The DataReader: Access financial data online

IMPORTING AND MANAGING FINANCIAL DATA IN PYTHON

Stefan Jansen
Instructor

pandas_datareader

- Easy access to various financial internet data sources
- Little code needed to import into a `pandas` `DataFrame`
- Available sources include:
  - Yahoo! and Google Finance (including derivatives)
  - Federal Reserve
  - World Bank, OECD, Eurostat
  - OANDA

Stock prices: Google Finance

```
from pandas_datareader.data import DataReader
from datetime import date # Date & time functionality
```

```
start = date(2015, 1, 1) # Default: Jan 1, 2010
end = date(2016, 12, 31) # Default: today

ticker = 'GOOG'
data_source = 'google'

stock_data = DataReader(ticker, data_source, start, end)
```

Stock prices: Google Finance

```
stock_data.info()
```

```
DatetimeIndex: 504 entries, 2015-01-02 to 2016-12-30
Data columns (total 6 columns):
Open          504 non-null float64   # First price
High          504 non-null float64   # Highest price
Low           504 non-null float64   # Lowest price
Close         504 non-null float64   # Last price
Volume        504 non-null int64     # Nb shares traded
dtypes: float64(6), int64(1)
memory usage: 32.3 KB
```

Stock prices: Google Finance

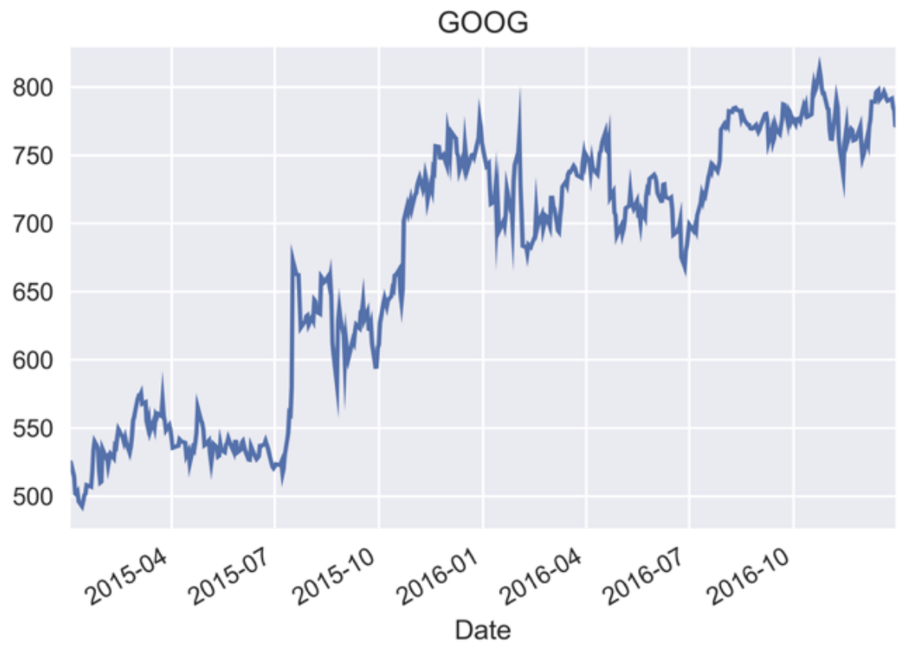
```
pd.concat([stock_data.head(3), stock_data.tail(3)])
```

```
                Open    High     Low   Close   Volume
Date
2015-01-02   529.01   531.27  524.10  524.81  1446662
2015-01-05   523.26   524.33  513.06  513.87  2054238
2015-01-06   515.00   516.18  501.05  501.96  2891950
2016-12-28   793.70   794.23  783.20  785.05  1153824
2016-12-29   783.33   785.93  778.92  782.79   744272
2016-12-30   782.75   782.78  770.41  771.82  1769950
```

Stock prices: Visualization

```
import matplotlib.pyplot as plt

stock_data['Close'].plot(title=ticker)
plt.show()
```



Let's practice!

