



Data and Statistics

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Aug 26, 2019

On the Agenda

- 1 Introduction
- 2 Statistics and Applications
- 3 Data
- 4 Descriptive Statistics
- 5 Statistical Inference

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Introduction

- ▶ **Instructor:** Dr. Carlos Hurtado (Please call me Carlos!)
- ▶ **email:** churtado@richmond.edu
- ▶ **Class Lecture:** M,W Sec:7 1:30 - 2:45 pm. Sec:8 3:00 - 4:15 pm.
- ▶ **Classroom:** RSB-254
- ▶ **Office Hours:** M,W 11 am - 1 pm.
Also, after 4:15 pm or by e-mail appointment
- ▶ **Office:** RSB-261

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What is Statistics?

- ▶ The term statistics can refer to numerical facts such as:
 - averages
 - medians
 - percentages
 - maximums
- ▶ Facts to understand a variety of business and economic situations
- ▶ Can also refer to data science:
 - collecting
 - analyzing
 - presenting
 - interpreting

Applications in Business and Economics

- ▶ Accounting
 - firms use statistical sampling when conducting audits for their clients
- ▶ Economics
 - use information in making forecasts about the economy
- ▶ Finance
 - use price-earnings ratios to guide their investment advice
- ▶ Marketing
 - use retail checkout data to develop marketing campaigns
- ▶ Production
 - use quality control charts to monitor the output of a production process

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Data

- ▶ Data are the facts and figures collected, analyzed, and summarized for presentation and interpretation
- ▶ All the data collected in a particular study are referred to as the data set for the study
- ▶ Some definitions:
 - Elements: are the entities on which data are collected
 - Variable: is a characteristic of interest for the elements
 - Observation: value or measure the variable of a particular element
- ▶ A data set with n elements contains n observations
- ▶ The total number of data values in a complete data set is the number of elements multiplied by the number of variables

Data: Example

Some Nations of the World Trade Organization

The diagram illustrates a data table with the following structure:

	Nation	WTO status	Per Capita GDP (\$)	Fitch Rating	
Element Names	Armenia	Member	5,400	BB -	Observation
	Australia	Member	40,800	AAA	
	Austria	Member	41,700	AAA	
	Azerbaijan	Observer	5,400	BBB -	
	Bahrain	Member	27,300	BBB	

Annotations in the diagram:

- Variables:** A bracket above the table points to the columns: Nation, WTO status, Per Capita GDP (\$), and Fitch Rating.
- Element Names:** A bracket on the left side of the table points to the rows of data.
- Observation:** A bracket on the right side of the table points to the rows of data.
- Data Set:** A bracket at the bottom right of the table points to the entire data structure.

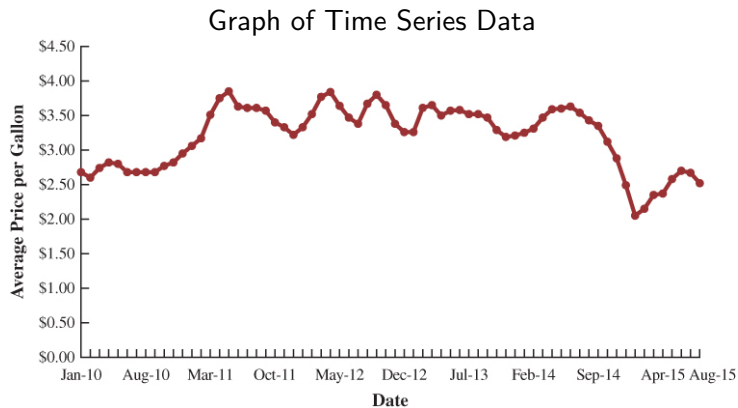
Cross-Sectional Data

- ▶ Cross-sectional data are collected at the same or approximately the same point in time
- ▶ Examples?
 - Data of the states of the World Trade Organization
 - Demographic information from the Census

Time Series Data

- ▶ Time series data are collected over several time periods
- ▶ Examples?
 - Average price per gallon of regular gasoline between 2010 and 2015
 - Unemployment rate between 2009 and 2013
- ▶ Graphs of time series help analysts understand:
 - what happened in the past
 - identify any trends over time
 - project future values for the time series

Time Series Data



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Descriptive Statistics

- ▶ Most of the statistical information in newspapers, magazines, company reports, and other publications consists of data that are summarized and presented in a form that is easy to understand
- ▶ Such summaries of data, which may be tabular, graphical, or numerical, are referred to as descriptive statistics
- ▶ Descriptive Statistics: Methods that organize, summarize and present data in a way that can be easily understood

Example: Auto Repair

- ▶ The manager of Hudson Auto would like to have a better understanding of the cost of parts used in the engine tune-ups performed in her shop
- ▶ She examines 50 customer invoices for tune-ups
- ▶ The costs of parts, rounded to the nearest dollar, are listed on the next slide

Example: Auto Repair

Sample of Parts Cost (\$) for 50 Tune-ups

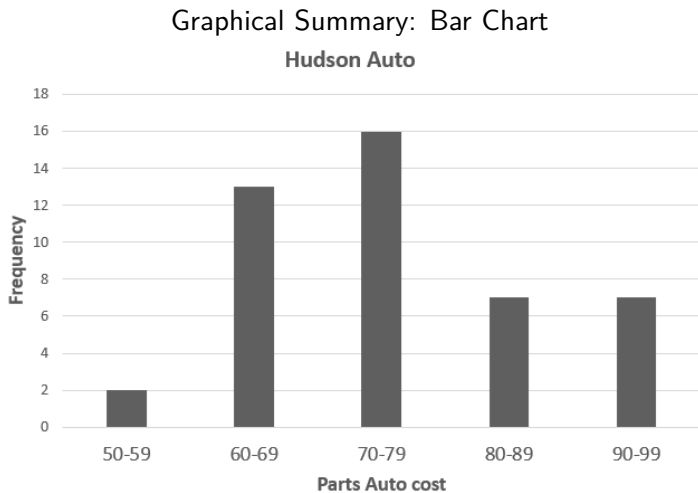
91	78	93	57	75	52	99	80	97	62
71	69	72	89	66	75	79	75	72	76
104	74	62	68	97	105	77	65	80	109
85	97	88	68	83	68	71	69	67	74
62	82	98	101	79	105	79	69	62	73

Example: Auto Repair

Tabular Summary: Frequency and Percent Frequency

Parts Cost (\$)	Frequency	Percent Frequency
50-59	2	4%
60-69	13	26%
70-79	16	32%
80-89	7	14%
90-99	7	14%
100-109	5	10%
TOTAL	50	100%

Example: Auto Repair



Numerical Descriptive Statistics

- ▶ The most common numerical descriptive statistic is the mean
- ▶ The mean demonstrates a measure of the central tendency, or central location, of the data for a variable.
- ▶ Hudson's mean cost of parts, based on the 50 tune-ups studied, is \$79
- ▶ The formula to compute the mean is:

$$\bar{x} = \frac{91 + 78 + 93 + \cdots + 69 + 62 + 73}{50} = \frac{\sum_{i=1}^{50} x_i}{50}$$

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Statistical Inference

- ▶ Population: The set of items under consideration in its totality
- ▶ Sample: A subset of the population
- ▶ Statistical inference: Methods that allow you to make estimates and test hypotheses about the characteristics of a population only from sample data
- ▶ Descriptive statistics: Methods that organize, summarize and present data in a way that can be easily understood
- ▶ Census: Collecting data for the entire population
- ▶ Sample survey: Collecting data for a sample

Process of Statistical Inference

