Data Report - Market Cap in Prespective

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This project will measure the increase in market cap of specific companies in their respective industries over the company age within the United States. For instance, comparing two companies like Apple and ExxonMobil, Apple was able to outpace the growth of ExxonMobil to become an industry leader and a relatively young age

The project will use data from Bloomberg to access market cap of the company along with other details like share price, and revenue.

We plan to present 6 graphs with the average market cap of the industry along with the age of each company. A final graph comparing the top performers of each of the industries to compare the market cap with the age. We are using market capitalization to show the size of a company is important because company size is a basic determinant of various characteristics in which investors are interested, including risk.

We use the data to analyse the market cap report for largest company, smallest company and the % weight of them

Overview: The data is sourced from Bloomberg. It provides a time scale from 1989 - 2019 for all company information regarding revenue and marekt capitalization. We can also use additional recources from CRSP US Stock Database, CRSP Historical Indexes, and CRSP US Treasury Database for the broadest representation of U.S. Markets

Access: I will use the the Bloomberg terminal to download and access the data and create a data set with the relevant metrics. Below I demonstrate that I have the ability to access the data.

Requisite Packages Below I bring in the packages I need...

In [1]:
```
import pandas as pd # We know this one...
import requests # This is usefull with the API
import numpy as np # For performing numerical analysis
import matplotlib.pyplot as plt # Plotting
import weightedcalcs as wc # This allows for "weighted" calculations
import os
import requests, io
import zipfile as zf
import shutil
import datetime
```

In [2]:
```
ticker = pd.DataFrame([["Tech", "Apple", "AAPL"], ["Tech", "Amazon", "AM
ZN"], ["Tech", "Google", "GOOGL"],
                       ["Energy", "ExxonMobil", "XOM"], ["Energy", "Chevron",
"CVX"],["Energy", "ChonocoPhillips", "COP"],
                       ["Motor Vehicles and Parts", "General Motors", "GM"],
["Motor Vehicles and Parts", "FORD", "FORD"], ["Motor Vehicles and Part
s", "Goodyear Tire & Rubber", "GT"],
                       ["Health", "CVS", "CVS"], ["Health", "Pfizer", "PFE"],
["Health", "Merk", "MRK"],
                       ["Industrials", "General Electrics", "GE"], ["Industri
als", "Honeywell International", "HON"], ["Industrials", "3M", "MMM"],
                       ["Food & Beverages", "Pepsi", "PEP"], ["Food & Beverag
es", "Archer Daniels Midland", "ADM"], ["Food & Beverages", "Coca-Cola",
"KO"]],
                       columns = ["Sector", "Company", "Ticker"])

ticker = ticker.set_index(["Sector", "Company", "Ticker"])
```

These are the list of tickers that corresponds to the companies.

In [3]:
```
ticker
```

Out[3]:

Sector	Company	Ticker
Tech	Apple	AAPL
	Amazon	AMZN
	Google	GOOGL
Energy	ExxonMobil	XOM
	Chevron	CVX
	ChonocoPhillips	COP
Motor Vehicles and Parts	General Motors	GM
	FORD	FORD
	Goodyear Tire & Rubber	GT
Health	CVS	CVS
	Pfizer	PFE
	Merk	MRK
Industrials	General Electrics	GE
	Honeywell International	HON
	3M	MMM
Food & Beverages	Pepsi	PEP
	Archer Daniels Midland	ADM
	Coca-Cola	KO

Grabbing the Data :

Get the data from here: Click Here (https://app.box.com/s/x062b29bjvwlwrta2rgromgna7p4gmmw)

Once you have downloaded the zip file of the dataset, relocate the zipfile onto the current working directory.

In [4]:
```
cwd = os.getcwd()
zipfile = "\\final_project_data_set.zip"
path = cwd + zipfile
```

In [5]:
```
data_set = zf.ZipFile(path)
```

These are the csv files that has the data of revenue and market capital for each company.

In [6]:
```
data_set.namelist()
```

Out[6]:
```
['3M.csv',
 'Amazon.csv',
 'Apple.csv',
 'Archer_Daniels_Midland.csv',
 'Chevron.csv',
 'ChonocoPhillips.csv',
 'Coca_Cola.csv',
 'CVS.csv',
 'ExxonMobil.csv',
 'FORD.csv',
 'General_Electrics.csv',
 'General_Motors.csv',
 'Goodyear_Tire&Rubber.csv',
 'Google.csv',
 'Honeywell_International.csv',
 'Merk.csv',
 'Pepsi.csv',
 'Pfizer.csv']
```

Here is an example of the data

In [7]:
```
example_df = pd.read_csv(data_set.open(data_set.namelist()[0]))
```

In [8]:
```
example_df.head()
```

Out[8]:

	Date	MMM US Equity - Revenue (R1)	MMM US Equity - Current Market Cap (L1)
0	2019-03-29	NaN	1.196600e+11
1	2018-12-31	7945.0	1.109490e+11
2	2018-09-30	8152.0	1.236050e+11
3	2018-06-30	8390.0	1.167910e+11
4	2018-03-31	8278.0	1.305500e+11

The data looks pretty raw. What I am going to do is to create a column with the ticker and sector for each company. This will allow us to merge all these separate data with neat classification in the futuere.

This is a function that creates a new directory in the current working directory.

The source: https://gist.github.com/keithweaver/562d3caa8650eefe7f84fa074e9ca949 (https://gist.github.com/keithweaver/562d3caa8650eefe7f84fa074e9ca949)

In [9]:
```
def createFolder(directory):
    try:
        if not os.path.exists(directory):
            os.makedirs(directory)
    except OSError:
        print ('Error: Creating directory. ' +  directory)
```

We are going to create a new directory that is called "New_Data_Set", and export the data files with the columns of ticker and sector to this new directory.

In [10]:
```
createFolder("New_Data_Set")
```

This for loop is going to create new csv files with the column of tickers and sectors and export them to the new directory, "New_Data_Set" that we just created.

In [11]:
```
company_sector = {"Apple":"Tech", "Amazon":"Tech", "Google":"Tech",
                  "ExxonMobil":"Energy", "Chevron":"Energy", "ChonocoPhi
llips":"Energy",
                  "General_Motors":"Motor Vehicles and Parts", "FORD":"M
otor Vehicles and Parts", "Goodyear_Tire&Rubber":"Motor Vehicles and Par
ts",
                  "CVS":"Health", "Pfizer":"Health", "Merk":"Health",
                  "General_Electrics":"Industrials", "Honeywell_Internat
ional":"Industrials", "3M":"Industrials",
                  "Pepsi":"Food & Beverages", "Archer_Daniels_Midland":
"Food & Beverages", "Coca_Cola":"Food & Beverages"}

file_list = data_set.namelist()

for var in file_list:
    df = pd.DataFrame(pd.read_csv(data_set.open(var)))
    df["Company"] = df.columns[1].split(maxsplit=1)[0]

    for key in company_sector.keys():
        if var == key+".csv":
            df["Sector"] = company_sector.get(key)


    df.to_csv(cwd + "\\New_Data_Set\\" + var, index = None)
```

We have created new csv files in the "New_Data_Set" directory. Now we are going to read in these files and turn them into one large dataframe.

In [12]:
```
path = cwd + "\\New_Data_Set"
new_file_list = os.listdir(path)
```

In [13]:
```
final_df = pd.DataFrame()

for file in new_file_list:
    indv_df = pd.DataFrame(pd.read_csv(path+"\\"+file))
    indv_df.rename(columns = {indv_df.columns[1]:"Revenue"}, inplace=Tru
e)
    indv_df.rename(columns = {indv_df.columns[2]:"Market Cap"}, inplace=
True)

    final_df = final_df.append(indv_df)
```

In [14]:
```
final_df.shape
```

Out[14]:
```
(2064, 5)
```

In [15]:
```
final_df
```

Out[15]:

	Date	Revenue	Market Cap	Company	Sector
0	2019-03-29	NaN	1.196600e+11	MMM	Industrials
1	2018-12-31	7945.0000	1.109490e+11	MMM	Industrials
2	2018-09-30	8152.0000	1.236050e+11	MMM	Industrials
3	2018-06-30	8390.0000	1.167910e+11	MMM	Industrials
4	2018-03-31	8278.0000	1.305500e+11	MMM	Industrials
5	2017-12-31	7990.0000	1.401880e+11	MMM	Industrials
6	2017-09-30	8172.0000	1.252610e+11	MMM	Industrials
7	2017-06-30	7810.0000	1.243390e+11	MMM	Industrials
8	2017-03-31	7685.0000	1.143380e+11	MMM	Industrials
9	2016-12-31	7329.0000	1.074040e+11	MMM	Industrials
10	2016-09-30	7709.0000	1.065130e+11	MMM	Industrials
11	2016-06-30	7662.0000	1.062130e+11	MMM	Industrials
12	2016-03-31	7409.0000	1.009460e+11	MMM	Industrials
13	2015-12-31	7298.0000	9.275100e+10	MMM	Industrials
14	2015-09-30	7712.0000	8.857016e+10	MMM	Industrials
15	2015-06-30	7686.0000	9.787882e+10	MMM	Industrials
16	2015-03-31	7578.0000	1.047960e+11	MMM	Industrials
17	2014-12-31	7719.0000	1.052990e+11	MMM	Industrials
18	2014-09-30	8137.0000	9.180427e+10	MMM	Industrials
19	2014-06-30	8134.0000	9.371885e+10	MMM	Industrials
20	2014-03-31	7831.0000	8.923829e+10	MMM	Industrials
21	2013-12-31	7569.0000	9.330017e+10	MMM	Industrials
22	2013-09-30	7916.0000	8.161291e+10	MMM	Industrials
23	2013-06-30	7752.0000	7.547278e+10	MMM	Industrials
24	2013-03-31	7634.0000	7.335287e+10	MMM	Industrials
25	2012-12-31	7387.0000	6.424582e+10	MMM	Industrials
26	2012-09-30	7497.0000	6.389175e+10	MMM	Industrials
27	2012-06-30	7534.0000	6.217093e+10	MMM	Industrials
28	2012-03-31	7486.0000	6.196025e+10	MMM	Industrials
29	2011-12-31	7089.0000	5.728004e+10	MMM	Industrials
...	...	...	...	...	...
81	2001-03-30	NaN	2.585580e+11	PFE	Health
82	2000-12-31	8167.0000	NaN	PFE	Health
83	2000-12-29	7158.0000	2.902160e+11	PFE	Health

	Date	Revenue	Market Cap	Company	Sector
84	2000-09-29	6989.0000	2.836000e+11	PFE	Health
85	2000-06-30	7161.0000	3.021370e+11	PFE	Health
86	2000-03-31	NaN	1.407290e+11	PFE	Health
87	1999-12-31	6746.0000	2.045440e+11	PFE	Health
88	1999-09-30	6516.0000	1.390140e+11	PFE	Health
89	1999-06-30	3927.0000	1.410750e+11	PFE	Health
90	1999-03-31	NaN	1.795430e+11	PFE	Health
91	1998-12-31	3866.0000	1.622240e+11	PFE	Health
92	1998-09-30	3330.0000	1.381720e+11	PFE	Health
93	1998-06-30	3312.0000	1.419060e+11	PFE	Health
94	1998-03-31	3036.0000	1.289960e+11	PFE	Health
95	1997-12-31	3072.0000	9.642833e+10	PFE	Health
96	1997-09-30	2747.0000	7.771866e+10	PFE	Health
97	1997-06-30	2913.0000	7.715183e+10	PFE	Health
98	1997-03-31	3001.0000	5.426063e+10	PFE	Health
99	1996-12-31	3160.0000	5.350412e+10	PFE	Health
100	1996-09-30	2803.0000	5.083069e+10	PFE	Health
101	1996-06-30	2661.0000	4.568336e+10	PFE	Health
102	1996-03-31	2682.0000	4.285614e+10	PFE	Health
103	1995-12-31	2598.0000	4.007770e+10	PFE	Health
104	1995-09-30	2538.5000	3.385139e+10	PFE	Health
105	1995-06-30	2401.0000	2.909077e+10	PFE	Health
106	1995-03-31	2338.0000	2.694488e+10	PFE	Health
107	1994-12-31	2064.3999	NaN	PFE	Health
108	1994-09-30	2006.7000	2.172219e+10	PFE	Health
109	1994-06-30	1923.3000	1.926480e+10	PFE	Health
110	1994-03-31	1982.9000	1.732984e+10	PFE	Health

2064 rows × 5 columns

Making the Dataframe Pretty

- We have 2064 rows and 4 columns. This dataframe still looks pretty raw.
- We are going to clean up some NaN values, set the Date column as an index, change it to datetime.
- We will also apply groupby function, so that the companies are grouped by sectors.
- These will allow us to arrange dataframe the way we want.

In [16]:
```
final_df.set_index(keys = "Date", inplace=True)
final_df = final_df.dropna()
final_df.index = pd.to_datetime(final_df.index, yearfirst = True)
groupby_df = final_df.groupby(["Sector", "Company", "Date"]).sum()
final_df.shape
```

Out[16]:
```
(1825, 4)
```

The dataframe looks pretty good now.

In [17]:
```
groupby_df
```

Out[17]:

			Revenue	Market Cap
Sector	**Company**	**Date**		
Energy	**COP**	**1989-12-31**	3030.0	6.142138e+09
		1990-03-31	3116.0	6.341270e+09
		1990-06-30	2859.0	6.281816e+09
		1990-09-30	3306.0	6.310733e+09
		1990-12-31	4322.0	6.407731e+09
		1991-03-31	3285.0	7.276500e+09
		1991-06-30	3150.0	6.597360e+09
		1991-09-30	2970.0	6.814290e+09
		1991-12-31	3199.0	6.232632e+09
		1992-03-31	2712.0	6.039908e+09
		1992-06-30	3042.0	6.299689e+09
		1992-09-30	3098.0	7.146865e+09
		1992-12-31	3081.0	6.529635e+09
		1993-03-31	3029.0	7.318996e+09
		1993-06-30	3230.0	7.293888e+09
		1993-09-30	3170.0	8.813476e+09
		1993-12-31	2880.0	7.580311e+09
		1994-03-31	2884.0	6.961905e+09
		1994-06-30	2995.0	8.166968e+09
		1994-09-30	3315.0	8.958533e+09
		1994-12-31	3017.0	8.564354e+09
		1995-03-31	3087.0	9.582492e+09
		1995-06-30	3591.0	8.736641e+09
		1995-09-30	3369.0	8.520005e+09
		1995-12-31	3321.0	8.943070e+09
		1996-03-31	3595.0	1.032589e+10
		1996-06-30	3937.0	1.100940e+10
		1996-09-30	3852.0	1.125000e+10
		1996-12-31	4347.0	1.164585e+10
		1997-03-31	3944.0	1.075495e+10
...	**...**	**...**	...	...
Tech	**GOOGL**	**2011-09-30**	9720.0	1.667060e+11
		2011-12-31	10584.0	2.091990e+11

Sector	Company	Date	Revenue	Market Cap
		2012-03-31	10645.0	2.089460e+11
		2012-06-30	11807.0	1.891070e+11
		2012-09-30	13304.0	2.474900e+11
		2012-12-31	14419.0	2.324410e+11
		2013-03-31	12951.0	2.629850e+11
		2013-06-30	13107.0	2.920770e+11
		2013-09-30	13754.0	2.918710e+11
		2013-12-31	15707.0	3.744150e+11
		2014-03-31	15420.0	3.751940e+11
		2014-06-30	15955.0	3.909290e+11
		2014-09-30	16523.0	3.939560e+11
		2014-12-31	18103.0	3.584200e+11
		2015-03-31	17258.0	3.750810e+11
		2015-06-30	17727.0	3.613430e+11
		2015-09-30	18675.0	4.265500e+11
		2015-12-31	21329.0	5.279610e+11
		2016-03-31	20257.0	5.177380e+11
		2016-06-30	21500.0	4.788040e+11
		2016-09-30	22451.0	5.427580e+11
		2016-12-31	26064.0	5.385720e+11
		2017-03-31	24750.0	5.794260e+11
		2017-06-30	26010.0	6.353420e+11
		2017-09-30	27772.0	6.692460e+11
		2017-12-31	32323.0	7.292940e+11
		2018-03-31	31146.0	7.191240e+11
		2018-06-30	32657.0	7.792350e+11
		2018-09-30	33740.0	8.346580e+11
		2018-12-31	39276.0	7.232460e+11

1825 rows × 2 columns

But we can do better with the dataframe. The function below will do the followings:

- Because the data has quaterly data, we want to resample it yearly. The function below takes in specific sector and company and turn revenue and market cap into yearly data.
- It also creates new column, "Year". This will help us to plot later.
- Also, as you can see above, the Market Cap column is in scientific notaion. The function will change it to inegers.
- After converting scientific notation into integers, we are going to change number to millions in order to match up with the Revenue column units.

