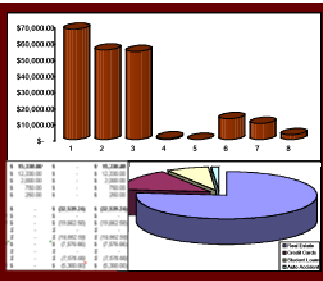


Week 6: Forecasting

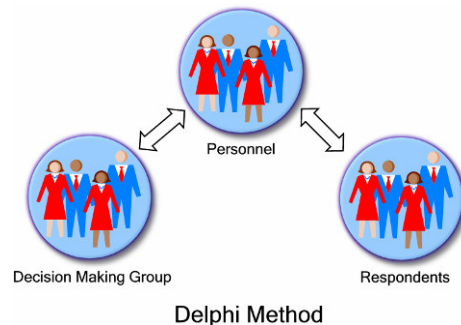
- ✓ Quiz:
Give one example of the use of forecasting in business. Include what is being forecast, who prepares the forecast, who uses the forecast, and how the forecast is used.
- ✓ Quiz for next week:
Provide a list of three benefits and three drawbacks to maintaining a small inventory. Provide a list of three benefits and three drawbacks to maintaining a large inventory.
- ✓ Assignments due this week:
 - Biography: Muḥammad ibn Mūsā al-Ḳwārizmī
- ✓ Assignments due next week:
 - Biography: Isaac Newton
 - Forecasting Spreadsheet: Build a model that includes both a trend and a cycle. Explain what you are modeling.
- ✓ Forecasting: Systematic approach to predicting future events.
 - What are some things that we frequently need to forecast? Sales, demand, prices, values, costs, and many more.
 - Why do we want a forecast? Intuitive predictions are rooted in a single person's limited experience and outlook. We use forecasting techniques when we want to minimize the effect of a single person's bias and/or ignorance. (This person whose limitations we must overcome is often us.) We usually do this by getting the perspectives of other people or studying relevant market statistics.
 - This does not mean that a forecast will always give you a better predication than someone who has a good crystal ball or is really lucky. But a sensible forecasting approach is much easier to explain to investors and, if necessary, jurors.
- ✓ Limitations:
 - It is still just a guess.
 - The further into the future you are looking, the greater your uncertainty.
 - The less perfect your data is, the less reliable your forecast will be.

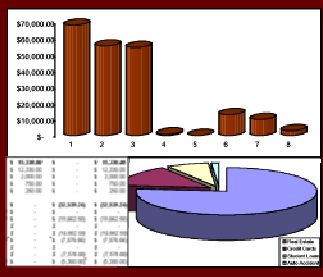


- ✓ Evaluation: How do you evaluate the usefulness of a forecast?
 - Reliability: “How often does it give the right answer?” Remember, even a broken clock is right twice a day.
 - Variance: “How close does it come to giving the right answer most of the time?” A lot of little errors can sometimes cancel each other out. Other times, they compound into a serious error.
 - Historical Performance: “Did it predict, or would it have predicted, the past and present?” You can often test the validity of a forecasting model by applying it to past events.

- ✓ Common Forecasting Techniques
 - Qualitative Models
 - Delphi Method
 - Jury of Executive Opinion
 - Sales Forecast Composite
 - Consumer Market Survey
 - Time Series Methods
 - Decomposition
 - Moving Average
 - Exponential Smoothing
 - Trend Projection
 - Causal Methods
 - Regression Analysis
 - Multiple Regression

- ✓ Qualitative Models
 - Delphi Method
 - Decision Makers
 - Staff Personnel
 - Respondents
 - Jury of Executive Opinion
 - Small group of high level managers make predictions
 - Sales Forecast Composite
 - Salespeople are asked to provide predictions.
 - Consumer Market Survey
 - Ask customers and prospective customers.





