cs105_phase3

March 18, 2020

[1]:
```
import pandas as pd
import numpy as np
df = pd.read_csv('CS 105 Project.csv')

#df = df.set_index(['Year', 'Rank'])

df["Number of Employees"] = df["Number of Employees"].replace({'\,':''}, regex␣
 ↪= True)
df["Number of Employees"] = df["Number of Employees"].replace({'\,':''}, regex␣
 ↪= True)
df["Number of Employees"] = df["Number of Employees"].fillna(0)
df["Number of Employees"] = df["Number of Employees"].astype(float)

df.loc[df['Change in Rank'] == '-', 'Change in Rank'] = 0
df["Change in Rank"] = df["Change in Rank"].fillna(0)
df["Change in Rank"] = df["Change in Rank"].astype(int)

df["Revenues ($millions)"] = df["Revenues ($millions)"].replace({'\$':''},␣
 ↪regex = True)
df["Revenues ($millions)"] = df["Revenues ($millions)"].replace({'\,':''},␣
 ↪regex = True)
df["Revenues ($millions)"] = df["Revenues ($millions)"].fillna(0)
df["Revenues ($millions)"] = df["Revenues ($millions)"].astype(float)

df["Revenue Change"] = df["Revenue Change"].replace({'\%':''}, regex = True)
df.loc[df['Revenue Change'] == '-', 'Revenue Change'] = 0
df["Revenue Change"] = df["Revenue Change"].fillna(0)
df["Revenue Change"] = df["Revenue Change"].astype(float)

df["Profits ($millions)"] = df["Profits ($millions)"].replace({'\$':''}, regex␣
 ↪= True)
df["Profits ($millions)"] = df["Profits ($millions)"].replace({'\,':''}, regex␣
 ↪= True)
df.loc[df['Profits ($millions)'] == '-', 'Profits ($millions)'] = 0
df["Profits ($millions)"] = df["Profits ($millions)"].fillna(0)
df["Profits ($millions)"] = df["Profits ($millions)"].astype(float)
```

```
df["Profit Change"] = df["Profit Change"].replace({'\%':''}, regex = True)
df.loc[df['Profit Change'] == '-', 'Profit Change'] = 0
df["Profit Change"] = df["Profit Change"].fillna(0)
df["Profit Change"] = df["Profit Change"].astype(float)

df["Assets ($millions)"] = df["Assets ($millions)"].replace({'\$':''}, regex =␣
↪True)
df["Assets ($millions)"] = df["Assets ($millions)"].replace({'\,':''}, regex =␣
↪True)
df["Assets ($millions)"] = df["Assets ($millions)"].fillna(0)
df["Assets ($millions)"] = df["Assets ($millions)"].astype(float)

df["Market Value As of 3/29/19 ($m)"] = df["Market Value As of 3/29/19 ($m)"].
↪replace({'\$':''}, regex = True)
df["Market Value As of 3/29/19 ($m)"] = df["Market Value As of 3/29/19 ($m)"].
↪replace({'\,':''}, regex = True)
df.loc[df['Market Value As of 3/29/19 ($m)'] == '-', 'Market Value As of 3/29/
↪19 ($m)'] = 0
df["Market Value As of 3/29/19 ($m)"] = df["Market Value As of 3/29/19 ($m)"].
↪fillna(0)
df["Market Value As of 3/29/19 ($m)"] = df["Market Value As of 3/29/19 ($m)"].
↪astype(float)

df.head()
#Usman
```

[1]:

	Rank	Company Name	Number of Employees	Change in Rank	Revenues ($millions)	Revenue Change	Profits ($millions)	Profit Change	Assets ($millions)	Market Value As of 3/29/19 ($m)	Year
0	1	Walmart	2200000.0	0	514405.0	2.8	6670.0	-32.4	219295.0	279880.0	2019
1	2	Exxon Mobil	71000.0	0	290212.0	18.8	20840.0	5.7	346196.0	342172.0	2019
2	3	Apple	132000.0	1	265595.0	15.9	59531.0	23.1	365725.0	895667.0	2019
3	4	Berkshire Hathaway	389000.0	-1	247837.0	2.4	4021.0	-91.1	707794.0	493870.0	2019
4	5	Amazon.com	647500.0	3	232887.0	30.9	10073.0	232.1	162648.0	874710.0	2019