In [18]:
```
def create_company_df(Sector, Company):

    groupby_cp = groupby_df.loc[Sector].loc[Company].resample('y').mean
()
    groupby_cp['Year'] = pd.DatetimeIndex(groupby_cp.index).year
    groupby_cp = groupby_cp[["Year", "Market Cap", "Revenue"]]
    groupby_cp["Market Cap"] = groupby_cp["Market Cap"]/1000000

    groupby_cp['Market Cap'] = groupby_cp['Market Cap'].astype('int64')
    groupby_cp['Revenue'] = groupby_cp['Revenue'].astype('int64')

    return groupby_cp
```

- Because we have 6 different sectors and 3 companies for each sector, we are going to use a nested for loop to apply the "groupby_companies()" function.
- Through this nested for loop, we will be able to turn this big dataframe into individual dataframes by companies.

In [19]:

```
company_list = [['XOM', 'CVX', 'COP'], ['AAPL', 'AMZN', 'GOOGL'],
                ['GM', 'FORD', 'GT'], ['CVS', 'PFE', 'MRK'],
                ['GE', 'HON', 'MMM'], ['PEP', 'ADM', 'KO']]

sector_list = ["Energy", "Tech", "Motor Vehicles and Parts",
               "Health", "Industrials", "Food & Beverages"]

for count in range(6):

    subcount = 0
    for comps in company_list[count]:
        company = create_company_df(sector_list[count], comps)

        #### Assigning names for energy sector companies ####
        if comps == "XOM":
            XOM = company
        elif comps == "CVX":
            CVX = company
        elif comps == "COP":
            COP = company

        #### Assigning names for tech sector companies ####
        elif comps == "AAPL":
            AAPL = company
        elif comps == "AMZN":
            AMZN = company
        elif comps == "GOOGL":
            GOOGL = company

        #### Assigning names for Motor Vehicles sector companies ####
        elif comps == "GM":
            GM = company
        elif comps == "FORD":
            FORD = company
        elif comps == "GT":
            GT = company

        #### Assigning names for Health sector companies ####
        elif comps == "CVS":
            CVS = company
        elif comps == "PFE":
            PFE = company
        elif comps == "MRK":
            MRK = company

        #### Assigning names for Industrials sector companies ####
        elif comps == "GE":
            GE = company
        elif comps == "HON":
            HON = company
        elif comps == "MMM":
            MMM = company

        #### Assigning names for Food & Beverages sector companies ####
        elif comps == "PEP":
            PEP = company
```

```
        elif comps == "ADM":
            ADM = company
        else:
            KO = company

        subcount = subcount + 1

        if subcount == 3:
            subcount = 0
            pass
```

We have assigned tickers for variable names. So, for example, if we want to see the yearly revenue and market cap for **General Electrics** we can simply type the ticker of General Electrics, **GE**.

In [20]:
```
GE
```

Out[20]:

Date	Year	Market Cap	Revenue
1990-12-31	1990	54700	14415
1991-12-31	1991	63092	14844
1992-12-31	1992	68010	14068
1993-12-31	1993	82333	13774
1994-12-31	1994	82506	13942
1995-12-31	1995	103782	17319
1996-12-31	1996	146704	19635
1997-12-31	1997	209492	22135
1998-12-31	1998	292404	24955
1999-12-31	1999	406933	27708
2000-12-31	2000	520708	32354
2001-12-31	2001	416864	31419
2002-12-31	2002	287162	32799
2003-12-31	2003	287798	33396
2004-12-31	2004	347497	37937
2005-12-31	2005	369250	36568
2006-12-31	2006	363309	37578
2007-12-31	2007	389067	42367
2008-12-31	2008	264791	45375
2009-12-31	2009	141638	38846
2010-12-31	2010	179202	37144
2011-12-31	2011	190834	35556
2012-12-31	2012	223474	36082
2013-12-31	2013	251611	35734
2014-12-31	2014	258478	32637
2015-12-31	2015	266528	28789
2016-12-31	2016	282407	29921
2017-12-31	2017	213687	29560
2018-12-31	2018	99807	30186

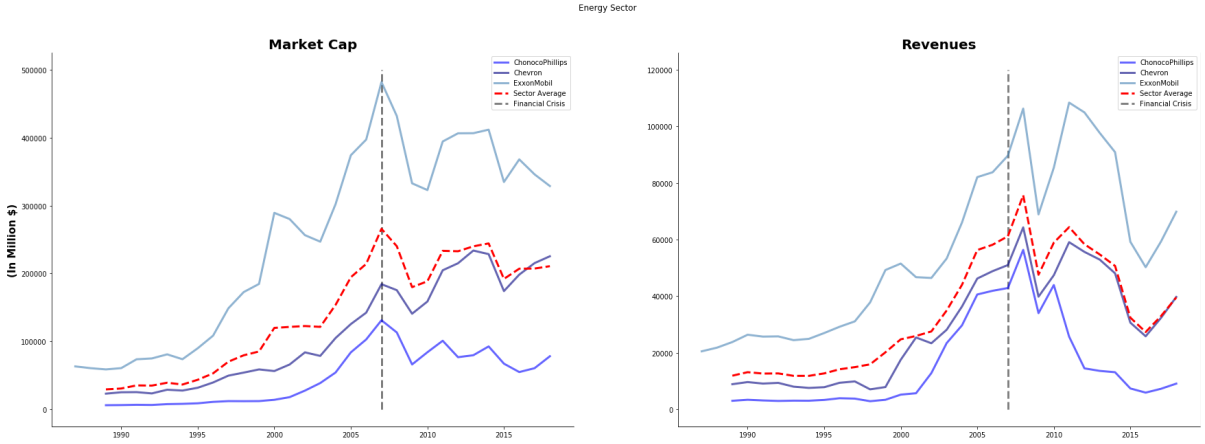
Now, let's plot this

Energy Sector

In [21]:

```
fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize=(30,10))
ax = axes

fig.suptitle("Energy Sector", fontdict = {'fontsize':40, 'fontweight':'b
old'})

########## Energy Sector Plot ###########

mrk_avg = (XOM["Market Cap"]+CVX["Market Cap"]+COP["Market Cap"])/3

ax[0].plot(COP.Year, COP["Market Cap"], color = "blue", alpha = 0.6, lin
ewidth = 3, label = "ChonocoPhillips")
ax[0].plot(CVX.Year, CVX["Market Cap"], color = "navy", alpha = 0.6, lin
ewidth = 3, label = "Chevron")
ax[0].plot(XOM.Year, XOM["Market Cap"], color = "steelblue", alpha = 0.6
, linewidth = 3, label = "ExxonMobil")
ax[0].plot(XOM.Year, mrk_avg, color = "red", linestyle = "--", alpha = 1
, linewidth = 3, label = "Sector Average")

ax[0].ticklabel_format(useOffset=False, style='plain')

ax[0].vlines(x = 2007, ymin = 0, ymax = 500000, colors = 'gray', linesty
les = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[0].legend(frameon = True)

ax[0].set_title(label = "Market Cap", fontdict = {'fontsize':20, 'fontwe
ight':'bold'})
ax[0].set_ylabel(ylabel = "(In Million $)", fontdict = {'fontsize':15,
'fontweight':'bold'})

ax[0].spines["right"].set_visible(False)
ax[0].spines["top"].set_visible(False)

##########################################################################
################################

rev_avg = (XOM["Revenue"]+CVX["Revenue"]+COP["Revenue"])/3

ax[1].plot(COP.Year, COP["Revenue"], color = "blue", alpha = 0.6, linewi
dth = 3, label = "ChonocoPhillips")
ax[1].plot(CVX.Year, CVX["Revenue"], color = "navy", alpha = 0.6, linewi
dth = 3, label = "Chevron")
ax[1].plot(XOM.Year, XOM["Revenue"], color = "steelblue", alpha = 0.6, l
inewidth = 3, label = "ExxonMobil")
ax[1].plot(XOM.Year, rev_avg, color = "red", linestyle = "--", alpha = 1
, linewidth = 3, label = "Sector Average")

ax[1].ticklabel_format(useOffset=False, style='plain')

ax[1].vlines(x = 2007, ymin = 0, ymax = 120000, colors = 'gray', linesty
les = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[1].legend(frameon = True)

ax[1].set_title(label = "Revenues", fontdict = {'fontsize':20, 'fontweig
```

```
ht':'bold'})

ax[1].spines["right"].set_visible(False)
ax[1].spines["top"].set_visible(False)

plt.savefig("energy_sector.png", bbox_inches = "tight", dip = 1200)

plt.show()
```



