In [2]:
```
# IMPORTING REQUIRED PACKAGE

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [3]:
```
# Settings to produce nice plots in a Jupyter notebook
plt.style.use('fivethirtyeight')
%matplotlib inline
```

In [6]:
```
# Reading in the data


stock_data = pd.read_csv('stock_data.csv',
    parse_dates=['Date'],
    index_col='Date'
    ).dropna()

benchmark_data = pd.read_csv('benchmark_data.csv',
    parse_dates=['Date'],
    index_col='Date'
    ).dropna()
```

In [16]:
```
print('Stocks\n')
```

```
Stocks
```

In [11]:
```
stock_data.info()
print(stock_data.head())
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 252 entries, 2016-01-04 to 2016-12-30
Data columns (total 2 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   Amazon    252 non-null    float64
 1   Facebook  252 non-null    float64
dtypes: float64(2)
memory usage: 5.9 KB
                Amazon    Facebook
Date                               
2016-01-04  636.989990  102.220001
2016-01-05  633.789978  102.730003
2016-01-06  632.650024  102.970001
2016-01-07  607.940002   97.919998
2016-01-08  607.049988   97.330002
```

In [15]:
```
print('\nBenchmarks\n')
```

```
Benchmarks
```

In [12]:

```
benchmark_data.info()
print(benchmark_data.head())
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 252 entries, 2016-01-04 to 2016-12-30
Data columns (total 1 columns):
 #   Column   Non-Null Count  Dtype  
---  ------   --------------  -----  
 0   S&P 500  252 non-null    float64
dtypes: float64(1)
memory usage: 3.9 KB
            S&P 500
Date
2016-01-04  2012.66
2016-01-05  2016.71
2016-01-06  1990.26
2016-01-07  1943.09
2016-01-08  1922.03
```

In [18]:

```
# summarize the stock_data

stock_data.describe()
```

Out[18]:

	Amazon	Facebook
count	252.000000	252.000000
mean	699.523135	117.035873
std	92.362312	8.899858
min	482.070007	94.160004
25%	606.929993	112.202499
50%	727.875000	117.765000
75%	767.882492	123.902502
max	844.359985	133.279999

In [21]:

```
# visualize the stock_data

stock_data.plot(title='Stock Data', subplots=True);
```

In [19]:

```
# summarize the benchmark_data
benchmark_data.describe()
```

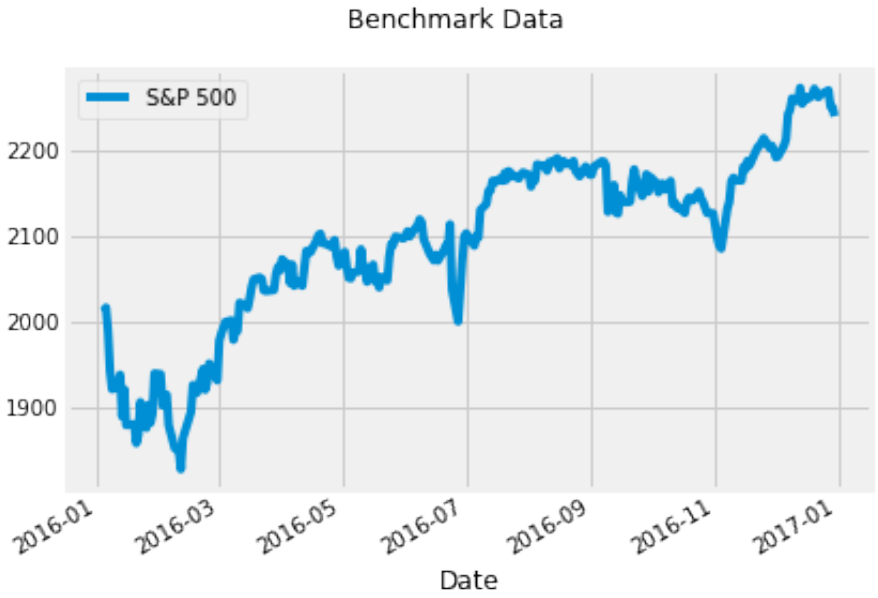
Out[19]:

	S&P 500
count	252.000000
mean	2094.651310
std	101.427615
min	1829.080000
25%	2047.060000
50%	2104.105000
75%	2169.075000
max	2271.720000

In [20]:

```
# plot the benchmark_data

benchmark_data.plot(title='Benchmark Data', subplots=True);
```



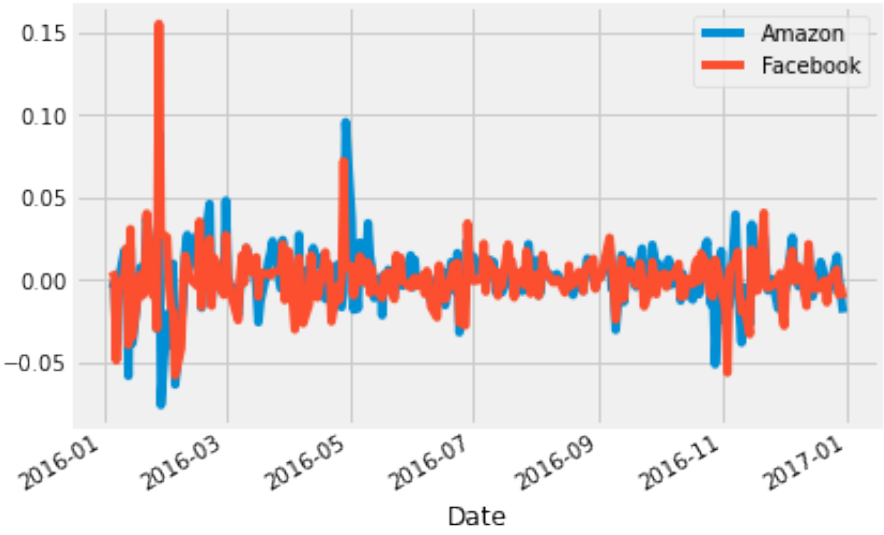
In [22]:
```
# calculate daily stock_data returns
stock_returns = stock_data.pct_change()
```

In [23]:
```
# summarize the daily returns
stock_returns.describe()
```

Out[23]:

	Amazon	Facebook
count	251.000000	251.000000
mean	0.000818	0.000626
std	0.018383	0.017840
min	-0.076100	-0.058105
25%	-0.007211	-0.007220
50%	0.000857	0.000879
75%	0.009224	0.008108
max	0.095664	0.155214

In [24]:
```
# plot the daily returns
stock_returns.plot();
```

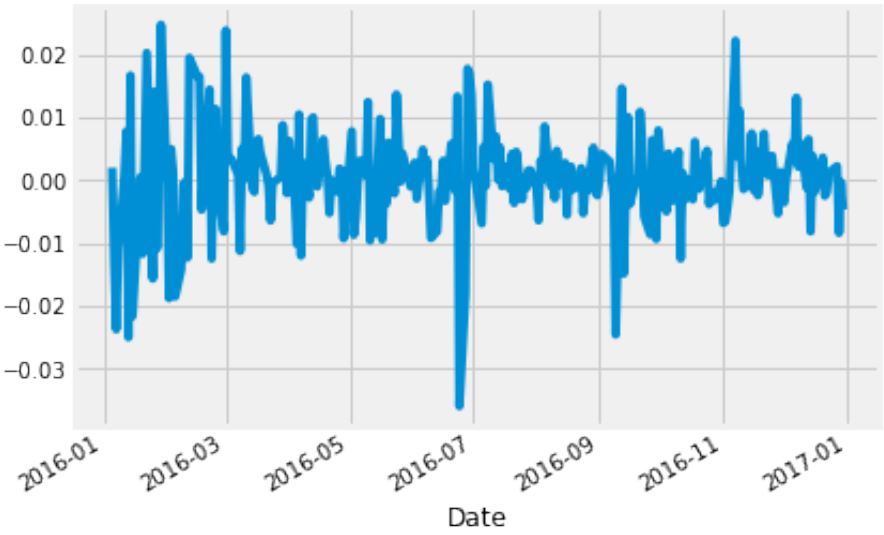


In [25]:
```
# calculate daily benchmark_data returns
sp_returns = benchmark_data['S&P 500'].pct_change()
```

In [26]:
```
# summarize the daily returns
sp_returns.describe()
```

Out[26]:
```
count    251.000000
mean       0.000458
