The DataReader: Access financial data online

IMPORTING AND MANAGING FINANCIAL DATA IN PYTHON

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Instructor

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pandas_datareader

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

Stock prices: Yahoo! 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 = 'yahoo'
stock_data = DataReader(ticker, data_source, start, end)
```

Stock prices: Yahoo! Finance

```
stock_data.info()
```

```
DatetimeIndex: 504 entries, 2015-01-02 to 2016-12-30
Data columns (total 6 columns):
 #   Column  Non-Null Count  Dtype
 --  ------     --------------  -----
 0   High       504 non-null    float64 # First price
 1   Low        504 non-null    float64 # Highest price
 2   Open       504 non-null    float64 # Lowest price
 3   Close      504 non-null    float64 # Last price
 4   Volume     504 non-null    float64 # No shares traded
 5   Adj Close  504 non-null    float64 # Adj. price
dtypes: float64(6)
```

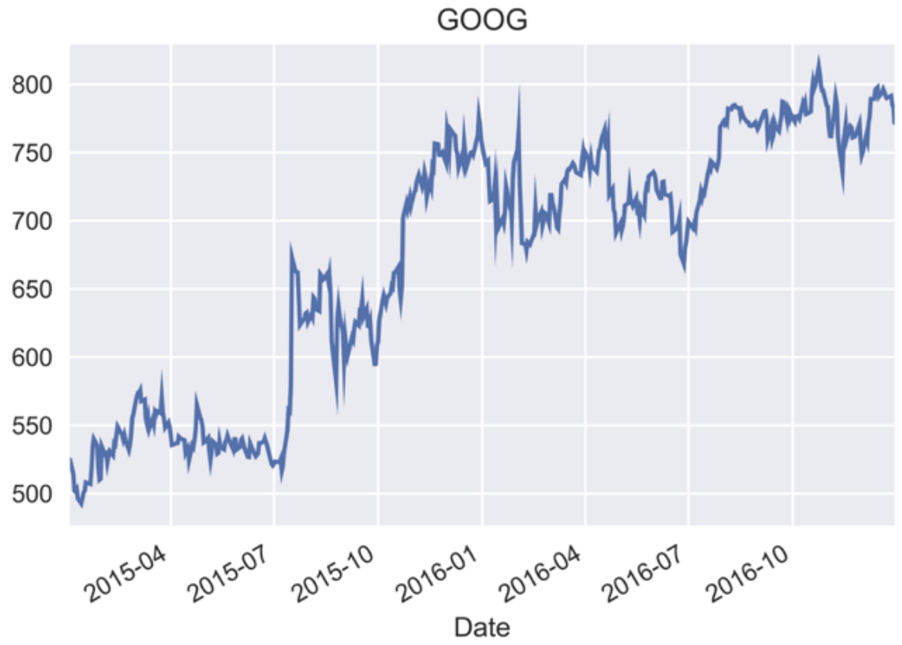
