Welcome!

Time Series Analytics

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Examples of Time Series Models

- Random Sample
- Random Walk
- Autoregression
- Moving Average
- ARIMA (Autoregressive Integrated Moving Average)
- Panel data
- Vector Autoregression (VAR)

Key Modeling Steps

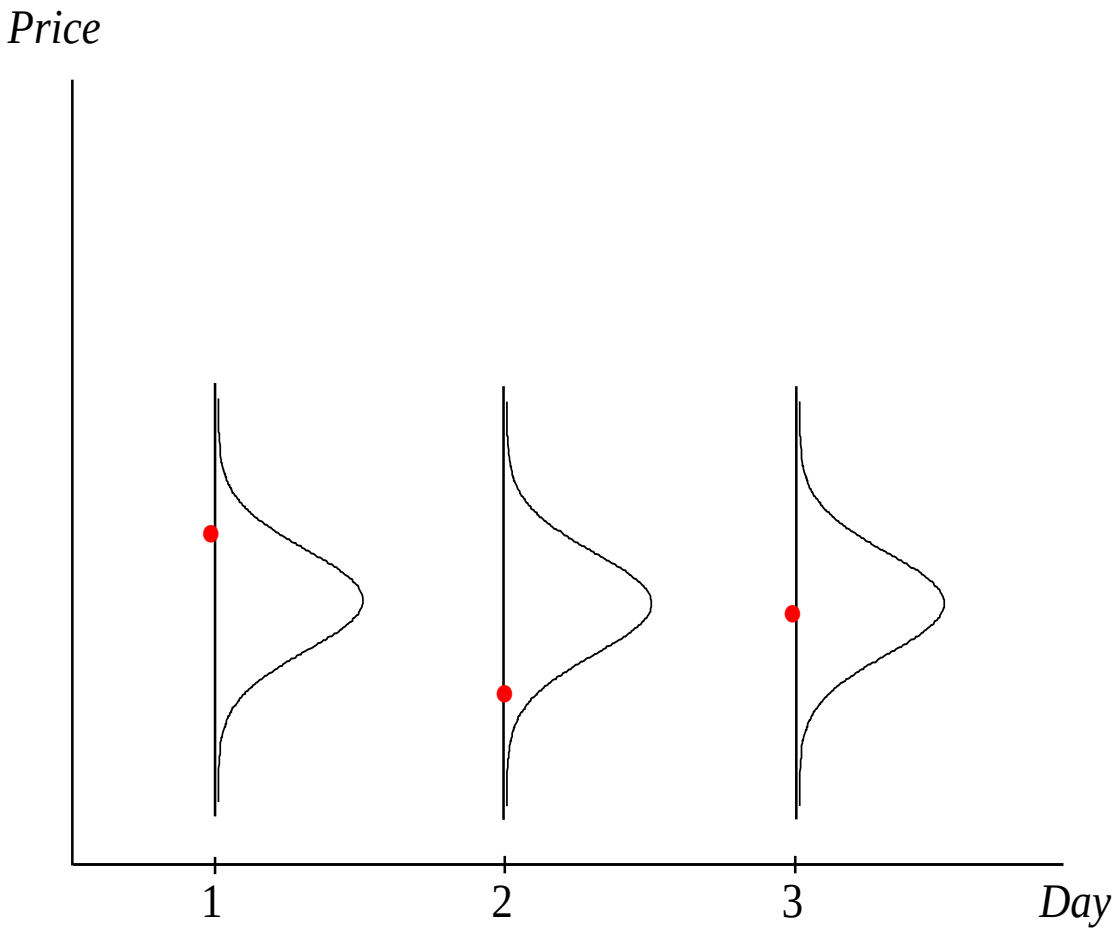
1. Propose
