example

- Suppose that your salary is \$35,000, and you are promised a salary raise 6%/year. Suppose that the inflation is 8%. What is the real situation?
 - Is that you are really “rising” salary?

Year	Salary in Actual Dollar
1	\$35,000
2	\$37,100
3	\$39,326
4	\$41,685

Year	Salary in Real Dollar
1	\$35,000
2	\$34,351
3	\$33,714
4	\$33,090

You will receive this amount for sure

The real purchasing power you have

Actual-Dollar Analysis

- Method 1 : Deflation Method – two steps
 1. Convert actual dollars to constant dollars by deflating with the general inflation rate of \bar{f}
 2. Calculate the present worth of constant dollars by discounting at i' .
- Method 2: Adjusted-discount method – one step (use the market interest rate):
 - Combine steps 1 & 2 into one step.

$$P_n = \frac{A_n}{[(1 - \bar{f})(1 + i')]^n}$$

$$\frac{A_n}{(1 + i)^n}$$

- where $i \neq i' \neq \bar{f} \neq \bar{i}' \neq \bar{f}'$

Actual-Dollar Analysis

$$P_n = \frac{A_n}{(1 + i')^n}$$

Step 1

Step 2

$$= \frac{A_n}{(1 + \bar{f})^n (1 + i')^n}$$

$$= \frac{A_n}{[(1 + \bar{f})(1 + i')]^n}$$

$$\begin{aligned} P_n &= \frac{A_n}{(1 + i)^n} \\ \frac{A_n}{(1 + i)^n} &= \frac{A_n}{[(1 + \bar{f})(1 + i')]^n} \\ (1 + i) &= (1 + \bar{f})(1 + i') \end{aligned}$$

$$= 1 + i' + \bar{f} + i' \bar{f}$$

$$i = i' + \bar{f} + i' \bar{f}$$

An Example

- A project of a electronic company is expected to generate the following cash flows in actual dollars:

n	Net Cash Flows in Actual Dollars
0	-\$75,000
1	\$32,000
2	\$35,700
3	\$32,800
4	\$29,000
5	\$58,000

- What are the equivalent year-zero dollars (constant dollars) if the general inflation rate f is 5% per year?
- Compute the present worth of the cash flows in constant dollars at $i'=10\%$.

Answer: Total Equivalent Present
Worth=\$45,268

Mixed-Dollar Analysis

- Convert all cash flow elements into the same dollar units (either constant or actual).
- Case 1: converted to actual dollars
 - Use market interest rate i in calculating the equivalence value
- Case 2: converted to constant dollars
 - Use the inflation-free interest rate i' in calculating the equivalence value

An Example

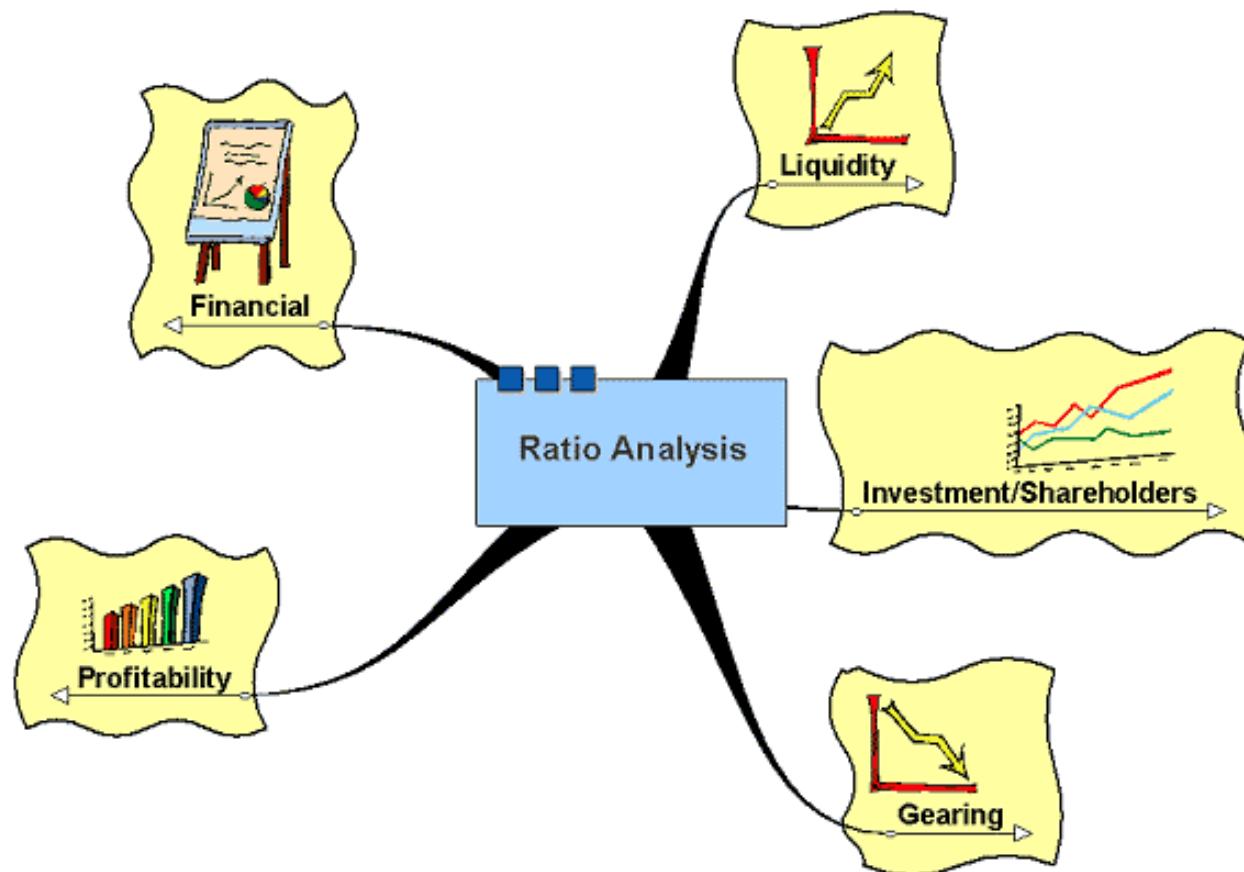
- A couple wishes to establish a college fund at a bank for their five-year-old child. The college fund will earn 8% interest compounded quarterly. Assuming the child enters college at 18, the estimated expenses for the four years is \$30,000 per year. The college expenses are estimated to increase at an annual rate of 6%.
- Determine the equal quarterly deposits the couple must make until they send their child to college.

58
Answer: \$2,888.48

- References
 - Chan S. Park, Fundamentals of Engineering Economics. Prentice Hall
 - Lecture 9: Inflation, by Gabriel Fung

Ratio Analysis

Ratio Analysis



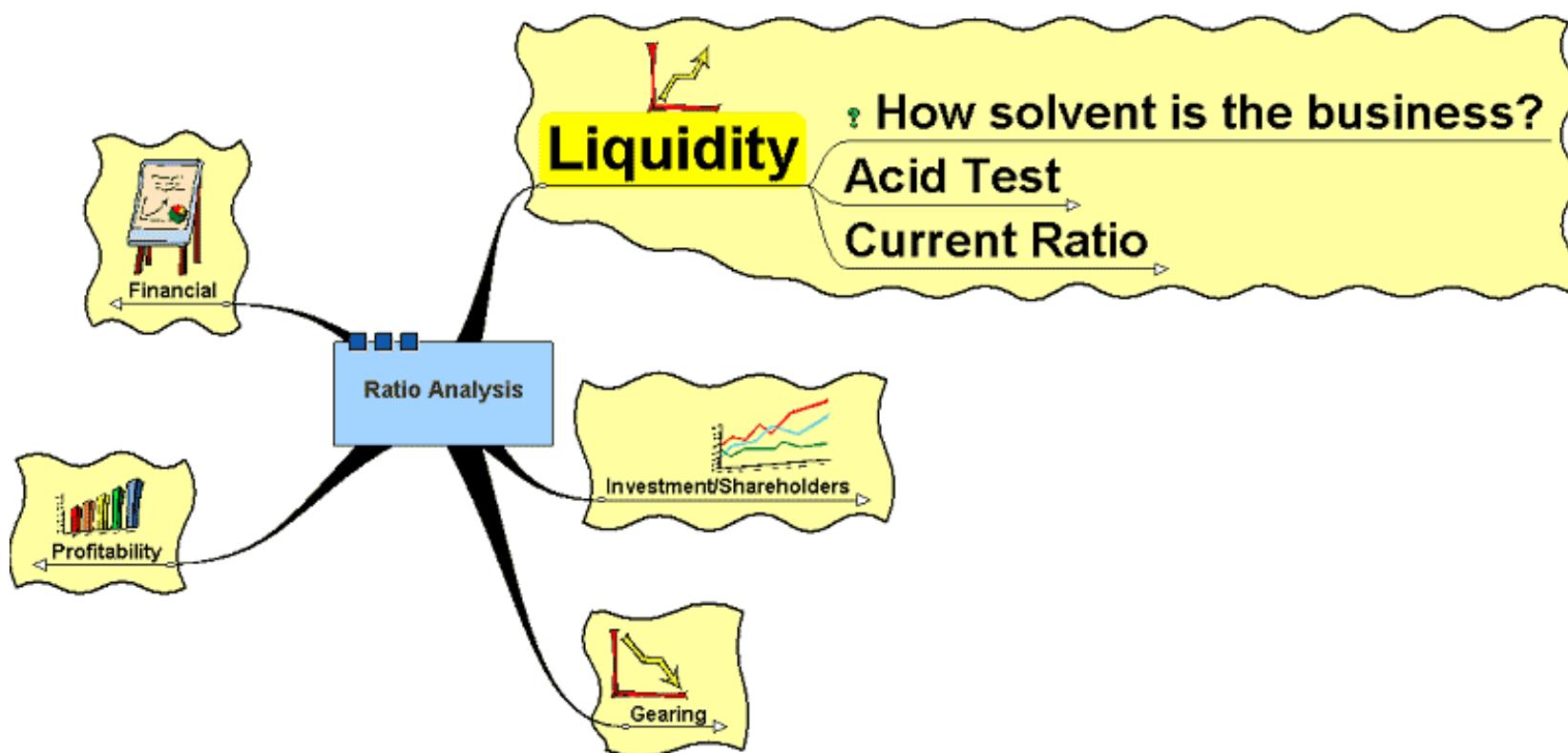
Ratio Analysis

- **Purpose:**
- To identify aspects of a business's performance to aid decision making
- Quantitative process – may need to be supplemented by qualitative factors to get a complete picture
- 5 main areas:

Ratio Analysis

1. **Liquidity** – the ability of the firm to pay its way
2. **Investment/shareholders** – information to enable decisions to be made on the extent of the risk and the earning potential of a business investment
3. **Gearing** – information on the relationship between the exposure of the business to loans as opposed to share capital
4. **Profitability** – how effective the firm is at generating profits given sales and or its capital assets
5. **Financial** – the rate at which the company sells its stock and the efficiency with which it uses its assets

Liquidity



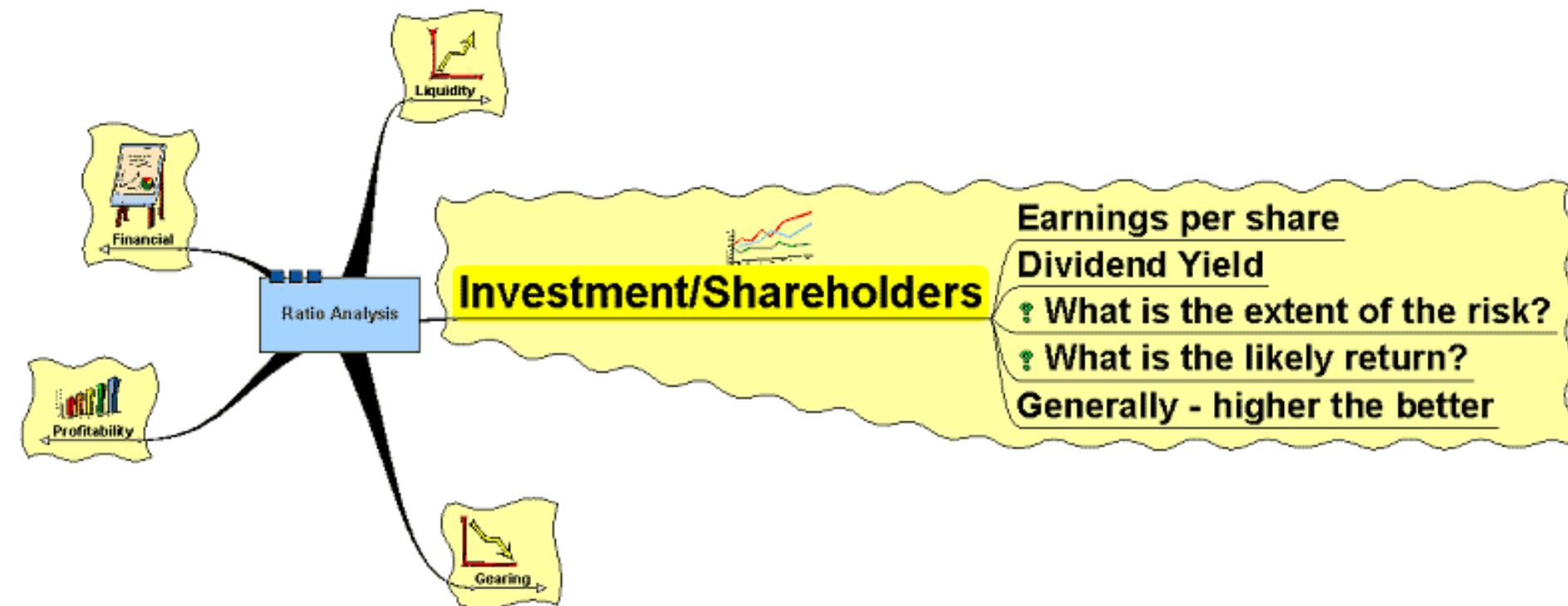
Acid Test

- Also referred to as the 'Quick ratio'
- **(Current assets – stock) : liabilities**
- 1:1 seen as ideal
- The omission of stock gives an indication of the cash the firm has in relation to its liabilities (what it owes)
- A ratio of 3:1 therefore would suggest the firm has 3 times as much cash as it owes – very healthy!
- A ratio of 0.5:1 would suggest the firm has twice as many liabilities as it has cash to pay for those liabilities. This **might** put the firm under pressure but is not in itself the end of the world!

Current Ratio

- Looks at the ratio between Current Assets and Current Liabilities
- **Current Ratio = Current Assets : Current Liabilities**
- Ideal level? – 1.5 : 1
- A ratio of 5 : 1 would imply the firm has £5 of assets to cover every £1 in liabilities
- A ratio of 0.75 : 1 would suggest the firm has only 75p in assets available to cover every £1 it owes
- Too high – Might suggest that too much of its assets are tied up in unproductive activities – too much stock, for example?
- Too low - risk of not being able to pay your way

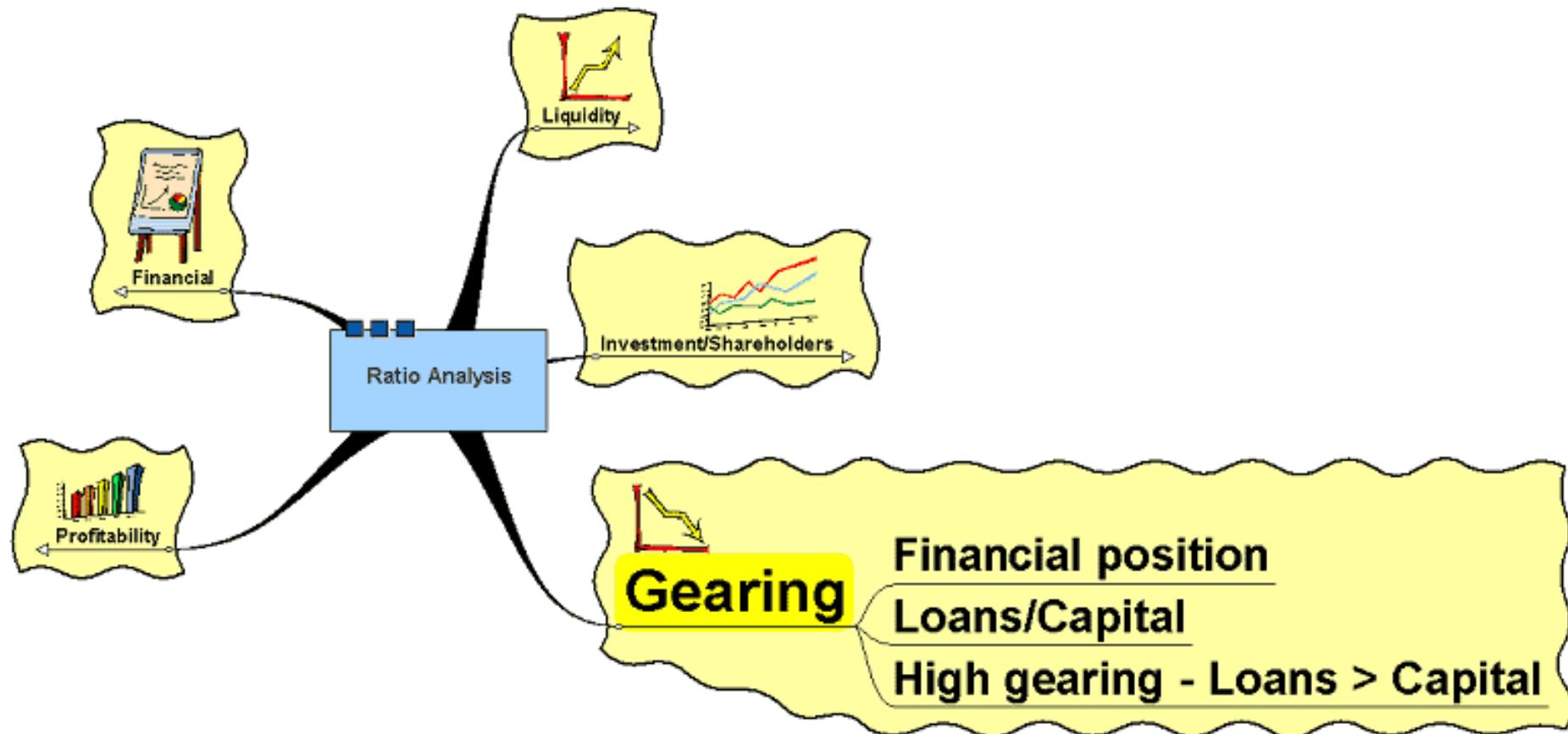
Investment/Shareholders



Investment/Shareholders

- **Earnings per share** – profit after tax / number of shares
- **Price earnings ratio** – market price / earnings per share – the higher the better generally. Comparison with other firms helps to identify value placed on the market of the business.
- **Dividend yield** – ordinary share dividend / market price x 100 – higher the better. Relates the return on the investment to the share price.

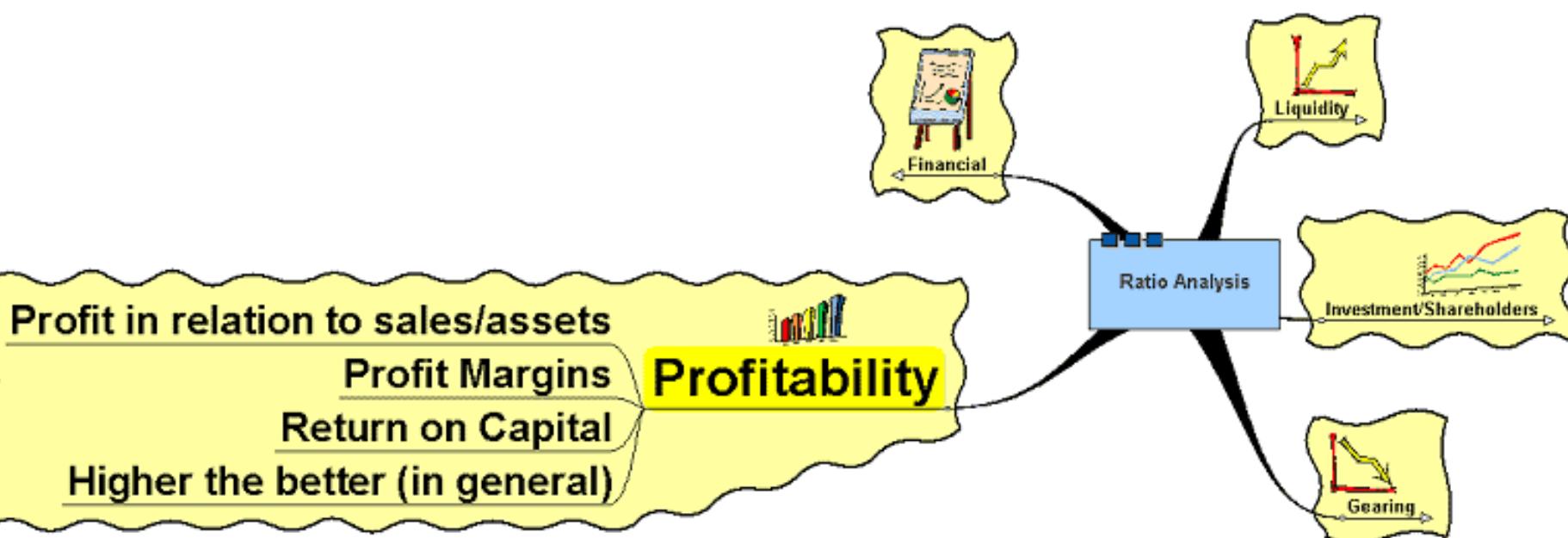
Gearing



Gearing

- **Gearing Ratio = Long term loans / Capital employed x 100**
- The higher the ratio the more the business is exposed to interest rate fluctuations and to having to pay back interest and loans before being able to re-invest earnings

Profitability



Profitability

- Profitability measures look at how much profit the firm generates from sales or from its capital assets
- Different measures of profit – gross and net
 - **Gross profit** – effectively total revenue (turnover) – variable costs (cost of sales)
 - **Net Profit** – effectively total revenue (turnover) – variable costs and fixed costs (overheads)

Profitability

- **Gross Profit Margin = Gross profit / turnover x 100**
- The higher the better
- Enables the firm to assess the impact of its sales and how much it cost to generate (produce) those sales
- A gross profit margin of 45% means that for every £1 of sales, the firm makes 45p in gross profit

Profitability

- **Net Profit Margin = Net Profit / Turnover x 100**
- Net profit takes into account the fixed costs involved in production – the overheads
- Keeping control over fixed costs is important – could be easy to overlook for example the amount of waste - paper, stationery, lighting, heating, water, etc.
 - e.g. – leaving a photocopier on overnight uses enough electricity to make 5,300 A4 copies. (1,934,500 per year)
 - 1 ream = 500 copies. 1 ream = £5.00 (on average)
 - Total cost therefore = £19,345 per year – or 1 person's salary

Profitability

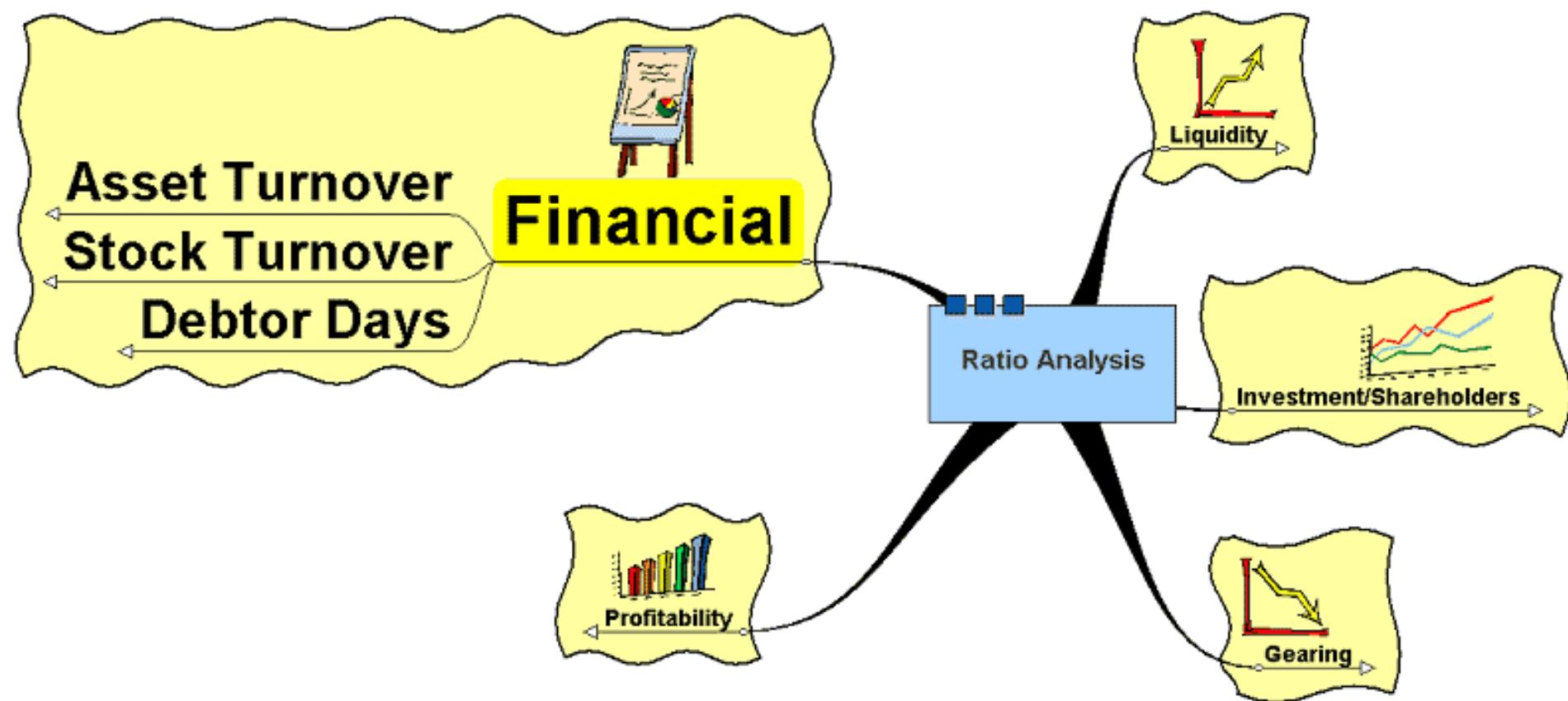
- **Return on Capital Employed (ROCE) = Profit / capital employed x 100**
- Be aware that there are different interpretations of what capital employed means – see

<http://www.bized.ac.uk/compfact/ratios/ror3.htm> for more information!

