

Exploratory Data Analysis

September 20, 2024

Functions (IGNORE)

Functions for Downloading Data

- 'get_data_from_start_to_end': Load in the data from YFinance API
- 'download_stock_data_for_periods': Look at different periods to understand how technical analysis changes throughout changes in macroeconomy

```
[ ]: import yfinance as yf
missing_data_tickers = [] # use this as a list of tickers with missing data

def get_data_from_start_to_end(ticker, start_date, end_date):
    global missing_data_tickers # Use the global list to accumulate missing
    ↪tickers
    try:
        stock_data = yf.download(ticker, start=start_date, end=end_date)
        if stock_data.empty:
            missing_data_tickers.append(ticker)
            raise ValueError(f"Stock data for ticker {ticker} during the period
    ↪from {start_date} to {end_date} was not found.")
        return stock_data
    except Exception as e:
        print(f"An error occurred for ticker {ticker}: {e}")
        missing_data_tickers.append(ticker)
        return None
```

```
[ ]: # for a variety of periods load in different list of tickers
def download_stock_data_for_periods(tickers, periods):
    all_data = {}

    for period, (start_date, end_date) in periods.items():
        period_data = {}
        for ticker in tickers:
            data = get_data_from_start_to_end(ticker, start_date, end_date)
            if data is not None:
                period_data[ticker] = data
        all_data[period] = period_data
```

```
return all_data
```

1 EDA and Data Cleaning

Assignment: Exploratory Data Analysis (EDA) and Data Cleaning Report

1.1 Dataset Overview:

1.1.1 Yahoo Finance API

The data that will be used for my capstone can be accessed through the Yahoo Finance API.

The Yahoo Finance API is a free popular API that is used by developers to load in a variety of stock data. This includes financial, candlestick and other information that can be utilized to make informed investment decisions.

Yahoo Finance is free and very easy to set up. First pip install yfinance and then simply load it into your notebook.

```
[ ]: # load the API in
import yfinance as yf # yf is the usual name for the package
```

As an example load in Microsoft data from the YFinance API.

```
[ ]: # save the ticker information of 'MSFT' as a variable
msft = yf.Ticker('MSFT')

# .info can be used for information about the company
print(msft.info)

# .get_balance_sheets returns the balance sheet information
print(msft.get_balance_sheet())
```

```
{'address1': 'One Microsoft Way', 'city': 'Redmond', 'state': 'WA', 'zip':
'98052-6399', 'country': 'United States', 'phone': '425 882 8080', 'website':
'https://www.microsoft.com', 'industry': 'Software - Infrastructure',
'industryKey': 'software-infrastructure', 'industryDisp': 'Software -
Infrastructure', 'sector': 'Technology', 'sectorKey': 'technology',
'sectorDisp': 'Technology', 'longBusinessSummary': 'Microsoft Corporation
develops and supports software, services, devices and solutions worldwide. The
Productivity and Business Processes segment offers office, exchange, SharePoint,
Microsoft Teams, office 365 Security and Compliance, Microsoft viva, and
Microsoft 365 copilot; and office consumer services, such as Microsoft 365
consumer subscriptions, Office licensed on-premises, and other office services.
This segment also provides LinkedIn; and dynamics business solutions, including
Dynamics 365, a set of intelligent, cloud-based applications across ERP, CRM,
power apps, and power automate; and on-premises ERP and CRM applications. The
Intelligent Cloud segment offers server products and cloud services, such as
azure and other cloud services; SQL and windows server, visual studio, system
center, and related client access licenses, as well as nuance and GitHub; and
```

enterprise services including enterprise support services, industry solutions, and nuance professional services. The More Personal Computing segment offers Windows, including windows OEM licensing and other non-volume licensing of the Windows operating system; Windows commercial comprising volume licensing of the Windows operating system, windows cloud services, and other Windows commercial offerings; patent licensing; and windows Internet of Things; and devices, such as surface, HoloLens, and PC accessories. Additionally, this segment provides gaming, which includes Xbox hardware and content, and first- and third-party content; Xbox game pass and other subscriptions, cloud gaming, advertising, third-party disc royalties, and other cloud services; and search and news advertising, which includes Bing, Microsoft News and Edge, and third-party affiliates. The company sells its products through OEMs, distributors, and resellers; and directly through digital marketplaces, online, and retail stores. The company was founded in 1975 and is headquartered in Redmond, Washington.',

'fullTimeEmployees': 228000, 'companyOfficers': [{ 'maxAge': 1, 'name': 'Mr. Satya Nadella', 'age': 56, 'title': 'Chairman & CEO', 'yearBorn': 1967, 'fiscalYear': 2023, 'totalPay': 9276400, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Mr. Bradford L. Smith LCA', 'age': 64, 'title': 'President & Vice Chairman', 'yearBorn': 1959, 'fiscalYear': 2023, 'totalPay': 3591277, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Ms. Amy E. Hood', 'age': 51, 'title': 'Executive VP & CFO', 'yearBorn': 1972, 'fiscalYear': 2023, 'totalPay': 3452196, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Mr. Judson B. Althoff', 'age': 50, 'title': 'Executive VP & Chief Commercial Officer', 'yearBorn': 1973, 'fiscalYear': 2023, 'totalPay': 3355797, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Mr. Christopher David Young', 'age': 51, 'title': 'Executive Vice President of Business Development, Strategy & Ventures', 'yearBorn': 1972, 'fiscalYear': 2023, 'totalPay': 2460507, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Ms. Carolina Dybeck Happe', 'age': 51, 'title': 'Executive VP & COO', 'yearBorn': 1972, 'fiscalYear': 2023, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Ms. Alice L. Jolla', 'age': 57, 'title': 'Corporate VP & Chief Accounting Officer', 'yearBorn': 1966, 'fiscalYear': 2023, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Mr. James Kevin Scott', 'age': 51, 'title': 'Executive VP of AI & CTO', 'yearBorn': 1972, 'fiscalYear': 2023, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Brett Iversen', 'title': 'Vice President of Investor Relations', 'fiscalYear': 2023, 'exercisedValue': 0, 'unexercisedValue': 0 }, { 'maxAge': 1, 'name': 'Mr. Hossein Nowbar', 'title': 'Chief Legal Officer', 'fiscalYear': 2023, 'exercisedValue': 0, 'unexercisedValue': 0 }], 'auditRisk': 3, 'boardRisk': 4, 'compensationRisk': 2, 'shareHolderRightsRisk': 2, 'overallRisk': 1, 'governanceEpochDate': 1726617600, 'compensationAsOfEpochDate': 1703980800, 'irWebsite': 'http://www.microsoft.com/investor/default.aspx', 'maxAge': 86400, 'priceHint': 2, 'previousClose': 438.69, 'open': 437.22, 'dayLow': 434.22, 'dayHigh': 439.21, 'regularMarketPreviousClose': 438.69, 'regularMarketOpen': 437.22, 'regularMarketDayLow': 434.22, 'regularMarketDayHigh': 439.21, 'dividendRate': 3.32, 'dividendYield': 0.0076, 'exDividendDate': 1732147200, 'payoutRatio': 0.2483, 'fiveYearAvgDividendYield': 0.9, 'beta': 0.896, 'trailingPE': 36.887287,

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 'fiftyDayAverage': 422.0348, 'twoHundredDayAverage': 413.57706,
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 'currency': 'USD', 'enterpriseValue': 3283120553984, 'profitMargins': 0.35956,
 'floatShares': 7422780788, 'sharesOutstanding': 7433039872, 'sharesShort':
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 'shortRatio': 2.99, 'shortPercentOfFloat': 0.0089, 'impliedSharesOutstanding':
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 1719705600, 'nextFiscalYearEnd': 1751241600, 'mostRecentQuarter': 1719705600,
 'earningsQuarterlyGrowth': 0.097, 'netIncomeToCommon': 88135999488,
 'trailingEps': 11.8, 'forwardEps': 15.23, 'pegRatio': 2.3, 'lastSplitFactor':
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 'enterpriseToEbitda': 25.365, '52WeekChange': 0.3838365, 'SandP52WeekChange':
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 'exchange': 'NMS', 'quoteType': 'EQUITY', 'symbol': 'MSFT', 'underlyingSymbol':
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 Corporation', 'firstTradeDateEpochUtc': 511108200, 'timeZoneFullName':
 'America/New_York', 'timeZoneShortName': 'EDT', 'uuid': 'b004b3ec-
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 'gmtOffsetMilliseconds': -14400000, 'currentPrice': 435.27, 'targetHighPrice':
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 'numberOfAnalystOpinions': 47, 'totalCash': 75531001856, 'totalCashPerShare':
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 'currentRatio': 1.275, 'totalRevenue': 245122007040, 'debtToEquity': 36.447,
 'revenuePerShare': 32.986, 'returnOnAssets': 0.14802, 'returnOnEquity': 0.37133,
 'freeCashflow': 56705249280, 'operatingCashflow': 118547996672,
 'earningsGrowth': 0.097, 'revenueGrowth': 0.152, 'grossMargins': 0.69764,
 'ebitdaMargins': 0.52804, 'operatingMargins': 0.43143, 'financialCurrency':
 'USD', 'trailingPegRatio': 2.3653}

	2024-06-30	2023-06-30 \
OrdinarySharesNumber	7434000000.0	7432000000.0
ShareIssued	7434000000.0	7432000000.0
NetDebt	33315000000.0	12533000000.0
TotalDebt	67127000000.0	59965000000.0
TangibleBookValue	121660000000.0	128971000000.0
...
CashCashEquivalentsAndShortTermInvestments	75531000000.0	111256000000.0
OtherShortTermInvestments	57216000000.0	76552000000.0
CashAndCashEquivalents	18315000000.0	34704000000.0
CashEquivalents	6744000000.0	26226000000.0
CashFinancial	11571000000.0	8478000000.0

	2022-06-30	2021-06-30
OrdinarySharesNumber	7464000000.0	7519000000.0
ShareIssued	7464000000.0	7519000000.0
NetDebt	35850000000.0	43922000000.0
TotalDebt	61270000000.0	67775000000.0
TangibleBookValue	87720000000.0	84477000000.0
...
CashCashEquivalentsAndShortTermInvestments	104749000000.0	130256000000.0
OtherShortTermInvestments	90818000000.0	116032000000.0
CashAndCashEquivalents	13931000000.0	14224000000.0
CashEquivalents	5673000000.0	6952000000.0
CashFinancial	8258000000.0	7272000000.0

[73 rows x 4 columns]

The list of functions that are associated to gain data on specific stocks are seemingly endless and should be the only data source that is going to be used for my Capstone Project.

