Finance Data Project

In this data project we will be performing exploratory data analysis of stock prices.

We will focus on bank stocks and see how they progressed throughout the [financial crisis] in 2016.(https://en.wikipedia.org/wiki/Financial_crisis_of_2007%E2%80%9308 (https://en.wikipedia.org/wiki/Financial_crisis_of_2007%E2%80%9308))

```
In this section we will try to use pandas to directly read data from
Google finance.

I have installed pandas-datareader for this project using
"pip install pandas-reader". Pandas datareader allows us to read stock
information directly from the internet.
```

In [51]:

```
import pandas as pd
pd.core.common.is_list_like = pd.api.types.is_list_like
from pandas_datareader import data, wb
from pandas.api.types import is_list_like
import numpy as np
import datetime
%matplotlib inline
```

In [52]:

```
import pickle
df = pd.read_pickle('all_banks')
```

In [53]:
```
df.head()
```

Out[53]:

Bank Ticker	BAC					C					...	MS	
Stock Info	**Open**	**High**	**Low**	**Close**	**Volume**	**Open**	**High**	**Low**	**Close**	**Volume**	**...**	**Open**	**Hig**
Date													
2006-01-03	46.92	47.18	46.15	47.08	16296700	490.0	493.8	481.1	492.9	1537660	...	57.17	58.
2006-01-04	47.00	47.24	46.45	46.58	17757900	488.6	491.0	483.5	483.8	1871020	...	58.70	59.
2006-01-05	46.58	46.83	46.32	46.64	14970900	484.4	487.8	484.0	486.2	1143160	...	58.55	58.
2006-01-06	46.80	46.91	46.35	46.57	12599800	488.8	489.0	482.0	486.2	1370250	...	58.77	58.
2006-01-09	46.72	46.97	46.36	46.60	15620000	486.0	487.4	483.0	483.9	1680740	...	58.63	59.

5 rows × 30 columns

In [54]:
```
df.columns
```

Out[54]:
```
MultiIndex(levels=[['BAC', 'C', 'GS', 'JPM', 'MS', 'WFC'], ['Open', 'H
igh', 'Low', 'Close', 'Volume']],
           labels=[[0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3,
3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 5, 5, 5], [0, 1, 2, 3, 4, 0, 1, 2, 3, 4,
0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4]],
           names=['Bank Ticker', 'Stock Info'])
```

Data

We need to get data using pandas datareader. We will get stock information for the following banks:

- Bank of America
- CitiGroup
- Goldman Sachs
- JPMorgan Chase
- Morgan Stanley
- Wells Fargo

I have obtained the stock price from Jan 1st 2006 to Jan 1st 2016 for each of these banks. Set each bank to be a separate dataframe, with the variable name for that bank being its ticker symbol. This will involve a few steps:

1. Use datetime to set start and end datetime objects.
2. Figure out the ticker symbol for each bank.
3. Figure out how to use datareader to grab info on the stock.

Reference (http://pandas.pydata.org/pandas-docs/stable/remote_data.html (http://pandas.pydata.org/pandas-docs/stable/remote_data.html)) for hints and instructions (it should just be a matter of replacing certain values. Tried using google finance as a source, for example:

```
# Bank of America
BAC = data.DataReader("BAC", 'google', start, end)
```

NOTE: google finance did not work as expected. So googled and found an alternative way using 'quandl' instead.

In [55]:
```
start = datetime.datetime(2006,1,1)
end = datetime.datetime(2016,1,1)
```

In [56]:
```
#BAC = BAC = data.DataReader('BAC', 'google', start, end)
# Google finance did not work. So using quandl instead.
BAC = data.DataReader('BAC', 'quandl', start, end)
```

In [57]:
```
BAC.head()
```

Out[57]:

	Open	High	Low	Close	Volume	ExDividend	SplitRatio	AdjOpen	AdjHigh	AdjL
Date										
2015-12-31	17.01	17.07	16.83	16.83	47106760.0	0.0	1.0	16.564256	16.622684	16.3
2015-12-30	17.20	17.24	17.04	17.05	35035518.0	0.0	1.0	16.749277	16.788229	16.5
2015-12-29	17.25	17.35	17.16	17.28	45628449.0	0.0	1.0	16.797967	16.895347	16.7
2015-12-28	17.22	17.23	16.98	17.13	41759993.0	0.0	1.0	16.768753	16.778491	16.5
2015-12-24	17.32	17.38	17.22	17.27	29373415.0	0.0	1.0	16.866133	16.924561	16.7

Observation : There are a lot of extra columns compared to google finance in quandl. So I dropped unnecessary columns

In [58]:
```
BAC.columns
```

Out[58]:
```
Index(['Open', 'High', 'Low', 'Close', 'Volume', 'ExDividend', 'SplitR
atio',
       'AdjOpen', 'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'],
      dtype='object')
```

In [59]:
```
BAC = BAC.drop(['ExDividend', 'SplitRatio','AdjOpen',
                'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'], axis = 1)
BAC.head()
```

Out[59]:

	Open	High	Low	Close	Volume
Date					
2015-12-31	17.01	17.07	16.83	16.83	47106760.0
2015-12-30	17.20	17.24	17.04	17.05	35035518.0
2015-12-29	17.25	17.35	17.16	17.28	45628449.0
2015-12-28	17.22	17.23	16.98	17.13	41759993.0
2015-12-24	17.32	17.38	17.22	17.27	29373415.0

In [60]:
```
#Sort the date index in ascending order
BAC = BAC.sort_index(ascending = True)
BAC.head()
```

Out[60]:

	Open	High	Low	Close	Volume
Date					
2006-01-03	46.92	47.18	46.15	47.08	16296700.0
2006-01-04	47.00	47.24	46.45	46.58	17757900.0
2006-01-05	46.58	46.83	46.32	46.64	14970700.0
2006-01-06	46.80	46.91	46.35	46.57	12599800.0
2006-01-09	46.72	46.97	46.36	46.60	15619400.0

In [61]:
```
C = data.DataReader('C', 'quandl', start, end)
C.head()
```

Out[61]:

	Open	High	Low	Close	Volume	ExDividend	SplitRatio	AdjOpen	AdjHigh	AdjL
Date										
2015-12-31	52.07	52.39	51.75	51.75	11274831.0	0.0	1.0	50.846027	51.158505	50.5
2015-12-30	52.84	52.94	52.25	52.30	8763137.0	0.0	1.0	51.597927	51.695577	51.0
2015-12-29	52.76	53.22	52.74	52.98	10153534.0	0.0	1.0	51.519808	51.968995	51.5
2015-12-28	52.57	52.57	51.96	52.38	8760444.0	0.0	1.0	51.334274	51.334274	50.7
2015-12-24	52.48	52.97	52.45	52.71	4671254.0	0.0	1.0	51.246390	51.724872	51.2

In [62]:
```
C.columns
```

Out[62]:
```
Index(['Open', 'High', 'Low', 'Close', 'Volume', 'ExDividend', 'SplitR
atio',
       'AdjOpen', 'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'],
      dtype='object')
```

In [63]:
```
C = C.drop(['ExDividend', 'SplitRatio','AdjOpen',
                'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'], axis = 1)
C.head()
```

Out[63]:

	Open	High	Low	Close	Volume
Date					
2015-12-31	52.07	52.39	51.75	51.75	11274831.0
2015-12-30	52.84	52.94	52.25	52.30	8763137.0
2015-12-29	52.76	53.22	52.74	52.98	10153534.0
2015-12-28	52.57	52.57	51.96	52.38	8760444.0
2015-12-24	52.48	52.97	52.45	52.71	4671254.0

In [64]:

```
#Sort the date index in ascending order
C = C.sort_index(ascending = True)
C.head()
```

Out[64]:

	Open	High	Low	Close	Volume
Date					
2006-01-03	49.00	49.38	48.11	49.29	15376000.0
2006-01-04	48.86	49.10	48.35	48.38	18709000.0
2006-01-05	48.44	48.78	48.40	48.62	11431000.0
2006-01-06	48.88	48.90	48.20	48.62	13702000.0
2006-01-09	48.60	48.74	48.30	48.39	16807000.0

In [65]:

```
GS = data.DataReader('GS', 'quandl', start, end)
GS.head()
```

Out[65]:

	Open	High	Low	Close	Volume	ExDividend	SplitRatio	AdjOpen	AdjHigh
Date									
2015-12-31	181.16	182.8850	180.0300	180.23	1773531.0	0.0	1.0	176.731715	178.414
2015-12-30	183.28	183.5300	181.8400	182.01	1514347.0	0.0	1.0	178.799893	179.043
2015-12-29	182.82	184.1800	182.5003	183.53	1848859.0	0.0	1.0	178.351137	179.677
2015-12-28	181.77	181.9325	179.8400	181.62	1723330.0	0.0	1.0	177.326804	177.485
2015-12-24	182.27	183.1700	182.0200	182.47	1107633.0	0.0	1.0	177.814582	178.692

In [66]:

```
GS.columns
```

Out[66]:

```
Index(['Open', 'High', 'Low', 'Close', 'Volume', 'ExDividend', 'SplitR
atio',
       'AdjOpen', 'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'],
      dtype='object')
```

In [67]:

```
GS = GS.drop(['ExDividend', 'SplitRatio','AdjOpen',
                'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'], axis = 1)
GS.head()
```

Out[67]:

	Open	High	Low	Close	Volume
Date					
2015-12-31	181.16	182.8850	180.0300	180.23	1773531.0
2015-12-30	183.28	183.5300	181.8400	182.01	1514347.0
2015-12-29	182.82	184.1800	182.5003	183.53	1848859.0
2015-12-28	181.77	181.9325	179.8400	181.62	1723330.0
2015-12-24	182.27	183.1700	182.0200	182.47	1107633.0

In [68]:

```
#Sort the date index in ascending order
GS = GS.sort_index(ascending = True)
GS.head()
```

Out[68]:

	Open	High	Low	Close	Volume
Date					
2006-01-03	126.70	129.44	124.23	128.87	6188700.0
2006-01-04	127.35	128.91	126.38	127.09	4861600.0
2006-01-05	126.00	127.32	125.61	127.04	3717400.0
2006-01-06	127.29	129.25	127.29	128.84	4319600.0
2006-01-09	128.50	130.62	128.00	130.39	4723500.0

In [69]:
```
JPM = data.DataReader('JPM', 'quandl', start, end)
JPM.head()
```

Out[69]:

	Open	High	Low	Close	Volume	ExDividend	SplitRatio	AdjOpen	AdjHigh	A
Date										
2015-12-31	66.19	66.7801	66.00	66.03	14654049.0	0.0	1.0	62.859378	63.419785	62
2015-12-30	67.04	67.0500	66.45	66.59	7189850.0	0.0	1.0	63.666607	63.676104	63
2015-12-29	66.84	67.3000	66.74	67.07	9820660.0	0.0	1.0	63.476671	63.913524	63
2015-12-28	66.29	66.4500	65.71	66.38	6610446.0	0.0	1.0	62.954346	63.106295	62
2015-12-24	66.62	66.8900	66.32	66.60	4468242.0	0.0	1.0	63.267741	63.524155	62

In [70]:
```
JPM = JPM.drop(['ExDividend', 'SplitRatio','AdjOpen',
                'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'], axis = 1)
JPM.head()
```

Out[70]:

	Open	High	Low	Close	Volume
Date					
2015-12-31	66.19	66.7801	66.00	66.03	14654049.0
2015-12-30	67.04	67.0500	66.45	66.59	7189850.0
2015-12-29	66.84	67.3000	66.74	67.07	9820660.0
2015-12-28	66.29	66.4500	65.71	66.38	6610446.0
2015-12-24	66.62	66.8900	66.32	66.60	4468242.0

In [71]:

```
#Sort the date index in ascending order
JPM = JPM.sort_index(ascending = True)
JPM.head()
```

Out[71]:

	Open	High	Low	Close	Volume
Date					
2006-01-03	39.83	40.36	39.30	40.19	12838600.0
2006-01-04	39.78	40.14	39.42	39.62	13491500.0
2006-01-05	39.61	39.81	39.50	39.74	8109400.0
2006-01-06	39.92	40.24	39.55	40.02	7966900.0
2006-01-09	39.88	40.72	39.88	40.67	16575200.0

In [72]:

```
MS = data.DataReader('MS', 'quandl', start, end)
MS.head()
```

Out[72]:

	Open	High	Low	Close	Volume	ExDividend	SplitRatio	AdjOpen	AdjHigh	A
Date										
2015-12-31	31.91	32.3000	31.770	31.81	8149307.0	0.0	1.0	30.552137	30.925541	3
2015-12-30	32.50	32.6450	32.200	32.23	5057162.0	0.0	1.0	31.117030	31.255860	3
2015-12-29	32.44	32.7016	32.325	32.55	6388244.0	0.0	1.0	31.059583	31.310052	3
2015-12-28	32.36	32.3600	31.950	32.17	5420280.0	0.0	1.0	30.982988	30.982988	3
2015-12-24	32.57	32.7100	32.440	32.48	2798163.0	0.0	1.0	31.184052	31.318094	3

In [73]:

```
MS = MS.drop(['ExDividend', 'SplitRatio','AdjOpen',
                'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'], axis = 1)
MS.head()
```

Out[73]:

	Open	High	Low	Close	Volume
Date					
2015-12-31	31.91	32.3000	31.770	31.81	8149307.0
2015-12-30	32.50	32.6450	32.200	32.23	5057162.0
2015-12-29	32.44	32.7016	32.325	32.55	6388244.0
2015-12-28	32.36	32.3600	31.950	32.17	5420280.0
2015-12-24	32.57	32.7100	32.440	32.48	2798163.0

In [74]:

```
#Sort the date index in ascending order
MS = MS.sort_index(ascending = True)
MS.head()
```

Out[74]:

	Open	High	Low	Close	Volume
Date					
2006-01-03	57.17	58.49	56.7400	58.31	5377000.0
2006-01-04	58.70	59.28	58.3500	58.35	7977800.0
2006-01-05	58.55	58.59	58.0200	58.51	5778000.0
2006-01-06	58.77	58.85	58.0500	58.57	6889800.0
2006-01-09	58.63	59.29	58.6244	59.19	4144500.0

In [75]:

```
WFC = data.DataReader('WFC', 'quandl', start, end)
WFC.head()
```

Out[75]:

	Open	High	Low	Close	Volume	ExDividend	SplitRatio	AdjOpen	AdjHigh	A
Date										
2015-12-31	54.51	54.9499	54.220	54.36	10929420.0	0.0	1.0	51.350518	51.764921	5
2015-12-30	55.27	55.3100	54.794	54.89	8016893.0	0.0	1.0	52.066467	52.104149	5
2015-12-29	55.11	55.3500	54.990	55.29	7894876.0	0.0	1.0	51.915741	52.141830	5
2015-12-28	54.55	54.7800	54.170	54.68	8288759.0	0.0	1.0	51.388199	51.604868	5
2015-12-24	54.97	55.0900	54.710	54.82	4999417.0	0.0	1.0	51.783856	51.896900	5

In [76]:

```
WFC = WFC.drop(['ExDividend', 'SplitRatio','AdjOpen',
                'AdjHigh', 'AdjLow', 'AdjClose', 'AdjVolume'], axis = 1)
WFC.head()
```

Out[76]:

	Open	High	Low	Close	Volume
Date					
2015-12-31	54.51	54.9499	54.220	54.36	10929420.0
2015-12-30	55.27	55.3100	54.794	54.89	8016893.0
2015-12-29	55.11	55.3500	54.990	55.29	7894876.0
2015-12-28	54.55	54.7800	54.170	54.68	8288759.0
2015-12-24	54.97	55.0900	54.710	54.82	4999417.0

In [77]:

```
#Sort the date index in ascending order
WFC = WFC.sort_index(ascending = True)
WFC.head()
```

Out[77]:

Date	Open	High	Low	Close	Volume
2006-01-03	63.20	63.95	62.39	63.80	5508200.0
2006-01-04	63.60	63.64	62.73	63.06	5435000.0
2006-01-05	63.00	63.11	62.62	62.99	5079000.0
2006-01-06	63.16	63.55	62.77	63.36	4201900.0
2006-01-09	63.35	63.65	63.11	63.35	2809800.0

Create a list of the ticker symbols (as strings) in alphabetical order. Call this list: tickers

In [78]:

```
tickers = ['BAC', 'C', 'GS', 'JPM', 'MS', 'WFC']
tickers
```

Out[78]:

```
['BAC', 'C', 'GS', 'JPM', 'MS', 'WFC']
```

Use pd.concat to concatenate the bank dataframes together to a single data frame called bank_stocks. Set the keys argument equal to the tickers list. Also set axis = 1, to concatenate the columns.

In [79]:

```
bank_stocks = pd.concat([BAC, C, GS, JPM, MS, WFC],
                        axis = 1, keys = tickers )
bank_stocks.head()
```

Out[79]:

	BAC					C					...	MS
	Open	High	Low	Close	Volume	Open	High	Low	Close	Volume	...	Open
Date												
2006-01-03	46.92	47.18	46.15	47.08	16296700.0	49.00	49.38	48.11	49.29	15376000.0	...	57.17
2006-01-04	47.00	47.24	46.45	46.58	17757900.0	48.86	49.10	48.35	48.38	18709000.0	...	58.70
2006-01-05	46.58	46.83	46.32	46.64	14970700.0	48.44	48.78	48.40	48.62	11431000.0	...	58.55
2006-01-06	46.80	46.91	46.35	46.57	12599800.0	48.88	48.90	48.20	48.62	13702000.0	...	58.77
2006-01-09	46.72	46.97	46.36	46.60	15619400.0	48.60	48.74	48.30	48.39	16807000.0	...	58.63

5 rows × 30 columns

Set the column name levels.

In [80]:

```
bank_stocks.columns.names = ['Bank Ticker','Stock Info']
```

Check the head of the bank_stocks dataframe.

```
In [81]: bank_stocks.head()
```

Out[81]:

Bank Ticker	BAC					C					...	MS
Stock Info	**Open**	**High**	**Low**	**Close**	**Volume**	**Open**	**High**	**Low**	**Close**	**Volume**	**...**	**Open**
Date												
2006-01-03	46.92	47.18	46.15	47.08	16296700.0	49.00	49.38	48.11	49.29	15376000.0	...	57.17
2006-01-04	47.00	47.24	46.45	46.58	17757900.0	48.86	49.10	48.35	48.38	18709000.0	...	58.70
2006-01-05	46.58	46.83	46.32	46.64	14970700.0	48.44	48.78	48.40	48.62	11431000.0	...	58.55
2006-01-06	46.80	46.91	46.35	46.57	12599800.0	48.88	48.90	48.20	48.62	13702000.0	...	58.77
2006-01-09	46.72	46.97	46.36	46.60	15619400.0	48.60	48.74	48.30	48.39	16807000.0	...	58.63

5 rows × 30 columns

Exploratory Data Analysis

Reference: Documentation on Multi-Level Indexing http://pandas.pydata.org/pandas-docs/stable/advanced.html (http://pandas.pydata.org/pandas-docs/stable/advanced.html) and Using cross-section (.xs) http://pandas.pydata.org/pandas-docs/stable/generated/pandas.DataFrame.xs.html (http://pandas.pydata.org/pandas-docs/stable/generated/pandas.DataFrame.xs.html)

We want to find the max Close price for each bank's stock throughout the time period

```
In [82]: bank_stocks.xs(key = 'Close', level = 'Stock Info', axis = 1).max()
```

```
Out[82]: Bank Ticker
         BAC       54.90
         C         60.34
         GS       247.92
         JPM       70.08
         MS        89.30
         WFC       73.00
         dtype: float64
```

Create a new empty DataFrame called returns. This dataframe will contain the returns for each bank's stock. returns are typically defined by:

$$r_t = \frac{p_t - p_{t-1}}{p_{t-1}} = \frac{p_t}{p_{t-1}} - 1$$

In [83]:

```
returns = pd.DataFrame()
```

We will use pandas pct_change() method on the Close column to create a column representing this return value. For this, use a for loop that will create this returns column and for each Bank Stock Ticker and set it as a column in the returns DataFrame.

In [84]:

```
for tick in tickers:
    returns[tick+' Return']=bank_stocks[tick]['Close'].pct_change()
```

