

01_pandas_datareader_demo

September 29, 2021

1 Remote data access using pandas

The pandas library enables access to data displayed on websites using the `read_html()` function and access to the API endpoints of various data providers through the related `pandas-datareader` library.

1.1 Imports & Settings

```
[1]: import warnings
warnings.filterwarnings('ignore')
```

```
[2]: %matplotlib inline
import os
from datetime import datetime
import pandas as pd
import pandas_datareader.data as web
import matplotlib.pyplot as plt
import mplfinance as mpf
import seaborn as sns
```

1.2 Download html table with SP500 constituents

The download of the content of one or more html tables works as follows, for instance for the constituents of the S&P500 index from Wikipedia

```
[3]: sp_url = 'https://en.wikipedia.org/wiki/List_of_S%26P_500_companies'
sp500_constituents = pd.read_html(sp_url, header=0)[0]
```

```
[4]: sp500_constituents.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 505 entries, 0 to 504
Data columns (total 9 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Symbol                505 non-null   object
1   Security              505 non-null   object
2   SEC filings           505 non-null   object
```

```

3  GICS Sector          505 non-null  object
4  GICS Sub-Industry    505 non-null  object
5  Headquarters Location 505 non-null  object
6  Date first added     453 non-null  object
7  CIK                  505 non-null  int64
8  Founded              505 non-null  object
dtypes: int64(1), object(8)
memory usage: 35.6+ KB

```

```
[5]: sp500_constituents.head()
```

```

[5]:   Symbol          Security SEC filings      GICS Sector \
0    MMM          3M Company      reports      Industrials
1    ABT  Abbott Laboratories      reports      Health Care
2    ABBV      AbbVie Inc.      reports      Health Care
3    ABMD          Abiomed      reports      Health Care
4    ACN      Accenture      reports  Information Technology

      GICS Sub-Industry  Headquarters Location Date first added \
0  Industrial Conglomerates      St. Paul, Minnesota      1976-08-09
1    Health Care Equipment  North Chicago, Illinois      1964-03-31
2      Pharmaceuticals  North Chicago, Illinois      2012-12-31
3    Health Care Equipment  Danvers, Massachusetts      2018-05-31
4  IT Consulting & Other Services      Dublin, Ireland      2011-07-06

      CIK      Founded
0    66740      1902
1     1800      1888
2  1551152  2013 (1888)
3   815094      1981
4  1467373      1989

```

1.3 pandas-datareader for Market Data

`pandas` used to facilitate access to data providers' APIs directly, but this functionality has moved to the related `pandas-datareader` library. The stability of the APIs varies with provider policies, and as of June 2018 at version 0.7, the following sources are available

See [documentation](#); functionality frequently changes as underlying provider APIs evolve.

1.3.1 Yahoo Finance

```

[6]: start = '2014'
      end = datetime(2017, 5, 24)

      yahoo= web.DataReader('FB', 'yahoo', start=start, end=end)
      yahoo.info()

```

```

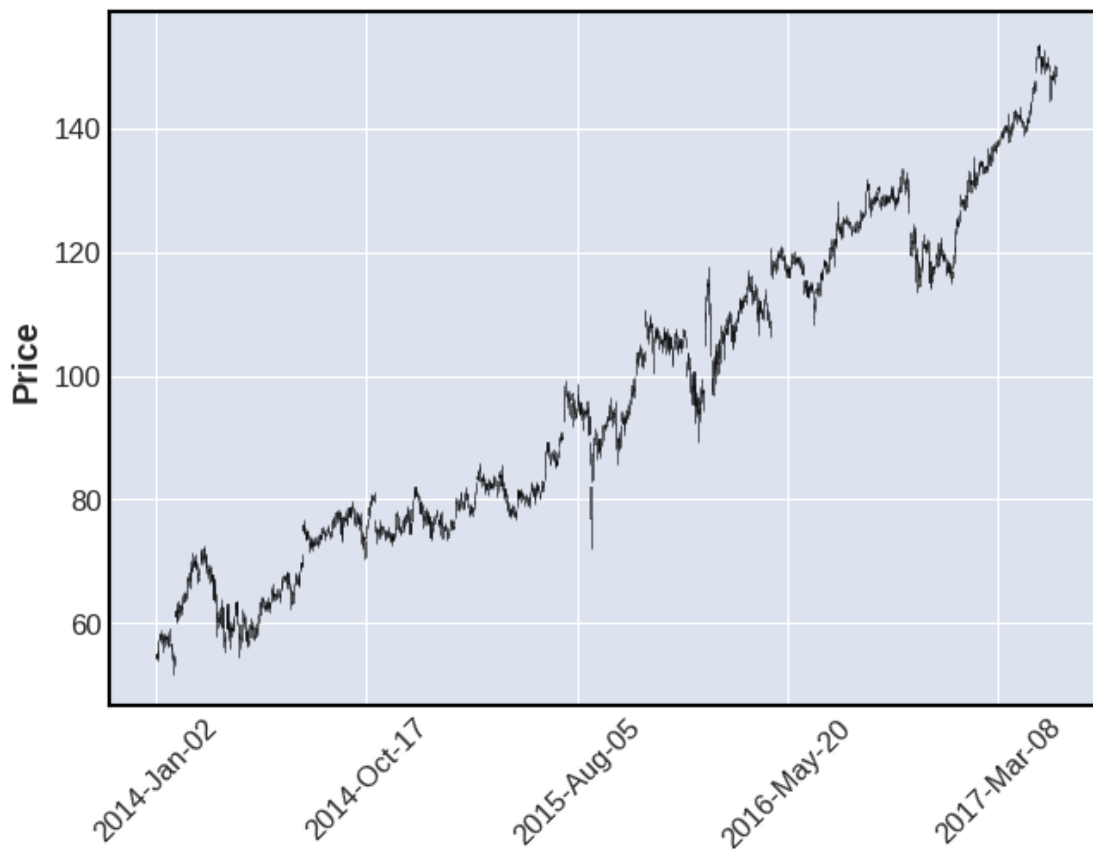
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 855 entries, 2014-01-02 to 2017-05-24
Data columns (total 6 columns):
#   Column      Non-Null Count  Dtype
---  -
0   High         855 non-null    float64
1   Low          855 non-null    float64
2   Open         855 non-null    float64
3   Close        855 non-null    float64
4   Volume       855 non-null    int64
5   Adj Close    855 non-null    float64
dtypes: float64(5), int64(1)
memory usage: 46.8 KB

