

Introduction to Forecasting



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This course is designed to be:

1. Introductory
2. Less math and fun!

Most important:

Feel free to ask any questions! 🗣️

Enjoy! 😊

What is Forecasting?



- ▶ A little more than a guess about the future.
- ▶ Good ways: modern, rigorous, replicable, largely-quantitative statistical/econometric methods.
- ▶ Important in business, finance, economics, government, and many other fields, and they guide many important decisions.

- ▶ Let's sketch some of the areas where forecasts feature prominently, and the corresponding diversity of decisions that they support.

Government, central banks, and private institutions routinely forecast major economic variables:

- ▶ gross domestic product (GDP)
- ▶ unemployment rate and interests rates
- ▶ the stage of the business cycle (expansion or contraction)
- ▶ the state of future stock market activity (bull or bear)
- ▶ the state of future foreign exchange market activity (appreciation or depreciation)

Governments use such forecasts to guide monetary and fiscal policy, and private firms use them for strategic planning.

Firms use forecasts to decide:

- ▶ What to produce?
- ▶ When to produce?
- ▶ Where to produce?
- ▶ How much to produce and how much capacity to build?

Firms also use forecasts of future prices and availability of inputs to guide production decisions.

Portfolio managers have keen interest in forecasting asset returns. The debate about the success of forecasts of asset returns:

- ▶ Asset returns should be very hard to forecast.
- ▶ Those who exploited any such opportunities may well have gotten rich!

Thus, simple, widely-available forecasting methods should have little success in financial markets, but there may well be profits to be made from using new and sophisticated techniques.

- ▶ **Financial risk management:** asset return volatility, which is crucial for evaluating and insuring risks associated with asset portfolios.
- ▶ **A variety of consulting firms.**
- ▶ **Population Forecasts,** which are crucial for planning government expenditure.
- ▶ **Default probability forecasts.**

The above examples are just the tip of the iceberg.

- ▶ With so many applications, are there a huge variety of forecasting techniques exists?
- ▶ A relatively small number of tools form the common core of almost all forecasting methods.
- ▶ We will focus on those underlying core principles in this course, which drive all applications.

Forecasting is inextricably linked to the **statistical models**:

- ▶ Before we can forecast a variable of interest, we typically first build a model for it.
- ▶ We then estimate the model's parameters using observed historical data.

The estimated model provides a statistical characterization of the links between the present and the past, from which we infer what to expect in the future.

In a **univariate model**, a single variable is modeled and forecast solely on the basis of its own past. Univariate approaches are tremendously important and worth studying for at least two reasons.

- ▶ Simple but not necessarily simplistic. A large amount of accumulated experience suggests that they often perform admirably.
- ▶ It's necessary to understand univariate forecasting models before tackling more complicated multivariate models.

Example: Using a stock's price history to forecast its price over the next week.

In a **multivariate model**, a variable (or each member of a set of variables) is modeled on the basis of its own past, as well as the past of other variables, thereby accounting for and exploiting cross-variable interactions.

Examples: Using a stock's price history and volatility history to forecast its price and volatility over the next week.

In **deterministic** models, the output of the model is fully determined by the parameter values and the initial conditions.

Stochastic models possess some inherent randomness. The same set of parameter values and initial conditions will lead to an ensemble of different outputs.

A **time series** is a series of data points indexed (or listed or graphed) in time order. Simply say, it is a sequence of discrete-time data. For example, the daily closing value of the Dow Jones Industrial Average.

Time series analysis comprises methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data.

Time series forecasting is the use of a model to predict future values based on previously observed values.