In [85]:

```
returns.head()
```

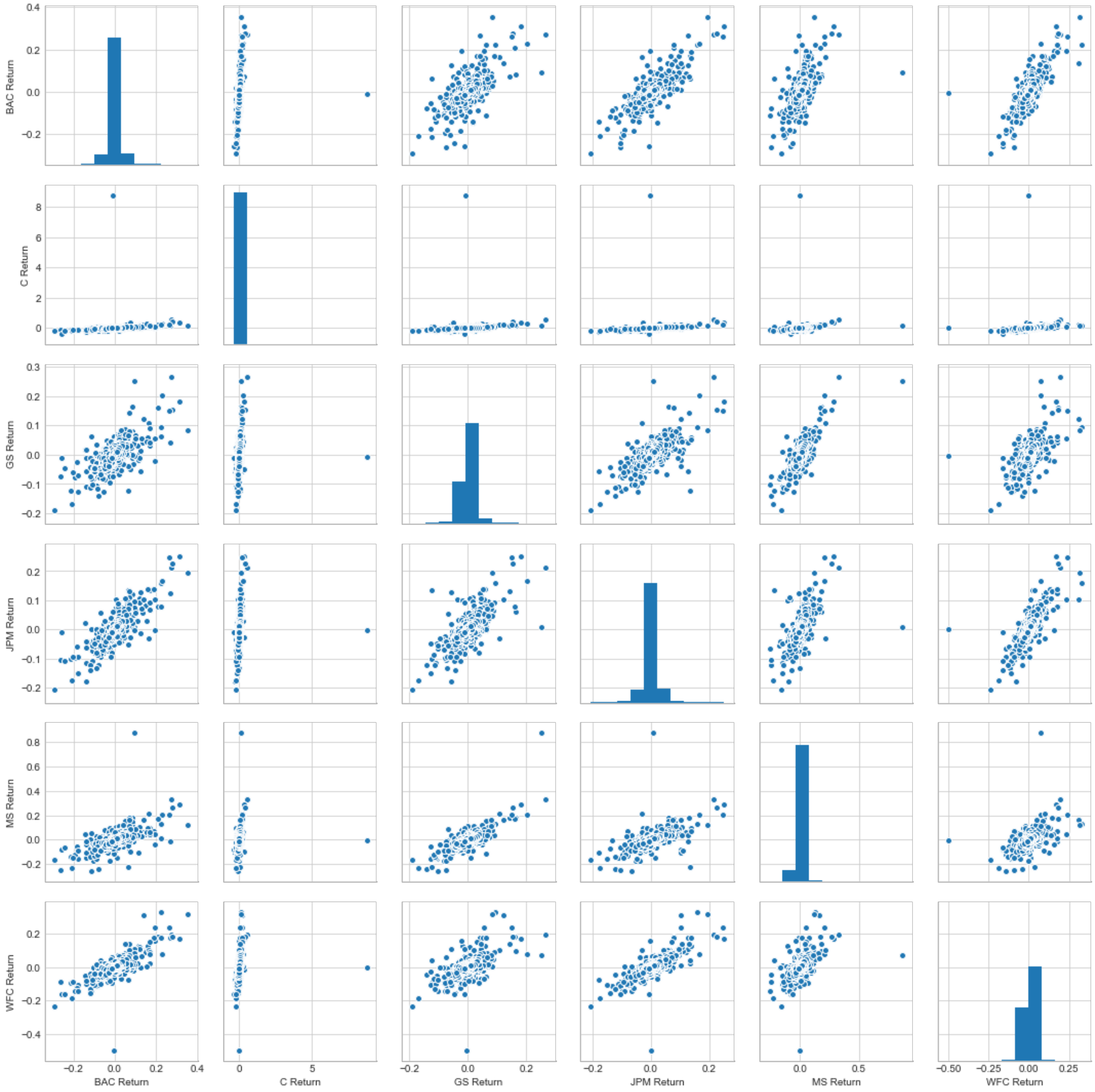
Out[85]:

	BAC Return	C Return	GS Return	JPM Return	MS Return	WFC Return
Date						
2006-01-03	NaN	NaN	NaN	NaN	NaN	NaN
2006-01-04	-0.010620	-0.018462	-0.013812	-0.014183	0.000686	-0.011599
2006-01-05	0.001288	0.004961	-0.000393	0.003029	0.002742	-0.001110
2006-01-06	-0.001501	0.000000	0.014169	0.007046	0.001025	0.005874
2006-01-09	0.000644	-0.004731	0.012030	0.016242	0.010586	-0.000158

Create a pairplot using seaborn of the returns dataframe. Let us see which stock stands out.

In [86]:
```
import seaborn as sns
sns.pairplot(returns[1:])
```

Out[86]:
```
<seaborn.axisgrid.PairGrid at 0x11bc73a58>
```



Observation: Citibank has a vertical line.

Using this returns DataFrame, figure out on what dates each bank stock had the best and worst single day returns.

In [87]:
```
#Get the head of the dataframe
returns.head()
```

Out[87]:

	BAC Return	C Return	GS Return	JPM Return	MS Return	WFC Return
Date						
2006-01-03	NaN	NaN	NaN	NaN	NaN	NaN
2006-01-04	-0.010620	-0.018462	-0.013812	-0.014183	0.000686	-0.011599
2006-01-05	0.001288	0.004961	-0.000393	0.003029	0.002742	-0.001110
2006-01-06	-0.001501	0.000000	0.014169	0.007046	0.001025	0.005874
2006-01-09	0.000644	-0.004731	0.012030	0.016242	0.010586	-0.000158

In [88]:
```
#Get the min
returns.min()
```

Out[88]:
```
BAC Return   -0.289694
C Return     -0.390244
GS Return    -0.189596
JPM Return   -0.207274
MS Return    -0.258929
WFC Return   -0.502084
dtype: float64
```

In [89]:
```
#Get the worst single day loss
returns.idxmin()
```

Out[89]:
```
BAC Return   2009-01-20
C Return     2009-02-27
GS Return    2009-01-20
JPM Return   2009-01-20
MS Return    2008-10-09
WFC Return   2006-08-14
dtype: datetime64[ns]
```

In [90]:
```
# Get the best single day gain
returns.idxmax()
```

Out[90]:
```
BAC Return   2009-04-09
C Return     2011-05-09
GS Return    2008-11-24
JPM Return   2009-01-21
MS Return    2008-10-13
WFC Return   2008-07-16
dtype: datetime64[ns]
```

Observation: We see that some largest drop and biggest gain were very close to one another.

To find out which stocks are the riskiest over the entire time period, take a look at the standard deviation of the returns.

In [91]:

```
# Riskiest stock for  the entire period
returns.std()
```

Out[91]:

```
BAC Return    0.036628
C Return      0.179066
GS Return     0.025358
JPM Return    0.027651
MS Return     0.037820
WFC Return    0.031838
dtype: float64
```

In [92]:

```
#Get stddev of returns
start_date = '2015-01-01'
end_date = '2016-01-01'
returns[start_date : end_date].std()
```

Out[92]:

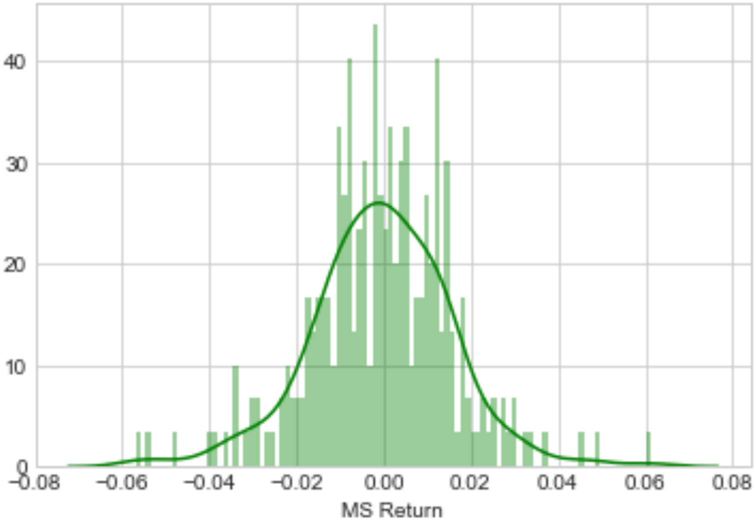
```
BAC Return    0.016163
C Return      0.015289
GS Return     0.014046
JPM Return    0.014017
MS Return     0.016249
WFC Return    0.012591
dtype: float64
```

