Equity_Analysis_Automobile(tesla,gm,ford)

March 18, 2018

```
In [ ]: # Stocks Analysis: automobile
```

```
In [409]: import numpy as np
          import pandas as pd
          import matplotlib.pyplot as plt
          %matplotlib inline
```

```
In [410]: from pandas_datareader import data, wb
          import pandas_datareader
          import datetime
          import pandas_datareader.data as web
```

```
In [411]: # DATA COLLECTION
          start = datetime.datetime(2012,1,1)
          end = datetime.datetime(2018,1,1)
          tesla = data.DataReader("TSLA", "morningstar", start, end)
          gm = data.DataReader("GM", "morningstar", start, end)
          ford = data.DataReader("F", "morningstar", start, end)
```

```
In [412]: tesla = pd.read_csv("Tesla_Stock.csv")
          gm = pd.read_csv("GM_Stock.csv")
          ford = pd.read_csv("Ford_Stock.csv")
```

```
In [413]: tesla.head()
```

```
Out[413]:          Date  Unnamed: 0  Unnamed: 0.1 Symbol  Close   High    Low   Open  \
          0  2012-01-02           0             0   TSLA  28.56  28.56  28.56  28.56
          1  2012-01-03           1             1   TSLA  28.08  29.50  27.65  28.94
          2  2012-01-04           2             2   TSLA  27.71  28.67  27.50  28.21
          3  2012-01-05           3             3   TSLA  27.12  27.93  26.85  27.76
          4  2012-01-06           4             4   TSLA  26.91  27.79  26.41  27.20

              Volume
          0        0
          1   928052
          2   630036
          3  1005432
          4   986287
```

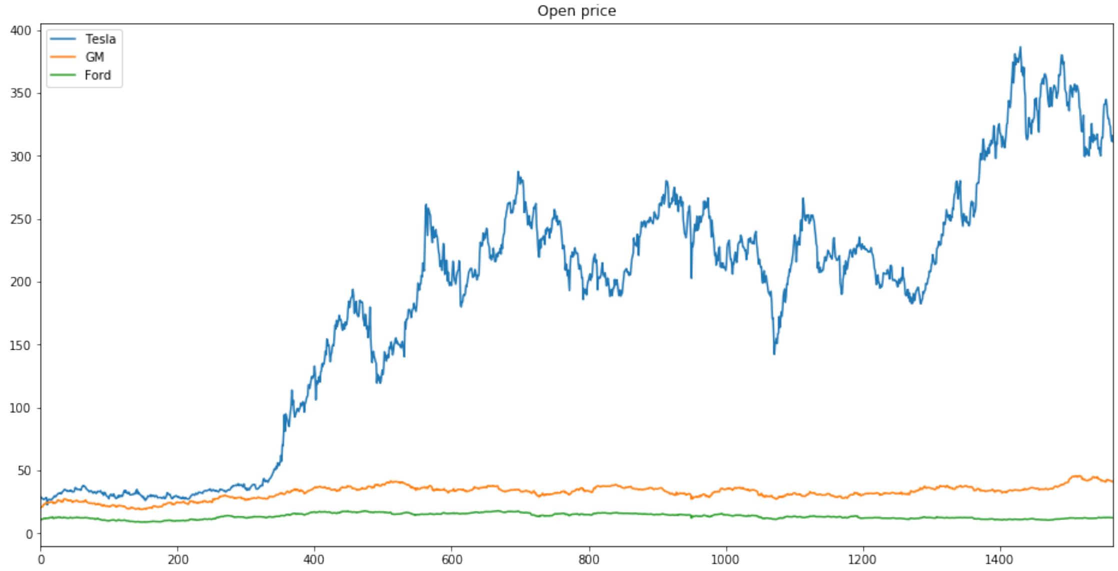
```
In [414]: tesla.head()

Out[414]:          Date  Unnamed: 0  Unnamed: 0.1 Symbol  Close   High    Low   Open  \
          0  2012-01-02           0             0   TSLA  28.56  28.56  28.56  28.56
          1  2012-01-03           1             1   TSLA  28.08  29.50  27.65  28.94
          2  2012-01-04           2             2   TSLA  27.71  28.67  27.50  28.21
          3  2012-01-05           3             3   TSLA  27.12  27.93  26.85  27.76
          4  2012-01-06           4             4   TSLA  26.91  27.79  26.41  27.20

              Volume
          0        0
          1   928052
          2   630036
          3  1005432
          4   986287

In [415]: tesla.to_csv('Tesla_Stock.csv')  # write csv file

In [416]: ford.head()

Out[416]:    Unnamed: 0  Unnamed: 0.1 Symbol        Date  Close   High    Low   Open  \
          0           0             0      F  2012-01-02  10.76  10.76  10.76  10.76
          1           1             1      F  2012-01-03  11.13  11.25  10.99  11.00
          2           2             2      F  2012-01-04  11.30  11.53  11.07  11.15
          3           3             3      F  2012-01-05  11.59  11.63  11.24  11.33
          4           4             4      F  2012-01-06  11.71  11.80  11.52  11.74

               Volume
          0         0
          1  45709811
          2  79725188
          3  67877467
          4  59840605

In [417]: gm.head()

Out[417]:    Unnamed: 0  Unnamed: 0.1 Symbol        Date  Close   High    Low   Open  \
          0           0             0     GM  2012-01-02  20.27  20.27  20.27  20.27
          1           1             1     GM  2012-01-03  21.05  21.18  20.75  20.83
          2           2             2     GM  2012-01-04  21.15  21.37  20.75  21.05
          3           3             3     GM  2012-01-05  22.17  22.29  20.96  21.10
          4           4             4     GM  2012-01-06  22.92  23.03  22.24  22.26

               Volume  MA50  MA200
          0         0   NaN    NaN
          1   9321420   NaN    NaN
          2   7856752   NaN    NaN
          3  17884040   NaN    NaN
          4  18234608   NaN    NaN
```

```
In [418]: gm.tail()

Out[418]:       Unnamed: 0  Unnamed: 0.1 Symbol        Date  Close     High    Low  \
          1561        1561          1561     GM  2017-12-26  41.80  42.0900  41.63
          1562        1562          1562     GM  2017-12-27  41.31  41.8500  41.30
          1563        1563          1563     GM  2017-12-28  41.38  41.4400  41.20
          1564        1564          1564     GM  2017-12-29  40.99  41.5922  40.99
          1565        1565          1565     GM  2018-01-01  40.99  40.9900  40.99

                 Open   Volume     MA50     MA200
          1561  41.86  3369417  43.2666  37.75470
          1562  41.76  4933638  43.1962  37.79195
          1563  41.34  5005263  43.1280  37.82865
          1564  41.52  6581442  43.0484  37.86425
          1565  40.99        0  42.9574  37.89780
```