Stock prices: Yahoo! Finance

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

Date	High	Low	Open	Close	Volume	Adj Close
2015-01-02	26.49	26.13	26.38	26.17	28951268	26.17
2015-01-05	26.14	25.58	26.09	25.62	41196796	25.62
2015-01-06	25.74	24.98	25.68	25.03	57998800	25.03
2016-12-28	39.71	39.16	39.69	39.25	23076000	39.25
2016-12-29	39.30	38.95	39.17	39.14	14886000	39.14
2016-12-30	39.14	38.52	39.14	38.59	35400000	38.59

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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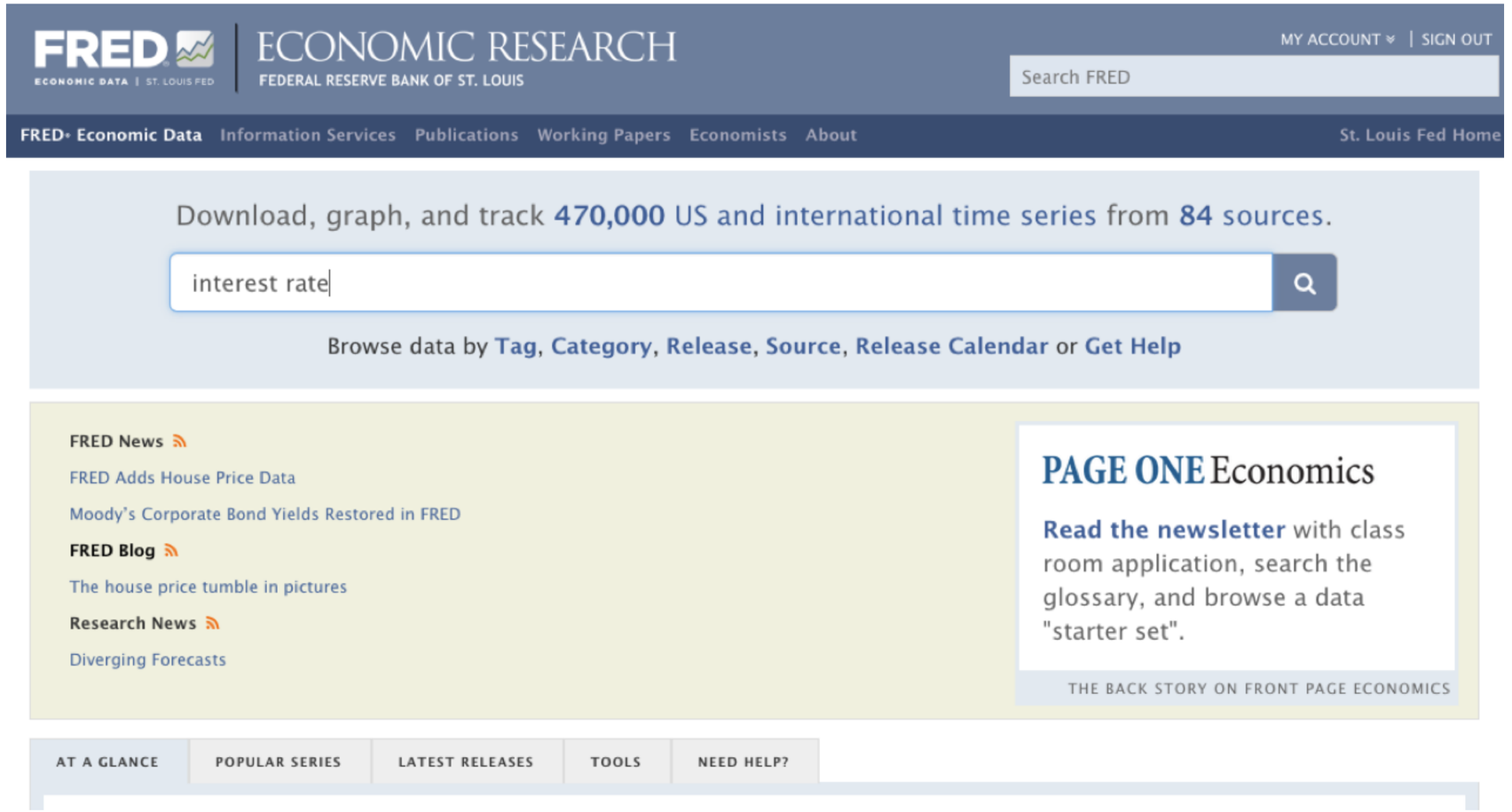
Economic data from FRED

- 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

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Interest rates

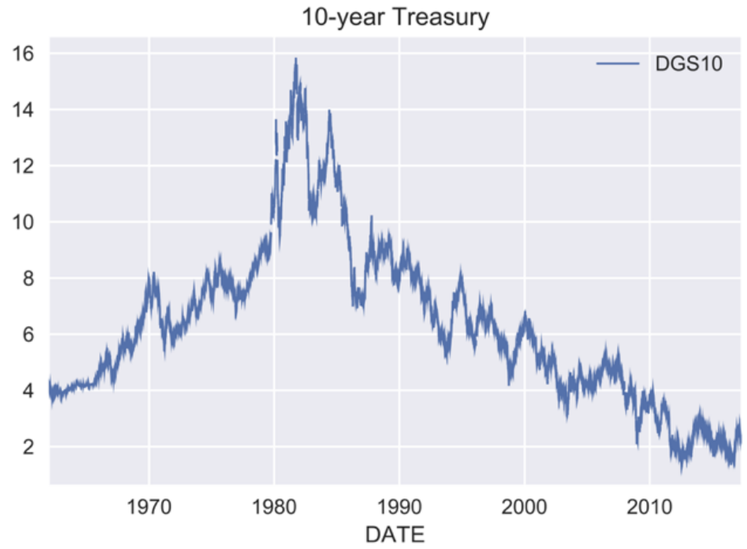
```
from pandas_datareader.data import DataReader
from datetime import date
series_code = 'DGS10' # 10-year Treasury Rate
data_source = 'fred' # FED Economic Data Service
start = date(1962, 1, 1)
data = DataReader(series_code, data_source, start)
data.info()
```