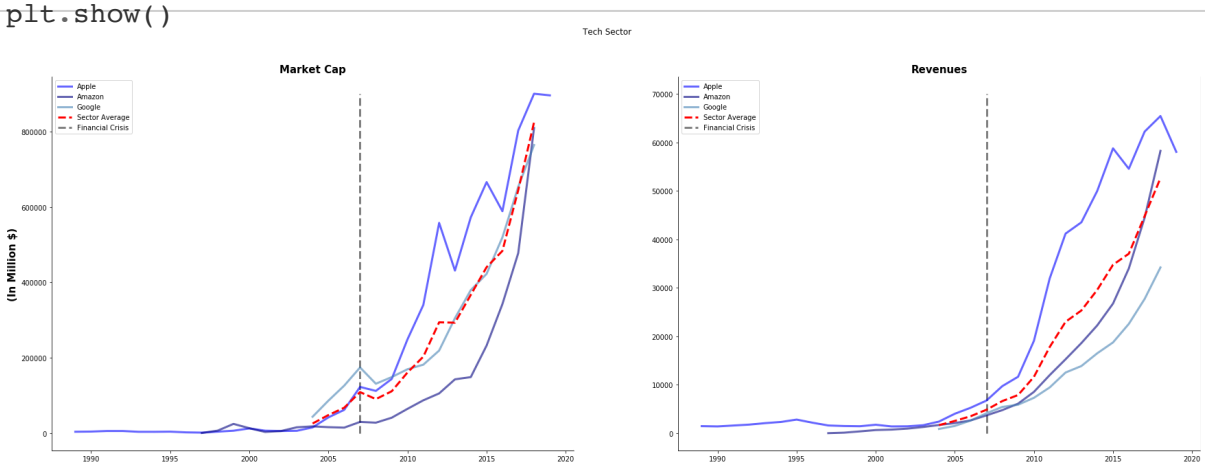
- The energy sector is plotted nicely. The effect of the Financial Crisis that broke out in 2007 is clearly shown on the market cap of the energy sector.
- And of course, the revenue was affected little after the year 2007. That's probably because the revenue is reported annually.

Tech Sector

In [22]:

```
fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize=(30,10))
ax = axes

fig.suptitle("Tech Sector", fontdict = {'fontsize':30, 'fontweight':'bol
d'})


########## Tech Sector Plot ###########

mrk_avg = (AAPL["Market Cap"]+AMZN["Market Cap"]+GOOGL["Market Cap"])/3

ax[0].plot(AAPL.Year, AAPL["Market Cap"], color = "blue", alpha = 0.6, l
inewidth = 3, label = "Apple")
ax[0].plot(AMZN.Year, AMZN["Market Cap"], color = "navy", alpha = 0.6, l
inewidth = 3, label = "Amazon")
ax[0].plot(GOOGL.Year, GOOGL["Market Cap"], color = "steelblue", alpha =
0.6, linewidth = 3, label = "Google")
ax[0].plot(AAPL.Year, mrk_avg, color = "red", linestyle = "--", alpha =
1, linewidth = 3, label = "Sector Average")
ax[0].ticklabel_format(useOffset=False, style='plain')

ax[0].vlines(x = 2007, ymin = 0, ymax = 900000, colors = 'gray', linesty
les = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[0].legend(frameon = True)

ax[0].set_title(label = "Market Cap", fontdict = {'fontsize':15, 'fontwe
ight':'bold'})
ax[0].set_ylabel(ylabel = "(In Million $)", fontdict = {'fontsize':15,
'fontweight':'bold'})

ax[0].spines["right"].set_visible(False)
ax[0].spines["top"].set_visible(False)


#########################################################################
################################

rev_avg = (AAPL["Revenue"]+AMZN["Revenue"]+GOOGL["Revenue"])/3

ax[1].plot(AAPL.Year, AAPL["Revenue"], color = "blue", alpha = 0.6, line
width = 3, label = "Apple")
ax[1].plot(AMZN.Year, AMZN["Revenue"], color = "navy", alpha = 0.6, line
width = 3, label = "Amazon")
ax[1].plot(GOOGL.Year, GOOGL["Revenue"], color = "steelblue", alpha = 0.
6, linewidth = 3, label = "Google")
ax[1].plot(AAPL.Year, rev_avg, color = "red", linestyle = "--", alpha =
1, linewidth = 3, label = "Sector Average")

ax[1].ticklabel_format(useOffset=False, style='plain')

ax[1].vlines(x = 2007, ymin = 0, ymax = 70000, colors = 'gray', linestyl
es = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[1].legend(frameon = True)
```

```
ax[1].set_title(label = "Revenues", fontdict = {'fontsize':15, 'fontweight':'bold'})

ax[1].spines["right"].set_visible(False)
ax[1].spines["top"].set_visible(False)

plt.savefig("tech_sector.png", bbox_inches = "tight", dip = 1200)

plt.show()
```



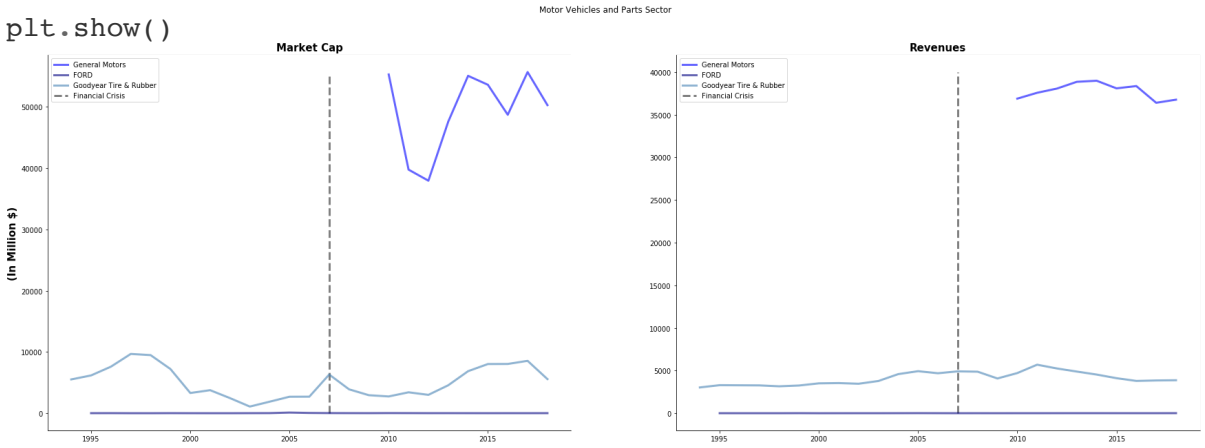
- The tech sector is also interesting. Both the market cap and the revenue were not really affected by the financial crisis.
- And the sector picked up the momentum of rapid growth on year 2010.

Motor Vehicles and Parts

In [23]:

```
fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize=(30,10))
ax = axes

fig.suptitle("Motor Vehicles and Parts Sector", fontdict = {'fontsize':3
0, 'fontweight':'bold'})


########## Motor Vehicles and Parts Sector Plot ##########

ax[0].plot(GM.Year, GM["Market Cap"], color = "blue", alpha = 0.6, linew
idth = 3, label = "General Motors")
ax[0].plot(FORD.Year, FORD["Market Cap"], color = "navy", alpha = 0.6, l
inewidth = 3, label = "FORD")
ax[0].plot(GT.Year, GT["Market Cap"], color = "steelblue", alpha = 0.6,
linewidth = 3, label = "Goodyear Tire & Rubber")
ax[0].ticklabel_format(useOffset=False, style='plain')

ax[0].vlines(x = 2007, ymin = 0, ymax = 55000, colors = 'gray', linestyl
es = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[0].legend(frameon = True)

ax[0].set_title(label = "Market Cap", fontdict = {'fontsize':15, 'fontwe
ight':'bold'})
ax[0].set_ylabel(ylabel = "(In Million $)", fontdict = {'fontsize':15,
'fontweight':'bold'})

ax[0].spines["right"].set_visible(False)
ax[0].spines["top"].set_visible(False)


##########################################################################
####


ax[1].plot(GM.Year, GM["Revenue"], color = "blue", alpha = 0.6, linewidt
h = 3, label = "General Motors")
ax[1].plot(FORD.Year, FORD["Revenue"], color = "navy", alpha = 0.6, line
width = 3, label = "FORD")
ax[1].plot(GT.Year, GT["Revenue"], color = "steelblue", alpha = 0.6, lin
ewidth = 3, label = "Goodyear Tire & Rubber")
ax[1].ticklabel_format(useOffset=False, style='plain')

ax[1].vlines(x = 2007, ymin = 0, ymax = 40000, colors = 'gray', linestyl
es = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[1].legend(frameon = True)

ax[1].set_title(label = "Revenues", fontdict = {'fontsize':15, 'fontweig
ht':'bold'})

ax[1].spines["right"].set_visible(False)
ax[1].spines["top"].set_visible(False)

plt.savefig("motor_sector.png", bbox_inches = "tight", dip = 1200)
```

```
plt.show()
```



