GKBoginyFreyaBank-Python

February 17, 2023

1 Chapter I: Analyzing World' Stock Indices

Source:

- https://towardsdatascience.com/analyzing-world-stock-indices-performance-in-python-610df6a578f

The stock index is a list of selected companies, where its averaged price (or weighted-average) reflects the stock market. Stock indices also may reflect a certain industry or region that they cover. They are also often referred to as a benchmark to measure the performance of funds. The more important part of the stock index than its current price is the performance or price changes to a definitive previous moment, whether it is the day or three months before.

Why we compare indexes from all around the world? After reading the end of Chapter 7 of The Intelligent Investor, the author said that we need to allocate few money in foreign land / foreign bonds / foreign stocks. Enlarge your knowledge, unlimit your world.

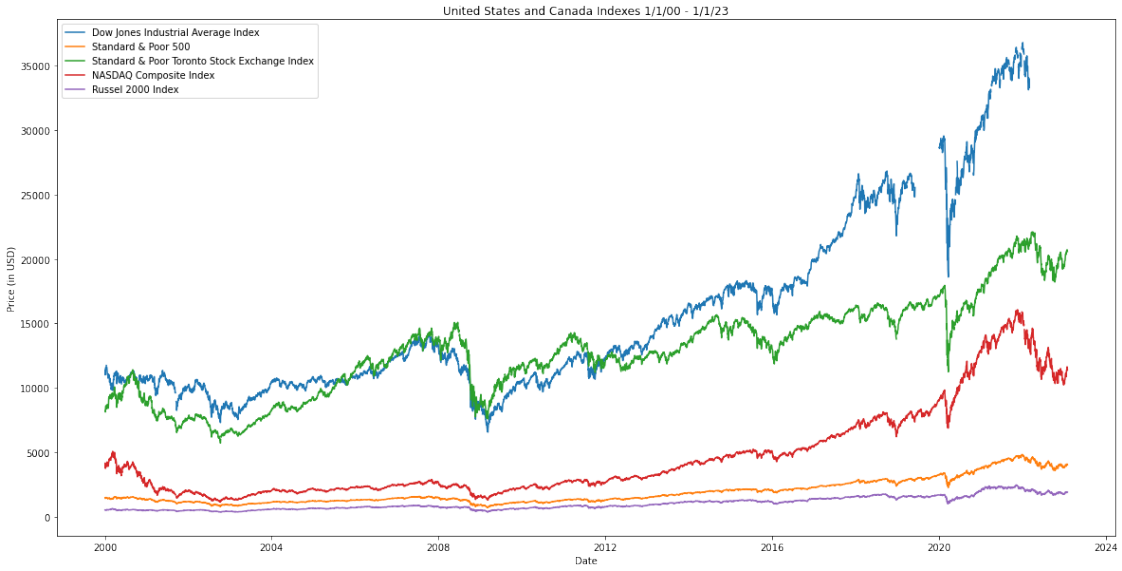
Obtain the Financial Data Data related to stock indices can be retrieved from Yahoo! Finance. In Python, there has been a popular module to retrieve data more easily from Yahoo! Finance. If it has not been installed yet, you can install it in your Jupyter Notebook by typing this chunk of codes, followed by importing the needed libraries/modules for processing.

1.1 US and Canada Indexes

[2]:
```
import matplotlib.pyplot as plt
import yfinance as yf

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['^GSPC', 'DJI', '^IXIC', '^RUT', '^GSPTSE']
from datetime import datetime
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)
```

```
data.rename(columns={'^GSPC': 'Standard & Poor 500',
                     'DJI': 'Dow Jones Industrial Average Index ',
                     '^IXIC': 'NASDAQ Composite Index',
                     '^RUT': 'Russel 2000 Index',
                     '^GSPTSE': 'Standard & Poor Toronto Stock Exchange␣
 ↪Index'}, inplace=True)

#print(data)
#data['Close'].plot()

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in USD)")
plt.title("United States and Canada Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  5 of 5 completed
```



1.2 Latin America Indexes

[3]:
```
import matplotlib.pyplot as plt
import yfinance as yf

from pandas_datareader import data as pdr
```

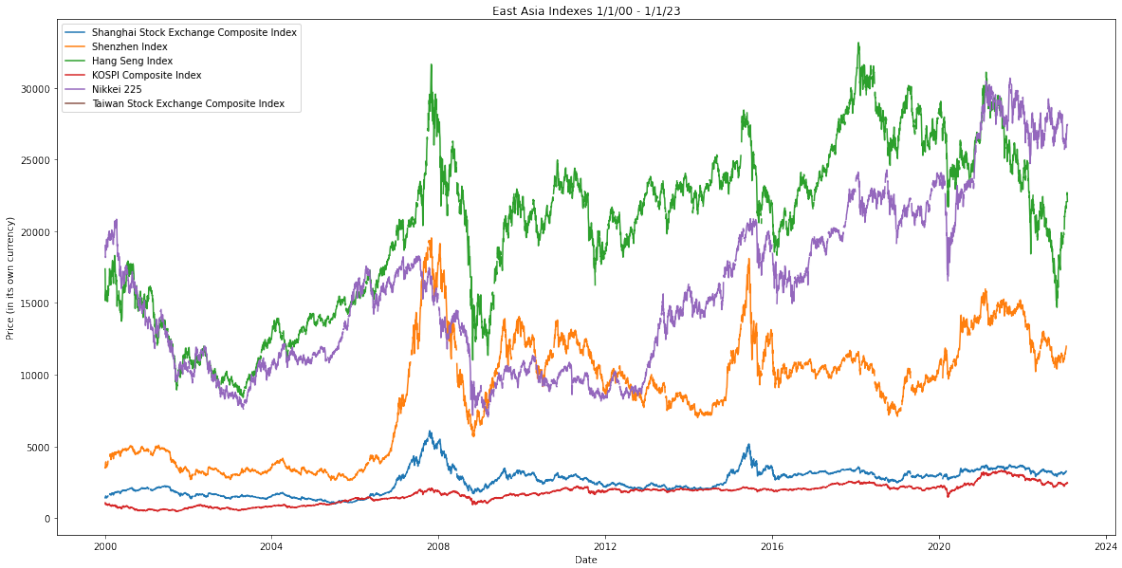
```
from datetime import datetime

yf.pdr_override()
y_symbols = ['^BVSP', '^MXX', '^IPSA']
from datetime import datetime
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'^BVSP': 'IBOVESPA Brazil Index',
                     '^MXX': 'Mexico Stock Exchange Index ',
                     '^IPSA': 'Santiago Composite Index'}, inplace=True)

#print(data)
#data['Close'].plot()

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in its own currency)")
plt.title("Latin America Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  3 of 3 completed
```

1.3 East Asia Indexes

[4]:
```
import matplotlib.pyplot as plt
import yfinance as yf

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['^N225', '^HSI', '000001.SS', '399001.SZ', '^TWII', '^KS11']
from datetime import datetime
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'^N225': 'Nikkei 225',
                     '^HSI': 'Hang Seng Index ',
                     '000001.SS': 'Shanghai Stock Exchange Composite Index',
                     '399001.SZ': 'Shenzhen Index ',
                     '^TWII': 'Taiwan Stock Exchange Composite Index ',
                     '^KS11': 'KOSPI Composite Index '}, inplace=True)

#print(data)
#data['Close'].plot()

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in its own currency)")
plt.title("East Asia Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********100%**********]  6 of 6 completed

1 Failed download:
- ^TWII: No data found for this date range, symbol may be delisted
```

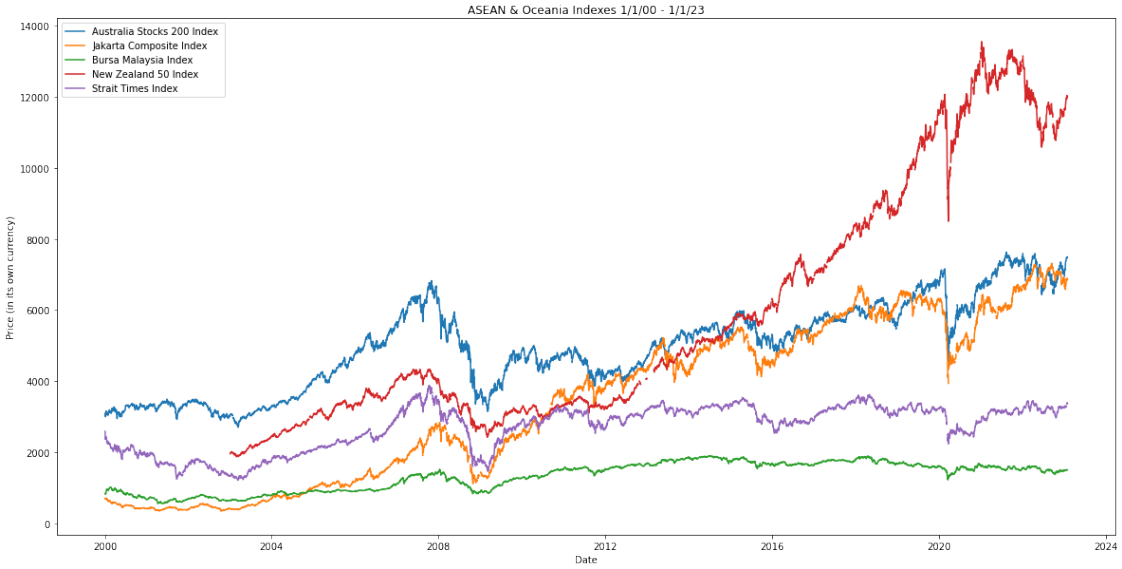


1.4 ASEAN & Oceania Indexes

[5]:
```
import matplotlib.pyplot as plt
import yfinance as yf

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['^STI', '^JKSE', '^KLSE','^AXJO',  '^NZ50']
from datetime import datetime
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'^STI': 'Strait Times Index',
                     '^JKSE': 'Jakarta Composite Index ',
                     '^KLSE': 'Bursa Malaysia Index',
                     '^AXJO': 'Australia Stocks 200 Index ',
                     '^NZ50': 'New Zealand 50 Index '}, inplace=True)

#print(data)
#data['Close'].plot()

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)
```

```
plt.xlabel("Date")
plt.ylabel("Price (in its own currency)")
plt.title("ASEAN & Oceania Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********100%**********]  5 of 5 completed
```