[2]:
```
df.describe()
```

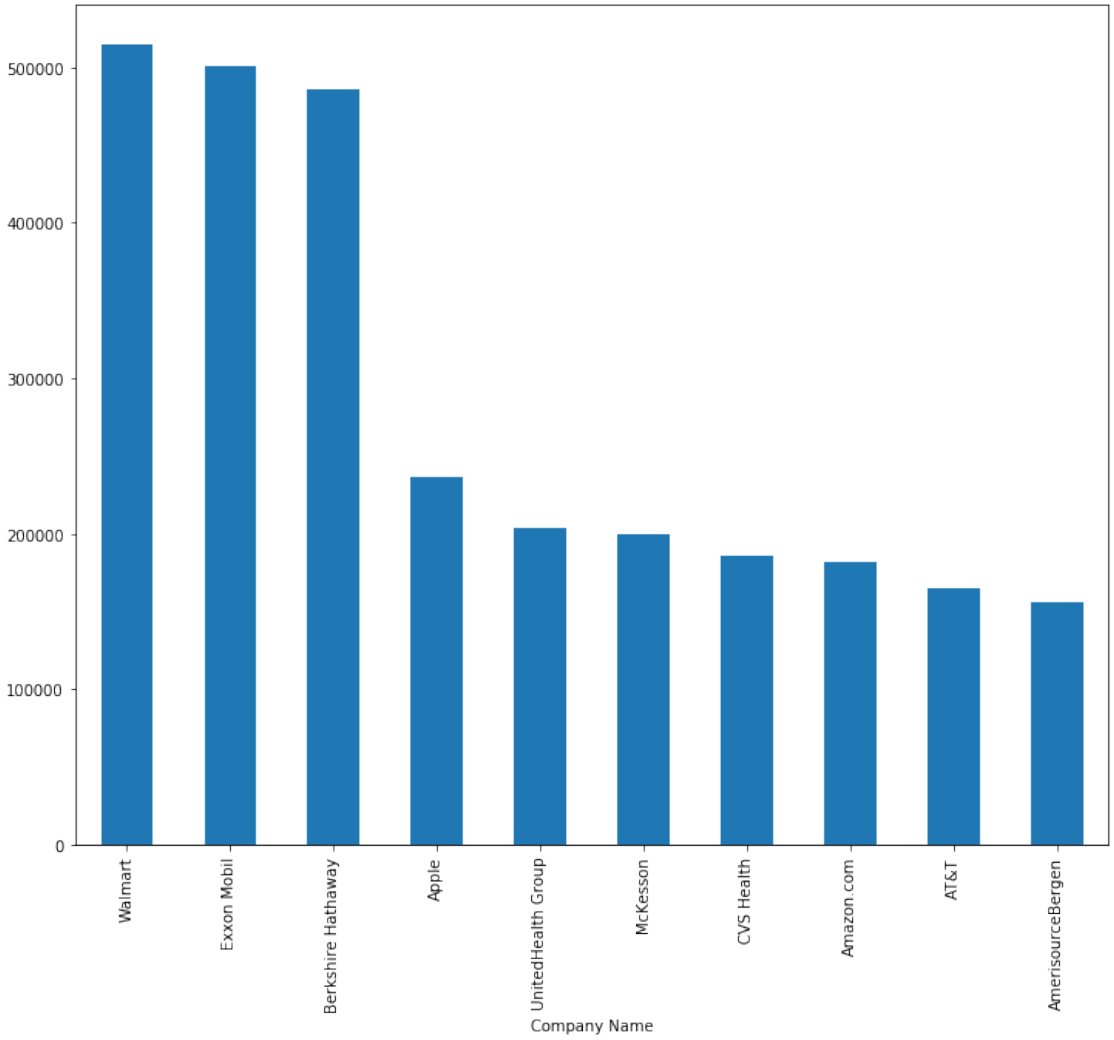
[2]:

	Rank	Number of Employees	Change in Rank	Revenues ($millions)
count	1500.000000	1.500000e+03	1500.000000	1500.000000
mean	250.499333	5.696114e+04	169.955333	25727.784000
std	144.385600	1.238835e+05	172.959504	41020.280072
min	1.000000	1.260000e+02	-131.000000	5145.000000
25%	125.750000	1.190000e+04	7.000000	7651.000000
50%	250.500000	2.520200e+04	123.500000	12024.000000
75%	375.250000	5.809925e+04	312.250000	23387.000000
max	500.000000	2.300000e+06	761.000000	514405.000000

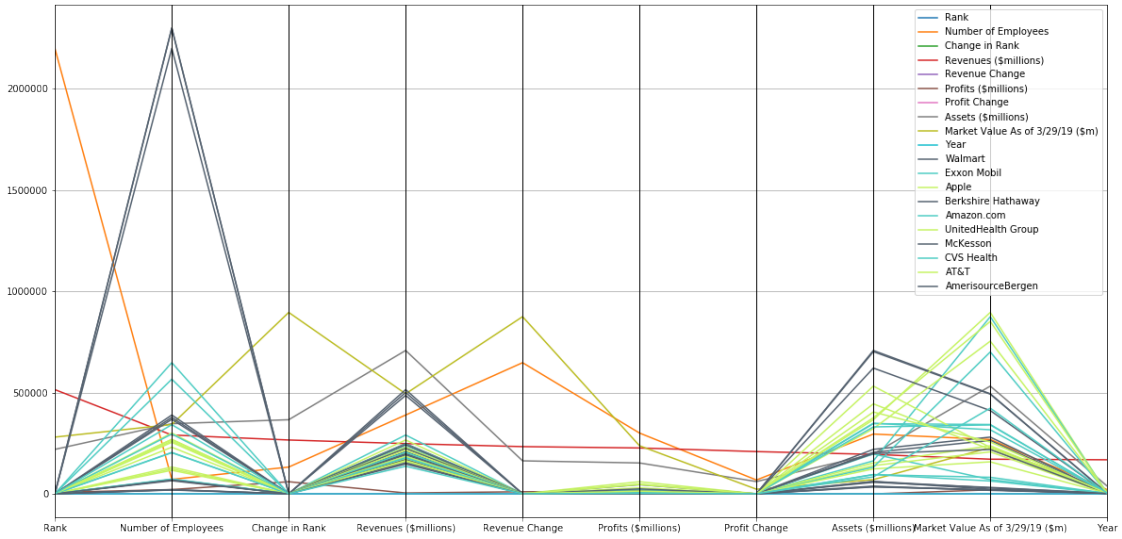
	Revenue Change	Profits ($millions)	Profit Change	Assets ($millions)
count	1500.000000	1500.000000	1500.000000	1.500000e+03
mean	8.232400	2020.940800	42.386000	8.351304e+04
std	23.497572	4578.042001	813.735767	2.759217e+05
min	-57.500000	-22355.000000	-11700.000000	4.370000e+02
25%	0.000000	288.950000	-16.225000	9.134250e+03
50%	5.100000	812.200000	0.900000	2.015800e+04
75%	11.725000	2062.500000	35.825000	5.128525e+04
max	465.300000	59531.000000	23178.300000	3.418318e+06