```

```

[7]: mpf.plot(yahoo.drop('Adj Close', axis=1), type='candle')
plt.tight_layout()

```



<Figure size 640x480 with 0 Axes>

1.3.2 IEX

IEX is an alternative exchange started in response to the HFT controversy and portrayed in Michael Lewis' controversial Flash Boys. It aims to slow down the speed of trading to create a more level playing field and has been growing rapidly since launch in 2016 while still small with a market share of around 2.5% in June 2018.

Note: IEX now requires an [API](#) key after registration for (free) account that you can store as environment variable and retrieve as illustrated below, or pass directly via keyword argument to `pandas_datareader`.

```
[8]: IEX_API_KEY=os.getenv('IEX_API_KEY')
```

```
[9]: start = datetime(2015, 2, 9)
# end = datetime(2017, 5, 24)

iex = web.DataReader('FB', 'iex', start, api_key=IEX_API_KEY)
iex.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 1519 entries, 2015-02-09 to 2021-02-19
Data columns (total 5 columns):
#   Column  Non-Null Count  Dtype
---  -
0   open    1519 non-null     float64
1   high    1519 non-null     float64
2   low     1519 non-null     float64
3   close   1519 non-null     float64
4   volume  1519 non-null     int64
dtypes: float64(4), int64(1)
memory usage: 71.2+ KB
```

```
[10]: iex.tail()
```

```
[10]:
```

	open	high	low	close	volume
date					
2021-02-12	270.520	271.18	268.34	270.50	9097597
2021-02-16	270.800	276.60	270.05	273.97	15417243
2021-02-17	271.240	273.97	269.58	273.57	12763240
2021-02-18	269.565	271.95	266.03	269.39	15249134
2021-02-19	269.860	270.27	260.15	261.56	25622587

```
[11]: sns.set_style('whitegrid')
iex.close.plot(figsize=(14, 5))
sns.despine()
```



Book Data In addition to historical EOD price and volume data, IEX provides real-time depth of book quotations that offer an aggregated size of orders by price and side. This service also includes last trade price and size information.

DEEP is used to receive real-time depth of book quotations direct from IEX. The depth of book quotations received via DEEP provide an aggregated size of resting displayed orders at a price and side, and do not indicate the size or number of individual orders at any price level. Non-displayed orders and non-displayed portions of reserve orders are not represented in DEEP.

DEEP also provides last trade price and size information. Trades resulting from either displayed or non-displayed orders matching on IEX will be reported. Routed executions will not be reported.

Only works on trading days.

```
[12]: book = web.get_iex_book('AAPL')
```

```
[13]: list(book.keys())
```

```
[13]: ['symbol',
      'marketPercent',
      'volume',
      'lastSalePrice',
      'lastSaleSize',
      'lastSaleTime',
      'lastUpdated',
      'bids',
      'asks',
      'systemEvent',
      'tradingStatus',
      'opHaltStatus',
      'ssrStatus',
      'securityEvent',
      'trades',
```

```
'tradeBreaks']
```

```
[14]: orders = pd.concat([pd.DataFrame(book[side]).assign(side=side) for side in
↳ ['bids', 'asks']])
orders.head()
```

```
[14]: Empty DataFrame
      Columns: [side]
      Index: []
```

```
[15]: for key in book.keys():
      try:
          print(f'\n{key}')
          print(pd.DataFrame(book[key]))
      except:
          print(book[key])
```

```
symbol
AAPL
```

```
marketPercent
0.01824
```

```
volume
1874997
```

```
lastSalePrice
125.98
```

```
lastSaleSize
3
```

```
lastSaleTime
1614027994379
```

```
lastUpdated
1614031191208
```

```
bids
Empty DataFrame
Columns: []
Index: []
```

```
asks
Empty DataFrame
Columns: []
```

