Statistics for Decision Making:

Broad Introduction

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Course Title Explained!

1. Statistics
2. [to be filled]
3. Decision Making

Statistics

Question: What is statistics?

What is statistics?

There are many different answers to this question, and people indeed have proposed many.

The definitions also varied drastically over time, from the early days when we simply define statistics as methods to collect data (not even analyze the data) to now as a study of all stages of investigation of data.

What is statistics?

Many considered statistics as a data-related or even data-driven discipline.

Not a surprising view, much consistent with Ronald Fisher's claim that

"the object of statistical methods is the reduction of data"

What is statistics?

Traditional yet Simplistic View: the main purpose of statistics is to make sense of data.

Useful yet inaccruate characterization of statistics (too much emphasis on data analysis itself)

Data Analysis $\neq$ the end goal of Statistics

What is statistics?

From an economist's perspective, at least,

Instead, our goal is to **understand how the world works**, for which data analysis is simply a means.

e.g.,

1. We may be interested in whether or not education indeed improves a worker's productivity and hence her wages. (An example of **Causal Question**)

Useful for individuals (who would like to make decisions about how to allocate their time and money) and policymakers (with limited budgets who need to decide how to allocate resources beween schools alternative public goods such as hosipitals)

What is statistics?

Without having these goals in mind, it is easy to arrive at the view that statistics or econometrics is simply about data minining.

And much attention is indeed paid to data miniming exercises, **extract the maximum amount of information possible from the available data**.

$\implies$ **Description** of the data, as opposed to **understanding the process generating it**

What is statistics?

Question What is so unique about statistics?

What is statistics?

Question What is so unique about statistics?

The object of interest is **random**, **uncertain**, or **stochastic**.

What is statistics?

My attempt as an **economist**:

A discipline that attempts to discover **deterministic** patterns in a **stochastic** world

What is statistics?

My search for a more accurate charaterization of statistics useful for economists reflects

1. Question-driven: **for decision making**! as exactly our course title suggests.
2. Unique feature of the subject that statistics is concerned about: **Uncertain** or **Stochastic**

What is statistics?

Because of the unique feature, the meaningful pattern is charaterized by *distribution*, be it univariate or multivariate.

A distribution governs the probability assigned to each possible value.

We would like to provide mathematical description of a distribution, or obtain specific parameters of it.

What is statistics?

The statistical way of discovering patterns relies on three key components:

1. **Development of theoretical methods**. We examine issues such as: under what assumptions, we can discover meaningful patterns, and how we can go about discovering them.
2. **Data**. We examine questions such as sampling designs about how to collect data that are useful for discovering meaningful patterns.
3. **Computation**. We examine questions such as how we can implement the theoretical results in practice and improve the efficiency of these implementations.

What is statistics?

Thinking about our purpose to understand the world (and the population), it does not make sense to classify statistics into

descriptive statistics vs. **inferential** statistics

In the book,

1. The former is defined as methods of "organizing summarizing and presenting data in an informative way",
2. The latter is defined as a branch of statistics used to "estimate a property of a population on the basis of a sample".

What is statistics?

Our material (Econ 5023 and Managerial Economics II) is split into two "big" sections

1. Univariate Statistics
2. Multivariate Statistics

In the first section, we will further split it into two parts

1. Estimation
2. Inference

Course Title Explained!

1. Statistics $\implies$ Patterns
2. [Forecasting or Prediction]
3. Decision Making

Decision Making

Our process should always be:

1. Figure out what our goals are
2. Figure out the information required for decision making that can be quantified
3. Collect data and discover the underlying patterns for the object(s) of interest (**statistics**)
4. Make predictions (**forecasting**)
5. Make decisions

Both 3 and 4 are what we will focus on in this course. While how statistics and forecasting are applied depends on the actual scenario, we can discuss some examples of how statistics and forecasting can help improve decision making.

Course Title Explained!

1. Statistics $\implies$ Patterns
2. [Forecasting or Prediction]
3. Decision Making

In this course, we will focus on the first part: uncovering the pattern (features of the distributions of interest) and keep the third part in the background (since it depends on a context).

Econ 5023: Statistics ~~for Decision Making~~