	Market Value As of 3/29/19 ($m)	Year
count	1500.000000	1500.000000
mean	42423.356667	2018.000000
std	86966.635543	0.816769
min	0.000000	2017.000000
25%	5907.750000	2017.000000
50%	15753.500000	2018.000000
75%	41470.500000	2019.000000
max	904861.000000	2019.000000

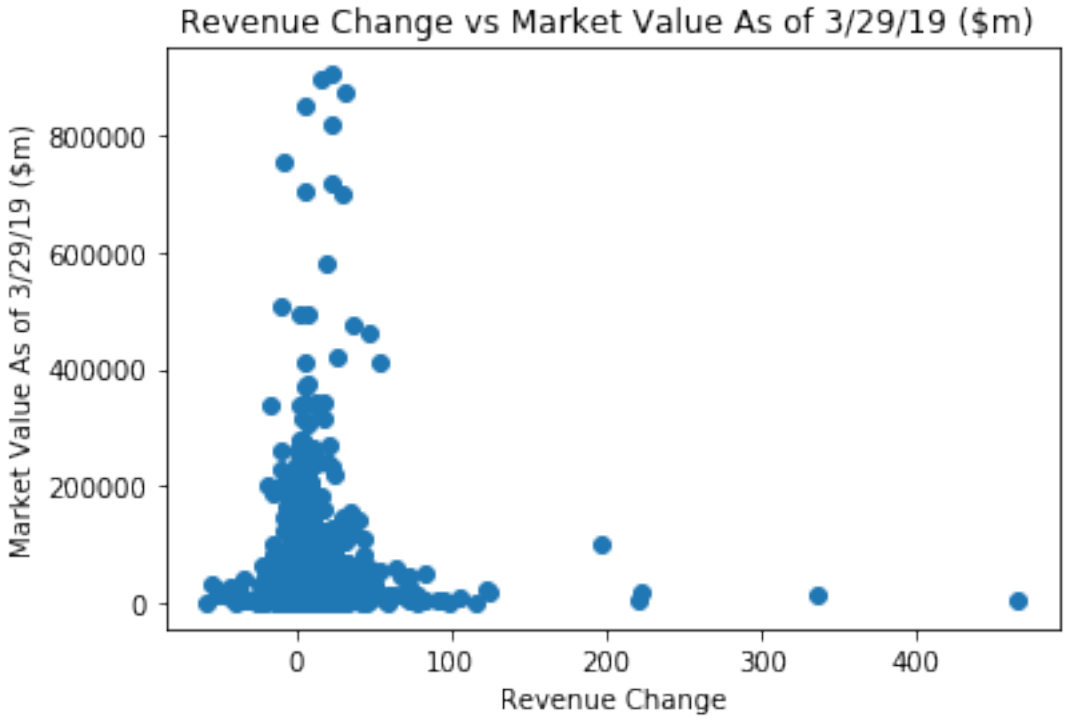
[3]:
```
import matplotlib.pyplot as plt
df1 = df[(df['Company Name'] == "Apple") | (df['Company Name'] == "Walmart") |␣
 ↪(df['Company Name'] == "Exxon Mobil") | (df['Company Name'] == "Berkshire␣
 ↪Hathaway") | (df['Company Name'] == "Amazon.com") | (df['Company Name'] ==␣
 ↪"UnitedHealth Group") | (df['Company Name'] == "McKesson") | (df['Company␣
 ↪Name'] == "CVS Health") | (df['Company Name'] == "AT&T") | (df['Company␣
 ↪Name'] == "AmerisourceBergen")]
df1.groupby('Company Name')['Revenues ($millions)'].plot(kind = 'bar',␣
 ↪fig=(12,10))
df1.groupby(['Company Name']).mean()['Revenues ($millions)'].
 ↪sort_values(ascending=False).plot(kind="bar",figsize=(12,10))
plt.show()
#Devang
```