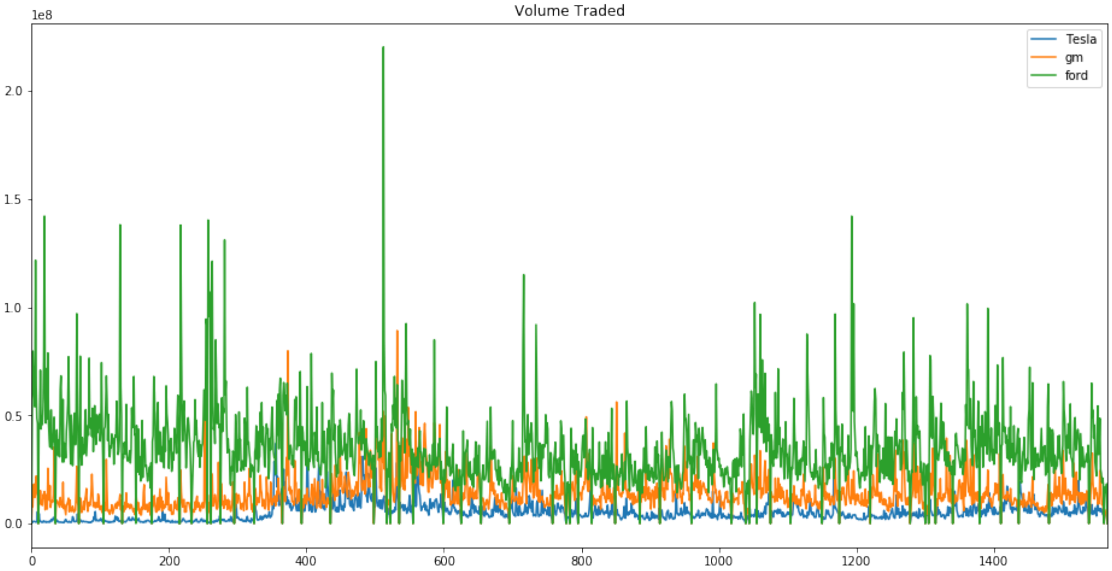
```
In [419]: ford.to_csv("Ford_Stock.csv")
```

```
In [420]: gm.to_csv("GM_Stock.csv")
```

```
In [421]: # VISUALIZING
          tesla['Open'].plot(label="Tesla",figsize=(16,8),title="Open price")
          gm['Open'].plot(label="GM")
          ford['Open'].plot(label="Ford")
          plt.legend()

Out[421]: <matplotlib.legend.Legend at 0x1a26f7ebe0>
```

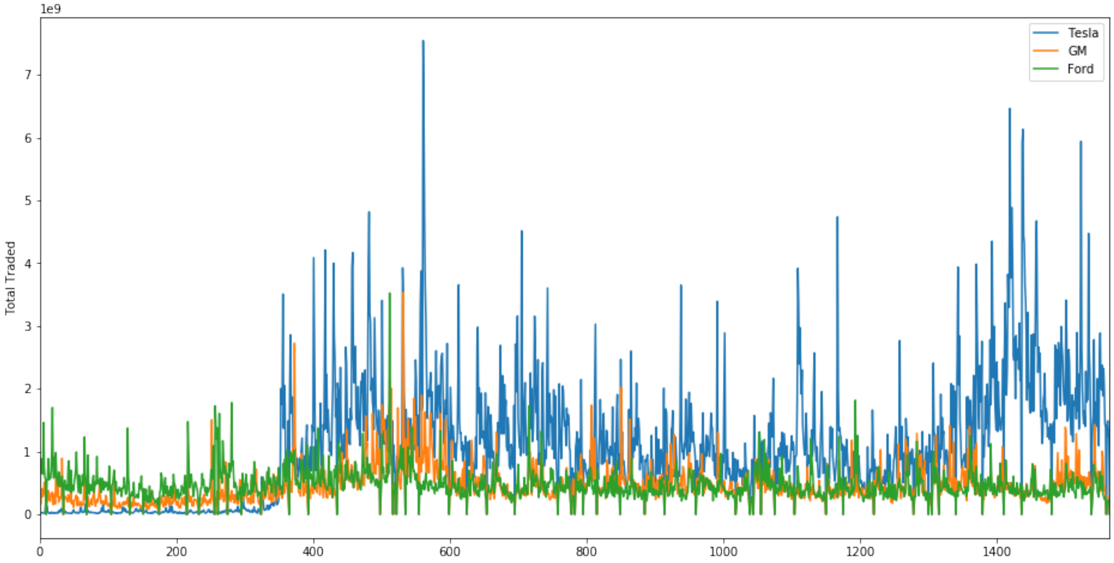


```
In [422]: tesla['Volume'].plot(label='Tesla',figsize=(16,8),title='Volume Traded')
          gm['Volume'].plot(label='gm')
          ford['Volume'].plot(label='ford')
          plt.legend()

Out[422]: <matplotlib.legend.Legend at 0x1a26ed7160>
```

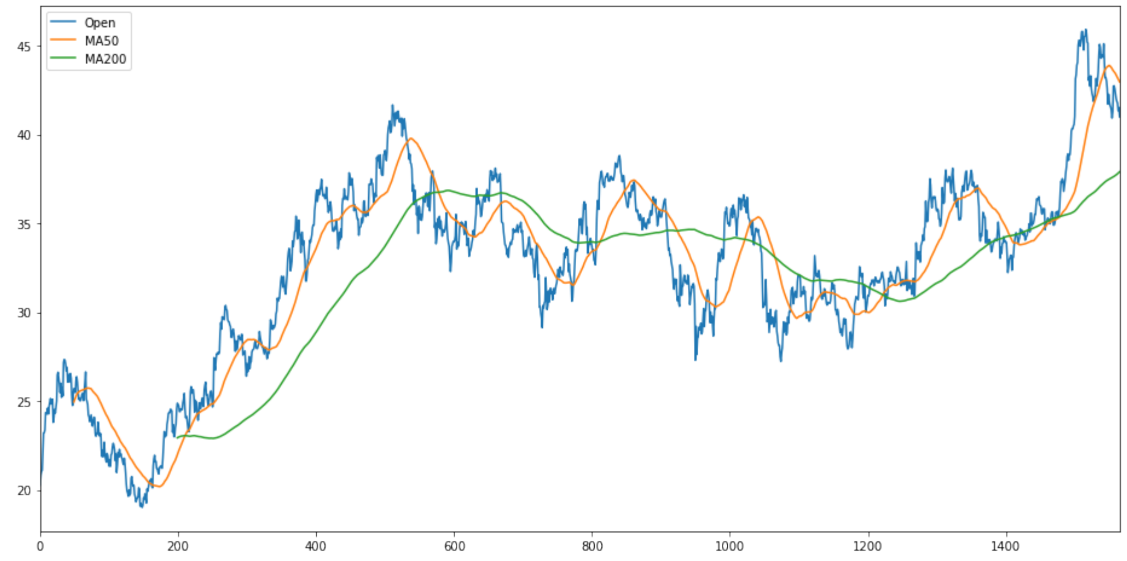


```
In [423]: # spike check
          ford['Volume'].argmax()

Out[423]: 512

In [424]: # What happened:
          # http://money.cnn.com/2013/12/18/news/companies/ford-profit/
          # https://www.usatoday.com/story/money/cars/2013/12/18/ford-2014-profit-warning/41100
          # https://media.ford.com/content/dam/fordmedia/North%20America/US/2014/01/28/4QFinanc

In [425]: # understand total market cap
          # Volume * Open price: total amount of money being traded
          # create a new colume for each dataframe called "Total Traded"
          tesla['Total Traded'] = tesla['Open']*tesla['Volume']
          ford['Total Traded'] = ford['Open']*ford['Volume']
          gm['Total Traded'] = gm['Open']*gm['Volume']

In [426]: tesla['Total Traded'].plot(label='Tesla', figsize=(16,8))
          gm['Total Traded'].plot(label='GM')
          ford['Total Traded'].plot(label='Ford')
          plt.legend()
          plt.ylabel('Total Traded')
```