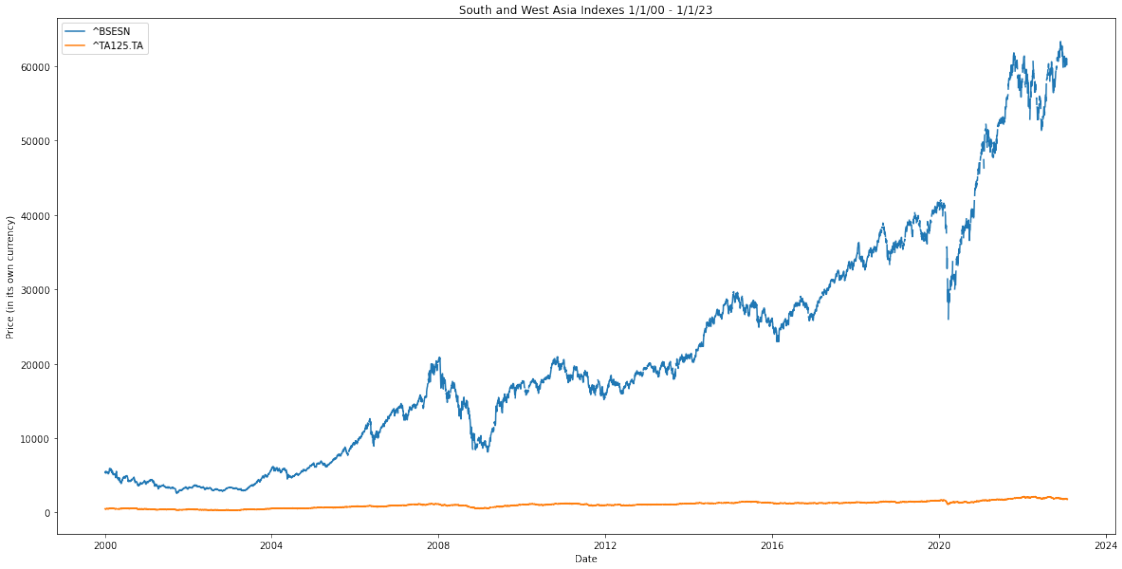


1.5 South and West Asia Indexes

[10]:
```
from pandas_datareader import data as pdr
import yfinance as yf

yf.pdr_override()
y_symbols = ['^BSESN', '^TA125.TA']
from datetime import datetime
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

#print(data)
#data['Close'].plot()

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
```

```
plt.ylabel("Price (in its own currency)")
plt.title("South and West Asia Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

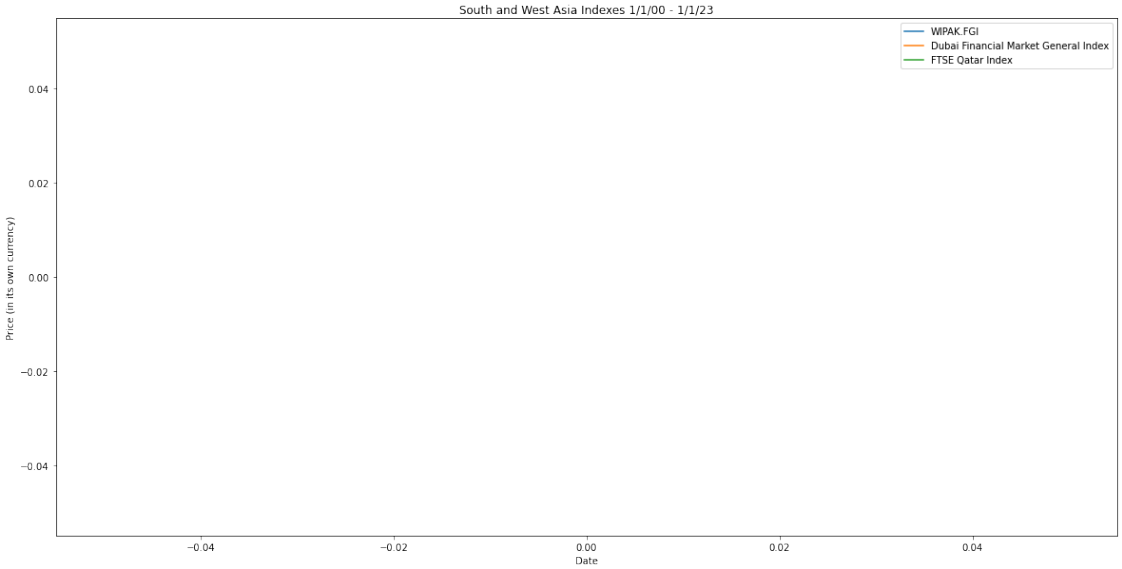
```
[**********100%**********]  2 of 2 completed
```



[11]:
```
import matplotlib.pyplot as plt
import yfinance as yf

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['^DFMGI.AE', '^WIQAT.FGI','WIPAK.FGI']
from datetime import datetime
startdate = datetime(2010,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'^DFMGI.AE': 'Dubai Financial Market General Index',
                     '^WIQAT.FGI': 'FTSE Qatar Index ',
                     '^WIPAK.FGI': 'FTSE Pakistan Index'}, inplace=True)

#print(data)
#data['Close'].plot()

plt.figure(figsize=(20,10))
```

```
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in its own currency)")
plt.title("South and West Asia Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  3 of 3 completed

3 Failed downloads:
- ^WIQAT.FGI: No timezone found, symbol may be delisted
- ^DFMGI.AE: No timezone found, symbol may be delisted
- WIPAK.FGI: Period 'max' is invalid, must be one of ['1d', '5d']
```

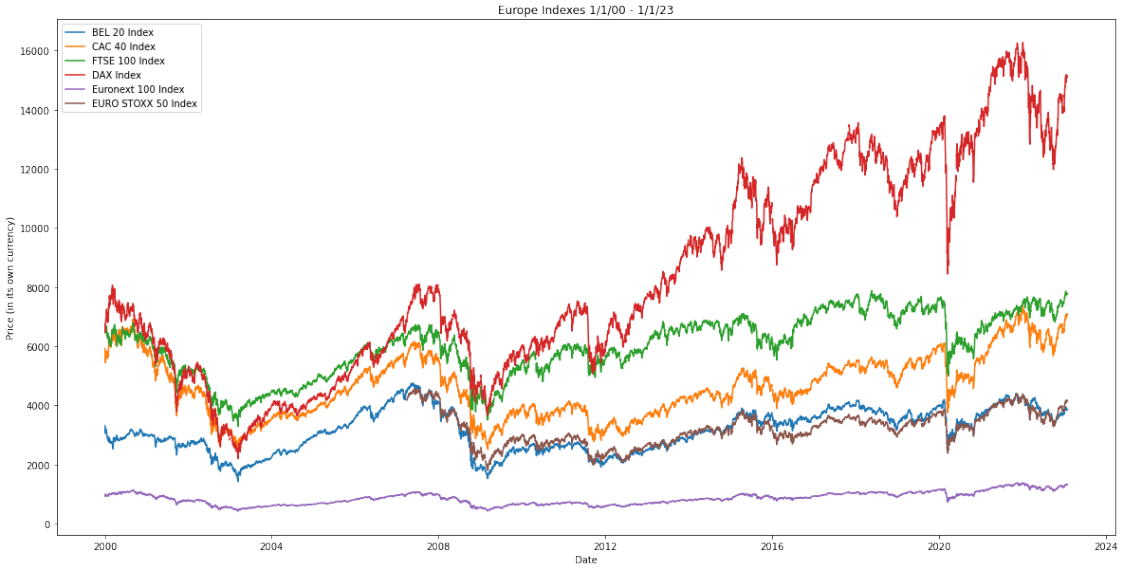


1.6 Europe Indexes

[1]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from forex_python.converter import CurrencyRates
from datetime import datetime

cr = CurrencyRates()

# Get exchange rate between GBP and USD and EUR and USD
```

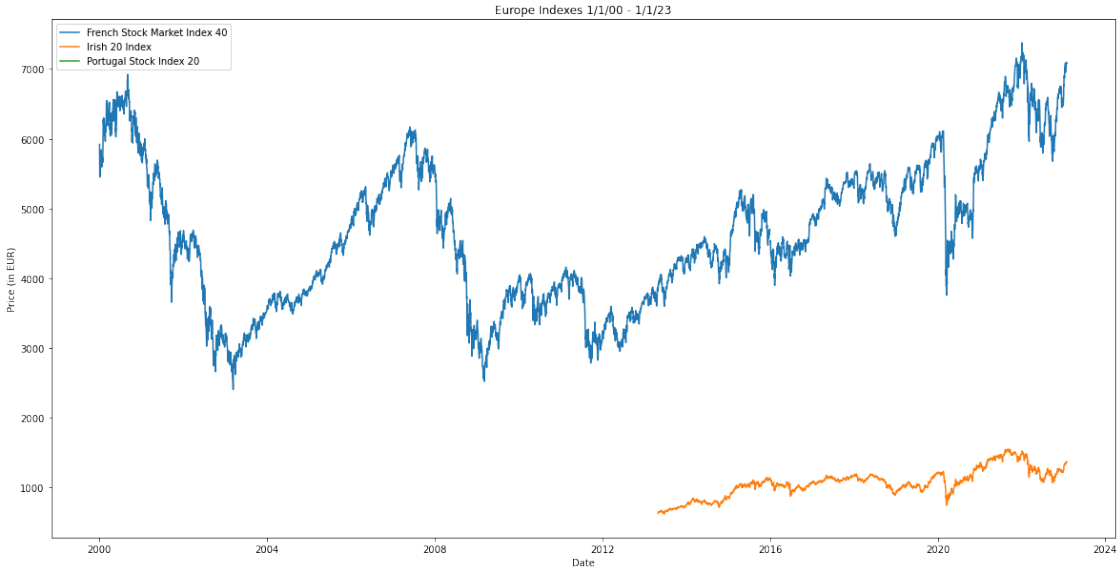
```
gbp_to_usd = cr.get_rate('GBP', 'USD')
eur_to_usd = cr.get_rate('EUR', 'USD')

yf.pdr_override()
y_symbols = ['^FTSE', '^GDAXI', '^FCHI', '^STOXX50E','^N100', '^BFX']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'^FTSE': 'FTSE 100 Index',
                     '^GDAXI': 'DAX Index',
                     '^FCHI': 'CAC 40 Index',
                     '^STOXX50E': 'EURO STOXX 50 Index',
                     '^N100': 'Euronext 100 Index',
                     '^BFX': 'BEL 20 Index'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in its own currency)")
plt.title("Europe Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  6 of 6 completed
```



[18]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from forex_python.converter import CurrencyRates
from datetime import datetime

cr = CurrencyRates()

# Get exchange rate between GBP and USD and EUR and USD
gbp_to_usd = cr.get_rate('GBP', 'USD')
eur_to_usd = cr.get_rate('EUR', 'USD')

yf.pdr_override()
y_symbols = ['^FCHI', '^IETP', '^PSI20.LS']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'^FCHI': 'French Stock Market Index 40',
                     '^IETP': 'Irish 20 Index',
                     '^PSI20.LS': 'Portugal Stock Index 20'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in EUR)")
plt.title("Europe Indexes 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  3 of 3 completed