Profitability

- The higher the better
- Shows how effective the firm is in using its capital to generate profit
- A ROCE of 25% means that it uses every £1 of capital to generate 25p in profit
- Partly a measure of efficiency in organisation and use of capital

Financial



Asset Turnover

- **Asset Turnover = Sales turnover / assets employed**
- Using assets to generate profit
- Asset turnover x net profit margin = ROCE

Stock Turnover

- **Stock turnover = Cost of goods sold / stock expressed as times per year**
- The rate at which a company's stock is turned over
- A high stock turnover might mean increased efficiency?
 - But: dependent on the type of business – supermarkets might have high stock turnover ratios whereas a shop selling high value musical instruments might have low stock turnover ratio
 - Low stock turnover could mean poor customer satisfaction if people are not buying the goods (Marks and Spencer?)

Debtor Days

- **Debtor Days = Debtors / sales turnover x 365**
- Shorter the better
- Gives a measure of how long it takes the business to recover debts
- Can be skewed by the degree of credit facility a firm offers

MCQ Test

- 1) Ideal value for Current ratio is
 - a) 1:1 b) 1.5:1 c) 0.75:1 d) 2:1
- 2) For any Firm “Debator Days are.....”
 - a) Higher the better b) Longer the better c) Shorter the better d) Lower the better
- 3) Liquidity gives you an idea about
 - a) How solvent Business is? b) How much assets business has? C) How much profit business makes?
- 4) Define ‘Inflation’ in one line.....
- 5) Full Form of CPI is
 - a) Corporate Price Index b) Customer Price Index
 - c) Consumer Price Index

MCQ Test

6) Net profits includes

- a) Taxes and interests b) Excludes taxes and interests
- c) salaries d) depreciation costs

7) ROI means

- a) Return on Investments b) Rate on Investments c) Rupees on Investments

8) CPI includes a) Price of Cars and bikes b) Price of Vegetables and Entertainment c) Fees for education

9) Give the Formula for “Gearing Ratio”

10) Give the Formula for “Dividend Yield”

Cash Flow Estimation

Financial Statements Revisited

- We learned the uses and sources of cash earlier in the semester for the entire firm
- Now, use the same concepts to find the changes in free cash flow that result from a new project under consideration.

Free Cash Flow

Net Operating Profit After Taxes
+ depreciation
-Gross Capital Expenditure
-Change in net operating working capital
Free Cash Flow

Incremental Cash Flow

- Cash flow changes that result from a particular project
- Relevant Cash Outflows (uses of cash)
 - Increase Cash outflow
 - Elimination of cash inflow
 - Investment in Assets
- Relevant Cash Inflow (sources of cash)
 - Increase in cash inflow
 - Elimination of cash outflow
 - Liquidation of assets

Three Stages of a Project

- Acquisition Stage
 - Initial outlay of cash
- Operating Stage
 - Sales Revenue, Operating Expenses, Taxes etc
- Disposition Stage
 - Sales of fixed assets, Tax consequences

Steps in estimating Cash Flow

- Estimate the Income Statement
- Estimate the Balance Sheet
- Combine the income statement and balance sheet into a cash flow statement
- Make a decision

Estimation of Income Statement

- Most business use an accrual basis - Expenses and Income are recorded whether or not the actual payment is made.
- Book value of assets decrease via depreciation
- When goods are purchased or produced it is considered an increase in inventory

Estimation of the Balance Sheet

- Accounts Receivable and Accounts Payable are active in the early stages of the business and must be accounted for
- Most assets begin on the balance sheet and flow onto the cash flow statement

Combine Income Statement and Balance Sheet

Accounts Receivable

- An increase in Accounts receivable represents a sale recorded as income but no cash was received (negative entry on the CF statement)

Accounts Payable

- An increase in accounts payable represents the purchase of items on credit recorded as an expense, but no cash flow occurred (positive entry on CF statement)

Combine Income Statement and Balance Sheet

● Inventory

- Two forms items produced and spare parts
- Holding Losses (theft, obsolescence) are deductible in income statement
- Increases in inventory are a negative entry on CF

● Prepaid expenses

- Insurance Premiums for example will be recognized as a prepaid expense on Balance Sheet but cash flow occurred in 1st year

Combine Income Statement and Balance Sheet

● Cash Balances

- Initial Cash Balance is considered a year 0 cash flow, it represents cash that could have been used elsewhere
- In disposition stage cash is recovered

● Land

- Negative CF (if purchased for the project) at acquisition
- Positive Cash flow at disposition
- Land is separated from buildings since it is not depreciable

Combine Income Statement and Balance Sheet

- Buildings
 - Negative CF entry at year 0 and depreciated (nonresidential)
- Equipment
 - Recognized as purchase price, setup expenses, shipping and installation. Can be depreciated
 - Changes in Net working capital (inventory cannot be depreciated)

Combine Income Statement and Balance Sheet

- Depreciation

- Represents a non cash expense and is a positive entry on the cash flow statement

- Net Working Capital

- Current Assets minus Current liabilities
 - Incremental changes throughout the life of the project

Combine Income Statement and Balance Sheet

- Taxes During Acquisition Stage
 - Investment Tax Credits, lowers tax liability
 - Training and Advertising are a one time deduction at the beginning of the project

Combine Income Statement and Balance Sheet

- Taxes during Operating Stage
 - Depreciation
 - Loss back and Carry forward

Negative income can be used to offset current tax liability and carried to other periods.

Special Problems

- Sunk Costs
- Externalities
- Opportunity Costs

Sunk Costs

- Occur prior to the decision concerning the new project and should not be counted
- Example Nestle spent \$1 Million to develop new coffee flavor
- If they produce the project $NPV = \$600,000$ if the sunk cost is ignored
- Counting the sunk cost the loss is $-\$400,000$
- Should the project be undertaken?

Externalities

- Indirect Costs (shared costs and overhead costs).
 - New plant requiring additional computer support
- Pure Joint Costs
 - Cannot be separated
 - Airline pilot salary who carries freight and passengers.

Externalities continued

- Pure Joint Costs
 - Estimate the NPV of the project with an estimate of the impact of the joint cost
 - If they have positive NPV consider groups of projects including all joint costs
- Cannibalization
 - IBM and Main Frames

Externalities continued

Indirect benefits

- Assume a bank offers a new checking account -- some customers will also sign up for credit card.
- New suburban location of a bank
Existing customers start using new branch
New customers using original location

Opportunity Costs

- The best foregone opportunity
- Dole Inc. Prime real estate in Hawaii could be used to grow pineapple or as resort land. Early 1980's converted the land after looking at the lost income
- GM forgoes \$1Million it could earn by renting a plant site and decides to build a new plant on the land.

Combine Income Statement and Balance Sheet

● Taxes at Disposition Stage

- Capital Gains and Losses Gain or loss on assets that were not intended to be used in the regular course of business.
- 1245 Gain and Loss All assets except real estate gain or loss from comparing Sale Price to Original basis
- 1250 Gain or Loss Real Assets that are depreciated (buildings) Gain or loss from comparing sale price to remaining basis

Make a Decision

- Once the Balance sheet and income statement are combined and cash flow is estimated use NPV, and other decision tools to make a decision on the project.

Project Interactions

- Once individual projects are investigated you need to look at possible interactions between projects and timing options for the projects.
- Given that all the future cash flows can be estimated. This is relatively easy. You would want to investigate projects so that the NPV is maximized (keeping other constraints constant).

The Capital Investment Process

- Capital Budget – An annual assessment of investment projects
- The budget is a product of negotiation between divisional managers and plant managers.
- The budget should also reflect the strategic plan of the firm, the two process should compliment each other.

Capital Budget vs. Approval

- The capital budget is a general plan that does not always imply final approval of a project.
- Final approval is often contingent upon a more detailed cash flow analysis in the appropriation request.

Capital Budgets and Spending

- Not all large investments are part of the capital budget
 - Information Technology
 - Research and Development
 - Marketing
 - Training and Development
 - Operating Decisions

Monitoring

- Due to the ability of costs to exceed forecasts and changes in the economy it is important for the firm to perform audits of the project as it progresses.

Information Problems

- For good investment decisions to take place management needs to have correct and reliable information.

Measuring Stand Alone Risk

- Sensitivity Analysis
- Scenario Analysis
- Monte Carlo Simulation

Sensitivity Analysis

- Looks at the change in your decision variable (NPV or IRR in our case) when one input changes.
- For example what if the cost of capital changes (or sales or salvage value of the equipment or...)

Example

Time	CF
0	-5000
1	4000
2	4000
3	3000

NPV @ 10% = 4196.09

NPV @ 11% = 4043.67

NPV @ 9% = 4352.99

Sensitivity Analysis

- Usually the results are represented in a table where the response of the decision variable to changes in more than one individual variable are reported.
- Then you can compare across variables to see which one has the largest impact on your decision

Example Results

NPV When there is a
change in

Change from Base Case	Unit Sales	Variable Costs	Cost of Capital
-10%	7944	20287	13772
0	12075	12075	12075
10%	16207	3864	10521

Example Results

NPV When there is a
 change in

Change	Unit	Variable	Cost of Capital
Base Case	Sales	Costs	13772
-10%	7944	20287	
	>4131	>8212	>1697
0	12075	12075	12075
	>4132	>8211	>1697
10%	16207	3864	10378

Sensitivity Analysis

- Benefits
 - a. Easy to Calculate and Understand
 - b. Measures risk associated with individual inputs
- Weaknesses
 - a. Ignores probability of event
 - b. Ignores interaction among the variables
 - c. Ignores gains from diversification

Example Problem

- Your firm is considering a new project. However the capital budgeting team is not certain about the future cost of capital or the sales revenue. Conduct a sensitivity analysis assuming that the cost of capital will be either 10%, 11% or 12% and that the future cash flows will be either the base case (next slide), or 10% higher or 10% lower than the base case.

Example continued

Time	0	1	2	3	4	
Cash Flow		-12,750		5,000	4,000	4,000 3,000
NPV @ 9%	= 417.89					
NPV @ 11%	= -98.047					

Time	0	1	2	3	4	
Cash Flow		-12,750		5,500	4,400	4,400 3,300
NPV @ 10%	= 1,446.09					

Time	0	1	2	3	4	
Cash Flow		-12,750		4,500	3,600	3,600 2,700
NPV @ 10%	= -1,135.01					

Example Continued

NPV following a Change in:

WACC	Sales
-10% 417.89	-1,135.01
Base 155.54	155.54
+10% 98.047	1,446.09

Scenario Analysis

- Differences from Sensitivity Analysis

- Allows you to change more than one variable at a time
- Look at a group of scenarios (best case, base case, and worst case) for example worst case – what if all variables change against us by 20%....
- Includes probability estimates of each scenario

Scenario Analysis Example Results

- Assume you want to look at changes in price and sales which result in the following NPV

Scenario	Sales	Price	NPV	Prob.
Worst	15,000	1,700	-10,079	.25
Base	25,000	2,200	12,075	.50
Best	35,000	2,700	41,752	.25

Scenario Analysis

- Given the NPV and Probability you can find the expected NPV and standard deviation

Scenario	NPV	Prob.	NPV(Prob)
Worst	-10,079	.25	-2,250
Base	12,075	.50	6,038
Best	41,752	.25	<u>10,438</u>
Expected NPV			13,956
Standard Deviation			18,421

Interpreting the Results

- The project has an expected return on 13,956 with standard deviation of 18,421
- This implies a 68 % confidence interval of (-4,465 to 32,377) a large range of possible outcomes
- The coefficient of variation would be 1.3 (you are accepting 1.3 units of risk for each unit of return)

Scenario Analysis

Benefits

1. More than one variable to changes at a time
2. Accounts for probability
3. Easy to perform

Weaknesses

1. Small number of scenarios is unrealistic
2. Probability distributions difficult to estimate

Example problem

- Using the same data as before, assume that the firm decided to calculate a scenario analysis. Both cost of capital and cash flows will vary by 10%. The best case has a 25% probability, the base a 50% probability and the worst case a 25% probability.

Example continued

Base Case

Time	0	1	2	3	4		
Cash Flow		-12,750		5,000	4,000	4,000	3,000

NPV @ 10% = 155.54

Best Case

Time	0	1	2	3	4		
Cash Flow		-12,750		5,500	4,400	4,400	3,300

NPV @ 9% = 1,734.67

Worst Case

Time	0	1	2	3	4		
Cash Flow		-12,700		4,500	3,600	3,600	2,700

NPV @ 11% = -1,363.24

Example Continued

NPV Prob

Worst Case -1,363.24 25% -340.81

Base Case 155.54 50% 77.50

Best Case 1,734.67 25% 433.67

Expected NPV 170.36

Monte Carlo Simulation

- A more advanced form of scenario analysis
- Utilizes the computer to make random choices for each variable input then calculate the expected return and standard deviation

Monte Carlo Simulation

Benefits

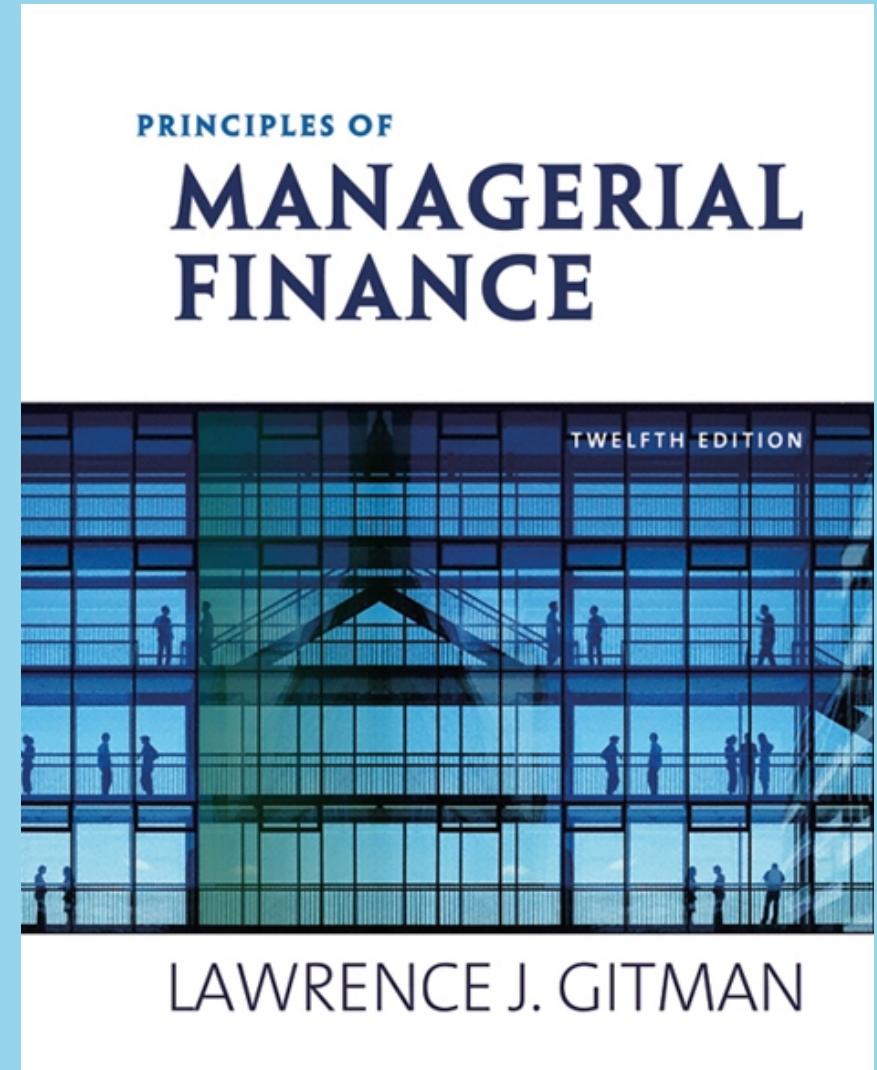
1. More realistic selection of variables
2. Easy to understand results

Weaknesses

1. Only as good as probability estimate and correlation of variables

Chapter 3

- Cash Flow
and Financial
Planning





Learning Goals

1. Understand tax depreciation procedures and the effect of depreciation on the firm's cash flows.
2. Discuss the firm's statement of cash flows, operating cash flow, and free cash flow.
3. Understand the financial planning process, including long-term (strategic) financial plans and short-term (operating) plans.
4. Discuss the cash-planning process and the preparation, evaluation, and use of the cash budget.



Learning Goals (cont.)

5. Explain the simplified procedures used to prepare and evaluate the pro forma income statement and the pro forma balance sheet.
6. Evaluate the simplified approaches to pro forma financial statement preparation and the common uses of pro forma statements.

Analyzing the Firm's Cash Flows



- **Cash flow** (as opposed to accounting “profits”) is the primary focus of the financial manager.
- An important factor affecting cash flow is **depreciation**.
- From an accounting perspective, cash flow is summarized in a firm’s **statement of cash flows**.
- From a financial perspective, firms often focus on both **operating cash flow**, which is used in managerial decision-making, and **free cash flow**, which is closely monitored by participants in the capital market.



Depreciation

- **Depreciation** is the systematic charging of a portion of the costs of fixed assets against annual revenues over time.
- Depreciation for tax purposes is determined by using the modified accelerated cost recovery system (MACRS).
- On the other hand, a variety of other depreciation methods are often used for reporting purposes.



Depreciation: Depreciation & Cash Flow

- Financial managers are much more concerned with **cash flows** rather than **profits**.
- To adjust the income statement to show cash flows from operations, all **non-cash charges** should be added back to net profit after taxes.
- By lowering taxable income, depreciation and other non-cash expenses create a **tax shield** and enhance cash flow.



Depreciation: Depreciable Value & Depreciable Life

- Under the basic **MACRS** procedures, the depreciable value of an asset is its full cost, including outlays for installation.
- No adjustment is required for expected salvage value.
- For tax purposes, the depreciable life of an asset is determined by its MACRS recovery predetermined period.
- MACRS property classes and rates are shown in Table 3.1 and Table 3.2 on the following slides.



Depreciation

Table 3.1 First Four Property Classes under MACRS

Property class (recovery period)	Definition
3 years	Research equipment and certain special tools
5 years	Computers, typewriters, copiers, duplicating equipment, cars, light-duty trucks, qualified technological equipment, and similar assets
7 years	Office furniture, fixtures, most manufacturing equipment, railroad track, and single-purpose agricultural and horticultural structures
10 years	Equipment used in petroleum refining or in the manufacture of tobacco products and certain food products

Table 3.2 Rounded Depreciation Percentages by Recovery Year Using MACRS for First Four Property Classes



Recovery year	Percentage by recovery year ^a			
	3 years	5 years	7 years	10 years
1	33%	20%	14%	10%
2	45	32	25	18
3	15	19	18	14
4	7	12	12	12
5		12	9	9
6		5	9	8
7			9	7
8			4	6
9				6
10				6
11				4
Totals	<u><u>100%</u></u>	<u><u>100%</u></u>	<u><u>100%</u></u>	<u><u>100%</u></u>

^aThese percentages have been rounded to the nearest whole percent to simplify calculations while retaining realism. To calculate the *actual* depreciation for tax purposes, be sure to apply the actual unrounded percentages or directly apply double-declining balance (200%) depreciation using the half-year convention.



Depreciation: An Example

- Baker Corporation acquired, for an installed cost of \$40,000, a machine having a recovery period of 5 years. Using the applicable MACRS rates, the depreciation expense each year is as follows:

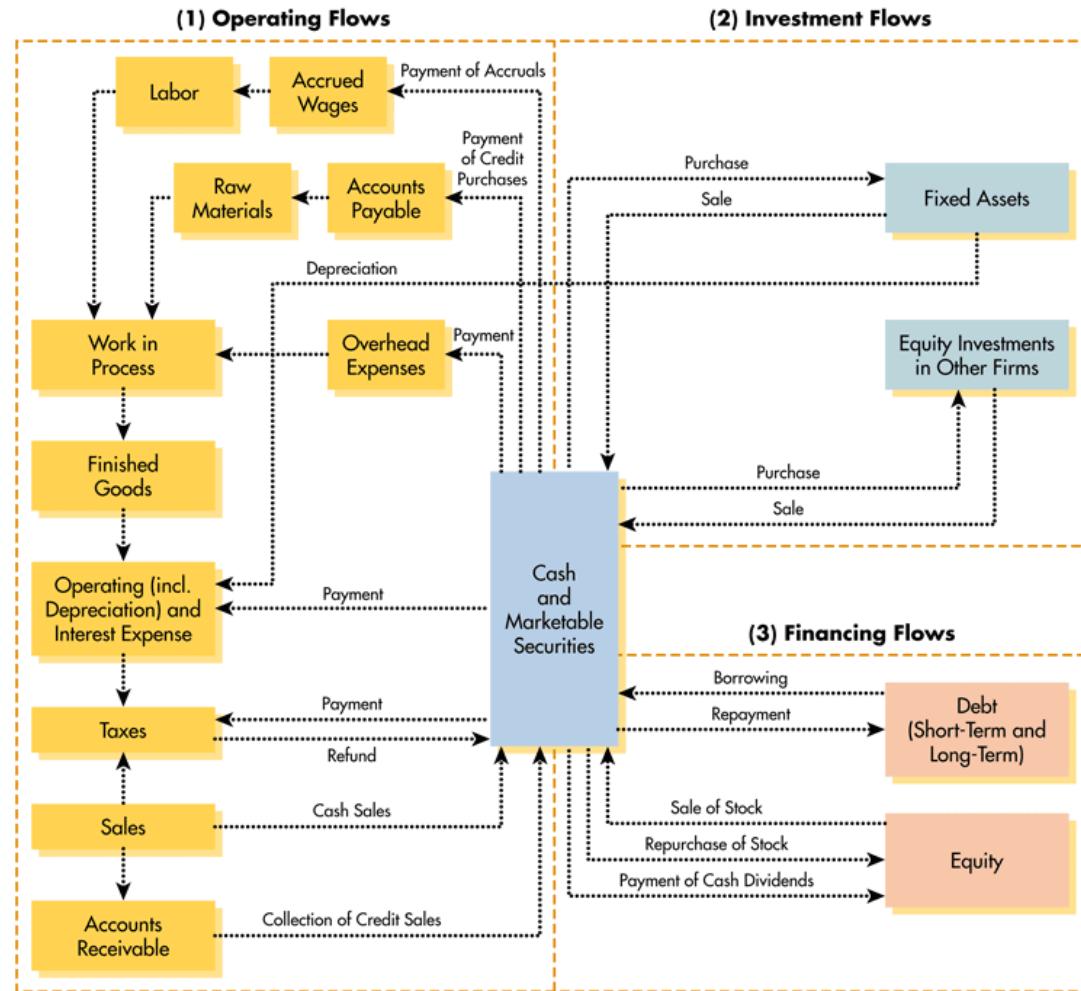
Year	Cost (1)	Percentages (from Table 3.2) (2)	Depreciation [(1) × (2)] (3)
1	\$40,000	20%	\$ 8,000
2	40,000	32	12,800
3	40,000	19	7,600
4	40,000	12	4,800
5	40,000	12	4,800
6	40,000	5	2,000
Totals		<u>100%</u>	<u>\$40,000</u>



Developing the Statement of Cash Flows

- The **statement of cash flows** summarizes the firm's cash flow over a given period of time.
- The statement of cash flows is divided into three sections:
 - Operating flows
 - Investment flows
 - Financing flows
- The nature of these flows is shown in Figure 3.1 on the following slide.

Figure 3.1 Cash Flows



Developing the Statement of Cash Flows: Classifying Inflows and Outflows of Cash



- The statement of cash flows essentially summarizes the inflows and outflows of cash during a given period.

Table 3.3 Inflows and Outflows of Cash

Inflows (sources)	Outflows (uses)
Decrease in any asset	Increase in any asset
Increase in any liability	Decrease in any liability
Net profits after taxes	Net loss
Depreciation and other noncash charges	Dividends paid
Sale of stock	Repurchase or retirement of stock

Table 3.4 Baker Corporation Income Statement (\$000) for the Year Ended December 31, 2009



Sales revenue	\$1,700
Less: Cost of goods sold	<u>1,000</u>
Gross profits	\$ 700
Less: Operating expenses	
Selling expense	\$ 70
General and administrative expenses	120
Lease expense ^a	40
Depreciation expense	<u>100</u>
Total operating expense	\$ 330
Earnings before interest and taxes (EBIT)	\$ 370
Less: Interest expense	<u>70</u>
Net profits before taxes	\$ 300
Less: Taxes (rate = 40%)	<u>120</u>
Net profits after taxes	\$ 180
Less: Preferred stock dividends	<u>10</u>
Earnings available for common stockholders	\$ 170
Earnings per share (EPS) ^b	\$1.70

^aLease expense is shown here as a separate item rather than included as interest expense as specified by the FASB for financial reporting purposes. The approach used here is consistent with tax reporting rather than financial reporting procedures.