1.1.2 Stock Data

There are thousands of equities to choose from on the stock market, to reduce the overload of data that will be used in training the trading techniques sector ETF's will be used instead.

Exchange Traded Funds (ETF) Electronically Traded Funds or ETF's are an investment equity which has a basket of securities that tracks or seeks to outperform indexes. It takes a smaller proportion of a large number of individual stocks so that the equity is a broader representation of a specific idea. For example if you want to invest in small-cap companies, there are a number of ETF's that can be used to take a smaller investment of a hundred companies rather than one. This looks to spread out investments to reduce risk.

Economic Time Periods The macroeconomic business cycle is the representation of overall economic activity within the economy. During different periods of economic activity the market sectors will react differently. The following are the typical components of the macroeconomic business cycle.

- Trough : This is the low point of the economy where supply is in excess and demand is in shortage. This can turn into a recession which is where there are two consecutive quarters where the GDP growth is negative.
- Expansion : Following a trough, there is a period of economic growth which leads to an increase in consumer and business confidence. This will result in an increase in wage growth and a decrease in unemployment. Expansion periods should be steady and not exponential to ensure prolonged prosperity.
- Peak : A peak occurs when an expansion has reached its limit and there ends up being downward pressure on the growth rate within economic activity. Businesses will then reevaluate their decision making to review budgets and other outlooks.

- Contraction : This is when growth slows, unemployment increases and business investment falls.

```
[ ]: # create time periods for where this takes place
economic_cycle_periods = {

    "trough": ("2008-01-01", "2009-07-01"),
    "contraction": ("2007-06-01", "2009-06-01"),
    "expansion": ("2016-01-01", "2020-01-01"),
    "recovery": ("2020-10-01", "2024-09-02")
}

economic_cycle_periods_list = ['trough', 'contraction', 'expansion', 'recovery']
```

GICS Sectors According to Global Industry Classification Standard there are 11 major sectors at play within the economy. Each with their own industries and sub-industries but this capstone project there will be a concentration on the sectors.

For the capstone project a concentration on ETF's that represent the sectors will be used to help understand how different sectors will perform. The following ETF equities are going to be invested in based on their sector. More information about the equities can be found in the report.

- Materials : XLB
- Industrials : XLI
- Financials : XLF
- Information Technology : XLK
- Consumer Discretionary : XLY
- Consumer Staples : XLP
- Energy : XLE
- Healthcare : XLV
- Communication Services : VOX
- Utilities : XLU
- Real Estate : IYR

```
[ ]: # create etf tickers for sectors
sector_etf_tickers = [
    'XLB', # materials sector
    'XLI', # industrials sector
    'XLF', # financials
    'XLK', # information technology
    'XLY', # consumer discretionary
    'XLP', # consumer staples
    'XLE', # energy
    'XLV', # healthcare
    'VOX', # communication services
    'XLU', # utilities
    'IYR' # real estate
]
```

1.1.3 Nested Dictionary Storage of Relevant Data

Using the YFinance API load in candlestick data with the 11 industry sectors during the four different economic time periods. This can be used to evaluate sector etfs during different economic time periods using the daily adjusted closed price.

```
[ ]: # save nested dictionary data as a variable to be accessed.
sector_etf_data = 
    download_stock_data_for_periods(sector_etf_tickers, economic_cycle_periods)
```

[illegible]

```

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

```

```

[ ]: # the nested dictionary is now saved as follows
sector_etf_data

```

```

[ ]: {'trough': {'XLB':
Close      Volume      Open      High      Low      Close  Adj
Date
2008-01-02  41.700001  41.950001  40.980000  41.299999  28.801882  9539300
2008-01-03  41.520000  42.169998  41.450001  42.049999  29.324926  8798200
2008-01-04  41.570000  41.570000  40.700001  40.779999  28.439266  14375000
2008-01-07  40.810001  41.060001  39.669998  40.220001  28.048723  19606300
2008-01-08  40.400002  41.070000  39.470001  39.599998  27.616341  22922900
...
2009-06-24  25.480000  25.920000  25.180000  25.320000  18.324320  11639400
2009-06-25  25.290001  25.910000  25.000000  25.860001  18.715120  10998600
2009-06-26  25.870001  26.030001  25.670000  25.820000  18.686171  6945300
2009-06-29  26.010000  26.240000  25.700001  26.049999  18.852625  5011400
2009-06-30  26.129999  26.280001  25.639999  25.799999  18.671705  7835600

[377 rows x 6 columns],
'XLI':
Open      High      Low      Close  Adj  Close
Volume
Date
2008-01-02  39.049999  39.209999  38.220001  38.509998  27.678576  7781500
2008-01-03  38.759998  38.810001  38.490002  38.540001  27.700127  5334700
2008-01-04  38.139999  38.310001  37.549999  37.750000  27.132332  12500300
2008-01-07  37.730000  37.900002  37.040001  37.279999  26.794527  8542800
2008-01-08  37.450001  37.540001  36.259998  36.450001  26.197973  10547800
...
2009-06-24  21.480000  21.900000  21.290001  21.400000  16.016407  13853900
2009-06-25  21.320000  22.110001  21.320000  22.059999  16.510370  18079300
2009-06-26  22.070000  22.200001  21.910000  21.969999  16.443008  11819300
2009-06-29  22.150000  22.350000  21.950001  22.190001  16.607672  6238800
2009-06-30  22.190001  22.290001  21.770000  21.959999  16.435528  8985100

[377 rows x 6 columns],
'XLF':
Open      High      Low      Close  Adj  Close
Volume
Date
2008-01-02  23.623072  23.696182  23.013809  23.038179  16.648191  80446096
2008-01-03  23.135662  23.257515  22.875711  22.891958  16.542524  55290488
2008-01-04  22.672625  22.688871  22.201462  22.242081  16.072908  93318540

```


2008-01-07	22.404549	22.607635	21.990252	22.298944	16.114000	112017799
2008-01-08	22.453291	22.599512	21.486595	21.486595	15.526956	148535168
...
2009-06-24	9.447604	9.585703	9.358245	9.431357	7.210425	133115662
2009-06-25	9.398863	9.634444	9.341998	9.634444	7.365690	156577784
2009-06-26	9.585703	9.723802	9.536962	9.683184	7.402948	90023153
2009-06-29	9.707555	9.829407	9.601950	9.805037	7.496109	137113950
2009-06-30	9.813160	9.837530	9.634444	9.707555	7.421581	124690329

[377 rows x 6 columns],
'XLK':

	Open	High	Low	Close	Adj	Close
Volume						
Date						
2008-01-02	26.650000	26.719999	25.969999	26.120001	20.682898	7460600
2008-01-03	26.290001	26.290001	25.940001	26.160000	20.714575	2011000
2008-01-04	25.709999	25.750000	25.000000	25.139999	19.906893	3892000
2008-01-07	24.959999	25.180000	24.650000	24.920000	19.732698	5599200
2008-01-08	25.030001	25.250000	24.200001	24.260000	19.210072	5294900
...
2009-06-24	17.840000	18.070000	17.790001	17.930000	14.505182	6681700
2009-06-25	17.840000	18.250000	17.750000	18.190001	14.715516	8693300
2009-06-26	18.129999	18.250000	18.080000	18.160000	14.691250	8954700
2009-06-29	18.200001	18.410000	18.170000	18.350000	14.844964	5331500
2009-06-30	18.389999	18.430000	18.080000	18.209999	14.731691	7748800

[377 rows x 6 columns],
'XLY':

	Open	High	Low	Close	Adj	Close
Volume						
Date						
2008-01-02	32.990002	32.990002	32.110001	32.200001	25.905016	3901000
2008-01-03	32.099998	32.220001	31.680000	31.840000	25.615396	9587000
2008-01-04	31.580000	31.580000	30.730000	30.840000	24.810888	5985100
2008-01-07	31.139999	31.180000	30.680000	30.950001	24.899384	6121900
2008-01-08	31.030001	31.309999	30.290001	30.350000	24.416685	4300200
...
2009-06-24	22.500000	22.790001	22.290001	22.340000	18.439779	8931800
2009-06-25	22.230000	23.170000	22.230000	23.120001	19.083605	9044600
2009-06-26	22.980000	23.160000	22.879999	22.959999	18.951534	4967300
2009-06-29	23.020000	23.360001	22.879999	23.250000	19.190908	5258300
2009-06-30	23.209999	23.450001	22.920000	23.080000	19.050583	6532900