Create a distplot using seaborn of the 2015 returns for Morgan Stanley

```
In [93]: sns.set_style('whitegrid')
         sns.distplot(returns[start_date : end_date]['MS Return'], bins = 100,
                      color = 'green')
```

```
/Users/Jayashri/anaconda/lib/python3.6/site-packages/scipy/stats/stats
.py:1713: FutureWarning:

Using a non-tuple sequence for multidimensional indexing is deprecated
; use `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will
be interpreted as an array index, `arr[np.array(seq)]`, which will res
ult either in an error or a different result.
```

```
Out[93]: <matplotlib.axes._subplots.AxesSubplot at 0x11c149c88>
```



Create a distplot using seaborn of the 2008 returns for CitiGroup

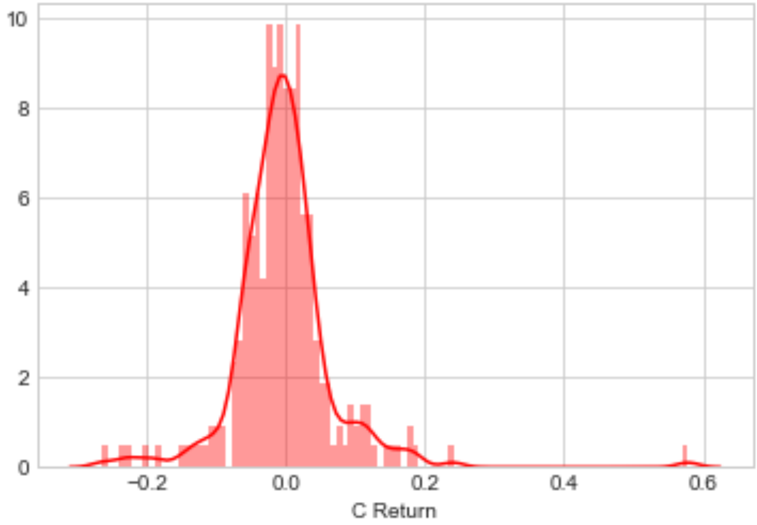
In [94]:

```
start_date = '2008-01-01'
end_date = '2009-01-01'
sns.distplot(returns[start_date : end_date]['C Return'], bins = 100,
             color = 'red')
```

```
/Users/Jayashri/anaconda/lib/python3.6/site-packages/scipy/stats/stats
.py:1713: FutureWarning:

Using a non-tuple sequence for multidimensional indexing is deprecated
; use `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will
be interpreted as an array index, `arr[np.array(seq)]`, which will res
ult either in an error or a different result.
```

Out[94]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a27a55dd8>
```



More Visualization

Imports

In [95]:

```
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid')
%matplotlib inline

# Plotly Method Imports
import plotly
import cufflinks as cf
cf.go_offline()
```

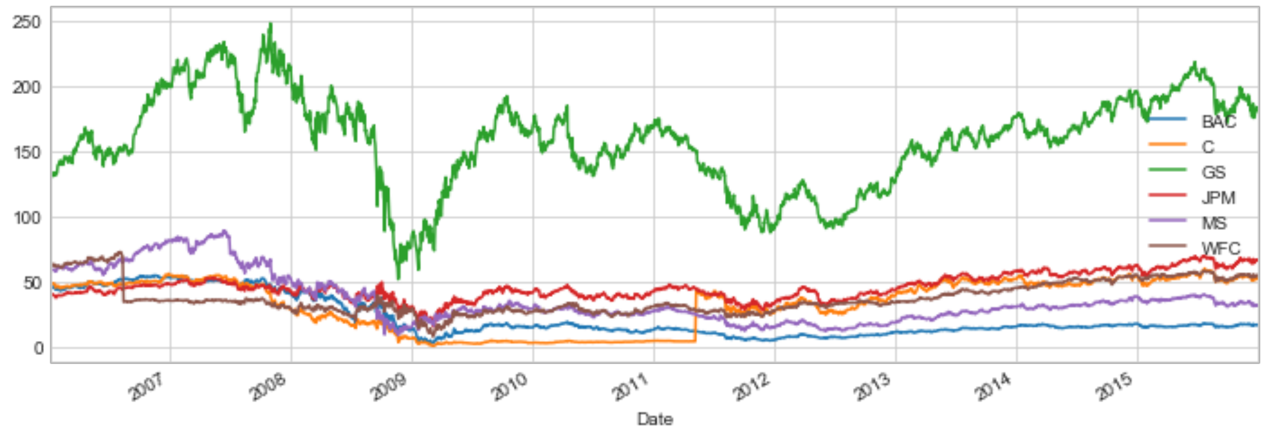
Create a line plot showing Close price for each bank for the entire index of time. This can be done using a for loop, or [.xs] http://pandas.pydata.org/pandasdocs/stable/generated/pandas.DataFrame.xs.html (http://pandas.pydata.org/pandasdocs/stable/generated/pandas.DataFrame.xs.html)) to get a cross section of the data.

In [100]:

```
#Using for loop
for tick in tickers:
    bank_stocks[tick]['Close'].plot(label=tick, figsize=(12,4))
plt.legend()
```

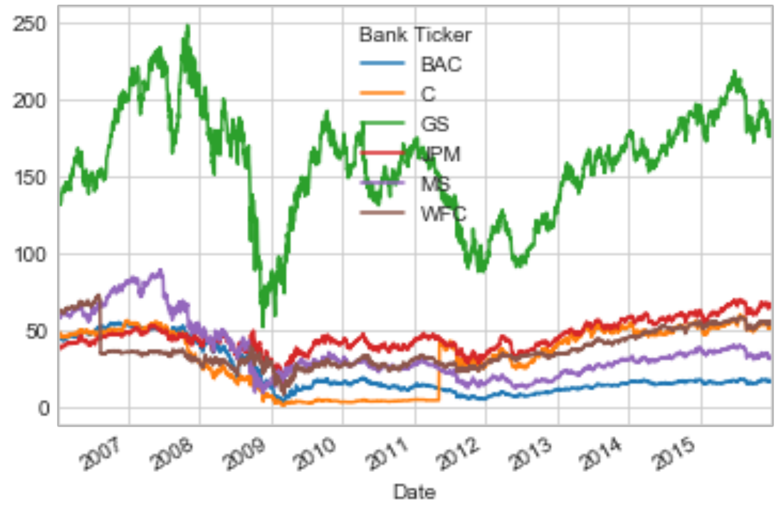
Out[100]:

```
<matplotlib.legend.Legend at 0x1a290e72e8>
```

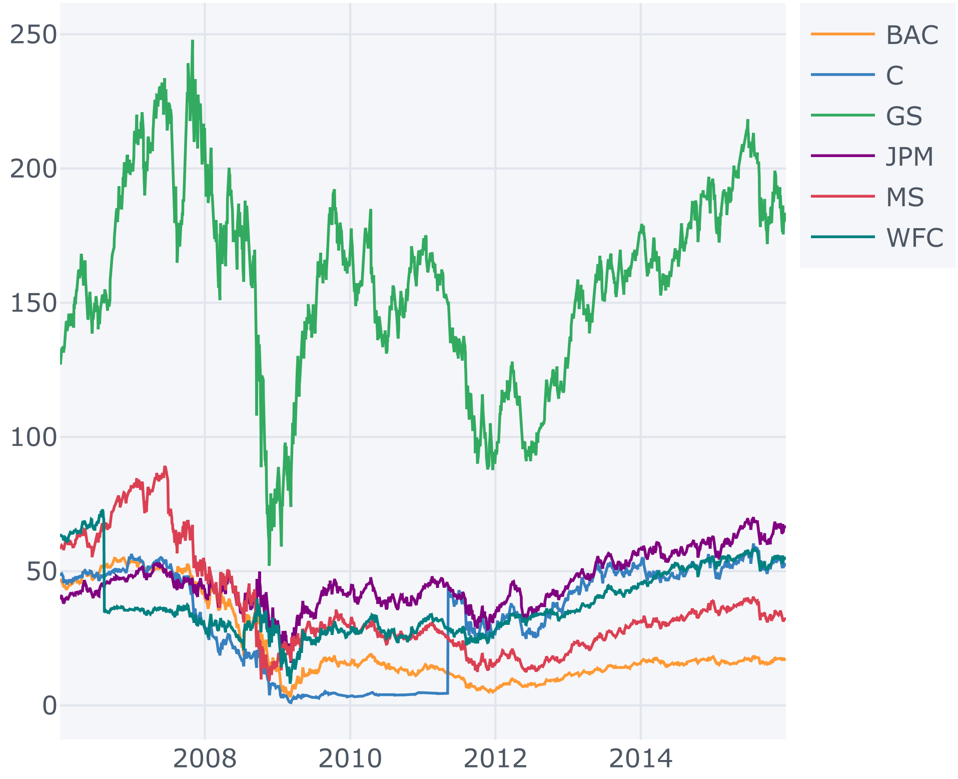


In [101]:
```
#Using cross-section .xs
bank_stocks.xs(key='Close', axis=1, level='Stock Info').plot()
```

Out[101]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2920acc0>
```



In [102]:
```
#Using plotly - use iplot instead of plot in
#the previous command
bank_stocks.xs(key='Close', axis=1, level='Stock Info').iplot()
```



Export to plot.ly »

Moving Averages

Let's analyze the moving averages for these stocks in the year 2008.

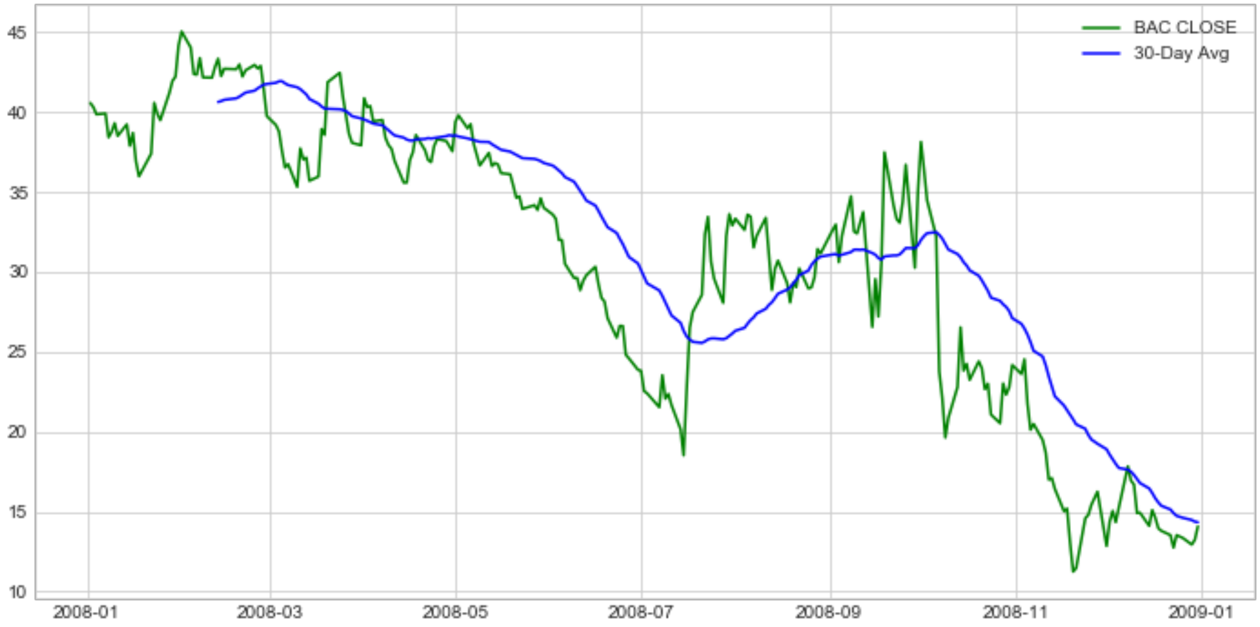
Plot the rolling 30 day average against the Close Price for Bank Of America's stock for the year 2008

In [103]:

```
# Get 30 day moving average
start_date = '2008-01-01'
end_date = '2009-01-01'
fig, ax = plt.subplots(figsize = (12, 6))
ax.plot(BAC.loc[start_date: end_date].index,
        BAC.loc[start_date: end_date, 'Close'], label = 'BAC CLOSE',
        color = 'green')
ax.plot(BAC.loc[start_date: end_date].index,
        BAC['Close'].loc[start_date: end_date].rolling(window = 30).mean(
        label = '30-Day Avg',
        color = 'blue')
plt.legend()
```

Out[103]:

```
<matplotlib.legend.Legend at 0x1a2a1bf978>
```



Create a heatmap of the correlation between the stocks Close Price.

In [109]:

```
bank_stocks.xs(key='Close', axis=1, level='Stock Info').head()
```

Out[109]:

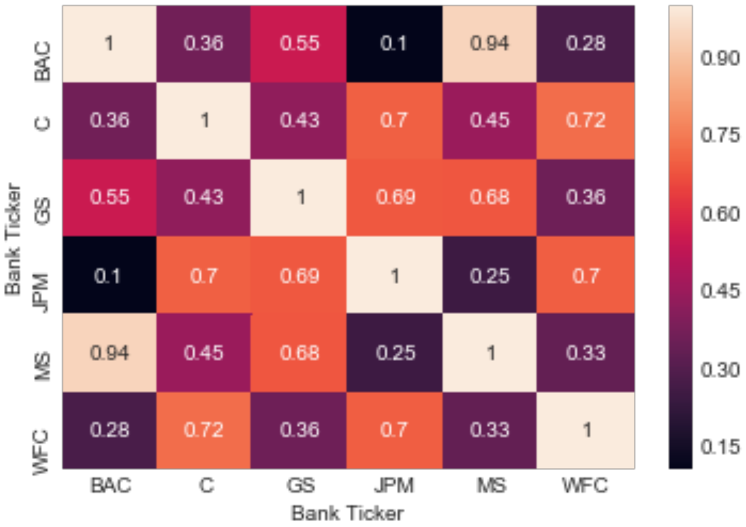
Bank Ticker	BAC	C	GS	JPM	MS	WFC
Date						
2006-01-03	47.08	49.29	128.87	40.19	58.31	63.80
2006-01-04	46.58	48.38	127.09	39.62	58.35	63.06
2006-01-05	46.64	48.62	127.04	39.74	58.51	62.99
2006-01-06	46.57	48.62	128.84	40.02	58.57	63.36
2006-01-09	46.60	48.39	130.39	40.67	59.19	63.35

In [110]:

```
sns.heatmap(bank_stocks.xs(key='Close', axis=1, level='Stock Info').corr(
```