^bCalculated by dividing the earnings available for common stockholders by the number of shares of common stock outstanding ($\$170,000 \div 100,000$ shares = \$1.70 per share).

Table 3.5 Baker Corporation Balance Sheets (\$000) (cont.)



Assets	December 31	
	2009	2008
Current assets		
Cash	\$ 400	\$ 300
Marketable securities	600	200
Accounts receivable	400	500
Inventories	600	900
Total current assets	<u>\$2,000</u>	<u>\$1,900</u>
Gross fixed assets (at cost)		
Land and buildings	\$1,200	\$1,050
Machinery and equipment	850	800
Furniture and fixtures	300	220
Vehicles	100	80
Other (includes certain leases)	50	50
Total gross fixed assets (at cost)	<u>\$2,500</u>	<u>\$2,200</u>
Less: Accumulated depreciation	<u>1,300</u>	<u>1,200</u>
Net fixed assets	<u>\$1,200</u>	<u>\$1,000</u>
Total assets	<u>\$3,200</u>	<u>\$2,900</u>

Table 3.5 Baker Corporation Balance Sheets (\$000)



Liabilities and Stockholders' Equity		
Current liabilities		
Accounts payable	\$ 700	\$ 500
Notes payable	600	700
Accruals	<u>100</u>	<u>200</u>
Total current liabilities	<u>\$1,400</u>	<u>\$1,400</u>
Long-term debt	<u>\$ 600</u>	<u>\$ 400</u>
Total liabilities	<u>\$2,000</u>	<u>\$1,800</u>
Stockholders' equity		
Preferred stock	\$ 100	\$ 100
Common stock—\$1.20 par, 100,000 shares outstanding in 2009 and 2008	120	120
Paid-in capital in excess of par on common stock	380	380
Retained earnings	<u>600</u>	<u>500</u>
Total stockholders' equity	<u>\$1,200</u>	<u>\$1,100</u>
Total liabilities and stockholders' equity	<u><u>\$3,200</u></u>	<u><u>\$2,900</u></u>

Table 3.6 Baker Corporation Statement of Cash Flows (\$000) for the Year Ended December 31, 2009



Cash Flow from Operating Activities	
Net profits after taxes	\$180
Depreciation	100
Decrease in accounts receivable	100
Decrease in inventories	300
Increase in accounts payable	200
Decrease in accruals	(<u>100</u>) ^a
Cash provided by operating activities	\$780
Cash Flow from Investment Activities	
Increase in gross fixed assets	(\$300)
Changes in equity investments in other firms	<u>0</u>
Cash provided by investment activities	(300)
Cash Flow from Financing Activities	
Decrease in notes payable	(\$100)
Increase in long-term debts	200
Changes in stockholders' equity ^b	0
Dividends paid	(<u>80</u>)
Cash provided by financing activities	<u>20</u>
Net increase in cash and marketable securities	<u><u>\$500</u></u>

^aAs is customary, parentheses are used to denote a negative number, which in this case is a cash outflow.

^bRetained earnings are excluded here, because their change is actually reflected in the combination of the "Net profits after taxes" and "Dividends paid" entries.



Interpreting Statement of Cash Flows

- The statement of cash flows ties the balance sheet at the beginning of the period with the balance sheet at the end of the period after considering the performance of the firm during the period through the income statement.
- The net increase (or decrease) in cash and marketable securities should be equivalent to the difference between the cash and marketable securities on the balance sheet at the beginning of the year and the end of the year.



Operating Cash Flow

- A firm's **Operating Cash Flow (OCF)** is the cash flow a firm generates from normal operations—from the production and sale of its goods and services.
- OCF may be calculated as follows:

$$\text{NOPAT} = \text{EBIT} \times (1 - T)$$

$$\text{OCF} = \text{NOPAT} + \text{Depreciation}$$

$$\text{OCF} = [\text{EBIT} \times (1 - T)] + \text{Depreciation}$$



Operating Cash Flow (cont.)

- Substituting for Baker Corporation, we get:

$$\text{OCF} = [\$370 \times (1 - .40) + \$100 = \$322]$$

- Thus, we can conclude that Baker's operations are generating positive operating cash flows.



Free Cash Flow

- **Free Cash Flow (FCF)** is the amount of cash flow available to debt and equity holders after meeting all operating needs and paying for its **net fixed asset investments (NFAI)** and **net current asset investments (NCAI)**.

$$FCF = OCF - NFAI - NCAI$$

- Where:

$$NFAI = \text{Change in net fixed assets} + \text{Depreciation}$$

$$NCAI = \text{Change in CA} - \text{Change in A/P and Accruals}$$



Free Cash Flow (cont.)

- Using Baker Corporation we get:

$$NFAI = [(\$1,200 - \$1,000) + \$100] = \$300$$

$$NCAI = [(\$2,000 - \$1,900) + (\$800 - \$700)] = \$0$$

$$FCF = \$322 - \$300 - \$0 = \$22$$

- This FCF can be used to pay its creditors and equity holders.



The Financial Planning Process

- **Financial planning** involves guiding, coordinating, and controlling the firm's actions to achieve its objectives.
- Two key aspects of financial planning are **cash planning** and **profit planning**.
- Cash planning involves the preparation of the firm's cash budget.
- Profit planning involves the preparation of both cash budgets and pro forma financial statements.

The Financial Planning Process: Long-Term (Strategic) Financial Plans



- **Long-term strategic financial plans** lay out a company's planned financial actions and the anticipated impact of those actions over periods ranging from 2 to 10 years.
- Firms that are exposed to a high degree of operating uncertainty tend to use shorter plans.
- These plans are one component of a company's integrated strategic plan (along with production and marketing plans) that guide a company toward achievement of its goals.

The Financial Planning Process: Long-Term (Strategic) Financial Plans (cont.)



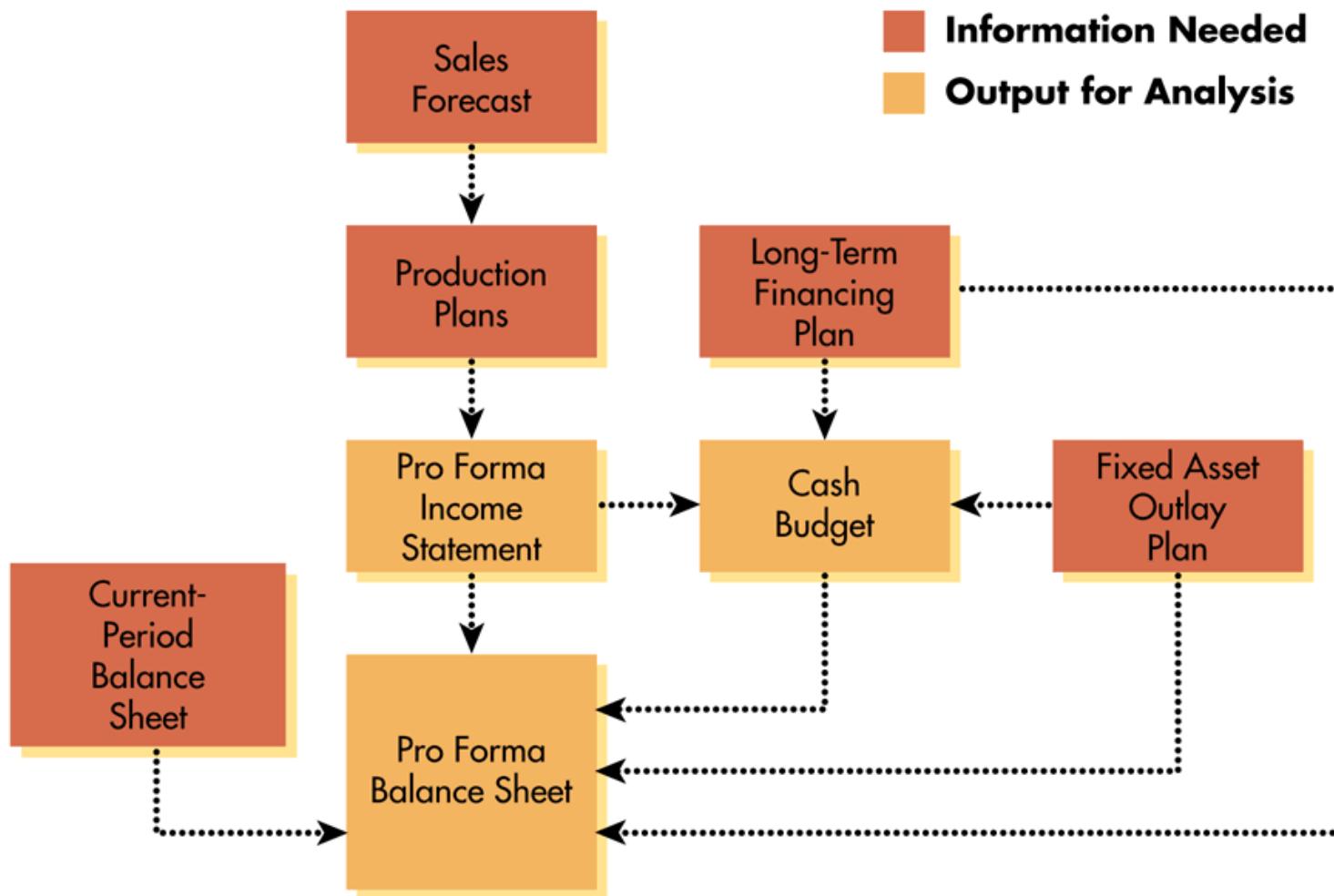
- Long-term financial plans consider a number of financial activities including:
 - Proposed fixed asset investments
 - Research and development activities
 - Marketing and product development
 - Capital structure
 - Sources of financing
- These plans are generally supported by a series of annual budgets and profit plans.

The Financial Planning Process: Short-Term (Operating) Financial Plans



- **Short-term (operating) financial** plans specify short-term financial actions and the anticipated impact of those actions and typically cover a one to two year operating period.
- Key inputs include the sales forecast and other operating and financial data.
- Key outputs include operating budgets, the cash budget, and pro forma financial statements.
- This process is described graphically on the following slide.

Figure 3.2 Short-Term Financial Planning



The Financial Planning Process: Short-Term (Operating) Financial Plans (cont.)



- As indicated in the previous exhibit, short-term financial planning begins with a **sales forecast**.
- From this sales forecast, **production plans** are developed that consider lead times and raw material requirements.
- From the production plans, direct labor, factory overhead, and operating expense estimates are developed.
- From this information, the **pro forma** income statement and cash budget are prepared—ultimately leading to the development of the pro forma balance sheet.



Cash Planning: Cash Budgets

- The **cash budget** or **cash forecast** is a statement of the firm's planned inflows and outflows of cash.
- It is used to estimate short-term cash requirements with particular attention to anticipated cash surpluses and shortfalls.
- **Surpluses** must be invested and **deficits** must be funded.
- The cash budget is a useful tool for determining the timing of cash inflows and outflows during a given period.
- Typically, monthly budgets are developed covering a 1-year time period.



Cash Planning: Cash Budgets (cont.)

- The cash budget begins with a **sales forecast**, which is simply a prediction of the sales activity during a given period.
- A prerequisite to the sales forecast is a forecast for the **economy**, the **industry**, the **company** and other external and internal factors that might influence company sales.
- The sales forecast is then used as a basis for estimating the monthly cash inflows that will result from projected sales—and outflows related to production, overhead and other expenses.



Cash Planning: Cash Budgets (cont.)

Table 3.7 The General Format of the Cash Budget

	Jan.	Feb.	...	Nov.	Dec.
Cash receipts	\$XXX	\$XXG		\$XXM	\$XXT
Less: Cash disbursements	<u>XXA</u>	<u>XXH</u>	...	<u>XXN</u>	<u>XXU</u>
Net cash flow	\$XXB	\$XXI		\$XXO	\$XXV
Add: Beginning cash	<u>XXC</u>	<u>XXD</u>	<u>XXJ</u>	<u>XXP</u>	<u>XXQ</u>
Ending cash	\$XXD	\$XXJ		\$XXQ	\$XXW
Less: Minimum cash balance	<u>XXE</u>	<u>XXK</u>	...	<u>XXR</u>	<u>XXY</u>
Required total financing		\$XXL		\$XXS	
Excess cash balance	\$XXF				\$XXZ

Cash Planning: Cash Budgets An Example: Coulson Industries



- Coulson Industries, a defense contractor, is developing a cash budget for October, November, and December. Halley's sales in August and September were \$100,000 and \$200,000 respectively. Sales of \$400,000, \$300,000 and \$200,000 have been forecast for October, November, and December. Historically, 20% of the firm's sales have been for cash, 50% have been collected after 1 month, and the remaining 30% after 2 months. In December, Coulson will receive a \$30,000 dividend from stock in a subsidiary.

Cash Planning: Cash Budgets An Example: Coulson Industries (cont.)



- Based on this information, we are able to develop the following schedule of cash receipts for Coulson Industries.

Table 3.8 A Schedule of Projected Cash Receipts for Coulson Industries (\$000)

Forecast sales	Aug.	Sept.	Oct.	Nov.	Dec.
	\$100	\$200	\$400	\$300	\$200
Cash sales (0.20)	\$20	\$40	\$ 80	\$ 60	\$ 40
Collections of A/R:					
Lagged 1 month (0.50)		50	100	200	150
Lagged 2 months (0.30)			30	60	120
Other cash receipts					30
Total cash receipts			<u><u>\$210</u></u>	<u><u>\$320</u></u>	<u><u>\$340</u></u>

Cash Planning: Cash Budgets An Example: Coulson Industries (cont.)



- Coulson Company has also gathered the relevant information for the development of a cash disbursement schedule. Purchases will represent 70% of sales—10% will be paid immediately in cash, 70% is paid the month following the purchase, and the remaining 20% is paid two months following the purchase. The firm will also expend cash on rent, wages and salaries, taxes, capital assets, interest, dividends, and a portion of the principal on its loans. The resulting disbursement schedule thus follows.

Table 3.9 A Schedule of Projected Cash Disbursements for Coulson Industries (\$000)



	Aug.	Sept.	Oct.	Nov.	Dec.
Purchases (0.70 × sales)	\$70	\$140	\$280	\$210	\$140
Cash purchases (0.10)	\$7	\$14	\$ 28	\$ 21	\$ 14
Payments of A/P:					
Lagged 1 month (0.70)		49	98	196	147
Lagged 2 months (0.20)			14	28	56
Rent payments			5	5	5
Wages and salaries			48	38	28
Tax payments					25
Fixed-asset outlays				130	
Interest payments					10
Cash dividend payments			20		
Principal payments					20
Total cash disbursements			<u><u>\$213</u></u>	<u><u>\$418</u></u>	<u><u>\$305</u></u>

Cash Planning: Cash Budgets An Example: Coulson Industries (cont.)



- The Cash Budget for Coulson Industries can be derived by combining the receipts budget with the disbursements budget. At the end of September, Coulson's cash balance was \$50,000, notes payable was \$0, and marketable securities balance was \$0. Coulson also wishes to maintain a minimum cash balance of \$25,000. As a result, it will have excess cash in October, and a deficit of cash in November and December. The resulting cash budget follows.

Table 3.10 A Cash Budget for Coulson Industries (\$000)



	Oct.	Nov.	Dec.
Total cash receipts ^a	\$210	\$320	\$340
Less: Total cash disbursements ^b	<u>213</u>	<u>418</u>	<u>305</u>
Net cash flow	(\$ 3)	(\$ 98)	\$ 35
Add: Beginning cash	<u>50</u>	<u>47</u>	<u>(51)</u>
Ending cash	\$ 47	(\$ 51)	(\$ 16)
Less: Minimum cash balance	<u>25</u>	<u>25</u>	<u>25</u>
Required total financing (notes payable) ^c	—	\$ 76	\$ 41
Excess cash balance (marketable securities) ^d	\$ 22	—	—

^aFrom Table 3.8.

^bFrom Table 3.9.

^cValues are placed in this line when the ending cash is less than the desired minimum cash balance. These amounts are typically financed short-term and therefore are represented by notes payable.

^dValues are placed in this line when the ending cash is greater than the desired minimum cash balance. These amounts are typically assumed to be invested short-term and therefore are represented by marketable securities.



Evaluating the Cash Budget

- Cash budgets indicate the extent to which cash shortages or surpluses are expected in the months covered by the forecast.

Account	End-of-month balance (\$000)		
	Oct.	Nov.	Dec.
Cash	\$25	\$25	\$25
Marketable securities	22	0	0
Notes payable	0	76	41

- The excess cash of \$22,000 in October should be invested in marketable securities. The deficits in November and December need to be financed.

Coping with Uncertainty in the Cash Budget



- One way to cope with **cash budgeting uncertainty** is to prepare several cash budgets based on several forecasted scenarios (e.g., pessimistic, most likely, optimistic).
- From this range of cash flows, the financial manager can determine the amount of financing necessary to cover the most adverse situation.
- This method will also provide a sense of the riskiness of alternatives.
- An example of this sort of “sensitivity analysis” for Coulson Industries is shown on the following slide.

Coping with Uncertainty in the Cash Budget (cont.)



Table 3.11 A Scenario Analysis of Coulson Industries' Cash Budget (\$000)

	October			November			December		
	Pessimistic	Most likely	Optimistic	Pessimistic	Most likely	Optimistic	Pessimistic	Most likely	Optimistic
Total cash receipts	\$160	\$210	\$285	\$210	\$320	\$410	\$275	\$340	\$422
Less: Total cash disbursements	200	213	248	380	418	467	280	305	320
Net cash flow	(\$ 40)	(\$ 3)	\$ 37	(\$170)	(\$ 98)	(\$ 57)	(\$ 5)	\$ 35	\$102
Add: Beginning cash	50	50	50	10	47	87	(160)	(51)	30
Ending cash	\$ 10	\$ 47	\$ 87	(\$160)	(\$ 51)	\$ 30	(\$165)	(\$ 16)	\$132
Less: Minimum cash balance	25	25	25	25	25	25	25	25	25
Required total financing	\$ 15	—	—	\$185	\$ 76	—	\$190	\$ 41	—
Excess cash balance	—	\$ 22	\$ 62	—	—	\$ 5	—	—	\$107



Profit Planning: Pro Forma Statements

- **Pro forma financial statements** are projected, or forecast, financial statements – income statements and balance sheets.
- The inputs required to develop pro forma statements using the most common approaches include:
 - Financial statements from the preceding year
 - The sales forecast for the coming year
 - Key assumptions about a number of factors
- The development of pro forma financial statements will be demonstrated using the financial statements for Vectra Manufacturing.

Profit Planning: Pro Forma Financial Statements



**Table 3.12 Vectra
Manufacturing's
Income Statement
for the Year Ended
December 31,
2009**

Sales revenue	
Model X (1,000 units at \$20/unit)	\$20,000
Model Y (2,000 units at \$40/unit)	<u>80,000</u>
Total sales	\$100,000
Less: Cost of goods sold	
Labor	\$28,500
Material A	8,000
Material B	5,500
Overhead	<u>38,000</u>
Total cost of goods sold	<u>80,000</u>
Gross profits	\$ 20,000
Less: Operating expenses	<u>10,000</u>
Operating profits	\$ 10,000
Less: Interest expense	<u>1,000</u>
Net profits before taxes	\$ 9,000
Less: Taxes ($0.15 \times \$9,000$)	<u>1,350</u>
Net profits after taxes	\$ 7,650
Less: Common stock dividends	<u>4,000</u>
To retained earnings	\$ 3,650

Profit Planning: Pro Forma Financial Statements (cont.)



Table 3.13 Vectra Manufacturing's Balance Sheet, December 31, 2009

Assets	Liabilities and Stockholders' Equity		
Cash	\$ 6,000	Accounts payable	\$ 7,000
Marketable securities	4,000	Taxes payable	300
Accounts receivable	13,000	Notes payable	8,300
Inventories	<u>16,000</u>	Other current liabilities	<u>3,400</u>
Total current assets	<u>\$39,000</u>	Total current liabilities	<u>\$19,000</u>
Net fixed assets	<u>\$51,000</u>	Long-term debt	\$18,000
Total assets	<u><u>\$90,000</u></u>	Stockholders' equity	
		Common stock	\$30,000
		Retained earnings	<u>\$23,000</u>
		Total liabilities and stockholders' equity	<u><u>\$90,000</u></u>

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 1: Start with a Sales Forecast
 - The first and key input for developing pro forma financial statements is the sales forecast for Vectra Manufacturing.

Table 3.14 2010 Sales Forecast for Vectra Manufacturing

Unit sales	
Model X	1,500
Model Y	1,950
Dollar sales	
Model X (\$25/unit)	\$ 37,500
Model Y (\$50/unit)	<u>97,500</u>
Total	<u><u>\$135,000</u></u>

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 1: Start with a Sales Forecast (cont.)
 - The previous sales forecast is based on an increase in price from \$20 to \$25 per unit for Model X and from \$40 to \$50 per unit for Model Y.
 - These increases are required to cover anticipated increases in various costs, including labor, materials, & overhead.

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 2: Preparing the Pro Forma Income Statement
 - A simple method for developing a pro forma income statement is the **“percent-of-sales”** method.
 - This method starts with the sales forecast and then expresses the cost of goods sold, operating expenses, and other accounts as a percentage of projected sales.
 - Using the Vectra example, the easiest way to do this is to recast the historical income statement as a percentage of sales.

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 2: Preparing the Pro Forma Income Statement (cont.)
 - Using these percentages and the sales forecast we developed, the entire income statement can be projected.
 - The results are shown on the following slide.
 - It is important to note that this method implicitly assumes that all costs are variable and that all increase or decrease in proportion to sales.
 - This will underestimate profits when sales are increasing and overstate them when sales are decreasing.

Profit Planning: Pro Forma Financial Statements (cont.)



Table 3.15 A Pro Forma Income Statement, Using the Percent-of-Sales Method, for Vectra Manufacturing for the Year Ended December 31, 2010

Sales revenue	\$135,000
Less: Cost of goods sold (0.80)	<u>108,000</u>
Gross profits	\$ 27,000
Less: Operating expenses (0.10)	<u>13,500</u>
Operating profits	\$ 13,500
Less: Interest expense (0.01)	<u>1,350</u>
Net profits before taxes	\$ 12,150
Less: Taxes ($0.15 \times \$12,150$)	<u>1,823</u>
Net profits after taxes	\$ 10,327
Less: Common stock dividends	<u>4,000</u>
To retained earnings	\$ 6,327

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 2: Preparing the Pro Forma Income Statement (cont.)
 - Clearly, some of the firm's expenses will increase with the level of sales while others will not.
 - As a result, the strict application of the percent-of-sales method is a bit naïve.
 - The best way to generate a more realistic pro forma income statement is to segment the firm's expenses into fixed and variable components.
 - This may be demonstrated as follows.

Profit Planning: Pro Forma Financial Statements (cont.)



Vectra Manufacturing
Income Statements

	2009 Actual	2010 Pro forma
Sales revenue	\$100,000	\$135,000
Less: Cost of good sold		
Fixed cost	40,000	40,000
Variable cost ($0.40 \times$ sales)	<u>40,000</u>	<u>54,000</u>
Gross profits	\$ 20,000	\$ 41,000
Less: Operating expenses		
Fixed expense	5,000	5,000
Variable expense ($0.05 \times$ sales)	<u>5,000</u>	<u>6,750</u>
Operating profits	\$ 10,000	\$ 29,250
Less: Interest expense (all fixed)	<u>1,000</u>	<u>1,000</u>
Net profits before taxes	\$ 9,000	\$ 28,250
Less: Taxes ($0.15 \times$ net profits before taxes)	<u>1,350</u>	<u>4,238</u>
Net profits after taxes	<u><u>\$ 7,650</u></u>	<u><u>\$ 24,012</u></u>

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 3: Preparing the Pro Forma Balance Sheet
 - Probably the best approach to use in developing the pro forma balance sheet is the **judgmental approach**.
 - Under this simple method, the values of some balance sheet accounts are estimated and the company's external financing requirement is used as the balancing account.
 - To apply this method to Vectra Manufacturing, a number of simplifying assumptions must be made.

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 3: Preparing the Pro Forma Balance Sheet (cont.)
 1. A minimum cash balance of \$6,000 is desired.
 2. Marketable securities will remain at their current level of \$4,000.
 3. Accounts receivable will be approximately \$16,875 which represents 45 days of sales on average $[(45/365) \times \$135,000]$.
 4. Ending inventory will remain at about \$16,000. 25% (\$4,000) represents raw materials and 75% (\$12,000) is finished goods.
 5. A new machine costing \$20,000 will be purchased. Total depreciation will be \$8,000. Adding \$20,000 to existing net fixed assets of \$51,000 and subtracting the \$8,000 depreciation yields a net fixed assets figure of \$63,000.

Profit Planning: Pro Forma Financial Statements (cont.)



- Step 3: Preparing the Pro Forma Balance Sheet (cont.)
 6. Purchases will be \$40,500 which represents 30% of annual sales ($30\% \times \$135,000$). Vectra takes about 73 days to pay on its accounts payable. As a result, accounts payable will equal \$8,100 [$(73/365) \times \$40,500$].
 7. Taxes payable will be \$455 which represents one-fourth of the 1998 tax liability.
 8. Notes payable will remain unchanged at \$8,300.
 9. There will be no change in other current liabilities, long-term debt, and common stock.
 10. Retained earnings will change in accordance with the pro forma income statement.

Profit Planning: Pro Forma Financial Statements (cont.)