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Economic data from the Federal Reserve

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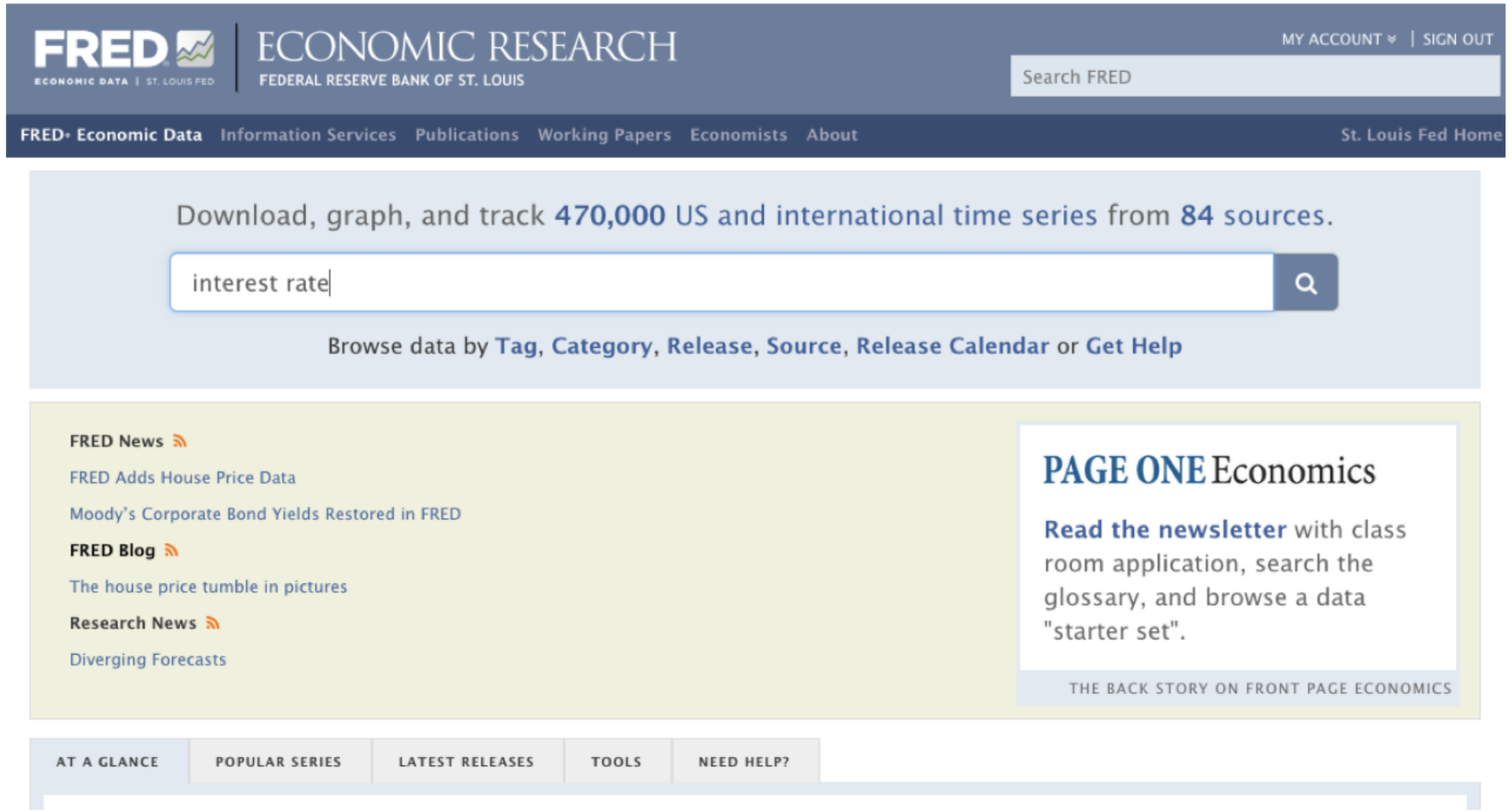
Economic data from FRED