2. Validate
3. Use

The Random Sample

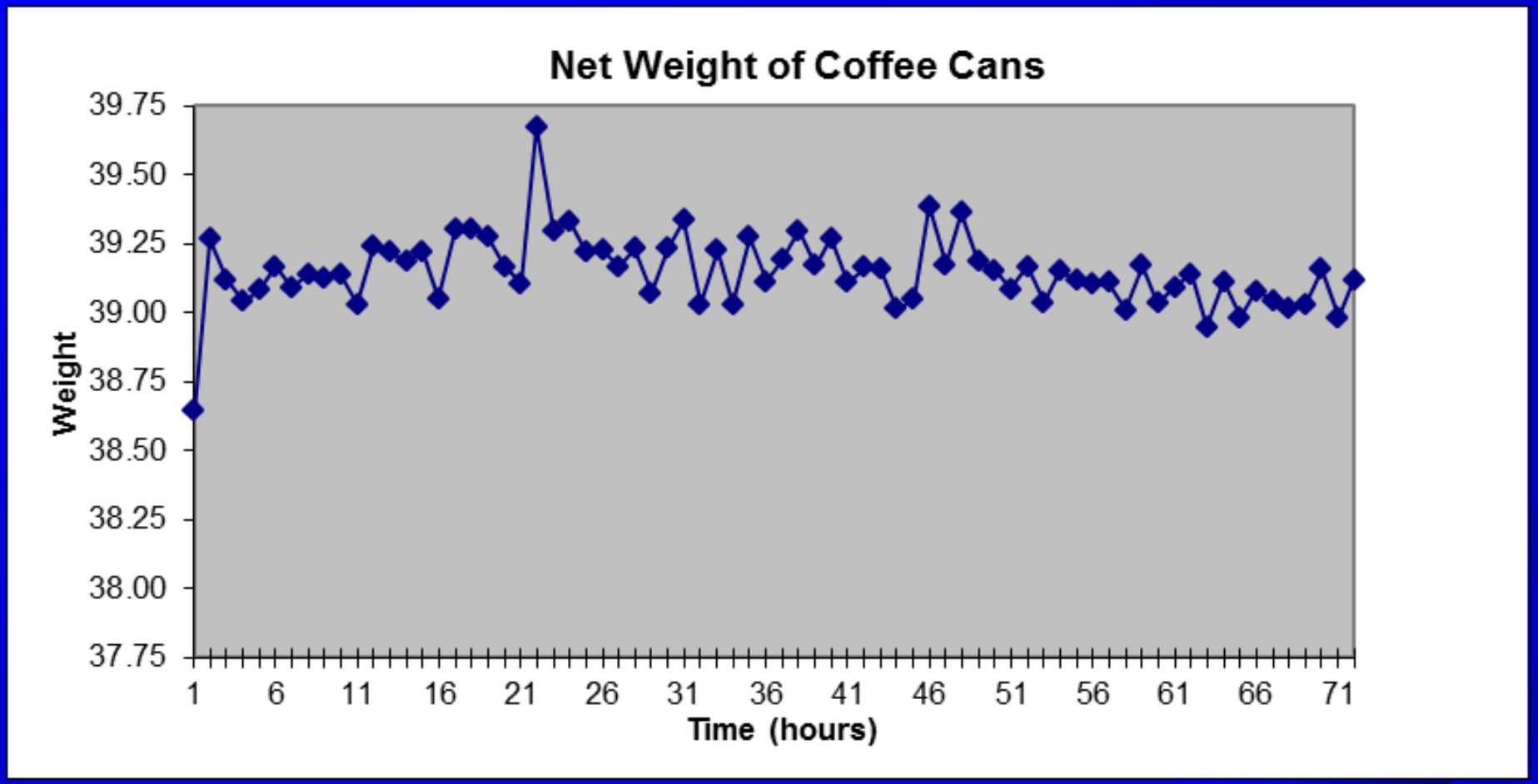
- The fundamental time series model
- Defining features of this model:

- The data are independent and identically distributed (*i.i.d.*).
- The data at every time have same uncertainty distribution, and a draw at one time does not depend upon a draw at any other time

