

9.2 Introduction to Time Series

MBC 638

Data Analysis and Decision Making

Introduction

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 - $y = f(y)$?

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1. Trend
2. Calendar cycles
3. Business cycles
4. Autoregressive behavior
5. Random variation

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Potential Components of Variation

1. Trend
 - Long-term rise and fall
2. Calendar cycles
 - Seasonality
3. Business cycles
 - Affected by American politics
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Time Series Analysis

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- Time plot: tool to study/visualize time series

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- Model patterns: trends and seasonality

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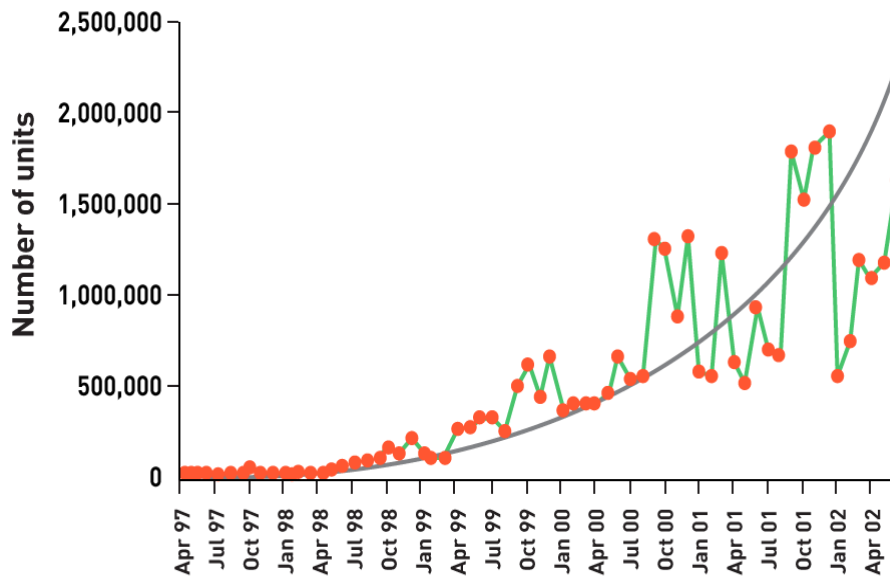
- Time plot: tool to study/visualize time series
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- Forecast: predict future values of time series

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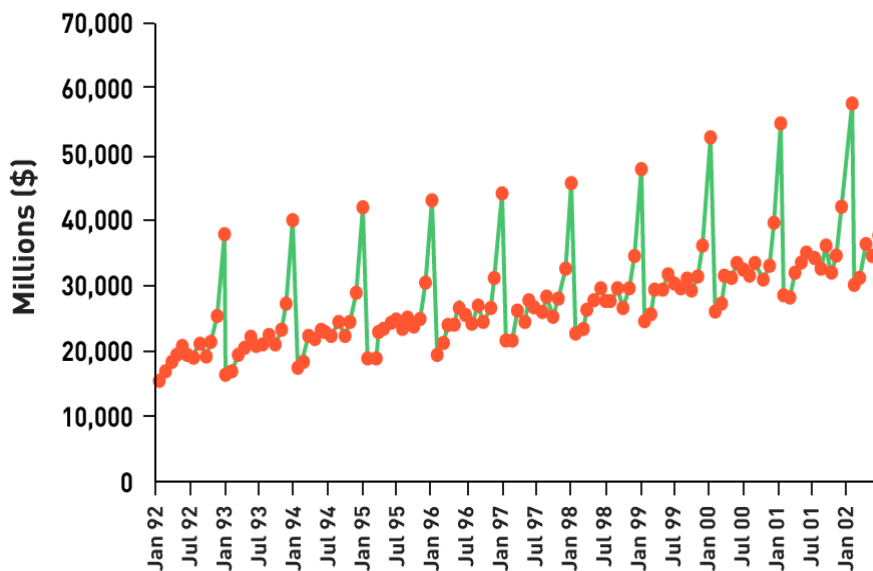
- Time plot: tool to study/visualize time series
- Model patterns: trends and seasonality
- Forecast: predict future values of time series
- Remember **practical, graphical, analytical**

Systematic Patterns

Exponential trend fitted to the number of DVD players sold



Time plot of U.S. retail sales of general merchandise stores



Trend

Steady movement in a particular direction

Simple linear regression

output (y) =
data of interest

input (x) =
indexed numbers
1,2,3, ...

output (y) =
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Seasonality

Repeating pattern due to "seasons"

Simple linear regression

input (x) =

Include indicator variables
(add seasonal effects)

Include seasonality factors
(multiply a factor to adjust trend)

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 - Input (x) = indexed numbers, e.g., 1979, 1980, 1981
 - Output (y) = data of interest, e.g., budget information

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- Multiply regression equation by a given month's SF to account for seasonality in a trend model.
- Trend + season model: $\hat{y} = (\beta_0 + \beta_1 x) \times \text{SF}$