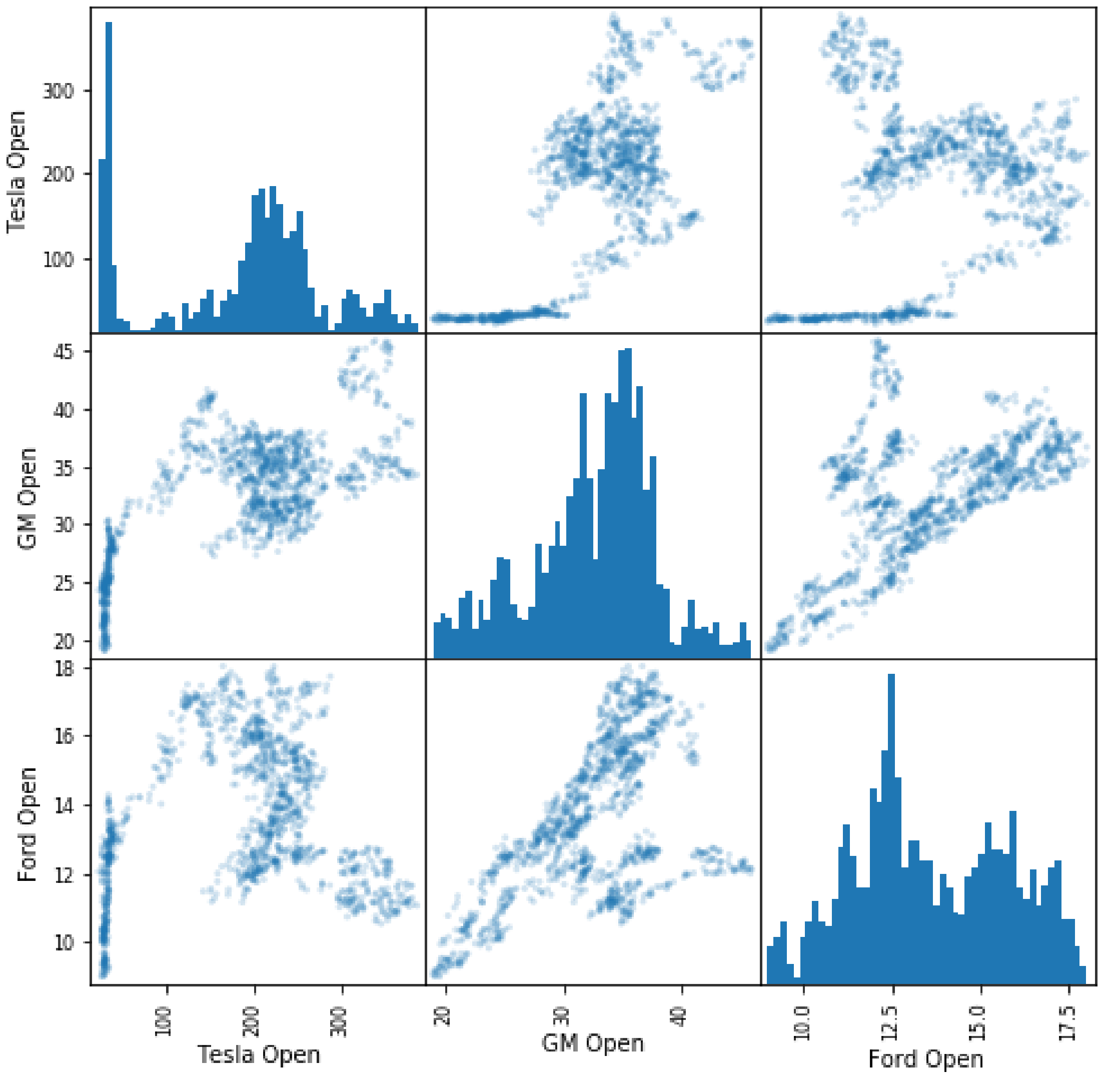
```
Out[426]: Text(0,0.5,'Total Traded')
```



```
In [427]: # spike check
          tesla['Total Traded'].argmax()  #### higier earning than expected

Out[427]: 561

In [428]: # http://money.cnn.com/2014/02/25/investing/tesla-record-high/
          # https://blogs.wsj.com/moneybeat/2014/02/25/tesla-shares-surge-on-morgan-stanley-rep
          # https://www.washingtonpost.com/news/wonk/wp/2014/02/25/teslas-stock-is-up-644-why-
          # http://www.cnbc.com/2014/02/25/tesla-soars-ford-falls-in-consumer-reports-study.htm

In [429]: # MA: MA50 AND MA200
          gm['MA50'] = gm['Open'].rolling(50).mean()
          gm['MA200'] = gm['Open'].rolling(200).mean()
          gm[['Open', 'MA50', 'MA200']].plot(label='gm', figsize=(16,8))

Out[429]: <matplotlib.axes._subplots.AxesSubplot at 0x1a267f3828>
```



```
In [430]: # Scatter matrix
          from pandas.plotting import scatter_matrix

In [431]: car_comp = pd.concat([tesla["Open"],gm["Open"],ford['Open']], axis=1)
          car_comp.head()

Out[431]:     Open   Open   Open
          0  28.56  20.27  10.76
          1  28.94  20.83  11.00
          2  28.21  21.05  11.15
          3  27.76  21.10  11.33
          4  27.20  22.26  11.74

In [432]: car_comp.columns = ['Tesla Open', 'GM Open', 'Ford Open']

In [433]: # You can use a semi-colon to remove the axes print outs
          scatter_matrix(car_comp, figsize=(8,8),alpha=0.2,hist_kwds={'bins':50});
```



```
In [434]: from matplotlib.finance import candlestick_ohlc
          from matplotlib.dates import DateFormatter, date2num, WeekdayLocator, DayLocator, MO
```

```
In [531]: ford
```

```
Out[531]:             Unnamed: 0  Unnamed: 0.1 Symbol   Close    High    Low    Open  \
          Date
          2012-01-02           0             0      F  10.760  10.760  10.76  10.760
          2012-01-03           1             1      F  11.130  11.250  10.99  11.000
          2012-01-04           2             2      F  11.300  11.530  11.07  11.150
          2012-01-05           3             3      F  11.590  11.630  11.24  11.330
          2012-01-06           4             4      F  11.710  11.800  11.52  11.740
          2012-01-09           5             5      F  11.800  11.950  11.70  11.830
          2012-01-10           6             6      F  11.800  12.050  11.63  12.000
```