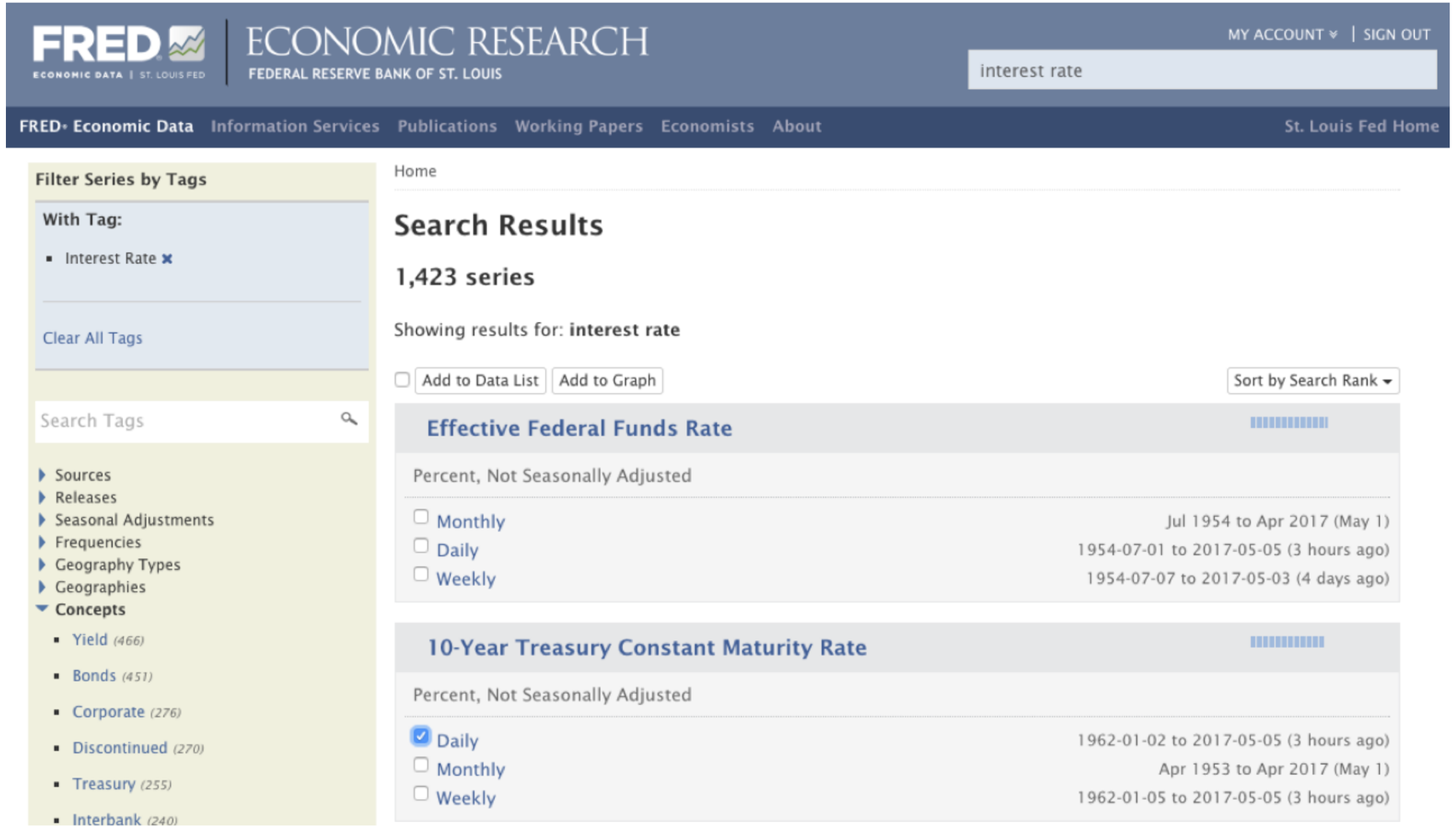
- Federal Reserve Economic Data
- 500,000 series covering a range of categories:
  - Economic growth & employment
  - Monetary & fiscal policy
  - Demographics, industries, commodity prices
  - Daily, monthly, annual frequencies

Get data from FRED



[1] https://fred.stlouisfed.org/

Get data from FRED



[1] https://fred.stlouisfed.org/

Get data from FRED

[1] https://fred.stlouisfed.org/

Interest rates

```
from pandas_datareader.data import DataReader
from datetime import date

series_code = 'DGS10' # 10-year Treasury Rate

data_source = 'fred' # FED Economic Data Service

start = date(1962, 1, 1)

data = DataReader(series_code, data_source, start)

data.info()
```

```
DatetimeIndex: 14439 entries, 1962-01-02 to 2017-05-05
Data columns (total 1 columns):
DGS10    13821 non-null float64
dtypes: float64(1)
```

Stock prices: Visualization

- `.rename(columns={old_name: new_name})`

```
series_name = '10-year Treasury'
data = data.rename(columns={series_code: series_name})
data.plot(title=series_name); plt.show()
```