1 Failed download:
- ^PSI20.LS: No timezone found, symbol may be delisted
```



2 Chapter II: Comparing Multiple Corporation Stocks Price and Using Indicator for Single Stocks Price

Sources: * https://tcoil.info/plot-multiple-stocks-in-python/

- https://medium.com/wealthy-bytes/visualizing-free-stock-data-for-algorithmic-trading-with-python-and-matplotlib-dca1abbd286c
- https://pythoninoffice.com/draw-stock-chart-with-python/

In this section we are going to:

1. Plot multiple corporations stocks price to compare their performance against their competitor within an industry
2. Plot a single stocks price, to put all your eggs in a single basket, after choosing your winning corporation, all in.
3. Plot a single stocks price, with indicator Moving Average, the average price of the stocks in 50 days and 200 days
4. Plot a single stocks price, with indicator of Bollinger Bands. It is quite a strong indicator that trader will love.
5. Plot a single stocks price, with volume indicator. To make sure the corporation' stocks is liquid enough.
6. Plot a single stocks price, with candlestick style.
7. Plot a single stocks price, with candlestick style and 20 Days Moving Average.

8. Plot a single stocks price, with candlestick style and 20 Days Moving Average that hiding non-trading days.

Why comparing? we need to compare stock performance between each other or against the index during specific time interval to choose the one we want to invest in.

Very useful for comparing not only stocks between each other, but also major indexes (or ETFs) in the world, or commodities prices.

2.1 Multiple Plots using Pandas and yfinance

[6]:
```
import matplotlib.pyplot as plt
import yfinance as yf

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['EA', 'TTWO', 'ATVI']

from datetime import datetime
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'EA': 'Electronic Arts',
                     'TTWO': 'Take-Two Interactive',
                     'ATVI': 'Activision Blizzard'}, inplace=True)
```

```
[**********************100%**********************]  3 of 3 completed
```

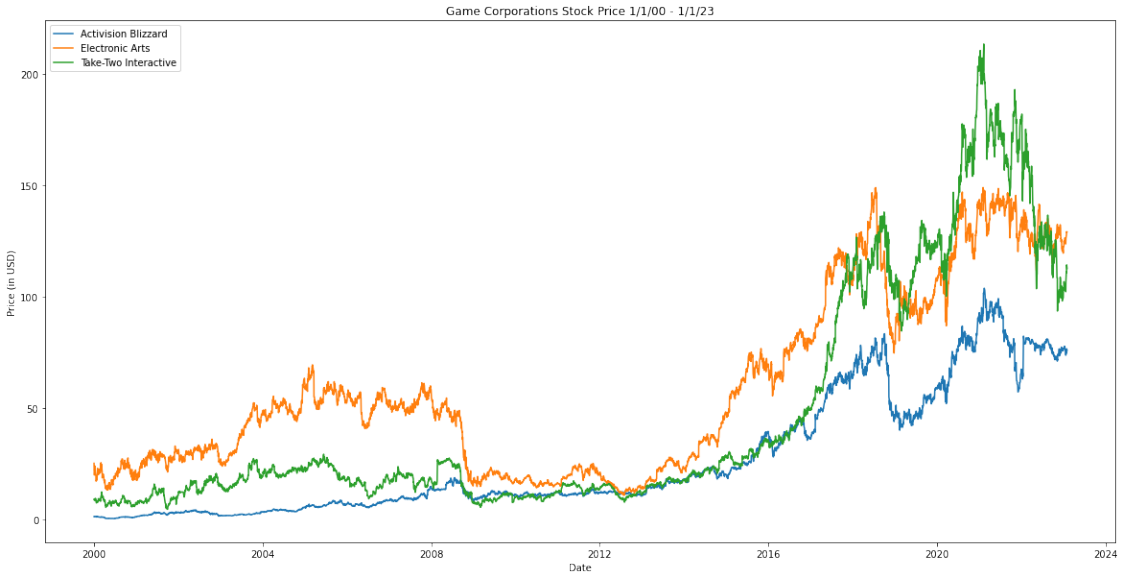
[7]:
```
print(data)
```

```
                  Adj Close                                          \
           Activision Blizzard Electronic Arts Take-Two Interactive
Date
2000-01-03            1.214421       24.965614              9.124436
2000-01-04            1.177480       22.078434              8.874452
2000-01-05            1.182098       22.062996              8.832788
2000-01-06            1.159010       19.762518              8.749459
2000-01-07            1.191333       20.349213              8.999444
…                          …              …                    …
2023-01-24           75.110001      127.489998            111.269997
2023-01-25           74.639999      127.559998            110.699997
2023-01-26           75.599998      129.139999            111.889999
2023-01-27           76.610001      128.869995            114.279999
2023-01-30           75.959999      128.990005            112.660004
```

```
                     Close                                          \
           Activision Blizzard Electronic Arts Take-Two Interactive
Date
2000-01-03            1.369792       25.265625              9.125000
2000-01-04            1.328125       22.343750              8.875000
2000-01-05            1.333333       22.328125              8.833333
2000-01-06            1.307292       20.000000              8.750000
2000-01-07            1.343750       20.593750              9.000000
…                          …              …                     …
2023-01-24           75.110001      127.489998            111.269997
2023-01-25           74.639999      127.559998            110.699997
2023-01-26           75.599998      129.139999            111.889999
2023-01-27           76.610001      128.869995            114.279999
2023-01-30           75.959999      128.990005            112.660004

                     High                                           \
           Activision Blizzard Electronic Arts Take-Two Interactive
Date
2000-01-03            1.375000       28.765625             10.000000
2000-01-04            1.354167       24.500000              9.333333
2000-01-05            1.364583       24.375000              8.875000
2000-01-06            1.333333       22.625000              9.000000
2000-01-07            1.354167       21.656250              9.041667
…                          …              …                     …
2023-01-24           75.430000      128.070007            111.660004
2023-01-25           75.110001      127.650002            111.389999
2023-01-26           75.660004      129.449997            112.250000
2023-01-27           76.760002      130.570007            115.339996
2023-01-30           77.080002      129.470001            114.540001

                      Low                                           \
           Activision Blizzard Electronic Arts Take-Two Interactive
Date
2000-01-03            1.166667       20.593750              8.666667
2000-01-04            1.187500       22.312500              8.666667
2000-01-05            1.312500       21.515625              8.333333
2000-01-06            1.296875       19.843750              8.500000
2000-01-07            1.291667       20.312500              8.375000
…                          …              …                     …
2023-01-24           74.500000      126.370003            109.050003
2023-01-25           74.529999      126.269997            109.269997
2023-01-26           74.650002      128.190002            110.559998
2023-01-27           75.220001      128.789993            113.360001
2023-01-30           75.839996      128.110001            112.339996

                     Open                                           \
           Activision Blizzard Electronic Arts Take-Two Interactive
Date
```

```
2000-01-03            1.312500       21.250000             8.916667
2000-01-04            1.343750       23.750000             9.083333
2000-01-05            1.317708       22.000000             8.750000
2000-01-06            1.322917       22.062500             8.791667
2000-01-07            1.322917       21.015625             8.666667
…                          …              …                    …
2023-01-24           75.000000      127.709999           110.470001
2023-01-25           75.000000      126.589996           109.589996
2023-01-26           74.790001      128.309998           111.849998
2023-01-27           75.500000      129.139999           114.099998
2023-01-30           76.629997      128.919998           113.099998

                        Volume
           Activision Blizzard Electronic Arts Take-Two Interactive
Date
2000-01-03             7226400         9040800              1176750
2000-01-04             4262400         6331200               345300
2000-01-05             3390000         5072000               628800
2000-01-06             2430000         6408400               374100
2000-01-07            15549600         5456400               482850
…                          …              …                    …
2023-01-24             5069600         1301800              1245900
2023-01-25             4004300         1099800              1821200
2023-01-26             3960800         1196100              1252900
2023-01-27             4381700         1786200              1864900
2023-01-30             4247400         2446900              1368800

[5806 rows x 18 columns]
```

[8]:
```
#data['Close'].plot()

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in USD)")
plt.title("Game Corporations Stock Price 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```



2.2 Multiple Plot of Japan Game Corporations using Pandas and yfinance

Who does not remember PlayStation 1 and PlayStation 2 era? I love Crash Team Racing, Digimon World, Valkyrie Profile, Star Ocean 3, Suikoden series, Resident Evil, Final Fantasy VIII, Phoenix Wright and want to learn law to defend ourselves. Turns out we can sue anything.. anywhere.. if it means we have been abused not only physically, but mentally.

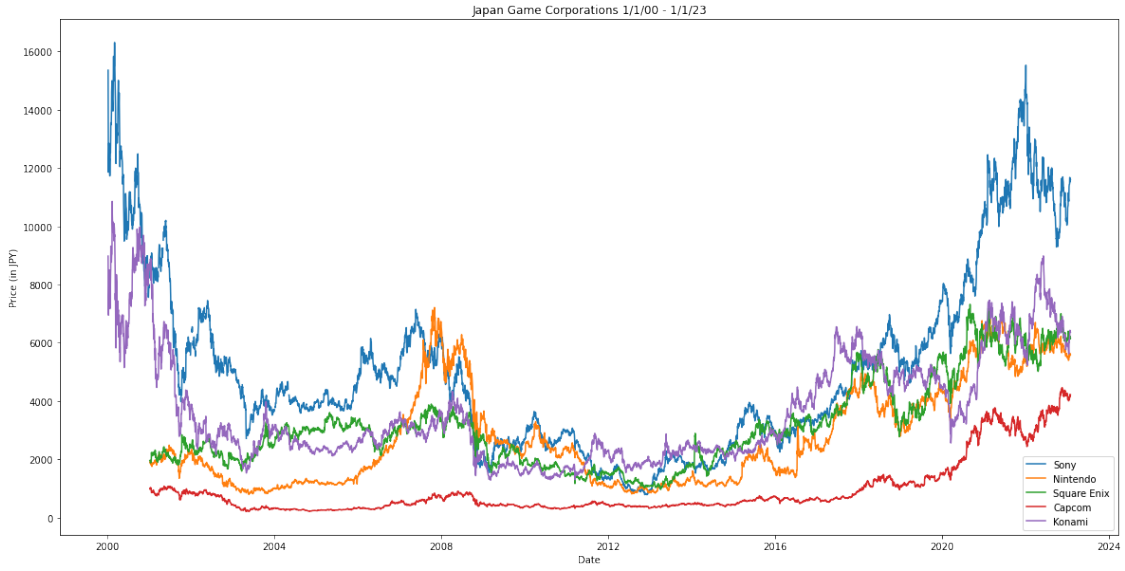
From game I met my best friends TREVOCALL. Met my wife Freya afterwards. Now with the 8 Queens all from game. Maybe just like Ghostbumps story when you thought your neighboor is a ghost, but in the end you are the ghost. Maybe we are just a game character, get what we will achieve due to our experiences in past lifes and karma and hard work through grinding in real life: work, study, connections..

Thanks Konami, Capcom, Tri-Ace and Atlus..

