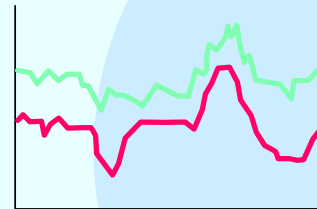


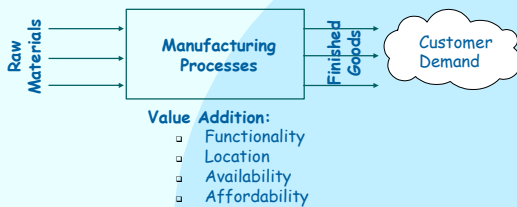
BUS 241 Production & Operations Management

Vinay Vasudev, Ph.D.

Forecasting



Why Forecast?



- ✓ An estimate of future demand
- ✓ A prediction of future events used for planning purposes

Why Forecast?

- To plan for the future by reducing uncertainty
- To anticipate and manage change
- To increase communication and integration of planning teams
- To anticipate inventory and capacity demands and manage lead times
- To project costs of operations into budgeting processes
- To improve competitiveness and productivity through decreased costs and improved delivery and responsiveness to customer needs

Factors Affecting Demand

Internal (Intrinsic) Factors

These are within management's control

- ❑ Product life-cycle management
- ❑ Planned price changes
- ❑ Changes in the sales force
- ❑ Resource constraints
- ❑ Marketing and sales promotion
- ❑ Advertising
- ❑ Product substitution



Factors Affecting Demand

External (Extrinsic) Factors

These are beyond management's control

- Random fluctuation
- Seasonality
- Changing customer preferences and demands
- Competition
- New customers
- Plans of major customers
- Government policies
- Regulatory concerns
- Economic conditions/cycles
- Environmental issues
- Weather conditions
- Global and local trends

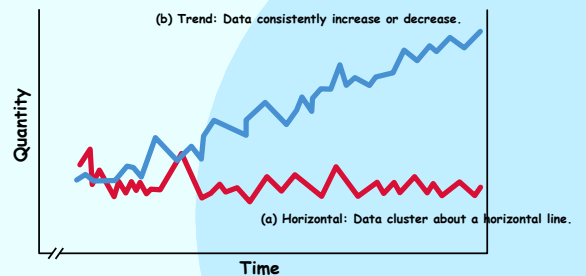


Leading Indicators

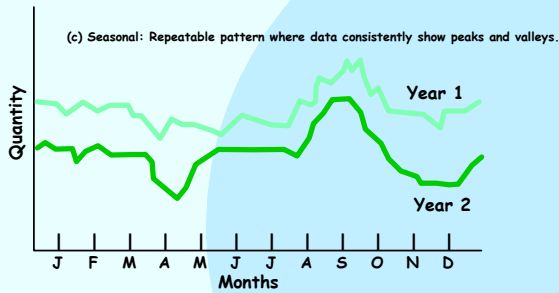
Indicator (Causal Factor)	<u>Influences volume of</u>
------------------------------	-----------------------------

- | | |
|-----------------------|--------------------------|
| • Housing starts | → • Building materials |
| | → • Home furnishings |
| • Birth rate | → • Baby products |
| • Hits on a Web site | → • e-commerce sales |
| • Health trends | → • Medical supplies |
| • Healthier lifestyle | → • Nutritional products |
| | → • Fitness products |

Patterns of Demand

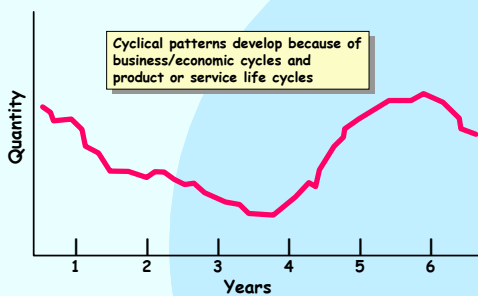


Patterns of Demand



Turkeys have a long-term trend for increasing demand with a seasonal pattern. Sales are highest during September to November and sales are lowest during December and January.