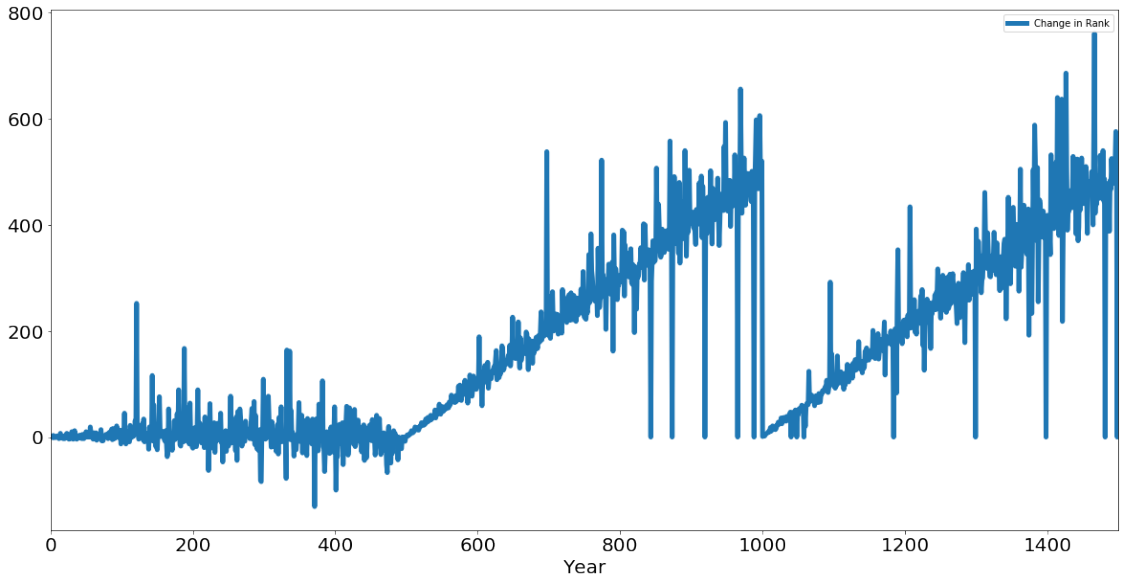
[4]:
```
import matplotlib.pyplot as plt

df1 = df[(df['Company Name'] == "Apple") | (df['Company Name'] == "Walmart") |␣
 ↪(df['Company Name'] == "Exxon Mobil") | (df['Company Name'] == "Berkshire␣
 ↪Hathaway") | (df['Company Name'] == "Amazon.com") | (df['Company Name'] ==␣
 ↪"UnitedHealth Group") | (df['Company Name'] == "McKesson") | (df['Company␣
 ↪Name'] == "CVS Health") | (df['Company Name'] == "AT&T") | (df['Company␣
 ↪Name'] == "AmerisourceBergen")]
df1.plot(figsize=(20,10))
pd.plotting.parallel_coordinates(
        df1, 'Company Name',
        color=('#556270', '#4ECDC4', '#C7F464'))
plt.show()

#Devang
```



[5]:
```
fig=plt.figure()
plt.scatter(df["Revenue Change"], df["Market Value As of 3/29/19 ($m)"])
axis = fig.gca() #get current axis
axis.set_title('Revenue Change vs Market Value As of 3/29/19 ($m) ')
axis.set_xlabel('Revenue Change')
axis.set_ylabel('Market Value As of 3/29/19 ($m)')
fig.canvas.draw()
#Luis
```

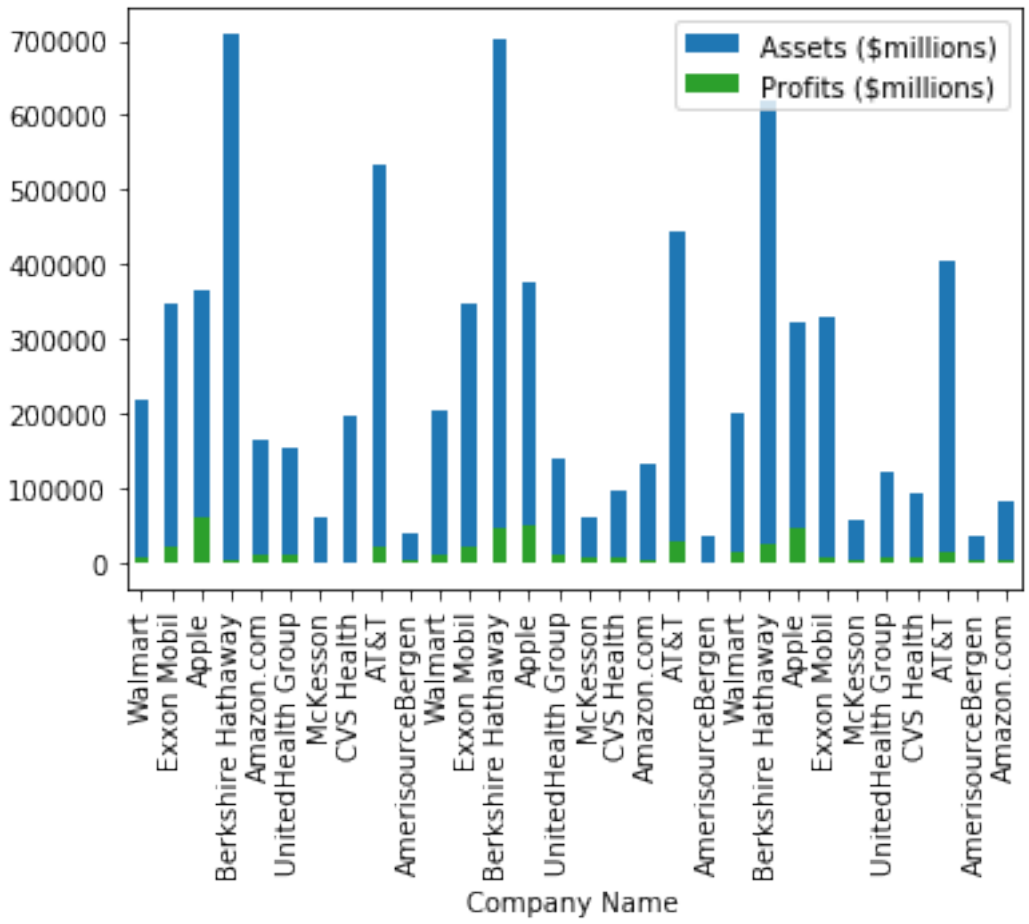


[6]:
```
df[['Change in Rank']].plot(figsize=(20,10), linewidth=5, fontsize=20)
plt.xlabel('Year', fontsize=20);
#Luis
```