Index: []

systemEvent

{'systemEvent': 'C', 'timestamp': 1614031800007}

tradingStatus

{'status': 'T', 'reason': ' ', 'timestamp': 1613996038606}

opHaltStatus

{'isHalted': False, 'timestamp': 1613996038606}

ssrStatus

{'isSSR': False, 'detail': ' ', 'timestamp': 1613996038606}

securityEvent

{'securityEvent': 'MarketClose', 'timestamp': 1614027600000}

trades

	price	size	tradeId	isISO	isOddLot	isOutsideRegularHours	\
0	125.980	3	2565301038	True	True		True
1	126.010	20	2561192133	False	True		False
2	126.010	35	2561162510	False	True		False
3	126.005	100	2560819178	False	False		False
4	126.005	100	2560535358	False	False		False
5	126.010	100	2559785204	False	False		False
6	126.020	132	2559650792	False	False		False
7	126.045	100	2559329974	False	False		False
8	126.060	300	2559317473	True	False		False
9	126.050	1	2559295066	True	True		False
10	126.035	100	2559185683	False	False		False
11	126.010	300	2558525991	False	False		False
12	126.010	6	2558455856	True	True		False
13	126.010	30	2558411929	True	True		False
14	126.020	300	2558025659	False	False		False
15	126.010	300	2558014028	False	False		False
16	126.015	100	2557970786	False	False		False
17	126.020	90	2557488823	True	True		False
18	126.020	3	2557462987	True	True		False
19	126.000	100	2557328682	True	False		False

	isSinglePriceCross	isTradeThroughExempt	timestamp
0	False	False	1614027994379
1	False	False	1614027597753
2	False	False	1614027597658
3	False	False	1614027596970
4	False	False	1614027596307
5	False	False	1614027594703
6	False	False	1614027594402

7	False	False	1614027593980
8	False	True	1614027593950
9	False	False	1614027593916
10	False	False	1614027593636
11	False	False	1614027592039
12	False	False	1614027591885
13	False	False	1614027591777
14	False	False	1614027591036
15	False	False	1614027591023
16	False	False	1614027590959
17	False	False	1614027590145
18	False	False	1614027590119
19	False	False	1614027590005

```
tradeBreaks
Empty DataFrame
Columns: []
Index: []
```

```
[16]: pd.DataFrame(book['trades']).head()
```

```
[16]:
```

	price	size	tradeId	isISO	isOddLot	isOutsideRegularHours	\
0	125.980	3	2565301038	True	True		True
1	126.010	20	2561192133	False	True		False
2	126.010	35	2561162510	False	True		False
3	126.005	100	2560819178	False	False		False
4	126.005	100	2560535358	False	False		False

	isSinglePriceCross	isTradeThroughExempt	timestamp
0	False	False	1614027994379
1	False	False	1614027597753
2	False	False	1614027597658
3	False	False	1614027596970
4	False	False	1614027596307

1.3.3 Quandl

Obtain Quandl [API Key](#) and store in environment variable as QUANDL_API_KEY.

```
[17]: symbol = 'FB.US'

quandl = web.DataReader(symbol, 'quandl', '2015-01-01')
quandl.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 813 entries, 2018-03-27 to 2015-01-02
Data columns (total 12 columns):
#   Column      Non-Null Count  Dtype
#   ...
```



```

---  -----  -----  -----
0  Open      813 non-null  float64
1  High      813 non-null  float64
2  Low       813 non-null  float64
3  Close     813 non-null  float64
4  Volume    813 non-null  float64
5  ExDividend 813 non-null  float64
6  SplitRatio 813 non-null  float64
7  AdjOpen   813 non-null  float64
8  AdjHigh   813 non-null  float64
9  AdjLow    813 non-null  float64
10 AdjClose  813 non-null  float64
11 AdjVolume 813 non-null  float64
dtypes: float64(12)
memory usage: 82.6 KB

```

1.3.4 FRED

```

[18]: start = datetime(2010, 1, 1)

end = datetime(2013, 1, 27)

gdp = web.DataReader('GDP', 'fred', start, end)

gdp.info()

```

```

<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 13 entries, 2010-01-01 to 2013-01-01
Data columns (total 1 columns):
#   Column  Non-Null Count  Dtype
---  ---
0    GDP      13 non-null      float64
dtypes: float64(1)
memory usage: 208.0 bytes

```

```

[19]: inflation = web.DataReader(['CPIAUCSL', 'CPILFESL'], 'fred', start, end)

inflation.info()

```

```

<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 37 entries, 2010-01-01 to 2013-01-01
Data columns (total 2 columns):
#   Column  Non-Null Count  Dtype
---  ---
0    CPIAUCSL  37 non-null      float64
1    CPILFESL  37 non-null      float64
dtypes: float64(2)
memory usage: 888.0 bytes