Table 3.16
A Pro Forma Balance Sheet, Using the Judgmental Approach, for Vectra Manufacturing (December 31, 2010)

Assets		Liabilities and Stockholders' Equity	
Cash	\$ 6,000	Accounts payable	\$ 8,100
Marketable securities	4,000	Taxes payable	455
Accounts receivable	16,875	Notes payable	8,300
Inventories		Other current liabilities	3,400
Raw materials	\$ 4,000	Total current liabilities	\$ 20,255
Finished goods	<u>12,000</u>	Long-term debt	\$ 18,000
Total inventory	<u>16,000</u>	Stockholders' equity	
Total current assets	\$ 42,875	Common stock	\$ 30,000
Net fixed assets	<u>\$ 63,000</u>	Retained earnings	<u>\$ 29,327</u>
Total assets	<u>\$105,875</u>	Total	\$ 97,582
		External financing required ^a	<u>\$ 8,293</u>
		Total liabilities and stockholders' equity	<u>\$105,875</u>

^aThe amount of external financing needed to force the firm's balance sheet to balance. Because of the nature of the judgmental approach, the balance sheet is not expected to balance without some type of adjustment.

Evaluation of Pro Forma Statements: Weaknesses of Simplified Approaches



- The major weaknesses of the approaches to pro forma statement development outlined above lie in two assumptions:
 - That the firm's past financial performance will be replicated in the future
 - That certain accounts can be forced to take on desired values
- For these reasons, it is imperative to first develop a forecast of the overall economy and make adjustments to accommodate other facts or events.

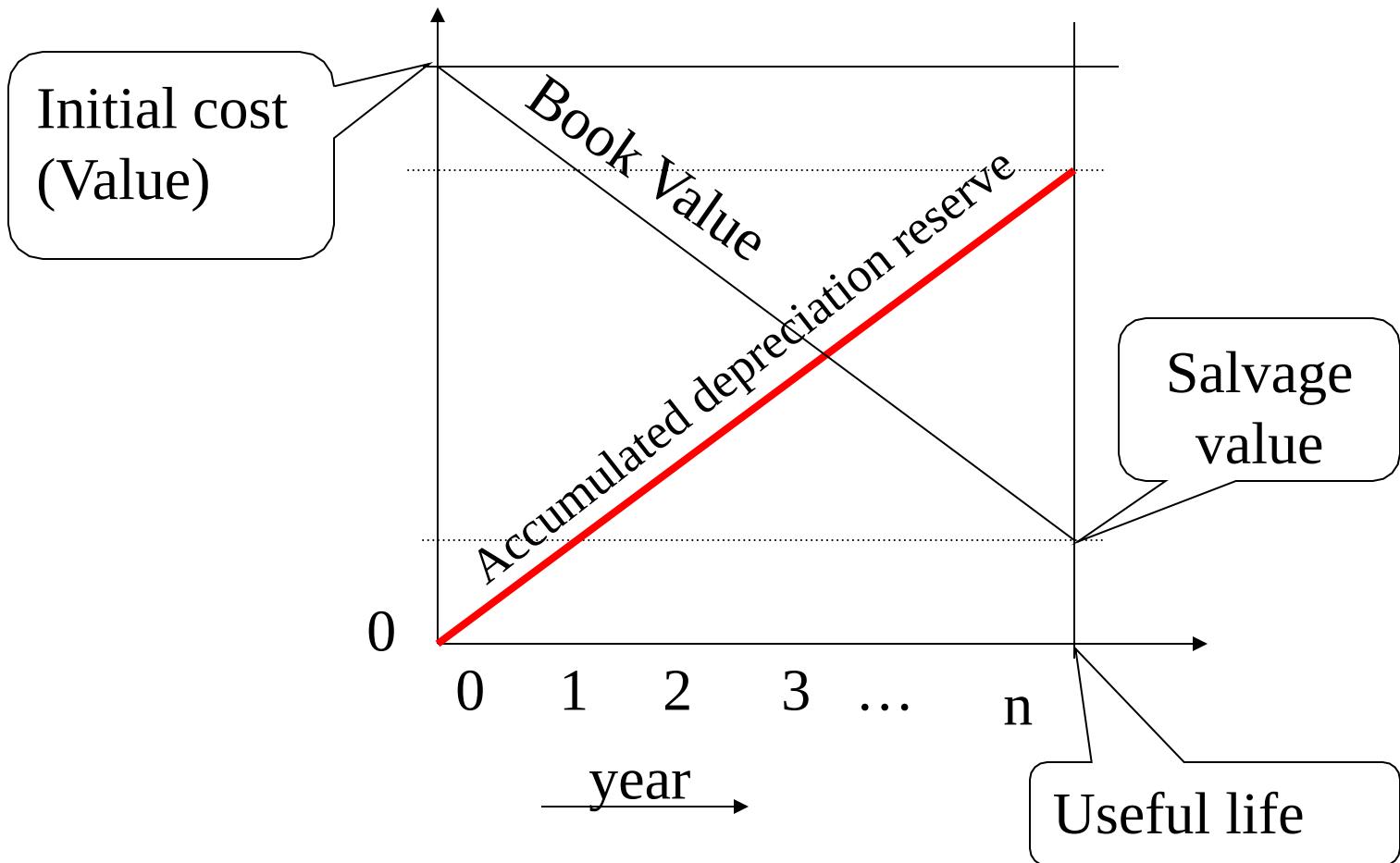
Deprecition

Depreciation def.

- In simple words we can say that depreciation is the reduction in the value of an asset due to usage, passage of time, wear and tear, technological outdated or obsolescence, depletion or other such factors.

Methods of depreciation

- **Methods of depreciation**
- There are several methods for calculating depreciation, generally based on either the passage of time or the level of activity (or use) of the asset.
- **Straight-line depreciation**
- Straight-line depreciation is the simplest and most often used technique,
 - in which the company estimates the salvage value of the asset at the end of the period during which it will be used to generate revenues (useful life),
 - and will expense a portion of **original cost** in equal increments over that period.
- The salvage value is an estimate of the value of the asset at the time it will be sold or disposed of; it may be zero. Salvage value is scrap value, by another name.



Depreciation : straight line Method

Straight-Line Method:

- For example, a vehicle that depreciates over 5 years,
- is purchased at a cost of **US\$17,000**,
- and will have a salvage value of **US\$2000**,
- will depreciate at
 : $(\$17,000 - \$2,000) / 5 \text{ years} = \$3,000$ annual straight-line depreciation expense.

In other words, it is the **depreciable cost** of the asset divided by the number of years of its useful life.

- Book value at the beginning of the first year of depreciation is the original cost of the asset.
- At any time book value equals original cost minus accumulated depreciation.
- **Book Value = Original Cost - Accumulated Depreciation**

An ex on straight method

- A vehicle costing Rs 8 Lacs has a salvage value of Rs 50000 after useful life of 10 years. Calculate its book value after 4 tears of purchase,
- Book value = initial cost - accumulated depreciation
- Annual rate of depreciation=[Initial cost – salvage value] / useful life in years
 - $= [800000-50000]/10 = 75000 \text{ Rs}$
 - Book value after 4 years $=800000-(75000 \times 4)$
 $=500000$

Sinking fund Method

- The amount invested at the end of every year with a compound interest rate ‘r’ will accumulate to the total depreciation over the useful life ‘n’ years (i.e. to initial cost –salvage value)
- If x is the annual sinking fund then

$$x[1+r]^{n-1} + x[1+r]^{n-2} + x[1+r]^{n-3} + \dots + x[1+r]^{n-n}$$

Gives total depreciation.

Series sums to $\left\{ (1+r)^n - 1 \right\} / r$

Annual sinking fund = [initial cost- salvage value] $[r/ \left\{ (1+r)^n - 1 \right\}]$

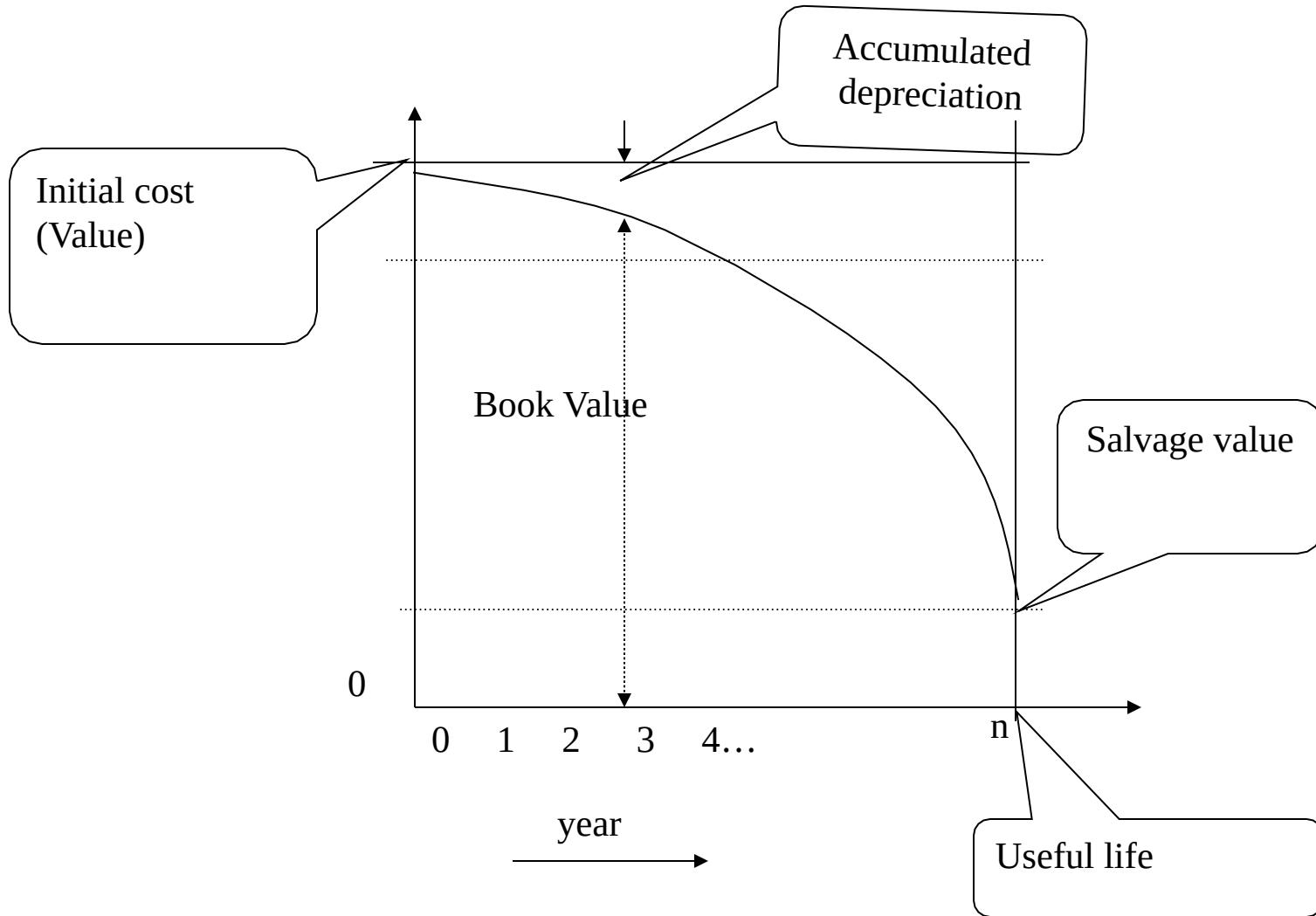
Ex on sinking fund

- Calculate the annual sinking fund for asset with
 - Initial cost 800000
 - Salvage value 50000
 - Useful life 10 years
 - Annual interest rate 12%

Annual sinking fund =

$$[\text{initial cost} - \text{salvage value}] \left[r / \{(1+r)^n - 1\} \right]$$

$$\begin{aligned} & [800000 - 50000] \left[0.12 / \{(1+0.12)^{10} - 1\} \right] \\ & = 42738.12 \text{ Rs} \end{aligned}$$



Depreciation : sinking fund Method

Declining-Balance Method

- **Declining-Balance Method**
- Depreciation methods that provide for a higher depreciation charge in the first year of an asset's life and gradually decreasing charges in subsequent years are called **accelerated depreciation methods**.
- This may be a more realistic reflection of an asset's actual expected benefit from the use of the asset: many assets are most useful when they are new. One popular accelerated method is the **declining-balance method**. Under this method the Book Value is multiplied by a fixed rate.
- **Annual Depreciation = Depreciation Rate * Book Value at Beginning of Year**

$$C \{1-x/100\}^n = S$$

where C = initial cost, S is salvage value and 'x' is depreciation rate.

Declining Balance method

- **Annual Depreciation = Depreciation Rate * Book Value at Beginning of Year**

$$C \{1-x/100\}^n = S$$

where C = initial cost, S is salvage value and ' x ' is depreciation rate.

e.g. for $C=2x10^8$ Rs $S= 15\%$ of initial value and useful life 12 years

$$2x10^8 [\{1-x/100\}^{12} = 0.15x 2x10^8 \text{ gives } x = 14.6 \%$$

Therefore annual depreciation reserve at the end of first year = $C x /100 = 2x10^8 x 0.146 = 29.2 x10^6$

Declining-Balance Method

- The most common rate used is double the straight-line rate. For this reason, this technique is referred to as the **double-declining-balance method**.
- To illustrate, suppose a business has
 - an asset with **\$1,000** Original Cost,
 - \$100** Salvage Value,
 - and **5 years** useful life.

First, calculate straight-line depreciation rate. Since the asset has 5 years useful life, the straight-line depreciation rate equals **(100% / 5) 20%** per year. With double-declining-balance method, as the name suggests, double that rate, or **40%** depreciation rate is used.

- The table below illustrates the double-declining-balance method of depreciation. Book Value at the beginning of the first year of depreciation is the Original Cost of the asset. At any time Book Value equals Original Cost minus Accumulated Depreciation.

Declining-Balance Method

- **Book Value = Original Cost - Accumulated Depreciation**
- Book Value at the end of year becomes Book Value at the beginning of next year. The asset is depreciated until the Book Value equals Salvage Value, or Scrap Value.

- Ex2; $c=50,000$ $s= 5000$, $n=5$

$$50,000[1-x/100]^5 = 5000$$

Gives $x = 36.9\%$

year	Book value at the beginning of the year	Depreciation reserve during the year at the rate of 36.9%	Accumulated depreciation
1st	50,000	18452.13	18452.13
2 nd	31547.8	11641.13	30,093.26
3 rd	19,906	7345.55	37438.8
4 th	12560	4634.8	42073.6
5 th	7926.4	2924.8	44998.44

Current power position

- India cannot solve its energy-power needs in the near future
- (the current five year plan - 2007 to 2012, proposes production of about 78,000 MW in addition to a current installed capacity of about 141,000 MW).
- A large number of the citizens ... up to 450 million (about 85 million households as per 2001 Census), are forced to live with no access to electricity, they still use Kerosene. Some 3.3 million (0.62 million households), have no means of home lighting at all.
- The other sources of energy: crude oil, coal, biomass, gas, solar and wind, are also not accessible-affordable to many Indian citizens, most of who live in the total 229,000 villages (population above 1,000 as per 2001 Census), in India.
- *India* presently has installed capacity of 86015 MW of *thermal generation* (as on March 31, 2007) constituting 65% of total installed capacity. ...

Intermediate Accounting, 11th ed.
Kieso, Weygandt, and Warfield

Chapter 11: Depreciation, Impairments and Depletion

Chapter 11: Depreciation, Impairments and Depletion

**After studying this chapter, you should
be able to:**

1. Explain the concept of depreciation.
2. Identify the factors involved in the depreciation process.
3. Compare activity, straight-line, and decreasing-charge methods of depreciation.
4. Explain special depreciation methods.

Chapter 11: Depreciation, Impairments and Depletion

5. Explain the accounting issues related to asset impairment.
6. Explain the accounting procedures for depletion of natural resources.
7. Explain how property, plant, equipment, and natural resources are reported and analyzed.

Depreciation: Concept

- Depreciation is a means of cost allocation.
- It is not a method of valuation.
- Depreciation involves:
allocating the cost of tangible assets to expense in a systematic and rational manner to periods expected to benefit from use of its depreciable assets.

Factors in the Depreciation Process

Questions to be answered:

1. What is the **depreciable base** of the asset?
2. What is the asset's **useful life**?
3. What **method** of depreciation is best for the asset in question?

Depreciable Base

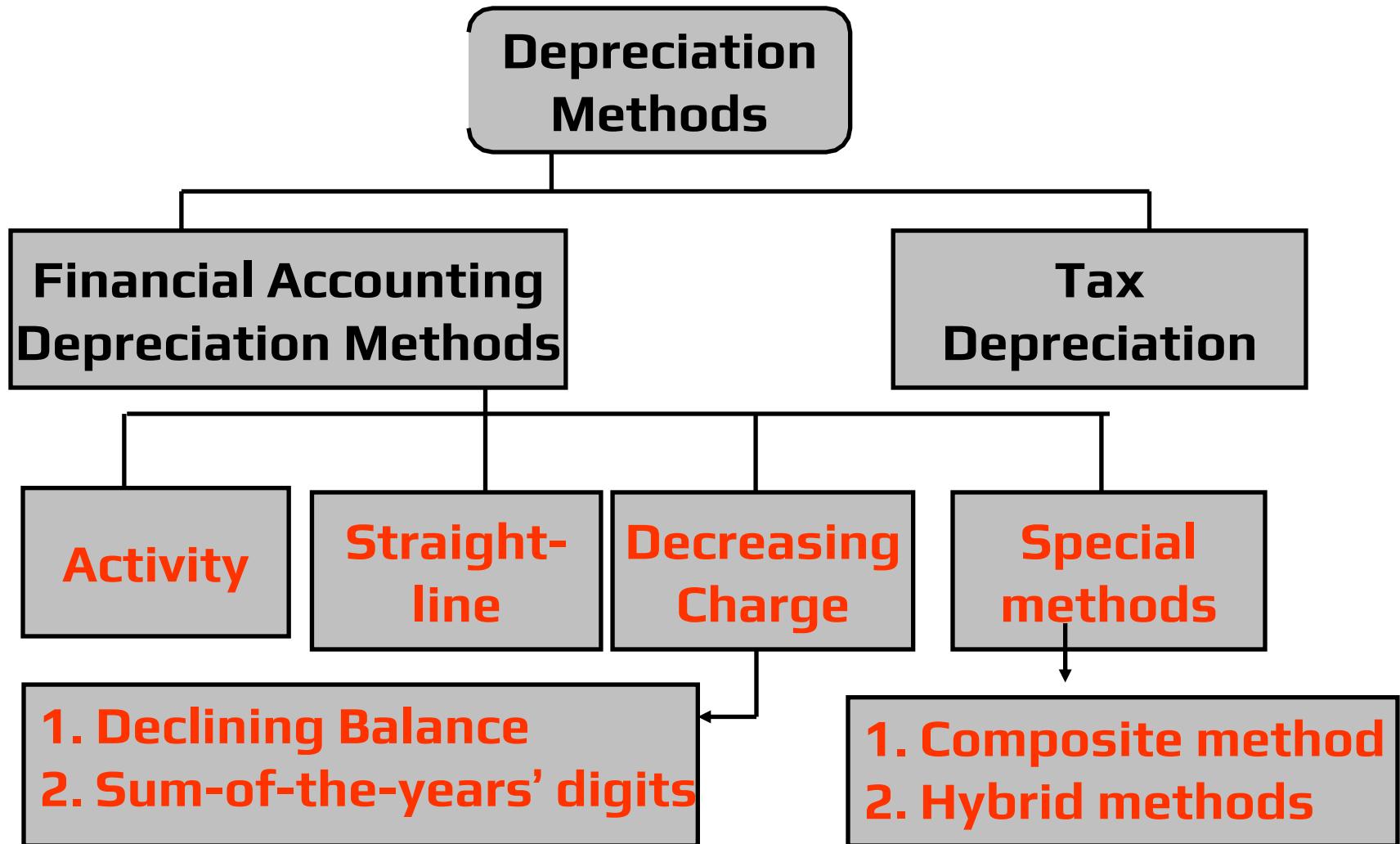
- Depreciable base is the dollar amount subject to depreciation.
- It is determined as:

Original cost of the asset less
Estimated salvage or disposal value

Estimated Service Lives

- An asset's **service life** and **physical life** are not the same.
- Assets' service life are affected by: physical factors, and economic factors
- Economic factors include:
 - Inadequacy (asset can not meet current demand)
 - Supercession (by a better asset)
 - Obsolescence (other factors)

Depreciation Methods: Overview



Depreciation Methods: Straight-Line

- Is a function of time rather than usage
- Results in an equal amount of depreciation expense for a given period
- Depreciation Expense is computed as:

$$\frac{\text{Cost} - \text{Salvage Value}}{\text{Estimated Life}}$$

Depreciation Methods: Activity

- Is a function of usage rather than time.
- Estimated life is in terms of total input/output of asset.
- Depreciation expense is computed as:

$$\frac{\text{Cost} - \text{Salvage Value} \times \text{Input/Output this period}}{\text{Total Estimated Input/Output}}$$

Depreciation Methods: Decreasing Charge (Accelerated)

These methods result in higher depreciation expense in the earlier years and lower charges in the later years.

Two decreasing charge methods are:

1. Declining balance
2. Sum-of-the-years'-digits

Depreciation Methods: Declining Balance

1. Salvage value is not deducted when computing depreciable base.
2. Utilizes a **depreciation rate (%)** that is some multiple of the SL rate.
3. The depreciation rate is multiplied by the asset's **book value** at the beginning of the period to get the depreciation expense for the period.
4. Since the book value decreases over time this results in a decreasing amount of depreciation expense over time.
5. An asset's book value can never be less than its estimated salvage value.

Depreciation Methods: Sum-of-the-Years' Digits

- A fraction is multiplied by the depreciable base to arrive at the depreciation expense per period.
- The fraction is:
 1. Numerator: number of years remaining in the asset's life as of the beginning of the period.
 2. Denominator: sum of the years in the life
 3. For example, a 5 year life property would have depreciation expense for the first year as:
 4. (Cost – Salvage value) X 5 (years remaining)
15 (computed as
 $5+4+3+2+1$)

Group and Composite Depreciation Methods

- The **group method** is applied to a collection of assets similar in nature.
- The **composite method** is applied to a collection of assets dissimilar in nature.
- The composite depreciation rate is determined as follows:

total of annual depreciation for all assets

total cost of all assets

Partial Year Depreciation

- When an asset is bought sometime during the year, a partial depreciation charge is required.
- The procedure is:
determine depreciation for a full year, and allocate the amount between the two periods affected

Revision of Depreciation Estimates

- Determination of depreciation involves initial **estimates** (e.g., life, salvage value)
- When these estimates are revised, depreciation must be re-computed:

Remaining B.V. – Est. Salvage Value

Remaining Est. Life

- These revised depreciation expenses apply prospectively to the remaining life of asset.
- These changes do not affect prior periods.