```
DatetimeIndex: 15754 entries, 1962-01-02 to 2022-05-20
Data columns (total 1 columns):
 #   Column  Non-Null Count  Dtype
 --  ------  --------------  -----
 0   DGS10   15083 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()
```



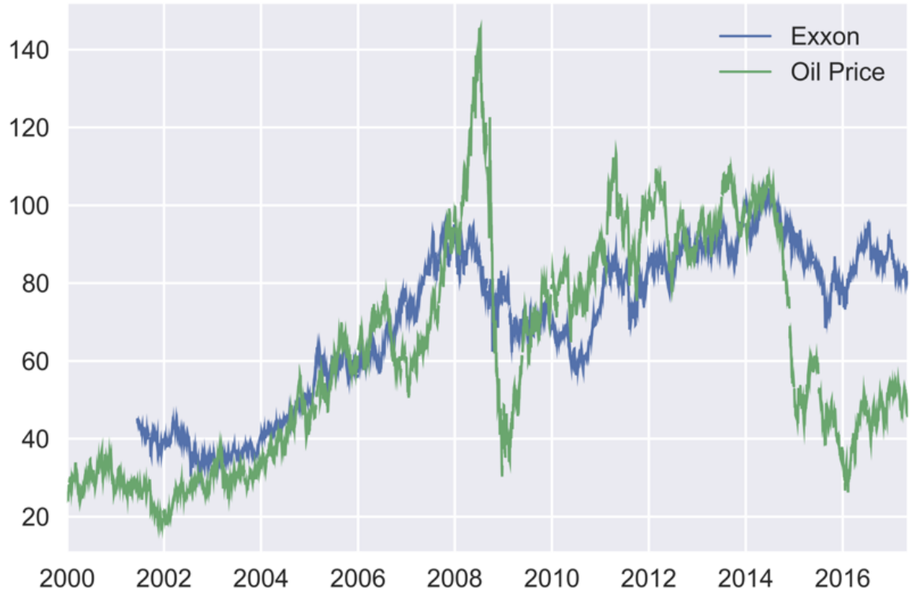
Combine stock and economic data

```
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, 'yanoo', start)
data = pd.concat([stock[['Close']], oil], axis=1)
data.info()
```

```
DatetimeIndex: 5841 entries, 2000-01-03 to 2022-05-23
Data columns (total 2 columns):
 #   Column      Non-Null Count  Dtype
 --  ------      --------------  -----
 0   Close       5634 non-null   float64
 1   DCOILWTICO  5615 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 Yahoo! 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',sheet_name='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):
 #   Column                 Non-Null Count  Dtype
 --  ------                 --------------  -----
 0   Company Name           3147 non-null   object
 1   Last Sale              3079 non-null   float64
 2   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()
```

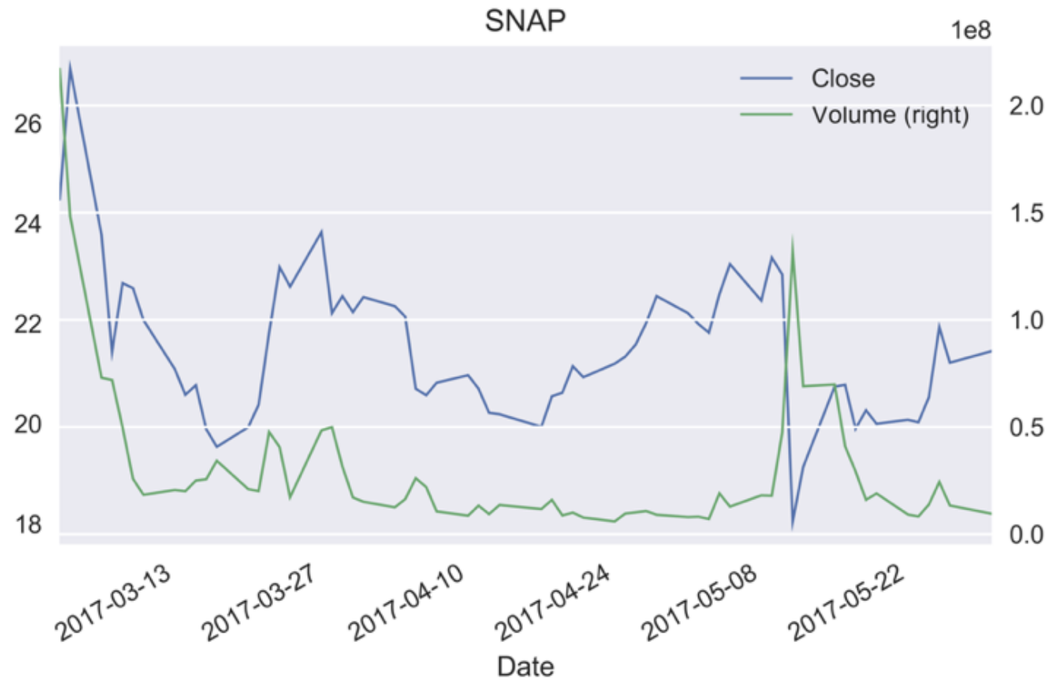
```
'ORCL'
```

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, 'yahoo') # 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!

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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 Yahoo! 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', sheet_name='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

