Budgeting, Planning & Management Reporting

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EuroMaTech

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Consultant's profile:

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- Mr. Manjit Biant is a Senior Consultant with EuroMaTech specializing in Accounting which includes Finance & Business including Finance for Non Finance Managers, IFRS, IPSAS, Risk Anaylisis & Strategy Management, Forensic Accounting & Auditing and Corporate Governance.
- His degree in Business Administration included a placement year with Deloitte Haskins & Sells, one of the top five Accountancy firms at the time. He proceeded to continue his career with the newly merged firm Coopers & Lybrand Deloitte. He worked in Financial Services for a number of years with Lloyds TSB and AMP(UK Financial Services).
- He went on to work for Hays PLC as a Commercial Accountant, then finally decided to run his own business and get street experience, putting his entrepreneurial skills to the test. After selling his business at a young age, he now enjoys semi-retirement, working as a part-time lecturer, free-lance trainer, business consultant & Internet Marketing Coach.
- Manjit has had extensive training in the Thompsett Project Management program, Quality Management Techniques and Customer care implementation. Manjit has conducted courses in Europe, Africa, USA and the Middle East.

Opening

- Introductions
- Expectations
- Disclaimer
- Confidentiality
- Health and Safety



Disclaimer

- The information in this seminar or any manual, which does not purport to be comprehensive, has not been independently verified. While this information has been prepared in good faith, no representation or warranty, express or implied, is or will be made and no responsibility or liability is or will be accepted by EuroMaTech or by the presenter or by any of their respective officers, employees or agents in relation to the accuracy or completeness of this seminar or manual or any other written or oral information made available to any delegate or its advisers and any such liability is expressly disclaimed.

Training Methodology

- Your programme leader will present, guide and facilitate learning, using a range of methods including the use of the programme material, case studies and discussion of “real life” issues in organizations, to ensure the development of skills as well as knowledge
- Participants will learn by active participation preparing both budgets and forecasts using a variety of statistical tools and by using budgets to make management decisions.

Introduction

- Budgeting lies at the heart of business management, yet businesses often encounter financial difficulties as a result of either inadequate planning or errors within the compilation of the budgets.

- This programme takes a practical approach to financial planning for the organisation and considers the following:

- The planning process and how to improve it
- The compilation of budgets – who needs to be involved and why;
- How to identify potential problems arising and suggests actions which can be taken
- Ways of improving financial control using effective management reporting

Who should Attend?

- Professionals responsible for budget preparation and management reporting
- Process owners who require a more in-depth understanding of integrated planning and budgeting techniques, along with Financial planners and cost analysts
- Anyone with direct planning and budgeting responsibility, as well as advisors, accountants and business consultants

Programme Objectives

- Implement advanced planning and control techniques into your budgeting process
- Integrate the budgeting process with the development of the company's long-term strategic vision
- Successfully build an integrated planning, budgeting and reporting process
- Apply management tools to the budgeting process that contribute to strategic goals
- Identify key performance indicators for effective and focused decision making
- Increase profitability and performance through stream lined planning and reporting

Seminar Outline

DAY 1

Planning for Success
•What are planning strategies?
•Strategy analysis, choice & implementation
•Introducing the Strategy maps
•Corporate value and shareholder value
•The agency problem and corporate governance
•Planning requirements and working capital

DAY 2

The Forecasting Process

•Determine the purpose and objective of the forecast
•Statistical analytical tools
•Quantitative analysis and forecasting
•Forecasting techniques
•Causal analysis models – regression analysis
•Using Excel ® to analyse historical data

Seminar Outline

DAY 3

Budgets, Costs and Budgetary Control

- Why do we budget? – the purposes of budgeting
- Planning and control
- Putting the budget together
- Cost behaviour and classification
- Cost / volume /profit (CVP) and 'what-if' analysis
- Standard costing
- Flexed budgets
- Variance analysis and the reasons for variances

DAY 4

Activity Based Costing (ABC) And Activity Based Budgeting (ABB)

- Activity based costing (ABC)
- Refinement of the costing system
- ABC and cost management
- Design of ABC systems
- The cost hierarchy and cost drivers
- Advantages and disadvantages of ABC systems
- From traditional budgeting to activity based budgeting (ABB)
- The ABB process
- Motivation and the behavioural aspect of budgeting

Seminar Outline

DAY 5

Measuring corporate performance: requirements of a successful performance measurement system

- Broadening performance measurement systems
- The Drive toward Shareholder Value (EVA®)
- Beyond budgeting: integrating financial and non-financial issues
- Introducing the Balanced Scorecard and the key perspective

Day 1

Planning for Success

- What are planning strategies?
- Strategy analysis, choice & implementation
- Corporate value and shareholder value
- Introducing the Strategy maps
- The agency problem and corporate governance
- Planning requirements and working capital

Planning For Success

- What is success? How do we plan for success?
- Case Study Video

What are planning strategies?

- How do we define planning?
- How do we define strategy?

Corporate Strategy and Financial Policy & Planning

- **Strategy**
  - Strategy is set of defined probable action that can be taken in different circumstances for achieving long term goal of the firm
  - The aim of strategy formulation is to equip a firm with the strength it needs to overcome hurdles

- Strategy Formulation Process
- Defining the firm's businesss- Before designing policies for organisation it is important to define the purpose and meaning of business. This step describes what business is all about and accordingly all the functional managers are guided to work in accordance with objective of organisation
- Setting a vision and long-term company goal
- Environmental and internal analysis to identify opportunities- External and internal environment needs to be analyzed to identify opportunities and resources available for implementing strategies successfully

Corporate Strategy and Financial Policy & Planning

- **Strategy selection and implementation-** After various alternatives are analyzed the best alternative will be selected and finally strategy will be implemented. Strategy implementation includes designing the organisation's structure, allocating resources, developing information and decision process and managing human resources
- **Evaluation of company performance for evaluating the successful implementation of startegy-** Strategy needs to be evaluated by comparing the actual performance with planned one to check whether the firm is moving in the desired direction or there is requirement of any correction

- Corporate Strategy Levels
- Corporate level strategy- vertical integration(eliminating distributor and suppliers control) and diversification
- Business level strategy- cost leadership, differentiation and focus
- International strategy- international diversification(same or different)
- Functional strategy- focus on internal functions such as production, marketing, R&D, finance, HR etc

Corporate Strategy and Financial Policy & Planning

- **Differences between strategy and policy**
- **Corporate strategy should answer 3 basic questions**
  - **Suitability (**would it work?)- Whether given strategy will work for accomplishment of common goal of the firm
  - **Feasibility (**can it be made to work?)- Determines the kind and number of resources required to formulate and implement the strategy
  - **Acceptability (**will they work it)- Accepatbility is concerned with stakeholders satisfaction which can be financial as well as non-financial. Financial satisfaction comes in the from of higher dividend and higher emoluments to employees. Non-financial satisfaction can be improvement in career of its employees.
- **What are reasons for failure of corporate strategy?**

Corporate Strategy and Financial Policy & Planning

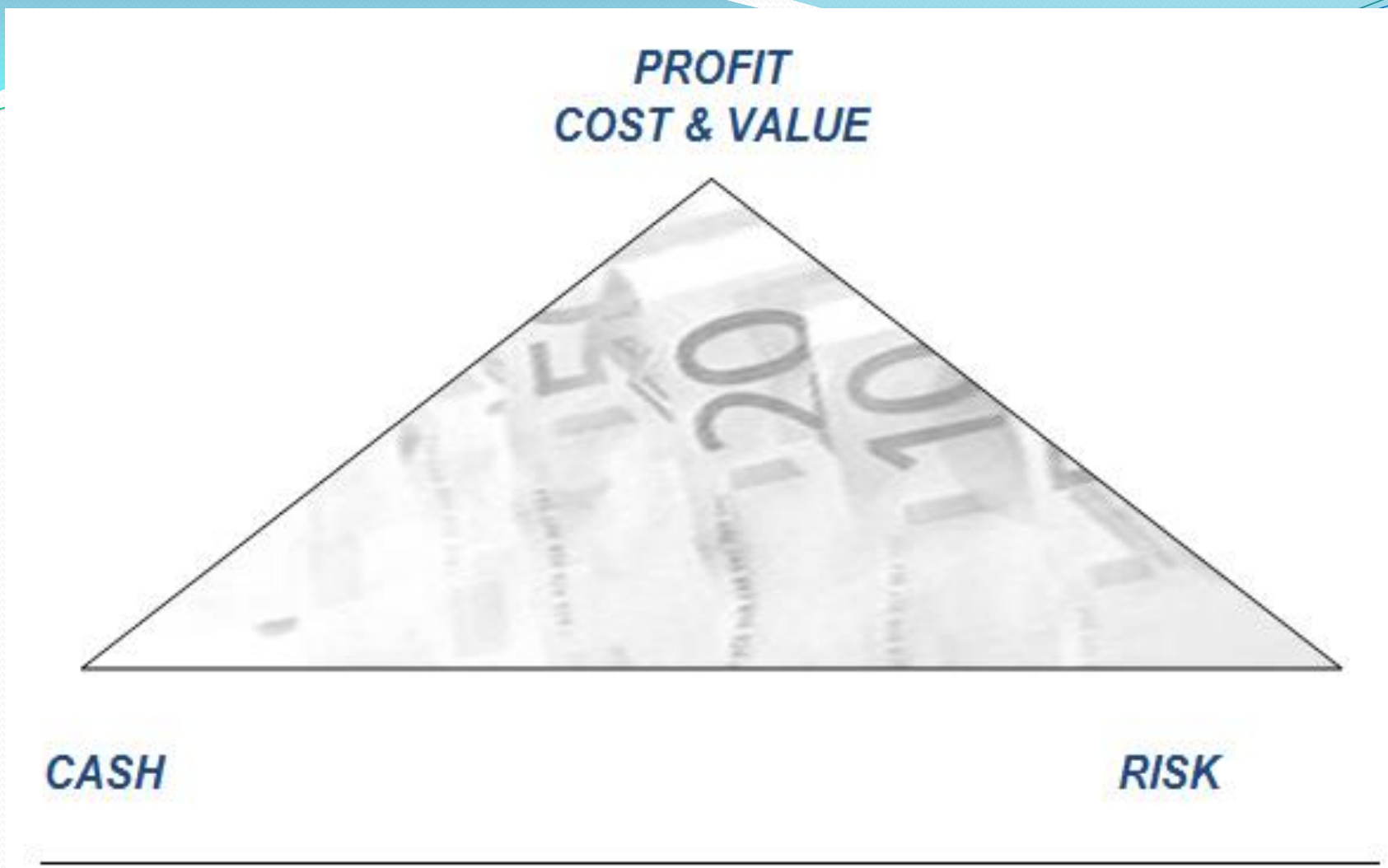
- **Relationship between corporate strategy and financial policy & planning**
  - Corporate strategy gives outline and financial policy support to execute that strategy
  - The purpose of developing financial policy is to ensure that the firm has adequate funds available to meet its growth and competitive needs in a timely manner
  - Financial policy directly helps the firm to achieve its objective of wealth maximisation via creating value for investors or stakeholders.
  - Finance manager has to take decision for such projects which can provide more rate of return(ROR)
  - Another aim of finance function is to find borrowed funds where cost of capital is low (COC)
- **What are Advantages and Disadvantages of corporate strategy and financial policy & planning**

Strategy analysis, choice & implementation

- How do we analyse strategy?
- How do we make choices?
- What are the dangers of implementation?

PESTLE

- P – Political
- E – Economical
- S – Sociological
- T – Technological
- L – Legal
- E - Environmental


PROFIT
COST & VALUE
CASH
RISK

Profit & Cash

Profit Is Vanity

Cash Is Sanity

Valu



"There is little money in making"

Design	Manufacture	Marketing
"Cool"	FOXCONN	"Cool"
Technology		Technology
	Standard	
$80	$10	$80

LI-NING

What about Commodities?







Cut Cost Not Value









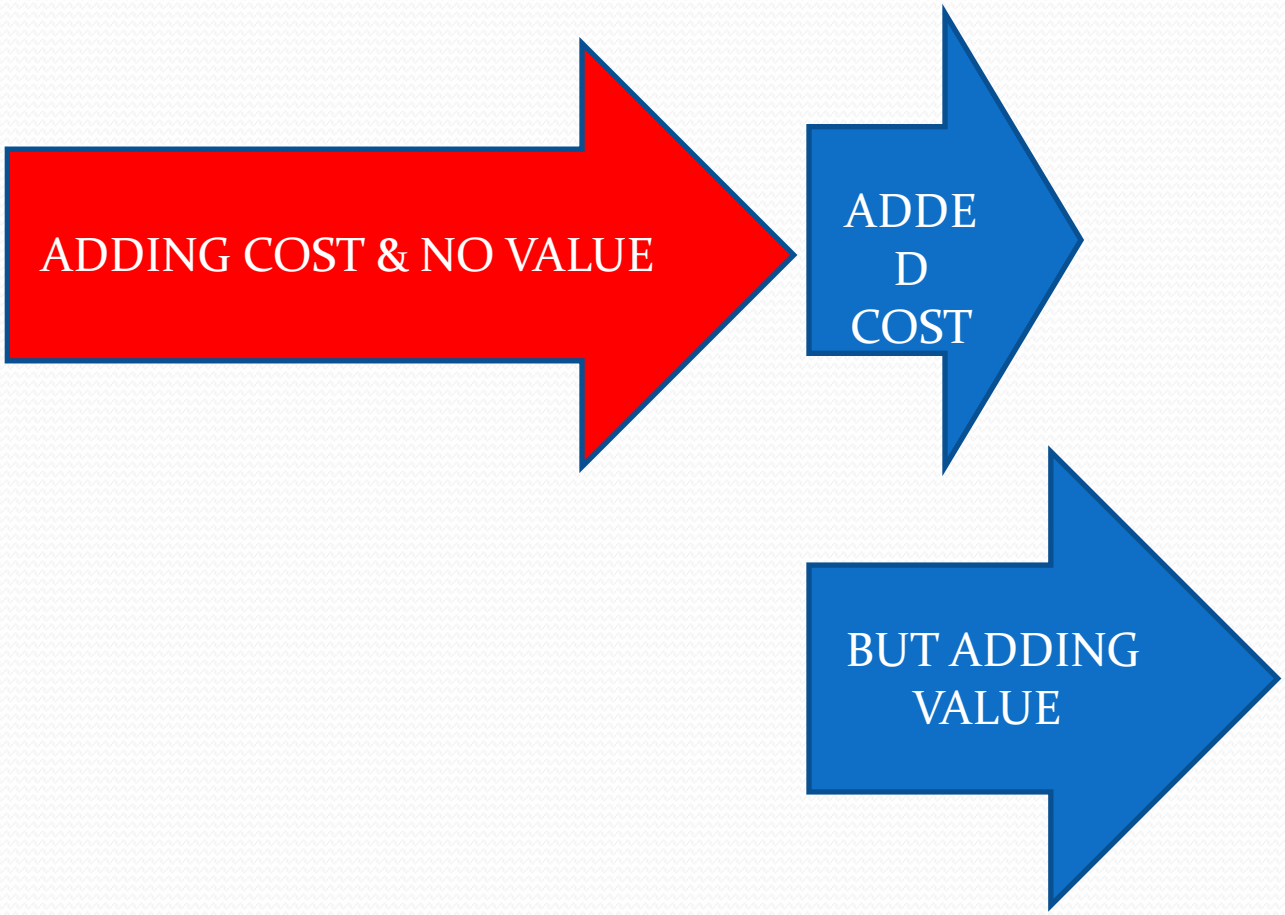
Are Business Buyers Different?



A Question of Value

	VALUE	DO NOT VALUE
You as a customer (consumer)		
You as a customer for your Company		
Your Internal Customer		

Activities Adding Value or Waste



Educating Budget Managers about Cost & Value

- How COSTs change
- COST Drivers
- Defining VALUE



- Making business cases including VALUE (With Evidence)

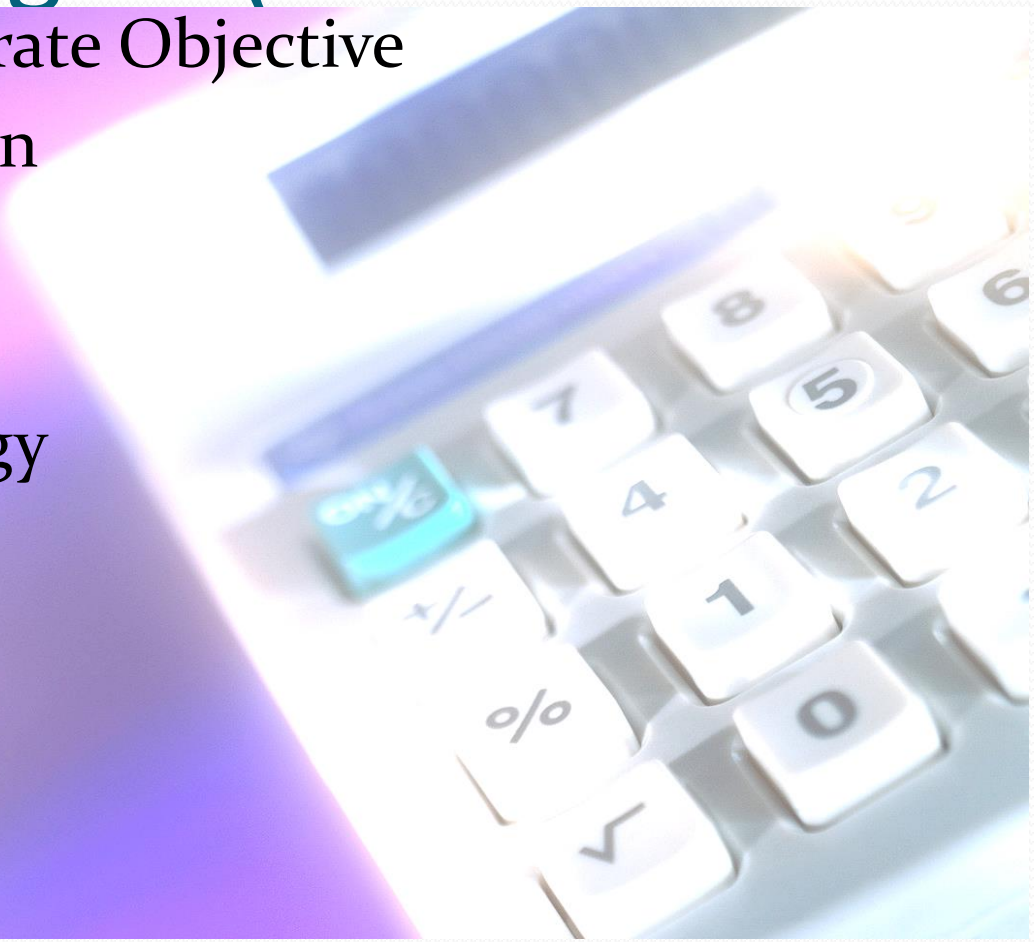
Educating Budget Managers / Non Accountants about Accounting

- Accruals Accounting
- Cash Accounting
- Commitment Accounting
- Cash v Accruals v Commitment



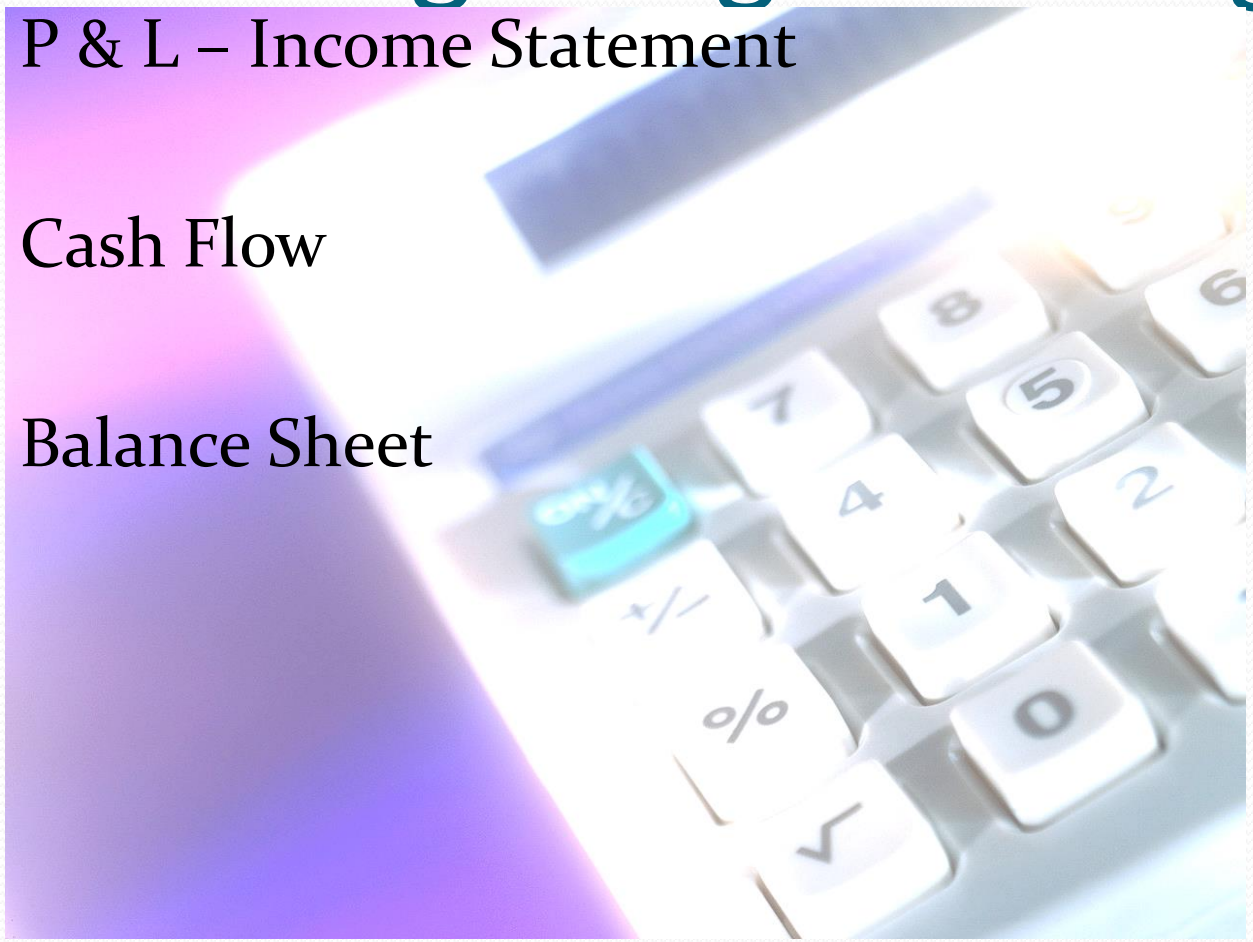
Educating / Communicating Budget Managers (& Shareholders?)

- Corporate Objective
- Mission
- Vision
- Values
- Strategy



Educating Budget Managers

- P & L – Income Statement
- Cash Flow
- Balance Sheet





SHELL OMAN
Change Location

- Environment & Society
- Innovation
- Products & Services
- About Shell
- Who we are
- Shell in Oman

You are here: Shell Oman Home > About Shell > Who we are > Shell in Oman > Shell General Business Principles >

Mission Statement & Vision

Mission Statement & Vision

Mission statement and Vision of shell oman marketing company

Our Mission Statement

"To enhance profitability through innovative management strategies while ensuring cost effectiveness and harnessing creative ideas."

Our Vision

"To be the market leader and deliver the best value to our stakeholders."





GLOBAL
Change Location

Environment & Society

Innovation

You are here: Home > About Shell > Who we are > **Our values**

Our values

As a global energy company we set high standards of performance and ethical behaviours. We are judged by how we act - our reputation is upheld by how we live up to our core values honesty, integrity and respect for people. The Shell General Business Principles, Code of Conduct and Code of Ethics help everyone at Shell act in line with these values and comply with all relevant legislation and regulations.

What we stand for

BP wants to be recognised as a great company – competitively successful and a force for progress. We have a fundamental belief that we can make a difference in the world.

We help the world meet its growing need for heat, light and mobility. We strive to do that by producing energy that is affordable, secure and doesn't damage the environment.

BP is progressive, responsible, innovative and performance driven.

Progressive

We believe in the principle of mutual advantage and build productive relationships with each other, our partners and our customers.

Responsible

We are committed to the safety and development of our people and the communities and societies in which we operate. We aim for no accidents, no harm to people and no damage to the environment.

Innovative

We push boundaries today and create tomorrow´s breakthroughs through our people and technology.

Performance driven

We deliver on our promises through continuous improvement and safe, reliable operations.

These values guide us in the conduct of our business. In all our business we expect high ethical standards and act in accordance with our Code of Conduct.

PTT GROUP VISION

PTT GROUP MISSION

To conduct integrated energy and petrochemical business as the national energy company with a balanced mission of stakeholder satisfaction through



To the country
Ensuring long-term energy security by providing sufficient, high-quality energy supply at fair prices to enhance economic growth

To community and society
Being a good corporate citizen by maximizing positive environmental contributions, minimizing negative impacts, and improving the quality of life for communities and society

To shareholders
Conducting profitable business leading to sustainable growth and providing appropriate returns

To customers
Ensuring customer satisfaction and engagement by delivering world-class quality products and services at fair prices

To business partners
Conducting fair business with partners of the same standard, building value, and cooperation to develop capability and maximize efficiency in long-term business partnership

To employees
Supporting capability building in professional conduct and ensuring employees' well-being in par with other leading companies to forge employee engagement

PTT GROUP VALUES

S P I R I T

Synergy
Innovation
Responsibility for Society
Integrity & Ethics
Trust & Respect

The way we work together

PTT STRATEGIC FRAMEWORK





Thai Premier Multinational Energy Company

BIG A world scale Company to be listed in Fortune 100 by 2020

LONG A company with sustainable growth to be listed in DJSI in 2013

STRONG Operational excellence to achieve Top Quartile Performance by 2020

Business Strategy

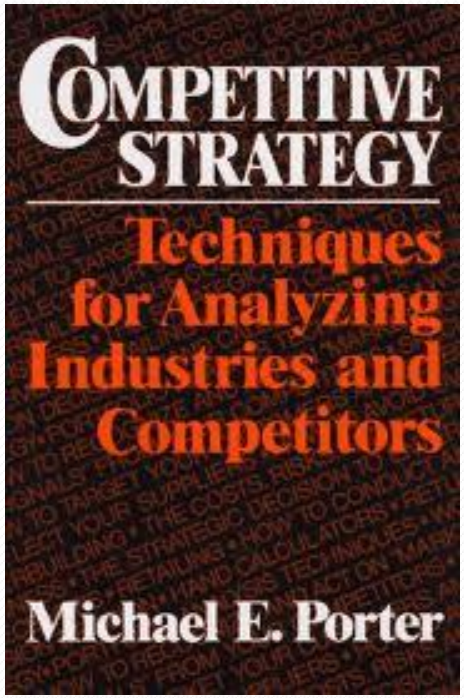
What is your business strategy?

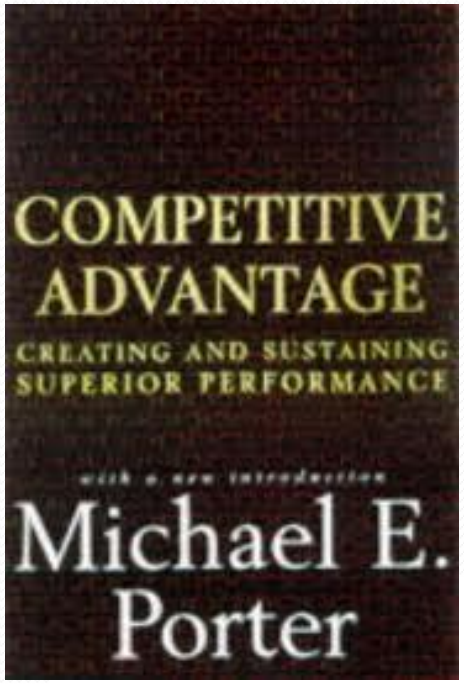
How do you beat your competitors by serving your customers better?

Describe your business's business strategy in less than three sentences

List out words that describe your business's business strategy, contrast this against your main competitors

Strategy – Michael Porter Harvard Business School



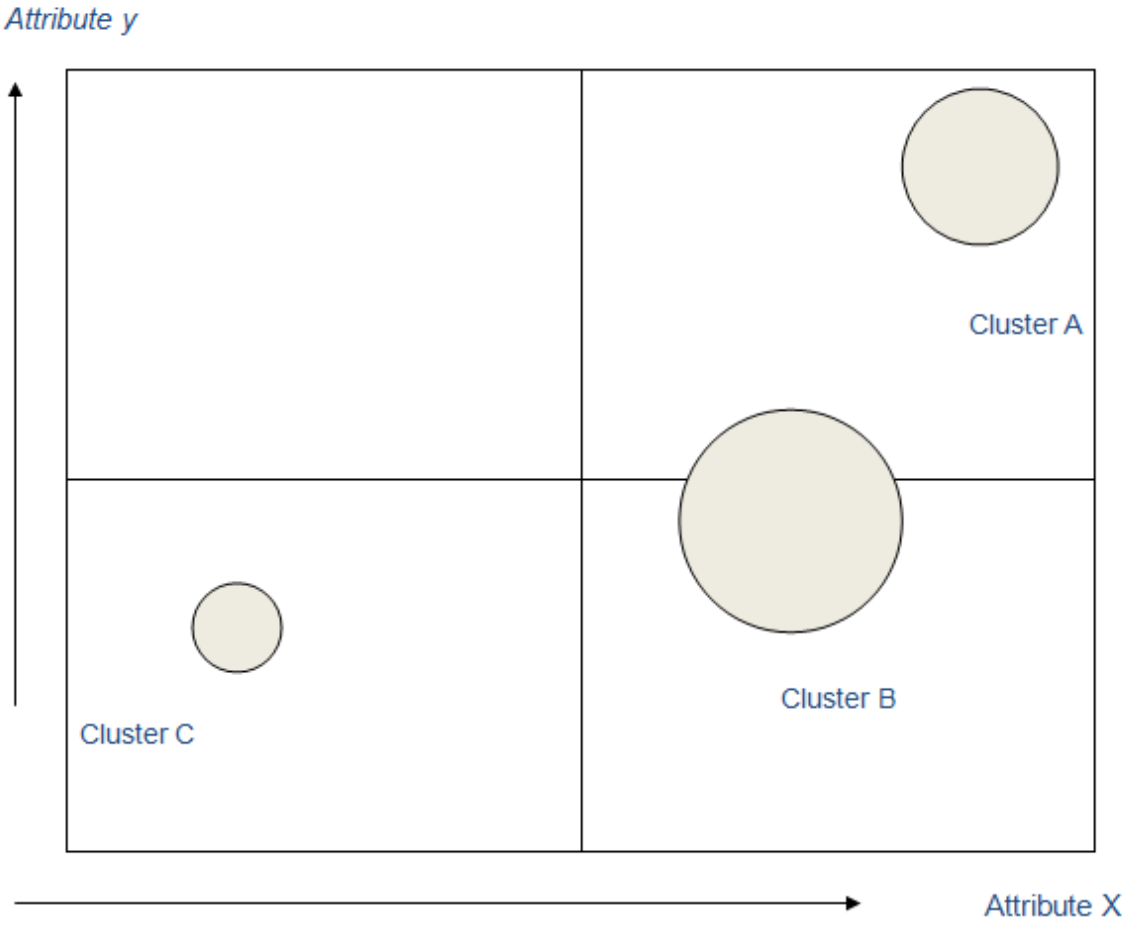




HARVARD BUSINESS

"Non Strategy" - "Stuck in the Middle"

	Lower Cost	**Differentiation**
Broad Target	1. Cost Leadership	2. Differentiation
Narrow Target	3a. Cost Focus	3b. Differentiation Focus



Mapping cluster of customer preferences against attributes

Preferences / needs may be

a. The same– No opportunity for segmentation
b. Diffused – No opportunity for segmentation
c. Clustered – segmentation opportunity

SWOT Analysis

INTERNAL	STRENGTHS	WEAKNESSES
EXTERNAL	OPPORTUNITIES	THREATS

Porter's Generic Strategies Exercise

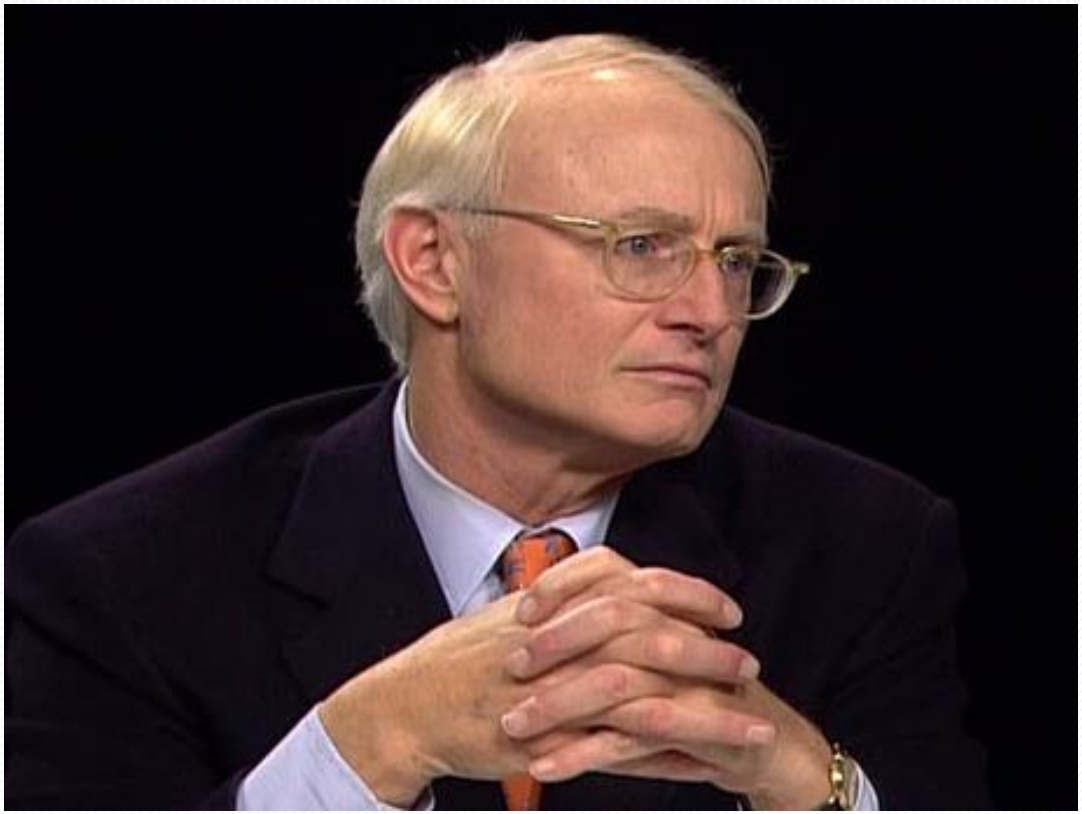
	Cost Leadership	Differentiation	Cost Focus	Differentiation Focus	"Stuck in the Middle"
Ford	X				
Land Rover				X	
BMW		X			
Saab					?
Lotus				X	
Smart				X	
Citroen	X				
Mercedes		X			
Dell					
Bang & Olufsen					
Your Business					

Your Company

SWOT Analysis

INTERNAL	**S**TRENGTHS	**W**EAKNESSES
EXTERNAL	**O**PPORTUNITIES	**T**HREATS

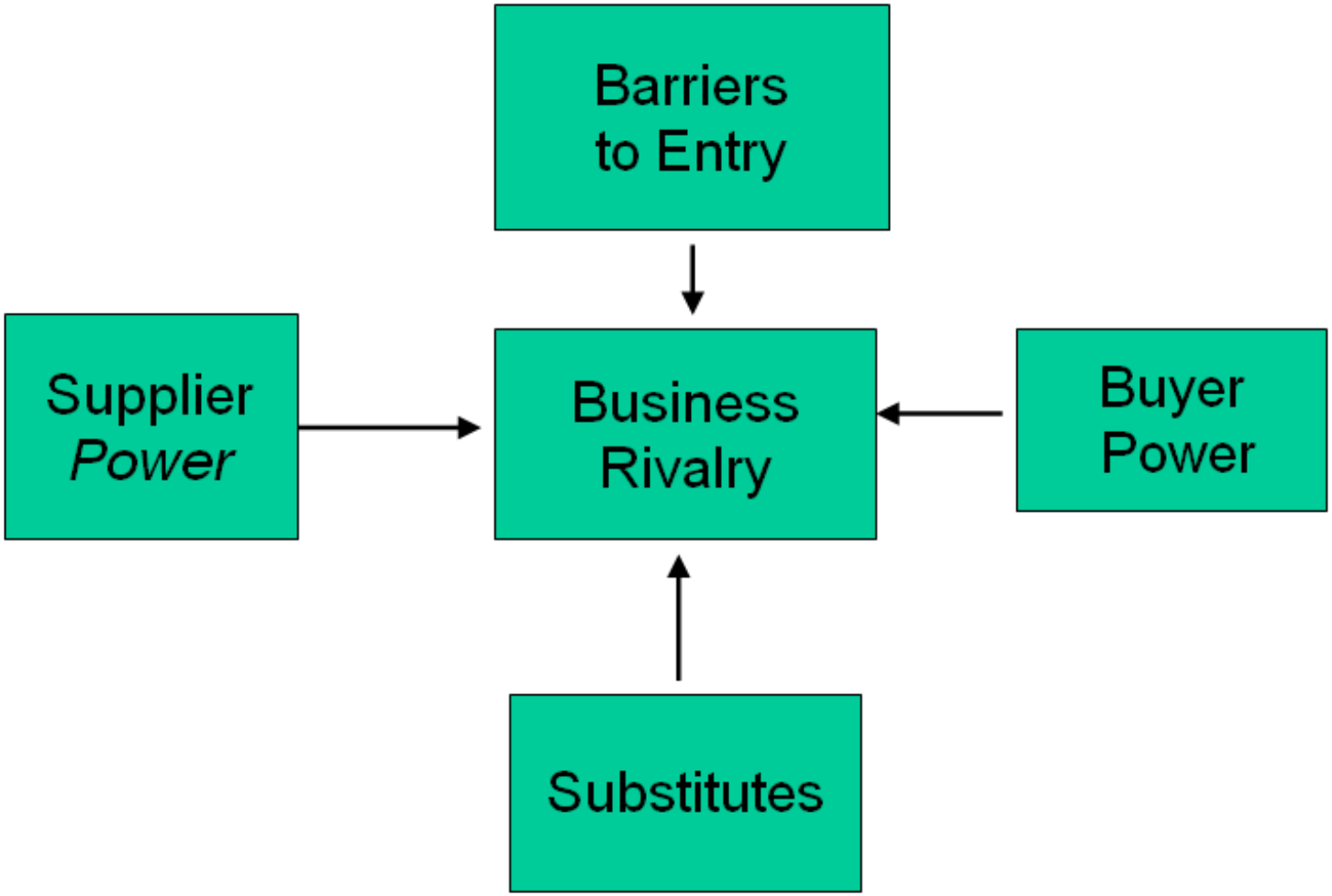
Michael Porter "SWOT"



SW - Value Chain
OT – Five Forces

Analysis of Threats & Opportunities

Porter's Five Forces

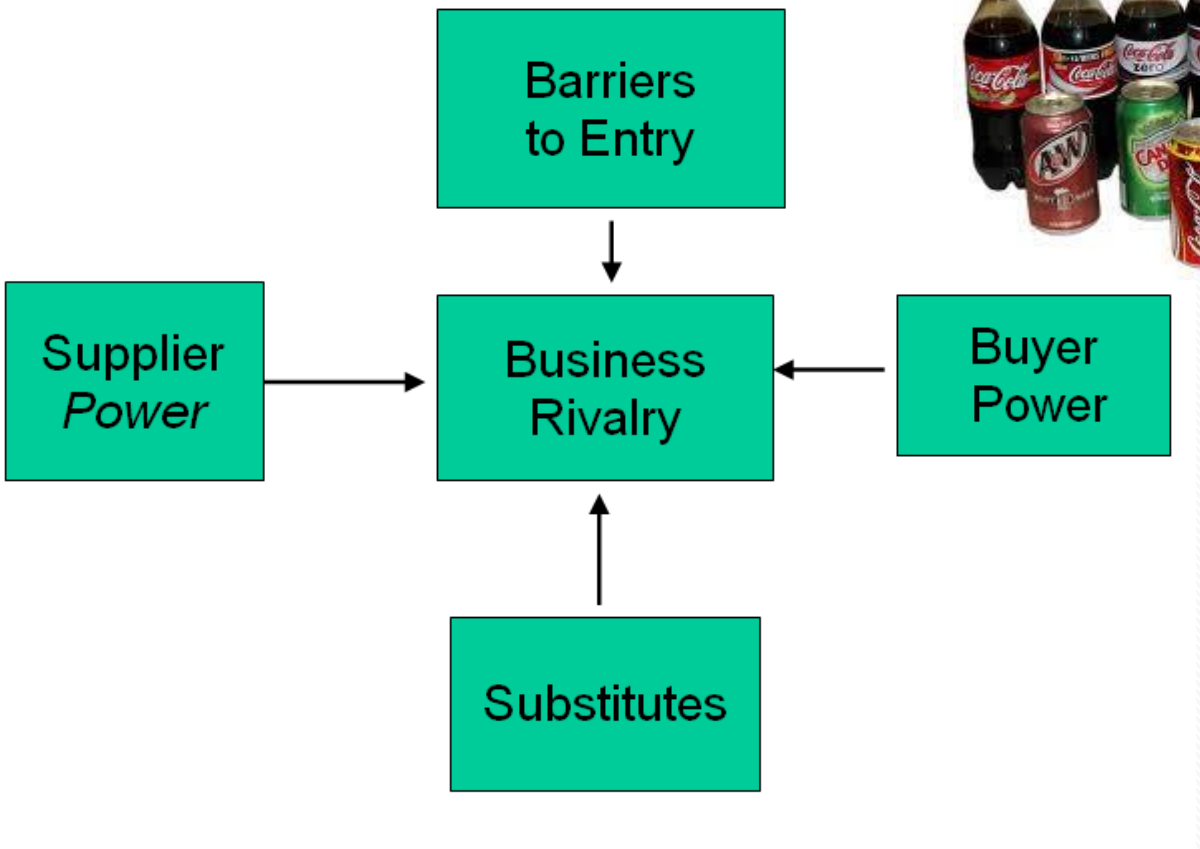


Five Star Industries – Soft Drinks

Analysis of Threats & Opportunities

Porter's Five Forces



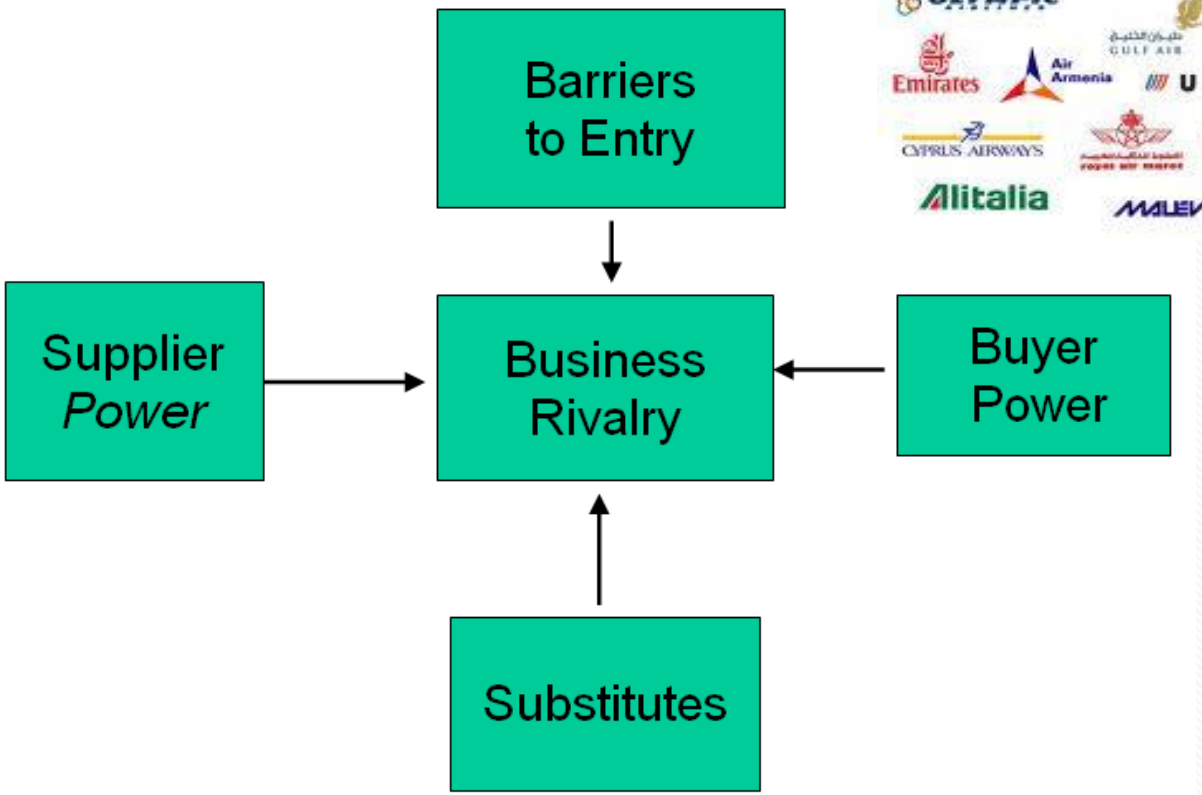


No Star Industries - Airlines

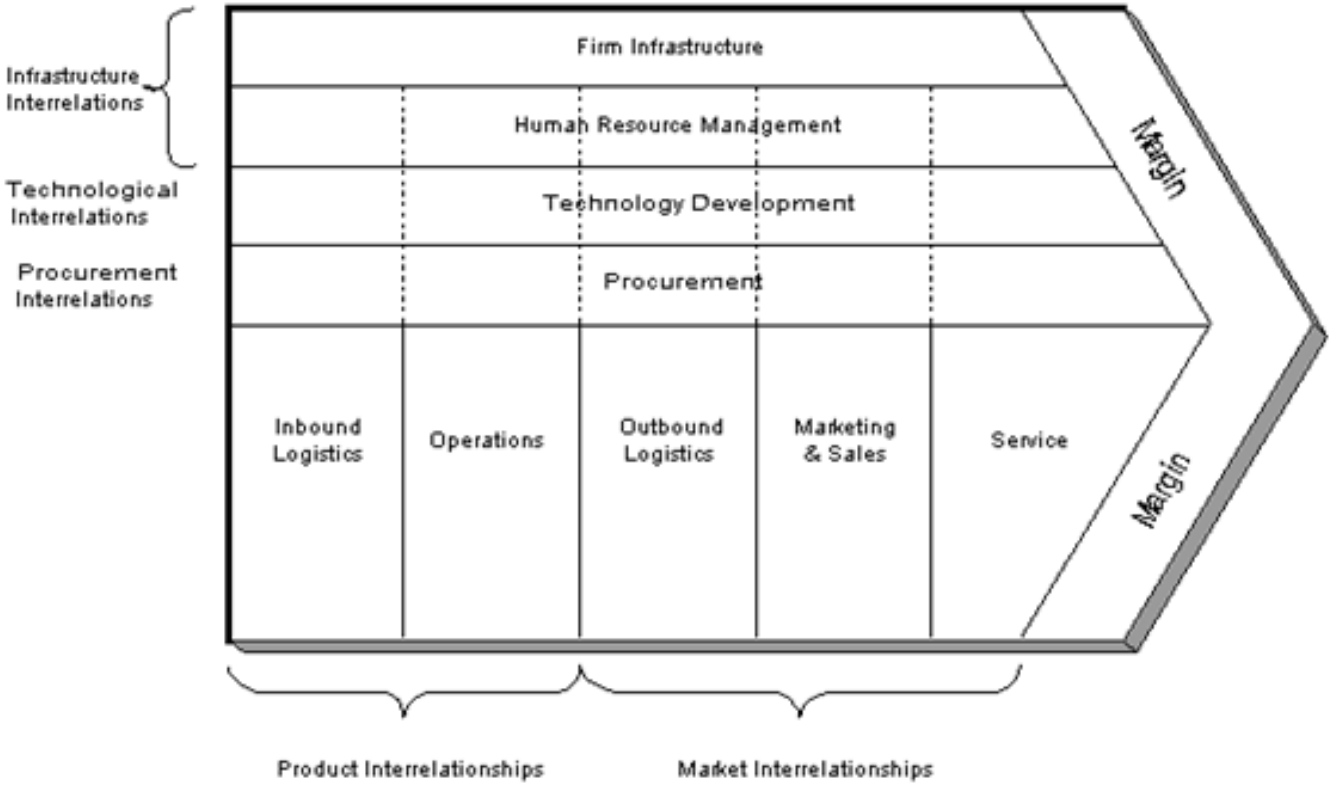


Analysis of Threats & Opportunities

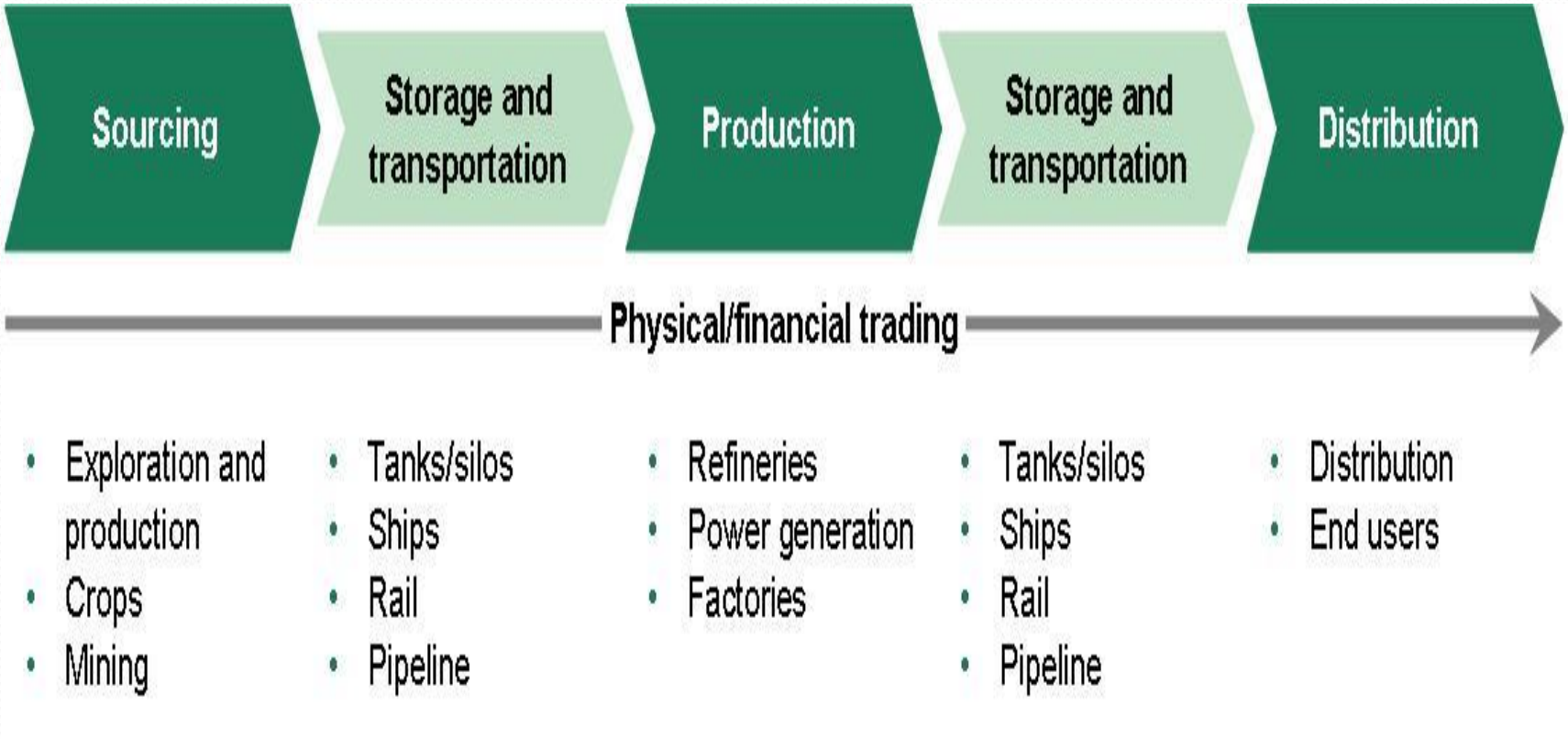
Porter's Five Forces

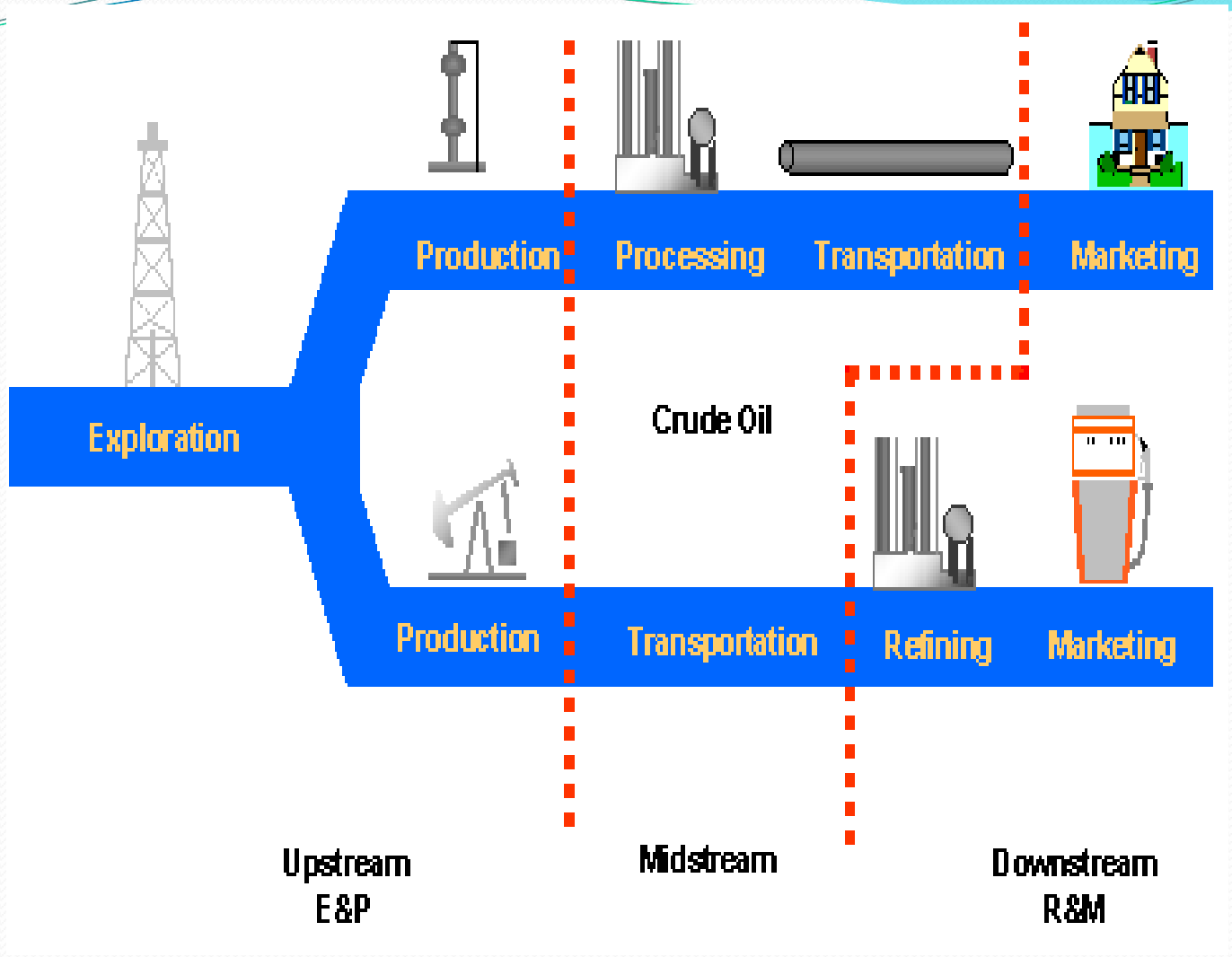


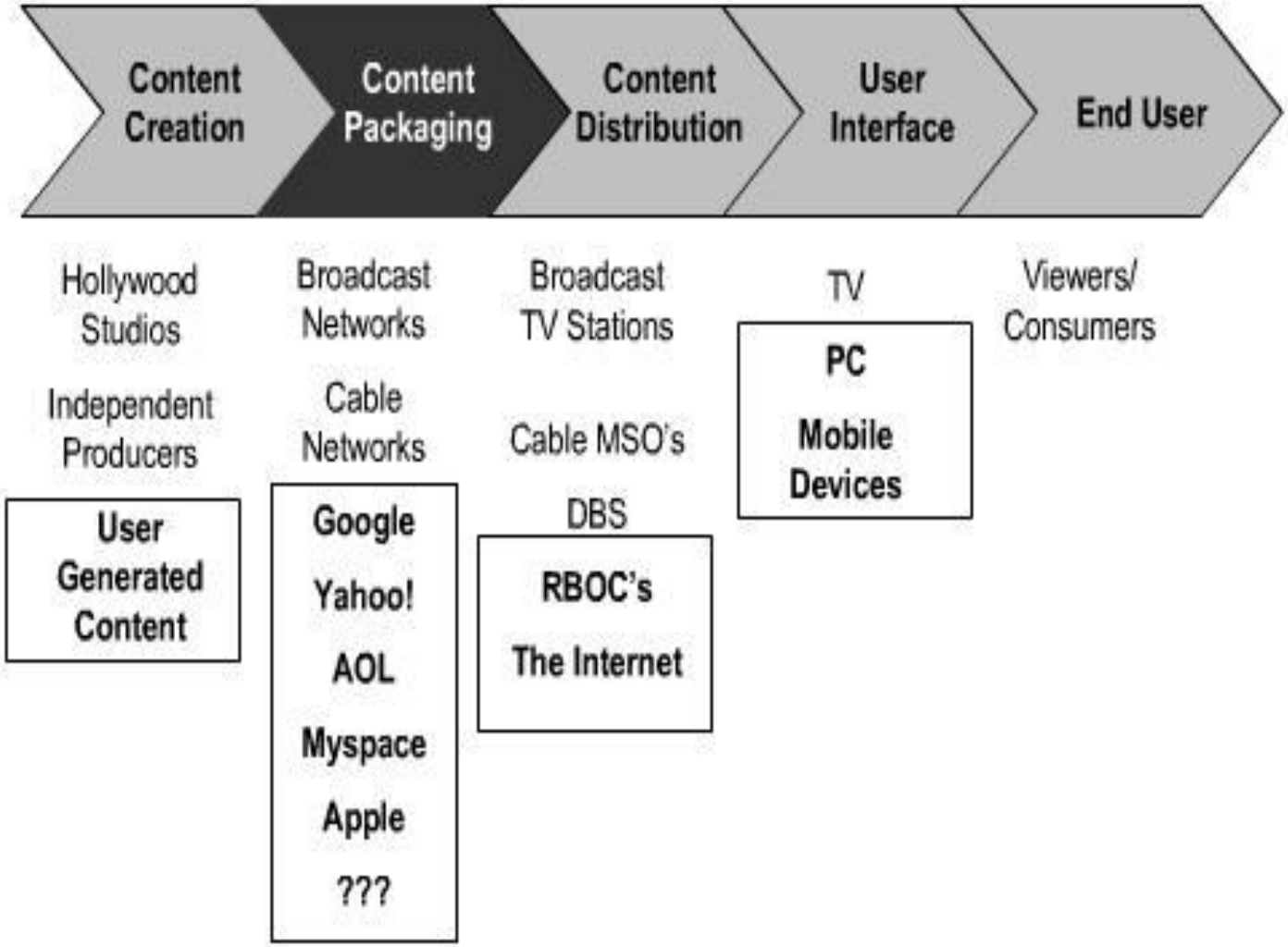
Porter's Value Chain – Strengths & Weaknesses



Generic Industry Value Chain




Production
Processing
Transportation
Marketing
Exploration
Crude Oil
Production
Transportation
Refining
Marketing
Upstream
E&P
Midstream
Downstream
R&M


Content Creation
Content Packaging
Content Distribution
User Interface
End User
Hollywood Studios
Independent Producers
User Generated Content
Broadcast Networks
Cable Networks
Google
Yahoo!
AOL
Myspace
Apple
???
Broadcast TV Stations
Cable MSO's
DBS
RBOC's
The Internet
TV
PC
Mobile Devices
Viewers/ Consumers

The Routes to Competitive Advantage

3 types of Business Systems

1. Operational Excellence
    a. MacDonalds
    b. EasyJet

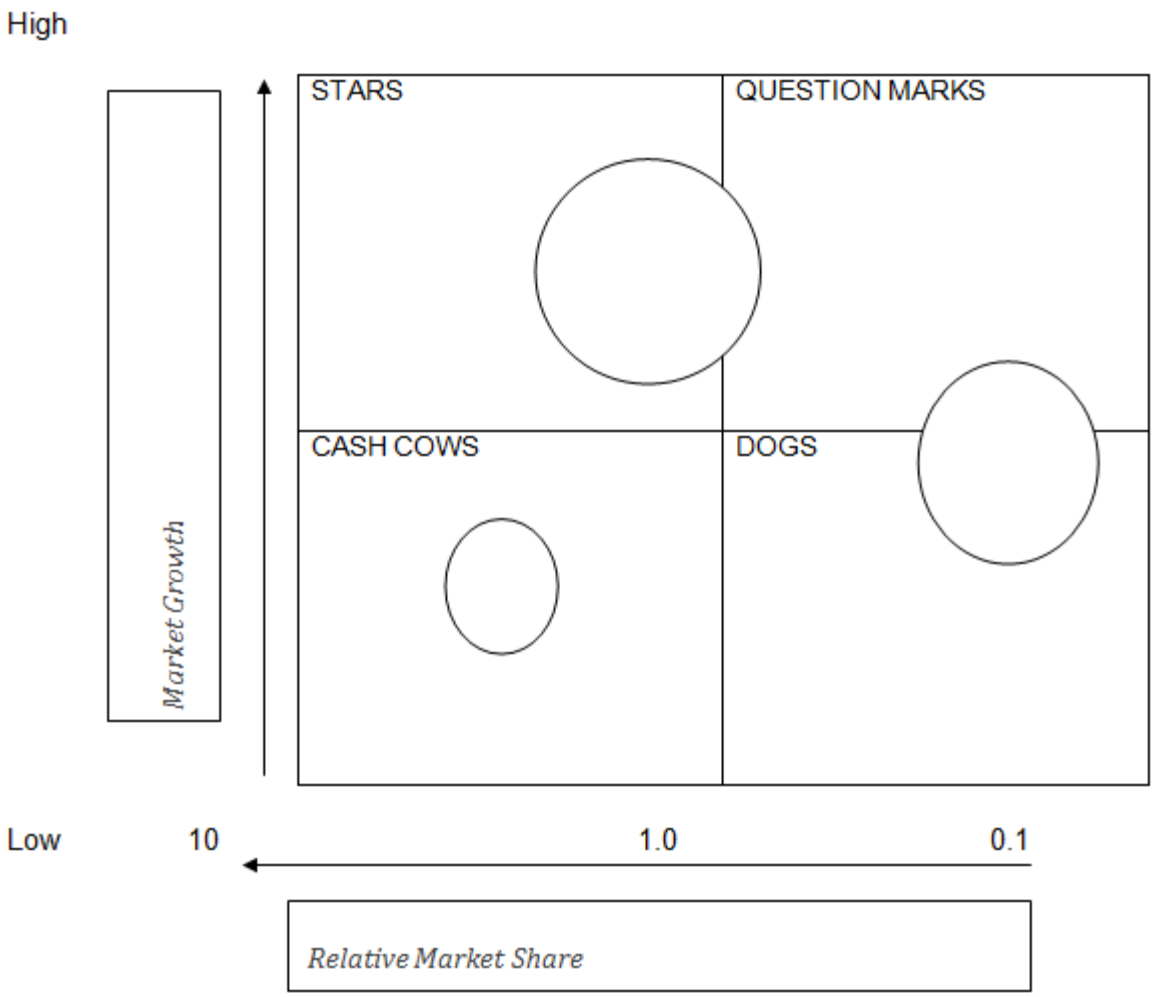
2. Product Leadership
    a. Microsoft
    b. Apple

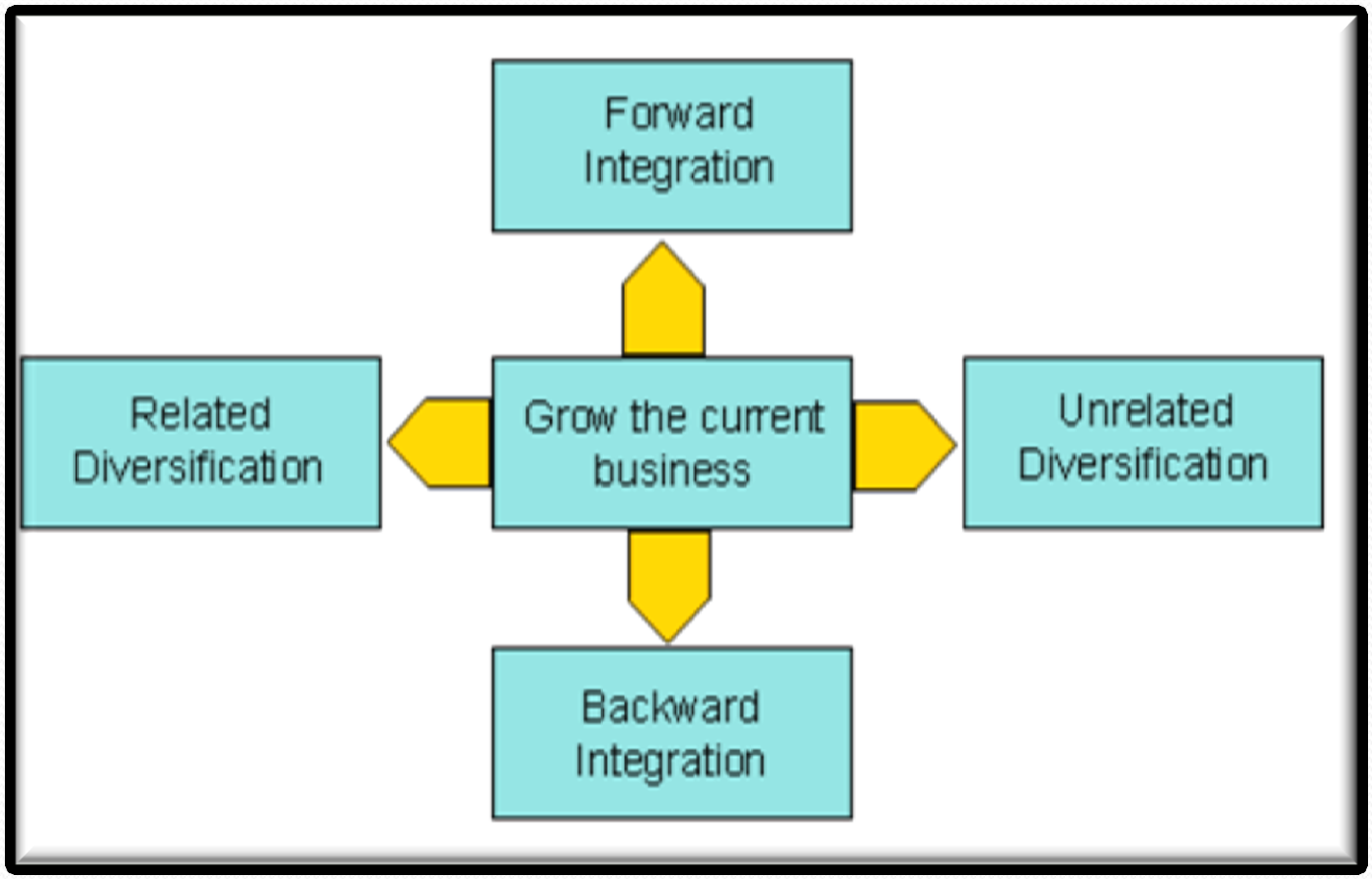
3. Customer Intimacy
    a. Rolls Royce cars
    b. Banks (in theory)

Source: 'The Discipline of Market Leaders' by Treacy & Wiersema

1. Other Business Strategy Models
"Box Inflation"

Boston Consulting Group Growth Share Matrix – "Boston Box" – 4 Box Model




Forward Integration
Related Diversification
Grow the current business
Unrelated Diversification
Backward Integration

Corporate value and shareholder value

- How do evaluate corporate value and increase shareholder value?

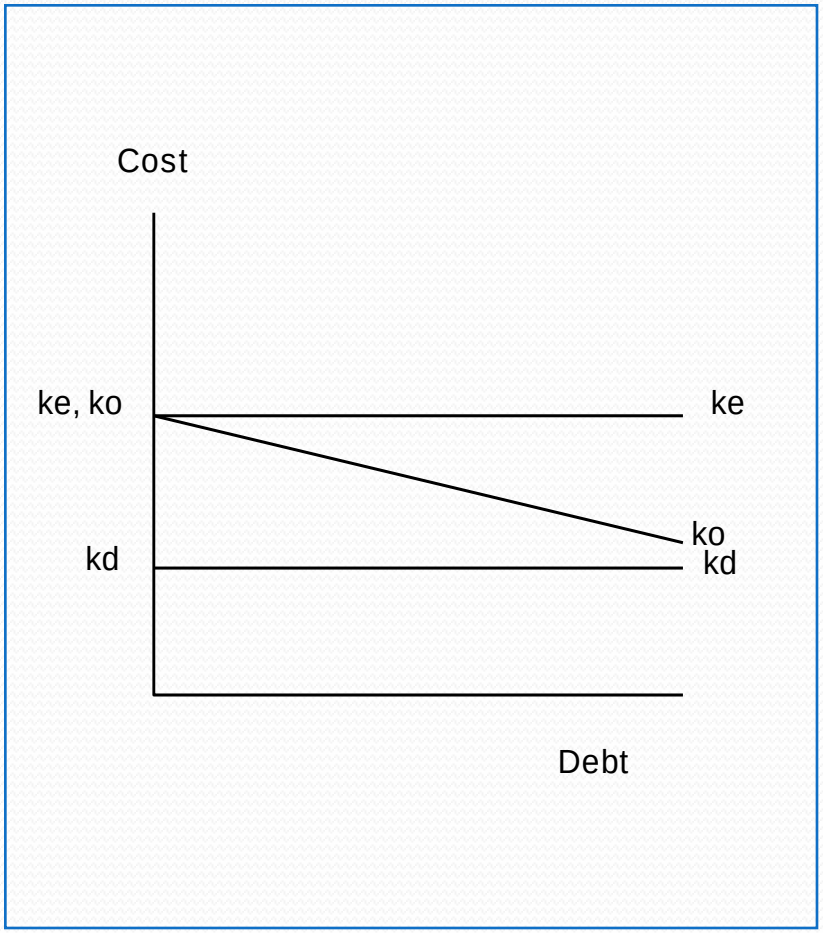
Cost of capital, EVA and financial strategies

- **Cost of capital-** It refers to rate company pays on its total capital
- **Importance of cost of capital**
  - Cost of capital is an important consideration in capital structure decisions. The finance manager must raise capital from different sources in such a way that it optimizes the risk and cost factors
  - Cost of capital may be used as the measuring road for adopting an investment proposal. The firm, naturally, will choose the project which gives a satisfactory return on investment which would in no case be less than the cost of capital incurred for its financing.

- Deciding about the Method of Financing
- The cost of capital can be used to evaluate the financial performance of the top executives. Evaluation of the financial performance will involve a comparison of actual profitabilities of the projects and taken with the projected overall cost of capital and an appraisal of the actual cost incurred in raising the required funds
- The concept of cost of capital is also important in many others areas of decision making, such as dividend decisions, working capital policy etc.

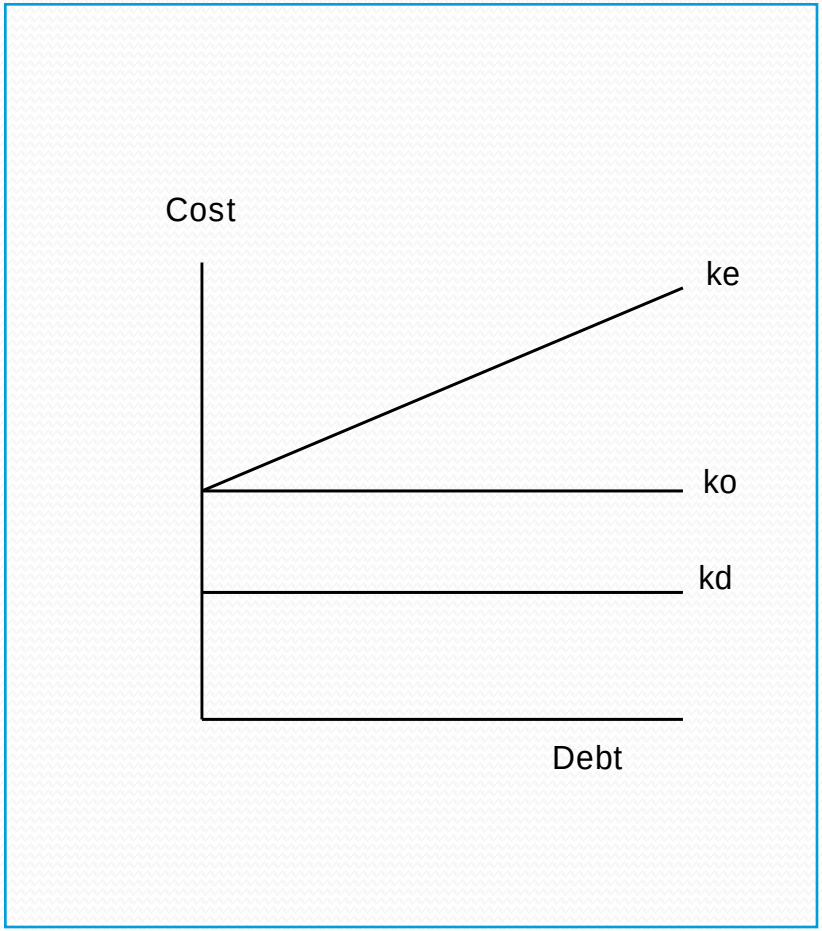
Net Income (NI) Approach

- Financial leverage will lead to corresponding change in the overall cost of capital and value of the firm.
- Degree of financial leverage is debt/equity. If this is increased WACC will decline and MV will increase.
- Assumptions
- Cost of debt is less than the cost of equity
- Including debt in capital structure does not affect the risk perception of investors



Net Operating Income (NOI) Approach

- The value of the firm and the weighted average cost of capital are independent of the firm's capital structure. In the absence of taxes, an individual holding all the debt and equity securities will receive the same cash flows regardless of the capital structure and therefore, value of the company is the same.



Modigliani Millar approach

- Modigliani Millar approach is similar to the NOI approach. It agrees with the fact that the cost of capital is independent of the degree of leverage but it provides operational justification for constant cost of capital at any degree of leverage
- Assumptions

Determination of cost of capital

- **Cost of equity**
  - **Dividend Price Approach-** Present dividend paid by the company will be considered for calculating market price of the share. This approach is better for those investors who are interested in dividends and not in capital gain.
  - **Capital Asset Pricing Approach-** Required rate of return on any stock will be equal to risk free rate plus premium for risk. This approach is more technical and practical in terms of having premium for risk faced in holding risky security.
  - **Growth Approach-** Cost of capital will not depend upon only expected dividend but also growth, investor expects in share price.
  - **Yield Approach-** This approach is based on yield actually realised over the period of past years.
- **Cost of debt**
- **Cost of preference shares**
- **WACC**

Approaches to value measurement

- **Economic value added(EVA)-** It is a measure of the surplus that is left after meeting the cost of capital. Positive EVA suggests that the shareholder wealth is maximised.
- **Market value added(MVA)-** It measures the change in the market value of the firm's equity vis-a vis equity investment. The application of this approach is very limited to only those firms whose market price is available.
- MVA=MV of firm equity- Equity Capital investment
- If MVA is positive company is having good growth prospects

Dividend policy and capital structure choices

- **Dividend Policy**
- The policy a company uses to decide how much it will payout to shareholders as dividends
- When company has abundant investment opportunities the dividend payout ratio would be zero and when company do not have profitable investment opportunities the dividend payout ratio will be 100
- If whole profit is distributed as dividend the company will have to get funds from market for future projects. This will change the capital structure of the company. If debt increases to finance future projects the earning per share will increase and the default risk will also increase
- So the company looks for other alternatives to satisfy shareholders as well as to finance future projects. One of such alternatives is to pay non-cash dividends. Eg- bonus issue
- Capital structure and dividend policy are two important and interrelated decisions

Dividend policy and capital structure choices

- **Types of Dividend**
- **Cash Dividends**
- **Bonus shares stock dividends-** They are usually issued in proportion to shares owned.eg- For every 100 shares owned 5% stock dividend will yield 5 extra share
- **Property Dividends-** It can either include shares of a subsidiary company or physical assets such as inventories that the company holds
- **Special dividends-** This is a one-off payment. Special dividends are distributed if a company has exceptionally strong earnings that it wishes to distribute to shareholders

Dividend policy and capital structure choices

- **Relevant Dividend Policy-** Dividend decision affect value of the firm
- When ROR>COC earnings should be retained
- When ROR<COC, 100%payout will increase the market price of share.
- **Gordon theory -** 100% retention may bring dissatisfaction among shareholders which will affect the market price of share as future is uncertain. Investors will discount the value of shares of firm which postpones dividends.
- **Theory of Irrelevance of Dividend-** Payout ratio will have no effect on the value of the firm, so market price of share will be same.
- If company decides for 100% dividend payout ratio, the market price of share will decline as a fall in earning. The gain of investors as a result of dividends will be neutralised completely by the reduction in the MV of the shares

Dividend policy and capital structure choices

- **Situational Dividend Policy**
- **Policy of paying higher dividend per share**
  - When firms get advantage to raise funds from market. Higher dividend payout may be considered
  - Future earning is predicted and confirmed
  - Company has sufficient and unused borrowing capacity and enjoys sound liquidity position
- **Reduction in dividend**
  - Firms working capital is ineffective and liquidity position is poor
  - There is substantial reduction in earning of the firm
  - The firm has good and profitable projects in hand
- **Opinion and communication of dividend policy-** Management communicates its dividend policy to its investors and based on the reactions and opinions of investors decision would be taken
- **Irregular dividend**

Dividend policy and capital structure choices

- **Factors Affecting Capital Structure-** which of type of fund- equity or debt
- **Risk and Return Analysis**
  - Debt fixed obligation to pay interest, Equity will affect control ability of the management
- **Cost Factor-** Debt is cheaper as returns fixed and also tax deductible. Floatation cost is also less.
- **Time Factor-** During boom and prosperity company can issue equity shares, during days of depression firm can go for debt capital
- **Flexibility Factors**

Cost of financial distress, information asymmetry & conflict of interest

- **Financial distress-** Tight cash situation in which a business, household, or individual cannot pay the owed amounts on the due date. If prolonged, this situation can force the owing entity into bankruptcy or forced liquidation. It is compounded by the fact that banks and other financial institutions refuse to lend to those in serious distress. When a firm is under financial distress, the situation frequently sharply reduces its market value, suppliers of goods and services usually insist on COD terms, and large customer may cancel their order in anticipation of not getting deliveries on time.
- **Steps taken to reorganise the firm**
  - **Asset Restructuring**
    - Selling major assets for gaining funds from the market
    - Merging with another firm
    - Reducing capital spending and R&D spending
  - **Financial Restructuring**
    - Issuing new securities
    - Negotiating with banks and other creditors

Cost of financial distress, information asymmetry & conflict of interest

- Exchanging debt for equity
- Filing for bankruptcy
- **Indicators of a Financially Distressed Firm**
- **Dividend reduction**: A company which has shown a continuous decline in amount of dividend over time, or even failed to declare dividends at all.
- **Plant closing**: A financial distressed company may not support all its plants leading to closure of some branches.
- **Losses**: Operating losses make a company not to pay dividends or increasing investment. A loss is a reduction in capital, hence the company moves towards bankruptcy.
- **Lay offs**
- **CEO resignations**: The top managers of an organization are well placed to see much ahead of time the performance of their organizations. They can therefore resign and move to firms that show potential for withstanding economic hardship. This resignation can be a sign of poor performance.
- **Plummeting stock prices**: Stock prices are indicators of a market value for the company. Instability and often decline in price may force shareholders to pull out of the company by disposing shares. Creditors observe performances of an organization based on the stock prices.

Cost of financial distress, information asymmetry & conflict of interest

- There are a number of early warning signs to alert businesses of pending financial problems. These warning signs can be categorized into Operational, Managerial, Financial and market signals.

- **Operational signals**
- changes in senior management
- high employee turnover
- resignation of members of the Board of Directors
- A failure to make changes in technology and changes in customer taste can lead to fall in sales leading to financial distress
- the cancellation of a large order
- a change in supplier payments and pricing issues.
- **Managerial signals**
  An inadequate management system

Cost of financial distress, information asymmetry & conflict of interest

- **Financial signals**
- A decline in sales
- lower profit margins
- increased debt
- negative working capital and reduced cash flow
- Breaching of loan covenants or miss of the loan payments
- **Market Signals**

  Low rating by government or independent agencies which work on all the aspects of the company such as financial statement analysis as well as market responses

Cost of financial distress, information asymmetry & conflict of interest

- **Factors leading to Financial Distress**
- Inadequate financing- business didn't start with enough finance and has struggled from day one
- Owner/CEO suffers ill health or dies and there is no management succession
- Management team is unbalanced and there are essential skills missing
- Innovative products from competitors or from substitute solutions reduce the attractiveness of the company's products and services
- Highly levered firm
- High employee dissatisfaction which leads to high turnover
- Fall in production and efficiency
- Mismanagement and corporate misconduct

Cost of financial distress, information asymmetry & conflict of interest

- **Financial Distress Cost**
- **Direct Cost-** Legal fee, auditors' fees, management fees
- **Indirect Cost-** Loss of market share, inefficient asset sales, expensive financing, opportunity costs of projects, less productive employees
- **Bankruptcy Costs-** Stockholders walk away, former creditors become the new stockholders
- **Impact of Financial Distress**
- **Corporate Control-** Financial distress adversely affects the corporate control because the participation of creditors and shareholders' increases when company faces any financial problem, Management may be forced to liquidate all the assets to fulfill their needs repaying loans and interest.
- **Management turnover-** The turnover of the employees increases in financial crisis situation which further leads to operational losses

Cost of financial distress, information asymmetry & conflict of interest

- **Trade-Off Theory-** It refers to the idea that a company chooses how much debt finance and how much equity finance to use by balancing the costs and benefits. There should be tradeoff between the cost and benefit of increase in debt capital. The marginal benefit from increase in debt in the form of tax advantage start falling and marginal cost increases after a certain increase in debt.
- **Pecking Order Theory-** Firms should prefer internal financing and if still funds are required other options should be considered

Business Restructuring and Modes of Restructuring

- **Restructuring** is the act of reorganizing the legal, ownership, operational, or other structures of a company for the purpose of making it more profitable, or better organized for its present needs. Alternate reasons for restructuring include a change of ownership or ownership structure, demerger, or a response to a crisis or major change in the business such as bankruptcy, repositioning, or buyout.
- Executives involved in restructuring often hire financial and legal advisors to assist in the transaction details and negotiation. It may also be done by a new CEO hired specifically to make the difficult and controversial decisions required to save or reposition the company. It generally involves financing debt, selling portions of the company to investors, and reorganizing or reducing operations to facilitate a prompt resolution of a distressed situation.

Business Restructuring and Modes of Restructuring

- **Why Business Restructuring**
- **Financial Losses**
- **Expansion**
- **Government-legal pressure**
- **Balance sheet resizing-** Companies in order to perform well needs to balance its financials in such a way that funds can be utilised in an efficient way
- **Family type business-** In situation of family disputes, the need of separation is realised and business restructuring becomes important
- **Value maximisation-** Shareholders value maximisation is the main objective of every organisation. When in any case increase in debt affect the cash availability and reduction of same may affect earning of the shareholders, capital restructuring is done
- **Expansion of business-** Eg- Essar Steel Ltd recently announced its restructuring plan through which the company plans to reduce its interest burden. The company has also initiated steps like increasing production and lowering operating costs as part of its restructuring program

Business Restructuring and Modes of Restructuring

- **Exploitation of favourable conditions in the market-** Relaxation in taxes and other changes motivate companies to go for expanding business beyond its geographical boundaries. Capital restructuring in the form of joint venture facilitate it to exploit favorable condition in the market
- **Financial Distress**
- **How to restructure and reorganise your business**
- Planning and communication are critical for any reorganisation and restructure. Getting top management involved in planning and executing any major changes can improve your chances of success.
- Remember to plan well ahead, assessing any risks, and setting flexible priorities and changing them with your circumstances.
- Research shows that reorganisations that involve employees are more successful than those that exclude them. Regular meetings with managers and employees should be scheduled to explain why the business is changing and how it will affect them.

Business Restructuring and Modes of Restructuring

- Ensure managers keep their teams focused during restructuring
- Build a change program team to take over some of the responsibilities
- Provide adequate resources for ensuring cultural change
- Set goals based on appropriate targets that are achievable
- Take accurate account of up-front and ongoing cost of planned changes
- Consider incentives to retain key employees
- Be flexible and ready to incorporate any unexpected changes

Business Restructuring and Modes of Restructuring

- **Financial restructuring** is the reorganization of the financial assets and liabilities of a corporation in order to create the most beneficial financial environment for the company.
- In some cases, the process of restructuring takes place as a means of allocating resources for a new marketing campaign or the launch of a new product line. When this happens, the restructure is often viewed as a sign that the company is financially stable and has set goals for future growth and expansion.
- The process of financial restructuring may be undertaken as a means of eliminating waste from the operations of the company. For example, the restructuring effort may find that two divisions or departments of the company perform related functions and in some cases duplicate efforts. Rather than continue to use financial resources to fund the operation of both departments, their efforts are combined. This helps to reduce costs without impairing the ability of the company to still achieve the same ends in a timely manner.
- In some cases, financial restructuring is a strategy that must take place in order for the company to continue operations. This is especially true when sales decline and the corporation no longer generates a consistent net profit. A financial restructuring may include a review of the costs associated with each sector of the business and identify ways to cut costs and increase the net profit.

Business Restructuring and Modes of Restructuring

- The restructuring may also call for the reduction or suspension of production facilities that are obsolete or currently produce goods that are not selling well and are scheduled to be phased out.
- Financial restructuring can be seen as a tool that can ensure the corporation is making the most efficient use of available resources and thus generating the highest amount of net profit possible within the current set economic environment

Business Restructuring and Modes of Restructuring

- **Important Regulations for Restructuring the business**
- **Securities Exchange Boards -** lay down certain rules and regulations for the implementation of restructuring share capital
- **Ministry of Company Affairs-** The conditions and steps to be followed under restructuring process are laid down by ministry of company affairs
- **Competition Act 2002-** The restructuring through joint venture and mergers & acquisitions needs to pass through the regulation of this act
- **Income tax Act 1961-** The act presents the norms related to tax on capital gain, tax on transfer of shares, tax on business income, carry forward of losses, stamp duty, service tax and value added tax

Business Restructuring and Modes of Restructuring

- **Characteristics of Business Restructuring**
- Changes in ownership and control of the business
- Reorganising financial aspects of the business. eg-debt restructuring
- Cash management and cash generation during crisis
- Sale of underutilized assets, such as patents or brands
- Asking for support from employees for salary reduction
- Giving part of the business on contract basis to third party. Eg- Outsourcing of operations such as payroll and technical support to a more efficient third party
- Moving of operations such as manufacturing to lower-cost locations
- Reorganization of functions such as sales, marketing, and distribution
- Renegotiation of labor contracts to reduce overhead
- A major public relations campaign to reposition the company with consumers

Business Restructuring and Modes of Restructuring

- **Modes of Restructuring**
- **Expansions:** The growth of the business lies in two modes
- **Internal expansion-** Introduction of new product, stopping low demanded product or replacement of obsolete goods. Does not require much attention of market and legal authorities
- **External expansion-** Firm enters into new business and acquire or merges with new business. Attention of market and government authorities is of prime importance and affects goodwill and long term sustainability of the business
- **For expansion there are four major modes of restructuring**
- **Mergers**
- It involves a combination of two firms such that only one firm survives
- To gain advantage of facilities and expertise of each other
- Board of directors have to take stakeholders approval
- Merger can take the form of :
  Horizontal merger- It involves two firms in similar businesses. The combination of two oil companies, for example would represent horizontal mergers

Business Restructuring and Modes of Restructuring

- **Vertical mergers-** It involves two or more firms involved in different stages of production or distribution of the same product to gain competitive advantage. Eg- Joining of a shoes manufacturing company and a shoes marketing company. Vertical merger may take the form of forward or backward merger.
- Backward merger- When a company combines with the supplier of material
- Forward merger- When a company combines with the distributor
- **Conglomerate merger-** Combination of firms engaged in unrelated lines of business. Eg- Merging of different businesses like manufacturing of FMCG products, steel products, electronic products, travelling services and advertising agencies
- **Acquisitions-** It means an attempts by one firm, called the acquiring firm to gain a majority interest in another firm called the target firm. There are a number of strategies that can be employed in corporate acuisitions like
- **Friendly takeovers-** The firm agrees to be acquired by other company
- **Hostile takeovers-** The firm is acquired forcefully
- **Reverse Acquisition-** When a private company acquires a public company

Business Restructuring and Modes of Restructuring

- **Tender offer-** One firm offers to buy the outstanding stock of other firm at a specific price and communicates this offer in advertisements and mailing to stockholders, bypassing the management and BOD of the firm. Not prevalent in India
- **Joint venture-** A contractual agreement joining together two or more parties for the purpose of executing a particular business undertaking. All parties agree to share in the profits and losses of the enterprise. It can be formed between companies of similar countries and can be formed between companies of different countries
- **Contractions:** Restructuring for contracting the business is done through
- **Spin-offs-** A spin off occurs when a subsidiary becomes an independent entity. The parent firm distributes shares of the subsidiary to its shareholders through a stock dividend
- **Splits-** This is an extension of a spin off, the firm splits into different business lines, distributes shares in these business lines to the original stockholders in proportion to their original ownership in the firm and then ceases to exist
- **Corporate Control**
- The buyback of shares is done by a company in order to reduce the number of shares in the market for controlling stake or to increase the value of shares

Business Restructuring and Modes of Restructuring

- **Why Restructuring fails?**
- Restructuring process involves higher cash expense which in results affects the present cash position of the firm. When the company fails to achieve planned targets, designed for restructuring, the restructuring process fails
- Lack of accounatbility
- Lack of experience of restructuring process
- **Cultural Issues-** Culture shock is one of the reason of failure of M&A deal. If cultural issues are not handled at right time conflict among employees may arise which may affect productivity and efficiency of the firm
- **Managerial Egos-** Disagreement between senior managers of the combining firm
- **Poor implementation**
- **Lack of knowledge of legal aspects of restructuring**
- **Improper Auditing-** Improper auditing of the target company
- **Improper Corodination-** between the restructing process and the employees as they are not aware

Financial Restructuring and Turnaround Strategies

- Turnaround is the process of corporate renewal and involves planning and analytical tools to save troubled companies and return them to solvent position
- To identify the reasons of financial distress
- **Characteristics of a successful turnaround plan**
  - Employment of Business Consultant, Turnaround specialist, Interim CEO/Turnaround CEO, Accounting firm, Legal firm and Public Relations Firm
  - Predicting financial distress through ratio analysis
  - Considering financial and non-financial aspects of the business
  - Expert turnaround team- business knowledge, expertise and experience
- **Turnaround Strategies**
  - **Revenue Enhancement-** Improvement of systems, processes and technology
  - **Cost Reduction**
  - **Asset Reduction-** Portfolio disinvestment through selling off assets is used as mechanism to raise cash for the turnaround

Financial Restructuring and Turnaround Strategies

- **The 3 Stages Of Turnaround Management**
- **Stage 1 – Assess Viability**
- This consists of a high level and detailed investigation of the business and its situation
- The investigation acquires a wide range of information including: current and historical financials (P&L, balance sheet, cash flow)
- assess if business issues are controllable
- assess if ongoing business is viable
- develop SWOT analysis to provide clarity on options.
- This is summarised to provide decision-makers with a concise assessment, including options, risks and priorities to consider in implementing a turnaround.
- **Stage 2 – Stabilise and Develop Strategy**
- Once the issues and priorities have been identified and agreed to, Stage 2 focuses on stabilising the business and planning the recovery strategy.
- **Stage 3 – Implementation and Monitoring**

Green field ventures & venture Funding

- **Greenfield venture**
- It is the establishment of new venture from scratch
- Greenfield ventures are slower to establish and highly risky(risk of failure of the company)
- It occurs when multinational corporations enter into developing countries to build new factories
- Huge investment is required
- Developing countries often offer prospective companies tax-breaks, subsidies and other incentives to set up green field ventures as jobs are created and knowledge and technology is gained to boost the country's human capital
- Venture capitalists are experts and are able to advice firms in various issues involved in development of the business
- **Forms of Venture Capital**
- **Equity Participation-** Venture capital finances a percentage of the equity capital and the ownership remains with the entrepreneur
- **Conditional Loan-** It is repayable in the form of royalty after venture is able to generate sales and no interest is paid

Green field ventures & venture Funding

- **Conventional Loan-** Lower rate is charged until operational activities get started, after which normal interest is paid and loan is to be repaid as per the agreement
- **Income notes-** Entrepreneur has to pay both interest and royalty on sales at low rates
- **Analysis of Greenfield ventures**
- **Analysis of financial aspects of the proposed greenfield venture-** sufficient gains in the form of either capital gain or fixed interest
- **Technical aspects of the project**
- ✓ Licensing/registration requirements
- ✓ Availability of the basic infrastructure- land, building, power, water etc
- ✓ Type of technology used- does it require upgradation
- ✓ What type of suppliers firm has in its panel
- ✓ Study of process
- ✓ Whether the firm has repair and maintenance centre

Green field ventures & venture Funding

- **Economical and political viability analysis-** If project is affected by any government policy and rules, then it may be constraint in implementation of project and venture will not be profiatble to satisfy customers
- **Analysis of management expertise and experience**
- **Commercial viability**
- ✓ Firm should study the market to understand the type of product or sevice market demanded
- ✓ Eg- ITC launched “Bingo” to capture and penetrate the existing market where “Lays” or similar products are known and are much in demand so only strong advertisement and distribution networks were required
- ✓ **Difference between Greenfield venture and Acquisition**

Green field ventures & venture Funding

- **Venture Capital**
- It is a source of equity financing for rapidly-growing private companies
- Helps in developing entrepreneurial skills
- It doesn’t require any collateral and interest charge and return for venture capitalist will be long term capital gain rather than immediate and regular interest payments
- Facilitate in translating ideas into reality
- **Investment in high-risk, high-returns ventures:** As VCs invest in untested, innovative ideas the investments entail high risks.
- **Participation in management:** Besides providing finance, venture capitalists may also provide technical, marketing and strategic support. To safeguard their investment, they may also at times expect participation in management.

Green field ventures & venture Funding

- **Expertise in managing funds:** VCs generally invest in particular type of industries or some of them invest in particular type of businesses and hence have a prior experience and contacts in the specific industry which gives them an expertise in better management of the funds deployed.
- **Raises funds from several sources:** A misconception among people is that venture capitalists are rich individuals who come together in a partnership. In fact, VCs are not necessarily rich and almost always deal with funds raised mainly from others. The various sources of funds are rich individuals, other investment funds, pension funds
- **Diversification of the portfolio:** VCs reduce the risk of venture investing by developing a portfolio of companies and the norm followed by them is same as the portfolio managers, that is, not to put all the eggs in the same basket.
- **Exit after specified time:** VCs are generally interested in exiting from a business after a pre-specified period. This period may usually range from 3 to 7 years.

Green field ventures & venture Funding

- **Disadvantages of venture capital**
  - Most venture capitalists seek to realise their investment in a company in three to five years. If an entrepreneur's business plan contemplates a longer timetable before providing liquidity, venture capital may not be appropriate. Entrepreneurs should also consider:
    Intrusion - Venture capitalists are more likely to want to influence the strategic direction of the company.
    Control - Venture capitalists are more likely to be interested in taking control of the company if the management is unable to drive the business.

Green field ventures & venture Funding

- ***Stages of venture capital fund***
- ***Seed Capital*** – If your business is still in the idea stage and you have yet to perform feasibility studies, market research, and product development, you probably are in need of seed money in order to continue getting your business idea into fruition.
- ***Start-up Capital*** – A business that has performed studies and research into their chosen market and is ready to take their product into the public is prepared to receive start-up capital from venture capitalists. Start-up money can help with the initial marketing push, helping to distribute your product in the market.
- **Additional Finance-** At any point of time when firm required additional funds to meet its production or marketing needs or any other need, additional funds will be provided to meet additional expense
- **Expansion**
- Expansion capital is for businesses already in or ready to start production today. The amounts that venture capitalists usually invest in expansion companies range from $500,000 to $5 million.

Green field ventures & venture Funding

- There are usually four stages to expansion capital:
- ***1st Stage*** – 1st stage funding is used towards full-scale production of a product.
- ***2nd Stage*** – Usually for companies in production and generating revenue, but not yet making a profit, second stage capital helps to grow receivables, inventory, etc.
- ***3rd Stage*** – Third stage, or "mezzanine" financing, helps businesses perform major expansion and perhaps even develop and introduce new products.
- ***4th Stage*** – Also known as "Bridge Financing," companies in this stage are in need of capital to help smooth the way to a potential IPO within about six to twelve months.

➢ **Acquisition/Buyout**

- A company in this stage has advanced operations and is prepared to acquire another competing company as a subsidiary, or expand into new markets and products with the purchase of an existing company. Monies for this type of capital can range from $3 million up to $20 million.

Green field ventures & venture Funding

- **Challenges faced by venture capitalist**
- High capital gain tax- This is the only return venture capitalists get and imposing tax on such gains demoralise them
- Limited exit options are available to venture capital funds to liquidate their investment as there is no market for trading in unlisted securities
- Shortage of expert venture capitalist
- Lack of long term finance for venture capital companies through public financial institutions
- Lack of awareness of availability of venture capital finance from private and public financial institution
- High level of risk is an important challenge for financial institutions to get into such field
- Venture capital is still not regarded as commercial activity as its scope is restricted to hi-tech projects

Green field ventures & venture Funding

- The following points can be considered as the harbingers of VC financing :-
- Existence of a globally competitive high technology.
- Globally competitive human resource capital.
- Second Largest English speaking, scientific & technical manpower in the world.
- Vast pool of existing and ongoing scientific and technical research carried by large number of research laboratories.
- Initiatives taken by the Government in formulating policies to encourage investors and entrepreneurs.

Consolidation Strategies

- **Consolidation-** Consolidation or amalgamation is the act of merging many things into one. In business, it often refers to the mergers and acquisitions of many smaller companies into much larger ones.
- **Types of business amalgamations**
- **Statutory Merger**: a business combination that results in the liquidation of the acquired company's assets and the survival of the purchasing company.
- **Statutory Consolidation**: a business combination that creates a new company in which none of the previous companies survive.
- **Stock Acquisition**: a business combination in which the purchasing company acquires the majority, more than 50%, of the Common stock of the acquired company and both companies survive.
- **Amalgamation:** Means an existing Company which is taken over by another existing company. In such course of amalgamation, the consideration may be paid in "cash" or in "kind", and the purchasing company survives in this process.

Consolidation Strategies

- **Process of Consolidation**
- **Planning and developing strategies-** Plan for M&A and analyse the strength and weaknesses of such deal. Company needs to convince its shareholders and employees for the positive future aspects of the deal
- **Analysis of alternatives-** Analysis of alternatives will include valuation of alternative firms
- **Choosing target firm-** After analysis of all the firms, target firm will be selected on the basis of objective of acquiring firm
- **Approaching target firm-** If the proposal is acceptable, target firm will enter into agreement and deal will finalise
- **Post consolidation performance analysis**

Consolidation Strategies

- **Consolidation strategies**
- **Expansion of the firm-** To expand the firm and maximise the market share. It can be manifested in any of the following motives for acquisition
- **Managerial self-interest-** When consolidation is of manager's interest, they put their best efforts to take target firm even when it cost billion of rupees. Managers are also motivated to go for consolidation when their compensation or rewards depend upon successful merger or acquisition or for expanding market share
- **Building image-** Top managers interests lies in building image and aim to make firm largest and most dominant in the industry
- **Create operating or financial synergy-** Operating and financial advantages from M&A are the main advantages or motivation to get into consolidation. Synergy is the potential additional value from combining two firms. **Operating advantages from consolidation includes-**
- **Economies of scale-** Operational capacity of combined firm increases which leads it to be cost efficient and profitable
- **Minimise competition-** M&A reduces competition if done in related industry. Thus pricing power and higher market share will result in higher margins and operating income
- **Higher development**

Consolidation Strategies

- **Financial advantages from consolidation includes-**
- A combination of a firm with excess cash(and limited project opportunities) and a firm with high return projects(and limited cash) can give a payoff in terms of higher value for the merged firm
- A combination of firms where earning of one firm is higher and of other is lower will lead to tax advantage for merged firm. Only those firms will be target firms where earnings are low not because of operational losses but because of more investments in fixed assets
- Combination of two major firms will improve the market value of the firm and thus company's image in the market will be improved, which will facilitate in raising funds from the market
- **Reduction in risk-** Diversification helps to reduce risk and maximise the returns as resources and funds of two firms can be combined
- **Acquisition of undervalued firms-** Firms are undervalued by market but not in actual. Buying an undervalued firm is easier as the cost of purchase will be less

Consolidation Strategies

- **Consolidation of low performing or new entities-** Highly motivated entrepreneurs find low performing firms as a challenge to manage. Factors need to be considered while developing strategies for such consolidation:
- The reason of low performance of target firm should be internal one i.e management control, low productivity and sales. Industry related factors will not be considered for calling any firm low performing for the purpose of consolidation
- The market price of the share of low performing firm should reflect the poor management control and any such internal factor

Transfer pricing and interface with strategic cost management

- **Transfer Pricing**
- Transfer Pricing is the price that is assumed to have been charged by one part of a company for products and services it provides to another part of the same company, in order to calculate each division's profit and loss separately.
- **Objectives of Transfer Pricing**
- To determine an optimum price to be charged from other center to resolve conflict between two responsibility centers
- To measure economic performance of the individual business units
- To administer the revenue and expenditure of each business unit
- To make all the individuals of the organisation a part of revenue generation team
- To promote uniformity of goal of every center of the firm

Transfer pricing and interface with strategic cost management

- **Methods of Transfer Pricing**
- **Market Price-based transfer price-** This will use market price prevailing in the market for the product. The following conditions should exist-
- Such price should exist in the market. If the product sold in the market has no competitor and no market rate is applicable then this method will not be used
- The product which needs to be transferred from one unit to other should have competitor in the market with which comparisons can be made
- The buying and selling units should have freedom of taking decision regarding whether to sell or not. Buying unit if it feels that it cannot afford price offered by selling unit or same product can be bought from the market at lower price, the unit will be free to decide for buying from outside
- The negotiation team should be competent enough to decide for the market based transfer price
- Parties involved in transfer pricing decision should have full knowledge and information about the alternatives available in the market and cost and revenue of product prevailing in market

Transfer pricing and interface with strategic cost management

- **Problems involved in Market Price-based transfer price**
  - The existence of internal capacity may limit development of external sales
  - If the seller is the sole producer of the product or no outside source exists, getting market price would be difficult
  - If the product is affected by inflation in the market, that will be reflected in transfer pricing also
  - Transfer pricing will not differentiate the price of product from the market. Thus may not motivate the seller or buyer to take initiative in producing or selling intermediate products within the organisation
  - Giving freedom to the selling or buying units to decide for choosing market may also create problem
- **Cost plus transfer price-** In order to remove the problem of absence of market price cost plus transfer pricing method is used. Selling price is sum of cost of production and profit

Transfer pricing and interface with strategic cost management

- **Negotiated price-** When transactions are limited and temporary, the transfer price will be selected by expert committee on the basis of their knowledge and experience
- **Two step pricing**
- For each unit sold, a charge is made that is equal to the standard variable cost of production and
- a periodic charge is made that is equal to the fixed costs associated with the facilities reserved for the buying unit.
- Both components should include a profit margin
- **Comparable uncontrolled price method-** CUP method compares the price charged for property transferred in a controlled transaction to the price charged for property transferred in a comparable uncontrolled transaction in comparable circumstances. If there is any difference between the two prices, this may indicate that the conditions of the commercial and financial relations of the associated enterprises are not arm's length.
- What is Meaning of arm's length

Transfer pricing and interface with strategic cost management

- **Administration of Transfer Pricing**
- **Negotiation-** Transfer prices are set in mutual agreement with each other to remove chances of conflicts
- **Classification of Product-** If the product is of special nature and large in quantity, senior management will take the decision and maintain a control over the price. If the product can be produced outside or relatively small volume, transfer pricing can be done at market price.
- **Conflict Resolution Technique-** One representative will be from buying center and other from selling unit and one person will head these two representatives.

Tax treaties and double tax avoidance agreements

- **Double tax avoidance agreement**
- **Double taxation** is the imposition of two or more taxes on the same income (in the case of income taxes), asset (in the case of capital taxes), or financial transaction (in the case of sales taxes).
- It is not unusual for a business or individual who is resident in one country to make a taxable gain (earnings, profits) in another. This person may find that he is obliged by domestic laws to pay tax on that gain locally and pay again in the country in which the gain was made. Since this is inequitable, many nations make bilateral **double taxation agreements** with each other. In some cases, this requires that tax be paid in the country of residence and be exempt in the country in which it arises. In the remaining cases, the country where the gain arises deducts taxation at source and the taxpayer receives a compensating foreign tax credit in the country of residence to reflect the fact that tax has already been paid. To do this, the taxpayer must declare himself (in the foreign country) to be non-resident there.
- **Double tax agreement** is defined as an agreement between two or more countries for the removal of double taxation on same income
- The objective of such agreement is to have uniformity in taxation system and promote trade and commerce

Tax treaties and double tax avoidance agreements

- **Classification**
  Double taxation avoidance agreements, depending on their scope, can be classified as Comprehensive and Limited.
- **Comprehensive Double Taxation Agreements** provide for taxes on income, capital gains and capital. Comprehensive agreements ensure that the taxpayers in both the countries would be treated equally and on equitable basis, in respect of the problems relating to double taxation
- **Limited Double Taxation Agreements** refer only to income from shipping and air transport, or estates, inheritance and gifts.
- **Objectives of Double Taxation Avoidance Agreement**
- First, they help in avoiding and alleviating the adverse burden of international double taxation, by -
  a) laying down rules for division of revenue between two countries;
  b) exempting certain incomes from tax in either country ;
  c) reducing the applicable rates of tax on certain incomes taxable in either countries
- Secondly, and equally importantly tax treaties help a taxpayer of one country to know with greater certainty the potential limits of his tax liabilities in the other country.

Tax treaties and double tax avoidance agreements

- Still another benefit from the tax-payers point of view is that, to a substantial extent, a tax treaty provides against non-discrimination of foreign tax payers or the permanent establishments in the source countries vis-à-vis domestic tax payers.
- To promote and motivate international trade by removing or minimising double tax barriers

Tax treaties and double tax avoidance agreements

- **Methods of Eliminating Double Taxation**
- **Exemption Method –** Method of avoiding double taxation for the residence country to altogether exclude foreign income from its tax base. The country of source is then given exclusive right to tax such incomes.
- **Credit Method**
  Resident remains liable in the country of residence on its global income, however as far the quantum of tax liabilities is concerned credit for tax paid in the source country is given by the residence country against its domestic tax as if the foreign tax were paid to the country of residence itself.
- **Tax Sparing**- Tax sparing gives right to investor to protect his/her benefits of tax incentives available in India. Tax credit is allowed by the country of its residence, not only in respect of taxes actually paid by it in India but also in respect of those taxes India forgoes due to its fiscal incentive provisions under the Indian Income Tax Act

Introducing the Strategy maps

- Strategy maps are connected with the Balanced Scorecard and make a good combination.
- However can be used as stand alone system.

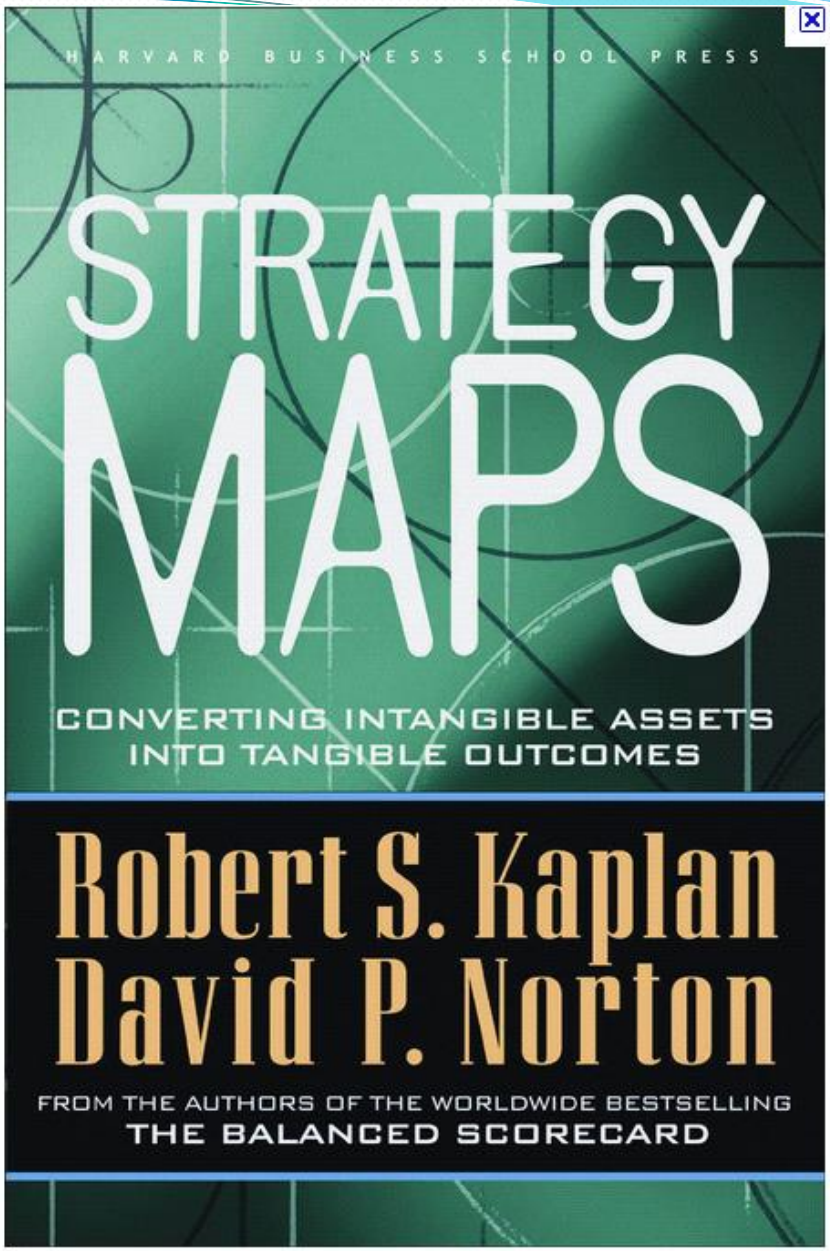
TOOLBOX 1

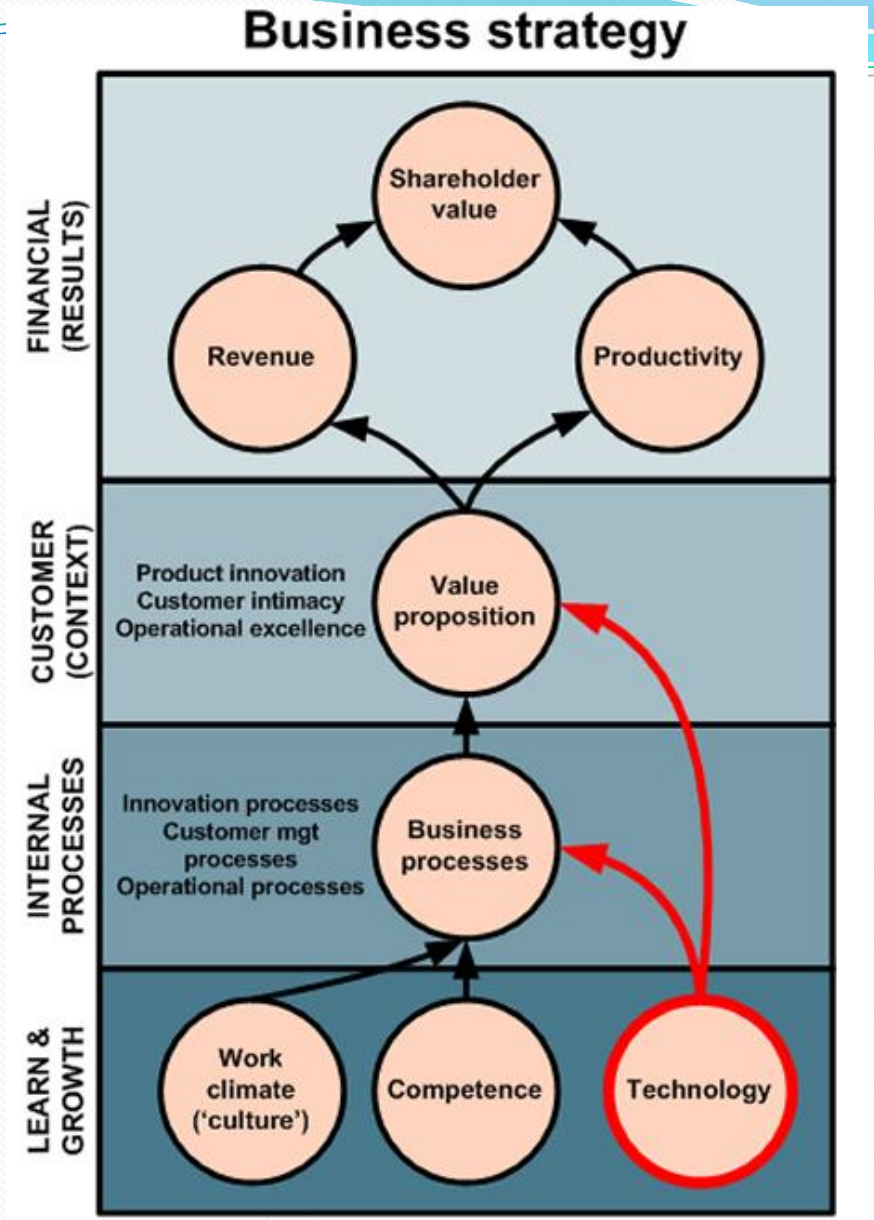
Exercise / Toolbox 1 Strategy Statement "Profit (Value, Cost) - Cash - Risk" Impact Matrix

To give our team guidance on managing costs and budget we need to develop some simple statement that describes our strategy – Managers should make their decisions with this statement in mind.

Google could have a statement about – better reliably providing more effective search result

Your Sentence....