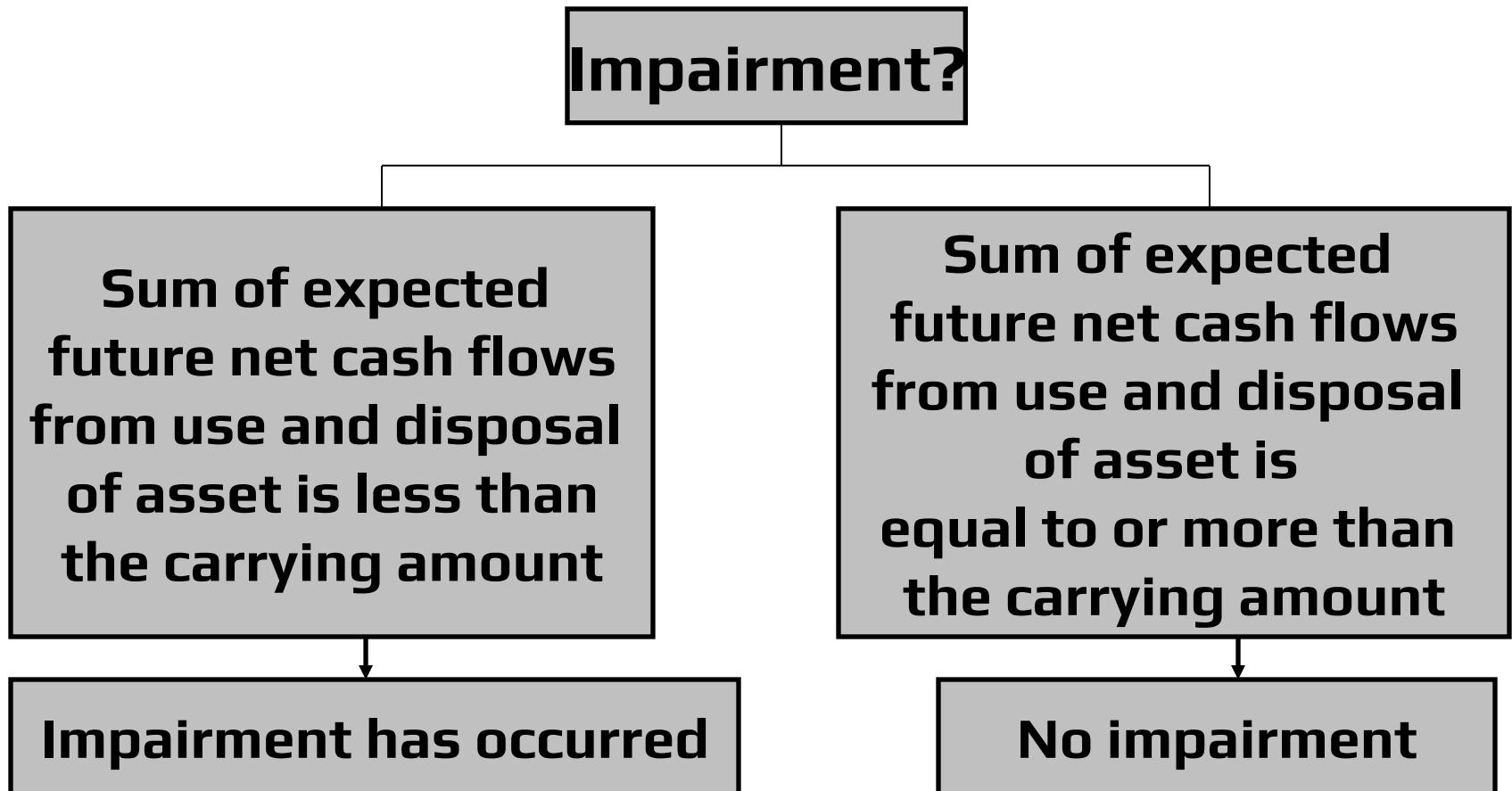
Impairments

An **impairment** of a depreciable asset occurs when:

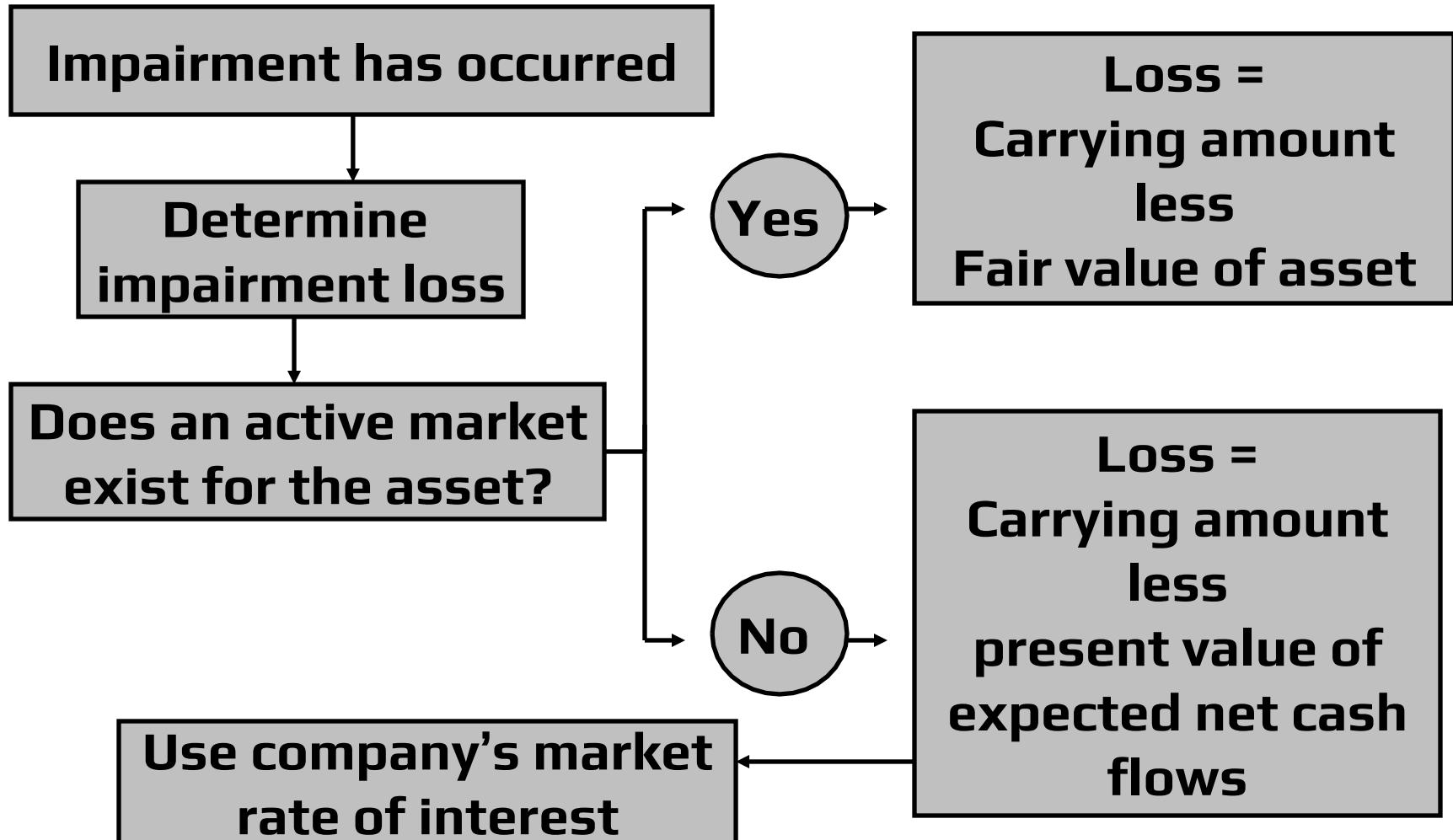
- the carrying amount of the asset is not recoverable, and therefore a write-off is needed.

The **recoverability test** determines if an impairment has occurred.

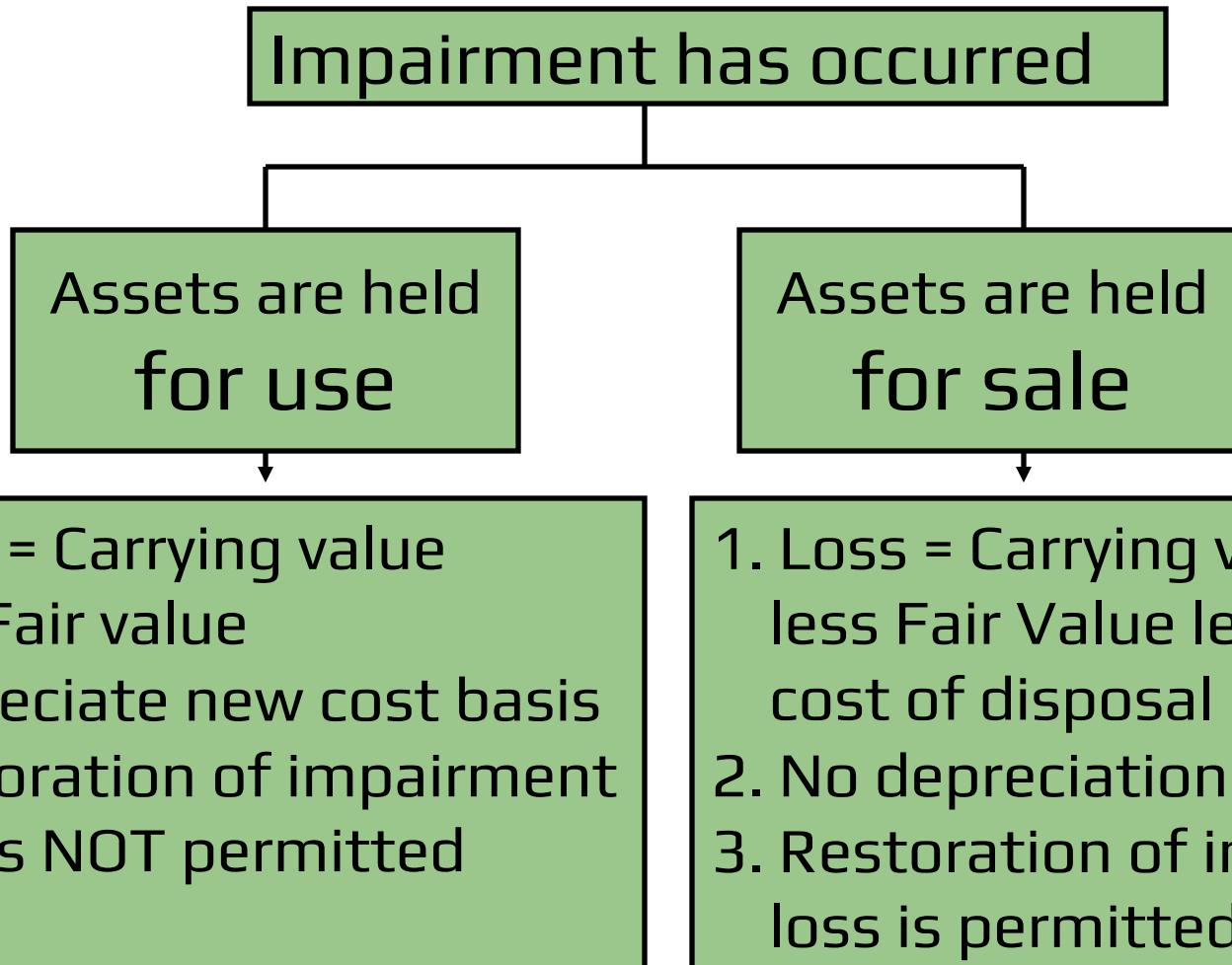
Impairments: The Recoverability Test



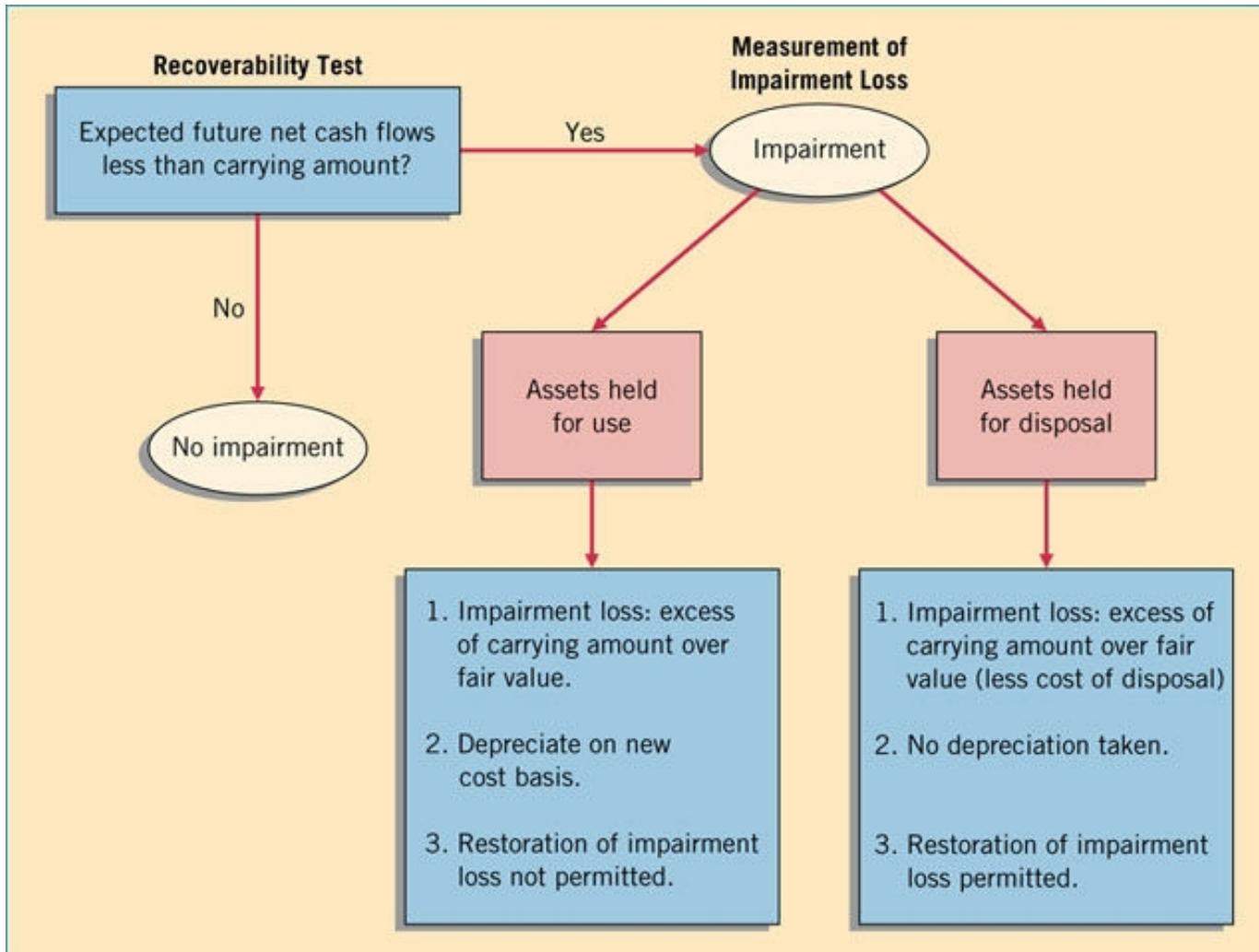
Impairments: Measuring Loss



Impairment: Accounting



Graphic of Accounting for Impairments



Depletion: Terminology

Depletion refers to the cost basis write-off of natural resources (e.g., coal, oil, timber)

Depletion expense per unit is calculated:

Cost – Estimated Salvage Value

Total Estimated Units Available

This per unit cost is then multiplied by the units extracted during a period to derive the depletion for the period.

Depletion: Special Problems

- Difficulty of estimating recoverable reserves
- Problems of discovery value
- Accounting for liquidating dividends

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Developing Project Cash Flow Statement

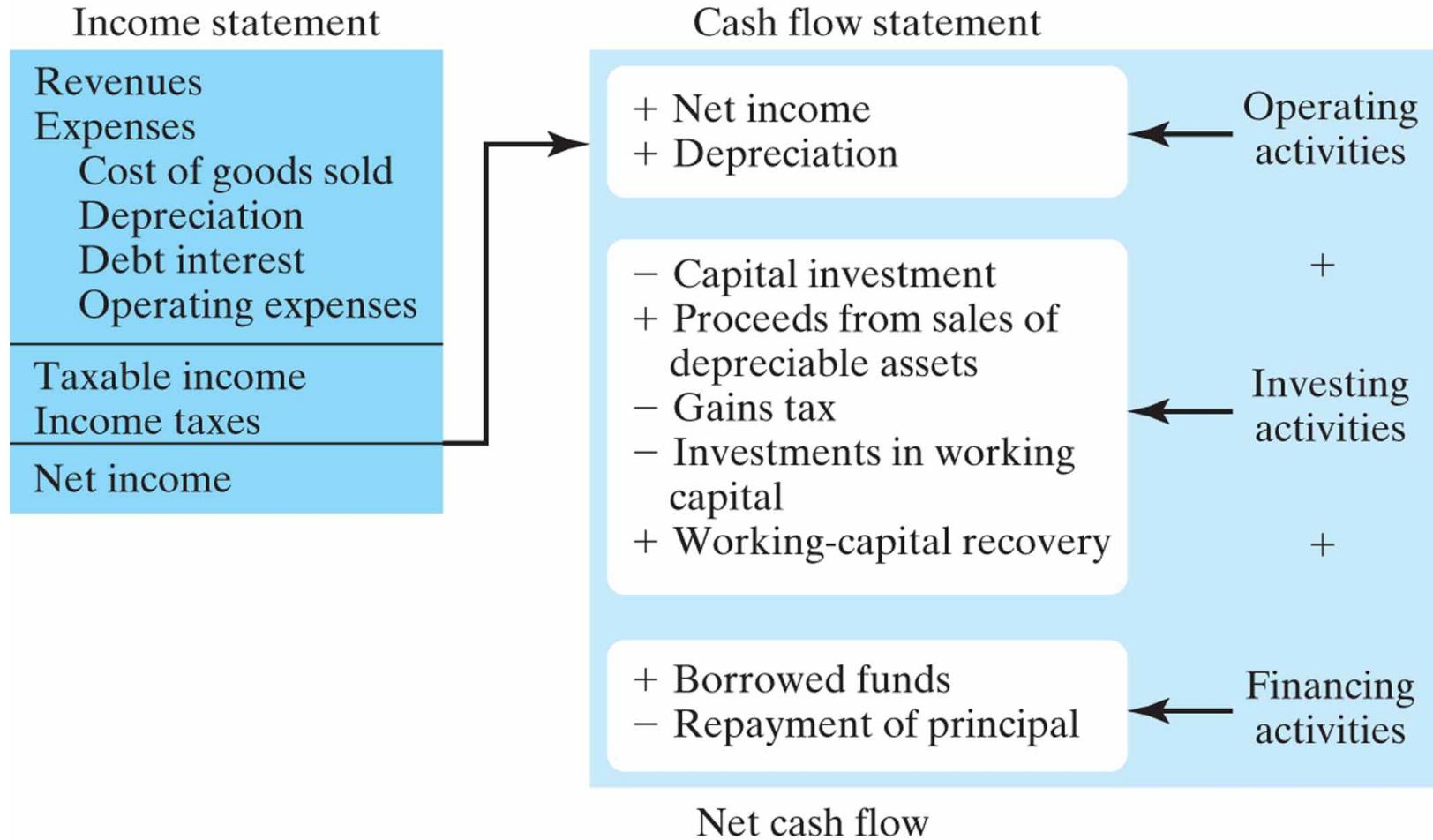
Lecture No. 23

Chapter 9

Fundamentals of Engineering Economics

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A Typical Format Used in Presenting a Net Cash Flow Statement



Cash Flows from Operating Activities

- q Cash flows from operation:
 - Sales revenues
 - Cost of goods sold
 - Operating expenses
 - Income taxes
- q How to estimate the cash flows from operation:
 - q $\text{Cash flows from operation} = \text{net income} + \text{non-cash expenses (depreciation and amortization)}$

Cash Flows from Investing Activities

- q Investment in physical assets
 - Should be capitalized (depreciated).
- q Investment in working capital
 - q Investment in working capital refers to the investment made in non-depreciable assets, such as carrying raw-material inventories.
 - q Should be treated as capital expenditures, but no depreciation deduction is allowed.
 - q Any recovery of working capital at the end of project life has no tax consequences.

Cash Flows from Financing Activities

- q Cash flows from financing activities:
 - The amount of borrowing
 - The repayment of principal
- q Treatment of interest expenses:
 - q Interest payments are tax-deductible expenses, so they are classified as operating, not financing activities

Example 9.2 Cash Flow Statement with Only Operating and Investing Activities

- q Project Nature: Purchase of a new milling machine
- q Financial Data:
 - q Investment activities:
 - n Capital expenditure (milling machine): \$162,000
 - n Project life: 5 years
 - n Salvage value: \$45,000
 - n Investment in working capital: \$25,000, which will be recovered in full at the end of year 5
 - q Operating activities:
 - q Annual operating revenue: \$175,000
 - q Annual operating expenses:
 - q Labor: \$60,000
 - q Materials: \$20,000
 - q Overhead: \$10,000
- q Accounting Data:
 - q Depreciation method: 7-year MACRS
 - q Income tax rate: 40%
 - q MARR after tax: 15%

Step 1: Depreciation Calculation

Cost basis = \$162,000

n	MACRS Rate	Depreciation Amount	Allowed Depreciation Amount
1	14.29%	\$23,143	\$23,143
2	24.49%	\$39,673	\$39,673
3	17.49%	\$28,338	\$28,338
4	12.49%	\$20,242	\$20,242
5	8.93%	\$14,458	\$7,229
6	8.92%	\$14,450	0
7	8.93%	\$14,458	0
8	4.46%	\$7,229	0

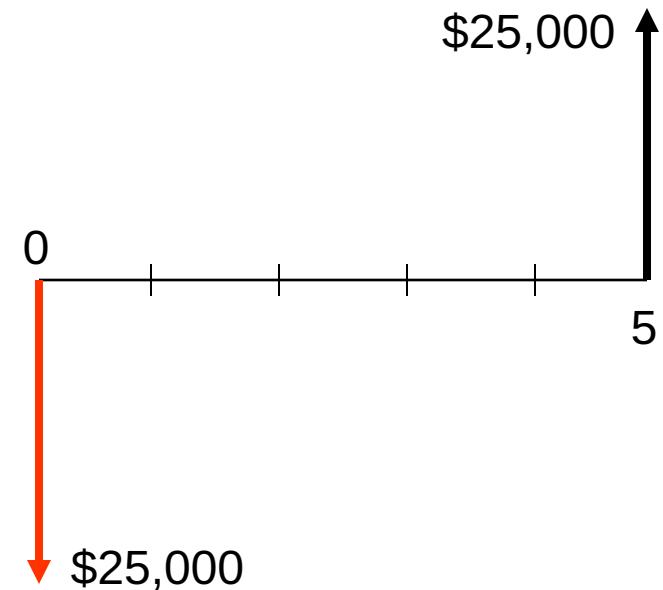
Step 2: Gains (Losses) Associated with Asset Disposal

- q Salvage value = \$45,000
- q Book Value (year 5) = Cost Basis – Total Depreciation
= \$162,000 - \$118,625
= \$ 43,375
- q Taxable gains = Salvage Value – Book Value
= \$45,000 - \$43,375
= \$1,625
- q Gains taxes = (Taxable Gains)(Tax Rate)
= \$1,625 (0.40)
= \$650

Step 3: Consideration of Working Capital Investments

- q Working capital means the amount carried in cash, accounts receivable, and inventory that is available to meet day-to-day operating needs.
- q How to treat working capital investments: just like a capital expenditure except that *no depreciation* is allowed.

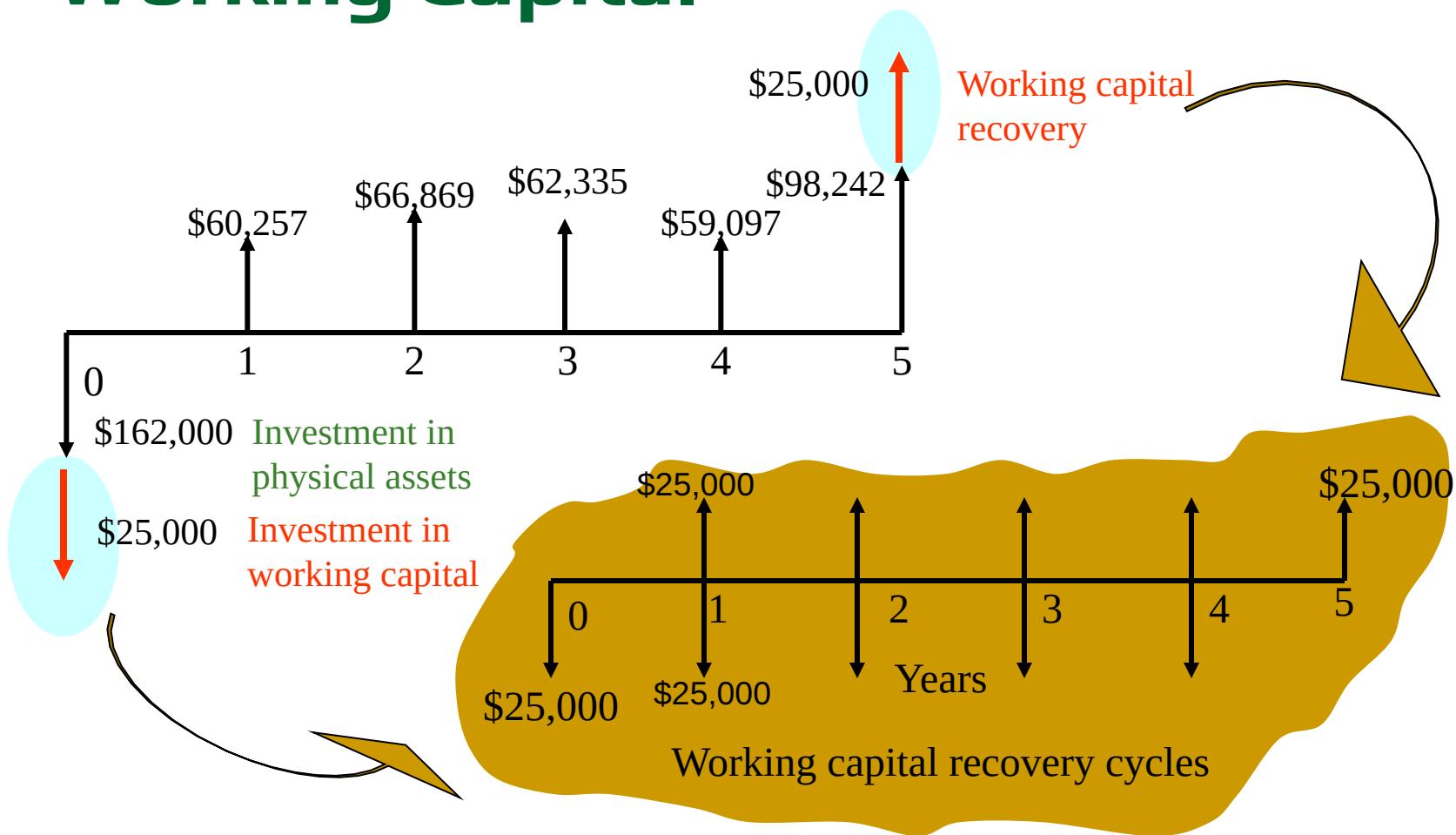
0	1	2	3	4	5
\$25,000					\$25,000



Step 4: Develop the Cash Flow Statement

	A	B	C	D	E	F	G
1							
2	Income Statement						
3	End of Year	0	1	2	3	4	5
4							
5	Revenue		\$ 175,000	\$ 175,000	\$ 175,000	\$ 175,000	\$ 175,000
6	Expenses:						
7	Labor		\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000
8	Materials		\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000
9	Overhead		\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000
10	Depreciation		\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229
11							
12	Taxable Income		\$ 61,857	\$ 45,327	\$ 56,662	\$ 64,758	\$ 77,771
13	Income Taxes (40%)		\$ 24,743	\$ 18,131	\$ 22,665	\$ 25,903	\$ 31,108
14							
15	Net Income		\$ 37,114	\$ 27,196	\$ 33,997	\$ 38,855	\$ 46,663
16							
17	Cash Flow Statement						
18	Operating Activities:						
19	Net Income		\$ 37,114	\$ 27,196	\$ 33,997	\$ 38,855	\$ 46,663
20	Depreciation		\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229
21	Investment Activities:						
22	Milling machine	\$ (162,000)					
23	Salvage Value			=-(G23-(-B22-SUM(C10:G10)))*0.4			\$ 45,000
24	Gains Tax						\$ (650)
25	Working capital	\$ (25,000)					\$ 25,000
26							
27	Net Cash Flow	\$ (187,000)	\$ 60,257	\$ 66,869	\$ 62,335	\$ 59,097	\$ 123,242
28							
29							
30	PW(15%)=	\$ 52,008		=NPV(15%,C27:G27)+B27			
31	IRR =	25.12%					
32				=IRR(B27:G27,15%)			
33							
34							

Cash Flow Diagram including Working Capital



When Projects are Financed with Borrowed Funds

- q **Key issue:** Interest payment is a tax-deductible expense.
- q **What needs to be done:** Once a loan repayment schedule is known, separate the interest payments from the annual installments.
- q **What about principal payments?** As the amount of borrowing is NOT viewed as income to the borrower, the repayments of principal are NOT viewed as expenses either— NO tax effect.