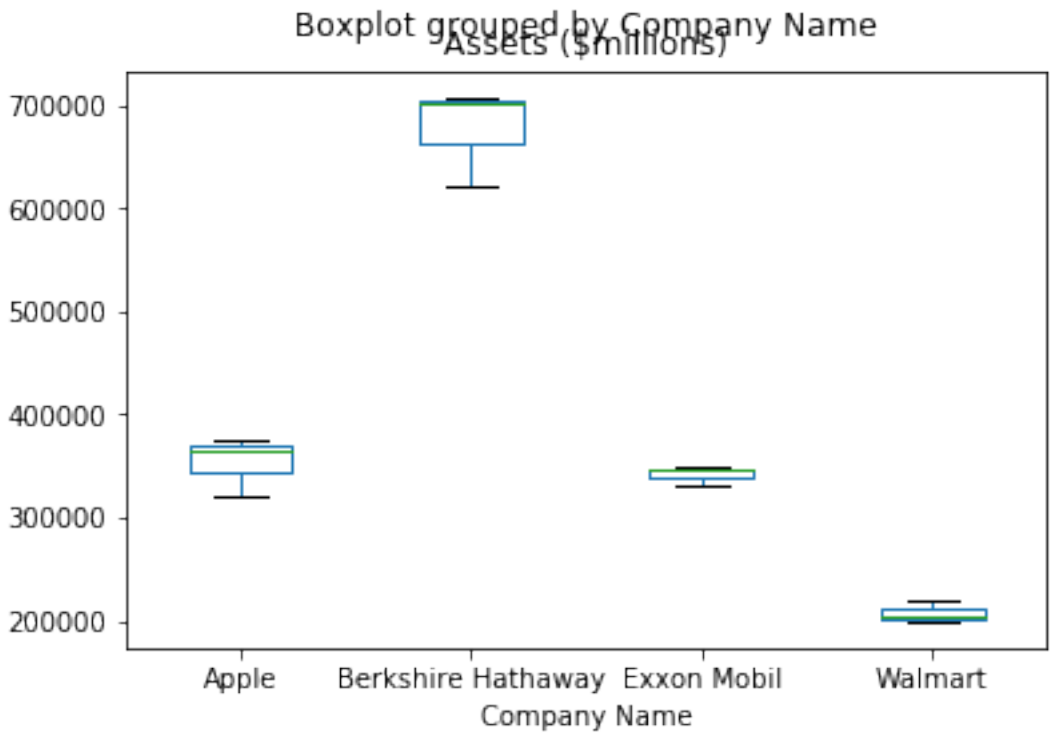
[7]:
```
df1 = df[(df['Company Name'] == "Apple") | (df['Company Name'] == "Walmart") |␣
↪(df['Company Name'] == "Exxon Mobil") | (df['Company Name'] == "Berkshire␣
↪Hathaway") | (df['Company Name'] == "Amazon.com") | (df['Company Name'] ==␣
↪"UnitedHealth Group") | (df['Company Name'] == "McKesson") | (df['Company␣
↪Name'] == "CVS Health") | (df['Company Name'] == "AT&T") | (df['Company␣
↪Name'] == "AmerisourceBergen")]

ax = df1.plot(x="Company Name", y="Assets ($millions)", kind="bar")
df1.plot(x="Company Name", y="Profits ($millions)", kind="bar", ax=ax,␣
↪color="C2")

#Usman
```

[7]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f6846e086d8>
```

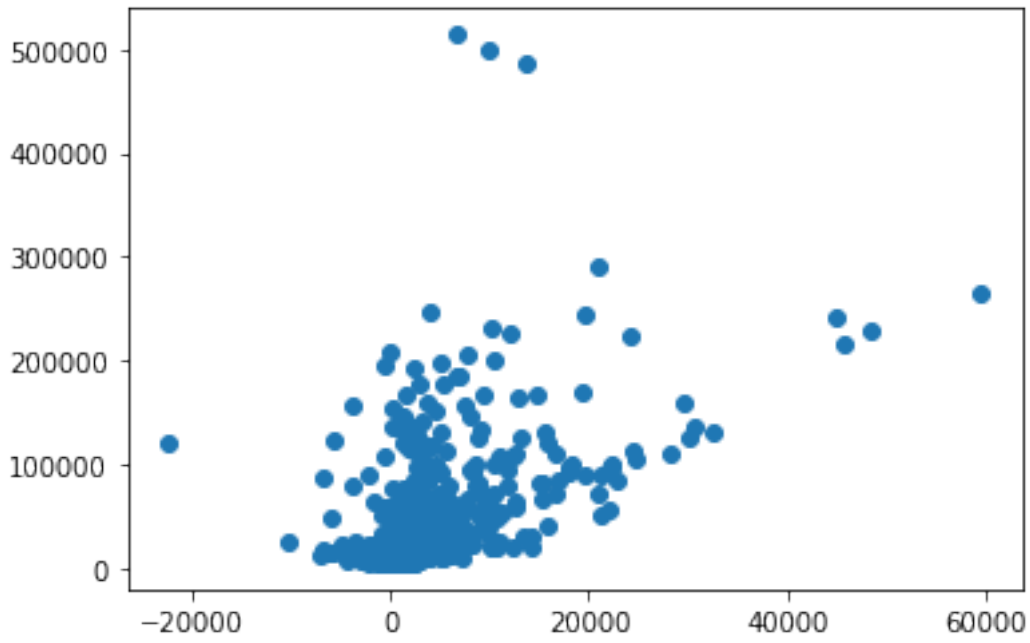


[8]:
```
df1 = df[(df['Company Name'] == "Apple") | (df['Company Name'] == "Walmart") |␣
↪(df['Company Name'] == "Exxon Mobil") | (df['Company Name'] == "Berkshire␣
↪Hathaway")]
df1.boxplot(by ='Company Name', column =['Assets ($millions)'], grid = False)
#Devang
```

[8]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f6846bf7978>
```