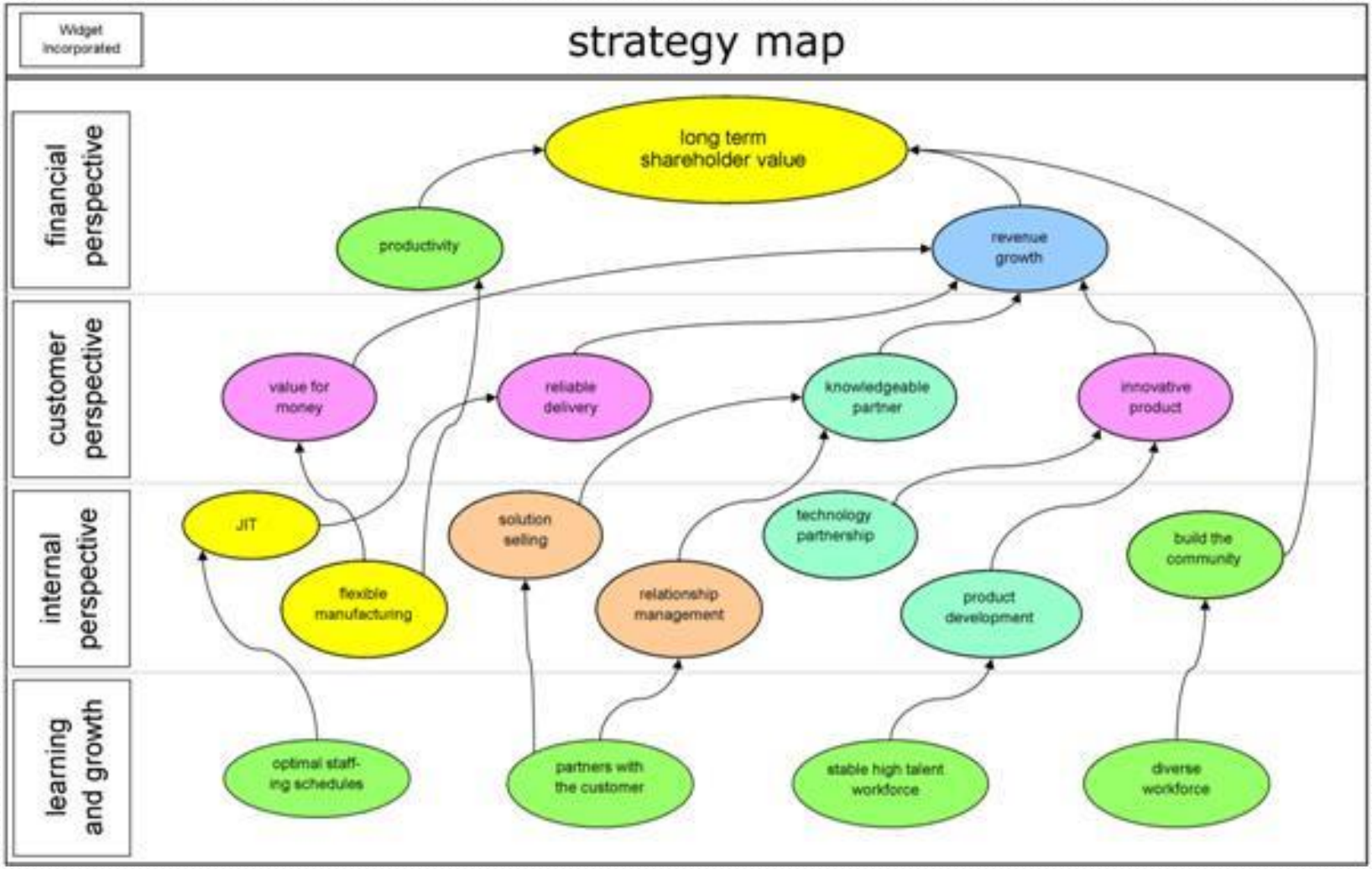

HARVARD BUSINESS SCHOOL PRESS
STRATEGY MAPS
CONVERTING INTANGIBLE ASSETS INTO TANGIBLE OUTCOMES
Robert S. Kaplan
David P. Norton
FROM THE AUTHORS OF THE WORLDWIDE BESTSELLING
THE BALANCED SCORECARD


Business strategy
FINANCIAL (RESULTS)
Shareholder value
Revenue
Productivity
CUSTOMER (CONTEXT)
Product innovation
Customer intimacy
Operational excellence
Value proposition
INTERNAL PROCESSES
Innovation processes
Customer mgt processes
Operational processes
Business processes
LEARN & GROWTH
Work climate ('culture')
Competence
Technology

CAUSE & EFFECT Diagram

- What we need to deliver in one “perspective” to effect another “perspective” to deliver..
- Ultimate to deliver our corporate objectives – Shareholder Value?
- Underpinned by our values, driven by our mission and vision

The strategy map – a ‘picture’ of the strategy’



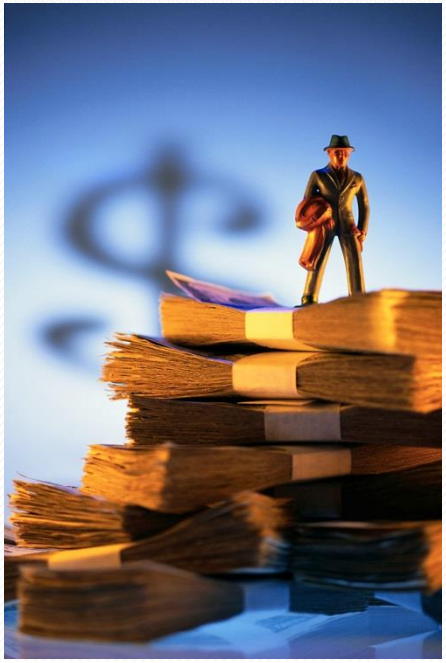
The agency problem and corporate governance

- Class discussion
- What do we mean by agency?
- What is corporate governance?

Planning requirements and working capital

- Planning requirements and managing cashflow is what keeps a company afoat.

Managing Cash Flow& Working Capital



Cash Management

- Common cause of business failure: Cash crisis!
- A business can be earning a profit and be forced to close because it runs out of cash!
- NFIB study:
  - 67 percent of small business owners have at least occasional problems managing cash flow.
  - 19 percent report cash flow as a continuing problem.

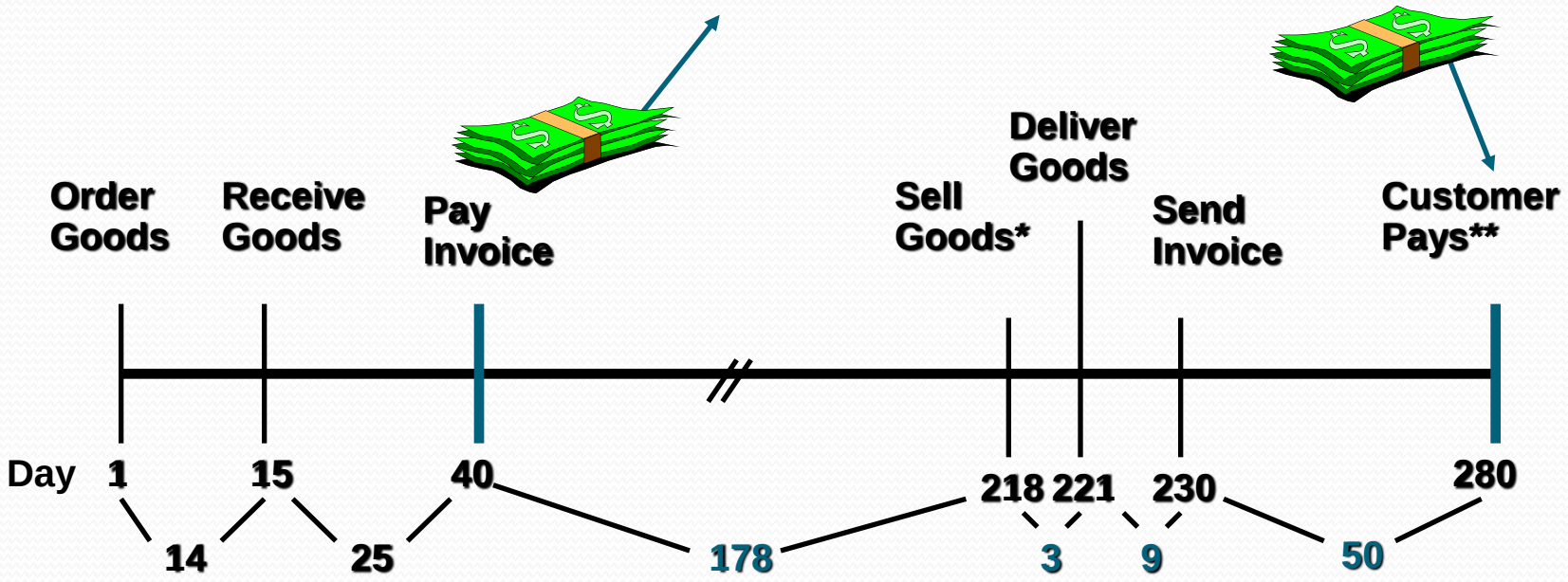


Cash Management

- Cash management – forecasting, collecting, disbursing, investing, and planning for the cash a company needs to operate smoothly.
- Young, growing companies are “cash sponges.”
- Know your company’s cash flow cycle.



The Cash Flow Cycle



Cash Flow Cycle = 240 days

* Based on Average Inventory Turnover:

$$\frac{365 \text{ days}}{2.05 \text{ times/year}} = 178 \text{ days}$$

** Based on Average Collection Period:

$$\frac{365 \text{ days}}{7.31 \text{ times/year}} = 50 \text{ days}$$

Five Cash Management Roles of an Entrepreneur

- Cash Finder
- Cash Planner
- Cash Distributor
- Cash Collector
- Cash Conserver



Cash Flow

Increase in Cash

Decrease in Cash



Leakage

Cash

Accounts Receivable

Accounts Payable

Cash Sales

Production/Cash Purchases

Inventory

Leakage



The Cash Budget

- A “cash map,” showing the amount and the timing of a firm's cash receipts and cash disbursements over time.
- Predicts the amount of cash a company will need to operate smoothly.
- A helpful tool for visualizing the firm's cash receipts and cash disbursements and the resulting cash balance.



Preparing a Cash Budget

- Determine a Minimum Cash Balance
- Forecast Sales
- Forecast Cash Receipts
- Forecast Cash Disbursements
- Estimate End-of-Month Cash Balance



Determine a Minimum Cash Balance

- Remember Goldilocks, the Three Bears, and the porridge:
  - **Not too much...**
  - **not too little...**
  - **but a cash balance that's just right ... for you!**



Forecast Sales

- The *heart* of the cash budget.
- Sales are ultimately transformed into cash receipts and cash disbursements.
- Cash forecast is only as accurate as the sales forecast from which it is derived.
- "Lumpy" sales patterns are common.
  - 15 percent to 18 percent of wine and spirits shops' annual sales occur between December 15 and 31.
  - 40 percent of toy sales take place in last 6 weeks of the year.

Forecast Sales

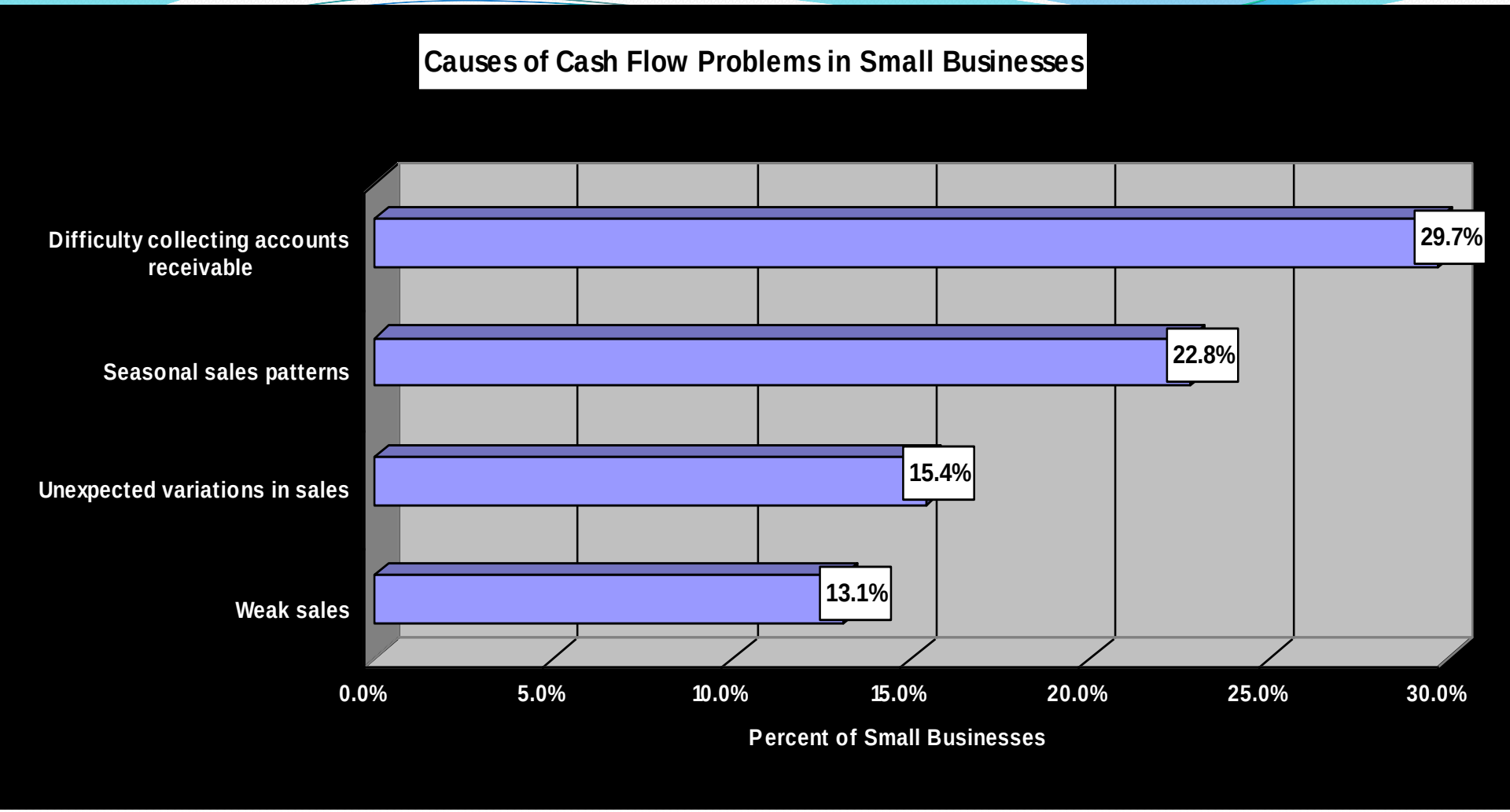
- Prepare three sales forecasts:
  - Most Likely
  - Pessimistic
  - Optimistic



Sales Forecast for a Start-Up

Example:

Number of cars in trading zone	84,000
x Percent of imports	x 24%
= Number of imported cars in trading zone	20,160
Number of imports in trading zone	
20,160	
x Average expenditure on repairs	x $485
= Total import repair sales potential	$9,777,600
Total import repair sales potential	$9,777,600
x Estimated market share	x 9.9%
= Sales estimate	$967,982

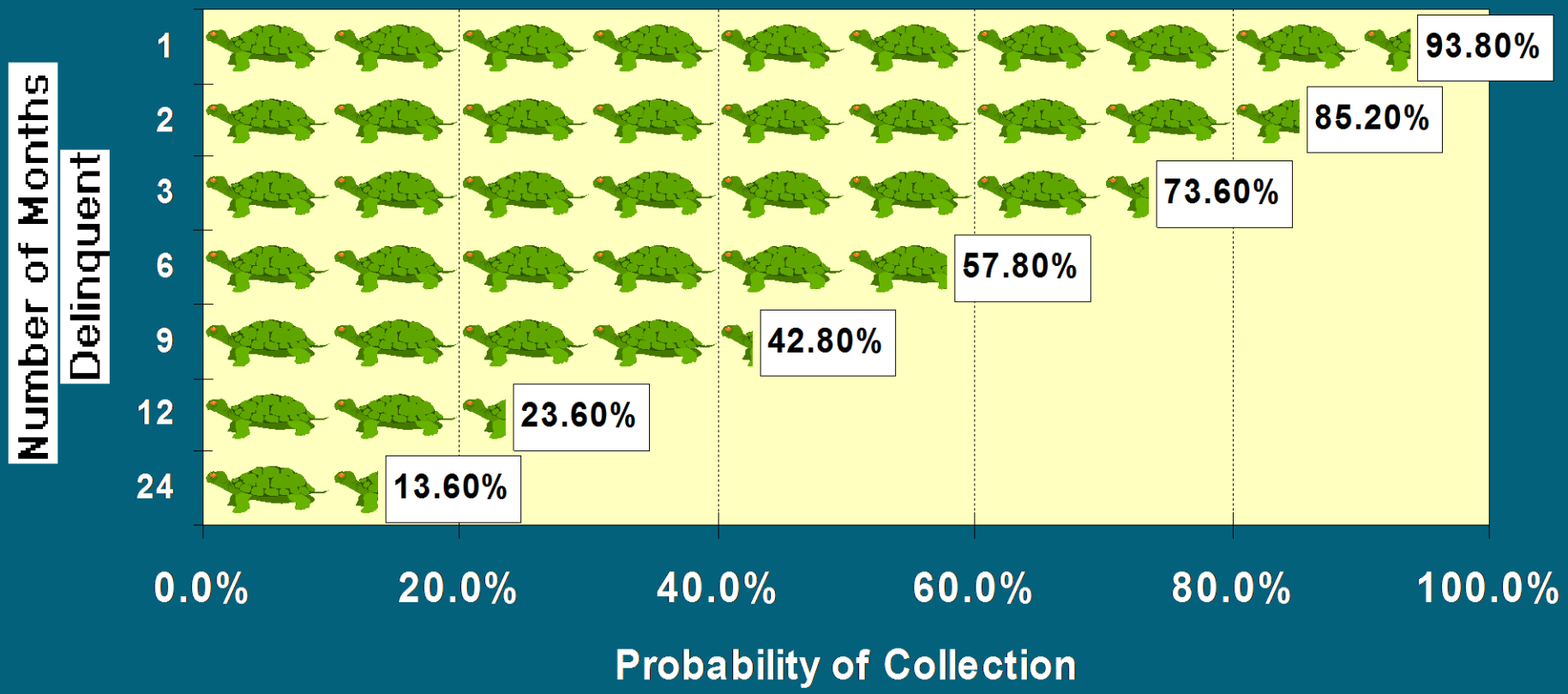

Causes of Cash Flow Problems in Small Businesses
Difficulty collecting accounts receivable
Seasonal sales patterns
Unexpected variations in sales
Weak sales
29.7%
22.8%
15.4%
13.1%
0.0%
5.0%
10.0%
15.0%
20.0%
25.0%
30.0%
Percent of Small Businesses

Forecast Cash Receipts

- Record all cash receipts when *actually received* (i.e., the cash method of accounting).
- Determine the collection pattern for credit sales; then add cash sales.
- Monitor closely slow and nonpayers.



Collecting Delinquent Accounts



Forecast Cash Disbursements

- Record disbursements when you expect to make them.
- Start with those disbursements that are fixed amounts due on certain dates.
- Review the business checkbook to ensure accurate estimates.
- Add a cushion to the estimate to account for "Murphy's Law."
- Don't know where to begin? Try making a *daily* list of the items that generate cash and those that consume it.

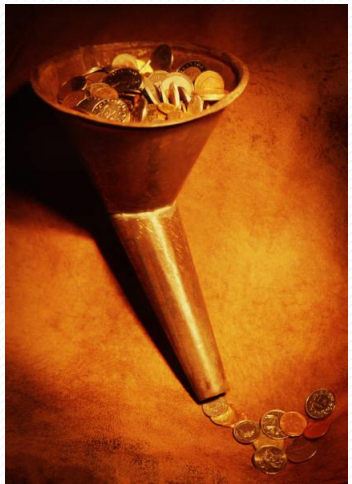
Estimate End-of-Month Balance

- Take Beginning Cash Balance…
- Add Cash Receipts…
- Subtract Cash Disbursements
- Result is Cash Surplus or Cash Shortage (Repay or Borrow?)



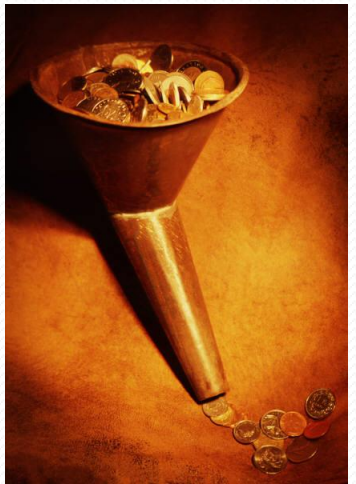
Benefits of Cash Management

- Increase amount and speed of cash flowing into the company
- Reduce the amount and speed of cash flowing out
- Make the most efficient use of available cash
- Take advantage of money-saving opportunities such as cash discounts
- Finance seasonal business needs



Benefits of Cash Management

- Develop a sound borrowing and repayment program
- Impress lenders and investors
- Reduce borrowing costs by borrowing only when necessary
- Provide funds for expansion
- Plan for investing surplus cash



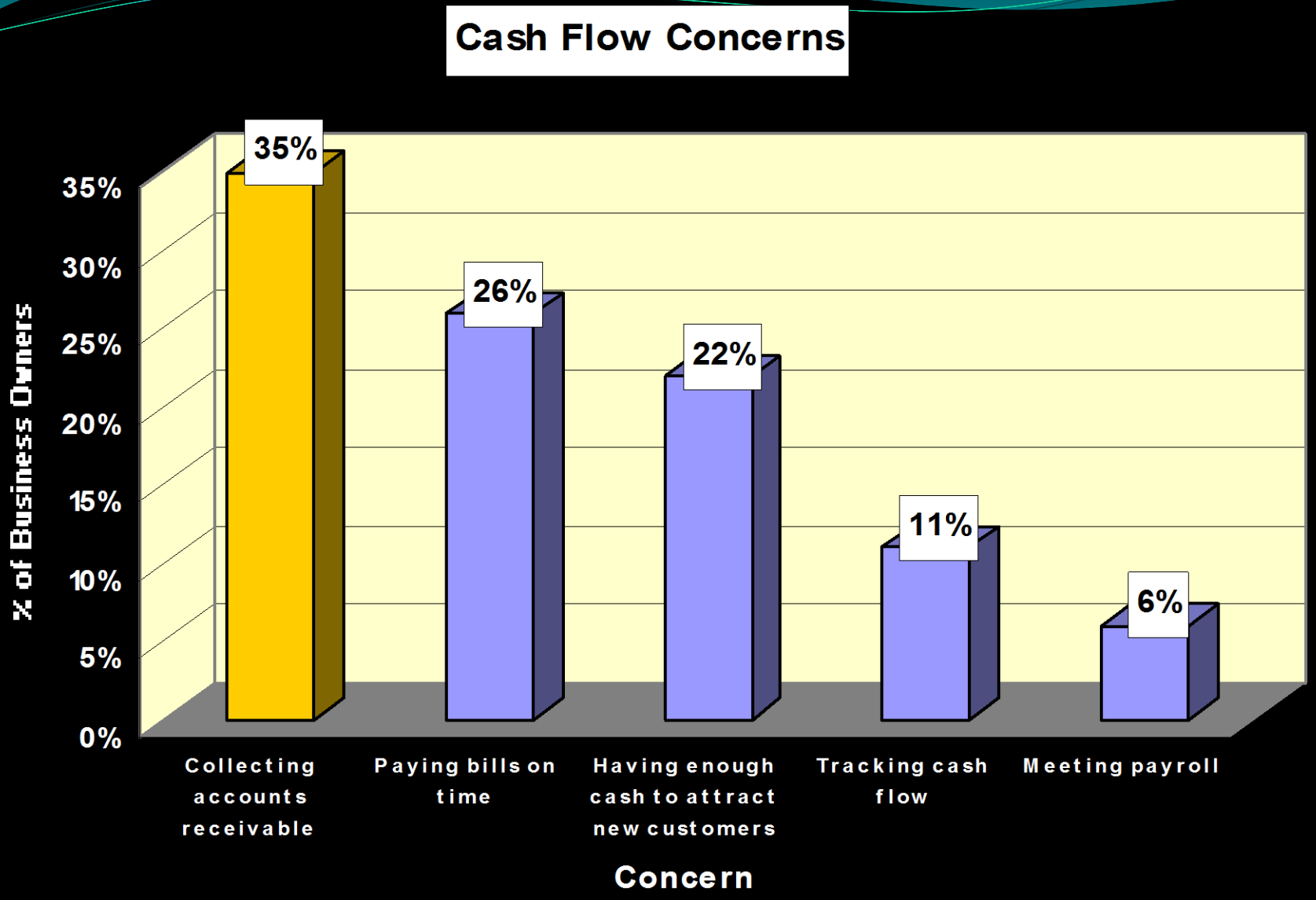
The "Big Three" of Cash Management

- Accounts Receivable
- Accounts Payable
- Inventory



Accounts Receivable

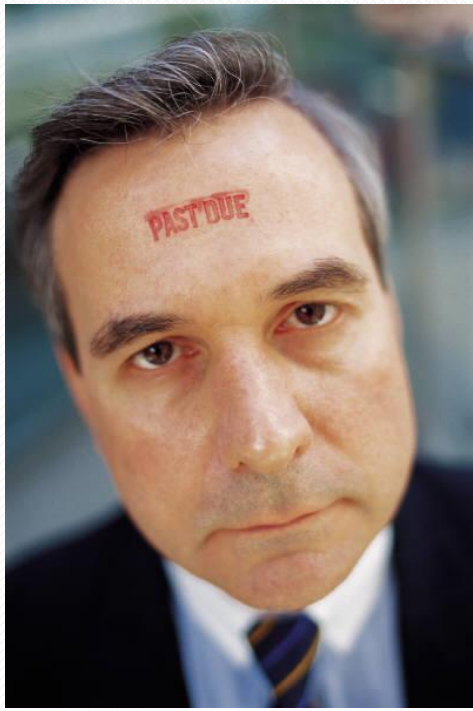
- About 90 percent of industrial and wholesale sales are on credit, and 40 percent of retail sales are on account.
- Survey of small companies across a variety of industries found that 77 percent extend credit to their customers.
- Remember: "A sale is not a sale until you collect the money."
- The goal with accounts receivable is to collect your company's cash as fast as you can.


Cash Flow Concerns
% of Business Owners
35%
30%
25%
20%
15%
10%
5%
0%
35%
26%
22%
11%
6%
Collecting accounts receivable
Paying bills on time
Having enough cash to attract new customers
Tracking cash flow
Meeting payroll
Concern

Beating the Cash Crisis

Accounts Receivable

- Establish a firm credit-granting policy.
- Screen credit customers carefully.
- When an account becomes overdue, take action *immediately*.
- Add finance charges to overdue accounts (check the law first!).
- Develop a system of collecting accounts.
- Send invoices promptly.



Accelerating Accounts Receivable

- Ask customers to fax or e-mail orders
- Send invoices when goods are shipped
- Highlight the due date on invoices
- Restrict customers' credit until past-due bills are paid
- Deposit checks and credit card receipts daily



Accelerating Accounts Receivable

- Identify the top 20 percent of your customers and monitor them closely
- Ask customers for up-front payments
- Watch for signs that a customer may be about to declare bankruptcy
- Consider using a lockbox service
- Track the results of your company's collection efforts



Beating the Cash Crisis

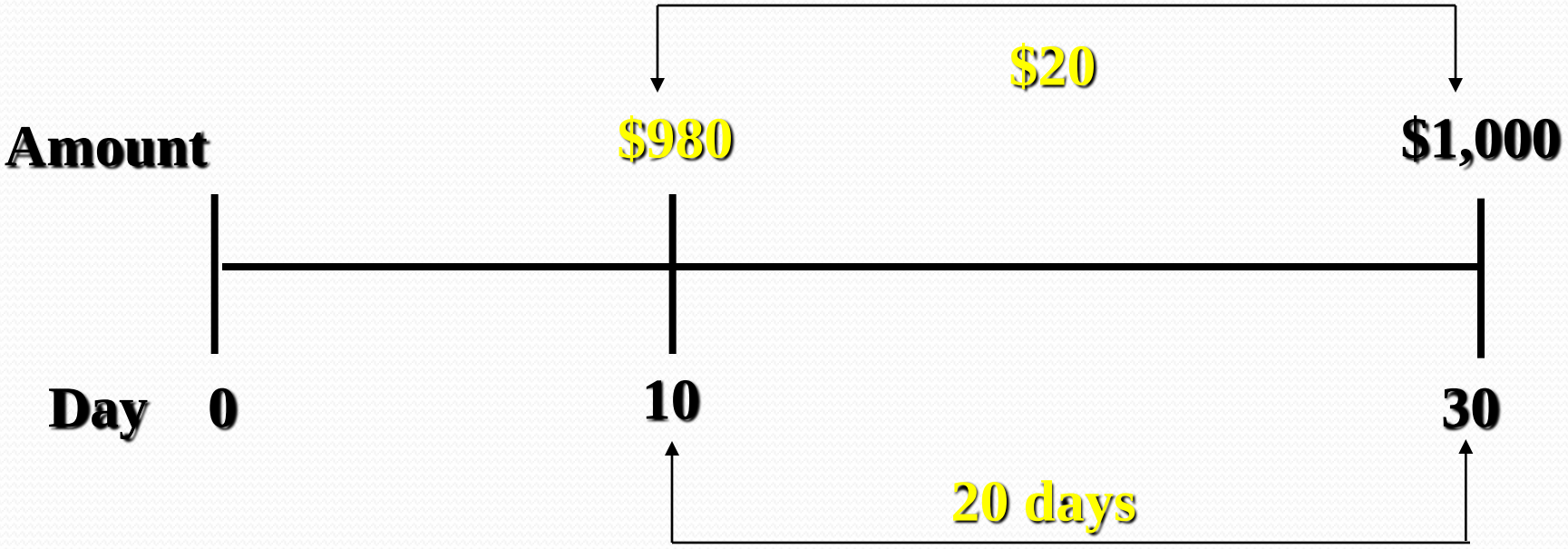
Accounts Payable

- Stretch out payment times as long as possible *without damaging your credit rating*.
- Verify *all* invoices before paying them.
- Take advantage of cash discounts.



The Cost of Forgoing a Cash Discount

$1,000 invoice 2/10, net 30



$$R = \frac{I}{P \times T} = \frac{\$20}{\$980 \times 20/360} = 36.7\%$$

Beating the Cash Crisis

Accounts Payable

- Negotiate the best possible terms with your suppliers.
- Be honest with creditors; avoid the "the check is in the mail" syndrome.
- Schedule controllable cash disbursements to come due at different times.
- Use credit cards wisely.



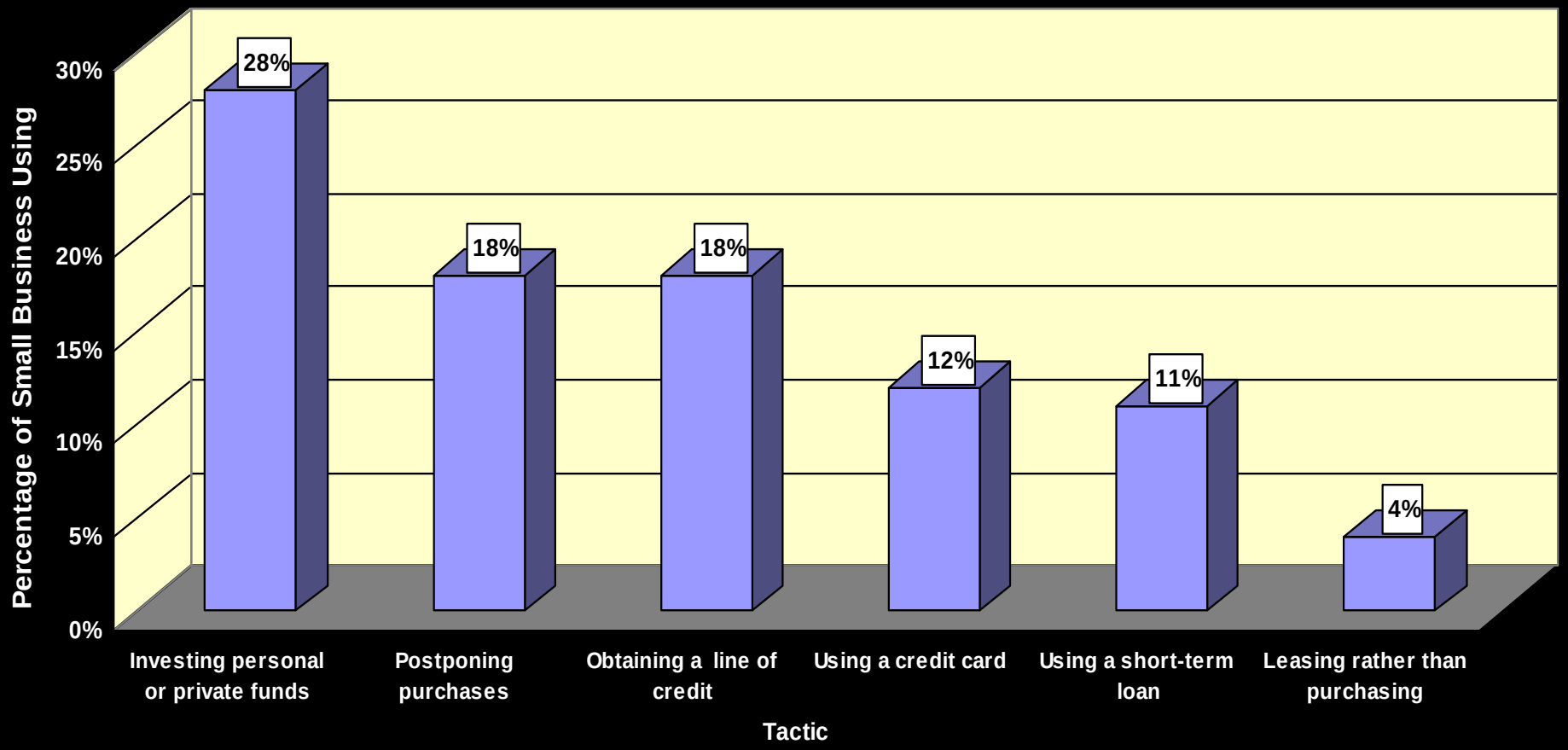
Beating the Cash Crisis

Inventory

- Monitor it closely; it can drain a company's cash.
- Avoid inventory "overbuying." It ties up valuable cash at a zero rate of return.
- Arrange for inventory deliveries at the latest possible date.
- Negotiate quantity discounts with suppliers when possible.



Coping with a Cash Crunch
Tactics Used by Small Businesses



Avoiding the Cash Crunch

- Consider bartering, exchanging goods and services for other goods and services, to conserve cash.
- Trim overhead costs. For example:
  - Ask for discounts and "freebies"
  - Periodically evaluate expenses
  - Lease rather than buy
  - Avoid nonessential cash outlays
  - Negotiate fixed loan payments to coincide with your company's cash flow



Avoiding the Cash Crunch

- Trim overhead costs. For example:
  - Buy used equipment
  - Hire part-time employees and freelancers
  - Outsource nonessential activities
  - Control employee advances and loans
  - Establish an internal security and control system
  - Devise a method for fighting check fraud
  - Change shipping terms
  - Start selling gift cards
  - Switch to zero-based budgeting



Avoiding the Cash Crunch

- Be on the lookout for employee theft
- Keep your business plan current
- Invest surplus cash



Planning to reduce costs

- To survive and be competitive organisations need to control costs.

Reduce Needless..
(needless = non value adding)

- Complexity
- Variety
- Choice – “Any colour, so long as it is black”
- Activity

Opportunities to “Rationalise”

- Product
- Customers
- Supplies
- Processes
- Places
- People – less work – less people – less cost

Product

- Complexity –range / options / components
- Variety
- 80/20 Rule – most sales (and perhaps profits from a few products?)
- Standardise
- If you cannot standardise – Use “Late differentiation”

Customers

- Are small customers / jobs profitable?
- Are some sectors' customers' requirements too onerous to be profitable?
- Can we measure customers' profitability?
- Can we serve unprofitable customers differently?
- 80/20 Rule – most sales (and perhaps profits from a few customers?)

Suppliers

- Do we have too many suppliers?
- How much does it cost us working with our suppliers?

Place - Location

- Fewer places?
- Cheaper place?

Process

- Can we make processes simpler?
- Reduce processes
- Can we outsource work to others who do it better?

Fewer Purchase Orders & Invoices

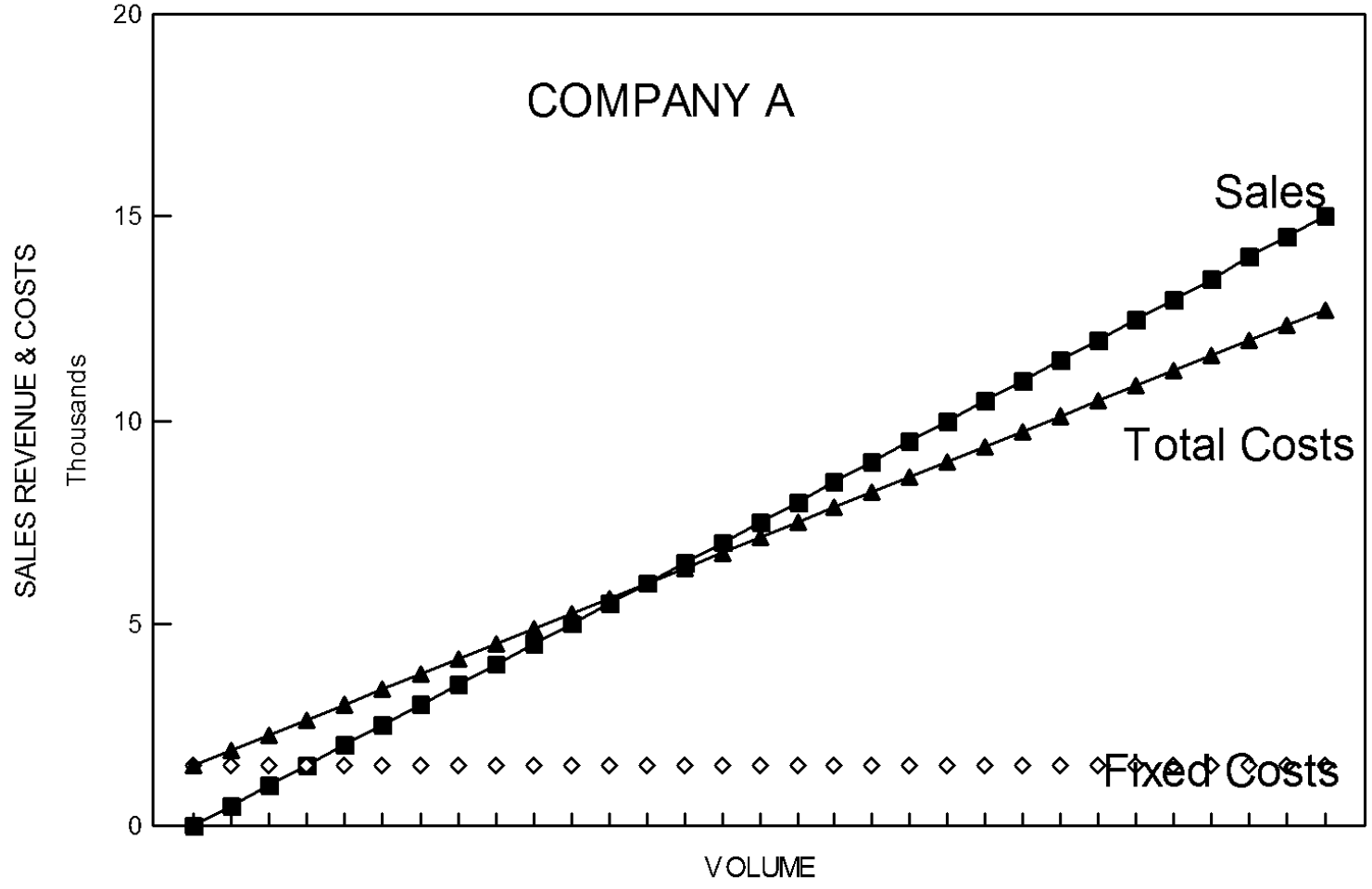
- Cost to raise an invoice?
- Cost to raise a purchase order?

Cost Structure

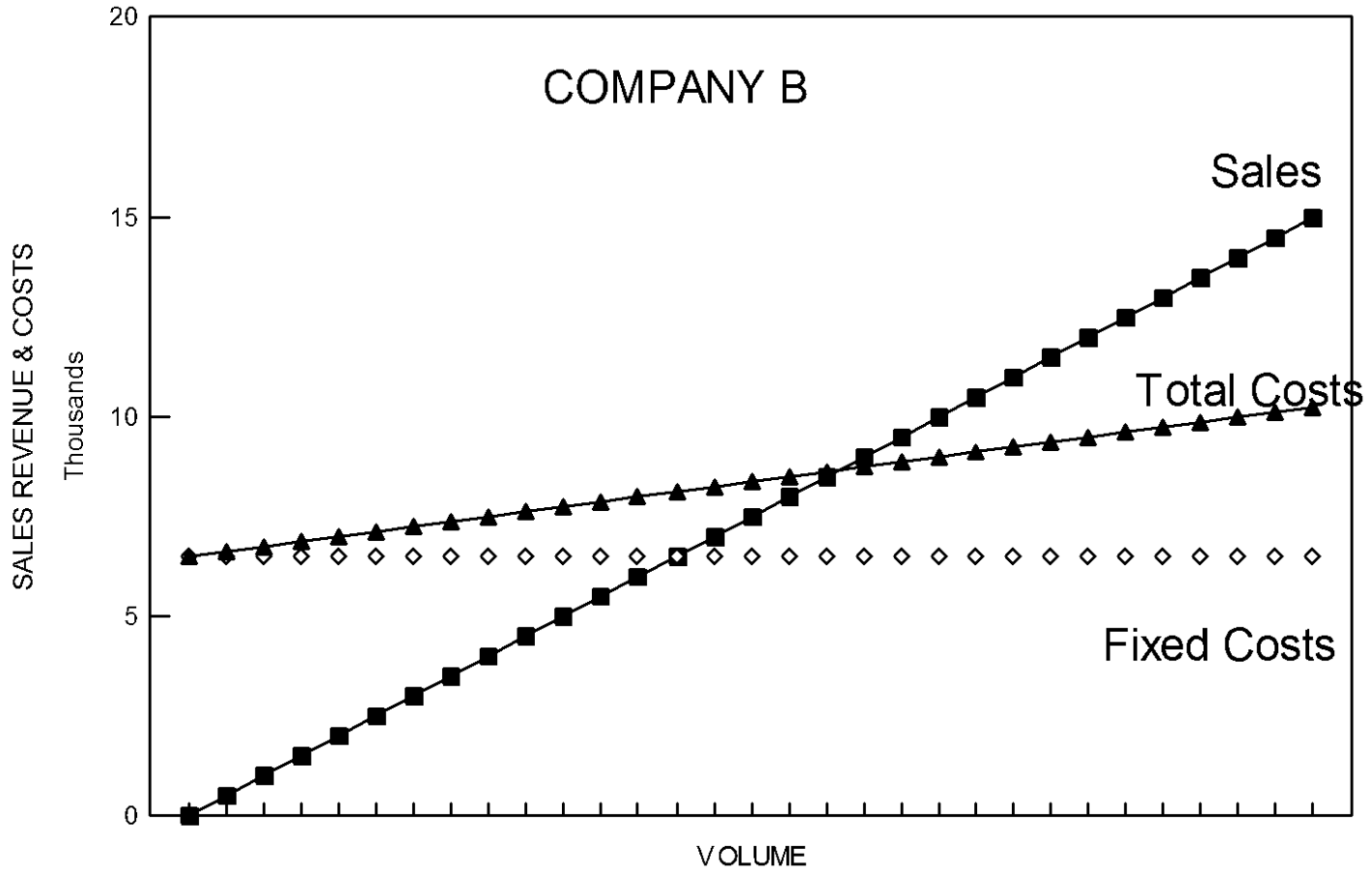
Operational Gearing

- Fixed v Variable Cost
- Cost structure and strategy
- Trends in changes in cost structure
- Alternative cost drivers to volume - ABC

Cost Structure



Cost Structure



	A	B
Company A Low contribution rate High variable cost percentage	✓	
Company B High contribution rate High fixed costs Percentage		✓
1. Hotel Chain		
2. Airline		
3. Tour Operator		
4. Supermarket		
5. Motor Manufacturer		
6. Mobile Telecoms		
7. Cinema Chain		
8. Car rental firm		
9. Power Generator (coal)		
10. Power Generator (gas)		
11. Power Generator (nuclear)		
12. Management Consultants		
13. Training Company		

Rethinking (Changing) Cost Structures

- Less Fixed
- More Variable

- More Fixed
- Less Variable

Lean Manufacturing

- Toyota Production System (TPS)
- Kaizen
- 5S
- Kanban
- Six Sigma
- Visual Factory
- Design v Delivery

Toyota Production System (TPS)

- Best Quality – Right first time
- Lowest Cost
- Shortest lead time
- JIT – Just in Time
- Standardise
- Eliminate Waste
- Motivate people to care



Toyota Production System (TPS)

Reduce

Overburden Muri,

Inconsistency - Mura

Eliminate waste - Muda.



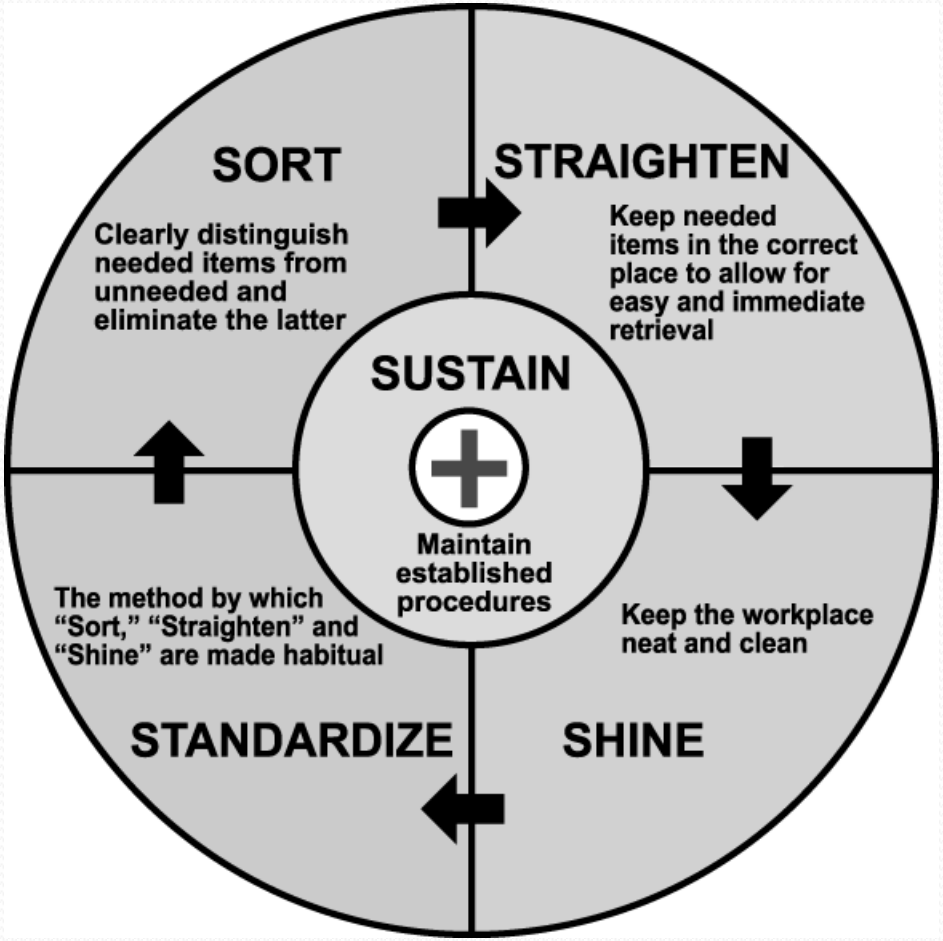
Eliminate Waste – Not Just Scrap
7 Wastes (Muda) under TPS



Kaizen

- Traditional Western Approach – If it isn't broke – don’t fix it
- Japanese Kaizen Approach – all can contribute, all the time to continuous improvement – do it better, improve it – however small

5 S - Lean


SORT
Clearly distinguish needed items from unneeded and eliminate the latter
STRAIGHTEN
Keep needed items in the correct place to allow for easy and immediate retrieval
SUSTAIN
Maintain established procedures
STANDARDIZE
The method by which "Sort," "Straighten" and "Shine" are made habitual
SHINE
Keep the workplace neat and clean

Ford - CANDO

- CANDO program (Cleaning up, Arranging, Neatness, Discipline, Ongoing Improvement),

Kanban

Kan – Visual Ban - Board

- JIT maintained by a signalling system
- Supply is “pulled” by demand

Six Sigma

- *Developed By Motorola*
- *Then GE*

Six Sigma

- "...Six Sigma is a highly disciplined process that helps us focus on developing and delivering near-perfect products and services
- To achieve Six Sigma Quality, a process must produce no more than 3.4 defects per million opportunities."

From GE

Visual Factory

- Visual factory is a term to describe how data and information is conveyed in a lean manufacturing environment. In a lean manufacturing environment time and resources dedicated to conveying information, although necessary, are a form of waste. By using visual methods to convey information such as signs and charts, information is easily accessible to those who need it. The current status of all processes is immediately apparent

Design v Delivery

Cheaper & Better by Design

- More and more costs are set at the design stage rather than at delivery (Manufacture)
- Cost Reduction should be included in design – Target Costing

Failure Costs!

- Right first time
- Poka-Yoke – zero defects objective



Alliance / Partnering

A **Strategic Alliance** is a mutually beneficial long-term formal relationship formed between two or more parties to pursue a set of agreed upon goals or to meet a critical business need while remaining independent organizations.

Alliance / Partnering

Example of Strategic Alliances

Airlines
Code Sharing
Integrated schedules

Mobile Phones
Roaming
Infrastructure sharing
Example – T-Mobile – Virgin Mobile



Getting your team to deliver more for less

Developing a cost conscious culture

Cost – Outcome Impact Model

Economy
Efficiency
Effectiveness
Capacity and Risk

"Quicker Faster Better Cheaper" Motivating and encouraging people to effectively manage cost and value

Internal service level and internal markets agreements – Pros and Cons

Mini Case Study – "Doctors; Orders" – delivering savings in a hospital

Exercise / Toolbox 4 –VFM & Getting the Team onboard and improving performance

VFM - Value For Money 3 Es

A Public Sector Model / But Good for Cost Centres?

- Economy
- Efficiency
- Effectiveness



VFM - Value For Money

- Cost – Input
- Resources
- Output
- Outcomes



VALUE FOR MONEY

ECONOMY

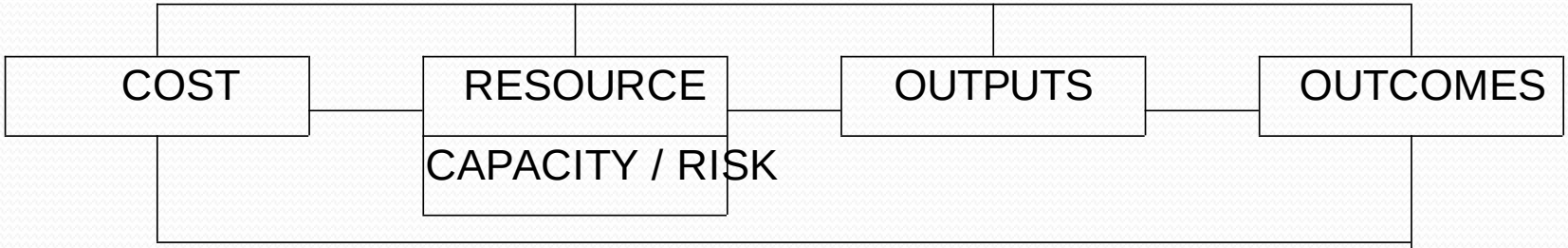
RESOURCE / COST

EFFICIENCY

OUTPUT / RESOURCE

EFFECTIVENESS

OUTCOME / OUTPUT



VFM - VALUE FOR MONEY

OUTPUT / COST

DOES IT ADD VALUE?

$$\text{VFM} = \frac{\text{RESOURCE}}{\text{COST}} \times \frac{\text{OUTPUT}}{\text{RESOURCE}} \times \frac{\text{OUTCOME}}{\text{OUTPUT}} = \frac{\text{OUTCOME}}{\text{COST}}$$

ECONOMY **EFFICIENCY** **EFFECTIVENESS**

OBJECTIVES

Economy

- Minimising the costs of resources used within the public sector, but having regard to quality.
- Better Prices!

Efficiency

- The relationship between output, in terms of goods, services or other results, and the resources used to produce them.
- Example - Get staff to be more productive – deliver more

Effectiveness

- The extent to which objectives have been achieved. The relationship between the intended impacts and actual impacts of an activity
- Delivering the required result!

Exercise

- 3 Es

VFM – Value For Money

4th E

EVIDENCE

Cost Reduction ideas In your business

Cost Control (Management Ideas) In your business

Day 2

The Forecasting Process

- Determine the purpose and objective of the forecast
- Statistical analytical tools
- Quantitative analysis and forecasting
- Forecasting techniques
- Causal analysis models – regression analysis
- Using Excel ® to analyse historical data

Business Forecasting

Determine the purpose and objective of the forecast

Forecasting for Management Decisions

Topics

- Introduction
- Importance of Forecasting
- Financial and Strategic Importance of Forecasting
- The Commonality of Forecasting

Importance of Business Forecasting

- Allows organizations to improve profits
- Essential in eliminating waste such as:
  - Inventory shortages
  - Missed due dates
  - Plant shut-downs
  - Lost sales
  - Lost customers
  - Expensive expediting
  - Missed strategic opportunities.

Financial and Strategic Importance

- Better strategic information
- Better marketing information
- Better financial information
- Better operating information
- Increased customer service
- Better allocation of resources

Financial and Strategic Importance

- Increased manufacturing and operating efficiency
- Higher productivity
- Stability in planning
- Reduced finished goods inventory
- Elimination of waste
- Increased profitability
- Increased return on investment.

The Commonality of Forecasting

- All organizations wish for excellence in management (whether manufacturing or a hospital).

- Demand for products, labor, materials, and other resources must be estimated using either formal or informal forecasting methods.

Business Forecasting

- The Art and Science of Forecasting
- The Forecasting Process

Business Forecasting Process

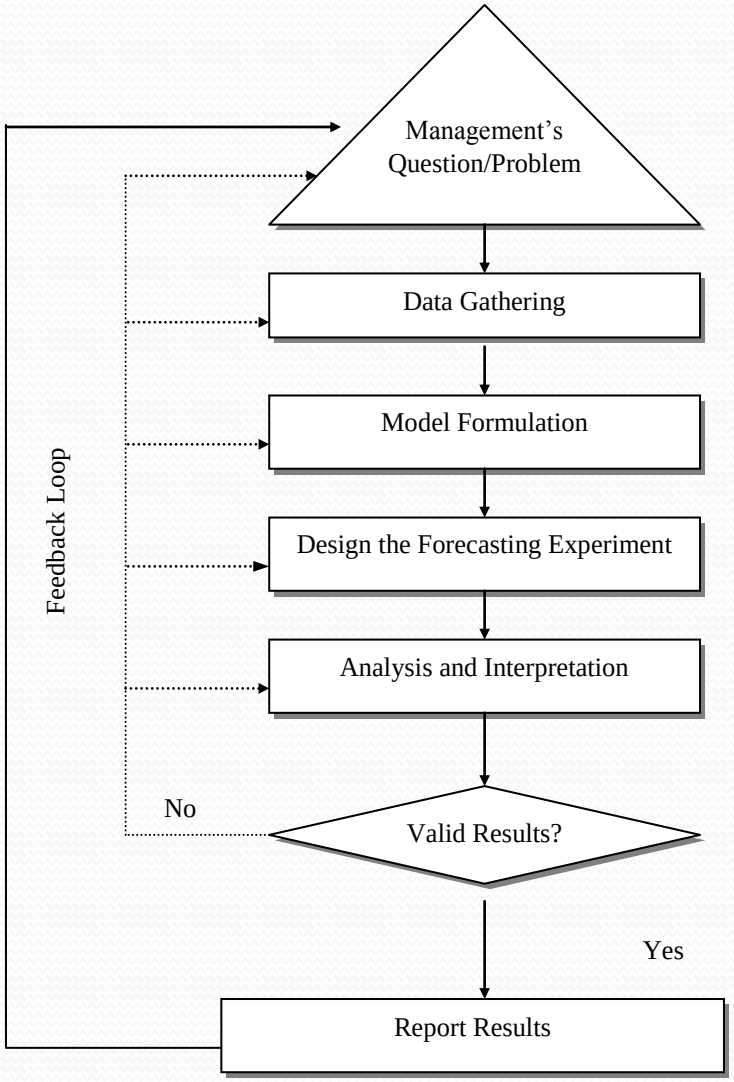


Figure 1.1 The Forecasting Process

Summary

- Importance of Business Forecasting
  - As a Strategic Tool
  - Planning and Control Tool
- Various Application of Forecasting in Business
- The Art and Science of Forecasting
- The Process of Forecasting

Statistical analytical tools

Business Forecasting

Data Patterns and Choice of Forecasting Techniques

Topics

- Data Patterns
- Forecasting Methodologies
- Technique Selection
- Model Evaluation

Data Pattern and Choice of Technique

- The pattern of data
- The nature of the past relationship in the data
- The level of subjectivity in making a forecast

All of the above help us in how we classify the forecasting technique.

Data Pattern and Choice of Technique

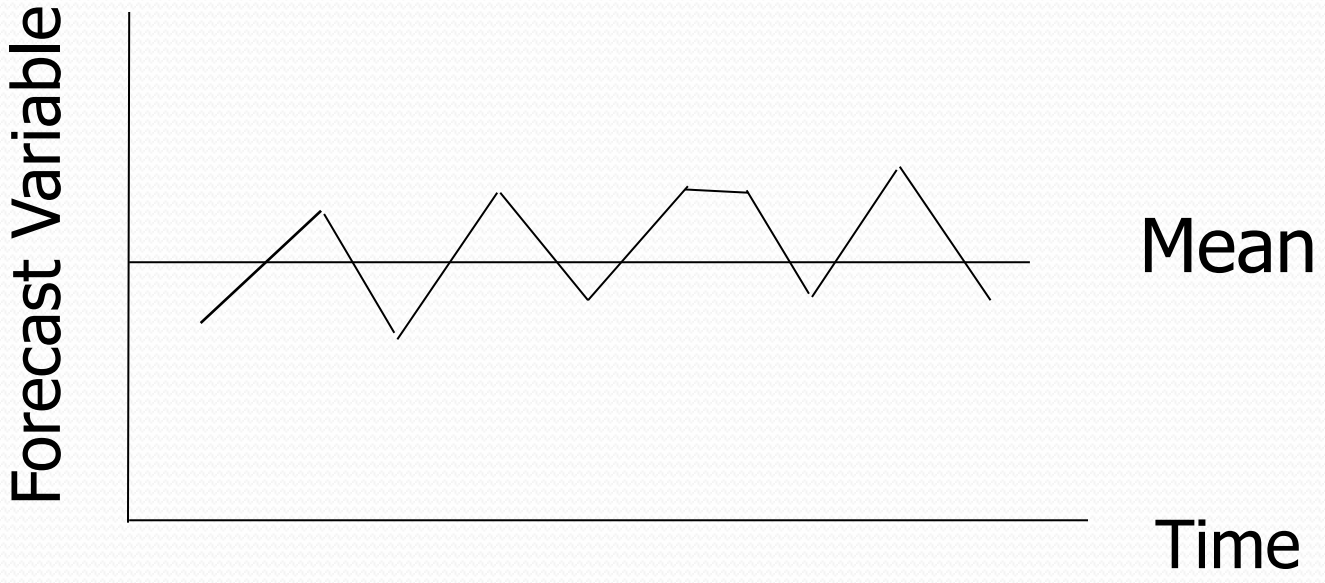
- Univariate forecasting techniques depend on:
  - Past data patterns.
- Multivariate forecasting techniques depend on
  - Past relationships.
- Qualitative forecasts depend on:
  - Subjectivity: Forecasters intuition.

Data Patterns

- Data Patterns as a Guide
  - Simple observation of the data will show the way that data have behaved over time.
  - Data pattern may suggest the existence of a relationship between two or more variables.
  - Four Patterns: Horizontal, Trend, Seasonal, Cyclical.

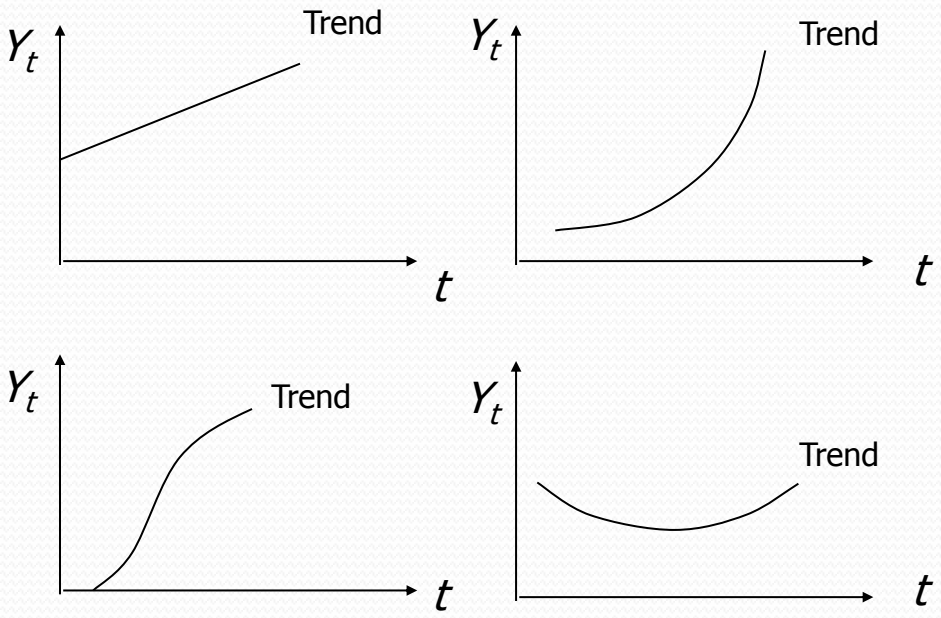
Data Patterns

- Horizontal
  - When there is no trend in the data pattern, we deal with horizontal data pattern.



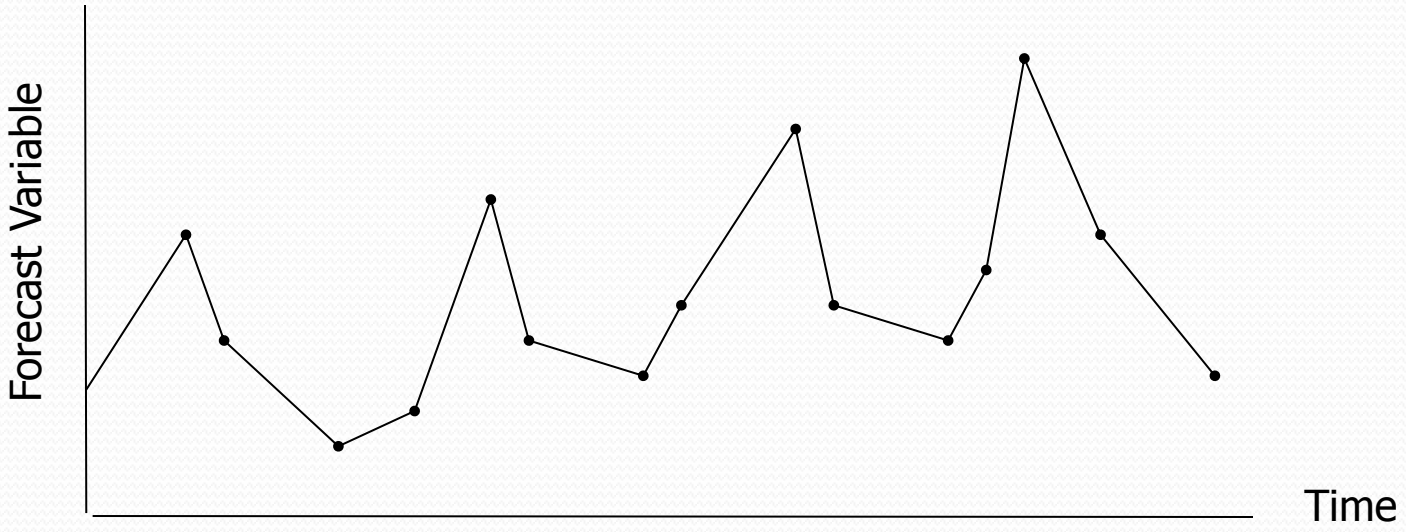
Data Patterns

- Trend
  - Long-term growth movement of a time series



Data Patterns

- Seasonal Pattern
  - A predictable and repetitive movement observed around a trend line within a period of 1 year or less.



Data Patterns

- Cyclical
  - Occurs with business and economic expansions and contractions.
  - Lasts longer than 1 year.
  - Correlated with business cycles.

Other Data Patterns

- Autocorrelated Pattern
  - Data in one period are related to their values in the previous period.
  - Generally, if there is a high positive autocorrelation, the value in the month of June, for example, is positively related to the values in the month of May.
  - This pattern is more fully discussed when we talk about the Box–Jenkins methodology.

Measures of Accuracy in Forecasting

- Error in Forecasting

$$e_t = Y_t - \hat{Y}_t$$

  - Measures the average error that can be expected over time.
  - The average error concept has some problems with it. The positive and negative values cancel each other out and the mean is very likely to be close to zero.

Error in Forecasting

- Mean Average Deviation (MAD)

$$\mathrm{MAD} = \frac{\sum_{t=1}^{n} |e_t|}{n}$$

Error in Forecasting

- Mean Square Error (MSE)

$$\mathrm{MSE} = \frac{\sum_{t=1}^{n} (e_t^2)}{n}$$

Error in Forecasting

- Mean Absolute Percentage Error

$$\text{MAPE} = \sum_{t=1}^{n} \frac{\left|(e_t / Y_t) \cdot 100\right|}{n}$$

Error in Forecasting

- Mean Percentage Error

$$\text{MPE} = \frac{\sum_{t=1}^{n} (e_t / Y_t)}{n}$$

- No bias, MPE should be zero.

Evaluating Reliability

- Forecasters use the following two approaches to determine if the forecast is reliable or not:
  - Root Mean Square (RMS)

$$RMS = \sqrt{\frac{\sum_{t=1}^{n} e_t^2}{n}}$$

Evaluating Reliability

- Root Percent Mean Square (R%MS)

$$R\%MS = \sqrt{\frac{\sum_{t=1}^{n} (e_t^2 / Y_t)}{n}}$$

Forecasting Methodologies

- Forecasting methodologies fall into three categories:
  - Quantitative Models
  - Qualitative Models
  - Technological Approaches

Forecasting Methodologies

- Quantitative Models
  - Also known as statistical models.
  - Include time series and regression approaches.
  - Forecast future values entirely on the historical observation of a variable.

Forecasting Methodologies

- Quantitative Models
  - An example of a quantitative model is shown below:

$$Y_{t+1} = \alpha_0 + \alpha_1 Y_t + \alpha_2 Y_{t-1}$$

Y_{t+1} = Sales one time period into the future

Y_t = Sales in the current period

Y_{t-1} = Sales in the last period

Forecasting Methodologies

- Qualitative Models
  - Non-statistical or judgment models
  - Expert opinion
  - Executive opinion
  - Sale force composite forecast
  - Focus groups
  - Delphi method

Forecasting Methodologies

- Technological Approach
  - Combines quantitative and qualitative methods.
  - The objective of the model is to combine technological, societal, political, and economic changes.

Technique Selection

- Forecasters depend on:
  - The characteristics of the decision making situation which may include:
    - Time horizon
    - Planning vs. control
    - Level of detail
    - Economic conditions in the market (stability vs. state of flux)

Technique Selection

- Forecasters depend on:
  - The characteristics of the forecasting method
    - Forecast horizon
    - Pattern of data
    - Type of model
    - Costs associated with the model
    - Level of accuracy and ease of application

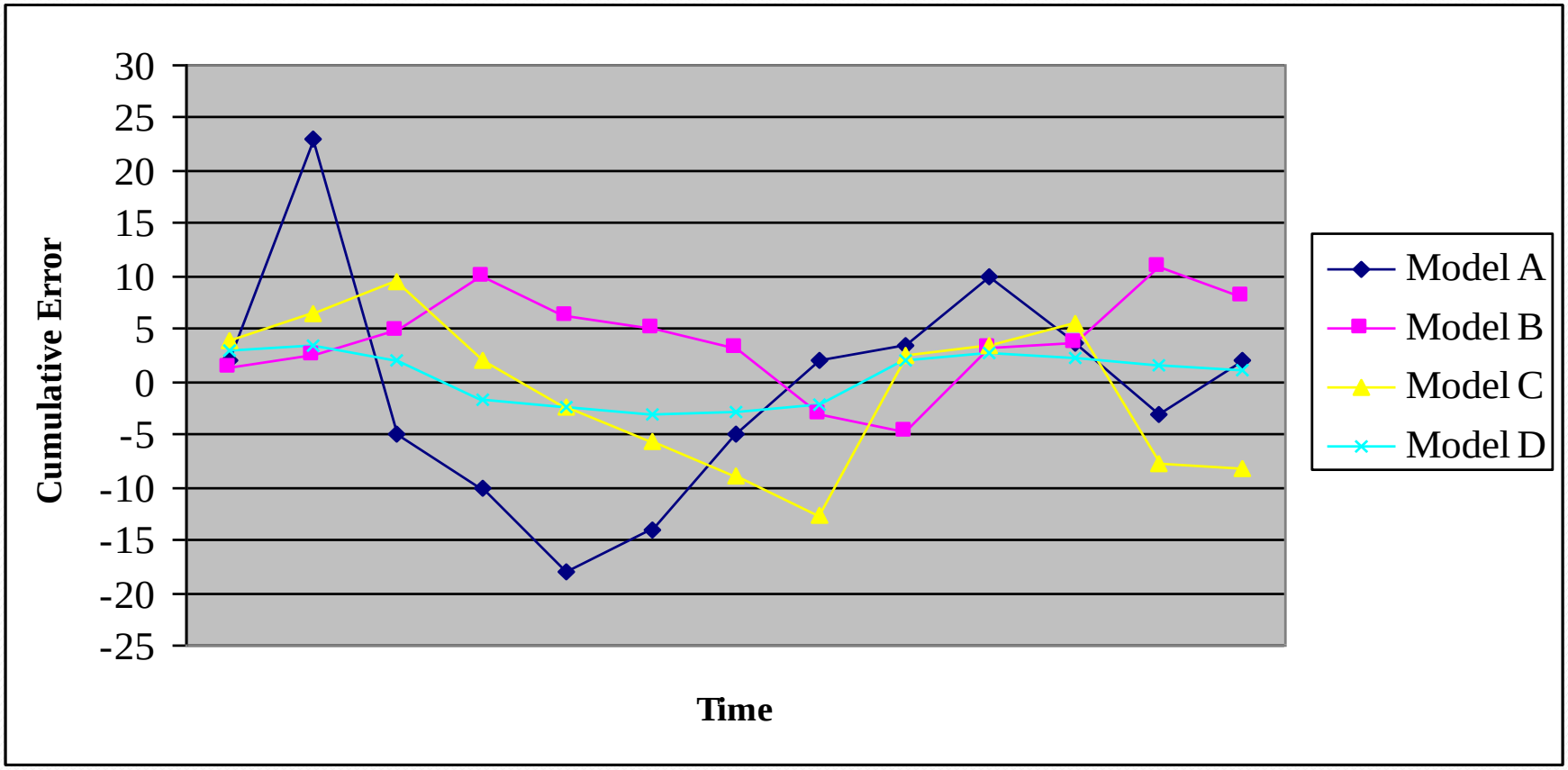
Model Evaluation

- Forecasters depend on:
  - The level of error associated with each model.
  - Error is computed and looked at graphically.
  - Control charts are used for model evaluations.
  - Turning point diagram is used to evaluate a model.

Model Evaluation

- A pattern of cumulative errors moving systematically away from zero in either direction is a signal that the model is generating biased forecasts.
- Management has to establish the upper and lower control limits.
- One fairly common rule of thumb is that the control limits are equal to 2 or 3 time the standard error.

Model Evaluation



Model Evaluation

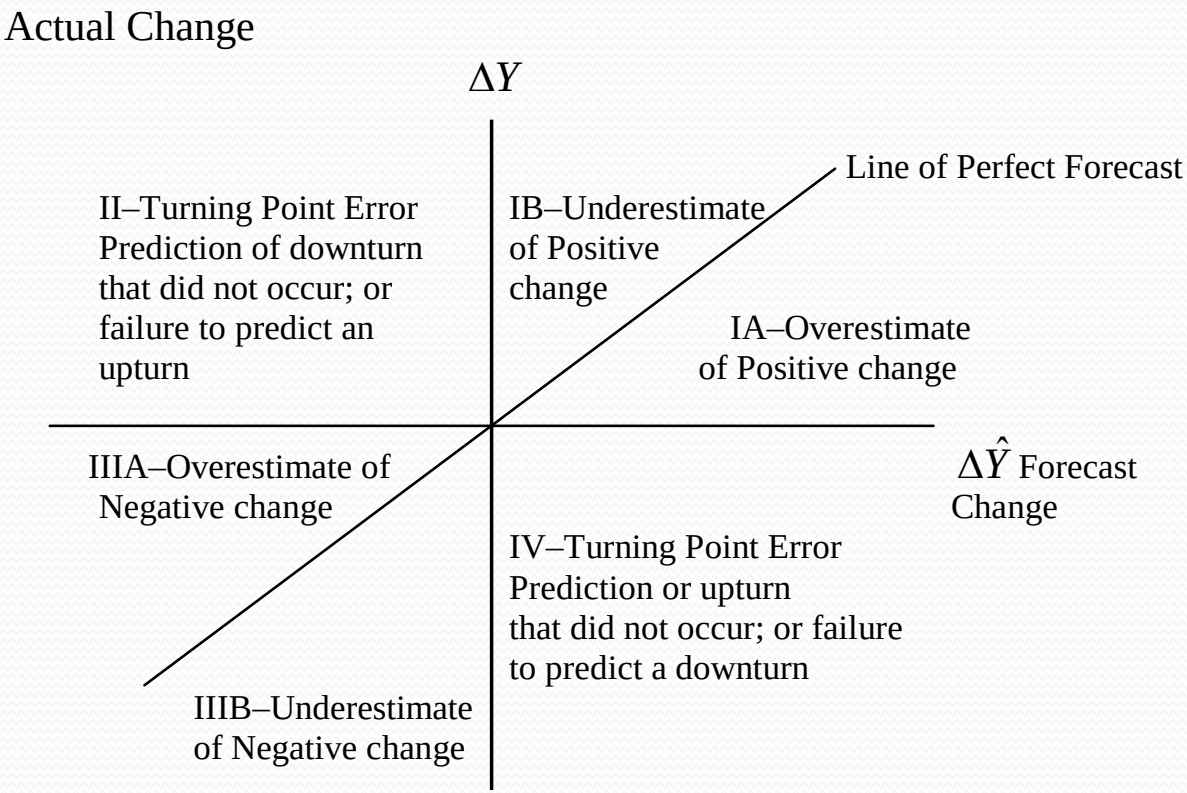


Figure 2.6 Turning Point Error Diagram

Model Evaluation

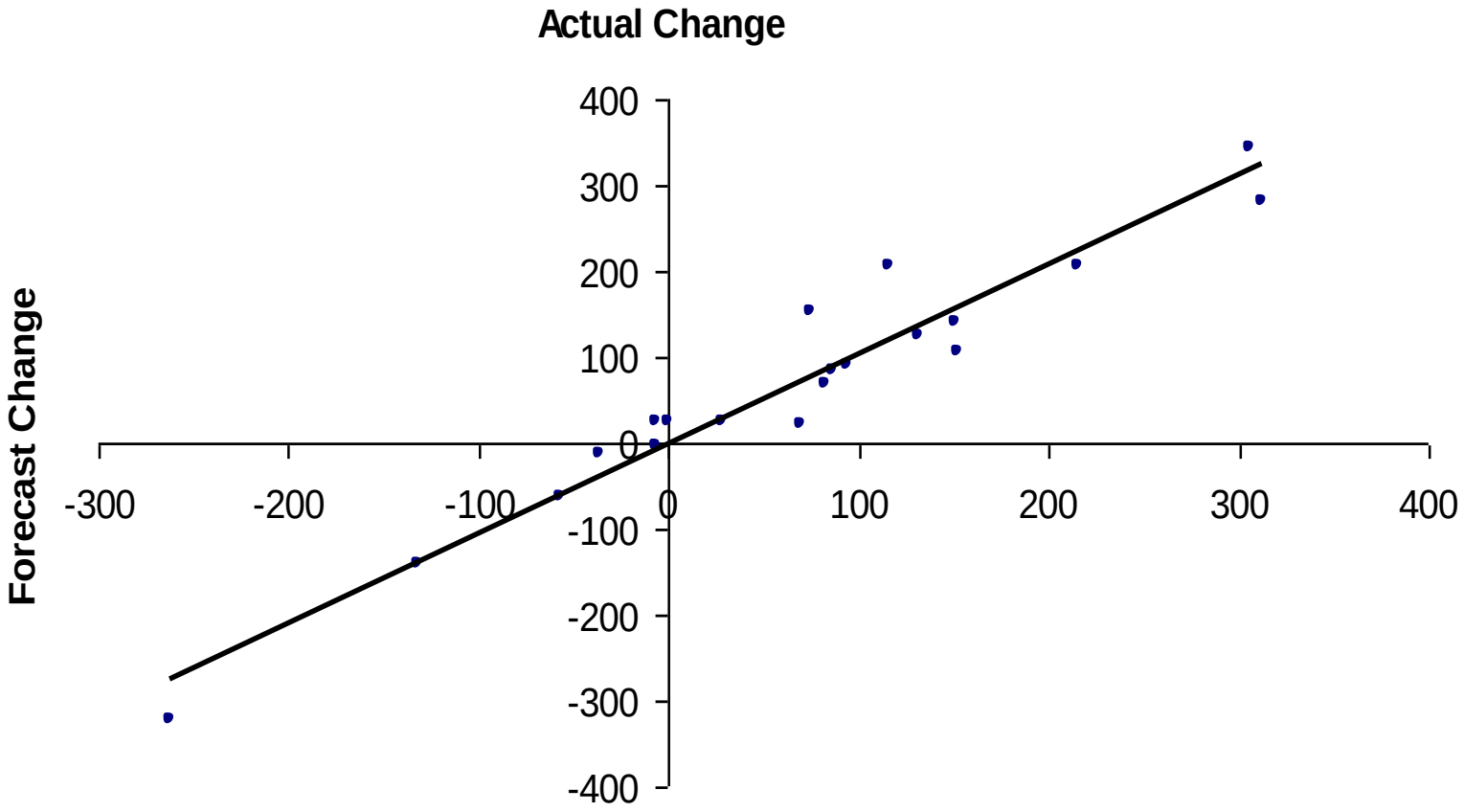


Figure 2.7 Turning Point Analysis for Model C

Summary

- Data Patterns
- Forecasting Methodologies
- Technique Selection
- Model Evaluation

Business Forecasting

The Macroeconomy and Business Forecasts

Topics

- Introduction
  - Cyclical Linkages and Forecasting
- Phases of Business Cycles
  - Peaks
  - Recession
  - Trough
  - Recovery
- Historical events of Business Cycles

Topics

- Macroeconomic Models and Forecasting
- Use of Macroeconomic Models at Industry and Firm Level

Business Cycles

- Peak
  - Refers to economic condition at which business activity has reached a temporary maximum.
  - During this phase the economy shows full employment and the level of real output is at, or very close to, its capacity.
  - There is expectation of a price rise at this phase.

Business Cycles

- Recession
  - A decline in output, income, employment, and trade lasting more than 6 months.
  - Often a widespread contraction of the business in many sectors of the economy.
  - Prices may not decline (stickiness) as fast unless there is a prolonged recession or depression.

Business Cycles

- Trough
  - Output and employment “bottom out” at their lowest level.
  - Duration of the trough may be short or long.

- Recovery
  - Output and employment surge toward full employment.
  - Price level may begin to rise before full employment is reached.

Historical Events and their impact on Business Cycles

Growth Rate for the Various Macroeconomic Indicators

Series	1886–1916	1920–1940	1948–1997
	%	%	%
Industrial Production	6.2	16.0	5.0
GNP	3.0	7.1	2.5
Commodity Output	5.2	9.0	4.9
Unemployment Rate	1.4		1.1

Historical Events and their impact on Business Cycles

Dates of Peaks and Troughs

1886–1916		1920–1940		1948–1997	
Peak	Trough	Peak	Trough	Peak	Trough
1887:2	1887:7	1920:1	1921:3	1948:11	1949:10
1893:1	1894:2	1923:5	1924:7	1953:7	1954:5
1896:1	1897:1	1927:3	1927:12	1957:8	1958:4
1900:4	1900:12	1929:9	1932:7	1960:4	1961:2
1903:7	1904:3	1937:8	1938:6	1969:12	1970:11
1907:7	1908:6	1939:12	1940:3	1973:11	1975:3
1910:1	1911:5			1980:1	1980:7
1914:6	1914:12			1981:7	1982:11
1916:5	1917:1			1990:7	1991:3

Historical Events and their impact on Business Cycles

Length of Recessions and Expansions

1886–1916			1920–1940			1948–1997		
Year of Peak	Months to Trough	Months from Trough to Peak	Year of Peak	Months to Trough	Months from Trough to Peak	Year of Peak	Months to Trough	Months from Trough to Peak
1887	5	66	1920	14	26	1948	11	45
1893	13	23	1923	14	32	1953	10	39
1896	12	39	1927	9	21	1957	8	24
1900	8	31	1929	34	61	1960	10	106
1903	8	40	1937	10	18	1969	11	36
1907	11	19	1939	3		1973	16	58
1910	16	37				1980	6	12
1914	6	17				1981	16	92
1916	8					1990	8	
Avg.	9.7	34.0	Avg.	14.0	31.6	Avg.	10.7	51.5

Source: Romer, C.D. (1999). "Changes in business cycles: evidence and explanations." *Journal of Economic Perspective* 13 (Spring): 31.

Macroeconomic Models and Forecasting

- Many variables interact to shape the economy.
- Forecasters use necessary tools to observe the interrelationships in the overall economy.
- Macroeconomic models are general equilibrium models.
- In building macroeconomic models for forecasting, we depend on theory and statistical techniques.

Use of Macroeconomic Models at the Industry and Firm Level

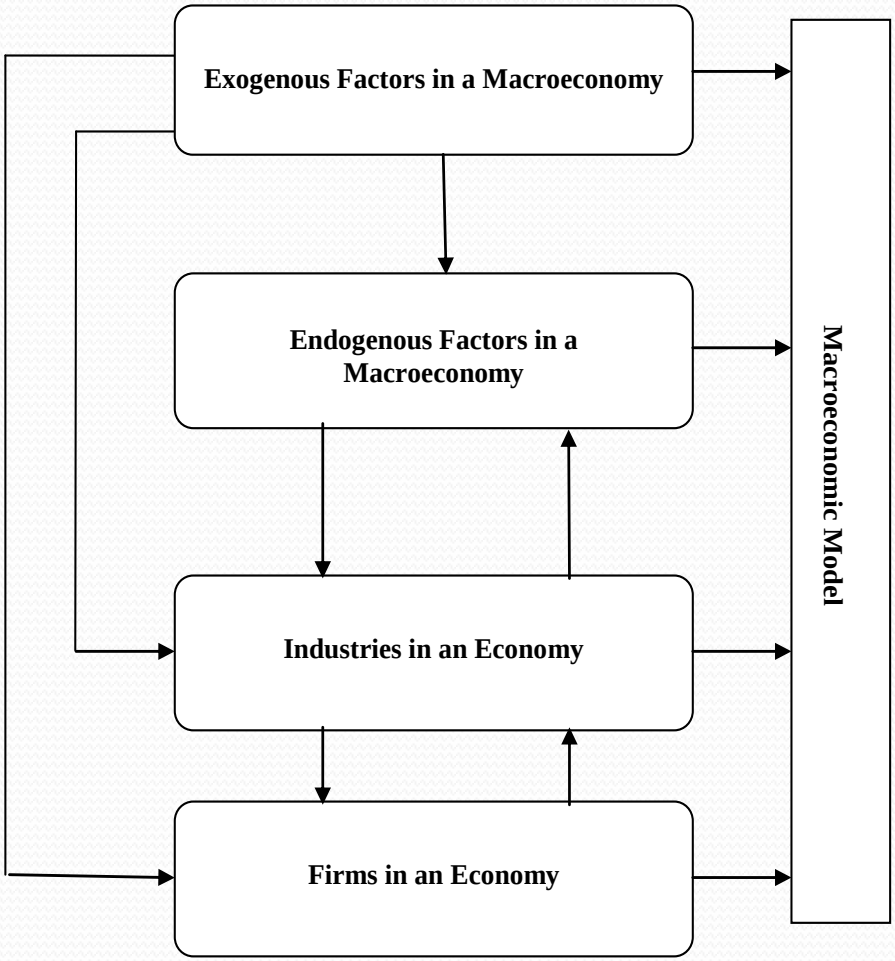


Figure 3.1 Linkages between the Macroeconomy, Industry, and Firms

Summary

- Business decisions are made in the context of the overall economy.
- Long-term trends, seasonal patterns, cyclical movements, and irregular factors play an important role in the overall economy.
- Understanding the various phases of business cycles is helpful to forecasters.

Quantitative analysis and forecasting

Business Forecasting

Data Collection and Analysis in Forecasting

Topics

- Preliminary Adjustments to Data
- Data Transformation
- Patterns in Time Series Data
- The Classical Decomposition Method

Preliminary Data Adjustments

- Trading Day Adjustments
- Price Change Adjustments
- Population Change Adjustments

Trading Day Adjustments

Yr	J	F	M	A	M	J	J	A	S	O	N	D
05	21	20	23	21	22	22	21	23	22	21	22	22
06	22	20	23	20	23	22	21	23	22	22	22	21
07	23	20	22	21	23	21	22	23	20	23	22	21

Trading Day Adjustment

Number of Computers Sold (in Millions) in 2005, 2006, and 2007

Month	2005	2006	2007
January	**3**	**4**	**5**
February	**4**	**4**	**5**
March	**3**	**5**	**6**
April	**5**	**3**	**6**
May	**5**	**3**	**6**
June	**5**	**4**	**7**
July	**6**	**5**	**6**
August	**6**	**4**	**6**
September	**6**	**5**	**7**
October	**5**	**5**	**4**
November	**5**	**6**	**4**
December	**6**	**6**	**5**
Yearly unit sales	**59**	**54**	**67**

Trading Day Adjustment

Average Trading Days for Each Month

Month	*Average Number of Trading Days*
January	22.00
February	20.00
March	22.67
April	20.67
May	22.67
June	21.67
July	21.33
August	23.00
September	21.33
October	22.00
November	22.00
December	21.33

Trading Day Adjustments

Trading Day Computation for October

Year	*Trading Days*	*Trading Day Coefficient*	*Actual Data*	*Adjusted Data*
2005	21	21/22 = 0.954	5,000,000	5,241,090
2006	22	22/22 = 1.000	5,000,000	5,000,000
2007	23	23/22 = 1.045	4,000,000	3,827,751

Price Change Adjustments

Compunet Sales Data, 1990–2005

(1) Year	(2) Compunet Sales in Current $ (Thousands)	(3) Computer Price Index 1995=100	(4) Software Price Index 1995=100	(5) Price Index* 1995=100	(6) Sales in Constant $ (Thousands)
1990	89.0	58.40	63.81	59.48	149.63
1991	90.0	57.03	71.98	60.02	149.94
1992	95.4	66.57	77.61	68.78	138.71
1993	96.6	72.47	86.19	75.21	128.44
1994	98.9	79.27	91.55	81.73	121.01
1995	99.4	100.00	100.00	100.00	99.40
1996	100.2	110.14	114.61	111.03	90.24
1997	106.2	123.15	144.10	127.34	83.40
1998	107.5	131.92	166.22	138.78	77.46
1999	108.3	145.23	204.56	157.10	68.94
2000	120.0	153.40	236.19	169.96	70.60
2001	105.0	129.20	234.18	150.20	69.91
2002	103.8	116.79	224.66	138.37	75.02
2003	102.1	117.70	229.76	140.11	72.87
2004	98.7	124.51	247.05	149.02	66.23
2005	99.6	128.74	260.05	155.01	64.26

Price Change Adjustments

- Having computed the price index, we are now able to deflate the sales revenue with the weighted price index in the following way:

$$\textit{Deflated}\ 1990\ \textit{sales} = (89.0)\left(\frac{100}{59.48.0}\right) = 149.63$$

Price Change Adjustments

- To see the impact of separating the effect of price level changes, we graph the price of computers in constant and current dollars.

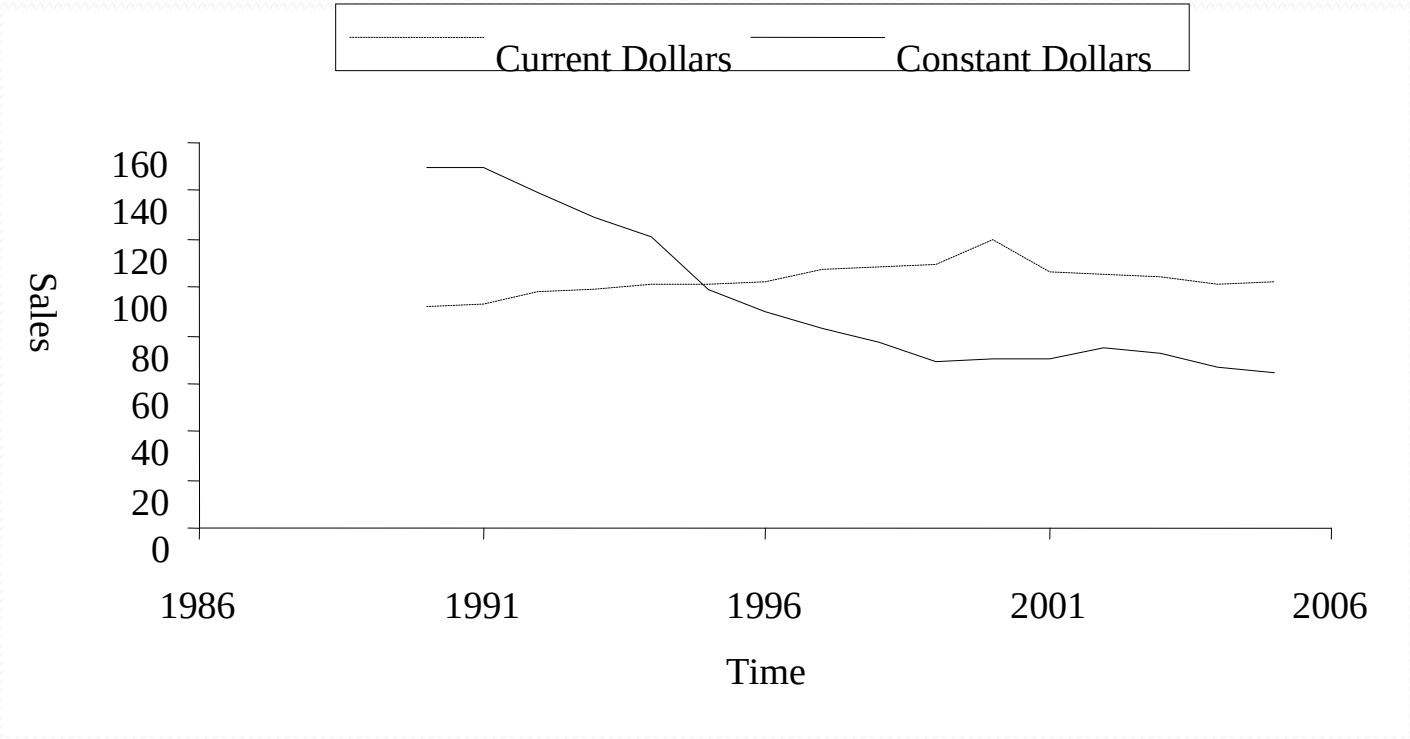


Figure 4.1 Computer Sales in Current and Constant Dollars

Population Change Adjustments

Disposable Personal Income and Per Capita Income for the U.S. 1990 and 2005

Year	Disposable Income Billions of Dollars	Population (in Millions)	Per Capita Disposable Income ($)
1990	4285.8	250.2	17,129.50
1991	4464.3	253.5	17,610.65
.....	.....	.....	.....
.....	.....	.....	.....
1999	6695.0	279.3	23,970.64
2000	7194.0	282.4	25,474.50
2001	7486.8	285.4	26,232.66
2002	7830.1	288.3	27,159.56
2003	8162.5	291.1	28,040.19
2004	8681.6	293.9	29,539.30
2005	9036.1	296.7	30,455.34

Data Transformation

- Most appropriate remedial measure for variance heterogeneity.
- Original data are converted into a new scale, resulting in a new data set that is expected to satisfy the condition of homogeneity of variance.
- Several transformation techniques are available.

Data Transformation

- Linear Transformation:
  - An important assumption in using the regression model for forecasting is that the pattern of observation is linear.
  - Obviously, there are many situations in which this is not a valid assumption.
    - For example, if we were forecasting monthly sales and it was believed that those sales varied according to the season of the year, then the assumption of linearity would not hold.

Linear Transformation

- A forecasting equation may be of the form:

$$Y = \alpha e^{\beta X} . \mathrm{u}$$

- The above could easily be transformed into a linear form for estimation purposes:

$$\log Y = \log \alpha + \beta X + \log u$$

Logarithmic Transformation

Southwest Airlines Operating Revenue between 1990 and 2006

Year	*Operating Revenue (Million Dollars)*	*Logarithmic Transformation*
1990	1237	3.09
1991	1379	3.14
1992	1803	3.26
……	……	……
……	……	……
2003	5937	3.77
2004	6530	3.81
2005	7584	3.88
2006	9086	3.96

Logarithmic Transformation

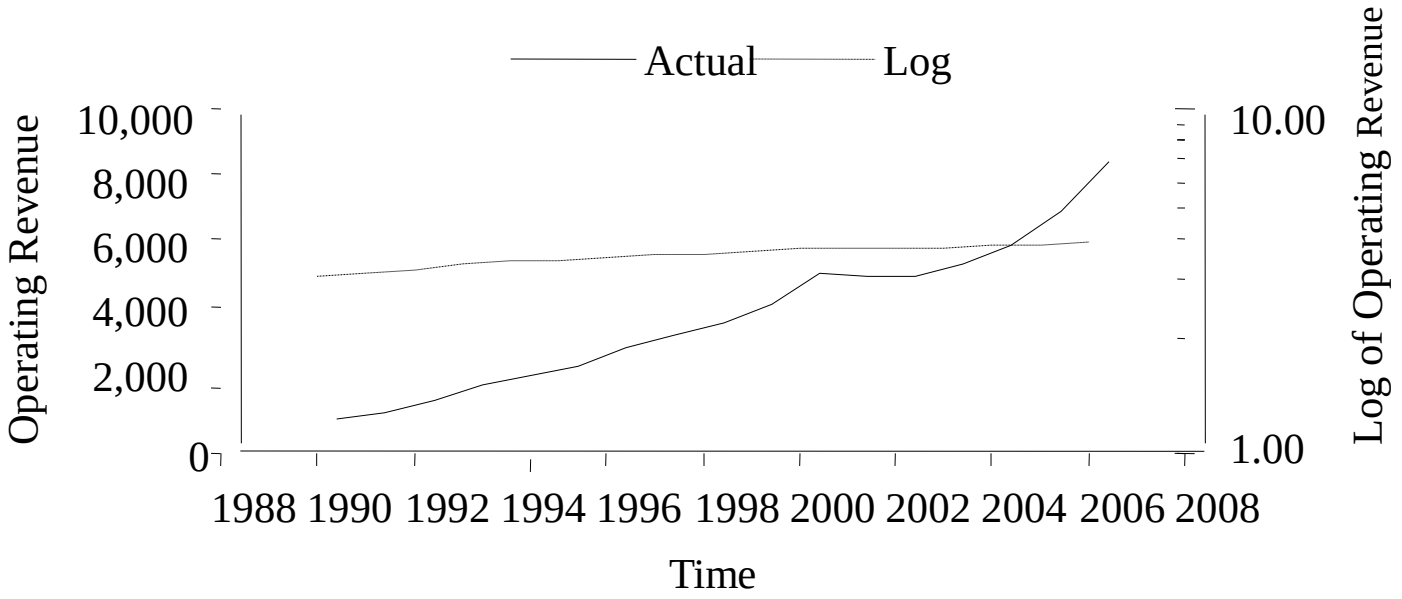


Figure 4.2 Actual and Logarithmically Transformed Operating Revenue for Southwest Airlines

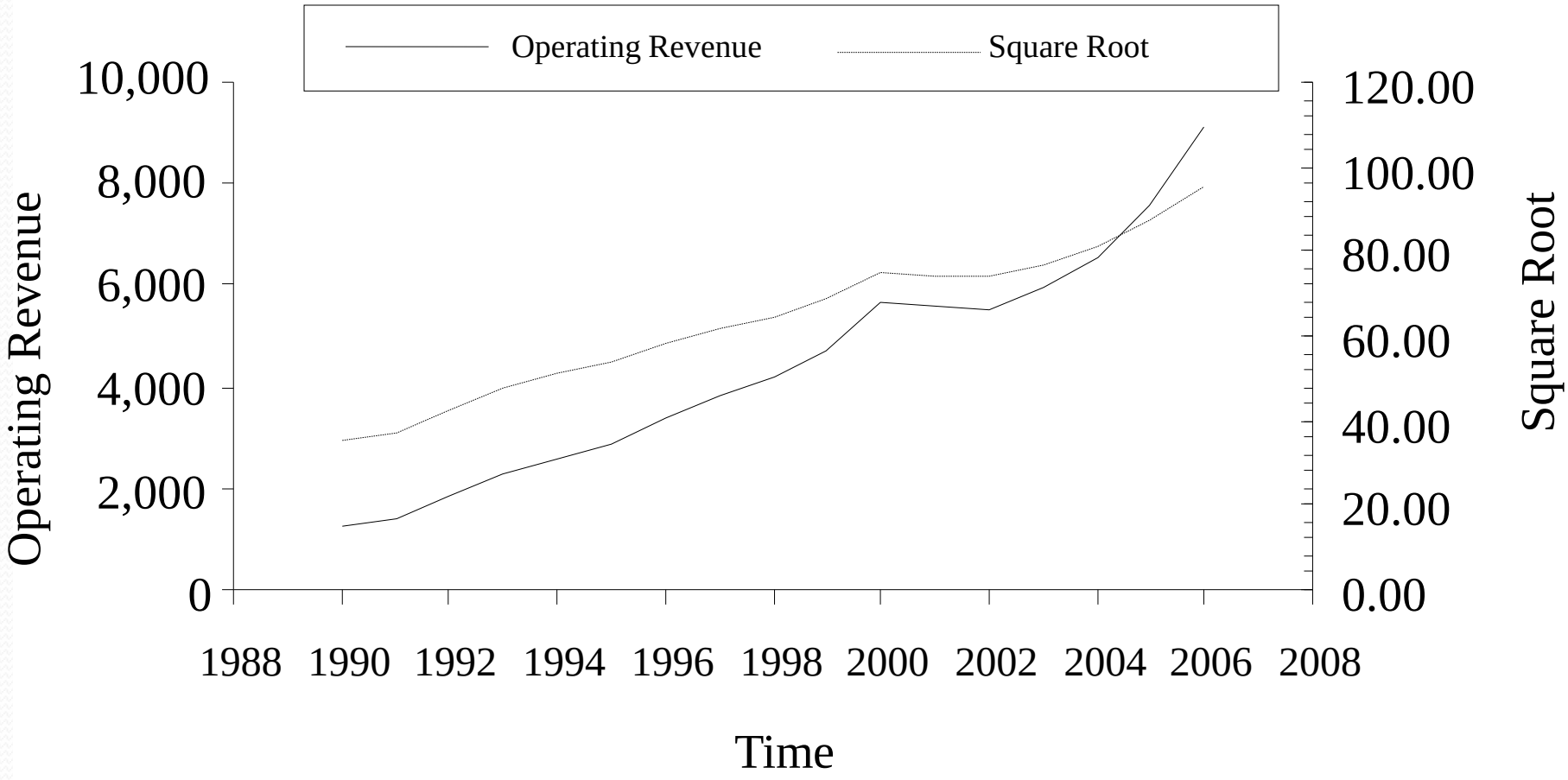
Square Root Transformation

Southwest Airlines Operating Revenue for the Years 1990 and 2006

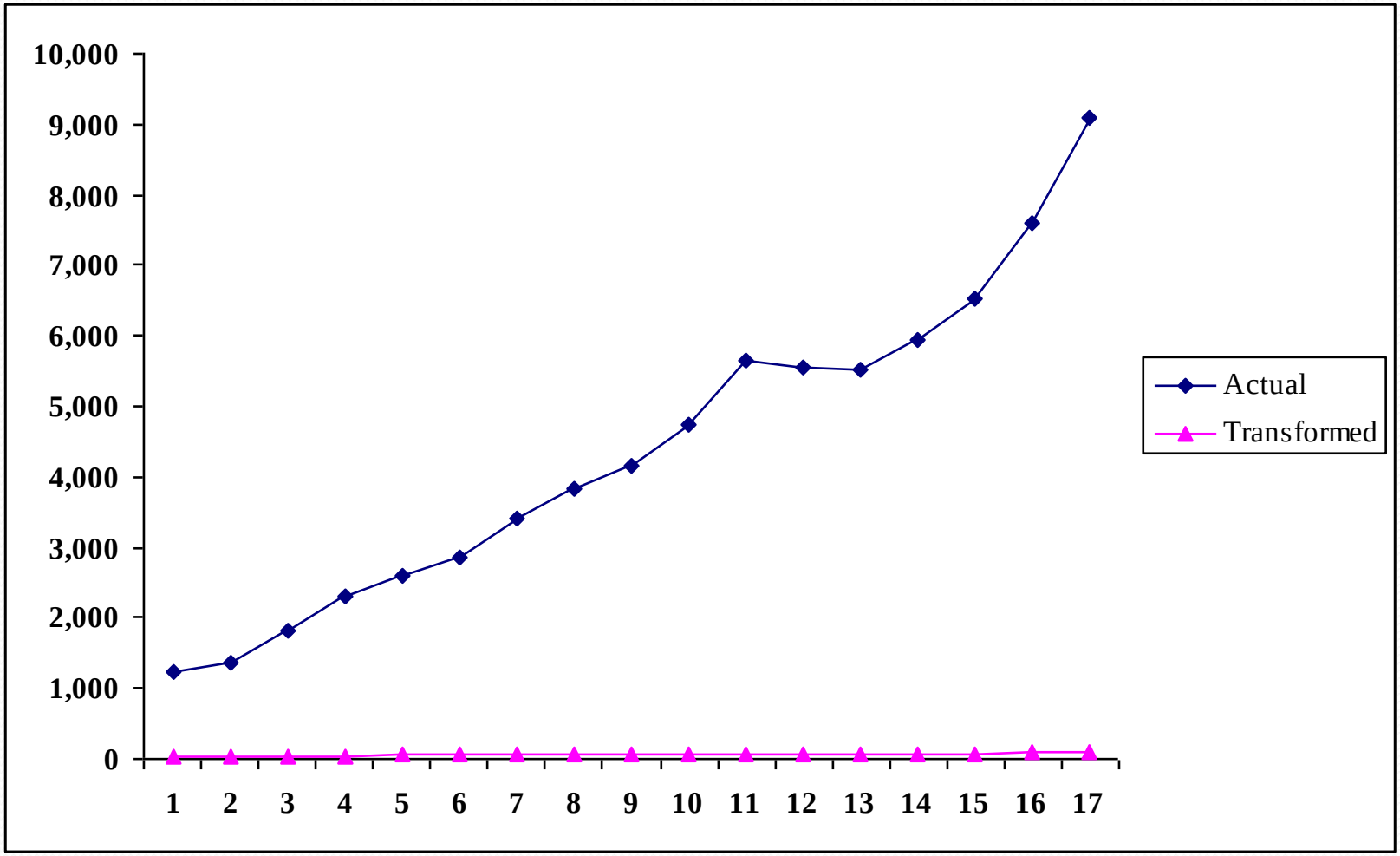
Year	*Operating Revenue (Million Dollars)*	*Square Root Transformation*
1990	1,237	35.17
1991	1,379	37.13
……	……	……
……	……	……
2002	5,522	74.31
2003	5,937	77.05
2004	6,530	80.81
2005	7,584	87.09
2006	9,086	95.32

Square Root Transformation

(Scaled Square Root Data)



Square Root Transformation (Unscaled Square Root Data)



Classical Time Series Model

- Secular Trend (T)
- Seasonal Variation (S)
- Cyclical Variation (C)
- Random or Irregular Variation

Trend

- Linear Trend

$$Y_t = a + bx$$

- Non-linear Trend

$$Y_t = e^{a+b_t}$$

$$Y_t = a + bT + cT^2$$

Trend

- Computing the Linear Trend
  - The Freehand Method
  - The Semi-average Method
  - The Least Squares Method

Freehand Method

U.S. Private Fixed Investment for the Years 1995–2005

Year	*Total Private Fixed Investment ($ Billion)*
1995	1,112.9
1996	1,209.9
1997	1,317.8
1998	1,438.4
1999	1,558.8
2000	1,679.0
2001	1,646.1
2002	1,570.2
2003	1,649.8
2004	1,830.6
2005	2,036.2

Freehand Method

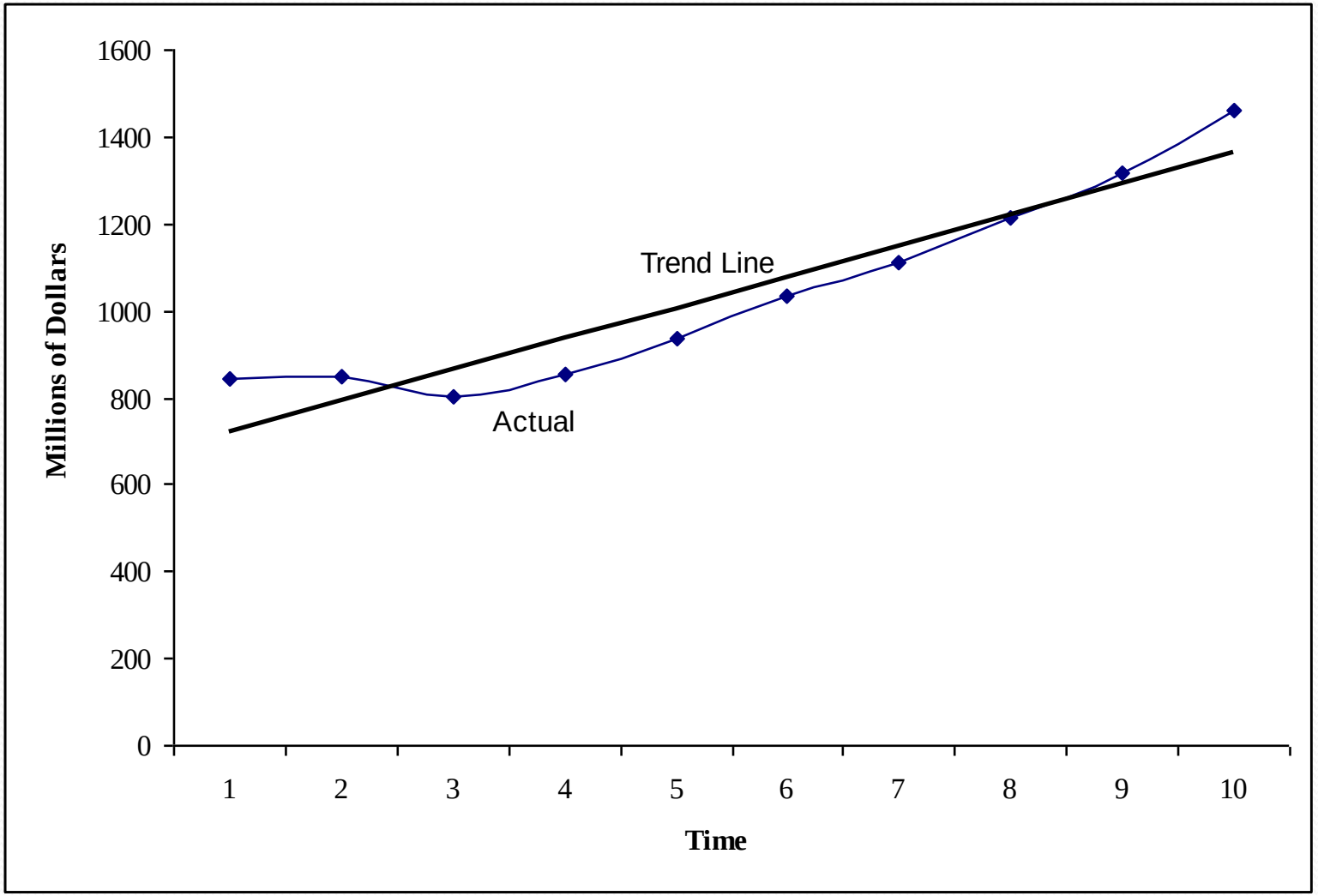
Since a linear trend by this method is simply an approximation of a straight line equation, we have to determine the intercept and the slope of the line.

$$Y_t = a + bx$$

Based on our data, we have:

$$\hat{Y}_t = 845.2 + 61.48x$$

Freehand Method



Freehand Method

- Now we can use this equation to make a forecast of the trend. For example, the forecast for 2006 would be:

$$\hat{Y}_t = 1{,}112.9 + 83.94(12)$$

$$\hat{Y}_{2006} = 2{,}120.18 \text{ Billion Dollars}$$

Freehand Method

- Based on your understanding, what are the pitfalls of using the freehand method?
- Simple method but not objective.
- Why not objective?

The Semi-average Method

- Simple but objective method in fitting a trend line.
- Divides the data into two equal parts and computes the average for each part.
- The computed averages for each part provide two points on a straight line.
- The slope of the line is computed by taking the difference between the averages and dividing it by half of the total number of observations.

The Semi-average Method

Fitting a Straight Line by the Semi-Average Method to Income from the Export of Durable Goods, 1996–2005

Year	Income	Semi-total	Semi-average	Coded Time
1996	**394.9**			**−2**
1997	**466.2**			**−1**
1998	**481.2**	**2,415.1**	**483.02**	**0**
1999	**503.6**			**1**
2000	**569.2**			**2**
2001	**522.2**			**3**
2002	**491.2**			**4**
2003	**499.8**	**2,679**	**535.8**	**5**
2004	**556.1**			**6**
2005	**609.7**			

The Semi-average Method

We see that the intercept of the line is:

$$483.02$$

The slope is:

$$b = \frac{535.80 - 483.02}{5} = 10.56$$

The fitted equation is:

$$\hat{Y}_t = 483.02 + 10.56x$$

The Semi-average Method

- For the year 2005, the forecast revenue from export of durable goods is:

$$\hat{Y}_t = 483.02 + 10.56(7)$$

$$\hat{Y}_t = \$556.94 \text{ Billion}$$

The Least Squares Method

- Provides the best method of fitting a trend.
- The intercept and the slope are computed as follows:

$$a = \frac{\sum Y}{n}$$

$$b = \frac{\sum xY}{\sum x^2}$$

The Least Squares Method

- Using the data from the previous example, we have:

$$a = \frac{5{,}094.1}{10} = 509.4$$

$$b = \frac{2{,}571.3}{330} = 7.79$$

The Least Squares Method

- The fitted trend line equation is:

$$\hat{Y}_t = 509.4 + 7.79x$$

x = 0 in 2000 ½

1 x = ½ year

Y = Billions of Dollars

- Note: Since x is measured in a half year, we have to multiply it by two to get the full year.

The Least Squares Method

- To compare the two methods, we note:
  - Semi-average:

$$\hat{Y}_t = 483.02 + 10.56x$$

  - Least squares:

$$\hat{Y}_t = 509.4 + 15.58x$$

Nonlinear Trend

- In many business and economic environments we observe that the time series does not follow a constant rate of increase or decrease, but follows an increasing or decreasing pattern.
- Whenever there is dramatic change in production technology, we expect the trend line not to follow a constant linear pattern.

Nonlinear Trend

- A polynomial function best exemplifies business conditions.

- A second-degree parabola provides a good historical description of an increase or decrease per time period.

$$\hat{Y}_t = a + bx_t + cx_t^2$$

Nonlinear Trend

- To solve for the constants a, b, and c in the previous equation, we use the following simultaneous equations:

$$\sum Y = na + c\sum x^2$$

$$\sum x^2 Y = a\sum x^2 + c\sum x^4$$

$$b = \frac{\sum xY}{\sum x^2}$$

Nonlinear Trend

World Carbon Emissions from Fossil Fuel Burning 1982–1994

Year X	Million tonnes Y	x	xY	x^2Y	x^2	x^4
1982	4,960	−6	−29,760	178,560	36	1,296
1983	4,947	−5	−24,735	123,675	25	625
1984	5,109	−4	−20,436	81,744	16	256
1985	5,282	−3	−15,846	47,538	9	81
1986	5,464	−2	−10,928	21,856	4	16
1987	5,584	−1	−5,584	5,584	1	1
1988	5,801	0	0	0	0	0
1989	5,912	1	5,912	5,921	1	1
1990	5,941	2	11,882	23,764	4	16
1991	6,026	3	18,078	54,234	9	81
1992	5,910	4	23,640	94,560	16	256
1993	5,893	5	29,465	147,325	25	625
1994	5,925	6	35,550	213,300	36	1,296
	72,754	0	17,238	998,061	182	4,550

Nonlinear Trend

- The data from the table is used to compute the following:

$$\hat{Y}_t = 5{,}739.8 + 94.71x - 10.24x^2$$

x = 0 in 1988

$1x$ = one year

Y = million tonnes

Logarithmic Trend

- When we wish to fit a trend line to percentage rates of change, we use the logarithmic trend line.
- This is more prevalent when dealing with economic growth in an environment.

- The logarithmic trend equation is:

$$\log Y_t = \log a + x \log b$$

Logarithmic Trend

- The least squares trend is computed as:

$$\log a = \frac{\sum \log Y}{n}$$

$$\log b = \frac{\sum (x \log Y)}{\sum x^2}$$

Logarithmic Trend Example

Year	Chinese Exports ($100 Million)	log Y	x	x log Y	x^2
1990	620.9	2.793	−15	−41.89	225
1991	719.1	2.857	−13	−37.13	169
1992	849.4	2.929	−11	−32.22	121
1993	917.4	2.963	−9	−26.66	81
1994	1,210.1	3.083	−7	−21.57	49
1995	1,487.8	3.173	−5	−15.86	25
1996	1,510.5	3.179	−3	−9.53	9
1997	1,827.9	3.262	−1	−3.26	1
1998	1,837.1	3.264	1	3.26	1
1999	1,949.3	3.290	3	9.86	9
2000	2,492.0	3.397	5	16.98	25
2001	2,661.0	3.425	7	23.97	49
2002	3,256.0	3.513	9	31.61	81
2003	4,382.28	3.642	11	40.05	121
2004	5,933.2	3.773	13	49.05	169
2005	7,619.5	3.882	15	58.22	225
		52.42	0.00	44.89	1360.0

Logarithmic Trend Example (*continued*)

$$\log a = \frac{\sum \log Y}{n} = \frac{52.42}{16} = 3.28$$

$$\log b = \frac{\sum (x \log Y)}{\sum x^2} = \frac{44.89}{1360} = 0.033$$

Logarithmic Trend Example

(*continued*)

- The estimated trend line equation is:

$$\log \hat{Y}_t = 3.28 + 0.033x$$

$$x = 0 \text{ in } 1997 \text{ ½}$$

$$1\,x = \text{½ year}$$

Logarithmic Trend *(continued)*

- Check the goodness of fit by substituting two data points such as 1992 and 2003, into the fitted equation.
- For 1992, we will have:

$$Log\,\hat{Y}_{1992} = 3.28 + 0.033(-11)$$

$$Log\,\hat{Y}_{1992} = 2.917$$

Logarithmic Trend *(continued)*

- For 2003, we will have:

$$\text{Log}\,\hat{Y}_{2003} = 3.28 + 0.033(11)$$

$$\text{Log}\,\hat{Y}_{2003} = 3.643$$

Logarithmic Trend

- Interpretation of the estimated trend line would be similar to a linear trend. However, before we can interpret the estimated values, we have to convert the log values into actual values of the data points.

- This is done by taking the antilog.

Logarithmic Trend

- The results are:

$$\hat{Y}_{1992} = \text{antilog}\,(\log\hat{Y}) = \text{antilog}\,2.917$$

$$\hat{Y}_{1992} = 826.04$$

And

$$\hat{Y}_{2003} = \text{antilog}\,(\log\hat{Y}) = \text{antilog}\,3.643$$

$$\hat{Y}_{2003} = 4{,}395.42$$

Logarithmic Trend

- To determine the rate of change or the slope of the line we have:

$$R = \text{antilog } 0.033 = 1.079$$

Since the rate of change (r) was defined as $R - 1$, then

$$r = 1.079 - 1 = 0.079$$

r = 7.9 percent per half-year

Therefore the growth rate is 15.8% or 16% per year.