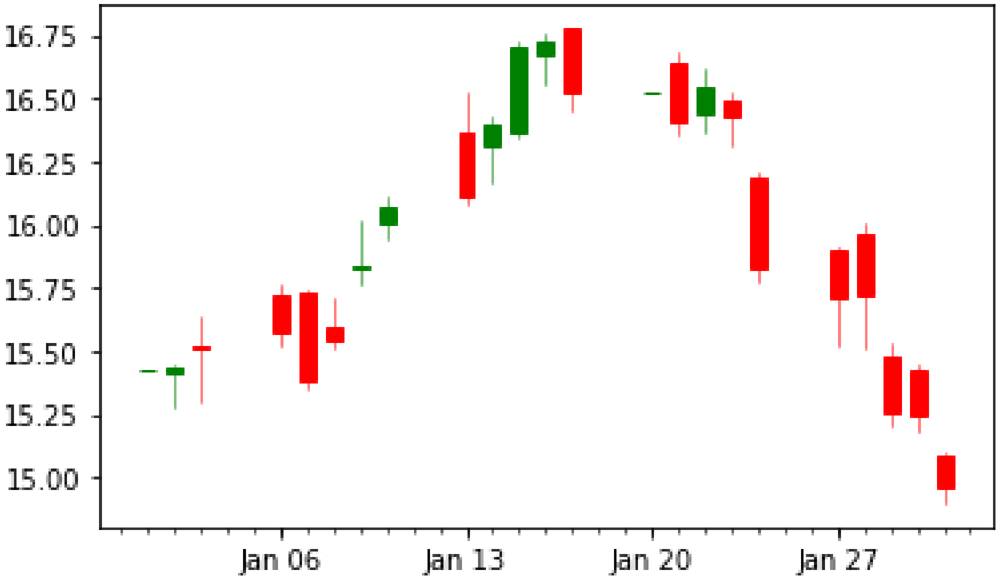
```
2012-01-11           7             7     F  12.070  12.180  11.65  11.740
2012-01-12           8             8     F  12.140  12.180  11.89  12.160
2012-01-13           9             9     F  12.040  12.080  11.84  12.010
2012-01-16          10            10     F  12.040  12.040  12.04  12.040
2012-01-17          11            11     F  12.015  12.260  11.96  12.200
2012-01-18          12            12     F  12.340  12.370  12.00  12.030
2012-01-19          13            13     F  12.610  12.720  12.43  12.480
2012-01-20          14            14     F  12.590  12.635  12.45  12.550
2012-01-23          15            15     F  12.660  12.840  12.55  12.690
2012-01-24          16            16     F  12.820  12.860  12.46  12.560
2012-01-25          17            17     F  12.930  12.980  12.70  12.800
2012-01-26          18            18     F  12.790  13.050  12.66  13.030
2012-01-27          19            19     F  12.210  12.530  11.79  11.960
2012-01-30          20            20     F  12.290  12.440  12.00  12.060
2012-01-31          21            21     F  12.420  12.510  12.20  12.470
2012-02-01          22            22     F  12.330  12.750  12.29  12.730
2012-02-02          23            23     F  12.260  12.430  12.20  12.400
2012-02-03          24            24     F  12.790  12.840  12.39  12.470
2012-02-06          25            25     F  12.960  13.000  12.71  12.850
2012-02-07          26            26     F  12.880  12.970  12.83  12.930
2012-02-08          27            27     F  12.840  12.960  12.80  12.910
2012-02-09          28            28     F  12.690  12.900  12.67  12.890
2012-02-10          29            29     F  12.440  12.660  12.37  12.520
...                ...           ...   ...     ...     ...    ...     ...
2017-11-21        1536          1536     F  12.120  12.225  12.12  12.140
2017-11-22        1537          1537     F  12.070  12.150  12.05  12.110
2017-11-23        1538          1538     F  12.070  12.070  12.07  12.070
2017-11-24        1539          1539     F  12.100  12.150  12.03  12.100
2017-11-27        1540          1540     F  12.110  12.190  12.06  12.090
2017-11-28        1541          1541     F  12.210  12.240  12.08  12.150
2017-11-29        1542          1542     F  12.560  12.570  12.23  12.240
2017-11-30        1543          1543     F  12.520  12.650  12.42  12.530
2017-12-01        1544          1544     F  12.580  12.700  12.35  12.620
2017-12-04        1545          1545     F  12.630  12.810  12.59  12.650
2017-12-05        1546          1546     F  12.430  12.620  12.40  12.610
2017-12-06        1547          1547     F  12.380  12.430  12.28  12.400
2017-12-07        1548          1548     F  12.530  12.590  12.33  12.395
2017-12-08        1549          1549     F  12.610  12.610  12.43  12.530
2017-12-11        1550          1550     F  12.580  12.630  12.51  12.600
2017-12-12        1551          1551     F  12.600  12.635  12.51  12.560
2017-12-13        1552          1552     F  12.630  12.725  12.59  12.610
2017-12-14        1553          1553     F  12.460  12.690  12.41  12.650
2017-12-15        1554          1554     F  12.580  12.660  12.50  12.510
2017-12-18        1555          1555     F  12.660  12.750  12.61  12.660
2017-12-19        1556          1556     F  12.690  12.780  12.66  12.710
2017-12-20        1557          1557     F  12.720  12.750  12.65  12.720
2017-12-21        1558          1558     F  12.630  12.770  12.63  12.740
2017-12-22        1559          1559     F  12.580  12.660  12.56  12.660
```

```
2017-12-25       1560          1560      F  12.580  12.580  12.58  12.580
2017-12-26       1561          1561      F  12.600  12.650  12.55  12.570
2017-12-27       1562          1562      F  12.500  12.580  12.45  12.570
2017-12-28       1563          1563      F  12.580  12.580  12.47  12.480
2017-12-29       1564          1564      F  12.490  12.610  12.49  12.580
2018-01-01       1565          1565      F  12.490  12.490  12.49  12.490

               Volume  Total Traded   returns  Cumulative Returns
Date
2012-01-02          0  0.000000e+00       NaN                 NaN
2012-01-03   45709811  5.028079e+08  0.034387            1.034387
2012-01-04   79725188  8.889358e+08  0.015274            1.050186
2012-01-05   67877467  7.690517e+08  0.025664            1.077138
2012-01-06   59840605  7.025287e+08  0.010354            1.088290
2012-01-09   53981467  6.386008e+08  0.007686            1.096654
2012-01-10  121750545  1.461007e+09  0.000000            1.096654
2012-01-11   63806007  7.490825e+08  0.022881            1.121747
2012-01-12   48687666  5.920420e+08  0.005800            1.128253
2012-01-13   46388677  5.571280e+08 -0.008237            1.118959
2012-01-16          0  0.000000e+00  0.000000            1.118959
2012-01-17   44398472  5.416614e+08 -0.002076            1.116636
2012-01-18   47102604  5.666443e+08  0.027050            1.146840
2012-01-19   70894167  8.847592e+08  0.021880            1.171933
2012-01-20   43705665  5.485061e+08 -0.001586            1.170074
2012-01-23   49388566  6.267409e+08  0.005560            1.176580
2012-01-24   45768308  5.748499e+08  0.012638            1.191450
2012-01-25   54021553  6.914759e+08  0.008580            1.201673
2012-01-26   75470624  9.833822e+08 -0.010828            1.188662
2012-01-27  142155259  1.700177e+09 -0.045348            1.134758
2012-01-30   57752526  6.964955e+08  0.006552            1.142193
2012-01-31   46425332  5.789239e+08  0.010578            1.154275
2012-02-01   71668979  9.123461e+08 -0.007246            1.145911
2012-02-02   48347559  5.995097e+08 -0.005677            1.139405
2012-02-03   78851121  9.832735e+08  0.043230            1.188662
2012-02-06   46363233  5.957675e+08  0.013292            1.204461
2012-02-07   39413408  5.096154e+08 -0.006173            1.197026
2012-02-08   35352410  4.563996e+08 -0.003106            1.193309
2012-02-09   52290479  6.740243e+08 -0.011682            1.179368
2012-02-10   52507996  6.574001e+08 -0.019701            1.156134
...               ...           ...       ...                 ...
2017-11-21   28510260  3.461146e+08 -0.000824            1.126394
2017-11-22   36184010  4.381884e+08 -0.004125            1.121747
2017-11-23          0  0.000000e+00  0.000000            1.121747
2017-11-24    9549629  1.155505e+08  0.002486            1.124535
2017-11-27   28525156  3.448691e+08  0.000826            1.125465
2017-11-28   33199323  4.033718e+08  0.008258            1.134758
2017-11-29   64865973  7.939595e+08  0.028665            1.167286
2017-11-30   49224189  6.167791e+08 -0.003185            1.163569
```

```
2017-12-01   52458736  6.620292e+08  0.004792            1.169145
2017-12-04   39558857  5.004195e+08  0.003975            1.173792
2017-12-05   45527163  5.740975e+08 -0.015835            1.155204
2017-12-06   28453762  3.528266e+08 -0.004023            1.150558
2017-12-07   25417119  3.150452e+08  0.012116            1.164498
2017-12-08   21981870  2.754328e+08  0.006385            1.171933
2017-12-11   44194633  5.568524e+08 -0.002379            1.169145
2017-12-12   54370612  6.828949e+08  0.001590            1.171004
2017-12-13   31858995  4.017419e+08  0.002381            1.173792
2017-12-14   37073960  4.689856e+08 -0.013460            1.157993
2017-12-15   48655453  6.086797e+08  0.009631            1.169145
2017-12-18   25022657  3.167868e+08  0.006359            1.176580
2017-12-19   23056884  2.930530e+08  0.002370            1.179368
2017-12-20   18989429  2.415455e+08  0.002364            1.182156
2017-12-21   21004663  2.675994e+08 -0.007075            1.173792
2017-12-22   17876156  2.263121e+08 -0.003959            1.169145
2017-12-25          0  0.000000e+00  0.000000            1.169145
2017-12-26   11664564  1.466236e+08  0.001590            1.171004
2017-12-27   17005626  2.137607e+08 -0.007937            1.161710
2017-12-28   14793534  1.846233e+08  0.006400            1.169145
2017-12-29   18362455  2.309997e+08 -0.007154            1.160781
2018-01-01          0  0.000000e+00  0.000000            1.160781

[1566 rows x 11 columns]
```

```
In [503]: from matplotlib.finance import quotes_historical_yahoo_ohlc, candlestick_ohlc
          from matplotlib.dates import DateFormatter, date2num, WeekdayLocator, DayLocator, MO


          # Rest the index to get a column of January Dates
          ford_reset = ford.loc['2014-01'].reset_index()

          # Create a new column of numerical "date" values for matplotlib to use
          ford_reset['date_ax'] = ford_reset['Date'].apply(lambda date: date2num(date))
          ford_values = [tuple(vals) for vals in ford_reset[['date_ax', 'Open', 'High', 'Low',

          mondays = WeekdayLocator(MONDAY)        # major ticks on the mondays
          alldays = DayLocator()              # minor ticks on the days
          weekFormatter = DateFormatter('%b %d')  # e.g., Jan 12
          dayFormatter = DateFormatter('%d')      # e.g., 12

          #Plot it
          fig, ax = plt.subplots()
          fig.subplots_adjust(bottom=0.2)
          ax.xaxis.set_major_locator(mondays)
          ax.xaxis.set_minor_locator(alldays)
          ax.xaxis.set_major_formatter(weekFormatter)
```

```
candlestick_ohlc(ax, ford_values, width=0.6, colorup='g',colordown='r');
```



```
In [511]: # Daily Percentage Change: .shift()  or pct_change
```

```
In [512]: # method 1: using .shift()
          tesla['returns'] = (tesla['Close']/tesla['Close'].shift(1)) - 1
```

```
In [513]: tesla.tail()
```

```
Out[513]:             Unnamed: 0  Unnamed: 0.1 Symbol   Close    High     Low    Open  \
          Date
          2017-12-26        1561          1561   TSLA  317.29  323.94  316.58  323.83
          2017-12-27        1562          1562   TSLA  311.64  317.68  310.75  316.00
          2017-12-28        1563          1563   TSLA  315.36  315.82  309.54  311.75
          2017-12-29        1564          1564   TSLA  311.35  316.41  310.00  316.18
          2018-01-01        1565          1565   TSLA  311.35  311.35  311.35  311.35

                       Volume  Total Traded   returns  Cumulative Returns
          Date
          2017-12-26  4378413  1.417861e+09 -0.024323           11.109594
          2017-12-27  4712111  1.489027e+09 -0.017807           10.911765
          2017-12-28  4316347  1.345621e+09  0.011937           11.042017
          2017-12-29  3777155  1.194261e+09 -0.012716           10.901611
          2018-01-01        0  0.000000e+00  0.000000           10.901611
```

```
In [514]: # method 2: using pct_change()
          tesla['returns'] = tesla['Close'].pct_change(1)
```

```
In [515]: tesla.tail()
```

```
Out[515]:             Unnamed: 0  Unnamed: 0.1 Symbol   Close    High     Low    Open  \
          Date
          2017-12-26        1561          1561   TSLA  317.29  323.94  316.58  323.83
          2017-12-27        1562          1562   TSLA  311.64  317.68  310.75  316.00
          2017-12-28        1563          1563   TSLA  315.36  315.82  309.54  311.75
          2017-12-29        1564          1564   TSLA  311.35  316.41  310.00  316.18
          2018-01-01        1565          1565   TSLA  311.35  311.35  311.35  311.35

                       Volume  Total Traded   returns  Cumulative Returns
          Date
          2017-12-26  4378413  1.417861e+09 -0.024323           11.109594
          2017-12-27  4712111  1.489027e+09 -0.017807           10.911765
          2017-12-28  4316347  1.345621e+09  0.011937           11.042017
          2017-12-29  3777155  1.194261e+09 -0.012716           10.901611
          2018-01-01        0  0.000000e+00  0.000000           10.901611
```

```
In [516]: gm['returns'] = gm['Close'].pct_change(1)
          ford['returns'] = ford['Close'].pct_change(1)
```

```
In [517]: ford.tail()
```

```
Out[517]:             Unnamed: 0  Unnamed: 0.1 Symbol  Close   High    Low   Open  \
          Date
          2017-12-26        1561          1561      F  12.60  12.65  12.55  12.57
          2017-12-27        1562          1562      F  12.50  12.58  12.45  12.57
          2017-12-28        1563          1563      F  12.58  12.58  12.47  12.48
          2017-12-29        1564          1564      F  12.49  12.61  12.49  12.58
          2018-01-01        1565          1565      F  12.49  12.49  12.49  12.49

                        Volume  Total Traded   returns  Cumulative Returns
          Date
          2017-12-26  11664564  1.466236e+08  0.001590            1.171004
          2017-12-27  17005626  2.137607e+08 -0.007937            1.161710
          2017-12-28  14793534  1.846233e+08  0.006400            1.169145
          2017-12-29  18362455  2.309997e+08 -0.007154            1.160781
          2018-01-01         0  0.000000e+00  0.000000            1.160781
```

```
In [518]: gm.tail()
```

