Applied predictive modeling:

Predictive models to determine price risk

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Agenda

- Business case for predictive models
  - What is predictive modeling?
  - Models for price prediction
- Demo of price predictive model in @Risk/ModelRisk
  - Selection of predictive model
  - Application of predictive model to forecast prices
  - Adding price risk in financial models
- Predictive models with Machine Learning
  - Python programming steps for deploying predictive model
  - Python libraries for predictive modeling

Business case for predictive models

- What is predictive modeling?
- Models for price prediction

What is predictive modelling?

Objective: to predict future values of a variable by using historical data and predictive algorithms
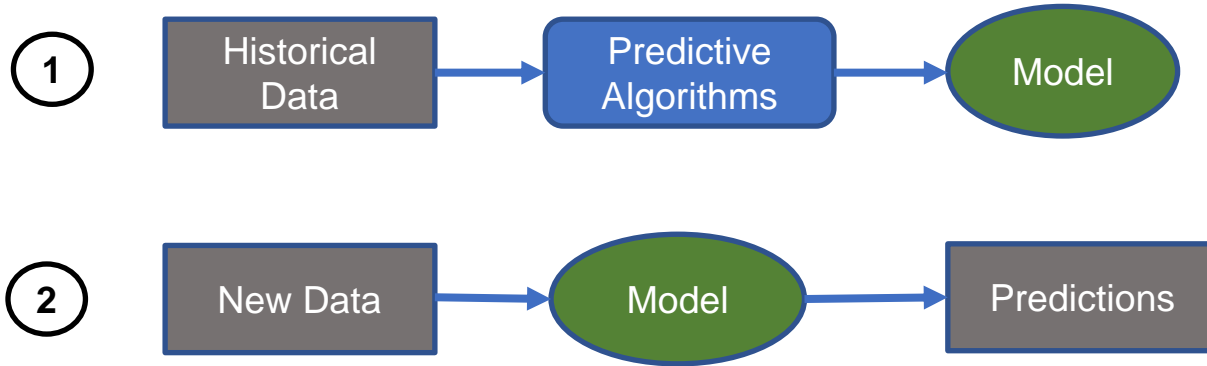
Predictive models we can use for price analysis

- Classification models (for categorical/binary variables). Examples: Logit (Logistic regression) and Probit models
  - To price loans based on borrower's credit score: What's the probability that a particular borrower defaults on his loan in the next 24 months?
  - To price life-insurance premiums based on applicant's health risk: What's the probability that a particular applicant has a heart attack in the next 5 years?

- Linear regression models (for a predicted variable, also called dependent variable, that is continuous, e.g., the price for flight, or the price of a financial asset)

- Time series models (for predicting the future values of a variable)

Price prediction demo in @Risk/ModelRisk

- Selection of predictive model
- Application to forecast prices
- Adding price risk in financial models

Resources to replicate demo

- ModelRisk 15-day Free Trial:
  https://www.vosesoftware.com/products/modelrisk/register.php

- @Risk 15-day Free Trial: https://go.palisade.com/RISKDownload.html

- Natural gas time series used in today's demo:
  https://www.eia.gov/dnav/ng/hist/rngwhhdM.htm

Predictive models with Machine Learning

- Python programming steps for deploying predictive model
- Python Libraries for predictive modeling

Predictive models with Machine Learning in Python

- **Why use ML for predictive modeling?** Use ML to:
    - a) turn a predictive model into a production system, and
    - b) as new data is incorporated, dynamically update the model to make accurate predictions on new unseen data

Programming steps in Python:

- Split dataset into train/test
- Apply different <u>learning algorithms</u> on the <u>training dataset</u> and thus obtain the <u>parameters of the predictive models</u>
- Evaluate the performance of the alternative models on the <u>testing data</u>
- Select algorithm that gives the best prediction in the testing dataset
- Save the selected model and deploy it in production (to make predictions against new data)
- Repeat steps above to <u>dynamically improve</u> the model

Python ML Libraries for Predictive Modeling

- Leverage from libraries for ML in Python

- Scikit-learn (also known as Sklearn) provides a range of learning algorithms in Python for predictive modeling https://scikit-learn.org/stable/

- Sktime is a Python ML toolbox for time series. It provides dedicated time series algorithms for multiple learning tasks and scikit-learn compatible tools for building, tuning, and evaluating models https://www.sktime.org/en/stable/

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