Other Approaches to Trend Line

- Two more sophisticated methods of determining whether there is a trend in the data:
  - Differencing
  - Autocorrelation (Box–Jenkins Methodology)

- Allows the analyst to see whether a linear equation, a second-degree polynomial, or a higher-degree equation should be used to determine a trend.

Differencing

- First Difference

$$\Delta Y_t = Y_t - Y_{t-1}$$

- Second Difference

$$\Delta_2 Y_t = \Delta Y_t - \Delta Y_{t-1}$$

Differencing Method Example

First and Second Difference of Hypothetical Data

Yt	*First Difference*	*Second Difference*
20,000		
22,000	2,000	
24,300	2,300	300
26,900	2,600	300
29,800	2,900	300
33,000	3,200	300

Seasonal Analysis

- Seasonal variation is defined as a predictable and repetitive movement observed around a trend line within a period of 1 year or less.
- There are several reasons for measuring seasonal variations.
  - When analyzing the data from a time series, it is important to be able to know how much of the variation in the data is due to the seasonal factors.

Seasonal Variation (*Continued*)

- We may use seasonal variation patterns in making projections or forecasts of a short-term nature.

- By eliminating the seasonal variation from a time series, we may discover the *cyclical* pattern of the time series.

Seasonal Variation

Computation of Ratio of Original Data to Moving Average

Year and Month (1)	*Passenger Enplanement (Million)* (2)	*Moving 12-month Total* (3)	*Moving Average* (4)	*Ratio of Original Data to Moving Average, %* (5)
2001 Jan.	44.107			
Feb.	43.177			
March	53.055			
April	50.792			
May	51.120			
June	53.471			
July	55.803	560.359	46.70	119.50
Aug.	56.405	554.809	46.23	122.00
Sept.	30.546	550.277	45.86	66.61
Oct.	40.291	545.723	45.48	88.60

Seasonal Variation

- To compute a seasonal index, we do the following:
  - sum the modified means

Months

Year	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
2001							119.5	122.0	66.6	88.6	90.4	91.5
2002	87.0	87.9	111.4	102.5	104.7	108.6	111.1	110.3	86.2	103.2	94.2	105.7
2003	91.3	86.6	104.7	97.7	101.5	107.4	114.7	110.8	90.3	101.2	94.4	99.1
2004	86.7	89.0	105.8	103.5	102.2	109.0	113.6	108.6	90.0	101.6	96.7	97.6
2005	88.6	86.6	108.0	100.4	104.8	109.0	114.0					
Mean	87.4	87.1	106.2	100.2	102.8	108.3	112.9	109.9	88.8	102.0	95.1	96.1

Seasonal Variation

Month	*Mean Middle Three Ratios*	*Seasonal Index*
Jan.	87.42	87.68
Feb.	87.05	87.31
March	106.19	106.50
April	100.19	100.50
May	102.80	103.11
June	108.32	108.64
July	112.91	113.25
Aug.	109.90	110.23
Sep.	88.81	89.07
Oct.	102.00	102.31
Nov.	95.09	95.38
Dec.	96.07	96.36

Seasonal Variation

- If production is full, we expect the index to equal 100 for each month. If not, we have to adjust it by computing a correction factor.

$$\text{Correction Factor} = \frac{1200}{1197.97} = 1.002$$

- Compute the seasonal index.

Seasonal Variation

Partial Deseasonalized Data for Passenger Enplanement, 2001–2005

Year and Month (1)		*Passengers (Million) (2)*	*Seasonal Index (3)*	*Deseasonalized Passenger Enplanement [col 2 ÷ col 3] X 100*
2001	Jan.	44.107	87.68	50.306
	Feb.	43.177	87.31	49.452
	March	53.055	106.50	49.814
	April	50.792	100.50	50.539
	…..	…..….	…….	…….
2005	Sept.	50.776	89.07	57.005
	Oct.	53.971	102.31	52.754
	Nov.	52.962	95.38	55.530
	Dec.	53.007	96.36	55.008

Cyclical Variation

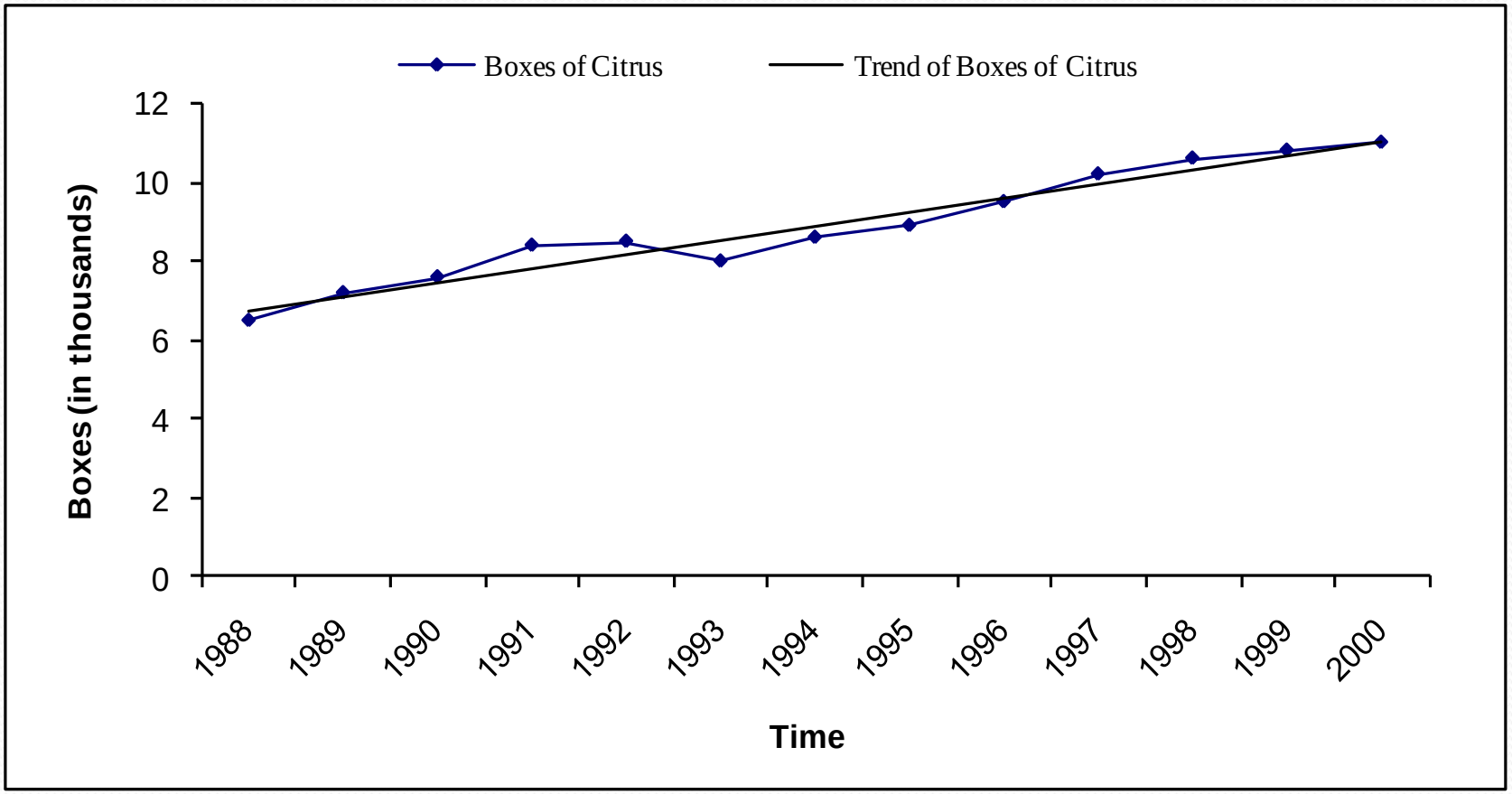
- Similar to seasonal variation except that it occurs every 5 to 10 years.
- There is a systematic pattern in the data that mirrors what is happening in the economy.
- Movements from a recession to a depression or recession to recovery follow a cycle.
- Every time series data has a random component. If there were no random components, we would have perfect prediction of future values. However, this is not the case with real-world conditions.
- The cyclical component is measured as a proportion of the trend.

Cyclical Variation

Citrus Received by the Cooperative during 1994–2006, and the Estimated Trend

Year X	*Boxes of Citrus (in 1,000)* Y	*Trend* Y_t
1994	6.5	6.7
1995	7.2	7.1
1996	7.6	7.5
1997	8.4	7.9
1998	8.5	8.3
1999	8.0	8.7
2000	8.6	8.9
2001	8.9	8.7
2002	9.5	9.5
2003	10.2	9.9
2004	10.6	10.3
2005	10.8	10.7
2006	11.0	11.1

Cyclical Variation



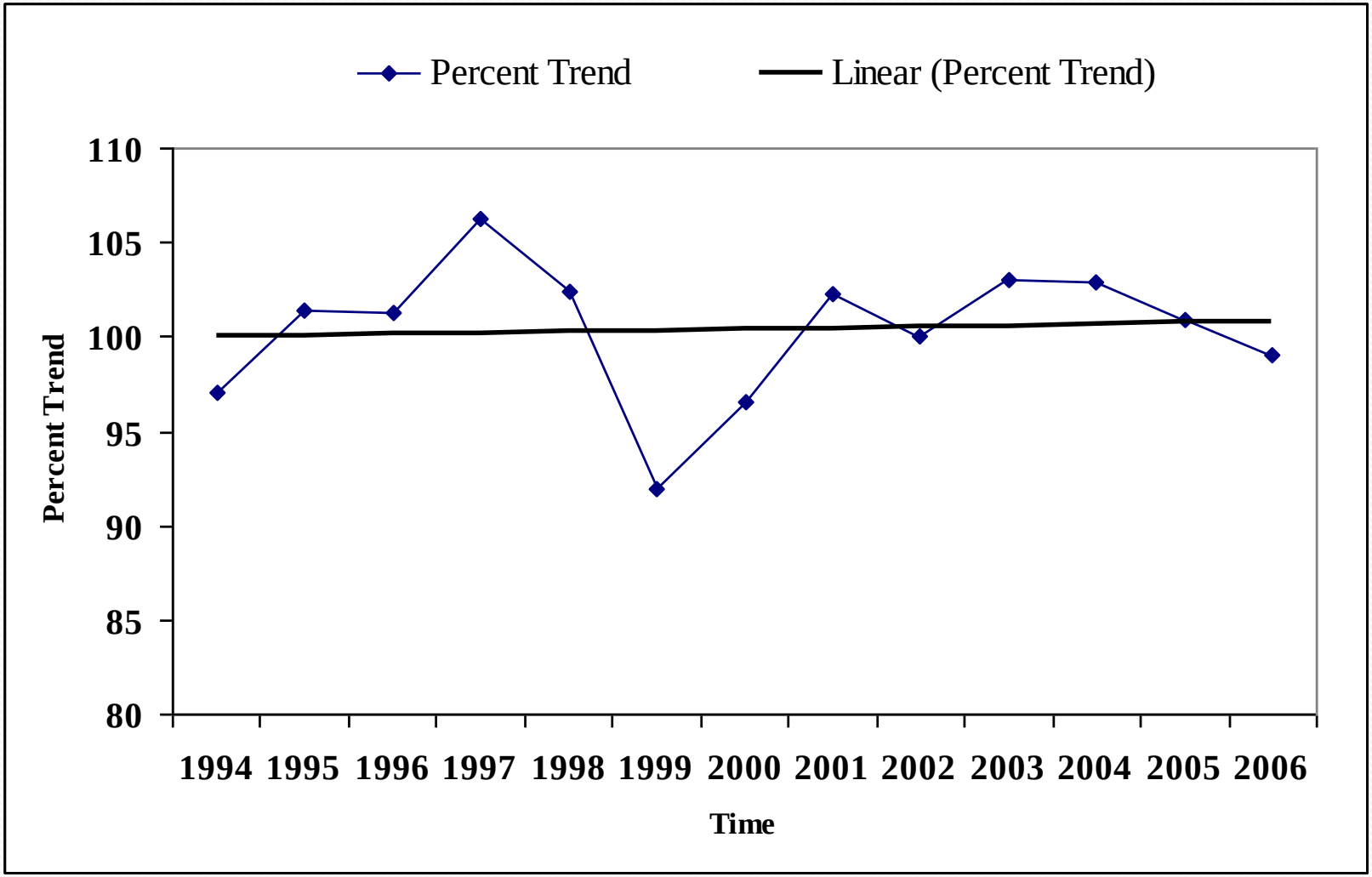
Cyclical Fluctuations around the Trend Line

Cyclical Variation

Calculation of Percent of Trend

Year X	*Boxes of Citrus (in 1,000)* Y	*Trend* Y_t	*Percent of trend* $(Y/Y_t \times 100)$
1994	6.5	6.7	97.0
1995	7.2	7.1	101.4
1996	7.6	7.5	101.3
1997	8.4	7.9	106.3
1998	8.5	8.3	102.4
1999	8.0	8.7	91.9
2000	8.6	8.9	96.6
2001	8.9	8.7	102.3
2002	9.5	9.5	100.0
2003	10.2	9.9	103.0
2004	10.6	10.3	102.9
2005	10.8	10.7	100.9
2006	11.0	11.1	99.1

Cyclical Variation Example



Summary

- Preliminary Adjustments to Data:
  - Trading Day Adjustment
  - Price Adjustment
  - Population Adjustment
- Data Transformation
- Patterns in Time Series Data
- The Classical Decomposition Method

Forecasting techniques

Business Forecasting

Forecasting with Smoothing Techniques

Topics

- Introduction
- Naïve Model
- Forecasting with Averaging Models:
  - Simple Average Model
  - Moving Average Model
  - Double Moving Average Model
- Exponential Smoothing:
  - Double Exponential Smoothing

Exponential Smoothing

- Holt's Method
- Triple Exponential Smoothing
- Winters' Seasonal Exponential Smoothing

Introduction

- Elaborate statistical models are not always required to develop accurate forecasts.
- The principle of parsimony suggests that the simpler the model the better.
- The main advantage of simple models is that they serve as a benchmark with which to gauge applicability, reliability, and necessity of the more sophisticated models.

Introduction

- These time series models are good tools in forecasting short-term events.
- The cardinal premise underlying all time series models is that the historical pattern of the dependent variable can be used as the basis for developing forecasts.
- In these models, historical data for the forecast variable are analyzed in an attempt to discern any underlying pattern(s).

Introduction

- Time series or autoregressive forecasting models will be most useful when economic conditions can be expected to remain relatively stable.
- Reliance of time series models on analysis and extrapolation of historical patterns carries several important implications with respect to technique selection:

Introduction

1. Time series are best when applied to short-term forecasts.
2. Time series models prove most satisfactory when historical data contain either no systematic data pattern or when the changes are occurring very slowly or consistently.
3. Data requirements and ease of implementation are a function of the specific time series technique selected.

Naïve Model

- Uses recent past as the best indicator of the future.

$$\hat{Y}_{t+1} = Y_t$$

- The error associated with this model is computed as:

$$e_t = Y_t - \hat{Y}_t$$

Example for the Naïve Model

Week	Sales (in $1,000)	Forecast
1	9	-
2	8	9
3	9	8
5	12	9
6	9	12
7	12	9
8	11	12
9	?	11

Example for the Naïve Model

Week	Sales (in $1,000)	Forecast	Error	Absolute Error	Squared Error
1	9				
2	8	9	−1	1	1
3	9	8	1	1	1
5	12	9	3	3	9
6	9	12	−3	3	9
7	12	9	3	3	9
8	11	12	−1	1	1
		Sum	2	12	30
		Mean	0.33	2	5

Example for the Naïve Model

- What you should keep in mind is that, although MAD is often used as the measurement of error in evaluating a forecast, an alternative criterion is the MSE.

- Note that the difference between MAD and MSE is that the latter penalizes a forecast much more for extreme deviations than it does for small ones.

Example for the Naïve Model

- Whenever a manager evaluates alternative forecasting techniques in terms of their accuracy, it is necessary to go beyond the computation of error.
- Managers are generally concerned with two forms of accuracy:
  - Accuracy of the technique in predicting the underlying patterns or relationship of past data.
  - Accuracy of the changes in the pattern. That is, how fast forecasting procedure can respond to that basic change.

Averaging Models

- The basic premise of these models is that a weighted-average of past observations can be used to smooth the fluctuations in the data in the short term.

Simple Average Model

- Similar to the naïve model, this model uses part of the historical data to make a forecast.

$$\hat{Y}_{t+1} = \frac{\sum_{t=1}^{n} Y_t}{n}$$

Moving Average Model

- Recent observations play an important role in the forecast.
- As new observations become available, a new average is computed.
- The choice of using a smaller or larger number of observations has implications for the forecast.

Double Moving Average Model

- Used when we have a linear trend in the data.
- Two different moving averages are computed in this model.
- The idea is to remove the trend.

Double Moving Average Model

Week	Sales (in $1,000)	Simple Moving Average	Simple Moving Average Forecast	Double Moving Average
1	9			
2	11	10		
3	10	10.5	10	10.25
5	14	12	10.5	11.25
6	18	16	12	14
7	22	20	16	18
8	23	22.5	20	21.25

Exponential Smoothing Model

- The model relies on the assumption that the data are stationary.

- Most recent observations play a more important role than the distant past.

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3}$$

Exponential Smoothing Model

- The model depends on three pieces of data:
  - Most recent actual
  - Most recent forecast
  - Smoothing constant.

- The value of alpha assigned as a smoothing constant is critical to the forecast.
- The best alpha should be chosen on the basis of minimal sum of error squared.

Exponential Smoothing Model

- Several approaches are followed in selecting the smoothing constant.
  - If a great amount of smoothing is desired, a small alpha should be chosen.
  - The choice of alpha is affected by the characteristics of the time series. If sharp ups and downs are noticed in the data, the best smoothing constant is 0.1. That is alpha chosen should equal 0.1.
  - If the data show that the past is very different from the present, then alpha of 0.9 is appropriate.

Exponential Smoothing Model

- Exponential smoothing is used for routine sales forecasting of inventory, production, distribution, and retail planning.

Double Exponential Smoothing Model

- Similar to the double moving average model.
- Also known as Brown's double exponential smoothing model.

$$\hat{Y}_{t+x} = a_t + b_t x$$

Double Exponential Smoothing Model

- The model is represented as:

$$\hat{Y}_{t+x} = a_t + b_t x$$

$\hat{Y}_{t+x}$ = forecast value x periods in the future

a_t = the difference between the simple A' and the double A'' smoothed values

b_t = slope in a time series

X = number of periods ahead to be forecasted

Double Exponential Smoothing Model

- To compute the difference between simple and double smoothed values:

$$A_t^{'} = \alpha Y_t + (1-\alpha) A_{t-1}^{'}$$

$$A_t^{''} = \alpha A_t^{'} + (1-\alpha) A_{t-1}^{''}$$

Double Exponential Smoothing Model

- Once we have computed the simple and double smoothed values, we then compute the intercept and the slope of the forecast line as follows:

$$a_t = 2A_t^{'} - A_t^{''}$$

$$b_t = \frac{\alpha}{1-\alpha}(A_t^{'} - A_t^{''})$$

The forecast equation is:

$$\hat{Y}_{t+x} = a_t + b_t x$$

Holt's Exponential Smoothing Model

- To handle linear trend, similar to the Brown's Method.
- The difference is that in this method we smooth the trend and the slope in the time series by using different constants for each.
- How do we find the best combination of smoothing constant?
- Low values of alpha and beta should be used when there are frequent random fluctuations in the data.
- High values of alpha and beta should be used when there is a pattern such as trend in the data.

Holt's Exponential Smoothing Model

- The following equations are used when applying the Holt's method:

$$A_t = \alpha Y_t + (1-\alpha)(A_{t-1} + T_{t-1})$$

$$T_t = \beta(A_t - A_{t-1}) + (1-\beta)T_{t-1}$$

$$\hat{Y}_{t+x} = A_t + xT_t$$

Triple Exponential Smoothing Model

- When faced with nonlinear pattern in the data, this model provides a good forecast.
- The life cycle model of products, and cost structures are environments where the triple exponential smoothing should be used.
- The forecasting equation is:

$$\hat{Y}_{t+x} = a_t + b_t x \ + (1/2)c_t x^2$$

Triple Exponential Smoothing Model

- In this model we have to compute three coefficients: a, b, and c .

- Each of the coefficients is computed as follows:

$$a_t = 3A_t^1 - 3A_t^2 + A_t^3$$

$$b_t = \frac{\alpha}{2(1-\alpha)^2}\left\{(6-5\alpha)A_t^1 - (10-8\alpha)A_t^2 + (4-3\alpha)A_t^3\right\}$$

$$c_t = \left[\left\{\frac{\alpha}{1-\alpha}\right\}\right]^2 (A_t^1 - 2A_t^2 + A_t^3)$$

Triple Exponential Smoothing Model

- You will note that the estimation of the coefficients (*a*, *b*, and *c*) requires us to compute three smoothing values.

$$A_t^1 = \alpha Y_t + (1-\alpha) A_{t-1}^1$$

$$A_t^2 = \alpha A_t^1 + (1-\alpha) A_{t-1}^2$$

$$A_t^3 = \alpha A_t^2 + (1-\alpha) A_{t-1}^3$$

Winters' Seasonal Exponential Smoothing

- Allows for both trend and seasonal patterns to be taken into account.
- This is an extension of the Holt's method of smoothing.
- In computing the forecast, we add an equation for seasonality as an index.
- The forecast model is:

$$\hat{Y}_{t+x} = (A_t + xT_t)I_{t-L+x}$$

Winters' Seasonal Exponential Smoothing

- The Winters' model has the following components:

Smoothing value $$A_t = \alpha \frac{Y_t}{I_{t-L}} + (1-\alpha)(A_{t-1} + T_{t-1})$$

Trend estimate $$T_t = \beta(A_t - A_{t-1}) + (1-\beta)T_{t-1}$$

Seasonality estimate $$I_t = \gamma \frac{Y_t}{A_t} + (1-\gamma)I_{t-L}$$

Summary

- Discussed how the naïve model is used in forecasting.
- Elaborated on the moving averages model, which included the simple moving average and the double moving average.
- Discussed the exponential smoothing models of Brown, Holt, and Winters.
- Identified the criteria for using the various models.

Business Forecasting

Adaptive Filtering as a Forecasting Technique

Topics

- Introduction
- How the Model is Used in Forecasting
- Summary

Introduction

- The adaptive filtering approach also depends heavily on historical observations.
- More complicated data patterns such as those with cycles are easily accommodated.
- The model makes it possible to learn from past errors and correct for it before making a final forecast.

Introduction

- In both the moving average and the exponential smoothing models, the forecaster depended on selecting the right value for the smoothing constant or the weight.
- In the adaptive filtering technique, the model seeks to determine the “best” set of weights that needs to be used in making a forecast.

Introduction

- The model is capable of generating information about past inaccuracy and corrects itself.

Basic Elements of the Technique

- The technique has two distinct phases:
  - The first phase is the adapting or training of a set of weights with historical data.
  - The second phase uses these weights to make a forecast.
- As in the previous methods, we compute the error for the forecast.
- The weights are adjusted based on the errors, and a new forecast is made.

Basic Elements of the Technique

- Note how we forecast for period 5, for example, using the weights:

$$\hat{Y}_5 = w_1 Y_4 + w_2 Y_3 + w_3 Y_2 + w_4 Y_1$$

- The error will be computed as:

$$e_5 = Y_5 - \hat{Y}_5$$

Adapting and Training Process

Hypothetical Data Used in Adjusting the Weights by Adaptive Filtering

Time	*Observed Data*	*Weights*	*Forecast*
1	Y_1	w_4	
2	Y_2	w_3	
3	Y_3	w_2	
4	Y_4	w_1	
5	Y_5		$\hat{Y}_5$
6	Y_6		
7	Y_7		
8	Y_8		
9	Y_9	w_4	
10	Y_{10}	w_3	
11	Y_{11}	w_2	
12	Y_{12}	w_1	
13			$\hat{Y}_{13}$

Training Phase

- In the training phase we use the following equation to adjust or revise the weights:

$$w_i' = w_i + 2k\left[e_t / y^2\right]Y_{t-i+1}$$

where :

w_i' = The revised ith weight

Training Phase

w_i = the old i th weight

k = a constant term referred to as the learning constant

e_t / y^2 = the standardized error of forecast in the period

Y_{t-i+1} = the observed value at period $t - i + 1$

$i = 1, 2, \ldots, p$ (p = number of weights)

$t = p + 1, p + 2, \ldots, N$ (N = number of observations)

y = the largest of the most recent N values of Y.

Training Phase

- As you can see, the revised set of weights is equal to the old set of weights plus some adjustments made for the error.
- The adjustment for each weight is based on:
  - The observed value
  - The value of the learning constant *k*
  - The error for that forecast.

Training Phase

- The learning constant allows the weights to be changed automatically as the time series changes its patterns.
- The steps for this adjustment process involves:
  - Specifying the number of weights
  - Specifying the learning constant (k).

Training Phase

- There are at least two ways of assigning the initial weights:
  - Forecaster uses his/her judgment to assign the weight.
  - A statistical approach is used to determine the weight as shown below:

where

$$w_i = 1/N$$

N = the number of observations in the data series.

Training Phase

- For quarterly data, *N* would equal 4 and for monthly data, *N* would equal 12
- The minimum number of weights that can be used in adaptive filtering is two.

- The learning constant (k) has a value between 0 and 1.

Training Phase

- If we choose a higher value for *k*, then we can expect rapid adjustment to changes in patterns, making it difficult to find the optimal weight.
- If we select a small value for *k*, the number of iterations needed to reach optimal weights may increase significantly.

Training Phase

- As a rule, *k* can be set to equal to 1/*p* where *p* is the number of weights.
- Alternative values of *k* are used, and the one that has the smallest standard error is selected.
- When data have a great deal of variation, a smaller *k* is recommended.

Example

Table 6.3 Quarterly Production Output

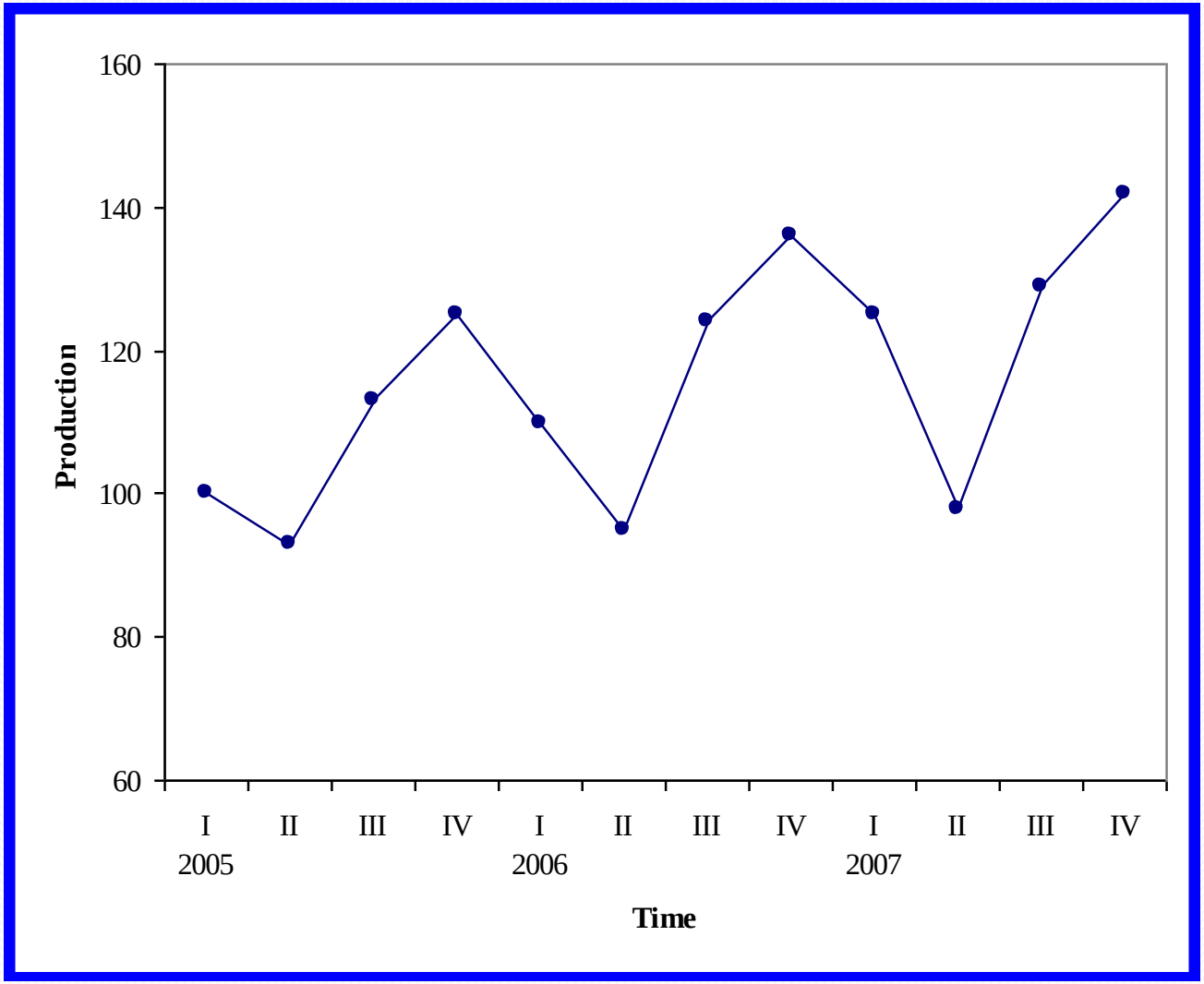
Period	*Year*	*Quarter*	*Output*
1	2005	I	100
2		II	93
3		III	113
4		IV	125
5	2006	I	110
6		II	95
7		III	124
8		IV	136
9	2007	I	125
10		II	98
11		III	129
12		IV	142

Example

Step 1:

Graph the data to see what observations can be made from the scatter plot.

Example


160
140
120
100
80
60
Production
I
II
III
IV
I
II
III
IV
I
II
III
IV
2005
2006
2007
Time

Example

Step 2:

Select the weight. Given that we have quarterly data, the weight will be:

$1/n = 0.25$ for each quarter.

Step 3:

Since there is seasonality in the data, we may want to give more weight to the quarter prior to the one for which the forecast is being made.

Example

Suppose we arbitrarily give the following weights for each quarter:

Q1 = 0.2

Q2 = 0.2

Q3 = 0.2

Q4 = 0.4

Example

Step 4:

The forecast for the first quarter of 2006 will be:

$$\hat{Y}_5 = (0.2)(125) + (0.2)(113) + (0.2)(93) + (0.4)(102) = 107$$

Step 5:

The error associated with this forecast will be:

Error = Observed value in period 5 – Forecast in period 5

= 110–107= 3.0

Example

Step 6:

Compute a new adjusted (or optimized) set of weights.

To do this, we have to know the learning constant (k).

We can set k to equal $1/p$, which in this case would be 0.25, since we have used four weights.

Example

Step 7:

Compute a new adjusted set of weights:

$$w_1^{'} = 0.2 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]125 = 0.2120$$

$$w_2^{'} = 0.2 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]113 = 0.2108$$

$$w_3^{'} = 0.2 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]93 = 0.1999$$

$$w_4^{'} = 0.4 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]102 = 0.4098$$

Example

Step 8:

The forecast for period 6, the second quarter of 2006, is now based on the new weights that we have just computed.

$$\hat{Y}_6 = (0.2120)(110) + (0.2108)(125) + (0.1999)(113) + (0.4098)(93) = 110$$

Example

Step 9:

This process of using the newly adjusted weights is used to compute the forecasts for the subsequent quarters (Table 6.4).

Example

Table 6.4 Forecast of Quarterly Production and Adjusted Weights for the 12 Periods

Period t	*Year/Quarter*		*Output* Y_t	*Forecast* F_t	W_1	W_2	W_3	W_4
1	2005:	I	102					
2		II	93					
3		III	113					
4		IV	125		0.2	0.2	0.2	0.4
5	2006:	I	110	107	0.2120	0.2108	0.1999	0.4098
6		II	95	110	0.1579	0.1493	0.1443	0.3641
7		III	124	91	0.2594	0.2669	0.2779	0.4849
8		IV	136	149	0.2090	0.2283	0.2332	0.4341
9	2007	I	125	127	0.2030	0.2228	0.2327	0.4336
10		II	98	126	0.1093	0.1209	0.1398	0.3624
11		III	129	90	0.2132	0.2534	0.2840	0.4939
12		IV	142	155	0.1678	0.2189	0.2400	0.4461

Example

Step 10:

Refine the weights by substituting those weights that are generated at the end of the training period:

$$w_1^{'} = 0.1678$$

$$w_2^{'} = 0.2189$$

$$w_3^{'} = 0.2400$$

$$w_4^{'} = 0.4461$$

Example

Step 11:

Using the computer program provided with this book, this process is continued until we have minimized the standard error and no more reduction is noted with repeated iterations.

Example

Adjusted Weights and the Standard Error after 200 Iterations

Iteration Number	*Standard Error*	W_1	W_2	W_3	W_4
1	**22.4013**	**0.1682**	**0.2188**	**0.2454**	**0.4419**
2	**20.8818**	**0.1213**	**0.2179**	**0.2771**	**0.4712**
3	**20.2727**	**0.0766**	**0.2121**	**0.3063**	**0.5023**
4	**19.7485**	**0.0344**	**0.2021**	**0.3331**	**0.5353**
5	**19.2626**	**-0.0051**	**0.1886**	**0.3572**	**0.5698**
……	**…….**	**……**	**….**	**……**	**…..**
120	**4.6367**	**−0.0990**	**0.1435**	**−0.3307**	**1.3484**
130	**4.4662**	**−0.1082**	**0.1694**	**−0.3328**	**1.3451**
140	**4.4153**	**−0.1227**	**0.1804**	**−0.3274**	**1.3507**
150	**4.4179**	**−0.1321**	**0.1785**	**−0.3250**	**1.3613**

Example

Step 11:

The forecast for period 13 will be:

$$\hat{Y}_{13} = (-0.1227)(142) + (0.1804)(129) + (-0.3274)(98) + (1.3507)(125) = 142.60$$

Summary

- The adaptive filtering approach depends heavily on historical observations.
- But, in this technique more complicated data patterns such as those with cycles are easily accommodated.
- Additionally, adaptive filtering makes it possible to learn from past errors and correct for it before making a final forecast.

Summary

- In comparison with the moving average and the exponential smoothing models, the adaptive filtering model seeks to determine the “best” set of weights that needs to be used in making a forecast.
- The model is capable of generating information about past inaccuracy and corrects itself.

Summary

- The technique has two distinct phases. The first phase is the adapting or training of a set of weights with historical data, and the second is to use these weights to make a forecast.
- We discussed how the weights are selected at the beginning and how finally the revised weights are used in making a forecast.

Summary

- Two important elements of the technique are the selection of the weights and the learning constant (k).
- Use of the computer program specially designed for this session makes the process of forecasting very easy.

Causal analysis models – regression analysis

Business Forecasting

Forecasting with Simple Regression

Topics

- Types of Regression Models
- Determining the Simple Linear Regression Equation
- Measures of Variation
- Assumptions of Regression and Correlation
- Residual Analysis
- Measuring Autocorrelation
- Inferences about the Slope

Topics

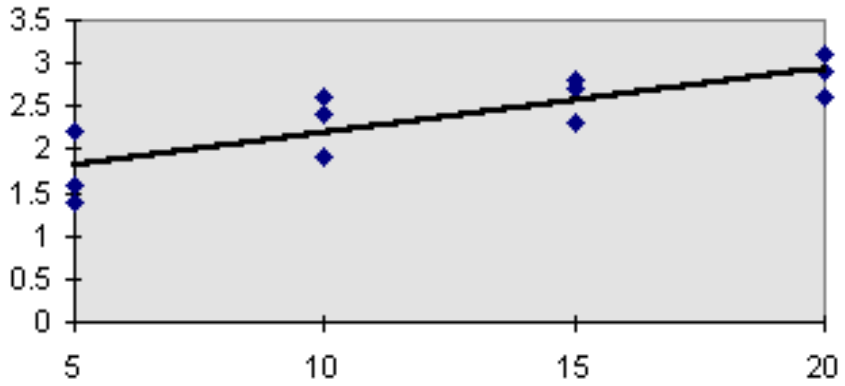
- Correlation—Measuring the Strength of the Association
- Estimation of Mean Values and Prediction of Individual Values
- Pitfalls in Regression and Ethical Issues

Purpose of Regression Analysis

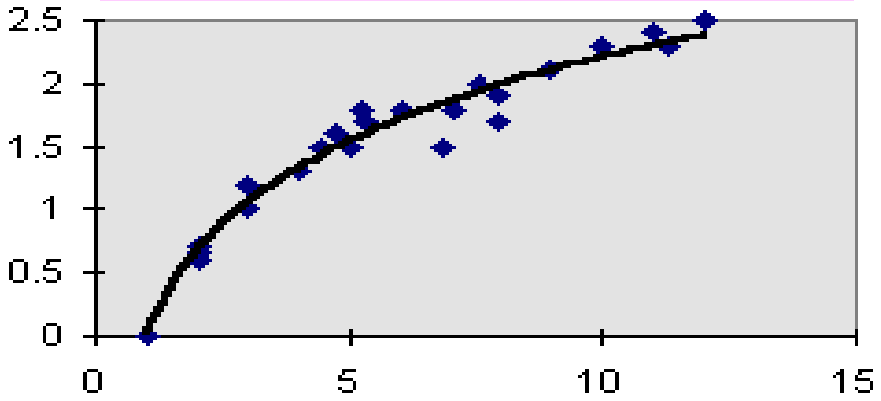
- Regression Analysis is Used Primarily to Model Causality and Provide Prediction
  - Predict the values of a dependent (response) variable based on values of at least one independent (explanatory) variable.
  - Explain the effect of the independent variables on the dependent variable.

Types of Regression Models

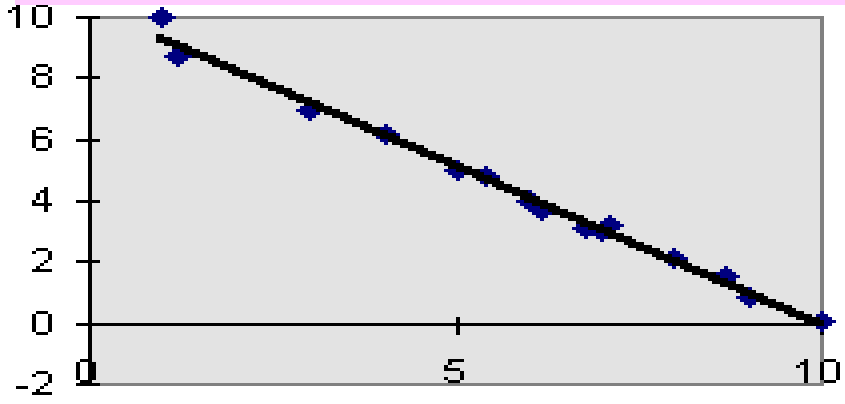
Positive Linear Relationship



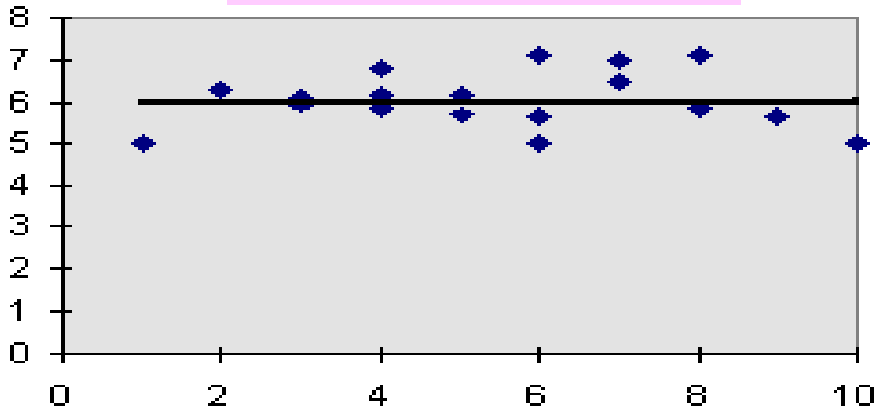
Relationship NOT Linear



Negative Linear Relationship

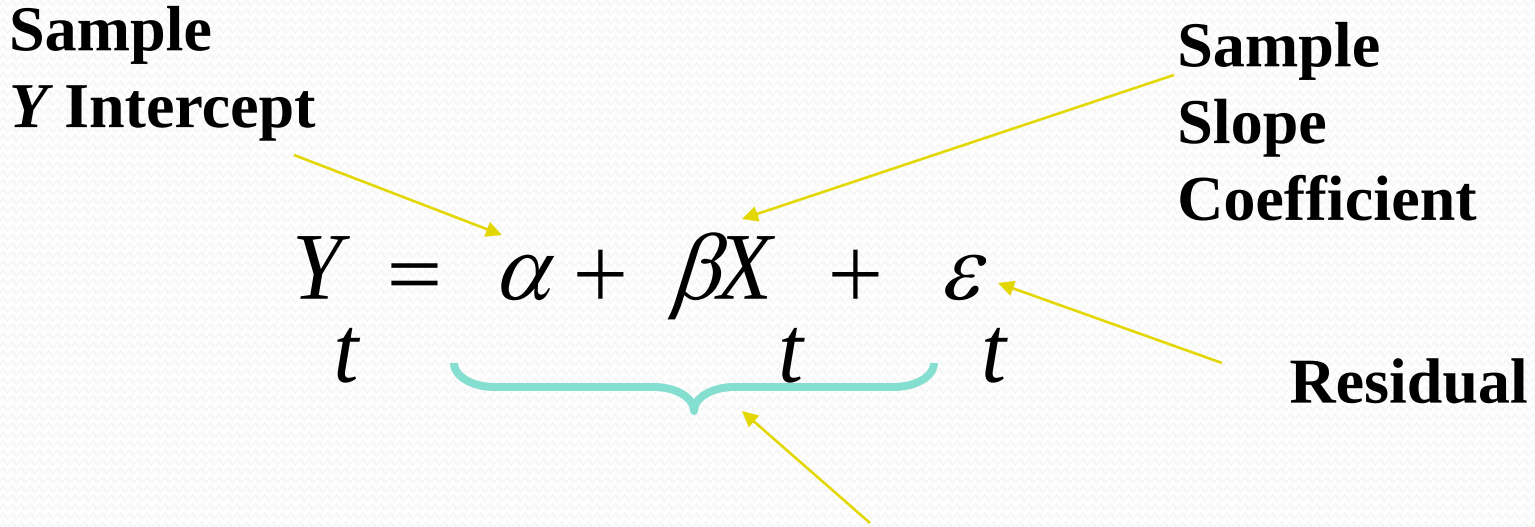


No Relationship



Linear Regression Equation

Sample regression line provides an *estimate* of the population regression line as well as a predicted value of Y.



$$\hat{Y} = a + bX$$

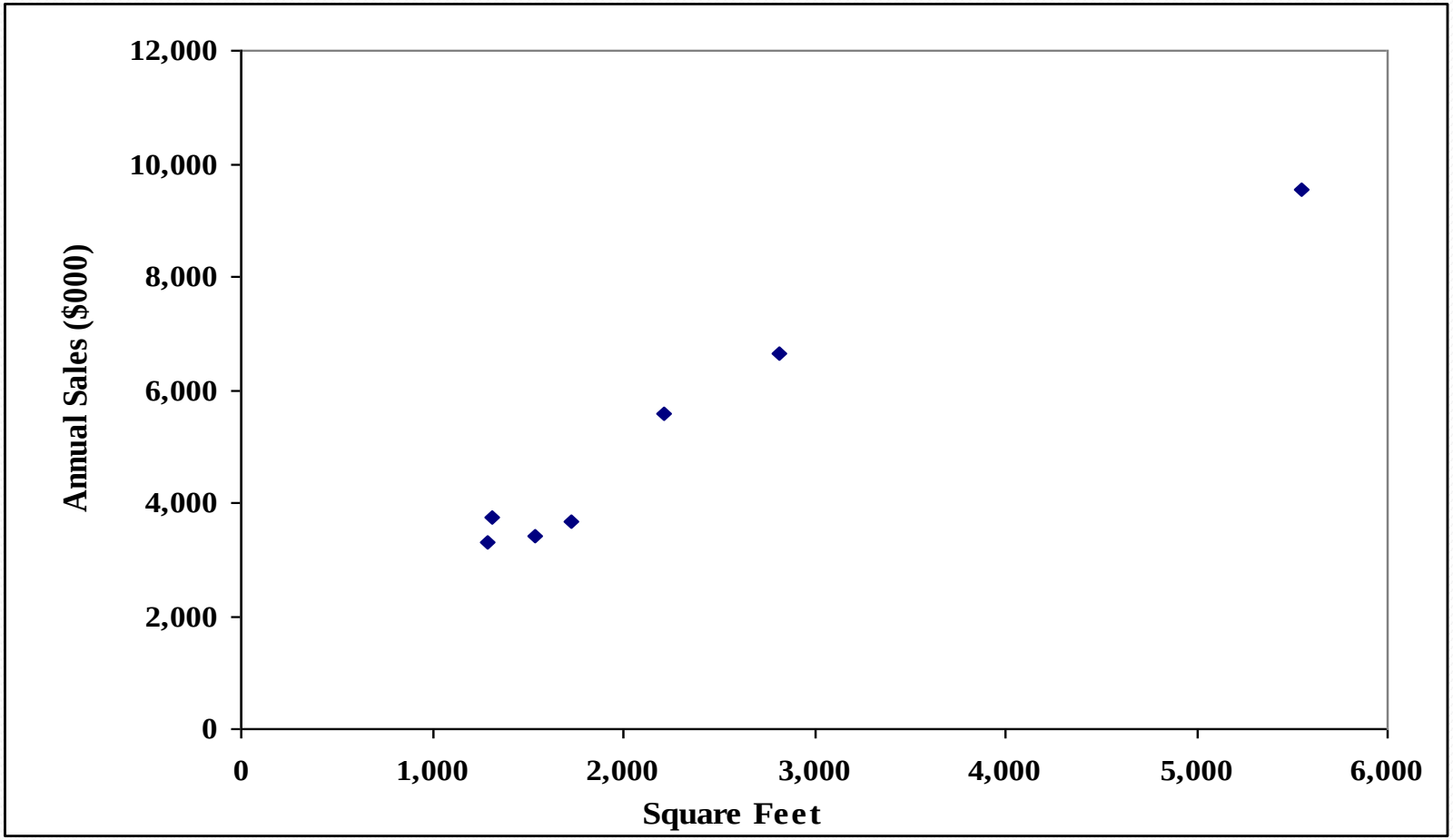
Simple Regression Equation (Fitted Regression Line, Predicted Value)

Simple Linear Regression: Example

You wish to examine the linear dependency of the annual sales of produce stores on their sizes in square footage. Sample data for seven stores were obtained. Find the equation of the straight line that best fits the data.

Store	Square Feet	Annual Sales ($1000)
1	1,726	3,681
2	1,542	3,395
3	2,816	6,653
4	5,555	9,543
5	1,292	3,318
6	2,208	5,563
7	1,313	3,760

Scatter Diagram: Example



Excel Output

Simple Linear Regression Equation: Example

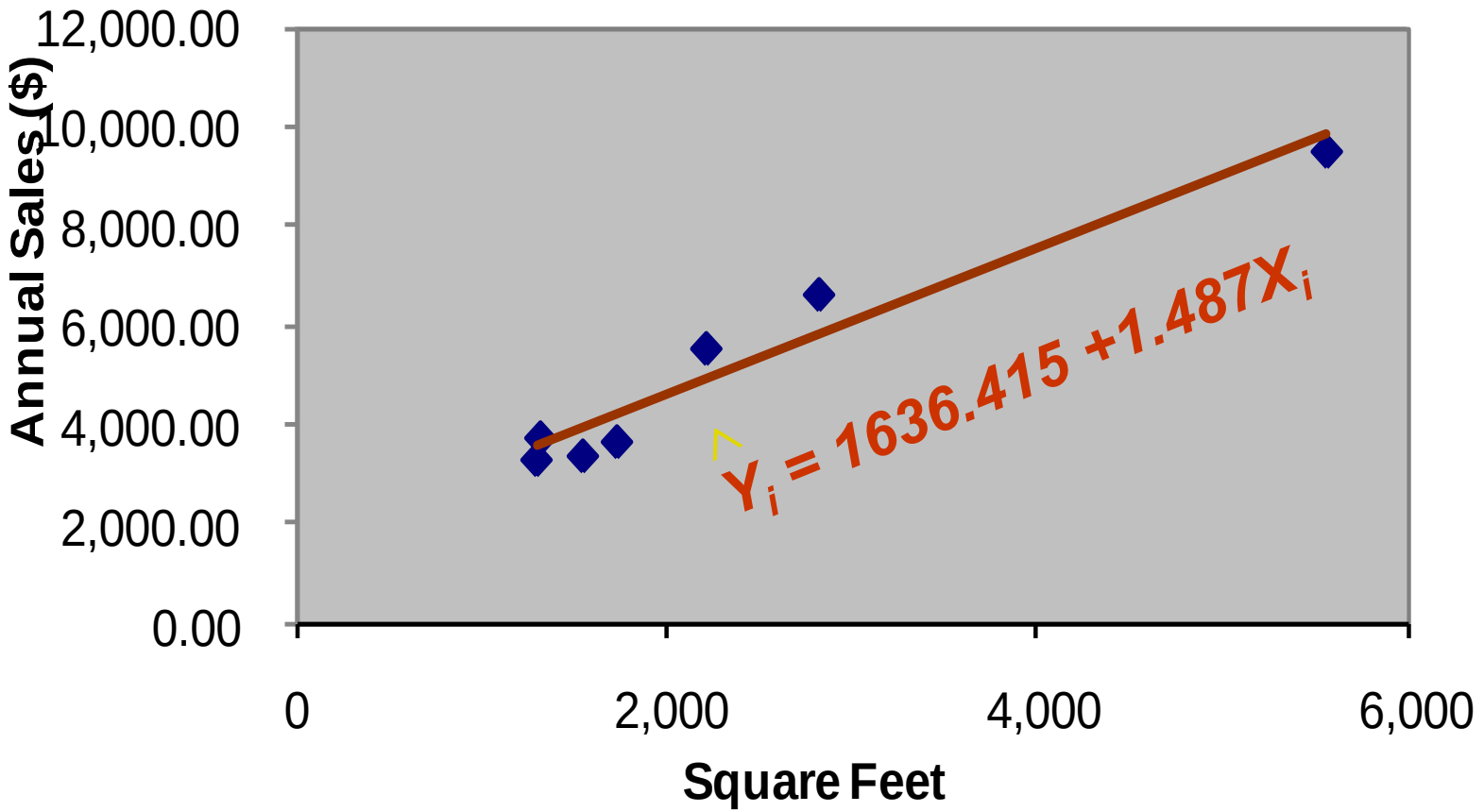
$$\hat{Y}_i = a + bX_i$$

$$= 1636.415 + 1.487 X_i$$

From Excel Printout:

Intercept	1636.415
Square Footage	1.486634

Graph of the Simple Linear Regression Equation: Example



Interpretation of Results: Example

$$\hat{Y}_i = 1636.415 + 1.487 X_i$$

The slope of 1.487 means that, for each increase of one unit in X, we predict the average of Y to increase by an estimated 1.487 units.

The equation estimates that, for each increase of 1 square foot in the size of the store, the expected annual sales are predicted to increase by $1,487.

Simple Linear Regression in Excel

- In Excel, use | Regression …
- EXCEL Spreadsheet of Regression Sales on Square Footage



Microsoft Excel Worksheet

Measures of Variation: The Sum of Squares

SST = **SSR** + **SSE**

Total Sample Variability = **Explained Variability** + **Unexplained Variability**

The ANOVA Table in Excel

ANOVA					
	df	**SS**	**MS**	***F***	***Significance F***
Regression	*k*	SSR	MSR=SSR/*k*	MSR/MSE	*P*-value of the *F* Test
Residuals	*n−k−1*	SSE	MSE= SSE/(n−k−1)		
Total	*n−1*	SST			

Measures of Variation
The Sum of Squares: Example

Excel Output for Produce Stores

Degrees of freedom

Regression (explained) df

ANOVA

	df	SS	MS	F	Significance F
Regression	1	30,380,456.12	30,380,456.12	81.17909	0.000281201
Residual	5	1,871,199.59	374,239.92		
Total	6	32,251,655.71			

Error (residual) df

Total df

SST

SSE

SSR

The Coefficient of Determination

- $$r^2 = \frac{\text{SSR}}{\text{SST}} = \frac{\text{Regression Sum of Squares}}{\text{Total Sum of Squares}}$$

- Measures the proportion of variation in Y that is explained by the independent variable X in the regression model.

Measures of Variation: Produce Store Example

Excel Output for Produce Stores

Regression Statistics	
Multiple *R*	0.9705572
R Square	0.94198129
Adjusted *R* Square	0.93037754
Standard Error	611.751517
Observations	7

$r^2 = 0.94$

S_{yx}

94% of the variation in annual sales can be explained by the variability in the size of the store as measured by square footage.

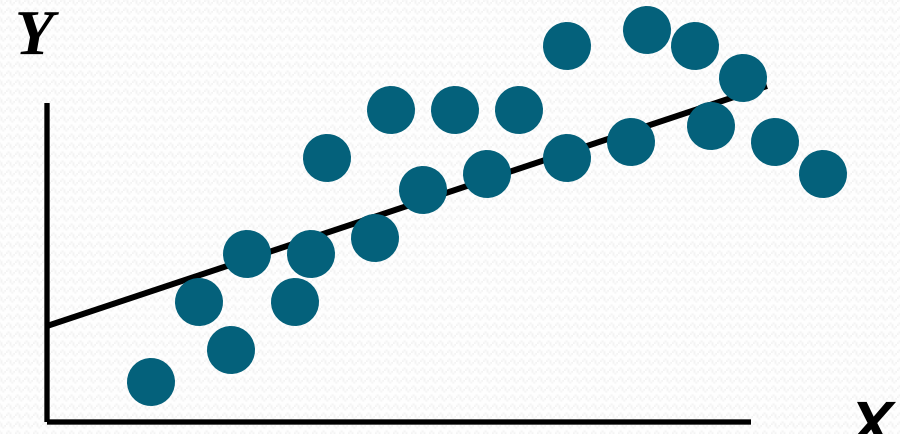
Linear Regression Assumptions

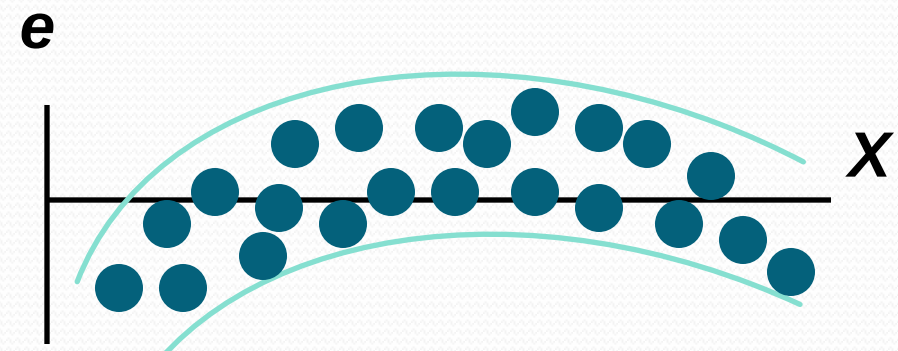
- Normality
  - *Y* values are normally distributed for each *X*.
  - Probability distribution of error is normal.
- 2. Homoscedasticity (Constant Variance)
- 3. Independence of Errors

Residual Analysis

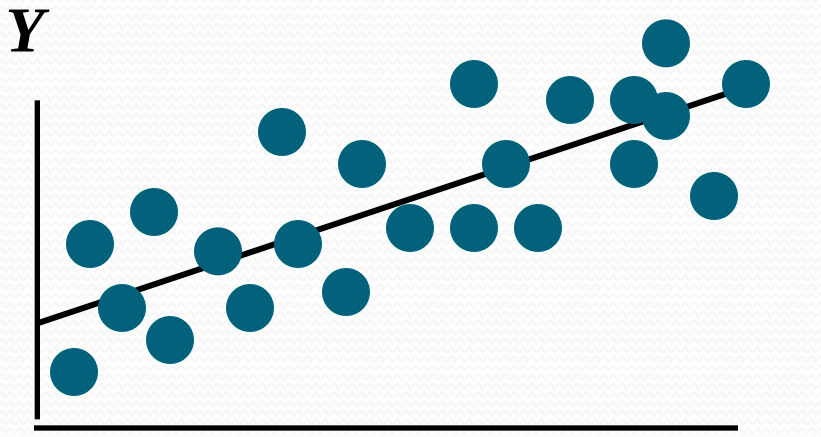
- Purposes
  - Examine linearity
  - Evaluate violations of assumptions
- Graphical Analysis of Residuals
  - Plot residuals vs. X and time

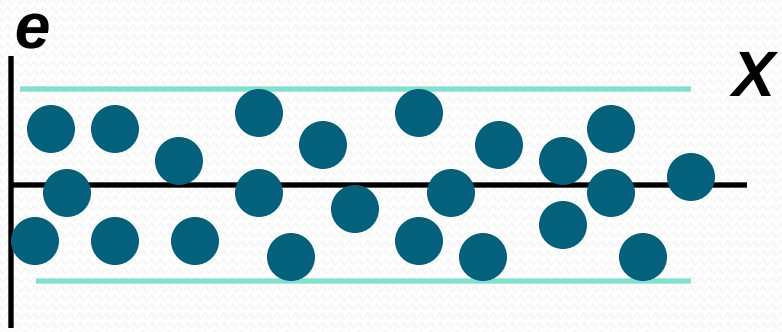
Residual Analysis for Linearity





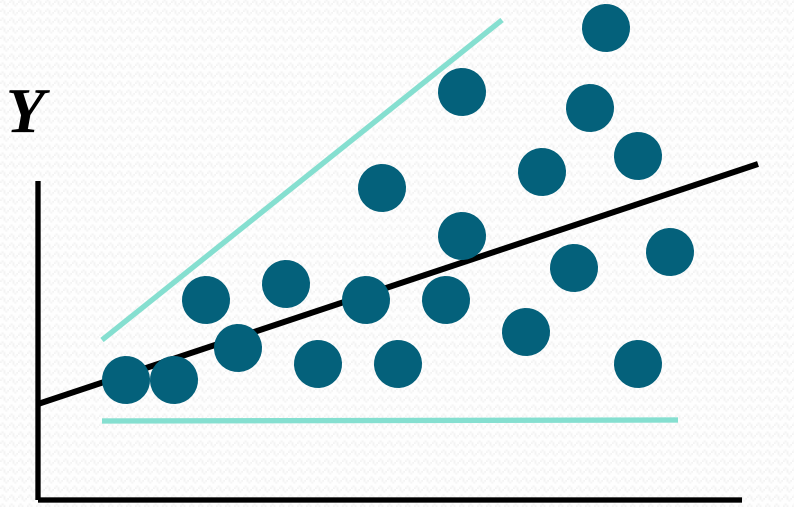
Not Linear

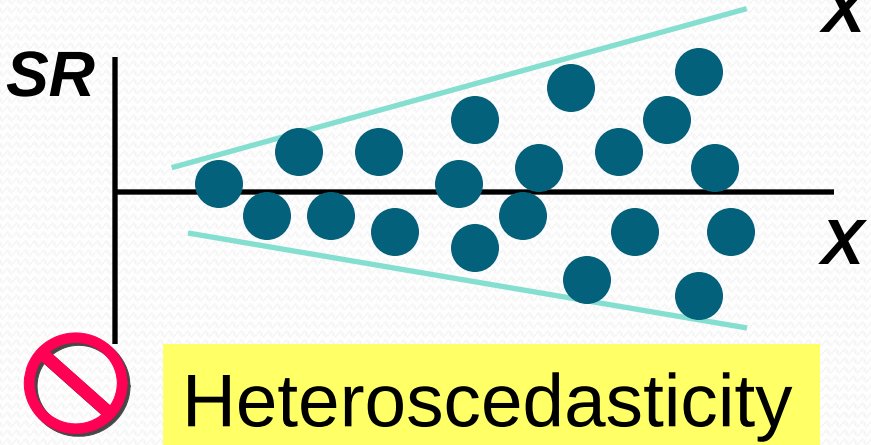




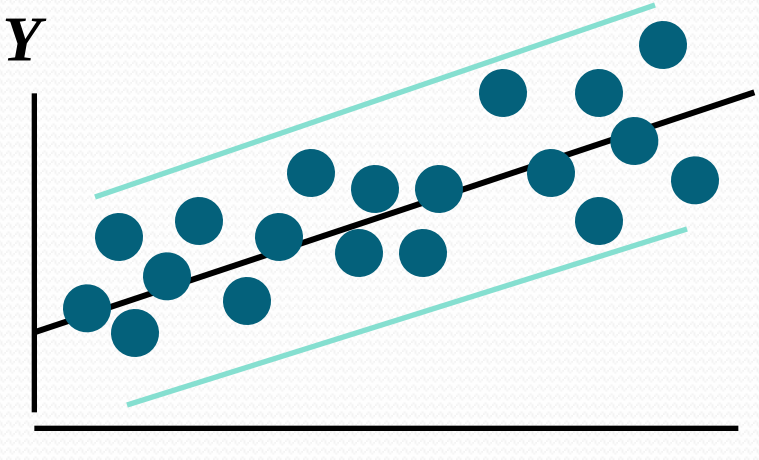
Linear

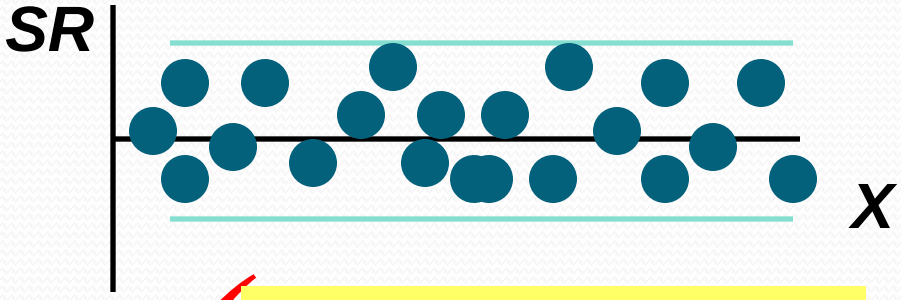
Residual Analysis for Homoscedasticity





Heteroscedasticity



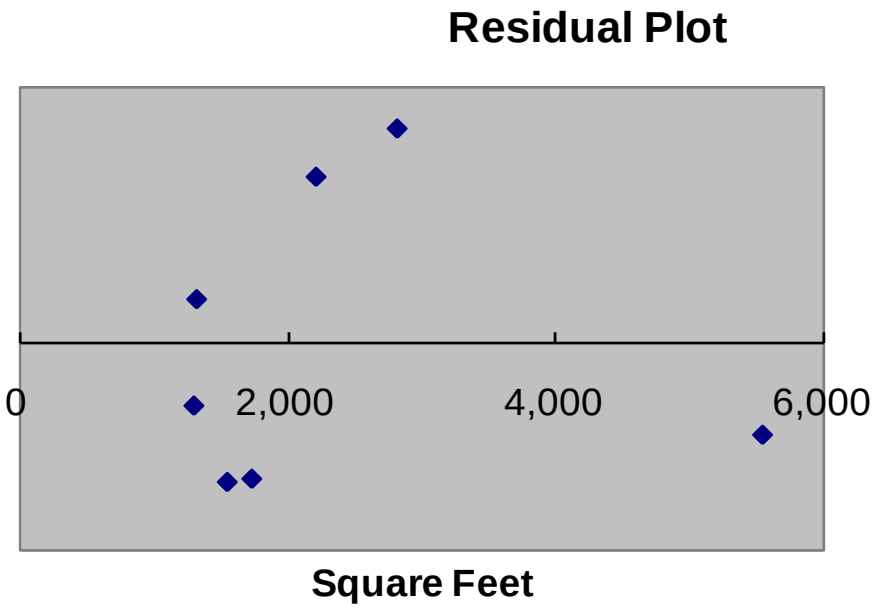


Homoscedasticity

Residual Analysis: Excel Output for Produce Stores Example

Excel Output

Observation	Predicted Y	Residuals
1	4,202.34442	-$521.34442
2	3,928.80382	-$533.80382
3	5,822.77510	$830.22490
4	9,894.66469	-$351.66469
5	3,557.14541	-$239.14541
6	4,918.90184	$644.09816
7	3,588.36472	$171.63528



Residual Analysis for Independence

- The Durbin–Watson Statistic
  - Used when data are collected over time to detect autocorrelation (residuals in one time period are related to residuals in another period).
  - Measures the violation of the independence assumption

$$D = \frac{\sum_{i=2}^{n} (e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

Should be close to 2.

If not, examine the model for autocorrelation.

Durbin–Watson Statistic in Minitab

- Minitab | Regression | Simple Linear Regression …
  - Check the box for Durbin–Watson Statistic

Obtaining the Critical Values of Durbin–Watson Statistic

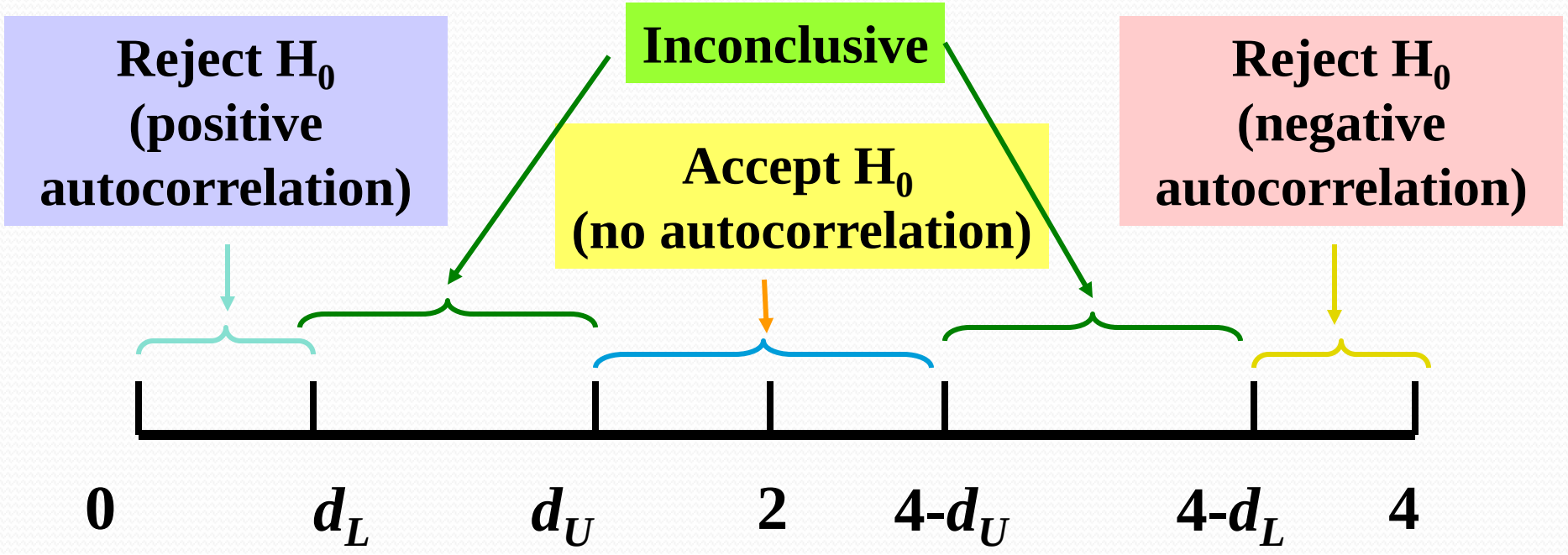
Finding the Critical Values of Durbin–Watson Statistic

$\alpha = .05$				
	$k=1$		$k=2$	
n	d_L	d_U	d_L	d_U
15	1.08	1.36	0.95	1.54
16	1.10	1.37	0.98	1.54

Using the Durbin–Watson Statistic

H_0 : No autocorrelation (error terms are independent).

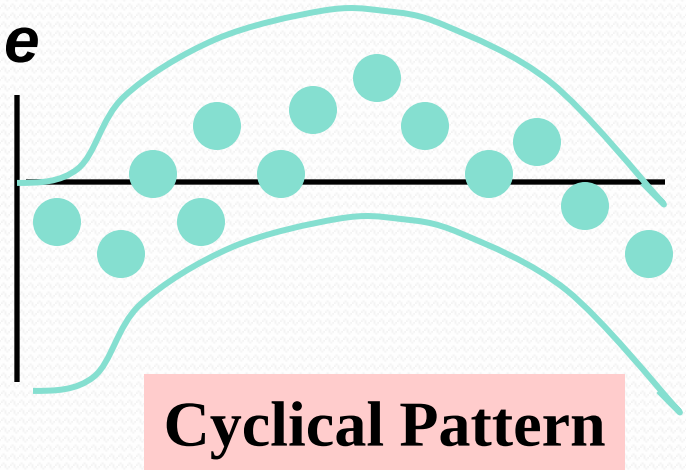
H_1 : There is autocorrelation (error terms are not independent).



Residual Analysis for Independence

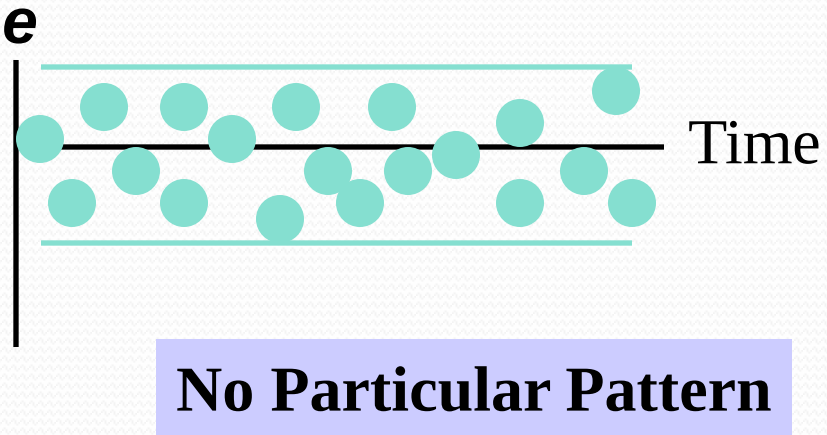
Graphical Approach

Not Independent



Cyclical Pattern

Independent



No Particular Pattern

Residual is plotted against time to detect any autocorrelation

Inference about the Slope: *t* Test

- *t* Test for a Population Slope
  - Is there a linear dependency of *Y* on *X* ?
- Null and Alternative Hypotheses
  - H_0: $\beta = 0$ (No Linear Dependency)
  - H_1: $\beta \neq 0$ (Linear Dependency)
- Test Statistic

$$t = \frac{b - \beta}{S_b} \quad \text{where} \quad S_b = \frac{S_{YX}}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2}}$$

df = n - 2

Example: Produce Store

Data for Seven Stores:

Store	Square Feet	Annual Sales ($000)
1	1,726	3,681
2	1,542	3,395
3	2,816	6,653
4	5,555	9,543
5	1,292	3,318
6	2,208	5,563
7	1,313	3,760

Estimated Regression Equation:

$$\hat{Y} = 1636.415 + 1.487 X_i$$

The slope of this model is 1.487.

Does Square Footage Affect Annual Sales?

Inferences about the Slope: *t* Test Example

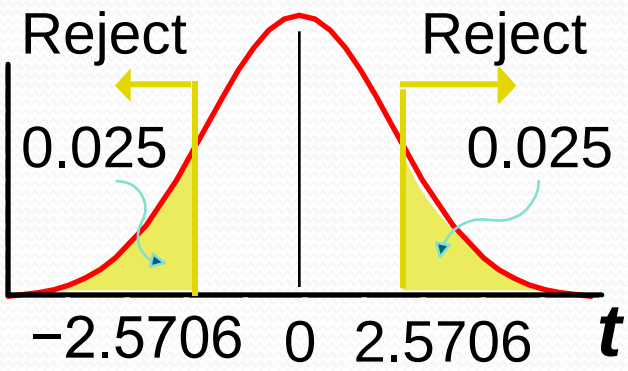
$H_0: \beta = 0$

$H_1: \beta \neq 0$

$\alpha = 0.05$

$df = 7 - 2 = 5$

Critical Value(s):



Test Statistic:

From Excel Printout

b S_b t

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	1636.4147	451.4953	3.6244	0.01515
Footage	1.4866	0.1650	9.0099	0.00028

Decision:

Reject H_0

Conclusion:

There is evidence that square footage affects annual sales.

Inferences about the Slope: *F* Test

- F Test for a Population Slope
  - Is there a linear dependency of Y on X ?
- Null and Alternative Hypotheses
  - H_0: $\beta = 0$ (No Linear Dependency)
  - H_1: $\beta \neq 0$ (Linear Dependency)
- Test Statistic

$$F = \frac{\frac{SSR}{1}}{\frac{SSE}{(n-2)}}$$

  - Numerator df=1, denominator df=n-2

Relationship between a *t* Test and an *F* Test

- Null and Alternative Hypotheses
  - H_o: $\beta = 0$ (No Linear Dependency)
  - H_1: $\beta \neq 0$ (Linear Dependency)

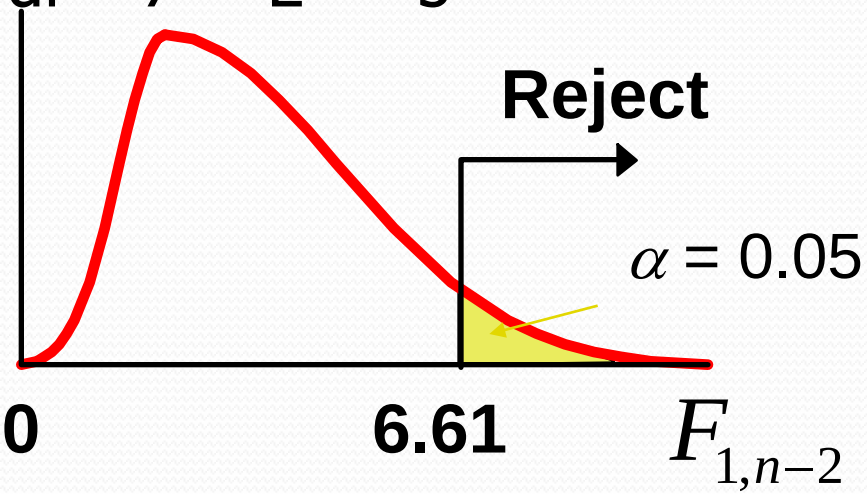
$$\left(t_{n-2}\right)^2 = F_{1,n-2}$$

Inferences about the Slope: *F* Test Example

H_0: $\beta = 0$
H_1: $\beta \neq 0$
$\alpha = 0.05$
numerator
df = 1
denominator
df = 7 − 2 = 5

Test Statistic:
From Excel Printout

ANOVA	df	SS	MS	F	Significance F
Regression	1	30,380,456.12	30,380,456.12	81.179	0.000281
Residual	5	1,871,199.59	374,239.92		
Total	6	32,251,655.71			



Decision: Reject H_0

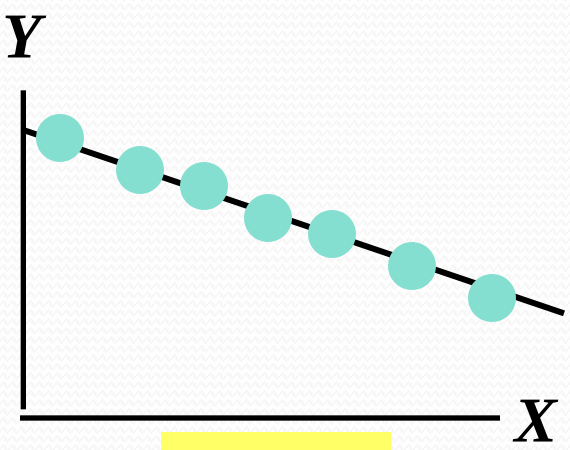
Conclusion:

There is evidence that square footage affects annual sales.

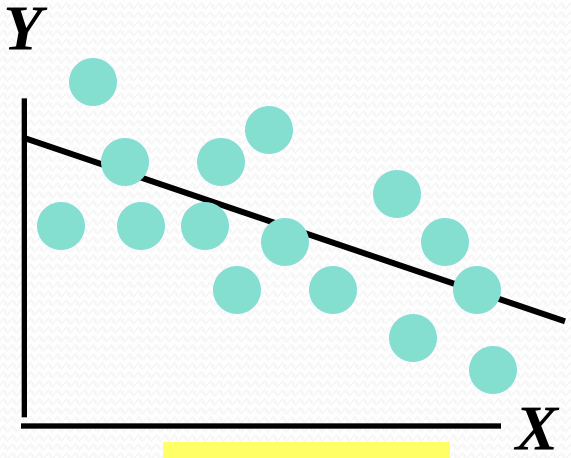
Purpose of Correlation Analysis

- Population Correlation Coefficient ρ (rho) is used to measure the strength between the variables.
- Sample Correlation Coefficient r is an estimate of ρ and is used to measure the strength of the linear relationship in the sample observations.

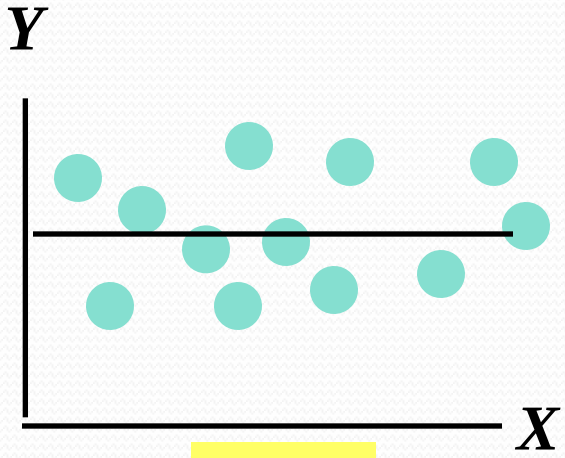
Sample of Observations from Various *r* Values



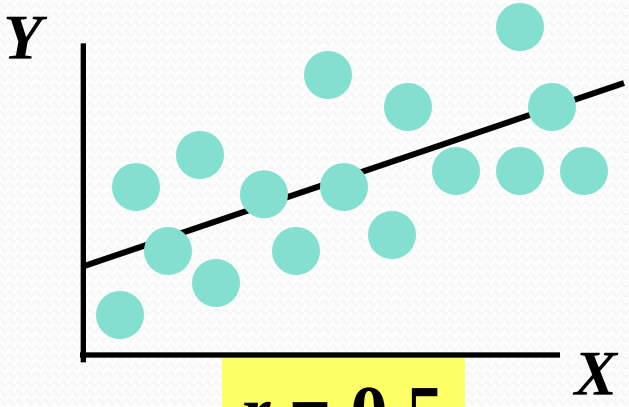
$r = -1$



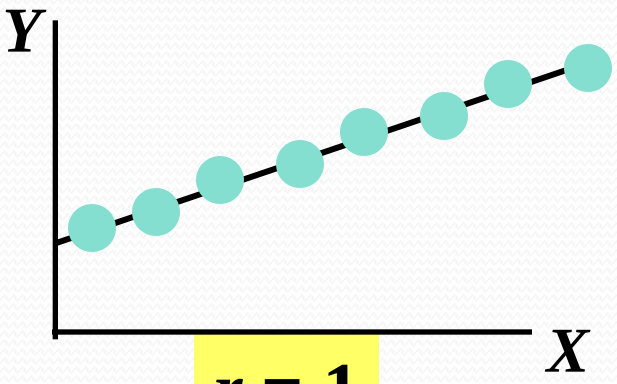
$r = -0.5$



$r = 0$



$r = 0.5$



$r = 1$

Features of ρ and r

- Unit Free
- Range between –1 and 1
- The Closer to –1, the Stronger the Negative Linear Relationship.
- The Closer to 1, the Stronger the Positive Linear Relationship.
- The Closer to 0, the Weaker the Linear Relationship.

Pitfalls of Regression Analysis

- Lacking an Awareness of the Assumptions Underlining Least-squares Regression.
- Not Knowing How to Evaluate the Assumptions.
- Not Knowing What the Alternatives to Least-squares Regression are if a Particular Assumption is Violated.
- Using a Regression Model Without Knowledge of the Subject Matter.

Strategy for Avoiding the Pitfalls of Regression

- Start with a scatter plot of *X* on *Y* to observe possible relationship.
- Perform residual analysis to check the assumptions.
- Use a normal probability plot of the residuals to uncover possible non-normality.

Strategy for Avoiding the Pitfalls of Regression

- If there is violation of any assumption, use alternative methods (e.g., least absolute deviation regression or least median of squares regression) to least-squares regression or alternative least-squares models (e.g., curvilinear or multiple regression).
- If there is no evidence of assumption violation, then test for the significance of the regression coefficients and construct confidence intervals and prediction intervals.

Summary

- Introduced Types of Regression Models.
- Discussed Determining the Simple Linear Regression Equation.
- Described Measures of Variation.
- Addressed Assumptions of Regression and Correlation.
- Discussed Residual Analysis.
- Addressed Measuring Autocorrelation.

Summary

- Described Inference about the Slope.
- Discussed Correlation—Measuring the Strength of the Association.
- Discussed Pitfalls in Regression and Ethical Issues.

Business Forecasting

Forecasting with Multiple Regression

Topics

- The Multiple Regression Model
- Estimating the Multiple Regression Model—The Least Squares Method
- The Standard Error of Estimate
- Multiple Correlation Analysis
  - Partial Correlation
  - Partial Coefficient of Determination

Topics

- Inferences Regarding Regression and Correlation Coefficients
- The *F*-Test
- The t-test
- Confidence Interval
- Validation of the Regression Model for Forecasting
- Serial or Autocorrelation

Topics

- Equal Variances or Homoscedasticity
- Multicollinearity
- Curvilinear Regression Analysis
  - The Polynomial Curve
- Application to Management
- Summary

The Multiple Regression Model

Relationship between one dependent and two or more independent variables is a linear function.

Population *Y*-intercept

Population slopes

Random Error

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \varepsilon_i$$

Dependent (Response) Variable

Independent (Explanatory) Variables

Interpretation of Estimated Coefficients

- Slope (b_i)
  - Estimated that the average value of Y changes by b_i for each 1 unit increase in Xi, holding all other variables constant (ceterus paribus).
  - Example: If $b_1 = -2$, then fuel oil usage (Y) is expected to decrease by an estimated 2 gallons for each 1 degree increase in temperature (X_1), given the inches of insulation (X_2).
- Y-Intercept (b_0)
  - The estimated average value of Y when all $X_i = 0$.

Multiple Regression Model: Example

Develop a model for estimating heating oil used for a single family home in the month of January, based on average temperature and amount of insulation in inches.



Oil (Gal)	Temp (°F)	Insulation
267.00	38	4
350.00	25	3
158.30	39	11
45.30	76	8
88.00	66	9
210.80	32	8
350.50	11	7
310.60	6	11
232.80	25	12
130.90	59	4
34.70	63	11
216.70	40	5
398.50	20	4
302.80	37	4
65.40	54	12

Multiple Regression Equation: Example

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + \cdots + b_k X_{ki}$$

Excel Output

	Coefficients
Intercept	515.8174635
Temperature	-4.860259128
Insulation	-15.0668036

$$\hat{Y}_i = 515.82 - 4.86 X_{1i} - 15.07 X_{2i}$$

For each degree increase in temperature, the estimated average amount of heating oil used is decreased by 4.86 gallons, holding insulation constant.

For each increase in one inch of insulation, the estimated average use of heating oil is decreased by 15.07 gallons, holding temperature constant.

Multiple Regression Using Excel

- Stat | Regression …

- EXCEL spreadsheet for the heating oil example.



Microsoft Excel Worksheet

Simple and Multiple Regression Compared

- Coefficients in a ***simple*** regression pick up the impact of that variable (plus the impacts of other variables that are correlated with it) and the dependent variable.
- Coefficients in a ***multiple*** regression account for the impacts of the other variables in the equation.

Simple and Multiple Regression Compared: Example

- Two simple regressions:

$$\text{Oil} = \beta_0 + \beta_1 \text{ Temp} + \varepsilon_i$$

$$\text{Oil} = \beta_0 + \beta_1 \text{ Insulation} + \varepsilon_i$$

- Multiple Regression:

$$\text{Oil} = \beta_0 + \beta_1 \text{ Temp} + \beta_2 \text{ Insulation} + \varepsilon_i$$

Standard Error of Estimate

- Measures the standard deviation of the residuals about the regression plane, and thus specifies the amount of error incurred when the least squares regression equation is used to predict values of the dependent variable.
- The standard error of estimate is computed by using the following equation:

$$s_e = \sqrt{\frac{\text{SSE}}{n-k-1}}$$

Coefficient of *Multiple* Determination

- Proportion of total variation in Y explained by all X Variables taken together.
  - $$r^2_{Y.12\ldots k} = \frac{\text{SSR}}{\text{SST}} = \frac{\text{Explained Variation}}{\text{Total Variation}}$$
- Never decreases when a new X variable is added to model.
  - Disadvantage when comparing models.

Adjusted Coefficient of Multiple Determination

- Proportion of variation in Y explained by all X variables adjusted for the number of X variables used and sample size:
  - $$r^2_{adj} = 1 - \left[\left(1 - r^2_{Y \bullet 12 \cdots k}\right) \frac{n-1}{n-k-1} \right]$$
  - Penalizes excessive use of independent variables.
  - Smaller than $r^2_{Y \bullet 12 \cdots k}$.
  - Useful in comparing among models.

Coefficient of Multiple Determination

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.98145
R Square	0.963245
Adjusted R Square	0.957119
Standard Error	24.74983
Observations	15

$$r^2_{Y.12..k} = \frac{SSR}{SST}$$

Adjusted R^2

- **Reflects the number of explanatory variables and sample size**
- **Is smaller than R^2**

Interpretation of Coefficient of Multiple Determination

$$r^2_{Y.12} = \frac{\text{SSR}}{\text{SST}} = 0.9632$$

- 96.32% of the total variation in heating oil can be explained by temperature and amount of insulation.

$$r^2_{adj} = 0.9571$$

- 95.71% of the total fluctuation in heating oil can be explained by temperature and amount of insulation after adjusting for the number of explanatory variables and sample size.

Using The Regression Equation to Make Predictions

Predict the amount of heating oil used for a home if the average temperature is 30° and the insulation is 6 inches.

$$\hat{Y}_i = 515.82 - 4.86X_{1i} - 15.07X_{2i}$$

$$= 515.82 - 4.86(28) - 15.07(5)$$

$$= 304.39$$

The predicted heating oil used is 304.39 gallons.

Predictions Using Excel

- Stat | Regression …
  - Check the "Confidence and Prediction Interval Estimate" box
- EXCEL spreadsheet for the heating oil example.

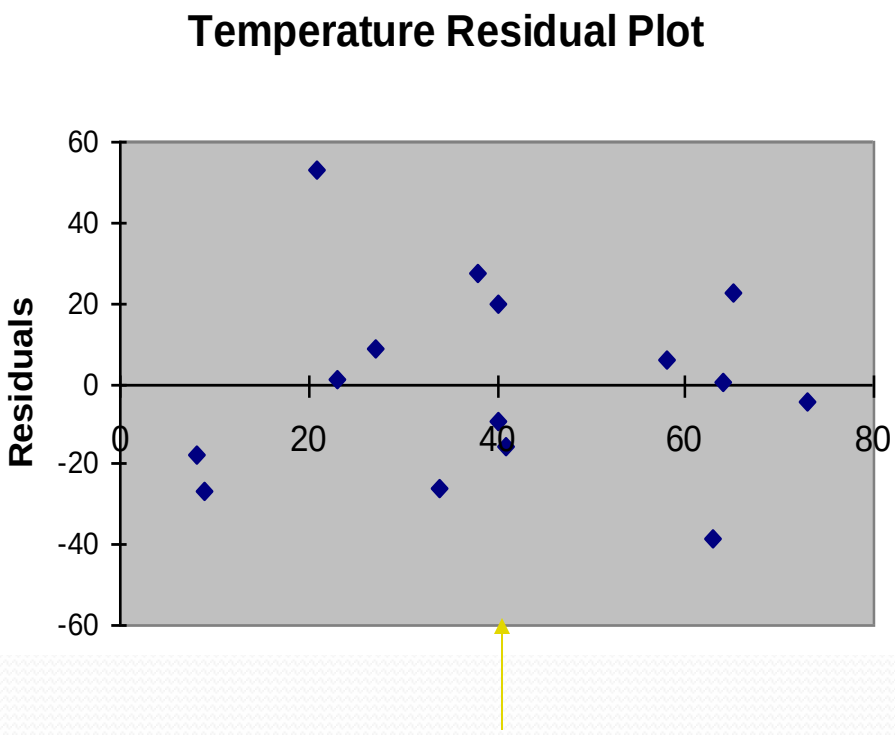


Microsoft Excel Worksheet

Residual Plots

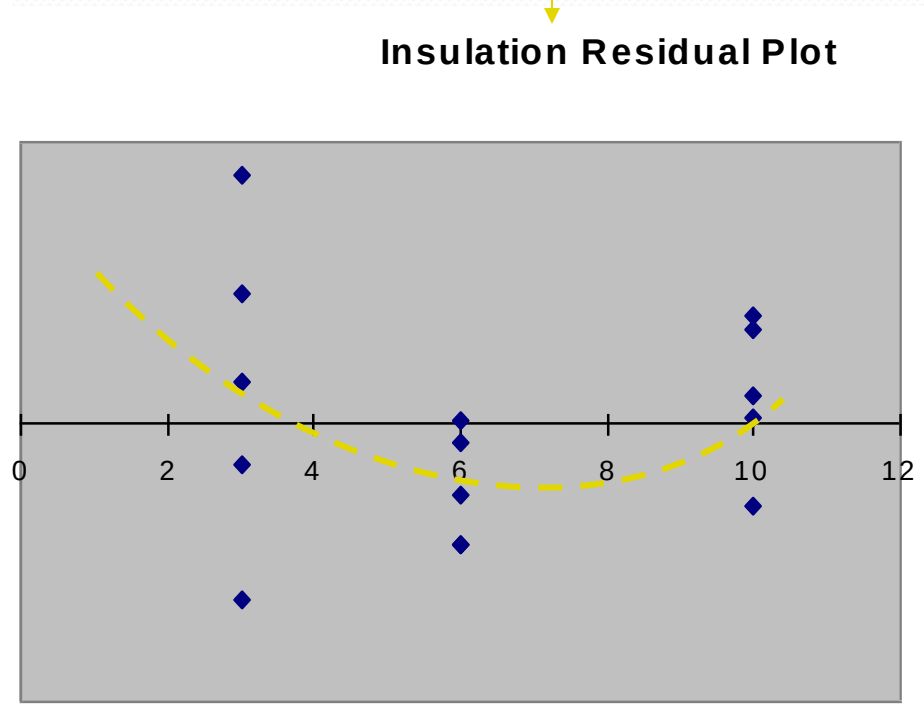
- Residuals vs. $\hat{Y}$
  - May need to transform Y variable.
- Residuals vs. X_1
  - May need to transform X_1 variable.
- Residuals vs. X_2
  - May need to transform X_2 variable.
- Residuals vs. Time
  - May have autocorrelation.

Residual Plots: Example



No Discernible Pattern

May be some non-linear relationship.



Testing for Overall Significance

- Shows if there is a linear relationship between all of the X variables together and Y.
- Use F test statistic.
- Hypotheses:
  - H_o: $\beta_1 = \beta_2 = \ldots = \beta_k = 0$ (No linear relationship)
  - H_1: At least one $\beta_i \neq 0$ (At least one independent variable affects Y.)
- The Null Hypothesis is a very strong statement.
- The Null Hypothesis is almost always rejected.

Testing for Overall Significance

- Test Statistic:

$$F = \frac{\mathrm{MSR}}{\mathrm{MSE}} = \frac{\mathrm{SSR(all)}/k}{\mathrm{MSE(all)}}$$

  - where F has k numerator and $(n\text{-}k\text{-}1)$ denominator degrees of freedom.

Test for Overall Significance

Excel Output: Example

ANOVA					
	df	SS	MS	*F*	*Significance F*
Regression	2	192637.4	96318.69	157.241063	2.4656E-09
Residual	12	7350.651	612.5543		
Total	14	199988			

k = 2, the number of explanatory variables.

n - 1

p value

$$\frac{\mathrm{MSR}}{\mathrm{MSE}} = F \text{ Test Statistic}$$

Test for Overall Significance Example Solution

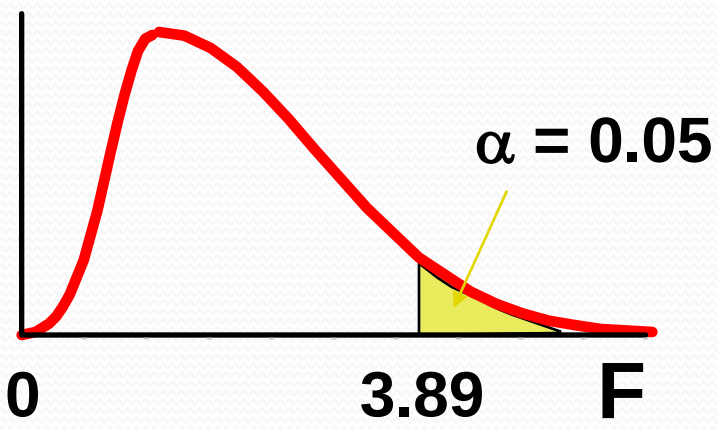
$H_0: \beta_1 = \beta_2 = \ldots = \beta_k = 0$

$H_1:$ At least one $\beta_i \neq 0$

$\alpha = 0.05$

df = 2 and 12

Critical Value:



Test Statistic:

$F = 157.24$

(Excel Output)

Decision:

Reject at $\alpha = 0.05$

Conclusion:

There is evidence that at least one independent variable affects Y.

Test for Significance: Individual Variables

- Shows if there is a linear relationship between the variable X_i and Y.
- Use t Test Statistic.
- Hypotheses:
  - H_0: $\beta_i = 0$ (No linear relationship.)
  - H_1: $\beta_i \neq 0$ (Linear relationship between X_i and Y.)

t Test Statistic
Excel Output: Example

t Test Statistic for X_1 (Temperature)

	Coefficients	*Standard Error*	t *Stat*
Intercept	515.8174635	19.61379316	26.29871
Temperature	-4.860259128	0.322210331	-15.0841
Insulation	-15.0668036	1.996236982	-7.5476

$$t = \frac{b_i}{S_{b_i}}$$

t Test Statistic for X_2 (Insulation)

t Test : Example Solution

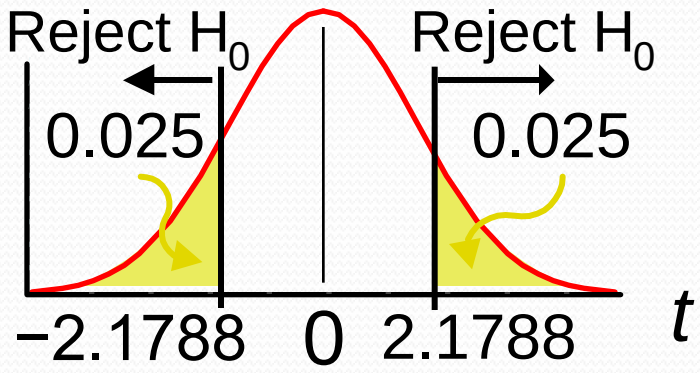
Does temperature have a significant effect on monthly consumption of heating oil? Test at $\alpha = 0.05$.

H_0: $\beta_1 = 0$

H_1: $\beta_1 \neq 0$

df = 12

Critical Values:



Test Statistic:

t Test Statistic = –15.084

Decision:

Reject H_0 at $\alpha = 0.05$

Conclusion:

There is evidence of a significant effect of temperature on oil consumption.

Confidence Interval Estimate for the Slope

Provide the 95% confidence interval for the population slope β_1 (the effect of temperature on oil consumption).

$$b_1 \pm t_{n-p-1} S_{b_1}$$

	Lower 95%	*Upper 95%*
Intercept	473.0827	558.5522
Temp	-5.562295	-4.158223
Insulation	-19.41623	-10.71738

$$-5.56 \leq \beta_1 \leq -4.15$$

The estimated average consumption of oil is reduced by between 4.15 gallons and 5.56 gallons for each increase of 1° F.

Contribution of a Single Independent Variable

X_k

- Let X_k be the independent variable of interest
- $$\text{SSR}\left\langle X_k \,\middle|\, \text{all others except } X_k \right\rangle$$
  $$= \text{SSR(all)} - \text{SSR(all others except } X_k\text{)}$$
  - Measures the contribution of X_k in explaining the total variation in Y.

Contribution of a Single Independent Variable

X_k

$$\mathrm{SSR}\left\langle X_1 \middle| X_2 \text{ and } X_3 \right\rangle$$

$$= \mathrm{SSR}(X_1, X_2, \text{and } X_3) - \mathrm{SSR}(X_2, \text{and } X_3)$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + b_3 X_{3i}$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_2 X_{2i} + b_3 X_{3i}$$

Measures the contribution of X_1 in explaining Y.

Coefficient of Partial Determination of X_k

- $$r_{Yk.\text{all others}} = \frac{\text{SSR}\left\langle \text{X}_k \,\middle|\, \text{all others} \right\rangle}{\text{SST} - \text{SSR(all)} + \text{SSR}\left\langle \text{X}_\text{k} \,\middle|\, \text{all others} \right\rangle}$$

- Measures the proportion of variation in the dependent variable that is explained by X_k , while controlling for (Holding Constant) the other independent variables.

Coefficient of Partial Determination for X_k

Example: Model with two independent variables

$$r^2_{Y1.2} = \frac{\text{SSR}\left\langle \text{X}_1 \middle| \text{X}_2 \right\rangle}{\text{SST} - \text{SSR}(\text{X}_1, \text{X}_2) + \text{SSR}\left\langle \text{X}_1 \middle| \text{X}_2 \right\rangle}$$

Coefficient of Partial Determination in Excel

- Stat | Regression…
  - Check the "Coefficient of partial determination" box.
- EXCEL spreadsheet for the heating oil example.



Microsoft Excel Worksheet

Contribution of a Subset of Independent Variables

- Let X_s be the subset of independent variables of interest
  - $$\mathrm{SSR}\left(X_s \mid \text{all others except } X_s\right)$$
    $$= \mathrm{SSR}(\text{all}) - \mathrm{SSR}(\text{all others except } X_s)$$
  - Measures the contribution of the subset X_s in explaining SST.

Contribution of a Subset of Independent Variables: Example

Let X_s be X_1 and X_3

$$\text{SSR}\left(X_1 \text{ and } X_3 \mid X_2\right)$$

$$= \text{SSR}(X_1, X_2, \text{and } X_3) - \text{SSR}(X_2)$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + b_3 X_{3i}$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_2 X_{2i}$$

Testing Portions of Model

- Examines the contribution of a subset X_s of explanatory variables to the relationship with Y.
- Null Hypothesis:
  - Variables in the subset do not improve significantly the model when all other variables are included.
- Alternative Hypothesis:
  - At least one variable is significant.

Testing Portions of Model

- One-tailed Rejection Region
- Requires comparison of two regressions:
  - One regression includes everything.
  - Another regression includes everything except the portion to be tested.

Partial *F* Test for the Contribution of a Subset of *X* variables

- Hypotheses:
  - H_0 : Variables X_s do not significantly improve the model, given all other variables included.
  - H_1 : Variables X_s significantly improve the model, given all others included.
- Test Statistic:

$$F = \frac{\mathrm{SSR}\left(\mathrm{X_s} \,\middle|\, \text{all others}\right) / m}{\mathrm{MSE\,(all)}}$$

  - with df = m and $(n\text{-}k\text{-}1)$
  - m = # of variables in the subset X_s .

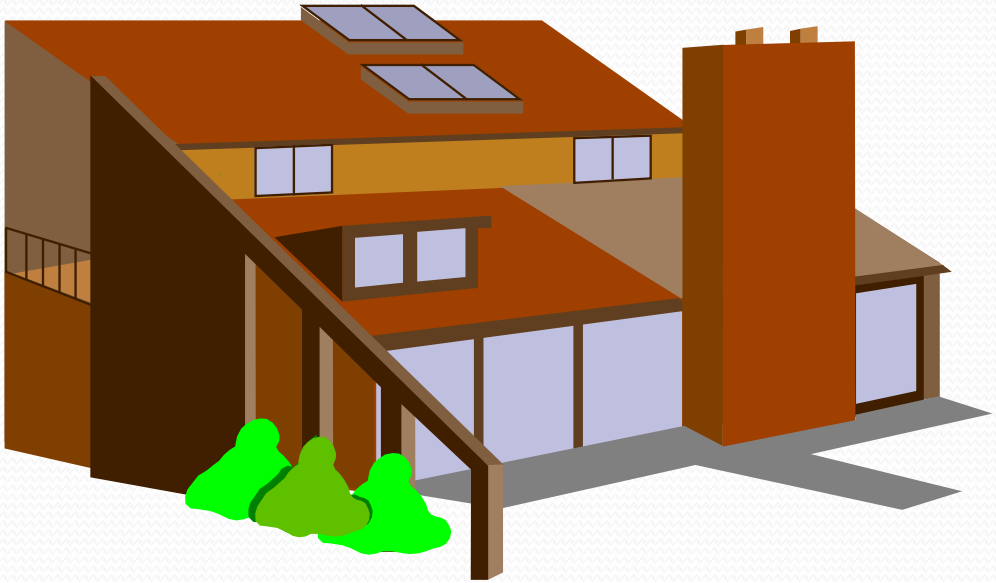
Partial *F* Test for the Contribution of a Single X_j

- Hypotheses:
  - H_0 : Variable X_j does not significantly improve the model, given all others included.
  - H_1 : Variable X_j significantly improves the model, given all others included.
- Test Statistic:

$$F = \frac{\text{SSR}\left(X_j \,\middle|\, \text{all others}\right)/m}{\text{MSE(all)}}$$

  - With df = 1 and $(n-k-1)$
  - $m = 1$ here

Testing Portions of Model: Example



Test at the $\alpha = 0.05$ level to determine if the variable of average temperature significantly improves the model, given that insulation is included.

Testing Portions of Model: Example

H_0: X_1 (temperature) does not improve model with X_2 (insulation) included.

H_1: X_1 does improve model

α = 0.05, df = 1 and 12

Critical Value = 4.75

(For X_1 and X_2)

	df	SS	MS
Regression	2	192,637.37	96,318.69
Residual	12	7,350.65	612.5543
Total	14	199,988.02	

(For X_2)

	df	SS
Regression	1	53,262.49
Residual	13	146,725.53
Total	14	199,988.02

$$F = \frac{SSR\langle X_1 | X_2 \rangle}{MSE(X_1, X_2)} = \frac{(192{,}637 - 53{,}262)}{612.55} = 227.53$$

Conclusion: Reject H_0; X_1 does improve model.

Testing Portions of Model in Excel

- Stat | Regression…
  - Calculations for this example are given in the spreadsheet. When using Minitab, simply check the box for "partial coefficient of determination.
- EXCEL spreadsheet for the heating oil example.



Microsoft Excel Worksheet

Do We Need to Do This for One Variable?

- The *F* Test for the inclusion of a single variable after all other variables are included in the model is IDENTICAL to the *t* Test of the slope for that variable.
- The only reason to do an *F* Test is to test several variables together.

The Quadratic Regression Model

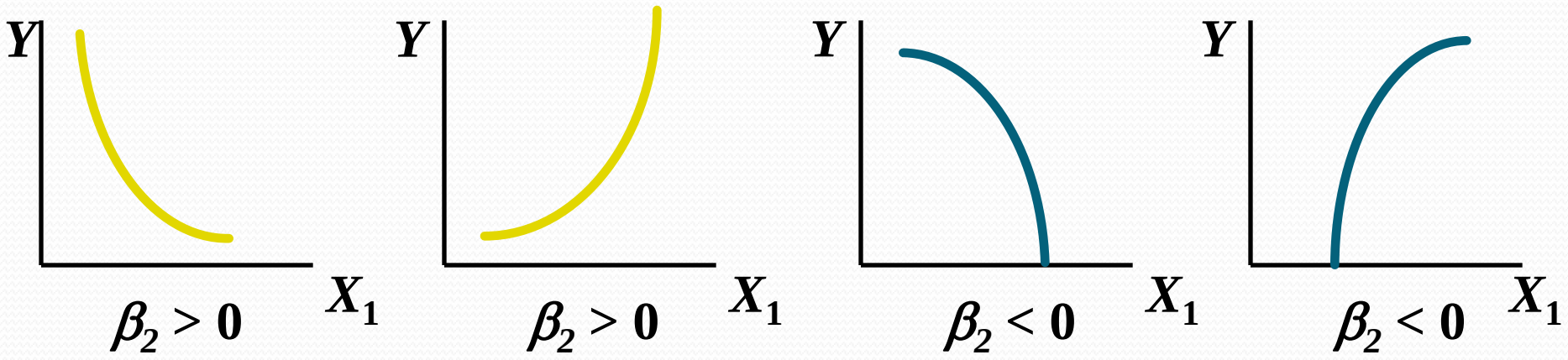
- Relationship between the response variable and the explanatory variable is a quadratic polynomial function.
- Useful when scatter diagram indicates non-linear relationship.
- Quadratic Model:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{1i}^2 + \varepsilon_i$$

- The second explanatory variable is the square of the first variable.

Quadratic Regression Model

Quadratic model may be considered when a scatter diagram takes on the following shapes:



β_2 = the coefficient of the quadratic term.

Testing for Significance: Quadratic Model

- Testing for Overall Relationship
  - Similar to test for linear model
  - F test statistic = $\frac{MSR}{MSE}$
- Testing the Quadratic Effect
  - Compare quadratic model:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{1i}^2 + \varepsilon_i$$

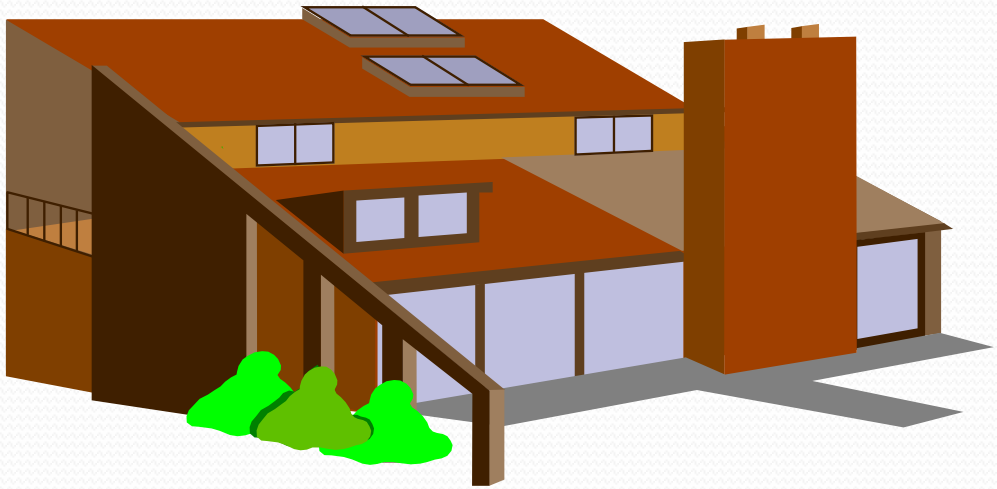
with the linear model:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \varepsilon_i$$

  - Hypotheses:
    - $H_0 : \beta_2 = 0$ (No quadratic term.)
    - $H_1 : \beta_2 \neq 0$ (Quadratic term is needed.)

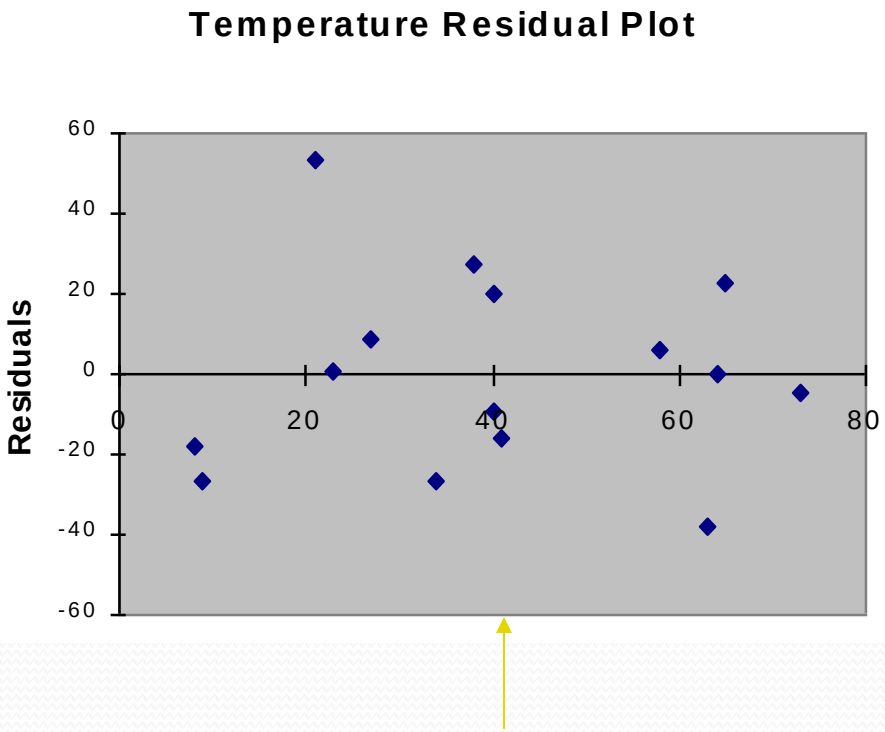
Heating Oil Example

Determine if a quadratic model is needed for estimating heating oil used for a single family home in the month of January based on average temperature and amount of insulation in inches.



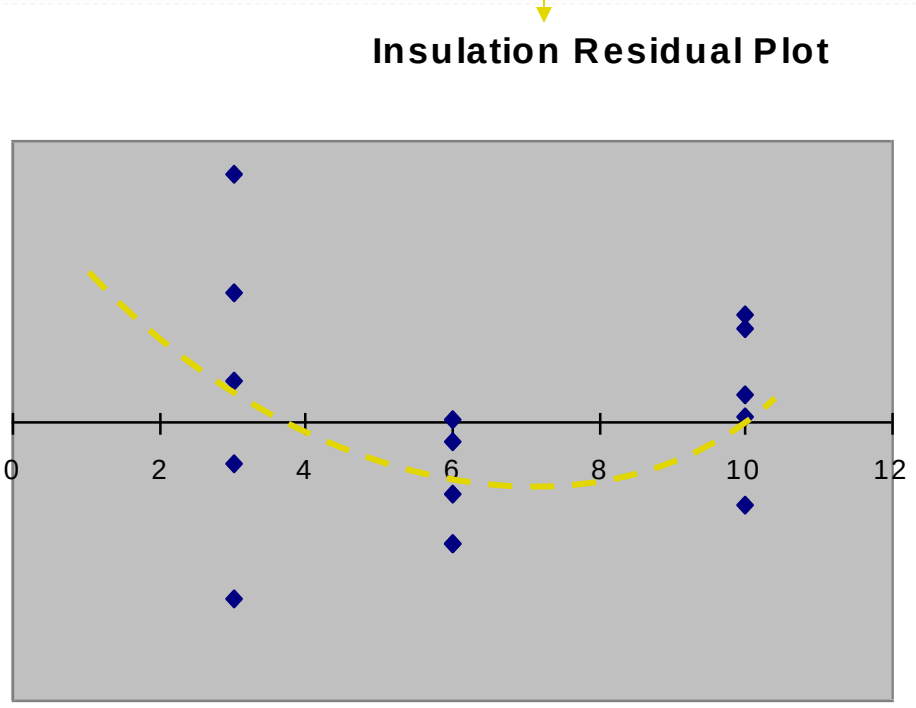
Oil (Gal)	Temp (°F)	Insulation
267.00	38	4
350.00	25	3
158.30	39	11
45.30	76	8
88.00	66	9
210.80	32	8
350.50	11	7
310.60	6	11
232.80	25	12
130.90	59	4
34.70	63	11
216.70	40	5
398.50	20	4
302.80	37	4
65.40	54	12

Heating Oil Example: Residual Analysis



No Discernible Pattern

Possible non-linear relationship



Heating Oil Example: *t* Test for Quadratic Model

- Testing the Quadratic Effect
  - Model with quadratic insulation term:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{2i}^2 + \varepsilon_i$$

  - Model without quadratic insulation term:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$$

  - Hypotheses
    - $H_0 : \beta_3 = 0$ (No quadratic term in insulation.)
    - $H_1 : \beta_3 \neq 0$ (Quadratic term is needed in insulation.)

Example Solution

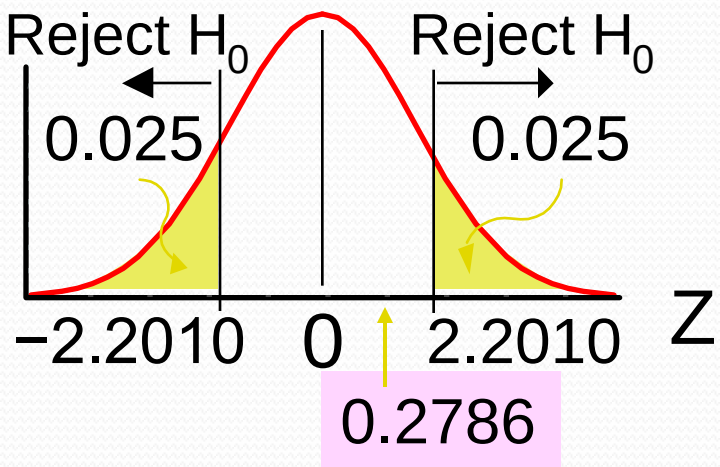
Is quadratic term in insulation needed on monthly consumption of heating oil? Test at $\alpha = 0.05$.

H_0: $\beta_3 = 0$

H_1: $\beta_3 \neq 0$

df = 11

Critical Values:



$$t = \frac{b_3 - \beta_3}{S_{b_3}} = \frac{0.2768}{0.9934} = 0.2786$$

Do not reject H_0 at $\alpha = 0.05$.

There is not sufficient evidence for the need to include quadratic effect of insulation on oil consumption.

Validation of the Regression Model

- Are there violations of the multiple regression assumption?
  - Linearity
  - Autocorrelation
  - Normality
  - Homoscedasticity

Validation of the Regression Model

- The independent variables are nonrandom variables whose values are fixed.
- The error term has an expected value of zero.
- The independent variables are independent of each other.

Linearity

- How do we know if the assumption is violated?
  - Perform regression analysis on the various forms of the model and observe which model fits best.
  - Examine the residuals when plotted against the fitted values.
  - Use the Lagrange Multiplier Test.

Linearity

- Linearity assumption is met by transforming the data using any one of several transformation techniques.
  - Logarithmic Transformation
  - Square-root Transformation
  - Arc-Sine Transformation

Serial or Autocorrelation

- Assumption of the independence of *Y* values is not met.
- A major cause of autocorrelated error terms is the misspecification of the model.
- Two approaches to determine if autocorrelation exists:
  - Examine the plot of the error terms as well as the signs of the error term over time.

Serial or Autocorrelation

- Durbin–Watson statistic could be used as a measure of autocorrelation:

$$\mathrm{DW} = d = \frac{\sum_{t=2}^{n} (e_t - e_{t-1})^2}{\sum_{t=1}^{n} e_t^2}$$

Serial or Autocorrelation

- Serial correlation may be caused by misspecification error such as an omitted variable, or it can be caused by correlated error terms.
- Serial correlation problems can be remedied by a variety of techniques:
  - Cochrane–Orcutt and Hildreth–Lu iterative procedures

Serial or Autocorrelation

- Generalized least square
- Improved specification
- Various autoregressive methodologies
- First-order differences

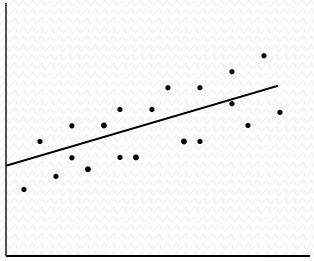
Homoscedasticity

- One of the assumptions of the regression model is that the error terms all have equal variances.
- This condition of equal variance is known as homoscedasticity.
- Violation of the assumption of equal variances gives rise to the problem of heteroscedasticity.
- How do we know if we have heteroscedastic condition?