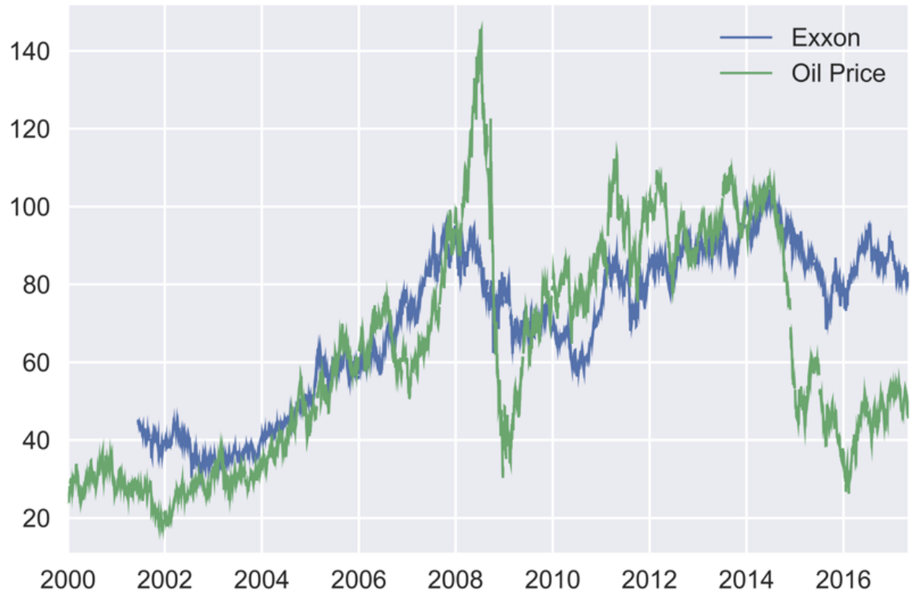
Combine stock and economic data

```
start = date(2000, 1, 1)
series = 'DCOILWTICO' # West Texas Intermediate Oil Price
oil = DataReader(series, 'fred', start)
ticker = 'XOM' # Exxon Mobile Corporation
stock = DataReader(ticker, 'google', start)
data = pd.concat([stock[['Close']], oil], axis=1)
data.info()
```

```
DatetimeIndex: 4526 entries, 2000-01-03 to 2017-05-08
Data columns (total 2 columns):
Close          4364 non-null float64
DCOILWTICO     4352 non-null float64
```

Combine stock and economic data

```
data.columns = ['Exxon', 'Oil Price']
data.plot()
plt.show()
```



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Select stocks and get data from Google Finance

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Select stocks based on criteria

- Use the listing information to select specific stocks
- As criteria:
  - Stock Exchange
  - Sector or Industry
  - IPO Year
  - Market Capitalization

Get ticker for largest company

```
nyse = pd.read_excel('listings.xlsx',sheetname='nyse', na_values='n/a')
nyse = nyse.sort_values('Market Capitalization', ascending=False)
nyse[['Stock Symbol', 'Company Name']].head(3)
```

```
     Stock Symbol             Company Name
1586          JNJ         Johnson & Johnson
1125          XOM  Exxon Mobil Corporation
1548          JPM     J P Morgan Chase & Co
```

```
largest_by_market_cap = nyse.iloc[0]  # 1st row
largest_by_market_cap['Stock Symbol'] # Select row label
```

```
'JNJ'
```

Get ticker for largest company

```
nyse = nyse.set_index('Stock Symbol') # Stock ticker as index
nyse.info()
```

```
Index: 3147 entries, JNJ to EAE
Data columns (total 6 columns):
Company Name              3147 non-null object
Last Sale                 3147 non-null object
Market Capitalization     3147 non-null float64
...
```

```
nyse['Market Capitalization'].idxmax() # Index of max value
```

```
'JNJ'
```

Get ticker for largest tech company

```
nyse['Sector'].unique() # Unique values as numpy array
```

```
array(['Technology', 'Health Care', ...], dtype=object)
```

```
tech = nyse.loc[nyse.Sector == 'Technology']
tech['Company Name'].head(2)
```

```
Stock Symbol                          Company Name
ORCL                             Oracle Corporation
TSM           Taiwan Semiconductor Manufacturing
```

```
nyse.loc[nyse.Sector=='Technology', 'Market Capitalization'].idxmax()
```

```
'ORCL'
```