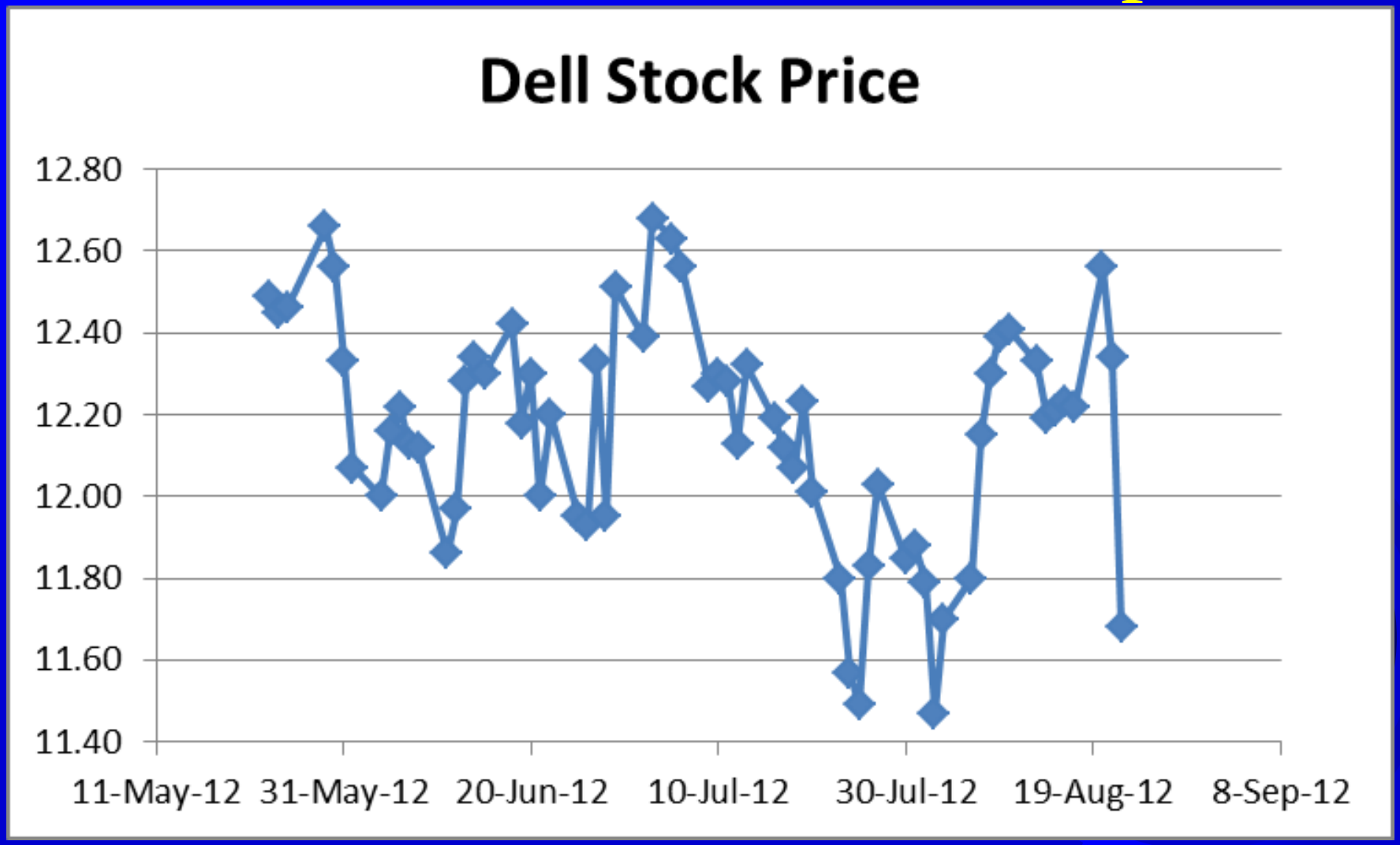
Random Sample Time Series



A Real Random Sample



A Real *non*-Random Sample



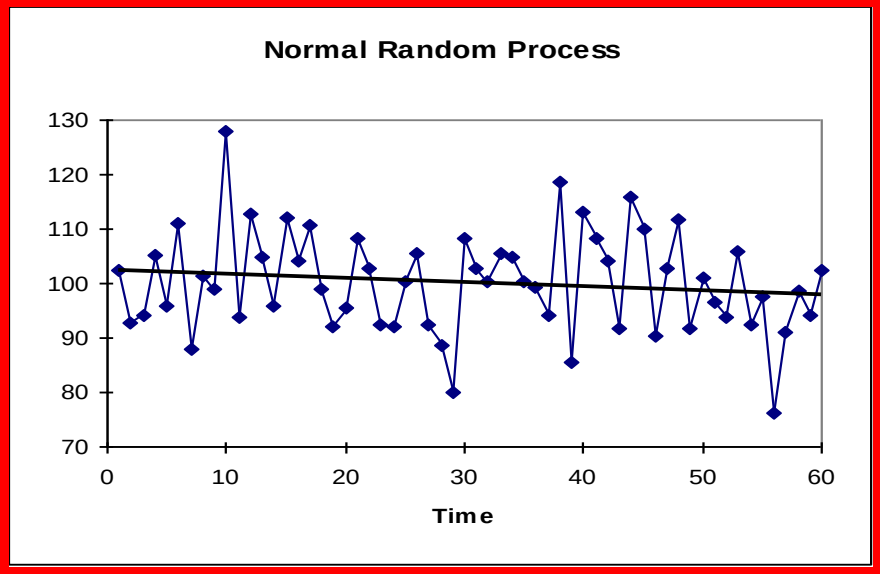
The Random Sample

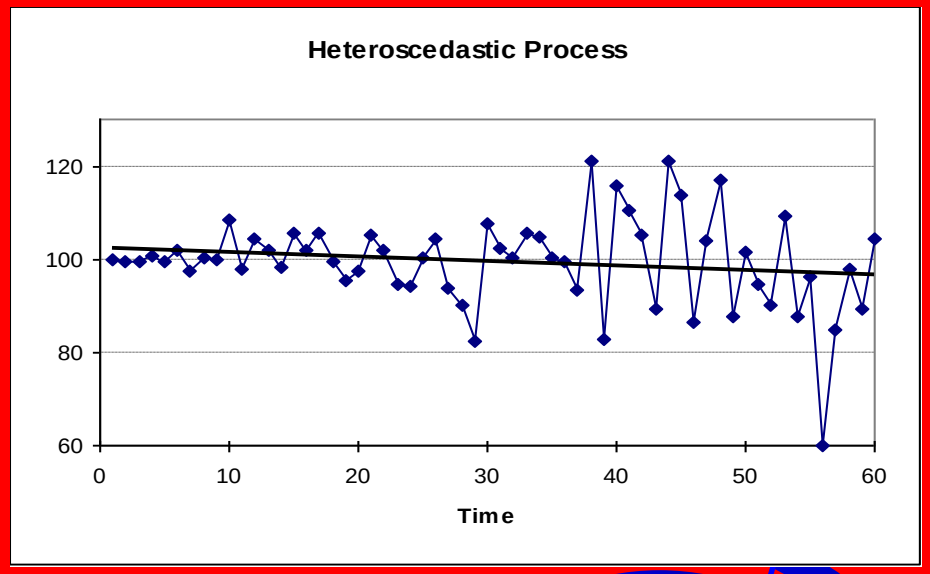
- To validate the random sample (i.i.d.) model:
  1. RS has approx constant level (L)
  2. RS has approx constant variability (H)
  3. RS has approx zero autocorrelation (I)