[377 rows x 6 columns],
'XLP':

	Open	High	Low	Close	Adj	Close
Volume						
Date						
2008-01-02	28.530001	28.719999	28.260000	28.389999	18.187733	10122700
2008-01-03	28.400000	28.500000	28.200001	28.240000	18.091639	4379600

2008-01-04	28.010000	28.340000	28.010000	28.120001	18.014759	4172500
2008-01-07	28.100000	28.549999	28.100000	28.450001	18.226171	3826400
2008-01-08	28.629999	28.860001	28.240000	28.240000	18.091639	5549600
...
2009-06-24	22.830000	22.879999	22.639999	22.719999	15.126421	6364800
2009-06-25	22.700001	23.160000	22.639999	23.110001	15.386085	6931400
2009-06-26	23.219999	23.219999	22.910000	23.030001	15.332822	3293400
2009-06-29	23.139999	23.250000	23.020000	23.170000	15.426033	2135000
2009-06-30	23.129999	23.520000	22.900000	22.990000	15.306184	3496300

[377 rows x 6 columns],

'XLE':		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	79.949997	80.300003	79.269997	79.500000	47.723316	19295700
2008-01-03	80.070000	80.750000	79.849998	80.440002	48.287590	14605400
2008-01-04	79.690002	79.739998	77.500000	77.500000	46.522724	26878000
2008-01-07	78.000000	78.610001	76.230003	77.199997	46.342636	32408800
2008-01-08	77.879997	78.190002	75.849998	75.849998	45.532242	22607900
...
2009-06-24	47.369999	48.040001	46.910000	47.220001	29.038153	18022300
2009-06-25	47.080002	48.430000	47.000000	48.209999	29.646948	26715500
2009-06-26	48.060001	48.240002	47.680000	47.889999	29.450169	12310000
2009-06-29	48.200001	48.799999	48.070000	48.340000	29.726913	13812200
2009-06-30	48.340000	48.910000	47.270000	48.049999	29.548561	22869700

[377 rows x 6 columns],

'XLV':		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	35.630001	35.630001	34.709999	34.939999	26.220284	6611300
2008-01-03	35.279999	35.299999	35.029999	35.150002	26.377874	2544400
2008-01-04	34.889999	35.160000	34.759998	34.790001	26.107716	3270600
2008-01-07	34.820000	35.580002	34.820000	35.480000	26.625526	5457900
2008-01-08	35.660000	36.389999	35.570000	35.770000	26.843153	6231200
...
2009-06-24	25.709999	25.809999	25.490000	25.660000	19.861151	4161500
2009-06-25	25.730000	26.520000	25.570000	26.370001	20.410692	8134500
2009-06-26	26.400000	26.480000	26.100000	26.370001	20.410692	4967700
2009-06-29	26.320000	26.559999	26.090000	26.530001	20.534536	4266200
2009-06-30	26.469999	26.549999	26.110001	26.309999	20.364260	5414000

[377 rows x 6 columns],

'VOX':		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	74.989998	75.699997	73.820000	74.260002	51.236706	33700

2008-01-03	74.099998	74.540001	73.669998	74.059998	51.098713	24900
2008-01-04	73.540001	73.550003	72.129997	72.279999	49.870571	32700
2008-01-07	72.440002	73.360001	72.070000	73.059998	50.408733	99500
2008-01-08	73.500000	74.470001	69.809998	70.489998	48.635532	110100
...
2009-06-24	49.389999	49.709999	48.980000	49.070000	34.930641	24900
2009-06-25	49.220001	50.279999	48.930000	50.200001	35.735020	160400
2009-06-26	50.139999	50.400002	49.830002	49.930000	35.542824	77800
2009-06-29	50.330002	50.599998	49.900002	50.369999	35.856041	17300
2009-06-30	50.889999	50.889999	49.400002	49.720001	35.393337	28700

[377 rows x 6 columns],

'XLU':		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	42.150002	42.740002	41.900002	42.090000	23.351946	4998900
2008-01-03	41.970001	42.580002	41.970001	42.029999	23.318657	5143600
2008-01-04	42.099998	42.619999	41.860001	42.349998	23.496201	7023300
2008-01-07	42.599998	43.349998	42.400002	43.230000	23.984432	9154500
2008-01-08	43.279999	44.110001	43.240002	43.240002	23.989986	9603900
...
2009-06-24	27.290001	27.559999	27.170000	27.379999	16.102037	5630600
2009-06-25	27.600000	27.950001	27.129999	27.840000	16.372566	8727600
2009-06-26	27.830000	27.990000	27.580000	27.740000	16.313751	3339400
2009-06-29	27.900000	28.129999	27.680000	28.100000	16.525473	4483100
2009-06-30	28.370001	28.370001	27.570000	27.889999	16.401966	6621600

[377 rows x 6 columns],

'IYR':		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	65.730003	66.550003	64.809998	65.150002	35.358303	7140100
2008-01-03	65.650002	65.900002	63.040001	63.040001	34.213154	7858800
2008-01-04	62.320000	63.000000	61.009998	61.040001	33.127716	11329300
2008-01-07	61.759998	62.070000	60.060001	61.610001	33.437069	8651900
2008-01-08	61.900002	63.360001	59.209999	59.369999	32.221363	10957900
...
2009-06-24	31.299999	31.700001	31.049999	31.350000	18.738132	22650300
2009-06-25	31.240000	31.860001	30.870001	31.850000	19.036987	23072800
2009-06-26	31.700001	32.410000	31.549999	32.130001	19.204338	17176800
2009-06-29	32.290001	32.400002	31.670000	32.209999	19.252157	13423100
2009-06-30	32.299999	32.650002	32.080002	32.419998	19.377678	18188400

[377 rows x 6 columns]],

'contraction': {'XLB':		Open	High	Low	Close
Adj Close	Volume				
Date					

2007-06-01	41.000000	41.470001	41.000000	41.470001	28.389374	2217500
2007-06-04	41.259998	41.259998	41.029999	41.220001	28.218218	1995700
2007-06-05	41.160000	41.209999	40.860001	41.080002	28.122383	4230200
2007-06-06	40.939999	40.950001	40.410000	40.549999	27.759558	5365600
2007-06-07	40.349998	40.580002	39.459999	39.639999	27.136597	8333500

...
2009-05-22	26.530001	26.660000	26.110001	26.299999	18.932846	8421500
2009-05-26	26.170000	26.969999	25.830000	26.930000	19.386375	7886900
2009-05-27	26.790001	26.850000	25.860001	25.920000	18.659290	7216600
2009-05-28	26.190001	26.440001	25.760000	26.379999	18.990433	8773400
2009-05-29	26.670000	27.200001	26.500000	27.170000	19.559147	7792200

[503 rows x 6 columns],
'XLI':

		Open	High	Low	Close	Adj Close
--	--	------	------	-----	-------	-----------

Volume
Date

2007-06-01	39.380001	39.430000	39.090000	39.279999	27.884405	5356800
2007-06-04	39.029999	39.360001	39.029999	39.290001	27.891483	5474900
2007-06-05	39.250000	39.400002	39.009998	39.169998	27.806297	4470400
2007-06-06	38.959999	39.009998	38.630001	38.750000	27.508146	6151500
2007-06-07	38.480000	38.790001	38.060001	38.119999	27.060917	5776000
...
2009-05-22	21.750000	21.990000	21.570000	21.690001	16.125708	8858200
2009-05-26	21.840000	22.510000	21.510000	22.480000	16.713055	16082300
2009-05-27	22.480000	22.580000	21.750000	21.750000	16.170321	10835700
2009-05-28	21.950001	22.090000	21.469999	21.959999	16.326450	10851400
2009-05-29	22.160000	22.520000	21.930000	22.490000	16.720484	10999600

[503 rows x 6 columns],
'XLF':

		Open	High	Low	Close	Adj Close
--	--	------	------	-----	-------	-----------

Volume
Date

2007-06-01	30.836718	30.942324	30.771730	30.885460	21.835596	8891390
2007-06-04	30.787977	30.844843	30.747360	30.844843	21.806883	12312831
2007-06-05	30.617384	30.771730	30.576767	30.658003	21.674791	17915974
2007-06-06	30.544273	30.544273	30.324940	30.398050	21.491003	18752069
2007-06-07	30.284323	30.430544	29.805037	29.886271	21.129183	31728533
...
2009-05-22	9.626320	9.650690	9.431357	9.471974	7.204324	118089215
2009-05-26	9.358245	9.821284	9.350122	9.780666	7.439115	185271163
2009-05-27	9.870024	9.902518	9.455727	9.488221	7.216683	211276284
2009-05-28	9.561332	9.788790	9.398863	9.756296	7.420579	228614303
2009-05-29	9.837530	10.032494	9.650690	9.935012	7.556507	231964224

[503 rows x 6 columns],
'XLK':