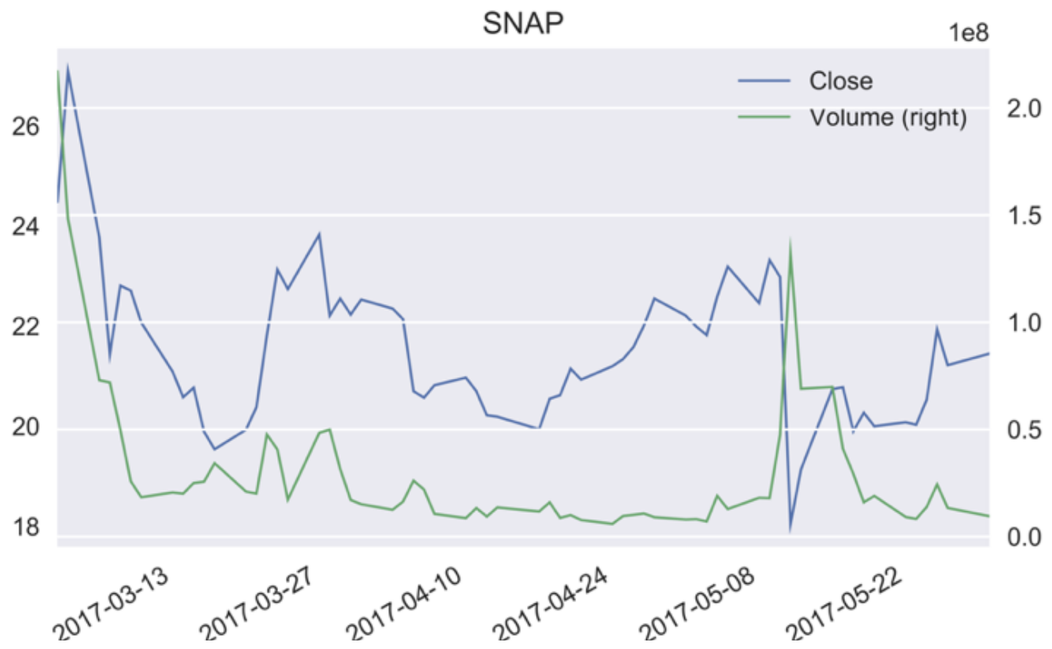
Get data for largest tech company with 2017 IPO

```
ticker = nyse.loc[(nyse.Sector=='Technology') & (nyse['IPO Year']==2017),
                  'Market Capitalization'].idxmax()

data = DataReader(ticker, 'google') # Start: 2010/1/1
data = data.loc[:, ['Close', 'Volume']]
```

Visualize price and volume on two axes

```
import matplotlib.pyplot as plt
data.plot(title=ticker, secondary_y='Volume')
plt.tight_layout(); plt.show()
```



Let's practice!

IMPORTING AND MANAGING FINANCIAL DATA IN PYTHON

Get several stocks & manage a MultiIndex

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Get data for several stocks

- Use the listing information to select multiple stocks
  - E.g. largest 3 stocks per sector
- Use Google Finance to retrieve data for several stocks
- Learn how to manage a `pandas` `MultiIndex`, a powerful tool to deal with more complex data sets

Load prices for top 5 companies

```
nasdaq = pd.read_excel('listings.xlsx', sheetname='nasdaq', na_values='n/a')
nasdaq.set_index('Stock Symbol', inplace=True)
top_5 = nasdaq['Market Capitalization'].nlargest(n=5) # Top 5
top_5.div(1000000) # Market Cap in million USD
```

```
AAPL     740024.467000
GOOG     569426.124504
...           ...
Name: Market Capitalization, dtype: float64
```

```
tickers = top_5.index.tolist() # Convert index to list
```

```
['AAPL', 'GOOG', 'MSFT', 'AMZN', 'FB']
```

Load prices for top 5 companies

```
panel = DataReader(tickers, 'google', start=date(2015, 1, 1))
```