✓ Time Series Methods

○ Decomposition of Time Series

- Trend (T)
- Seasonality (S)
- Cycles (C)
- Random Variations (R)
- Two common approaches: multiplicative and additive
 - Demand = T x S x C x R
 - Demand = T + S + C + R

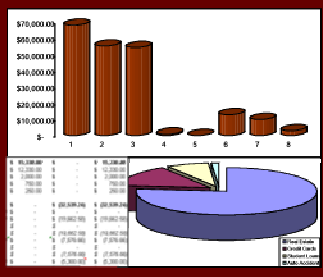
○ Moving Average

- Moving Average for n Periods = $\frac{\sum \text{Demand in Previous } n \text{ Periods}}{n}$

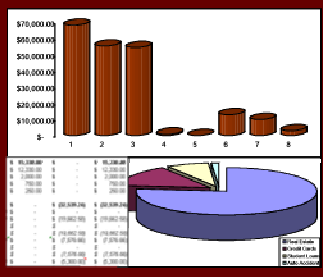
Quarter	Demand	Moving Average (3 Qs)	Moving Average (4 Qs)	Moving Average (5 Qs)
1	10.0			
2	12.0			
3	15.0	12.3		
4	18.0	15.0	13.8	
5	20.0	17.7	16.3	15.0
6	22.0	20.0	18.8	17.4
7	21.0	21.0	20.3	19.2
8	23.0	22.0	21.5	20.8
9	25.0	23.0	22.8	22.2
10	26.0	24.7	23.8	23.4

○ Exponential Smoothing

- New forecast = Last forecast + α (Last demand – Last forecast)
- F_t : New forecast (for time period t)
- F_{t-1} : Previous forecast (for time period t-1)
- α : smoothing constant ($0 \leq \alpha \leq 1$)
- A_{t-1} : Previous period's actual demand
- $F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$

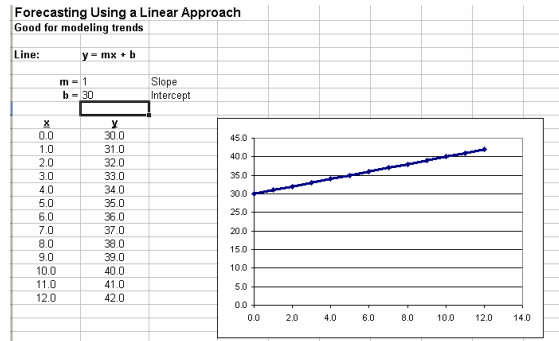


- Trend Projection
 - Least squares method
 - Calculate the sum of variances (difference between model and actual value at each point), then solve to minimize this number.
 - Pretty easy to calculate with Excel
 - Really easy to draw with Excel graphs (trend lines)
- ✓ Causal Methods
 - Regression Analysis
 - $\hat{Y} = a + bX$
 - Gives you a mathematical relationship between cause and effect.
 - Built with historical data.
 - Multiple Regression (aka “Multiple Linear Regression”)
 - $\hat{Y} = a + b_1X_1 + b_2X_2$
 - Gives you a mathematical relationship that combines multiple causes into a collective effect.
 - Built with historical data.

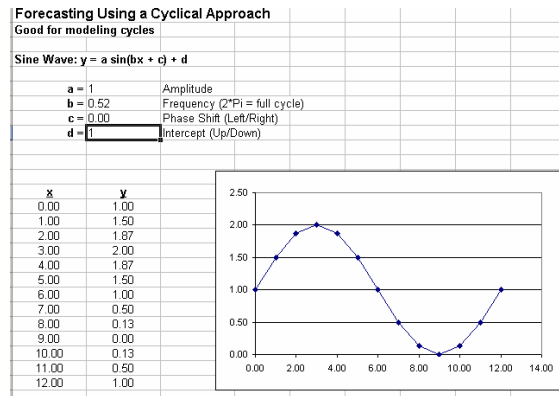


✓ Example: Linear and Cyclical Time Series Forecasts

- Linear:
 - What are we trying to forecast?
 - What is the starting value?
 - How much do we expect it to increase or decrease during each time period?



- Cyclical
 - What are we trying to forecast?
 - What is the starting value?
 - What is the length of the cycle?
 - What is the cycle maximum?
 - What is the cycle minimum?
 - When is the cycle at the midpoint of the upturn?



- Combined: Add the trend and the cycle together.