```
df = DataReader(tickers, 'yahoo', start=date(2020, 1, 1))
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 712 entries, 2020-01-02 to 2022-10-27
Data columns (total 30 columns):
 #   Column              Non-Null Count  Dtype
 --  ------              --------------  -----
 0   (Adj Close, AAPL)  712 non-null    float64
 1   (Adj Close, GOOG)  712 non-null    float64
 2   (Adj Close, MSFT)  712 non-null    float64
...
 28  (Volume, AMZN)     712 non-null    float64
 29  (Volume, FB)       253 non-null    float64
dtypes: float64(30)
memory usage: 172.4 KB
```

```
df = df.stack()
```

Load prices for top 5 companies

```
df.info()
```

```
MultiIndex: 3101 entries, (Timestamp('2020-01-02 00:00:00'), 'AAPL') to (Timestamp('
Data columns (total 6 columns):
 #   Column     Non-Null Count  Dtype
 --  ------     --------------  -----
 0   Adj Close  3101 non-null   float64
...
```

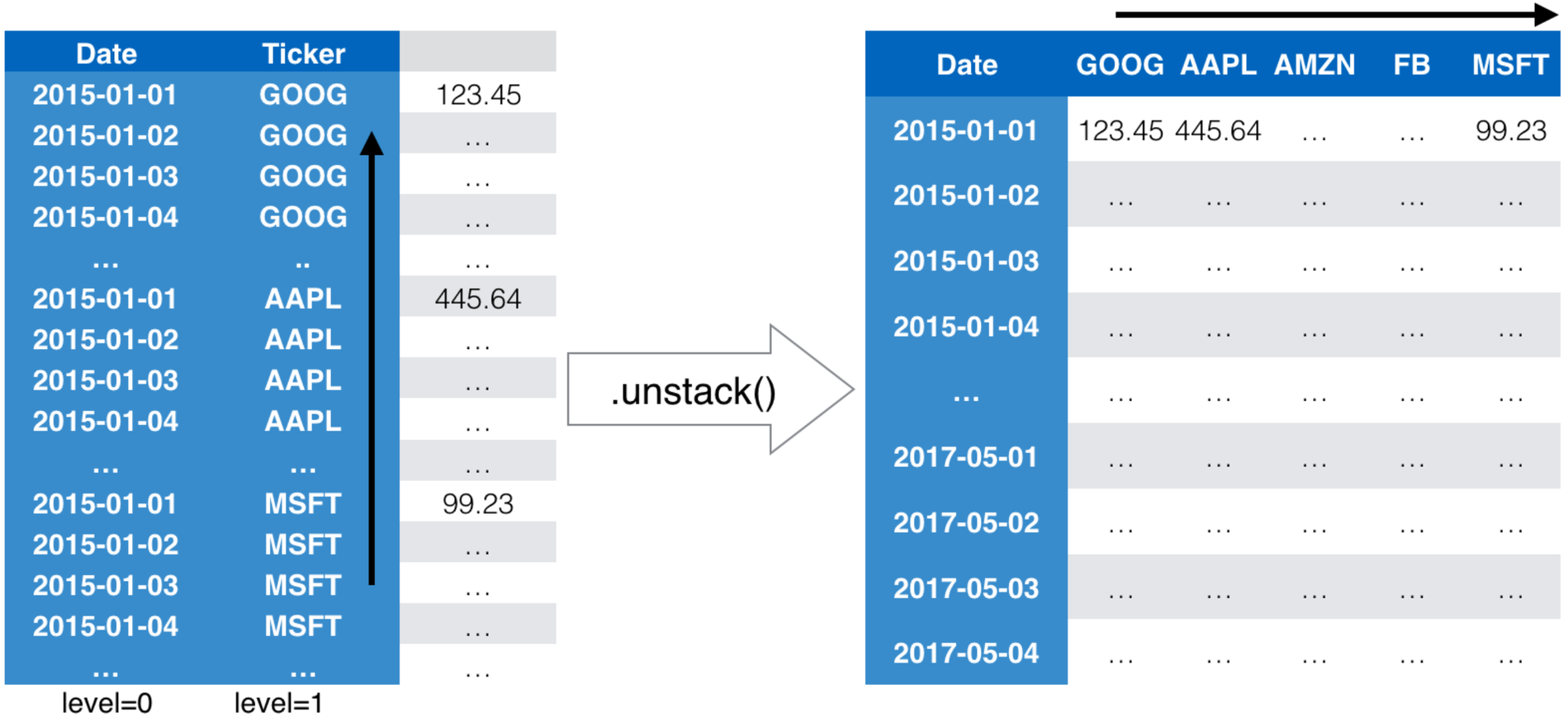
Reshape your data: .unstack()

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