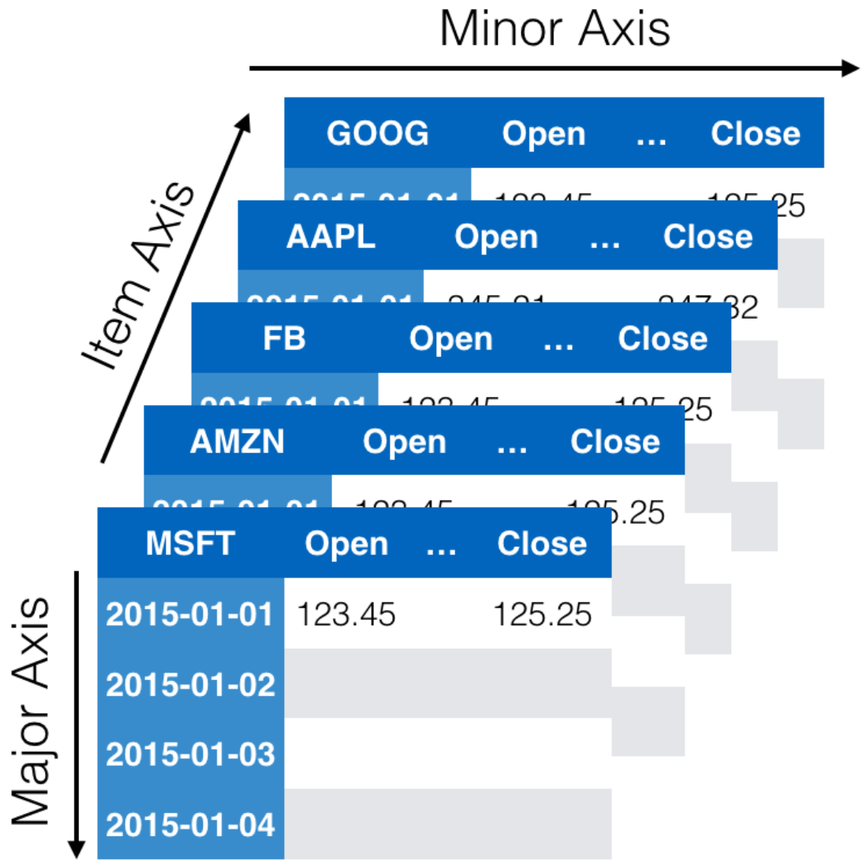
```
<class 'pandas.core.panel.Panel'>
Dimensions: 5 (items) x 591 (major_axis) x 5 (minor_axis)
Items axis: Open to Volume
Major_axis axis: 2015-01-02 to 2017-05-08
Minor_axis axis: AAPL to MSFT
```

```
data = panel.to_frame()
data.info()
```

```
MultiIndex: 2955 entries, (2015-01-02, AAPL) to (2017-05-08, MSFT)
Data columns (total 5 columns):
Open      2955 non-null float64
...
```