```

1.3.5 Fama/French

```
[20]: from pandas_datareader.famafrench import get_available_datasets
      get_available_datasets()
```

```
[20]: ['F-F_Research_Data_Factors',
      'F-F_Research_Data_Factors_weekly',
      'F-F_Research_Data_Factors_daily',
      'F-F_Research_Data_5_Factors_2x3',
      'F-F_Research_Data_5_Factors_2x3_daily',
      'Portfolios_Formed_on_ME',
      'Portfolios_Formed_on_ME_Wout_Div',
      'Portfolios_Formed_on_ME_Daily',
      'Portfolios_Formed_on_BE-ME',
      'Portfolios_Formed_on_BE-ME_Wout_Div',
      'Portfolios_Formed_on_BE-ME_Daily',
      'Portfolios_Formed_on_OP',
      'Portfolios_Formed_on_OP_Wout_Div',
      'Portfolios_Formed_on_OP_Daily',
      'Portfolios_Formed_on_INV',
      'Portfolios_Formed_on_INV_Wout_Div',
      'Portfolios_Formed_on_INV_Daily',
      '6_Portfolios_2x3',
      '6_Portfolios_2x3_Wout_Div',
      '6_Portfolios_2x3_weekly',
      '6_Portfolios_2x3_daily',
      '25_Portfolios_5x5',
      '25_Portfolios_5x5_Wout_Div',
      '25_Portfolios_5x5_Daily',
      '100_Portfolios_10x10',
      '100_Portfolios_10x10_Wout_Div',
      '100_Portfolios_10x10_Daily',
      '6_Portfolios_ME_OP_2x3',
      '6_Portfolios_ME_OP_2x3_Wout_Div',
      '6_Portfolios_ME_OP_2x3_daily',
      '25_Portfolios_ME_OP_5x5',
      '25_Portfolios_ME_OP_5x5_Wout_Div',
      '25_Portfolios_ME_OP_5x5_daily',
      '100_Portfolios_ME_OP_10x10',
      '100_Portfolios_10x10_ME_OP_Wout_Div',
      '100_Portfolios_ME_OP_10x10_daily',
      '6_Portfolios_ME_INV_2x3',
      '6_Portfolios_ME_INV_2x3_Wout_Div',
      '6_Portfolios_ME_INV_2x3_daily',
      '25_Portfolios_ME_INV_5x5',
      '25_Portfolios_ME_INV_5x5_Wout_Div',
      '25_Portfolios_ME_INV_5x5_daily',
```

'100_Portfolios_ME_INV_10x10',
 '100_Portfolios_10x10_ME_INV_Wout_Div',
 '100_Portfolios_ME_INV_10x10_daily',
 '25_Portfolios_BEME_OP_5x5',
 '25_Portfolios_BEME_OP_5x5_Wout_Div',
 '25_Portfolios_BEME_OP_5x5_daily',
 '25_Portfolios_BEME_INV_5x5',
 '25_Portfolios_BEME_INV_5x5_Wout_Div',
 '25_Portfolios_BEME_INV_5x5_daily',
 '25_Portfolios_OP_INV_5x5',
 '25_Portfolios_OP_INV_5x5_Wout_Div',
 '25_Portfolios_OP_INV_5x5_daily',
 '32_Portfolios_ME_BEME_OP_2x4x4',
 '32_Portfolios_ME_BEME_OP_2x4x4_Wout_Div',
 '32_Portfolios_ME_BEME_INV_2x4x4',
 '32_Portfolios_ME_BEME_INV_2x4x4_Wout_Div',
 '32_Portfolios_ME_OP_INV_2x4x4',
 '32_Portfolios_ME_OP_INV_2x4x4_Wout_Div',
 'Portfolios_Formed_on_E-P',
 'Portfolios_Formed_on_E-P_Wout_Div',
 'Portfolios_Formed_on_CF-P',
 'Portfolios_Formed_on_CF-P_Wout_Div',
 'Portfolios_Formed_on_D-P',
 'Portfolios_Formed_on_D-P_Wout_Div',
 '6_Portfolios_ME_EP_2x3',
 '6_Portfolios_ME_EP_2x3_Wout_Div',
 '6_Portfolios_ME_CFP_2x3',
 '6_Portfolios_ME_CFP_2x3_Wout_Div',
 '6_Portfolios_ME_DP_2x3',
 '6_Portfolios_ME_DP_2x3_Wout_Div',
 'F-F_Momentum_Factor',
 'F-F_Momentum_Factor_daily',
 '6_Portfolios_ME_Prior_12_2',
 '6_Portfolios_ME_Prior_12_2_Daily',
 '25_Portfolios_ME_Prior_12_2',
 '25_Portfolios_ME_Prior_12_2_Daily',
 '10_Portfolios_Prior_12_2',
 '10_Portfolios_Prior_12_2_Daily',
 'F-F_ST_Reversal_Factor',
 'F-F_ST_Reversal_Factor_daily',
 '6_Portfolios_ME_Prior_1_0',
 '6_Portfolios_ME_Prior_1_0_Daily',
 '25_Portfolios_ME_Prior_1_0',
 '25_Portfolios_ME_Prior_1_0_Daily',
 '10_Portfolios_Prior_1_0',
 '10_Portfolios_Prior_1_0_Daily',
 'F-F_LT_Reversal_Factor',