Example 9.3 Cash Flow Statement with Financing Activities

Amount financed: \$64,800, or 50% of the total capital expenditure

Financing rate: 12% per year

Annual installment: \$17,976 or, $A = \$64,800(A/P, 12\%, 5)$

End of Year	Beginning Balance	Interest Payment	Principal Payment	Ending Balance
1	\$64,800	\$7,776	\$10,200	\$54,600
2	54,600	6,552	11,424	43,176
3	43,176	5,181	12,795	30,381
4	30,381	3,646	14,330	16,051
5	16,051	1,926	16,051	0

\$17,976

Cash Flow Statement (Table 9.3)

	A	B	C	D	E	F	G	H	I	J
1										
2	Income Statement									
3	End of Year	0	1	2	3	4	5			
4										
5	Revenue		\$ 175,000	\$ 175,000	\$ 175,000	\$ 175,000	\$ 175,000			
6	Expenses:									
7	Labor		\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000			
8	Materials		\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000			
9	Overhead		\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000			
10	Debt Interest		\$ 7,776	\$ 6,552	\$ 5,181	\$ 3,646	\$ 1,926			
11	Depreciation		\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229			
12										
13	Taxable Income		\$ 54,081	\$ 38,775	\$ 51,481	\$ 61,112	\$ 75,845	=G5-SUM(G7:G11)		
14	Income Taxes (40%)		\$ 21,632	\$ 15,510	\$ 20,592	\$ 24,445	\$ 30,338			
15								=G13*0.4		
16	Net Income		\$ 32,449	\$ 23,265	\$ 30,889	\$ 36,667	\$ 45,507			
17										
18	Cash Flow Statement									
19	Operating Activities:									
20	Net Income		\$ 32,449	\$ 23,265	\$ 30,889	\$ 36,667	\$ 45,507	=G13-G14		
21	Depreciation		\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229			
22	Investment Activities:									
23	Milling machine	\$ (162,000)								
24	Salvage Value						\$ 45,000			
25	Gains Tax						\$ (650)	=-(G24-(-B23-SUM(C11:G11)))*0.4		
26	Working capital	\$ (25,000)					\$ 25,000			
27	Financing Activities:									
28	Borrowed Funds	\$ 64,800								
29	Principal Repayment		\$ (10,200)	\$ (11,424)	\$ (12,795)	\$ (14,330)	\$ (16,050)	=PPMT(12%,5,5,-64800)		
30										
31	Net Cash Flow	\$ (122,200)	\$ 45,392	\$ 51,514	\$ 46,432	\$ 42,579	\$ 106,036			
32										
33										
34	PW(15%)=	\$ 63,816								
35	IRR =	32.95%								
36										
37										
38								=IRR(B31:G31,15%)		
39										

When Projects Results in Negative Taxable Income

- Negative taxable income (project loss) means you can reduce your taxable income from regular business operation by the amount of loss, which results in a tax savings.
- Handling Project Loss

	Regular Business	Project	Combined Operation
Taxable income	\$100M	(10M)	\$90M
Income taxes (35%)	\$35M	?	\$31.5M


$$\begin{aligned} \text{Tax Savings} &= \$35M - \$31.5M \\ &= \$3.5M \\ \text{Or } (10M)(0.35) &= -\$3.5M \end{aligned}$$

Effects of Inflation on Project Cash Flows – (1) Depreciation Expenses

Item	Effects of Inflation
Depreciation expense	Depreciation expense is charged to taxable income in dollars of declining values ; taxable income is overstated, resulting in higher taxes

Note: Depreciation expenses are based on historical costs and always expressed in actual dollars

Effects of Inflation on Project Cash Flows – (2) Interest Expenses

Item	Effects of Inflation
Loan repayments	Borrowers repay historical loan amounts with dollars of decreased purchasing power, reducing the debt-financing cost.

Effects of Inflation on Project Cash Flows – (3) Working Capital

Item	Effects of Inflation
Working capital requirement	Known as working capital drain , the cost of working capital increases in an inflationary environment, as additional cash must be invested to maintain new price levels.

Effects of Inflation on Project Cash Flows – (4) Profitability

Item	Effects of Inflation
Rate of Return and NPW	Unless revenues are sufficiently increased to keep pace with inflation, tax effects and/or a working capital drain result in lower rate of return or lower NPW.

Example 9.4 Effects of Inflation on Projects with Depreciable Assets

Project Description	Milling Machine Project in the Absence of Inflation
Required investment:	\$162,000
Investment in working capital:	\$25,000
Debt ratio (0.40), meaning that 40% of the capital will be borrowed at 12% interest:	\$64,800
Project life:	five years
Salvage value:	\$45,000
Depreciation method:	seven-year MACRS
Annual revenues:	\$175,000 per year
Annual expenses:	
Labor	\$60,000 per year
Material	\$20,000 per year
Overhead	\$10,000 per year
Marginal tax rate:	40%
Inflation-free interest rate (i'):	15%

Cash Flow Statement (Table)

	A	B	C	D	E	F	G	H
1								
2	Income Statement							
3	End of Year	Inflation Rate	0	1	2	3	4	5
4								
5	Revenue	5%		\$ 183,750	\$ 192,938	\$ 202,584	\$ 212,714	\$ 223,349
6	Expenses:							
7	Labor	5%		\$ 63,000	\$ 66,150	\$ 69,458	\$ 72,930	\$ 76,577
8	Materials	5%		\$ 21,000	\$ 22,050	\$ 23,153	\$ 24,310	\$ 25,526
9	Overhead	5%		\$ 10,500	\$ 11,025	\$ 11,576	\$ 12,155	\$ 12,763
10	Debt Interest			\$ 7,776	\$ 6,552	\$ 5,181	\$ 3,646	\$ 1,926
11	Depreciation			\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229
12								
13	Taxable Income			\$ 58,331	\$ 47,488	\$ 64,879	\$ 79,430	\$ 99,329
14	Income Taxes (40%)			\$ 23,332	\$ 18,995	\$ 25,952	\$ 31,772	\$ 39,732
15								
16	Net Income			\$ 34,999	\$ 28,493	\$ 38,927	\$ 47,658	\$ 59,597
17								
18	Cash Flow Statement							
19	Operating Activities:							
20	Net Income			\$ 34,999	\$ 28,493	\$ 38,927	\$ 47,658	\$ 59,597
21	Depreciation			\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229
22	Investment Activities:							
23	Milling machine			\$ (162,000)				
24	Salvage Value	5%						\$ 57,433
25	Gains Tax							\$ (5,623)
26	Working capital	5%		\$ (25,000)	(\$1,250)	(\$1,313)	(\$1,378)	(\$1,447)
27	Financing Activities:							
28	Borrowed Funds			\$ 64,800				
29	Principal Repayment				\$ (10,200)	\$ (11,424)	\$ (12,795)	\$ (14,330)
30								
31	Net Cash Flow (Actual Dollars)			\$ (122,200)	\$ 46,692	\$ 55,429	\$ 53,092	\$ 52,123
32								
33								
34			PW(20.75%)=	\$ 60,957				
35			IRR =	38.77%				

Example 9.5 Applying Specific Inflation Rates

Cash Flow Item	Inflation Rate
qRevenue	6%
qLabor	5%
qMaterials	4%
qOverhead	5%
qSalvage value	3%
qWorking capital	5%

qGeneral inflation rate = 6%

qInflation-free interest rate = 15%

qMarket interest rate = 21.90%

Cash Flow Statement (Table 9.5)

	A	B	C	D	E	F	G	H
2	Income Statement							
3	End of Year	Inflation Rate	0	1	2	3	4	5
4								
5	Revenue	6%		\$ 185,500	\$ 196,630	\$ 208,428	\$ 220,933	\$ 234,189
6	Expenses:							
7	Labor	5%		\$ 63,000	\$ 66,150	\$ 69,458	\$ 72,930	\$ 76,577
8	Materials	4%		\$ 20,800	\$ 21,632	\$ 22,497	\$ 23,397	\$ 24,333
9	Overhead	5%		\$ 10,500	\$ 11,025	\$ 11,576	\$ 12,155	\$ 12,763
10	Debt Interest			\$ 7,776	\$ 6,552	\$ 5,181	\$ 3,646	\$ 1,926
11	Depreciation			\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229
12								
13	Taxable Income			\$ 60,281	\$ 51,598	\$ 71,378	\$ 88,563	\$ 111,362
14	Income Taxes (40%)			\$ 24,112	\$ 20,639	\$ 28,551	\$ 35,425	\$ 44,545
15								
16	Net Income			\$ 36,169	\$ 30,959	\$ 42,827	\$ 53,138	\$ 66,817
17								
18	Cash Flow Statement							
19	Operating Activities:							
20	Net Income			\$ 36,169	\$ 30,959	\$ 42,827	\$ 53,138	\$ 66,817
21	Depreciation			\$ 23,143	\$ 39,673	\$ 28,338	\$ 20,242	\$ 7,229
22	Investment Activities:							
23	Milling machine			\$ (162,000)				
24	Salvage Value	3%						\$ 52,167
25	Gains Tax							\$ (3,517)
26	Working capital	5%	\$ (25,000)	(\$1,250)	(\$1,313)	(\$1,378)	(\$1,447)	\$ 30,388
27	Financing Activities:							
28	Borrowed Funds		\$ 64,800					
29	Principal Repayment			\$ (10,200)	\$ (11,424)	\$ (12,795)	\$ (14,330)	\$ (16,050)
30								
31	Net Cash Flow (Actual Dollars)			\$ (122,200)	\$ 47,862	\$ 57,895	\$ 56,992	\$ 57,603
32								
33								
34		PW(21.90%)=		\$ 64,485				
35				IRR =	41.15%			

Decision Rules

- q If you use 41.15% (which was calculated based on the cash flows in actual dollars) as your IRR, you should use a market interest rate (21.90%) to make an accept and reject decision.
- q If you use 33.16% (which was obtained based on the cash flows in constant dollars) as your IRR, you should use an inflation-free interest rate (15%) to make an accept and reject decision.

Chapter 9

Project cash flow analysis

1. Understanding project cost elements
2. Why use cash flow in economic analysis
3. Income-tax rate to use in economic analysis
4. Incremental cash flows from undertaking a project
5. Developing project cash flow statements
6. Effects of inflation on project cash flows
7. Discount rate to be used in after-tax economic analysis:
cost of capital

General cost terms

Manufacturing costs

- direct materials
- direct labor
- mfg. overhead

Non-manufacturing costs

- overhead
- marketing
- administrative

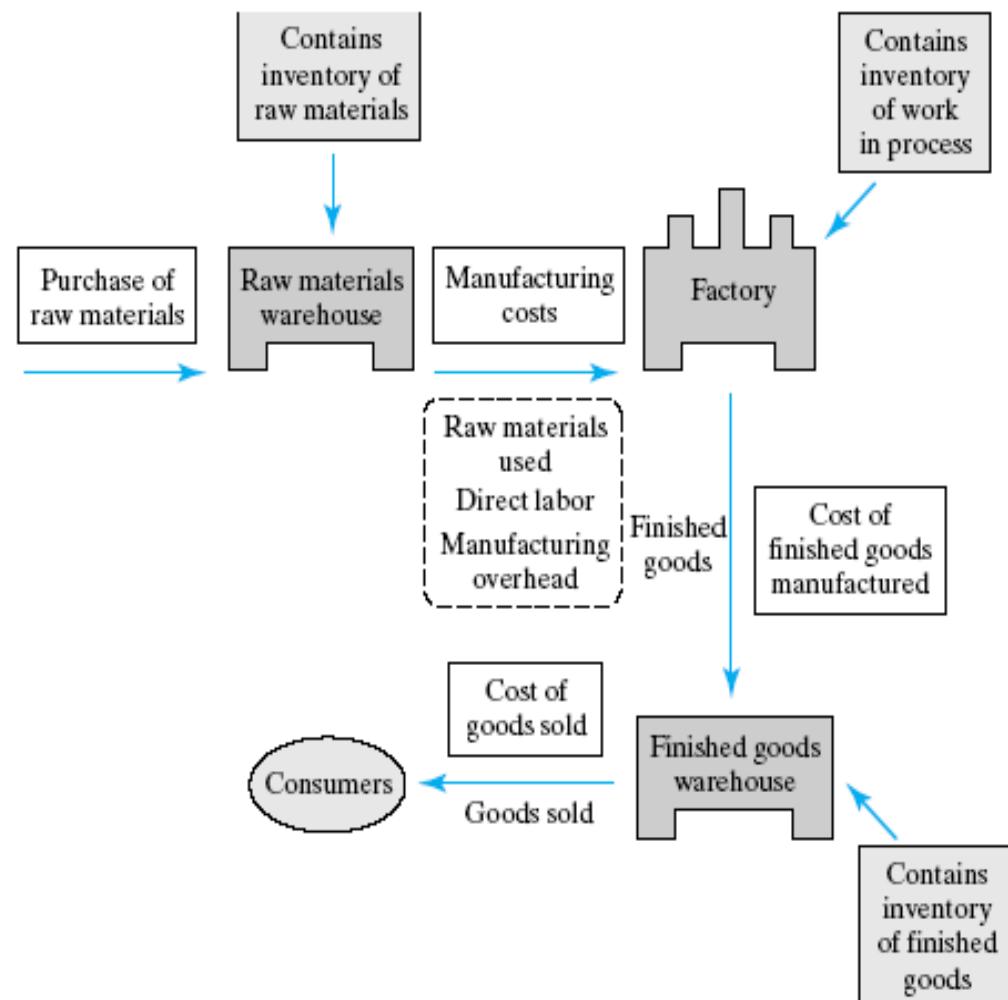


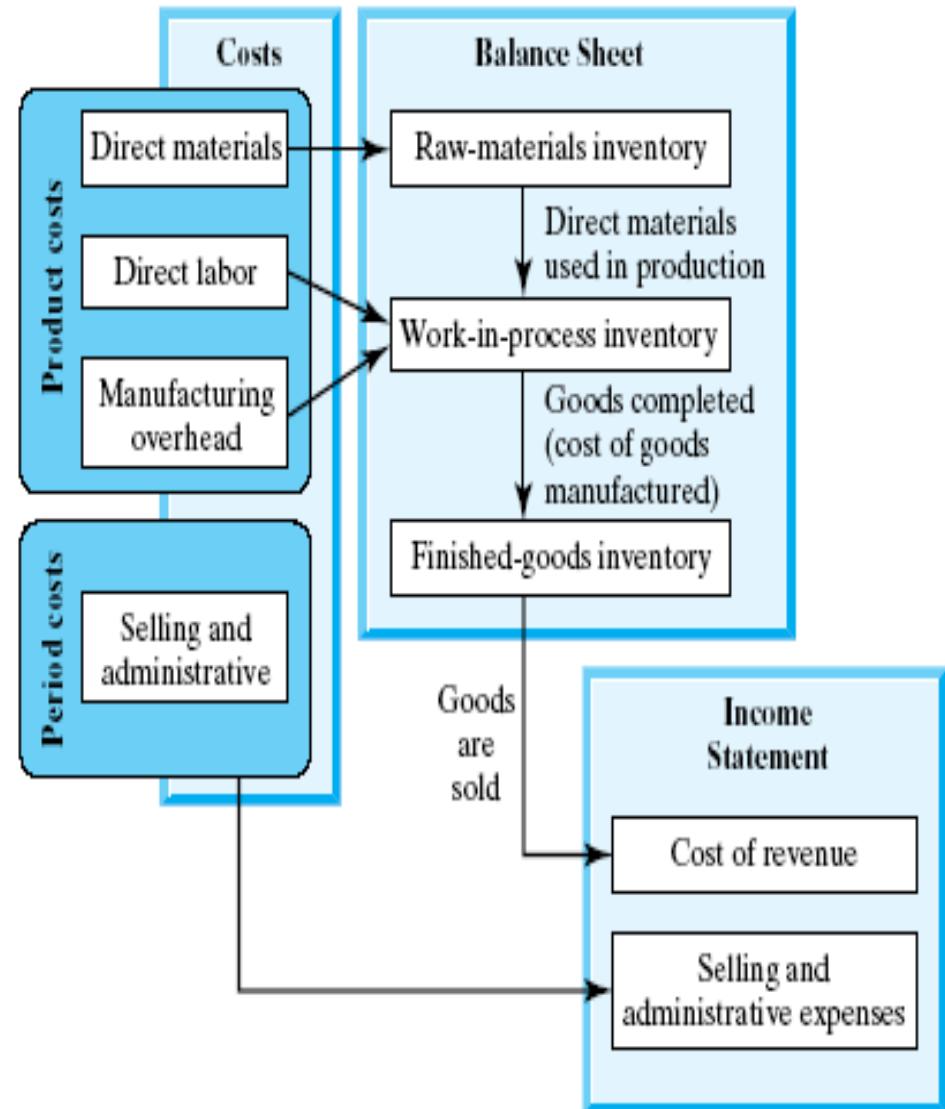
FIGURE 9.1 Various types of manufacturing costs

Classifying costs for financial statements

Matching concept: the costs incurred to generate particular revenue should be recognized as expenses in the same period that the revenue is recognized

Period costs: those costs that are matched against revenues on a time period basis

Product costs: those costs that are matched against revenues on a product basis



Cost classification for predicting cost behavior

Volume index: the unit measure used to define “volume”,
e.g. automobile miles driven, generating plant kWh
produced, stamping machine parts stamped

Fixed costs: The costs of providing a company’s basic
operating capacity – remain constant over the relevant
range.

Variable costs: Costs that vary depending on the level of
production or sales – increase or decrease
proportionally according to the volume.

Mixed costs: semi-variable, e.g. depreciation

Average unit costs: activity cost per unit basis, including
fixed cost that varies with changes in volume & variable
cost that is constant per unit of volume.

Cost classification example

You have 3,000 units to produce

Labor cost = \$20,000

Material cost = \$25,000

Overhead cost = \$15,000

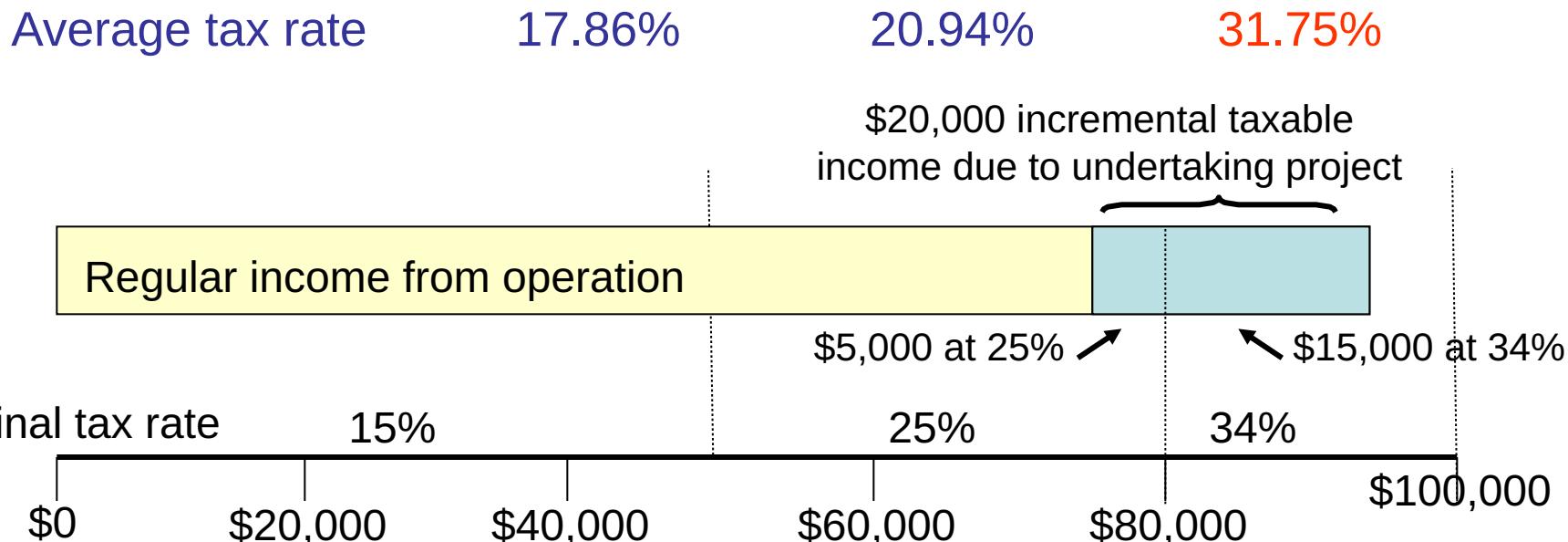
Fixed cost = \$40,000

What is the average cost per unit?

Average cost = $(\$100,000)/3,000 = \$33.33/\text{unit}$

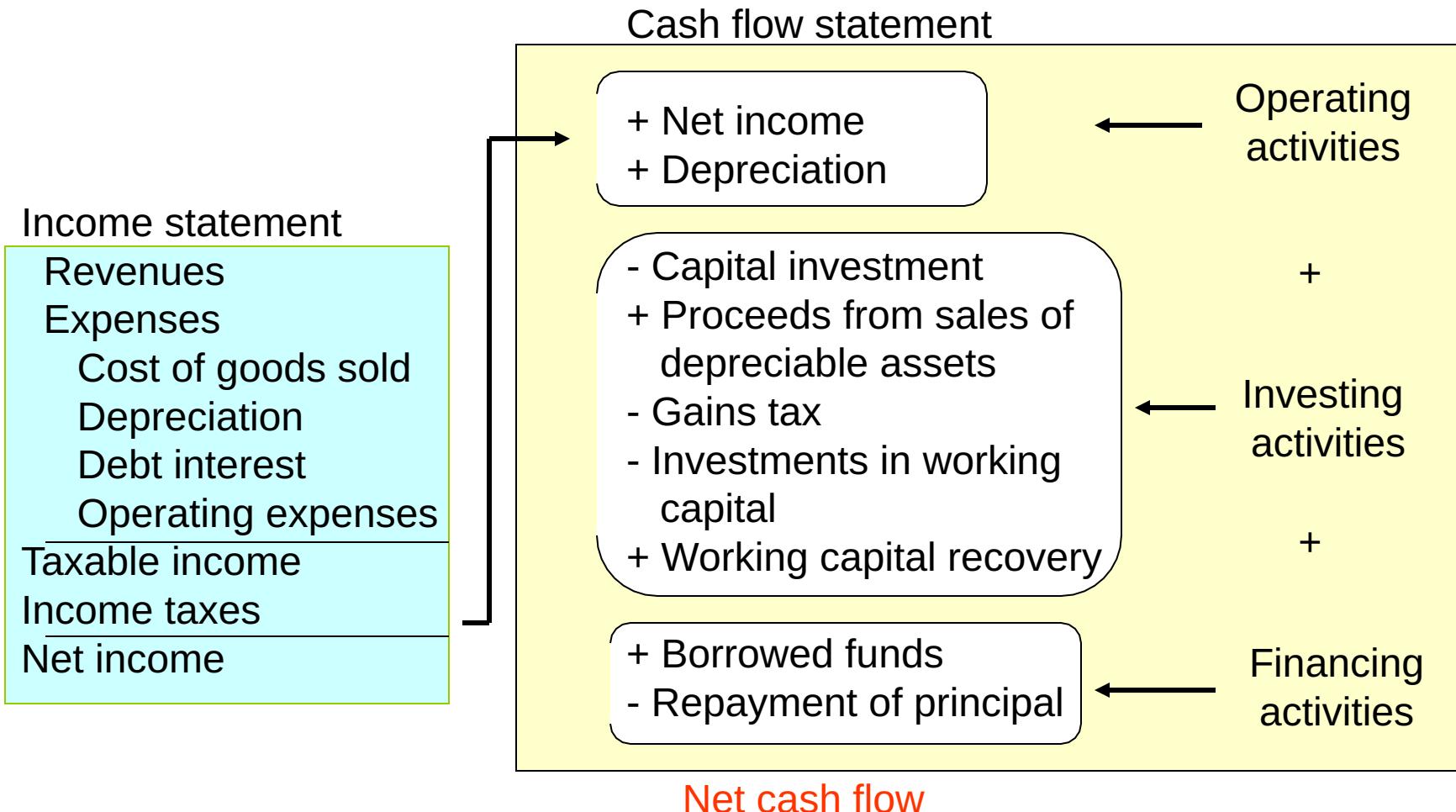
Income tax rate to use in project analysis?