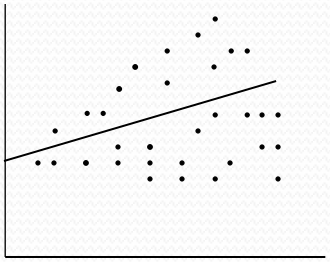
Homoscedasticity

- Plot the residuals against the values of *X*.
- When there is a constant variance appearing as a band around the predicted values, then we do not have to be concerned about heteroscedasticity.

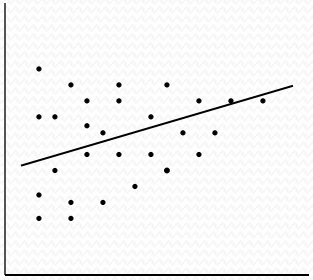
Homoscedasticity



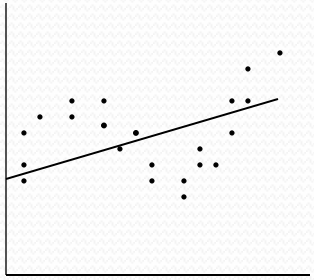
Constant Variance



Fluctuating Variance



Fluctuating Variance



Fluctuating Variance

Homoscedasticity

- Several approaches have been developed to test for the presence of heteroscedasticity.
  - Goldfeld–Quandt test
  - Breusch–Pagan test
  - White's test
  - Engle's ARCH test

Homoscedasticity Goldfeld–Quandt Test

- This test compares the variance of one part of the sample with another using the *F*-test.
- To perform the test, we follow these steps:
  - Sort the data from low to high of the independent variable that is suspect for heteroscedasticity.
  - Omit the observations in the middle fifth or one-sixth. This results in two groups with $\frac{(n-d)}{2}$.
  - Run two separate regression one for the low values and the other with high values.
  - Observe the error sum of squares for each group and label them as SSE_L and SSE_H.

Homoscedasticity Goldfeld-Quandt Test (*Continued…*)

- Compute the ratio of SSE_H / SSE_L
- If there is no heteroscedasticity, this ratio will be distributed as an F-Statistic with $\frac{(n-d)}{2} - k$ degrees of freedom in the numerator and denominator, where k is the number of coefficients.
- Reject the null hypothesis of homoscedasticity if the ratio exceeds the F table value.

Multicollinearity

- High correlation between explanatory variables.
- Coefficient of multiple determination measures combined effect of the correlated explanatory variables.
- Leads to unstable coefficients (large standard error).

Multicollinearity

- How do we know whether we have a problem of multicollinearity?
  - When a researcher observes a large coefficient of determination (R^2) accompanied by statistically insignificant estimates of the regression coefficients.
  - When one (or more) independent variable(s) is an exact linear combination of the others, we have perfect multicollinearity.

Detect Collinearity (Variance Inflationary Factor)

- VIF_j Used to Measure Collinearity

$$\mathrm{VIF}_j = \frac{1}{(1 - R_j^2)}$$

R_j^2 = The coefficient of multiple determination from the regression of X_j on all the other explanatory variables.

- If $\mathrm{VIF}_j > 5, X_j$ is Highly Correlated with the Other Explanatory Variables.

Detect Collinearity in Excel

- Stat | Regression…
  - Check the "Variance Inflationary Factor (VIF)" box.
- EXCEL spreadsheet for the heating oil example
  - Since there are only two explanatory variables, only one *VIF* is reported in the Excel spreadsheet.
    - No *VIF* is >5
    - There is no evidence of collinearity.



Microsoft Excel Worksheet

Summary

- Developed the Multiple Regression Model.
- Discussed Residual Plots.
- Addressed Testing the Significance of the Multiple Regression Model.
- Discussed Inferences on Population Regression Coefficients.
- Addressed Testing Portions of the Multiple Regression Model.

Summary

- Described the Quadratic Regression Model.
- Addressed the violations of the regression assumptions.

Business Forecasting

Advanced Regression Methodologies in Forecasting

Topics

- Proxy and dummy variables
- Selection of Independent variables
  - All possible regression
  - Stepwise regression
- Lagged variables
  - Distributed lag models
  - Adaptive expectation models
  - Partial adjustment model
- Summary

Dummy Variable Models (with two Levels)

Given: $\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i}$

Y = Assessed Value of House

X_1 = Square footage of House

X_2 = Desirability of Neighborhood = { 0 if undesirable; 1 if desirable

Desirable ($X_2 = 1$)

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2(1) = (b_0 + b_2) + b_1 X_{1i}$$

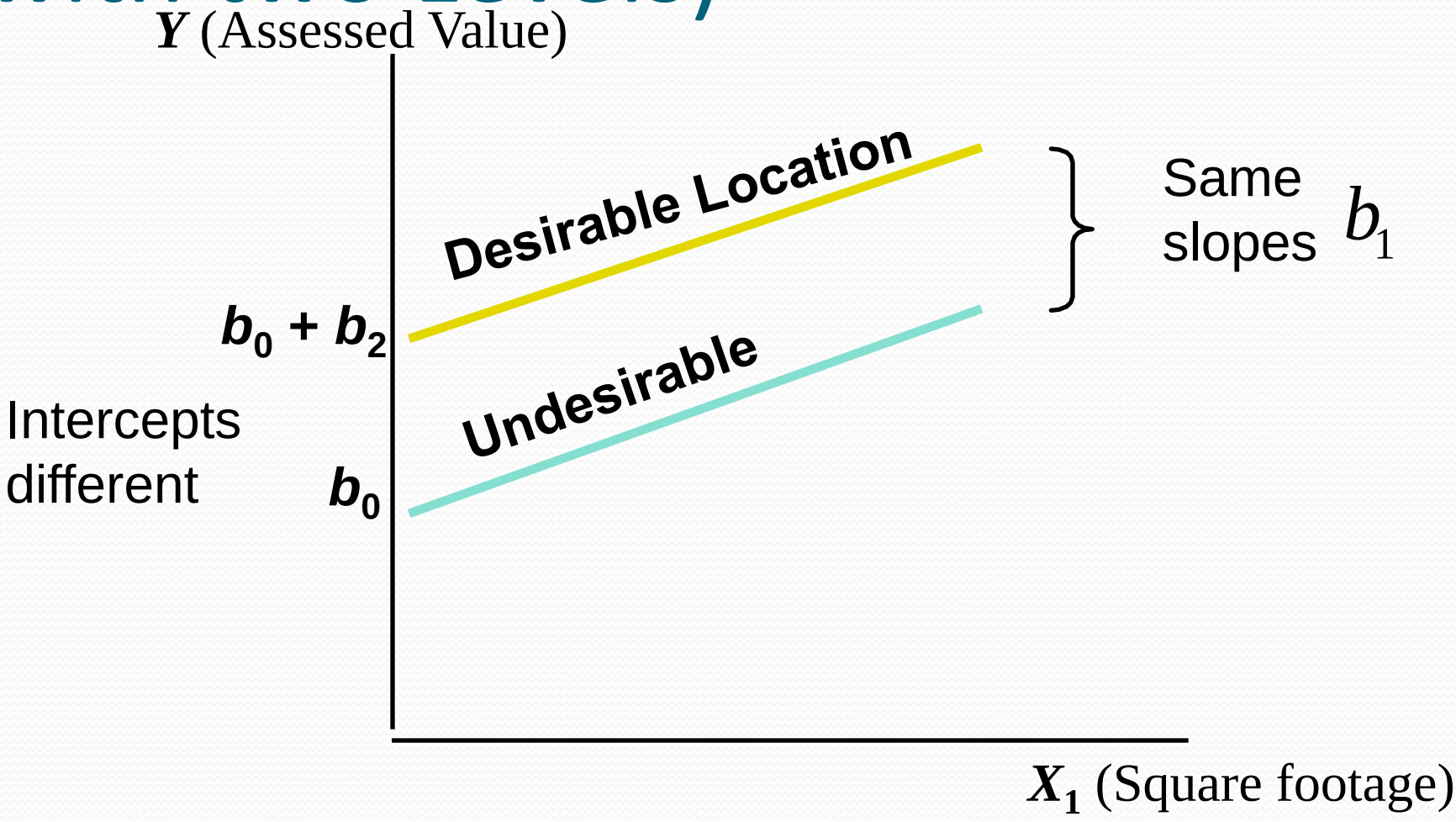
Undesirable ($X_2 = 0$)

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2(0) = b_0 + b_1 X_{1i}$$

Same slopes

Dummy Variable Models (with two Levels)

(continued)



Interpretation of the Dummy Variable Coefficient (with two Levels)

Example:

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} = 20 + 5X_{1i} + 6X_{2i}$$

Y: **Annual salary of college graduate in thousand \$**

X_1: **GPA**

X_2: **0 nonbusiness degree**

1 business degree

With the same GPA, college graduates with a business degree are making an estimated 6 thousand dollars more than graduates with a nonbusiness degree on average.

Selection of Independent Variables

- Theory should be the guiding principle.
- Follow the principle of "Parsimony."
  - Less is better than more.
- A number of approaches can be adopted:
  - All possible Regression
  - Stepwise Regression
    - Forward stepwise selection
    - Backward stepwise elimination

Stepwise Regression

- Forward Stepwise Selection
  - A simple regression model is developed with one independent variable, and other variables are added to the equation without deleting any variable as the process continues.
  - May lead to a model that includes too many variables without satisfying the theoretical framework or the statistical criterion for selection.

Stepwise Regression

- Backward stepwise elimination
  - Begins with a model that considers all variables of interest and subsequently reduces the number until the "best" model that satisfies theory and is statistically significant is found.
  - The steps in using this model are:
    - Choose a value of α_{stay} and α_{entry}.

Stepwise Regression

- The stepwise approach considers the *k* possible one-independent variable regression model of the form:

$$Y = \beta_o + \beta_1 X_j + \varepsilon$$

- where X_j is a different potential independent variable in a different model.
- If the *t* Statistic shows that values for X_j are not significant, the stepwise procedure terminates otherwise the variable included.

Stepwise Regression

- The stepwise approach considers the *k* possible one-independent variable regression model of the form:

$$Y = \beta_o + \beta_1 X_j + \varepsilon$$

- where X_j is a different potential independent variable in a different model.
- If the *t* Statistic shows that values for X_j are not significant, the stepwise procedure terminates otherwise the variable is included.

Stepwise Regression

- After each addition or deletion of an independent variable to the model, the stepwise procedure checks all the independent variables included and removes those independent variables that have the smallest (in absolute value) *t* Statistic from the model and that are considered not significant at the level.

Lagged Variables

- In a dynamic model the variable of interest may be influenced by the value of the same variable in the previous time period.
- In these cases the explanatory variable determines the dependent variable with a lag.

Lagged Variables *(continued)*

- A regression model where the dependent variable depends not only on the current value, but also on a one-period lag, may be written as:

$$Y_i = \beta_o + \beta_1 X_1 + \beta_2 X_{i-1} + e_i$$

where X_{i-1} is the value of X one period before i, and e_i is the error term.

Distributed Lagged Models

- In this model we will consider the fact that the recent past may have more impact on the variable of interest than a more distant time period.
- Hence in specifying a distributed lag model we assign weights (ω) to each variable that is lagged.

$$Y_t = \beta_0 + \beta_1(\omega_0 X_t + \omega_1 X_{t-1} + \omega_2 X_{t-2} + \ldots) + \varepsilon_t$$

Adaptive Expectation Models

- In this model, the dependent variable Y_t is impacted by the "expectation" of the causal variable X_t
- Suppose capital investment is the dependent variable and is influenced by corporate earnings.
- Since decisions to invest might be tied to the expected future earnings, the independent variable is unobservable.

Adaptive Expectation Models

- How then do we capture the notion of Y_t "expectation" in a model?

$$Y_t = \beta_0 + \beta_1 X_t^* + \varepsilon_t$$

where X_t^* is the independent variable representing the expectation.

Adaptive Expectation Models

- Since X_t^* is unobservable, we must make some assumptions about the way in which expectations are formed:

$$X_t^* = (1-\omega)X_t + \omega X_{t-1}^*$$

$$0 < \omega < 1$$

Adaptive Expectation Models

where X_t is the actual earnings at time t, and the expectation at time t and the expectations are adjusted proportionally by the factor ω to the difference between expected values in period t –1 and the actual value of X in t.

Adaptive Expectation Models

- To link the observable process of Y_t and X_t we put the two equations together. With simple manipulations of the equations, we are able to create a model for prediction.
- Note that we substituted $t-1$ for t. The result is:

$$Y_{t-1} = \beta_0 + \beta_1 X^*_{t-1} + \varepsilon_{t-1}$$

Adaptive Expectation Models

- We multiply both sides of the previous two equations by ω, and subtract it from the first equation to get:

$$Y_t - \omega Y_{t-1} = \beta_0(1-\omega) + \beta_1(X_t^* - \omega X_{t-1}^*) + \varepsilon_t + \omega\varepsilon_{t-1}$$

$$= \beta_0(1-\omega) + \beta_1(1-\omega)X_t + \varepsilon_t - \omega\varepsilon_{t-1}$$

Adaptive Expectation Models

- This last equation can be rewritten as:

$$Y_t = \alpha + \beta X_t + \omega Y_{t-1} + u_t$$

Where:

$$\alpha = \beta_0(1-\omega)$$

$$\beta = \beta_1(1-\omega)$$

$$u_t = \varepsilon_t - \omega\varepsilon_{t-1}$$

- We now have a multiple regression equation that can be used for prediction.

Partial Adjustment Model

- The partial adjustment model presumes that habit plays a critical role in how consumers and producers do not move completely from one equilibrium point to another.
- The theory behind the partial adjustment model is that the behaviorally desired level of Y in period t is an unobservable variable Y^* that can be written as:

Partial Adjustment Model

$$Y_t^* = \alpha + \beta_0 X_t + \varepsilon_t$$

- For reasons such as inertia, habit, cost, or other constraints, actual behavior in each period closes only part of the gap between last period's actual and this period's desired Y^*. This can be stated as:

$$Y_t - Y_{t-1} = \omega(Y_t^* - Y_{t-1}), \qquad 0 < \omega < 1$$

Partial Adjustment Model

- Similarly to the adaptive expectation model, we combine equations and rearrange the terms to arrive at:

$$Y_t = \omega\alpha + \omega\beta_0 X_t + (1-\omega)Y_{t-1} + u_t$$

where:

$$u_t = \omega\varepsilon_t$$

- The coefficient on Y_{t-1} identifies the adjustment factor ω

Summary

- Proxy and dummy variables
- Selection of independent variables
  - All possible regression
  - Stepwise regression
- Lagged variables
  - Distributed lag models
  - Adaptive expectation models
  - Partial adjustment model

Business Forecasting

The Box–Jenkins Method of Forecasting

Topics

- The Box–Jenkins Models
- Forecasting with Autoregressive Models (AR)
- Forecasting with Moving Average Models (MA)
- Autoregressive Integrated Moving Average (ARIMA) models
- Trends and Seasonality in Time Series
  - Trends
  - Seasonal Data
- Summary

Univariate Data

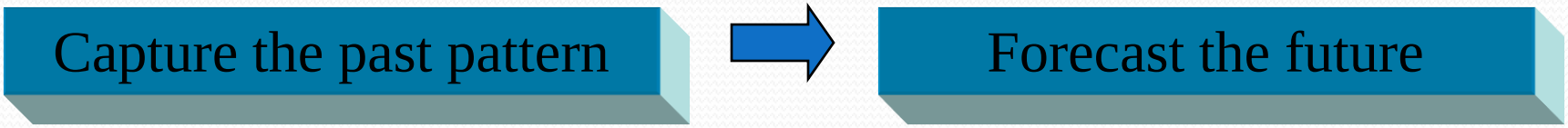
- Stationary
- Trend
- Seasonality
- Cyclical

- A majority of the real-world data show certain combinations of the above patterns.

Box–Jenkins Method

Besides the smoothing techniques, what other methods can we use to forecast univariate data?

Using Box–Jenkins Methods



Why Use The Box–Jenkins Method?

- When facing very complicated data patterns such as a combination of a trend, seasonal, cyclical, and random fluctuations:

  e.g. Earning data of a corporation

  e.g. Forecasting stock price

  e.g. Sales forecasting

  e.g. Energy forecasting (electricity, gas)

  e.g. Traffic flow of a city

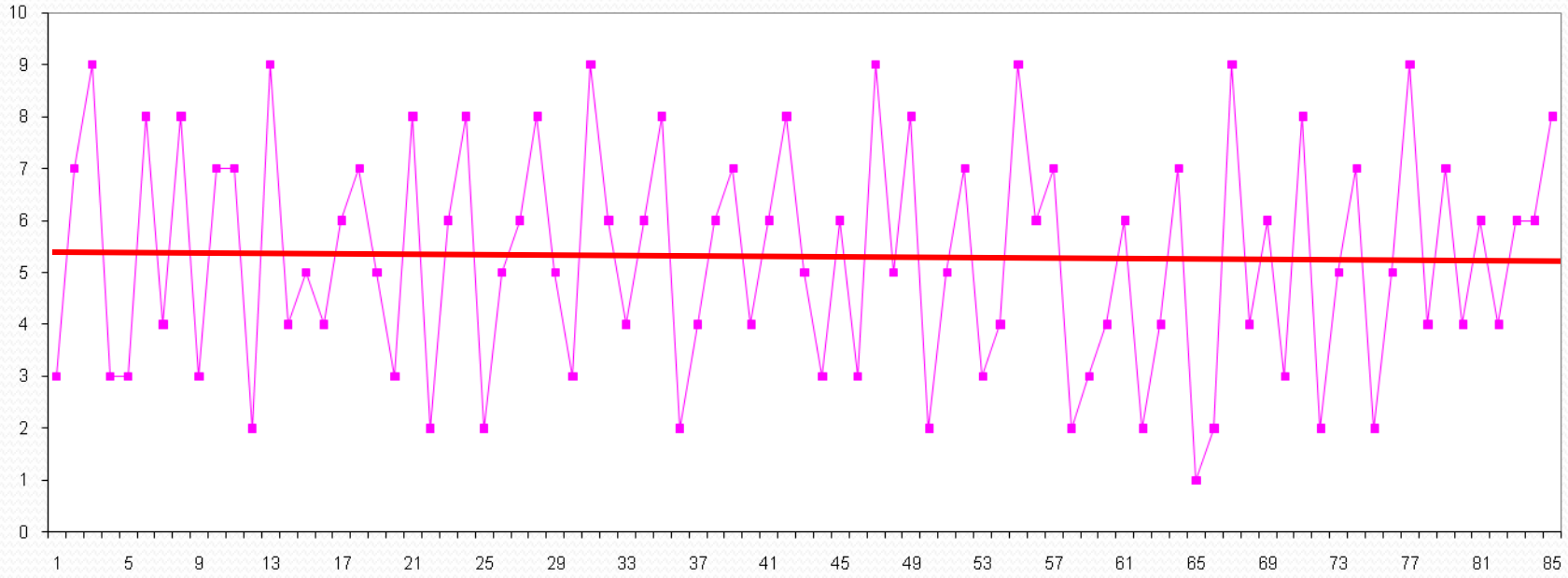
Why Use the Box–Jenkins Method?

- When forecasting is the sole purpose of the model.
- Very reliable especially in short term (0–6 months) prediction; reliable in short-to-mid (6 months–1.5years) -term prediction.
- Confidence intervals for the estimates are easily constructed.

Pattern I: Stationary

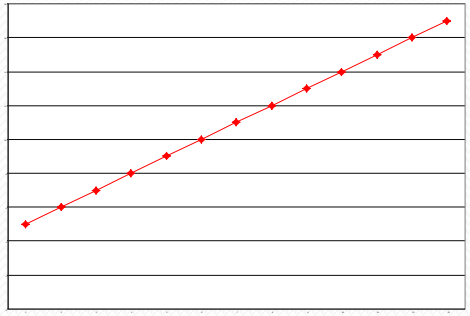
Pattern 1: No Trend—Stationary

demand seems to cluster around a specific level.

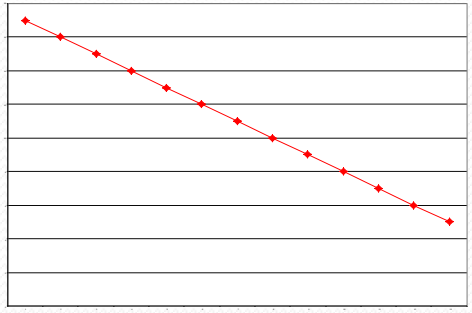


Pattern II: Trend

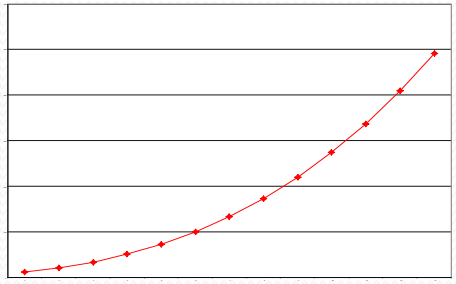
Demand consistently increases or decreases over time.



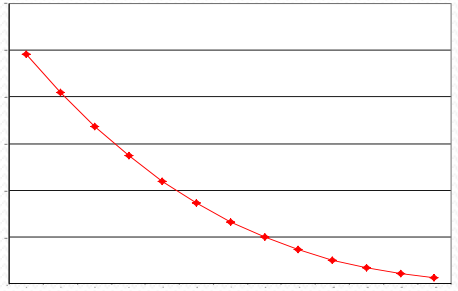
Time



Time

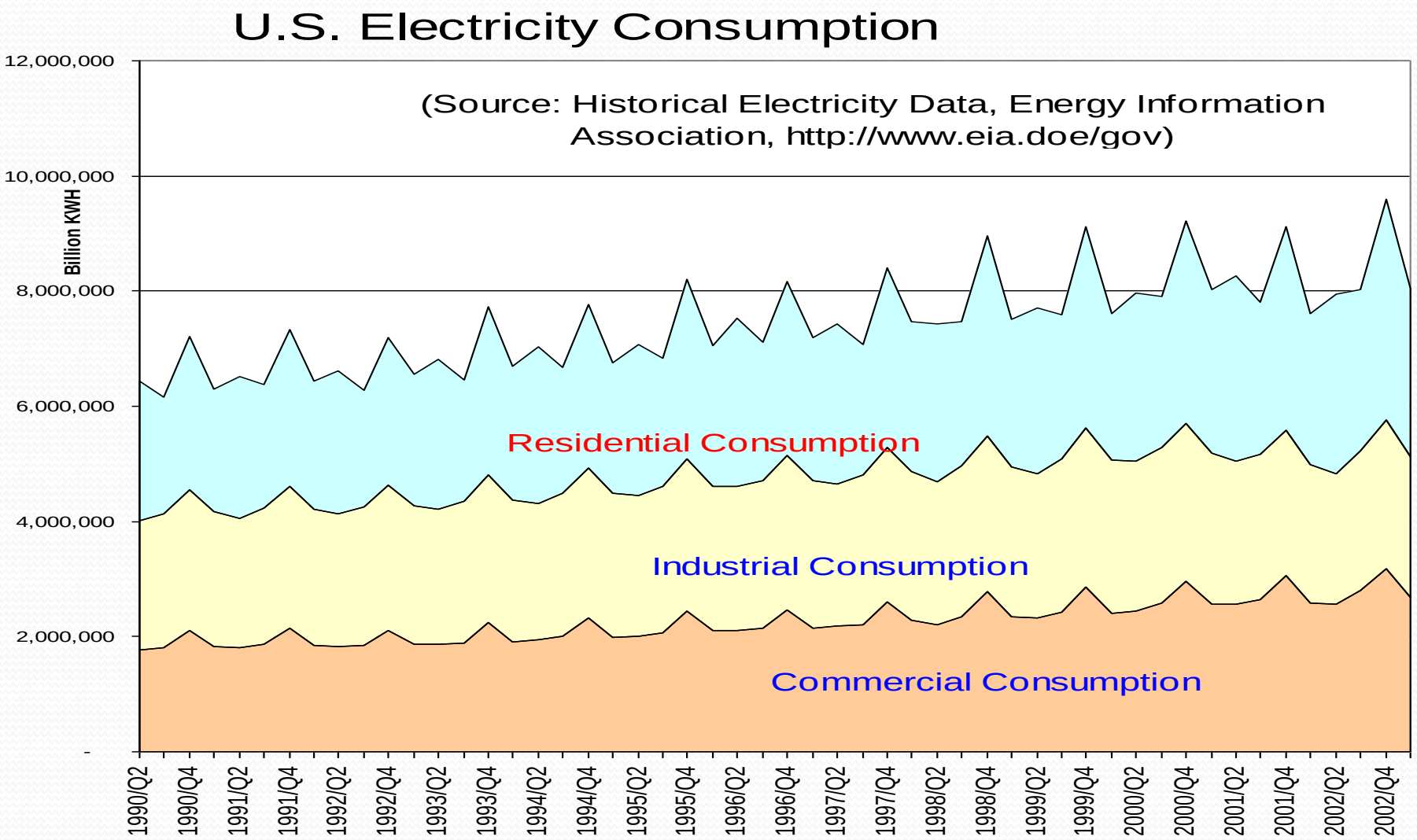


Time

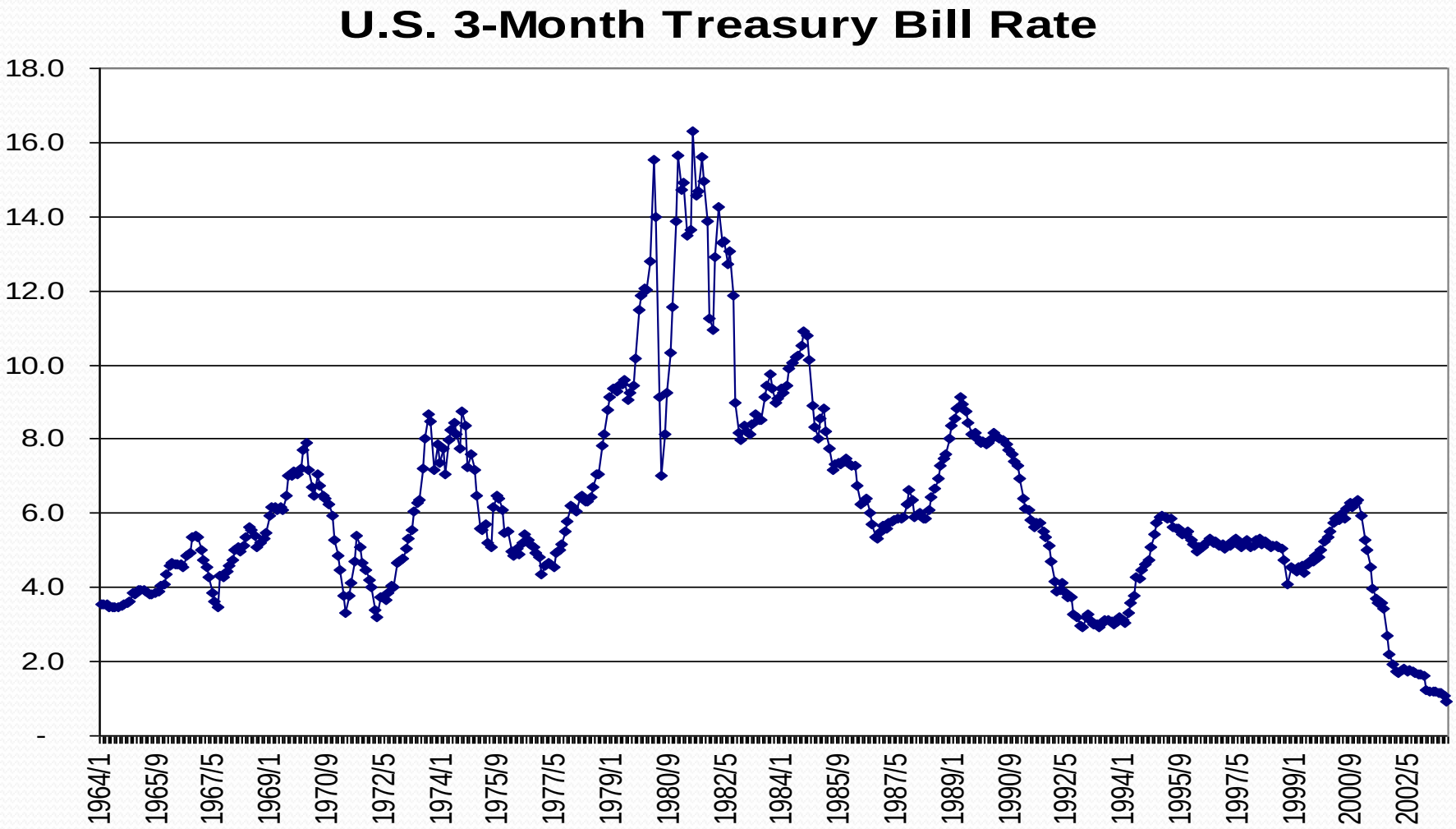


Time

Pattern III: Seasonality

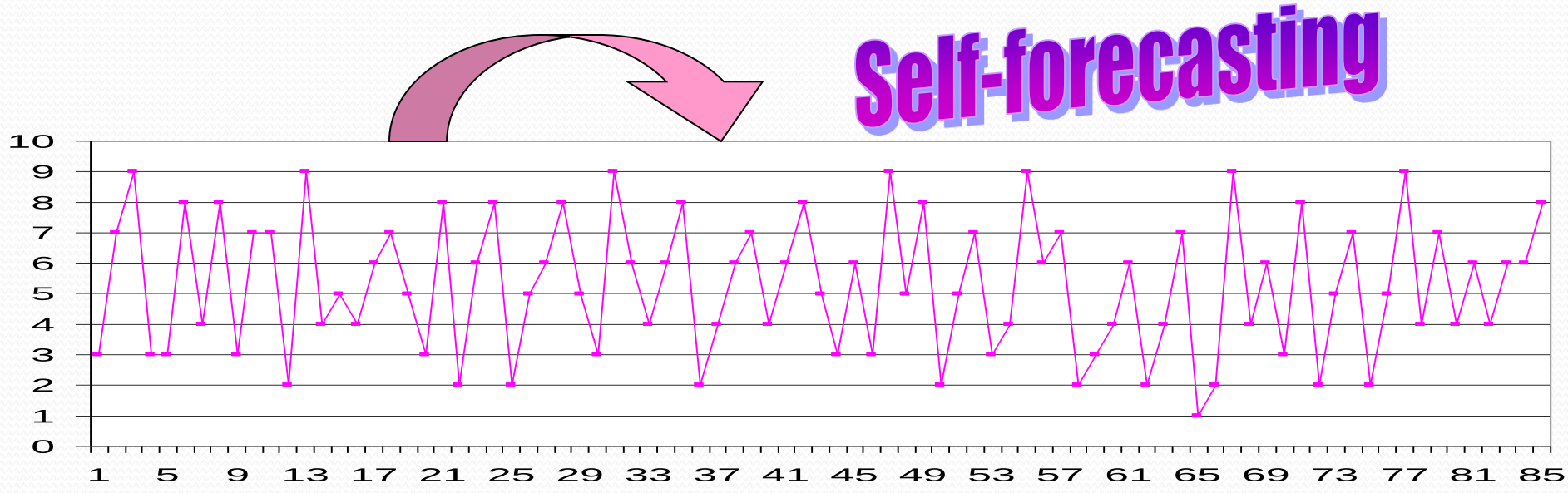


Pattern IV: Cyclical



Box–Jenkins Method Assumption

- In order to use the B/J method, the time series should be stationary.
- B/J main idea: Any stationary time series can self-predict its own future from the past data.



Box–Jenkins Method Assumption

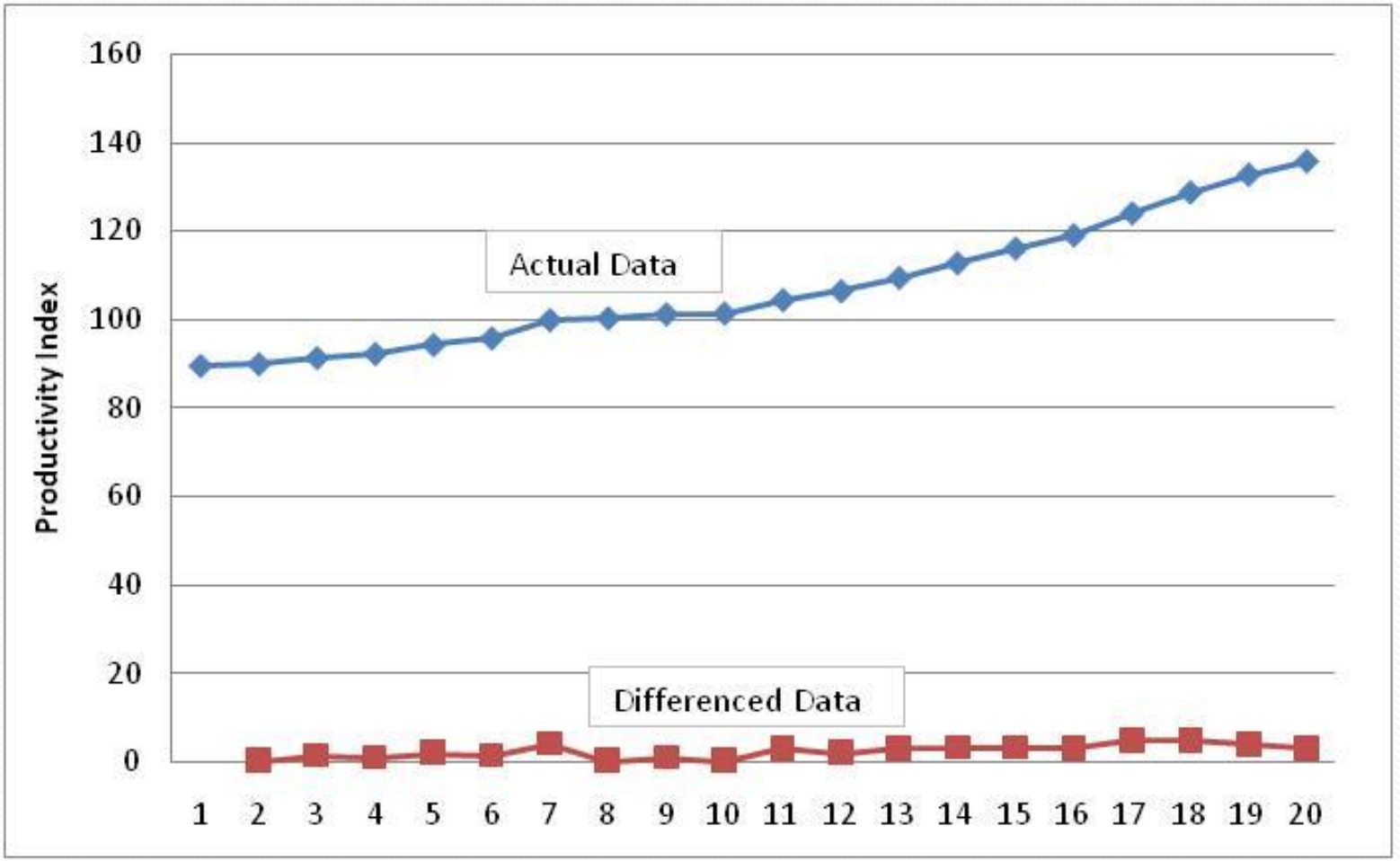
- We know that not all time series are stationary.
- However, it is easy to convert a trend or a seasonal time series to a stationary time series.
- Simply use the concept of “Differencing.”

Example of Differencing

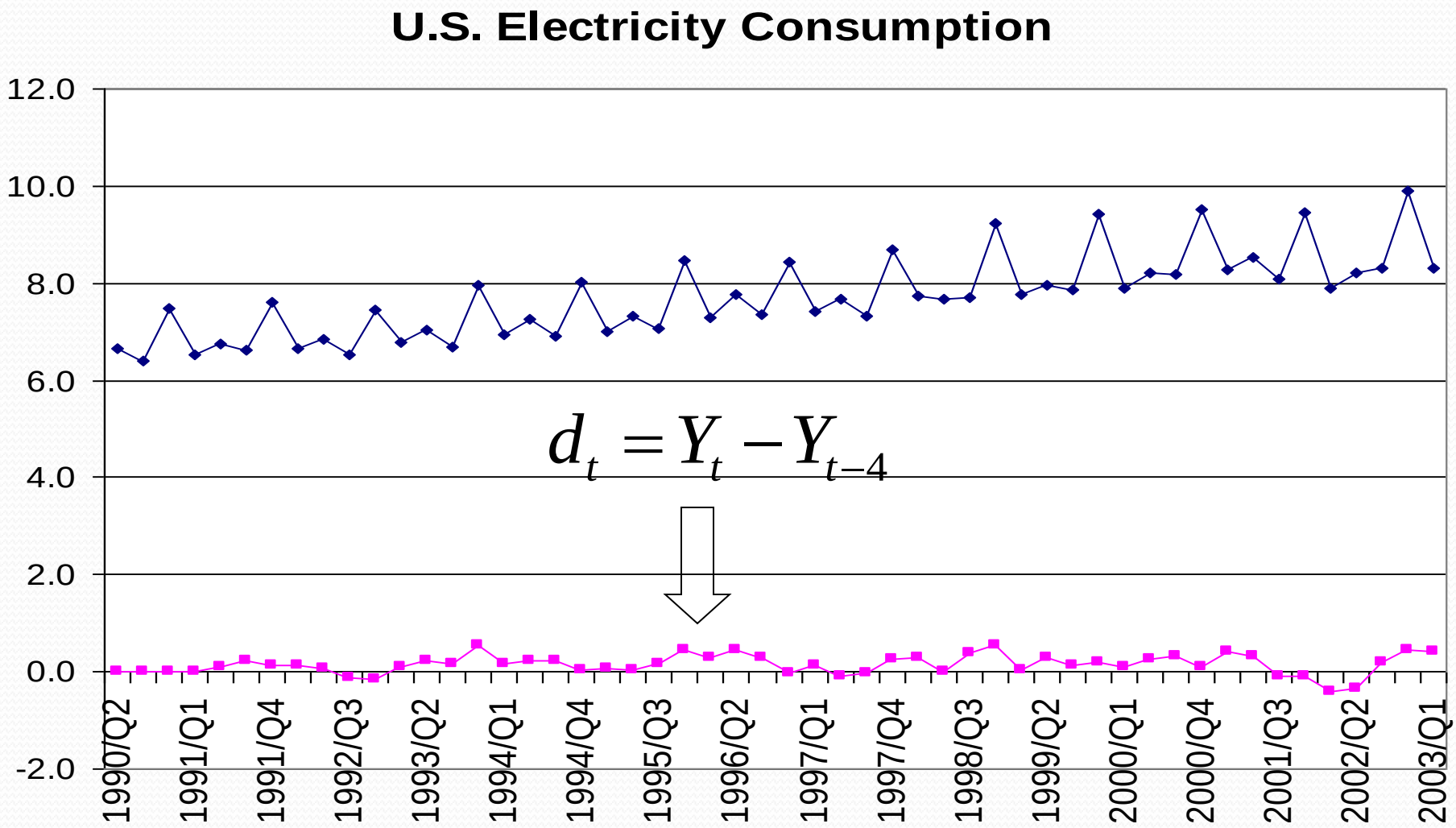
Partial Data from Table 10.6

Time (t) *(1)*	*Actual Index* Y_t *(2)*	*Differences* $(Y_t - Y_{t-1})$ *(3)*
t_{86}	89.7	na
t_{87}	90.1	0.4
t_{88}	91.5	1.4
t_{89}	92.4	0.9
t_{90}	94.4	2.0

Convert a trend time series to stationary time series using the differencing method



Convert a seasonal time series to stationary time series



Differencing Summary

- To convert trend time series to stationary time series:

$$d_t = Y_t - Y_{t-1}$$

- To convert seasonal time series to stationary time series:

$$d_t = Y_t - Y_{t-4}$$

- Both of the above two methods can be applied/combined to remove the cyclical effects.

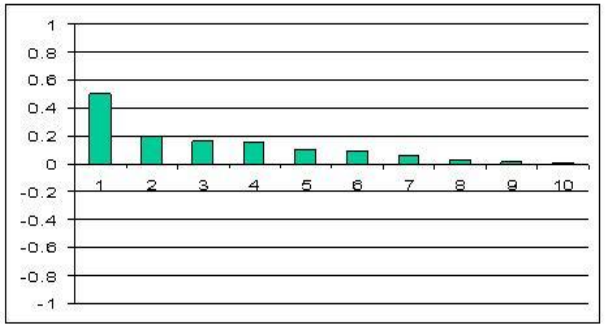
How do we decide the model?

- Use Autocorrelation (AC) and Partial Autocorrelation (PAC)
- First-order autocorrelation is a measure of how correlated an observation is with an observation one period away, that is: (y_t, y_{t-1})
- Second-order autocorrelation is a measure of how correlated an observation is with an observation two periods away (y_t, y_{t-2})
- etc…

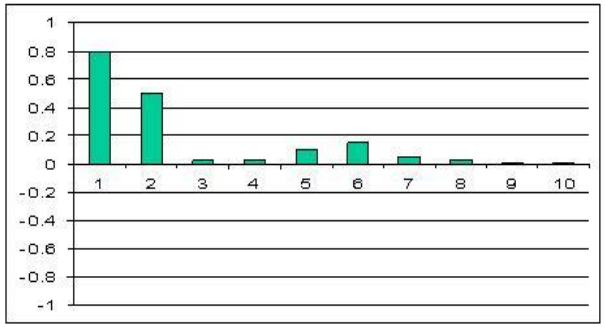
AR Model Fit

- When the autocorrelation coefficients gradually fall to 0, and the partial correlation has spikes, an AR model is appropriate. The order of the model depends on the number of spikes.
- An AR(2) model is shown below.

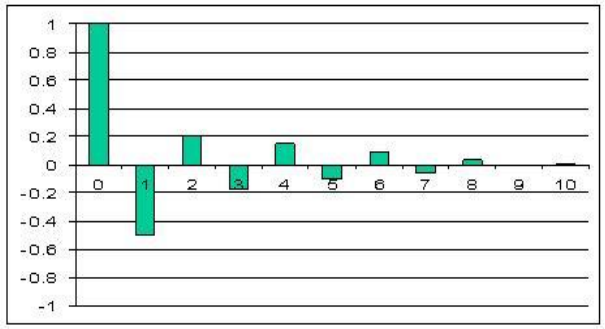
AC



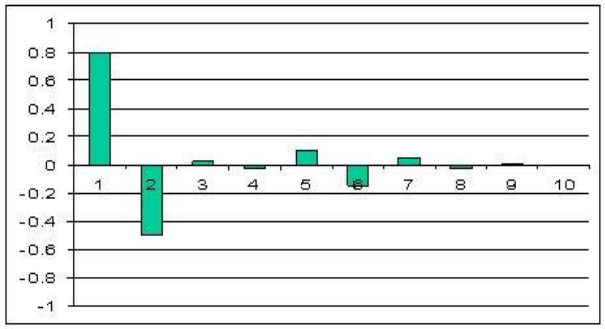
PAC



AC



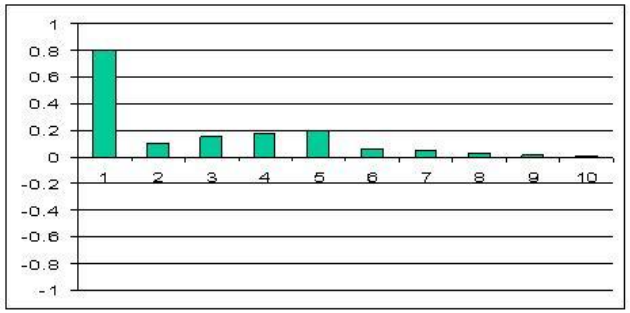
PAC



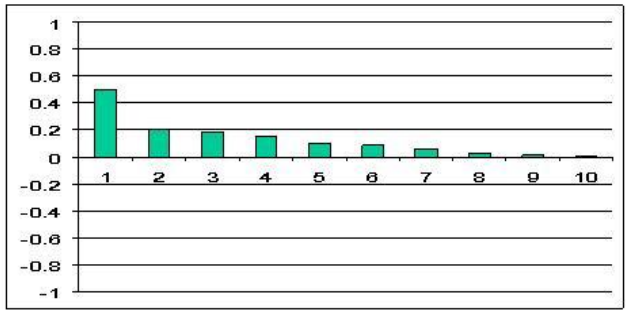
MA Model Fit

- When the partial correlation coefficients gradually fall to 0, and the autocorrelation has spikes, a MA model is appropriate. The order of the model depends on the number of spikes.
- An MA(1) model is shown below.

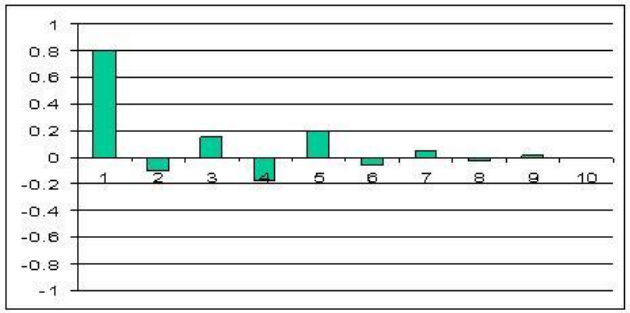
AC



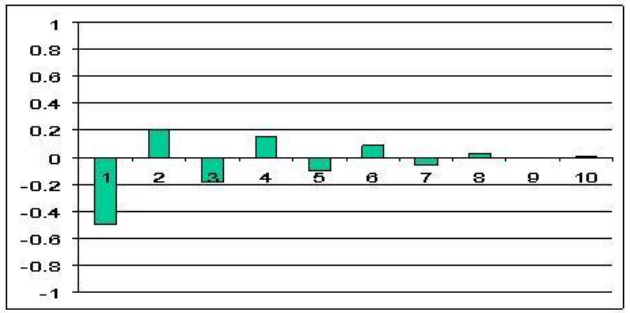
PAC



AC



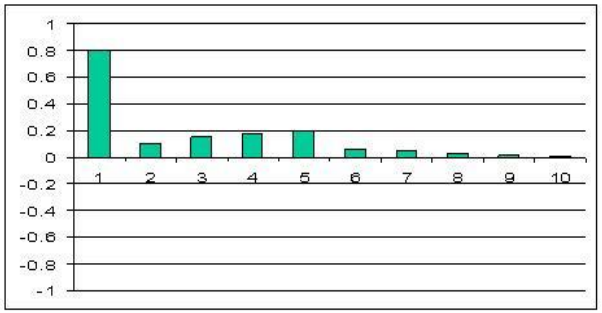
PAC



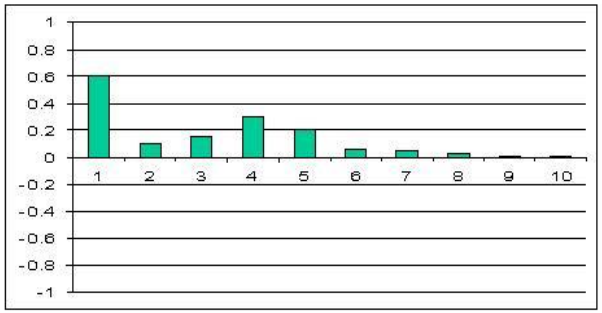
ARIMA Model Fit

- When both the autocorrelation and the partial correlograms show irregular patterns, then an ARIMA model is appropriate. The order of the model depends on the number of spikes.
- An ARIMA(1,0,1) model is shown below.

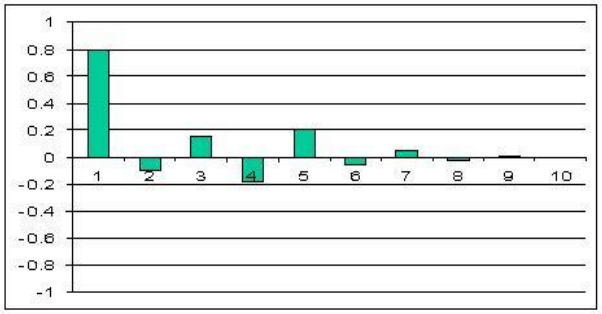
AC



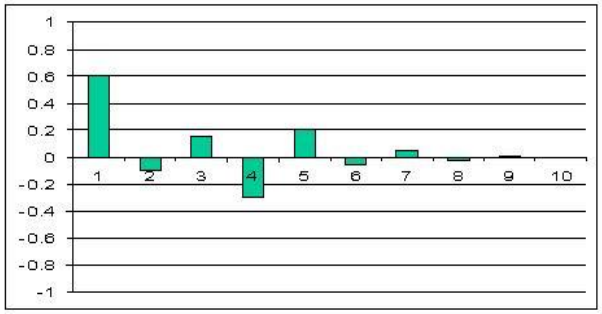
PAC



AC



PAC



Summary

- Box–Jenkins models capture a wide variety of time series patterns.
- When faced with a complicated time series that includes a combination of trend, seasonal factor, cyclical, as well as random fluctuations, use of the Box–Jenkins is appropriate.
- This methodology for forecasting is an iterative process that begins by assuming a tentative pattern that is fitted to the data so that error will be minimized.
- The major assumption of the model is that the data is stationary.

Summary

- "Differencing" could be used to make the data stationary.
- In using the different models of Box–Jenkins, we depend on the autocorrelation (AC) and partial autocorrelation (PAC) as diagnostic tools.
- Computer programs such as Minitab, and SPSS provide all the analysis tools for using the Box–Jenkins.

Business Forecasting

Communicating Forecasts to Management

Topics

- Forecasts and Their Use in Managerial Decisions
- Presentation of Forecasts to Management
- The Future of Business Forecasting
- Summary

Use of Forecasts in Managerial Decision

- Allows organizations to make appropriate decisions.
- Essential in providing the decision makers with information on:
  - Forecast of sales
  - Cash flow
  - Inventory
  - Cost projections
  - Implication of tax hikes on profits
  - Effects of monetary policy on the business sector.

Presentation of Forecasts to Management

- Methodologies discussed in this book can effectively be used by small and large business units.
- Analysts for either sized firms can assist management to make good business decisions.
- To be effective in their role as forecasters, the analyst must pay attention to the following:

Presentation of Forecasts to Management

- Why is the forecast needed?
- Who will use the forecast?
- Participation of management is needed in the initial stage.

- The Analyst must understand management's problems and concerns. Specifically, they should try to understand:
  - What level of detail or aggregation is required.
  - What time horizon should be used in the forecast.

Presentation of Forecasts to Management

- A good forecast incorporates feedback from management.
- Forecasters and managers should pay attention to some common mistakes that undermine the forecasting process:
  - Poor or inadequate data system
  - Lack of commitment on the part of the middle management
  - Decision makers may find the data or the forecast are not available in a timely fashion.

Presentation of Forecasts to Management

- If an incorrect model is used, the analyst should inform the management of its consequences.
- The forecasting unit should be an integrated part of the existing corporate structure.
- In communicating the forecast, the analyst has to recognize the political and human relations skills.

Presentation of Forecasts to Management

- To develop the human relations skills and protect the integrity and objectivity of the forecast, the analyst should follow the recommendations of Bails and Pepper (1993):
  - Become familiar with those who use the forecast.
  - Learn about the user's concerns.
  - Before you start your forecast, resolve any concerns of a particular business unit.
  - Defend your forecast against purely political concerns.

The Future of Business Forecasting

- Uses of forecasting are numerous.
- Good decisions are based on good forecasts.
- Forecasts are used for:
  - Budgeting
  - Planning
  - Specific areas such as production, inventory control, marketing, advertising, sales projections, and investment.
- Recent economic downturns around the world point to the need for strategic planning.

The Future of Business Forecasting

- Forecasting tools can effectively be employed in such planning strategies.
- Given the interdependence of nations on trade, resources, and investments, business organizations cannot make choices without good forecasts.

Summary

- Communicating the results of a forecast is just as important as making the forecast.
- The forecasting process calls for a clear understanding of who, how, and when the forecast is used.
- Forecasters need to understand how management wishes to use the forecast—planning or control and budgeting.
- In a globalized world, good forecasts provide strategic tools for management.

Using Excel ® to analyse historical data

- Using Excel spread-sheet models for examples

Day 3

Budgets, Costs and Budgetary Control

- Why do we budget? – the purposes of budgeting
- Planning and control
- Putting the budget together
- Cost behaviour and classification
- Cost / volume /profit (CVP) and 'what-if' analysis
- Standard costing
- Flexed budgets
- Variance analysis and the reasons for variances

Why Do We Budget? The Purpose of Budgeting

Budgeting fundamentals

Budgeting fundamentals

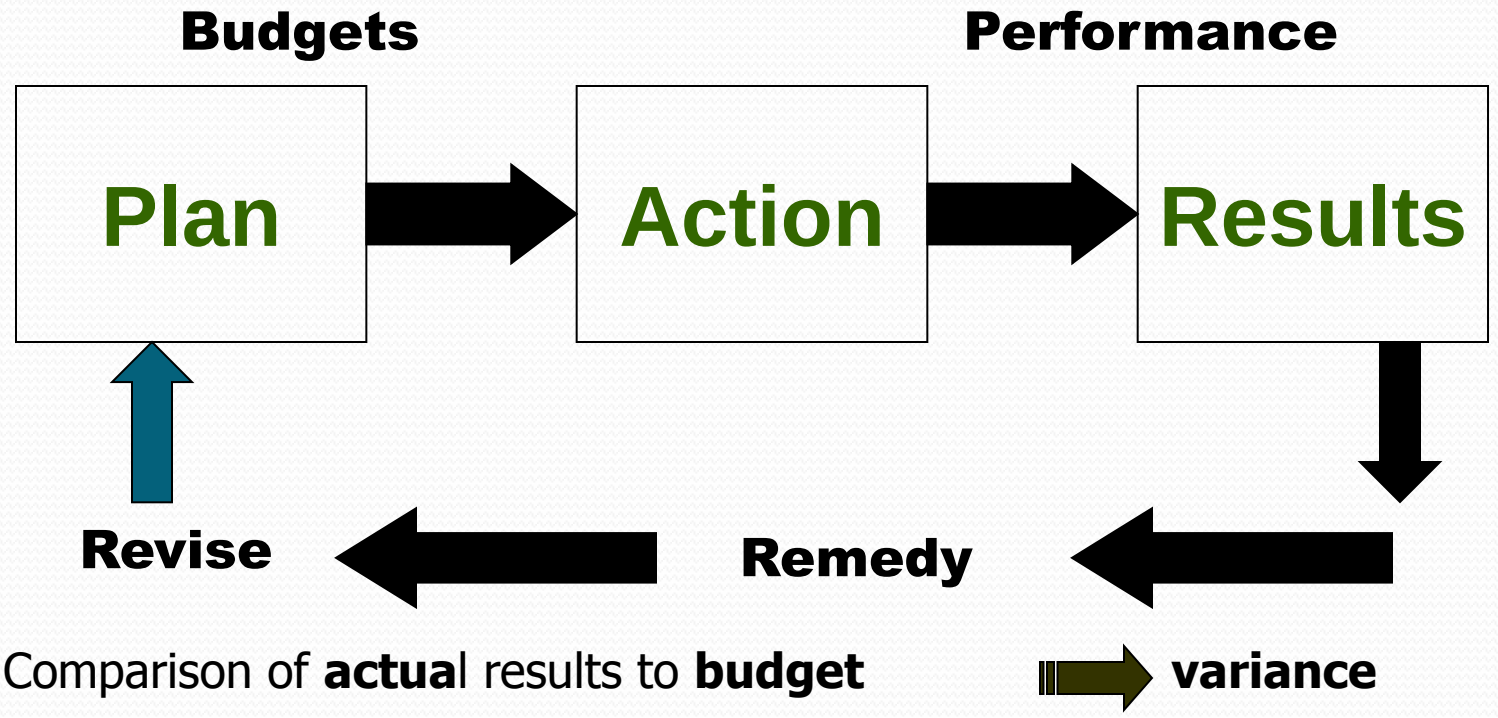
- Budgeting is the process used to develop:
  - A formal written statement
  - Of managements plans for the future
  - Expressed in financial terms

Types of plans

- Long term: 5 to 10 years
- Medium term: 1 to 5 years
- Short term: up to 1 year

The planning cycle

Budgets are the mechanism by which management control of an organisation becomes possible.



Benefits of budgets

1. Forces managers to do **planning.**
2. Realistic performance targets.
3. Basis for **controlling** what happens within the organisation.
4. Helps **coordinate** the activities of the various centres that make up the business.
5. **Communication** – managers exchange information on ideas, etc.
6. **Motivating** tool – if the process involves staff.

Limitations of budgets

- Only estimates, not statements of facts.
- No substitute for sound management practices.
- Need to be amended if circumstances change.
- Preparation does not guarantee success.
- Aspects of people's behaviour may undermine the value of the process.

Budget classification

- **Static (fixed) budgets**: prepared for one level of activity, usually around the forecasts made for sales.

- **Flexible budgets**: a series of fixed budgets set to different levels of sales activity within which the organisation may operate.

Cost/volume relationships

- **Fixed costs**: in **total** remain the **same** for a period of time and over a particular range of activity.

- **Variable costs**: in **total** tend to **change** as the level of activity changes.

Budget processes

- **Zero-based budgeting**: sets the initial figures for each activity to zero.
- **Period budgets**: developed for a specific period of time, e.g. a month.
- **Rolling (continuous) budgets**: are continually updated by periodically adding a new incremental time period and dropping the period just completed.

Types of budgets

- **Revenue budgets**: estimates of the income of an organisation from the sale of goods and/or provision of services for a specific period.
- **Operating budgets**: estimate activities that will affect profit.
- **Budgeted financial statements**: show the estimated results and projected financial position of a business. That is budgeted income statement, balance sheet and statement of cash flows.

Master budget

A combination of all the budgets of an organisation.

Master budget

Merchandising firm	**Professional services**	**Manufacturing firm**
Sales budget	Fees or fees & sales budget	Sales budget
Purchases budget	Professional & support labour budget	Cost of production budget
Cost of goods sold budget	Cost of supplies used	Cost of goods sold budget
Other operating expense budgets	Other operating expense budgets	Other operating expense budgets

Master budget

- Irrespective of the type of organisation, the following budgets will be part of the master budget:
  - Statement of financial performance [revenue budget]
  - Statement of financial position [balance sheet]
  - Statement of cash flow

Planning & Control

Cost Planning for the Product Life Cycle: Target Costing, Theory of Constraints, and Strategic Pricing

Learning Objectives

- Explain how to use *target costing* to facilitate strategic management
- Apply the *theory of constraints* (TOC) to strategic cost management
- Describe how *life-cycle costing* facilitates strategic management
- Outline the objectives and techniques of *strategic pricing*

The Product Life Cycle

Four management methods discussed in this section:

- Target costing
- Theory of constraints (TOC)
- Life-cycle costing
- Strategic pricing

All involve the entire product life cycle:

- Managers now need to look at costs upstream (before manufacturing) and downstream (after manufacturing)

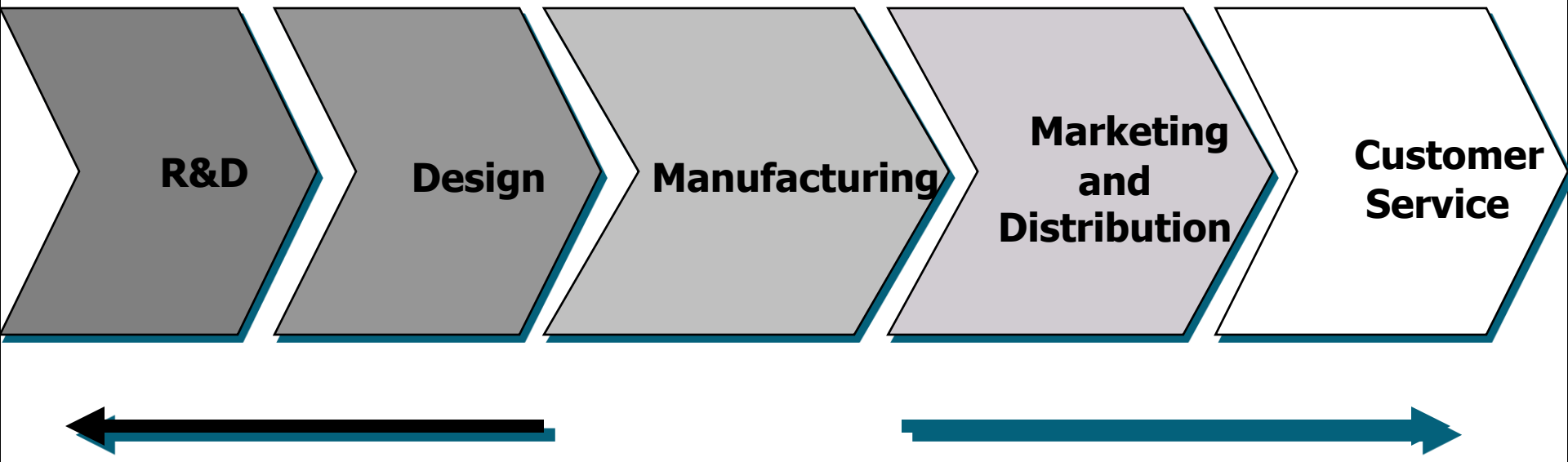
The Cost Life Cycle

"Cost life cycle" refers to the following sequence of activities:

- Research and Development (R&D)
- Design
- Manufacturing (or providing the service)
- Marketing/distribution
- Customer service

It is the life cycle of a product or service from the viewpoint of costs incurred

The Cost Life Cycle



Upstream Activities **Downstream Activities**

Design decisions account for much of total life-cycle costs

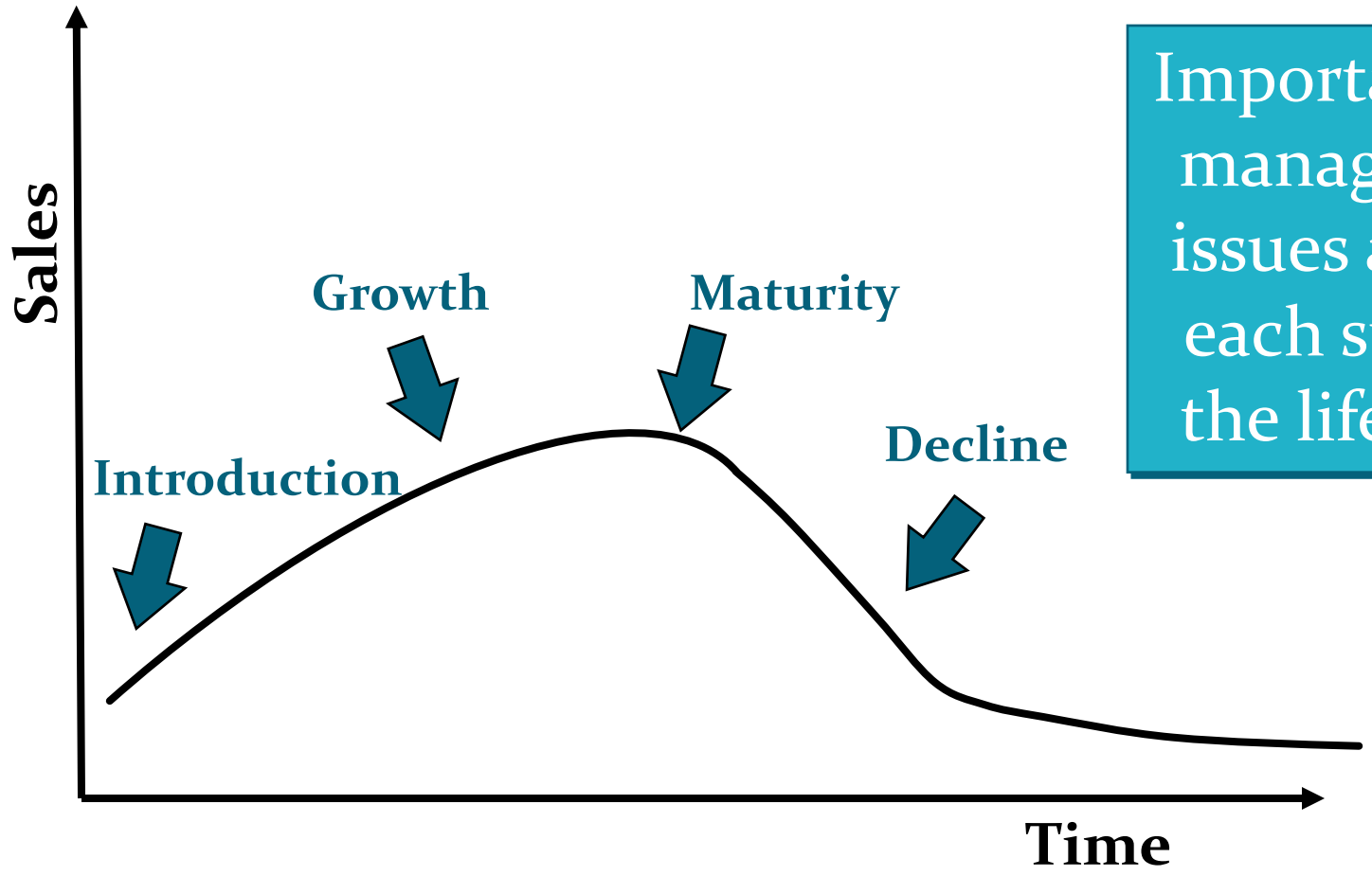
The Sales Life Cycle

The Sales life cycle is the sequence of phases in the product's or service's life:

- Introduction of the product or service to the market
- Growth in sales
- Maturity
- Decline
- Withdrawal from the market

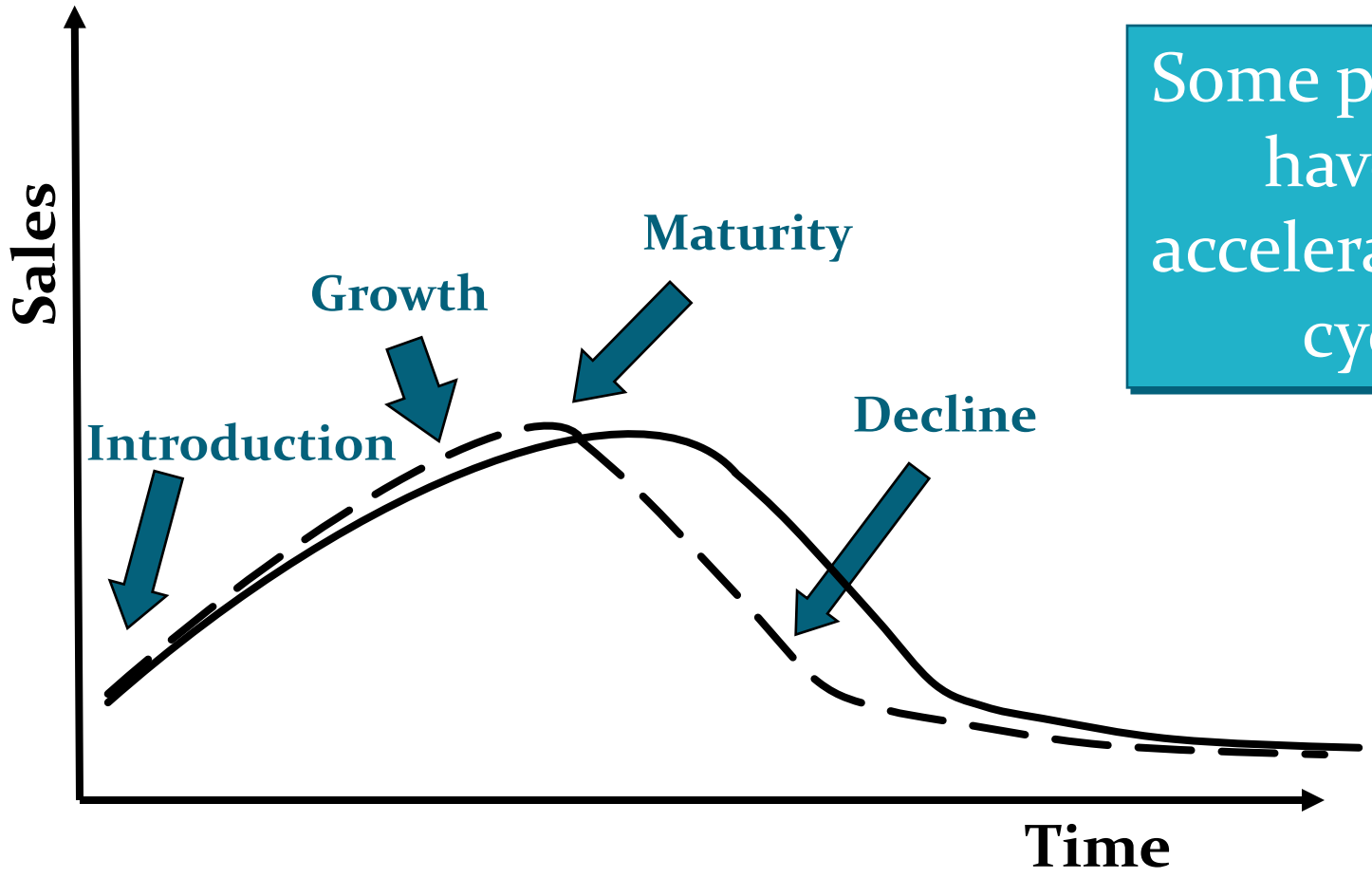
The sales life cycle is the life cycle of a product or service from the viewpoint of sales volume achieved

The Sales Life Cycle



Important cost management issues arise in each stage of the life cycle.

The Sales Life Cycle



Some products have an accelerated life cycle

Target Costing

- **Target costing: a costing method in which the firm determines the allowable (i.e., "target") cost for a product or service, given a competitive market price and a targeted profit**

- **Two options for reducing costs to achieve the target-cost level:**
  - By integrating new manufacturing technology using advanced cost management techniques, (such as ABC), and seeking higher productivity
  - By redesigning the product or service

Implementing Target Costing

1. Determine the market price
2. Determine the desired profit
   - Profit per unit
   - Profit as a % of revenue or cost
3. Calculate the target cost as market price less desired profit
4. Use "value engineering" to reduce cost
5. Use kaizen costing and operational control to further reduce costs

Value Engineering

Value engineering (step 4):

- Analyze trade-offs between product functionality (features) and total product cost
- Perform a consumer analysis during the design stage of the new or revised product to identify critical consumer preferences

Value Engineering

For firm's that can add and delete features easily, *functional analysis* (examining the performance and cost of each major function or feature of the product) can be used

- *Benchmarking* is often used in this step to determine which features give the firm a competitive advantage
- Goal: provide a desired level of performance without exceeding the target cost

Value Engineering

Design analysis:

- Useful when the **firm cannot add and delete features easily**
- The design team prepares several possible designs of the product, each having similar features with different levels of performance and different costs
- Accountants work with the design team to choose one design that best meets customer preferences while not exceeding the target cost

Value Engineering

Other cost-reduction methods:

- *Cost tables:* computer-based databases (costs and cost drivers)
  - Firms that manufacture parts of different size from the same design can estimate the difference in cost and material usage for increasing or decreasing size
- *Group technology* is a method of identifying similarities in the parts of products a firm manufactures so the same parts can be used in two or more products, thereby reducing costs

Kaizen

Kaizen (step five): using continuous improvement & operational control to reduce costs in the *manufacturing stage* of the product life cycle

- Achieved through:
  - Streamlining the supply chain
  - Lean manufacturing
  - Improving manufacturing methods and productivity programs
  - Employing new management techniques
- Used extensively in the time period between product redesigns

Target Costing Example

HPI manufactures a hearing aid, HPI-2, that has 30% of the market. It has a cost of $650 and sells for $750. A competitor has just introduced a new model that incorporates a computer chip that improves quality. Its cost is $1,200. A consumer analysis indicates that cost-conscious consumers will remain loyal to HPI as long as price does not exceed $600. HPI wants to maintain the current rate of profit, $100 per hearing aid.

HPI must therefore reduce its cost to $500 ($600 price - $100 profit) to meet its profit goal

Target Costing Example

Design analysis options :

- Alternative A: reduce R&D, replace parts, and change inspection procedure – savings = $150
- Alternative B: replace parts and change inspection procedure – savings = $150
- Alternative C: increase R&D to develop a computer chip type hearing aid, replace parts, change inspection procedure, renegotiate new supplier contract – savings = $150

Target Costing Example

Management chooses alternative C because:

- The increase in R&D will improve the firm's competitive position in the future
- The move is strategically important: the new technology may be dominant in the future

Quality Function Deployment (QFD)

QFD: the integration of value engineering, marketing analysis, and target costing to assist in determining which components of the product should be targeted for redesign or cost reduction

Four steps in QFD:

1. Identify and rank customers' purchasing criteria for the product
2. Identify the components of the product and the cost of each component
3. Determine how the product's components contribute to customer satisfaction
4. Determine the importance index of each component

QFD Example: Step 1

First: Customer Criteria and Ranking

	Importance	Relative Importance	
Safety	95	46.3%	= 95÷205
Performance	60	29.3%	= 60÷205
Economy	50	24.4%	= 50÷205
Total	205	100.0%	

QFD Example: Step 2

Second: Identify Components and Cost of Each

	Cost	Percent of Total	
Motor	$40	53.3%	= 40÷75
Saw	20	26.7%	= 20÷75
Frame	15	20.0%	= 15÷75
Total	$75	100.0%	

QFD Example: Step 3

How Components Contribute to Customer Satisfaction

	Customer Criter		
	Safety	Performance	Economy
Motor	10%	10%	60%
Saw	30%	50%	10%
Frame	60%	40%	30%
Total	100%	100%	100%

QFD Example: Step 4

Fourth: Determine Importance Index for Each Component

	Safety	Perform.	Economy	Importance Index
Relative importance	46.3%	29.3%	24.4%	
% contribution:				
Motor	10%	10%	60%	22.2%*
Saw	30%	50%	10%	31.0%
Frame	60%	40%	30%	46.8%
Total	100%	100%	100%	100.00%

* (10% × 46.3%) + (10% × 29.3%) + (60% × 24.4%)

QFD Example: Conclusion

	Importance Index	Relative Cost
Motor	22.2%	53.3%
Saw	31.0%	26.7%
Frame	46.8%	20.0%
Total	100.0%	100.0%

The above analysis shows that too much is being spent on the motor component, relative to its value to the customer. In contrast, not enough is being spent on the frame component relative to its value to the customer.

Benefits of Target Costing

- Increases customer satisfaction (design is focused on customer value)
- Reduces costs (more effective and efficient design)
- Helps the firm achieve desired profitability on new and redesigned products
- Can decrease total time required for product development through improved coordination of design, manufacturing, and marketing
- Can increase communication and cooperation among departments
- Can improve overall product quality

Measuring and Improving Speed

- **Many strategic initiatives undertaken by firms today focus on improving the speed of operations**

- **Manufacturing *cycle time* (*lead time* or *throughput time*) is the amount of time between the receipt of a customer order and the shipment of that order**
  - Note that start and finish time of the cycle can be defined in several ways. Example: the start time could be defined as the time raw materials are ordered, and the finish time as the time production is completed

Measuring and Improving Speed (continued)

- ***Manufacturing cycle efficiency*** **(MCE) is defined as processing time divided by total cycle time**
  - MCE separates total cycle time into:
    - Processing time
    - Inspection time
    - Materials handling time
    - Waiting time, and so on
  - Most firms would like to see MCE close to one
- ***Constraints*** **are activities that slow a product's total cycle time**

The Theory of Constraints (TOC)

TOC focuses on improving speed at the constraints, to decrease overall cycle time

Five steps in TOC:

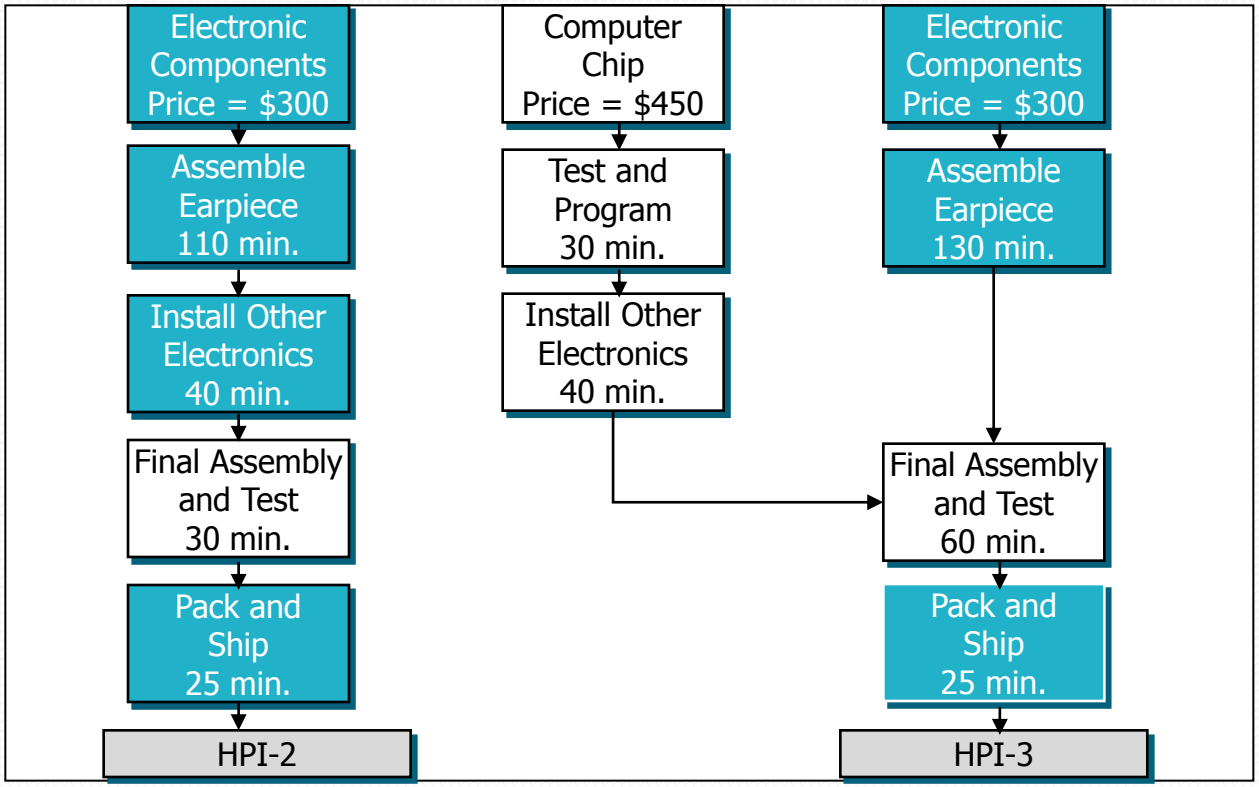
1. Identify the constraint
2. Determine the most profitable product mix given the constraint
3. Maximize the flow through the constraint
4. Add capacity to the constraint
5. Redesign the manufacturing process for flexibility and fast cycle time

TOC Example

HPI manufactures both the second generation (HPI-2) and the third generation (HPI-3) of hearing aids. Prices are competitive at $600 and $1,200, respectively, and are not expected to change. The monthly orders average 3,000 units for HPI-2 and 1,800 units for HPI-3. New customers are told they may have to wait at least three weeks for their orders, and management is concerned about the need to improve speed in the manufacturing process.

TOC Example Step 1: Identify the Constraint

Develop a *flow diagram*, which shows the sequence and time of each process



TOC Example Step 1: Identify the Constraint

Use the flow diagram and additional operational data to identify the constraint for HPI

- There is difficulty maintaining adequate staffing in all process areas except process 5
- Analysis of the process flow, staffing levels, and process time reveals the constraint occurs in process 4, perform final assembly and test; the other four processes have slack time

TOC Example Step 2: Determine the most profitable product mix given the constraint

The most profitable mix provides the maximum total profits for both products

- First, use throughput margin to determine the most profitable product given the constraint
- Throughput margin = selling price less materials cost

  In the example, the relevant measure of profitability is *throughput margin per minute in final assembly and testing*

Step 2: (continued)

HPI-3 has a higher throughput margin per unit, but with the time constraint in process 4, HPI-2 is the more profitable product per constraint time minute.

	HPI-2	HPI-3
Price	$600.00	$1,200.00
Materials cost	300.00	750.00
Throughput margin	$300.00	$450.00
Constraint time (for Process 4)	30	60
Throughput per minute	$10.00	$7.50

Step 2: (continued)

HPI will produce all 3,000 units (total demand) for HPI-2 since it is the more profitable, and the remaining capacity will be used to produce HPI-3. HPI-2 will use 1,500 (3,000 units × 0.5 hour per unit) hours of the 2,400-hour capacity. The 900 hours remaining allow for production of 900 units of HPI-3.

	HPI-2	HPI-3
Total demand in units	3,000	1,800
Units of product in optimal mix	3,000	900
Unmet demand	-	900

TOC Example Step 3: Maximize the flow through the constraint

- Look for ways to speed the flow by simplifying the process, improving product design, reducing setup, and reducing other delays

- Objective is to balance the flow of production through the system (processes prior to and including the constraint) by carefully timing and scheduling those activities

Step 3: (continued)

- Another method to use is *Takt time* (total time available to meet expected customer demand)

- Example: after allowing for employee break time, a manufacturing plant operation has 400 minutes of manufacturing time available per day. If average customer demand is 800 units, the Takt time is 30 seconds per unit. The Takt time of 30 seconds is used to balance the flow of product through the processes.

400 minutes ÷ 800 units = 30 seconds per unit *takt time*

TOC Example Steps 4 & 5

Step 4: Add capacity to the constraint

- Adding new machines or additional labor is a long-term measure that can improve flow through the constraint

Step 5: Redesign the manufacturing process for flexibility and fast cycle time

- This step involves the most complete strategic response to the constraint because simply removing one or more minor features of a product might speed up the production process significantly

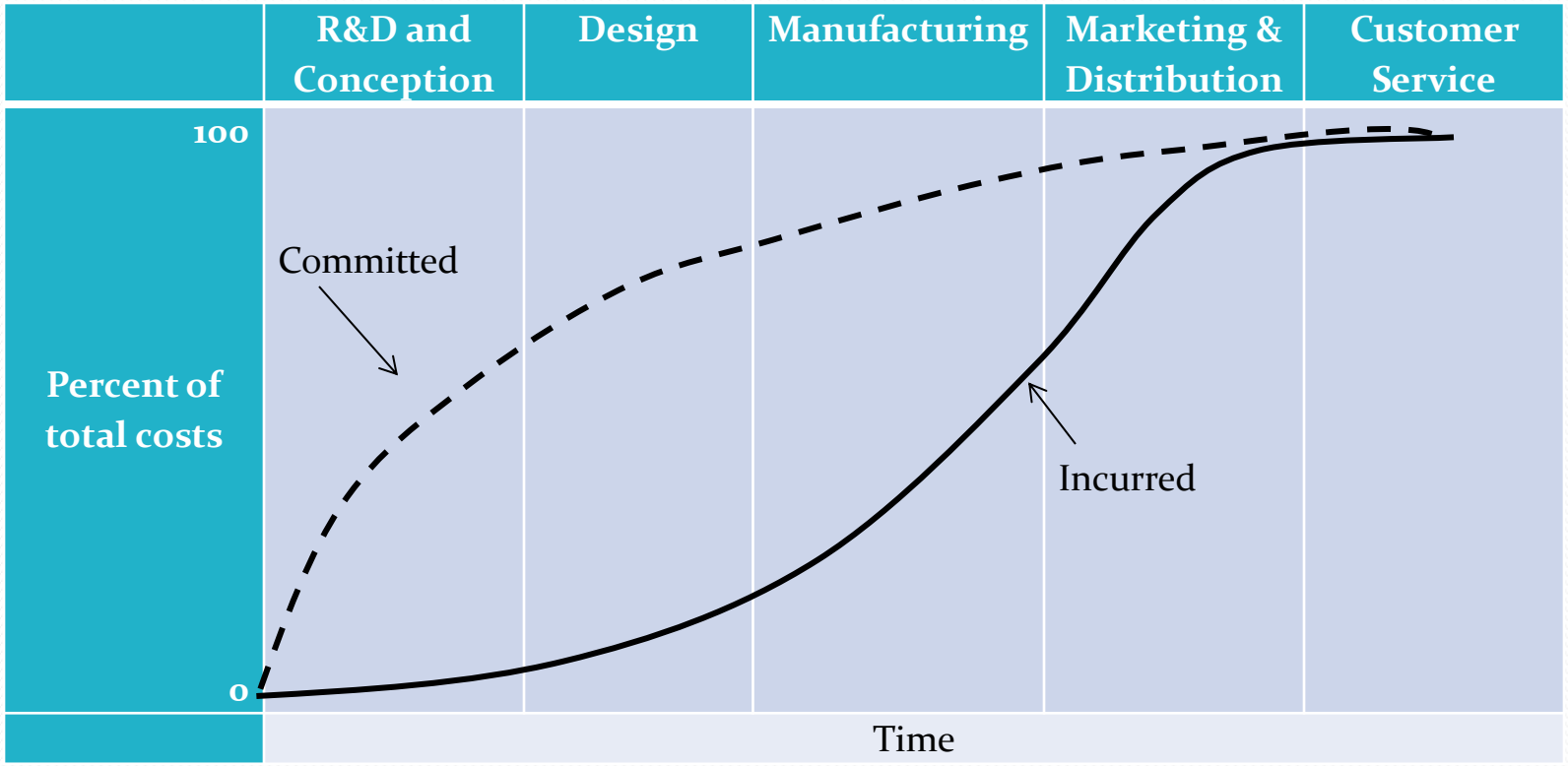
The Five Steps in Strategic Decision Making: Importance of Speed in the Fashion Industry: The Burberry Group PLC

1. **Determine the Strategic Issues Surrounding the Problem:** *Burberry competes on design and innovation in the fashion industry*
2. **Identify the Alternative Actions:** *focus on design or operations*?
3. **Obtain Information and Conduct Analyses of the Alternatives:** *using an enterprise system, SAP, Burberry carefully determines product and process costs*
4. **Based on Strategy and Analysis, Choose and Implement the Desired Alternative:** *Burberry's CEO decides to simply the product line to "one brand…one image," and to focus on more efficient and less costly operations*
5. **Provide an On-going Evaluation of the Effectiveness of implementation in Step 4.**

TOC vs. ABC

	TOC	ABC
Main Objective	Short-term focus: through put margin analysis based on materials and materials-related costs	Long-term focus; analysis of all product costs
Resource constraints	Included explicitly, a principal focus of TOC	Not included explicitly
Cost drivers	No direct utilization of cost drivers	Develop an understanding of cost drivers at all levels
Major Use	Optimization of production flow and short-term product mix	Strategic pricing and profit planning

Committed vs. Incurred Costs



Life-Cycle Costing

Life-cycle costing provides a more complete perspective of product costs and profitability than pricing based on manufacturing costs alone

- Managers need to be concerned with costs outside the manufacturing process because upstream and downstream costs can account for a significant portion of total life-cycle costs.

- Decision-making at the design stage is critical because decisions at this point commit a firm to a given production, marketing, and service plan, and lock in most of the product's total life cycle costs. most crucial way to manage these costs is at the design stage of the product and the manufacturing process.

Life-Cycle Costing Example

According to the "traditional" product-line statements below, ADI-1 appears to be the more profitable product

Product Line Income Statements Analytical Decisions, Inc.			
	ADI-1	ADI-2	Total
Sales	$ 4,500,000	$ 2,500,000	$ 7,000,000
Cost of sales	1,240,000	1,005,000	2,245,000
Gross margin	$ 3,260,000	$ 1,495,000	$ 4,755,000
R & D			2,150,000
Selling and service			1,850,000
Income before taxes			$ 755,000

Life-Cycle Costing Example (continued)

However, when upstream and downstream costs are considered, ADI-2 is actually more profitable

Life-Cycle Costing Analytical Decisions, Inc.			
	ADI-1	ADI-2	Total
Sales	$ 4,500,000	$ 2,500,000	$ 7,000,000
Cost of sales	1,240,000	1,005,000	2,245,000
Gross margin	$ 3,260,000	$ 1,495,000	$ 4,755,000
R & D	1,550,000	600,000	2,150,000
Selling and service	1,450,000	400,000	1,850,000
Income before taxes	$ 260,000	$ 495,000	$ 755,000

Strategic Pricing

- **Strategic pricing decisions require information from:**
  - The cost life cycle
  - The sales life cycle
- **The cost information for pricing is commonly based on one of four methods:**
  - Full manufacturing cost plus markup
  - Life-cycle cost plus markup
  - Full cost and desired gross margin percent
  - Full cost plus desired return on assets

Strategic Pricing (continued)

Strategic pricing depends on the position of the product or service in the *sales life cycle*

Phase 1 Introduce	Pricing is set relatively high to recover development costs and take advantage of new-product demand
Phase 2 Growth	Pricing is likely to stay relatively high as the firm attempts to build profitability
Phase 3 Maturity	The firm becomes more of a price taker than a price setter and attempts to reduce upstream and downstream costs
Phase 4 Decline	Volume and prices decline and the firm increases emphasis on controlling upstream and downstream costs

Peak Load Pricing

- Designed to capitalize on or modify consumer behavior, examples include:
  - Charging different rates for peak and off-peak cell phone minutes used
  - Charging more per kilowatt of electricity in the afternoon than in the middle of the night

Summary

- *Target costing* determines the allowable (i.e., "target") cost for a product or service, given a competitive market price and a target profit
- The target costing approach involves five steps:
  - Determine the market price
  - Determine the desired profit
  - Calculate the *target cost* (market price less desired profit)
  - Use *value engineering* to reduce cost
  - Use *kaizen costing* and *operational control* to further reduce costs

Summary

- The theory of constraints (TOC) focuses on improving speed at the constraints, which causes a decrease in overall cycle time

- Five steps in TOC:
  - Identify the constraint
  - Determine the most profitable product mix given the constraint
  - Maximize the flow through the constraint
  - Add capacity to "relax" the constraint
  - Redesign the manufacturing process for flexibility and faster cycle time

Summary

- Life-cycle costing provides a more complete perspective of product costs and product or service profitability because it considers the entire cost life cycle of the product or service

- Management accountants prepare information from both the perspective of the cost life cycle and the sales life cycle to help management make strategic pricing decisions

Putting The Budget Together

Revenue budgets

Forecasting methods

- **Qualitative methods**: rely on attitudes, beliefs, feelings and experience.
  - Jury of executive opinion
  - Sales force composite
  - Delphi technique
  - Market research
- **Quantitative methods**: more objective, use mathematical models.
  - Time serious models
  - Causal models

Factors affecting revenue budgets

- Past sales levels for business and entire industry.
- General economic trends.
- Economic trends in the business's industry.
- Climatic changes affecting industry.
- Political and legal events.
- Intended pricing policy.
- Planned advertising.
- Expected actions of competitors.
- Market research studies.

Types of revenue budgets

- Sales by product.
- Sales by product and period.
- Sales by area and period.
- Sales by product, area and period.
- Fees income by type of service.
- Sales and fees income by period.

Sale by product

Sales budget for the year ending June 30

Type of biscuit	**Sales volume kg**	**Sales price $**	**Sales $**
Sweet Hearts			
Cherry Surprises			
Chocolate Supremes			
Almond Delights			
Total sales $			

Sales by product and period

Sales budget for the quarter ending
31 March

	Jan	Feb	March	Total
Hot Dogs				
Sales volume				
Selling price $				
Sales $				
Pies				
Sales volume				
Selling price $				
Sales $				

Fees income budget for the quarter ended 30 September

	July	Aug	Sept	Total
Normal consultations				
No. of patients				
Fee per visit $				
Fees income $				
Home visits				
No. of patients				
Fee per visit $				
Fees income				
Total fees income $				

Operating budgets

Operating budgets

- Purchases budget
- Cost of goods sold budget
- Operating expense budgets
    1. Marketing expense budget
    2. Administration expense budget
    3. Financial expense budget
- Specialised service industry budgets
    1. Professional and support labour budget
    2. Materials usage budget
- Budgeted income statement of financial performance

Purchases budget in dollars for 3 months ending 30 June

	April $	**May $**	**June $**	**Quarter $**
Cost of sales				
a*dd* ending stock				
Total requirements				
less beginning stock				
purchases				

Purchases budget in units for quarter ending 31 March

	Jan	Feb	March	Quarter
Sales [units]				
Ending stock [units]				
Total req. [units]				
less beginning stock [units]				
Purchases [units]				
Cost per unit **$**				
Cost of purchases **$**				

Cost of goods sold budget for 3 months ending 30 June

	April $	May $	June $	Quarter $
Beginning stock				
Purchases				
Goods available for sale				
Ending stock				
Cost of sales				

Marketing expense budget for 3 months ending 30 June

	April $	May $	June $	Quarter $

Administration expense budget for 3 months ending 30 June

	April $	May $	June $	Quarter $

Financial ~~expense budget~~ for 3 months ending 30 June

	April $	May $	June $	Quarter $

Budgeted income statement for 3 months ending 30 June

	April $	**May $**	**June $**	**Quarter $**
Sales				
less COGS				
Gross Profit				
Operating exp.				
Marketing				
Administration				
Financial				
Total Expenses				
Net Profit				

Cash budgets

Cash budgets

- Cash receipts budget:
  Estimated receipt of cash from **all** sources.
- Cash payments budget:
  All estimated payments of cash by the business.

GST and cash budgets

- This unit assumes all businesses are registered for GST and pay their liability monthly.
- Collection of Goods & Services Tax (GST) when the business makes a taxable supply.
- **Taxable supply:** a sale of a good or service that is not GST-free or input taxed.
- **GST input tax credits:** a credit for the GST included in the purchase of a good or service.

Sample cash receipts budget where all receipts are GST-free or input taxed

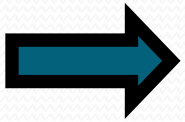
Cash receipts budget for the quarter ending 30 September				
	July	August	Sept.	Total
	$	$	$	$
Consultion fees received	12510	11970	10880	35360
Cash sales	3200	2980	2740	8920
Rental income	500	500	500	1500
Interest received			150	150
Total cash receipts	16210	15450	14270	45930

Sample cash payments budget where some acquisitions include GST

Cash payments budget for the quarter ending 30 September (p. 61)				
	July	August	Sept	Total
	$	$	$	$
Cash purchases				
Rent				
Laundry				
Telephone				
Insurances				
Stationery				
Vehicle running costs				
Massage table				
Payments including GST				
GST input taxcredit				

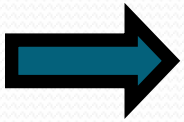
Cash budget format

- Cash balance @start
- *add* cash receipts
- *add* GST refund



total cash available for needs

- cash payments
- *add* GST payable



total payments

- Cash balance @end

Collections from debtors

- Calculate cash and credit sales.
  - work out cash sales GST exclusive
  - work out GST payable on cash sales
  - work out credit sales GST inclusive
- Prepare a collection from debtors schedule for the budget period.
- Show separately at bottom of schedule the GST payable included in the figures.

Dermott Jewellers

Schedule of collections from debtors for the quarter ending 31 March						
			Month received			
			Jan	Feb	March	Total
Month of sale		$	$	$	$	$
October		33600				
November		38400				
December		42000				
January		39600				
February		31200				
March		40800				
Total collections						
GST included above						

GST reported on accrual basis

- GST is payable at point of sale.
- Input tax credit is receivable when the entity receives the tax invoice.
- GST adjustment for a bad debt is made when the debt is actually written off as bad.
- GST adjustment for discount allowed is made when discount is given.
- GST collected each month is not the same as GST payable.

Collection from debtors with discount allowed and doubtful debts

Schedule of collections from debtors for the quarter ending 30 September								
					Month received			
			D. Debts	Dicount	July	August	Sept	Total
Month of sale		$	$	$	$	$	$	$
May		39900						
June		44100						
July		50400						
August		35700						
September		25200						
Total collections								
GST included above								

Desired balance and financial requirements

- Management may desire to have a minimum cash balance.
- May involve borrowing funds to attain required balance.
- Borrowings are made in the month that a deficit is likely.
- There may be conditions attached to the amounts that can be borrowed.

Budgeted financial statements

Budgeted financial statements

- Income statement of financial performance
- Balance sheet of financial position
- Cash flow statement

The above budgets summarise the forecasts made in all other budgets.

Budgeted income statement is a summary of the following budgets

- Sales and/or fees
- Cost of goods sold
- Operating expenses
  - marketing
  - administration
  - financial

This budget is not affected by GST accounts.

Budgeted balance sheet

- This budget is prepared from asset, liability and owners equity accounts.
- If GST payable is >GST input tax credits, the net GST payable is shown as a current liability.
- If GST payable is <GST input tax credits, the net GST input tax credit is shown as a current asset.

Preparation budgeted balance sheet

Examples of the information needed:

- Net profit or loss
- Accounts receivable balance
- Accounts payable balance
- Pattern of paying expenses
- Rates and methods of depreciation
- Any acquisition or disposal of assets
- Any drawings made by the owner
- Any capital contributions made by the owner

Budgeted statement of cash flows

- Is a cash budget in a format that complies with either AASB107 or AASB1026.
- If the GST payable is >input credits receivable in the relevant period the resultant amount is paid to the ATO.
- If the GST payable is <input credits receivable in the relevant period the resultant amount will be refunded by the ATO.

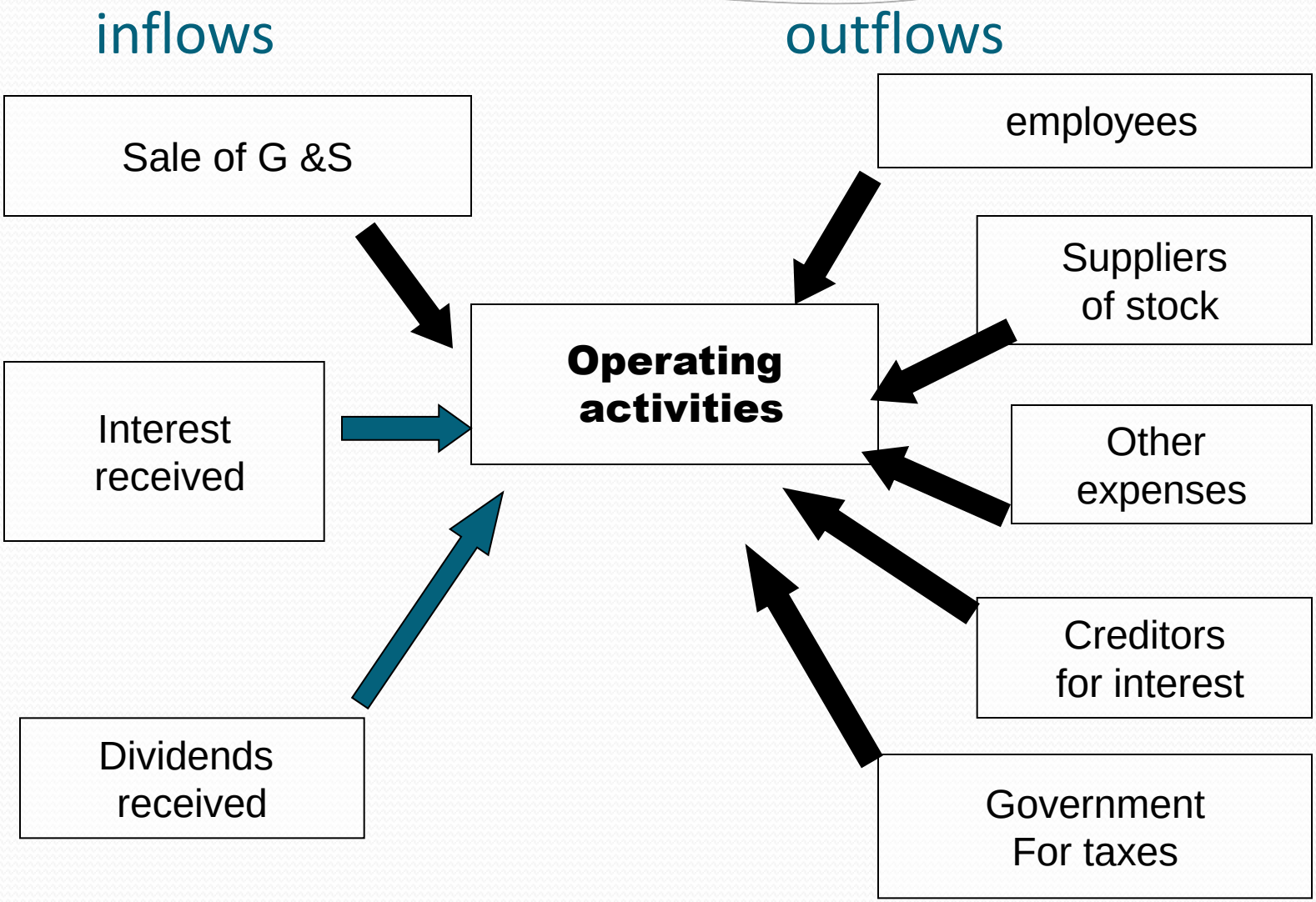
The budgeted cash flow statement is divided into 3 main categories

- **Operating activities:** provision of goods and services.

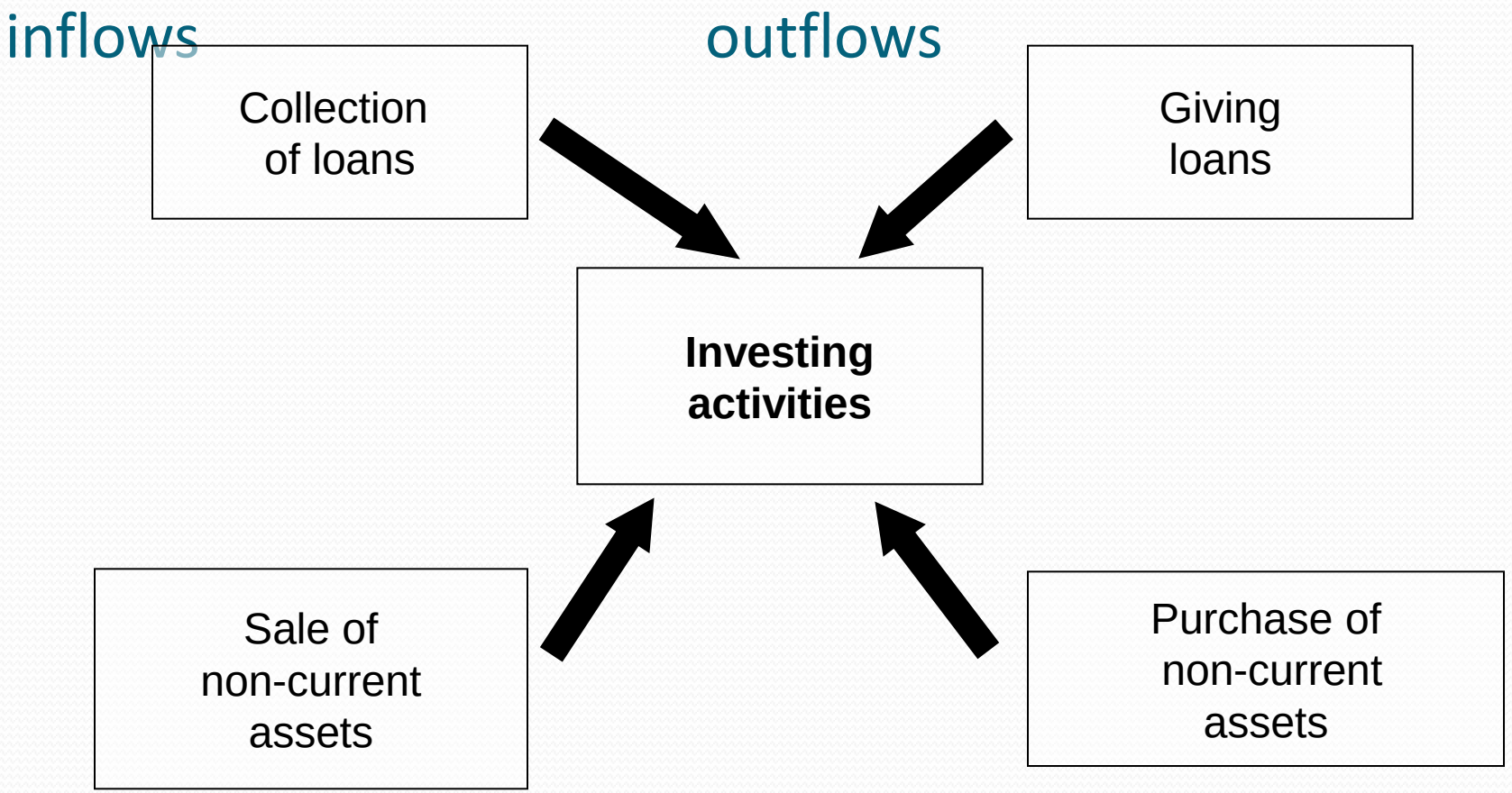
- **Investing activities:** acquisition and disposal of non-current assets.

- **Financial activities:** changes to the financial structure of the business.

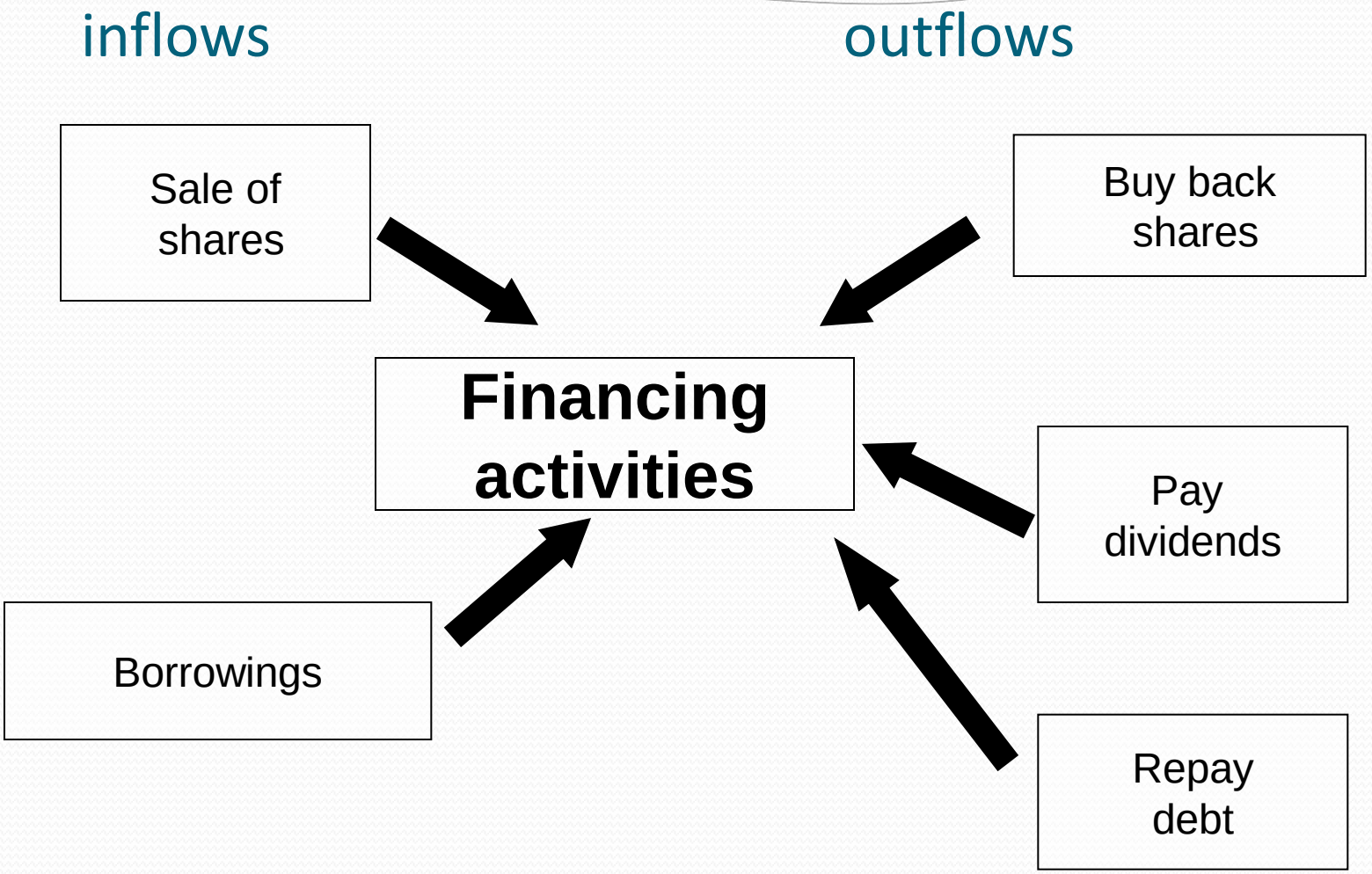
Classification of cash



Classification of cash



Classification of cash



Budgeted statement of cash flows for period ended...

	$	$
Cash flows from operating activities:		
Net cash inflow (outflow) from operating activities		
Cash flows from investing activities:		
Net cash inflow (outflow) from investing activities		
Cash flows from financing activities:		
Net cash inflow (outflow) from financing activities		
Net increase (decrease) in cash held		
Cash at beginning of period		
Cash at end of period		

Master budget for manufacturing organisations

Cost classifications

- **Product costs** are the costs of converting raw materials into a finished product.
    1. Raw materials
    2. Direct labour
    3. Factory overhead

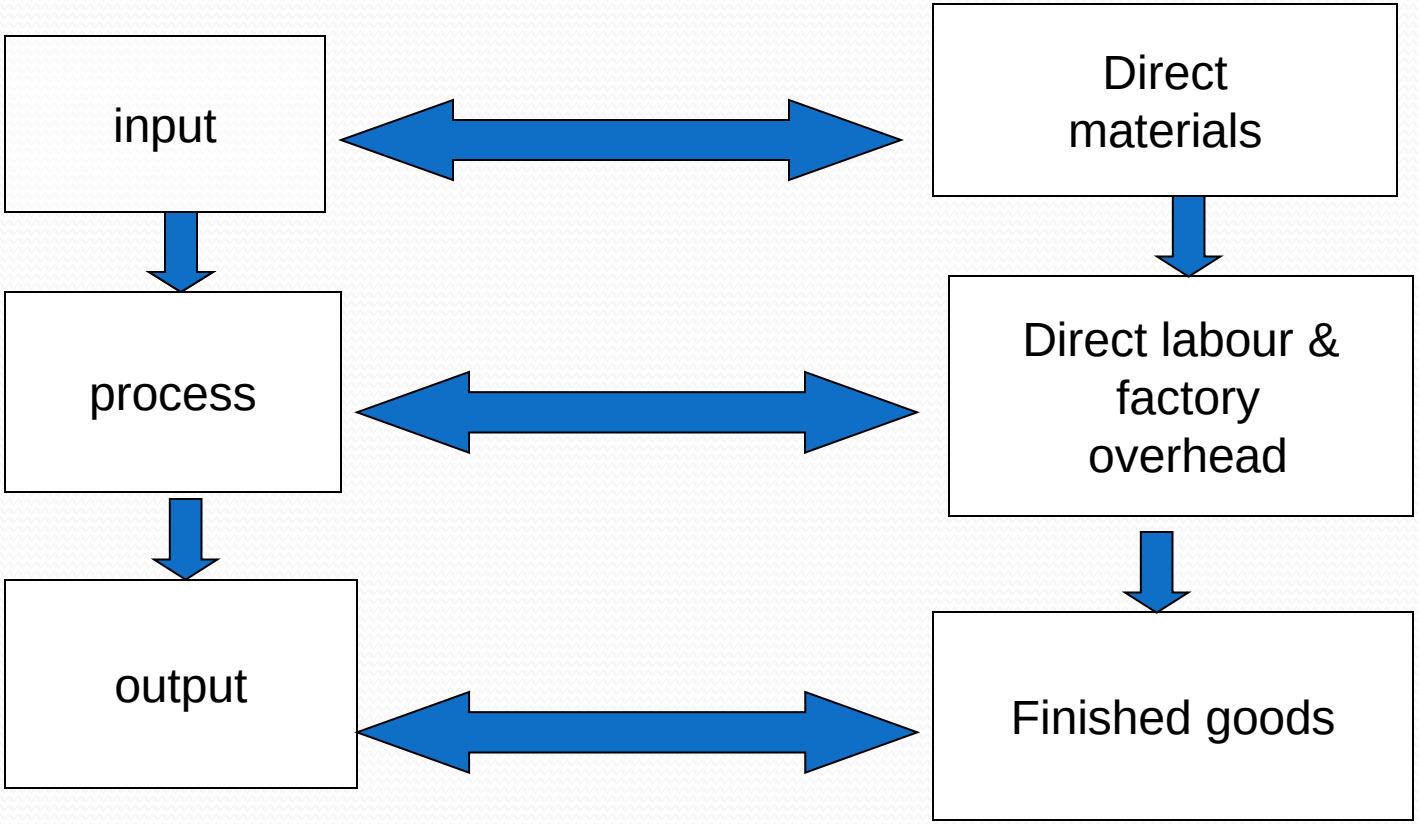
- **Period costs** are all **other** costs associated with the business.
    1. Marketing expenses
    2. General and administration expenses
    3. Financial expenses

Product costs

- **Direct costs:**
  major items of cost that can be relatively easily traced to the product, such as raw materials and direct labour.
- **Raw materials and direct labour**
  Prime cost
- **Raw materials and direct labour**
  → **Prime cost**

- **Indirect costs:**
  cannot **not** be easily traced directly to the product. All factory overhead.
- **Factory overhead:**
  all indirect costs of running a factory.
  Examples: indirect materials, indirect labour, factory insurance.

Manufacturing process



Cost of production requires the preparation of the following budgets

- Sales
- Production
- Direct materials usage
- Direct labour
- Factory overhead

Production budget for the year ending 30 June				
			Units	
sales				
add desired ending inventory				
total units needed				
less beginning inventory				
Units to be produced				

Factory overhead budget

Factory overhead budget for year ended 30 June				
				$
Indirect materials				
Indirect labour				
Light & power				
Rates				
Factory insurances				
Depreciation on factory equipment				
Total factory overhead				

Direct materials and labour budget

***less* beginning inventory**						
Direct material usage budget for period ending June 30						
Boxes to be prduced						
kg per box						
Cardboard needed for production(kg)						
Cost per kg						
cost of cardboard to be used in production ($)						
Direct labour budget for period ending June 30						
Boxes to be produced						
Boxes produced per hour						

Factory overhead application rate

- This allows the business to charge the product with an estimated amount.

- Application rate can be calculated on different bases:
  - per unit
  - direct labour cost
  - direct labour hours
  - machine hours.

Cost of goods sold budget

- **Merchandising business**
  stock @ beginning
  add **net purchases**
  cost of goods available for sale
  less
  stock @ end
  cost of goods sold

- **Manufacturing business**
  stock @ beginning
  add **cost of production**
  cost of goods available for sale
  less
  stock @ end
  cost of goods sold

Cost behaviour and classification

The Cost Function

Learning objectives

- Q1: What are the different ways to describe cost behavior?
- Q2: What process is used to estimate future costs?
- Q3: How are engineered estimates, account analysis, and two-point methods used to estimate cost functions?
- Q4: How does a scatter plot assist with categorizing a cost?
- Q5: How is regression analysis used to estimate a cost function?
- Q6: How are cost estimates used in decision making?