'F-F_LT_Reversal_Factor_daily',
 '6_Portfolios_ME_Prior_60_13',
 '6_Portfolios_ME_Prior_60_13_Daily',
 '25_Portfolios_ME_Prior_60_13',
 '25_Portfolios_ME_Prior_60_13_Daily',
 '10_Portfolios_Prior_60_13',
 '10_Portfolios_Prior_60_13_Daily',
 'Portfolios_Formed_on_AC',
 '25_Portfolios_ME_AC_5x5',
 'Portfolios_Formed_on_BETA',
 '25_Portfolios_ME_BETA_5x5',
 'Portfolios_Formed_on_NI',
 '25_Portfolios_ME_NI_5x5',
 'Portfolios_Formed_on_VAR',
 '25_Portfolios_ME_VAR_5x5',
 'Portfolios_Formed_on_RESVAR',
 '25_Portfolios_ME_RESVAR_5x5',
 '5_Industry_Portfolios',
 '5_Industry_Portfolios_Wout_Div',
 '5_Industry_Portfolios_daily',
 '10_Industry_Portfolios',
 '10_Industry_Portfolios_Wout_Div',
 '10_Industry_Portfolios_daily',
 '12_Industry_Portfolios',
 '12_Industry_Portfolios_Wout_Div',
 '12_Industry_Portfolios_daily',
 '17_Industry_Portfolios',
 '17_Industry_Portfolios_Wout_Div',
 '17_Industry_Portfolios_daily',
 '30_Industry_Portfolios',
 '30_Industry_Portfolios_Wout_Div',
 '30_Industry_Portfolios_daily',
 '38_Industry_Portfolios',
 '38_Industry_Portfolios_Wout_Div',
 '38_Industry_Portfolios_daily',
 '48_Industry_Portfolios',
 '48_Industry_Portfolios_Wout_Div',
 '48_Industry_Portfolios_daily',
 '49_Industry_Portfolios',
 '49_Industry_Portfolios_Wout_Div',
 '49_Industry_Portfolios_daily',
 'ME_Breakpoints',
 'BE-ME_Breakpoints',
 'OP_Breakpoints',
 'INV_Breakpoints',
 'E-P_Breakpoints',
 'CF-P_Breakpoints',

'D-P_Breakpoints',
 'Prior_2-12_Breakpoints',
 'Developed_3_Factors',
 'Developed_3_Factors_Daily',
 'Developed_ex_US_3_Factors',
 'Developed_ex_US_3_Factors_Daily',
 'Europe_3_Factors',
 'Europe_3_Factors_Daily',
 'Japan_3_Factors',
 'Japan_3_Factors_Daily',
 'Asia_Pacific_ex_Japan_3_Factors',
 'Asia_Pacific_ex_Japan_3_Factors_Daily',
 'North_America_3_Factors',
 'North_America_3_Factors_Daily',
 'Developed_5_Factors',
 'Developed_5_Factors_Daily',
 'Developed_ex_US_5_Factors',
 'Developed_ex_US_5_Factors_Daily',
 'Europe_5_Factors',
 'Europe_5_Factors_Daily',
 'Japan_5_Factors',
 'Japan_5_Factors_Daily',
 'Asia_Pacific_ex_Japan_5_Factors',
 'Asia_Pacific_ex_Japan_5_Factors_Daily',
 'North_America_5_Factors',
 'North_America_5_Factors_Daily',
 'Developed_Mom_Factor',
 'Developed_Mom_Factor_Daily',
 'Developed_ex_US_Mom_Factor',
 'Developed_ex_US_Mom_Factor_Daily',
 'Europe_Mom_Factor',
 'Europe_Mom_Factor_Daily',
 'Japan_Mom_Factor',
 'Japan_Mom_Factor_Daily',
 'Asia_Pacific_ex_Japan_MOM_Factor',
 'Asia_Pacific_ex_Japan_MOM_Factor_Daily',
 'North_America_Mom_Factor',
 'North_America_Mom_Factor_Daily',
 'Developed_6_Portfolios_ME_BE-ME',
 'Developed_6_Portfolios_ME_BE-ME_daily',
 'Developed_ex_US_6_Portfolios_ME_BE-ME',
 'Developed_ex_US_6_Portfolios_ME_BE-ME_daily',
 'Europe_6_Portfolios_ME_BE-ME',
 'Europe_6_Portfolios_ME_BE-ME_daily',
 'Japan_6_Portfolios_ME_BE-ME',
 'Japan_6_Portfolios_ME_BE-ME_daily',
 'Asia_Pacific_ex_Japan_6_Portfolios_ME_BE-ME',