[9]:
```
import matplotlib.pyplot as plt
import yfinance as yf

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['9684.T', '9697.T', '9766.T','7974.T', '6758.T']
from datetime import datetime
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)
```

```
data.rename(columns={'9684.T': 'Square Enix',
                     '9697.T': 'Capcom',
                     '9766.T': 'Konami',
                     '7974.T': 'Nintendo',
                     '6758.T': 'Sony'}, inplace=True)

#print(data)
#data['Close'].plot()

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in JPY)")
plt.title("Japan Game Corporations 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  5 of 5 completed
```



2.3 Single Plot using Pandas and yfinance

[67]:
```
import matplotlib.pyplot as plt
import datetime as dt
import yfinance as yf

company = 'AAPL'
```

```
# Define a start date and End Date
start = dt.datetime(2000,1,1)
end =  dt.datetime(2023,1,31)

# Read Stock Price Data
data = yf.download(company, start , end)

data.tail(10)
#print(data)
```

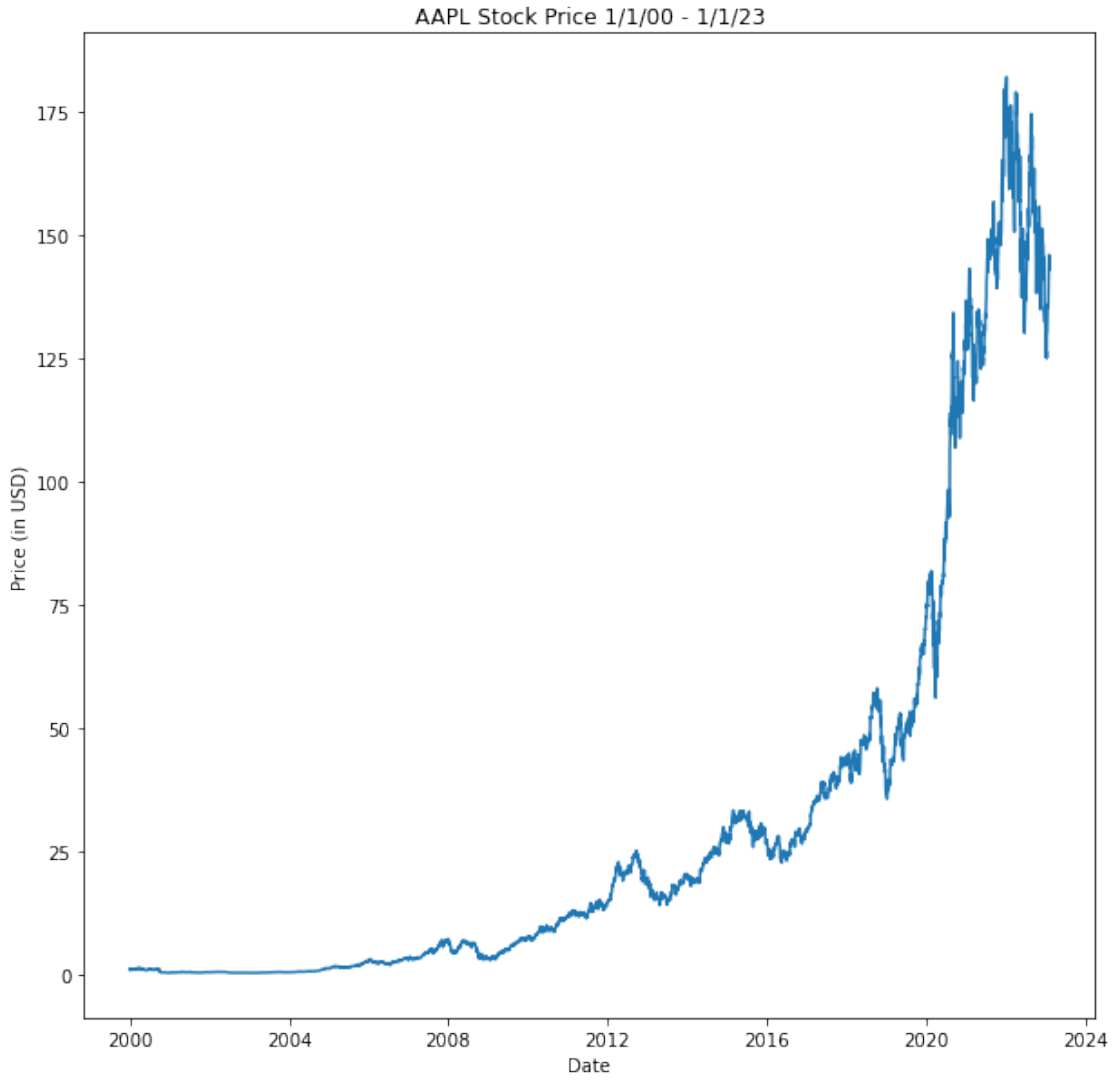
```
[**********************100%**********************]  1 of 1 completed
```

[67]:

Date	Open	High	Low	Close	Adj Close	Volume
2023-01-17	134.830002	137.289993	134.130005	135.940002	135.732758	63646600
2023-01-18	136.820007	138.610001	135.029999	135.210007	135.003876	69672800
2023-01-19	134.080002	136.250000	133.770004	135.270004	135.063782	58280400
2023-01-20	135.279999	138.020004	134.220001	137.869995	137.659805	79972200
2023-01-23	138.119995	143.320007	137.899994	141.110001	140.894882	81760300
2023-01-24	140.309998	143.160004	140.300003	142.529999	142.312714	66435100
2023-01-25	140.889999	142.429993	138.809998	141.860001	141.643738	65799300
2023-01-26	143.169998	144.250000	141.899994	143.960007	143.740540	54105100
2023-01-27	143.160004	147.229996	143.080002	145.929993	145.707520	70492800
2023-01-30	144.960007	145.550003	142.850006	143.000000	142.781998	64015300

[68]:
```
#data['Close'].plot()

plt.figure(figsize=(10,10))
plt.plot(data.index, data['Close'])
plt.xlabel("Date")
plt.ylabel("Price (in USD)")
plt.title("AAPL Stock Price 1/1/00 - 1/1/23")
```

[68]: Text(0.5, 1.0, 'AAPL Stock Price 1/1/00 - 1/1/23')

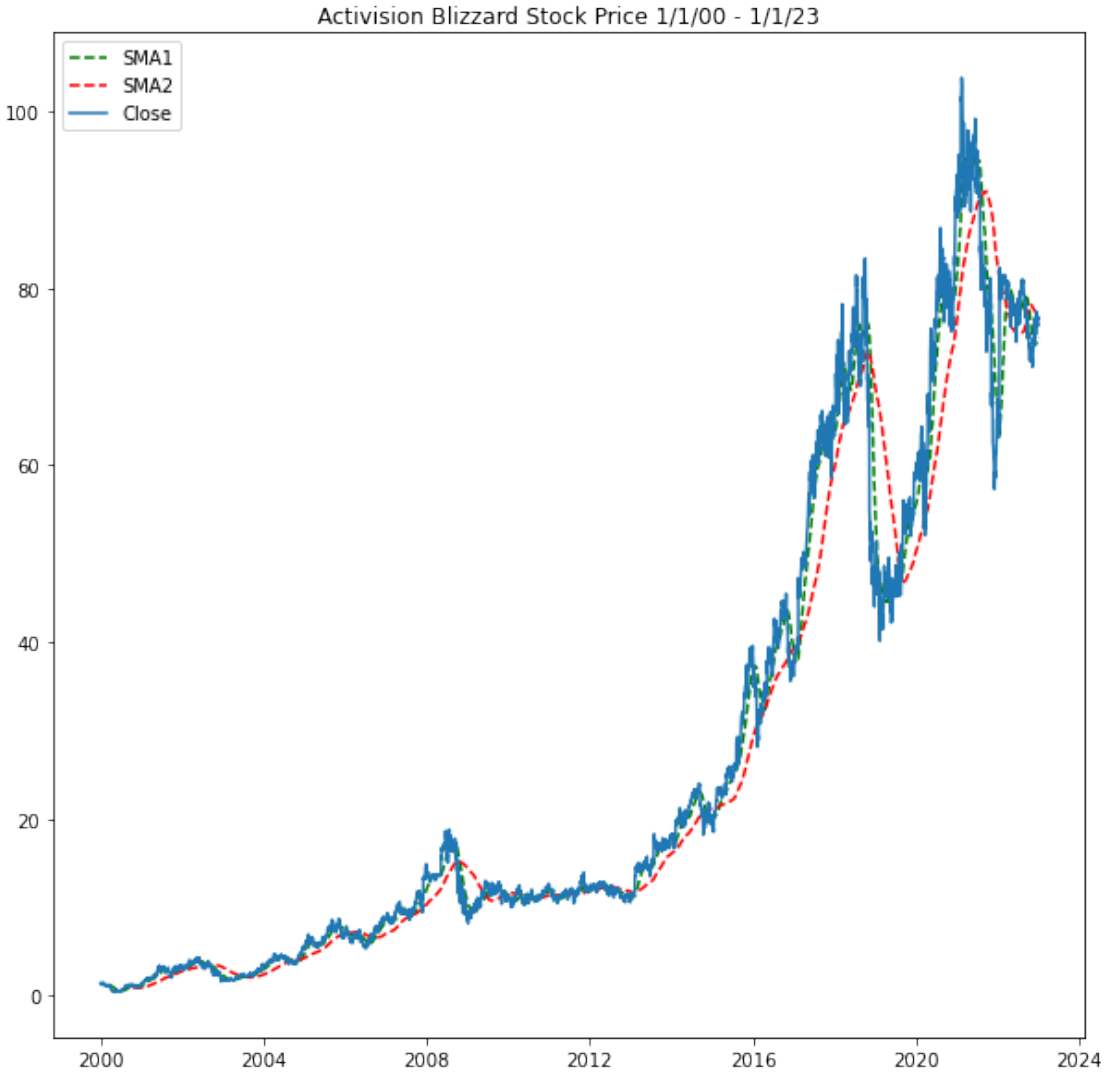


2.4 Single Plot using Pandas and yfinance with Moving Average

[84]:
```
import matplotlib.pyplot as plt
import datetime as dt
import yfinance as yf

company = 'ATVI'

# Define a start date and End Date
start = dt.datetime(2000,1,1)
```

```
end =  dt.datetime(2023,1,1)

# Read Stock Price Data
data = yf.download(company, start , end)

#data.tail(10)
#print(data)

# Creating and Plotting Moving Averages
data["SMA1"] = data['Close'].rolling(window=50).mean()
data["SMA2"] = data['Close'].rolling(window=200).mean()
data['ewma'] = data['Close'].ewm(halflife=0.5, min_periods=20).mean()

plt.figure(figsize=(10,10))
plt.plot(data['SMA1'], 'g--', label="SMA1")
plt.plot(data['SMA2'], 'r--', label="SMA2")
plt.plot(data['Close'], label="Close")
plt.title("Activision Blizzard Stock Price 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  1 of 1 completed
```