Q1: Different Ways to Describe Costs

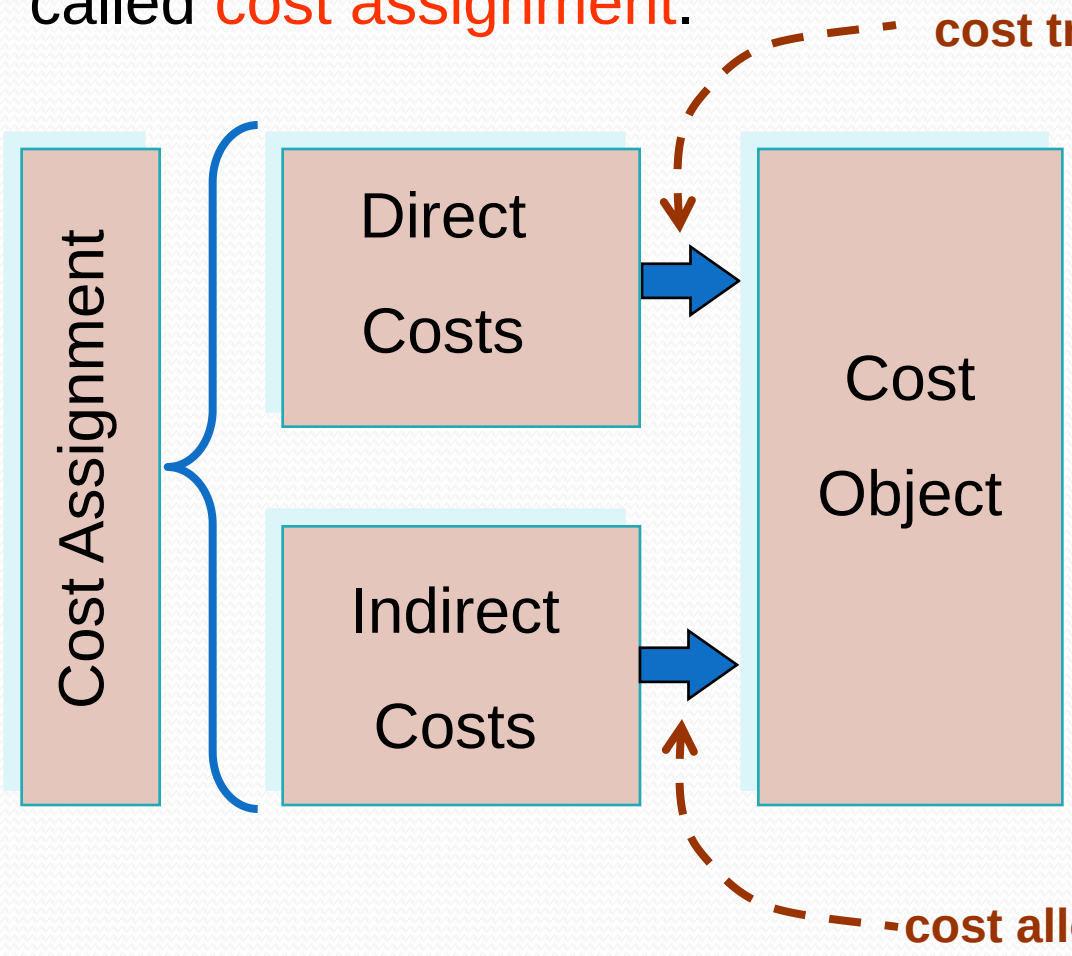
- Costs can be defined by how they relate to a cost object, which is defined as any thing or activity for which we measure costs.

- Costs can also be categorized as to how they are used in decision making.

- Costs can also be distinguished by the way they change as activity or volume levels change.

Q1: Assigning Costs to a Cost Object

Determining the costs that should attach to a cost object is called cost assignment.



Direct costs are easily traced to the cost object.

Indirect costs are not easily traced to the cost object, and must be allocated.

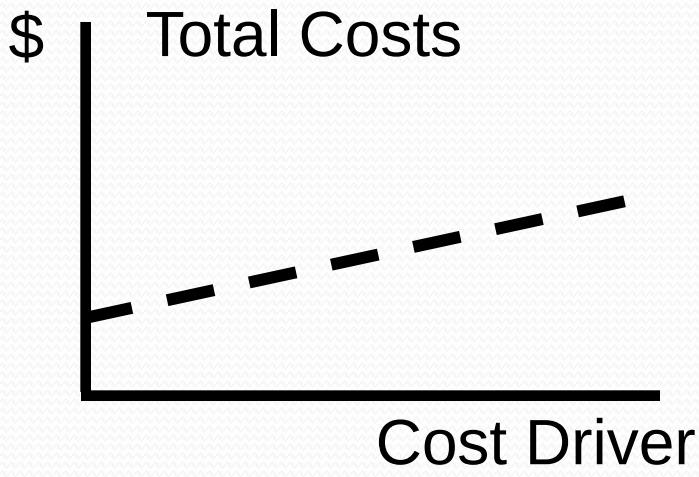
Q1: Direct and Indirect Costs

- In manufacturing:
  - all materials costs that are easily traced to the product are called direct material costs
  - all labor costs that are easily traced to the product are called direct labor costs
  - all other production costs are called overhead costs
- Whether or not a cost is a direct cost depends upon:
  - the definition of the cost object
  - the precision of the bookkeeping system that tracks costs
  - the technology available to capture cost information
  - whether the benefits of tracking the cost as direct exceed the resources expended to track the cost
  - the nature of the operations that produce the product or service

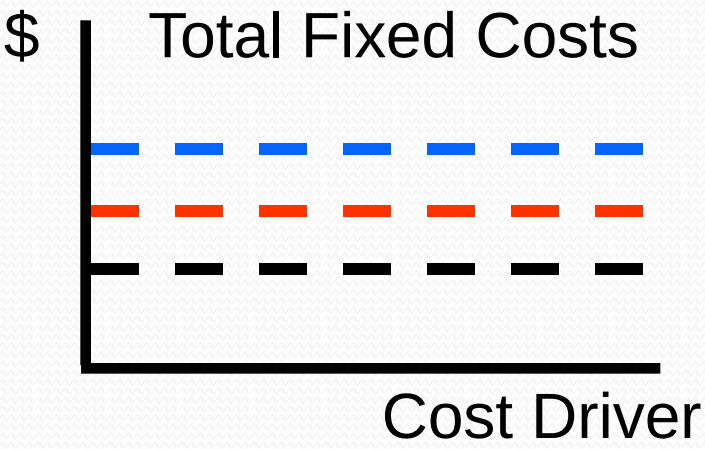
Q1: Linear Cost Behavior Terminology

- Total fixed costs are costs that do not change (in total) as activity levels change.
- Total variable costs are costs that increase (in total) in proportion to the increase in activity levels.
- Total costs equal total fixed costs plus total variable costs.
- The relevant range is the span of activity levels for which the cost behavior patterns hold.
- A cost driver is a measure of activity or volume level; increases in a cost driver cause total costs to increase.

Q1: Behavior of Total (Linear) Costs



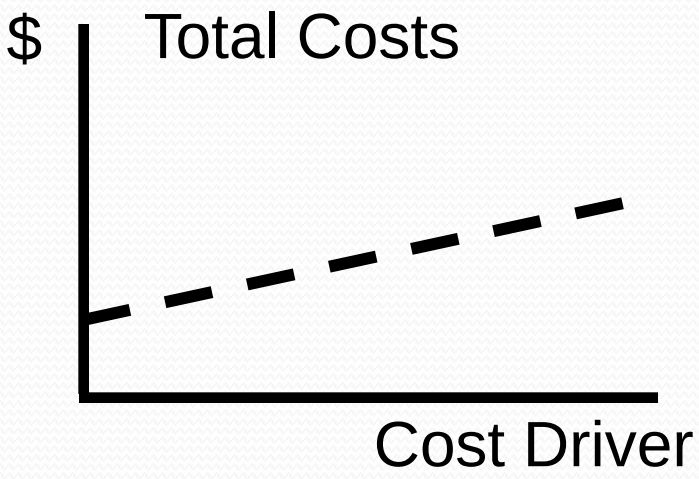
If costs are linear, then total costs graphically look like this.



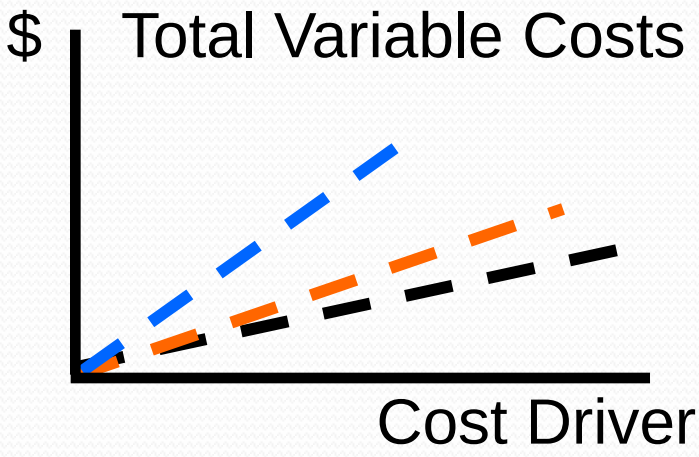
Total fixed costs do not change as the cost driver increases.

Higher total fixed costs are higher above the x axis.

Q1: Behavior of Total (Linear) Costs



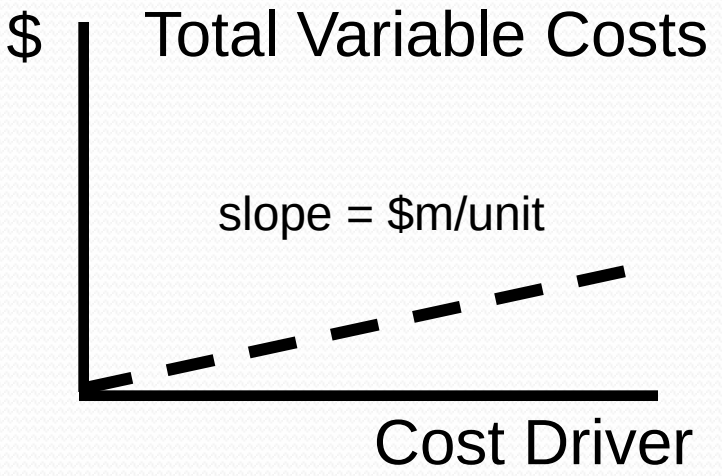
If costs are linear, then total costs graphically look like this.



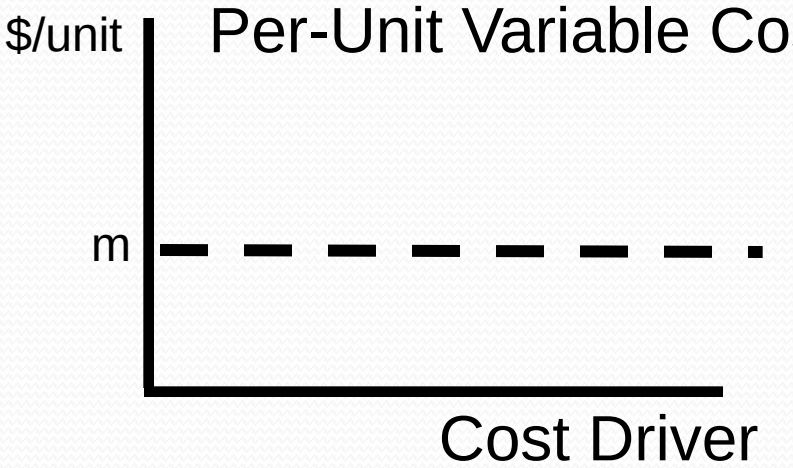
Total variable costs increase as the cost driver increases.

A steeper slope represents higher variable costs per unit of the cost driver.

Q1: Total Versus Per-unit (Average) Cost Behavior

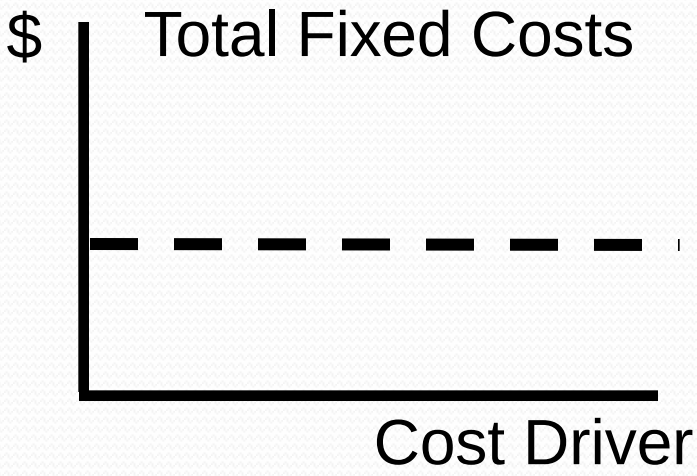


If total variable costs look like this . . .

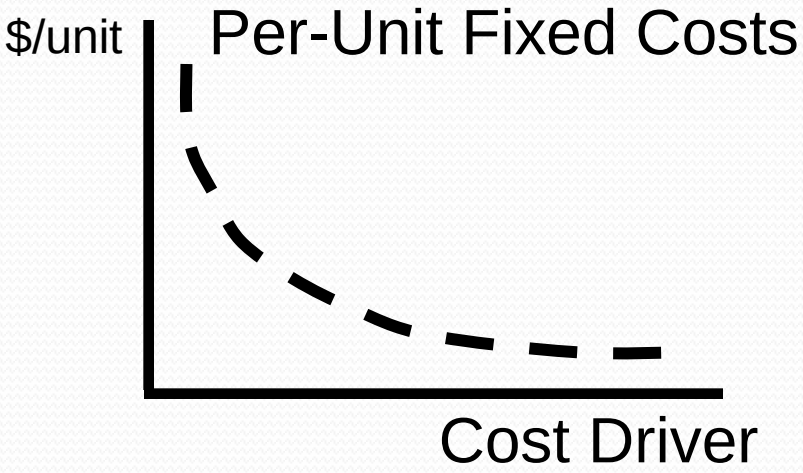


. . . then variable costs per unit look like this.

Q1: Total Versus Per-Unit (Average) Cost Behavior



If total fixed costs look like this . . .



. . . then fixed costs per unit look like this.

Q1: Total Versus Per-Unit (Average) Cost Behavior

Lari's Leather produces customized motorcycle jackets. The leather for one jacket costs $50, and Lari rents a shop for $450/month. Compute the total costs per month and the average cost per jacket if she made only one jacket per month. What if she made 10 jackets per month?

Average variable costs are constant

Total variable costs go up

1 Jacket

	Total Costs/ Month	Average Cost/ Jacket
Leather	$50	$50
Rent	$450	$450
Total	$500	$500

10 Jackets

	Total Costs/ Month	Average Cost/ Jacket
Leather	$500	$50
Rent	$450	$45
Total	$950	$95

Total fixed costs are constant

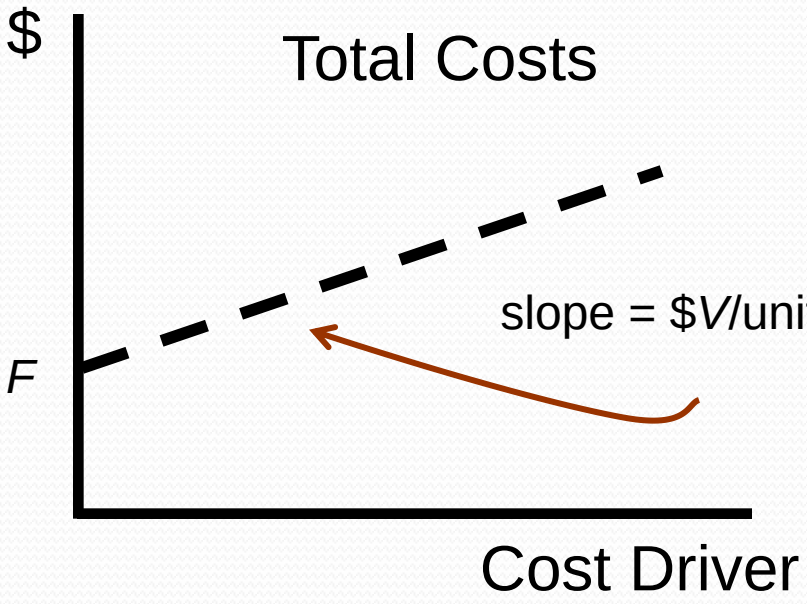
Average fixed costs go down

Q1: The Cost Function

When costs are linear, the cost function is:

$TC = F + V \times Q$, where

F = total fixed cost, V = variable cost per unit of the cost driver, and Q = the quantity of the cost driver.



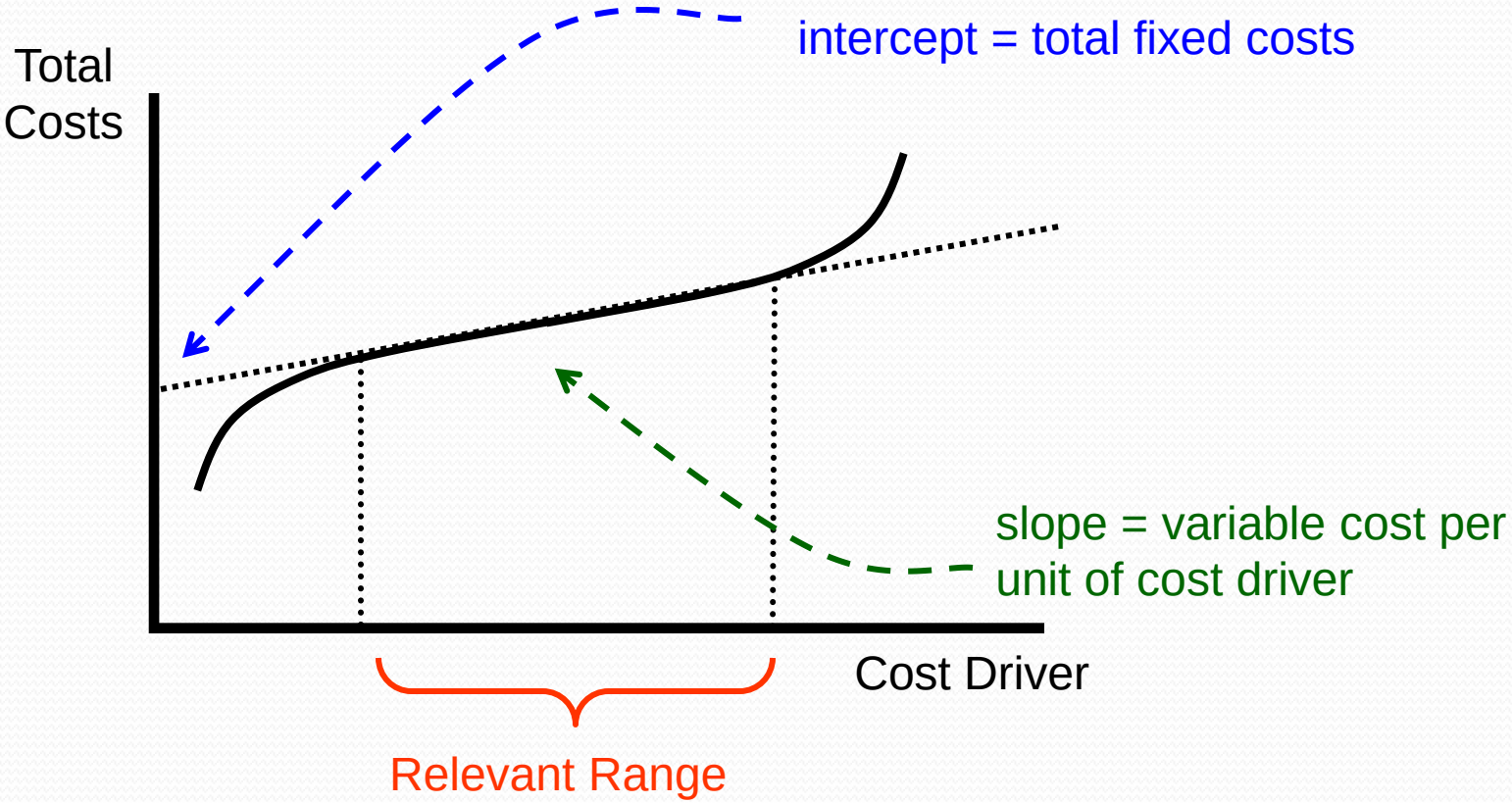
The intercept is the total fixed cost.

The slope is the variable cost per unit of the cost driver.

A cost that includes a fixed cost element and a variable cost element is known as a mixed cost.

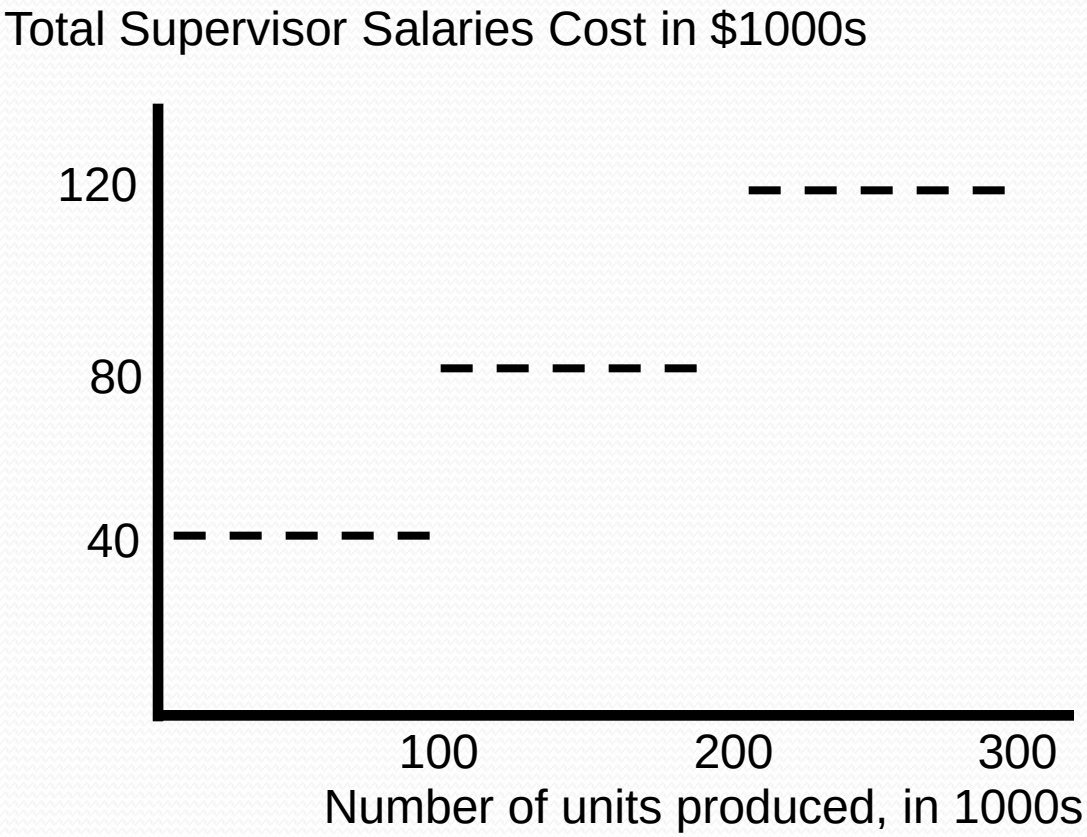
Q1: Nonlinear Cost Behavior

Sometimes nonlinear costs exhibit linear cost behavior over a range of the cost driver. This is the relevant range of activity.



Q1: Stepwise Linear Cost Behavior

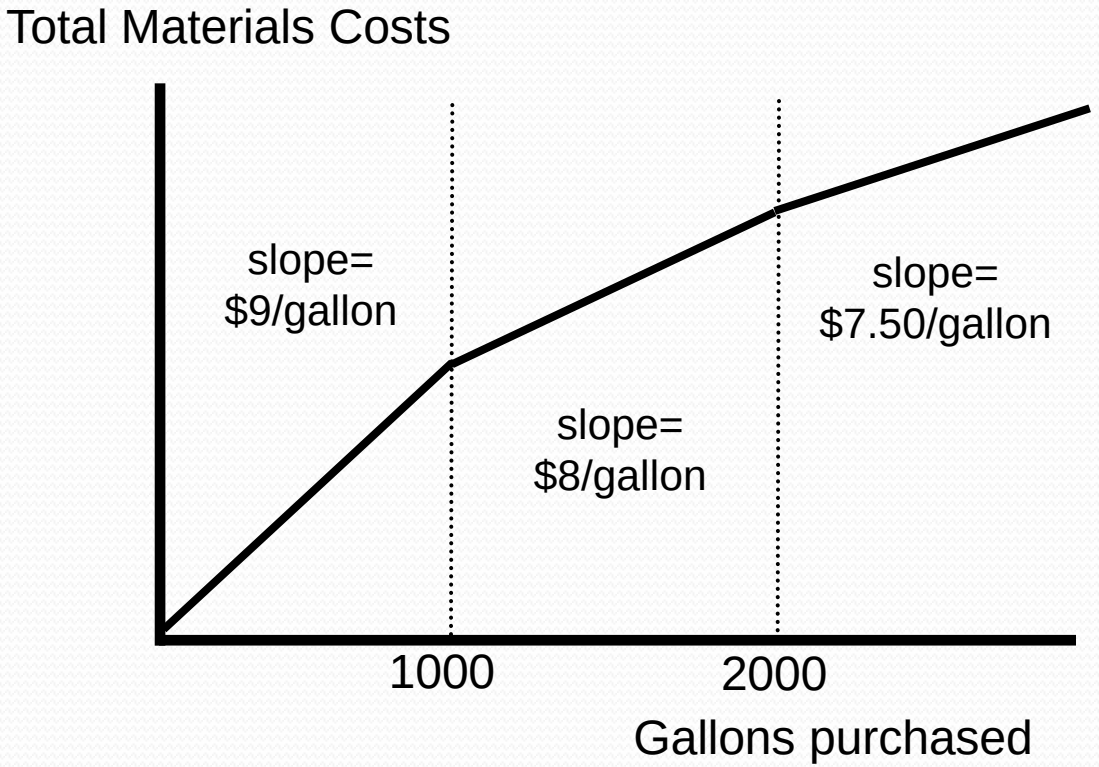
Some costs are fixed at one level for one range of activity and fixed at another level for another range of activity. These are known as stepwise linear costs.



Example: A production supervisor makes $40,000 per year and the factory can produce 100,000 units annually for each 8-hour shift it operates.

Q1: Piecewise Linear Cost Behavior

Some variable costs per unit are constant at one level for one range of activity and constant at another level for another range of activity. These are known as piecewise linear costs.



Example: A supplier sells us raw materials at $9/gallon for the first 1000 gallons, $8/gallon for the second 1000 gallons, and at $7.50/gallon for all gallons purchased over 2000 gallons.

Q1: Cost Terms for Decision Making

- In earlier session we learned the distinction between relevant and irrelevant cash flows.

- Opportunity costs are the benefits of an alternative one gives up when that alternative is not chosen.
  - Opportunity costs are difficult to measure because they are associated with something that did not occur.
  - Opportunity costs are always relevant in decision making.

- Sunk costs are costs that were incurred in the past.
  - Sunk costs are never relevant for decision making.

Q1: Cost Terms for Decision Making

- Discretionary costs are periodic costs incurred for activities that management may or may not determine are worthwhile.
  - These costs may be variable or fixed costs.
  - Discretionary costs are relevant for decision making only if they vary across the alternatives under consideration.
- Marginal cost is the incremental cost of producing the next unit.
  - When costs are linear and the level of activity is within the relevant range, marginal cost is the same as variable cost per unit.
  - Marginal costs are often relevant in decision making.

Q2: What Process is Used to Estimate Future Costs?

Past costs are often used to estimate future, non-discretionary, costs. In these instances, one must also consider:

- whether the past costs are relevant to the decision at hand
- whether the future cost behavior is likely to mimic the past cost behavior
- whether the past fixed and variable cost estimates are likely to hold in the future

Q3: Engineered Estimates of Cost Functions

- Use accountants, engineers, employees, and/or consultants to analyze the resources used in the activities required to complete a product, service, or process.

- For example, a company making inflatable rubber kayaks would estimate some of the following:
  - the amount and cost of the rubber required
  - the amount and cost of labor required in the cutting department
  - the amount and cost of labor required in the assembly department
  - overhead costs and the best cost allocation base to use
  - the selling costs, including commissions and advertising
  - the distribution costs

Q3: Account Analysis Method of Estimating a Cost Function

- Review past costs in the general ledger and past activity levels to determine each cost's past behavior.

- For example, a company producing clay wine goblets might review its records and find:
  - the cost of clay is piecewise linear with respect to the number of pounds of clay purchased
  - skilled production labor is variable with respect to the number of goblets produced
  - unskilled production labor is mixed, and the variable portion varies with respect to the number of times the kiln is operated
  - production supervisors' salary costs are stepwise linear
  - distribution costs are mixed, with the variable portion dependent upon the number of retailers ordering goblets

Q3: Example - Account Analysis Method of Estimating a Cost Function

- The table on the right contains the expenditures for Scott Manufacturing during the last year.
- 100,000 units were produced and sold
- $500,000 of sales revenue was recorded

Required:

1. Determine the cost function using units produced as the driver
2. Repeat using sales dollars as the driver

Expense	Amount	Variable	Fixed
Direct Materials	$500,000		
Direct Labor	300,000		
Rent	25,000		
Insurance	15,000		
Commissions	200,000		
Property Tax	20,000		
Telephone	10,000		
Depreciation	85,000		
Power & Light	30,000		
Admin Salaries	100,000		
Total	1,285,000		

Q3: Example - Account Analysis Method of Estimating a Cost Function

- Steps in estimating a cost function using account analysis
  - Separate fixed and variable costs
  - Total the fixed costs
  - Total the variable costs
  - Calculate a variable cost per driver
  - Write out the cost function

Q3: Solution - Account Analysis Method of Estimating a Cost Function

Expense	Amount	Variable	Fixed
Direct Materials	$500,000	500,000	
Direct Labor	300,000	300,000	
Rent	25,000		25,000
Insurance	15,000		15,000
Commissions	200,000	200,000	
Property Tax	20,000		20,000
Telephone	10,000		10,000
Depreciation	85,000		85,000
Power & Light	30,000		30,000
Admin Salaries	100,000		100,000
Total	1,285,000	1,000,000	285,000

Cost Function on Units:

TC = FC + VC/Unit * Qty
TC = $285,000 + ($10/unit) * Qty

Cost Function on Dollars:

TC = FC + VC/Sales $ * Sales $
TC = $285,000 + ($0.20) * Sales $

Q3: Two-Point Method of Estimating a Cost Function

- Use the information contained in two past observations of cost and activity to separate mixed and variable costs.
- It is much easier and less costly to use than the account analysis or engineered estimate of cost methods, but:
  - it estimates only mixed cost functions,
  - it is not very accurate, and
  - it can grossly misrepresent costs if the data points come from different relevant ranges of activity

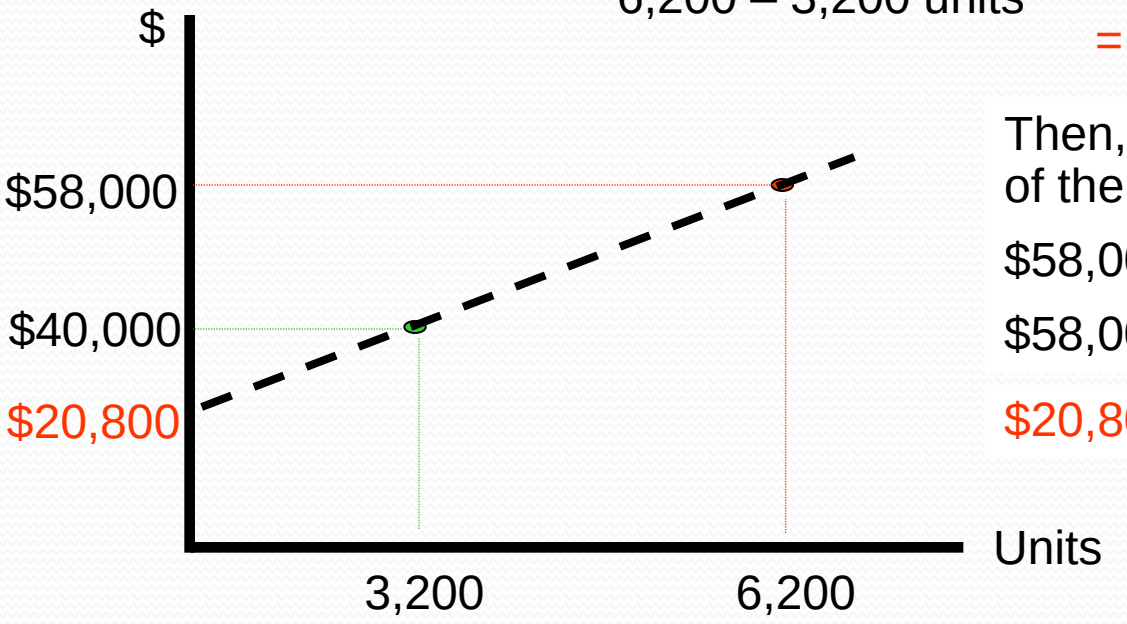
Q3: Example - Two-Point Method of Estimating a Cost Function

In July the Gibson Co. incurred total overhead costs of $58,000 and made 6,200 units. In December it produced 3,200 units and total overhead costs were $40,000. What are the total fixed factory costs per month and average variable factory costs?

We first need to determine *V*, using the equation for the slope of a line.

rise/run = $\frac{\$58,000 - \$40,000}{6,200 - 3,200 \text{ units}}$ = $18,000/3,000 units

= $6/unit



Then, using TC = *F* + *V* x *Q*, and one of the data points, determine F.

$58,000 = *F* + $6/unit x 6,200 units

$58,000 = *F* + $37,200

$20,800 = *F*

Q3: High-Low Method of Estimating a Cost Function

- The high-low method is a two-point method
  - the two data points used to estimate costs are observations with the highest and the lowest activity levels

- The extreme points for activity levels may not be representative of costs in the relevant range
  - this method may underestimate total fixed costs and overestimate variable costs per unit,
  - or vice versa.

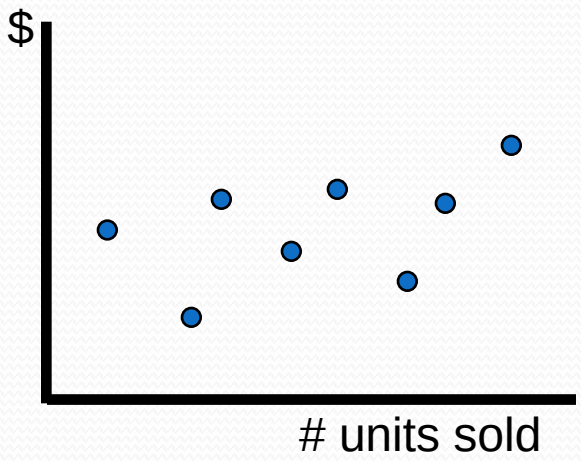
Q4: How Does a Scatterplot Assist with Categorizing a Cost?

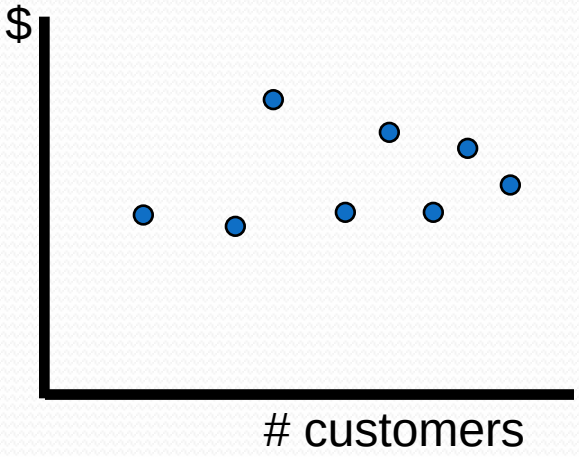
- A scatterplot shows cost observations plotted against levels of a possible cost driver.

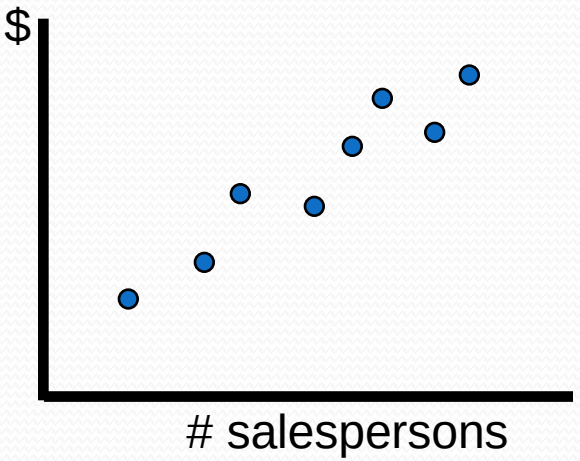
- A scatterplot can assist in determining:
  - which cost driver might be the best for analyzing total costs, and
  - the cost behavior of the cost against the potential cost driver.

Q4: Which Cost Driver Has the Best Cause & Effect Relationship with Total Cost?

8 observations of total selling expenses plotted against 3 potential cost drivers

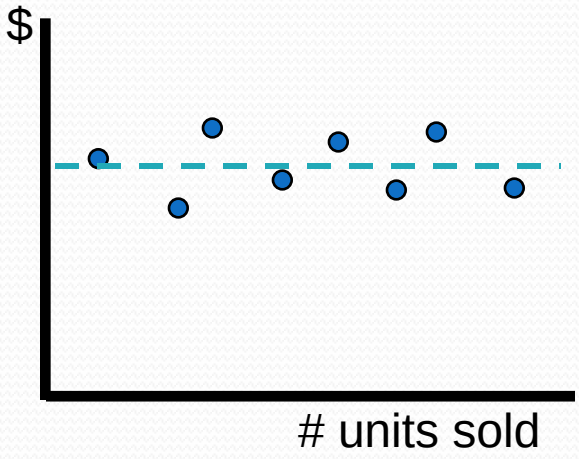






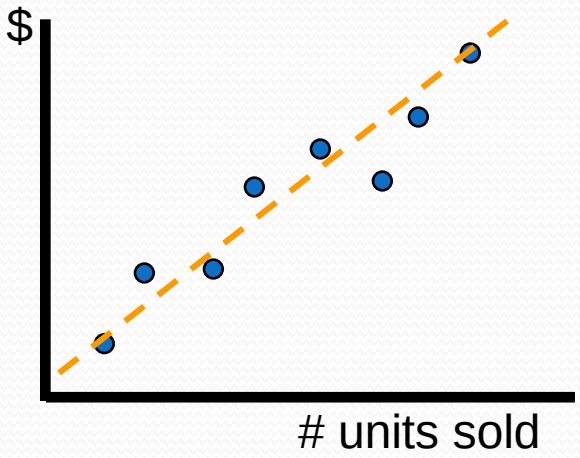
The number of salespersons appears to be the best cost driver of the 3.

Q4: What is the Underlying Cost Behavior?

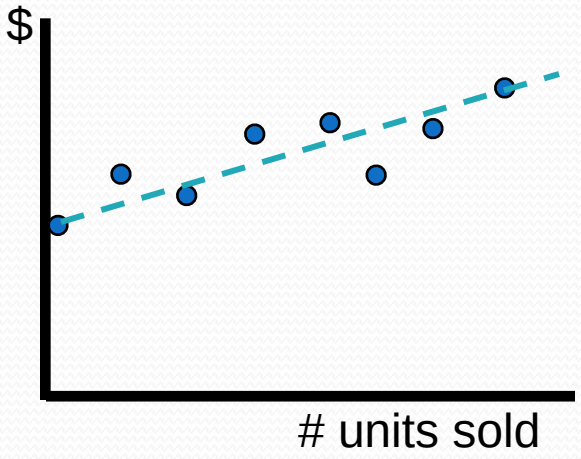


This cost is probably linear and fixed.

This cost is probably linear and variable.

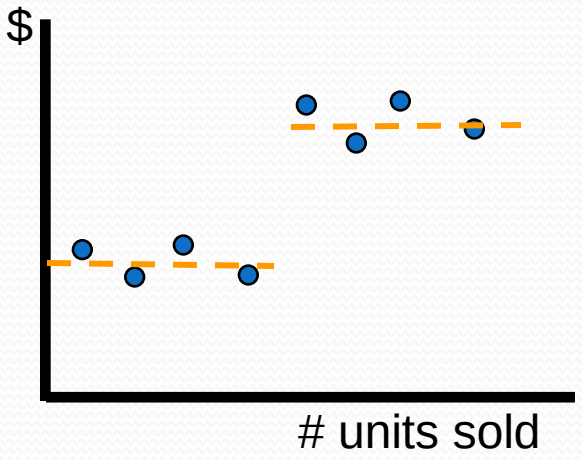


Q4: What is the Underlying Cost Behavior?

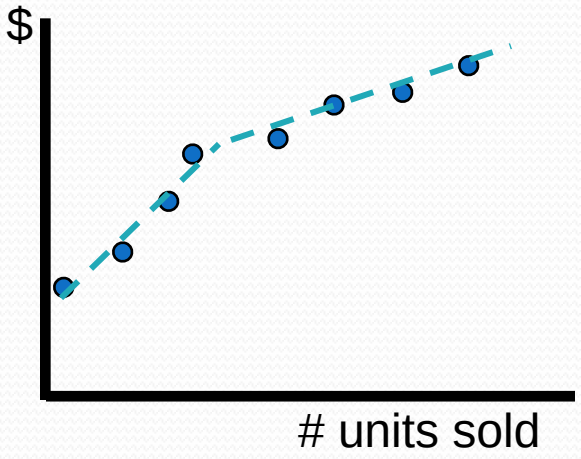


This cost is probably linear and mixed.

This is likely a stepwise linear cost.

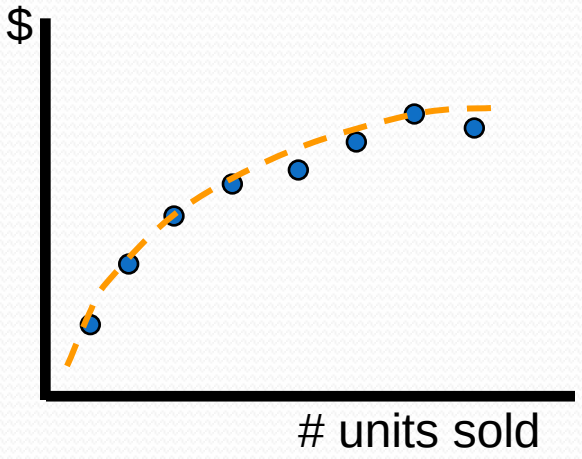


Q4: What is the Underlying Cost Behavior?



This cost may be piecewise linear.

This cost appears to have a nonlinear relationship with units sold.



Q5: How is Regression Analysis Used to Estimate a Mixed Cost Function?

- Regression analysis estimates the parameters for a linear relationship between a dependent variable and one or more independent (explanatory) variables.

- When there is only one independent variable, it is called simple regression.

- When there is more than one independent variable, it is called multiple regression.

$$Y = \alpha + \beta X + \square$$

dependent variable

independent variable

α and β are the parameters; $\square$ is the error term (or residual)

Q5: How is Regression Analysis Used to Estimate a Mixed Cost Function?

We can use regression to separate the fixed and variable components of a mixed cost.

$$Y_i = \alpha + \beta X_i + \square_i$$

Y_i is the actual total costs for data point i

$\square_i$ is the difference between the predicted total cost for X_i and the actual total cost for observation i

X_i is the actual quantity of the cost driver for data point i

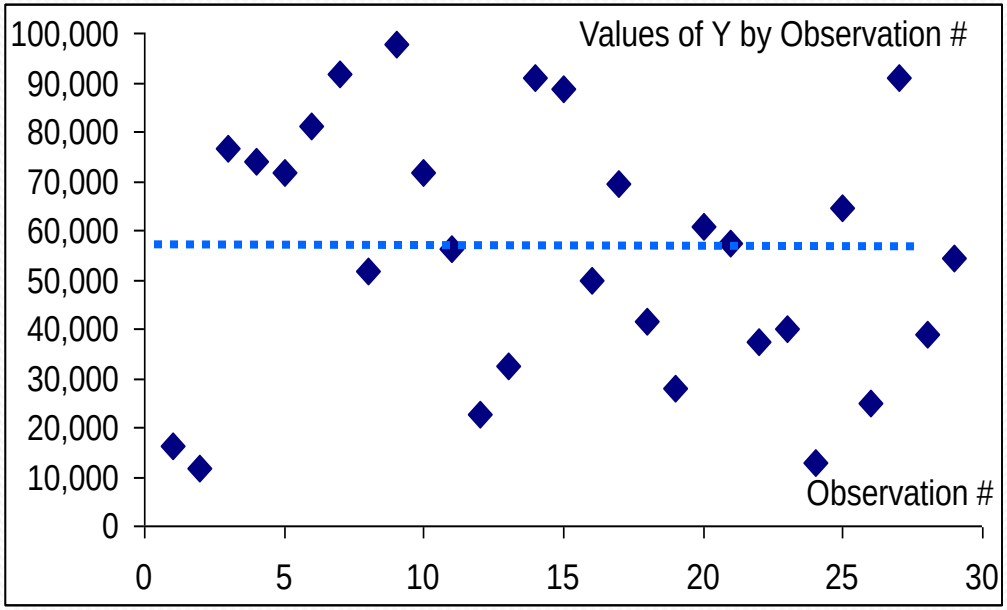
the intercept term is total fixed costs

the slope term is the variable cost per unit

Q5: Regression Output Terminology: Adjusted *R*-Square

- Goodness of fit
  - How well does the line from the regression output fit the actual data points?
  - The adjusted *R*-square statistic shows the percentage of variation in the Y variable that is explained by the regression equation.
  - The next slide has an illustration of how a regression equation can explain the variation in a Y variable.

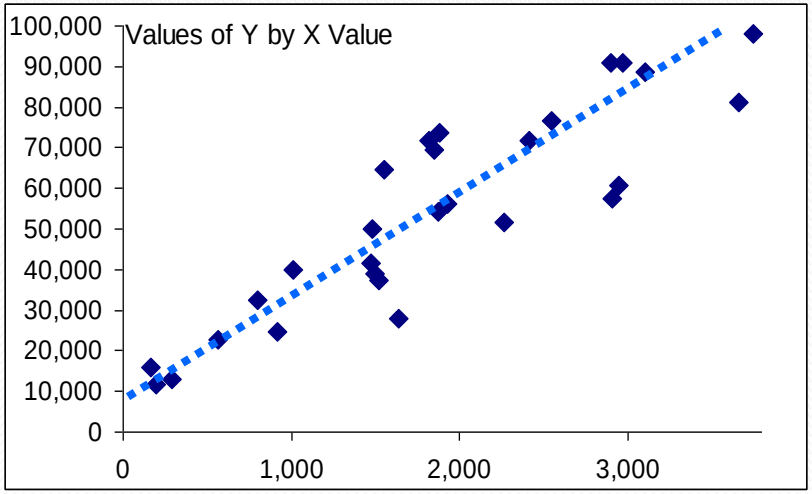
Q5: Regression Output Terminology: Adjusted *R*-Square



- We have 29 observations of a Y variable, and the average of the Y variables is 56,700.
- If we plot them in order of the observation number, there is no discernable pattern.
- We have no explanation as to why the observations vary about the average of 56,700.

Q5: Regression Output Terminology: Adjusted *R*-Square

If each Y value had an associated X value, then we could reorder the Y observations along the X axis according to the value of the associated X.



Now we can measure how the Y observations vary from the "line of best fit" instead of from the average of the Y observations. Adjusted *R*-Square measures the portion of Y's variation about its mean that is explained by Y's relationship to X.

Q5: Regression Output Terminology: *p*-value and *t*-statistic.

- Statistical **significance** of regression coefficients
  - When running a regression we are concerned about whether the "true" (unknown) coefficients are non-zero.
  - Did we get a non-zero intercept (or slope coefficient) in the regression output only because of the particular data set we used?

Q5: Regression Output Terminology: *p*-value and *t*-statistic.

- The *t*-statistic and the *p*-value both measure our confidence that the true coefficient is non-zero.
  - In general, if the t-statistic for the intercept (slope) term > 2, we can be about 95% confident (at least) that the true intercept (slope) term is not zero.
  - The p-value is more precise
    - it tells us the probability that the true coefficient being estimated is zero
    - if the p-value is less than 5%, we are more than 95% confident that the true coefficient is non-zero.

Q5: Interpreting Regression Output

Suppose we had 16 observations of total costs and activity levels (measured in machine hours) for each total cost. If we regressed the total costs against the machine hours, we would get . . .

Regression Statistics	
Multiple R	0.885
R Square	0.783
Adjusted R Square	0.768
Standard Error	135.3
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	2937	64.59	45.47	1.31E-16
Machine Hours	5.215	0.734	7.109	5.26E-06

The coefficients give you the parameters of the estimated cost function.

Predicted total costs = $2,937 + ($5.215/mach hr) x (# of mach hrs)

Total fixed costs are estimated at $2,937.

Variable costs per machine hour are estimated at $5.215.

Q5: Interpreting Regression Output

Regression Statistics	
Multiple R	0.885
R Square	0.783
Adjusted R Square	0.768
Standard Error	135.3
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	2937	64.59	45.47	1.31E-16
Machine Hours	5.215	0.734	7.109	5.26E-06

The regression line explains 76.8% of the variation in the total cost observations.

(5.26E-06 means 5.26 x 10^{-6}, or 0.00000526)

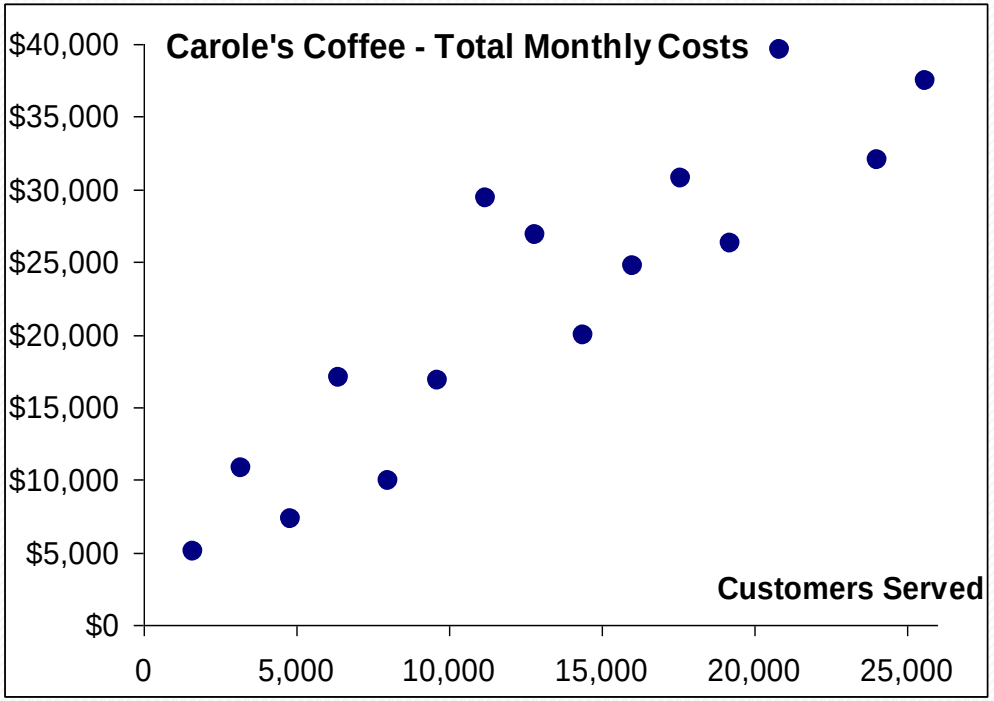
The high *t*-statistics . . .

. . . and the low p-values on both of the regression parameters tell us that the intercept and the slope coefficient are “statistically significant”.

Q5: Regression Interpretation Example

Carole's Coffee asked you to help determine its cost function for its chain of coffee shops. Carole gave you 16 observations of total monthly costs and the number of customers served in the month. The data is presented below, and the a portion of the output from the regression you ran is presented on the next slide. Help Carole interpret this output.

Costs	Customers
$5,100	1,600
$10,800	3,200
$7,300	4,800
$17,050	6,400
$9,900	8,000
$16,800	9,600
$29,400	11,200
$26,900	12,800
$20,000	14,400
$24,700	16,000
$30,800	17,600
$26,300	19,200
$39,600	20,800
$42,000	22,400
$32,000	24,000
$37,500	25,600



Q5: Regression Interpretation Example

Regression Statistics	
Multiple R	0.91
R Square	0.8281
Adjusted R Square	0.8158
Standard Error	4985.6
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	4634	2614	1.7723	0.0980879
Customers	1.388	0.169	8.2131	1.007E-06

What is Carole's estimated cost function? In a store that serves 10,000 customers, what would you predict for the store's total monthly costs?

Predicted total costs = $4,634 + ($1.388/customer) x (# of customers)

Predicted total costs at 10,000 customers = $4,634 + ($1.388/customer) x 10,000 customers

= $18,514

Q5: Regression Interpretation Example

Regression Statistics	
Multiple R	0.91
R Square	0.8281
Adjusted R Square	0.8158
Standard Error	4985.6
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	4634	2614	1.7723	0.0980879
Customers	1.388	0.169	8.2131	1.007E-06

What is the explanatory power of this model? Are the coefficients statistically significant or not? What does this mean about the cost function?

The model explains 81.58% of the variation in total costs, which is pretty good.

The slope coefficient is significantly different from zero. This means we can be pretty sure that the true cost function includes nonzero variable costs per customer.

The intercept is not significantly different from zero. There's a 9.8% probability that the true fixed costs are zero*.

*(Some would say the intercept is significant as long as the p-value is less than 10%, rather than 5%.)

Q6: Considerations When Using Estimates of Future Costs

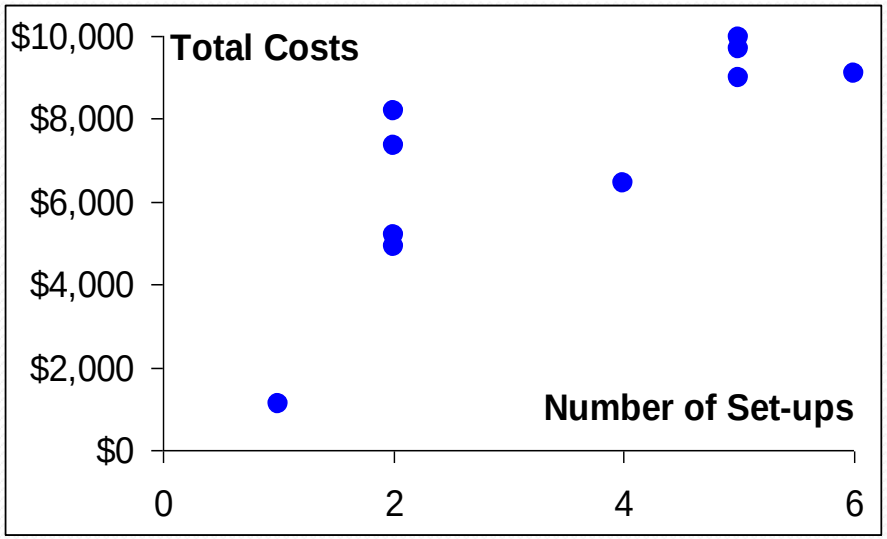
- The future is always unknown, so there are uncertainties when estimating future costs.
  - The estimated cost function may have mis-specified the cost behavior.
  - The cost function may be using an incorrect cost driver.
  - Future cost behavior may not mimic past cost behavior.
  - Future costs may be different from past costs.

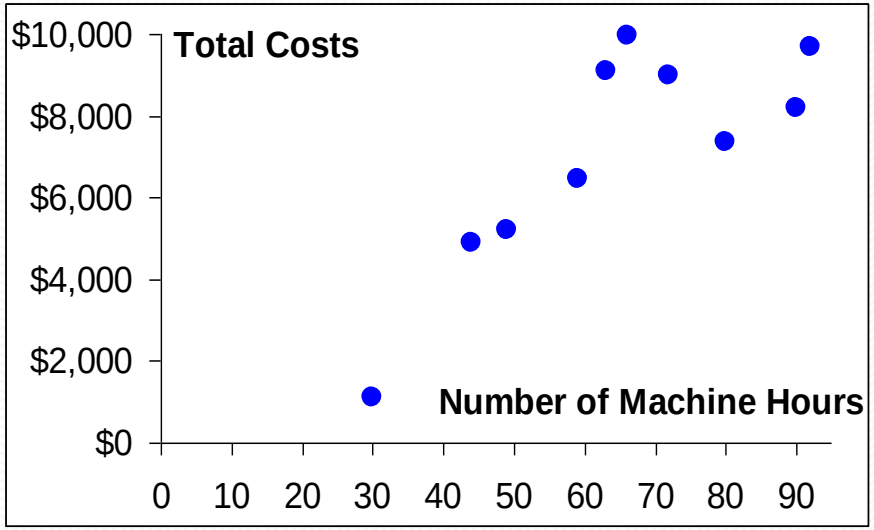
Q6: Considerations When Using Estimates of Future Costs

- The data used to estimate past costs may not be of high-quality.
  - The accounting system may aggregate costs in a way that mis-specifies cost behavior.
  - Information from outside the accounting system may not be accurate.
- The true cost function may not be in agreement with the cost function assumptions.
  - For example, if variable costs per unit of the cost driver are not constant over any reasonable range of activity, the linearity of total cost assumption is violated.

Multiple Regression Example

We have 10 observations of total project cost, the number of machine hours used by the projects, and the number of machine set-ups the projects used.





Multiple Regression Example

Regress total costs on the number of set-ups to get the following output and estimated cost function:

Regression Statistics	
Multiple R	0.788
R Square	0.621
Adjusted R Square	0.574
Standard Error	1804
Observations	10

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	2925.6	1284	2.278	0.0523
# of Set-ups	1225.4	338	3.62	0.0068

Predicted project costs = $2,926 + ($1,225/set-up) x (# set-ups)

The explanatory power is 57.4%. The # of set-ups is significant, but the intercept is not significant if we use a 5% limit for the p-value.

Multiple Regression Example

Regress total costs on the number of machine hours to get the following output and estimated cost function:

Regression Statistics	
Multiple R	0.814
R Square	0.663
Adjusted R Square	0.621
Standard Error	1701
Observations	10

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	-173.8	1909	-0.09	0.9297
# Mach Hrs	112.65	28.4	3.968	0.0041

Predicted project costs = - $173 + ($113/mach hr) x (# mach hrs)

The explanatory power is 62.1%. The intercept shows up negative, which is impossible as total fixed costs can not be negative. However, the *p*-value on the intercept tells us that there is a 93% probability that the true intercept is zero. The # of machine hours is significant.

Multiple Regression Example

Regress total costs on the # of set ups *and* the # of machine hours to get the following:

Regression Statistics	
Multiple R	0.959
R Square	0.919
Adjusted R Square	0.896
Standard Error	891.8
Observations	10

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	-1132	1021	-1.11	0.3044
# of Set-ups	857.4	182.4	4.7	0.0022
# of Mach Hrs	82.31	16.23	5.072	0.0014

Predicted project costs = - $1,132 + ($857/set-up) x (# set-ups) + ($82/mach hr) x (# mach hrs)

The explanatory power is now 89.6%. The *p*-values on both slope coefficients show that both are significant. Since the intercept is not significant, project costs can be estimated based on the project's usage of set-ups and machine hours.

What is a Learning Curve?

A learning curve is

- the rate at which labor hours per unit decrease as the volume of activity increases
- the relationship between cumulative average hours per unit and the cumulative number of units produced.

A learning curve can be represented mathematically as:

$Y = \alpha X^r$, where

Y = cumulative average labor hours,

α = time required for the first unit,

X = cumulative number of units produced,

r = an index for learning = ln(% learning)/ln(2), and

ln is the natural logarithmic function.

Learning Curve Example

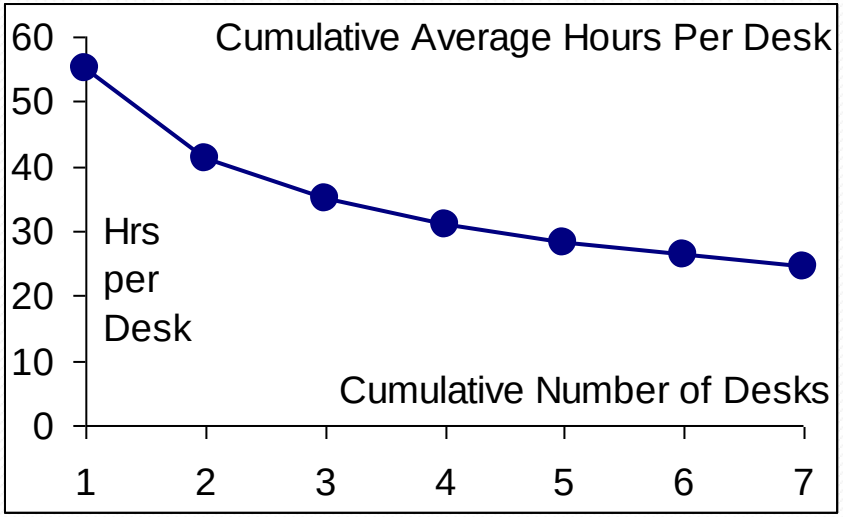
Deanna's Designer Desks just designed a new solid wood desk for executives. The first desk took her workforce 55 labor hours to make, but she estimates that each desk will require 75% of the time of the prior desk (i.e. "% learning" = 75%). Compute the cumulative average time to make 7 desks, and draw a learning curve.

First compute *r*: $r = \ln(75\%)/\ln(2) = -0.2877/0.693 = -0.4152$

Then compute the cumulative average time for 7 desks:

$Y = 55 \times 7^{(-0.4152)} = 25.42$ hrs

In order to draw a learning curve, you must compute the value of *Y* for all *X* values from 1 to 7. . . .



Short-Term Profit Planning: Cost-Volume-Profit (CVP) Analysis

Learning Objectives

- Explain cost-volume-profit (CVP) analysis, the CVP model, and the strategic role of CVP analysis
- Apply CVP analysis for breakeven planning
- Apply CVP analysis for profit planning
- Apply CVP analysis using activity-based costing (ABC)

Learning Objectives (continued)

- Understand different approaches for dealing with risk and uncertainty in CVP analysis
- Adapt CVP analysis for multiple products/ services
- Apply CVP analysis in not-for-profit organizations
- Identify the assumptions and limitations of CVP analysis

CVP Analysis

- CVP analysis is a planning tool for analyzing how operating decisions and marketing decisions affect short-term operating profit

- CVP relies on an understanding of the relationship between variable costs, fixed costs, unit selling price, and output level (volume)

CVP Analysis (continued)

CVP analysis can be used in:

- Setting prices for products and services
- Determining whether to introduce a new product or service
- Replacing a piece of equipment
- Determining breakeven point
- Making "Make-or-buy" (i.e., sourcing) decisions
- Determining the best product mix
- Performing strategic "what-if" (sensitivity) analysis

CVP Analysis (continued)

The CVP model is as follows:

Operating profit = Sales – Total costs

or

Sales = Fixed costs + Variable costs + Operating profit

or

Operating profit = (Units sold × selling price/unit) – (Units sold × variable cost/unit) – Fixed costs

CVP Analysis (continued)

For convenience, the (single-product) model is commonly shown in symbolic form:

$$\pi_B = (p \times Q) - (v \times Q) - F$$

Where:

Q = units sold (i.e., sales volume)
p = selling price per unit
F = total fixed cost
v = variable cost per unit
π_B = operating profit (before tax)

CVP Analysis (continued)

Three additional concepts regarding the CVP model:

1. Contribution margin:

- *Unit contribution margin* (cm) = Unit sales price (p) – Unit variable cost (v)
- Unit contribution margin (cm) = the increase in operating profit for a unit increase in sales = (p – v)
- *Total contribution margin* (CM) = Unit contribution margin (cm) × Units sold (Q)

CVP Analysis (continued)

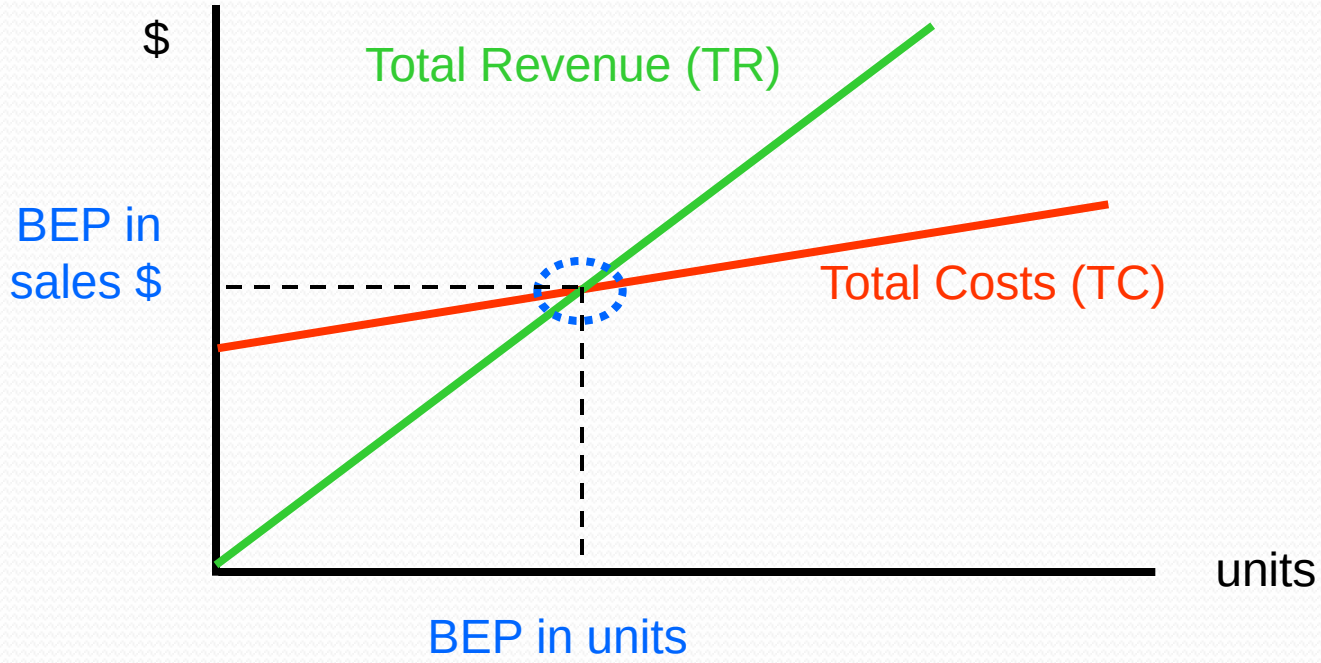
- *Contribution margin ratio* = Unit contribution margin (cm)÷ unit sales price (p)

$$= (p - v) \div p \quad = \quad cm/p$$

- The *contribution income statement*:
  - A useful way to show information developed in CVP analysis
  - Classifies costs based on cost *behavior* (fixed versus variable) rather than cost type (product versus period)
  - Provides an easy and accurate prediction of the effect of a change in sales on operating profit

Q1: CVP Analysis and the Breakeven Point

- CVP analysis looks at the relationship between selling prices, sales volumes, costs, and profits.
- The breakeven point (BEP) is where total revenue equal total costs.



Q2: How is CVP Analysis Used?

- CVP analysis can determine, both in units and in sales dollars:
  - the volume required to break even
  - the volume required to achieve target profit levels
  - the effects of discretionary expenditures
  - the selling price or costs required to achieve target volume levels
- CVP analysis helps analyze the sensitivity of profits to changes in selling prices, costs, volume and sales mix.

Q2: CVP Calculations for a Single Product

$$\text{Units required to achieve target pretax profit} = Q = \frac{F + \text{Profit}}{P - V}$$

where F = total fixed costs

P = selling price per unit

V = variable cost per unit

$P - V$ = contribution margin per unit

To find the breakeven point in units, set Profit = 0.

Q2: CVP Calculations for a Single Product

$$\text{Sales \$ required to achieve target pretax profit} = \frac{F + \text{Profit}}{CMR}$$

where F = total fixed costs

CMR = contribution margin ratio

$= (P - V)/P$

Note that CMR can also be computed as

$$CMR = \frac{\text{Total Revenue} - \text{Total Variable Costs}}{\text{Total Revenue}}$$

To find the breakeven point in sales $, set Profit = 0.

Strategic Role of CVP Analysis

CVP analysis can help a firm choose its competitive position and execute its strategy by providing an understanding of how changes in sales volume affect costs and profits

- This process is most important for cost leadership firms during the manufacturing stage
- Differentiated firms use CVP analysis to assess profitability and desirability of new products and features

Strategic Role of CVP Analysis (continued)

CVP analysis is also important in life-cycle costing and target costing

- CVP analysis can assist in *life-cycle costing* by helping to determine whether a product is likely to achieve its desired profitability, the most cost-effective manufacturing process, the best marketing and distribution channels, the best compensation plan, whether to offer discounts, etc.
- CVP analysis can assist in *target costing* by showing the effect on profit of alternative product designs that have different target costs

Breakeven (B/E) Planning

Determining the "breakeven point" is the starting point of many business plans:

- *Breakeven* is the point at which revenues equal total costs and profit is zero
- The breakeven (B/E) point can be determined in either of two ways:
  - Based on Units Sold (Q)
  - Based on Sales Dollars (Y)

B/E Planning (continued)

Breakeven in Units, Q (@ B/E, π_B = $0)

$$\$0 = (p \times Q) - (v \times Q) - F$$

$$\$0 = (p - v)Q - F$$

$$F = (p - v)Q$$

$$Q = F/(p - v)$$

That is, Q = Fixed costs ÷ contribution margin per unit

B/E Planning

Breakeven in Sales Dollars, Y (@ B/E, π_B = \$0)

Operating profit = Sales − total variable costs − Fixed costs

$$\$0 = (p \times Q) - (v \times Q) - F$$

$$\$0 = [p \times (Y/p)] - [v \times (Y/p)] - F$$

$$p \times (Y/p) = [v \times (Y/p)] + F$$

$$Y = [(v/p) \times Y] + F$$

$$Y = F \div (p - v)/p$$

= fixed costs ÷ contribution margin ratio

Example: Breakeven Planning

Household Furnishings, Inc. (HFI) wants to perform a B/E analysis given the following expected results for 2013 and 2014:

	Per Unit	2013	2014
Fixed cost (per year)		$60,000	$60,000
Selling price	$75		
Variable cost	35		
Planned production		2,400 units	2,600 units
Planned sales volume		2,400 units	2,600 units

	2013		2014			
	Amount	Percent	Amount	Percent	Change	Notes
Sales	$180,000	100.00%	$195,000	100.00%	$15,000	
Variable costs	84,000	46.67	91,000	46.67	7,000	
Total contribution margin	$ 96,000	53.33%	$104,000	53.33%	$ 8,000	53.33% is the contribution margin ratio
Fixed costs	60,000		60,000		0	
Operating profit	$ 36,000		$ 44,000		$ 8,000	$8,000 = 0.5333 × $15,000

Breakeven Example (continued)

Breakeven in units, Q :

$$\text{Operating profit} = \text{Sales} - \text{Total variable costs} - \text{Fixed cost}$$

$$\pi_B = (p \times Q) - (v \times Q) - F$$

$$= (\$75 \times Q) - (\$35 \times Q) - \$5{,}000/\text{month}$$

$$0 = [(\$75 - \$35) \times Q] - \$5{,}000/\text{month}$$

$$\$40 \times Q = \$5{,}000/\text{month}$$

$$Q = \$5{,}000/\text{month}/\$40 \text{ per unit}$$

$$Q = 125 \text{ units/month}$$

Breakeven Example (continued)

Breakeven in dollars, Y:

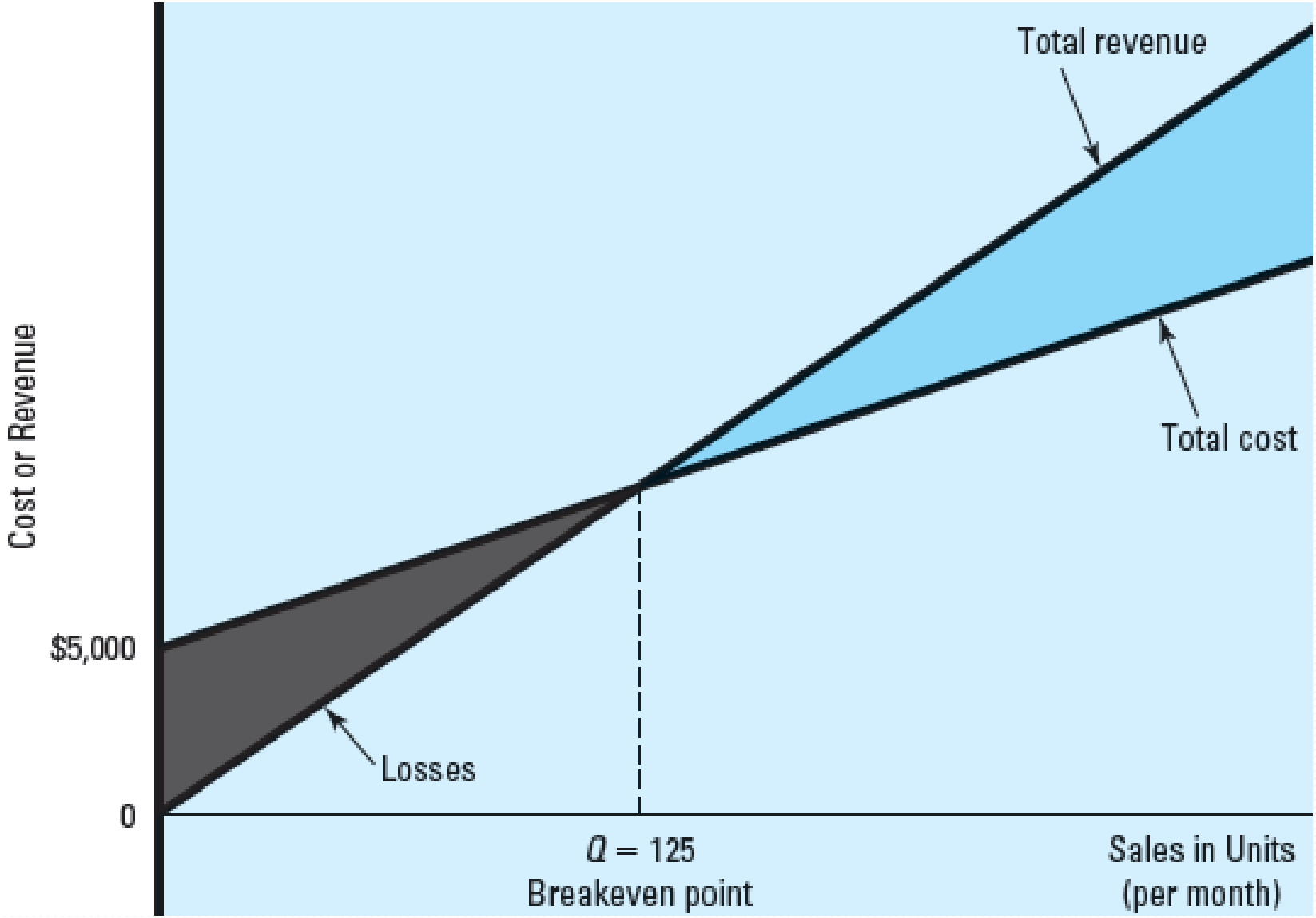
1. Breakeven in units, *Q*, times selling price per unit, *p*
   = 125 units/month × $75/unit = $9,375/month

2. Alternatively, breakeven point in sales dollars, Y
   = Fixed cost/month ÷ contribution margin ratio
   = $5,000/month ÷ ($75 – $35)/$75
   = $5,000/month ÷ 0.5333333= $9,375/month

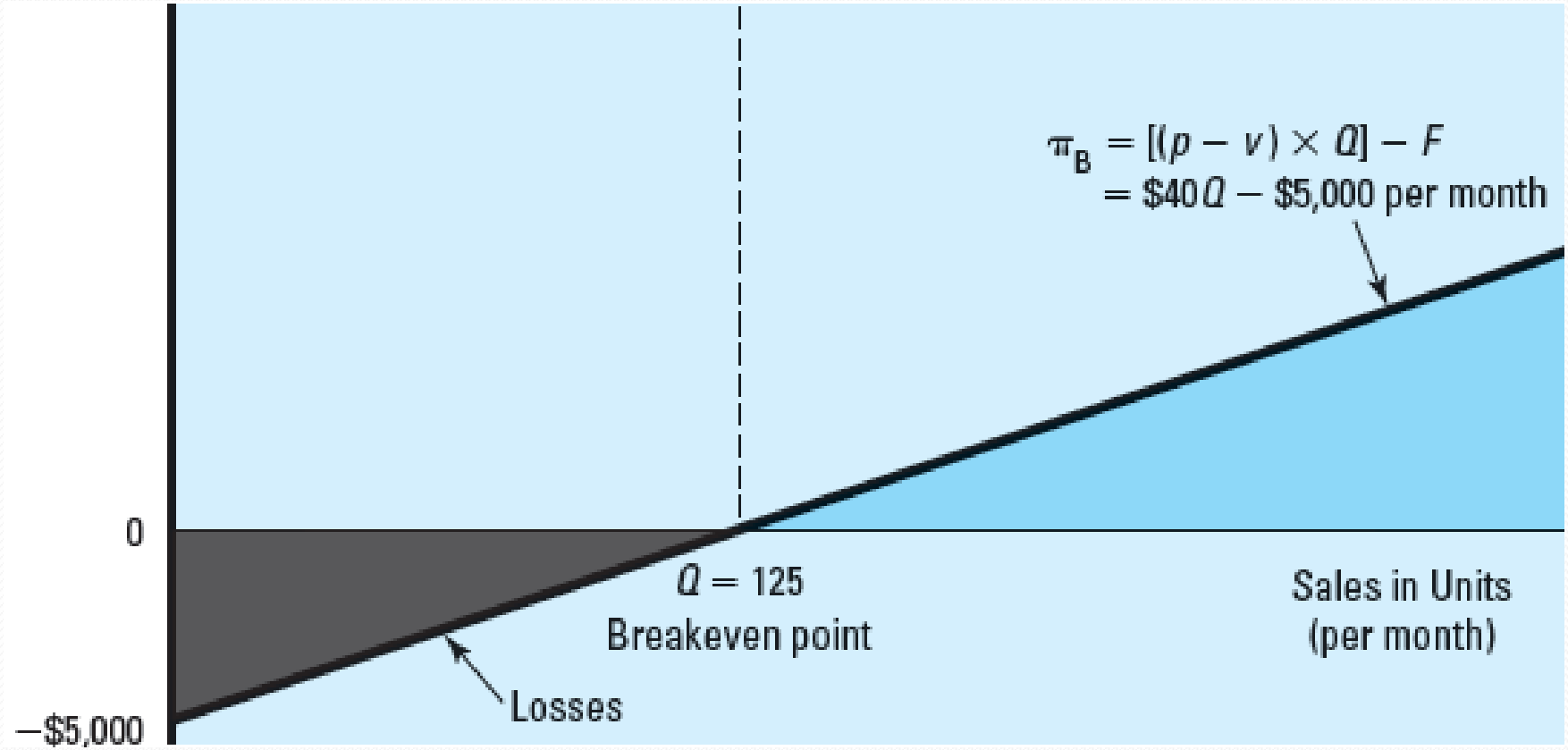
CVP Graph and Profit-Volume (PV) Graph

- The *CVP graph* illustrates how the levels of revenues and total costs change as output (sales volume) changes
- A *profit-volume (PV) graph* illustrates how the level of operating profit changes as output (sales volume) changes
  - This graph allows a person to clearly see how total contribution margin, and therefore profit, changes as the output level (i.e., volume) changes

CVP Graph


Total revenue
Total cost
Cost or Revenue
$5,000
0
Losses
Q = 125
Breakeven point
Sales in Units
(per month)

PV Graph


Operating profit, π_B
$\pi_B = [(p - v) \times Q] - F$
$= \$40Q - \$5{,}000$ per month
0
$-\$5{,}000$
$Q = 125$
Breakeven point
Losses
Sales in Units (per month)

CVP Analysis in Profit Planning

CVP analysis can be used to determine the sales volume needed to achieve a desired level of before tax profit:

$$Q = \frac{F + \pi_B}{p - v}$$

$$Q = \frac{\$60{,}000 + \$48{,}000}{(\$75 - \$35)/\text{unit}}$$

$$Q = 2{,}700 \text{ units per year}$$

In sales dollars the result is

$$p \times Q = \$75/\text{unit} \times 2{,}700 \text{ units/year}$$

$$p \times Q = \$202{,}500 \text{ per year}$$

CVP and Profit Planning

Assume that HFI has the option to choose between two machines that will complete the same operation with the same quality, but with different variable costs per unit (v) and different total fixed costs (F). B/E analysis can help HFI find the level of sales (called the "indifference point"), such that having sales > that this level will favor the option with the higher fixed costs, and having sales < this level will favor the low fixed cost option.

Which alternative should be chosen?

CVP and Profit Planning (continued)

Cost of Machine A	=	Cost of Machine B
$5,000 + ($10 × *Q*)	=	$15,000 + ($5 × *Q*)
Q	=	$10,000 ÷ $5/unit
Q	=	2,000 units

CVP and Profit Planning

Management decisions about costs and prices usually must include *income taxes* because taxes affect the amount of net profit at a given level of sales

In the HFI example, if we assume that the average income tax rate is 20 percent, to achieve the desired annual *after-tax* profit of $48,000, HFI must generate before-tax profits of ....

$$\text{Before-tax profit, } \pi_B = \text{After-tax profit, } \pi_A/(1 - \text{Tax Rate})$$

$$\pi_B = \pi_A \div (1 - t)$$

$$\pi_B = \$48{,}000 \div (1 - 0.2)$$

$$\pi_B = \$60{,}000$$

CVP and Profit Planning

Thus, when taxes are considered, the CVP model is as follows, with t = average tax rate

$$Q = \frac{F + \dfrac{\text{After-Tax Profit}}{(1 - t)}}{(p - v)}$$

$$Q = \frac{\$60{,}000 + [\$48{,}000 \div (1 - 0.20)]}{(\$75 - \$35)/\text{unit}}$$

$$Q = 3{,}000 \text{ units}$$

Q2: Breakeven Point Calculations

Bill's Briefcases makes high quality cases for laptops that sell for $200. The variable costs per briefcase are $80, and the total fixed costs are $360,000. Find the BEP in units and in sales $ for this company.

$$\text{BEP in units} = \frac{F + 0}{P - V} = \frac{\$360{,}000}{\$200/\text{unit} - \$80/\text{unit}}$$

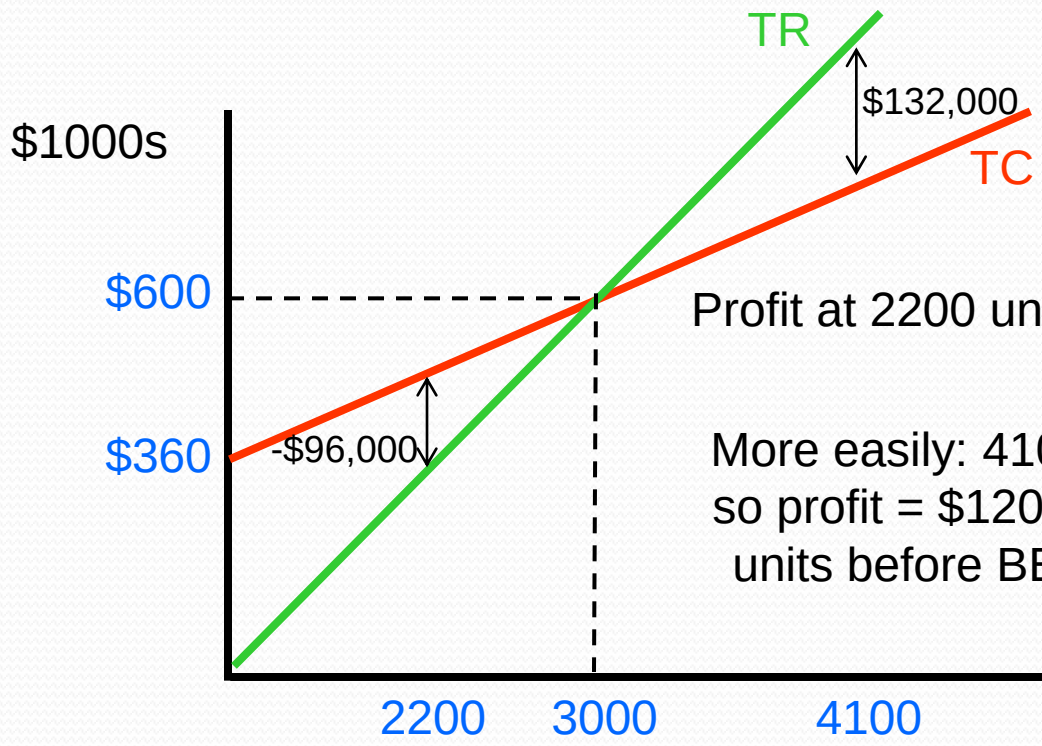
$$= \frac{\$360{,}000}{\$120/\text{unit}} = 3{,}000 \text{ units}$$

$$\text{BEP in sales \$} = \frac{F + 0}{CMR} = \frac{F}{(P - V)/P} = \frac{\$360{,}000}{(\$200 - \$80)/\$200}$$

$$= \frac{\$360{,}000}{60\%} = \$600{,}000$$

Q2: CVP Graph

Draw a CVP graph for Bill's Briefcases. What is the pretax profit if Bill sells 4100 briefcases? If he sells 2200 briefcases? Recall that P = $200, V = $80, and F = $360,000.



Profit at 4100 units = $120 x 4100 - $360,000.

Profit at 2200 units = $120 x 2200 - $360,000.

More easily: 4100 units is 1100 units past BEP, so profit = $120 x 1100 units; 2200 units is 800 units before BEP, so loss = $120 x 800 units.

Q2: CVP Calculations

How many briefcases does Bill need to sell to reach a target pretax profit of $240,000? What level of sales revenue is this? Recall that P = $200, V = $80, and F = $360,000.

Units needed to reach target pretax profit

$$= \frac{F + \text{Profit}}{P - V} = \frac{\$360{,}000 + \$240{,}000}{\$120/\text{unit}}$$

$$= 5{,}000 \text{ units}$$

Sales $ required to reach target pretax profit

$$= \frac{F + \$240{,}000}{CMR} = \frac{F}{(P - V)/P}$$

$$= \frac{\$600{,}000}{60\%} = \$1{,}000{,}000$$

Of course, 5,000 units x $200/unit = $1,000,000, too.

But sometimes you only know the CMR and not the selling price per unit, so this is still a valuable formula.

Q2: CVP Calculations

How many briefcases does Bill need to sell to reach a target after-tax profit of $319,200 if the tax rate is 30%? What level of sales revenue is this? Recall that P = $200, V = $80, and F = $360,000.

First convert the target after-tax profit to its target pretax profit:

$$\text{Pretax profit} = \frac{\text{After-tax profit}}{(1 - \text{Tax rate})} = \frac{\$319,200}{(1 - 0.3)} = \$456,000$$

$$\text{Units needed to reach target pretax profit} = \frac{\$360,000 + \$456,000}{\$120/\text{unit}} = 6,800 \text{ units}$$

$$\text{Sales \$ needed to reach target pretax profit} = \frac{\$360,000 + \$456,000}{60\%} = \$1,360,000$$

Q1,2: Using CVP to Determine Target Cost Levels

Suppose that Bill's marketing department says that he can sell 6,000 briefcases if the selling price is reduced to $170. Bill's target pretax profit is $210,000. Determine the highest level that his variable costs can so that he can make his target. Recall that F = $360,000.

Use the CVP formula for units, but solve for V:

$$\text{Q} = 6{,}000 \text{ units} = \frac{\$360{,}000 + \$210{,}000}{\$170/\text{unit} - V}$$

$$\$170/\text{unit} - V = \frac{\$360{,}000 + \$210{,}000}{6{,}000 \text{ units}} = \$95/\text{unit}$$

$$V = \$75/\text{unit}$$

If Bill can reduce his variable costs to $75/unit, he can meet his goal.

Q4: Business Risk in Bill's Decision

- After this analysis, Bill needs to consider several issues before deciding to lower his price to $170/unit.

  - How reliable are his marketing department's estimates?
  - Is a $5/unit decrease in variable costs feasible?
  - Will this decrease in variable costs affect product quality?
  - If 6,000 briefcases is within his plant's capacity but lower than his current sales level, will the increased production affect employee morale or productivity?

Q1: Using CVP to Compare Alternatives

- CVP analysis can compare alternative cost structures or selling prices.
  - high salary/low commission vs. lower salary/higher commission for sales persons
  - highly automated production process with low variable costs per unit vs. lower technology process with higher variable costs per unit and lower fixed costs.
  - broad advertising campaign with higher selling prices vs. minimal advertising and lower selling prices
- The indifference point between alternatives is the level of sales (in units or sales $) where the profits of the alternatives are equal.

Q1,2: Using CVP to Compare Alternatives

Currently Bill's salespersons have salaries totaling $80,000 (included in F of $360,000) and earn a 5% commission on each unit ($10 per briefcase). He is considering an alternative compensation arrangement where the salaries are decreased to $35,000 and the commission is increased to 20% ($40 per briefcase). Compute the BEP in units under the proposed alternative. Recall that P = $200 and V = $80 currently.

First compute F and V under the proposed plan:

F = $360,000 - $45,000 decrease in salaries = $315,000

V = $80 + $30 increase in commission = $110

Then compute Q under the proposed plan:

Units needed to breakeven $= Q = \dfrac{F + 0}{P - V} = \dfrac{\$315{,}000}{\$200/\text{unit} - \$110/\text{unit}} = 3{,}500 \text{ units}$

Q1: Determining the Indifference Point

Compute the volume of sales, in units, for which Bill is indifferent between the two alternatives.

The indifference point in units is the *Q* for which the profit equations of the two alternatives are equal.

	Current Plan	Proposed Plan
Contribution margin per unit	$120	$90
Total fixed costs	$360,000	$315,000

Profit (current plan) = $120*Q* - $360,000

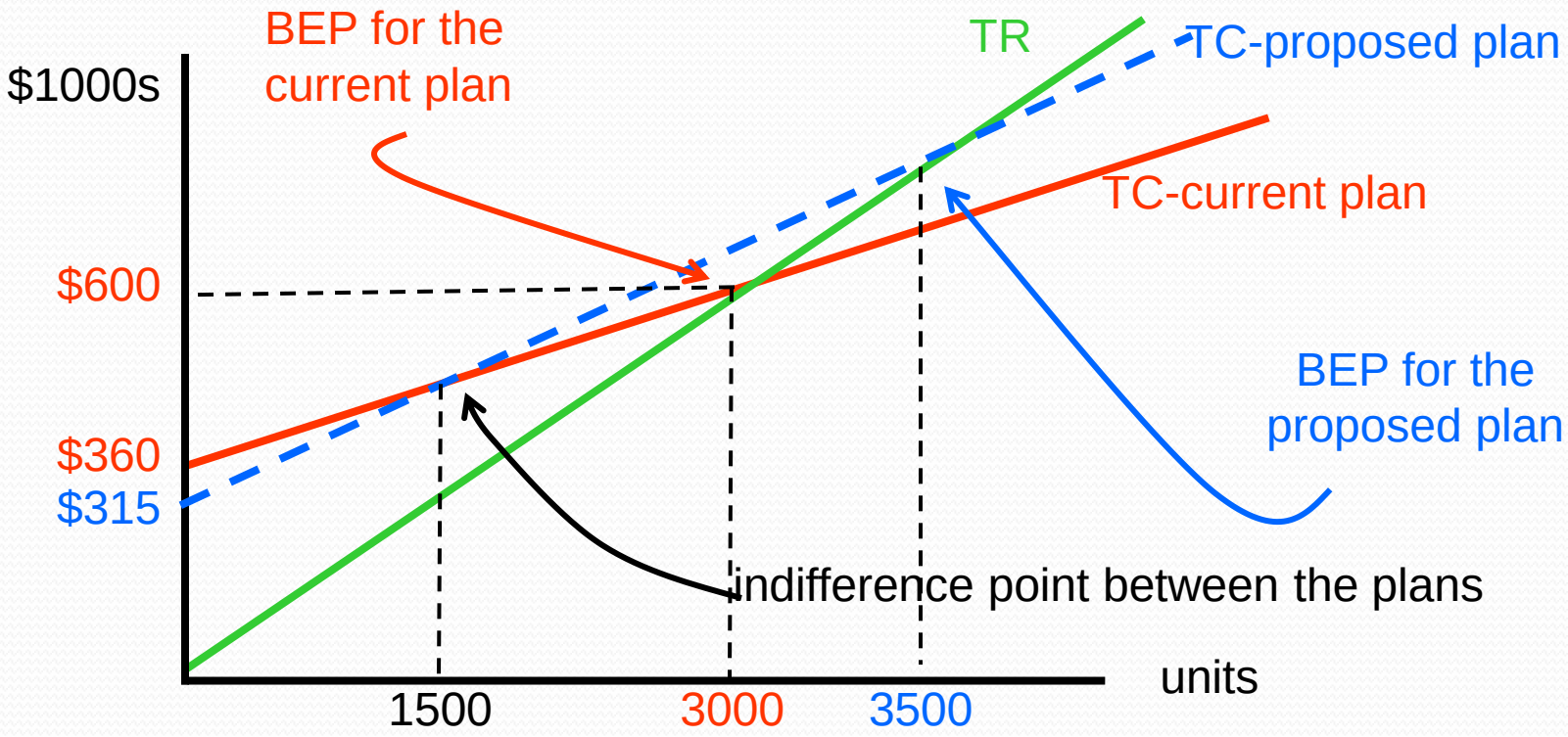
Profit (proposed plan) = $90*Q* - $315,000

$120*Q* - $360,000 = $90*Q* - $315,000

$30*Q* = $45,000 ⟶ *Q* = 1,500 units

Q1,2: CVP Graphs of the Indifference Point

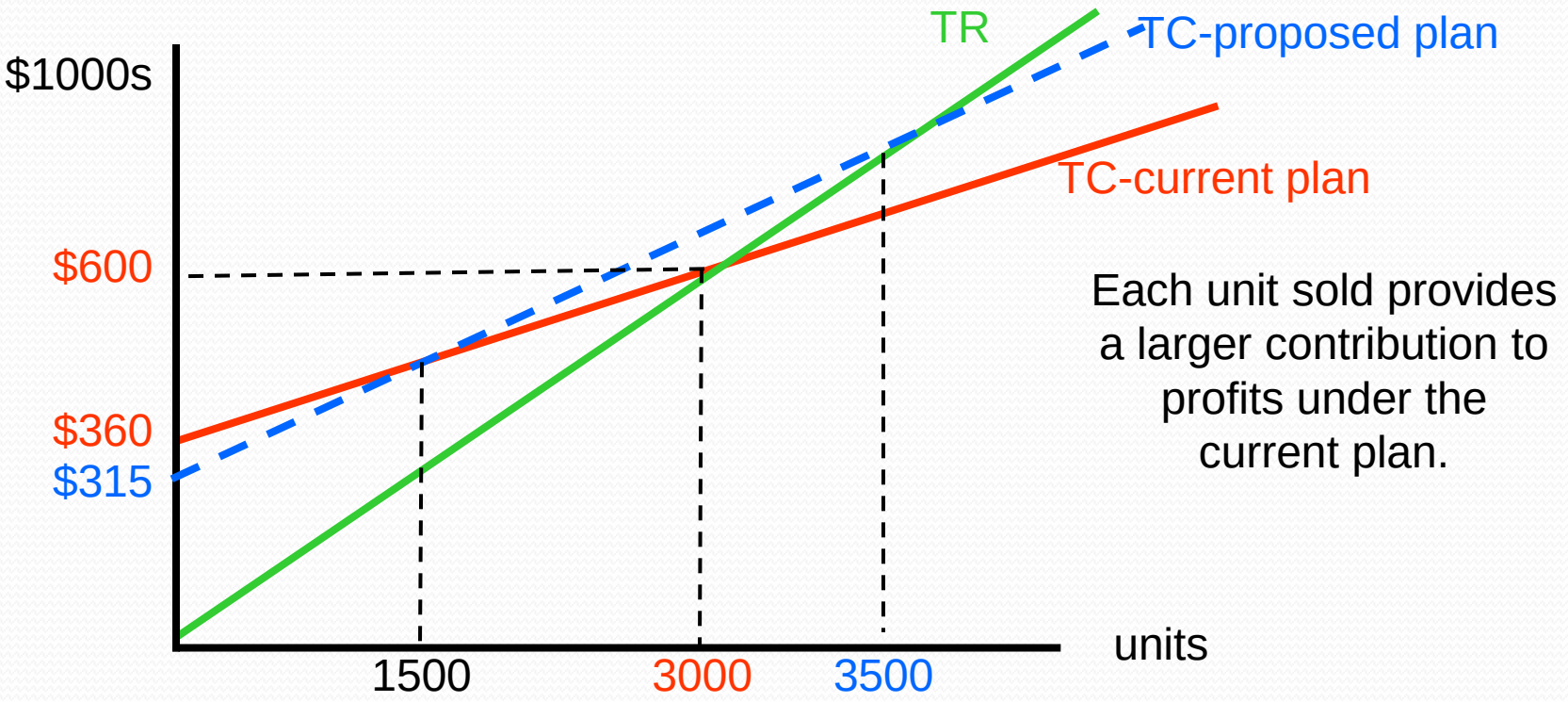
Draw a CVP graph for Bill's that displays the costs under both alternatives. Notice that the total revenue line for both alternatives is the same, but the total cost lines are different.



Q1,2: Comparing Alternatives

The current plan breaks even before the proposed plan.

At 1500 units, the plans have the same total cost.



Q4: Business Risk in Bill's Decision

- Hopefully Bill is currently selling more than 1500 briefcases, because profits are negative under BOTH plans at this point.

- The total costs of the current plan are less than the those of the proposed plan at sales levels past 1500 briefcases.

- Therefore, it seems the current plan is preferable to the proposed plan.

However, . . .

Q5: Business Risk in Bill's Decision

. . . this may not be true because the level of future sales is always uncertain.

- What if the briefcases were a new product line?
  - Estimates of sales levels may be highly uncertain.
  - The lower fixed costs of the proposed plan may be safer.
- The plans may create different estimates of the likelihood of various sales levels.
  - Salespersons may have an incentive to sell more units under the proposed plan.

CVP Analysis and Activity-Based Costing (ABC)

The conventional approach to CVP analysis is to use a volume-based measure to forecast costs, but an ABC approach is also possible:

- If the assumption is made that total batch-level costs are fixed relative to the number of batches, both approaches will produce the same result
- On the other hand, if the activity cost pool is a mixed cost, the ABC approach will provide a more accurate estimate of cost because the volume-based approach treats all activity costs that do not vary with output volume, such as machine setup, materials handling, inspection, and engineering, as fixed

CVP Analysis and ABC

In the ABC approach, additional terms are needed to define the fixed cost element (HFI's results are in parentheses below):

- F^{VB} = the level of *volume-based fixed costs*, or the portion of fixed costs that do not vary with the activity cost driver, $50,000 ($60,000 – $10,000)
- F^{AB} = the portion of fixed costs that *does* vary with the activity cost driver ($10,000)
- v^{AB} = the cost per batch for the ABC driver ($100/batch)
- b = the number of units in a batch (30)
- v^{AB}/b = the cost per unit for batch-related costs when the batch is size b, $3.333 ($100/batch ÷ 30 units/batch)

CVP Analysis and ABC

The CVP model under ABC (for batch-related costs):

$$Q = \frac{F^{VB} + \pi_B}{p - v - (v^{AB}/b)}$$

Therefore, output quantity for HFI is:

$$Q = \frac{\$50{,}000 + \$48{,}000}{\$75 - \$35 - (\$100/30)} = 2{,}673 \text{ units } (2{,}673/30 = 89.1 \text{ batches})$$

There are no partial batches so \$9,000 (90 batches × \$100 per batch) must be figured into the equation

$$Q = \frac{\$50{,}000 + \$9{,}000 + \$48{,}000}{\$75 - \$35} = 2{,}675 \text{ units in 90 batches}$$

Dealing with Risk and Uncertainty

Sensitivity analysis is the name for a variety of methods that examine how an amount (e.g., B/E point) changes if factors involved in predicting that amount change (e.g., sales volume or unit variable cost). For CVP, three methods of *sensitivity analysis* are commonly employed:

(1) ***What-if analysis*** *(using the contribution margin and contribution margin ratio)*

(2) Construction of ***decision tables/decision trees***, and

(3) ***Monte Carlo Simulation*** (MCS)

Other Approaches to handling risk/uncertainty:

(1) Margin of safety and Margin of safety Ratio

(2) Degree of operating leverage (DOL)

Handling Risk and Uncertainty: What-if analysis

What-if analysis is the calculation of an amount given different levels of a factor that influences that amount

- Example: if contribution margin (cm) is $40 per unit and the cm ratio is 0.53333, each unit change in sales volume affects profit by $40 and each dollar change in sales affects profits by $0.53333

Risk and Uncertainty: Some Useful Metrics

Margin of safety (MOS) is the dollar amount of sales above the B/E point (i.e., forecasted (or actual) sales level minus the B/E sales level):

MOS = planned (or actual) sales – breakeven sales (in units or in dollars)

Margin of safety ratio (MOS%) = MOS ÷ planned (or actual) sales volume = the percentage that sales could fall (from planned or actual levels) before losses occur

Handling Risk and Uncertainty: Degree of Operating Leverage

- Operating leverage refers to the extent of fixed costs in the cost structure of an organization. The greater the operating leverage, the greater the operating risk (i.e., not being able to cover fixed costs via operations).
- Degree of operating leverage (DOL), at any sales volume level, represents the sensitivity of operating income to changes in sales volume.

$$\text{DOL} = \text{CM} \div \text{operating profit}$$

The Five Steps of Strategic Decision Making for CVP Analysis: A Real Estate Business Example

1. **Determine the Strategic Issues Surrounding the Problem:** *the business competes on quality and reliability of service*
2. **Identify the Alternative Actions**: *choose among printer and cartridge options*
3. **Obtain Information and Conduct Analyses of the Alternatives:** *CVP analysis favors the larger cartridge and determines an indifference point for the new printer*
4. **Based on Strategy and Analysis, Choose and Implement the Desired Alternative**: *because of concerns for the print quality of the new printer, the current printer is chosen*
5. **Provide an On-going Evaluation of the Effectiveness of implementation in Step 4.**

Multi-Product (or Service) CVP Analysis

- If all fixed costs are traceable to individual products, then the organization can develop a separate CVP model for each product
- Alternatively, the multi-product firm can make an assumption regarding a standard sales mix in which its products are sold
- Sales mix can be determined on the basis of sales dollars or unit sales
- The assumption of sales mix allows the firm to calculate and use a weighted-average contribution margin (cm) *per unit* and weighted average cm *ratio* to complete the multi-product CVP analysis

Example: Multi-Product CVP Analysis

Windbreakers, Inc. sells light-weight sports/recreational jackets and currently has three products: Calm, Windy, and Gale. Total (joint) fixed costs for the period are expected to be $168,000, and we assume the windbreakers' sales mix, measured by sales ***dollars***, will remain constant. Additional information is provided below. (Since sales mix is constant in $, we will use the contribution margin ratio in the analysis. See next slide…)

	Calm	Windy	Gale	Total
Last period's sales	$ 750,000	$ 600,000	$ 150,000	$ 1,500,000
Percent of sales	50%	40%	10%	100%
Price	$ 30	$ 32	$ 40	
Unit variable cost	24	24	36	
Contribution margin	$ 6	$ 8	$ 4	
Contribution margin ratio	0.20	0.25	0.10	

Example: Multi-Product CVP

From this information, we can calculate the wtd. avg. cm ratio:

Weighted-average CMR = 0.5(0.2) + 0.4(0.25) + 0.1(0.1) = 0.21

The breakeven point for all three products can be calculated as follows:

$$Y = \$168{,}000 \div 0.21$$

$$Y = \$800{,}000$$

This means that for Windbreakers to break even, $800,000 of all three products must be sold in the same proportion as last year's sales mix. The sales for each product need to be as follows:

For Calm	0.5($800,000) =	$400,000	(13,334 units)
For Windy	0.4($800,000) =	320,000	(10,000 units)
For Gale	0.1($800,000) =	80,000	(2,000 units)
		$800,000	

Q3: CVP Analysis for Multiple Products

When a company sells more than one product the CVP calculations must be adjusted for the sales mix. The sales mix should be stated as a proportion

- of total units sold when performing CVP calculations for in units.

- of total revenues when performing CVP calculations in sales $.

Q3: Sales Mix Computations

- The weighted average contribution margin is the weighted sum of the products' contribution margins:

$$WACM = \sum_{i=1}^{n} \lambda_i CM_i$$

where λ_i is product i's % of total sales in units, CM_i is product i's contribution margin, and n= the number of products.

- The weighted average contribution margin ratio is the weighted sum of the products' contribution margin ratios:

$$WACMR = \sum_{i=1}^{n} \gamma_i CMR_i$$

where γ_i is product i's % of total sales revenues, CMR_i is product i's contribution margin ratio, and n= the number of products.

Q3: Multiple Product Breakeven Point

Peggy's Kitchen Wares sells three sizes of frying pans. Next year she hopes to sell a total of 10,000 pans. Peggy's total fixed costs are $40,800. Each product's selling price and variable costs is given below. Find the BEP in units for this company.

	Small	Medium	Large	Total
Expected sales in units	2,000	5,000	3,000	10,000
Selling price per unit	$10.00	$15.00	$18.00	
Variable costs per unit	$4.00	$8.00	$11.00	
Contribution margin per unit	$6.00	$7.00	$7.00	

First note the sales mix in units is 20%:50%:30%, respectively; then compute the weighted average contribution margin:

$$WACM = 20\% \times \$6 + 50\% \times \$7 + 30\% \times \$7 = \$6.80$$



Q3: Multiple Product Breakeven Point

Next, compute the BEP in terms of total units:

$$\text{Total units needed to breakeven} = Q = \frac{F + 0}{P - V} = \frac{\$40{,}800}{\$6.80/\text{unit}} = 6{,}000 \text{ units}$$

But 6,000 units is not really the BEP in units; the BEP is only 6,000 units *if* the sales mix remains the same.

The BEP should be stated in terms of how many of each unit must be sold:

Units required to break even:		
Small pans	20%	1,200
Medium pans	50%	3,000
Large pans	30%	1,800
		6,000

Q3: Multiple Product Breakeven Point

Find the BEP in sales $ for Peggy's Kitchen Wares. The total revenue and total variable cost information below is based on the expected sales mix.

	Small	Medium	Large	Total
Expected sales in units	2,000	5,000	3,000	10,000
Total revenue	$20,000	$75,000	$54,000	$149,000
Total variable costs	$8,000	$40,000	$33,000	$81,000
Total contribution margin	$12,000	$35,000	$21,000	$68,000
Contribution margin ratio	60.0%	46.7%	38.9%	45.6%

First compute the weighted average contribution margin ratio:

WACMR = (20/149)x60% + (75/149)x46.7% + (54/149)x38.9% =



Q3: Multiple Product Breakeven Point

. . . = 45.6%, of course! Depending on how the given information is structured, it may be easier to compute the CMR as Total contribution margin/Total revenue.

Next compute the BEP in sales $:

$$\text{BEP in sales \$} = \frac{F + 0}{CMR} = \frac{\$40{,}800}{0.456} = \$89{,}474^{*}$$

* If you sum the number of units of each size pan required at breakeven times its selling price you get $89,400. The extra $74 in the answer above comes from rounding the contribution margin ratio to three decimals.

Q4: Assumptions in CVP Analysis

CVP analysis assumes that costs and revenues are linear within a relevant range of activity.

- Linear total revenues means that selling prices per unit are constant and the sales mix does not change.
  - Offering volume discounts to customers violates this assumption.
- Linear total costs means total fixed costs are constant and variable costs per unit are constant.
  - If volume discounts are received from suppliers, then variable costs per unit are not constant.
  - If worker productivity changes as activity levels change, then variable costs per unit are not constant.

Q4: Assumptions in CVP Analysis

- These assumptions may induce a small relevant range.
  - Results of CVP calculations must be checked to see if they fall within the relevant range.
- Linear CVP analysis may be inappropriate if the linearity assumptions hold only over small ranges of activity.
  - Nonlinear analysis techniques are available.
  - For example, regression analysis, along with nonlinear transformations of the data, can be used to estimate nonlinear cost and revenue functions.

Q5: Margin of Safety

The margin of safety is a measure of how far past the breakeven point a company is operating, or plans to operate. It can be measured 3 ways.

$$\text{margin of safety in units} = \text{actual or estimated units of activity} - \text{BEP in units}$$

$$\text{margin of safety in \$} = \text{actual or estimated sales \$} - \text{BEP in sales \$}$$

$$\text{margin of safety percentage} = \frac{\text{Margin of safety in units}}{\text{Actual or estimated units}}$$

$$= \frac{\text{Margin of safety in \$}}{\text{Actual or estimated sales \$}}$$

Q5: Margin of Safety

Suppose that Bill's Briefcases has budgeted next year's sales at 5,000 units. Compute all three measures of the margin of safety for Bill. Recall that P = \$200, V = \$80, F = \$360,000, the BEP in units = 3,000, and the BEP in sales \$ = \$600,000.

margin of safety in units = 5,000 units – 3,000 units = 2,000 units

margin of safety in \$ = \$200 x 5,000 - \$600,000 = \$400,000

$$\text{margin of safety percentage} = \frac{2{,}000 \text{ units}}{5{,}000 \text{ units}} = \frac{\$400{,}000}{\$200 \times 5{,}000} = 40\%$$

The margin of safety tells Bill how far sales can decrease before profits go to zero.

Q5: Degree of Operating Leverage

- The degree of operating leverage measures the extent to which the cost function is comprised of fixed costs.

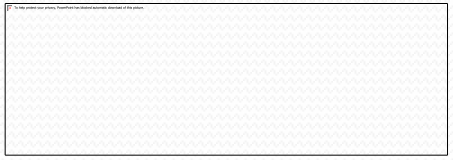
- A high degree of operating leverage indicates a high proportion of fixed costs.
- Businesses operating at a high degree of operating leverage
  - face higher risk of loss when sales decrease,
  - but enjoy profits that rise more quickly when sales increase.

Q5: Degree of Operating Leverage

The degree of operating leverage can be computed 3 ways.

degree of operating leverage =

$$\frac{\text{Contribution margin}}{\text{Profit}}$$



$$\frac{1}{\text{Margin of safety percentage}}$$

Q5: Degree of Operating Leverage

Suppose that Bill's Briefcases has budgeted next year's sales at 5,000 units. Compute Bill's degree of operating leverage. Recall that P = \$200, V = \$80, F = \$360,000, and the margin of safety percentage at 5,000 units is 40%.

First, compute contribution margin and profit at 5,000 units:

Contribution margin = (\$200 - \$80) x 5,000 = \$600,000

Profit = \$600,000 - \$360,000 = \$240,000

$$\text{Degree of operating leverage} = \frac{\$600{,}000}{\$240{,}000} = 2.5$$

$$\text{or, degree of operating leverage} = \frac{\$360{,}000}{\$240{,}000} + 1 = 2.5$$

$$\text{or, degree of operating leverage} = \frac{1}{40\%} = 2.5$$

Summary Assumptions of CVP Analysis

- The CVP model assumes revenues and costs are *linear* over a "relevant range" (even though the actual cost behavior may not be linear)
- Outside the *relevant range*, these calculations may not be accurate
- *Step costs* also make approximation via the relevant range unworkable; CVP analysis becomes much more cumbersome
- The basic model is *deterministic*.

Q5: Using the Degree of Operating Leverage

- The degree of operating leverage shows the sensitivity of profits to changes in sales.

- On the prior slide Bill's degree of operating leverage was 2.5 and profits were $240,000.
  - If expected sales were to increase to 6,000 units, a 20% increase, then profits would increase by 2.5 x 20%, or 50%, to $360,000.*
  - If expected sales were to decrease to 4,500 units, a 10% decrease, then profits would decrease by 2.5 x 10%, or 25%, to $180,000.**

* $240,000 x 1.5 = $360,000

** $240,000 x 0.75 = $180,000

Summary

- CVP analysis is a method for analyzing how operating and marketing decisions affect profit
- CVP analysis depicts the relationship between variable costs, fixed costs, unit selling price, and output level (volume)
- CVP analysis can help a firm choose its strategic position and execute its strategy by providing an understanding of how changes in its volume of sales affect costs and profits

Summary (continued)

The breakeven (B/E) point is the starting point of many business plans:

- B/E is the point at which total revenues equal total costs, i.e., point of sales at which operating profit is zero
- The B/E point can also be defined as the sales level at which total contribution margin = fixed costs, and profit is zero
- There are two methods, equation and contribution margin, that can be used for profit-planning (i.e., CVP analysis) purposes
  - In each method, sales volume can be expressed either on the basis of units or dollars

Summary (continued)

- *CVP analysis* can be used to determine the level of sales needed to achieve a desired level of profit through revenue planning, cost planning, and accounting for the effect of income taxes

- The conventional approach to CVP analysis is to use a volume-based measure, but an activity-based costing (ABC) approach to CVP analysis is preferred when batch-level cost behavior is significant

Summary (continued)

- Two general approaches for addressing risk/uncertainty in CVP analysis:
  - *Sensitivity analysis*
  - *Other approaches*
- *Sensitivity analysis* is the name for a variety of methods that examine how an amount changes if factors involved in predicting that amount change.

Summary (continued)

- The session provides three different approaches to sensitivity analysis:
  - What-if analysis
  - Decision tables/trees
  - Monte Carlo Simulation (MCS)
- Other approaches to dealing with risk/uncertainty:
  - Margin of safety (MOS) and Margin of Safety Ratio (MOS%)
  - Degree of Operating Leverage (DOL)

Summary (continued)

CVP analysis can be used in the multi-product/service case, but it is often impractical to apply CVP analysis separately for each product

- The existence of joint/common (i.e., non-traceable) fixed costs complicates short-run profit planning through CVP analysis

- If the firm can assume that its sales mix (either in units or in dollars) remains relatively constant as total volume changes, then it can use for profit-planning purposes a *weighted-average cm per unit* (sales mix constant in units) or a *weighted-average cm ratio* (sales mix constant in dollars) for short-term profit-planning purposes.

Summary (continued)

CVP analysis relies for its validity on a number of assumptions:

- For conventional CVP analysis, volume of sales (units) is the only important cost driver
- Costs, both variable and fixed, are linear within the relevant range of output
- The revenue function is linear within the relevant range (i.e., the firm's price is constant)

Summary (continued)

- Total costs can be reliably split into fixed and variable components
- The inputs in the CVP model are known with certainty; for this purpose, conventional CVP uses point estimates for the factors in the model
- For the multi-product firm, either fixed costs can be traced (or reliably allocated) to individual products OR the firm's products are sold in a constant sales-mix (expressed either in dollars or units)

Standard costing

Standard Costs and Variance Analysis

Standard Costs & Variance Analysis

Learning objectives

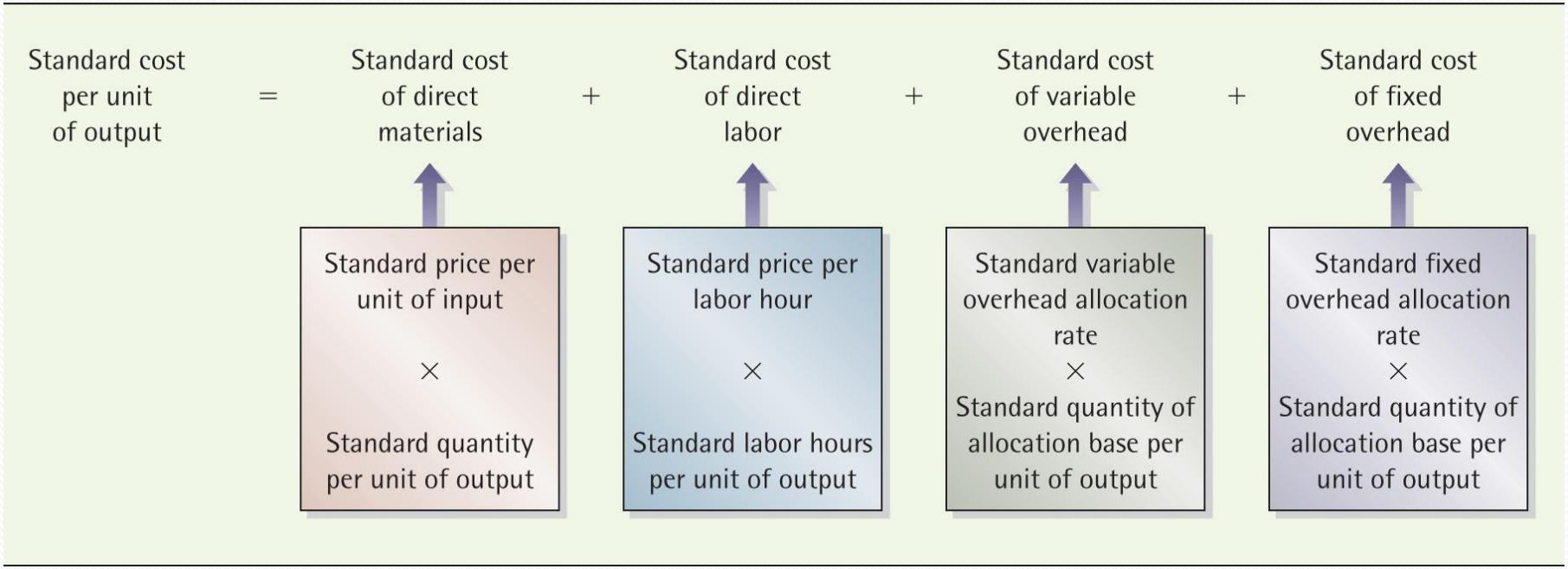
- Q1: How does variance analysis contribute to the strategic management process?
- Q2: What is a standard costing system and how is it used?
- Q3: How are direct cost variances calculated?
- Q4: How is direct cost variance information analyzed and used?
- Q5: How are variable and fixed overhead variances calculated?
- Q6: How is overhead variance information analyzed and used?
- Q7: How are manufacturing cost variances closed?
- Q8: Which profit-related variances are commonly analyzed?