Patterns of Demand



(d) Cyclical: Data reveal gradual increases and decreases over extended periods.

Demand Forecast Applications

Application	Time Horizon		
	Short Term (0-3 months)	Medium Term (3 months- 2 years)	Long Term (more than 2 years)
Forecast quantity	Individual products or services	Total sales Groups or families of products or services	Total sales
Decision area	Inventory management Final assembly scheduling Workforce scheduling Master production scheduling	Staff planning Production planning Master production scheduling Purchasing Distribution	Facility location Capacity planning Process management
Forecasting technique	Time series Causal Judgment	Causal Judgment	Causal Judgment

Characteristics of Forecasts

- Forecasts are always wrong; so consider both expected value and a measure of forecast error
- Long-term forecasts are less accurate than short-term forecasts
- Aggregate forecasts are more accurate than disaggregate forecasts



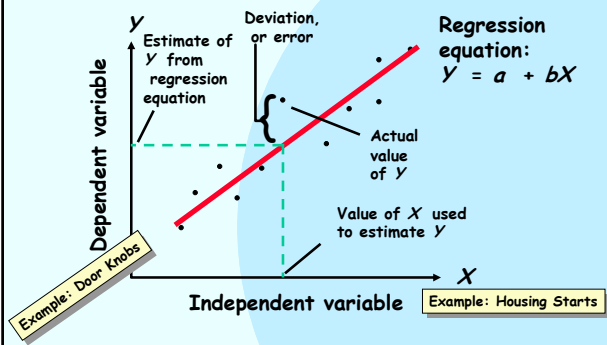
General Forecasting Techniques

- ❑ **Qualitative**—based on intuitive or judgmental evaluation
- ❑ **Quantitative**—based on computational projection of a numeric relationship
 - Causal
 - Time-Series

Qualitative Techniques

- ✓ Expert/executive opinion
- ✓ Sales-force estimates
- ✓ Market research/ Focus groups
- ✓ Historical analogy
- ✓ Delphi method

Causal Methods: Linear Regression



Causal Methods: Linear Regression

Example 12.1, page 552

Month	Sales (000 units)	Advertising (000 \$)
1	264	2.5
2	116	1.3
3	165	1.4
4	101	1.0
5	209	2.0

$$a = -8.136$$

$$b = 109.229X$$

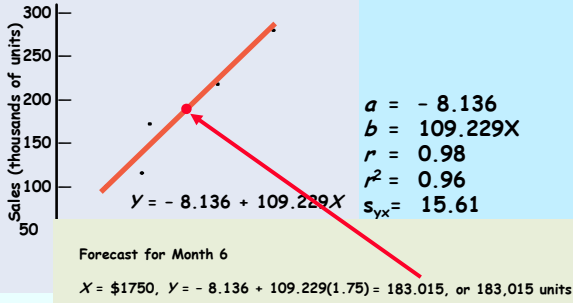
$$r = 0.98$$

$$r^2 = 0.96$$

$$s_{yx} = 15.61$$

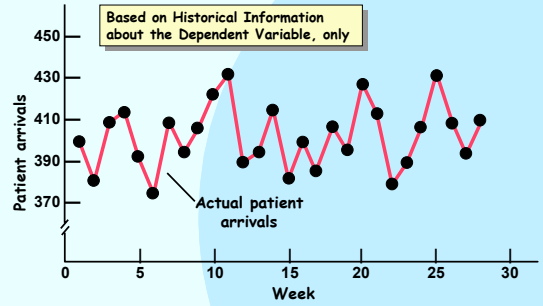
r = sample correlation coefficient, -1.0 to +1.0
 r^2 = sample coefficient of determination 0.0 to 1.0
 s_{yx} = standard error of the estimate