'Asia_Pacific_ex_Japan_6_Portfolios_ME_BE-ME_daily',
 'North_America_6_Portfolios_ME_BE-ME',
 'North_America_6_Portfolios_ME_BE-ME_daily',
 'Developed_25_Portfolios_ME_BE-ME',
 'Developed_25_Portfolios_ME_BE-ME_daily',
 'Developed_ex_US_25_Portfolios_ME_BE-ME',
 'Developed_ex_US_25_Portfolios_ME_BE-ME_daily',
 'Europe_25_Portfolios_ME_BE-ME',
 'Europe_25_Portfolios_ME_BE-ME_daily',
 'Japan_25_Portfolios_ME_BE-ME',
 'Japan_25_Portfolios_ME_BE-ME_daily',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_BE-ME',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_BE-ME_daily',
 'North_America_25_Portfolios_ME_BE-ME',
 'North_America_25_Portfolios_ME_BE-ME_daily',
 'Developed_6_Portfolios_ME_OP',
 'Developed_6_Portfolios_ME_OP_Daily',
 'Developed_ex_US_6_Portfolios_ME_OP',
 'Developed_ex_US_6_Portfolios_ME_OP_Daily',
 'Europe_6_Portfolios_ME_OP',
 'Europe_6_Portfolios_ME_OP_Daily',
 'Japan_6_Portfolios_ME_OP',
 'Japan_6_Portfolios_ME_OP_Daily',
 'Asia_Pacific_ex_Japan_6_Portfolios_ME_OP',
 'Asia_Pacific_ex_Japan_6_Portfolios_ME_OP_Daily',
 'North_America_6_Portfolios_ME_OP',
 'North_America_6_Portfolios_ME_OP_Daily',
 'Developed_25_Portfolios_ME_OP',
 'Developed_25_Portfolios_ME_OP_Daily',
 'Developed_ex_US_25_Portfolios_ME_OP',
 'Developed_ex_US_25_Portfolios_ME_OP_Daily',
 'Europe_25_Portfolios_ME_OP',
 'Europe_25_Portfolios_ME_OP_Daily',
 'Japan_25_Portfolios_ME_OP',
 'Japan_25_Portfolios_ME_OP_Daily',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_OP',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_OP_Daily',
 'North_America_25_Portfolios_ME_OP',
 'North_America_25_Portfolios_ME_OP_Daily',
 'Developed_6_Portfolios_ME_INV',
 'Developed_6_Portfolios_ME_INV_Daily',
 'Developed_ex_US_6_Portfolios_ME_INV',
 'Developed_ex_US_6_Portfolios_ME_INV_Daily',
 'Europe_6_Portfolios_ME_INV',
 'Europe_6_Portfolios_ME_INV_Daily',
 'Japan_6_Portfolios_ME_INV',
 'Japan_6_Portfolios_ME_INV_Daily',

'Asia_Pacific_ex_Japan_6_Portfolios_ME_INV',
 'Asia_Pacific_ex_Japan_6_Portfolios_ME_INV_Daily',
 'North_America_6_Portfolios_ME_INV',
 'North_America_6_Portfolios_ME_INV_Daily',
 'Developed_25_Portfolios_ME_INV',
 'Developed_25_Portfolios_ME_INV_Daily',
 'Developed_ex_US_25_Portfolios_ME_INV',
 'Developed_ex_US_25_Portfolios_ME_INV_Daily',
 'Europe_25_Portfolios_ME_INV',
 'Europe_25_Portfolios_ME_INV_Daily',
 'Japan_25_Portfolios_ME_INV',
 'Japan_25_Portfolios_ME_INV_Daily',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_INV',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_INV_Daily',
 'North_America_25_Portfolios_ME_INV',
 'North_America_25_Portfolios_ME_INV_Daily',
 'Developed_6_Portfolios_ME_Prior_12_2',
 'Developed_6_Portfolios_ME_Prior_250_20_daily',
 'Developed_ex_US_6_Portfolios_ME_Prior_12_2',
 'Developed_ex_US_6_Portfolios_ME_Prior_250_20_daily',
 'Europe_6_Portfolios_ME_Prior_12_2',
 'Europe_6_Portfolios_ME_Prior_250_20_daily',
 'Japan_6_Portfolios_ME_Prior_12_2',
 'Japan_6_Portfolios_ME_Prior_250_20_daily',
 'Asia_Pacific_ex_Japan_6_Portfolios_ME_Prior_12_2',
 'Asia_Pacific_ex_Japan_6_Portfolios_ME_Prior_250_20_daily',
 'North_America_6_Portfolios_ME_Prior_12_2',
 'North_America_6_Portfolios_ME_Prior_250_20_daily',
 'Developed_25_Portfolios_ME_Prior_12_2',
 'Developed_25_Portfolios_ME_Prior_250_20_daily',
 'Developed_ex_US_25_Portfolios_ME_Prior_12_2',
 'Developed_ex_US_25_Portfolios_ME_Prior_250_20_daily',
 'Europe_25_Portfolios_ME_Prior_12_2',
 'Europe_25_Portfolios_ME_Prior_250_20_daily',
 'Japan_25_Portfolios_ME_Prior_12_2',
 'Japan_25_Portfolios_ME_Prior_250_20_daily',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_Prior_12_2',
 'Asia_Pacific_ex_Japan_25_Portfolios_ME_Prior_250_20_daily',
 'North_America_25_Portfolios_ME_Prior_12_2',
 'North_America_25_Portfolios_ME_Prior_250_20_daily',
 'Developed_32_Portfolios_ME_BE-ME_OP_2x4x4',
 'Developed_ex_US_32_Portfolios_ME_BE-ME_OP_2x4x4',
 'Europe_32_Portfolios_ME_BE-ME_OP_2x4x4',
 'Japan_32_Portfolios_ME_BE-ME_OP_2x4x4',
 'Asia_Pacific_ex_Japan_32_Portfolios_ME_BE-ME_OP_2x4x4',
 'North_America_32_Portfolios_ME_BE-ME_OP_2x4x4',
 'Developed_32_Portfolios_ME_BE-ME_INV(TA)_2x4x4',

```

'Developed_ex_US_32_Portfolios_ME_BE-ME_INV(TA)_2x4x4',
'Europe_32_Portfolios_ME_BE-ME_INV(TA)_2x4x4',
'Japan_32_Portfolios_ME_BE-ME_INV(TA)_2x4x4',
'Asia_Pacific_ex_Japan_32_Portfolios_ME_BE-ME_INV(TA)_2x4x4',
'North_America_32_Portfolios_ME_BE-ME_INV(TA)_2x4x4',
'Developed_32_Portfolios_ME_INV(TA)_OP_2x4x4',
'Developed_ex_US_32_Portfolios_ME_INV(TA)_OP_2x4x4',
'Europe_32_Portfolios_ME_INV(TA)_OP_2x4x4',
'Japan_32_Portfolios_ME_INV(TA)_OP_2x4x4',
'Asia_Pacific_ex_Japan_32_Portfolios_ME_INV(TA)_OP_2x4x4',
'North_America_32_Portfolios_ME_INV(TA)_OP_2x4x4',
'Emerging_5_Factors',
'Emerging_MOM_Factor',
'Emerging_Markets_6_Portfolios_ME_BE-ME',
'Emerging_Markets_6_Portfolios_ME_OP',
'Emerging_Markets_6_Portfolios_ME_INV',
'Emerging_Markets_6_Portfolios_ME_Prior_12_2',
'Emerging_Markets_4_Portfolios_BE-ME_OP',
'Emerging_Markets_4_Portfolios_OP_INV',
'Emerging_Markets_4_Portfolios_BE-ME_INV']