		Open	High	Low	Close	Adj Close
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Volume

Date						
2007-06-01	25.770000	25.830000	25.590000	25.650000	20.163029	2067900
2007-06-04	25.570000	25.750000	25.559999	25.740000	20.233774	1417600
2007-06-05	25.610001	25.690001	25.490000	25.650000	20.163029	1376100
2007-06-06	25.540001	25.570000	25.350000	25.350000	19.927210	2049000
2007-06-07	25.309999	25.459999	24.930000	24.990000	19.644209	2473800
...
2009-05-22	16.950001	17.040001	16.700001	16.940001	13.642550	5434700
2009-05-26	16.760000	17.420000	16.700001	17.379999	13.996901	5743400
2009-05-27	17.389999	17.600000	17.200001	17.209999	13.859990	7714900
2009-05-28	17.420000	17.540001	17.110001	17.459999	14.061324	6177900
2009-05-29	17.510000	17.680000	17.340000	17.650000	14.214336	5396800

[503 rows x 6 columns],
'XLY':

		Open	High	Low	Close	Adj	Close
Volume							
Date							
2007-06-01	40.259998	40.389999	40.169998	40.330002	32.095371		1755500
2007-06-04	40.220001	40.430000	40.130001	40.410000	32.159027		1364100
2007-06-05	40.220001	40.270000	39.959999	40.169998	31.968033		1950700
2007-06-06	39.910000	39.939999	39.660000	39.660000	31.562164		2859400
2007-06-07	39.650002	39.669998	38.919998	38.919998	30.973259		3534800
...
2009-05-22	22.540001	22.740000	22.150000	22.580000	18.558603		7362500
2009-05-26	22.389999	23.410000	22.110001	23.340000	19.183247		11048600
2009-05-27	23.250000	23.480000	22.730000	22.830000	18.764074		7775100
2009-05-28	23.090000	23.139999	22.350000	22.740000	18.690109		5382100
2009-05-29	22.900000	23.180000	22.600000	23.120001	19.002432		4351000

[503 rows x 6 columns],
'XLP':

		Open	High	Low	Close	Adj	Close
Volume							
Date							
2007-06-01	27.809999	28.030001	27.790001	27.900000	17.575796		1677500
2007-06-04	27.910000	28.020000	27.879999	28.000000	17.638798		511100
2007-06-05	27.870001	27.920000	27.770000	27.830000	17.531698		1942000
2007-06-06	27.670000	27.780001	27.610001	27.650000	17.418308		2511600
2007-06-07	27.450001	27.680000	27.299999	27.299999	17.197824		2088500
...
2009-05-22	22.760000	23.129999	22.760000	22.930000	15.150269		6040400
2009-05-26	22.920000	23.250000	22.780001	23.219999	15.341878		5478700
2009-05-27	23.200001	23.260000	22.629999	22.629999	14.952058		6976400
2009-05-28	22.760000	23.000000	22.570000	22.870001	15.110626		7246000
2009-05-29	22.930000	23.180000	22.840000	23.120001	15.275811		6894700

[503 rows x 6 columns],
'XLE':

		Open	High	Low	Close	Adj	Close
--	--	------	------	-----	-------	-----	-------

Volume

Date						
2007-06-01	68.639999	69.180000	68.610001	68.919998	41.038502	11914900
2007-06-04	68.730003	70.070000	68.639999	70.000000	41.681595	17668000
2007-06-05	69.589996	69.959999	69.209999	69.750000	41.532734	15326000
2007-06-06	69.510002	69.510002	68.500000	68.860001	41.002773	18985400
2007-06-07	68.739998	69.250000	67.410004	67.639999	40.276329	20154300
...
2009-05-22	48.900002	49.459999	48.500000	48.610001	29.740952	13646000
2009-05-26	48.290001	49.779999	47.650002	49.639999	30.371141	26906900
2009-05-27	49.849998	50.500000	49.029999	49.099998	30.040764	20871300
2009-05-28	49.540001	51.209999	49.060001	50.730000	31.038021	25906900
2009-05-29	51.540001	51.889999	50.970001	51.680000	31.619272	22238700

[503 rows x 6 columns],

'XLV':

	Open	High	Low	Close	Adj	Close
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Volume

Date						
2007-06-01	36.740002	36.820000	36.639999	36.770000	27.250864	3572300
2007-06-04	36.599998	36.770000	36.599998	36.700001	27.198992	1749200
2007-06-05	36.590000	36.650002	36.430000	36.610001	27.132292	1685300
2007-06-06	36.540001	36.540001	36.200001	36.270000	26.880325	3136400
2007-06-07	35.939999	36.200001	35.650002	35.730000	26.480118	3280800
...
2009-05-22	25.280001	25.400000	25.070000	25.290001	19.476891	3655700
2009-05-26	25.190001	25.660000	24.889999	25.520000	19.654013	4412900
2009-05-27	25.549999	25.600000	25.219999	25.260000	19.453781	4591100
2009-05-28	25.209999	25.590000	25.139999	25.389999	19.553902	5720000
2009-05-29	25.360001	25.840000	25.290001	25.830000	19.892771	6549200

[503 rows x 6 columns],

'VOX':

	Open	High	Low	Close	Adj	Close
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Volume

Date						
2007-06-01	84.720001	84.849998	84.139999	84.339996	56.687824	1029100
2007-06-04	84.379997	84.620003	84.139999	84.519997	56.808804	129000
2007-06-05	84.199997	84.300003	83.699997	84.019997	56.472736	37000
2007-06-06	83.300003	83.680000	83.220001	83.489998	56.116512	21100
2007-06-07	83.099998	83.250000	81.550003	81.839996	55.007481	39400
...
2009-05-22	46.830002	46.889999	46.360001	46.580002	33.158119	37500
2009-05-26	46.299999	48.360001	46.299999	48.250000	34.346924	32200
2009-05-27	48.250000	48.680000	47.759998	47.770000	34.005230	36200
2009-05-28	48.090000	48.560001	47.189999	48.380001	34.439457	29800
2009-05-29	48.619999	48.660000	47.869999	48.660000	34.638783	40800

[503 rows x 6 columns],

'XLU':		Open	High	Low	Close	Adj Close
Volume						
Date						
2007-06-01	41.900002	42.009998	41.470001	41.610001	22.594271	11632900
2007-06-04	41.430000	41.580002	41.110001	41.450001	22.507397	10742400
2007-06-05	41.200001	41.410000	40.700001	40.900002	22.208748	15758800
2007-06-06	40.619999	40.700001	40.119999	40.250000	21.855797	15417800
2007-06-07	40.099998	40.150002	38.950001	39.000000	21.177046	27352100
...
2009-05-22	25.559999	26.059999	25.559999	25.830000	15.019256	4892500
2009-05-26	25.660000	26.580000	25.580000	26.580000	15.455349	7123400
2009-05-27	26.629999	26.629999	25.980000	26.040001	15.141353	5936900
2009-05-28	26.080000	26.709999	26.080000	26.580000	15.455349	6475000
2009-05-29	26.629999	26.860001	26.350000	26.770000	15.565829	5180300

[503 rows x 6 columns],

'IYR':		Open	High	Low	Close	Adj Close
Volume						
Date						
2007-06-01	85.660004	86.169998	85.120003	85.580002	45.077591	3208400
2007-06-04	85.239998	86.500000	85.000000	86.120003	45.362007	3440100
2007-06-05	86.050003	86.050003	84.550003	84.629997	44.577202	8411300
2007-06-06	84.099998	84.730003	83.650002	84.099998	44.298035	7537000
2007-06-07	83.260002	83.690002	81.480003	81.500000	42.928543	10550600
...
2009-05-22	32.480000	32.880001	31.590000	31.709999	18.670607	24961700
2009-05-26	31.400000	33.639999	31.250000	33.349998	19.636229	42247200
2009-05-27	33.529999	33.529999	31.950001	32.240002	18.982674	36683800
2009-05-28	32.619999	33.049999	31.730000	32.849998	19.341833	31800800
2009-05-29	33.099998	33.770000	32.490002	33.750000	19.871740	28518600