Q2: Standard Costs

- Organizations set standards to help plan operations.

- A standard cost is the expected cost of providing a good or service.
- In manufacturing, the standard cost of a unit of output is comprised of:
  - the standard price (SP) of the input, and
  - the standard quantity of the input expected to be consumed in the production of one output unit.

Q2: Standard Costs



Q2: Establishing & Using Standard Costs

- Standards can be set using:
  - Information from the prior year
  - Engineered estimates
  - New information available

- Standards can be used for:
  - Planning future operations
  - Monitoring current operations
  - Motivating manager and employee behavior
  - Evaluating performance

Q2: Standard Costing Systems

Advantages

- Information can be used to quickly estimate job or project costs
- Monitor resources to measure efficiency
- Communicates targets (goals) to employeess
- Provides information to analyze operations

Disadvantages

- May reduce employee motivation if the standards are too high or low
- Time involved in setting standards and analyzing variances
- Incorrect standards could result in inappropriate employee rewards or penalties

Q1: Variance Analysis

- The difference between an actual cost and the standard cost of producing goods or services at the *actual volume level* is called a standard cost variance.

- Managers investigate the reasons for standard cost variances so that:
  - efficiencies can be rewarded and replicated,
  - inefficiencies can be minimized, and
  - the validity of the standards can be assessed.

Q1: Variance Analysis in Diagnostic Control System

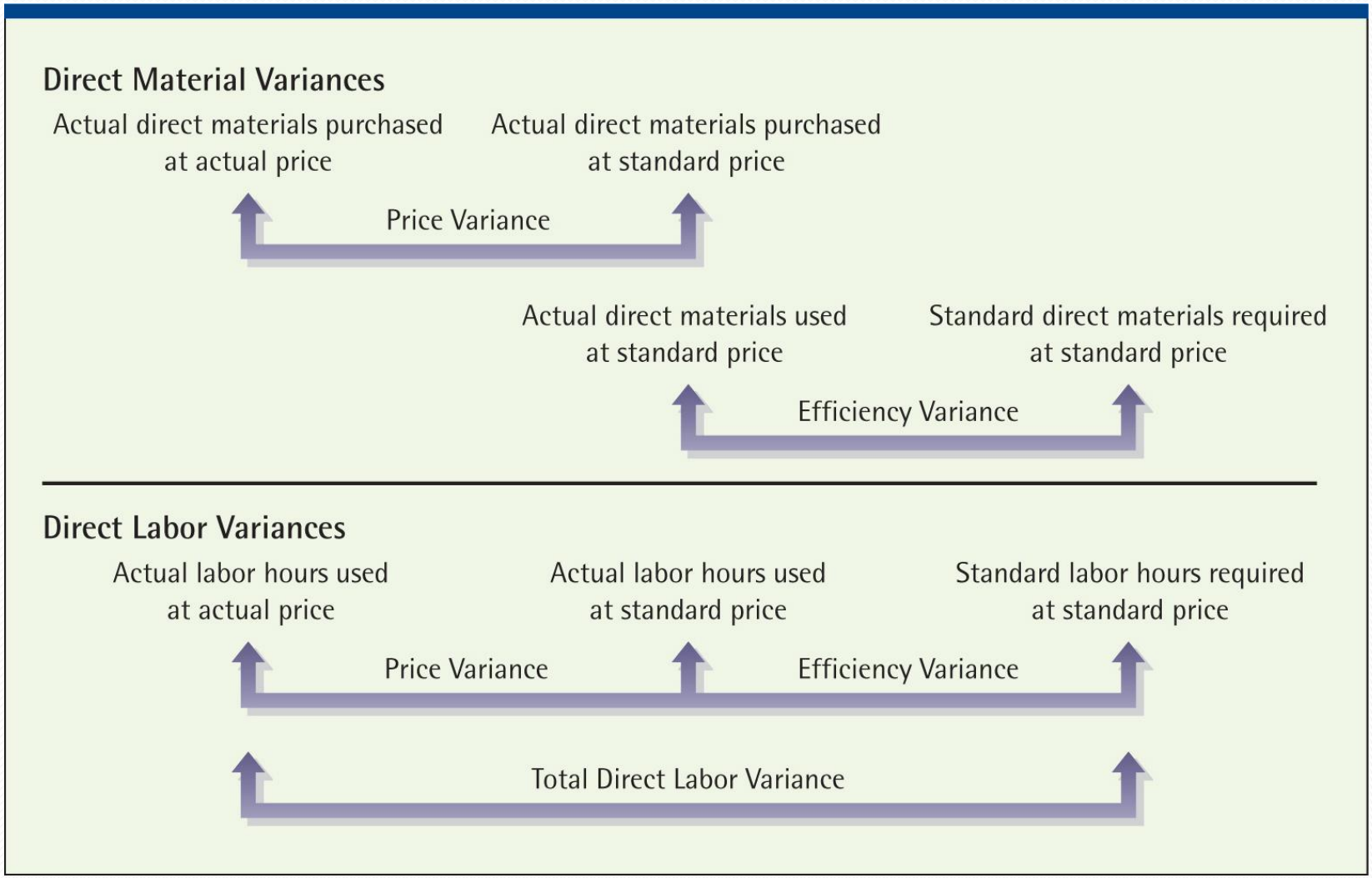
- Investigating Variances
  - Must decide what amount of variance needs to be investigated (% of budget, given $ amount)
  - Trends in variances should also be considered
  - Separating variances into component parts improves analysis
- Conclusions and Actions
  - After determining reasons for variances, managers need to draw conclusions about what happened
  - Determine if corrective action is required
  - Must consider behavioral implications and employee incentives to ensure standards are promoting overall success

Q3: Direct Cost Variances

- A price variance is the difference between the standard cost of resources purchased (or that should have been consumed) and the actual cost.

- An efficiency variance measures whether inputs were used efficiently.
  - It is the difference between the inputs used and the inputs that should have been used, times the standard price of the input

Q3: Direct Cost Variances



Q3: Direct Labor Cost Variances

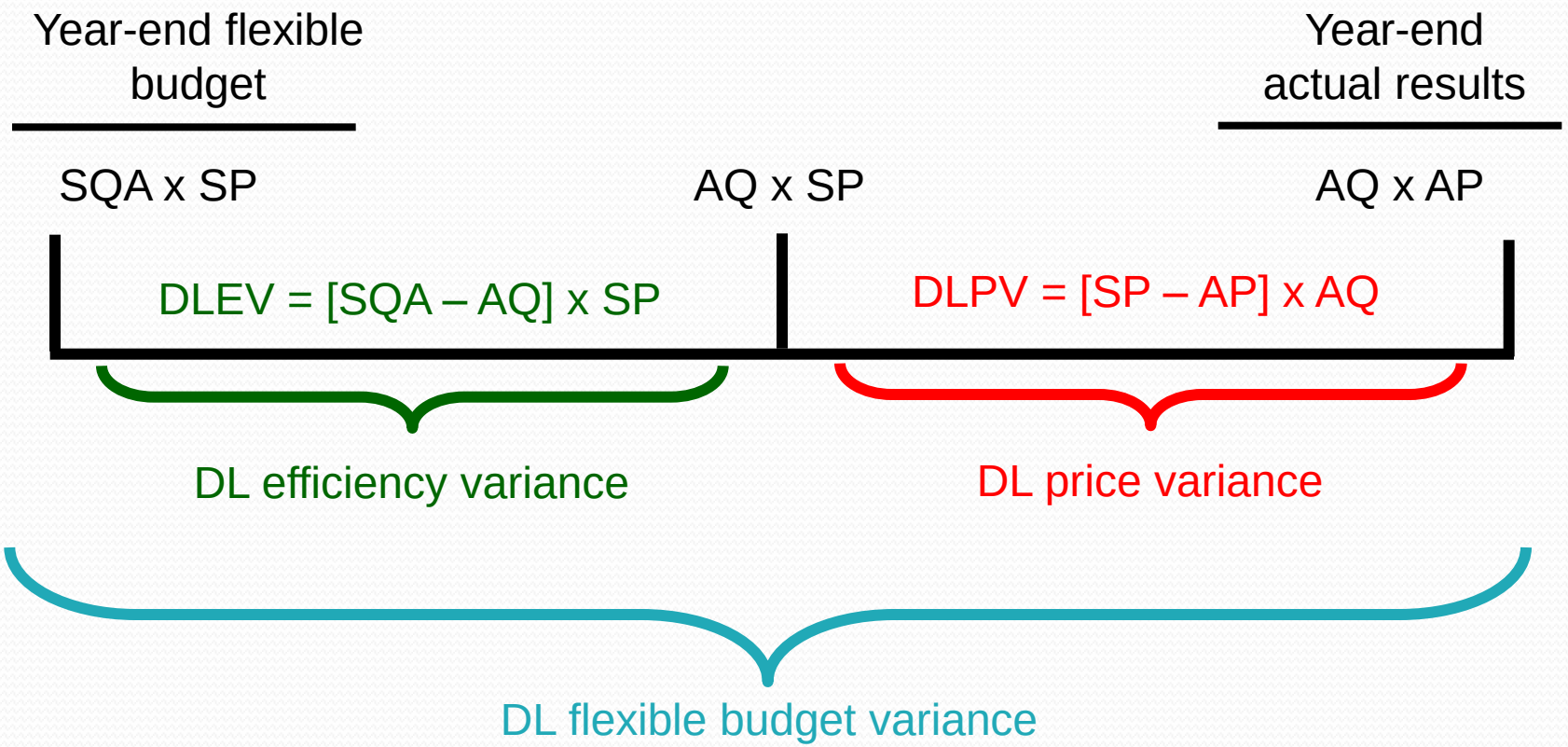
- The direct labor price and efficiency variances are a decomposition of the direct labor flexible budget variance.

- The year-end flexible budget direct labor cost is based on the standard direct labor hours for the actual output, or standard quantity allowed (SQA).

- Other abbreviations used:
  - SP = standard price of the input
  - AP = actual price of the input
  - AQ = actual quantity of the input used

Q3: Direct Labor Cost

The direct labor price and efficiency variances are a decomposition of the direct labor flexible budget variance.



Q3: Direct Labor Cost Variances Example

Matthews Manufacturing makes a product that is expected to use ¼ hour of direct labor to produce. At the beginning of the year Matthews expected to produce 10,000 units. Actual production, however, was 9,800 units. The standard price of direct labor is $10/hour. Actual direct labor costs were $24,696 for the 2,520 labor hours used. Compute the direct labor cost variances.

First compute SQA for direct labor:

SQA = 9,800 units x ¼ hour/unit = 2,450 hours

Then compute AP for direct labor:

AP = $24,696/2,520 hours = $9.80/hour

DLPV = [SP – AP] x AQ = [$10/hour - $9.80/hour] x 2,520 hours = $504F

DLEV = [SQA – AQ] x SP = [2,450 hours - 2,520 hours] x $10/hour = $700U

Note that the DL FBV = $504F + $700U = $196U

Q4: Direct Labor Cost Variances Example

What are some possible explanations for the direct labor cost variances of Matthews Manufacturing?

- The favorable price variance could be due to:
  - an incorrect standard price,
  - using a higher percentage of lower-paid workers than expected, or
  - a favorable renegotiation of a labor contract.

- The unfavorable efficiency variance could be due to:
  - an incorrect standard quantity for labor,
  - inefficiency of direct labor personnel,
  - unexpected problems with machinery, or
  - lower quality of inputs that were more difficult to use.

Q3: Direct Material Cost Variances

- The direct materials and direct labor efficiency variances are computed in the same fashion.
- The direct material price variance is computed slightly differently than the direct labor price variance.
- Direct materials can be purchased and stored, and direct labor is consumed as it is purchased.
- The direct materials price and efficiency variances do not sum to the direct material flexible budget variance when there are any direct materials inventories.

Q3: Direct Material Cost

The direct material price variance is based on the actual quantity of direct materials purchased, not the actual quantity of direct materials used.

Year-end flexible budget

SQA x SP — AQ x SP

DMEV = [SQA – AQ] x SP

DM efficiency variance

Remember that AQ=Actual quantity used, not actual quantity purchased.

Actual Quantity Purchased x SP — Actual Quantity Purchased x AP

DMPV = [SP – AP] x Actual Quantity Purchased

DM price variance

Q3: Direct Material Cost Variances Example

Matthews Manufacturing makes a product that is expected to use 2 pounds of direct material to produce. At the beginning of the year Matthews expected to produce 10,000 units. Actual production, however, was 9,800 units. The standard price of direct materials is $3/pound. Matthews purchased 20,500 pounds of direct material at $3.10/pound, and used 19,400 pounds. Compute the direct material cost variances.

First compute SQA for direct materials:

SQA = 9,800 units x 2 pounds/unit = 19,600 pounds

DMPV = [SP – AP] x Actual Quantity Purchased =

[$3/pound - $3.10/pound] x 20,500 pounds = $2,050U

DMEV = [SQA – AQ] x SP =

[19,600 pounds - 19,400 pounds] x $3/pound = $600F

Q4: Direct Material Cost Variances Example

What are some possible explanations for the direct material cost variances of Matthews Manufacturing?

- The unfavorable price variance could be due to:
  - an incorrect standard price,
  - an unexpected price increase from a supplier, or
  - the purchase of higher quality materials.

- The favorable efficiency variance could be due to:
  - an incorrect standard quantity for material,
  - efficient use of direct materials during production, or
  - less waste of direct materials due to higher material quality.

Q3: Recording Direct Cost Variances

- The direct material price variance is recorded when the materials are purchased.
- The direct material efficiency variance is recorded when the materials are used in production.
- The direct labor price and efficiency variances are recorded when labor is used in production.
- Work in process inventory is debited for the standard cost of the inputs that should have been used to produce the actual quantity of outputs (SP x SQA).

Q3: Recording Direct Labor Cost Variances

The journal entry to record the use of direct labor is:

dr. Work in process inventory	SP x SQA
dr. or cr. DLEV	[SQA-AQ] x SP
dr. or cr. DLPV	[SP-AP] x AQ
cr. Accrued payroll	AP x AQ

Unfavorable variances are debited to the variance accounts and favorable variances are credited to the variance accounts.

Q3: Recording Direct Labor Cost Variances Example

Prepare a summary journal entry to record the direct labor costs for Matthews Manufacturing, including the direct labor cost variances. Refer to slide #8.

dr. Work in process inventory [2,450 hrs x $10/hr]	24,500	
dr. DLEV [(2,450 hrs – 2,520 hrs) x $10/hr]	700	
cr. DLPV [($10/hr - $9.80/hr) x 2,520 hrs]		504
cr. Accrued payroll [given]		24,696

Q3: Recording Direct Material Cost Variances

The journal entry to record the purchase of direct materials is:

dr. Raw materials inventory	SP x Actual Qty Purch'd
dr. or cr. DMPV	[SP–AP] x Actual Qty Purch'd
cr. Accounts payable	AP x Actual Qty Purch'd

The journal entry to record the use of direct materials is:

dr. Work in process inventory	SP x SQA
dr. or cr. DMEV	[SQA-AQ] x SP
cr. Raw materials inventory	SP x AQ

Q3: Recording Direct Material Cost Variances Example

Prepare summary journal entries to record the purchase and the use of direct material for Matthews Manufacturing, including the direct material cost variances. Refer to slide #12.

The journal entry to record the purchase of direct materials is:

dr. Raw materials inventory [$3/lb x 20,500 lbs]	61,500	
dr. DMPV [($3/lb –$3.10/lb) x 20,500 lbs]	2,050	
cr. Accounts payable [$3.10/lb x 20,500 lbs]		63,550

The journal entry to record the use of direct materials is:

dr. Work in process inventory [$3/lb X 19,600 lbs]	58,800	
cr. DMEV [(19,600 lbs – 19,400 lbs) x $3/lb]		600
cr. Raw materials inventory [19,400 lbs x $3/lb]		58,200

Q5: Allocating Overhead Costs

- We covered the allocation of overhead to units of production.
- Estimated overhead rates are calculated for both fixed and variable overhead.

$$\text{Standard variable overhead allocation rate} = \frac{\text{Estimated variable overhead costs}}{\text{Estimated volume of an overhead allocation base}}$$

$$\text{Standard fixed overhead allocation rate} = \frac{\text{Estimated fixed overhead costs}}{\text{Estimated volume of an overhead allocation base}}$$

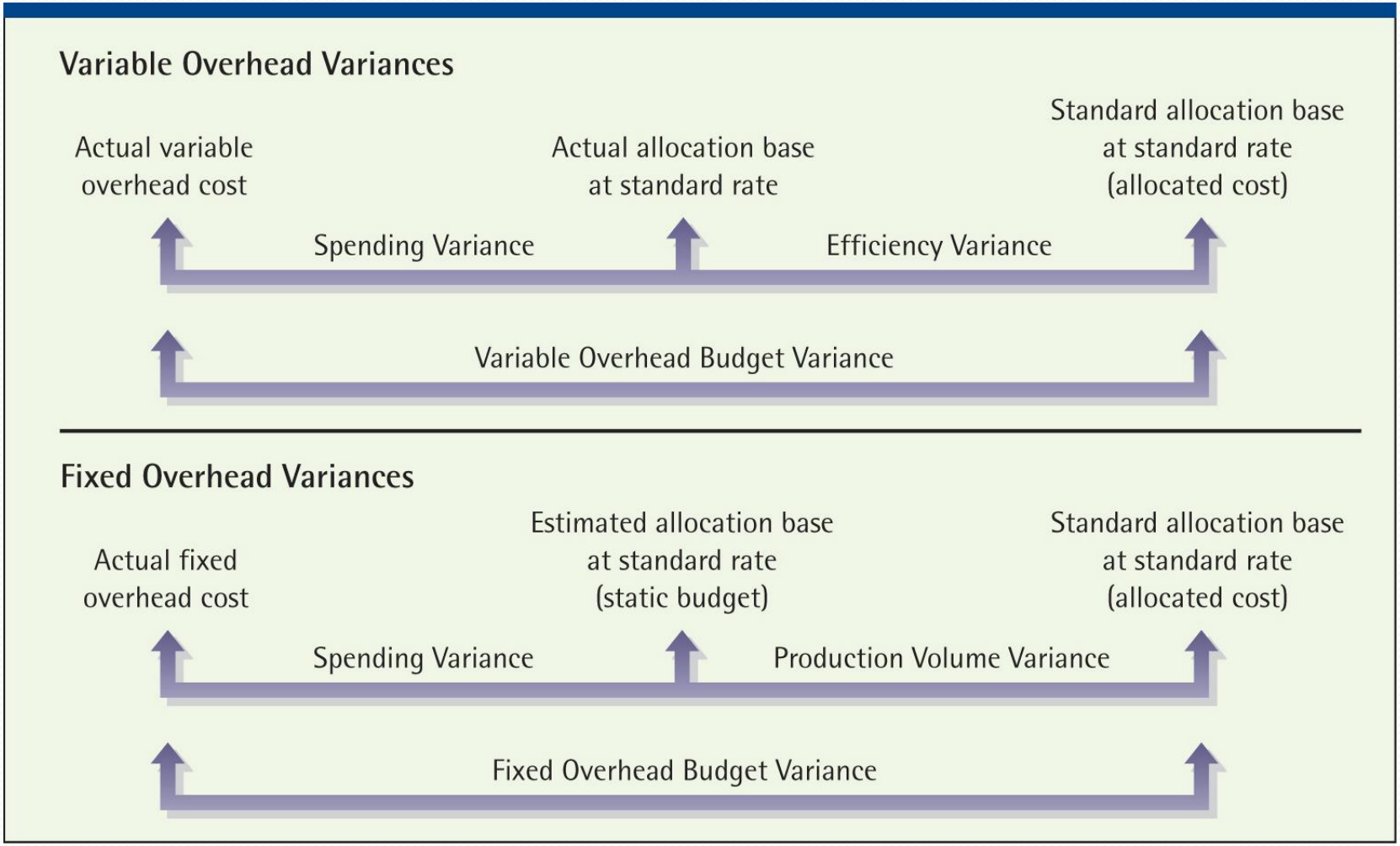
Q5: Overhead Cost Management

- For both variable and fixed overhead, cost management includes reducing non-value-added costs.

- For each variable overhead cost pool, cost management includes reducing the consumption of the related cost allocation base.

- For fixed overhead, cost management involves a trade-off between insufficient and excess capacity.

Q5: Overhead Cost Variances

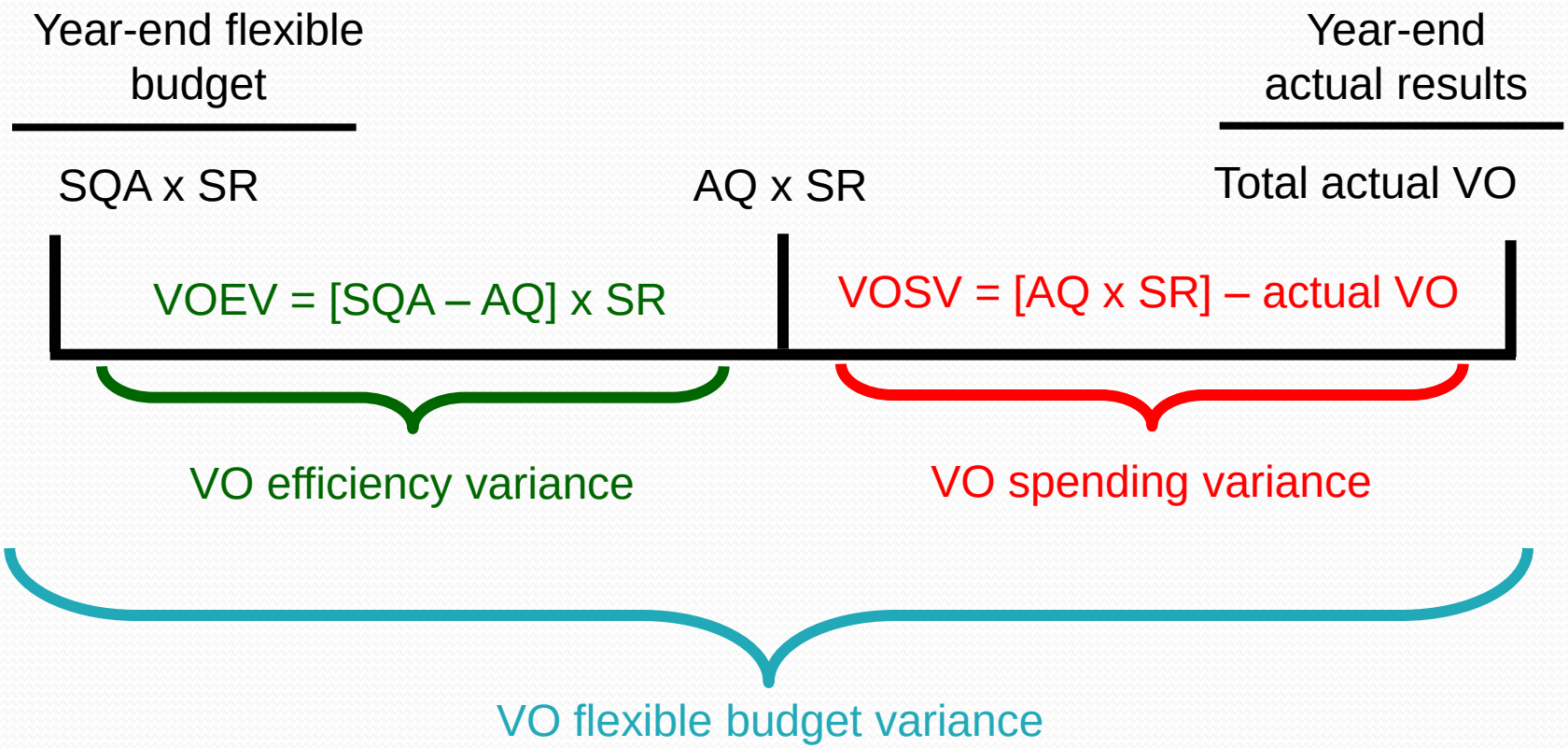


Q5: Variable Overhead Cost Variances

- The variable overhead cost variances are computed in the same fashion as the direct labor cost variances.
- The variable overhead spending variance is similar to the direct labor price variance.
- The variable overhead efficiency variance is similar to the direct labor efficiency variance.
- The variable overhead (flexible) budget variance is the sum of these two variable overhead variances.

Q5: Variable Overhead Cost

The standard quantity allowed (SQA) in the variable overhead cost variance calculations is the quantity of the variable overhead allocation base that should have been used to produce the actual output. SR is the standard variable overhead allocation rate.



Q5: Variable Overhead Cost Variances Example

Matthews Manufacturing makes a product that is expected to use ¼ hour of direct labor to produce. At the beginning of the year Matthews expected to produce 10,000 units. Actual production, however, was 9,800 units. The estimated variable overhead allocation rate is $4 per direct labor hour, actual variable overhead costs were $10,450, and actual direct labor hours were 2,520. Compute the variable overhead cost variances.

First compute SQA for direct labor, the VO cost allocation base:

SQA = 9,800 units x ¼ hour/unit = 2,450 hours

VOEV = [SQA – AQ] x SR = [2,450 hours - 2,520 hours] x $4/hour = $280U

VOSV = AQ x SR – actual VO = 2,520 hrs x $4/hr - $10,450 = $370U

Note that the VO FBV = $280U + $370U = $650U

Q6: Variable Overhead Cost Variances Example

What are some possible explanations for the variable overhead cost variances of Matthews Manufacturing?

- The favorable spending variance could be due to:
  - an incorrect standard variable overhead rate per direct labor hour,
  - lower prices than expected for the components of the variable overhead cost pool (e.g. a lower price per quart of machine oil), or
  - lower consumption than expected of the components of the variable overhead cost pool (e.g. less indirect labor used per direct labor hour).
- The unfavorable efficiency variance could be due to:
  - an incorrect standard quantity for labor,
  - inefficiency of direct labor personnel,
  - unexpected problems with machinery, or
  - lower quality of inputs that were more difficult to use.

Q5: Recording Variable Overhead Cost Variances

The summary entry to record the incurrence of variable overhead costs is:

dr. Variable overhead cost control Actual VO costs

cr. Various accounts Actual VO costs

The summary entry to record the allocation of variable overhead costs is:

dr. Work in process inventory SR x SQA

cr. Variable overhead cost control SR x SQA

The year-end entry to close the Variable overhead cost control and record the variable overhead cost variances will:

- close the Variable overhead cost control account with a debit or credit, whichever is required, and
- debit (credit) the Variable overhead spending variance and Variable overhead efficiency variance accounts for unfavorable (favorable) variances.

Q3: Recording Variable Overhead Cost Variances Example

Prepare summary journal entries to record the incurrence of and the allocation to work in process of variable overhead costs for Matthews Manufacturing. Also prepare the year-end entry to close variable overhead control and record the variances. Refer to slide #22.

The journal entry to record the incurrence of variable overhead costs is:

dr. Variable overhead cost control	10,450	
cr. Various accounts		10,450

The journal entry to record the allocation of variable overhead is:

dr. Work in process inventory [$4/hr X 2,450 hrs]	9,800	
cr. Variable overhead cost control		9,800

The year-end entry to close the Variable overhead cost control account is:

dr. VOSV	280	
dr. VOEV	370	
cr. Variable overhead cost control		650

Q5: Fixed Overhead Cost Variances

- The fixed overhead spending variance is the same as the fixed overhead (flexible) budget variance.

- There is no fixed overhead efficiency variance because changes in the quantity of the fixed overhead allocation base do not cause changes in actual total fixed overhead costs.
- The production volume variance occurs when actual volume is different than the static budget estimated volume.

Q5: The Production Volume Variance

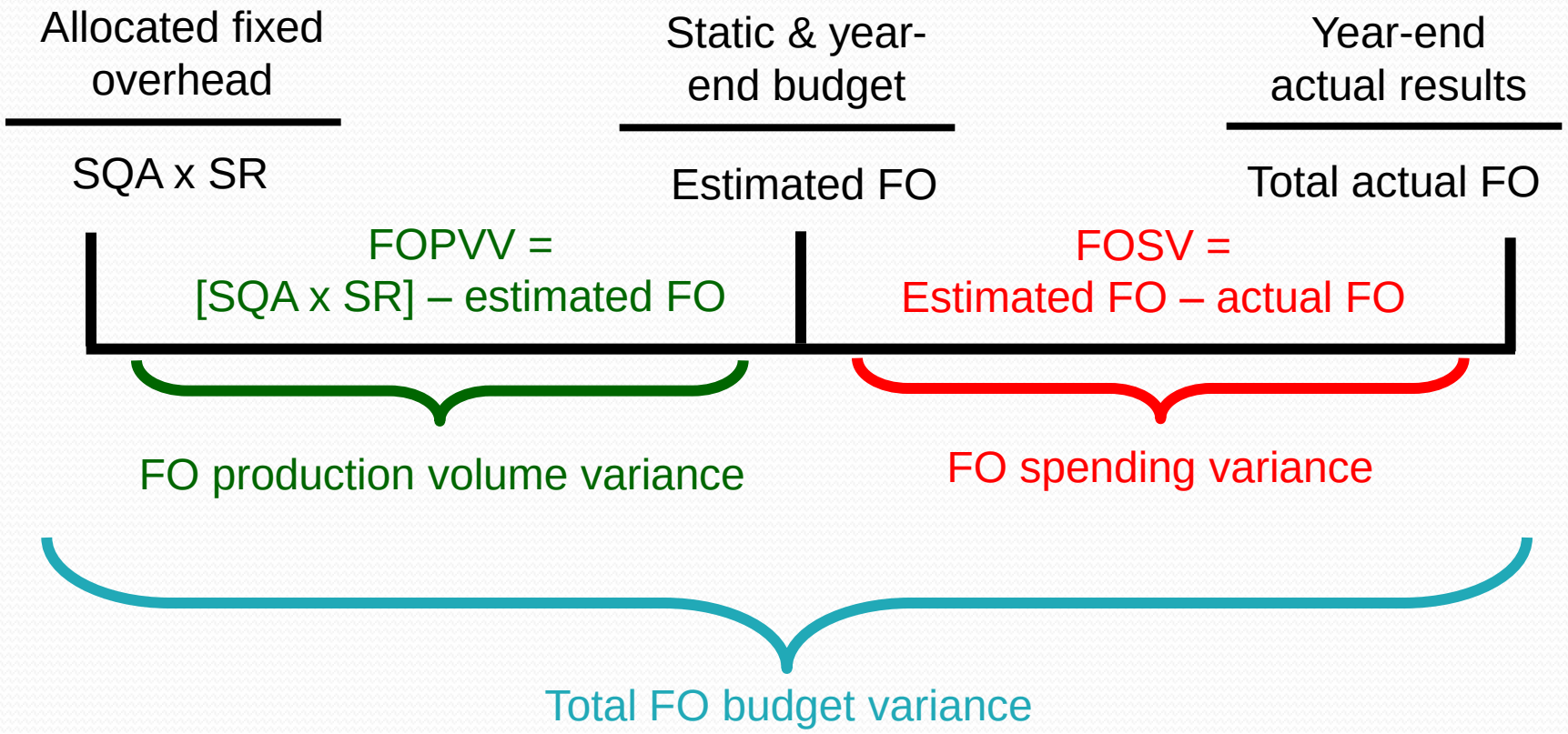
- Allocating fixed overhead to production using a standard rate per unit of a cost allocation base treats fixed overhead as a variable cost for bookkeeping purposes.

- Since fixed overhead is not a variable cost, the fixed overhead allocated to production will differ from budgeted fixed overhead when actual volume differs from static budget estimated volume.

- The production volume variance is favorable (unfavorable) when actual volume exceeds (is less than) static budget estimated volume.

Q5: Fixed Overhead Cost Variances

The standard quantity allowed (SQA) in the fixed overhead cost variance calculations is the quantity of the fixed overhead allocation base that should have been used to produce the actual output. SR is the standard fixed overhead allocation rate.



Q5: Fixed Overhead Cost Variances Example

Matthews Manufacturing makes a product that is expected to use 1.2 machine hours to produce. At the beginning of the year Matthews expected to produce 10,000 units. Actual production, however, was 9,800 units. Estimated fixed overhead at the beginning of the year was $60,000 and actual fixed overhead was $58,100. Actual machine hours for the year totaled 12,200 hours. Compute the fixed overhead cost variances.

First compute SQA for machine hours:

SQA = 9,800 units x 1.2 hours/unit = 11,760 hours

Next compute the estimated fixed overhead rate per machine hour:

SR = $60,000/[10,000 units x 1.2 hrs/unit] = $5/hr

FOSV = Estimated FO – actual FO = $60,000 - $58,100 = $1,900F

FOPVV = SQA x SR – estimated FO =

11,760 hours x $5/hr - $60,000 = $1,200U

Q6: Fixed Overhead Cost Variances Example

What are some possible explanations for the fixed overhead cost variances of Matthews Manufacturing?

- The favorable spending variance could be due to:
  - an incorrect estimate for fixed overhead costs,
  - a decision to forgo a budgeted discretionary fixed cost, or
  - a favorable renegotiation of leasing agreements.

- The unfavorable production volume variance is due to:
  - an actual volume level that is less than the static budget volume level.

Q5: Recording Fixed Overhead Cost Variances

The summary entry to record the incurrence of fixed overhead costs is:

dr. Fixed overhead cost control Actual FO costs

cr. Various accounts Actual FO costs

The summary entry to record the allocation of fixed overhead costs is:

dr. Work in process inventory SR x SQA

cr. Fixed overhead cost control SR x SQA

The year-end entry to close the fixed overhead cost control and record the fixed overhead cost variances will:

- close the Fixed overhead cost control account with a debit or credit, whichever is required, and
- debit (credit) the fixed overhead production volume variance and fixed overhead spending variance accounts for unfavorable (favorable) variances.

Q5: Recording Fixed Overhead Cost Variances Example

Prepare summary journal entries to record the incurrence of and the allocation to work in process of fixed overhead costs for Matthews Manufacturing. Also prepare the year-end entry to close Fixed overhead control and record the variances. Refer to slide #29.

The journal entry to record the incurrence of variable overhead costs is:

dr. Fixed overhead cost control	58,100	
cr. Various accounts		58,100

The journal entry to record the allocation of fixed overhead is:

dr. Work in process inventory [$5/hr x 11,760 hrs]	58,800	
cr. Fixed overhead cost control		58,800

The year-end entry to close the fixed overhead cost control account is:

dr. Fixed overhead cost control	700	
dr. Fixed overhead production volume variance	1,200	
cr. Fixed overhead spending variance		1,900

Q7: Closing Manufacturing Variances

- At the end of the year, all eight variance accounts are closed out to Work in process inventory, Finished goods inventory, and Cost of goods sold.

- The net of the variance accounts is generally prorated to the three accounts using a ratio of the accounts' ending balances.

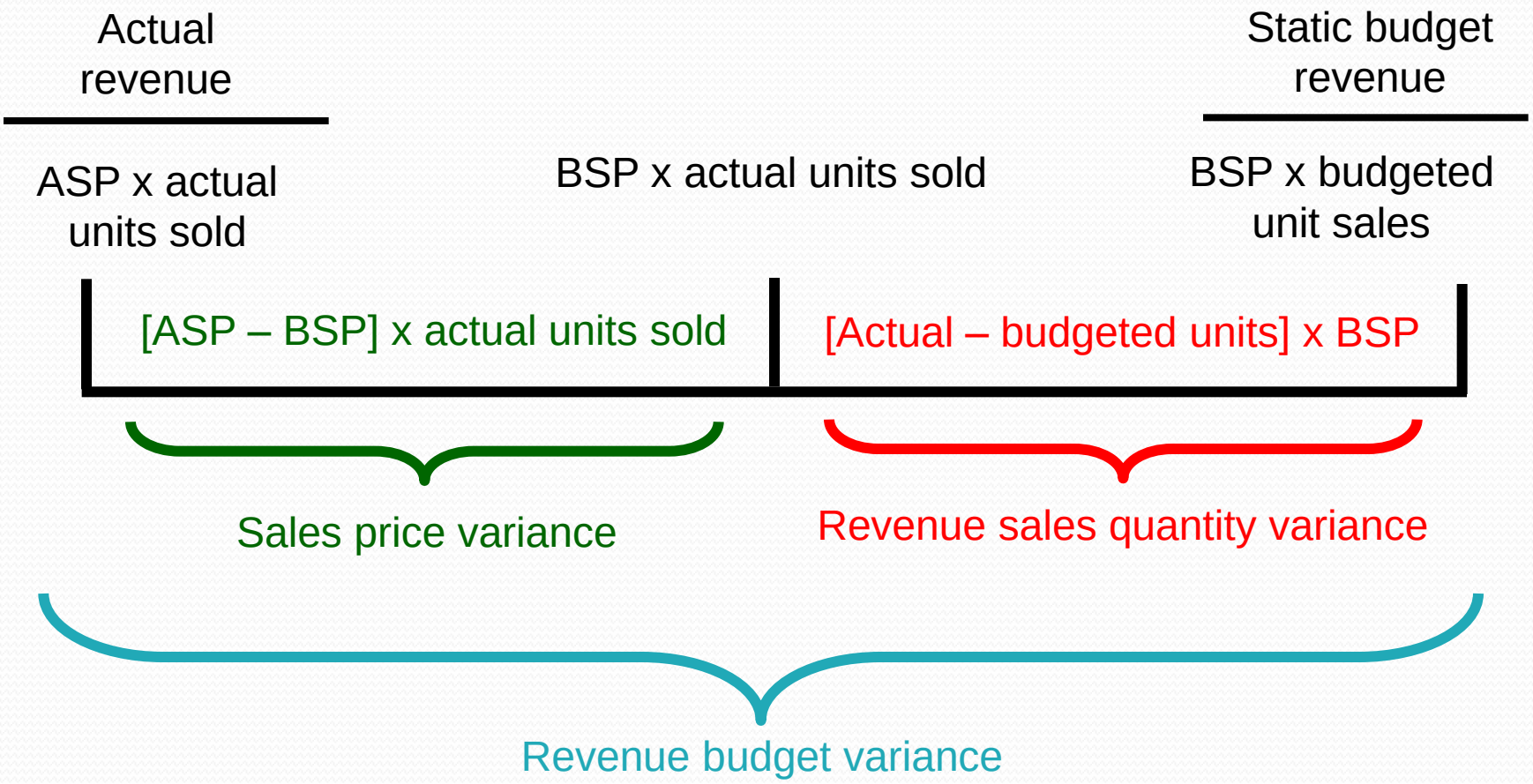
- Technically, a portion of the direct materials price variance should also be allocated to Raw materials inventory, but this complication is ignored here.

Q8: Revenue Budget Variance

- The revenue budget variance measures the difference between actual revenues and static budget revenues, and has two components:
  - The sales price variance is due to the difference between actual average selling price and the budgeted selling price per unit.
  - The revenue sales quantity variance is due to the difference between the actual number and the budgeted number of units sold.

Q8: Revenue Budget Variance

ASP is the actual average selling price per unit; BSP is the budgeted selling price from the static budget.



Q7: Revenue Budget Variance Example

Matthews Manufacturing makes a product with a budgeted selling price of $15/unit. At the beginning of the year Matthews expected to sell 10,000 units. Actual sales, however, were 9,800 units, and actual revenue was $156,800. Compute the revenue budget variances.

First compute the actual average selling price per unit:

ASP = $156,800/9,800 units = $16/unit

Sales price variance = [$16/unit - $15/unit] x 9,800 units = $9,800F

Revenue sales quantity variance =
[9,800 units – 10,000 units] x $15/unit = $3,000U

Note the revenue budget variance is $9,800F + $3,000U = $6,800F

Q8: Contribution Margin Budget Variance

- The contribution margin budget variance measures the difference between actual contribution margin and the contribution margin budgeted at the beginning of the year. It has two components:
  - The contribution margin variance is the difference between the actual contribution margin and the budgeted contribution margin in in the year-end flexible budget (which is based on actual sales levels).
  - The contribution margin sales volume variance is difference budgeted contribution margin at the beginning of the year and the budgeted contribution margin in the year-end flexible budget.

Q8: Contribution Margin Sales Volume Variance

- When a company sells more than one product, the contribution margin sales volume variance itself has two components:
  - The contribution margin sales mix variance is the portion of the contribution margin sales volume variance caused by a change in the sales mix from the budgeted mix.
  - The contribution margin sales quantity variance is the portion of the contribution margin sales volume variance caused by the difference between budgeted total unit sales at the beginning of the year and actual total unit sales.

Q7: Profit-Related Variances Example

Matthews Manufacturing produces three products, Alpha, Beta, and Gamma. You are given the following information from Matthews' static budget:

Product	Budgeted Selling Price Per Unit	Budgeted CM per Unit	Static Budget Unit Sales	Static Budget Revenue	Static Budget Total CM	Static Budget Sales Mix
Alpha	$20.00	$12.00	3,000	$60,000	$36,000	30%
Beta	$15.00	$9.00	4,500	$67,500	$40,500	45%
Gamma	$12.00	$3.00	2,500	$30,000	$7,500	25%
			10,000	$157,500	$84,000	100%

Q7: Profit-Related Variances Example

You are given below the actual results for Matthews Manufacturing. Compute the revenue budget variances.

Product	Actual Selling Price Per Unit	Actual CM per Unit	Actual Unit Sales	Actual Revenue	Actual Total CM	Actual Sales Mix
Alpha	$22.00	$13.00	3,350	$73,700	$43,550	30.45%
Beta	$12.00	$5.00	6,000	$72,000	$30,000	54.55%
Gamma	$13.00	$3.00	1,650	$21,450	$4,950	15.00%
			11,000	$167,150	$78,500	100.00%

Total Actual Revenue		Actual Units Sold Times Budgeted Selling Price		Total Static Budget Revenue
$167,150		$176,800		$157,500
Sales Price Variance			Revenue Sales Quantity Variance	
$9,650	Favorable		$19,300	Unfavorable

Revenue Budget Variance	
$9,650	Unfavorable

Q7: Profit-Related Variances Example

Use the given information on the prior two slides to compute all of the contribution margin budget variances for Matthews Manufacturing.

Total Static Budget CM	Actual Total Units Sold Times Static Budget Sales Mix Times Static Budget CM per Unit	Actual Total Units Sold Times Actual Sales Mix Times Static Budget CM per Unit	Units Sold Times Actual Sales Mix Times Actual CM
$84,000	$92,400	$99,150	$78,500

CM Sales Quantity Variance	CM Sales Mix Variance
$8,400 Favorable	$6,750 Favorable

CM Sales Volume Variance	CM Variance
$15,150 Favorable	$20,650 Favorable

CM Budget Variance
$5,500 Unfavorable

Flexible budgets

Flexible budgets

- **Static budget:** prepared for **one** level of planned activity.
- **Flexible budget:** covers **a range** of activity within a business.
- **Fixed costs:** in **total remain constant** in the short run within a given range of activity.
- **Variable costs:** in **total vary** as the level of activity changes.

Cost behavior:

The more knowledge of cost behavior, the more accurate the budgeting process.

- **Fixed costs:** in **total remain constant** in the short run within a given range of activity.
- **Variable costs:** in **total vary** as the level of activity changes.
- **Semi-variable costs:** have a fixed and a variable component.

Flexible budget equation

Total budgeted expenses=					
Budgeted Variable costs per activity unit		X	Total activity units	+	Budgeted fixed costs

Budgeted Variable costs per activity unit	=	budgeted variable costs / budgeted units sold

Statement of financial performance (applying cost behavior principles)

Anshar Manufacturing

	$	$	$
Sales			
Less **variable costs**			
Contribution margin			
Less **fixed costs**			
Net profit			

Flexible budget analysis

- **Activity volume variance:**

  shows what portion of the variance was due to the actual volume being different from the desired volume as per master budget.

- **Volume levels may be based on:**
  - Number of units sold
  - Professional hours
  - Machine hours
  - Student contact hours

- **Flexible budget variance:**

  shows the variance when the actual volume achieved is used to recalculate the budget figures

Summary

- **Static budget variance:**
  - Difference between actual results and master budget figures.
- **Activity volume variance:**
  - Difference between master budget figures and budgeted figures recalculated for actual volume achieved.
- **Flexible budget variance:**
  - Difference between actual results and budgeted figures recalculated for actual volume achieved.

Static and Flexible Budgets

Static and Flexible Budgets

Learning objectives

- Q1: How do budgets contribute to the strategic management process?
- Q2: What is a master budget and how is it prepared?
- Q3: What are flexible budgets and how can they be used for sensitivity analysis?
- Q4: How are budget variances calculated and used as performance measures?
- Q5: How do behavioral tensions influence the budgeting process?
- Q6: What approaches exist for addressing the problems of traditional budgeting?

Q1: Budgets & Strategic Management Process

- A budget is
  - A formalized financial plan.
  - A translation of an organization's strategies.
  - A method of communicating.
  - A way to define areas of responsibility and decision rights.

- The budget cycle is the series of sequential steps followed to create and use budgets.

Q1: Budgets & Strategic Management Process

- Budgeting process begins with the organizational vision, core competencies, and risk appetite
- Organizational strategies designed to achieve the vision will drive the capital expenditures and long term financing plans
- Operating plans are then created in line with the organizational strategies
- Actual results must be monitored, measured, and analyzed compared to budgeted plans

Q1: Budgets & Levers of Control

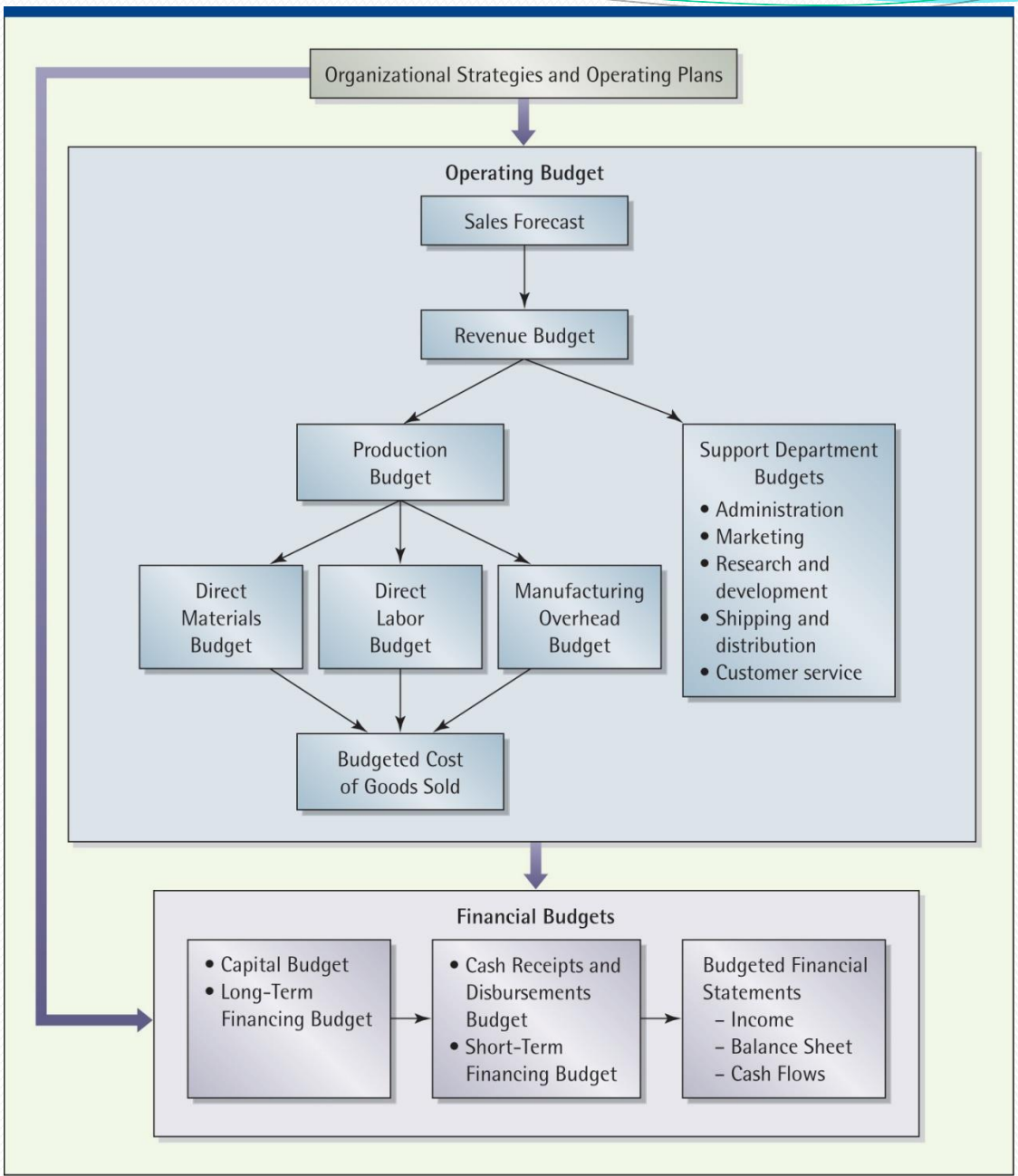
Belief Systems	Boundary Systems	Interactive Control Systems	Diagnostic Control Systems
• Communicates organizational strategies and goals • Motivates managers to plan in advance and coordinate activities	• Authorizes employees to engage in planned activities and spend within budget limits • Ensures sufficient cash flow for financial viability	• Utilize variances to identify opportunities and threats to the business • Revaluate strategies and operating plans as conditions changes	• Assign responsibility and reward employees for achieving budget targets • Motivate managers to provide good estimates and use resources appropriately

Q2: Master Budgets

- A master budget is
  - A comprehensive plan for the upcoming accounting period.
  - Usually prepared for a one-year period.
  - Is based on a series of budget assumptions.

- The master budget consists of several subsidiary budgets, in two categories:
  - Operating budgets.
  - Financial budgets.

Q2: Operating Budgets



Q2: Operating Budgets

The operating budget is created by preparing the following individual budgets, in this order:

- Revenue budget
- Production budget
- Direct materials budget
- Direct labor budget
- Manufacturing overhead budget
- Inventory and cost of goods sold budget
- Support department budgets
- Budgeted income statement

Q2: Financial Budgets

The financial budget is created by preparing the following individual budgets, in this order:

- Capital budget
- Long-term financing budget
- Cash budget
- Budgeted balance sheet
- Budgeted statement of cash flows

Q2: Operating Budget Example

Stanley J, Inc., makes a tool used by auto mechanics that sells for $68/unit. It expects to sell 6,000 units in April and 7,000 units in May. Stanley J prefers to end each period with a finished goods inventory equal to 10% of the next period's sales in units and a direct materials inventory equal to 20% of the direct materials required for the next period's production. The company never has any beginning or ending work-in-process inventories. There were 400 units in finished goods inventory on April 1. Prepare the revenue and production budgets for April.

Revenue budget	
Budgeted sales in units in April	6,000
Budgeted selling price per unit	$68.00
Budgeted revenues	$408,000

Production budget	
Budgeted sales in units in April	6,000
Desired ending FG inventory	700
Total units required	6,700
Less: beginning FG inventory	(400)
Required production in units	6,300

Q2: Operating Budget Example

Stanley J's product uses 0.3 pounds of direct material per unit, at a cost of $4/lb. There were 220 lbs. of direct material on hand on April 1. Assume that budgeted production for May is 6,500 units. Prepare the direct materials purchases and usage budget for April.

Direct materials budget	
Required production in units	6,300
DM required per unit, in pounds	0.3
Total DM required, in pounds	1,890
Less: Beginning DM inventory	(220)
Plus: Desired ending DM inventory	390
Required DM purchases in pounds	2,060
Budgeted DM cost per pound	$4.00
Budgeted cost of DM	$8,240

Usage Budget = 1,890 pounds * $4 per pound = $7,560

Q2: Operating Budget Example

Stanley J's product uses 0.2 hours of direct labor at a cost of $12/hr. Prepare the direct labor budget for April.

Direct labor budget	
Required production in units	6,300
DL required per unit, in hours	0.2
Total DL hours required	1,260
Budgeted cost per DL hour	$12.00
Budgeted cost of DL	$15,120

Q2: Operating Budget Example

Stanley J's budgeted fixed manufacturing overhead for April is $167,000, and variable manufacturing overhead is budgeted at $6 per direct labor hour. Prepare the manufacturing overhead budget for April.

Manufacturing overhead budget	
Total DL hours required	1,260
Budgeted variable overhead per DL hour	$6.00
Total budgeted variable overhead	$7,560
Budgeted fixed overhead	$167,000
Total budgeted overhead	$174,560

Q2: Operating Budget Example

Assume that Stanley J's April 1 direct materials inventory had a cost of $1,560. Prepare the April ending inventories budget for direct materials.

Ending inventories budgets	
Budgeted cost of DM purchases	$8,240
Beginning DM inventory	$854
DM available for use	$9,094
Budgeted cost of desired ending DM inventory:	
[6,500 units x 0.3 lbs/unit] x 20% x $4/lb	$1,560
Budgeted cost of DM to be used	$7,534

Q2: Operating Budget Example

Prepare the April ending inventories budget for finished goods.

Budgeted cost of DM to be used	$7,534
Budgeted cost of DL	$15,120
Total budgeted overhead	$174,560
Total budgeted manufacturing costs	$197,214
Required production in units	6,300
Budgeted manufacturing cost per unit	$31.3037
Budgeted ending FG inventory in units	700
Budgeted cost of ending FG inventory	$21,913

Q2: Operating Budget Example

Assume that Stanley J's April 1 finished goods inventory had a cost of $12,146. Prepare the cost of goods sold budget for April.

Cost of goods sold budget	
Beginning FG inventory	$12,146
Total budgeted manufacturing costs	$197,214
Cost of goods available for sale	$209,359
Less: budgeted ending FG inventory	$21,913
Budgeted cost of goods sold	$187,447

Q2: Operating Budget Example

Stanley J's budget for April includes $22,000 for administrative costs, $34,000 for fixed distribution costs, $18,000 for research and development, and $13,000 for fixed marketing costs. Additionally, the budgeted variable costs for distribution are $0.75/unit sold and the budgeted variable costs for marketing are 4% of sales revenue. Prepare the support department budget for April.

Support department budget		
Administration		$22,000
Distribution: Fixed costs	$34,000	
Variable costs	$4,500	$38,500
Research & development		$18,000
Marketing: Fixed costs	$13,000	
Variable costs	$16,320	$29,320
Total budgeted support department costs		$107,820

Q2: Operating Budget Example

Suppose that Stanley J's income tax rate is 28%. Prepare the budgeted income statement for April.

Budgeted income statement		
Sales revenue		$408,000
Cost of goods sold		$187,447
Gross margin		$220,553
Operating costs:		
Administration	$22,000	
Distribution	$38,500	
Research & development	$18,000	
Marketing	$29,320	$107,820
Net income before taxes		$112,733
Income taxes		$31,565
Net income		$81,168

Q4: Budget Variances

- Managers compare actual results to budgeted results in order to
  - Monitor operations, and
  - Motivate appropriate performance.

- Differences between budgeted and actual results are called budget variances.
  - Variances are stated in absolute value terms, and labeled as Favorable or Unfavorable.

Q4: Budget Variances

- Reasons for budget variances are investigated.

- The investigation may find:
  - Inefficiencies in actual operations that can be corrected.
  - Efficiencies in actual operations that can be replicated in other areas of the organization.
  - Uncontrollable outside factors that require changes to the budgeting process.

Q3: Static Budgets

- A budget prepared for a single level of sales volume is called a static budget.
- Static budgets are prepared at the beginning of the year.
- Differences between actual results and the static budget are called static budget variances.

Q3: Flexible Budgets

- A budget prepared for a multiple levels of sales volume is called a flexible budget.
- Flexible budgets are prepared at the beginning of the year for planning purposes and at the end of the year for performance evaluation.
- Flexible budgets are also used for sensitivity analysis and to manage risk due to uncertainty.
- Differences between actual results and the flexible budget are called flexible budget variances.

Q3, Q4: Flexible Budget Example

Tina's Trinkets is preparing a budget for 2006. The budgeted selling price per unit is $10, and total fixed costs for 2006 are estimated to be $5,000. Variable costs are budgeted at $3/unit. Prepare a flexible budget for the volume levels 1,000, 1,100, and 1,200 units.

	Volume Levels		
Sales in units	1,000	1,100	1,200
Revenues	$10,000	$11,000	$12,000
Variable costs	$3,000	$3,300	$3,600
Contribution margin	$7,000	$7,700	$8,400
Fixed costs	$5,000	$5,000	$5,000
Operating income	$2,000	$2,700	$3,400

Q3, Q4: Static Budget Variances Example

Suppose that Tina's 2006 static budget was for 1,100 units of sales. The actual results are given below. Compute the static budget variances for each row and discuss.

	Static Budget	Actual Results	Static Budget Variance	
Sales in units	1,100	980		
Revenues	$11,000	$9,604	$1,396	Unfavorable
Variable costs	$3,300	$2,989	$311	Favorable
Contribution margin	$7,700	$6,615	$1,085	Unfavorable
Fixed costs	$5,000	$4,520	$480	Favorable
Operating income	$2,700	$2,095	$605	Unfavorable

Q3, Q4: Flexible Budget Variances Example

Compute the flexible budget variances for Tina and discuss the results. Compare the flexible budget variances to the static budget variances on the prior page.

	Year-end Flexible Budget	Actual Results	Flexible Budget Variance	
Sales in units	980	980		
Revenues	$9,800	$9,604	$196	Unfavorable
Variable costs	$2,940	$2,989	$49	Unfavorable
Contribution margin	$6,860	$6,615	$245	Unfavorable
Fixed costs	$5,000	$4,520	$480	Favorable
Operating income	$1,860	$2,095	$235	Unfavorable

Q3, Q4: Performance Evaluation

- A static budget variance includes effects from output volume.
- A flexible budget variance removes these output volume effects.
- Other adjustments to the year-end flexible budget may be made for a fair performance evaluation, such as
  - Input price changes outside the control of the manager under evaluation
  - Fixed cost increases outside the control of the manager under evaluation

Q5: Behavior Tensions in Budgeting

- Budgets used to evaluate performance and compensation can create behavioral tension
- Participative budgeting – when managers who are responsible for the budgets prepare the budget forecasts
  - Can result in budgetary slack – when managers set targets so low that goals can be met easily (and bonuses achieved)
- Budget ratcheting – when top managers set targets
  - If targets unachievable, this can result in employees having little motivation to meet targets
- Organizations must watch for budget manipulation

Q6: Other Budgeting Approaches

- Zero based budgets are prepared without using past information as justification.
- Rolling budgets are prepared frequently for overlapping time periods and actual results may be used to update the budget for the next period.
- Kaizen budgets plan cost reductions over time.
- Activity based budgets use more cost pools and cost drivers.
- GPK and RCA budgets (route cause analysis) identify fixed and variable cost functions at the resource center level.
- Beyond budgeting uses external benchmarks to evaluate managers' performance

Performance reports

Performance reports

- **Responsibility accounting:**

  A management accounting system that encourages individuals to work together towards the achievement of organisational goals.

- **Performance reports:**

  A yardstick which compares actual results with the budget.

Responsibility accounting

- Where each division, branch or other sub-unit is known as a **responsibility centre**, the manager of which is accountable for the performance of the sub-unit.

- **Responsibility centers:**
  - Cost centre
  - Revenue centre
  - Profit centre
  - Investment centre

- **Performance reports** show any variance that may arise when actual figures are compared with budget figures.

- **Favourable variance (F)** means that actual income is >budgeted income or actual cost is <budgeted cost.

- **Unfavourable variance (U)** means that actual income is <budgeted income or actual cost is >budgeted cost.

- **Significant variances** (exceed an acceptable limit) are investigated by the manager of the organisational sub-unit.What is considered significant varies from business to business.

- **Reasons for variances** are numerous but fall into two main groups:
  1. are a result of external factors that management have no control over, and
  2. are a result of internal factors that management maybe able to change.

Objective of responsibility accounting

- Management by exception means that an appropriate person is notified when there is a significant deviation from plan.
- Performance reports highlight the areas that need attention.
- Major objective is to ensure that the set targets are achieved at all costs, not trying to find who is to blame.

Purpose of budgets

Purpose of budgets

- **Planning:**
  Necessitates setting of goals and establishing actions needed to attain goals.
- **Organising:**
  Involves the allocation of resources.
- **Leading:**
  Two main aspects are communicating & motivating.
- **Controlling:**
  Process of setting standards, measuring current performance and taking remedial action if needed.

Behavioral aspects of budgeting

- To maintain supportive and cooperative relationships with staff.
- The use of punishment (authoritarian style) tends to encourage attempts to 'beat the system'.
- Padding the budget means overestimating costs and/or underestimating revenue.
- Participation in the budgetary process tends to result increased productivity and satisfaction.

Advantages arising out of staff participation

- Improved communication.
- Greater understanding of what is involved.
- Opportunity to thrash out problems.
- Increased acceptance.
- Improved commitment.

Factors affecting behaviour

- Targets perceived by employees as being too difficult.
- Targets that do not provide any challenge.
- Insufficient flexibility.
- Narrow-minded managers.
- Emphasis on financial goals to the detriment of non-financial goals.

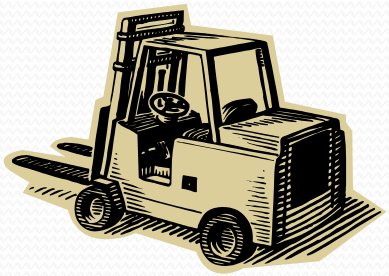
Operational Performance Measurement: Sales, Direct-Cost Variances Analysis, and the Role of Nonfinancial Performance Measures

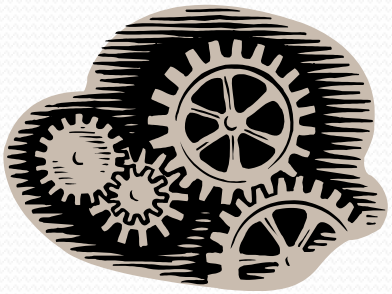
Learning Objectives

- Explain the essence of *control systems* in general and *operational control* systems in particular
- Explain the total operating-income variance for a given period
- Develop a general framework for subdividing the total operating-income variance into component variances
- Develop standard costs for product costing, performance evaluation, and control

Learning Objectives

- Record standard cost flows and associated variances in a standard cost system
- Discuss major operating functions and the need for nonfinancial-performance indicators





Management Accounting & Control Systems

- *Control* = set of procedures, tools, and systems organizations use to monitor activities and to achieve organizational goals
- *Management accounting & control system* = core performance-measurement system of the organization, including both *planning* and *feedback* components:
  - Management Control Systems
  - Operational Control Systems → short-term operating performance

Evaluating Short-Term Operating Performance

- ***Financial Performance Measures:***
  - Standard Cost (and Revenue) Variance Analysis
  - Use of standard costs and flexible budgets
  - Interpretation of variances
- ***Nonfinancial Performance Indicators:***
  - These measures can be leading indicators (predictors) of future financial performance
  - Variance analysis applies here, too!

Short-Term Financial Control

- Master (Static) Budget :
  - Prepared before the start of the period
  - Contains the following items:
    - Budgeted sales volume
    - Budgeted sales price per unit
    - Budgeted variable cost per unit
    - Budgeted total fixed costs

Short-Term Financial Control (continued)

- Flexible (Control) Budget:
  - Prepared at the end of the period (after actual activity is known)
  - Actual sales volume is used, but with budgeted selling price per unit, budgeted variable cost per unit, and budgeted total fixed costs
  - Key to performing *variance analysis* at the end of the period

Short-Term Financial Control (continued)

- Essence of short-term financial control—explain the **total operating-income variance** for the period
- Total operating-income variance = master budget operating income – actual operating income
- The total operating-income variance can be subdivided into the following component variances:
  - Flexible-budget variance (with components)
  - Sales volume variance
- Key tool: use of *standard costs* and *flexible budgets*

Master Budget Example

	Per Unit Amounts	Master Budget
Unit sales		1,000
Sales revenue	$800	$ 800,000
Less variable costs:	$450	450,000
Contribution margin	$350	$ 350,000
Less fixed costs		150,000
Operating income		$ 200,000

Actual Operating Profit Generated

During the period the company actual produced and sold 780 units (not 1,000 as was originally planned). The actual operating income was $128,000, as follows:

Unit sales	780
Sales revenue	$ 639,600
Less: variable costs	350,950
Contribution margin	$ 288,650
Less fixed costs	160,650
Operating income	$ 128,000

Total Operating-Income (Master Budget) Variance for the Period = $72,000 U

	Actual	Master Budget	Variances	
Unit sales	780	1,000	220	U
Sales revenue	$ 639,600	$ 800,000	$160,400	U
Less: variable costs	350,950	450,000	99,050	F
Contribution margin	$ 288,650	$ 350,000	$ 61,350	U
Less fixed costs	160,650	150,000	10,650	U
Operating income	$ 128,000	$ 200,000	$ 72,000	U

Explaining the Total Operating-Income Variance ($72,000 U)

- **The total operating-income variance should be traceable to a combination of the following four factors:**
  - Actual sales *volume* was different than planned
  - Actual *variable cost per unit* was different than planned
  - Actual *total fixed costs* were different than planned
  - Actual *selling price per unit* was different than planned
- **The flexible budget allows us to breakdown the total operating-income variance into components related to each of the above four factors**

Flexible Budget Example

To begin the variance-decomposition process at the end of the period we prepare a flexible (control) budget based on the 780-unit level, as follows:

Units	780
Sales ($800/unit)	$624,000
Variable costs ($450/unit)	$351,000
Contribution margin ($350/unit)	$273,000
Fixed costs	$150,000
Operating income	$123,000

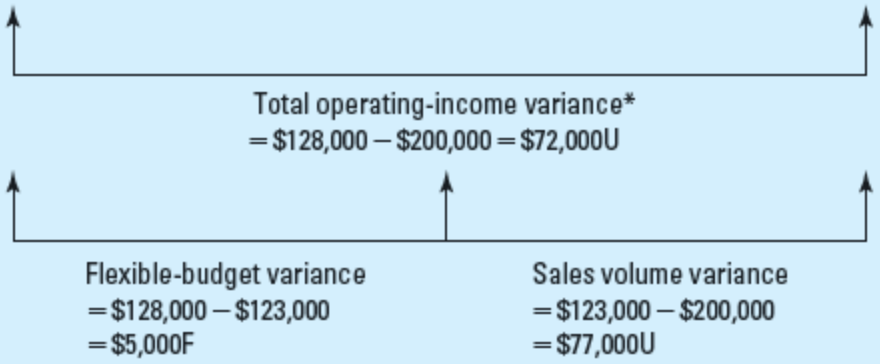
N.B.: Variable cost per unit = $400 manufacturing + $50 selling

Decomposing the Total Operating Income Variance ($72,000 U,)

SCHMIDT MACHINERY COMPANY
Analysis of Financial Results
For October 2013

	(1) Actual	(2) Flexible-Budget Variances	(3) Flexible Budget	(4) Sales Volume Variances	(5) Master (Static) Budget
Units	780	0	780	220U	1,000
Sales	$639,600	$15,600F	$624,000	$176,000U	$800,000
Variable costs	350,950	50F	351,000	99,000F	450,000
Contribution margin	$288,650	$15,650F	$273,000	$ 77,000U	$350,000
Fixed costs	160,650	10,650U	150,000**	0	150,000**
Operating Income	$128,000	$ 5,000F	$123,000	$ 77,000U	$200,000

Analysis of Total Operating-Income Variance



*Also called the *total master (static) budget variance.*
**Budgeted fixed factory overhead cost = $120,000; budgeted fixed selling and administrative expense = $30,000.

Breakdown of Total Operating Income Variance ($72,000 U)

The difference between actual operating income and the flexible budget operating income = **$5,000 F**:

- This difference is called the *total flexible* (controllable) *budget variance*
- This variance captures the net effect of:
  - Actual selling prices per unit being different than planned
  - Actual variable cost per unit was different than planned
  - Actual total fixed costs were different than planned

Breakdown of Total Operating Income Variance (continued)

The difference between the flexible budget operating income and the master budget operating income = **$77,000 U**:

- This difference is called the *sales volume variance*
- Everything else other than volume is being held constant in calculating this variance; hence, the difference in operating income between the two budget columns is due entirely to sales volume being different than planned
- The sales volume variance can also be calculated as: budgeted cm per unit × (actual – budgeted) units
- In the example: $350/unit × 220 units = **$77,000 U**

Breakdown of Total Operating Income Variance: Summary

- Total Operating Income Variance = Actual Operating Income – Master Budget Operating Income

  = $128,000 – $200,000 = **$72,000 U**

- Flexible (Controllable) Budget Variance = Actual Operating Income – Flexible Budget Operating Income

  = $128,000 – $123,000 = **$5,000 F**

Breakdown of Total Operating Income Variance (continued)

- Sales Volume Variance = Flexible-Budget Operating Income – Master Budget Operating Income

  = $123,000 – $200,000 = **$77,000 U**

- Total Operating Income Variance = Flexible-Budget Variance + Sales Volume Variance

  = $5,000F + $77,000U = **$5,300 U**

Breakdown of Total Flexible-Budget Variance ($5,000 F)

Sales Price Variance

= Actual Sales $ – Flexible Budget Sales $

= $639,600 – $624,000 = **$15,600 F**

or, = AQ × (AP – SP)

= 220 units × ($820 – $800)/unit = **$15,600 F**

Breakdown of Total Flexible-Budget Variance ($5,000 F) (continued)

- Total Fixed Cost Variance = Actual Fixed Costs – Flexible Budget Fixed Cost

  = $160,650 – $150,000 = **$10,650 U**

- Note that this budget (spending) variance on fixed costs can be further broken down:
  - First, by functional categories (e.g., Marketing)
  - Second, by individual costs within categories (e.g., Sales Manager Salaries)

Breakdown of Total Flexible-Budget Variance ($5,000F) (continued)

- Total Variable Cost Variance = Actual Variable Costs – Flexible Budget Variable Costs

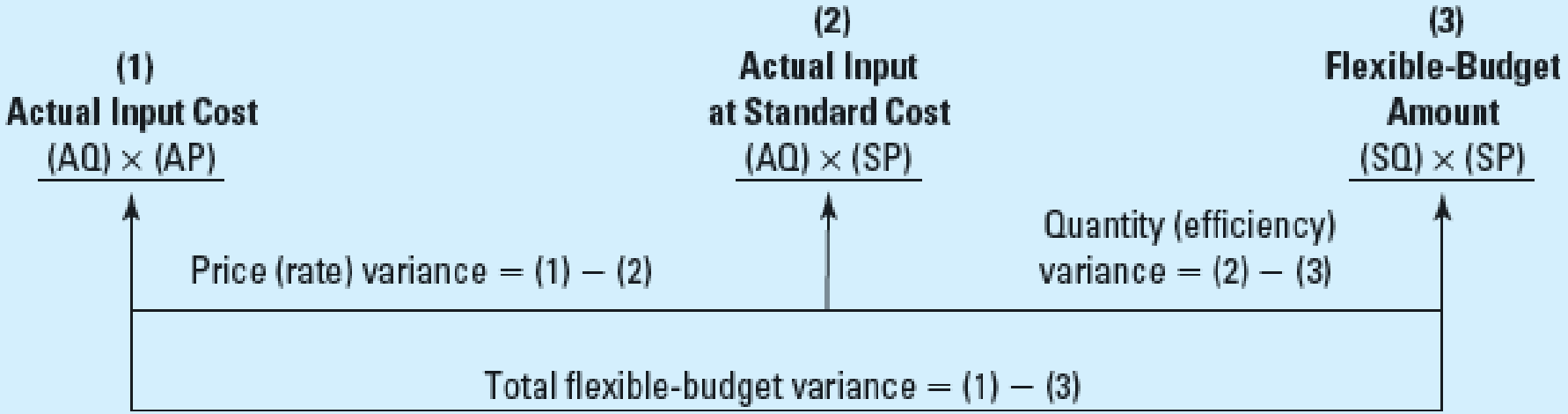
$$= \$350{,}950 - \$351{,}000 = \mathbf{\$50\ F}$$

or, $= AQ \times (AP - SP)$

$$= 780 \text{ units} \times (\$449.9359 - \$450.00)/\text{unit} = \mathbf{\$50\ F}$$

- This total variance can be further broken down:
  - First, by functional categories (e.g., Manufacturing)
  - Second, by individual costs within categories (e.g., Direct Materials Cost)

General Model for Analyzing Variable Cost Flexible Budget Variances



Legend:

AQ = Actual quantity of the resource (e.g., DM) purchased or used

AP = Actual cost per unit of the resource (e.g., per lb.)

SP = Standard cost per unit of the resource

SQ = Standard quantity of the resource that should have been used to produce the output for the period = Units of output × Standard resource input per unit of output

Formulas for Decomposing Variable Cost Flexible Budget Variances into Price and Quantity Components

- **Variable Cost Variance = Actual Variable Costs – Flexible Budget Variable Costs**

  = (AQ × AP) × (SQ × SP)

- **Breakdown of total variance:**
  - Price (Rate) Variance = AQ × (AP – SP)
  - Quantity (Efficiency) Variance = SP × (AQ – SQ)

Formulas for Decomposing Variable Cost Flexible Budget Variances into Price and Quantity Components (continued)

Notes:

- For DM: AQ in the Price Variance formula represents "actual quantity *purchased*"
- SQ = "standard quantity of resource input (e.g., DL) for the output of the period"
- In a standard cost system, these variances are recorded in the formal accounting records (i.e., each in a descriptive account, such as "Direct Labor Rate Variance")

Example: Direct Materials (DM) Variance Decomposition

Hanson Inc. has the following direct material standard to manufacture one unit of "Jerf":

1.5 pounds per Jerf at $4.00 per pound

Last month 1,700 pounds of material were purchased and used to make 1,000 Jerfs. The material cost a total of $6,630.

Direct Materials (DM) Variance: Question 1

What is the actual price per pound (AP) paid for the material?

a. $4.00 per pound.
b. $4.10 per pound.
c. $3.90 per pound.
d. $6.63 per pound.

Answer: Question 1

What is the actual price per pound (AP) paid for the material?

a. $4.00 per pound.

b. $4.10 per pound.

c. $3.90 per pound.

d. $6.63 per pound.



AP = $6,630 ÷ 1,700 lbs. = $3.90 per lb.

Direct Materials (DM) Variance: Question 2

Hanson's materials price variance (PV) for the month was:

a. $170 unfavorable.

b. $170 favorable.

c. $800 unfavorable.

d. $800 favorable.

Answer: Question 2

Hanson's materials price variance (PV) for the month was:

a. $170 unfavorable.
b. $170 favorable.
c. $800 unfavorable.
d. $800 favorable.

$$PV = AQ \times (AP - SP)$$
$$PV = 1{,}700 \text{ lbs.} \times (\$3.90 - 4.00)/\text{lb.} = \$170 \text{ Favorable}$$

Direct Materials (DM) Variance: Question 3

The standard quantity (SQ) of material that should have been used to produce 1,000 Jerfs is:

a. 1,700 pounds.

b. 1,500 pounds.

c. 2,550 pounds.

d. 2,000 pounds.

Answer: Question 3

The standard quantity of material (SQ) that should have been used to produce 1,000 Jerfs is:

a. 1,700 pounds.
b. 1,500 pounds.
c. 2,550 pounds.
d. 2,000 pounds.

SQ = 1,000 units × 1.5 lbs./unit = 1,500 lbs.

Direct Materials (DM) Variance: Question 4

Hanson's material usage variance (UV) for the month was:

a. $170 unfavorable.

b. $170 favorable.

c. $800 unfavorable.

d. $800 favorable.

Answer: Question 4

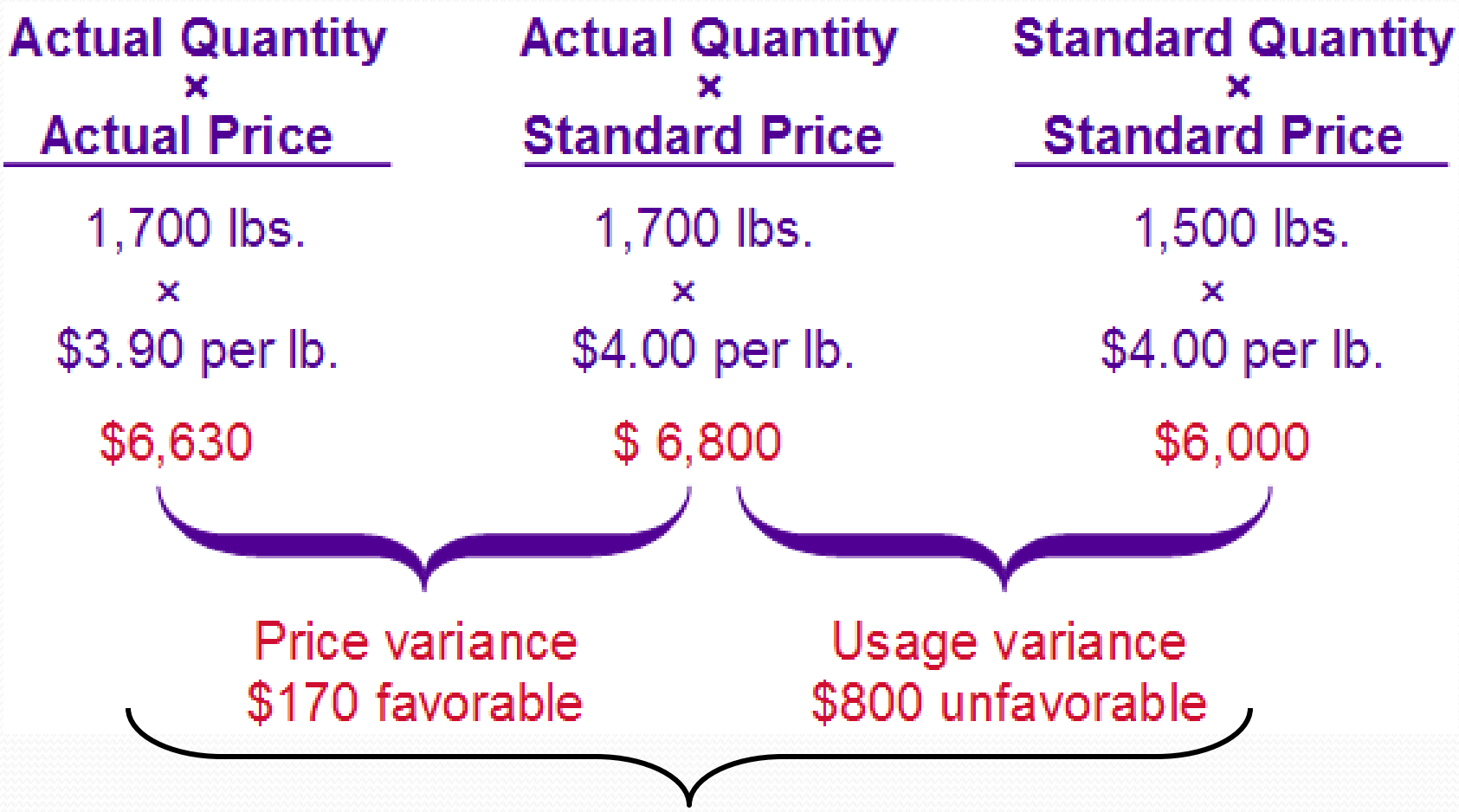
Hanson's material usage variance (UV) for the month was:

a. $170 unfavorable.
b. $170 favorable.
c. $800 unfavorable.
d. $800 favorable.



UV = SP × (AQ – SQ)
UV = $4.00 × (1,700 – 1,500) lbs. = $800 unfavorable

Hanson, Inc. Example: Summary



Total Flexible Budget Variance = $6,630 - $6,000 = $630U

Causes of DM Variances

- **Price Variances:**
  - Purchase of materials of different grade
  - Quantity discounts
  - Freight/delivery expediting cost (“rush orders”)
- **Quantity Variances:**
  - Purchase of non-standard quality materials
  - Poorly trained or poorly supervised workers
  - Poorly maintained machinery (not calibrated properly)

Causes of DL Variances

- **Price (Rate) Variances:**
  - Labor substitution
  - Out-of-date standards (e.g., new labor contract)
- **Quantity (Efficiency) Variances:**
  - Poorly trained workers
  - Poor quality raw materials used in production
  - Poorly maintained equipment
  - Poor supervision of workers
  - Out-of-date standards

Standard Costs

Standard Costs vs. a *Standard Cost System?*

- Standard Costs = costs that should be incurred under efficient operating conditions
- Standard Cost System = standard costs recorded in the formal accounting records
- Regardless of whether a standard cost system is used, standard costs can be useful at the end of the period for *financial control purposes* (i.e., conducting variance analysis)

Standard Costs

- Types of Standards:
  - Ideal (Perfection) Standards
  - Continuous-Improvement Standards
  - Currently Attainable Standards
- Standard-Setting Procedures:
  - Authoritative Standards
  - Participative Standards
- Standard Cost Sheet:
  - Contains both price and quantity components of each cost

Recording Standard Costs: Hanson, Inc. Example

Recording DM Purchases:

Materials Inventory (AQ × SP)	$6,800	
Materials Purchase Price Variance	$ 170	
Accounts Payable (AQ × AP)		$6,630

Recording DM Usage:

Work-in-process Inventory (SQ × SP)	$6,000	
Materials Usage Variance	$ 800	
Materials Inventory (AQ × SP)		$6,800

The Strategic Role of Nonfinancial Performance Indicators

- Limitations of short-term financial-performance indicators?

- Need to focus on business processes, including:
  - operating processes
  - customer-management processes
  - innovation processes
  - social/regulatory processes

The Strategic Role of Nonfinancial Performance Indicators (continued)

- Example: Operating Process—Assessing the Move to JIT
- *Costs* of Implementing JIT?
- *Benefits* of Implementing JIT:
  - reduction in out-of-pocket inventory carrying costs
  - reduction in inventory holding (i.e., opportunity) costs
  - increases in sales, productivity, and market share
  - decreased production costs
- Relevant *nonfinancial performance indicators*:
  - customer-response time (CRT)
  - process cycle efficiency

Summary

- We defined the terms *control systems*, *management accounting & control systems*, *short-term financial control*, and *operational control systems*
- We discussed the development of *standard costs* for product costing, performance evaluation, and control
- We distinguished between *flexible budgets* and *master budgets*; the former are key for evaluating short-term financial performance (i.e., for financial control purposes)

Summary

- The difference between actual operating income and master budgeted operating income = total operating income variance
  - Also called "total master (static) budget variance"
- Through the introduction of a *flexible budget* based on actual output, the total operating income variance is broken down into:
  - A *total flexible-budget variance*, and
  - A *sales-volume variance* = budgeted cm/unit × (actual – budgeted) sales in units

Summary

- The *total flexible-budget variance* is then broken down into component variances:
  - Total variable manufacturing cost variance
  - Total variable selling & administrative cost variance
  - Total fixed manufacturing cost variance
  - Total fixed selling & administrative cost variance
- Further breakdown of the total variable manufacturing cost variance:
  - Total DM variance
  - Total DL variance
  - Total variable overhead variance

Summary

- Breakdown (decomposition) of total DM variance:
  - DM Price Variance:

    = AQ × (AP – SP)
  - DM Quantity Variance:

    = SP × (AQ – SQ)
- Breakdown (decomposition) of total DL variance:
  - DL Price (Rate) Variance:

    = AQ × (AP – SP)
  - DL Quantity (Efficiency) Variance:

    = SP × (AQ – SQ)

Summary

- We discussed how to record manufacturing cost flows and associated variances in a *standard cost system*
  - Standard cost variance analysis for overhead costs is covered in later session
  - The end-of-period disposition of standard cost variance accounts is covered in later session
- Finally, we discussed the strategic role of nonfinancial performance indicators for operational control purposes
  - The basic idea is the need to control business processes, such as operating processes

Operational Performance Measurement: Indirect-Cost Variances and Resource-Capacity Management

Learning Objectives

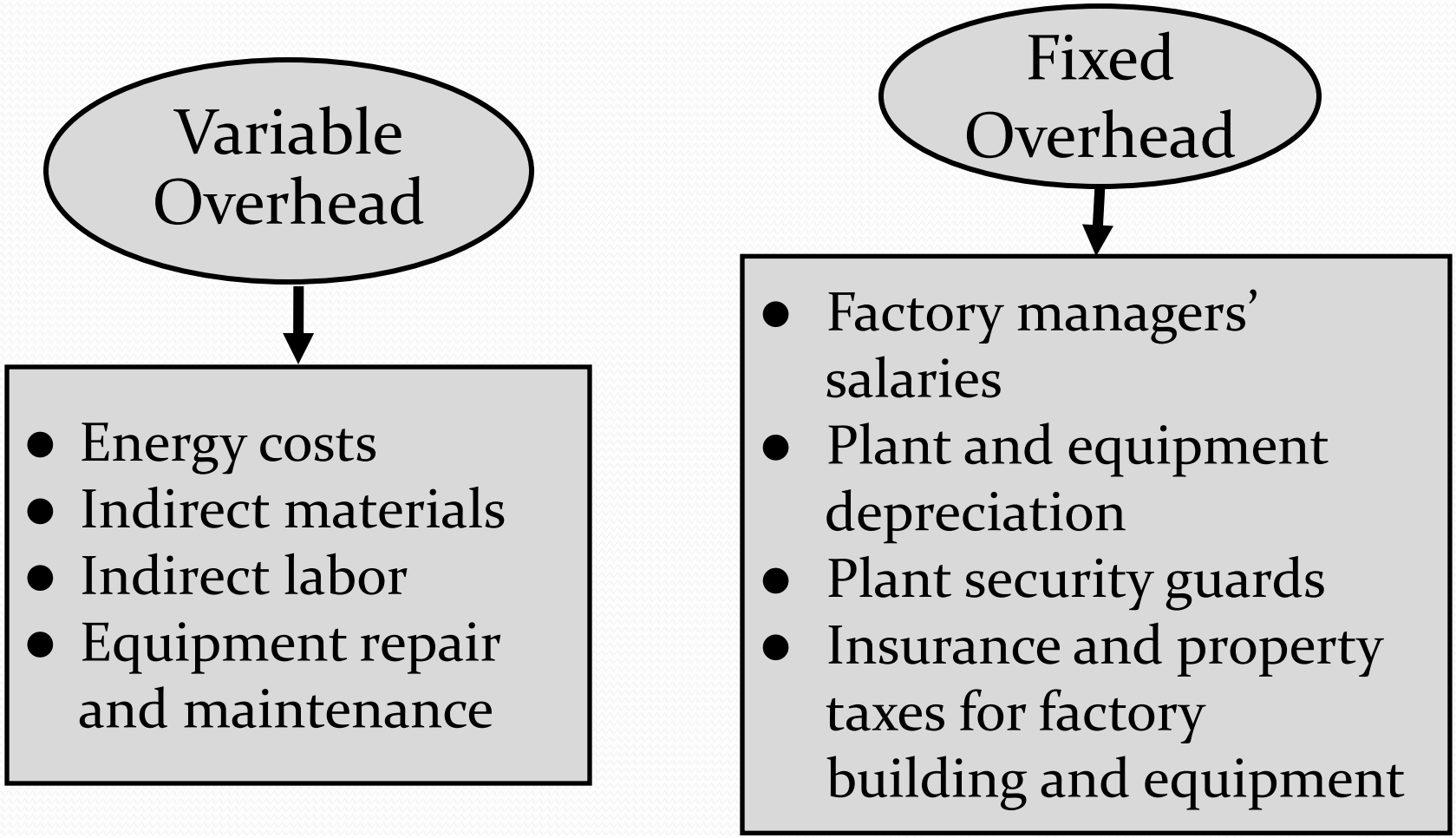
- Distinguish between the product-costing and control purposes of standard costs for manufacturing (factory) overhead
- Calculate and properly interpret standard cost variances for overhead using flexible budgets
- Record overhead costs and associated standard cost variances
- Apply standard costs to service organizations

Learning Objectives (continued)

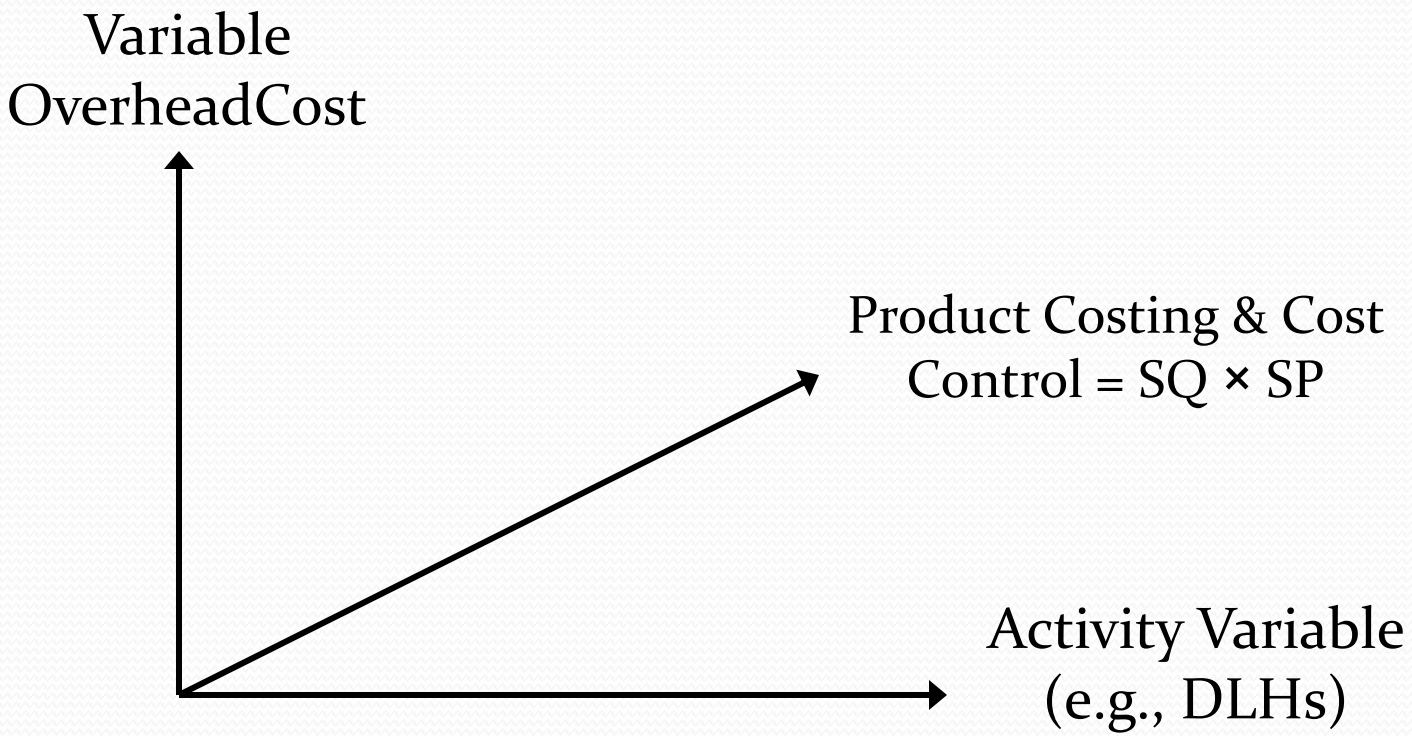
- Analyze overhead variances in a traditional activity-based cost (ABC) system
- Understand decision rules that can be used to guide the variance-investigation decision
- Formulate the variance-investigation decision under uncertainty (Appendix)



Manufacturing (Factory) Overhead Costs: Examples

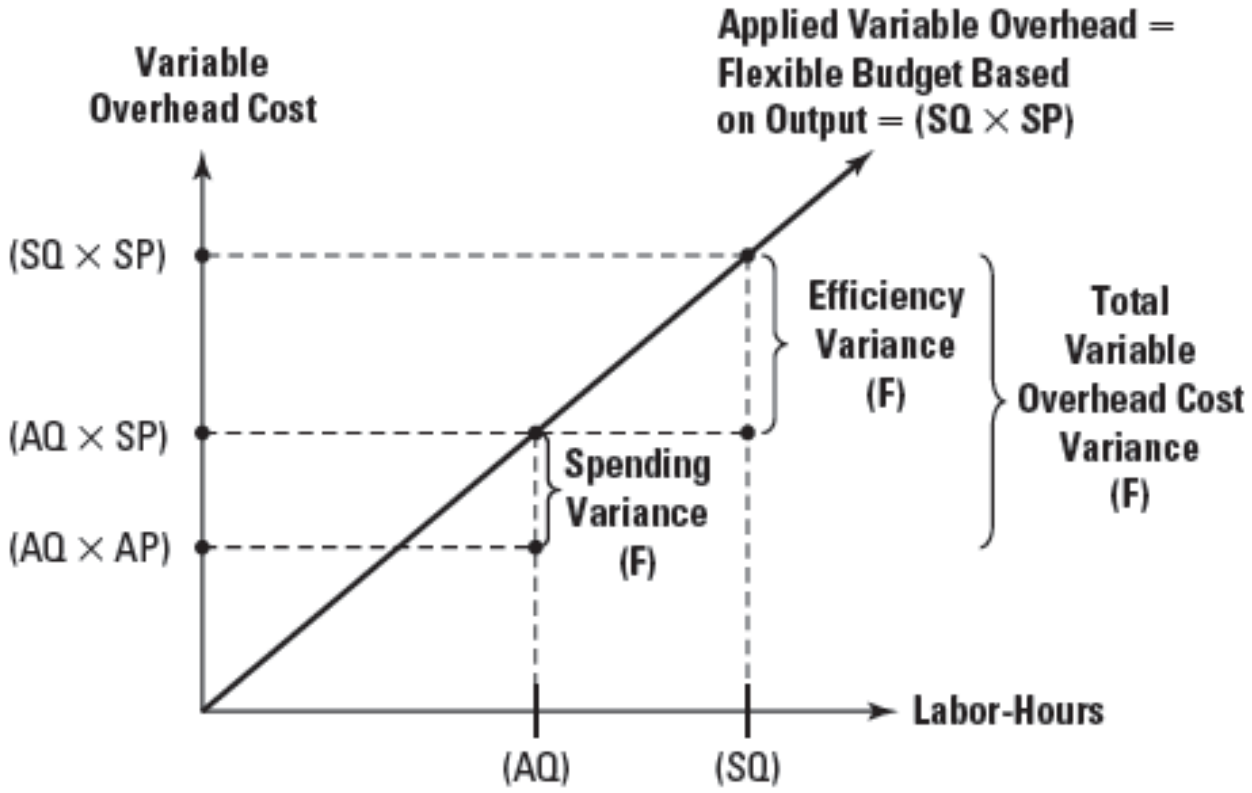


Standard Variable Overhead Costs: Product Costing vs. Control



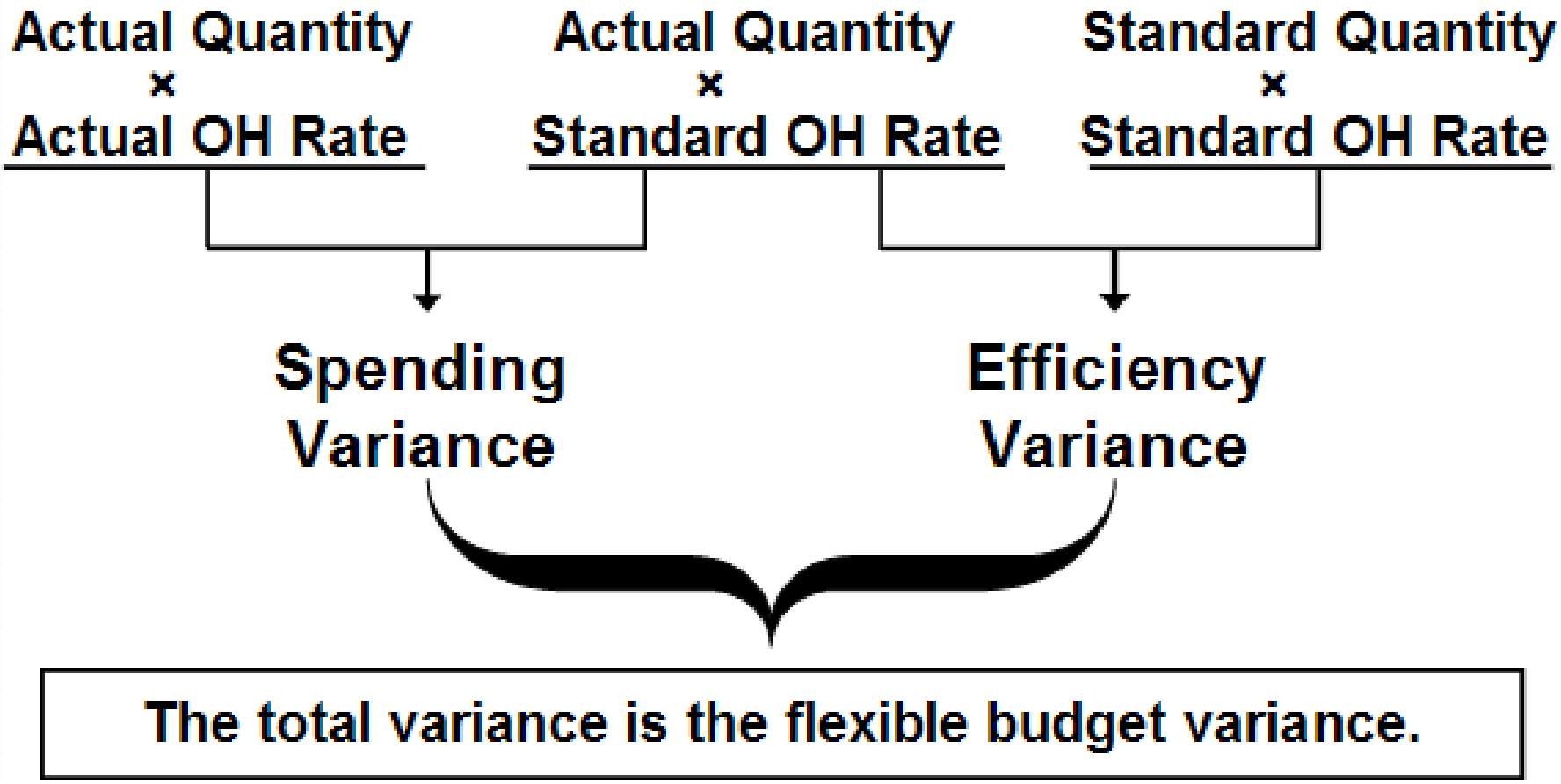
SQ = Standard allowed DLHs for units produced; SP = Standard *variable* overhead cost/DLH

Variable Overhead Variance Analysis

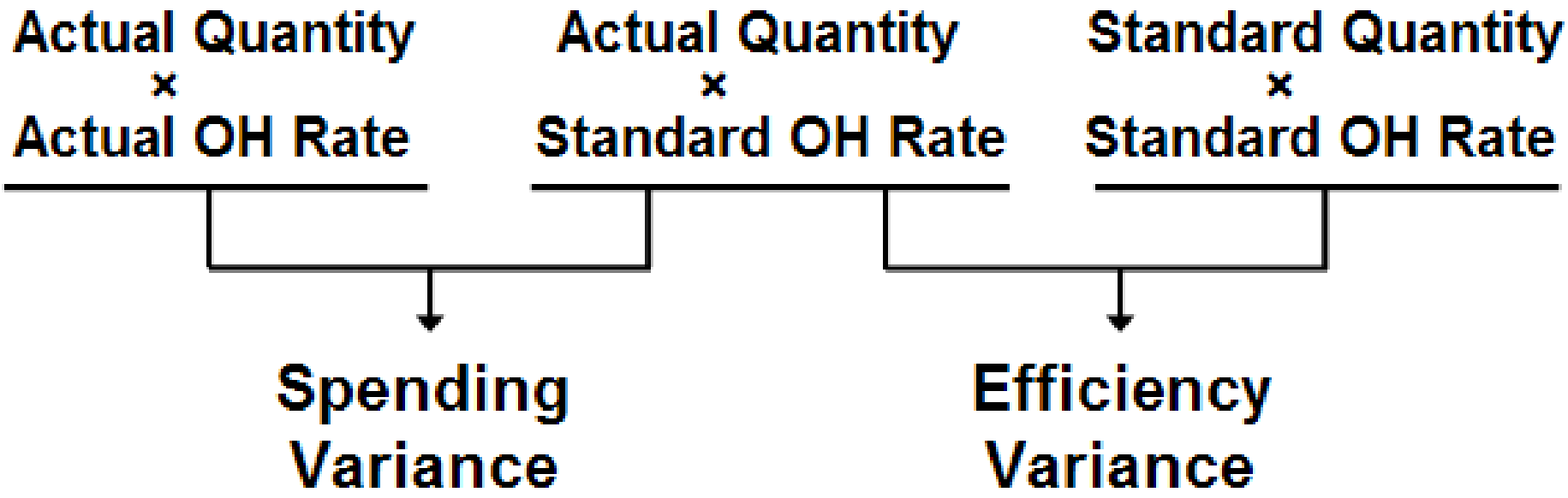


Legend: SQ = Standard direct labor-hours allowed for units produced = 5 hours/unit × 780 units = 3,900 hours
SP = Standard variable overhead cost per labor-hour = $12 (see Exhibit 15.2)
AQ = Actual labor-hours worked = 3,510 hours (Exhibit 14.6)
AP = Actual variable overhead cost per labor-hour worked = $40,630 ÷ 3,510 = $11.5755 (rounded)
Total variable overhead variance = Spending variance + Efficiency variance
F = A favorable effect on operating income

Variable Overhead Variance Analysis: Equation Approach



Variable Overhead Variance Analysis: Equation Approach (continued)



AQ x (AR - SR)	SR x (AQ - SQ)
AQ = Actual Quantity AR = Actual Rate	SR = Standard Rate SQ = Standard Quantity

Variable Overhead Variance Analysis: Example Calculations

Schmidt Machinery Co. applies variable factory overhead on the basis of DLHs. Hanson has the following variable factory overhead standard to manufacture one unit of product:

5.0 standard DLHs per unit @ a standard variable overhead rate of $12.00 per DLH

In October 2010, 3,510 hours were worked to make 780 units, and $40,630 was spent for variable factory overhead

Variable Overhead Variance Analysis: Example Calculations (continued)

Actual Hours	Actual Hours	Standard Hours
x	x	x
Actual Rate	Standard Rate	Standard Rate
3,510 DLHs	3,510 DLHs	3,900 DLHs
x	x	x
$11.5755/DLH	$12.00/DLH	$12.00/DLH
$40,630	**$42,120**	**$46,800**



Spending Variance	Efficiency Variance
$1,490 F	**$4,680 F**

Variable Overhead Variance Analysis: Alternative Presentation Format

Total Variable Overhead Variance = Actual Variable Overhead – Flexible Budget for Variable Overhead

= $40,630 – $46,800 = **$6,170 F**

Variable Overhead *Spending* Variance = AQ × (AP – SP)

= 3,510 DLHs × ($11.5755 – $12.00)/DLH = **$1,490 F**

Variable Overhead *Efficiency* Variance = SP x (AQ – SQ)

= $12.00/DLH x (3,510 – 3,900) DLHs = **$4,680 F**

Interpretation of Variable Overhead Cost Variances

Spending Variance

Results from spending more or less than expected for overhead items such as supplies and utilities.

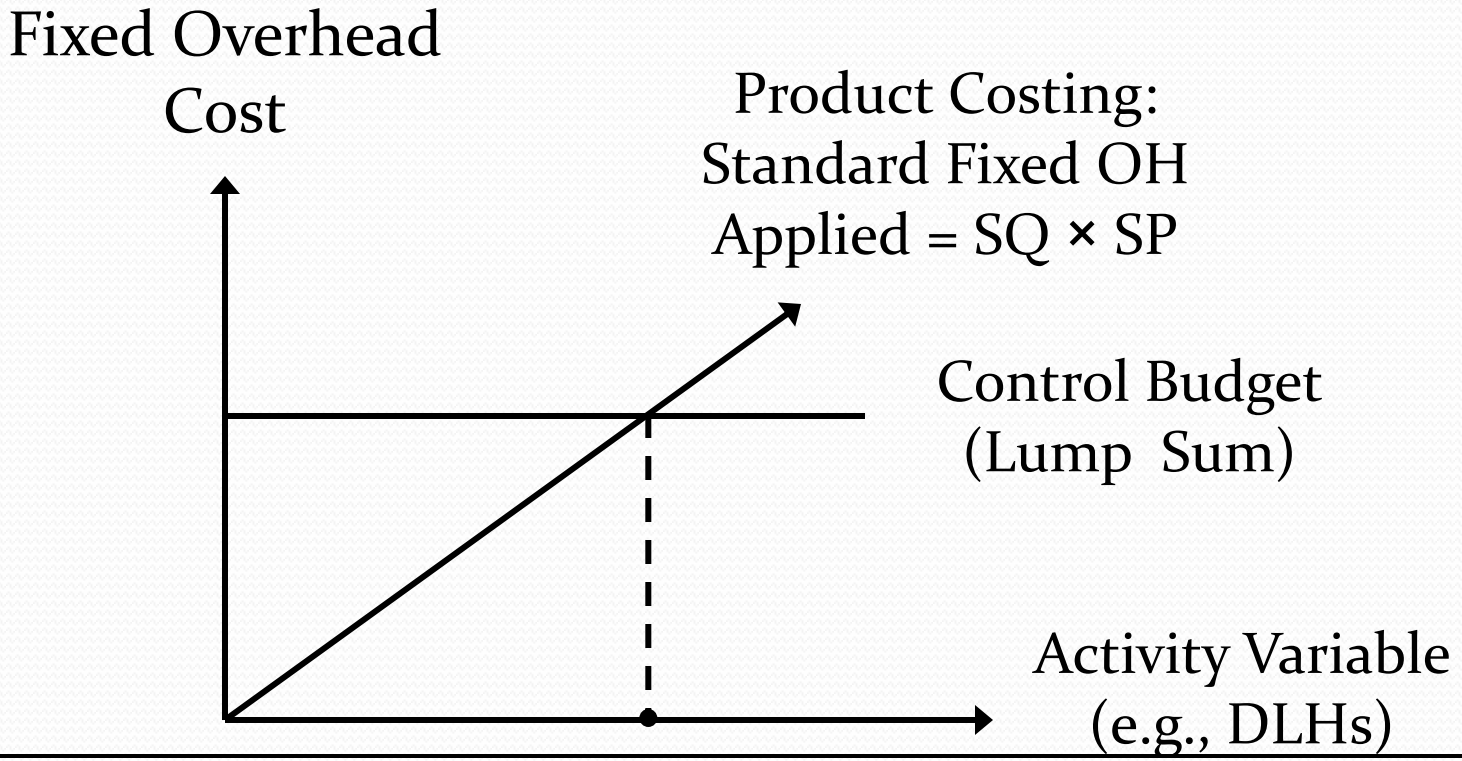


Efficiency Variance

Reflects efficiency or inefficiency in the use of the selected activity measure; does *not* reflect overhead control.



Standard Fixed Overhead Cost: Planning vs. Control



SQ = Standard allowed DLHs for units produced; SP = Standard *fixed* overhead cost/DLH; denominator volume = no. of DLHs used to set the fixed overhead application rate.

Product Costing: Determining the Standard Fixed Overhead Application Rate

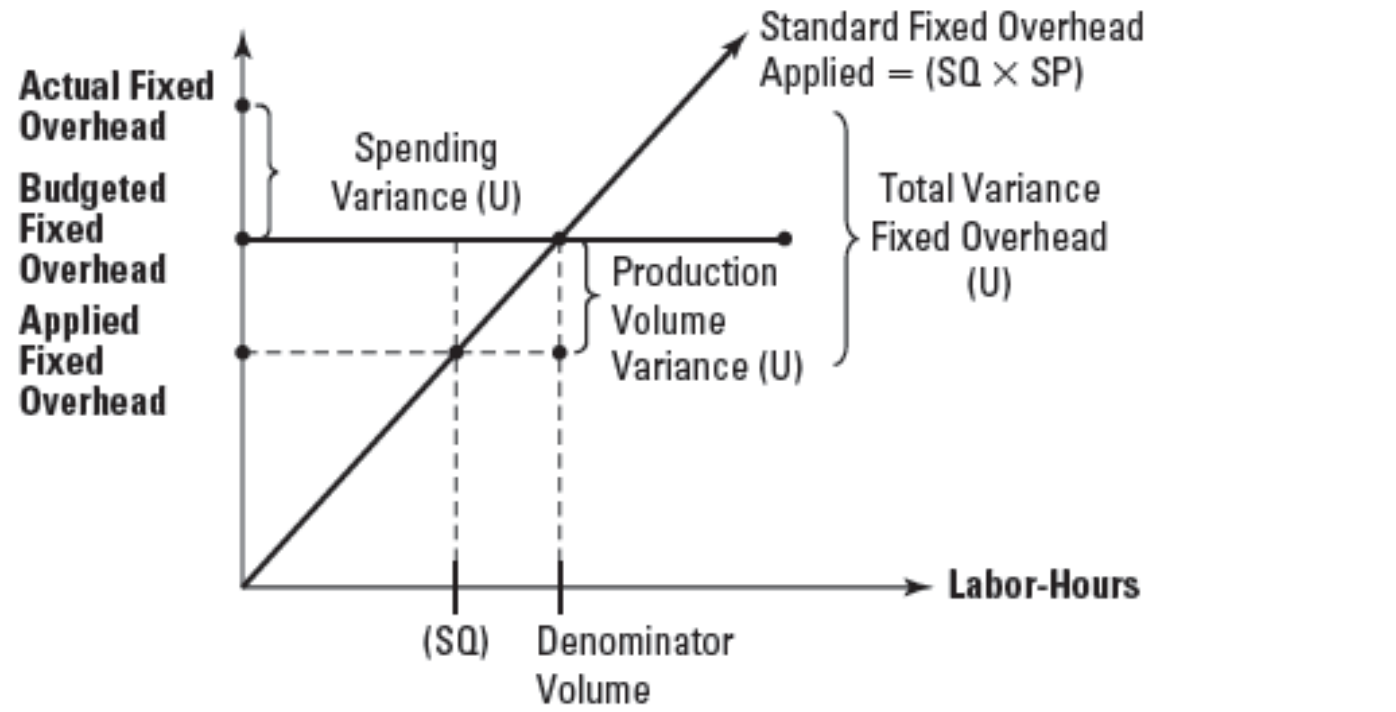
❶ Determine the total budgeted fixed manufacturing overhead for the upcoming period

❷ Select an activity variable for applying fixed factory overhead costs to outputs

❸ Choose a denominator volume level for the selected activity variable(e.g., “practical capacity”)

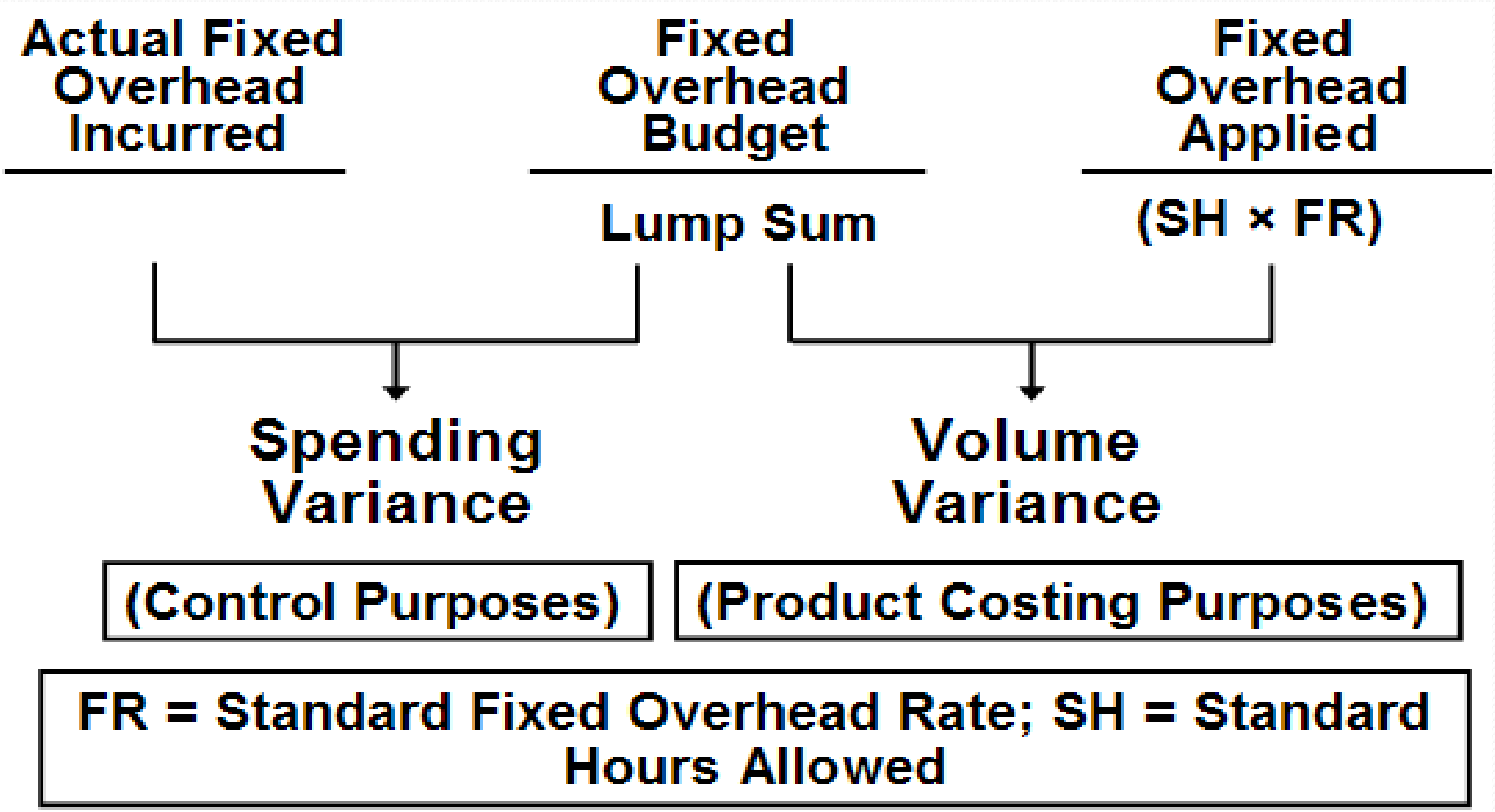
❹ Divide the amount in Step 1 by the amount in Step 3 to determine the standard fixed overhead application rate for product-costing purposes

Fixed Overhead Variance Analysis



Legend: SQ = Standard labor-hours allowed for units produced = 5 × 780 = 3,900 hours
Denominator volume = Number of labor-hours used to determine the fixed overhead application rate = 5,000 (i.e., 1,000 units × 5 hours/unit)
Budgeted fixed overhead = $120,000 (assumed)
SP = Standard fixed overhead cost per labor-hour = $120,000 ÷ 5,000 = $24 (see Exhibit 15.2)
Actual fixed overhead = $130,650 (assumed)
Total fixed overhead variance = Spending variance + Production volume variance

Calculating Fixed Overhead Variances



Example: Calculating Fixed Overhead Variances

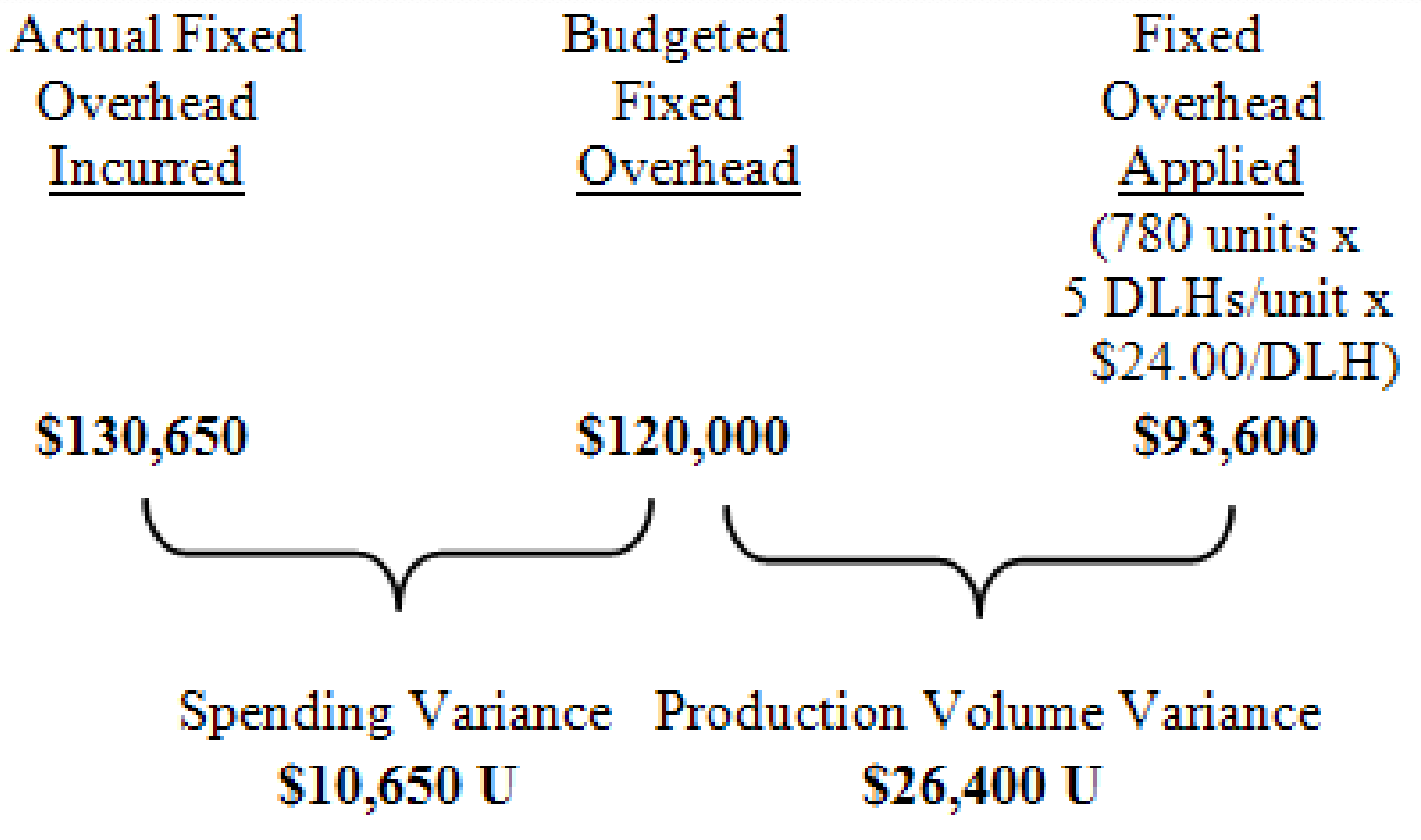
Schmidt's budgeted fixed manufacturing overhead cost is $120,000 for October 2010. The budgeted activity measure for the month is 1,000 units (@ 5 DLHs/unit).