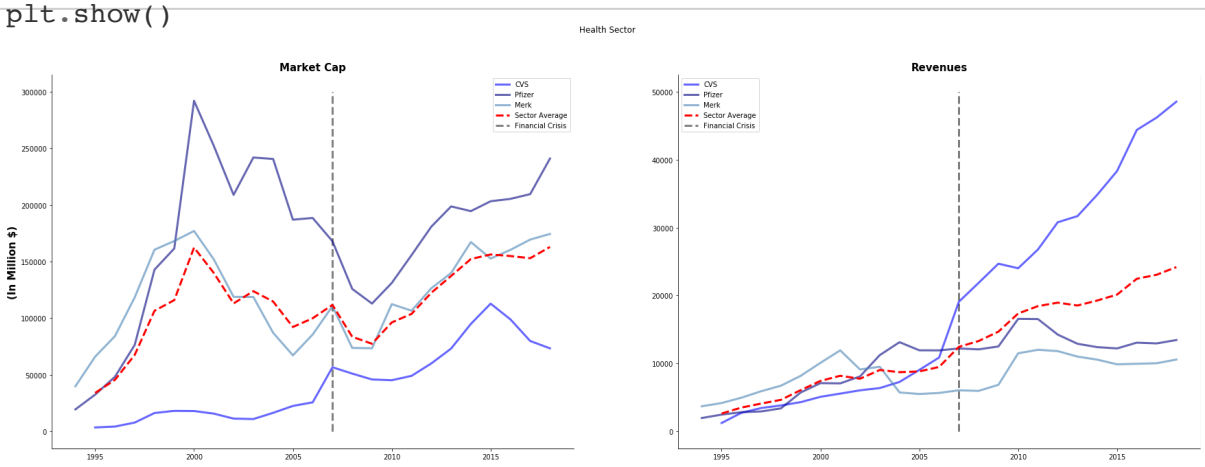
- The motor vehicles sector was not plotted the way we expected.
- This odd looking shape of the plot is due to the lack of available historical data and variance in individual observations.

Health Sector

In [24]:

```
fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize=(30,10))
ax = axes

fig.suptitle("Health Sector", fontdict = {'fontsize':30, 'fontweight':'b
old'})


########## Health Sector Plot ###########

mrk_avg = (CVS["Market Cap"]+PFE["Market Cap"]+MRK["Market Cap"])/3

ax[0].plot(CVS.Year, CVS["Market Cap"], color = "blue", alpha = 0.6, lin
ewidth = 3, label = "CVS")
ax[0].plot(PFE.Year, PFE["Market Cap"], color = "navy", alpha = 0.6, lin
ewidth = 3, label = "Pfizer")
ax[0].plot(MRK.Year, MRK["Market Cap"], color = "steelblue", alpha = 0.6
, linewidth = 3, label = "Merk")
ax[0].plot(PFE.Year, mrk_avg, color = "red", linestyle = "--", alpha = 1
, linewidth = 3, label = "Sector Average")

ax[0].ticklabel_format(useOffset=False, style='plain')

ax[0].vlines(x = 2007, ymin = 0, ymax = 300000, colors = 'gray', linesty
les = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[0].legend(frameon = True)

ax[0].set_title(label = "Market Cap", fontdict = {'fontsize':15, 'fontwe
ight':'bold'})
ax[0].set_ylabel(ylabel = "(In Million $)", fontdict = {'fontsize':15,
'fontweight':'bold'})

ax[0].spines["right"].set_visible(False)
ax[0].spines["top"].set_visible(False)

#################################################################

rev_avg = (CVS["Revenue"]+PFE["Revenue"]+MRK["Revenue"])/3

ax[1].plot(CVS.Year, CVS["Revenue"], color = "blue", alpha = 0.6, linewi
dth = 3, label = "CVS")
ax[1].plot(PFE.Year, PFE["Revenue"], color = "navy", alpha = 0.6, linewi
dth = 3, label = "Pfizer")
ax[1].plot(MRK.Year, MRK["Revenue"], color = "steelblue", alpha = 0.6, l
inewidth = 3, label = "Merk")
ax[1].plot(PFE.Year, rev_avg, color = "red", linestyle = "--", alpha = 1
, linewidth = 3, label = "Sector Average")
ax[1].ticklabel_format(useOffset=False, style='plain')

ax[1].vlines(x = 2007, ymin = 0, ymax = 50000, colors = 'gray', linestyl
es = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[1].legend(frameon = True)

ax[1].set_title(label = "Revenues", fontdict = {'fontsize':15, 'fontweig
ht':'bold'})
```

```
ax[1].spines["right"].set_visible(False)
ax[1].spines["top"].set_visible(False)

plt.savefig("health_sector.png", bbox_inches = "tight", dip = 1200)

plt.show()
```



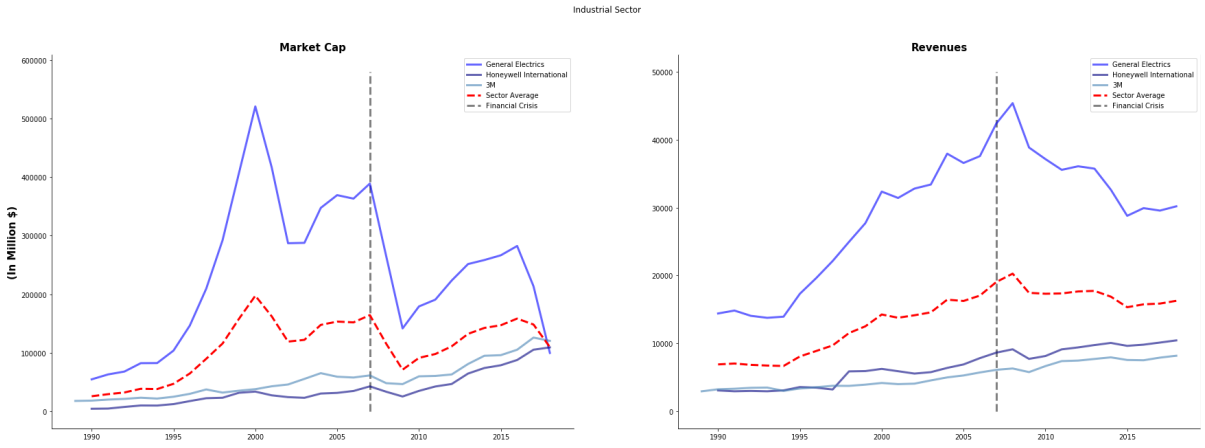
- The plot of the health sector has some interesting shape.
- Even though, CVS outpaced its competitors in revenue, it's market cap is remarkably lower than the others.
- From this analysis, it would be worthwhile to take a look at CVS's profit margin, number of outstanding shares, and growth potential.
- If none of these factors are negatively affecting CVS's market cap, then we may assume that CVS's stock price is seriously undervalued.