[503 rows x 6 columns]},

'expansion': {'XLB':		Open	High	Low	Close	
Adj Close	Volume					
Date						
2016-01-04	42.720001	42.860001	42.259998	42.740002	36.036125	14430200
2016-01-05	42.919998	42.919998	42.400002	42.720001	36.019241	9499000
2016-01-06	42.139999	42.180000	41.369999	41.599998	35.074932	9307400
2016-01-07	40.840000	41.250000	40.250000	40.470001	34.122169	12579700
2016-01-08	40.860001	40.900002	39.950001	40.060001	33.776482	8700200
...
2019-12-24	61.080002	61.259998	60.980000	61.119999	55.754547	1450700
2019-12-26	61.250000	61.389999	61.040001	61.389999	56.000851	2802400
2019-12-27	61.610001	61.610001	61.130001	61.160000	55.791039	6802700
2019-12-30	61.290001	61.299999	60.900002	60.970001	55.617729	3007700
2019-12-31	60.959999	61.480000	60.869999	61.419998	56.028221	2695000

```

[1006 rows x 6 columns],
'XLI':
Open      High      Low      Close  Adj Close
Volume
Date
2016-01-04  52.110001  52.320000  51.709999  52.299999  44.768238  16404600
2016-01-05  52.430000  52.529999  51.970001  52.439999  44.888077   8726300
2016-01-06  51.720001  52.060001  51.310001  51.630001  44.194733   9980000
2016-01-07  50.799999  51.099998  50.090000  50.230000  42.996342  17225600
2016-01-08  50.709999  50.709999  49.650002  49.720001  42.559780  17198600
...
2019-12-24  82.089996  82.199997  81.690002  81.779999  75.889603   4451600
2019-12-26  81.959999  81.980003  81.580002  81.970001  76.065933   3914200
2019-12-27  82.230003  82.230003  81.790001  81.900002  76.000961   5300700
2019-12-30  81.989998  81.989998  81.360001  81.519997  75.648354   7716400
2019-12-31  81.320000  81.690002  81.180000  81.470001  75.601936   6458200

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[1006 rows x 6 columns],
'XLF':
Open      High      Low      Close  Adj Close
Volume
Date
2016-01-04  18.960196  19.000813  18.765232  18.984566  16.104383  93387476
2016-01-05  19.017059  19.114540  18.887083  19.057676  16.166397  52096536
2016-01-06  18.781479  18.878960  18.667749  18.765232  15.918324  77248574
2016-01-07  18.375305  18.545898  18.164095  18.237206  15.470403  92006910
2016-01-08  18.399675  18.415922  17.912266  17.952885  15.229222  83028242
...
2019-12-24  30.670000  30.690001  30.600000  30.680000  28.029102  12315900
2019-12-26  30.709999  30.850000  30.709999  30.850000  28.184412  15891300
2019-12-27  30.900000  30.910000  30.750000  30.770000  28.111328  19417400
2019-12-30  30.910000  30.959999  30.650000  30.680000  28.029102  18819300
2019-12-31  30.660000  30.790001  30.620001  30.780001  28.120461  15788100

```

```

[1006 rows x 6 columns],
'XLK':
Open      High      Low      Close  Adj Close
Volume
Date
2016-01-04  42.060001  42.279999  41.610001  42.270000  38.133724  21638600
2016-01-05  42.400002  42.500000  41.970001  42.160000  38.034481  16067200
2016-01-06  41.540001  41.919998  41.389999  41.639999  37.565376  13858400
2016-01-07  40.790001  41.320000  40.389999  40.410000  36.455738  16840700
2016-01-08  40.759998  40.900002  40.040001  40.090000  36.167042  19233100
...
2019-12-24  91.370003  91.370003  91.029999  91.239998  87.496086   2445400
2019-12-26  91.430000  91.940002  91.370003  91.919998  88.148193   4134600
2019-12-27  92.290001  92.290001  91.680000  91.910004  88.138603   9666100
2019-12-30  91.889999  91.900002  90.680000  91.379997  87.630363   8245600
2019-12-31  91.070000  91.769997  90.949997  91.669998  87.908463   5800900

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[1006 rows x 6 columns],
'XLY':
\
      Open      High      Low      Close      Adj Close
Date
2016-01-04    76.779999    76.930000    75.980003    76.820000    69.853943
2016-01-05    76.889999    77.150002    76.169998    76.720001    69.763008
2016-01-06    75.599998    76.370003    75.360001    75.970001    69.081001
2016-01-07    74.459999    75.709999    74.239998    74.410004    67.662468
2016-01-08    75.010002    75.339996    73.440002    73.610001    66.935013
...
2019-12-24    124.430000    124.690002    124.260002    124.540001    119.797127
2019-12-26    124.910004    126.059998    124.779999    126.059998    121.259232
2019-12-27    126.470001    126.730003    125.889999    126.050003    121.249626
2019-12-30    126.160004    126.300003    124.970001    125.239998    120.470467
2019-12-31    125.029999    125.480003    124.849998    125.419998    120.643616

      Volume
Date
2016-01-04    13400400
2016-01-05     7424900
2016-01-06    10115400
2016-01-07    12645200
2016-01-08    10797700
...
2019-12-24     1648100
2019-12-26     2517900
2019-12-27     2958700
2019-12-30     3338700
2019-12-31     1783700

[1006 rows x 6 columns],
'XLP':
Volume
      Open      High      Low      Close      Adj Close
Date
2016-01-04    49.830002    49.849998    49.349998    49.849998    39.717815    17281200
2016-01-05    49.970001    50.290001    49.840000    50.169998    39.972763     8630500
2016-01-06    49.669998    50.200001    49.639999    50.000000    39.837318    12429100
2016-01-07    49.439999    49.930000    49.220001    49.400002    39.359283    16031500
2016-01-08    49.720001    49.720001    48.919998    49.020000    39.056496    14691000
...
2019-12-24    62.900002    62.990002    62.810001    62.910000    55.833920     1700100
2019-12-26    62.980000    63.090000    62.799999    62.970001    55.887169     8638600
2019-12-27    63.099998    63.270000    63.040001    63.250000    56.135674    10314100
2019-12-30    63.139999    63.240002    62.830002    62.919998    55.842789     6238600
2019-12-31    62.790001    63.020000    62.660000    62.980000    55.896034     4985400

```

```

[1006 rows x 6 columns],
'XLE':
Open      High      Low      Close  Adj Close
Volume
Date
2016-01-04  60.160000  60.779999  59.299999  60.299999  42.208145  21808700
2016-01-05  60.259998  60.599998  59.590000  60.529999  42.369133  15529200
2016-01-06  59.099998  59.220001  57.709999  58.200001  40.738197  26962100
2016-01-07  57.070000  58.380001  56.540001  56.779999  39.744240  28081900
2016-01-08  57.259998  57.389999  55.840000  56.049999  39.233273  19227100
...
2019-12-24  62.130001  62.220001  61.849998  61.959999  49.058323  5037400
2019-12-26  62.230000  62.439999  61.860001  61.939999  49.042484  10156200
2019-12-27  62.169998  62.230000  61.639999  61.680000  48.836620  10718300
2019-12-30  60.119999  60.230000  59.610001  59.700001  48.682507  14629500
2019-12-31  59.400002  60.099998  59.230000  60.040001  48.959759  10722400

```

```

[1006 rows x 6 columns],
'XLV':
Open      High      Low      Close  Adj Close
\
Date
2016-01-04  70.769997  71.000000  70.010002  70.730003  61.440041
2016-01-05  70.930000  71.379997  70.760002  71.070000  61.735352
2016-01-06  70.059998  70.980003  70.000000  70.489998  61.231548
2016-01-07  69.129997  70.010002  68.870003  69.059998  59.989365
2016-01-08  69.470001  69.650002  67.900002  68.019997  59.085968
...
2019-12-24  103.110001  103.239998  102.730003  102.980003  95.267311
2019-12-26  103.110001  103.230003  102.580002  102.910004  95.202538
2019-12-27  103.129997  103.139999  102.709999  102.940002  95.230278
2019-12-30  102.269997  102.489998  101.510002  101.660004  94.658585
2019-12-31  101.440002  101.949997  101.269997  101.860001  94.844803

```

```

Volume
Date
2016-01-04  19666300
2016-01-05  14540000
2016-01-06  14651700
2016-01-07  17850400
2016-01-08  17022800
...
2019-12-24  2071800
2019-12-26  2910100
2019-12-27  3605000
2019-12-30  5665100
2019-12-31  4746700

```

```

[1006 rows x 6 columns],

```

'VOX':		Open	High	Low	Close	Adj	Close
Volume							
Date							
2016-01-04	83.449997	83.449997	82.099998	82.720001	71.763748		67900
2016-01-05	83.000000	83.660004	82.540001	83.599998	72.527176		55900
2016-01-06	82.709999	83.680000	82.709999	83.239998	72.214867		47700
2016-01-07	82.129997	82.550003	81.500000	81.529999	70.731369		39300
2016-01-08	82.400002	82.610001	80.750000	80.889999	70.176109		70300
...		
2019-12-24	94.349998	94.349998	94.139999	94.139999	90.223427		40300
2019-12-26	94.309998	94.879997	94.290001	94.870003	90.923058		38300
2019-12-27	95.129997	95.129997	94.550003	94.690002	90.750542		45500
2019-12-30	94.739998	94.739998	93.669998	93.790001	89.887978		83700
2019-12-31	93.620003	94.029999	93.029999	93.930000	90.022163		60700

[1006 rows x 6 columns],

'XLU':		Open	High	Low	Close	Adj	Close
Volume							
Date							
2016-01-04	43.029999	43.200001	42.669998	43.189999	32.787575		14846700
2016-01-05	43.169998	43.610001	42.560001	43.500000	33.022915		10948000
2016-01-06	43.240002	43.599998	43.070000	43.419998	32.962173		12718800
2016-01-07	42.950001	43.349998	42.869999	43.130001	32.742023		12273700
2016-01-08	43.160000	43.459999	43.029999	43.110001	32.726845		11680800
...		
2019-12-24	64.059998	64.110001	63.740002	64.080002	55.464291		4512800
2019-12-26	64.139999	64.250000	63.919998	64.190002	55.559505		6658500
2019-12-27	64.190002	64.379997	64.070000	64.379997	55.723953		10301700
2019-12-30	64.110001	64.379997	64.029999	64.370003	55.715294		11934300
2019-12-31	64.360001	64.699997	64.279999	64.620003	55.931683		10808400