Actual production is 780 units and actual fixed overhead is $130,650 for the month.

Compute the fixed overhead *spending* and *production volume* variances.

$$FR = \frac{\$120{,}000 \text{ budgeted fixed overhead}}{5{,}000 \text{ DLHs}} = \$24.00/\text{DLH}$$

Example: Calculating Fixed Overhead Variances



Fixed Overhead Variance Analysis: Alternative Presentation Format

Total Fixed Overhead Variance = Actual Fixed Overhead – Fixed Overhead Applied to Production

= $130,650 – $93,600 = **$26,400 U** (also called *Under*applied fixed overhead)

Fixed Overhead Spending (Budget) Variance

= Actual Fixed Overhead – Budgeted Fixed Overhead
= $130,650 – $120,000 = **$10,650 U**

Fixed Overhead Production Volume Variance

= Budgeted Fixed Overhead – Applied Fixed Overhead
= $120,000 - $93,600 = **$26,400 U**

Fixed Overhead Production Volume Variance: Alternative Calculation

Fixed Overhead Production Volume Variance = Standard Fixed Overhead Application Rate × (Actual Units Produced – Denominator Volume, in units)

= $120.00/unit × (780 – 1,000) units

= **$26,400 U** (i.e., *under*applied fixed overhead)

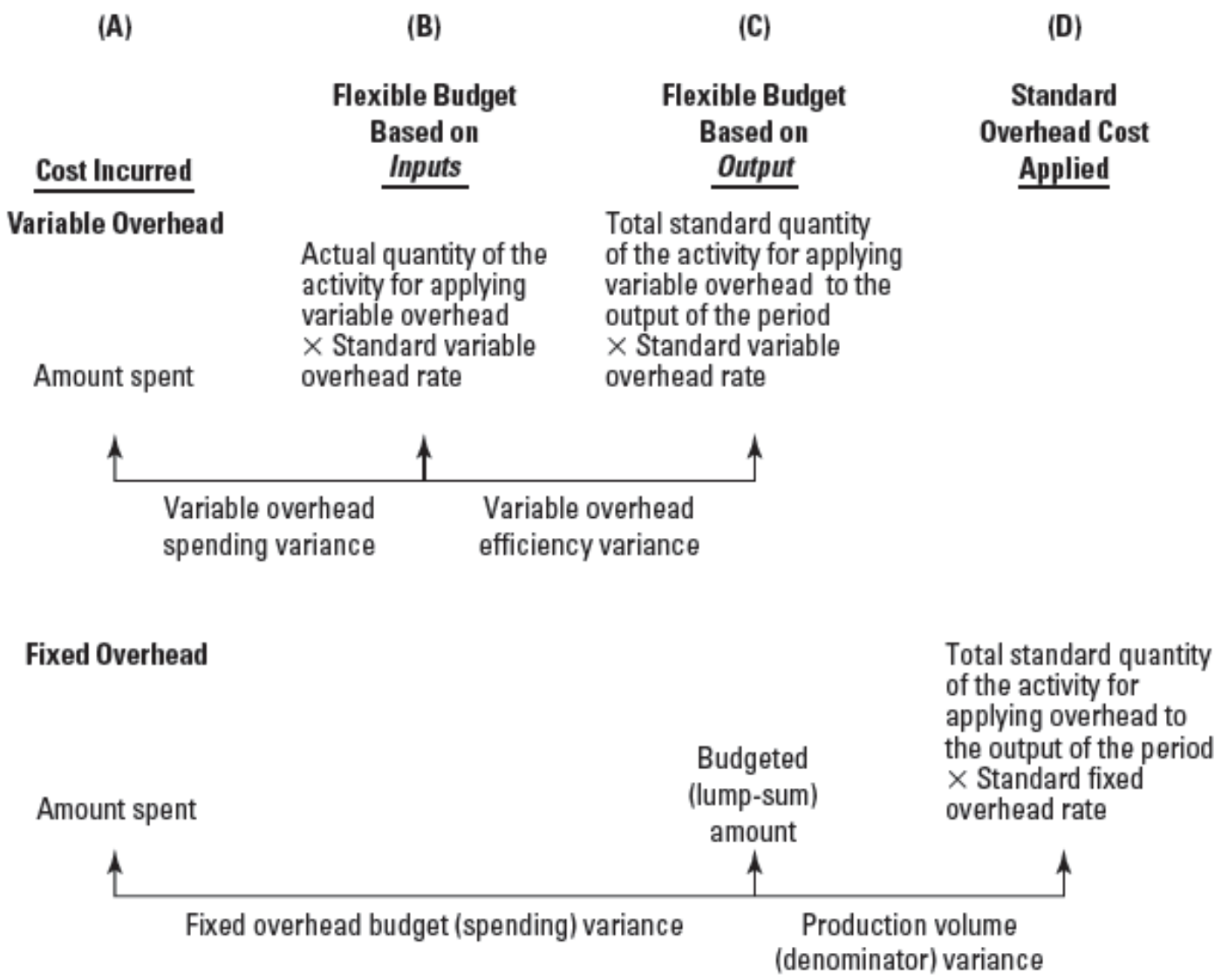
Interpretation of Fixed Overhead Variances

Spending (Budget) Variance	Production Volume Variance
Results from spending more or less than expected for individual fixed overhead items. That is, spending on individual fixed overhead items was different than planned.	Results from operating at a level other than the denominator volume level. Arises because of the *product-costing* purpose of fixed overhead. Not of direct interest for control purposes.

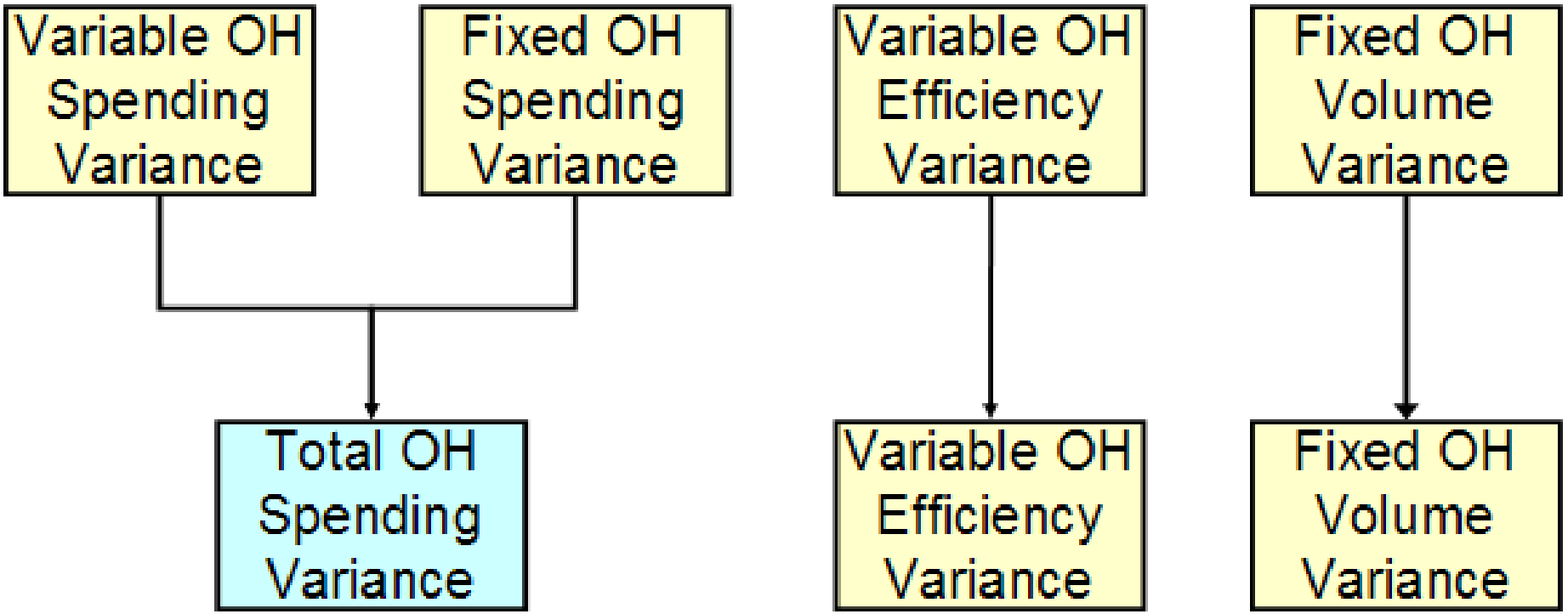
Causes of Fixed Overhead Variances

- Spending (Budget) Variance:
  - Ineffective budget procedures
  - Inadequate control of costs
  - Misclassification of cost items
- Production Volume Variance:
  - Management decisions
  - Unexpected changes in market demand
  - Unforeseen problems in manufacturing operations

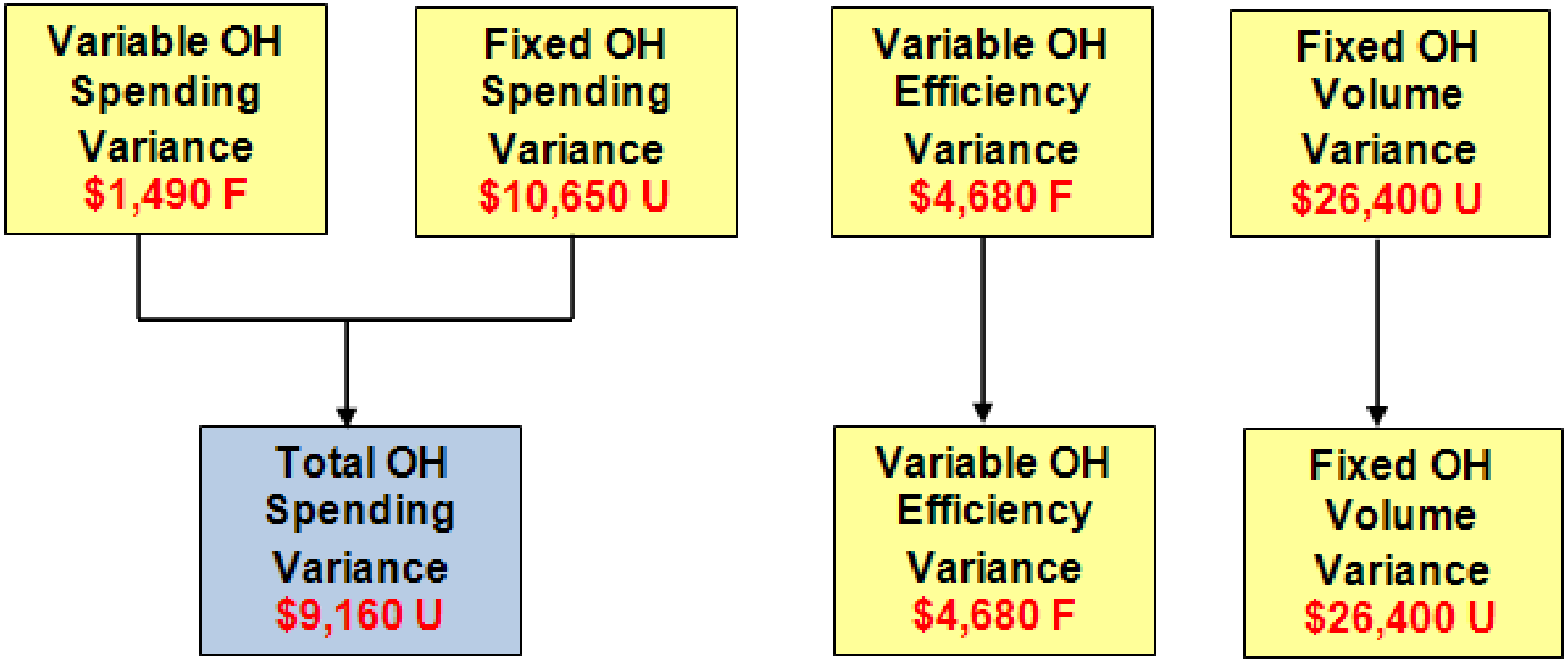
Four-Way Breakdown of the Total Overhead Variance: Summary



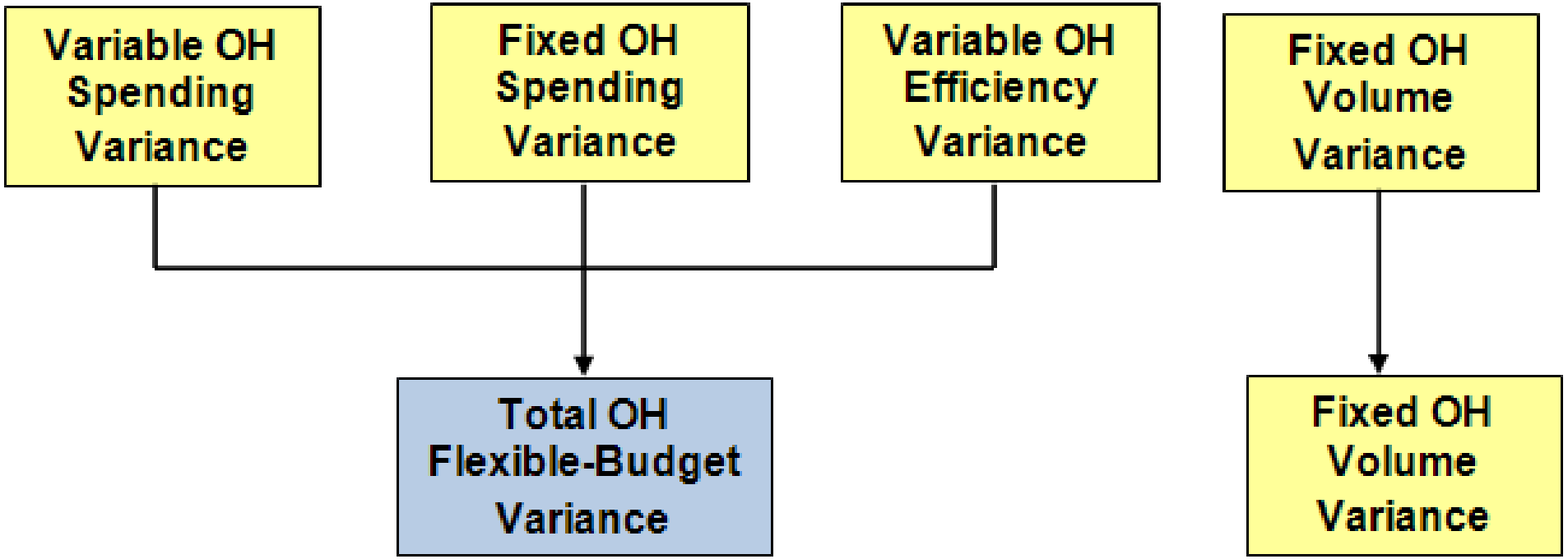
Alternative Analysis: Three-Way Breakdown of the Total Overhead Variance



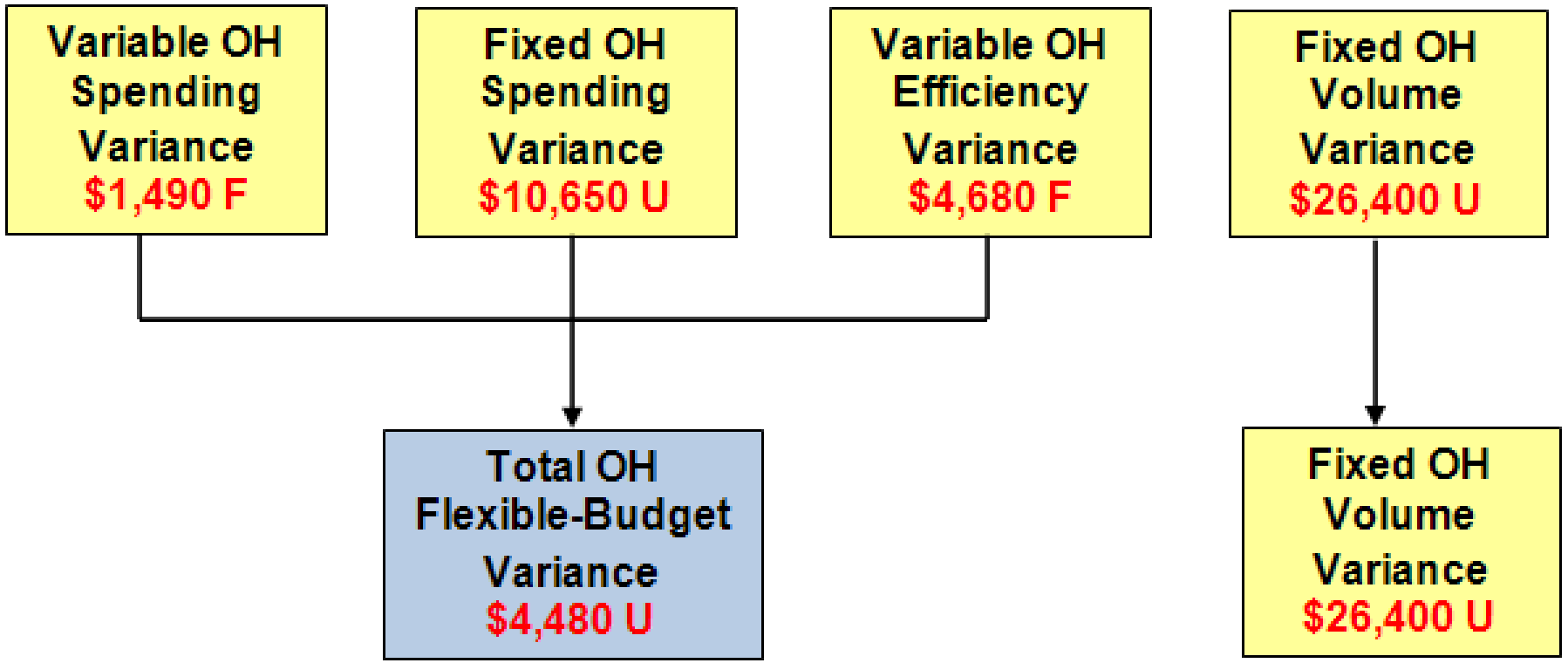
Schmidt Company: Three-Way vs. Four-Way Analysis of Total Factory Overhead Variance



Two-Way Analysis of Total Factory Overhead Variance



Schmidt Company: Two-Way Analysis of Total Factory Overhead Variance



Disposition of Standard Manufacturing Cost Variances

Schmidt Company
Manufacturing Cost Variances

From Chapter 14:	
DM purchase price variance	$ 4,350 U
DM usage variance	10,350 U
DL rate variance	7,020 U
DL efficiency variance	15,600 F
From Chapter 15:	
Variable factory overhead spending variance	1,490 F
Variable factory overhead efficiency variance	4,680 F
Fixed overhead spending variance	10,650 U
Fixed overhead production volume variance	26,400 U
Net manufacturing cost variance	$ 37,000 U

Alternative 1: Close Net Manufacturing Cost Variance to CGS

Dr. CGS (net variance)	**$37,000**	
Dr. DL Efficiency Variance	15,600	
Dr. VOH Efficiency Variance	4,680	
Dr. VOH Spending Variance	1,490	
Cr. DM Purchase Price Variance		$4,350
Cr. DM Quantity (Efficiency) Variance		10,350
Cr. DL rate variance		7,020
Cr. FOH spending variance		10,650
Cr. FOH Production Volume Variance		26,400

Income Statement after Disposition of Net Manufacturing Cost Variance

SCHMIDT MACHINERY COMPANY
Income Statement
For 2013

Sales (Exhibit 14.4), at standard selling price	$624,000	
Add: Selling price variance (Exhibit 14.4)	15,600F	
Net sales, at actual selling price		$639,600
Cost of goods sold (at standard: 780 units × $520/unit) (Exhibit 15.2)	$405,600	
Add: Net manufacturing cost variance	+37,000U[†]	
Total cost of goods sold		442,600
Gross margin		$197,000
Selling and administrative expenses ($39,000 variable + $30,000 fixed)		69,000
Operating income (before disposition of sales volume variance)		$128,000

Alternative 2: Prorate (Allocate) Net Manufacturing Cost Variance

- If the net variance is considered *material*, then the variance should be allocated (prorated) to the Inventory and CGS accounts
- Allocation should be based on the relative amount of this period's standard cost in the end-of-period balance of each affected account
- For external-reporting purposes, the provisions of FAS #151 regarding the treatment of "abnormal amounts" of idle-capacity expense must be followed

Effects on Absorption Costing Income of Denominator-Level Choice for Allocating Fixed Overhead Costs

- The issue: management's ability to *manage (or "smooth") reporting earnings*
- This ability is related to alternative treatments (dispositions) of the production volume variance
- The amount of fixed overhead cost absorbed into inventory or released as an expense on the income statement is affected by the denominator chosen for the fixed overhead application rate
- Income manipulation can occur if the production-volume variance is written off entirely to CGS

Standard Costs Applied to Service Organizations

- Jobs with repetitive tasks lend themselves to efficiency measures
- Computing non-manufacturing efficiency variances requires some assumed relationship between input and output activity



Examples

Service Applications (continued)

Department	Input	Output
Mailing	Labor hours	Number of pieces mailed
Personnel	Labor hours	Number of personnel changes processed
Food service	Labor hours	Number of meals served
Consulting	Billable hours	Customer revenues
Nursing	Labor hours	Number of patients and/or procedures
Check Processing	Computer hours	Number of checks processed

Overhead Cost Variances in ABC Systems

Traditional Approach to Product Costing :

Cost Item	Variable	Per	Fixed
Direct materials	$20	Unit	
Direct labor	30	DLH	
Indirect materials	2	DLH	
Repair and Maintenance	5	DLH	
Receiving			$5,000
Engineering Support			30,000
Setup			75,000

Traditional Financial-Performance Report

Cost Item	Actual Cost	Flexible Budget Based on Output	Flexible Budget Variance	
Direct materials	$50,000	$40,000	$10,000	U
Direct labor	36,000	30,000	6,000	U
Indirect materials	3,000	2,000	1,000	U
Repair and Maintenance	6,500	5,000	1,500	U
Receiving	3,000	5,000	2,000	F
Engineering Support	30,000	30,000	30,000	
Setup	50,000	75,000	25,000	F
Total	$178,500	$187,000	$8,500	F

Flexible Budget Using ABC

Cost Item	Flexible Budget	
Direct materials	$40,000	(2,000 × $20)
Direct labor	30,000	(2,000 × 0.5 × $30)
Indirect materials	2,000	(1,000 × $2)
Repair and Maintenance	6,000	(300,000 × $0.01) + $3,000
Receiving	3,500	(2 × $1,500) + $500
Engineering Support	30,000	($30,000 per period)
Setup	50,000	(2 × $25,000)
Total	$161,500	

Financial-Performance Report Using ABC

Cost Item	Actual Cost	Flexible Budget	Variance	
Direct materials	$50,000	$40,000	$10,000	U
Direct labor	36,000	30,000	6,000	U
Indirect materials	3,000	2,000	1,000	U
Repair and Maintenance	6,500	6,000	500	U
Receiving	3,000	3,500	500	F
Engineering Support	30,000	30,000		
Setup	50,000	50,000		
Total	$178,500	$161,500	$17,000	U

Flexible-Budget Analysis under ABC When There is a Standard Batch Size for Production Activity

- this situation provides the opportunity for a more detailed analysis

- variable setup costs under ABC:
  - convert actual output to standard # of batches
  - convert the above to standard setup hours

Flexible-Budget Analysis under ABC When There is a Standard Batch Size for Production Activity (continued)

- flexible budget cost for variable overhead = standard allowed hours × standard variable overhead cost per setup hour
- calculate flexible-budget variance for variable setup cost
- decompose flexible-budget variance into *spending* and *efficiency* components

Extensions of ABC Analysis: GPK and Resource Consumption Accounting (RCA)

- GPK (~ flexible standard costing) is a detailed German cost-accounting system
- RCA = comprehensive cost-management system represented (approximately) as a cross between GPK and ABC
- These systems rely on a large number of cost centers and cost pools
- Most appropriate with highly routine and repetitive operations

The Variance-Investigation Decision



How do I know which variances to investigate?



Larger variances, in dollar amount or as a percentage of the standard, are investigated first.

The Variance Investigation Decision (continued)

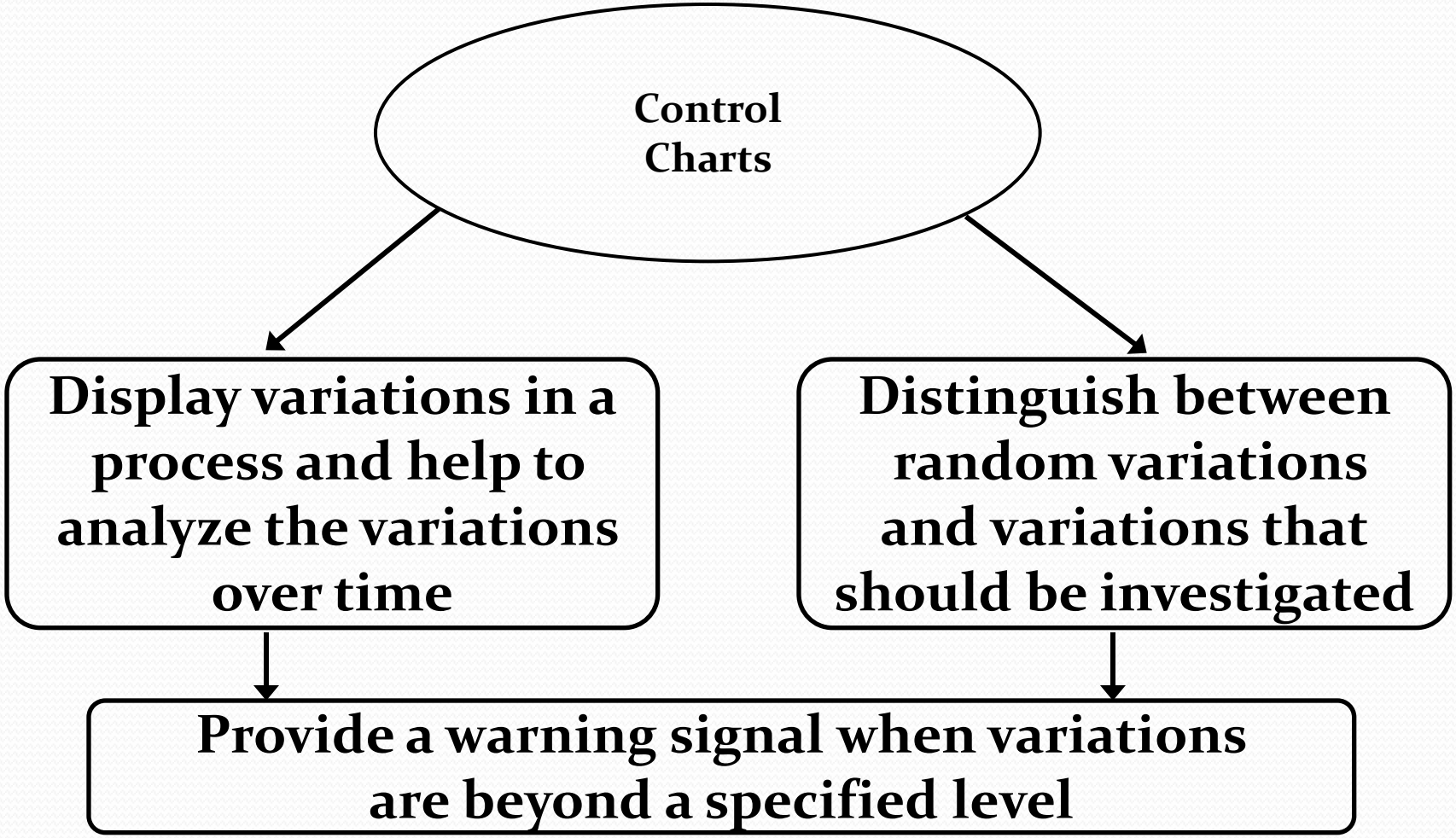
Uncontrollable (random) variances:

- Random Error

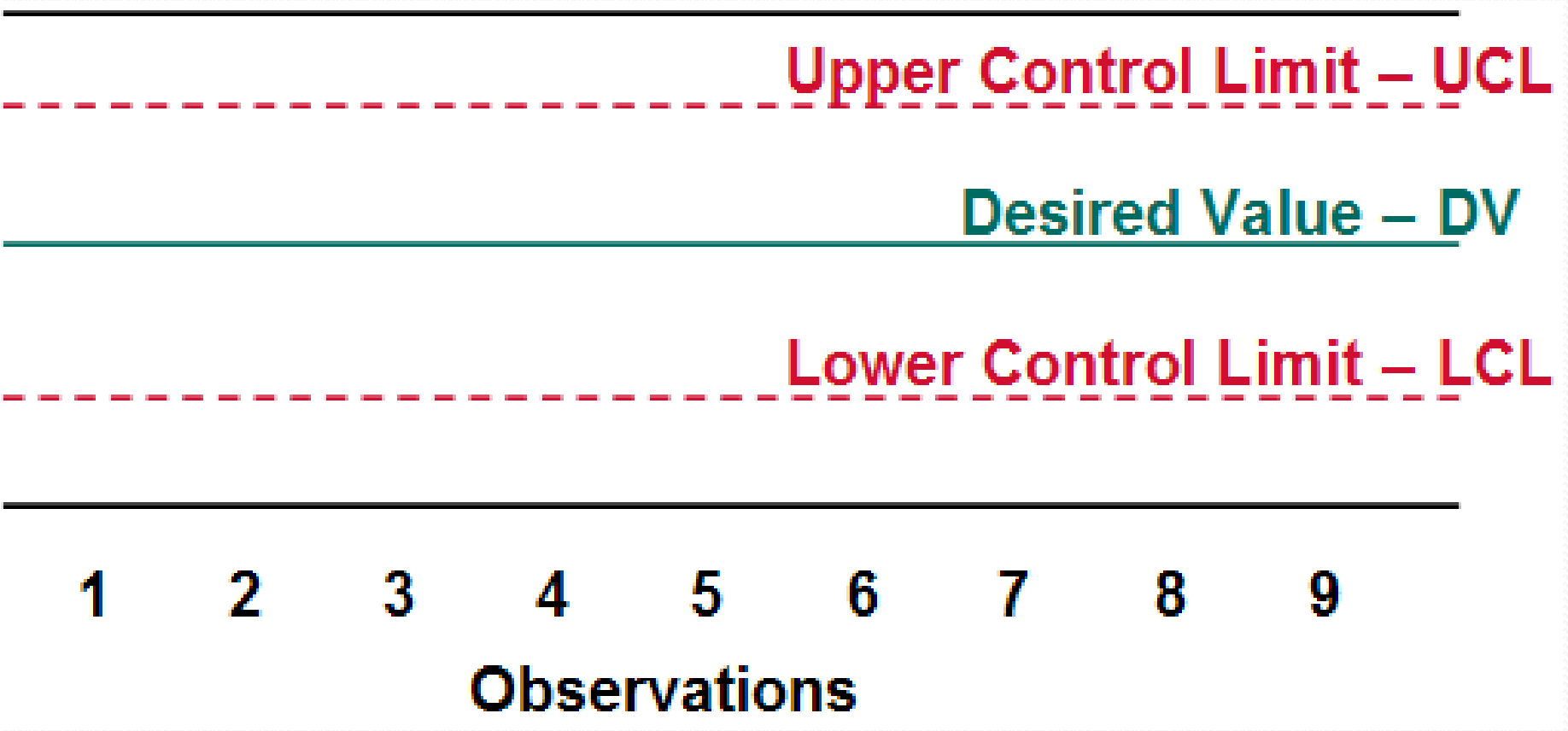
Controllable (systematic) variances:

- Prediction error
- Modeling error
- Measurement error
- Implementation error

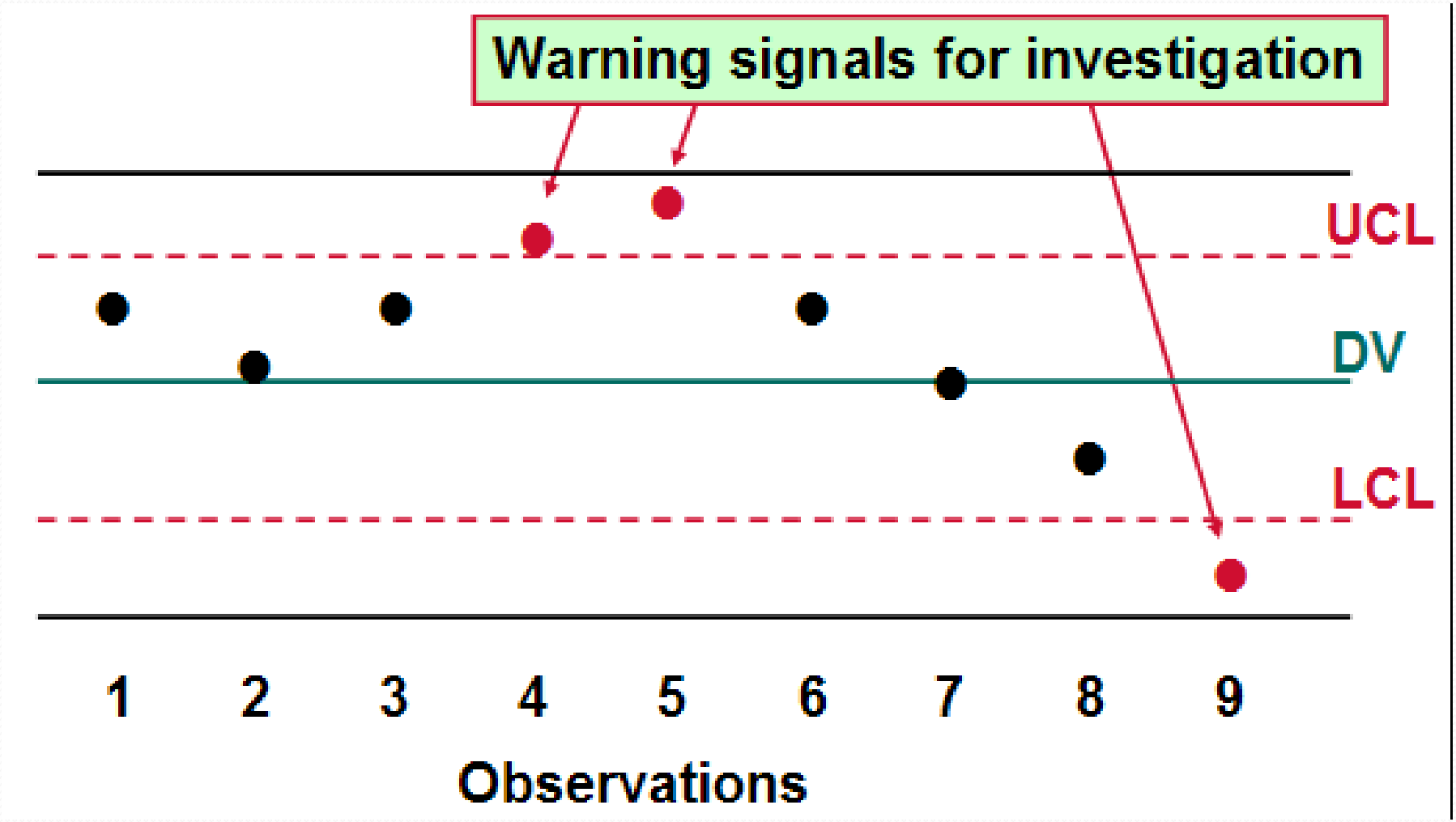
Role of Control Charts to Help Distinguish Random vs. Systematic Cost Variances



Control Charts (continued)



Control Charts (continued)



Variance Investigation Decisions Under Uncertainty

	States of Nature	
Action	**Random**	**Nonrandom**
Investigate	I	$I + C$
Do not investigate	none	L

Where: I = cost of an investigation

C = the cost to correct a variance

L = present value of losses by not correcting the variance

Variance Investigation Decisions—Indifference Probability

$$E(\text{Investigate}) = [(\text{I} + (1 - p)] + [(\text{I} + \text{C}) \times p]$$

$$E(\text{Do not investigate}) = \text{L} \times p$$

Set the above two equations equal, solve for p, the indifference probability:

$$p = \text{I} \div (\text{L} - \text{C})$$

Variance Investigation Decisions—Expected Value of Perfect Information

EVPI = Expected cost with perfect information – Expected cost without perfect information

EVPI = Expected cost with perfect information – Expected value of cost-minimizing choice under uncertainty

EVPI = Maximum amount a rational manager would pay for perfect information

Summary

We distinguished between the *product-costing* and *control* purposes of standard costs for manufacturing (factory) overhead costs:

- For *variable* overhead costs, we saw that these two purposes are the same
- For *fixed* overhead costs, these purposes are different

Summary

For product-costing purposes, we defined the total overhead variance for the period as the difference between the *actual overhead costs incurred* and the *overhead costs applied to production* using the overhead application rate

- We saw that this total variance is also referred to as the "total over- or under-applied" overhead for the period

Summary

The total overhead variance for the period can be decomposed using a four-way, three-way, or two-way analysis :

- *Four-way analysis* = variable overhead spending variance + variable overhead efficiency variance + fixed overhead spending (budget) variance + fixed overhead production volume variance
- *Three-way analysis* = total overhead spending variance + variable overhead efficiency variance + fixed overhead production volume variance
- *Two-way analysis* = flexible (controllable) budget variance + fixed overhead production volume variance

Summary

- We discussed how to record standard overhead costs in the accounting records and how standard cost variances for product-costing purposes are disposed of at the end of the accounting period

- We learned how traditional and ABC approaches to overhead cost analysis differ in terms of insights provided to management; further, we learned about additional insights into cost control are possible when production is characterized by a standard lot size

- We briefly discussed alternative comprehensive costing systems (viz., GPK and RCA) that, under certain circumstances can yield more relevant information for short-term cost-control purposes

Summary

- We discussed different types of standard-cost variances as well as the indicated managerial action associated with each type
- We covered the use of control charts, including statistical control charts, for monitoring activities and ensuring financial control
- Finally, we presented in the Appendix a formal decision approach to the variance-investigation decision under uncertainty; this decision model involved the use of "pay-off" tables and included the calculation of an "indifference probability" and the expected value of perfect information (EVPI)

Working Wounded:
The Budget Blues

The Budget Blues

Look at your budget numbers and visualize what they represent.

The Budget Blues

The more you see what the numbers represent, the more the budget comes to life.

The Budget Blues

One of the most important tasks is calculating the return on an investment.

The Budget Blues

Quantify the benefits that will accrue as a result of that expense.

The Budget Blues

Have a contingency plan.

The Budget Blues

Make budgeting just one of the skills you bring to bear on your business.

Building Budgets That Affect Reality

Realistic Budgets

1. Are based on agreed objectives.

Realistic Budgets

1. Are based on agreed objectives.
2. Are based on credible information.

Realistic Budgets

1. Are based on agreed objectives.
2. Are based on credible information.
3. Are achievable.

Resources

1. People with information.

Resources

1. People with information.
2. Historical data.

Resources

1. People with information.
2. Historical data.
3. Credible resources.

Realistic Budget

Determine if the budget reflects the organization's objectives.

Realistic Budget

Determine if revenues are based on realistic projections.

Realistic Budget

Everyone must understand the relationship between goals and budgets.

Capitalize Your Capital

Capitalize Your Capital

Creating value is more than just cash – it's what you can do with it.

Capitalize Your Capital

In a slowing economy, a company needs to work harder to access capital.

Capitalize Your Capital

It may cost a company a lot more to get less money.

Capitalize Your Capital

A company needs to conserve whatever money it has.

Capitalize Your Capital

Hunker down until there's more of an optimistic time.

Capitalize Your Capital

In the public sector, transactions are taking a lot more time and there is a much longer line of people trying to access capital.

Capitalize Your Capital

The whole public marketplace has now gone to the private sector so there are many companies coming to private investors.

Capitalize Your Capital

Take as little as you can until the psychological climate changes.

Capitalize Your Capital

Companies need to prioritize their resources.

Capitalize Your Capital

Companies need to be innovative and have immediacy.

Capitalize Your Capital

For a public company the future means one year; for a private company that means two years.

Capitalize Your Capital

Companies need to quantify where they’re going to be and when they’re going to be there.

Capitalize Your Capital

It’s not just innovation anymore, it’s immediacy.

Capitalize Your Capital

Companies need to show how their business is going to be:

- Profitable
- Integrated into the marketplace
- Innovative and better

Capitalize Your Capital

Companies need to conserve capital, be more efficient and accelerate the cash flow breakeven.

Capitalize Your Capital

Companies need to work toward profitability in a shorter period of time.

Capitalize Your Capital

Private equity financing has a lot to do with issuing stock and/or bonds.

Capitalize Your Capital

The advantages of private equity financing are:

- You know the investor

Capitalize Your Capital

The advantages of private equity financing are:

- You know the investor
- You know if the investor has other companies in the sector you are in

Capitalize Your Capital

The advantages of private equity financing are:

- You know the investor
- You know if the investor has other companies in the sector you are in
- You know their trading strategy

Cash Flow Analysis

Sales Revenue Income

Sales Revenue

“Sales” means an inflow of resources from operations. They can be cash or an account receivable from the customer.

Sales Revenue

Sales are usually recorded as soon as the seller delivers goods or provides a service to the customer.

Sales Revenue

If revenue is in cash terms, the seller gets paid right away.

Sales Revenue

If revenue is an account receivable, the customer gets time to pay, usually up to 30 days.

Sales Revenue

Payment delays can arise from billing disputes, processing delays from the bank or the customer’s own financial problems.

Income from Operations

Income from operations is sales revenue less expenses incurred to generate current sales.

Income from Operations

A to Z Office Supply
Income Statement
For the Quarter Ended June 30

Sales		*$275,000*
Less Expenses:		
Cost of Goods Sold	*$125,000*	
Sales Commissions	*37,500*	
Rent	*15,000*	
Depreciation	*7,000*	
Other Administrative Costs	*40,500*	*-225,000*
Income from Operations		*$ 50,000*

Income from Operations

If a minus number appears either in parentheses or in red, it is a loss from operations.

Cash Flow Analysis from Operations

Cash Inflow

Sales revenues are not always collected at the time of the sale.

Cash Inflow

In the operating cycle, you invest cash in inventory and sell on account.

Cash Inflow

You only recover your cash investment in inventories when you collect from the customer.

Statement of Cash Flows

Statement of Cash Flows

The statement of cash flows is an after-the-fact look at everything affecting cash flow during a particular period of time.

Statement of Cash Flows

The statement has three areas:

1. Operating Activities
2. Investing Activities
3. Financing Activities

Operating Activities

Operating activities are the business’s normal income earning activities.

Operating Activities

Statement of Cash Flows

Operating Activities

Cash provided (used) by Operations:		
Income from operations	*$50,000*	
Less increase in inventories		*(30,000)*
Plus increase in accounts payable		*5,000*
Less increase in accounts receivable		*(25,000)*
Less increase in prepayments		*(10,000)*
Plus Depreciation		*7,000*
Net Cash provided (used) by operations		*$ (3,000)*

Accounts Receivable

Money owed but not yet collected.

Operating Activities

If you get your customers to pay on time, you can pay your vendors on time.

Depreciation

The cost of buildings and equipment spread out over a time period.

Investing Activities

Investing activities account for the money spent on buying property, equipment and securities like stocks and bonds.

Investing Activities

Statement of Cash Flows
Investing Activities

Cash provided (used) by Investing Activities:	
Purchases of buildings and equipment	*$(100,000)*
Purchase of securities of other companies	*(10,000)*
Net cash provided (used) by investing activities	*$(110,000)*

Financing Activities

Financing activities include all the transactions between a company and its owners and long-term creditors.

Financing Activities

Statement of Cash Flows

Financing Activities

Cash provided (used) by Financing Activities:		
Proceeds from sale of common stock	*$ 30,000*	
Proceeds from issuing long-term note		*100,000*
Payment of cash dividend		*(9,000)*
Payment on long-term note		*(10,000)*
Net cash provided (used) by financing activities		*$111,000*

Summary Statement of Cash Flows

Determines the net cash available at the end of a period.

Summary Statement of Cash Flows

A to Z Office Supply
Summary Statement of Cash Flows
For the Quarter Ended June 30

Net cash provided (used) by operations $ (3,000) Net cash provided (used) by investing activities (110,000)
Net cash provided (used) by financing activities 111,000
Net increase (decrease) in cash $ (2,000)
Cash available at the start of the period 3,000
Cash available at the end of the period $ 1,000

Statement of Cash Flows

To successfully manage the cash in your organization, develop a cash budget and stick to it!

Cash Budgeting

Cash Budgeting

Developing a cash budget helps you to manage your cash and to see the big picture.

Cash Budgeting

Understand past cash flows by analyzing the company’s statement of cash flows for certain time frames.

Cash Budgeting

Gather information on your current assets and liabilities and list them out.

Cash Budgeting

A sales forecast is a best estimate on sales for an upcoming month or quarter.

Cash Budgeting

Do a best estimate on what portion of those sales will be for cash and what portion will be on account.

Cash Budgeting

Include predictions on known expenses such as utilities, rent, salaries and wages.

Cash Budgeting

Include information on planned purchases of inventory, management policies on payments and any information that applies to cash income or disbursement from investing or financing.

Cash Budgeting

The ending balance for each budget period is the starting balance for the new budget period just beginning.

Cash Budgeting

The statement of cash flows shows you where you’ve been. The cash budget shows where you’re going.

Several Months Later

Improving Cash Management

Improving Cash Management

Follow up on accounts receivable.

Improving Cash Management

Bill promptly for merchandise that has been shipped.

Improving Cash Management

Make sure the money from customers is deposited quickly.

Improving Cash Management

Give discounts to customers who pay promptly.

Improving Cash Management

Make sure merchandise is shipped out immediately after it’s sold.

Improving Cash Management

Pay bills promptly when they’ re due, and not earlier, unless you get a discount.

Improving Cash Management

Review your inventory levels.

Improving Cash Management

Consider some of the just-in-time approaches to inventory management.

Improving Cash Management

Buying inventory just before it’s sold can also free up cash.

Improving Cash Management

Review all proposed cash expenditures to make sure they match the company’s cash position.

Improving Cash Management

Establish and follow policies for issuing credit to customers.

Improving Cash Management

Establish credit to borrow money before it’s critical to borrow.

Improving Cash Management

Consider additional long-term equity financing by issuing stock to raise cash.

Key Financial Ratios

Criteria for Success

Criteria for Success

Key financial ratios are used to measure the financial success of a company.

Criteria for Success

Ratios indicate relationships that have the greatest significance when used to make year-to-year comparisons.

Criteria for Success

Ratios measure the financial health of a company.

Profitability Ratios

Measure the degree of success in creating wealth.

Efficiency Ratios

Measure the efficient use of resources.

Liquidity Ratios

Measure the ability of a company to pay its current debt or long-term obligation.

Leverage Ratios

Measure debt to stockholders' equity.

Criteria for Success

One number or ratio is never enough to accurately judge financial health, or detect positive or negative trends.

Profitability Ratios

Return on Sales

Measures the overall profitability of a company.

Return on Sales

Return on Sales = Net Income (Net Profits)/Sales (Revenues)

Return on Sales

The percentage of each sales dollar retained after paying all taxes.

Operating Profit Margin

The percentage of each sales dollar retained after paying operating expenses.

Operating Profit Margin

Operating Profit Margin = Profit Before Taxes/Sales

Operating Profit Margin

Measures the relative effectiveness of expense control.

Operating Profit Margin

A standard of comparison to evaluate how your business is doing from year to year.

Return on Assets

Return on Assets = Net Income/Total Average Assets

Return on Assets

Evaluates how effectively a company is managed by comparing the profitability of a company and its investments.

Return on Net Assets

Return on Net Assets = Net Income/Total Average Assets – Total Current Liabilities

Return on Equity

Return on Equity = Net Income/Equity

Return on Equity

Investors regard Return on Equity as the best indicator of the overall success of a company.

Return on Equity

Measures how well the company has produced a profit, utilizing its investors' money – the company's equity.

Return on Equity

Generally a good Return on Equity is 10% or greater.

Efficiency Ratios

Days Sales Outstanding

Days Sales Outstanding = Ending Accounts Receivable/Sales/365 Days

Days Sales Outstanding

Days Sales Outstanding ratio measures the activity of accounts receivable.

Days Sales Outstanding

A prolonged collection period means a company's funds are financing customers and not contributing to the cash flow of the company.

Days Sales Outstanding

It's best to compare with the industry average or a key competitor.

Causes for Excessive Collection Period

- Inefficient accounts receivable system

Causes for Excessive Collection Period

- Inefficient accounts receivable system
- Slow payment by customers due to incorrect billing

Causes for Excessive Collection Period

- Selling to high-risk customers

Causes for Excessive Collection Period

- Selling to high-risk customers
- Decrease in sales

Inventory Turnover

Inventory Turnover = Cost of Goods Sold/Inventory

Inventory Turnover

Evaluates how fast funds are flowing through Cost of Goods Sold to produce a profit.

Inventory Turnover

A decreasing ratio indicates a company is investing in inventory faster than money is coming from sales.

Causes for Negative Cash Flow

- Inaccurate sales forecasting
- Decreased sales productivity
- Sales competition
- Ineffective production scheduling
- Slow-moving inventory lines

Opportunities to Explore

See if your company's initiatives can reduce inventory or improve sales.

Opportunities to Explore

See if your inventory can be reduced by better forecasting and production scheduling.

Opportunities to Explore

Determine if slow-moving, obsolete products can be discounted.

Liquidity Ratio

Current Ratio

Current Ratio = Current Assets/Current Liabilities

Current Ratio

Measures the liquidity of a company.

Current Ratio

The ratio should be at least 2:1.

Current Ratio

Companies that have a ratio of 1:1 have no working capital.

Leverage Ratios

Debt to Equity

Debt to Equity = Debt/Equity

Debt to Equity

The extent of ownership of the stockholders in the company after all claims and liens.

Debt to Equity

Equity is also called Capital or Net Worth.

Debt to Equity

Most banks will loan up to a 2:1 ratio.

Earnings Per Share

Earnings Per Share = Net Income/Number of Shares Issued and Outstanding

Earnings Per Share

Provides the net income per outstanding shares of stock held by investors.

Price to Earnings Ratio

Price to Earnings = Price Per Share/Earnings Per Share

Price to Earnings Ratio

The higher the P/E ratio, the more the investors pay, and the more earnings growth they expect.

Linking Financial Management with Organizational Goals

Organizational Goals

Organizational goals need to be linked to financial infrastructure.

Financial Role

Every activity has a financial consequence.

Challenge

Not understanding the relationship between organizational goals and finance.

Overcoming Challenge

Share information and get buy-in.

Understanding Financial Statements

The Big Picture

The Big Picture

Every business activity you perform can impact stock price.

The Big Picture

The goal of any publicly held company is to maximize shareholder value, or the market value of stocks and dividends.

The Big Picture

Financial analysts look for profit and cash flow.

The Big Picture

Your role is to use the company's resources properly.

The Big Picture

External Accounting – Annual reports help a company effectively use its economic resources.

The Big Picture

Government – Financial reports are prepared for tax purposes.

The Big Picture

Management – The goal is efficient allocation of internal resources.

Financial Statements

- The Income Statement
- The Balance Statement
- Statement of Cash Flows

Financial Statements

How much profit was generated during the accounting period?

Financial Statements

What is the accumulated wealth of the business at the end of the accounting period?

Financial Statements

What cash movements took place?

Income Statement

Income Statement

The income statement includes all revenues and costs over the accounting period of an annual report.

Income Statement

Revenues - Expenses = Net Income

Balance Sheet

Balance Sheet

The balance sheet is a snapshot of a company's assets, liabilities and equity at a specific point in time.

Balance Sheet

The balance sheet shows who owns the company's assets – the creditors or the owners.

Balance Sheet

Assets = Liabilities or Debts + Net Worth

Assets

A probable future benefit exists.

Assets

The business has the exclusive right to control the benefit.

Assets

The benefit must arise from a past transaction or event.

Assets

The resource must be capable of being measured in monetary terms.

Current Assets

Current assets are the most liquid and can be converted easily to cash within one year.

Fixed Assets

Fixed assets are items such as buildings and equipment.

Long-Term Assets

Long-term assets are those expected to be collected or converted to cash at a period of time greater than one year.

Other Current Assets

Other current assets are inventories.

Other Long-Term Assets

Other long-term assets are goodwill, copyrights and long-term accounts receivable.

Liabilities

Liabilities are obligations of the business that have arisen from past transactions or events.

Current Liabilities

Current liabilities typically have a repayment date of one year or less.

Long-Term Liabilities

Long-term liabilities are those with repayment dates of more than one year.

Stockholder's Equity

Stockholders' equity is the difference between the total assets and total liabilities of the company.

Stockholder's Equity

It represents the claim of the business owners.

Capital Stock

The number of shares issued or outstanding at par value.

Retained Earnings

Net income for the year from the income statement minus dividends paid.

Other Paid-In Capital

Capital realized from stock sold in excess of par value.

Stockholder's Equity

The balance sheets must balance the assets owned by either creditors or owners.

Statement of Cash Flows

Statement of Cash Flows

The statement of cash flows shows how the company has used its cash.

Statement of Cash Flows

It's a summary of the cash receipts and payments over the accounting period.

Statement of Cash Flows

Net Total = Net Increase/Decrease of

Cash Balance

Statement of Cash Flows

Cash flow is the most critical aspect of finance.

Statement of Cash Flows

Any cash that flows into the business is added to the balance sheet from the previous year like a deposit.

Statement of Cash Flows

Any cash used by the business is deducted like a withdrawal.

Operating Activities

This includes net income (that is, a positive cash flow, or deposit), or accounts receivables or inventories.

Investing Activities

The purchase of property, plant and equipment or fixed assets.

Financing Activities

They are interest paid on loans.

Other Financing Activities

Activities such as new loans and stock sold.

Net Income

Net Income = Revenues - Expenses

Balance Sheet

Assets = Liabilities + Net Worth

Day 4

Activity Based Costing (ABC) And Activity Based Budgeting (ABB)

- Activity based costing (ABC)
- Refinement of the costing system
- ABC and cost management
- Design of ABC systems
- The cost hierarchy and cost drivers
- Advantages and disadvantages of ABC systems
- From traditional budgeting to activity based budgeting (ABB)
- The ABB process
- Motivation and the behavioural aspect of budgeting

Activity-Based Costing

Learning Objectives

- Explain the strategic role of activity-based costing (ABC)
- Describe ABC, the steps in developing an ABC system, and the benefits of an ABC system
- Determine product costs under both the volume-based method and the ABC method
- Explain activity-based management (ABM)

Learning Objectives (continued)

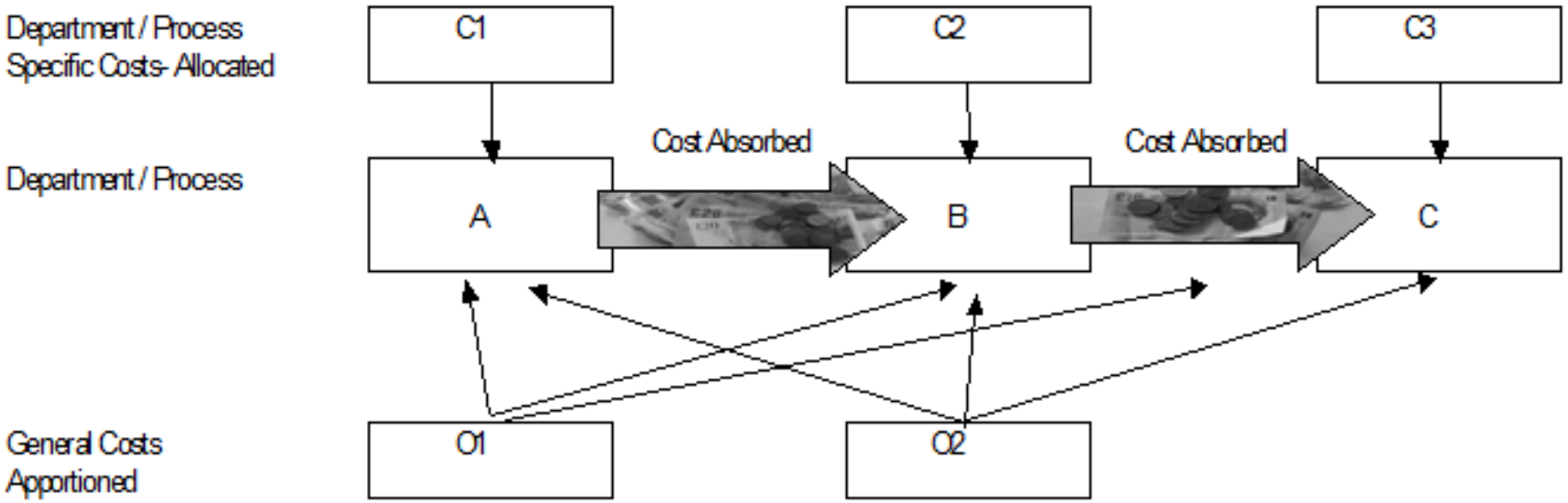
- Describe how ABC/M is used in manufacturing companies, service companies, and governmental organizations
- Use an activity-based approach to analyze customer profitability
- Identify key factors for successful ABC/M implementation

ABC



- Activity Based Costing
- Developed in the early 1980's
- Highlighted by Professor Robert Kaplan - *Relevance Lost: The Rise and Fall of Management Accounting*, with H. Thomas Johnson. Harvard Business School Press, 1987

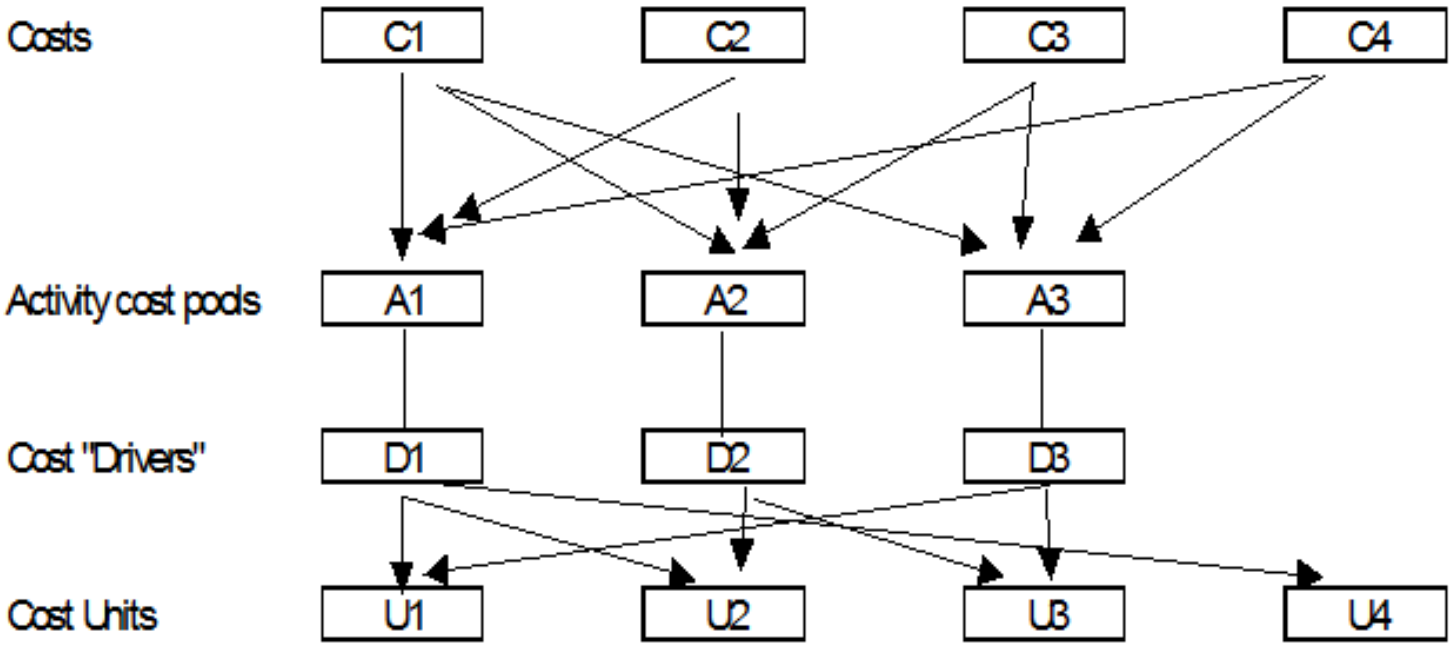
Absorption Costing Problems



Hours				
Labour	300	500	200	1000
Machine	100	50	50	200

	Product			
	A	B	C	
Sales	10000	4000	6000	20000
Direct Cost	3000	2000	3000	8000
Gross Profit	7000	2000	3000	12000
Less overheads				
Labour Hours	900	1500	600	3000
Machine Hours	1500	750	750	3000
Profit				
Labour Hours	6100	500	2400	9000
Machine Hours	5500	1250	2250	9000

Activity Based Costing



Traditional Absorption Costing v ABC

- "Traditional"
- OHR – typically based on labour
- Arbitrary cost allocation and absorption
- Simple
- Proven?
- Irrelevant
- Misleading

- ABC
- Allocate and apportion costs to activity pools
- Use Drivers to charge activity costs to costs units
- More Systematic?
- More Complex
- More Expensive
- Absorption Costing Re-invented

Invoices	30	40	30	100
Orders	10	20	20	50

	Product			
	A	B	C	
Sales	10000	4000	6000	20000
Direct Cost	3000	2000	3000	8000
Gross Profit	7000	2000	3000	12000
Less overheads				
Invoicing	600	800	600	2000
Orders	200	400	400	1000
Profit				
ABC	6200	800	2000	9000

					Cost per
Invoices		20	40	40	100	20
Orders		10	20	20	50	20

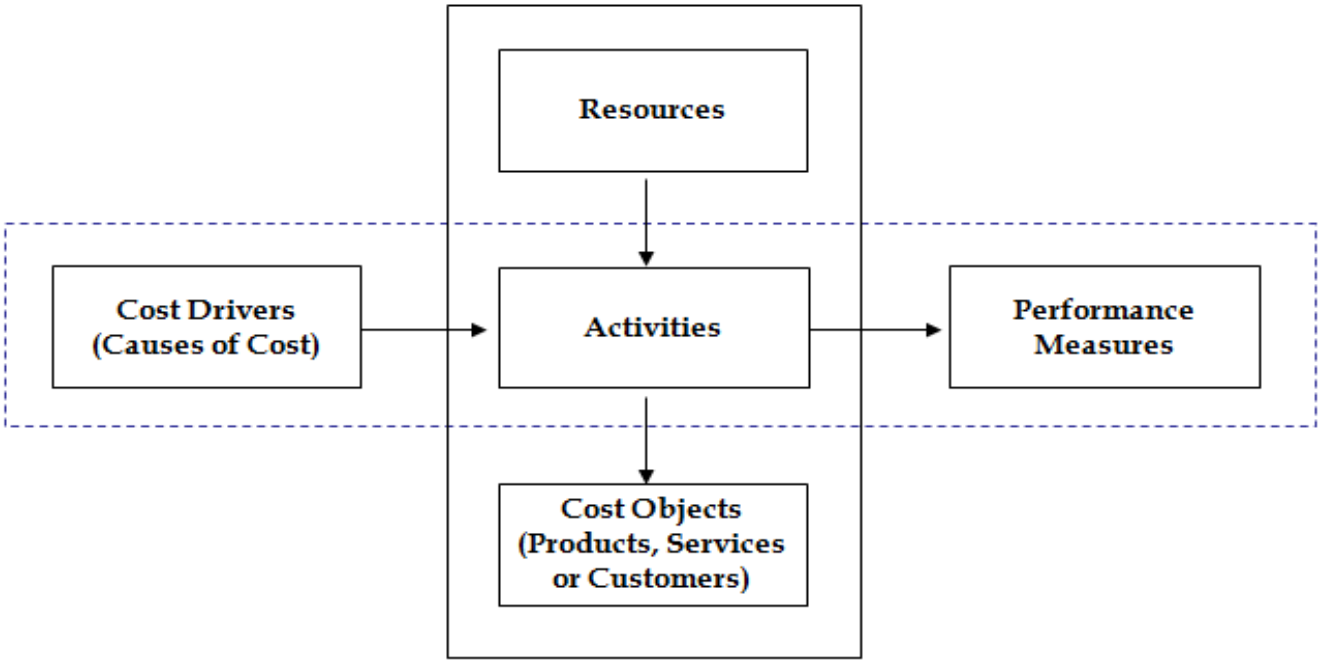
	Customer			
	X	Y	Z	
Sales	10000	2500	7500	20000
Direct Cost	4000	1500	2500	8000
Gross Profit	6000	1000	5000	12000
Less overheads				
Invoicing	400	800	800	2000
Orders	200	400	400	1000
Profit				
ABC	5400	-200	3800	9000

Cost Reduction under ABC

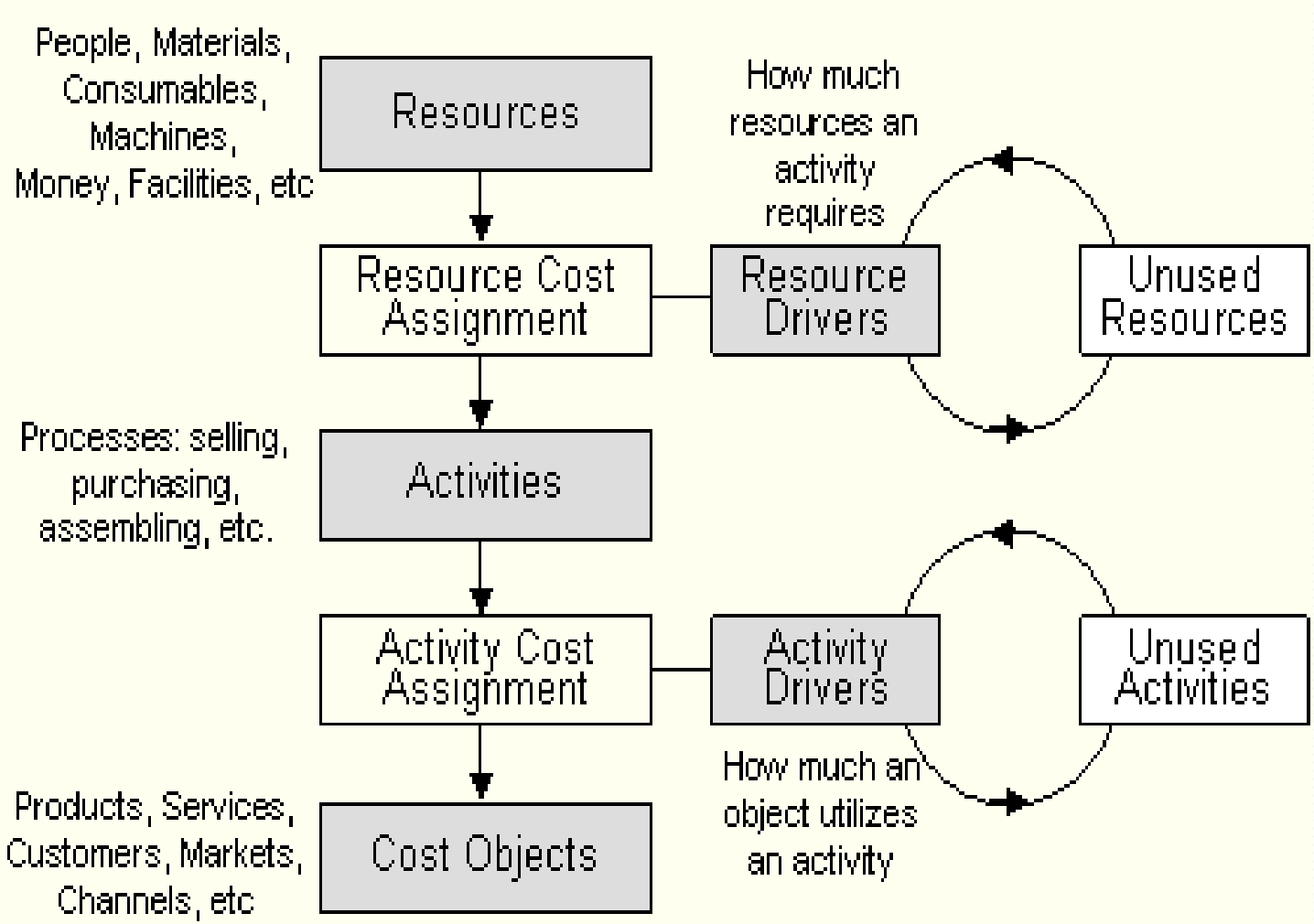
- Understand & Manage Costs
- Reduce Non Value Adding Cost
- Reduce Activity Cost
- Reduce (Needless) Activity

Over Three Decades of Industry-led Collaborative Research

Activity-Based Costing
The CAM-I Cross



CAM-I (Consortium for Advanced Management-International)


People, Materials, Consumables, Machines, Money, Facilities, etc
Resources
How much resources an activity requires
Resource Cost Assignment
Resource Drivers
Unused Resources
Processes: selling, purchasing, assembling, etc.
Activities
Activity Cost Assignment
Activity Drivers
Unused Activities
How much an object utilizes an activity
Products, Services, Customers, Markets, Channels, etc
Cost Objects

Refinement of the costing system

- ABC is a system that refines the costing system to develop understanding of detailed cost drivers.

ABC and cost Management

Activity-based costing (ABC) vs. volume-based costing:

- Volume-based costing results may be distorted because indirect costs do not always occur in proportion to output volume
- Volume-based costing generally causes cross-subsidization of outputs (i.e., some products will be overcosted and others undercosted)
- Activity-based costing uses detailed information about the activities that make up indirect costs so that outputs are charged only for resources consumed by the activities needed to perform them

Volume-Based Costing

- **May be a good strategic choice for some firms**
  - When the costs to be allocated are relatively small versus the directly traceable costs
  - When the activities supporting production are relatively homogeneous across different product/service lines
- **Volume-based costing is often used by paper product manufacturers, producers of agricultural products, other commodity firms, and professional service firms**

ABC Terms

- ***Activity*** **- a specific task or action of work done, such as production set-up**
- ***Resource*** **- an economic element needed or consumed in performing activities, such as salaries and supplies**
- **Cost driver - either a *resource consumption cost driver* or an *activity consumption cost driver***

ABC Terms

- **Resource consumption cost drivers** measure the amount of resources consumed by an activity, such as the number of items in a purchase or sales order
- **Activity consumption cost drivers** measure the amount of activity performed for an object, such as the number of batches used to manufacture a product

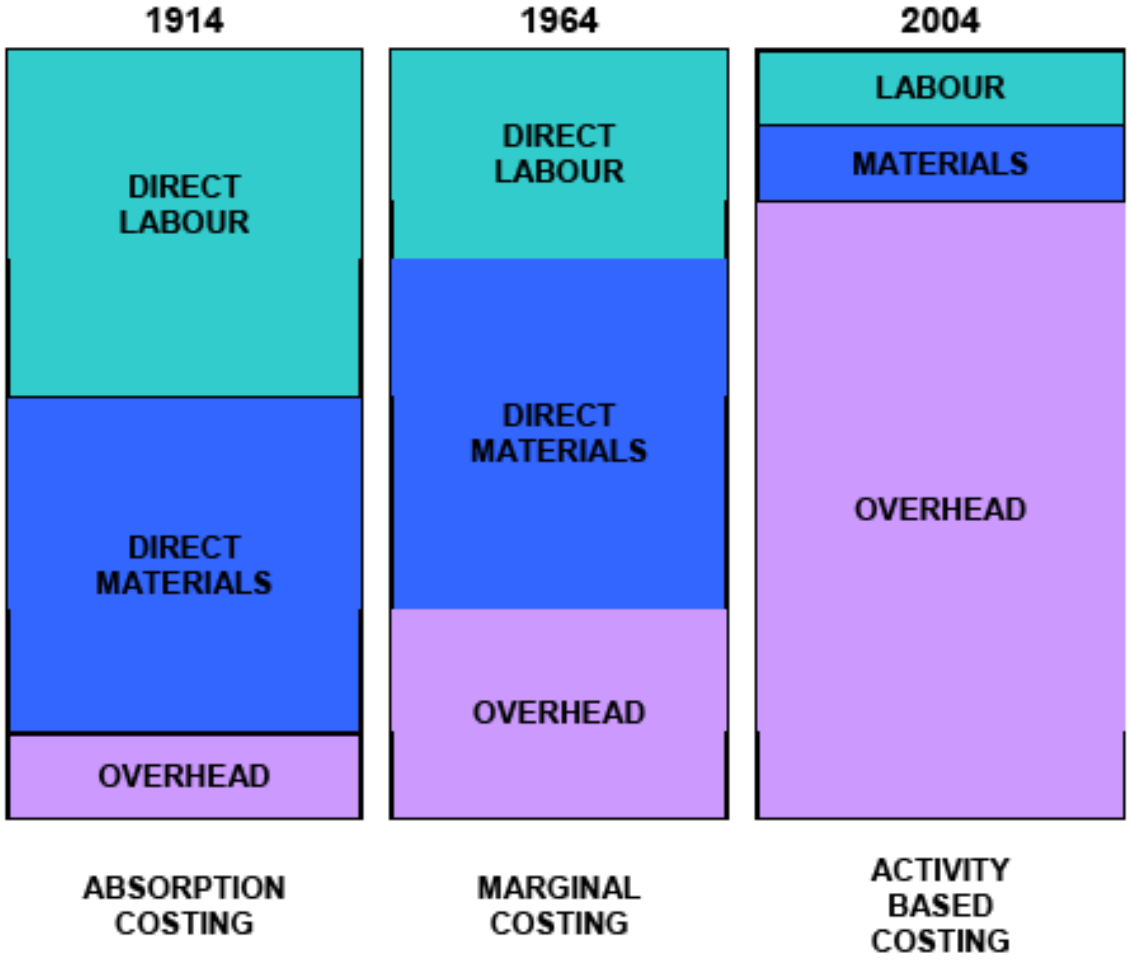
Cost Assignment

- ***The two-stage cost assignment* approach for indirect (support) costs: resource costs such as factory overhead are assigned to activity cost pools and then to cost objects (jobs, clients, products, patients, etc.)**
  - Volume-based systems assign factory overhead to a single plant or departmental cost pool first and then to products or services using a volume-based rate
  - ABC systems assign factory overhead costs to activities or activity cost pools using resource consumption cost drivers and then assign these costs to cost objects using activity consumption cost drivers

Design of ABC systems

- ABC systems became developed due to the extensive nature of overheads and complexities in corporate businesses.

Design of ABC systems



Summary: ABC vs. volume-based costing

ABC systems differ from volume-based costing systems in two ways:

- ABC system defines cost pools as activities rather than production plant or department cost centers
- Cost drivers
  - ABC systems use drivers based on an activity or activities performed for the cost object
  - Volume-based approaches use a volume-based cost driver that often bears little or no relationship to the consumption of resources by the cost objects

Activity Analysis

Through activity analysis, a firm identifies the work it performs to carry out its operations by

- Gathering data from existing documents and records
- Collecting additional data using questionnaires, observations, or interviews of key personnel
- Sample questions include:
  - What work or activities do you do?
  - How much time do you spend performing these activities?
  - What resources are required to perform these activities?
  - What value does the activity have for the product, service, customer, or organization?

Activity Analysis

To identify resource costs for various activities, a firm classifies all activities according to the way in which the activities consume resources

- A *unit-level* activity is performed on each individual unit of product or service of the firm (e.g., direct materials)
- A *batch-level* activity is performed for each batch or group of units of products or services (e.g., setting up machines or placing purchase orders)
- A *product-level* activity supports the production of a specific product or service (e.g., engineering changes to modify parts for a product)
- A f*acility-level* activity supports overall operations (e.g., property taxes and insurance)

Unit Level Costs

Performed for each unit of product or service

Examples include:

- Units of production related depreciation of factory machinery
- Energy costs for machinery used for individual units of production (e.g., A drill press that drills holes in pieces of metal)

Batch Level Costs

Performed for each batch of product or service produced

Examples include:

- Machine setup costs
- Quality control costs
- Wages for works that move products within the factory
- Energy costs for machinery that is used for multiple units of product at the same time (e.g., an oven that bakes a batch of cookies for a commercial baker)

Product Level Costs

Support production of a specific product or service line

Examples include:

- Salaries for product line purchasing managers
- Quality control costs
- Product development costs
- Depreciation and maintenance for specialized machinery dedicated to the production od a single product or service line

Facility Level Costs

Support overall operations

Examples include:

- Factory depreciation
- Security costs for the factory
- Insurance and property taxes for a factory
- Salary of a plant manager

Developing an ABC System

There are three steps in the development of an ABC system:

1. Identify resource costs and activities
   - An activity analysis is performed to identify key activities and the way in which the activities consume resources
2. Assign resource costs to activities
   - Use resource consumption cost drivers based on cause-and-effect relationships, such as the number of labor hours, setups, moves, machine-hours, employees, or square feet to assign resource costs
3. Assign activity costs to cost objects
   - Use activity consumption cost drivers, such as purchase orders, receiving reports, parts stored, direct labor-hours, or manufacturing cycle time to assign activity costs

Advantages and disadvantages of ABC systems

Benefits of ABC Systems

1. Better profitability measures due to more accurate costs
2. Better decision making: identification of value-added vs. non-value-added activities and associated costs
3. Information for process improvement
4. Improved cost planning
5. Helps identify and control the cost of unused capacity

Disadvantages

1. Complex to do
2. Expensive to implement
3. Expensive IT Equipment & software

The cost hierarchy and cost drivers

- In developing an ABC system you need to have clear cost hierarchy.
- Then identify the Cost drivers.

From traditional budgeting to activity based budgeting (ABB)

- For some industries ABC will give accurate information and results which are clearer than traditional budgeting.

Volume-Based vs. ABC Example

Haymarket BioTech, Inc. (HBT) produces and sells two secure communication systems, AW (Anywhere) and SZ (SecureZone). HBT has the following operating data for the two products:

	AW	SZ
Production volume	5,000	20,000
Selling price	$400.00	$200.00
Unit direct materials and labor	$200.00	$80.00
Direct labor-hours	25,000	75,000
Direct labor-hours per unit	5	3.75

Volume-Based vs. ABC

The **traditional volume-based costing system** assigns factory overhead (OH) based on direct labor-hours (DLH). The firm has a total budgeted overhead of $2,000,000. Since the firm budgeted 100,000 DLHs for the year, the overhead rate per DLH is $20 ($2,000,000÷100,000 DLH).

Therefore……

Volume-Based vs. ABC

The factory overhead assigned to AW is $500,000 (25,000 DLH × $20) in total and $100 ($500,000÷5,000 units) per unit, since the firm used 25,000 direct labor hours to manufacture 5,000 units of AW

and

The factory overhead assigned to SZ is $1,500,000 (75,000 DLH × $20) in total and $75 ($1,500,000÷20,000 units) per unit, since the firm used 75,000 direct labor hours to manufacture 20,000 units of SZ

Volume-Based vs. ABC

Product profitability analysis per unit using volume-based costing:

	AW		SZ	
Unit selling price		$400.00		$200.00
Unit-level manufacturing costs				
Direct materials and labor	$200.00		$80.00	
Factory overhead	100.00		75.00	
Cost per unit		300.00		155.00
Profit margin		100.00		45.00

Volume-Based vs. ABC

In an attempt to use an ABC system, HBT has identified the following activities, budgeted costs, and activity consumption cost drivers:

Activity	Budgeted Cost	Activity Consumption Cost Driver
Engineering	$ 125,000	Engineering hours
Setups	300,000	Number of setups
Machine operations	1,500,000	Machine hours
Packing	75,000	Number of packing orders
Total	$ 2,000,000	

Volume-Based vs. ABC

HBT also has gathered the following operating data pertaining to each of its products:

	AW	SZ	Total
Engineering hours	5,000	7,500	12,500
Number of setups	200	100	300
Machine hours	50,000	100,000	150,000
Number of packing orders	5,000	10,000	15,000

Volume-Based vs. ABC

Using the operating data, the activity rate for each activity consumption cost driver is calculated as follows:

(1)	(2)	(3)	(4) = (2) ÷ (3)
Consumption Cost Driver	Budgeted Cost	Budgeted Activity Consumption	Activity Consumption Rate
Engineering hours	$ 125,000	12,500	$ 10 per hour
Number of setups	300,000	300	1,000 per setup
Machine hours	1,500,000	150,000	10 per hour
Number of packing orders	75,000	15,000	5 per order

Volume-Based vs. ABC

Factory overhead costs for AW at 5,000 units of production:

(1)	(2)	(3)	(4) = (2) × (3)	(5)
Consumption Cost Driver	Activity Consumption Rate	Activity Consumption	Total Overhead	Overhead per Unit
Engineering hours	$ 10	5,000	$ 50,000	$ 10
Number of setups	1,000	200	200,000	40
Machine hours	10	50,000	500,000	100
Number of packing orders	5	5,000	25,000	5
Total			$ 775,000	$ 155

Volume-Based vs. ABC

Factory overhead costs for SZ at 20,000 units of production:

(1)	(2)	(3)	(4)=(2)×(3)	(5)
Consumption Cost Driver	Activity Consumption Rate	Activity Consumption	Total Overhead	Overhead per Unit
Engineering hours	$ 10	7,500	$ 75,000	$ 3.75
Number of setups	1,000	100	100,000	5.00
Machine hours	10	100,000	1,000,000	50.00
Number of packing orders	5	10,000	50,000	2.50
Total			$ 1,225,000	$ 61.25

Volume-Based vs. ABC Example

Product profitability analysis per unit using ABC:

	AW	SZ
Unit selling price	$ 400	$200.00
Unit-level manufacturing costs		
Direct materials and labor	$ 200	$ 80.00
Engineering	$ 10	3.75
Setups	40	5.00
Machine running	100	50.00
Packing	5	2.50
Factory overhead	155.00	61.25
Cost per unit	355.00	141.25
Profit margin	$ 45	$ 58.75

Volume-Based vs. ABC

The following chart compares the results of the two costing systems:

	AW	SZ
Unit overhead cost		
Volume-based	$ 100	$ 75.00
Ativity-based	155	61.25
Difference	$ 55	$ 13.75
Profit margin		
Volume-based	$ 100	$ 45.00
Ativity-based	45	58.75
Difference	$ 55	$ 13.75

Can you guess which is the high-volume and which is the low-volume product?

Keep in mind that volume-based costing tends to undercost low-volume products and overcost high-volume products, a situation often referred to as product cost cross-subsidization

The ABB process

- Case study worked example

Cost of Capacity for the HBT Example

- Suppose that instead of a budgeted activity consumption of 12,500 hours, HBT were to use the practical capacity of the engineering staff, which is 15,625 hours.
- Using practical capacity, the activity consumption rate would be $8 per engineering hour (=$125,000÷15,625). If only 12,500 hours were used, as shown in the HBT example, then the overhead cost charged to AW and SZ would be reduced because of the lower rate ($8 instead of the original rate of $10).
- AW overhead would be reduced by $10,000 (5,000 hours × $2) and SZ overhead would be reduced by $15,000 (7,500 hours × $2).
- The total reduction for the two products, $25,000 (=$10,000 + $15,000) is the **cost of unused capacity.**

Five Steps of Strategic Decision Making in the HBT Example

1. **Determine the Strategic Issues Surrounding the Problem:** ***HBT competes on differentiation***
2. **Identify the Alternative Actions:** ***focus on AW or SZ?***
3. **Obtain Information and Conduct Analyses of the Alternatives:** ***cost analysis based on ABC costing***
4. **Based on Strategy and Analysis, Choose and Implement the Desired Alternative:** ***do not promote AW over SZ, but instead focus on SZ to improve overall profitability***
5. **Provide an On-going Evaluation of the Effectiveness of implementation in Step 4.**

Activity-Based Management (ABM/ABB)

ABM manages activities to improve the value of products or services to customers and increase the firm's competitiveness and profitability:

- Focuses on the efficiency and effectiveness of key business processes and activities
- Improves management's focus on the firm's critical success factors thereby enhancing the firm's competitive advantage
- ABC is its major source of information

Activity-Based Management (ABM/ABB)

ABM applications can be classified into two categories:

- ***Operational ABM*** enhances operational efficiency and asset utilization and lowers costs; it focuses on doing things right and performing activities more efficiently
- ***Strategic ABM*** attempts to alter the demand for activities and increases profitability through improved activity efficiency

ABC/M Tools

Some key ABC/M tools:

- In *activity analysis* an organization assesses each of its activities based on its need by the product or the customer, its efficiency, and its value content

- *Value-added analyses* are performed in an effort to eliminate activities that add little or no value to the customer; resource consumption can be reduced and the firm can focus on activities that increase customer satisfaction

ABC/M Tools (continued)

High-value-added activities:

- Increase significantly the value of the product or service
- Are necessary to meet customer requirements
- Enhance purchased materials or components
- Contribute to customer satisfaction
- Are critical steps in a business process

In short, removal would reduce the value of the product or service

ABC/M Tools (continued)

Low-value-added activities:

- Consume time, resources, or space but add little or nothing to satisfying customer needs
- Can be eliminated without affecting the form/fit/function of the product or service

Customer Profitability Analysis

ABC/M can be used to estimate customer-related costs and in therefore in assessing the profitability of a specific customer or group of customers

- *Customer profitability analysis* identifies customer service activities and cost drivers and determines profitability for each customer or group; this process allows the firm to chose its customer mix, determine an appropriate offering of after-sale services, decide what discounts to offer, etc.

- *Customer cost analysis* is the first step in a customer profitability analysis; it identifies activities and cost drivers to service customers before and after sales

Customer Profitability Analysis (continued)

Customer-related costs can be classified into the following categories:

- Customer unit-level costs - resources consumed for each unit sold to a customer, such as sales commissions and shipping costs based on units sold or shipped
- Customer batch-level costs - resources consumed for each sales transaction, such as order-processing costs or invoicing costs
- Customer-sustaining costs -resources consumed to service a customer regardless of the number of units or batches sold, such as monthly statement processing costs and collection costs for late payments

Customer Profitability Analysis (continued)

Customer costs can be classified into the following categories (continued):

- Distribution-channel costs are resources consumed in each distribution channel the firm uses to service customers, such as the cost of operating a regional warehouse or centralized distribution center

- Sales-sustaining costs are resources consumed to sustain sales and service activities that cannot be traced to an individual unit, batch, customer, or distribution channel, such as general corporate marketing expenditures

Customer Profitability Analysis (continued)

- **Customer Profitability Analysis** combines customer revenues and customer costs to assess customer profitability and helps identify actions to improve customer profitability
- Some companies quantify customer value in what is called **Customer Lifetime Value** (CLV), which is equal to the net present value (NPV) of all estimated future profits from the customer for a specified period of time

Customer Profitability Analysis (continued)

Customer profitability analysis helps to assess a customer's value to the company:

- What is the growth potential of the customer and the customer's industry?
- What is its "cross-selling" potential?
- What are the possible reactions of the customer to changes in sales terms or services?
- How important is this customer as a future sales reference?

ABC/M Implementation Issues

- A successful ABC/M implementation requires close cooperation among management accountants, engineers, and manufacturing and operating managers

- There are three important issues to consider in ABC/M implementation:
  - Multiple-Stage ABC
  - Time-Driven ABC (TDABC)
  - Resource Consumption Accounting

ABC/M Implementation Issues (continued)

- **Multiple-stage ABC** takes into account that some activities are cost objects for other activities

- **Time-driven ABC (TDABC)** simplifies some of the complexity involved in large ABC systems

ABC/M Implementation Issues (continued)

- Time-driven ABC (TDABC)
- Is based on the idea that the common element in the utilization of many activities is the unit of time
- Assigns resource costs directly to cost objects using the cost per time unit of supplying the resource
- Requires the total activity cost be divided by the number of minutes available to that activity to provide a cost per unit of time

Resource Consumption Accounting

- Emphasis is on being able to attribute costs, both fixed and proportional, to cost objects for decision support
- Three foundational concepts for RCA:
  - The view of resources – resources are the suppliers of capacity, meaning that capacity is a function of the resources available.
  - The quantity-based model – an operational view of the organization based on the concept that there is a causal relationship that can be expressed in terms of input and output units.
  - Cost behavior – the characteristics of the cost are inherent to the underlying resource and the consumption of those resources by value creating operations.

TDABC Example

- Assume 2 clerical workers paid $45,000 annually perform a certain activity that is expected to require 17 minutes. TDABC calculates the total cost as $45,000 × 2 = $90,000; TDABC then calculates the total time available for the activity as 180,000 minutes (assuming 30 hours per week with two weeks vacation: 2 workers × 50 weeks × 30 hours × 60 minutes per hour = 180,000 minutes per year).

- The TDAC rate for the activity is $0.50 per minute ($90,000 ÷ 180,000). The cost of a unit of activity is $0.50 × 17 min = $8.50.

Summary

- Activity-based costing (ABC) is a costing approach that assigns resource costs to cost objects such as products, services, or customers based on activities performed for the cost objects

- Volume-based costing is often inadequate because indirect costs do not always occur in proportion to output volume; the use of volume-based costing can cause costing inaccuracies and product cost cross-subsidization

Summary

- Among other benefits, ABC yields information that can be used by management to guide strategic decision-making; the use of ABC data for decision-making purposes is referred to as ABM

- ABM manages activities to improve the value of products or services to customers and increase the firm's competitiveness and profitability

Summary

- ABC/M can be applied to customer-related costs and therefore for conducting customer profitability analysis; as such, ABC data become a powerful tool for increasing customer profitability
- A successful ABC/M implementation requires close cooperation among management accountants, engineers, and manufacturing and operating managers
- Implementation of ABC sometimes includes recent advances such as Multiple-Stage ABC, Time-Driven ABC, and Resource Consumption Accounting

Motivation and the behavioural aspect of budgeting

- Budgets can affect motivation of staff and affect the direction of an organisation.

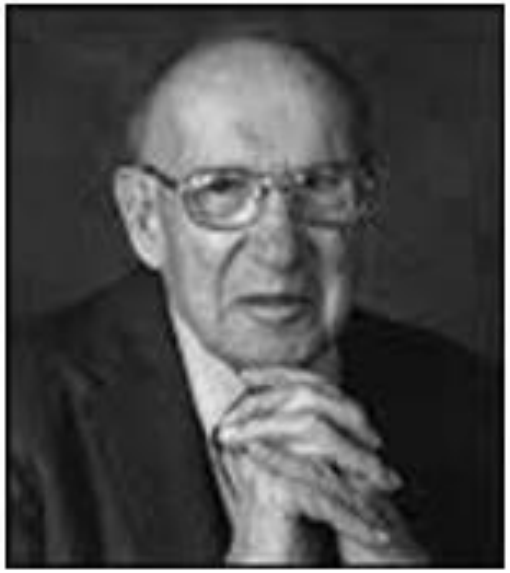
- Budgeting is the bane of corporate America'
-
  - Jack Welch, ex-CEO, General Electric



- 'The process of management is not about administering fixed budgets, it is about the dynamic allocation of resources'
-
  - Lord Browne, ex-CEO, BP



- 'Uncertainty…has become so great as to render futile, if not counterproductive, the kind of planning most companies still practice; forecasting based on probabilities'
-
  - Peter Drucker



Budgeting

The Purpose of Budgets

Meeting organization's objectives

Planning

Monitor & Control

Co-ordination

Evaluating Performance

Motivation for Managers

Management Contract

Communication

Provide a basis for authorising expenditure

Identify scarce resources

Delegation of responsibility

The smallest problem…



73% of companies need more than 3 months to complete the annual budget.

Hackett Group 2008

Budgets are bad for business?

Main criticisms of budgets are

- *Too resource and time consuming*
- *Slow to detect problems*
- *Not reliable for performance evaluation*
- *Quickly out of date*
- *Game Playing (Agency Problem)*
- *Financial targets overwhelming what is good for the business and ultimately shareholders*
- *Over emphasis on short term financial measures*
- *Departmental budgets may encourage "silo" thinking*
- *Disrupts cooperation*
- *Discourages innovation and adaption to changing conditions and opportunities*
- *Process lacks rigor*

VALUE FOR MONEY

ECONOMY

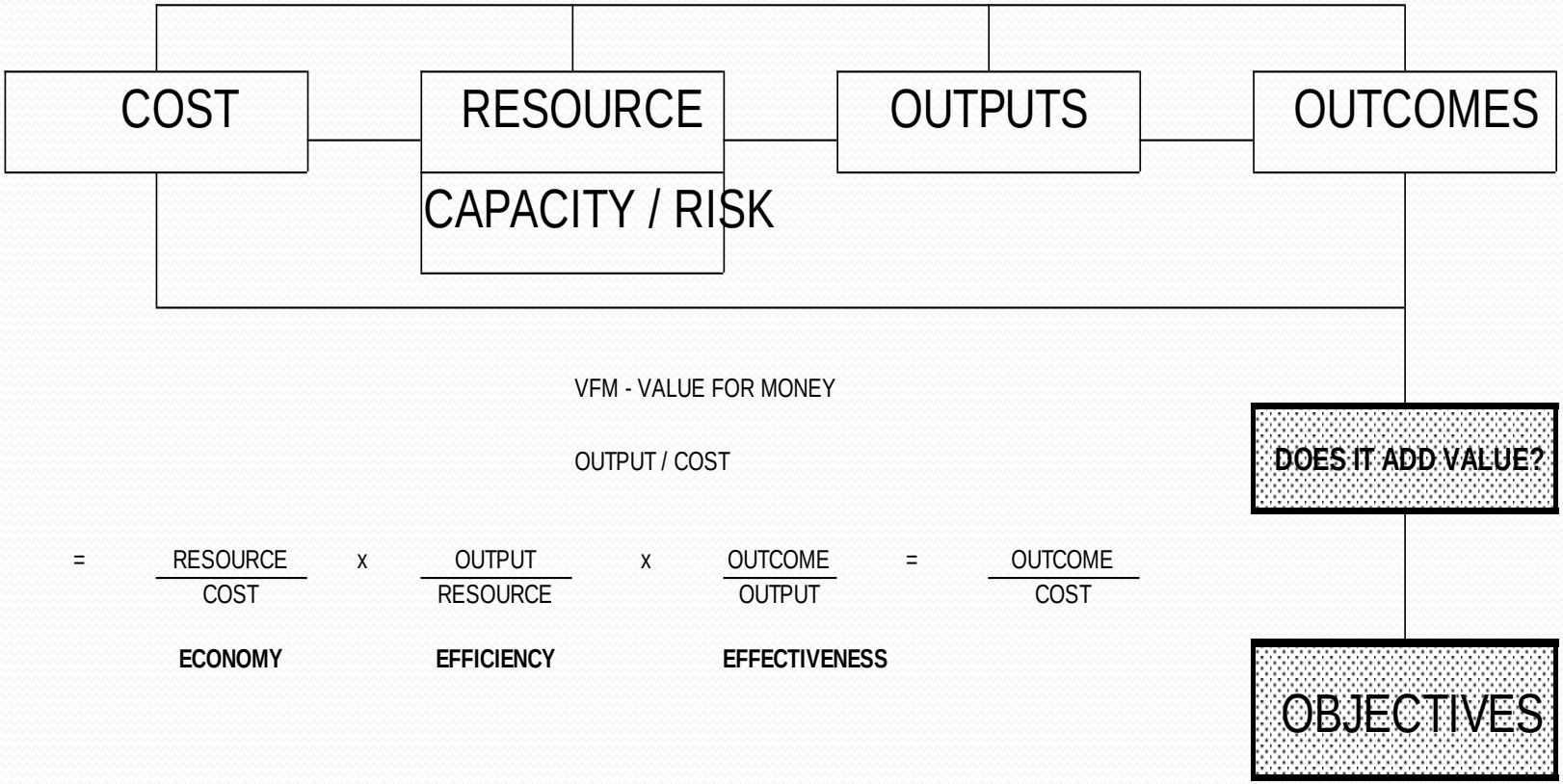
RESOURCE / COST

EFFICIENCY

OUTPUT / RESOURCE

EFFECTIVENESS

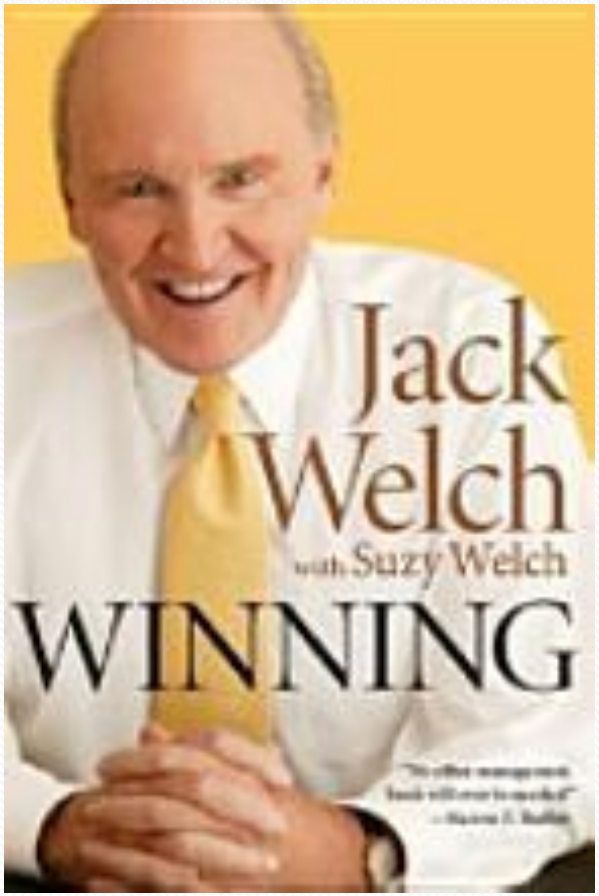
OUTCOME / OUTPUT



$$\text{VFM} = \frac{\text{RESOURCE}}{\text{COST}} \times \frac{\text{OUTPUT}}{\text{RESOURCE}} \times \frac{\text{OUTCOME}}{\text{OUTPUT}} = \frac{\text{OUTCOME}}{\text{COST}}$$

ECONOMY **EFFICIENCY** **EFFECTIVENESS**

Jack Welch - STRETCH



STRETCH - The fundamental part of Stretch came down to a focus on performance against the competition. Under the old system, if you met your budget you were a hero and got your bonus. Under Welch's new system the important measurement was your performance against that of your competitors

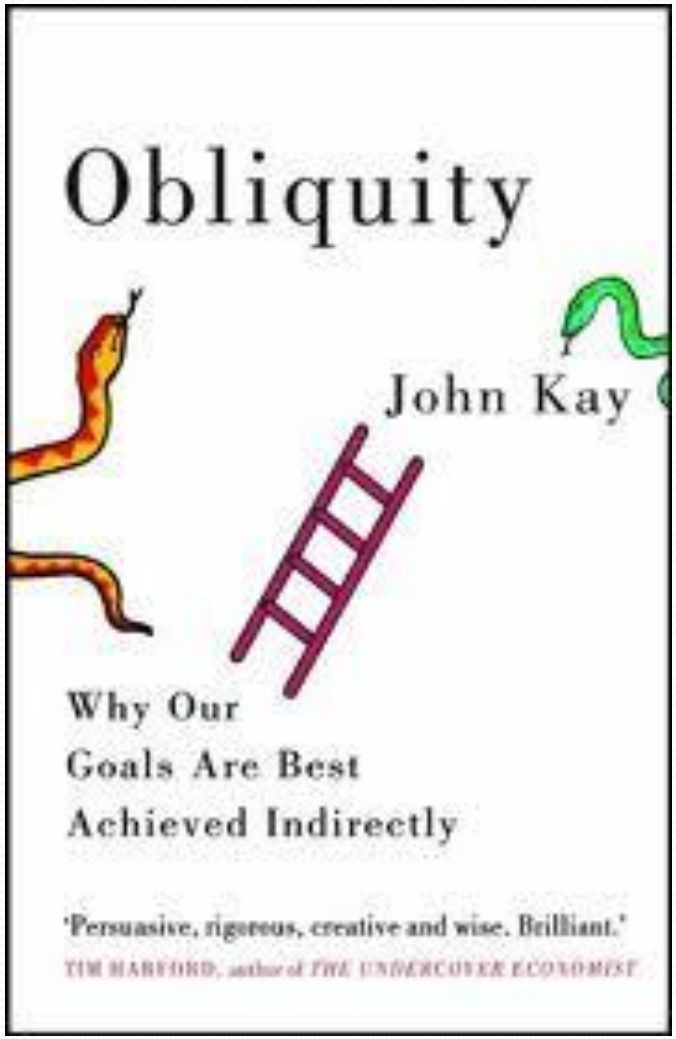
DON'T BEAT THE BUDGET – BEAT THE COMPETITION

USE RELATIVE PERFORMANCE MEASURES

Beyond Budgeting – Stretch Targets Advantages

- **VARIANCE CONTROLS**
  - **Lead to an "excuse" culture**
- **RELATIVE KPI CONTROLS**
  - **Lead to an "improvement" culture**

Obliquity – Indirect Routes Get You There Fastest John Kay





MONTHLY BUDGETARY REPORTING

MONTH		
ACTUAL	BUDGET	VARIANCE

YEAR TO DATE		
ACTUAL	BUDGET	VARIANCE

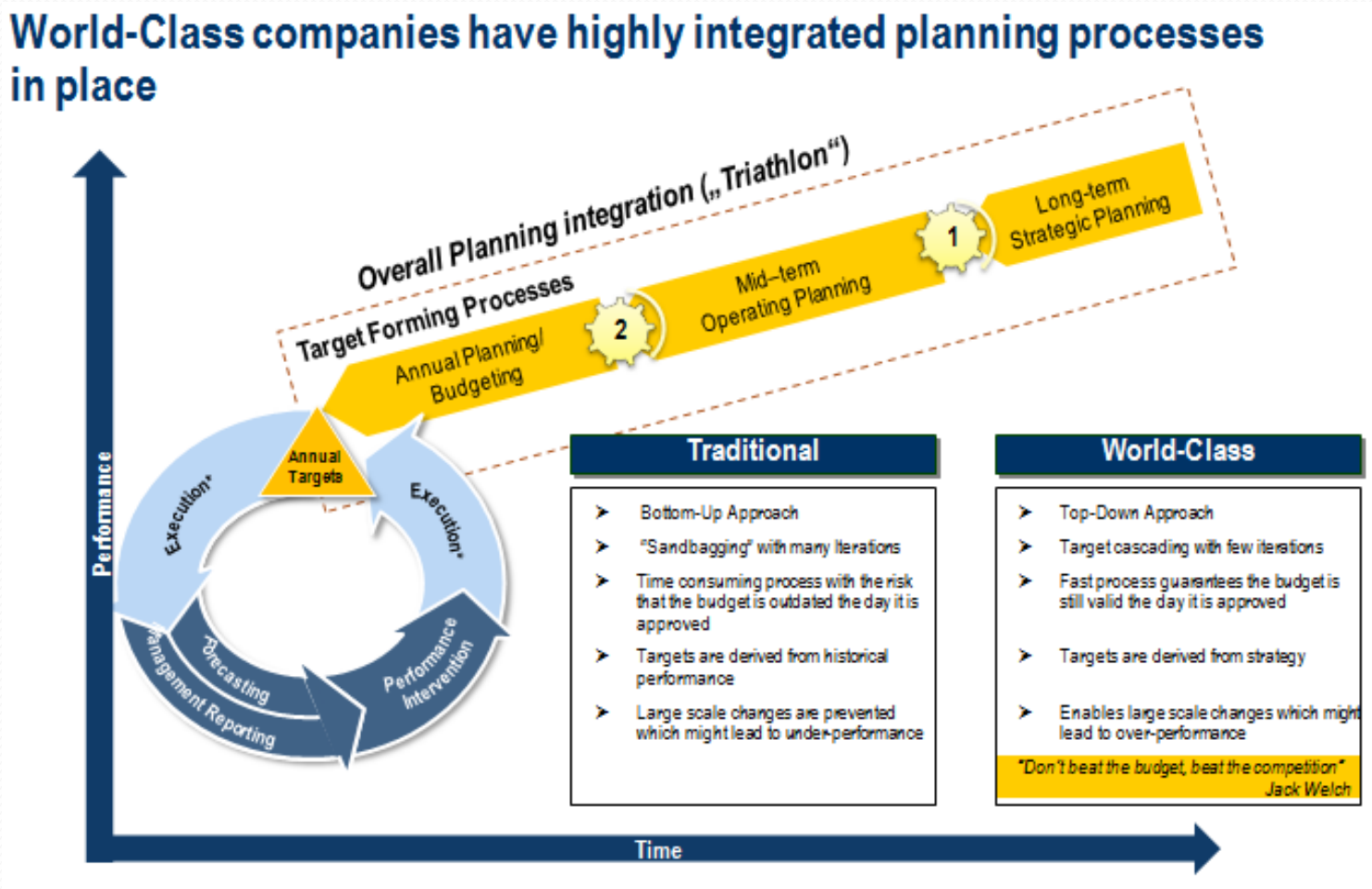
YEAR		
FORECAST	BUDGET	VARIANCE

COMMENTARY
REVIEW
ANALYSIS
ACTION

COMMENTARY
REVIEW
ANALYSIS
ACTION

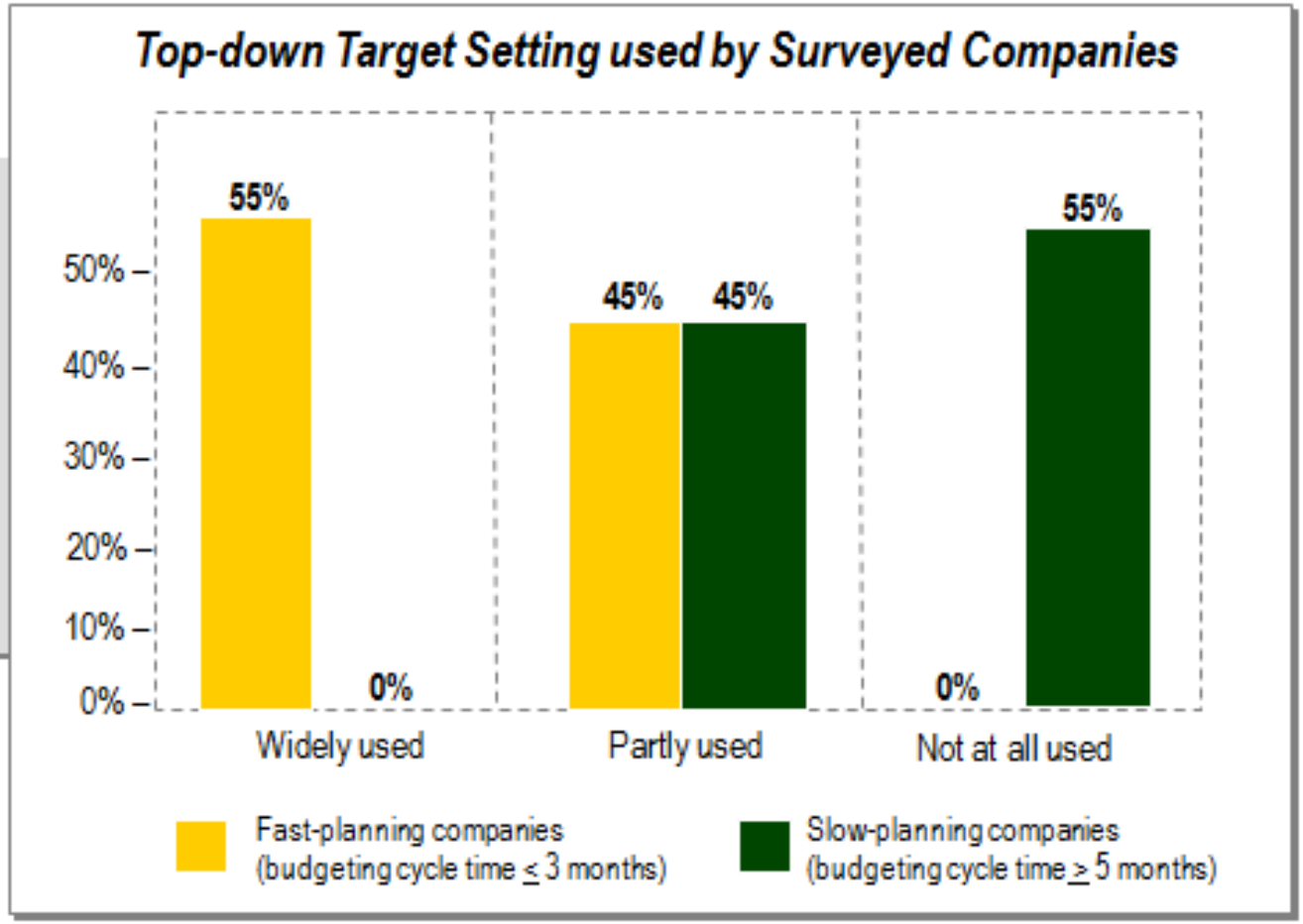
COMMENTARY
REVIEW
ANALYSIS
ACTION

“World Class” - Hackett



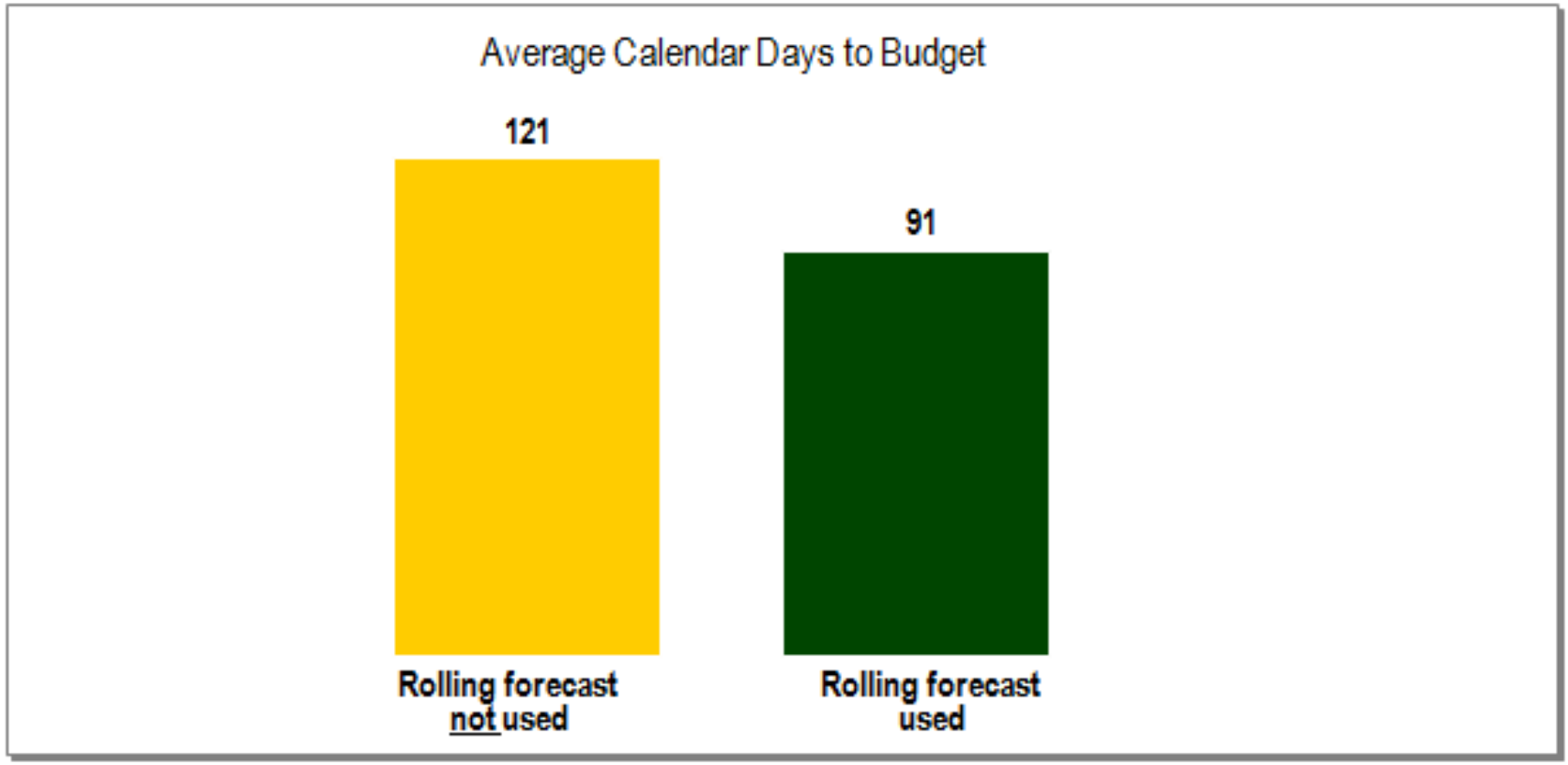
Top-down target setting is the key differentiator

The majority of fast-planning companies use top-down target setting; the remaining fast-planning companies use that best practice at least in part.