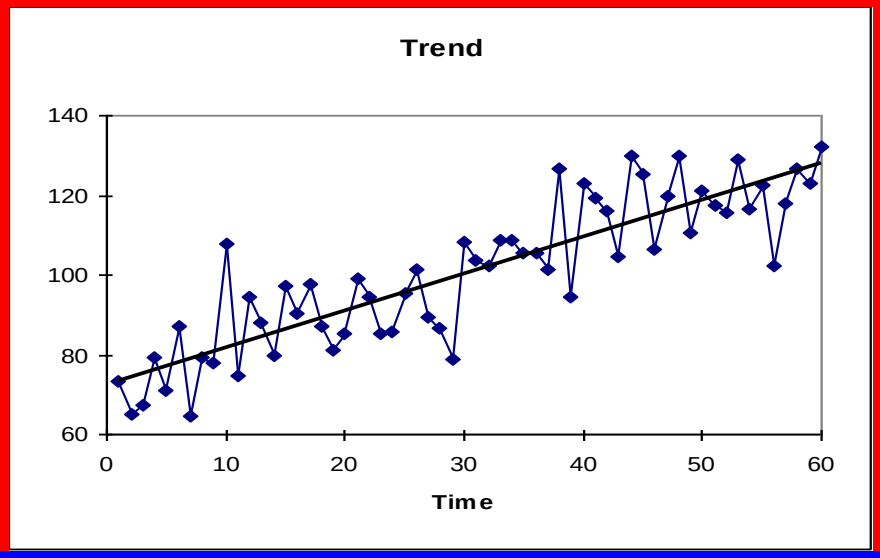
Random Sample …

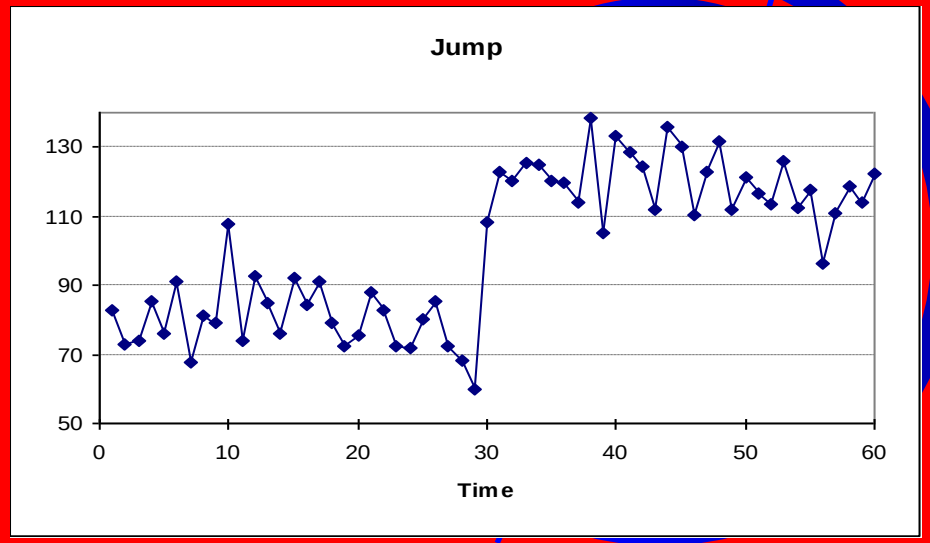
or not?

Random Sample ... or not?