[1006 rows x 6 columns],

'IYR':		Open	High	Low	Close	Adj	Close
Volume							
Date							
2016-01-04	74.709999	74.709999	73.570000	74.349998	56.998520		14761900
2016-01-05	74.330002	75.779999	74.239998	75.570000	57.933796		11206900
2016-01-06	74.949997	75.440002	74.830002	75.320000	57.742130		11334600
2016-01-07	74.230003	74.639999	73.620003	73.639999	56.454201		11830900
2016-01-08	74.220001	74.320000	72.639999	72.769997	55.787235		10708700
...		
2019-12-24	91.779999	91.910004	91.410004	91.730003	81.376282		2597600
2019-12-26	91.839996	92.220001	91.699997	92.220001	81.810966		3042600
2019-12-27	92.300003	92.629997	92.160004	92.470001	82.032761		4802800
2019-12-30	92.209999	92.739998	92.029999	92.540001	82.094856		6634400
2019-12-31	92.470001	93.180000	92.269997	93.080002	82.573914		6703000

```

[1006 rows x 6 columns]],
'recovery': {'XLB':
Close      Volume      Open      High      Low      Close Adj
Date
2020-10-01  63.939999  64.239998  62.529999  62.740002  58.204086  14577400
2020-10-02  62.029999  63.790001  61.840000  63.299999  58.723595  13926600
2020-10-05  63.810001  64.940002  63.790001  64.510002  59.846119  9320700
2020-10-06  64.830002  65.360001  63.580002  63.700001  59.094677  15679400
2020-10-07  64.510002  65.510002  64.410004  65.339996  60.616112  7138900
...
2024-08-26  93.139999  93.830002  92.989998  93.139999  93.139999  3831500
2024-08-27  93.070000  93.169998  92.550003  93.150002  93.150002  4422700
2024-08-28  92.839996  93.250000  92.410004  92.750000  92.750000  3262000
2024-08-29  93.080002  93.839996  92.489998  93.260002  93.260002  3025600
2024-08-30  93.519997  94.419998  93.070000  94.279999  94.279999  4323700

```

```

[985 rows x 6 columns],
'XLI':
\      Open      High      Low      Close      Adj Close
Date
2020-10-01  77.519997  77.870003  76.209999  76.750000  72.373741
2020-10-02  75.500000  78.059998  75.470001  77.610001  73.184700
2020-10-05  78.269997  79.029999  78.269997  78.860001  74.363426
2020-10-06  79.190002  79.720001  77.820000  77.900002  73.458160
2020-10-07  78.820000  79.860001  78.790001  79.620003  75.080093
...
2024-08-26  129.559998  130.000000  128.869995  129.139999  129.139999
2024-08-27  128.949997  129.289993  128.509995  129.220001  129.220001
2024-08-28  129.279999  129.949997  128.509995  129.160004  129.160004
2024-08-29  129.759995  131.199997  129.100006  130.070007  130.070007
2024-08-30  130.529999  131.589996  129.589996  131.460007  131.460007

```

```

      Volume
Date
2020-10-01  14045400
2020-10-02  17895400
2020-10-05   8880800
2020-10-06  12587300
2020-10-07  10049900
...
2024-08-26   6226600
2024-08-27   4000900
2024-08-28   4336300
2024-08-29   8226000
2024-08-30   8347900

```

```

[985 rows x 6 columns],

```

'XLF':		Open	High	Low	Close	Adj Close
Volume						
Date						
2020-10-01	24.170000	24.330000	23.920000	24.110001	22.478216	65766100
2020-10-02	23.790001	24.440001	23.730000	24.299999	22.655355	63368100
2020-10-05	24.530001	24.780001	24.469999	24.700001	23.028288	58911700
2020-10-06	24.910000	25.080000	24.360001	24.450001	22.795206	88404900
2020-10-07	24.680000	24.980000	24.680000	24.860001	23.177456	53815200
...
2024-08-26	44.580002	44.810001	44.470001	44.570000	44.570000	23716300
2024-08-27	44.660000	44.820000	44.580002	44.799999	44.799999	21583500
2024-08-28	44.680000	45.160000	44.639999	44.910000	44.910000	24726200
2024-08-29	45.060001	45.459999	44.750000	45.310001	45.310001	33726600
2024-08-30	45.439999	45.779999	45.230000	45.740002	45.740002	28967700

[985 rows x 6 columns],

'XLK':		Open	High	Low	Close	Adj Close
Date						
2020-10-01	118.320000	118.480003	117.180000	117.930000	114.247261	
2020-10-02	115.029999	116.940002	114.480003	114.940002	111.350624	
2020-10-05	115.760002	117.529999	115.690002	117.459999	113.791939	
2020-10-06	117.180000	118.290001	115.230003	115.639999	112.028763	
2020-10-07	116.849998	117.989998	116.760002	117.760002	114.082558	
...	
2024-08-26	223.759995	224.600006	220.020004	221.149994	221.149994	
2024-08-27	219.779999	222.960007	218.699997	222.490005	222.490005	
2024-08-28	222.199997	222.630005	217.580002	219.419998	219.419998	
2024-08-29	219.479996	222.570007	216.880005	217.440002	217.440002	
2024-08-30	219.809998	221.179993	217.440002	220.330002	220.330002	

Volume

Date	
2020-10-01	13538200
2020-10-02	18625800
2020-10-05	6135300
2020-10-06	13431100
2020-10-07	6496200
...	...
2024-08-26	3134400
2024-08-27	3828000
2024-08-28	4501100
2024-08-29	6657400
2024-08-30	5024200

[985 rows x 6 columns],

'XLY':		Open	High	Low	Close	Adj Close
--------	--	------	------	-----	-------	-----------

\

Date					
2020-10-01	148.429993	149.029999	147.490005	148.899994	144.567047
2020-10-02	146.119995	148.770004	146.059998	148.270004	143.955383
2020-10-05	149.059998	150.399994	148.929993	150.229996	145.858337
2020-10-06	150.369995	151.050003	147.210007	147.449997	143.159256
2020-10-07	149.240005	151.179993	149.240005	150.820007	146.431152
...
2024-08-26	187.690002	188.089996	185.830002	186.410004	186.410004
2024-08-27	185.949997	186.190002	184.660004	185.919998	185.919998
2024-08-28	185.809998	186.270004	182.649994	184.119995	184.119995
2024-08-29	185.740005	186.529999	184.169998	184.339996	184.339996
2024-08-30	185.020004	187.289993	184.279999	187.119995	187.119995

	Volume
Date	
2020-10-01	3879400
2020-10-02	4090800
2020-10-05	2320400
2020-10-06	3977200
2020-10-07	2502900
...	...
2024-08-26	1605500
2024-08-27	1664100
2024-08-28	2834300
2024-08-29	2308000
2024-08-30	2336100

[985 rows x 6 columns],						
'XLP':						
	Open	High	Low	Close	Adj	Close
Volume						
Date						
2020-10-01	64.470001	64.610001	63.910000	64.459999	58.330856	9262900
2020-10-02	63.820000	64.389999	63.610001	64.099998	58.005089	7463000
2020-10-05	64.250000	64.610001	64.150002	64.529999	58.394203	4501200
2020-10-06	64.680000	64.930000	63.919998	64.110001	58.014145	6552800
2020-10-07	64.480003	65.070000	64.349998	64.800003	58.638538	8073100
...
2024-08-26	81.930000	82.589996	81.919998	82.419998	82.419998	7270700
2024-08-27	82.540001	82.769997	82.309998	82.620003	82.620003	5674600
2024-08-28	82.639999	82.750000	81.959999	82.269997	82.269997	6666800
2024-08-29	82.169998	82.169998	81.690002	81.860001	81.860001	6343700
2024-08-30	82.019997	82.580002	81.800003	82.510002	82.510002	8884800

[985 rows x 6 columns],						
'XLE':						
	Open	High	Low	Close	Adj	Close
Volume						

Date						
2020-10-01	29.620001	29.750000	28.850000	29.030001	24.915934	28365200
2020-10-02	28.250000	29.559999	28.200001	29.309999	25.156250	28705200
2020-10-05	29.570000	30.209999	29.500000	30.190001	25.911543	31572200
2020-10-06	30.629999	30.799999	29.660000	29.740000	25.525314	31111600
2020-10-07	29.910000	30.240000	29.570000	30.160000	25.885792	21043000
...
2024-08-26	91.389999	92.000000	90.529999	91.199997	91.199997	9757400
2024-08-27	91.199997	91.449997	90.190002	90.349998	90.349998	8313600
2024-08-28	89.800003	90.330002	89.370003	89.769997	89.769997	8524500
2024-08-29	90.300003	91.279999	89.449997	90.940002	90.940002	11249400
2024-08-30	90.019997	91.309998	89.809998	91.279999	91.279999	14042500

[985 rows x 6 columns],

'XLV': Open High Low Close Adj Close

Date					
2020-10-01	105.970001	106.400002	104.669998	105.120003	99.164734
2020-10-02	104.120003	105.209999	103.709999	104.160004	98.259125
2020-10-05	104.910004	106.410004	104.879997	106.300003	100.277885
2020-10-06	106.599998	106.660004	104.790001	104.889999	98.947769
2020-10-07	105.629997	107.199997	105.610001	106.870003	100.815590
...
2024-08-26	155.600006	156.080002	155.220001	155.369995	155.369995
2024-08-27	155.520004	156.039993	155.059998	155.610001	155.610001
2024-08-28	155.509995	156.440002	155.059998	155.789993	155.789993
2024-08-29	156.410004	156.830002	155.460007	156.119995	156.119995
2024-08-30	156.229996	157.279999	155.550003	157.199997	157.199997