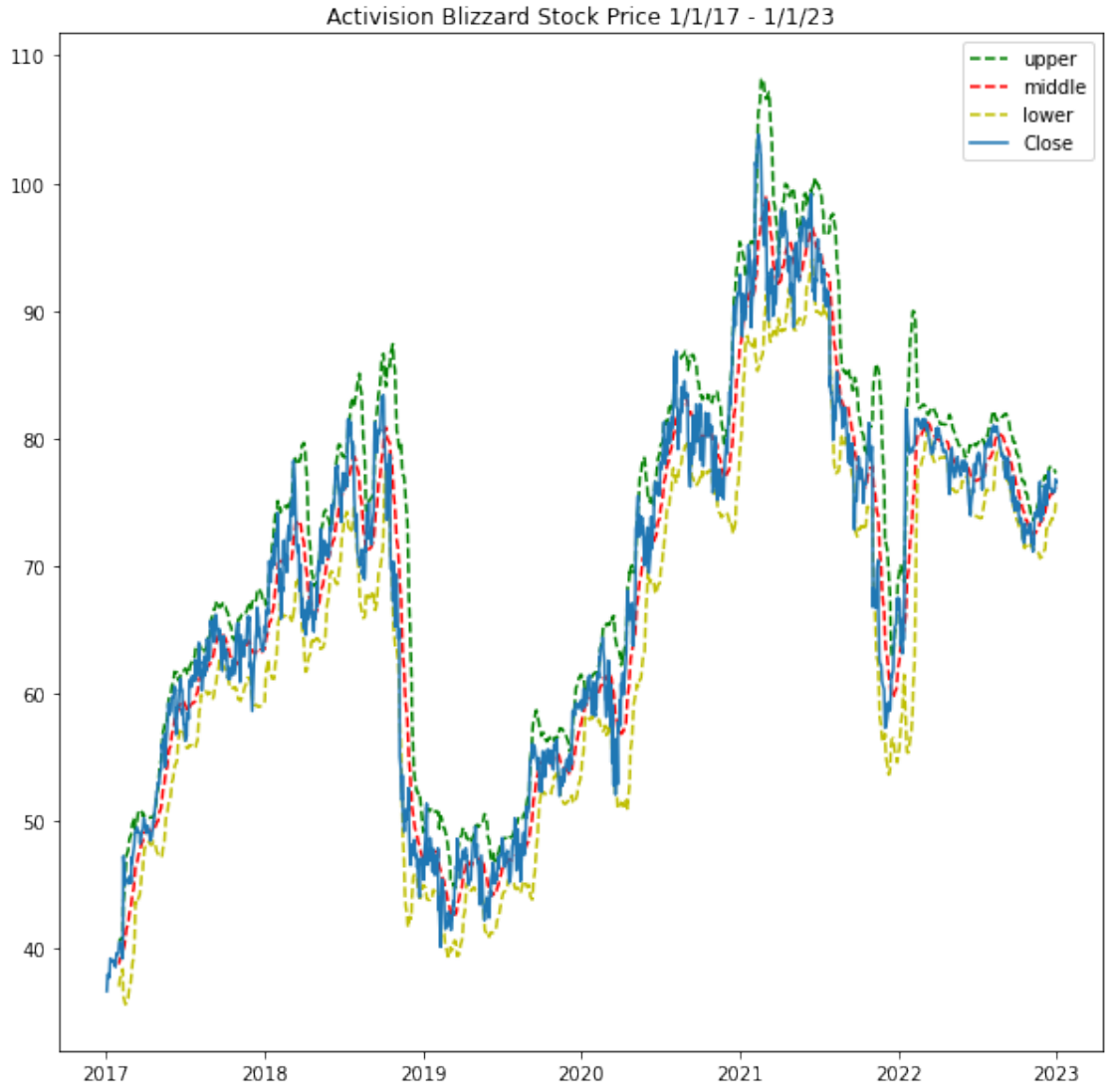


2.5 Single Plot using Pandas and yfinance with Bollinger Bands

[86]:
```
import matplotlib.pyplot as plt
import datetime as dt
import yfinance as yf

company = 'ATVI'

# Define a start date and End Date
start = dt.datetime(2017,1,1)
end =  dt.datetime(2023,1,1)
```

```
# Read Stock Price Data
data = yf.download(company, start , end)

#data.tail(10)
#print(data)

# Creating and Plotting Bollinger Bands
data['middle_band'] = data['Close'].rolling(window=20).mean()
data['upper_band'] = data['Close'].rolling(window=20).mean() + data['Close'].
 ↪rolling(window=20).std()*2
data['lower_band'] = data['Close'].rolling(window=20).mean() - data['Close'].
 ↪rolling(window=20).std()*2

plt.figure(figsize=(10,10))
plt.plot(data['upper_band'], 'g--', label="upper")
plt.plot(data['middle_band'], 'r--', label="middle")
plt.plot(data['lower_band'], 'y--', label="lower")
plt.plot(data['Close'], label="Close")
plt.title("Activision Blizzard Stock Price 1/1/17 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  1 of 1 completed
```

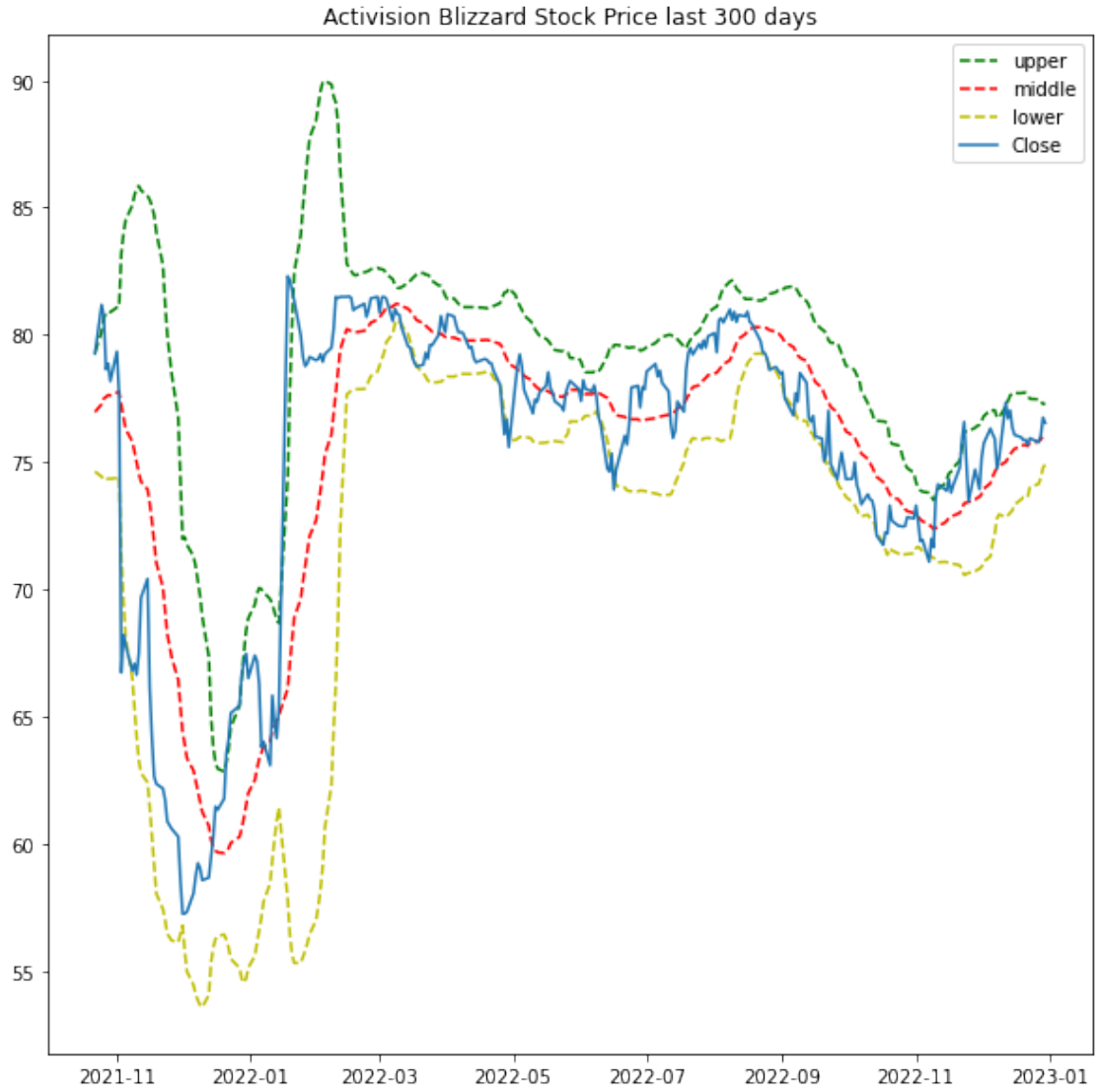


Bollinger Bands that zooms in on the past 300 days of trading

[102]:
```
import matplotlib.pyplot as plt
import datetime as dt
import yfinance as yf

company = 'ATVI'

# Define a start date and End Date
start = dt.datetime(2017,1,1)
end =  dt.datetime(2023,1,1)

# Read Stock Price Data
```

```
data = yf.download(company, start , end)

#data.tail(10)
#print(data)

# Creating and Plotting Bollinger Bands
data['middle_band'] = data['Close'].rolling(window=20).mean()
data['upper_band'] = data['Close'].rolling(window=20).mean() + data['Close'].
 ↪rolling(window=20).std()*2
data['lower_band'] = data['Close'].rolling(window=20).mean() - data['Close'].
 ↪rolling(window=20).std()*2

plt.figure(figsize=(10,10))
plt.plot(data['upper_band'].iloc[-300:], 'g--', label="upper")
plt.plot(data['middle_band'].iloc[-300:], 'r--', label="middle")
plt.plot(data['lower_band'].iloc[-300:], 'y--', label="lower")
plt.plot(data['Close'].iloc[-300:], label="Close")
plt.title("Activision Blizzard Stock Price last 300 days")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  1 of 1 completed
```



2.6 Single Plot using Pandas and yfinance with Volume

[116]:
```
import yfinance
stockvol = yfinance.Ticker('CAT')
hist = stockvol.history(period='3y')
```

[117]:
```
import plotly.graph_objects as go

fig = go.Figure(data=go.Scatter(x=hist.index,y=hist['Close'],␣
 ↪mode='lines+markers'))
fig.show()
```

[120]:
```
from plotly.subplots import make_subplots

fig2 = make_subplots(specs=[[{"secondary_y": True}]])
fig2.add_trace(go.Scatter(x=hist.
 ↪index,y=hist['Close'],name='Price'),secondary_y=False)
fig2.add_trace(go.Bar(x=hist.
 ↪index,y=hist['Volume'],name='Volume'),secondary_y=True)

#fig2.update_yaxes(range=[0,7000000000],secondary_y=True)
#fig2.update_yaxes(visible=False, secondary_y=True)

fig2.show()
```