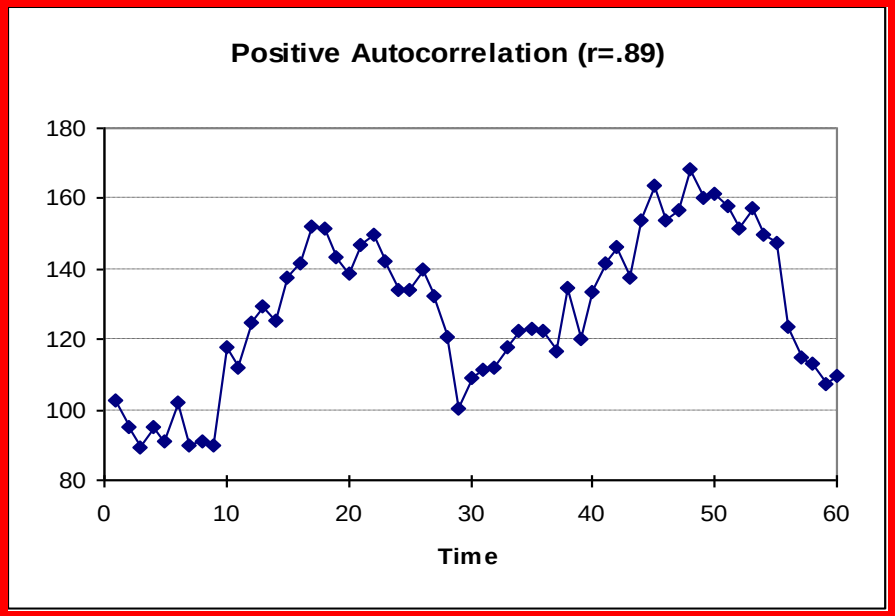


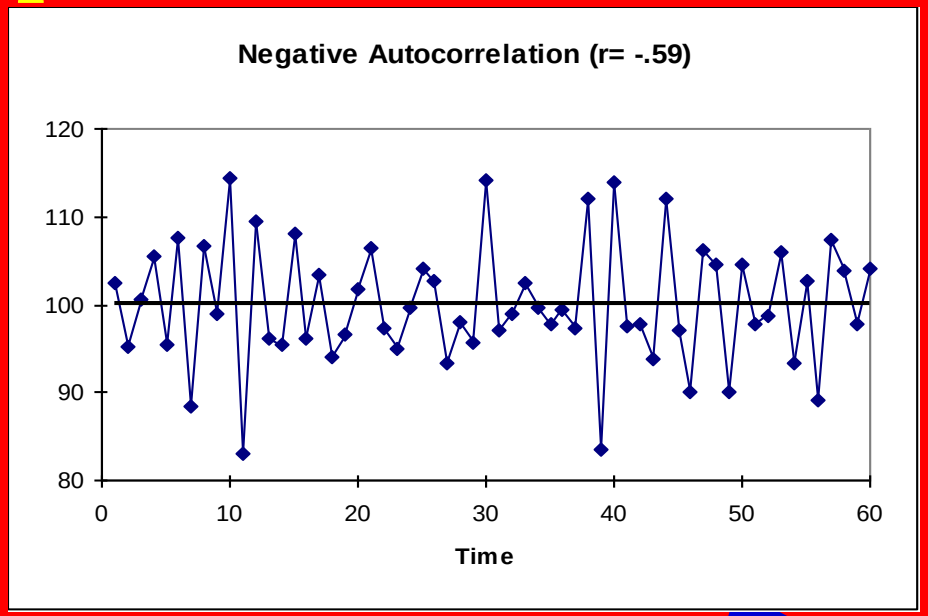


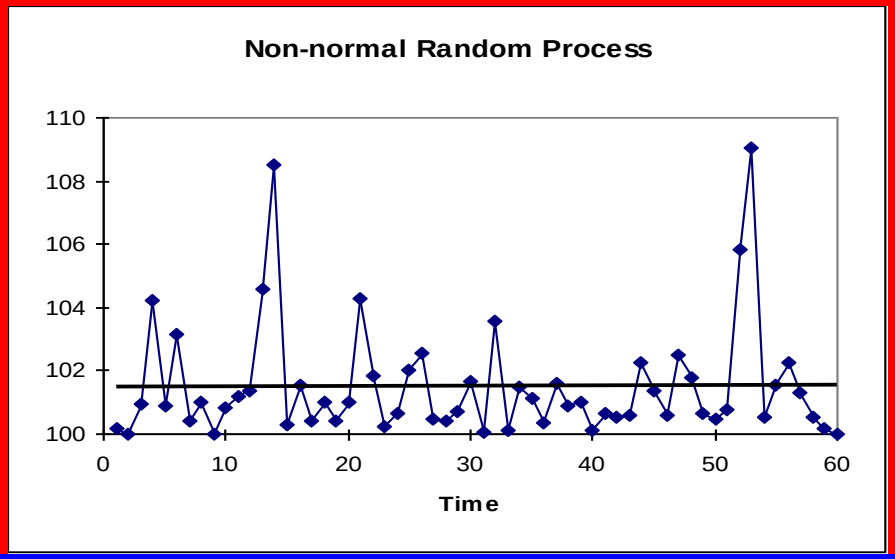


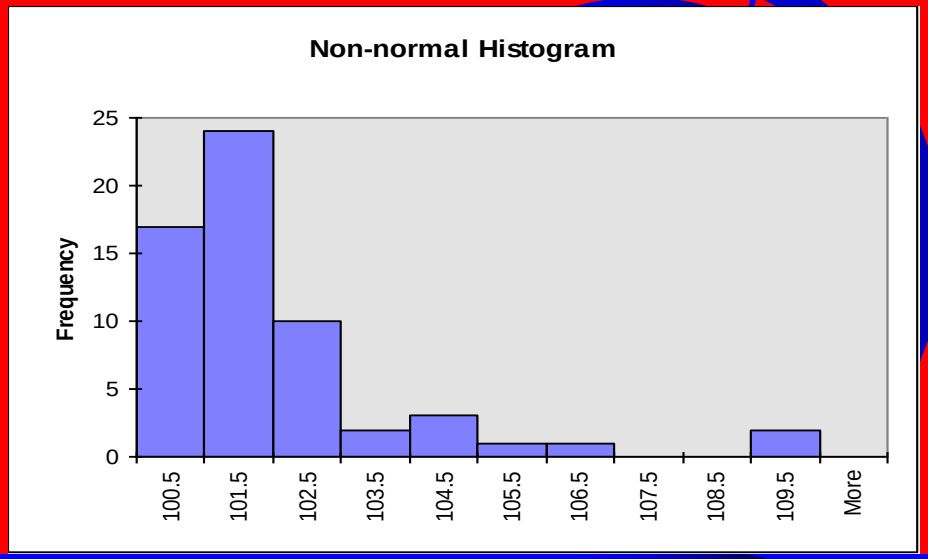