Volume

Date	
2020-10-01	9113200
2020-10-02	8628700
2020-10-05	6661200
2020-10-06	7747200
2020-10-07	7873100
...	...
2024-08-26	4433600
2024-08-27	3785400
2024-08-28	5150100
2024-08-29	4339200
2024-08-30	7020600

[985 rows x 6 columns],

'VOX': Open High Low Close Adj Close

Volume

Date

```

2020-10-01 102.690002 103.650002 102.690002 103.559998 99.959473 95400
2020-10-02 101.559998 102.949997 101.449997 101.809998 98.270317 172300
2020-10-05 102.339996 103.459999 102.110001 103.410004 99.814690 123400
2020-10-06 103.209999 103.650002 101.400002 101.589996 98.057945 185600
2020-10-07 102.339996 102.650002 101.510002 102.430000 98.868767 94800
...
2024-08-26 140.160004 140.500000 139.320007 139.779999 139.779999 110200
2024-08-27 139.380005 140.199997 139.100006 139.360001 139.360001 49100
2024-08-28 139.419998 139.419998 137.800003 138.529999 138.529999 79100
2024-08-29 139.070007 139.979996 137.970001 138.139999 138.139999 98600
2024-08-30 138.910004 139.309998 137.830002 139.160004 139.160004 58500

[985 rows x 6 columns],
'XLU':
Open High Low Close Adj Close
Volume
Date
2020-10-01 59.529999 60.130001 59.410000 59.980000 53.327789 13071000
2020-10-02 59.500000 61.000000 59.369999 60.689999 53.959038 16945000
2020-10-05 60.849998 61.619999 60.439999 61.450001 54.634750 11038400
2020-10-06 61.490002 62.669998 61.220001 61.970001 55.097080 16388400
2020-10-07 62.290001 62.610001 61.889999 62.349998 55.434933 12201800
...
2024-08-26 75.680000 76.220001 75.669998 75.910004 75.910004 6668200
2024-08-27 75.750000 76.019997 75.279999 75.309998 75.309998 8333400
2024-08-28 75.540001 75.959999 75.250000 75.309998 75.309998 5241400
2024-08-29 75.559998 75.790001 74.820000 75.720001 75.720001 6379100
2024-08-30 75.860001 76.400002 75.580002 76.290001 76.290001 8503700

[985 rows x 6 columns],
'IYR':
Open High Low Close Adj Close
Volume
Date
2020-10-01 80.120003 81.449997 79.809998 81.379997 73.820297 18707600
2020-10-02 80.260002 82.940002 79.900002 82.680000 74.999535 18898100
2020-10-05 82.900002 83.419998 81.639999 83.139999 75.416809 12648700
2020-10-06 83.330002 83.769997 82.290001 82.620003 74.945114 20491400
2020-10-07 83.120003 83.160004 82.330002 82.709999 75.026756 3424200
...
2024-08-26 99.529999 99.699997 98.849998 98.989998 98.989998 3571700
2024-08-27 98.250000 99.279999 98.199997 99.209999 99.209999 3713000
2024-08-28 99.209999 99.480003 98.309998 98.860001 98.860001 2873900
2024-08-29 98.750000 98.910004 98.080002 98.529999 98.529999 5013900
2024-08-30 99.010002 99.529999 98.250000 99.529999 99.529999 4101900

[985 rows x 6 columns]]}

```

The layout of the nested dictionary means that for any macroeconomic business cycle the candlestick data for any of the 11 sector ETF's as listed above can be accessed.

The following is an example of how you can access different data within the nested dictionary.

```
[ ]: # access healthcare sector during an expansion
      # first load in the trough data
      trough_sector_data = sector_etf_data['trough']
      trough_sector_data
```

```
[ ]: {'XLB':
```

		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	41.700001	41.950001	40.980000	41.299999	28.801882	9539300
2008-01-03	41.520000	42.169998	41.450001	42.049999	29.324926	8798200
2008-01-04	41.570000	41.570000	40.700001	40.779999	28.439266	14375000
2008-01-07	40.810001	41.060001	39.669998	40.220001	28.048723	19606300
2008-01-08	40.400002	41.070000	39.470001	39.599998	27.616341	22922900
...
2009-06-24	25.480000	25.920000	25.180000	25.320000	18.324320	11639400
2009-06-25	25.290001	25.910000	25.000000	25.860001	18.715120	10998600
2009-06-26	25.870001	26.030001	25.670000	25.820000	18.686171	6945300
2009-06-29	26.010000	26.240000	25.700001	26.049999	18.852625	5011400
2009-06-30	26.129999	26.280001	25.639999	25.799999	18.671705	7835600

```

[377 rows x 6 columns],
'XLI':
```

		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	39.049999	39.209999	38.220001	38.509998	27.678576	7781500
2008-01-03	38.759998	38.810001	38.490002	38.540001	27.700127	5334700
2008-01-04	38.139999	38.310001	37.549999	37.750000	27.132332	12500300
2008-01-07	37.730000	37.900002	37.040001	37.279999	26.794527	8542800
2008-01-08	37.450001	37.540001	36.259998	36.450001	26.197973	10547800
...
2009-06-24	21.480000	21.900000	21.290001	21.400000	16.016407	13853900
2009-06-25	21.320000	22.110001	21.320000	22.059999	16.510370	18079300
2009-06-26	22.070000	22.200001	21.910000	21.969999	16.443008	11819300
2009-06-29	22.150000	22.350000	21.950001	22.190001	16.607672	6238800
2009-06-30	22.190001	22.290001	21.770000	21.959999	16.435528	8985100

```

[377 rows x 6 columns],
'XLF':
```

		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	23.623072	23.696182	23.013809	23.038179	16.648191	80446096
2008-01-03	23.135662	23.257515	22.875711	22.891958	16.542524	55290488
2008-01-04	22.672625	22.688871	22.201462	22.242081	16.072908	93318540
2008-01-07	22.404549	22.607635	21.990252	22.298944	16.114000	112017799
2008-01-08	22.453291	22.599512	21.486595	21.486595	15.526956	148535168

...
2009-06-24	9.447604	9.585703	9.358245	9.431357	7.210425	133115662
2009-06-25	9.398863	9.634444	9.341998	9.634444	7.365690	156577784
2009-06-26	9.585703	9.723802	9.536962	9.683184	7.402948	90023153
2009-06-29	9.707555	9.829407	9.601950	9.805037	7.496109	137113950
2009-06-30	9.813160	9.837530	9.634444	9.707555	7.421581	124690329

[377 rows x 6 columns],

'XLK':

	Open	High	Low	Close	Adj	Close
--	------	------	-----	-------	-----	-------

Volume

Date						
2008-01-02	26.650000	26.719999	25.969999	26.120001	20.682898	7460600
2008-01-03	26.290001	26.290001	25.940001	26.160000	20.714575	2011000
2008-01-04	25.709999	25.750000	25.000000	25.139999	19.906893	3892000
2008-01-07	24.959999	25.180000	24.650000	24.920000	19.732698	5599200
2008-01-08	25.030001	25.250000	24.200001	24.260000	19.210072	5294900

...
2009-06-24	17.840000	18.070000	17.790001	17.930000	14.505182	6681700
2009-06-25	17.840000	18.250000	17.750000	18.190001	14.715516	8693300
2009-06-26	18.129999	18.250000	18.080000	18.160000	14.691250	8954700
2009-06-29	18.200001	18.410000	18.170000	18.350000	14.844964	5331500
2009-06-30	18.389999	18.430000	18.080000	18.209999	14.731691	7748800

[377 rows x 6 columns],

'XLY':

	Open	High	Low	Close	Adj	Close
--	------	------	-----	-------	-----	-------

Volume

Date						
2008-01-02	32.990002	32.990002	32.110001	32.200001	25.905016	3901000
2008-01-03	32.099998	32.220001	31.680000	31.840000	25.615396	9587000
2008-01-04	31.580000	31.580000	30.730000	30.840000	24.810888	5985100
2008-01-07	31.139999	31.180000	30.680000	30.950001	24.899384	6121900
2008-01-08	31.030001	31.309999	30.290001	30.350000	24.416685	4300200

...
2009-06-24	22.500000	22.790001	22.290001	22.340000	18.439779	8931800
2009-06-25	22.230000	23.170000	22.230000	23.120001	19.083605	9044600
2009-06-26	22.980000	23.160000	22.879999	22.959999	18.951534	4967300
2009-06-29	23.020000	23.360001	22.879999	23.250000	19.190908	5258300
2009-06-30	23.209999	23.450001	22.920000	23.080000	19.050583	6532900

[377 rows x 6 columns],

'XLP':

	Open	High	Low	Close	Adj	Close
--	------	------	-----	-------	-----	-------

Volume

Date						
2008-01-02	28.530001	28.719999	28.260000	28.389999	18.187733	10122700
2008-01-03	28.400000	28.500000	28.200001	28.240000	18.091639	4379600
2008-01-04	28.010000	28.340000	28.010000	28.120001	18.014759	4172500
2008-01-07	28.100000	28.549999	28.100000	28.450001	18.226171	3826400