	Before project	After project	Effect of project
Gross revenue	\$200,000	\$240,000	\$40,000
Expenses	130,000	150,000	20,000
Taxable income	\$70,000	\$90,000	\$20,000
Income taxes	\$12,500	\$18,850	\$6,350



$$0.25(\$5,000/\$20,000) + 0.34(\$15,000/\$20,000) = 31.75\%$$

Typical format used for presenting cash flow statement



Ex 9.1: When projects require only operating & investing activities

Project: Installation of a new computer control system

Financial data:

Investment: \$125,000

Project life: 5 years

Working capital investment: \$23,331

Salvage value: \$50,000

Annual labor savings: \$100,000

Annual additional expenses:

- labor: \$20,000
- material: \$12,000
- overhead: \$8,000

Depreciation method: 7-year MACRS

Income tax rate: 40%

MARR: 15%

Questions:

- Develop the project's cash flows over its project life.
- Is this project justifiable at a MARR of 15%?
- What is the internal rate of return of this project?



Working capital means the amount carried in cash, accounts receivable & inventory that is available to meet day-to-day operating needs

Treat working capital investments just like a capital expenditure except that no depreciation is allowed.

Ex 9.1a: Step 1 – Depreciation calculation

Cost base = \$125,000

Recovery = 7-year MACRS

N	MACRS rate	Depreciation amount	Allowed depreciation amount
1	14.29%	\$17,863	\$17,863
2	24.49%	\$30,613	\$30,613
3	17.49%	\$21,863	\$21,863
4	12.49%	\$15,613	\$15,613
5	8.93%	\$11,150	\$5,575
6	8.92%	\$11,150	0
7	8.93%	\$11,150	0
8	4.46%	\$5,575	0

Ex 9.1a: Step 2 – Gains (losses) associated w/ asset disposal

Salvage value = \$50,000

Book value (year 5) = cost base – depreciation
= \$125,000 - \$ 91,525 = \$ 33,475

Taxable gains = Salvage value – Book value
= \$50,000 - \$ 33,475 = \$16,525

Gains taxes = (Taxable gains)(Tax rate)
= \$16,525 (0.40) = \$6,610

Ex 9.1a: Step 3 – Create an income statement

Income Statement	0	1	2	3	4	5
Revenues		\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Expenses:						
Labor		20,000	20,000	20,000	20,000	20,000
Material		12,000	12,000	12,000	12,000	12,000
Overhead		8,000	8,000	8,000	8,000	8,000
Depreciation		17,863	30,613	21,863	15,613	5,581
Taxable income		\$42,137	\$29,387	\$38,137	\$44,387	\$54,419
Income taxes (40%)		16,855	11,755	15,255	17,755	21,768
Net Income		\$25,282	\$17,632	\$22,882	\$26,632	\$32,651

Ex 9.1a: Step 4 – Develop a cash-flow statement

Cash flow statement	0	1	2	3	4	5
Operating activities:						
Net income		\$25,282	\$17,632	\$22,882	\$26,632	\$32,651
Depreciation		17,863	30,613	21,863	15,613	5,581
Investment activities:						
Investment	(125,000)					
Working capital	(23,331)					23,331
Salvage						50,000
Gains tax						(6,613)
Net cash flow	(\$148,331)	\$43,145	\$48,245	\$44,745	\$42,245	\$104,950

Ex 9.1a: Net cash flow table generated by alternative approach

A	B	C	D	E	F	G	H	I	J
Year end	Investment & salvage value	Revenue	Labor	Materials expenses	Overhead	Depreciation	Taxable income	Income taxes	Net cash flow
0	-\$125,000 -23,331								- \$125,000
1		\$100,000	20,000	12,000	8,000	\$17,863	42,137	16,855	\$43,145
2		100,000	20,000	12,000	8,000	30,613	29,387	11,755	\$48,245
3		100,000	20,000	12,000	8,000	21,863	38,137	15,255	\$44,745
4		100,000	20,000	12,000	8,000	15,613	44,387	17,755	\$42,245
5		100,000	20,000	12,000	8,000	5,581	54,419	21,678	\$38,232
	50,000* 23,331						16,525	6,613	\$43,387 23,331

*Salvage value

Note that:

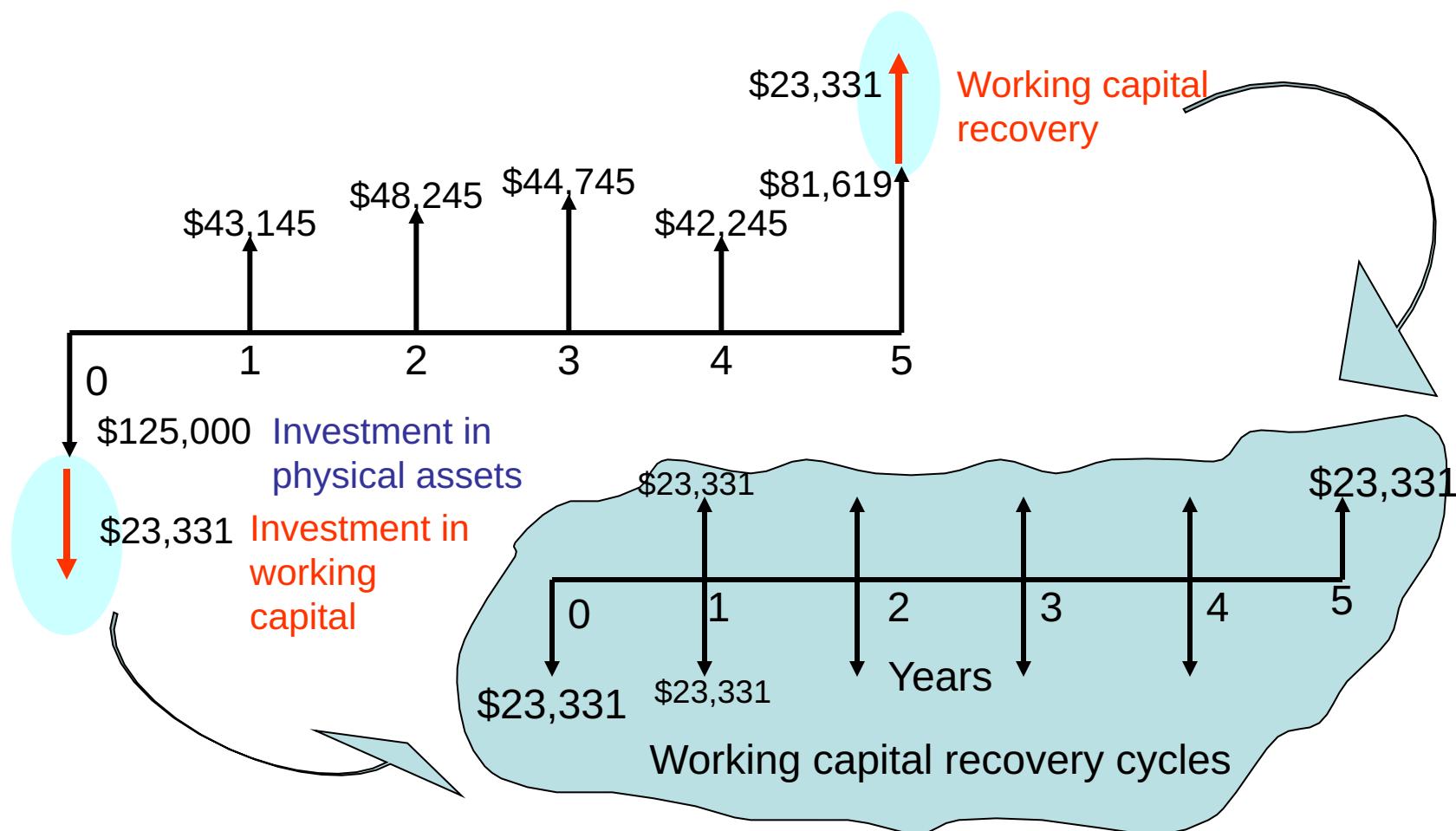
$$H = C - D - E - F - G$$

$$I = 0.4 H$$

$$J = B + C - D - E - F - I$$

Information required to calculate the income taxes

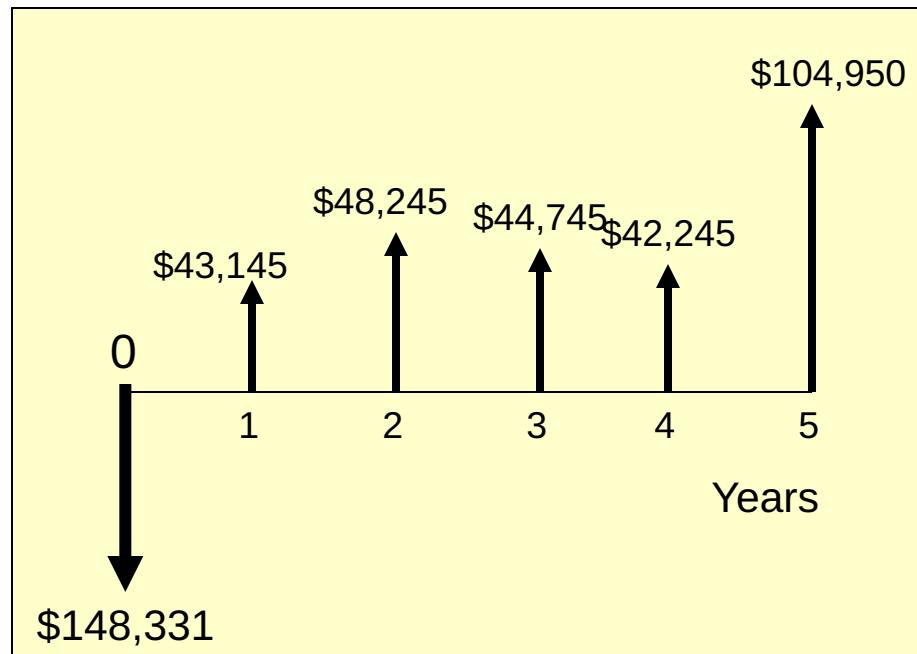
Ex 9.1a: Cash flow diagram including working capital



Ex 9.1b: Is this investment justifiable at a MARR of 15%?

$$\begin{aligned} \text{PW}(15\%) &= -\$148,331 + \$43,145(P/F, 15\%, 1) + \dots \\ &+ \$104,950 (P/F, 15\%, 5) = \$31,420 > 0 \end{aligned}$$

Yes, accept the project !



Ex 9.1c: IRR

	A	B
1	Period	Cash flow
2	0	(\$148,331)
3	1	43,145
4	2	48,245
5	3	44,745
6	4	42,245
7	5	104,950

Solve using Excel:
 $=IRR(B2:B7,0.10)$

or trial & error ...

IRR = 22.55%

Ex 9.1c: check rate of return analysis (IRR = 22.55%)

	$n = 0$	$n = 1$	$n = 2$	$n = 3$	$n = 4$	$n = 5$
Beginning balance		-\$148,331	-\$138,635	-\$121,652	-\$104,339	-\$85,622
Return on investment (interest)		-\$33,449	-\$31,262	-\$27,432	-\$23,528	-\$19,328
Payment	-\$148,331	\$43,145	\$48,245	\$44,745	\$42,245	\$104,950
Project balance	-\$148,331	-\$138,635	-\$121,652	-\$104,339	-\$85,622	0

When projects are financed with borrowed funds

Key issue: Interest payment is a tax-deductible expense.

What needs to be done: Once a loan repayment schedule is known, separate the interest payments from the annual installments.

What about principal payments? As the amount of borrowing is NOT viewed as income to the borrower, the repayments of principal are NOT viewed as expenses either – NO tax effect.

Ex 9.2: Loan repayment schedule

Amount financed: \$62,500, or 50% of total capital expenditure

Financing rate: 10% per year

Annual installment: \$16,487 or, $A = \$62,500(A/P, 10\%, 5)$

End of year	Beginning balance	Interest payment	Principal payment	Ending balance
1	\$62,500	\$6,250	\$10,237	\$52,263
2	52,263	5,226	11,261	41,002
3	41,002	4,100	12,387	28,615
4	28,615	2,861	13,626	14,989
5	14,989	1,499	14,988	0

\$16,487

Ex 9.2: Effect on income, cash flow & NPW

A	B	C	D	E	F	G	H	I
1								
6								
7			0	1	2	3	4	5
8	Income Statement							
9								
10	Revenues	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000		
11	Expenses:							
12	Labor	20,000	20,000	20,000	20,000	20,000		
13	Material	12,000	12,000	12,000	12,000	12,000		
14	Overhead	8,000	8,000	8,000	8,000	8,000		
15	Depreciation	17,863	30,613	21,863	15,613	5,581		
16	Debt Interest	6,250	5,226	4,100	2,861	1,499		
18	Taxable Income	\$ 35,887	\$ 24,161	\$ 34,037	\$ 41,526	\$ 52,920		
19	Income Taxes (40%)	14,355	9,664	13,615	16,610	21,168		
21	Net Income	\$ 21,532	\$ 14,497	\$ 20,422	\$ 24,916	\$ 31,752		
23	Cash Flow Statement							
25	Operating Activities:							
26	Net Income	21,532	14,497	20,422	24,916	31,752		
27	Depreciation	17,863	30,613	21,863	15,613	5,581		
28	Investment Activities:							
29	Investment	(125,000)						
30	Salvage					50,000		
31	Gains Tax					(6,613)		
32	Working Capital	(23,331)				23,331		
33	Financing Activities:							
34	Borrowed Funds	62,500						
35	Principal Repayment		(10,237)	(11,261)	(12,387)	(13,626)	(14,988)	
37	Net Cash Flow	\$ (85,831)	\$ 29,158	\$ 33,849	\$ 29,898	\$ 26,903	\$ 89,063	
38								
39								

Additional entries related to debt financing

$$\begin{aligned}
 PW(15\%) = -\$85,351 + \$29,158(P/F, 15\%, 1) + \dots \\
 + \$89,063 (P/F, 15\%, 5) = \$44,439 > \$31,420
 \end{aligned}$$

When projects result in negative taxable income

Negative taxable income

(project loss) means you can reduce your taxable income from regular business operation by the amount of loss, which results in a tax savings.

Handling project loss

	Regular business	Project	Combined operation
Taxable income	\$100M	(10M)	\$90M
Income taxes (35%)	\$35M	? Tax savings	\$31.5M

$$\text{Tax savings} = \$35M - \$31.5M = \$3.5M$$
$$\text{or } (10M)(0.35) = -\$3.5M$$



Effects of inflation on project cash flows

Depreciation expense is charged to taxable income in dollars of declining values; taxable income is overstated, resulting in higher taxes (*Depreciation expenses are based on historical costs & always expressed in actual dollars*)

Inflated salvage value combined with book values based on historical costs results in higher taxable gains.

Loan repayments: Borrowers repay historical loan amounts with dollars of decreased purchasing power, reducing the debt-financing cost.

Known as “working capital drain”, the cost of working capital increases in an inflationary environment.

Rate of return & NPW: Unless revenues are sufficiently increased to keep pace with inflation, tax effects and/or a working capital drain result in a lower rate of return or lower NPW.

	A	B	C	D	E	F	G	H
1	Example 9.3 Cash Flow Statement for the Automated Machining Center Project							
7								
8	Income Statement							
9	Inflation Rate	0	1	2	3	4	5	
11								
12	Revenues	5%		\$105,000	\$110,250	\$115,763	\$121,551	\$127,628
13	Expenses:							
14	Labor	5%		21,000	22,050	23,153	24,310	25,526
15	Material	5%		12,600	13,230	13,892	14,586	15,315
16	Overhead	5%		8,400	8,820	9,261	9,724	10,210
17	Depreciation			17,863	30,613	21,863	15,613	5,581
18								
19	Taxable Income			\$ 45,137	\$ 35,537	\$ 47,595	\$ 57,317	\$ 70,996
20	Income Taxes (40%)			18,055	14,215	19,038	22,927	28,398
21								
22	Net Income			\$ 27,082	\$ 21,322	\$ 28,557	\$ 34,390	\$ 42,598
23								
24	Cash Flow Statement							
25								
26	Operating Activities:							
27	Net Income			27,082	21,322	28,557	34,390	42,598
28	Depreciation			17,863	30,613	21,863	15,613	5,581
29	Investment Activities:							
30	Investment		(125,000)					
31	Salvage	5%						63,814
32	Gains Tax							(12,139)
33	Working Capital	5%	(23,331)	(1,167)	(1,225)	(1,287)	(1,351)	28,361
34								
35	Net Cash Flow		\$ (148,331)	\$ 43,778	\$ 50,710	\$ 49,133	\$ 48,652	\$ 128,215
36	(in actual dollars)							

Ex 9.3: effects of inflation

$$i = 0.15 + 0.05 + (0.15)(0.05) = 20.75\%$$

$PW(20.75\%) = \$23,441$ vs. \$31,420 w/o inflation

$IRR = 22.20\%$ vs. 22.55% w/o inflation $> 20.75\%$

$i' = 16.38\%$ (inflation free rate of return) $> MARR$ of 15%

Decline in PW of \$31,420 – \$23,441 = \$7,979 is due to income-tax considerations & working capital drains

Recall that: $i = i' + f + f i'$ $i' = \frac{i - f}{i + f}$

Ex 9.4: Applying specific inflation rates

Example 9.4 Cash Flow Statement for AMC Project under Inflation (Multiple Price Indices)								
Income Statement		Inflation Rate	0	1	2	3	4	5
Revenues	6%		\$106,000	\$112,360	\$119,102	\$126,248	\$133,823	
Expenses:								
Labor	5%		21,000	22,050	23,153	24,310	25,526	
Material	4%		12,480	12,979	13,498	14,038	14,600	
Overhead	5%		8,400	8,820	9,261	9,724	10,210	
Depreciation			17,863	30,613	21,863	15,613	5,581	
Taxable Income			\$ 46,257	\$ 37,898	\$ 51,327	\$ 62,562	\$ 77,906	
Income Taxes (40%)			18,503	15,159	20,531	25,025	31,162	
Net Income			\$ 27,754	\$ 22,739	\$ 30,796	\$ 37,537	\$ 46,744	
Cash Flow Statement								
Operating Activities:								
Net Income			27,754	22,739	30,796	37,537	46,744	
Depreciation			17,863	30,613	21,863	15,613	5,581	
Investment Activities:								
Investment			(125,000)					
Salvage	3%							57,964
Gains Tax								(9,799)
Working Capital	5%		(23,331)	(1,167)	(1,225)	(1,287)	(1,351)	28,361
Net Cash Flow (in actual dollars)			\$ (148,331)	\$ 44,450	\$ 52,127	\$ 51,372	\$ 51,799	\$ 128,851

Chapter 12

Statement of Cash Flows

PowerPoint Author:
Brandy Mackintosh, CA

Learning Objective 12-1

Identify cash flows arising from operating, investing, and financing activities.

Business Activities and Cash Flows

The Statement of Cash Flows focuses attention on:

Operating

Cash received and paid for day-to-day activities with customers, suppliers, and employees.

Investing

Cash paid and received from buying and selling long-term assets.

Financing

Cash received and paid for exchanges with lenders and stockholders.

Business Activities and Cash Flows

Checking and
Savings
Accounts



Cash

Currency



Cash Equivalents

Highly liquid short-term investments
within three months of maturity.

Classifying Cash Flows

UNDER ARMOUR, INC.
Statement of Cash Flows
For the Year Ended December 31, 2012

(in millions)

Net cash provided (used) by operating activities	\$ 179
Net cash provided (used) by investing activities	(54)
Net cash provided (used) by financing activities	42
Net Change in Cash and Cash Equivalents	167
Cash and cash equivalents, beginning of year	175
Cash and cash equivalents, end of year	\$ 342

Operating Activities

Cash inflows and outflows that directly relate to revenues and expenses reported on the Income Statement.

Inflows

Cash provided by
Collecting from customers
Receiving dividends
Receiving interest

Outflows

Cash used for
Purchasing services (electricity, etc.) and goods for resale
Paying salaries and wages
Paying income taxes
Paying interest

Investing Activities

Inflows	Outflows
Cash provided by	Cash used for
Sale or disposal of equipment	Purchase of equipment
Sale or maturity of investments in securities	Purchase of investments in securities

Under Armour's 2012 Investing Activities

Cash Flows Used in Investing Activities		Cash flows related to long-term assets
Purchase of equipment	(52)	Cash was used to purchase equipment
Purchase of intangible and other assets	(2)	Cash was used to purchase intangibles
Net cash used in investing activities	(54)	Indicates overall cash impact of investing activities

Financing Activities

Inflows

Cash provided by
Borrowing from lenders through formal debt contracts
Issuing stock to owners

Outflows

Cash used for
Repaying principal to lenders
Repurchasing stock from owners
Paying cash dividends to owners

Under Armour's 2012 Financing Activities

Cash Flows from Financing Activities

Additional borrowings of long-term debt	50
Payments on long-term debt	(61)
Proceeds from stock issuance	53
Net cash provided by financing activities	42

Cash flows from transactions with lenders, investors

Cash received from borrowing
Cash used to repay amounts previously borrowed
Cash received from issuing stock

Indicates overall cash impact of financing activities

Relationships Between Classified Balance Sheet and Statement of Cash Flow (SCF) Categories

SCF Categories

Operating

Classified Balance Sheet Categories

Current assets

Current liabilities

Relationship to Other Financial Statements

Information needed to prepare a Statement of Cash Flows:

- Comparative Balance Sheets.
- Income Statement.
- Additional details concerning selected accounts.
- Additional transactions that do not involve cash.



Relationship to Other Financial Statements

Recall that the basic Balance Sheet equation is:

$$\text{Assets} = \text{Liabilities} + \text{Stockholders' Equity}$$

We can recast the equation as follows:

$$\text{Cash} + \text{Noncash Assets} = \text{Liabilities} + \text{Stockholders' Equity}$$

The following equation is true:

$$\text{Cash} = \text{Liabilities} + \text{Stockholders' Equity} - \text{Noncash Assets}$$

From this basic Balance Sheet equation, we develop our model to solve for the change in cash:

$$\text{Change in Cash} = \text{Change in } (\text{Liabilities} + \text{Stockholders' Equity} - \text{Noncash Assets})$$

Direct and Indirect Reporting of Operating Cash Flows



Direct Method		Indirect Method
Cash collected from customers	\$1,794	Net income
Cash paid to suppliers of inventory	(907)	Depreciation
Cash paid to employees and suppliers of services	(627)	
Cash paid for interest	(5)	Changes in current assets and current liabilities
Cash paid for income tax	<u>(76)</u>	
Net cash provided by (used in) operating activities	<u><u>\$ 179</u></u>	Net cash provided by (used in) operating activities

Same result

We will concentrate on the indirect method for now, and we will look at the direct method again later in the chapter.

Learning Objective 12-2

Report cash flows from operating activities, using the indirect method.

Cash Flows from Operating Activities - Indirect Method

The indirect method adjusts Net Income by analyzing noncash items.

Changes in non-cash Current Assets and Current Liabilities.

Net Income

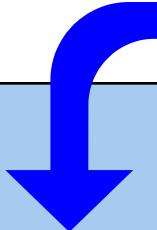
+ Noncash expenses such as Depreciation and Amortization.

Cash Flows from Operating Activities - Indirect Method

+ Losses and - Gains

Relationships to the Balance Sheet and the Income Statement

Change in account balances during the year



		Current Assets	Current Liabilities
Increase	Subtract from net income.	Add to net income.	
Decrease	Add to net income.	Subtract from net income.	

Use this table when adjusting Net Income to operating cash flows using the **indirect method**.

Statement of Cash Flows

Indirect Method Example

Use the following financial statements for Under Armour, Inc. and prepare the Statement of Cash Flows for the year ended December 31, 2012.



Statement of Cash Flows

Indirect Method Example

UNDER ARMOUR, INC.
Balance Sheet*

(in millions)	December 31, 2012	December 31 2011	<i>Change</i>
Assets			
Current Assets:			
Cash and Cash Equivalents	\$ 342	\$ 175	+167
Accounts Receivable	175	134	+41
Inventory	319	324	-5
Prepaid Expenses	67	56	+11
Total Current Assets	<u>903</u>	<u>689</u>	
Equipment	326	274	+52
Accumulated Depreciation—Equipment	(145)	(115)	-30
Intangible and Other Assets	73	71	+2
Total Assets	<u><u>\$1,157</u></u>	<u><u>\$ 919</u></u>	

Statement of Cash Flows

Indirect Method Example

UNDER ARMOUR, INC.

Balance Sheet*

(in millions)	December 31, 2012	December 31, 2011	Change
Liabilities and Stockholders' Equity			
Current Liabilities:			
Accounts Payable	\$ 144	\$ 100	+44
Accrued Liabilities	108	84	+24
Total Current Liabilities	<u>252</u>	<u>184</u>	
Notes Payable (long-term)	88	99	-11
Total Liabilities	<u>340</u>	<u>283</u>	
Stockholders' Equity:			
Common Stock	321	268	+53
Retained Earnings	496	368	+128
Total Stockholders' Equity	<u>817</u>	<u>636</u>	
Total Liabilities and Stockholders' Equity	<u><u>\$1,157</u></u>	<u><u>\$ 919</u></u>	

Statement of Cash Flows

Indirect Method Example

UNDER ARMOUR, INC.	
Income Statement*	
For the Year Ended December 31, 2012	
<hr/>	
(in millions)	
Net Sales	\$ 1,835
Cost of Goods Sold	956
Gross Profit	<u>879</u>
Operating Expenses:	
Selling, General, and Administrative Expenses	640
Depreciation Expense	30
Total Operating Expenses	<u>670</u>
Income from Operations	209
Interest Expense	5
Net Income before Income Tax Expense	204
Income Tax Expense	76
Net Income	<u><u>\$ 128</u></u>

The Statement of Cash Flows using the indirect method will begin with Under Armor, Inc.'s Net Income from the Income Statement.