Industrial Sector

In [25]:

```
fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize=(30,10))
ax = axes

fig.suptitle("Industrial Sector", fontdict = {'fontsize':30, 'fontweigh
t':'bold'})


########## Industrial Sector Plot ##########

mrk_avg = (GE["Market Cap"]+HON["Market Cap"]+MMM["Market Cap"])/3

ax[0].plot(GE.Year, GE["Market Cap"], color = "blue", alpha = 0.6, linew
idth = 3, label = "General Electrics")
ax[0].plot(HON.Year, HON["Market Cap"], color = "navy", alpha = 0.6, lin
ewidth = 3, label = "Honeywell International")
ax[0].plot(MMM.Year, MMM["Market Cap"], color = "steelblue", alpha = 0.6
, linewidth = 3, label = "3M")
ax[0].plot(MMM.Year, mrk_avg, color = "red", linestyle = "--", alpha = 1
, linewidth = 3, label = "Sector Average")
ax[0].ticklabel_format(useOffset=False, style='plain')

ax[0].vlines(x = 2007, ymin = 0, ymax = 580000, colors = 'gray', linesty
les = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[0].legend(frameon = True)

ax[0].set_title(label = "Market Cap", fontdict = {'fontsize':15, 'fontwe
ight':'bold'})
ax[0].set_ylabel(ylabel = "(In Million $)", fontdict = {'fontsize':15,
'fontweight':'bold'})

ax[0].spines["right"].set_visible(False)
ax[0].spines["top"].set_visible(False)

#################################################################

rev_avg = (GE["Revenue"]+HON["Revenue"]+MMM["Revenue"])/3

ax[1].plot(GE.Year, GE["Revenue"], color = "blue", alpha = 0.6, linewidt
h = 3, label = "General Electrics")
ax[1].plot(HON.Year, HON["Revenue"], color = "navy", alpha = 0.6, linewi
dth = 3, label = "Honeywell International")
ax[1].plot(MMM.Year, MMM["Revenue"], color = "steelblue", alpha = 0.6, l
inewidth = 3, label = "3M")
ax[1].plot(MMM.Year, rev_avg, color = "red", linestyle = "--", alpha = 1
, linewidth = 3, label = "Sector Average")
ax[1].ticklabel_format(useOffset=False, style='plain')

ax[1].vlines(x = 2007, ymin = 0, ymax = 50000, colors = 'gray', linestyl
es = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[1].legend(frameon = True)

ax[1].set_title(label = "Revenues", fontdict = {'fontsize':15, 'fontweig
ht':'bold'})
```

```
ax[1].spines["right"].set_visible(False)
ax[1].spines["top"].set_visible(False)

plt.savefig("industrial_sector.png", bbox_inches = "tight", dip = 1200)

plt.show()
```



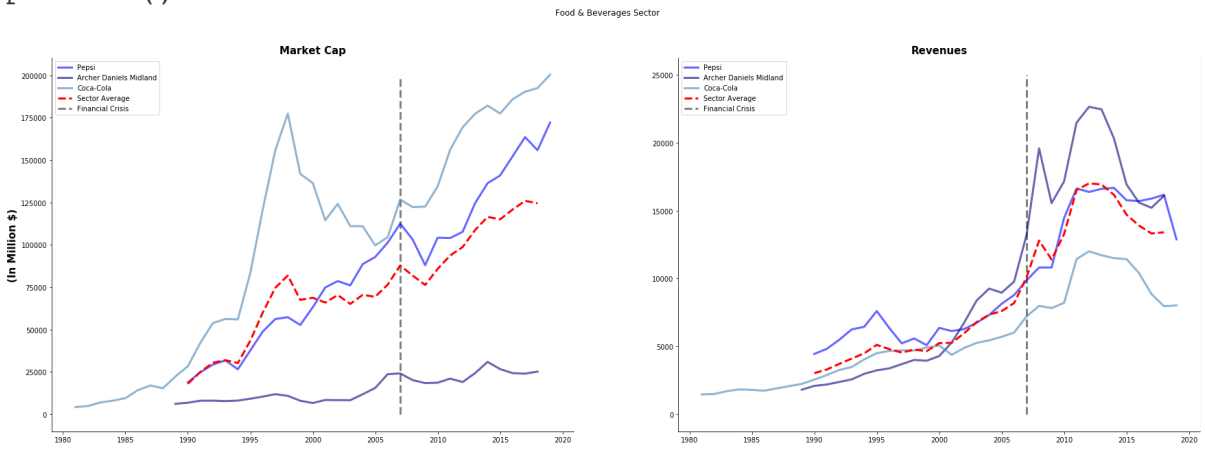
- One thing we can pinpoint in the industrial sector is the dramatic fall on GE's market cap in the year 2007.
- We can recall that GE was heavily depended on commercial papers (excessive short-term notes).
- When the financial crisis hit the market, the commercial paper market froze and led to the erosion of GE's stock price.
- This plot elaborately describes the the moment of the crisis.

Food & Beverages Sector

In [26]:

```
fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize=(30,10))
ax = axes

fig.suptitle("Food & Beverages Sector", fontdict = {'fontsize':30, 'font
weight':'bold'})


########## Food & Beverages Sector Plot ###########

mrk_avg = (PEP["Market Cap"]+ADM["Market Cap"]+KO["Market Cap"])/3

ax[0].plot(PEP.Year, PEP["Market Cap"], color = "blue", alpha = 0.6, lin
ewidth = 3, label = "Pepsi")
ax[0].plot(ADM.Year, ADM["Market Cap"], color = "navy", alpha = 0.6, lin
ewidth = 3, label = "Archer Daniels Midland")
ax[0].plot(KO.Year, KO["Market Cap"], color = "steelblue", alpha = 0.6,
linewidth = 3, label = "Coca-Cola")
ax[0].plot(KO.Year, mrk_avg, color = "red", linestyle = "--", alpha = 1,
linewidth = 3, label = "Sector Average")
ax[0].ticklabel_format(useOffset=False, style='plain')

ax[0].vlines(x = 2007, ymin = 0, ymax = 200000, colors = 'gray', linesty
les = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[0].legend(frameon = True)

ax[0].set_title(label = "Market Cap", fontdict = {'fontsize':15, 'fontwe
ight':'bold'})
ax[0].set_ylabel(ylabel = "(In Million $)", fontdict = {'fontsize':15,
'fontweight':'bold'})

ax[0].spines["right"].set_visible(False)
ax[0].spines["top"].set_visible(False)

#################################################################

rev_avg = (PEP["Revenue"]+ADM["Revenue"]+KO["Revenue"])/3

ax[1].plot(PEP.Year, PEP["Revenue"], color = "blue", alpha = 0.6, linewi
dth = 3, label = "Pepsi")
ax[1].plot(ADM.Year, ADM["Revenue"], color = "navy", alpha = 0.6, linewi
dth = 3, label = "Archer Daniels Midland")
ax[1].plot(KO.Year, KO["Revenue"], color = "steelblue", alpha = 0.6, lin
ewidth = 3, label = "Coca-Cola")
ax[1].plot(KO.Year, rev_avg, color = "red", linestyle = "--", alpha = 1,
linewidth = 3, label = "Sector Average")
ax[1].ticklabel_format(useOffset=False, style='plain')

ax[1].vlines(x = 2007, ymin = 0, ymax = 25000, colors = 'gray', linestyl
es = 'dashed', label = "Financial Crisis", linewidth = 3)

ax[1].legend(frameon = True)

ax[1].set_title(label = "Revenues", fontdict = {'fontsize':15, 'fontweig
ht':'bold'})
```

```
ax[1].spines["right"].set_visible(False)
ax[1].spines["top"].set_visible(False)

plt.savefig("food_sector.png", bbox_inches = "tight", dip = 1200)

plt.show()
```



- There are two things we would spotlight on the food & beverages sector.
- One is that Archer Daniels Midland outpaced its competitors in revenue from 2004 to 2016, but still struggled on its market cap.
- Two is that even though Coca-Cola's revenue roams below its competitors, it's market cap is sustained above the others.
- It may be that Coca-Cola's brand image or the number of outstanding shares is contributing to the current phenomena.

So far ....

So far, we have plotted the market caps and revenues of different companies by sector as well as their averages. Now, we are going to swtich the gear and give more attention to the average market caps by sectors and plot them all in one. In this way, we will be able to compare how the market caps of sectors changed over time.

Instead of using the previous dataframe to plot the market cap average, we are going to create a new dataframe. The function below takes in a name of a sector and three different companies within the sector. Then the funciton will generate a new dataframe with columns of each company's market cap and their average.

In [27]:
```
def create_avg_mk(Sector, Company_1, Company_2, Company_3):

    A_MK = pd.DataFrame(groupby_df.loc[Sector].loc[Company_1]["Market Ca
p"])
    A_MK.rename(columns = {"Market Cap": Company_1 + " Market Cap"}, inp
lace = True)

    B_MK = pd.DataFrame(groupby_df.loc[Sector].loc[Company_2]["Market Ca
p"])
    B_MK.rename(columns = {"Market Cap": Company_2 + " Market Cap"}, inp
lace = True)

    C_MK = pd.DataFrame(groupby_df.loc[Sector].loc[Company_3]["Market Ca
p"])
    C_MK.rename(columns = {"Market Cap": Company_3 + " Market Cap"}, inp
lace = True)

    sector_MK = A_MK.join([B_MK, C_MK], how="inner")

    sector_MK["Average Market Cap"] = (sector_MK[Company_1 + " Market Ca
p"]
                                       + sector_MK[Company_2 + " Market
 Cap"] +
                                       sector_MK[Company_3 + " Market Ca
p"])/3

    sector_MK.index = pd.to_datetime(sector_MK.index, yearfirst = True)

    sector_MK["Average Market Cap"] = sector_MK["Average Market Cap"]/10
00000
    sector_MK["Average Market Cap"] = sector_MK["Average Market Cap"].as
type('int64')

    return sector_MK
```

In [28]:
```
energy_MK = create_avg_mk("Energy", "XOM", "CVX", "COP")
tech_MK =  create_avg_mk("Tech", "AAPL", "AMZN", "GOOGL")
motor_MK =  create_avg_mk("Motor Vehicles and Parts", "GM", "FORD", "GT"
)
health_MK =  create_avg_mk("Health", "CVS", "PFE", "MRK")
indus_MK =  create_avg_mk("Industrials", "GE", "HON", "MMM")
food_MK =  create_avg_mk("Food & Beverages", "PEP", "ADM", "KO")
```

Here is an example of a new dataframe.