```
DatetimeIndex: 712 entries, 2020-01-02 to 2022-10-27
Data columns (total 5 columns):
 #   Column  Non-Null Count  Dtype
 --  ------  --------------  -----
 0   AAPL    712 non-null    float64
 1   GOOG    712 non-null    float64
 2   MSFT    712 non-null    float64
 3   AMZN    712 non-null    float64
 4   FB      253 non-null    float64
dtypes: float64(5)
memory usage: 33.4 KB
```

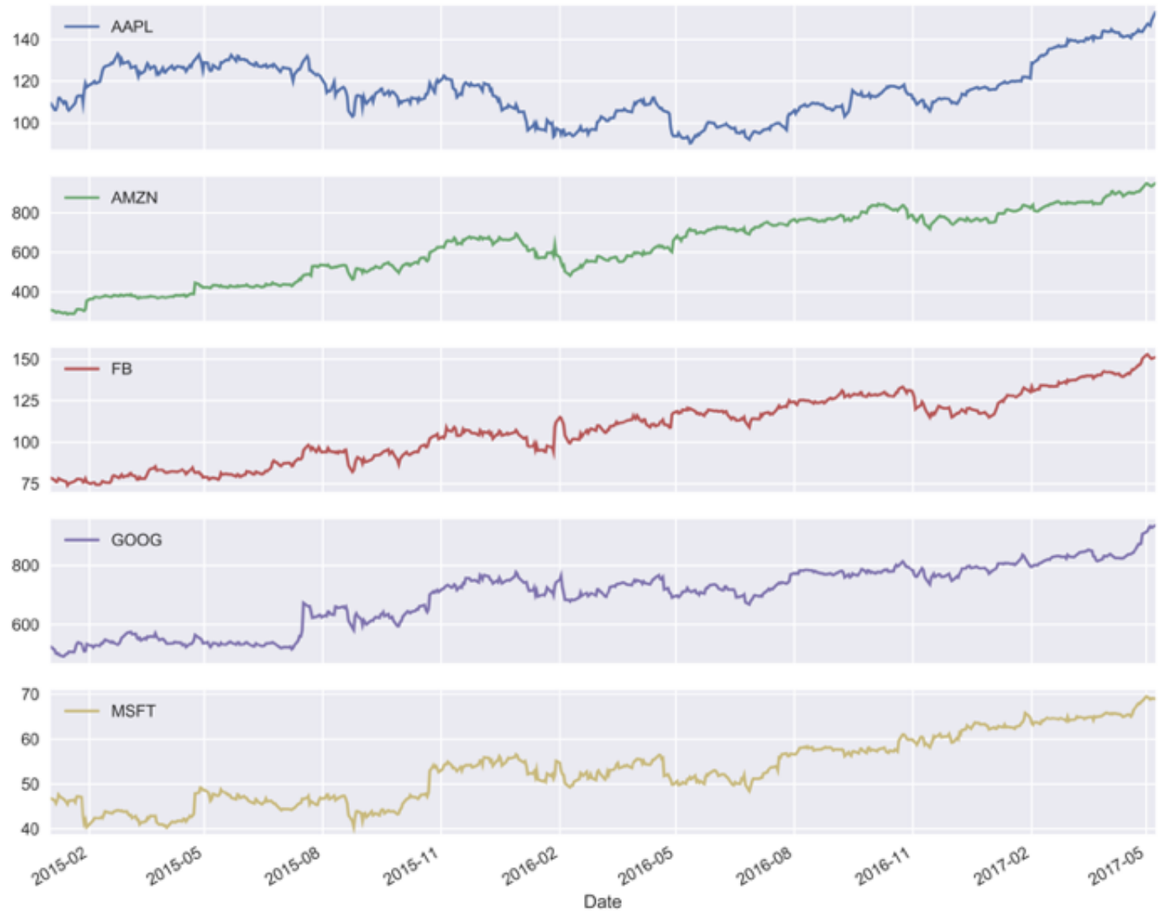
From long to wide format

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



Stock prices: Visualization

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



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