Gateway to Financial Time Series with Python

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Outline

- **Introduction to time series**
  - What is time series
  - Why we need time series
  - Decomposition of time series
- **Analyze financial time series with Python**
  - Retrieving Financial Data
  - Explore the data with Pandas
  - Visualization
- **More financial time series**
  - Stock/ ETF
  - Bonds
  - Commodities

Notes

- People:
  - For beginners, no background in finance and Python
- Objective:
  - To stimulate your interest in secondary market!
- Disclaimer:
  - There is no guarantee you can make a fortune after this seminar

Introduction

1. Introduction: What is a time series?

- A sequence of observations at regular time intervals:

$$Y(t),\ t=0,1,2,3,\cdots$$

- For example:
  - Hourly S&P 500 Index
  - Daily stock close price
  - Monthly housing price
  - Quarterly company financial reports
  - Annually GDP, number of new students,

1. Introduction: Why we need time series?

- Know something about future: Forecast

- For example:
- When will Coronavirus stop?
- When will stock stop falling?

Decomposition of time series

- Trend: T(t)
  - Long term tendency of time series, e.g. US debt
- Seasonality: S(t)
  - periodic fluctuations caused by regular influences
- Cyclical: C(t)
  - medium-term fluctuation caused by cyclically occurred influences
- Irregular: I(t)
  - Random variations caused by unpredictable influences

Decomposition of time series

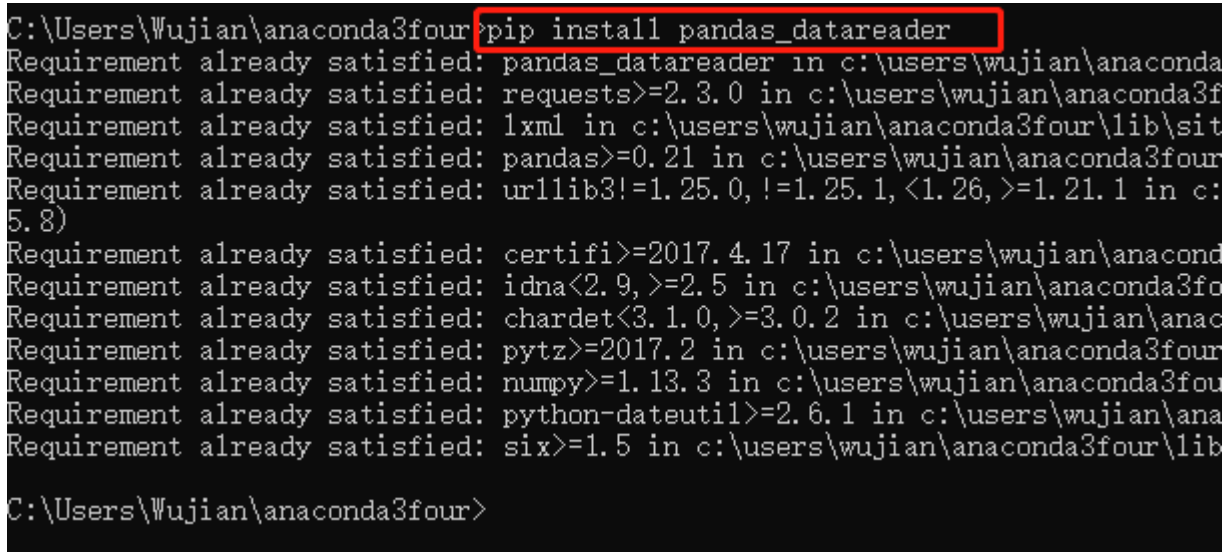
- Addictive model:
  - $Y(t) = T(t) + S(t) + C(t) + I(t)$
- Multiplicative model:
  - $Y(t) = T(t) * S(t) * C(t) * I(t)$

Analyze financial time series with Python

Retrieving Financial Data

- Traditionally, you can download data from Yahoo! Finance

- Now you can read data online
  - pip install pandas_datareader



Explore the data with Pandas

- TSLA.info
- TSLA.head()
- TSLA.shape
- TSLA.Close
- TSLA.Close.head()
- TSLA.Close.tail()

$$R_t = logP_t - logP_{t-1} = log\frac{P_t}{P_{t-1}}$$

- R_t: stock log return
- P_t: stock close price at day t
- P_{t-1}: stock close price at day t-1

Visualization: Tesla stock price

More financial time series

Financial Assets

Tools\Assets	Stocks	Bonds	Commodities	Forex
ETF	Stock ETF	Bond ETF	Commodity ETF	Forex ETF
Future	Stock Index future	Bond Future	Commodity Futures	Forex Future
Options	Stock Option	Bond Option	Commodity option	Forex Option
Swap	…	…	…	…
More derivatives				

Movie:

The Big Short

Analysis of financial time series, Tsay

https://github.com/wx2123/Financial_Time_Series/blob/master/Analysis%20of%20financial%20time%20series%20Tsay.pdf

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