2.7 Single Candlestick Plot using Pandas and yfinance

[127]:
```
import yfinance
stockvol = yfinance.Ticker('CAT')
hist = stockvol.history(period='3y')

import plotly.graph_objects as go

fig = go.Figure(data=go.Scatter(x=hist.index,y=hist['Close'],␣
 ↪mode='lines+markers'))

fig2 = make_subplots(specs=[[{"secondary_y": True}]])
fig2.add_trace(go.Scatter(x=hist.
 ↪index,y=hist['Close'],name='Price'),secondary_y=False)
fig2.add_trace(go.Bar(x=hist.
 ↪index,y=hist['Volume'],name='Volume'),secondary_y=True)

fig2.update_yaxes(range=[0,7000000000],secondary_y=True)
fig2.update_yaxes(visible=False, secondary_y=True)

fig3 = make_subplots(specs=[[{"secondary_y": True}]])
fig3.add_trace(go.Candlestick(x=hist.index,
                              open=hist['Open'],
                              high=hist['High'],
                              low=hist['Low'],
                              close=hist['Close'],
                             ))
fig3.show()

#fig3.add_trace(go.Bar(x=hist.index, y=hist['Volume'],␣
 ↪name='Volume'),secondary_y=True)
#fig3.update_layout(xaxis_rangeslider_visible=False)
```

2.8 Single Candlestick Plot using Pandas and yfinance with 20 Days MA

[128]:
```
import yfinance
stockvol = yfinance.Ticker('CAT')
hist = stockvol.history(period='3y')

import plotly.graph_objects as go

fig3.add_trace(go.Scatter(x=hist.index,y=hist['Close'].rolling(window=20).
 ↪mean(),marker_color='blue',name='20 Day MA'))
fig3.add_trace(go.Bar(x=hist.index, y=hist['Volume'],␣
 ↪name='Volume'),secondary_y=True)
fig3.update_layout(title={'text':'CAT', 'x':0.5})
fig3.update_yaxes(range=[0,1000000000],secondary_y=True)
fig3.update_yaxes(visible=False, secondary_y=True)
fig3.update_layout(xaxis_rangeslider_visible=False)  #hide range slider
fig3.show()

#hist['diff'] = hist['Close'] - hist['Open']
#hist.loc[hist['diff']>=0, 'color'] = 'green'
#hist.loc[hist['diff']<0, 'color'] = 'red'
```

2.9 Single Candlestick Plot using Pandas and yfinance with 20 Days MA + Hide Non-trading Days

[134]:
```
import yfinance
stockvol = yfinance.Ticker('CAT')
hist = stockvol.history(period='1y')

import plotly.graph_objects as go

hist['diff'] = hist['Close'] - hist['Open']
hist.loc[hist['diff']>=0, 'color'] = 'green'
hist.loc[hist['diff']<0, 'color'] = 'red'

fig3 = make_subplots(specs=[[{"secondary_y": True}]])
fig3.add_trace(go.Candlestick(x=hist.index,
                              open=hist['Open'],
                              high=hist['High'],
                              low=hist['Low'],
                              close=hist['Close'],
                              name='Price'))
fig3.add_trace(go.Scatter(x=hist.index,y=hist['Close'].rolling(window=20).
 ↪mean(),marker_color='blue',name='20 Day MA'))
```

```
fig3.add_trace(go.Bar(x=hist.index, y=hist['Volume'], name='Volume',␣
 ↪marker={'color':hist['color']}),secondary_y=True)
fig3.update_yaxes(range=[0,700000000],secondary_y=True)
fig3.update_yaxes(visible=False, secondary_y=True)
fig3.update_layout(xaxis_rangeslider_visible=False)  #hide range slider
fig3.update_layout(title={'text':'CAT', 'x':0.5})
#fig3.show()

fig3.update_xaxes(rangebreaks = [
                        dict(bounds=['sat','mon']), # hide weekends
                        #dict(bounds=[16, 9.5], pattern='hour'), # for hourly␣
 ↪chart, hide non-trading hours (24hr format)
                        dict(values=["2021-12-25","2022-01-01"]) #hide Xmas and␣
 ↪New Year
                                    ])
```

3 Chapter III: Commodities

Sources:

- https://www.icdx.co.id/product/gold?category=goldud
- https://finance.yahoo.com/commodities?.tsrc=fin-srch

We are going to plot the prices of several commodities:

1. Gold
2. Silver
3. Crude Oil
4. Aluminum
5. Natural Gas
6. Copper
7. Cocoa
8. Ethanol
9. Palladium
10. Soybean
11. Sugar
12. Cotton

Commodities are traded on Futures Exchange. Futures Exchange is the Exchange for commodities that will deliver the products from the seller of the contracts to the buyer at certain date in the future for fixed price paid today.If you look at the price of commodities it will contain the month and

year of delivery as well, e.g `Aluminum Futures,Apr-2023 (ALI=F)`. It means that the Aluminum contract you will buy at a price X will be delivered on April 2023. If you buy it today on February 14th, 2023, at a price of USD 2425 per metric ton to fill the base material of your packaging factory that will need new aluminum on April 2023, you will be happy if the Aluminum price on April 2023 (at spot rate / spot market) is USD 2788 (above your future price that you have bought on February 14th, 2023)

Why we need to learn this? Simple.. you can hedge and minimize your losses, mazimize your profit, another example if you want to start a business in garment / textile you might need to enter a contract with seller of Cotton in Futures Market / Exchange to deliver it at date which you predict your storage will be running out of cotton. You might have a lot of contracts ordering your garments if it is loved and have high quality and always stylist. It is better than buying cotton in the spot market, the futures market might be a good hedging that can save you a lot of money. Bad weather in the future can make the cotton price at spot market hikes beyond anticipation.

3.1 Gold

Gold is considered a category of precious metal because of its relatively high rarity. Due to its valuable nature and widespread use throughout the world, gold is valued universally almost equally between places or countries.

In the past, gold was used as bartering currency for daily necessities. However, its shape and weight made gold difficult to carry in large quantities. To that end, central banks then based their currency printing on the gold deposits in their vaults.

Other than its past function and characteristics, gold is also considered a safe haven asset because its value will remain the same over time. Regarding the characteristics of gold as a safe haven asset, gold prices move relatively in line with changes in global risk sentiment.

3.2 Silver

Silver is among the most traded commodities in the world. It is a precious metal which has been used by humanity for millennia now. Silver is intrinsic to industrial demand in sectors such as electronics, medicine etc. in fact, more than half of all silver consumption is for industrial purposes.

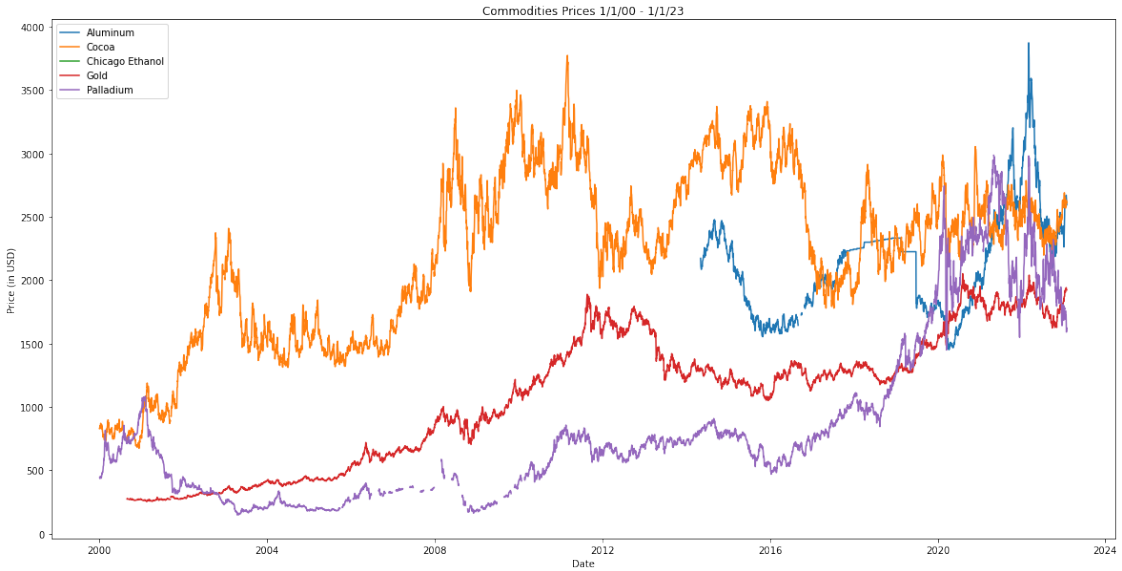
Futures contracts are the main way to trade silver. A futures contract is an agreement to buy or sell silver for a set price on a future date. While futures contracts can be used to take possession of the physical commodity, you don't necessarily have to – futures contracts can be settled in cash

3.3 Crude Oil

Crude oil is still the world's main energy source, contributing 40% of the world's total energy needs. The world consumes about 76 million barrels of crude oil per day. With more than 160 different types of benchmarks for oil, crude oil prices are pegged to three main benchmarks: London Brent, West Texas Intermediate (WTI) and Dubai / Oman crude.

[34]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['GC=F', 'ALI=F', 'CU=F', 'CC=F','PA=F']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'GC=F': 'Gold',
                     'ALI=F': 'Aluminum',
                     'CU=F': 'Chicago Ethanol',
                     'PA=F': 'Palladium',
                     'CC=F': 'Cocoa'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in USD)")
plt.title("Commodities Prices 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********100%**********]  5 of 5 completed

1 Failed download:
- CU=F: Period 'max' is invalid, must be one of ['1d', '5d']
```

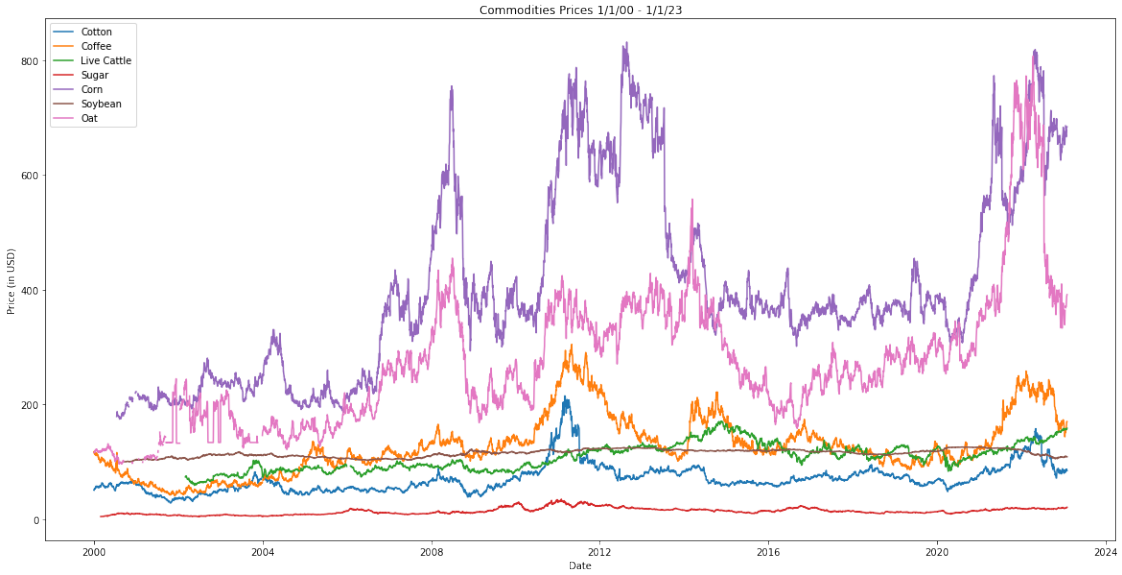


[28]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['SI=F', 'CL=F', 'NG=F','HG=F']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'SI=F': 'Silver',
                     'CL=F': 'Crude Oil',
                     'NG=F': 'Natural Gas',
                     'HG=F': 'Copper'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in USD)")
plt.title("Commodities Prices 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  4 of 4 completed
```