std        0.008205
min       -0.035920
25%       -0.002949
50%        0.000205
75%        0.004497
max        0.024760
Name: S&P 500, dtype: float64
```

In [27]:
```
# plot the daily returns
sp_returns.plot();
```



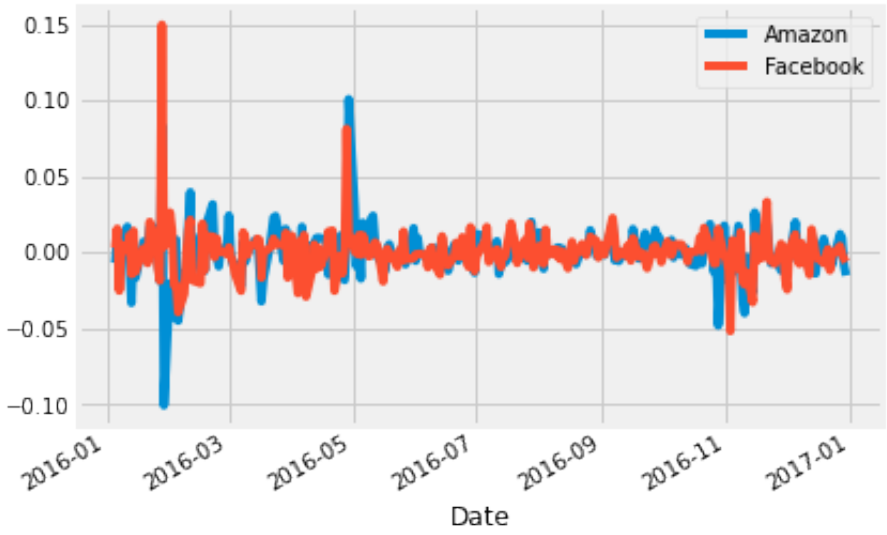
In [28]:
```
# calculate the difference in daily returns
excess_returns = stock_returns.sub(sp_returns, axis=0)
```

In [29]:
```
# summarize the excess_returns
excess_returns.describe()
```

Out[29]:

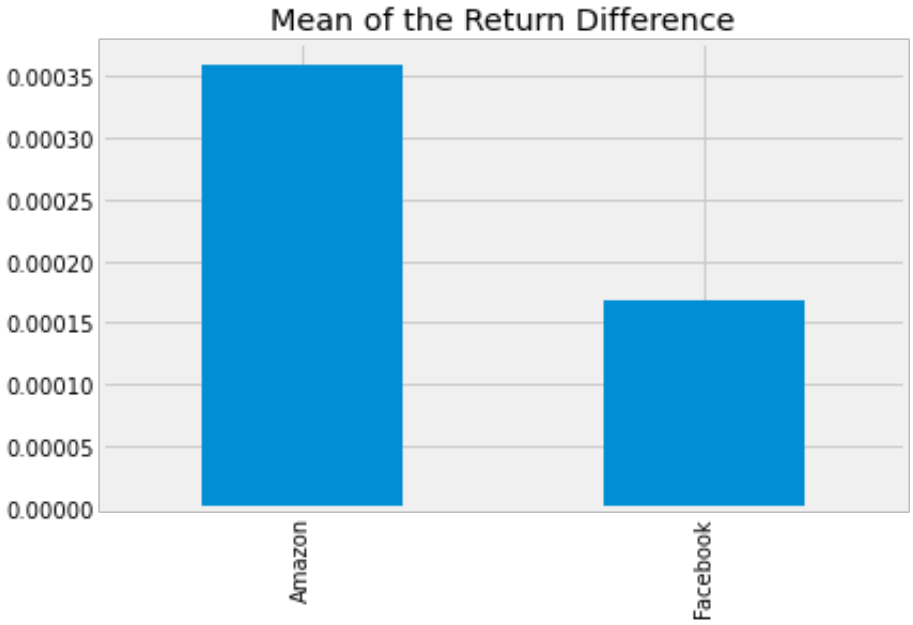
	Amazon	Facebook
count	251.000000	251.000000
mean	0.000360	0.000168
std	0.016126	0.015439
min	-0.100860	-0.051958
25%	-0.006229	-0.005663
50%	0.000698	-0.000454
75%	0.007351	0.005814
max	0.100728	0.149686

In [30]:
```
# plot the excess_returns
excess_returns.plot();
```



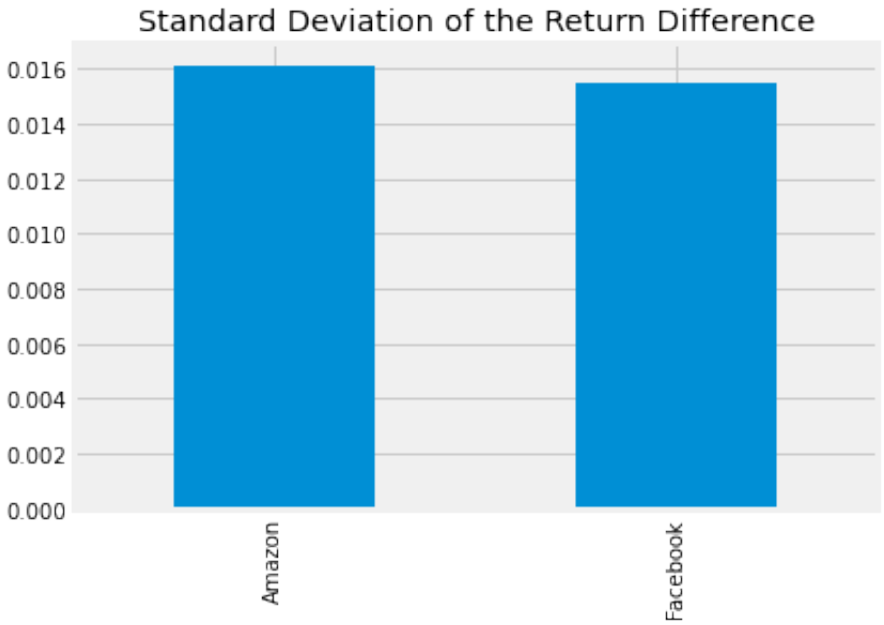
In [31]:
```