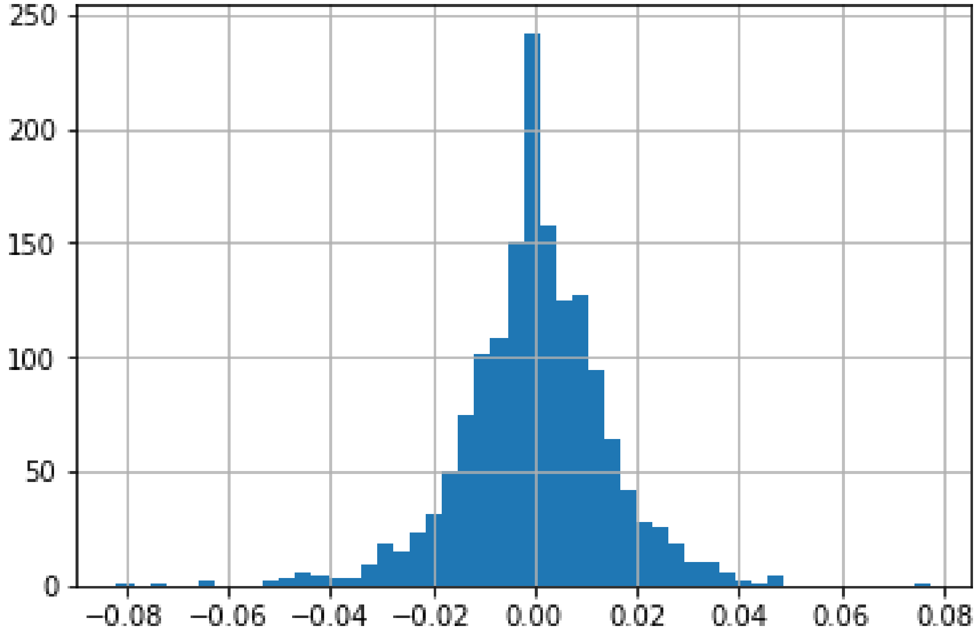
```
Out[518]:             Unnamed: 0  Unnamed: 0.1 Symbol  Close     High    Low   Open  \
          Date
          2017-12-26        1561          1561     GM  41.80  42.0900  41.63  41.86
          2017-12-27        1562          1562     GM  41.31  41.8500  41.30  41.76
          2017-12-28        1563          1563     GM  41.38  41.4400  41.20  41.34
          2017-12-29        1564          1564     GM  40.99  41.5922  40.99  41.52
          2018-01-01        1565          1565     GM  40.99  40.9900  40.99  40.99
```

```
              Volume     MA50     MA200  Total Traded   returns  \
Date
2017-12-26  3369417  43.2666  37.75470  1.410438e+08 -0.005236
2017-12-27  4933638  43.1962  37.79195  2.060287e+08 -0.011722
2017-12-28  5005263  43.1280  37.82865  2.069176e+08  0.001695
2017-12-29  6581442  43.0484  37.86425  2.732615e+08 -0.009425
2018-01-01        0  42.9574  37.89780  0.000000e+00  0.000000

            Cumulative Returns
Date
2017-12-26            2.062161
2017-12-27            2.037987
2017-12-28            2.041441
2017-12-29            2.022200
2018-01-01            2.022200
```

```
In [519]: # plot a histogram and see which is the most volatile
```

```
In [520]: # separately
          ford['returns'].hist(bins=50)
```