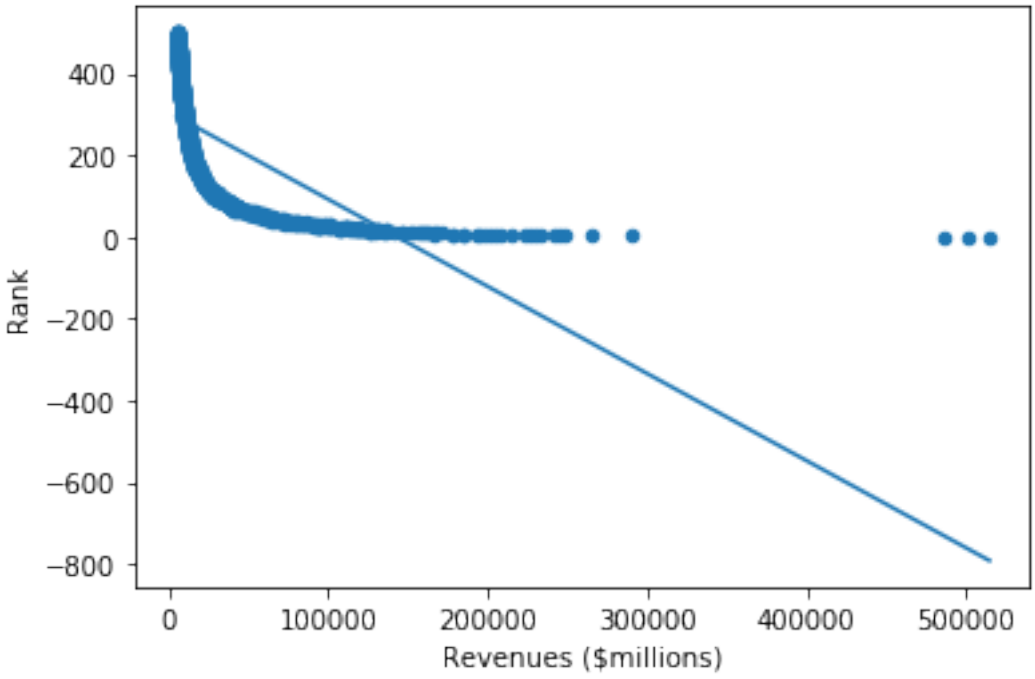


[9]:
```
import matplotlib.pyplot as plt
import pandas
plt.scatter(x=df['Profits ($millions)'], y=df['Revenues ($millions)'])
plt.show()
#Devang
```



[10]:
```
from sklearn.linear_model import LinearRegression
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
X_train = df[["Revenues ($millions)"]]
y_train = df["Rank"]

model = LinearRegression()
model.fit(X=X_train, y=y_train)

model.predict(X=X_train)
y = model.coef_ * df["Revenues ($millions)"] + model.intercept_
df.plot.scatter(x="Revenues ($millions)", y="Rank")
plt.plot(df["Revenues ($millions)"], y)
#Devang
```

[10]:
```
[<matplotlib.lines.Line2D at 0x7f6846b094e0>]
```

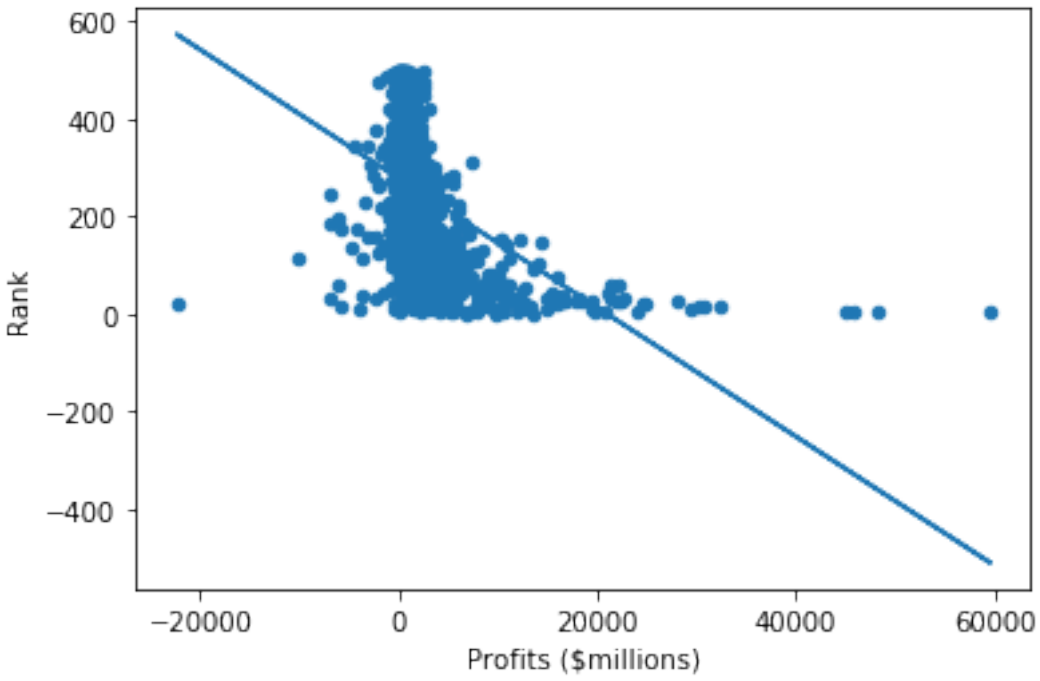


1 Does Revenue have any effect on the company fortune 500 rank?

Yes, it does. As revenue increases, the company rank increases. It appears that the weight of revenue is quite heavy when it comes to Fortune 500 rankings.