2008-01-08	28.629999	28.860001	28.240000	28.240000	18.091639	5549600
...
2009-06-24	22.830000	22.879999	22.639999	22.719999	15.126421	6364800
2009-06-25	22.700001	23.160000	22.639999	23.110001	15.386085	6931400
2009-06-26	23.219999	23.219999	22.910000	23.030001	15.332822	3293400
2009-06-29	23.139999	23.250000	23.020000	23.170000	15.426033	2135000
2009-06-30	23.129999	23.520000	22.900000	22.990000	15.306184	3496300

[377 rows x 6 columns],

'XLE':

	Open	High	Low	Close	Adj	Close
--	------	------	-----	-------	-----	-------

Volume

Date

2008-01-02	79.949997	80.300003	79.269997	79.500000	47.723316	19295700
2008-01-03	80.070000	80.750000	79.849998	80.440002	48.287590	14605400
2008-01-04	79.690002	79.739998	77.500000	77.500000	46.522724	26878000
2008-01-07	78.000000	78.610001	76.230003	77.199997	46.342636	32408800
2008-01-08	77.879997	78.190002	75.849998	75.849998	45.532242	22607900
...
2009-06-24	47.369999	48.040001	46.910000	47.220001	29.038153	18022300
2009-06-25	47.080002	48.430000	47.000000	48.209999	29.646948	26715500
2009-06-26	48.060001	48.240002	47.680000	47.889999	29.450169	12310000
2009-06-29	48.200001	48.799999	48.070000	48.340000	29.726913	13812200
2009-06-30	48.340000	48.910000	47.270000	48.049999	29.548561	22869700

[377 rows x 6 columns],

'XLV':

	Open	High	Low	Close	Adj	Close
--	------	------	-----	-------	-----	-------

Volume

Date

2008-01-02	35.630001	35.630001	34.709999	34.939999	26.220284	6611300
2008-01-03	35.279999	35.299999	35.029999	35.150002	26.377874	2544400
2008-01-04	34.889999	35.160000	34.759998	34.790001	26.107716	3270600
2008-01-07	34.820000	35.580002	34.820000	35.480000	26.625526	5457900
2008-01-08	35.660000	36.389999	35.570000	35.770000	26.843153	6231200
...
2009-06-24	25.709999	25.809999	25.490000	25.660000	19.861151	4161500
2009-06-25	25.730000	26.520000	25.570000	26.370001	20.410692	8134500
2009-06-26	26.400000	26.480000	26.100000	26.370001	20.410692	4967700
2009-06-29	26.320000	26.559999	26.090000	26.530001	20.534536	4266200
2009-06-30	26.469999	26.549999	26.110001	26.309999	20.364260	5414000

[377 rows x 6 columns],

'VOX':

	Open	High	Low	Close	Adj	Close
--	------	------	-----	-------	-----	-------

Volume

Date

2008-01-02	74.989998	75.699997	73.820000	74.260002	51.236706	33700
2008-01-03	74.099998	74.540001	73.669998	74.059998	51.098713	24900
2008-01-04	73.540001	73.550003	72.129997	72.279999	49.870571	32700

2008-01-07	72.440002	73.360001	72.070000	73.059998	50.408733	99500
2008-01-08	73.500000	74.470001	69.809998	70.489998	48.635532	110100
...
2009-06-24	49.389999	49.709999	48.980000	49.070000	34.930641	24900
2009-06-25	49.220001	50.279999	48.930000	50.200001	35.735020	160400
2009-06-26	50.139999	50.400002	49.830002	49.930000	35.542824	77800
2009-06-29	50.330002	50.599998	49.900002	50.369999	35.856041	17300
2009-06-30	50.889999	50.889999	49.400002	49.720001	35.393337	28700

```
[377 rows x 6 columns],
'XLU':
```

		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	42.150002	42.740002	41.900002	42.090000	23.351946	4998900
2008-01-03	41.970001	42.580002	41.970001	42.029999	23.318657	5143600
2008-01-04	42.099998	42.619999	41.860001	42.349998	23.496201	7023300
2008-01-07	42.599998	43.349998	42.400002	43.230000	23.984432	9154500
2008-01-08	43.279999	44.110001	43.240002	43.240002	23.989986	9603900
...
2009-06-24	27.290001	27.559999	27.170000	27.379999	16.102037	5630600
2009-06-25	27.600000	27.950001	27.129999	27.840000	16.372566	8727600
2009-06-26	27.830000	27.990000	27.580000	27.740000	16.313751	3339400
2009-06-29	27.900000	28.129999	27.680000	28.100000	16.525473	4483100
2009-06-30	28.370001	28.370001	27.570000	27.889999	16.401966	6621600

```
[377 rows x 6 columns],
'IYR':
```

		Open	High	Low	Close	Adj Close
Volume						
Date						
2008-01-02	65.730003	66.550003	64.809998	65.150002	35.358303	7140100
2008-01-03	65.650002	65.900002	63.040001	63.040001	34.213154	7858800
2008-01-04	62.320000	63.000000	61.009998	61.040001	33.127716	11329300
2008-01-07	61.759998	62.070000	60.060001	61.610001	33.437069	8651900
2008-01-08	61.900002	63.360001	59.209999	59.369999	32.221363	10957900
...
2009-06-24	31.299999	31.700001	31.049999	31.350000	18.738132	22650300
2009-06-25	31.240000	31.860001	30.870001	31.850000	19.036987	23072800
2009-06-26	31.700001	32.410000	31.549999	32.130001	19.204338	17176800
2009-06-29	32.290001	32.400002	31.670000	32.209999	19.252157	13423100
2009-06-30	32.299999	32.650002	32.080002	32.419998	19.377678	18188400

```
[377 rows x 6 columns]}
```

```
[ ]: # now access the healthcare sector etf 'XLV'
trough_sector_data['XLV']
```

```
[ ]:
      Open      High      Low      Close  Adj Close  Volume
Date
2008-01-02  35.630001  35.630001  34.709999  34.939999  26.220284  6611300
2008-01-03  35.279999  35.299999  35.029999  35.150002  26.377874  2544400
2008-01-04  34.889999  35.160000  34.759998  34.790001  26.107716  3270600
2008-01-07  34.820000  35.580002  34.820000  35.480000  26.625526  5457900
2008-01-08  35.660000  36.389999  35.570000  35.770000  26.843153  6231200
...
2009-06-24  25.709999  25.809999  25.490000  25.660000  19.861151  4161500
2009-06-25  25.730000  26.520000  25.570000  26.370001  20.410692  8134500
2009-06-26  26.400000  26.480000  26.100000  26.370001  20.410692  4967700
2009-06-29  26.320000  26.559999  26.090000  26.530001  20.534536  4266200
2009-06-30  26.469999  26.549999  26.110001  26.309999  20.364260  5414000
```

[377 rows x 6 columns]

This returns the candlestick data for the XLV equity during a trough which ranged from 2008-01-02 to 2009-6-30 due to the Global Financial Crises.

The same process can be completed in one step.

```
[ ]: # access 'XLV' equity in one line of code
sector_etf_data['trough']['XLV']
```

```
[ ]:
      Open      High      Low      Close  Adj Close  Volume
Date
2008-01-02  35.630001  35.630001  34.709999  34.939999  26.220284  6611300
2008-01-03  35.279999  35.299999  35.029999  35.150002  26.377874  2544400
2008-01-04  34.889999  35.160000  34.759998  34.790001  26.107716  3270600
2008-01-07  34.820000  35.580002  34.820000  35.480000  26.625526  5457900
2008-01-08  35.660000  36.389999  35.570000  35.770000  26.843153  6231200
...
2009-06-24  25.709999  25.809999  25.490000  25.660000  19.861151  4161500
2009-06-25  25.730000  26.520000  25.570000  26.370001  20.410692  8134500
2009-06-26  26.400000  26.480000  26.100000  26.370001  20.410692  4967700
2009-06-29  26.320000  26.559999  26.090000  26.530001  20.534536  4266200
2009-06-30  26.469999  26.549999  26.110001  26.309999  20.364260  5414000
```

[377 rows x 6 columns]

The columns contain candlestick data which is:

- ‘Open’ : The price of the equity at the beginning of the trading day.
- ‘High’ : The highest price of the equity throughout the day.
- ‘Low’ : The lowest price of the equity throughout the day.
- ‘Close’ : The price of the equity at the end of the trading day
- ‘Adjusted Close’ : The came as closing price however it takes dividends, stock splits and new stock offerings into account
- ‘Volume’: The number of times that equity is traded within a day.

This is extremely useful for technical analysis which is heavily reliant on historical data. There is now an easy process to access any stock data's candlestick data (in this case sector ETF's) during any time period (different macroeconomic time periods). This is going to be used to as a basis for the capstone project.

There are currently 6 columns however this will grow as different techniques require new columns to be used as features.

The size of the data currently stands at: 4 time periods with 11 sectors with 6 columns which is $264 \text{ columns} * (377 \text{ days for trough} + 503 \text{ days for contraction} + 1006 \text{ days for expansion} + 985 \text{ for peak}) = 757,944$

1.2 Initial Data Inspection