# calculate the mean of excess_returns
avg_excess_return = excess_returns.mean()
```

In [32]:
```
# plot avg_excess_returns
avg_excess_return.plot.bar(title='Mean of the Return Difference');
```



In [33]:
```
# calculate the standard deviations
sd_excess_return = excess_returns.std()
```

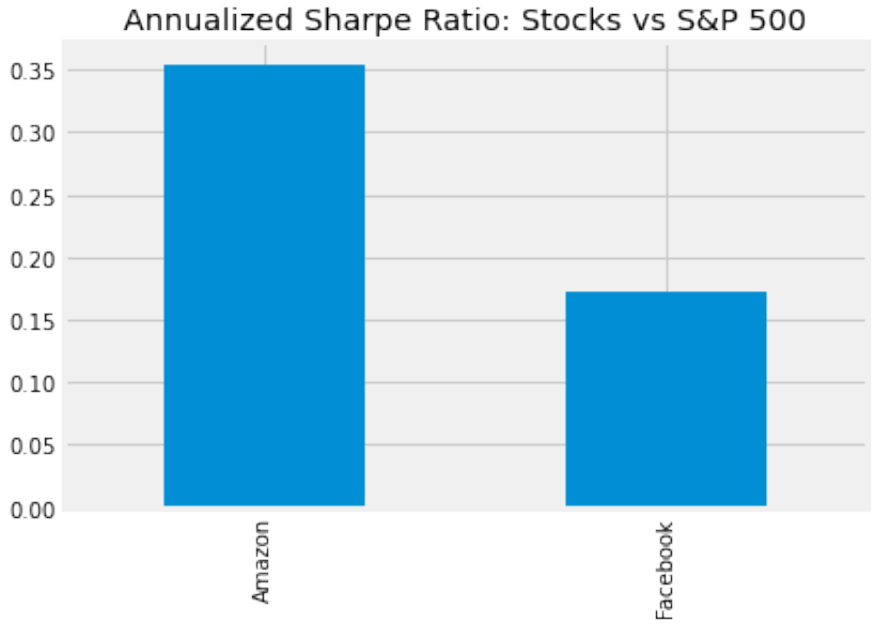
In [34]:
```
# plot the standard deviations
sd_excess_return.plot.bar(title='Standard Deviation of the Return Differen
```



In [35]:
```
# calculate the daily sharpe ratio
daily_sharpe_ratio = avg_excess_return.div(sd_excess_return)
```

In [36]:
```
# annualize the sharpe ratio
annual_factor = np.sqrt(252)
annual_sharpe_ratio = daily_sharpe_ratio.mul(annual_factor)
```

In [37]:
```
# plot the annualized sharpe ratio
annual_sharpe_ratio.plot.bar(title='Annualized Sharpe Ratio: Stocks vs S&P
```



In [38]:

```
# Uncomment your choice.
buy_amazon = True
```