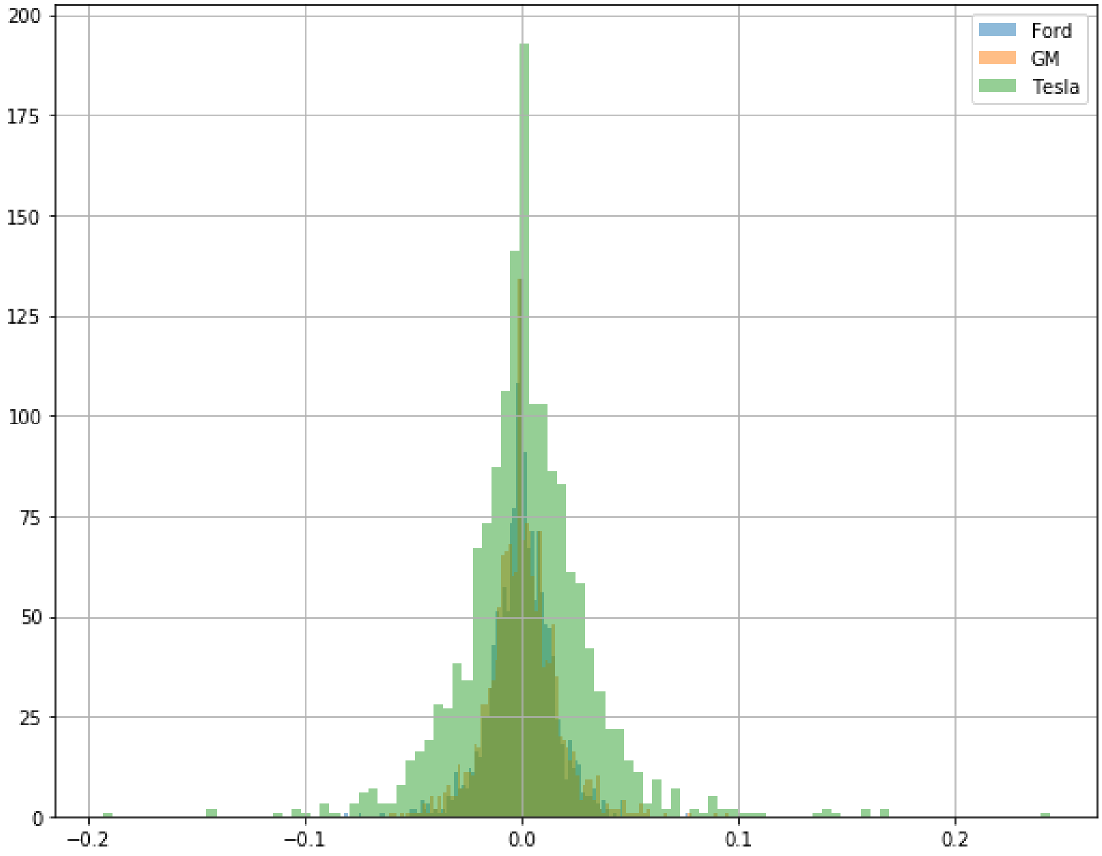
```
Out[520]: <matplotlib.axes._subplots.AxesSubplot at 0x1a28b56710>
```



```
In [521]: # stock them on top of each other
          ford['returns'].hist(bins=100, label='Ford', figsize=(10,8), alpha=0.5)
          gm['returns'].hist(bins=100, label='GM', alpha=0.5)
```

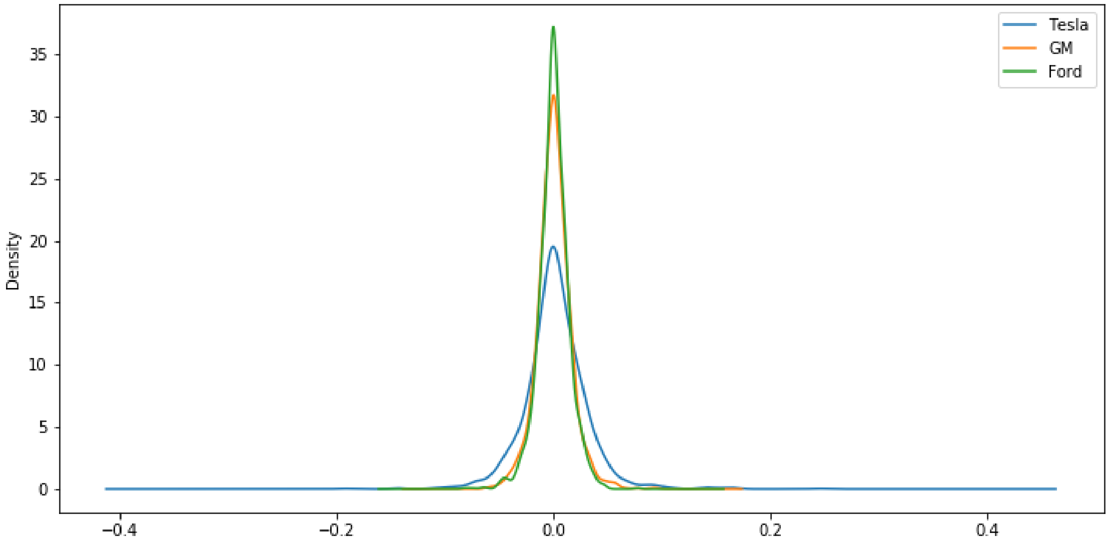
```
        tesla['returns'].hist(bins=100, label='Tesla', alpha=0.5)
        plt.legend()
```

```
Out[521]: <matplotlib.legend.Legend at 0x1a25b6aa20>
```