In [29]:
```
energy_MK
```

Out[29]:

Date	XOM Market Cap	CVX Market Cap	COP Market Cap	Average Market Cap
1989-12-31	6.445000e+10	2.317728e+10	6.142138e+09	31256
1990-03-31	5.765625e+10	2.404350e+10	6.341270e+09	29347
1990-06-30	5.976902e+10	2.494794e+10	6.281816e+09	30332
1990-09-30	6.110638e+10	2.615900e+10	6.310733e+09	31192
1990-12-31	6.449008e+10	2.565841e+10	6.407731e+09	32185
1991-03-31	7.283250e+10	2.701160e+10	7.276500e+09	35706
1991-06-30	7.235086e+10	2.468755e+10	6.597360e+09	34545
1991-09-30	7.400836e+10	2.576175e+10	6.814290e+09	35528
1991-12-31	7.581323e+10	2.413620e+10	6.232632e+09	35394
1992-03-31	6.799950e+10	2.218880e+10	6.039908e+09	32076
1992-06-30	7.681298e+10	2.286710e+10	6.299689e+09	35326
1992-09-30	7.930081e+10	2.527189e+10	7.146865e+09	37239
1992-12-31	7.588669e+10	2.369294e+10	6.529635e+09	35369
1993-03-31	8.212725e+10	2.703009e+10	7.318996e+09	38825
1993-06-30	8.212725e+10	2.854332e+10	7.293888e+09	39321
1993-09-30	8.135100e+10	3.181732e+10	8.813476e+09	40660
1993-12-31	7.840125e+10	2.837017e+10	7.580311e+09	38117
1994-03-31	7.809075e+10	2.736216e+10	6.961905e+09	37471
1994-06-30	7.048350e+10	2.728843e+10	8.166968e+09	35312
1994-09-30	7.138137e+10	2.712630e+10	8.958533e+09	35822
1994-12-31	7.545150e+10	2.908077e+10	8.564354e+09	37698
1995-03-31	8.274825e+10	3.128405e+10	9.582492e+09	41204
1995-06-30	8.771625e+10	3.023548e+10	8.736641e+09	42229
1995-09-30	8.973450e+10	3.178758e+10	8.520005e+09	43347
1995-12-31	9.995508e+10	3.416076e+10	8.943070e+09	47686
1996-03-31	1.012340e+11	3.662942e+10	1.032589e+10	49396
1996-06-30	1.079050e+11	3.850617e+10	1.100940e+10	52473
1996-09-30	1.033840e+11	4.087834e+10	1.125000e+10	51837
1996-12-31	1.216950e+11	4.240743e+10	1.164585e+10	58582
1997-03-31	1.338440e+11	4.549005e+10	1.075495e+10	63362
...	...	...	...	...
2011-09-30	3.531350e+11	1.854560e+11	8.693992e+10	208510
2011-12-31	4.062720e+11	2.118940e+11	9.675232e+10	238306

Date	XOM Market Cap	CVX Market Cap	COP Market Cap	Average Market Cap
2012-03-31	4.087780e+11	2.119510e+11	9.676948e+10	239166
2012-06-30	4.001390e+11	2.081170e+11	7.066342e+10	226306
2012-09-30	4.221280e+11	2.287070e+11	6.944793e+10	240094
2012-12-31	3.946110e+11	2.116500e+11	7.039375e+10	225551
2013-03-31	4.037330e+11	2.308310e+11	7.338168e+10	235981
2013-06-30	4.017300e+11	2.294590e+11	7.397100e+10	235053
2013-09-30	3.787160e+11	2.347410e+11	8.501123e+10	232822
2013-12-31	4.420940e+11	2.402240e+11	8.655322e+10	256290
2014-03-31	4.220990e+11	2.270150e+11	8.635833e+10	245157
2014-06-30	4.323580e+11	2.485230e+11	1.052510e+11	262044
2014-09-30	4.010940e+11	2.265810e+11	9.408655e+10	240587
2014-12-31	3.914820e+11	2.120680e+11	8.500684e+10	229518
2015-03-31	3.565490e+11	1.973810e+11	7.667080e+10	210200
2015-06-30	3.478680e+11	1.814100e+11	7.571526e+10	201664
2015-09-30	3.099990e+11	1.484310e+11	5.915668e+10	172528
2015-12-31	3.245010e+11	1.693080e+11	5.764543e+10	183818
2016-03-31	3.471290e+11	1.796530e+11	4.986901e+10	192217
2016-06-30	3.887030e+11	1.975730e+11	5.399368e+10	213423
2016-09-30	3.619200e+11	1.941610e+11	5.383782e+10	203306
2016-12-31	3.742810e+11	2.221900e+11	6.212484e+10	219531
2017-03-31	3.400560e+11	2.032620e+11	6.163097e+10	201649
2017-06-30	3.420740e+11	1.976600e+11	5.438309e+10	198039
2017-09-30	3.473580e+11	2.226630e+11	6.090831e+10	210309
2017-12-31	3.543920e+11	2.377830e+11	6.562186e+10	219265
2018-03-31	3.161570e+11	2.178450e+11	6.964070e+10	201214
2018-06-30	3.502650e+11	2.416030e+11	8.146001e+10	224442
2018-09-30	3.599590e+11	2.343060e+11	8.994618e+10	228070
2018-12-31	2.887030e+11	2.078730e+11	7.177993e+10	189451

117 rows × 4 columns

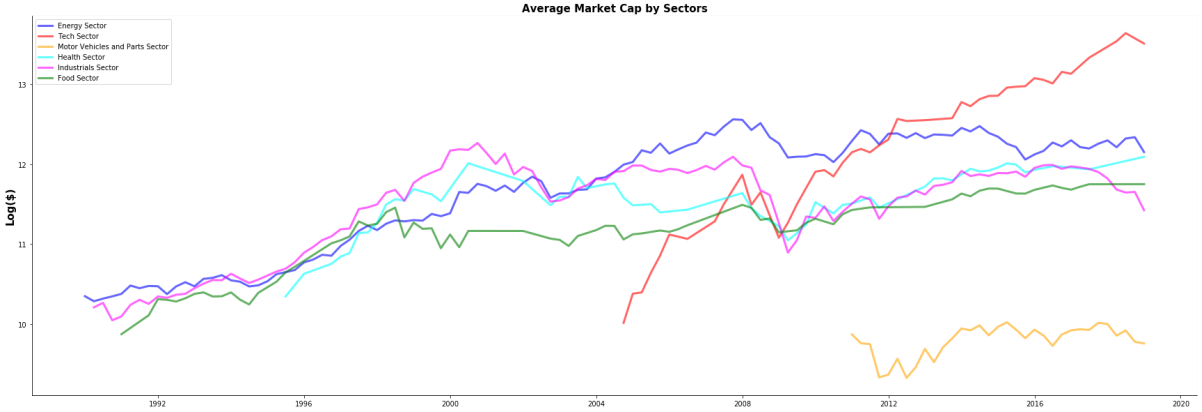
Now, we am going to plot the average Market Cap by the sectors

Log version of the plot

In [30]:

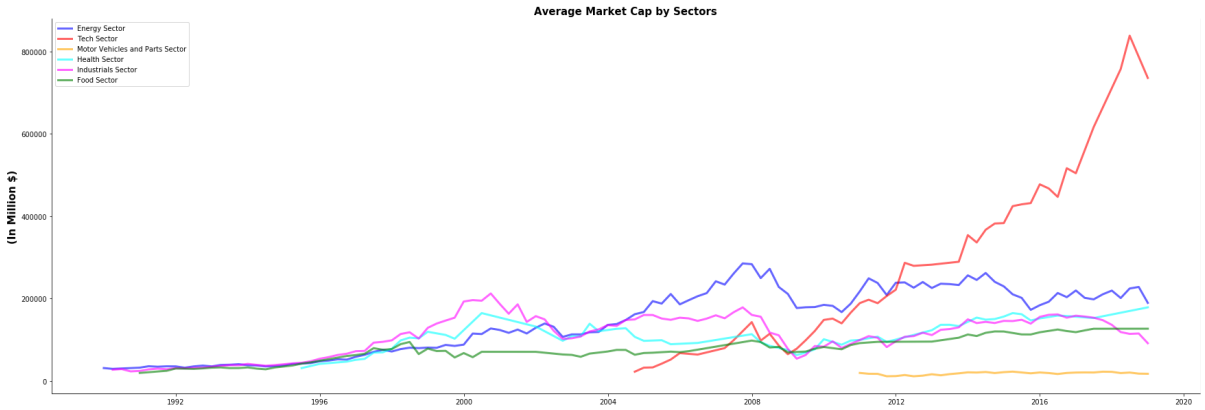
```
fig, axes = plt.subplots(nrows = 1, ncols = 1, figsize=(30,10))
ax = axes

########## Average Market Cap by the sectors Plot ###########


ax.plot(energy_MK.index, np.log(energy_MK["Average Market Cap"]), color
= "blue", alpha = 0.6, linewidth = 3, label = "Energy Sector")
ax.plot(tech_MK.index, np.log(tech_MK["Average Market Cap"]), color = "r
ed", alpha = 0.6, linewidth = 3, label = "Tech Sector")
ax.plot(motor_MK.index, np.log(motor_MK["Average Market Cap"]), color =
"orange", alpha = 0.6, linewidth = 3, label = "Motor Vehicles and Parts
 Sector")
ax.plot(health_MK.index, np.log(health_MK["Average Market Cap"]), color
= "cyan", alpha = 0.6, linewidth = 3, label = "Health Sector")
ax.plot(indus_MK.index, np.log(indus_MK["Average Market Cap"]), color =
"magenta", alpha = 0.6, linewidth = 3, label = "Industrials Sector")
ax.plot(food_MK.index, np.log(food_MK["Average Market Cap"]), color = "g
reen", alpha = 0.6, linewidth = 3, label = "Food Sector")
#ax.ticklabel_format(useOffset=False, style='plain')

ax.legend(frameon = True)

ax.set_title(label = "Average Market Cap by Sectors", fontdict = {'fonts
ize':15, 'fontweight':'bold'})
ax.set_ylabel(ylabel = "Log($)", fontdict = {'fontsize':15, 'fontweight'
:'bold'})

ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)

plt.savefig("avg_mk_log.png", bbox_inches = "tight", dip = 1200)

plt.show()
```

```
c:\users\shawnyoon\appdata\local\programs\python\python37\lib\site-packages\pandas\plotting\_converter.py:129: FutureWarning: Using an implicitly registered datetime converter for a matplotlib plotting method. The converter was registered by pandas on import. Future versions of pandas will require you to explicitly register matplotlib converters.

To register the converters:
        >>> from pandas.plotting import register_matplotlib_converters
        >>> register_matplotlib_converters()
  warnings.warn(msg, FutureWarning)
```



Normal version of the plot

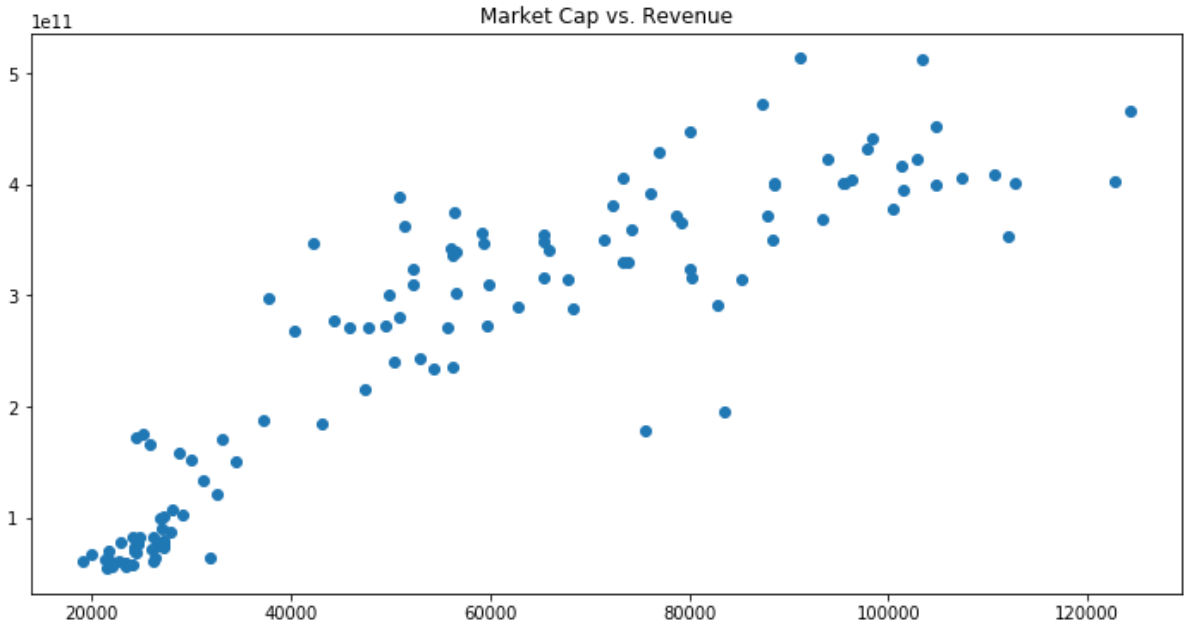
In [31]:
```
fig, axes = plt.subplots(nrows = 1, ncols = 1, figsize=(30,10))
ax = axes

########## Average Market Cap by the sectors Plot ###########


ax.plot(energy_MK.index, energy_MK["Average Market Cap"], color = "blue"
, alpha = 0.6, linewidth = 3, label = "Energy Sector")
ax.plot(tech_MK.index, tech_MK["Average Market Cap"], color = "red", alp
ha = 0.6, linewidth = 3, label = "Tech Sector")
ax.plot(motor_MK.index, motor_MK["Average Market Cap"], color = "orange"
, alpha = 0.6, linewidth = 3, label = "Motor Vehicles and Parts Sector")
ax.plot(health_MK.index, health_MK["Average Market Cap"], color = "cyan"
, alpha = 0.6, linewidth = 3, label = "Health Sector")
ax.plot(indus_MK.index, indus_MK["Average Market Cap"], color = "magent
a", alpha = 0.6, linewidth = 3, label = "Industrials Sector")
ax.plot(food_MK.index, food_MK["Average Market Cap"], color = "green", a
lpha = 0.6, linewidth = 3, label = "Food Sector")
#ax.ticklabel_format(useOffset=False, style='plain')

ax.legend(frameon = True)

ax.set_title(label = "Average Market Cap by Sectors", fontdict = {'fonts
ize':15, 'fontweight':'bold'})
ax.set_ylabel(ylabel = "(In Million $)", fontdict = {'fontsize':15, 'fon
tweight':'bold'})

ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)

plt.savefig("avg_mk.png", bbox_inches = "tight", dip = 1200)

plt.show()
```



Energy Sector Correlation Plot

This is just some extra plots that shows correlation between ExxonMobil's market cap and revenue. It looks like the relationship between the market cap and the revenue is highly correlated.

In [32]:
```
XOM_rev = groupby_df.loc["Energy"].loc["XOM"]["Revenue"]
XOM_mrk = groupby_df.loc["Energy"].loc["XOM"]["Market Cap"]

fig, ax = plt.subplots(figsize = (12,6))

ax.scatter(XOM_rev, XOM_mrk)

ax.set_title("Market Cap vs. Revenue")


plt.show()
```



In [33]:
```
XOM_rev = groupby_df.loc["Energy"].loc["XOM"]["Revenue"]
XOM_mrk = groupby_df.loc["Energy"].loc["XOM"]["Market Cap"]

from sklearn.linear_model import LinearRegression

X = XOM_rev.values.reshape(-1, 1)  # values converts it into a numpy arr
ay
Y = XOM_mrk.values.reshape(-1, 1)  # -1 means that calculate the dimensi
on of rows, but have 1 column
linear_regressor = LinearRegression()  # create object for the class
linear_regressor.fit(X, Y)  # perform linear regression
Y_pred = linear_regressor.predict(X)  # make predictions
plt.scatter(X, Y)
plt.plot(X, Y_pred, color='red')
plt.show()
```