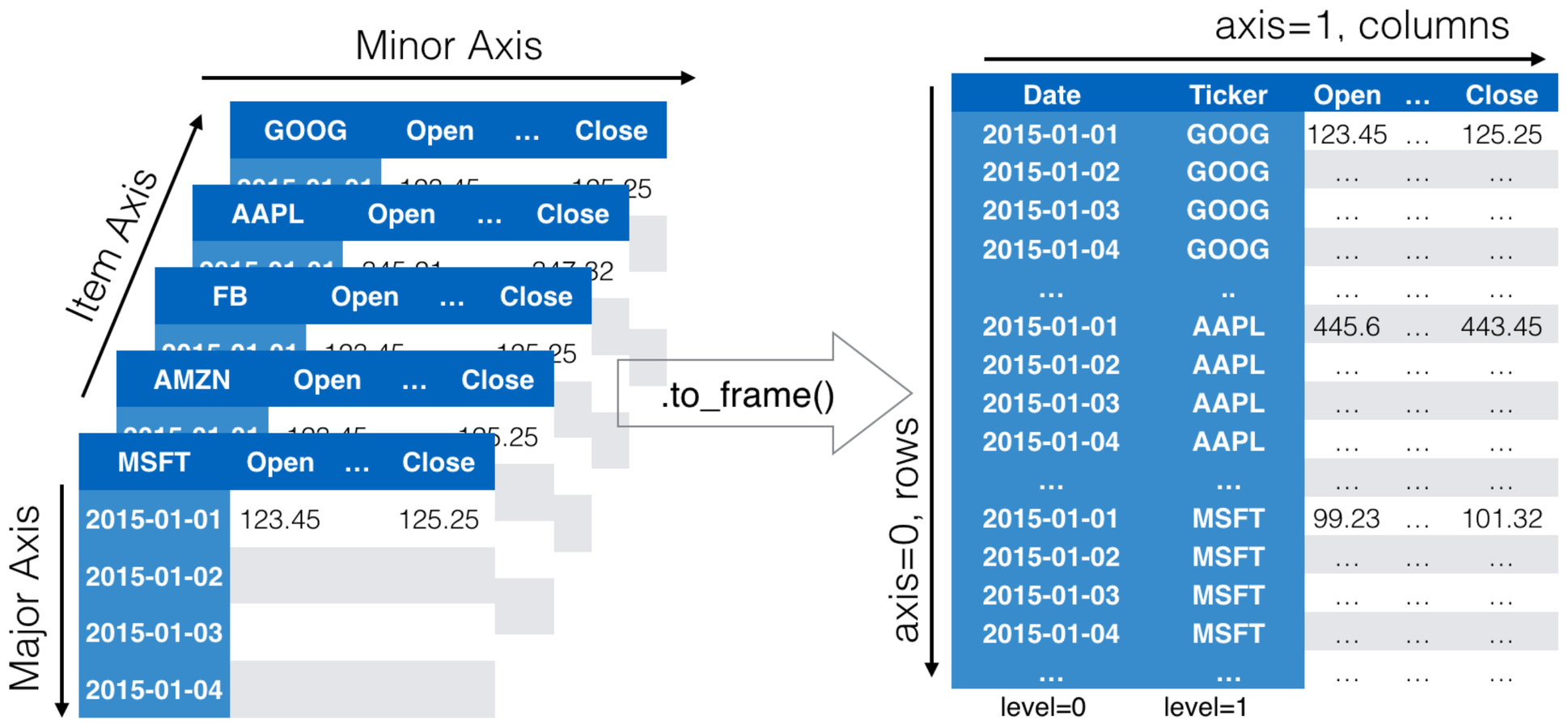
Into higher dimensions: MultiIndex

- `.to_frame()` : from `pd.Panel()` to `pd.DataFrame()`



Into higher dimensions: MultiIndex

- `.to_frame()` : from `pd.Panel()` to `pd.DataFrame()`



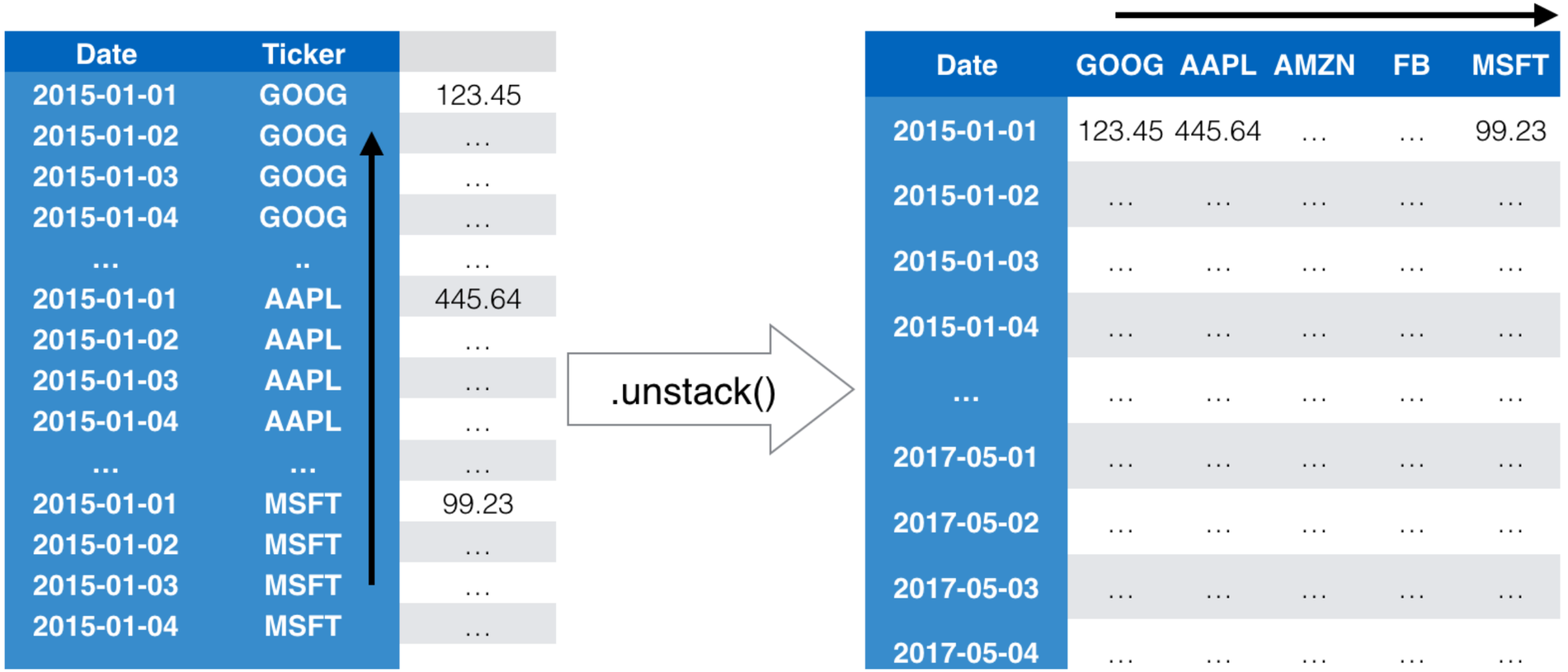
Reshape your data: .unstack()

```
unstacked = data['Close'].unstack()
unstacked.info()
```

```
DatetimeIndex: 591 entries, 2015-01-02 to 2017-05-08
Data columns (total 5 columns):
AAPL    591 non-null float64
AMZN    591 non-null float64
FB      591 non-null float64
GOOG    591 non-null float64
MSFT    591 non-null float64
dtypes: float64(5)
memory usage: 27.7 KB
```