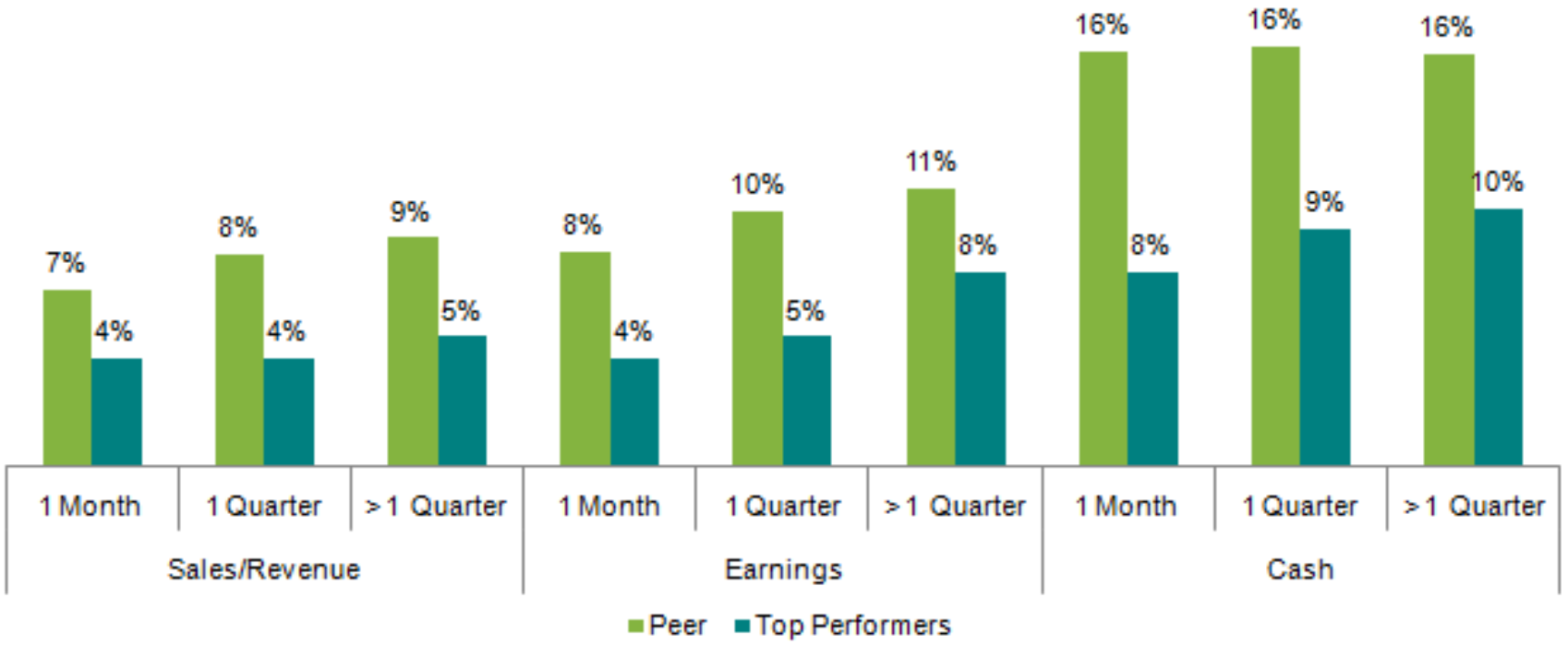


Fast-planning companies utilize a Rolling Forecast to reduce efforts and improve quality in budgeting

Utilization of a Rolling Forecast * and impact on cycle time



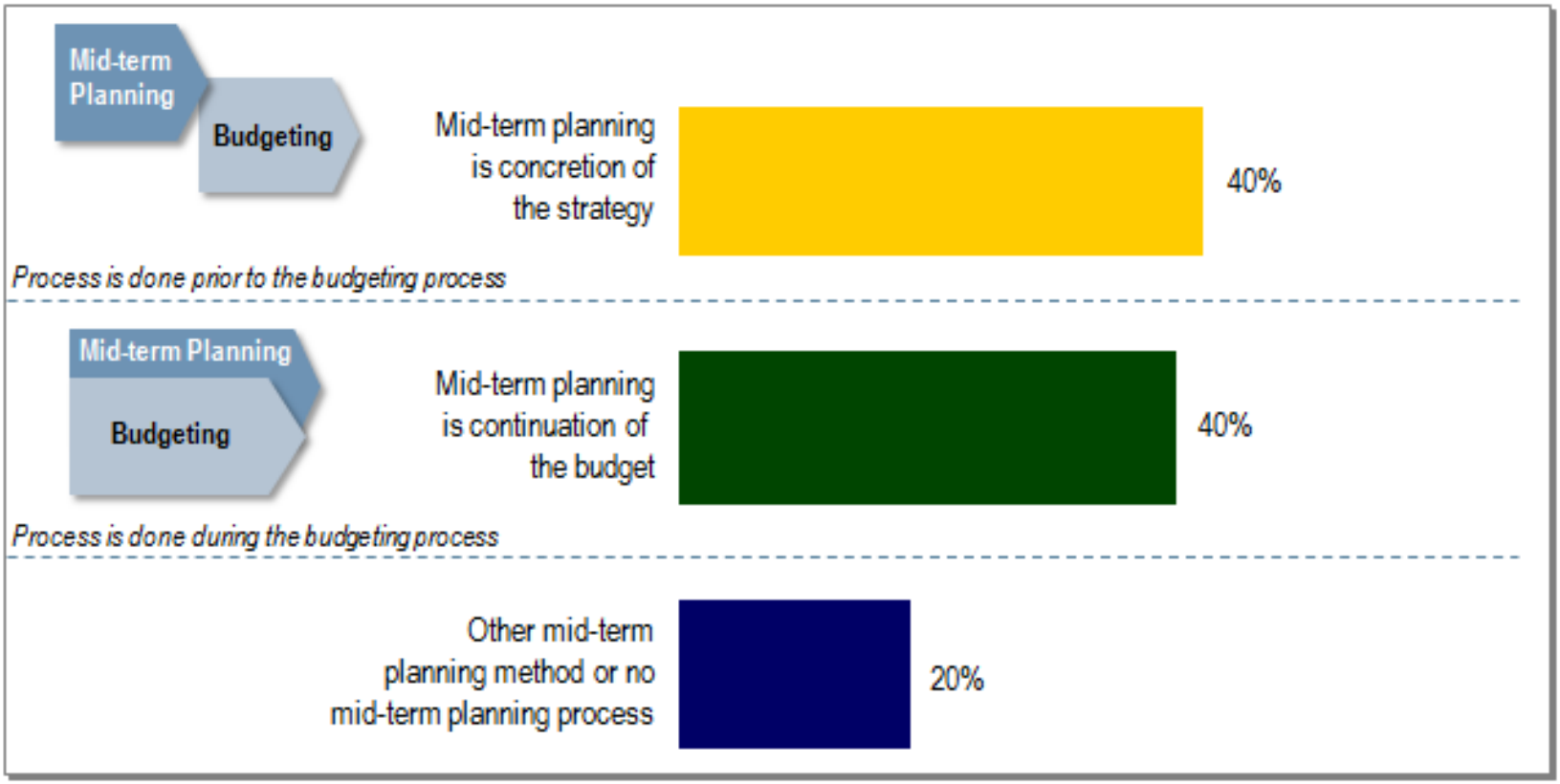
Top Performers have shorter cycle times and are almost twice as accurate that Peers according to Hackett 2011 – Global EPM Study



- Accuracy of forecasts of top performers is about twice higher than of peers
- Cash is by far the least accurately forecasted financial parameter, sales / revenue the most, and earnings in between
- Difference between short term and longer term forecasting accuracy is relatively small, with the exception of earnings

Two different approaches are widely used in mid-term operating planning

Mid-term Operating Planning Approaches used by Surveyed Companies



Tools

- Analytical Tools
- Excel
- Access
- SAP – Business Warehouse

Investment Decisions

Evaluating Capital Expenditure Options

The following are based on projected CASH FLOWS, **NOT** Costs:

	Option A	**Option B**
	£	£
Now	(10,000)	(10,000)
Year 1	5,000	1,000
Year 2	4,000	2,000
Year 3	2,000	3,000
Year 4	2,000	4,000
Year 5	1,000	5,000
Net Saving	**4,000**	**5,000**

Discount table - Present Value of £1

YEAR	8%	9%	10%	20%	21%	22%
0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.9259	0.9174	0.9091	0.8333	0.8264	0.8197
2	0.8573	0.8417	0.8264	0.6944	0.6830	0.6719
3	0.7938	0.7722	0.7513	0.5787	0.5645	0.5507
4	0.7350	0.7084	0.6830	0.4823	0.4665	0.4514
5	0.6806	0.6499	0.6209	0.4019	0.3855	0.3700
6	0.6302	0.5963	0.5645	0.3349	0.3186	0.3033
7	0.5835	0.5470	0.5132	0.2791	0.2633	0.2486
8	0.5403	0.5019	0.4665	0.2326	0.2176	0.2038
9	0.5002	0.4604	0.4241	0.1938	0.1799	0.1670
10	0.4632	0.4224	0.3855	0.1615	0.1486	0.1369

INVEST IN WHICH ?

YEAR	Project A	Project B	Discount Factor 10%		Project A DCF (10%)	Project B DCF (10%)
0	-10000	-10000	1.0000		-10000	-10000
1	5000	1000	0.9091		4545	909
2	4000	2000	0.8264		3306	1653
3	2000	3000	0.7513		1503	2254
4	2000	4000	0.6830		1366	2732
5	1000	5000	0.6209		621	3105
Net	4000	5000		**NPV**	1341	653

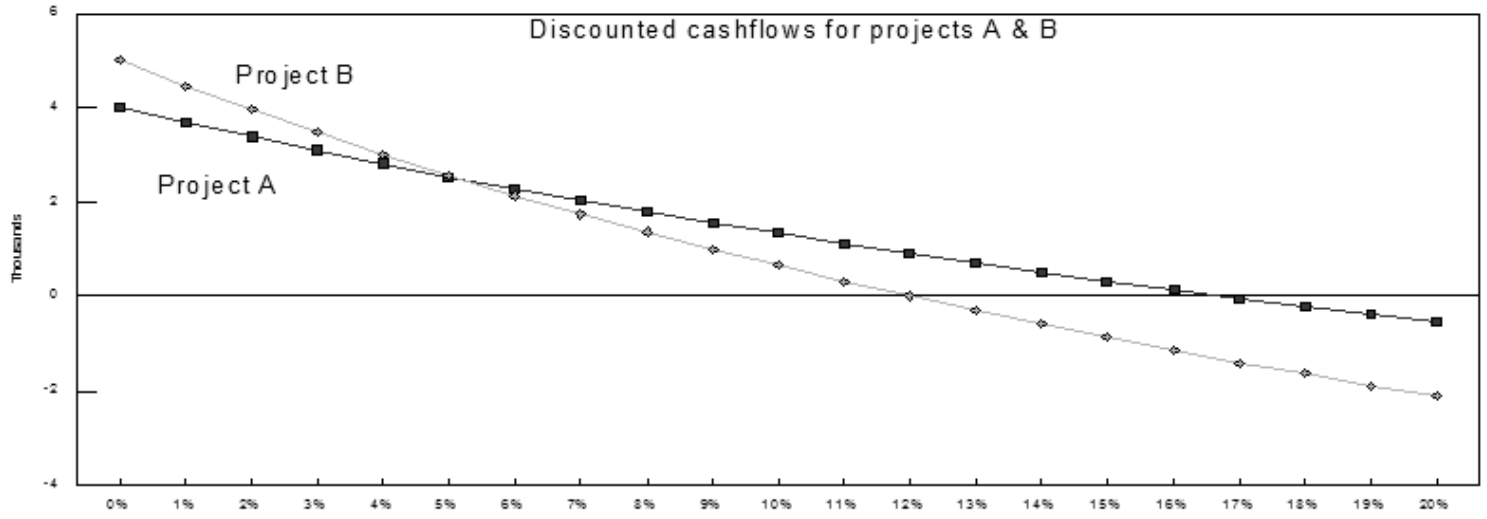
YEAR	Project A	Project B	Discount Factor 20%		Project A DCF (20%)	Project B DCF (20%)
0	-10000	-10000	1.0000		-10000	-10000
1	5000	1000	0.8333		4167	833
2	4000	2000	0.6944		2778	1389
3	2000	3000	0.5787		1157	1736
4	2000	4000	0.4823		965	1929
5	1000	5000	0.4019		402	2009
Net	4000	5000		**NPV**	-532	-2103

Internal Rate of Return

CAPITAL INVESTMENT APPRAISAL - EXAMPLE

NPV

	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
ProjectA	4000	3888	3385	3095	2815	2547	2288	2038	1797	1565	1341	1124	915.1	712.9	517.3	328.1	145	-32.3	-204	-370	-532
ProjectB	5000	4484	3954	3488	3008	2588	2147	1747	1385	1001	652.8	319.9	1.792	-303	-594	-873	-1140	-1398	-1642	-1877	-2103



Cost of Capital

Cost of Capital Calculations

Example from E.on published accounts 07

Cost of Equity

		A	Beta B	A x B
Risk Free Rate	5.10%	5.10%	1.0	5.10%
Market Premium		5.00%	0.7	3.50%
Required rate	Market	10.10%	E.on	8.60%

Cost of Debt

Cost of Debt before tax		5.60%
Tax shield - interest reduces tax	35.00%	-1.96%
After tax cost of debt		3.64%

WACC

	Mix M	Cost C	M x C	
Share of Equity	45%	8.60%	3.87%	
Share of Debt	55%	3.64%	2.00%	
WACC - weighted average cost of capital			5.87%	After tax rate
Tax	35%		3.16%	
	100%		9.03%	Before tax rate

Improving Financial Justification for Decisions 11 Ideas

1. Check the decision against objectives / policy
   - for major or long term decision demonstrate the *'strategic fit'*

2. Start with specifications / problems not solutions
   - avoid being enticed by the technology!

3. Learn from experience

4. Review previous decisions
   - use post investment / decision appraisal

5. State and document assumptions

6. Identify 'milestones' for monitoring projects/proposal progress

7. Identify critical success factors
   - what will cause the project/proposal to fail and therefore what needs to be managed

8. Recognise and try to quantify risks

9. Include sensitivity analysis

10. Consider relevant costs – ignore previous sunk cost

11. Gain commitment to the figures

Example

Buy Truck A or Truck B

	Year	Truck A	Truck B	DF 10%	Annuity Factor	Truck A	Truck B	EAC Truck A	EAC Truck B	EAC Discounted Truck A	EAC Discounted Truck B
Purchase Cost	0	-10,000.00	-16,000.00	1.00		-10,000.00	-16,000.00				
Running Cost	1	-2,000.00	-2,000.00	0.91	0.91	-1,818.18	-1,818.18	-6,021.15	-6,220.76	-5,473.77	-5,655.24
	2	-2,000.00	-2,000.00	0.83	1.74	-1,652.89	-1,652.89	-6,021.15	-6,220.76	-4,976.16	-5,141.12
	3	-2,000.00	-2,000.00	0.75	2.49	-1,502.63	-1,502.63	-6,021.15	-6,220.76	-4,523.78	-4,673.75
	4		-2,000.00	0.68	3.17	0.00	-1,366.03		-6,220.76	0.00	-4,248.86
	5		-2,000.00	0.62	3.79	0.00	-1,241.84		-6,220.76	0.00	-3,862.60
	Total	-16,000.00	-26,000.00			-14,973.70	-23,581.57			-14,973.70	-23,581.57
	Years	3.00	5.00		Annuity Factor	2.49	3.79				
	Average	-5,333.33	**-5,200.00**		EAC	**-6,021.15**	-6,220.76				

Day 5

Measuring corporate performance: requirements of a successful performance measurement system

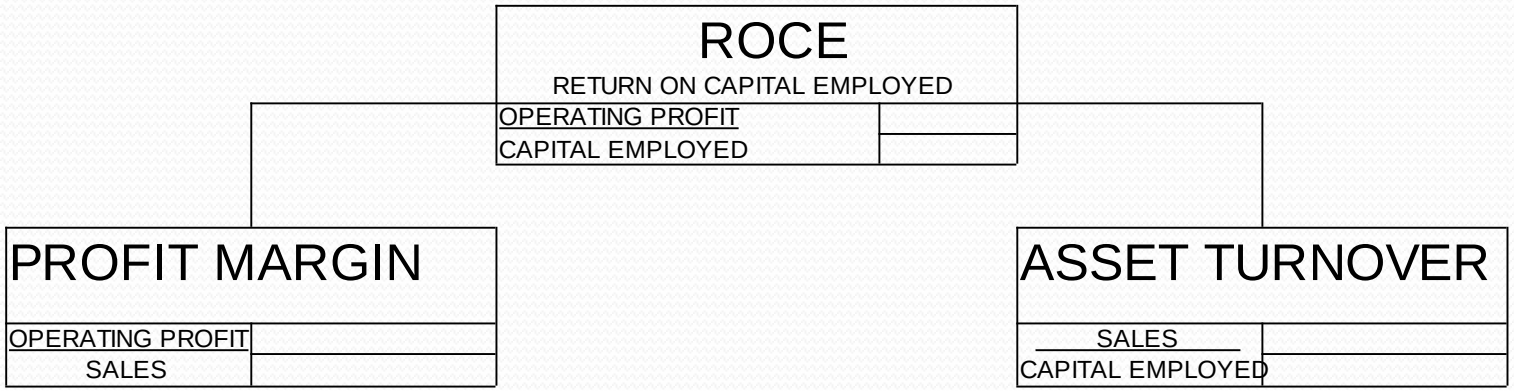
- Broadening performance measurement systems
- The Drive toward Shareholder Value (EVA®)
- Beyond budgeting: integrating financial and non-financial issues
- Introducing the Balanced Scorecard and the key perspective

Broadening performance measurement systems

- Why do we need to measure performance?

Traditional View of Performance

A HIERARCHY OF FINANCIAL RATIOS - DUPONT ANALYSIS



CAPITAL EMPLOYED = FIXED ASSETS + WORKING CAPITAL

FIXED ASSETS
WORKING CAPITAL

The Drive toward Shareholder Value (EVA®)

EVA – Economic Value Added



NOPLAT – Capital Charge

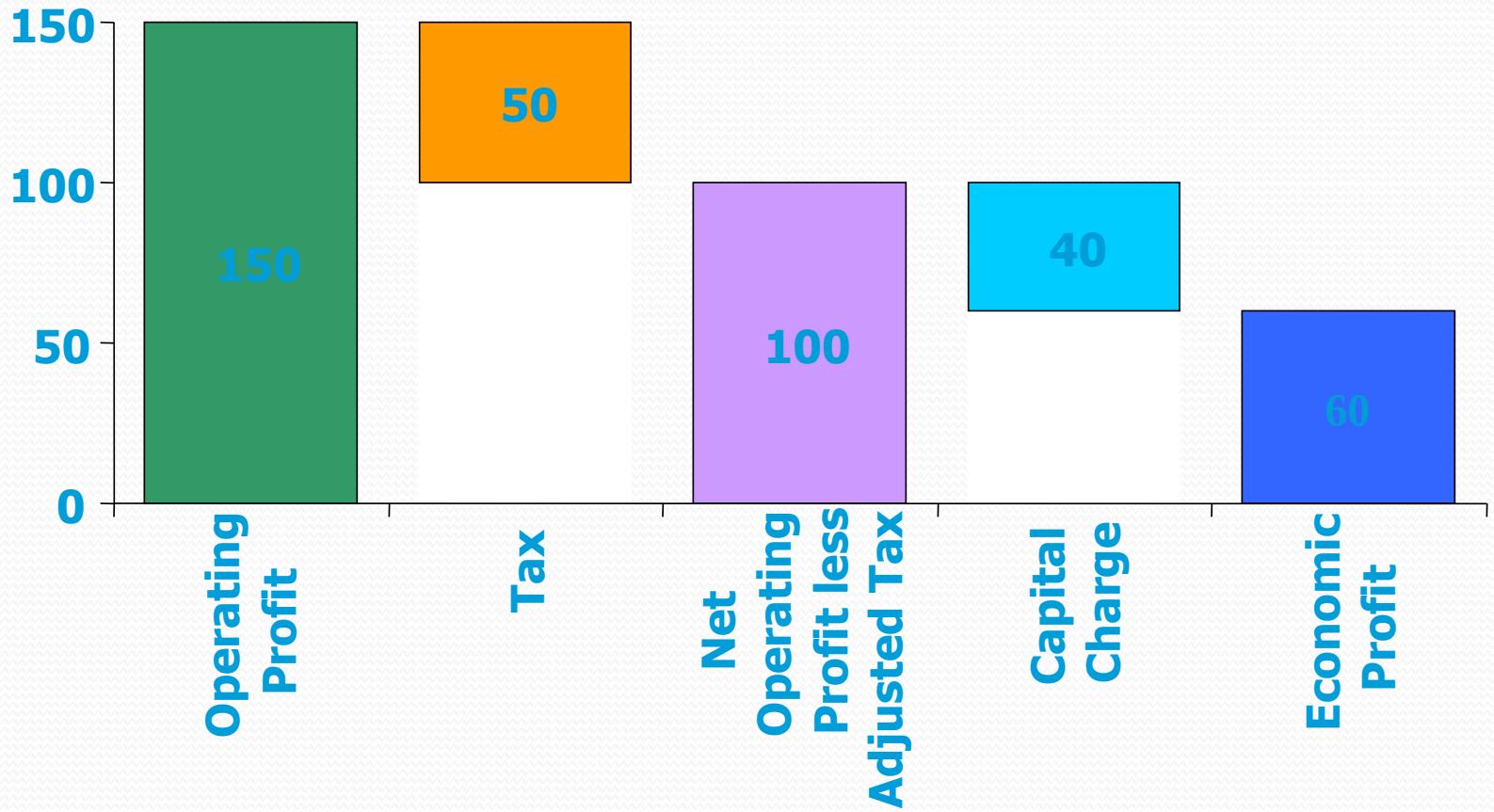
NOPLAT = Net Operating Profit After Tax (Calculated with adjustments)

System goes beyond measurement also includes rewards

Economic profit

- Re-branding of 'residual income'
- Surplus operating profit after tax & after deducting a charge for capital employed
- EVA® = EP with up to 164 adjustments (trademarked by Stern Stewart & Co.)
- Diageo & Siemens

Economic profit



Economic profit illustration: Royal Mail Holdings plc year ending March 2004

	£m
Operating profit	51
Tax on operating profit at 30%	(15)
NOPLAT	36
Capital Charge (£1,165m x 9.5%)	(111)
Economic Profit	(75)

Source: Shareholder Executive Annual Report 2004/5

Economic profit – the interpretation

- Although successful from an accounting profit perspective, the cost of using investors' funds is ignored by just focusing on operating profit
- Once the full cost of investors' funds is included (the capital charge) then we have a true indication of the underlying economic profit of an entity

Economic profit – the inputs

- Operating profit – excluding gains and losses arising from non-operating assets
- Capital charge, being:
  - Invested capital – being equity plus net debt, multiplied by…
  - Cost of capital – calculated using quoted comparables from relevant sectors

Economic profit insights – lessons from Diageo

Scotch Whisky	
Revenues	£100m
Costs	£50m
Invested capital	£400m
Cost of capital	10%

Vodka	
Revenues	£90m
Costs	£60m
Invested capital	£100m
Cost of capital	10%

Economic profit insights – lessons from Diageo

Scotch Whisky	
Operating profit	
Margin	
Economic profit	

Vodka	
Operating profit	
Margin	
Economic profit	

As a result of analysis like this, the business switched funds from lower value-added brands (whisky) to the higher ones (vodka) and diverted advertising expenditure accordingly

Cascading the measures

- The ultimate objective
- The stock market measure used at corporate level
- The internal short-term performance measure
- Generic financial value drivers
- Operational measures

- Maximise shareholder value
- Total Shareholder Returns (TSR)
- Economic profit
- Growth, margins, efficiency, cost of capital
- Financial and non-financial kpi's

Financial ratios	A	B	C	D	E
Performance					
ROCE	42.69%	18.96%	7.67%	8.96%	8.66%
Profit Margin	33.62%	5.07%	3.40%	15.32%	5.59%
Asset Turnover	1.27	3.74	2.26	0.58	1.55
Working Capital (expressed as 'days of sales')					
Stock	38	47	11	3	47
Trade Debtors	68	76	2	8	46
Trade Creditors	-14	-58	-29	-29	-41
(Finance from) / Invested in WC	93	66	-16	-17	52
Financial status					
Liquidity - Current ratio	1.51	1.74	0.41	0.59	1.43
Gearing - Debt / Equity	25.39%	47.51%	19.66%	84.85%	46.92%
Employee ratios					
Per employee (£000)					
Sales	228	316	106	45	101
Cost	54	31	13	14	31
Operating Profit	77	16	4	7	6
Employment costs to sales	24%	10%	12%	32%	31%

Stock market Ratios & Terms

1. EPS – Earnings Per share $\frac{\text{Profits Attributable to ordinary Shareholders}}{\text{Number of Ordinary Shares}}$

2. P/E ratio $\frac{\text{Share Market Price}}{\text{EPS}}$

3. Dividend Yield $\frac{\text{Dividend}}{\text{Share price}}$

4. Total Shareholder Return (TSR) $\frac{\text{Price Inncrease + Dividend}}{\text{Price (Start)}}$

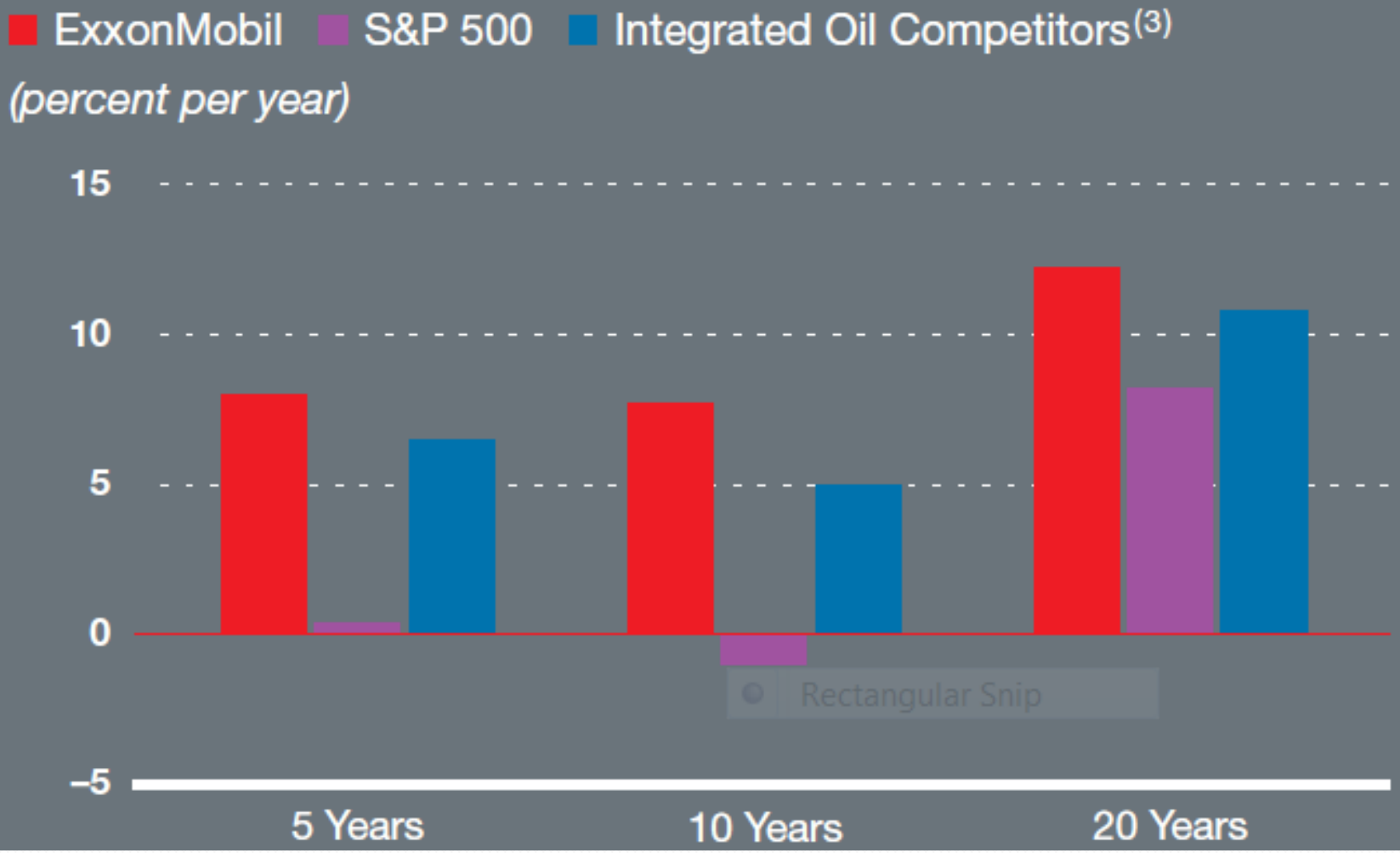
5. Market Capital = Market value (Share Price x Number of Shares)

6. Enterprise Value = market capitalization plus debt, minority interest and preferred shares, minus total cash and cash equivalents.

Share Prices & Ratios – Times Monday 7th January 2008

Company	Market Cap (£M)	Share Price	Yield %	P/E Ratio
Marks & Spencer	**8, 719.60**	**518**	**3.9**	**13.2**
Next	2,986.50	1464	3.5	10.0
Tesco	35,758.00	456	2.2	19.3
BP	118,736.0	627.5	3.3	11.7
GSK	70,287.10	1276	4.0	13.4
AstraZeneca	30,742.70	2110	4.2	12.4
Smith & Nephew	5,167.30	577	1.0	14.4
BSkyB	10,150.10	576.5	2.7	20.3
ITV	3,037.40	78	4.0	14.2

Total Shareholder Returns[2]



Top Tip

- Strive for more relative measures rather than internally focused measures
- Focus on Customers and Customer Value to Deliver Shareholder or Stakeholder Value
- "Beat the Competition" not the internal measure

- How do these ideas apply to you? / What can you do now?

Cost control and reduction

Cost behaviour and modelling

Cost Models for Management Decision Making

Activity Based Cost management

"Lean" and Cost management

Managing and costing constraints - what holds back your organisation? What do these constraints cost you and how could they be overcome?

Mini Case Study / Exercise – The Nature of Costs

Exercise / Toolbox 3 – Reducing Complexity and Variety to reduce needless cost

Understanding & working with costs

Cost	v	Value
Relevant	v	Irrelevant
Controllable	v	Uncontrollable
Capital	v	Revenue
Planned	v	Unplanned
Essential	v	Discretionary
Direct	v	Indirect/overhead
Fixed	v	Variable

Standard Cost

Opportunity Costs (Cost of Lost Opportunity)

Sunk Costs (Irrecoverable Costs)

Failure Costs (Cost of errors)

Activity Costs (Costing Complexity & Variety)

Activity Analysis (*Time is money* – What are our people spending our time or cost on? Is it the best use of their time?)

Resource costing and comparison

Benchmarking

Resource Substitution

Resource Sharing – Strategic Alliances

Value Based Pricing v Cost Plus Based Pricing

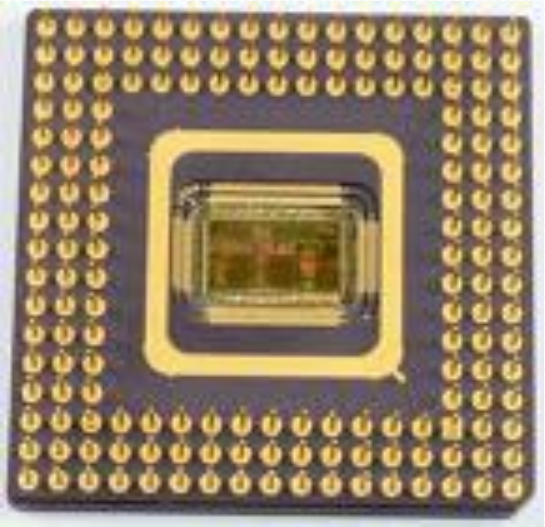
Cost Based	Value Based
Internal Focus	Customer / Market Focus
Inputs	Results
	Target Costing?

Price, Cost & Value

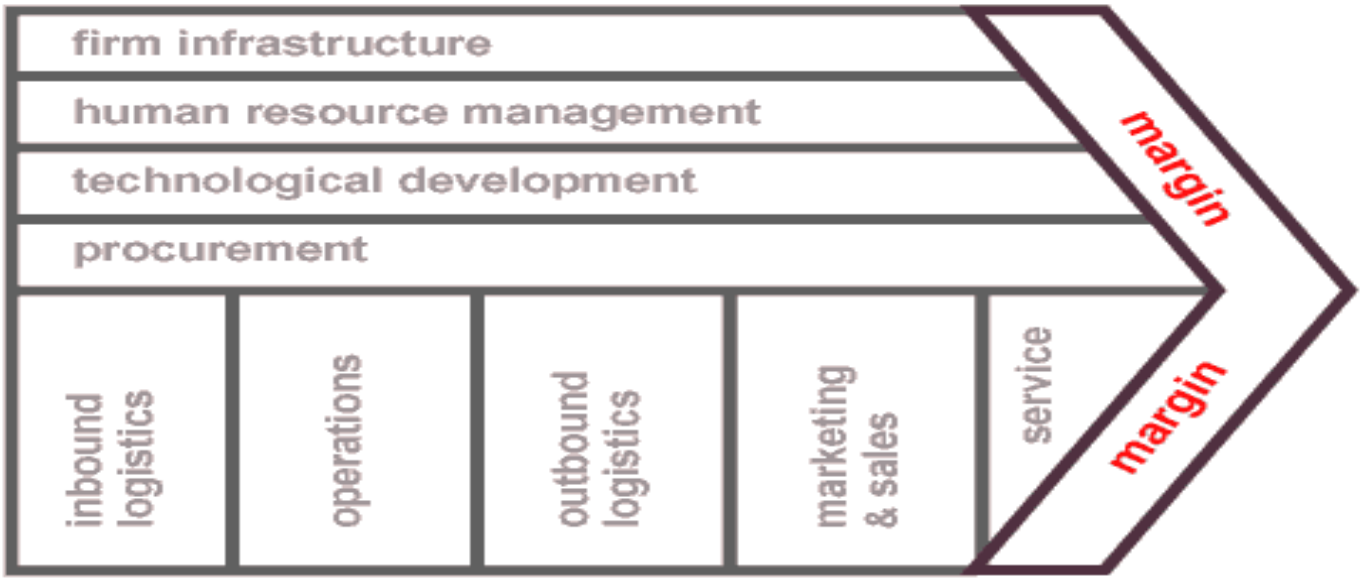
Coffee & Chips

- Cost is not Value
- Price can be used to gauge value
- Pricing can influence perceived “Value”





Value Chain – Michael Porter



Value Analysis / Engineering

Taking out cost without destroying value.

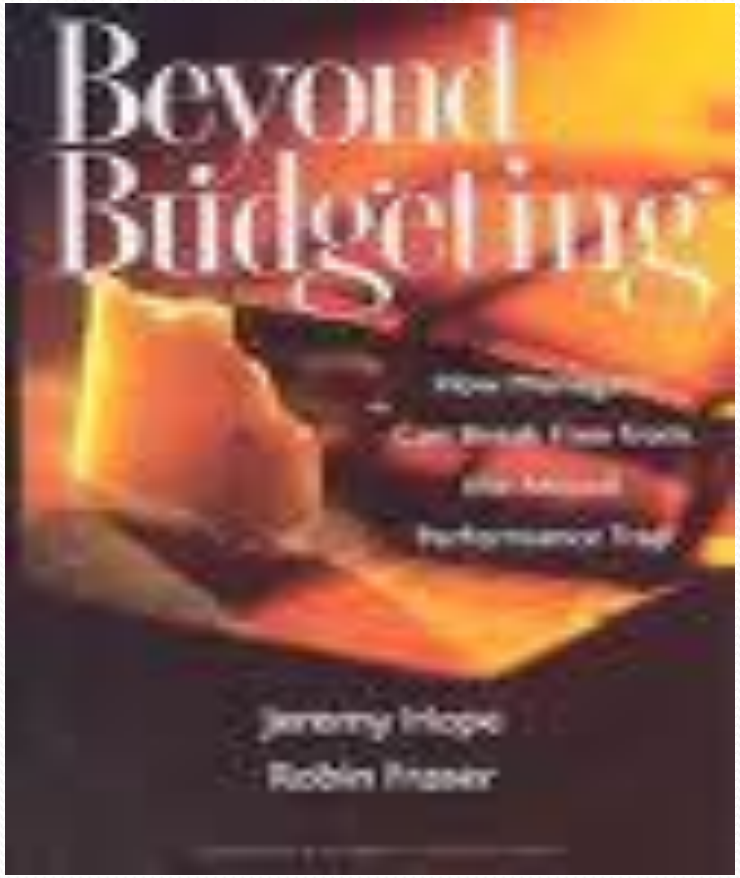
"Discovered" by GE in WWII – when searching for substitute materials



Beyond Budgeting

- Throw the budget in the bin.

Beyond Budgeting



Beyond Budgeting – Key Cases



Svenska Handelsbanken 1972

Statoil

BOREALIS

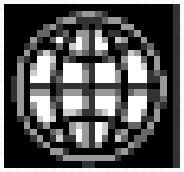
Borealis 1995

Beyond Budgeters?



































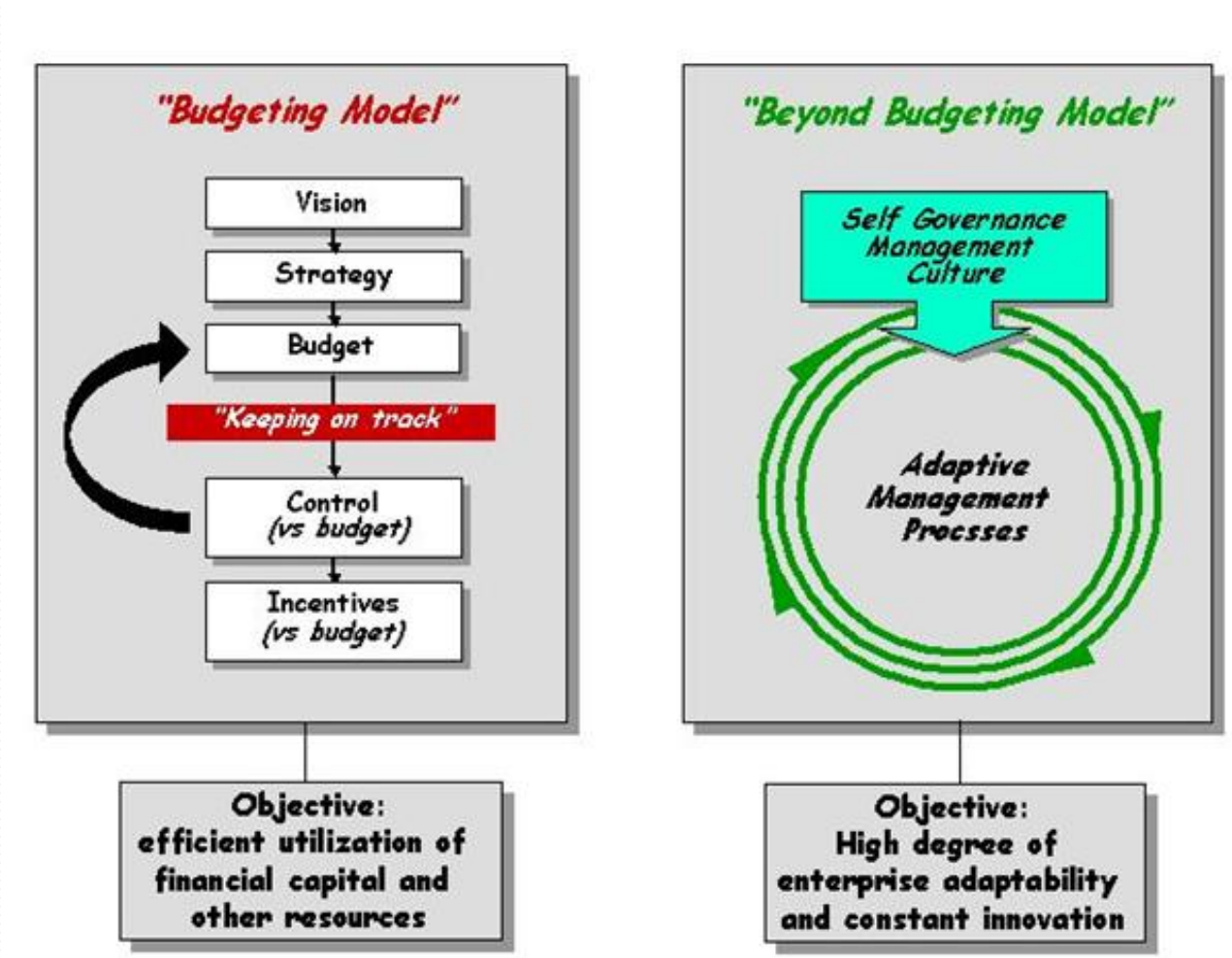






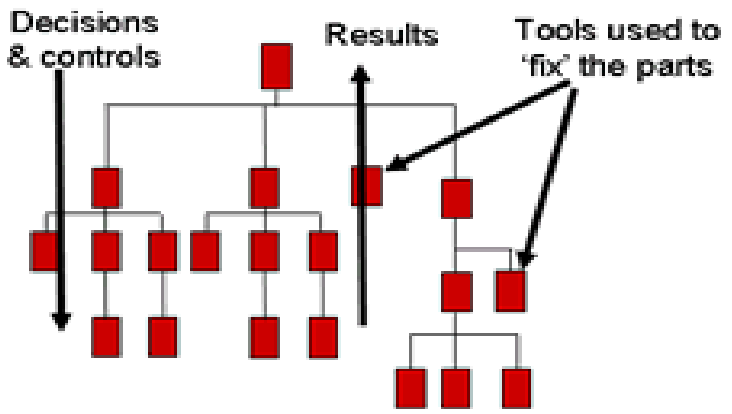


Traditional v Beyond Budgeting



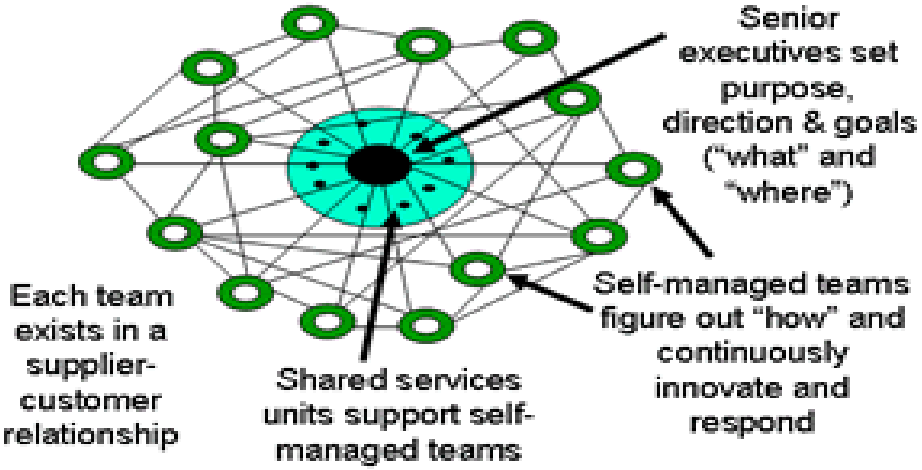
Alternative Management Models

The 'Command and Control' Model



- Organizations are obedient machines
- Organizations are a collection of replaceable parts (parts determine performance of the whole)
- Organizations comprise of 'cause-and-effect' relationships that are predictable
- Organization need central planning, coordination and control
- Change is reactive and project-driven

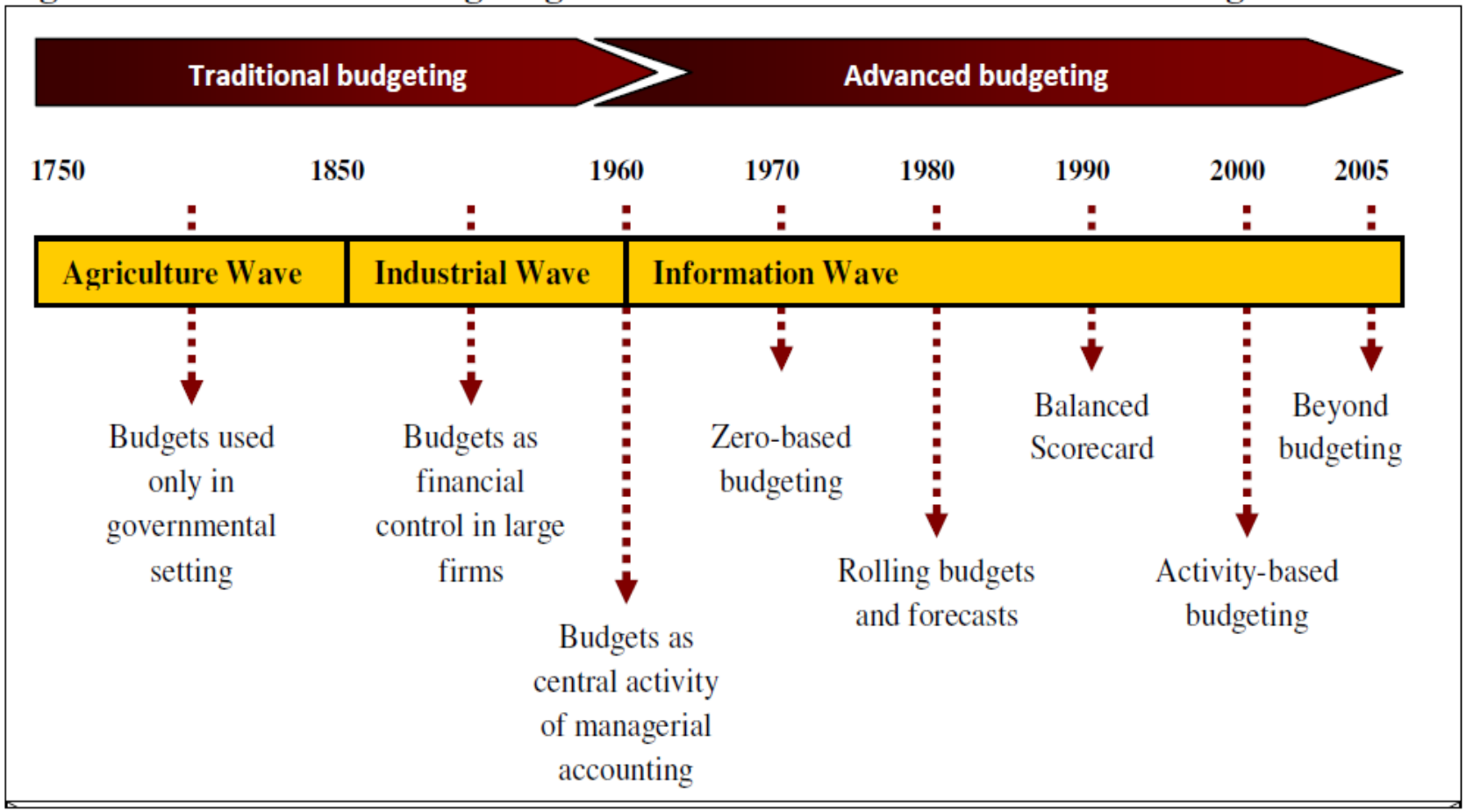
The 'Beyond Budgeting' Model



- Organizations are adaptive systems
- Organizations are holistic systems (whole system determines performance)
- Organizations are webs of relationships that are unpredictable
- Organization are self-organizing and self-regulating
- Change is integrative and adaptive

The 12 'beyond budgeting' (or 'adaptive') model principles	
Process principles	
1. Goals	Set aspirational goals aimed at continuous relative improvement, ***not*** *fixed annual targets*
2. Rewards	Reward shared success based on relative performance, ***not*** *on meeting fixed targets*
3. Planning	Make planning a continuous and inclusive process, ***not*** *an annual event*
4. Controls	Base controls on relative KPIs and performance trends, ***not*** *variances against plan*
5. Resources	Make resources available as needed, ***not*** *through annual budget allocations*
6. Coordination	Coordinate cross organisation interactions dynamically, ***not*** *through annual planning cycles*
Leadership principles	
1. Customers	Focus everyone on improving customer outcomes, ***not*** *on meeting internal targets*
2. Accountability	Create a network of teams accountable for results, ***not*** *centralized hierarchies*
3. Performance	Champion success as winning in the marketplace, ***not*** *on meeting internal targets*
4. Freedom to act	Give teams the freedom and capability to act, ***don't*** *merely require adherence to plan*
5. Governance	Base governance on clear values and boundaries, ***not*** *detailed rules and budgets*
6. Information	Promote open and shared information, ***don't*** *restrict it to those who 'need to know'*

Figure 3.1: Evolution of budgeting within the three waves of economic change



Source: Hope and Hope, 1997; Banovic, 2005.



"Managing the Numbers"

"Managing the Drivers of Business Performance"

But are - Are all decentralised organisations necessarily successful?

	Traditional (budget based) Mgmt. Model	BBM Model
Target & rewards	• Incremental targets • Fixed incentives	• Stretch goals • Relative rewards
Planning & controls	• Fixed annual plans • Variance controls	• Cont. planning • KPI's & rolling forecasts
Resources & coordination	• Pre-allocated resources • Central coordination	• Resources on demand • Dynamic coordination
Organ. & culture	• Central control • Focus on managing #s	• Local control of goals/plans • Focus on value creation

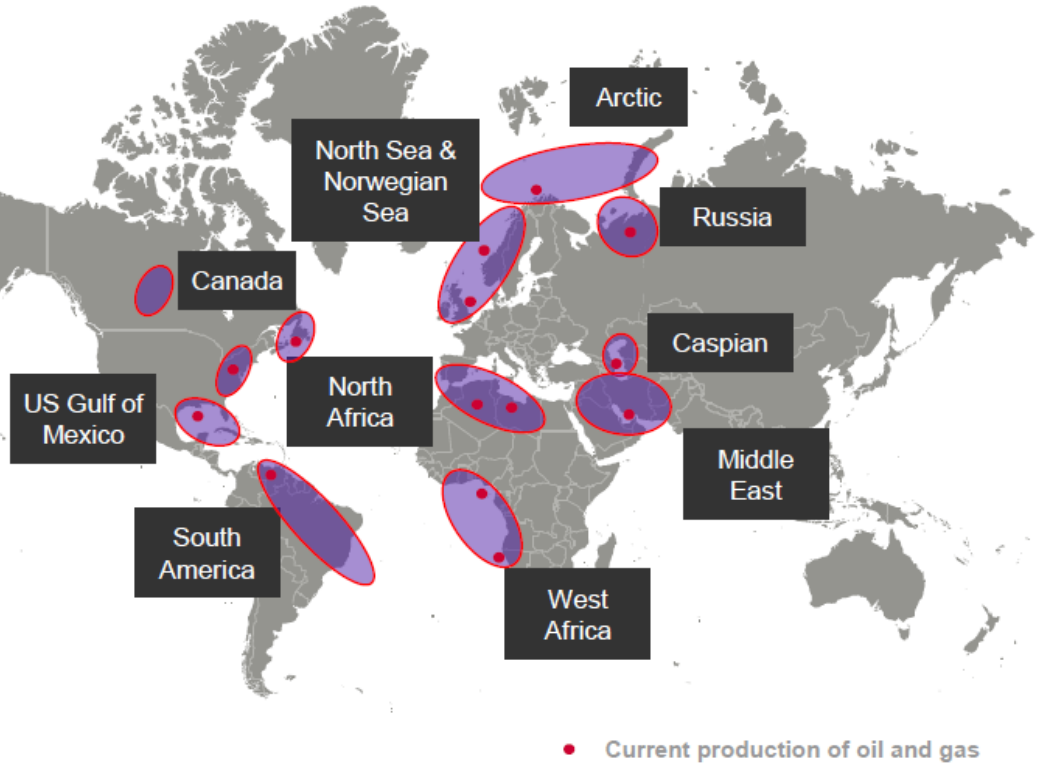
Beyond Budgeting Example - StatOil

- Model about people and behaviour more than P & L?

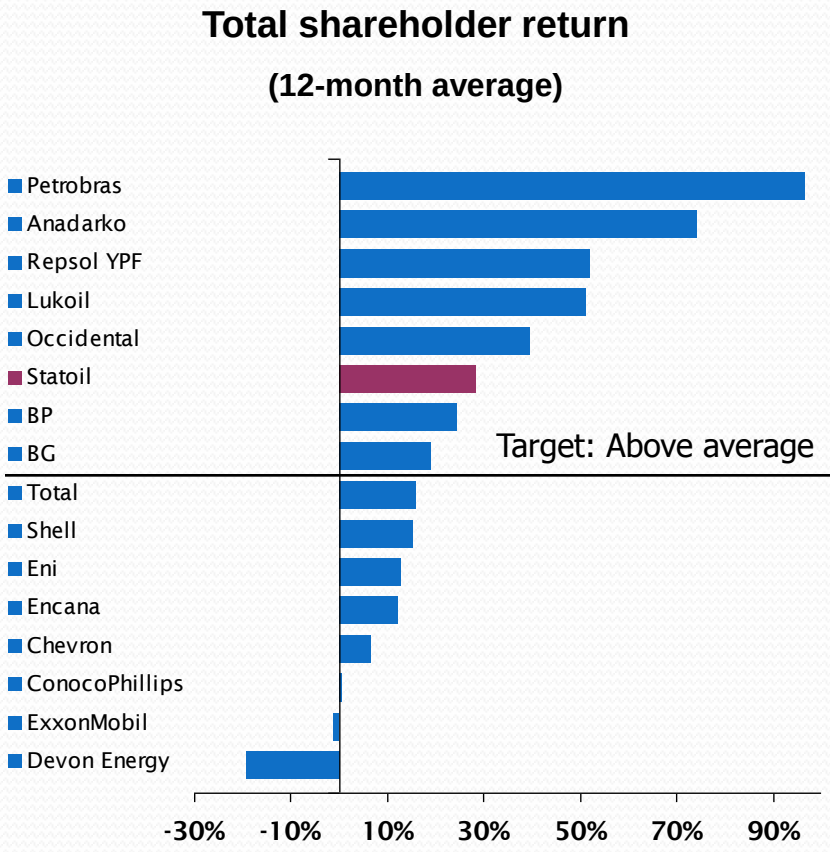
Stat Oil

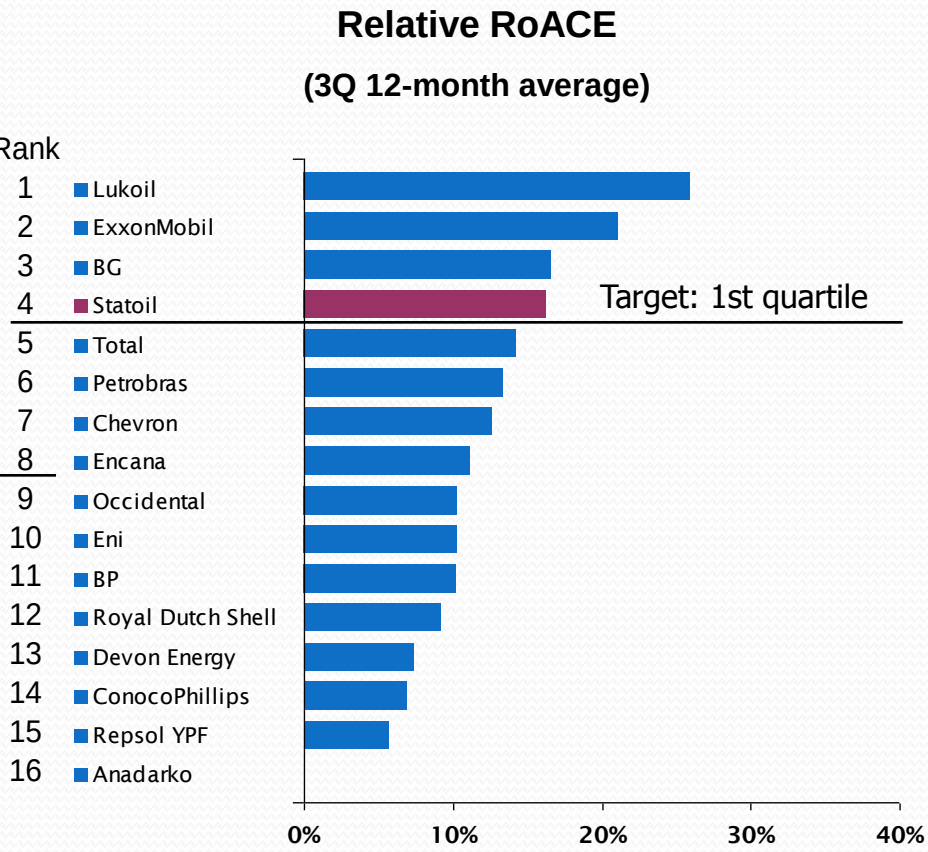
Statoil in brief

- Turnover and market cap approx. 80 bn. USD
- 20.000 employees in 34 countries
- World's largest offshore operator
- Europe's second largest gas supplier
- The world's third largest crude oil seller
- Listed in New York and Oslo



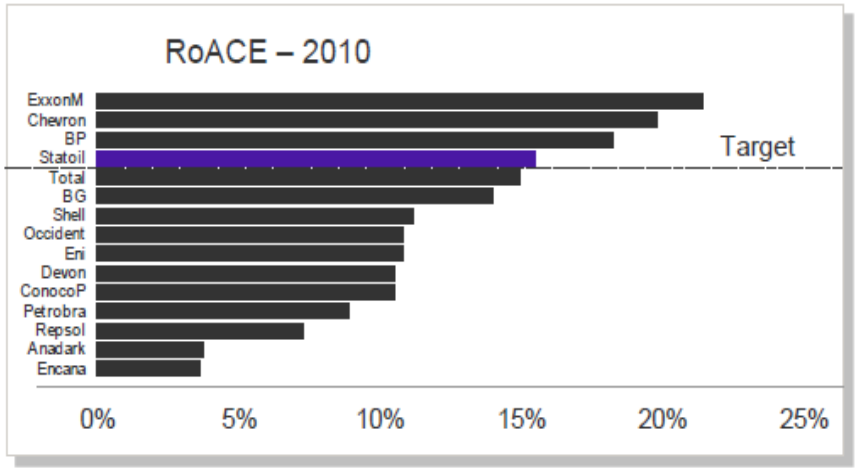
Relative Statoil performance

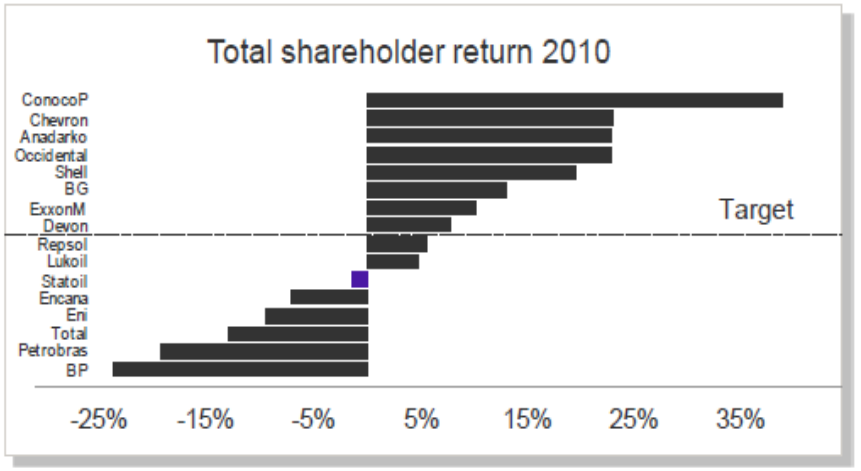


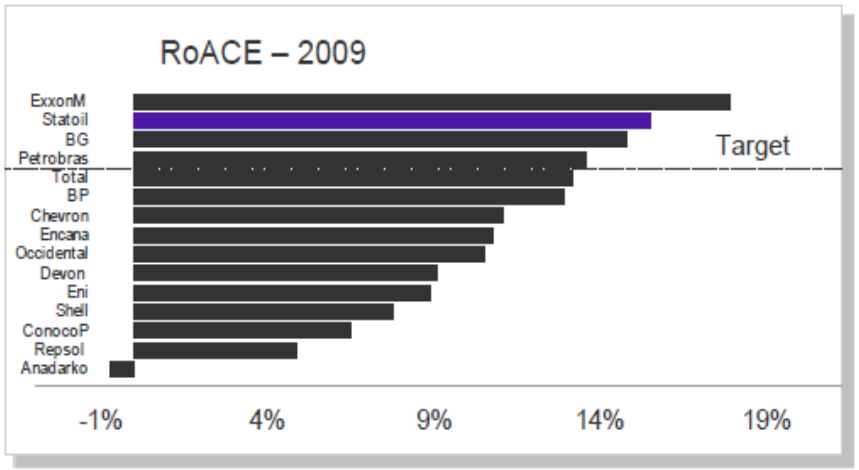


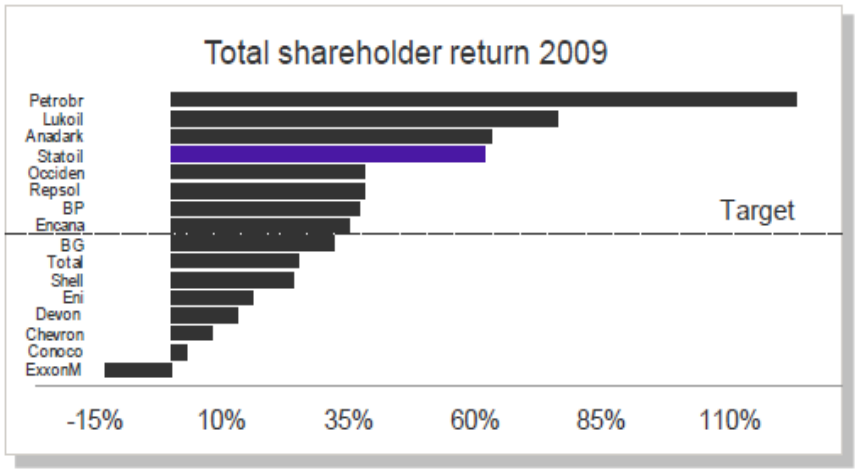
Classification: Internal
Status: Draft

Relative Statoil performance









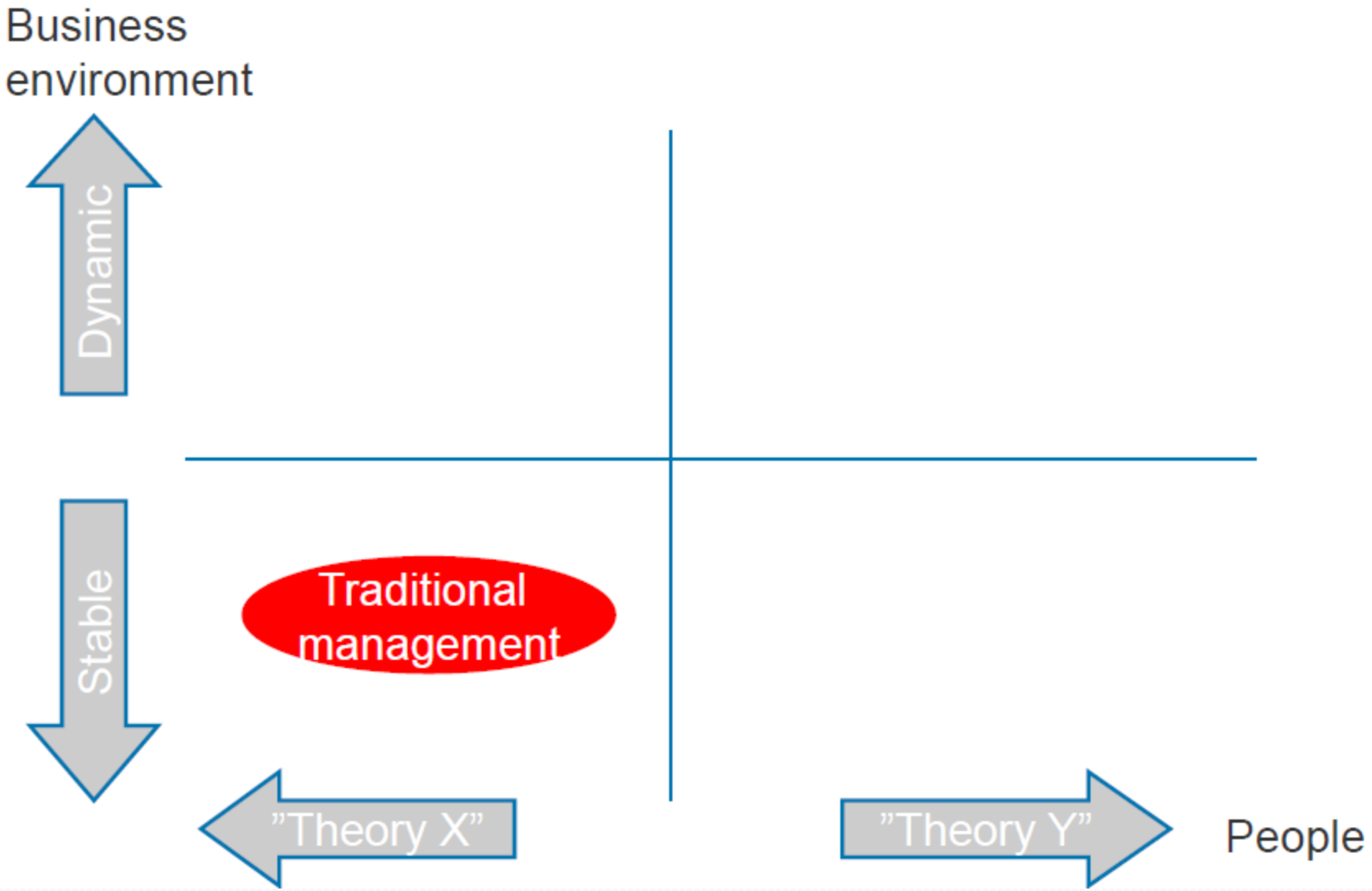
What is your view on people?

- **Theory X?**
- People prefer to be directed, do not want responsibility, and have little or no ambition.
- People have an inherent dislike for work and will avoid it whenever possible.
- People must be coerced, controlled, directed, or threatened with punishment in order to get them to achieve the organizational objectives.
- People seek security above all else.

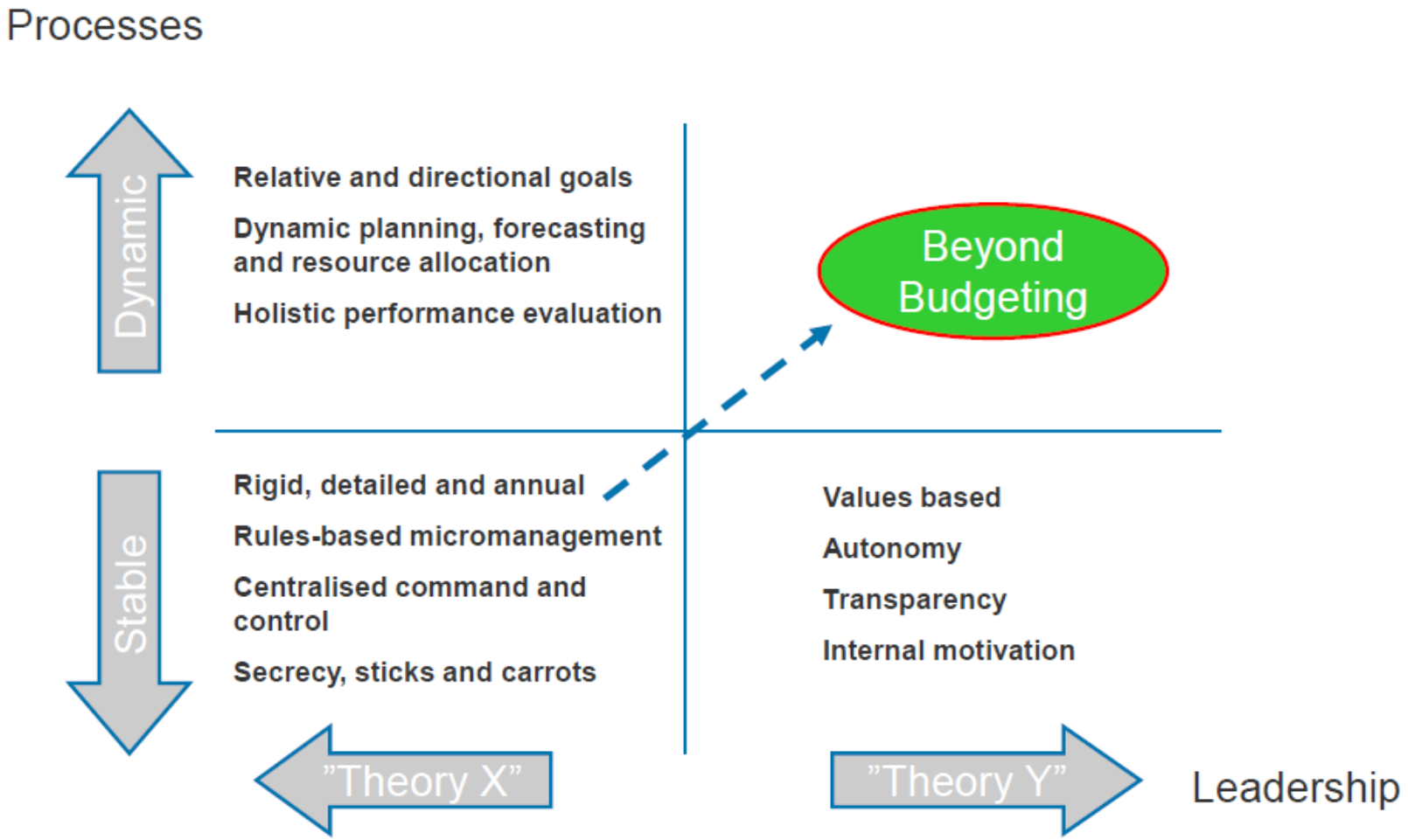
- **Theory Y?**
- Work is as natural as play and rest.
- People will exercise self-direction if they are committed to the objectives (they are not lazy).
- Creativity, ingenuity, and imagination are widely distributed among the population. People are capable of using these abilities to solve an organizational problem.
- People learn to accept and seek responsibility
- People have potential.

Douglas McGregor – ”The human side of enterprise” (1960)

The world has changed
- what about the way we lead and manage?



We must address both processes and leadership



The Beyond Budgeting principles

Change in *leadership*

1. Values - Govern through a few clear values, goals and boundaries, **not** detailed rules and budgets
2. Performance - Create a high performance climate based on relative success, **not** on meeting fixed targets
3. Transparency - Promote open information for self management, **don't** restrict it hierarchically
4. Organization - Organize as a network of lean, accountable teams, **not** around centralized functions
5. Autonomy - Give teams the freedom and capability to act; **don't** micro-manage them
6. Customers - Focus everyone on improving customer outcomes, **not** on hierarchical relationships

Change in *processes*

7. Goals - Set relative goals for continuous improvement, **don't** negotiate fixed performance contracts
8. Rewards - Reward shared success based on relative performance, **not** on meeting fixed targets
9. Planning - Make planning a continuous and inclusive process, **not** a top-down annual event
10. Coordination - Coordinate interactions dynamically, **not** through annual planning cycles
11. Resources - Make resources available as needed, **not** through annual budget allocations
12. Controls - Base controls on relative indicators and trends, **not** on variances against plan

StatOil Model – "Ambition to Action

Key principles – Ambition to action

- Performance is ultimately about **performing better** than those we **compare** ourselves with
- **Do the right thing** in the actual situation, guided by the Statoil Book, your Ambition to action, decision criteria & authorities and sound business judgement
- Within this framework, **resources** are made available or allocated case-by-case
- Business follow up is **forward looking** and **action** oriented
- Performance evaluation is a **holistic** assessment of delivery and behaviour

The CEO on Ambition to action



CEO Helge Lund

"We have a management model which is very well-suited to dealing with turbulence and rapid change. It enables us to act and reprioritise quickly so that we can fend off threats or seize opportunities. This is much more difficult in a traditional «budget world».

"One of the main principles in our Ambition to action concept is that Statoil consists of mature, professional and able people who both can and want to accept responsibility."

Ambition to action - a process which…

…is integrated - from strategy to people

…but provides sufficient freedom and flexibility

…and activates our values and leadership principles

Strong performance

Sustainable results

Strategic objectives → KPIs → Actions & forecasts → Individual goals

Where are we going - what does success look like?

- Most important strategic change areas
- Medium term horizon

How do we measure progress?

- Indicative measure of strategic delivery
- 10-12 KPIs, annual/ longer term targets

How do we get there?

- Concrete actions and expected delivery (forecast)
- Clear deadlines and accountabilities

What is my contribution?

- **My Performance Goals (MPG)**
- Delivery
- Behaviour

Ambition to action example



Globally competitive – an exceptional place to perform and develop

Strategic objectives	Performance indicators	Actions (top 5)
People and organisation		
A value based and performance driven organisation.	Living the values Progress PO action plan	Complete the integration and ensure a successful post-merger process (31.12.2010) Ensure right capacity and competence (31.12.2010) Consistent execution of the Statoil Hydro book ensuring alignment and compliance (31.12.2010) Simplify and improve the People@StatoilHydro process and strengthen [illegible] (31.12.2010) Strengthen capability and diversity in leadership pipeline, and build strong leadership teams (31.12.2010)
Health, safety and environment		
Industry leader in HSE No integrity violations Remain an industry leader in terms of having a low climate impact [illegible] where we are engaged	Serious incident frequency Climate [illegible] TTS Observations and actions	Improve HSE leadership and compliance to our management system (31.12.2010) Increased focus on technical integrity and barriers (31.01.2010) Implement optimisation of HSE requirements (31.12.2010) Operationalise climate policy and technology [illegible] (31.12.2010)
Operation		
Optimise performance [illegible] value chains	PE EPN Product [illegible] Product [illegible] Finding cost exploration (USD/boe)	Secure optimal scope of CCS and handle communication challenge (20.12.2009) Ensure successful deliveries from corporate initiatives on IOR, IO and exploration (20.12.2009) Forcefully execute programs to improve production efficiency and drilling performance (20.12.2009) Improve execution abilities through quality in the CVP decision process (20.12.2009)
Market		
Exploration success outperforming peers Maximise value creation through our value chains A balanced portfolio set to grow long-term value in line with the first quartile of our peers	NCS resources (quality marker) Reserves [illegible] Downstream NOI (NOK bn)	Secure access to quality acreage on NCS (20.12.2009) Improve downstream profitability and portfolio robustness (31.12.2009) Optimise strategic rig capacity (20.12.2009) Execute the technology strategy (20/12/2009) Utilize market conditions to continuously secure StatoilHydro competitive prices from our suppliers (20.12.2009)
Finance		
Competitive shareholder return Realise the full potential from the merger Maintain financial robustness through cycles	Relative RoACE Relative Shareholder Return Merger value capture (NOK bn)	Continuously monitor and build flexibility in the portfolio (20.12.2009) Improve compliance within intellectual service and maintain focus on SOX (20.12.2009) Improve the cost mindset in the organisation and deliver on cost improvements (20.12.2009)

Where are we going?

”Strategic objectives”

How do we measure progress?

”Key Performance Indicators”

How do we get there?

”Actions”

More than 1100 "Ambition to actions" across the company



Classification: Internal
Status: Draft

Solving a serious budget conflict

Traditional budget / plan

Step 1: Separate

Step 2: Improve

Budget / plan =
- Target
- Forecast
- Resource allocation

"Same number – conflicting purposes"



Target
- Front-loaded
- Ambitious
- Relative if possible



Forecast
- Business driven not calendar driven
- Expected outcome – early warning
- Frequency and time horizon – lead time and target horizon driven
- Limited detail



Resource allocation
- Dynamic - no pre-allocation
- Projects - decision gates & criteria
- Operations - relative KPIs etc.
- Monitoring - intervention if needed only

"Different numbers"

Classification: Internal
Status: Draft

A forecast is not a promise or a target …





…nor is it an application for resources

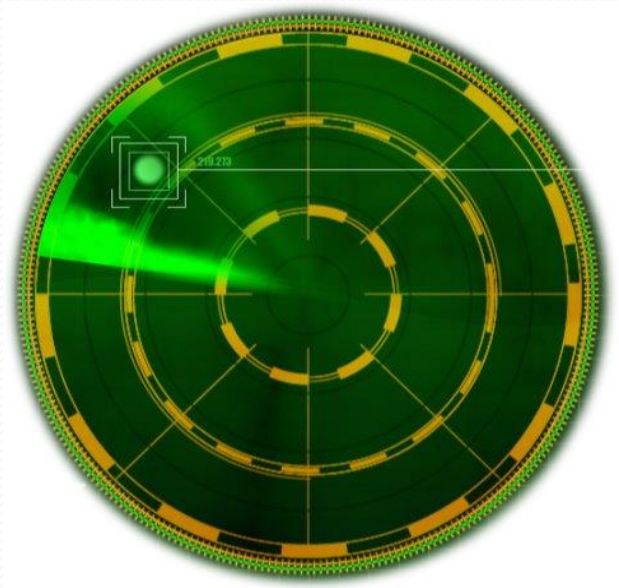
Classification: Internal
Status: Draft

A forecast is a call to action

Get issues on the radar screen early enough…

…..to be able to take corrective actions





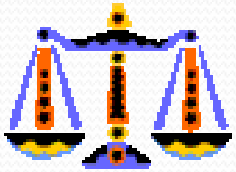
A forecast should:

- be brutally honest and unbiased
- be done for yourself more than for others
- be actionable
- have the right time horizon and detail level
- include an uncertainty analysis where relevant

Classification: Internal
Status: Draft

Relative performance

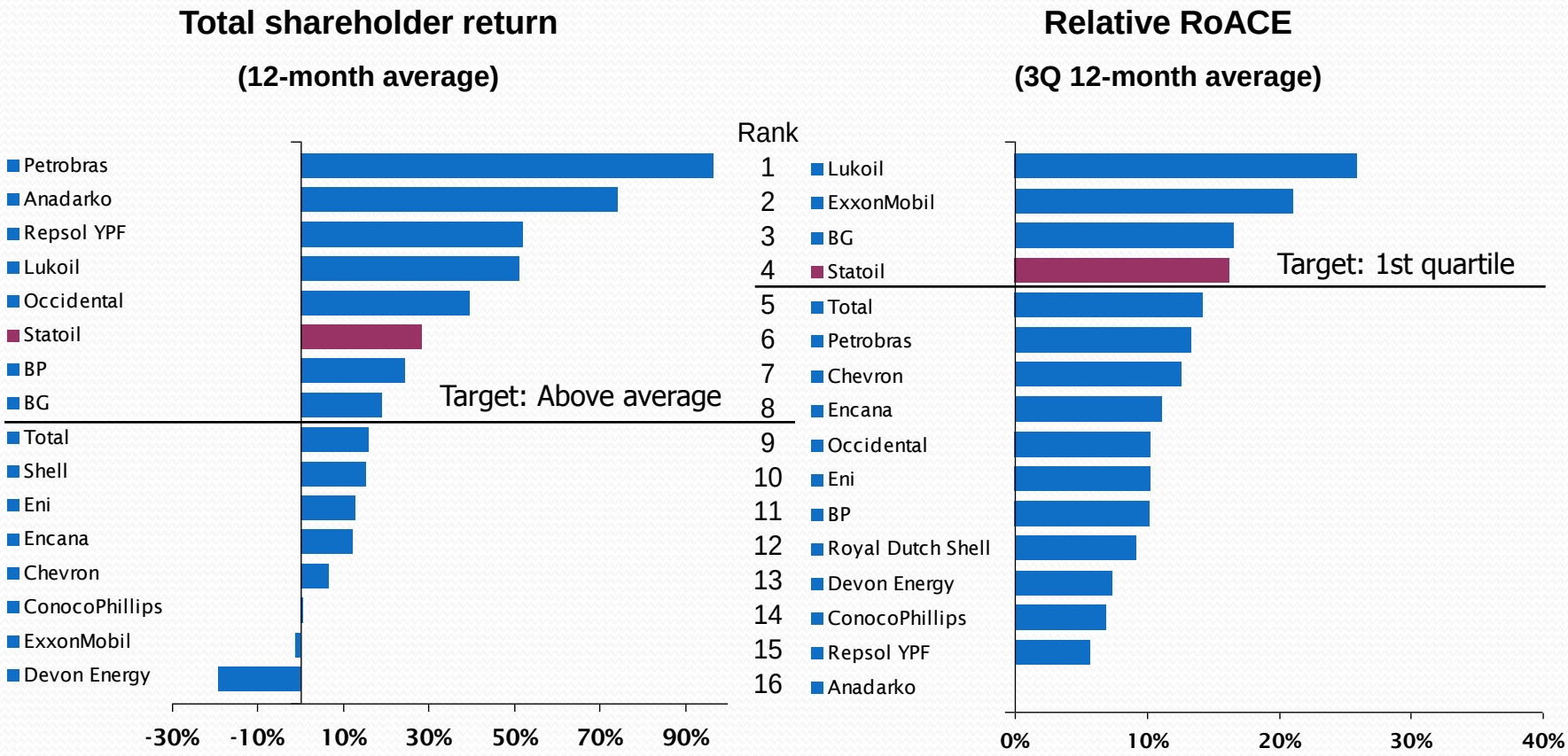
- Connect input with output



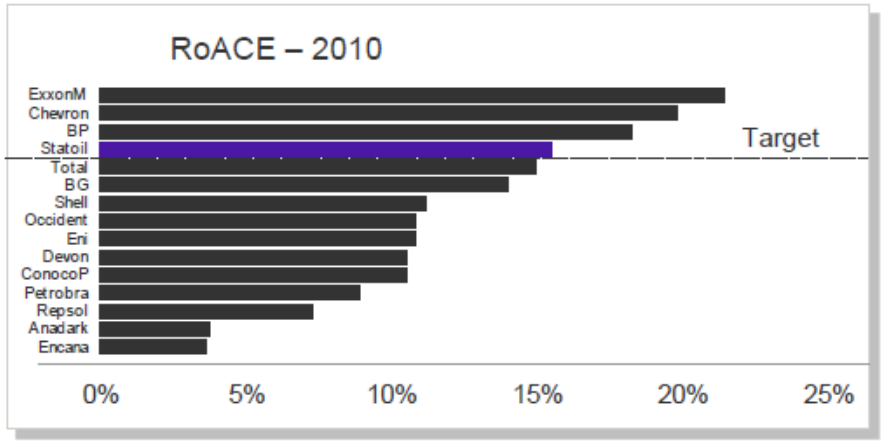
- Compare with others

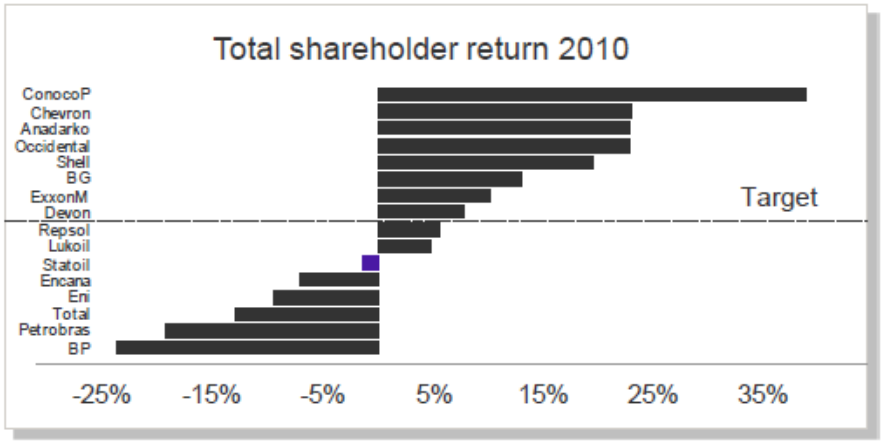


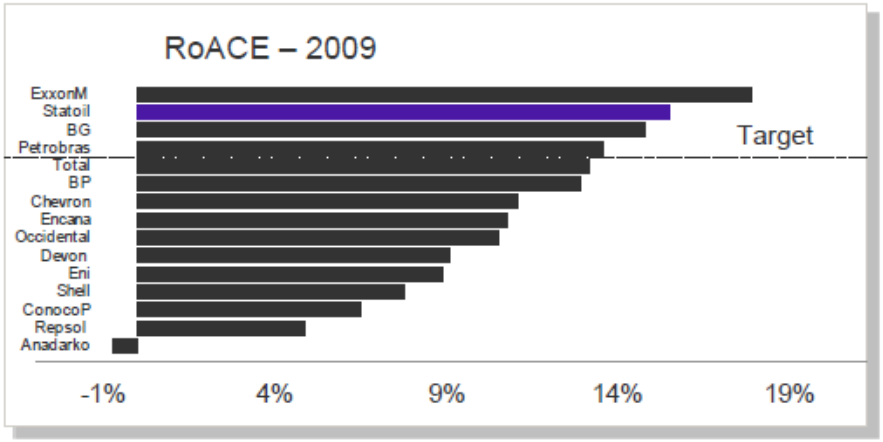
Relative Statoil performance

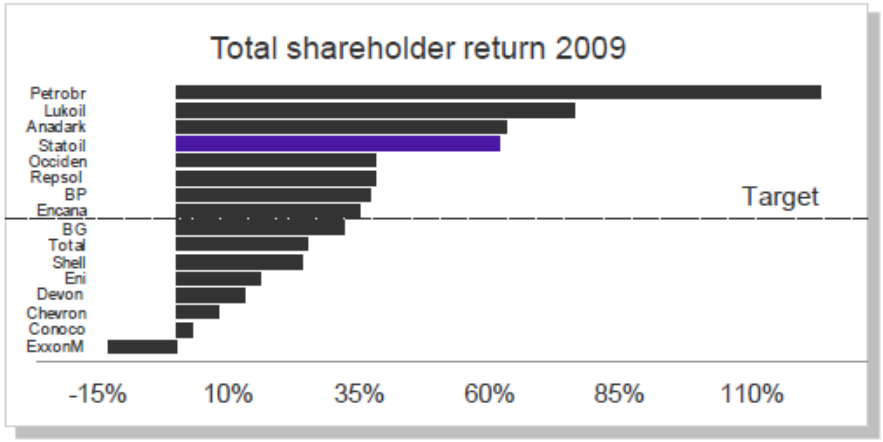


Relative Statoil performance





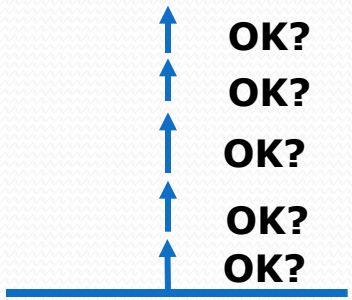




Dynamic resource allocation:
A different mindset - cost conscious from the first penny







Dynamic resource allocation – other costs

Absolute KPIs		Relative KPIs			No KPIs
Traditional cost budget	Absolute cost KPI	Unit cost input/output	Unit cost vs peers	Bottom line focus only	Strategic objectives or actions only
Xx Xx Xx Xx Xx Xx Xx Xx 1000	1000	 ”USD/bbl” ”USD/customer” ”USD/employee”	 ”1. quartile” ”Above average”	EBIT ROCE (abs/rel)	”Cost effective and competitive operations” ”More video –less travel” ”Reduce consultancy spending”

Increasing freedom and flexibility

Increasing need for strong values and clear direction

Monitoring of actual development, intervention if needed only

Select based on what is right and works for your organisation

A new performance language
- from mechanical measurement to a holistic assessment

(Previously only KPI targets)

"Ambition to Action"

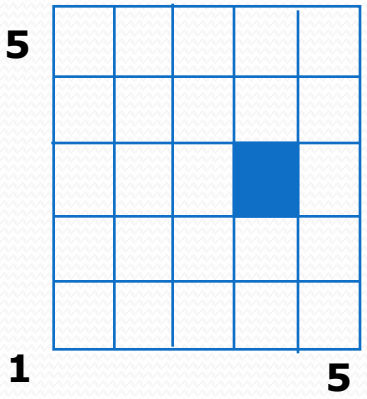
- Strategic objectives
- KPI targets
- Actions



Pressure testing KPI results:

- Deliver towards the strategic objectives?
- How ambitious KPI targets?
- Changed assumptions, with positive or negative effect?
- Agreed actions implemented, or corrective actions initiated as needed?
- Delivered results sustainable?





50/50

Behaviour

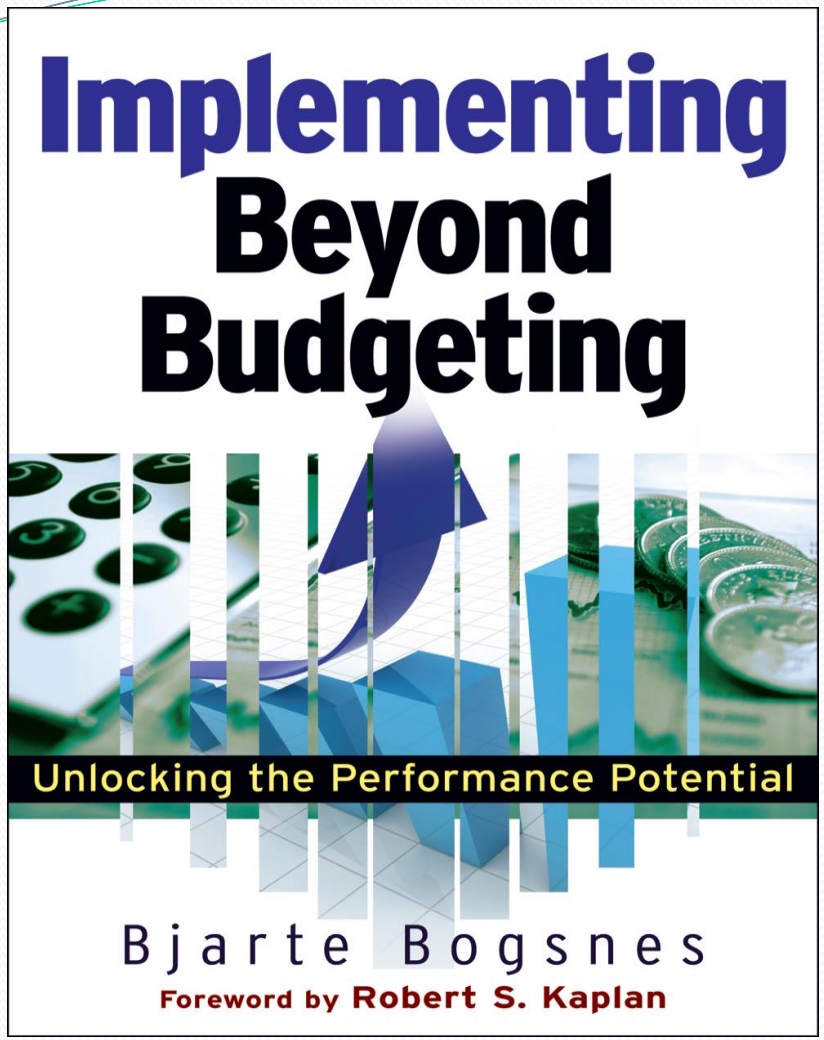
Living the values

- Day-to day-observations
- 360°/ 180°/ 90° surveys
- People survey
- Individual development plan

Classification: Internal
Status: Draft

A systematic change of the whole process

	”Annual command and control”	More dynamic & flexible A new performance language
Target setting	· Equal to plan – ”what we can deliver” · KPI targets · Absolute targets	· Aspiration driven –”what we must deliver”. Targets before plan. · ” Ambition to action” · Relative targets
Planning	· Plan = target, forecast and resource allocation · Gaps vs targets hidden · One outcome only · Very detailed	· Plan = forecast only (actions and expected performance) · Gaps vs. targets visible · Main uncertainty spans · Less detailed
Resource allocation	· Annual pre-allocation through budgets · Budgets ”an entitlement – my money”	· Resources available when needed, but within KPI targets + mandates + decision criteria. Monitoring of development
Business reporting	· Backward looking · Variance vs. YTD budget	· Forward looking · Forecast vs. targets, and actions to close gaps
Evaluation/ rewards	· Only based on budgets and KPIs	· A broader evaluation: ”Ambition to action” + Behaviour


Implementing
Beyond
Budgeting
Unlocking the Performance Potential
Bjarte Bogsnes
Foreword by Robert S. Kaplan

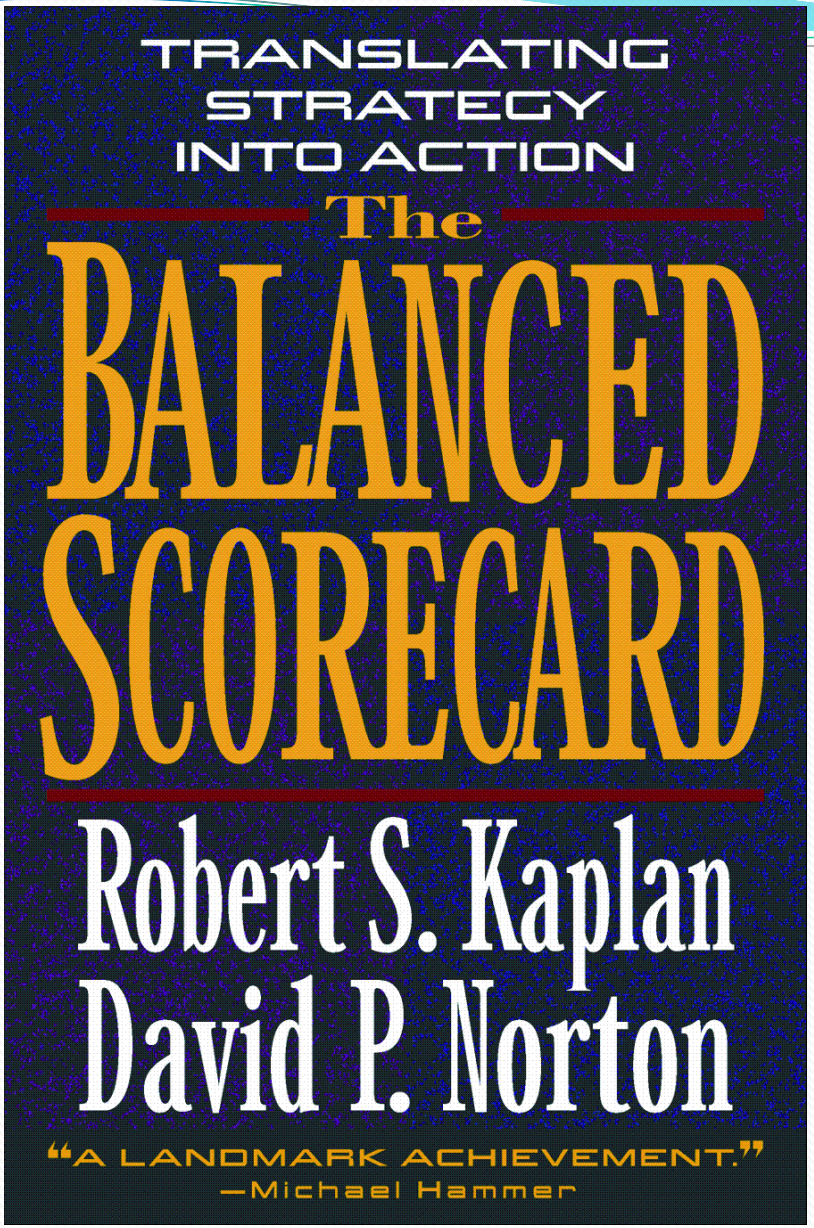
Beyond Budgeting Tools



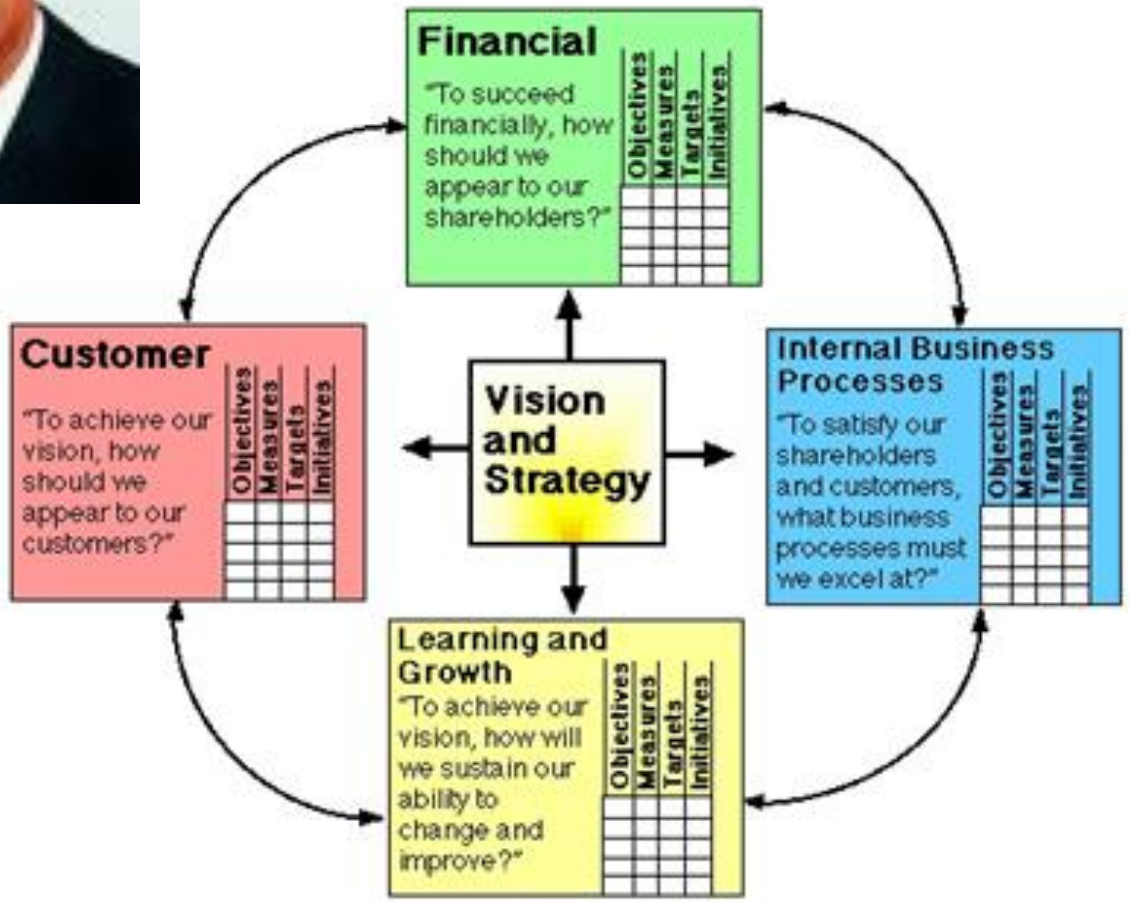
Balanced Scorecards
KPIs
Activity Based Management
Rolling Forecasts
"Real" costs v Standard cost
Relative (and continuous) improvement
External comparison & benchmarking
Delegation of Ownership of OUTCOMES not just INPUTS
Understand how the organisation is going to be successful
Understanding of people and motivation

The Balanced Scorecard

- Introducing the Balanced Scorecard and the key perspective
- Why the Balanced Scorecard


TRANSLATING
STRATEGY
INTO ACTION
The
BALANCED
SCORECARD
Robert S. Kaplan
David P. Norton
"A LANDMARK ACHIEVEMENT."
—Michael Hammer

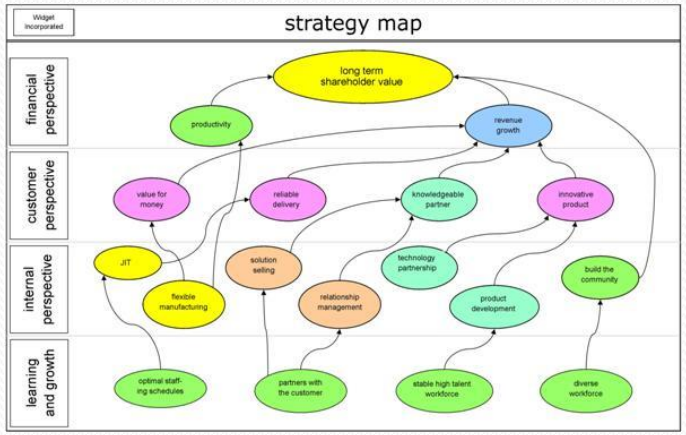


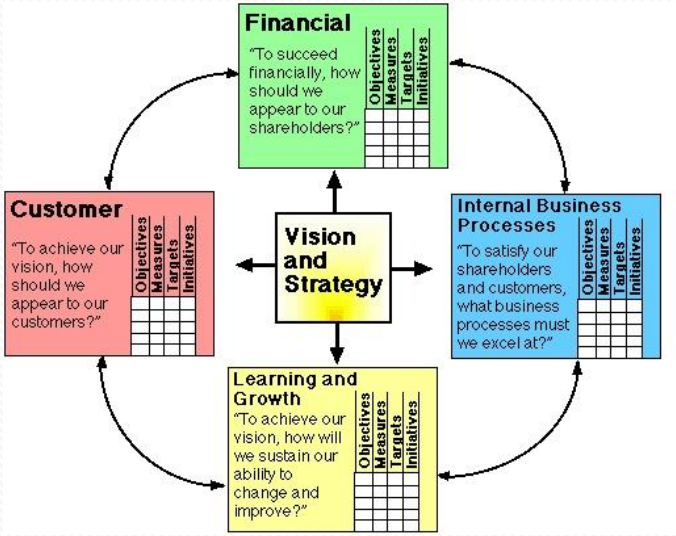


Adapted from Robert S. Kaplan and David P. Norton, "Using the Balanced Scorecard as a Strategic Management System," Harvard Business Review (January-February 1996): 76.


COMMUNITY
ACTIVELY SUPPORTING LOCAL COMMUNITIES
BUYING AND SELLING OUR PRODUCTS RESPONSIBLY
CARING FOR THE ENVIRONMENT
GIVING CUSTOMERS HEALTHY CHOICES
CREATING GOOD JOBS AND CAREERS
CUSTOMER
FINANCE
PEOPLE
OPERATIONS
Every little helps

Managing the business using a BSC approach

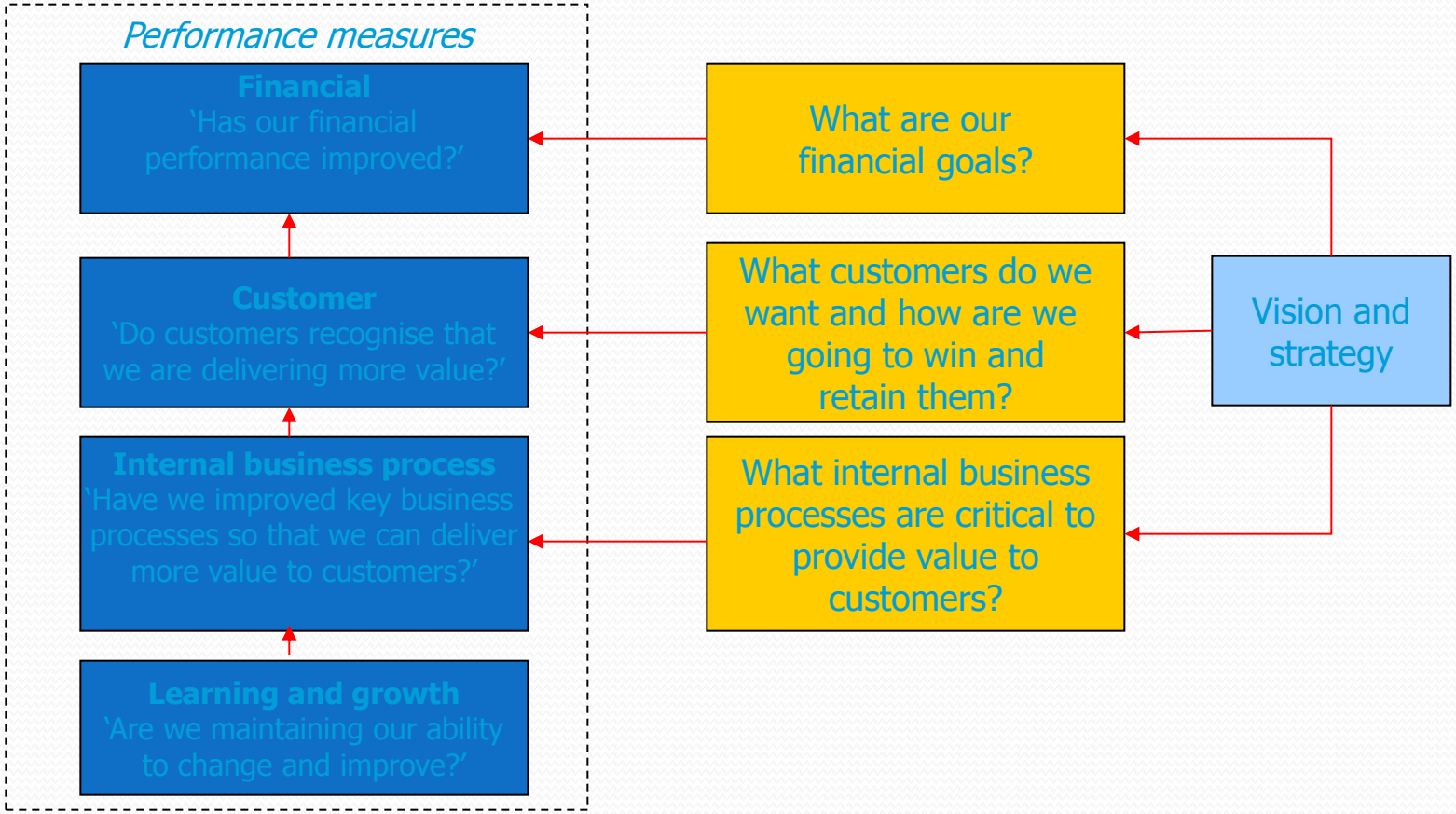




'Describe the strategy'

'Measure the strategy

Designing the Scorecard - from Strategy to Performance Measurement



Balanced Scorecard
Top 10 Implementation issues

1. No executive sponsorship
2. Lack of education and training
3. No strategy
4. No clear objectives for programme
5. Timing
6. Inconsistent management practices
7. No new measures – mainly focused on finance / process
8. Terminology
9. Lack of effective cascading
10. Poor understanding of cause and effect

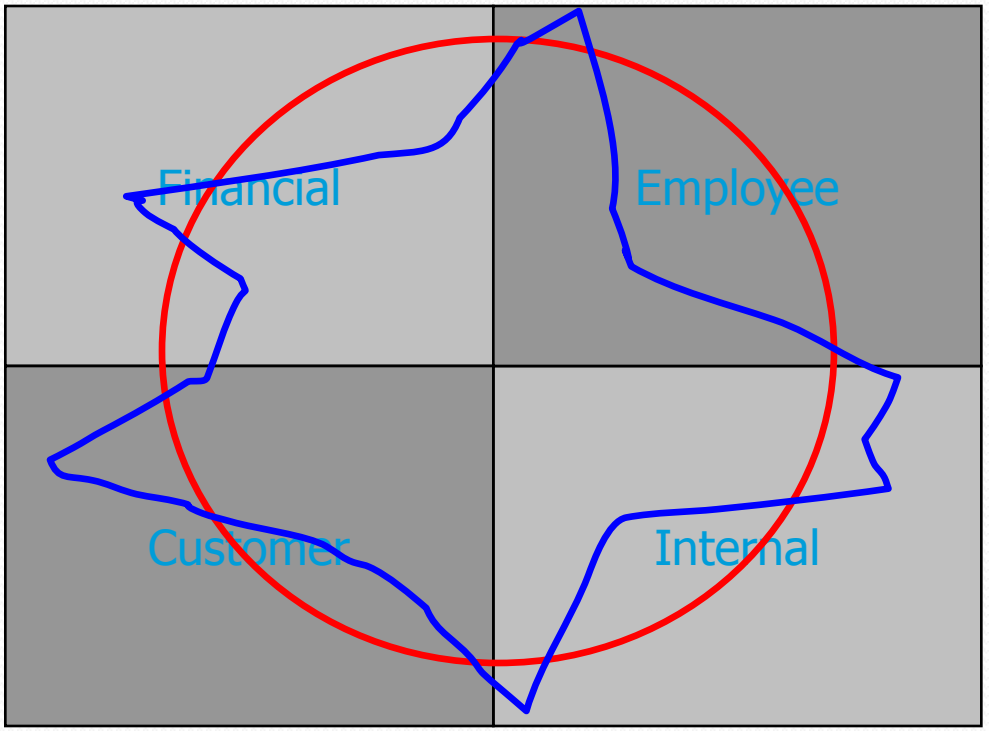
Balanced Scorecard – The Benefits

- Translating Strategy into Action
- Improved Resource Allocation
- Enhances Management Strategic Feedback & Learning
- Clear communication of Strategy may highlight divergent views on strategy
- Can result in a re-design / simplification of the Budget Process

Presentation
KPI wheel & RAG Status Traffic Lights

Actual

Target





Finally
Future of Finance Departments?

The changing role of the finance function

- Faculty of Finance & Management, ICAEW
- October 2003 – survey of members
- ‘How will the finance function within business change over the next five years?’
- 567 responses

Qualities and skills sought in finance personnel



Other results from the survey

- A trend towards outsourcing
- A move away from standard finance processes and towards strategy and business development
- Corporate governance came across as a major concern
- The drive to identify value is a continuing trend
- Accountants as Business Partners – support business units to deliver

ENRON

Collapsed 2nd December, 2001, destroying $60bn in market value

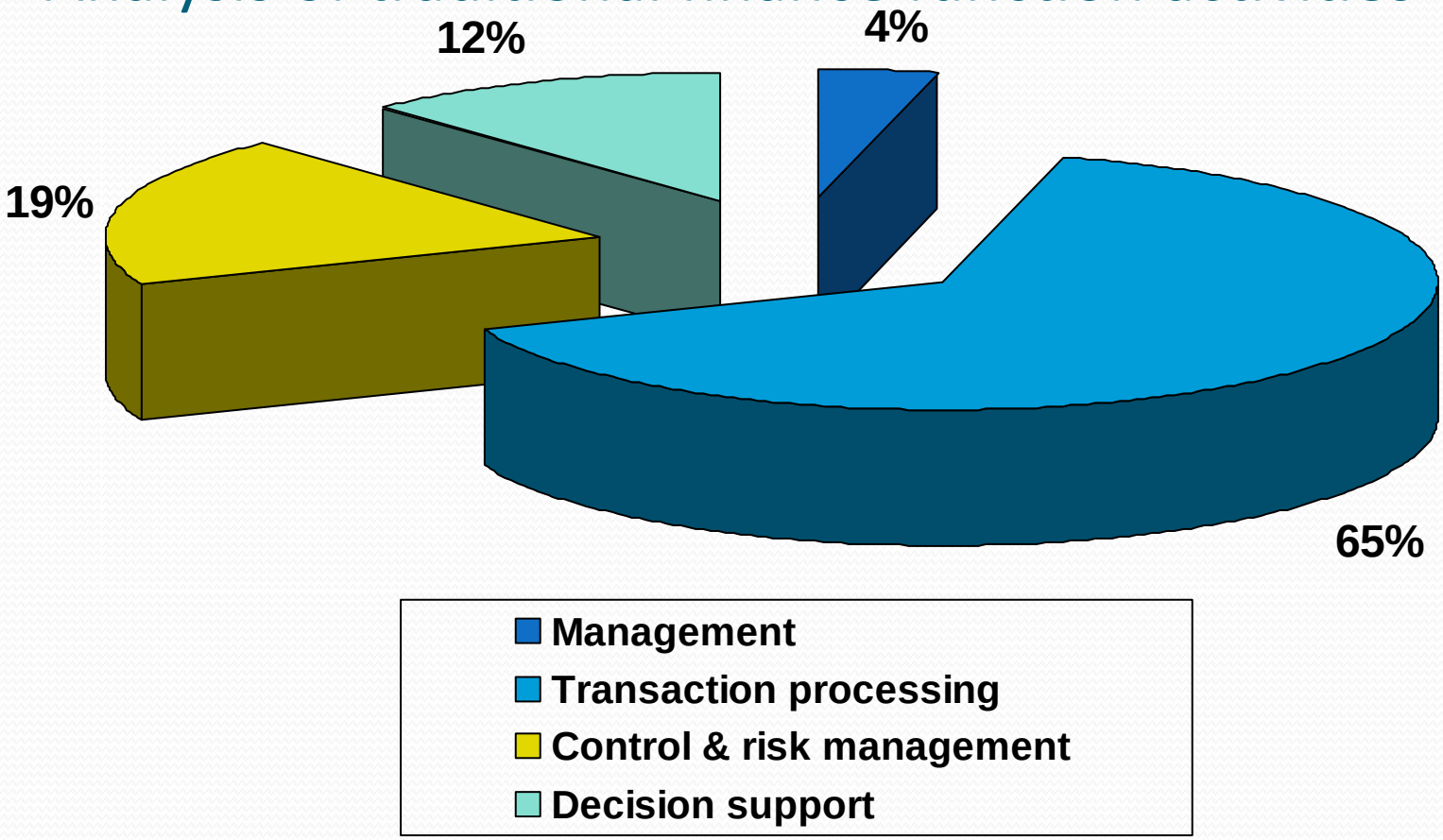
Year 2000 accounts reveal:

96% of reported net income and 105% of reported funds flow were attributed to accounting violations

Debt reported as $10bn v. $22bn actual

Source - Malcolm Salter, Harvard Business School

Analysis of traditional finance function activities

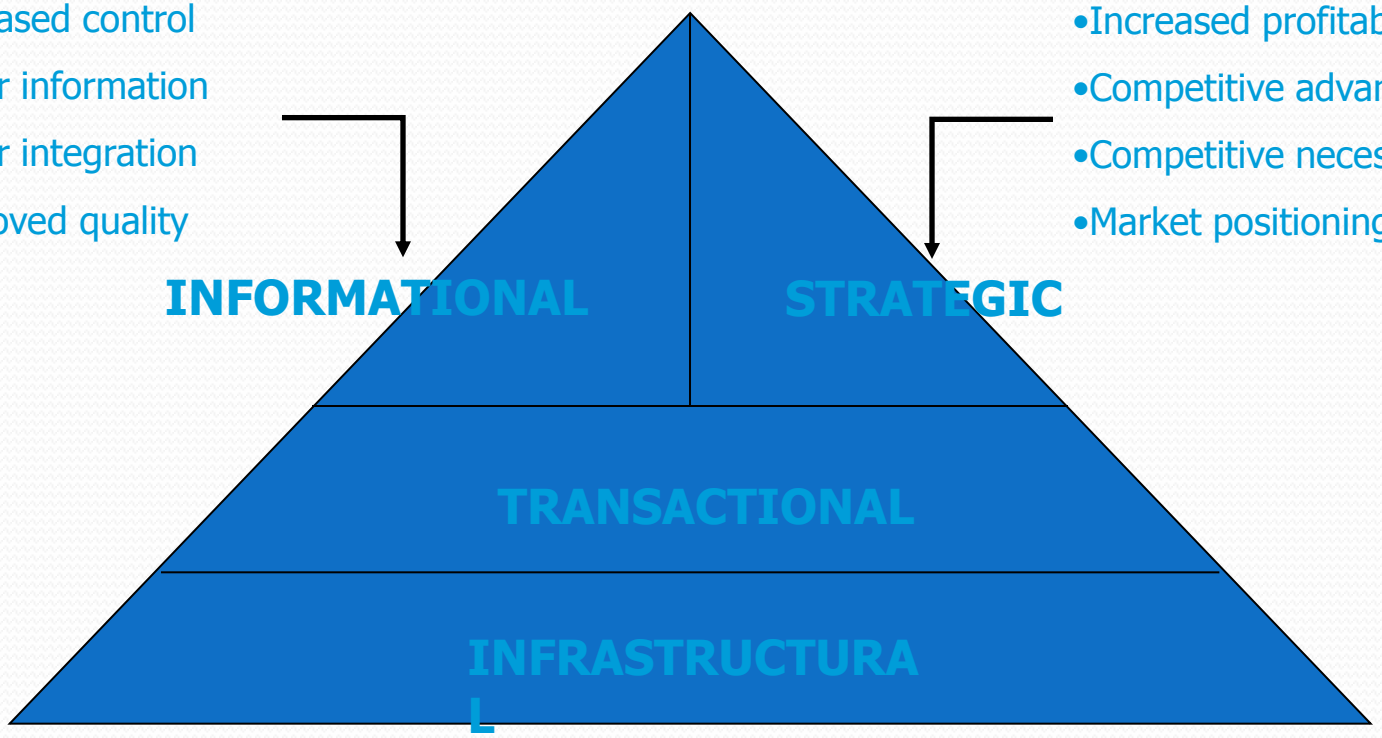


Source: Redesigning the finance function, CMA, 1999

Management objectives for finance function redesign

- Increased control
- Better information
- Better integration
- Improved quality

- Increased profitability
- Competitive advantage
- Competitive necessity
- Market positioning



Source: Redesigning the finance function, CMA, 1999

ICAEW – 2005 business member survey

FINANCE DEVELOPMENT NEEDS	Budgeting
	Financial Modelling & Forecasting
	Finance Function Effectiveness
	Financial Management
	Performance Measurement/Management
	Management Accounting
	Financial Reporting (inc IFRS)
MANAGEMENT DEVELOPMENT NEEDS	Managing People & Teams
	Strategic Planning
	Personal Skills
	Risk Management

- The changing role of finance – the need to ‘add value’
- ***Measuring value performance***
- Adding value with forecasting
- Adding value with ‘Beyond Budgeting’
- Adding value with the Balanced Scorecard

Final Review & Questions



Thank You