Out[110]:

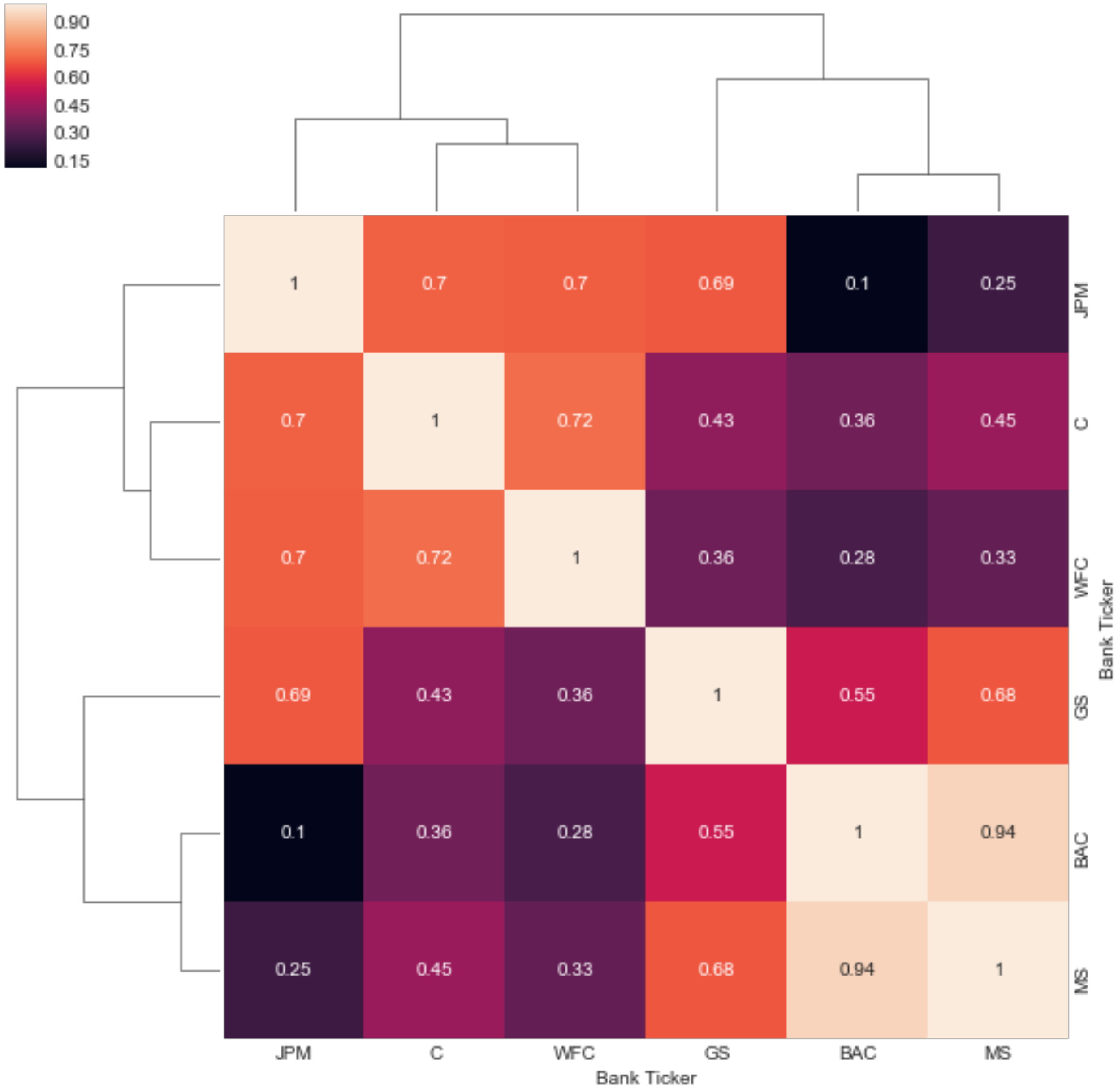
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a28a447f0>
```



Use seaborn's clustermap to cluster the correlations together:

```
In [111]: sns.clustermap(bank_stocks.xs(key='Close',
                                        axis=1, level='Stock Info').corr(),
                                        annot = True)
```

```
Out[111]: <seaborn.matrix.ClusterGrid at 0x1a28977be0>
```



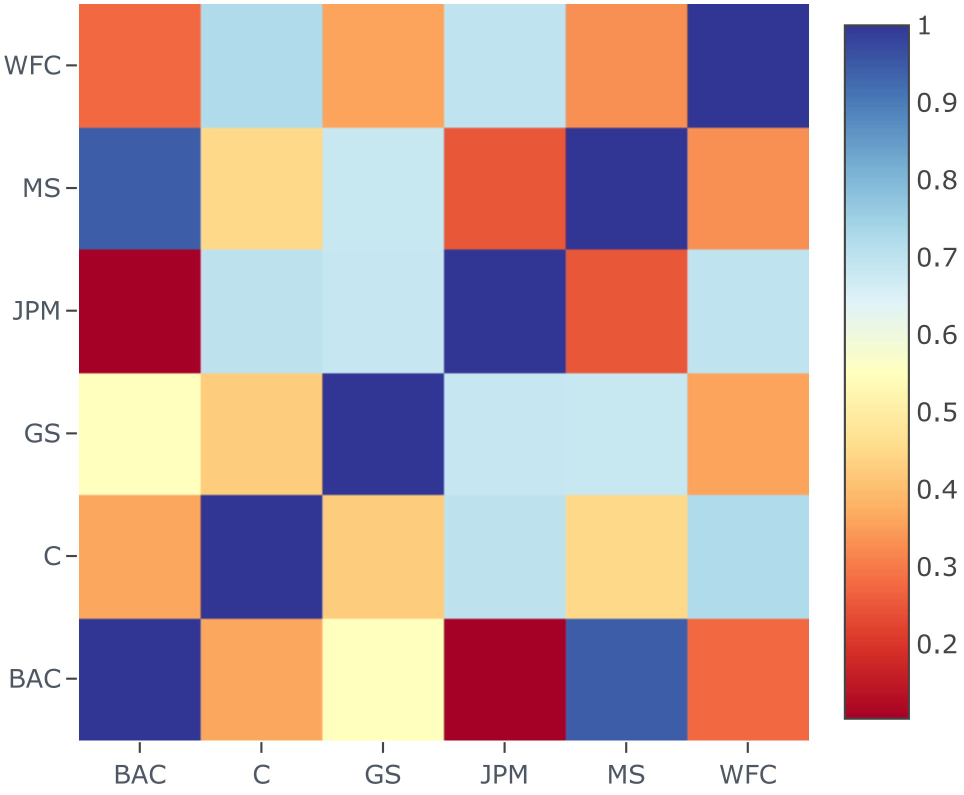
In [115]:

```
#Correlation Matrix
close_corr = bank_stocks.xs(key='Close', axis=1, level='Stock Info').corr
close_corr
```

Out[115]:

Bank Ticker	BAC	C	GS	JPM	MS	WFC
Bank Ticker						
BAC	1.000000	0.363303	0.550936	0.103855	0.944219	0.276687
C	0.363303	1.000000	0.426868	0.700735	0.449794	0.723474
GS	0.550936	0.426868	1.000000	0.685347	0.683830	0.359021
JPM	0.103855	0.700735	0.685347	1.000000	0.250410	0.697574
MS	0.944219	0.449794	0.683830	0.250410	1.000000	0.331510
WFC	0.276687	0.723474	0.359021	0.697574	0.331510	1.000000

In [116]:
```
#Using iplot()
close_corr.iplot(kind='heatmap', colorscale='rdylbu')
```



Export to plot.ly »

Using cufflinks library to create Technical Analysis plots.

In [117]:
```
import cufflinks as cf
from plotly.offline import download_plotlyjs, init_notebook_mode, plot,ip
cf.go_offline
```

Out[117]:
```
<function cufflinks.offline.go_offline>
```

Use .iplot(kind='candle) to create a candle plot of Bank of America's stock from Jan 1st 2015 to Jan 1st 2016.

In [118]:

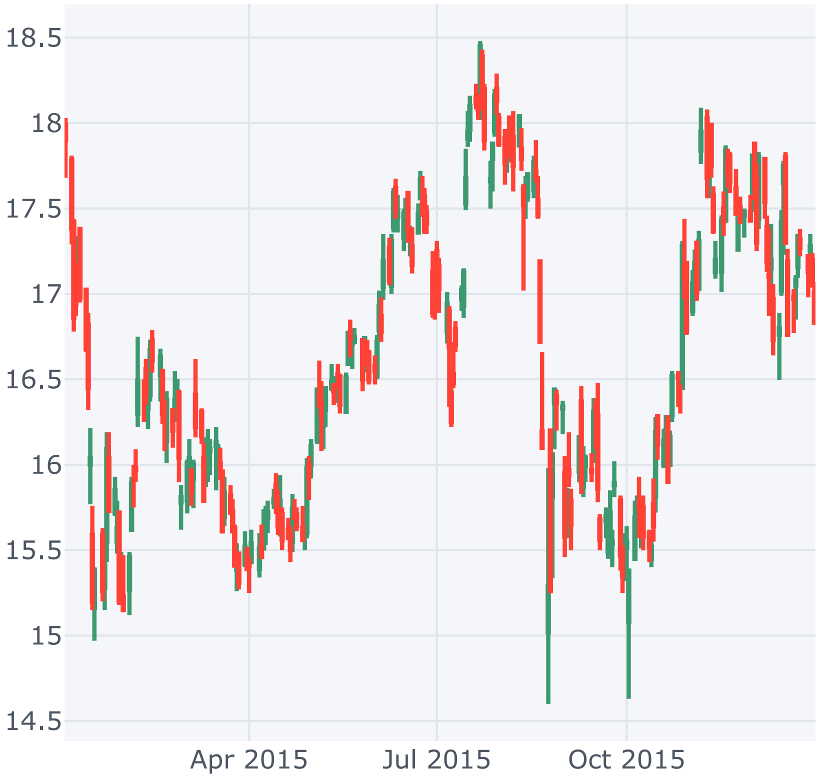
```
BAC15 = BAC[['Open','High', 'Low', 'Close']].ix['2015-01-01':'2016-01-01'
BAC15.head()
```

```
/Users/Jayashri/anaconda/lib/python3.6/site-packages/ipykernel_launche
r.py:1: DeprecationWarning:


.ix is deprecated. Please use
.loc for label based indexing or
.iloc for positional indexing

See the documentation here:
http://pandas.pydata.org/pandas-docs/stable/indexing.html#ix-indexer-i
s-deprecated (http://pandas.pydata.org/pandas-docs/stable/indexing.htm
l#ix-indexer-is-deprecated)
```

Out[118]:

	Open	High	Low	Close
Date				
2015-01-02	17.990	18.03	17.6801	17.90
2015-01-05	17.785	17.81	17.2900	17.38
2015-01-06	17.420	17.44	16.7800	16.86
2015-01-07	17.140	17.18	16.8700	16.94
2015-01-08	17.160	17.34	17.1000	17.29

In [119]:
```
BAC15.iplot(kind='candle')
```

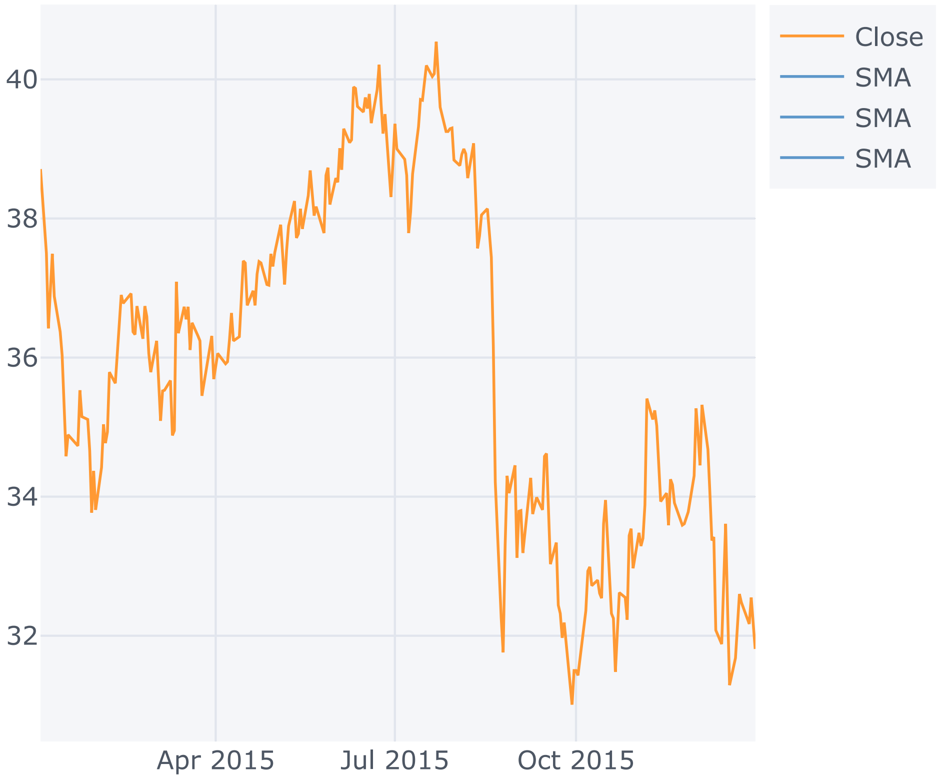


Export to plot.ly »

Use .ta_plot(study='sma') to create a Simple Moving Averages plot of Morgan Stanley for the year 2015.

```
In [120]: MS['Close'].ix['2015-01-01':'2016-01-01'].ta_plot(study='sma',
                                                          periods =[13,21,55])
```

```
/Users/Jayashri/anaconda/lib/python3.6/site-packages/ipykernel_launche
r.py:1: DeprecationWarning:


.ix is deprecated. Please use
.loc for label based indexing or
.iloc for positional indexing

See the documentation here:
http://pandas.pydata.org/pandas-docs/stable/indexing.html#ix-indexer-i
s-deprecated (http://pandas.pydata.org/pandas-docs/stable/indexing.htm
l#ix-indexer-is-deprecated)
```



Export to plot.ly »

Use .ta_plot(study='boll') to create a Bollinger Band Plot for Bank of America for the year 2015.

In [250]:

```
BAC['Close'].ix['2015-01-01': '2016-01-01'].ta_plot(study='boll')
```

...