[32]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['ZC=F', 'ZO=F', 'LE=F','KC=F', 'SB=F', 'CT=F', 'ZF=F']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'ZC=F': 'Corn',
                     'ZO=F': 'Oat',
                     'LE=F': 'Live Cattle',
                     'KC=F': 'Coffee',
                     'SB=F': 'Sugar',
                     'CT=F': 'Cotton',
                     'ZF=F': 'Soybean'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Price (in USD)")
plt.title("Commodities Prices 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  7 of 7 completed
```



4 Chapter IV: Foreign Exchange

After paying with gold in the past, we are now stuck for a very long time with cash money: USD, GBP, CNY, JPY. The exchange rate between a pair / two currencies are traded in the futures exchange, tourists are the targets to increase the value of one currency, you can see that country with lots of tourist will have high value of its own currency compared to country with less tourist. Besides tourist, trade is also the main factor, if a country is main exporter of almost all commodities that needed by other countries then its currencies will also have high value.

[37]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['EURUSD=X', 'GBPUSD=X']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'EURUSD=X': 'EUR/USD',
                     'GBPUSD=X': 'GBP/USD'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)
```

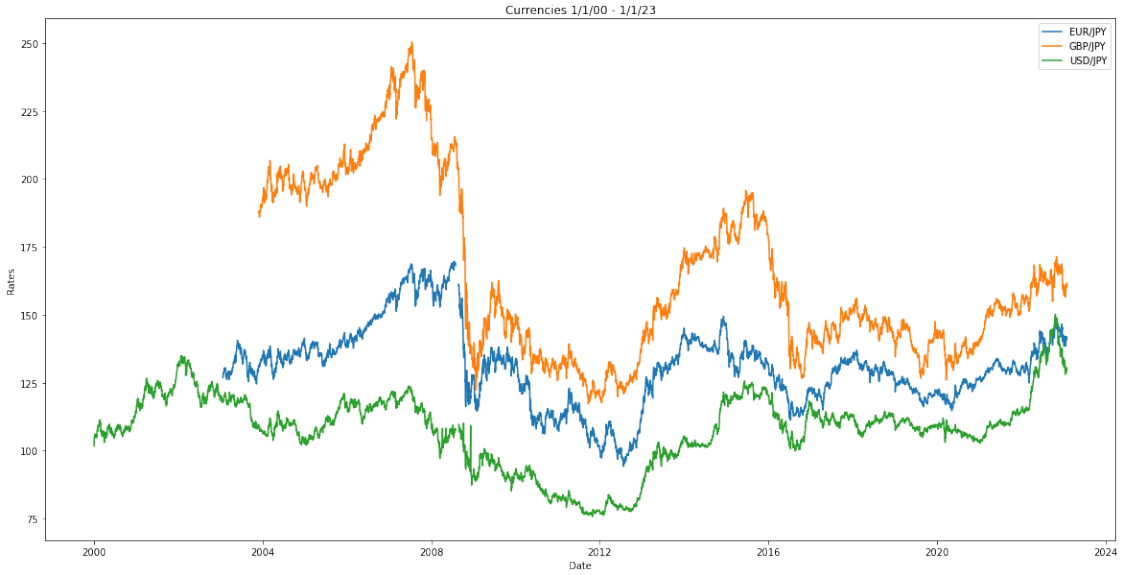
```
plt.xlabel("Date")
plt.ylabel("Rates")
plt.title("Currencies 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********100%**********]  2 of 2 completed
```

[38]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['USDJPY=X', 'GBPJPY=X', 'EURJPY=X']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'USDJPY=X': 'USD/JPY',
                     'GBPJPY=X': 'GBP/JPY',
                     'EURJPY=X': 'EUR/JPY'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)
```

```
plt.xlabel("Date")
plt.ylabel("Rates")
plt.title("Currencies 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

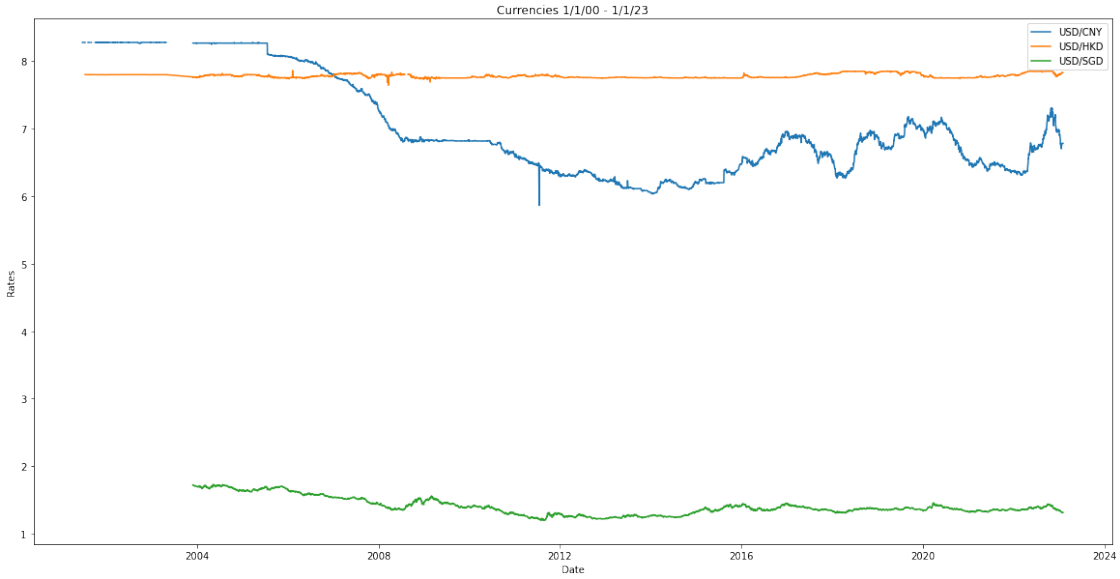
```
[**********100%**********]  3 of 3 completed
```



[39]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['USDCNY=X', 'USDHKD=X', 'USDSGD=X']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'USDCNY=X': 'USD/CNY',
                     'USDHKD=X': 'USD/HKD',
                     'USDSGD=X': 'USD/SGD'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
```

```
plt.ylabel("Rates")
plt.title("Currencies 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  3 of 3 completed
```



5 Chapter V: Bonds

Bonds are the safest instrument to invest in, either corporate or government, bondholders receive the right to be paid first before shareholders. It is based on the U.S. laws that is applied now.

Bonds are paid in coupon ever period (every 3 months, every 6 months or every year) before its maturity date, and it will pay the maturity price. There are lots of variations in bonds, bonds with lower face value, below its par value, or premium bonds.

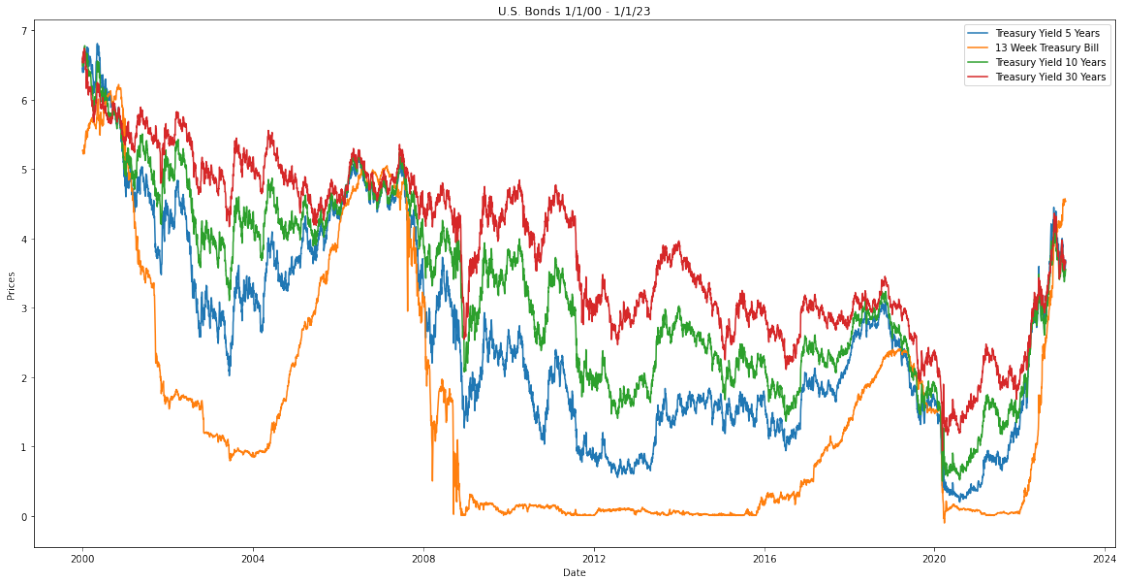
Yahoo Finance provides the bonds price for the U.S. government only.

5.1 Foreign Bonds: Indonesia Government Bond

In Indonesia there is SBR012, a government bond with maturity of 2 years(SBR012-T2) and 4 years(SBR012-T4), offered if you have an account in BNI Sekuritas around January 2023 and February 2023. The coupon for SBR012-T2 is 6.15 %, and the coupon for SBR012-T4 is 6.35 %. The rates / coupon might be higher than the U.S. government bonds with same maturity, but we know that the currency of Indonesia is very weak, with USD/IDR around 15,500 in February 14th, 2023. But if you are confident in 2 years USD/IDR could become 5,000 then why not take the chance?

[41]:
```
import yfinance as yf
import matplotlib.pyplot as plt

from pandas_datareader import data as pdr
from datetime import datetime

yf.pdr_override()
y_symbols = ['^IRX', '^FVX', '^TNX', '^TYX']
startdate = datetime(2000,1,1)
enddate = datetime(2023,1,31)
data = pdr.get_data_yahoo(y_symbols, start=startdate, end=enddate)

data.rename(columns={'^IRX': '13 Week Treasury Bill',
                     '^FVX': 'Treasury Yield 5 Years',
                     '^TNX': 'Treasury Yield 10 Years',
                     '^TYX': 'Treasury Yield 30 Years'}, inplace=True)

plt.figure(figsize=(20,10))
plt.plot(data.index, data['Close'], label=data["Close"].columns)

plt.xlabel("Date")
plt.ylabel("Prices")
plt.title("U.S. Bonds 1/1/00 - 1/1/23")
plt.legend()
plt.show()
```