Random Sample ... or not?

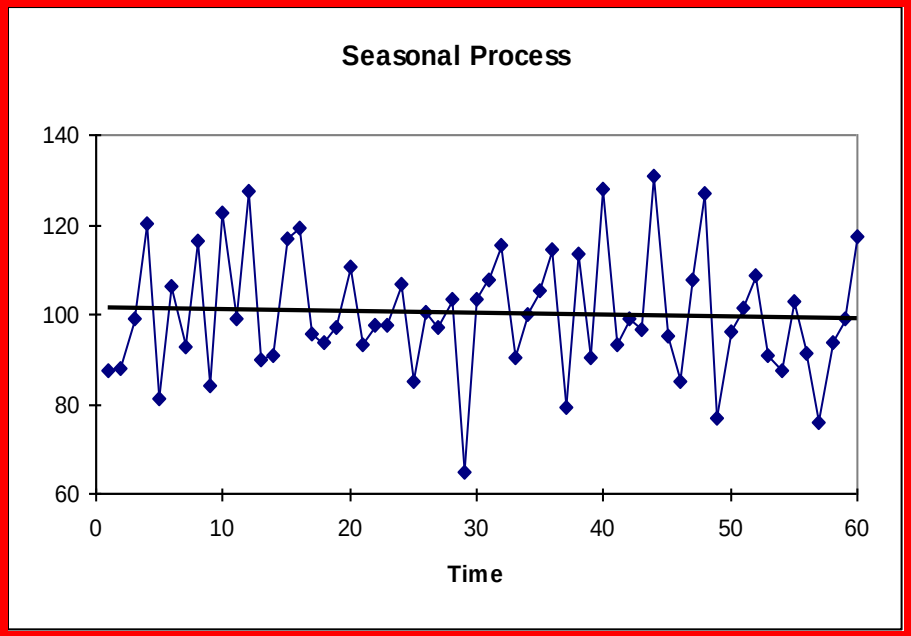


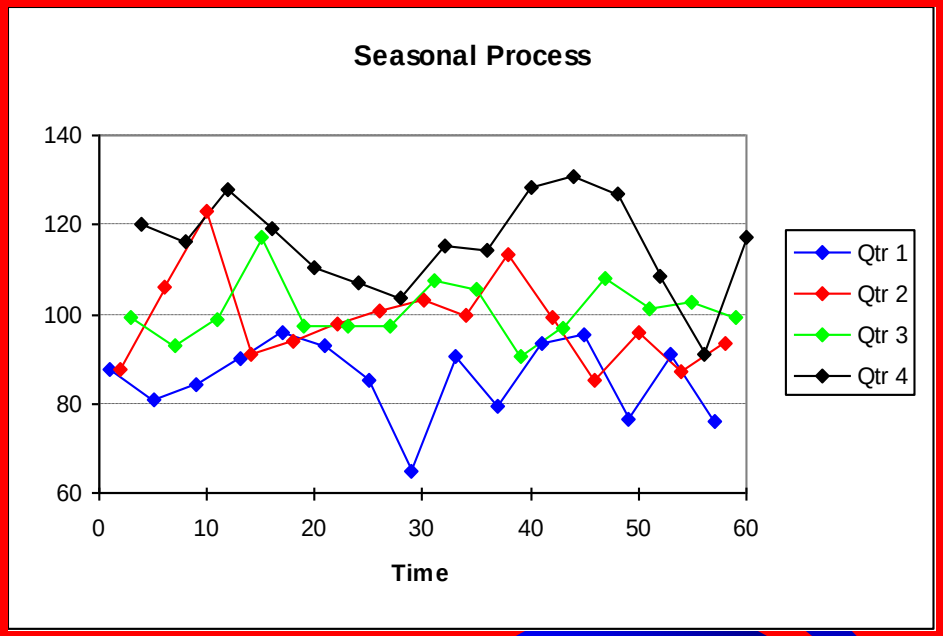






Random Sample ... or not?