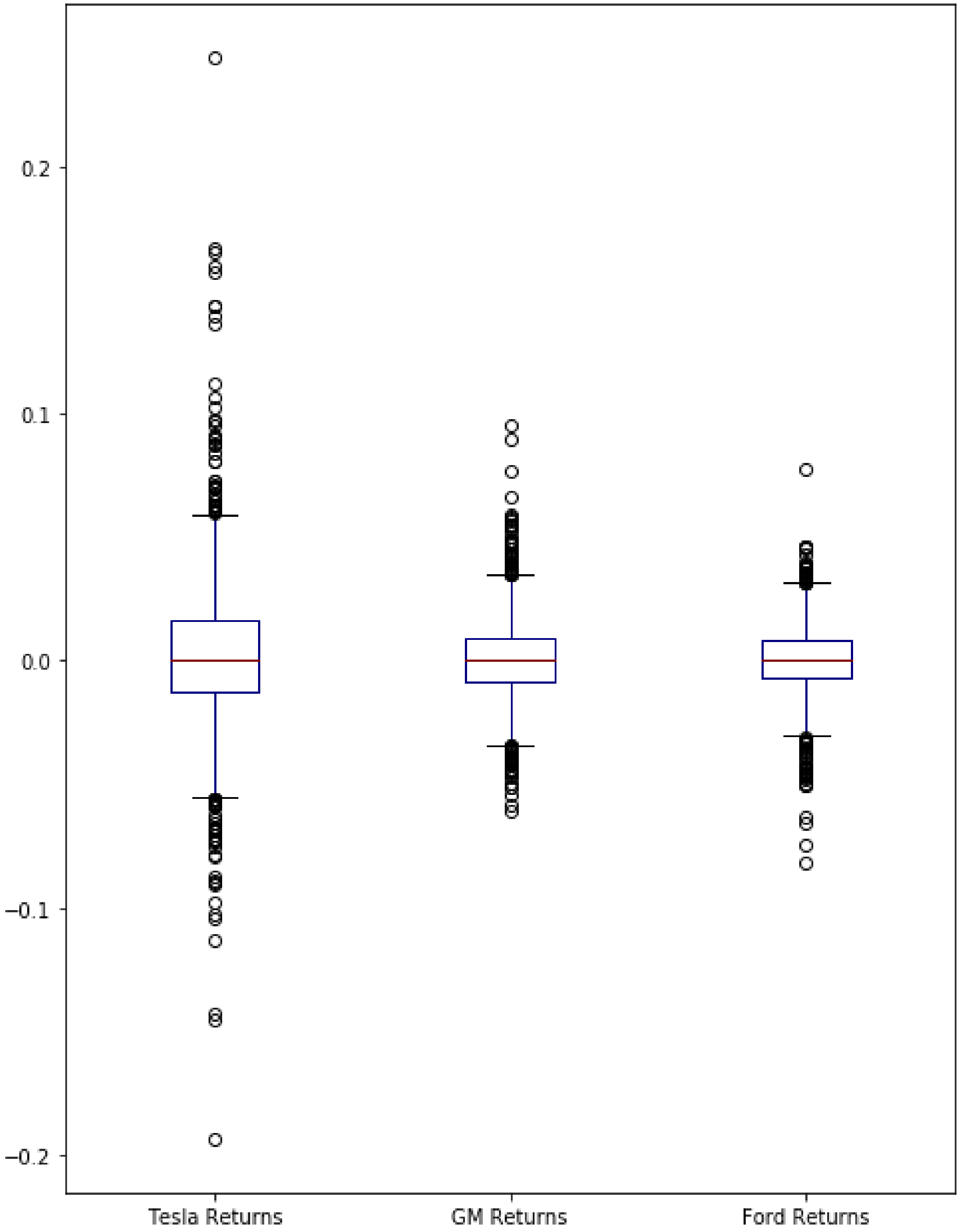
```
In [522]: # KDE(Kernel Density Estimation) : showing the widest plot
          tesla['returns'].plot(kind='kde', label='Tesla', figsize=(12,6))
          gm['returns'].plot(kind='kde', label='GM')
          ford['returns'].plot(kind='kde', label='Ford')
          plt.legend()
```

```
Out[522]: <matplotlib.legend.Legend at 0x1a2251b9b0>
```

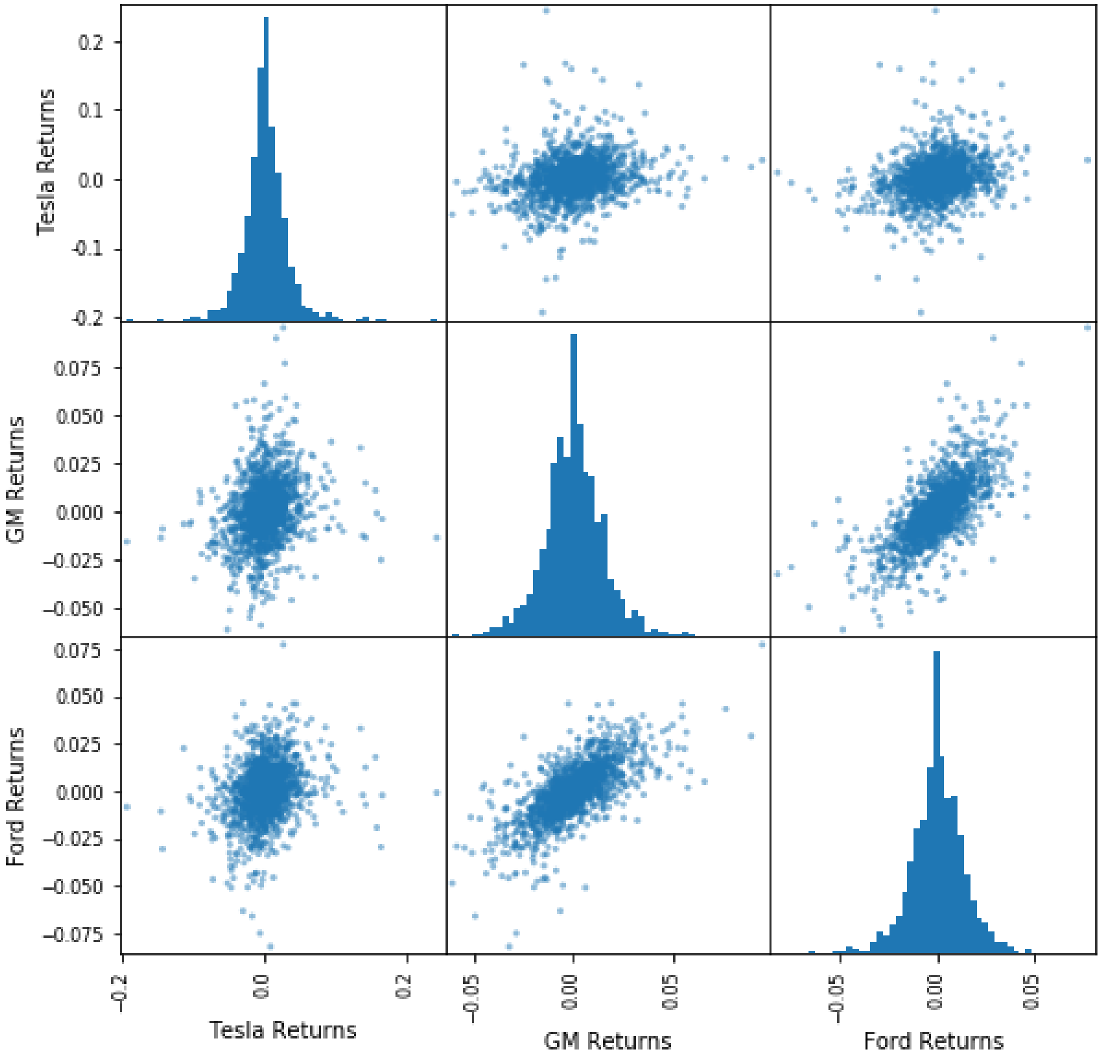


Tesla: the widest, the most volitile

```
In [523]: # box plots: comparing the returns
          # new df for box plot
          box_df = pd.concat([tesla['returns'], gm['returns'], ford['returns']], axis=1)
          box_df.columns = ['Tesla Returns', 'GM Returns', 'Ford Returns']
          box_df.plot(kind='box', figsize=(8,11), colormap='jet')

Out[523]: <matplotlib.axes._subplots.AxesSubplot at 0x1a22c6e9b0>
```