```
[**********************100%**********************]  4 of 4 completed
```



6 Chapter VI: Codes not working (Check)

6.1 Codes 1 not working (Check)

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import yfinance as yf

# Retrieving List of World Major Stock Indices from Yahoo! Finance
df_list = pd.read_html('https://finance.yahoo.com/world-indices/')
majorStockIdx = df_list[0]
majorStockIdx.head()
```

[1]:

	Symbol	Name	Last Price	Change	% Change	Volume
0	^GSPC	S&P 500	4090.46	8.96	+0.22%	2.312B
1	^DJI	Dow Jones Industrial Average	33869.27	169.37	+0.50%	289.725M
2	^IXIC	NASDAQ Composite	11718.12	-71.48	-0.61%	4.223B
3	^NYA	NYSE COMPOSITE (DJ)	15910.69	82.09	+0.52%	0
4	^XAX	NYSE AMEX COMPOSITE INDEX	4344.55	126.93	+3.01%	0

	Intraday High/Low	52 Week Range	Day Chart
0	NaN	NaN	NaN
1	NaN	NaN	NaN
2	NaN	NaN	NaN
3	NaN	NaN	NaN
4	NaN	NaN	NaN

[2]:
```
# ^GSPC is the symbol of S&P 500 in Yahoo! Finance
# the data will be retrieved daily ('1d') and started from 1 January 2020 until␣
 ↪30 September 2020.

tickerData = yf.Ticker('^GSPC')
tickerDf1 = tickerData.history(period='1d', start='2010-1-1', end='2020-10-1')
```

[3]:
```
tickerData.history(period='1d', start='2010-1-1', end='2020-10-1')
```

[3]:

Date	Open	High	Low	Close
2010-01-04 00:00:00-05:00	1116.560059	1133.869995	1116.560059	1132.989990
2010-01-05 00:00:00-05:00	1132.660034	1136.630005	1129.660034	1136.520020
2010-01-06 00:00:00-05:00	1135.709961	1139.189941	1133.949951	1137.140015
2010-01-07 00:00:00-05:00	1136.270020	1142.459961	1131.319946	1141.689941
2010-01-08 00:00:00-05:00	1140.520020	1145.390015	1136.219971	1144.979980
…	…	…	…	…
2020-09-24 00:00:00-04:00	3226.139893	3278.699951	3209.449951	3246.590088

```
2020-09-25 00:00:00-04:00  3236.659912  3306.879883  3228.439941  3298.459961
2020-09-28 00:00:00-04:00  3333.899902  3360.739990  3332.909912  3351.600098
2020-09-29 00:00:00-04:00  3350.919922  3357.919922  3327.540039  3335.469971
2020-09-30 00:00:00-04:00  3341.209961  3393.560059  3340.469971  3363.000000

                                Volume  Dividends  Stock Splits
Date
2010-01-04 00:00:00-05:00  3991400000        0.0           0.0
2010-01-05 00:00:00-05:00  2491020000        0.0           0.0
2010-01-06 00:00:00-05:00  4972660000        0.0           0.0
2010-01-07 00:00:00-05:00  5270680000        0.0           0.0
2010-01-08 00:00:00-05:00  4389590000        0.0           0.0
…                                 …          …             …
2020-09-24 00:00:00-04:00  4601920000        0.0           0.0
2020-09-25 00:00:00-04:00  3803330000        0.0           0.0
2020-09-28 00:00:00-04:00  3950910000        0.0           0.0
2020-09-29 00:00:00-04:00  3661590000        0.0           0.0
2020-09-30 00:00:00-04:00  4738640000        0.0           0.0

[2705 rows x 7 columns]
```

[4]:
```
stock_list = []
for s in majorStockIdx.Symbol: # iterate for every stock indices
    # Retrieve data from Yahoo! Finance
    tickerData = yf.Ticker(s)
    tickerDf1 = tickerData.history(period='1d', start='2010-1-1',␣
 ↪end='2020-9-30')
    # Save historical data
    tickerDf1['ticker'] = s # don't forget to specify the index
    stock_list.append(tickerDf1)
# Concatenate all data
msi = pd.concat(stock_list, axis = 0)
```

```
^CASE30: No data found for this date range, symbol may be delisted
```

[5]:
```
pd.concat(stock_list, axis = 0)
```

[5]:
```
                                 Open         High          Low        Close  \
Date
2010-01-04 00:00:00-05:00  1116.560059  1133.869995  1116.560059  1132.989990
2010-01-05 00:00:00-05:00  1132.660034  1136.630005  1129.660034  1136.520020
2010-01-06 00:00:00-05:00  1135.709961  1139.189941  1133.949951  1137.140015
2010-01-07 00:00:00-05:00  1136.270020  1142.459961  1131.319946  1141.689941
2010-01-08 00:00:00-05:00  1140.520020  1145.390015  1136.219971  1144.979980
…                                  …            …            …            …
2020-09-22 00:00:00+02:00  3134.750000  3198.909912  3111.439941  3155.520020
2020-09-23 00:00:00+02:00  3138.000000  3205.540039  3117.360107  3162.409912
```

```
2020-09-25 00:00:00+02:00  3193.300049  3193.870117  3066.290039  3105.010010
2020-09-28 00:00:00+02:00  3123.300049  3203.389893  3121.090088  3170.429932
2020-09-29 00:00:00+02:00  3183.360107  3211.629883  3141.090088  3186.250000

                                  Volume  Dividends  Stock Splits    ticker  \
Date
2010-01-04 00:00:00-05:00  3.991400e+09        0.0           0.0     ^GSPC
2010-01-05 00:00:00-05:00  2.491020e+09        0.0           0.0     ^GSPC
2010-01-06 00:00:00-05:00  4.972660e+09        0.0           0.0     ^GSPC
2010-01-07 00:00:00-05:00  5.270680e+09        0.0           0.0     ^GSPC
2010-01-08 00:00:00-05:00  4.389590e+09        0.0           0.0     ^GSPC
…                                   …          …             …       …
2020-09-22 00:00:00+02:00  0.000000e+00        0.0           0.0  ^JNOU.JO
2020-09-23 00:00:00+02:00  0.000000e+00        0.0           0.0  ^JNOU.JO
2020-09-25 00:00:00+02:00  0.000000e+00        0.0           0.0  ^JNOU.JO
2020-09-28 00:00:00+02:00  0.000000e+00        0.0           0.0  ^JNOU.JO
2020-09-29 00:00:00+02:00  0.000000e+00        0.0           0.0  ^JNOU.JO

                           Adj Close
Date
2010-01-04 00:00:00-05:00        NaN
2010-01-05 00:00:00-05:00        NaN
2010-01-06 00:00:00-05:00        NaN
2010-01-07 00:00:00-05:00        NaN
2010-01-08 00:00:00-05:00        NaN
…                                  …
2020-09-22 00:00:00+02:00        NaN
2020-09-23 00:00:00+02:00        NaN
2020-09-25 00:00:00+02:00        NaN
2020-09-28 00:00:00+02:00        NaN
2020-09-29 00:00:00+02:00        NaN

[90016 rows x 9 columns]
```

[6]:
```python
#  categorize each index by the region
region_idx={ 'US & Canada' : ['^GSPC', '^DJI', '^IXIC', '^RUT','^GSPTSE'],
  'Latin America' : ['^BVSP', '^MXX', '^IPSA'],
  'East Asia' : ['^N225', '^HSI', '000001.SS', '399001.SZ', '^TWII', '^KS11'],
  'ASEAN & Oceania' : ['^STI', '^JKSE', '^KLSE','^AXJO',  '^NZ50'],
  'South & West Asia' : ['^BSESN', '^TA125.TA'],
  'Europe' : ['^FTSE', '^GDAXI', '^FCHI', '^STOXX50E','^N100', '^BFX']
}

# make a new column for the region.

def getRegion(ticker):
    for k in region_idx.keys():
```

```
        if ticker in region_idx[k]:
            return k
msi['region']= msi.ticker.apply(lambda x: getRegion(x))
```

[ ]:
```
# Get the data for 4 Jan 2010

begRef = msi.loc[msi.index == '2010-01-04']
def retBegin(ticker, val):
    start_val = begRef.loc[begRef.ticker == ticker, 'Close'].values[0]
    return (val/start_val - 1) * 100

msi['chBegin'] = msi.apply(lambda x: retBegin(x.ticker, x.Close), axis = 1)

# Transform the data to be ticker column-wise
chBegin = msi.groupby(['Date', 'ticker'])['chBegin'].first().unstack()
# Fill null values with the values on the row before
chBegin = chBegin.fillna(method='bfill')
```

[ ]:
```
fig, axes = plt.subplots(3,2, figsize=(12, 8),sharex=True)
pagoda = ["#965757", "#D67469", "#4E5A44", "#A1B482", '#EFE482', "#99BFCF"] #␣
 ↪for coloring
for i, k in enumerate(region_idx.keys()):
# Iterate for each region
    ax = axes[int(i/2), int(i%2)]
    for j,t in enumerate(region_idx[k]):
        # Iterate and plot for each stock index in this region
        ax.plot(chBegin.index, chBegin[t], marker='', linewidth=1, color =␣
 ↪pagoda[j])
        ax.legend([ticker[t] for t in region_idx[k]], loc='upper left',␣
 ↪fontsize=7)
        ax.set_title(k, fontweight='bold')
fig.text(0.5,0, "Year", ha="center", va="center", fontweight ="bold")
fig.text(0,0.5, "Price Change/Return (%)", ha="center", va="center",␣
 ↪rotation=90, fontweight ="bold")
fig.suptitle("Price Change/Return for Major Stock Indices based on 2010",␣
 ↪fontweight ="bold",y=1.05, fontsize=14)
fig.tight_layout()
```

6.2 Codes 2 not working (Check)

[39]:
```
import numpy as np
import pandas as pd
from pandas_datareader import data as wb
import matplotlib.pyplot as plt
import yfinance as yf
```

```
stocks = [
    {
        'ticker': 'UU.L',
        'name': 'United Utilities'
    },
    {
        'ticker': 'VOD.L',
        'name': 'Vodafone Group'
    },
    {
        'ticker': 'BP.L',
        'name': 'BP Group'
    }
]

def create_plots(stocks):
    data = pd.DataFrame()
    for stock in stocks:
        data[stock['ticker']] = yf.download(stock['ticker'],␣
 ↪data_source='yahoo', start='2007-1-1')['Adj Close']
    returns = data.apply(lambda x: (x / x[0] * 100))

    plt.figure(figsize=(10,6))

    for stock in stocks:
        plt.plot(returns[stock['ticker']], label=stock['name'])
    plt.legend()
    plt.ylabel('Cumulative Returns %')
    plt.xlabel('Time')

    plt.show
```

7 Appendix

[ ]:
```
# To activate project designated for GKBoginyFreyaBank
# Create an empty folder named GKBoginyFreyaBank that is in one folder with␣
 ↪this notebook
import Pkg
Pkg.activate("GKBoginyFreyaBank")
```

[ ]:
```
pip list
```

[ ]:
```
pip install yfinance # install yfinance
```

[ ]:
```
pip install pandas_datareader
```

[ ]:
```
pip install seaborn
```

[ ]:
```

```