Causal Methods: Linear Regression



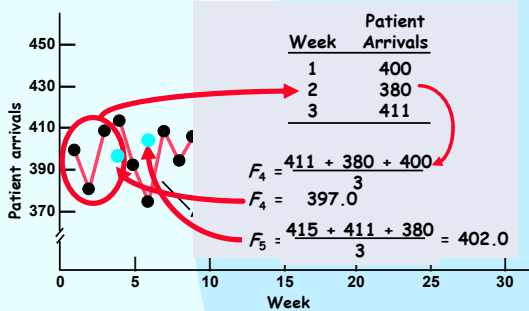
Time Series: Simple Moving Averages

Example 12.2, page 556

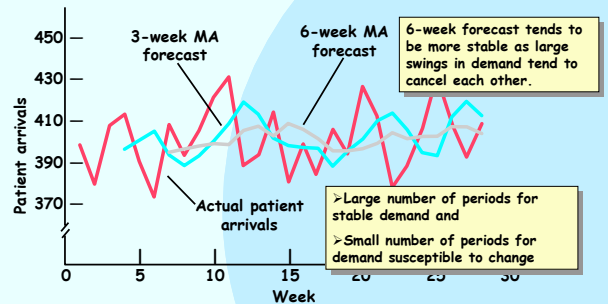


Time Series: Simple Moving Averages

Example 12.2, page 556



Time Series: Simple Moving Averages



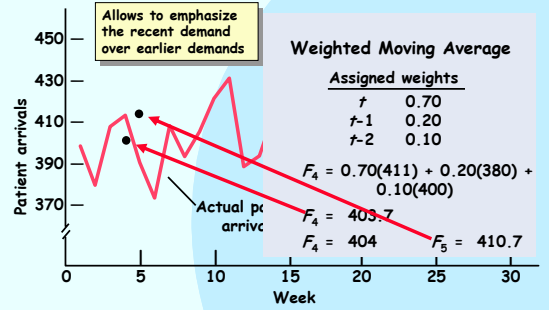
Taco Bell determined that the demand for each 15-minute interval can be estimated from a 6-week simple moving average of sales.



The forecast was used to determine the number of employees needed.

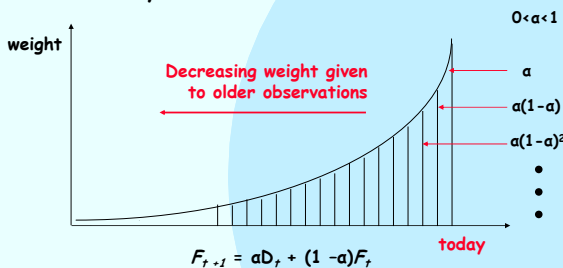
Time Series: Weighted Moving Averages

Example 12.3, page 557



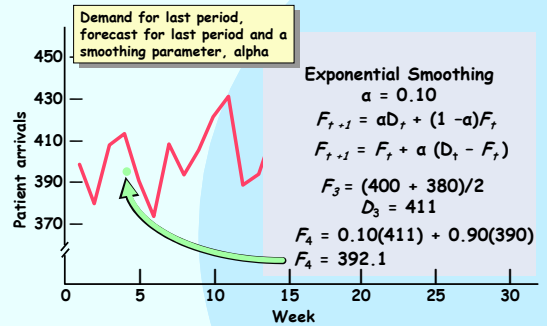
Time Series: Exponential Smoothing

- Include all past observations
- Weight recent observations much more heavily than very old observations:



Time Series: Exponential Smoothing

Example 12.4, page 559



Time Series: Exponential Smoothing

- Thus, new forecast is weighted sum of old forecast and actual demand
- Notes:
 - Only 2 values (D_t and F_t) are required, compared with n for moving average
 - Parameter α determined empirically (whatever works best)
 - Rule of thumb: $\alpha < 0.5$
 - Typically, $\alpha = 0.2$ or $\alpha = 0.3$ work well
- Large α value emphasizes recent demand levels and a forecast responsive to trends
- Small α value takes past demands into account and provide a more stable forecast

Time Series: Exponential Smoothing