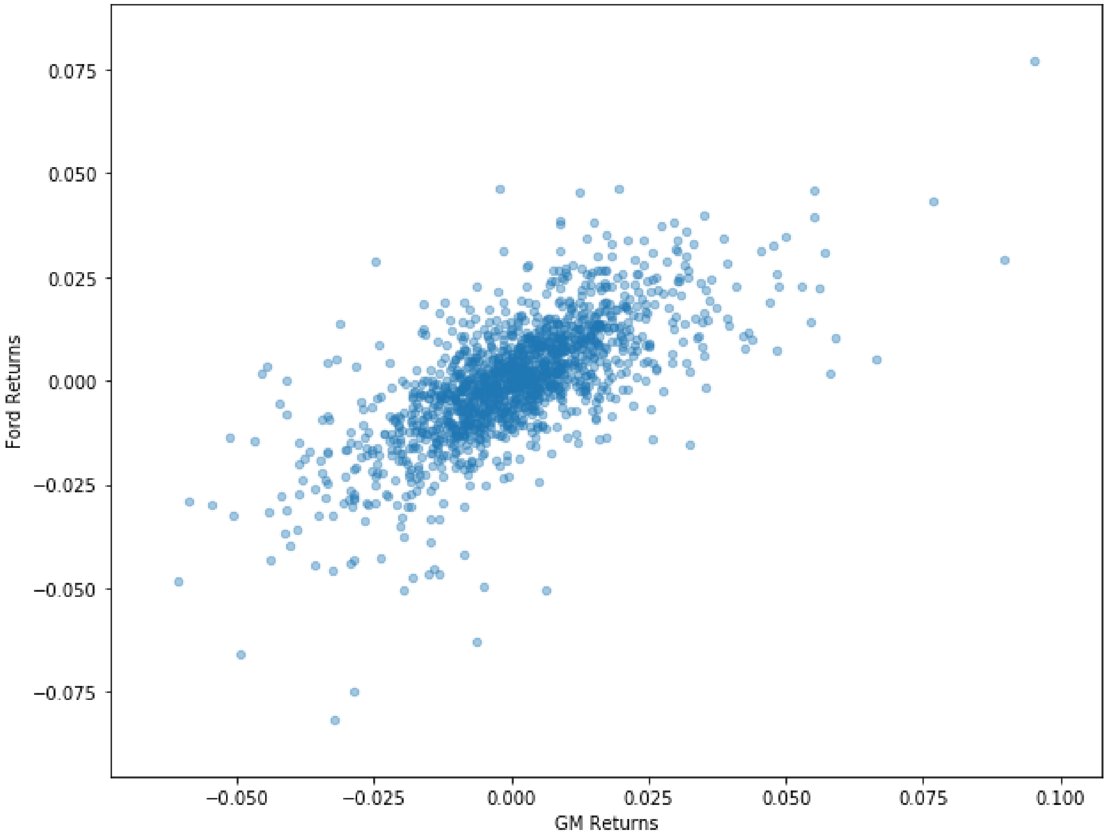


```
In [524]: # scatter matrix: showing correlation
          scatter_matrix(box_df, figsize=(8,8), hist_kwds={'bins':50});
```



Positive correlation btween GM and Ford

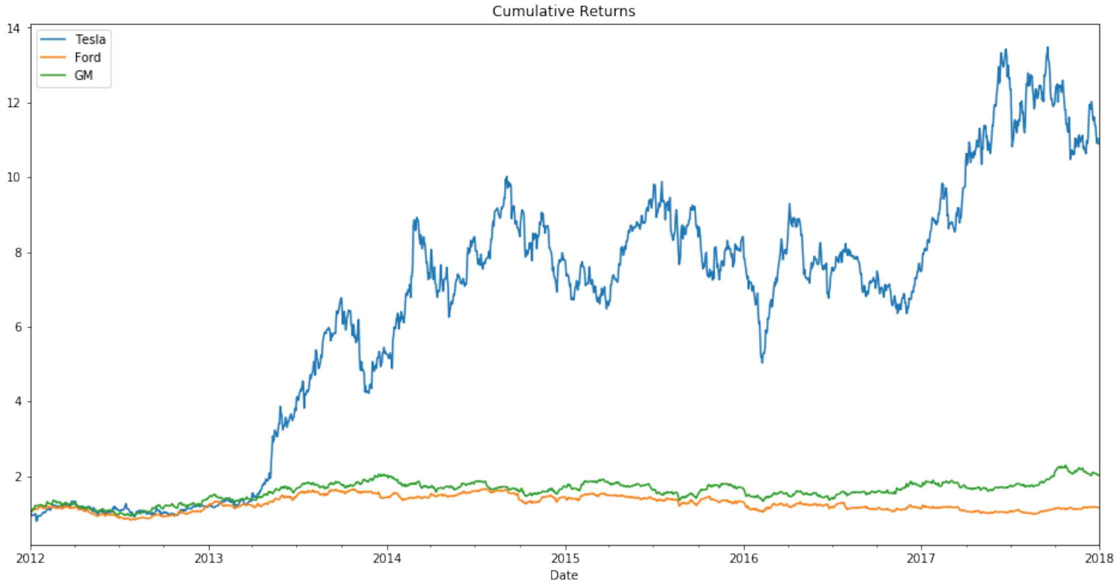
```
In [525]: # scatter plot: to check correlation btw GM and Ford
          box_df.plot(kind='scatter', x='GM Returns', y='Ford Returns', alpha=0.4, figsize=(10

Out[525]: <matplotlib.axes._subplots.AxesSubplot at 0x1a27b72940>
```



```
In [526]: box_df.columns

Out[526]: Index(['Tesla Returns', 'GM Returns', 'Ford Returns'], dtype='object')

In [527]: # cumulative daily returns: using cumprod()
          tesla['Cumulative Returns'] = (1 + tesla['returns']).cumprod()

In [528]: tesla.tail()

Out[528]:             Unnamed: 0  Unnamed: 0.1 Symbol   Close    High     Low    Open  \
          Date
          2017-12-26        1561          1561   TSLA  317.29  323.94  316.58  323.83
          2017-12-27        1562          1562   TSLA  311.64  317.68  310.75  316.00
          2017-12-28        1563          1563   TSLA  315.36  315.82  309.54  311.75
          2017-12-29        1564          1564   TSLA  311.35  316.41  310.00  316.18
          2018-01-01        1565          1565   TSLA  311.35  311.35  311.35  311.35

                       Volume  Total Traded   returns  Cumulative Returns
          Date
          2017-12-26  4378413  1.417861e+09 -0.024323           11.109594
          2017-12-27  4712111  1.489027e+09 -0.017807           10.911765
```

```
2017-12-28  4316347  1.345621e+09  0.011937           11.042017
2017-12-29  3777155  1.194261e+09 -0.012716           10.901611
2018-01-01        0  0.000000e+00  0.000000           10.901611
```

```
In [529]: # plot cumulative returns
          ford['Cumulative Returns'] = (1 + ford['returns']).cumprod()
          gm['Cumulative Returns'] = (1 + gm['returns']).cumprod()

          tesla['Cumulative Returns'].plot(label='Tesla', figsize=(16,8), title='Cumulative Re
          ford['Cumulative Returns'].plot(label='Ford')
          gm['Cumulative Returns'].plot(label='GM')
          plt.legend()

Out[529]: <matplotlib.legend.Legend at 0x1a25b339b0>
```


Cumulative Returns
Tesla
Ford
GM
Date