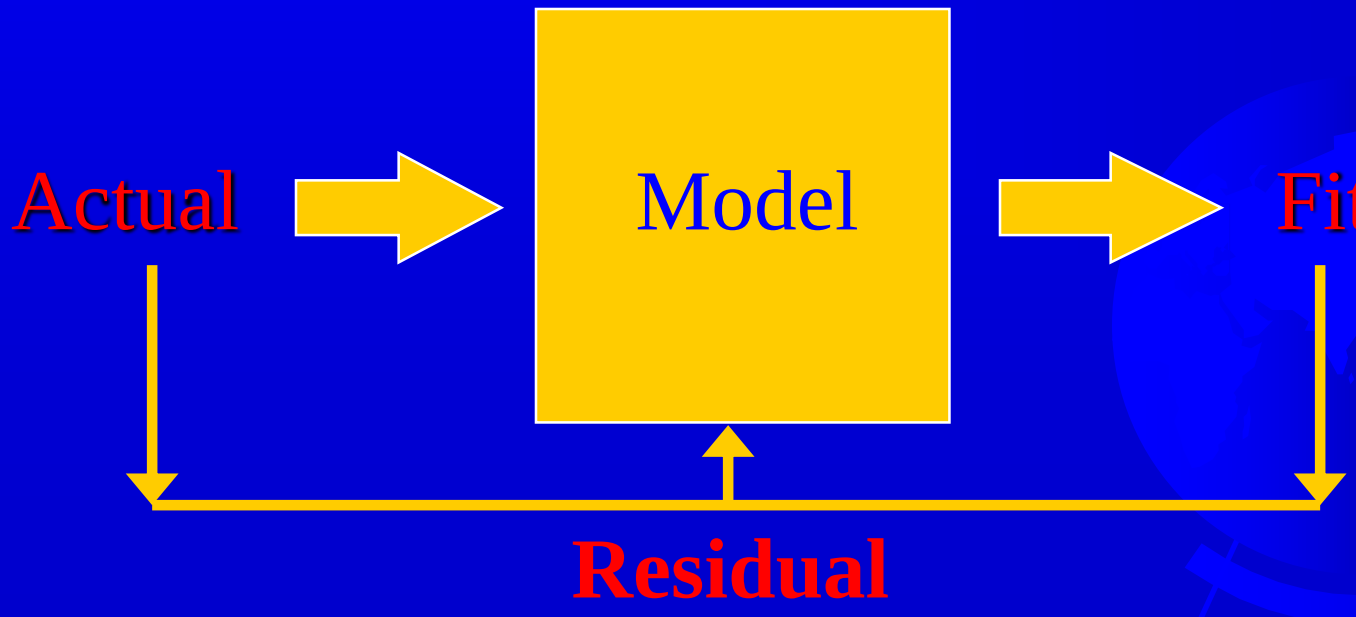




- Seasonal effects are also a form of non-stationarity (non-identically distributed) that makes a time series not a random sample.

The General Statistical Model

Actual = Fit + Residual



… applied to the Random Sample Model:

Actual* = Mean + *Residual

How to forecast of next value of a Random Sample:

***Forecast* = Mean**

(average level of the Random Sample)

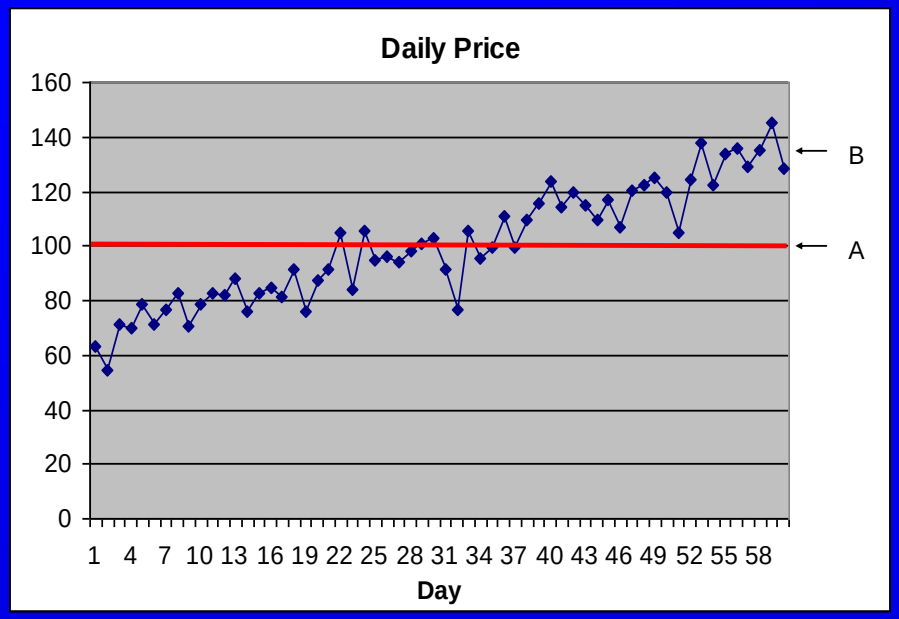
Margin of error for forecast of next value of a Random Sample:

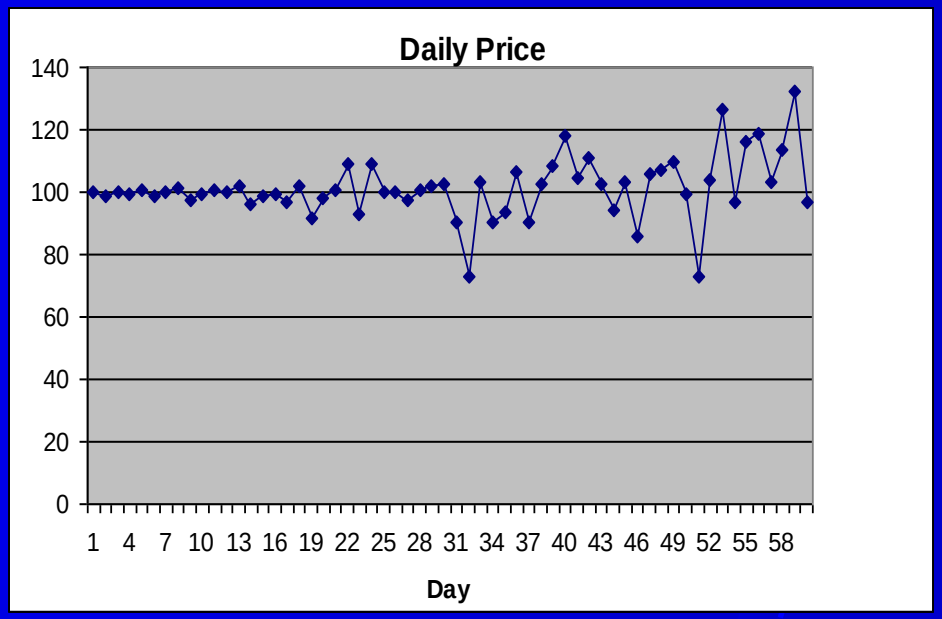
Forecast =

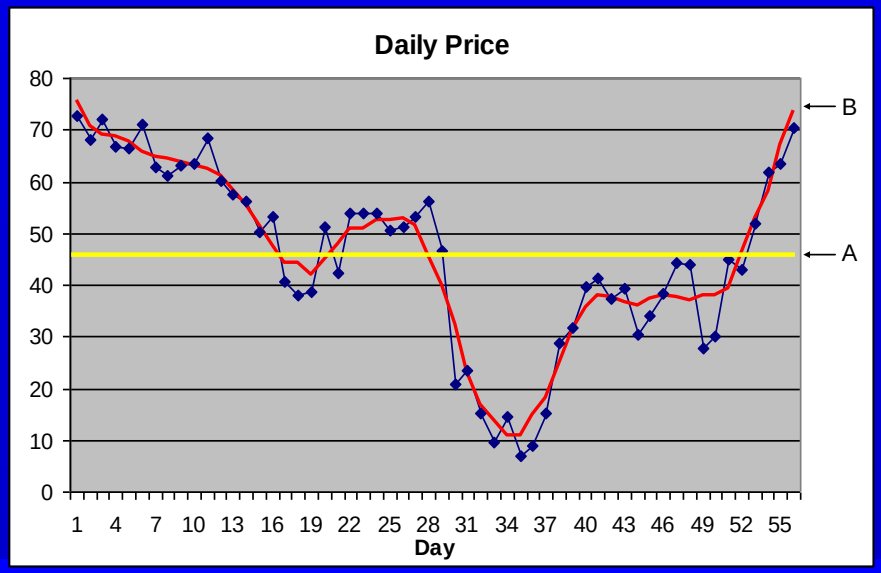
***Mean* ± St dev (residuals)**

(approx average magnitude of residuals)

Typical adverse consequences of using RS model if assumptions not met







Typical adverse consequences of using RS model if assumptions not met

- L not met → biased estimate of location
- H not met → margin of error over/under-stated
- I not met → (both of the above)

- N not met → estimates distorted by outliers in small samples