```

```

[21]: ds = web.DataReader('5_Industry_Portfolios', 'famafrench')
      print(ds['DESCR'])

```

5 Industry Portfolios

This file was created by CMPT_IND_RETs using the 202012 CRSP database. It contains value- and equal-weighted returns for 5 industry portfolios. The portfolios are constructed at the end of June. The annual returns are from January to December. Missing data are indicated by -99.99 or -999. Copyright 2020 Kenneth R. French

```

0 : Average Value Weighted Returns -- Monthly (59 rows x 5 cols)
1 : Average Equal Weighted Returns -- Monthly (59 rows x 5 cols)
2 : Average Value Weighted Returns -- Annual (5 rows x 5 cols)
3 : Average Equal Weighted Returns -- Annual (5 rows x 5 cols)
4 : Number of Firms in Portfolios (59 rows x 5 cols)
5 : Average Firm Size (59 rows x 5 cols)
6 : Sum of BE / Sum of ME (5 rows x 5 cols)
7 : Value-Weighted Average of BE/ME (5 rows x 5 cols)

```

1.3.6 World Bank

```

[22]: from pandas_datareader import wb
      gdp_variables = wb.search('gdp.*capita.*const')
      gdp_variables.head()

```



```
[22]:
```

	id	name \
680	6.0.GDPpc_constant	GDP per capita, PPP (constant 2011 internation...
9266	NY.GDP.PCAP.KD	GDP per capita (constant 2010 US\$)
9268	NY.GDP.PCAP.KN	GDP per capita (constant LCU)
9270	NY.GDP.PCAP.PP.KD	GDP per capita, PPP (constant 2017 internation...
9271	NY.GDP.PCAP.PP.KD.87	GDP per capita, PPP (constant 1987 internation...

	unit	source \
680		LAC Equity Lab
9266		World Development Indicators
9268		World Development Indicators
9270		World Development Indicators
9271		WDI Database Archives

	sourceNote \
680	GDP per capita based on purchasing power parit...
9266	GDP per capita is gross domestic product divid...
9268	GDP per capita is gross domestic product divid...
9270	GDP per capita based on purchasing power parit...
9271	

	sourceOrganization	topics
680	b'World Development Indicators (World Bank)'	Economy & Growth
9266	b'World Bank national accounts data, and OECD ...	Economy & Growth
9268	b'World Bank national accounts data, and OECD ...	Economy & Growth
9270	b'International Comparison Program, World Bank...	Economy & Growth
9271	b''	

```
[23]: wb_data = wb.download(indicator='NY.GDP.PCAP.KD',
                             country=['US', 'CA', 'MX'],
                             start=1990,
                             end=2019)

wb_data.head()
```

```
[23]:
```

	NY.GDP.PCAP.KD
country year	
Canada 2019	51588.761434
2018	51476.200774
2017	51170.475841
2016	50193.750410
2015	50262.027666