[11]:
```
X_train = df[["Profits ($millions)"]]
y_train = df["Rank"]

model = LinearRegression()
model.fit(X=X_train, y=y_train)

model.predict(X=X_train)
y = model.coef_ * df["Profits ($millions)"] + model.intercept_
df.plot.scatter(x="Profits ($millions)", y="Rank")
plt.plot(df["Profits ($millions)"], y)
#Devang
```

[11]:
```
[<matplotlib.lines.Line2D at 0x7f68357467f0>]
```

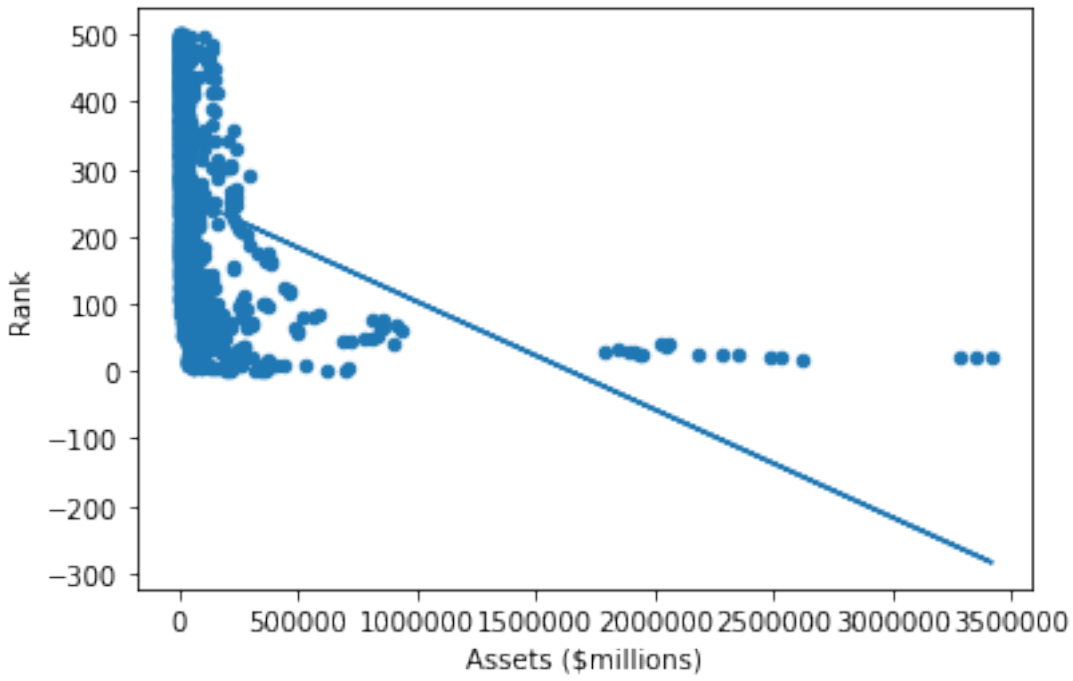


2 Does Profit have any effect on the company fortune 500 rank?

No, not really. As profit increases, the company rank could increase or decrease. It appears that the weight of profit is not quite heavy when it comes to Fortune 500 rankings.

[12]:
```
X_train = df[["Assets ($millions)"]]
y_train = df["Rank"]

model = LinearRegression()
model.fit(X=X_train, y=y_train)

model.predict(X=X_train)
y = model.coef_ * df["Assets ($millions)"] + model.intercept_
df.plot.scatter(x="Assets ($millions)", y="Rank")
plt.plot(df["Assets ($millions)"], y)
#Devang
```

[12]:
```
[<matplotlib.lines.Line2D at 0x7f6834d3beb8>]
```



3 Do Company Assets have any effect on the company fortune 500 rank?

No, not really. As assets increases, the company rank could increase or decrease. It appears that the weight of profit is not quite heavy when it comes to Fortune 500 rankings.

[13]:
```
from sklearn.linear_model import LinearRegression
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np

X_train = df[["Revenues ($millions)","Profits ($millions)","Assets␣
↪($millions)"]]
y_train = df["Rank"]

model = LinearRegression()
model.fit(X=X_train, y=y_train)
X_test = pd.DataFrame({"Revenues ($millions)": 9455, "Profits($millions)":␣
↪1101, "Assets($millions)": 28173}, index = [0])
model.predict(X = X_test)
#Devang
```

[13]:
```
array([285.82810888])
```

We are predicting the rank number based off of revenue, profit and assests. We will be doing this for select set of companies. X_train will be training on the revenues(millions), assests(millions) and profits. Y_train will be what we are actually predidcting, which is going to be the rank.

4 Question: What will be the fortune 500 rank be of a company with certain stats on the following year of 2020?

ANSWER: The average rank of a company with stats of Revenues: 9,455,000,000, Profits: 1,101,000,000, Assets: 28,173,000,000 will be 285. This is a prediction for our model.