Indirect Reporting of Operating Cash Flows

Net income

Items included in net income that do not involve cash

+ Depreciation

Changes in current assets and current liabilities

+ Decreases in current assets

- Increases in current assets

- Decreases in current liabilities

+ Increases in current liabilities

Net cash flow provided by (used in) operating activities

When using the indirect method, start with accrual basis Net Income and adjust it for:

1. items that are included in Net Income but do not involve cash, and
2. items that are not included in Net Income but do involve cash.

UNDER ARMOUR, INC.
Statement of Cash Flows*
For the Year Ended December 31, 2010

(in millions)

Cash Flows from Operating Activities

Net income	\$ 68
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**Next, adjust for the non-cash items included
in Net Income.**

**For Under Armour, the only non-cash adjustment
is for Depreciation Expense.**

UNDER ARMOUR, INC.
Statement of Cash Flows*
For the Year Ended December 31, 2012

(in millions)

Cash Flows from Operating Activities

Net income	\$128
Adjustments to reconcile net income to net cash provided by operating activities:	
Depreciation	30

Accumulated Depreciation increased by \$30, from \$115 in the 2011 Balance Sheet to \$145 in the 2012 Balance sheet. The same \$30 is shown as Depreciation Expense in the 2012 Income Statement.

To complete the Cash Flows from Operating Activities section, we must examine comparative Balance Sheets to determine the changes in current assets and current liabilities from the beginning of the period to the end of the period.

*Certain amounts have been adjusted to simplify the presentation.

UNDER ARMOUR, INC.
Statement of Cash Flows*
For the Year Ended December 31, 2012

These five items were shown earlier in the current portions of Under Armour's comparative Balance Sheets for 2011 and 2012

	Non-Cash Current Assets	Current Liabilities
Increase	Subtract from net income.	Add to net income.
Decrease	Add to net income.	Subtract from net income.
Accounts Receivable		(41)
Inventory		5
Prepaid Expenses		(11)
Accounts Payable		44
Accrued Liabilities		24
Net cash provided by (used in) operating activities		<u>179</u>

Learning Objective 12-3

Report cash flows from investing activities.

Reporting Cash Flows from Investing Activities

We will need this additional data to prepare the investing portion of the statement.

1. No disposals or impairments of Equipment or Intangibles occurred
2. Equipment costing \$52 million and Intangibles costing \$2 million were purchased with Cash.

Reporting Cash Flows from Investing Activities

UNDER ARMOUR, INC.
Statement of Cash Flows*
For the Year Ended December 31, 2012

(in millions)

Cash Flows from Investing Activities

Purchase of equipment	(52)
Purchase of intangible and other assets	(2)
Net cash provided by (used in) investing activities	<u>(54)</u>

Under Armour, Inc., has two investing activities on the Statement of Cash Flows that required the use of Cash:

1. Purchase of Equipment, and
2. Purchase of Intangibles and Other Assets.

Learning Objective 12-4

Report cash flows from financing activities.

Reporting Cash Flows from Financing Activities

We will need this additional data to prepare the financing portion of the statement.

1. No Dividends were declared or paid.
2. Long-term Debt of \$61 million was paid.
3. \$50 million in new long-term loans were issued.
4. Shares of Stock were issued for \$53 million.

Reporting Cash Flows from Financing Activities

UNDER ARMOUR, INC.
Statement of Cash Flows*
For the Year Ended December 31, 2012

(in millions)

Cash Flows from Financing Activities

Additional long-term notes	50
Payments on long-term notes	(61)
Proceeds from stock issuance	53
Net cash provided by (used in) financing activities	<u>42</u>

Long-term Debt increased because of \$50 in new loans during the year. The long-term Debt increase is a Cash inflow.

Reporting Cash Flows from Financing Activities

UNDER ARMOUR, INC.

Statement of Cash Flows*

For the Year Ended December 31, 2012

(in millions)

Cash Flows from Financing Activities

Additional long-term notes	50
Payments on long-term notes	(61)
Proceeds from stock issuance	53
Net cash provided by (used in) financing activities	<u>42</u>

Payments on Long-term Debt resulted in a Cash outflow of \$61. The net effect of these two Long-term Debt transactions decreased Long-term Debt by \$11, from \$99 on the 2011 Balance Sheet to \$88 on the 2012 Balance Sheet.

Reporting Cash Flows from Financing Activities

UNDER ARMOUR, INC.

Statement of Cash Flows*

For the Year Ended December 31, 2012

(in millions)

Cash Flows from Financing Activities

Additional long-term notes	50
Payments on long-term notes	(61)
Proceeds from stock issuance	<u>53</u>
Net cash provided by (used in) financing activities	<u>42</u>

The third financing activity is the issuance of Common Stock resulting in a Cash inflow of \$53. Common Stock increased from \$268 in the 2011 Balance Sheet to \$321 in the 2012 Balance Sheet.

Reporting Cash Flows

Now we can reconcile the change in Cash to the ending \$342 Cash balance that appears on the Balance Sheet.

(in millions)

Net cash provided by (used in) operating activities	<u>179</u>
Cash Flows from Investing Activities	
Purchase of equipment	(52)
Purchase of intangible and other assets	<u>(2)</u>
Net cash provided by (used in) investing activities	<u>(54)</u>
Cash Flows from Financing Activities	
Additional long-term notes	50
Payments on long-term notes	(61)
Proceeds from stock issuance	<u>53</u>
Net cash provided by (used in) financing activities	<u>42</u>
Net increase (decrease) in cash and cash equivalents	<u>167</u>
Cash and cash equivalents at beginning of period	<u>175</u>
Cash and cash equivalents at end of period	<u><u>\$342</u></u>

Noncash Investing and Financing Activities

Required Supplemental Information:

1. Cash paid for taxes and interest.
2. Significant non-cash investing and financing activities.

Cash Flows from Financing Activities

Additional long-term notes	50
Payments on long-term notes	(61)
Proceeds from stock issuance	53
Net cash provided by (used in) financing activities	<u>42</u>
Net increase (decrease) in cash and cash equivalents	167
Cash and cash equivalents at beginning of period	175
Cash and cash equivalents at end of period	<u>\$342</u>

Supplemental Disclosures

Cash paid for interest	\$ 5
Cash paid for income tax	76



Learning Objective 12-5

Interpret cash flows from operating, investing, and financing activities.

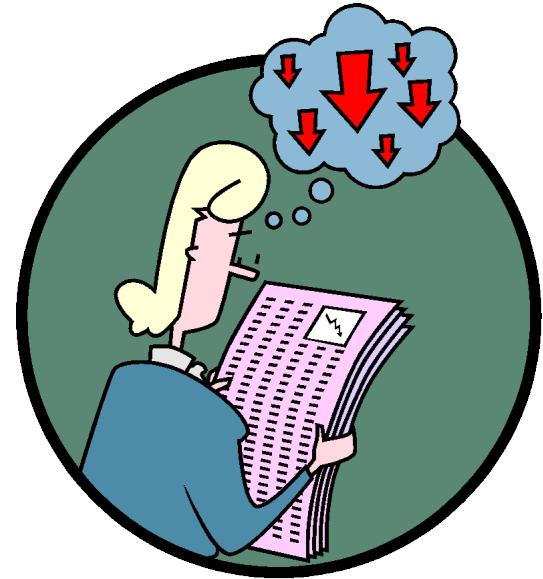
Evaluating Operating Cash Flows

- Operating cash flows must be positive over the long-run for a company to be successful.
- An upward trend in operating cash flows over time indicates growth and efficient operations.
- Look at the relationship between operating cash flows and Net Income.



Evaluating Investing Cash Flows

- Healthy companies tend to show negative cash flows in the investing activities section.
- Be cautious over a positive total cash flow in the investing activities section

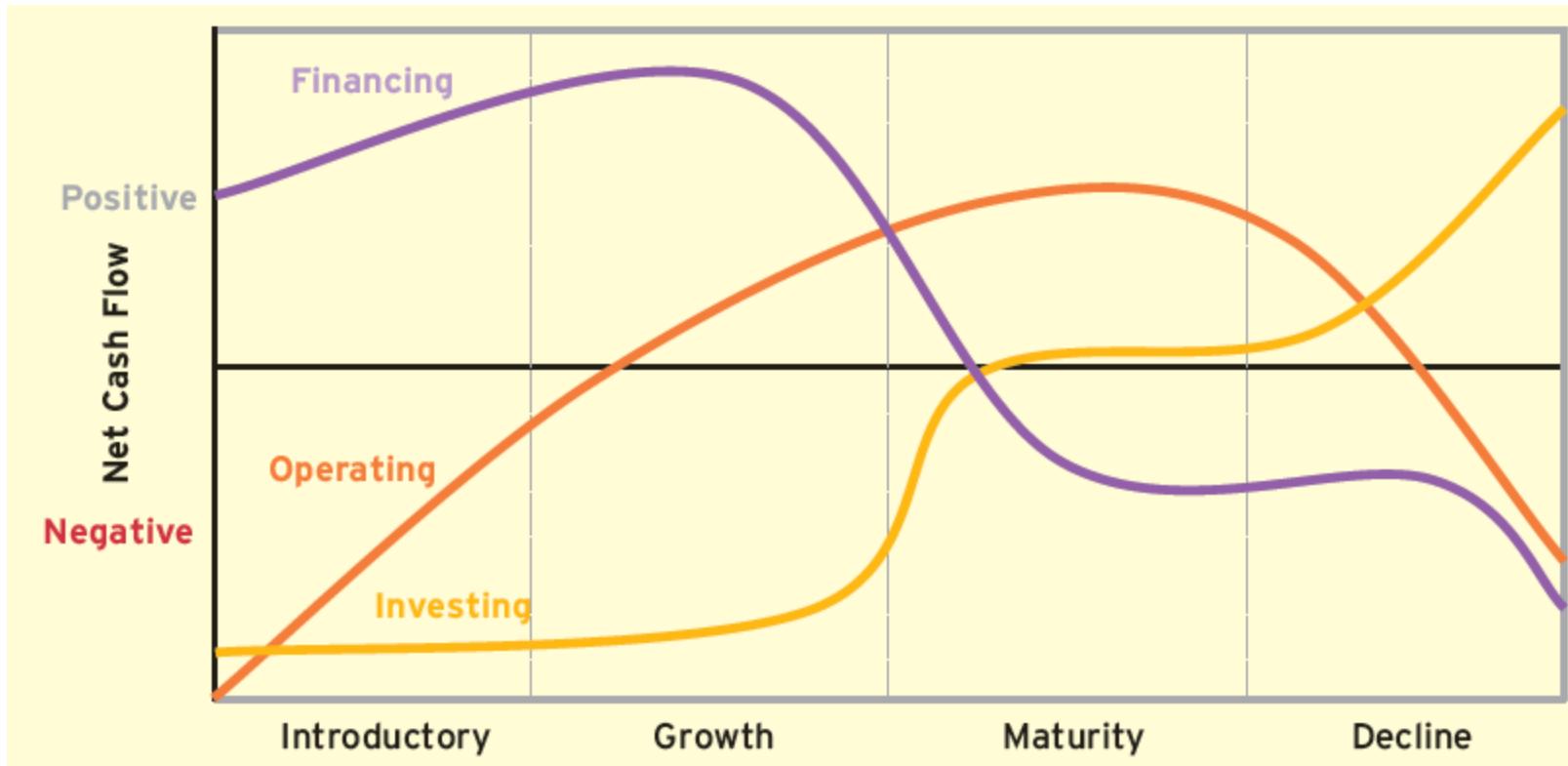


Evaluating Financing Cash Flows

- It's not possible to evaluate the company's financing cash flows by simply determining whether they are positive or negative on an overall basis.
- Instead, consider detailed line items with this section to assess the company's overall financing strategy.



Overall Patterns of Cash Flows



Learning Objective 12-6

Report and interpret cash flows from operating activities using the direct method.

Reporting Operating Cash Flows with the Direct Method

Provides more detailed information

Identifies cash inflows and outflows relationships

Prepared by adjusting accrual basis to cash basis

Investing and financing sections for the two methods are identical

Direct Method Operating Activities

UNDER ARMOUR, INC.

Statement of Cash Flows

For the Year Ended December 31, 2012

(in millions)

Cash Flows from Operating Activities

Cash collected from customers	\$1,794
Cash paid to suppliers of inventory	(907)
Cash paid to employees and suppliers of services	(627)
Cash paid for interest	(5)
Cash paid for income tax	<u>(76)</u>
Net cash provided by (used in) operating activities	<u>179</u>

When we prepared the operating section using the indirect method, we also arrived at net cash inflow of \$179.

Let's see how we arrive at these cash flows.

Direct Method Operating Activities

Net Sales	\$1,835
– Increase in Accounts Receivable	(41)
Cash collected from customers	<u>\$1,794</u>

Cost of Goods Sold	\$956
– Increase in Inventory	(5)
– Increase in Accounts Payable	(44)
Cash paid to inventory suppliers	<u>\$907</u>

Interest Expense	\$5
No change in Interest Payable	0
Cash paid for interest	<u>\$5</u>

Selling, General, and Administrative Expenses	\$640
+ Increase in Prepaid Expenses	11
– Increase in Accrued Liabilities	(24)
Cash paid to employees and suppliers of services	<u>\$627</u>

Income Tax Expense	\$76
No change in Income Tax Payable	0
Cash paid for income tax	<u>\$76</u>

With the direct method, we convert each revenue and expense on the Income Statement to a cash flow.

Supplement 12A

**Reporting Disposals of Property, Plant,
and Equipment (Indirect Method)**

Learning Objective 12-S1

Report cash flows from PPE disposals using the indirect method.

Reporting Sales of Property, Plant, and Equipment (PPE) (Indirect)

Depreciation Expense

Loss on Sale of PPE

A loss on the sale of PPE is added back to Net Income just as Depreciation Expense is added back. Adding these noncash items restores Net Income to what it would have been had Depreciation and the loss not been subtracted at all.

Gain on Sale of PPE

Just the opposite is true for a gain on the sale of PPE. Subtracting the gain reverses the effect of the gain having been added to Net Income.

Supplement 12B

T-Account (Indirect Method)

Learning Objective 12-S2

Use the T-account approach
for preparing an indirect
method statement of cash
flows.

T-account Approach (Indirect Method)

Instead of creating schedules for each section of the Statement of Cash Flows, some prefer to prepare a single large T-account to represent the changes that have taken place in Cash subdivided into the three sections of the Statement of Cash Flows.

Let's see how to use a T-account to prepare a Statement of Cash Flows on the next slide.

T-account Approach(Indirect Method)

		Cash (A)
Operating		
(1) Net Income	128	41 (3) Accounts Receivable
(2) Depreciation Expense	30	11 (5) Prepaid Expense
(4) Inventory	5	
(6) Accounts Payable	44	
(7) Accrued Liabilities	24	
Net cash flow provided by operating activities	179	
Investing		
		52 (8) Purchased Equipment
		2 (9) Purchased Intangibles
		54 Net cash used in investing activities
Financing		
(10) Additional long-term notes	50	61 (11) Payment of long-term notes
(12) Proceeds from stock issuance	53	
Net cash provided by financing activities	42	
Net increase in cash	167	
Beg. bal.	175	
End. bal.	342	

Chapter 12

Solved Exercises

E12-2, E12-3, E12-4, E12-5, E12-6, E12-7

E12-2 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Suppose your company sells services of \$180 in exchange for \$110 cash and \$70 on account.

Required:

1. Show the journal entry to record this transaction.

Record

Cash	110
Accounts Receivable	70
Service Revenue	180

2. Identify the amount that should be reported as net cash flows from operating activities.

The \$110 increase in Cash is reported as net cash flows from operating activities.

E12-2 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Required:

3. Identify the amount that would be included in Net Income.

\$180 of Service Revenue would be included in Net Income.

4. Show how the indirect method would convert Net Income (requirement 3) to net cash flows from operating activities (requirement 2).

Net Income	\$ 180
Less: Accounts Receivable increase	(70)
Net cash flow from operating activities	<u>\$ 110</u>

5. What general rule about converting Net Income to operating cash flows is revealed by your answer to requirement 4?

When Accounts Receivable increases, Sales Revenue is greater than Cash received, so subtract the increase to convert Net Income to cash flow from operating activities.

E12-3 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Suppose your company sells services for \$325 cash this month. Your company also pays \$100 in wages, which includes \$15 that was payable at the end of the previous month and \$85 for wages of this month.

Required:

1. Show the journal entries to record these transactions.

Record

Cash

325

Service Revenue

325

Record

Wages Payable

15

Wages Expense

85

Cash

100

E12-3 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Required:

2. Calculate the amount that should be reported as net cash flows from operating activities.

The \$225 increase in Cash (\$325 – \$100) should be reported as net cash inflow from operating activities.

3. Calculate the amount that would be included in Net Income.

\$325 of Service Revenue would be included along with Wages Expense of \$85, for a Net Income of \$240.

4. Show how the indirect method would convert Net Income (requirement 3) to Net Cash Flows from Operating Activities (requirement 2).

Net Income	\$ 240
Less: Wages Payable decrease	<u>(15)</u>
Net cash flow from operating activities	<u><u>\$ 225</u></u>

E12-3 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Required:

- What general rule about converting Net Income to operating cash flows is revealed by your answer to requirement 4?

When Wages Payable decreases, subtract that decrease to convert Net Income to cash flow from operating activities.

	Non-Cash Current Assets	Current Liabilities
Increase	Subtract from net income.	Add to net income.
Decrease	Add to net income.	Subtract from net income.

E12-4 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Suppose your company sells services of \$150 in exchange for \$120 cash and \$30 on account. Depreciation of \$50 also is recorded.

Required:

1. Show the journal entries to record these transactions.

Record

Cash	120
Accounts Receivable	30
Service Revenue	150

Record

Depreciation Expense	50
Accumulated Depreciation (+xA)	50

E12-4 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Required:

2. Calculate the amount that should be reported as Net Cash Flows from Operating Activities.

The \$120 increase in Cash should be reported as net cash flows from operating activities.

3. Calculate the amount that would be included in Net Income.

Net Income would include \$150 of Service Revenue and \$50 of Depreciation Expense, or \$100 in total.

4. Show how the indirect method would convert Net Income (requirement 3) to net cash flows from operating activities (requirement 2).

Net Income	\$ 100
Add: Depreciation	50
Less: Accounts Receivable increase	<u>(30)</u>
Net cash flow from operating activities	<u><u>\$ 120</u></u>

E12-4 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Required:

5. What general rules about converting Net Income to operating cash flows are revealed by your answer to requirement 4?

Two general rules are revealed:

1. Always add back the amount of Depreciation Expense subtracted in the Income Statement to convert Net Income to cash flow from operating activities.
2. When Accounts Receivable increases, Sales Revenue is greater than Cash received, so subtract the increase to convert Net Income to cash flow from operating activities.

E12-5 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Suppose your company sells goods for \$300, of which \$200 is received in cash and \$100 is on account. The goods cost your company \$125 and were paid for in a previous period. Your company also recorded wages of \$70, of which only \$30 has been paid in cash.

Required:

1. Show the journal entries to record these transactions

Record

Cash	200
Accounts Receivable	100
Service Revenue	300

Record

Cost of Goods Sold	125
Inventory	125

E12-5 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Required:

1. Show the journal entries to record these transactions:

Record

Wages Expense	70
Wages Payable	40
Cash	30

2. Calculate the amount that should be reported as net cash flows from operating activities.

Net cash flows from operating activities would be \$170, which equals the \$200 received from customers minus the \$30 paid to employees.

3. Calculate the amount that would be included in Net Income.

Net Income would be \$105, which equals \$300 of Sales Revenue minus Cost of Goods Sold (\$125) and Wages Expense (\$70).

E12-5 Understanding the Computation of Cash Flows from Operating Activities (Indirect Method)

Required:

4. Show how the indirect method would convert Net Income (requirement 3) to net cash flows from operating activities (requirement 2).

Net Income	\$ 105
Add: Inventory decrease	125
Wages Payable increase	40
Less: Accounts Receivable increase	<u>(100)</u>
Net cash flow from operating activities	<u>\$ 170</u>

5. What general rules about converting Net Income to operating cash flows are revealed by your answer to requirement 4?

Three general rules are revealed:

1. Add back decreases in noncash Current Assets.
2. Add back increases in Current Liabilities
3. Deduct increases in noncash Current Assets.

E12-6 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Suppose your company's Income Statement reports \$160 of Net Income and \$40 of cash dividends paid, and its comparative Balance Sheet indicates the following.

	Beginning	Ending
Cash	\$ 35	\$205
Accounts Receivable	75	175
Inventory	245	135
Total	<u>355</u>	<u>\$515</u>
Salaries and Wages Payable	\$ 10	\$ 50
Common Stock	100	100
Retained Earnings	245	365
Total	<u>\$355</u>	<u>\$515</u>

Required:

1. Prepare the operating activities section of the Statement of Cash Flows, using the indirect method.
2. Identify the most important cause of the difference between the company's Net Income and Net Cash Flows from Operating Activities.

E12-6 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Required:

1. Prepare the operating activities section of the Statement of Cash Flows, using the indirect method.

First, let's determine the changes in Balance Sheet accounts.

	Beginning	Ending	Change
ASSETS			
Current assets:			
Cash	\$ 35	\$ 205	\$ 170
Accounts Receivable	75	175	100
Inventory	<u>245</u>	<u>135</u>	(110)
Total	<u>\$ 355</u>	<u>\$ 515</u>	
Wages Payable	10	50	\$ 40
Common Stock	100	100	0
Retained Earnings	<u>245</u>	<u>365</u>	120
Total	<u>\$ 355</u>	<u>\$ 515</u>	

E12-6 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Required:

1. Prepare the operating activities section of the Statement of Cash Flows, using the indirect method.

Cash Flows from Operating Activities:

Net Income	\$ 160
Changes in Current Assets and Current Liabilities:	
Accounts Receivable increase	-100
Inventory decrease	110
Wages Payable increase	40
Net cash provided (used) by operating activities	\$ 210

	Current Assets	Current Liabilities
Increase	Subtract from Net Income.	Add to Net Income.
Decrease	Add to Net Income.	Subtract from Net Income.

E12-6 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Required:

2. Identify the most important cause of the difference between the company's Net Income and Net Cash Flows from Operating Activities.

Cash Flows from Operating Activities:

Net Income	\$ 160
Changes in current assets and current liabilities:	
Accounts Receivable increase	-100
Inventory decrease	110
Wages Payable increase	40
Net cash provided (used) by operating activities	\$ 210

The most important cause of the difference is the \$110 decrease in Inventory.

- The Inventory decrease indicates that Cost of Goods Sold (deducted in the Income Statement) was \$110 more than the cash paid to purchase Inventory.
- In other words, the company sold Inventory but did not replace it, creating a net cash inflow for the period.

E12-7 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Suppose the Income Statement for Goggle Company reports \$95 of Net Income, after deducting depreciation of \$35. The company bought equipment costing \$60 and obtained a long-term bank loan for \$70. The company's comparative balance sheet, at December 31, indicates the following.

	Previous Year	Current Year
Cash	\$ 35	\$ 240
Accounts Receivable	75	175
Inventory	260	135
Equipment	500	560
Accumulated Depreciation—Equipment	<u>(45)</u>	<u>(80)</u>
Total	<u>\$825</u>	<u>\$1,030</u>
Salaries and Wages Payable	\$ 10	\$ 50
Notes Payable (long-term)	445	515
Common Stock	10	10
Retained Earnings	360	455
Total	<u>\$825</u>	<u>\$1,030</u>

E12-7 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Required:

1. Calculate the change in each balance sheet account, and indicate whether each account relates to operating, investing, and/or financing activities.

	Previous	Current	Change	Type
Cash	\$ 35	\$ 240	205	Cash
Accounts Receivable	75	175	100	Operating
Inventory	260	135	(125)	Operating
Equipment	500	560	60	Investing
Accumulated Depreciation	(45)	(80)	35	Operating
Total	\$ 825	\$ 1,030		
Salaries and Wages Payable	\$ 10	\$ 50	40	Operating
Long-term Debt	445	515	70	Financing
Common Stock	10	10	-	Financing
Retained Earnings	360	455	95	Operating
Total	\$ 825	\$ 1,030		

E12-7 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Required:

2. Prepare a statement of cash flows using the indirect method.

Google Company		
Statement of Cash Flows		
For the Year Ended December 31		
<u>Cash Flows from Operating Activities:</u>		
Net Income	\$ 95	
Add Depreciation	35	
Subtract Accounts Receivable increase	(100)	
Add Inventory decrease	125	
Add Salaries and Wages Payable increase	40	
Net cash provided (used) by operating activities	<u>195</u>	
<u>Cash Flows from Investing Activities:</u>		
Equipment purchased	(60)	
Net cash provided (used) by investing activities	<u>(60)</u>	
<u>Cash Flows from Financing Activities:</u>		
Obtained long-term bank loan	70	
Net cash provided (used) by financing activities	<u>70</u>	
Net change in cash	205	
Cash, Beginning of current year	35	
Cash, End of current year	<u>\$ 240</u>	

E12-7 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Required:

3. In one sentence, explain why an increase in Accounts Receivable is subtracted.

The increase in Accounts Receivable indicates that sales on account were greater than cash collections.

4. In one sentence, explain why a decrease in Inventory is added.

A decrease in Inventory indicates that Cost of Goods Sold (subtracted in the Income Statement) was greater than Inventory purchases.

E12-7 Preparing and Evaluating a Simple Statement of Cash Flows (Indirect Method)

Required:

5. In one sentence, explain why an increase in Salaries and Wages Payable is added.

The Salaries and Wages Payable increase is added because more wages were subtracted when calculating Net Income than actually paid.

6. Are the cash flows typical of a start-up, healthy, or troubled company? Explain.

A healthy company since operating cash flows are positive and financing inflows are sufficient to cover investing outflows.

End of Chapter 12