1.3.7 OECD

```
[24]: df = web.DataReader('TUD', 'oecd', start='2010', end='2019')
df[['Japan', 'United States']]
```

```
[24]: Country          Japan \
Source      Administrative data
Series      Employees Union members Trade union density Employees
Year
2010-01-01      37100.0      12509.0      33.7      NaN
2011-01-01      37460.0      12437.0      33.2      NaN
2012-01-01      38990.0      12309.0      31.6      NaN
2013-01-01      40120.0      12369.0      30.8      NaN
2014-01-01      41020.0      12526.0      30.5      NaN
2015-01-01      42090.0      12520.0      29.7      NaN
2016-01-01      43010.0      12418.0      28.9      NaN
2017-01-01      43830.0      12343.0      28.2      NaN
2018-01-01      45650.0      12227.0      26.8      NaN
```

```
Country          United States \
Source      Administrative data
Series      Union members Trade union density Employees
Year
2010-01-01      NaN      NaN      80520.0
2011-01-01      NaN      NaN      83482.0
2012-01-01      NaN      NaN      89675.0
2013-01-01      NaN      NaN      89950.0
2014-01-01      NaN      NaN      NaN
2015-01-01      NaN      NaN      NaN
2016-01-01      NaN      NaN      NaN
2017-01-01      NaN      NaN      NaN
2018-01-01      NaN      NaN      NaN
```

```
Country          \
Source      Survey data
Series      Union members Trade union density Employees Union members
Year
2010-01-01      19634.0      24.4      80519.0      17403.0
2011-01-01      19695.0      23.6      83481.0      19335.0
2012-01-01      20055.0      22.4      89673.0      20986.0
2013-01-01      19843.0      22.1      89950.0      20095.0
2014-01-01      NaN      NaN      NaN      NaN
2015-01-01      NaN      NaN      91079.0      17717.0
2016-01-01      NaN      NaN      97406.0      16996.0
2017-01-01      NaN      NaN      99846.0      16975.0
2018-01-01      NaN      NaN      104642.0      17002.0
```

Country	Source	Series	Trade union	density
		Year		
		2010-01-01		21.6
		2011-01-01		23.2
		2012-01-01		23.4
		2013-01-01		22.3
		2014-01-01		NaN
		2015-01-01		19.5
		2016-01-01		17.4
		2017-01-01		17.0
		2018-01-01		16.2

1.3.8 Stooq

Google finance stopped providing common index data download. The Stooq site had this data for download for a while but is currently broken, awaiting release of [fix](#)

```
[25]: index_url = 'https://stooq.com/t/'
      ix = pd.read_html(index_url)
      len(ix)
```

[25]: 47

```
[26]: sp500_stooq = web.DataReader('^SPX', 'stooq')
      sp500_stooq.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1258 entries, 2021-02-22 to 2016-02-24
Data columns (total 5 columns):
 #   Column  Non-Null Count  Dtype
---  -
 0   Open    1258 non-null    float64
 1   High    1258 non-null    float64
 2   Low     1258 non-null    float64
 3   Close   1258 non-null    float64
 4   Volume  1258 non-null    int64
dtypes: float64(4), int64(1)
memory usage: 59.0 KB
```

```
[27]: sp500_stooq.head()
```

	Open	High	Low	Close	Volume
Date					
2021-02-22	3885.55	3902.92	3874.71	3876.50	2748914392
2021-02-19	3921.16	3930.41	3903.07	3906.71	2315685076

```

2021-02-18  3915.86  3921.98  3885.03  3913.97  2025989354
2021-02-17  3918.50  3933.61  3900.43  3931.33  2161952392
2021-02-16  3939.61  3950.43  3923.85  3932.59  2305147298

```

```
[28]: sp500_stooq.Close.plot(figsize=(14,4))
      sns.despine()
      plt.tight_layout()
```



1.3.9 NASDAQ Symbols

```
[29]: from pandas_datareader.nasdaq_trader import get_nasdaq_symbols
      symbols = get_nasdaq_symbols()
      symbols.info()
```

```

<class 'pandas.core.frame.DataFrame'>
Index: 9897 entries, A to ZYXI
Data columns (total 11 columns):
 #   Column                Non-Null Count  Dtype
---  -
 0   Nasdaq Traded         9897 non-null   bool
 1   Security Name         9897 non-null   object
 2   Listing Exchange      9897 non-null   category
 3   Market Category       9897 non-null   object
 4   ETF                   9897 non-null   bool
 5   Round Lot Size        9897 non-null   float64
 6   Test Issue            9897 non-null   bool
 7   Financial Status      4191 non-null   category
 8   CQS Symbol            5706 non-null   object
 9   NASDAQ Symbol         9897 non-null   object
10  NextShares            9897 non-null   bool
dtypes: bool(4), category(2), float64(1), object(4)
memory usage: 522.2+ KB

```

1.3.10 Tiingo

Requires [signing up](#) and storing API key in environment

```
[30]: df = web.get_data_tiingo('GOOG', api_key=os.getenv('TIINGO_API_KEY'))
```

```
[31]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
MultiIndex: 1258 entries, ('GOOG', Timestamp('2016-02-24 00:00:00+0000',
tz='UTC')) to ('GOOG', Timestamp('2021-02-22 00:00:00+0000', tz='UTC'))
Data columns (total 12 columns):
#   Column          Non-Null Count  Dtype
---  -
0   close           1258 non-null   float64
1   high            1258 non-null   float64
2   low             1258 non-null   float64
3   open            1258 non-null   float64
4   volume          1258 non-null   int64
5   adjClose        1258 non-null   float64
6   adjHigh         1258 non-null   float64
7   adjLow          1258 non-null   float64
8   adjOpen         1258 non-null   float64
9   adjVolume       1258 non-null   int64
10  divCash         1258 non-null   float64
11  splitFactor     1258 non-null   float64
dtypes: float64(10), int64(2)
memory usage: 164.0+ KB
```