[14]:
```
ashen_model = LinearRegression()

X_train = df[["Revenue Change", "Profit Change", "Assets ($millions)"]]
y_train = df["Rank"]

ashen_model.fit(
    X=X_train,
    y=y_train
)

X_test = pd.DataFrame({"Revenue Change": 8, "Profit Change": 42, "Assets␣
↪($millions)": 83513.042}, index =[0])
ashen_model.predict(X = X_test)
#Usman
```

[14]:
```
array([250.47570484])
```

Prediction the Median Fortune 500 Rank. If a company has less than: 8% positive revenue change, 42% positive profit change, and $83513.042 million in assets the company is gonna be in the bottom half of the fortune 500 company list while having values greater than the aforementioned values we can assume the company will be in the top 250 companies on the fortune 500 list.

[15]:
```
ashen_model = LinearRegression()

X_train = df[["Number of Employees", "Profit Change", "Assets ($millions)"]]
y_train = df["Rank"]

ashen_model.fit(
    X=X_train,
    y=y_train
)

X_test = pd.DataFrame({"Number of Employees": 150000 , "Profit Change": 42,␣
↪"Assets ($millions)": 83513.042}, index =[0])
ashen_model.predict(X = X_test)
#Luis
```

[15]:
```
array([216.00412038])
```

[16]:
```
ashen_model = LinearRegression()

X_train = df[["Number of Employees", "Market Value As of 3/29/19 ($m)",␣
 ↪"Revenue Change"]]
y_train = df["Rank"]

ashen_model.fit(
    X=X_train,
    y=y_train
)

X_test = pd.DataFrame({"Number of Employees": 150000 , "Market Value As of 3/29/
 ↪19 ($m)": 9455 , "Revenue Change": 10}, index =[0])
ashen_model.predict(X = X_test)
#Luis
```

[16]:
```
array([244.51663257])
```

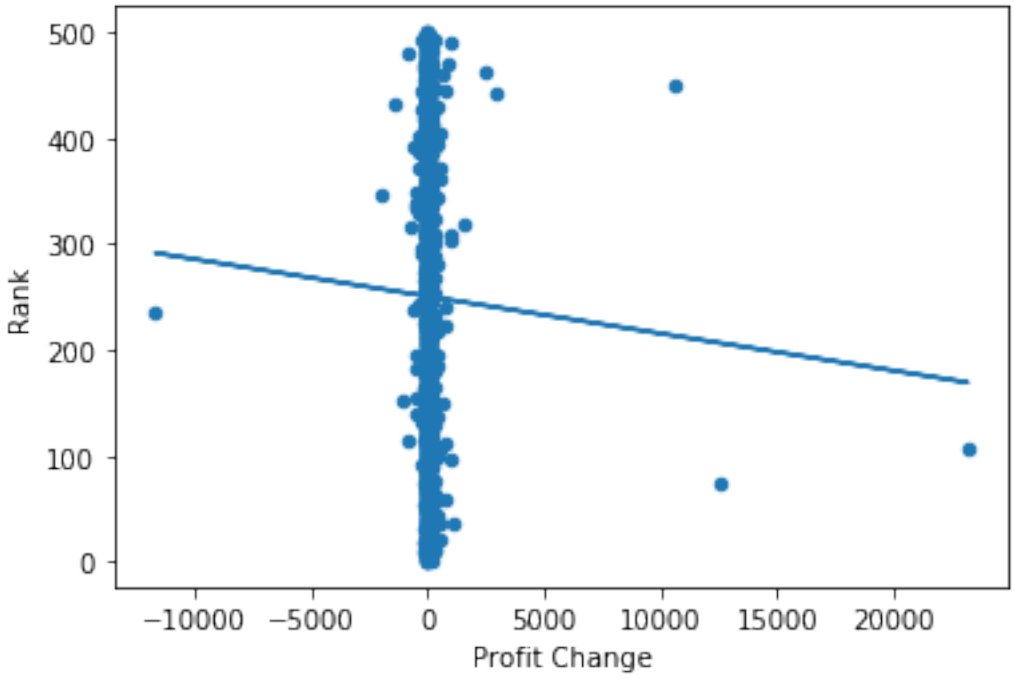
[17]:
```
ashen_model1 = LinearRegression()


tips_train = df.loc[:750].copy()
tips_test = df.loc[751:].copy()

X_train1 = tips_train[["Revenue Change"]]
X_test1 = tips_test[["Revenue Change"]]
y_train1 = tips_train["Rank"]

ashen_model1.fit(X=X_train1, y=y_train1)
ashen_model1.predict(X=X_test1)

import numpy as np

X_new1 = pd.DataFrame()
# create a sequence of 200 evenly spaced numbers from 10 to 41
X_new1["Revenue Change"] = np.linspace(3.070000, 50.810000, num=200)

# create a Series out of the predicted values
# (trailing underscore indicates fitted values)
y_new_1 = pd.Series(
    ashen_model1.predict(X_new1), # y values in Series.plot.line()
    index=X_new1["Revenue Change"]    # x values in Series.plot.line()
)

# plot the data, then the model
```

```
tips_train.plot.scatter(x="Revenue Change", y="Rank")
y_new_1.plot.line()
#Usman
```

[17]: <matplotlib.axes._subplots.AxesSubplot at 0x7f6834c9acc0>

[18]:
```
X_train = df[["Profit Change"]]
y_train = df["Rank"]

model = LinearRegression()
model.fit(X=X_train, y=y_train)

model.predict(X=X_train)
y = model.coef_ * df["Profit Change"] + model.intercept_
df.plot.scatter(x="Profit Change", y="Rank")
plt.plot(df["Profit Change"], y)
#Usman
```

[18]: [<matplotlib.lines.Line2D at 0x7f6834d92780>]


500
400
300
200
100
0
Rank
−10000
−5000
0
5000
10000
15000
20000
Profit Change