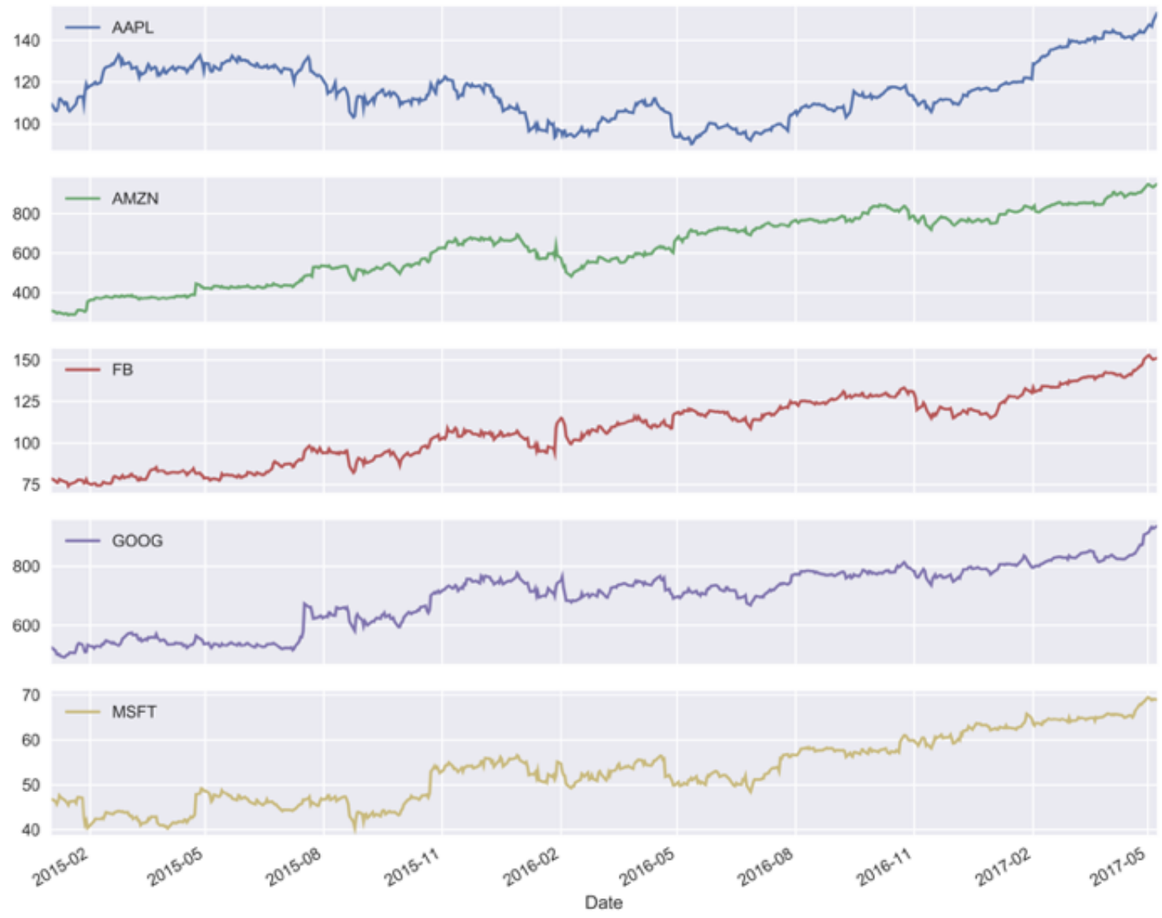
From long to wide format

```
unstacked = data['Close'].unstack() # Results in DataFrame
```



Stock prices: Visualization

```
unstacked.plot(subplots=True)
plt.tight_layout(); plt.show()
```



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