Correlations Between Twitter Activity and Stock Value

SAMUEL OWENS, JOHN RICE, ROGER GRIFFIN, ERNIE CHU, KEVIN CONLIN

Background

Our group was interested in seeing how the Tweets of several high profile CEOs related to the stock performance of several famous companies. We choose several CEOs known known for their controversial opinions, some relatively stable CEOs with the occasional controversial comment, and CEOs not known for controversy.

With this idea in mind, we ended up choosing Elon Musk, Lloyd Blankfein, Jeff Bezos, Jack Dorsey, and Tim Cook.

Objective

❖ Analyze the relationship between Twitter behavior of CEOs and stock performance using 4 methods:

➤ Evaluating stock price fluctuations surrounding 8 significant tweets from each CEO.

➤ Pinpointing periods of NASDAQ fluctuation for each company and analyzing tweets during these periods.

➤ Comparing stock performance with frequency of tweets.

➤ Utilizing Favorites to Retweets ratio to determine any potential relationship between popular tweets and stock performance.

Methodology

- ❖ Collected 8 significant tweets from each of the relevant CEOs using Postman to return a JSON file which was then parsed for relevant information and written as a CSV using a BASH shell script.

- ❖ Downloaded five years of Nasdaq data for each of the five corporations: Tesla, Amazon, Apple, Twitter and Goldman Sachs

- ❖ Used a Shell script containing a curl command to retrieve as many tweets as possible from each of the five CEOs from the Twitter API. These files ranged from 98 – 1200 tweets output as TSV files.

- ❖ Used Spark DataFrames as well as Spark SQL Queries to create tables containing relevant information and join tables to create an output table that showed the correlation between stock data and tweets.

- ❖ Loaded CSVs and Spark output tables into GNUPlot to represent the relationships graphically.

Technologies Used

- ❖ GNUPlot
- ❖ Hive/HDFS
- ❖ HTML / CSS / JS
- ❖ Jshon
- ❖ Linux / Apache
- ❖ Postman
- ❖ Scala 2.12.10
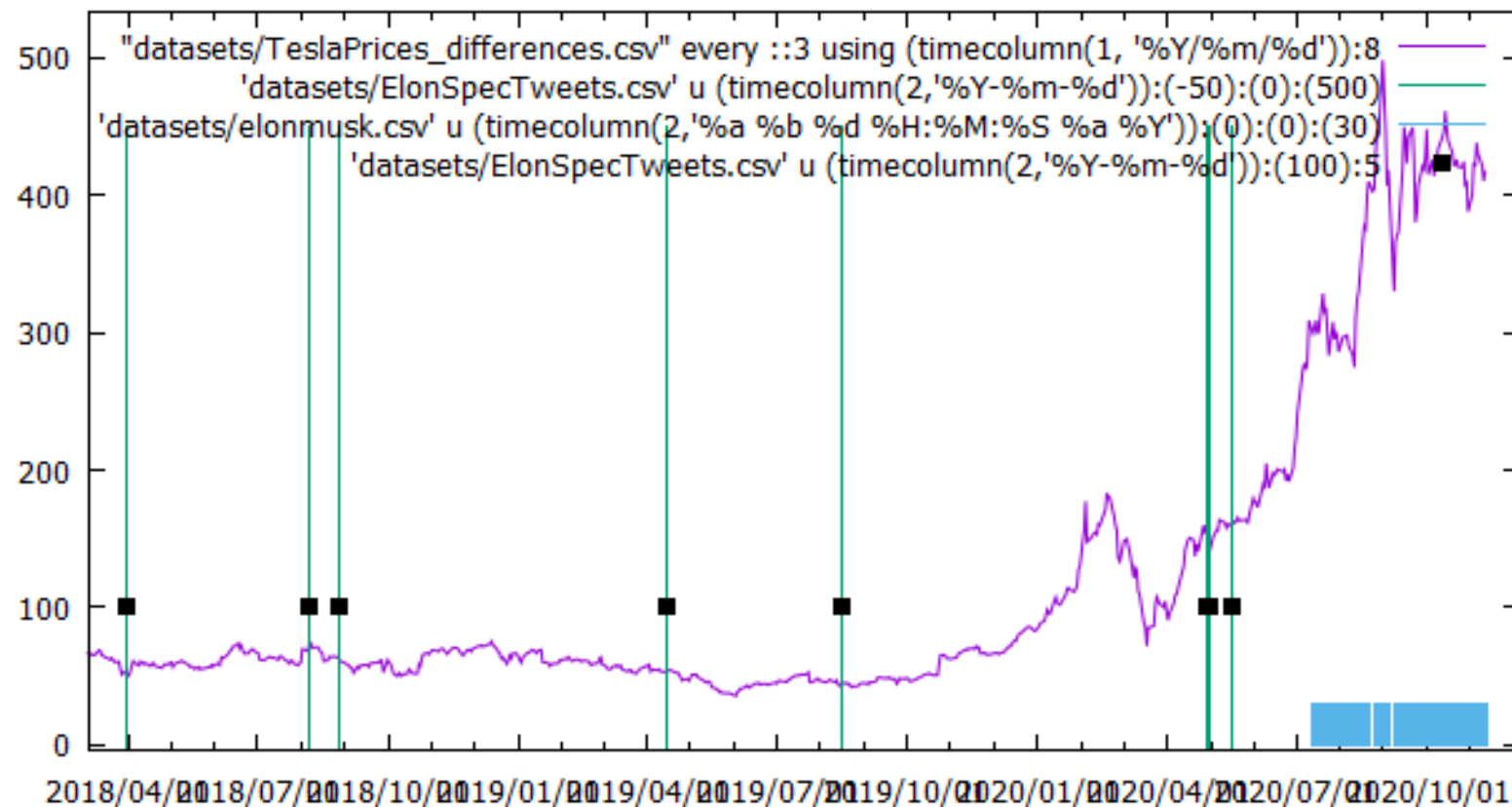- ❖ Shell Scripting
- ❖ Spark
- ❖ Twitter4j

Elon Musk Tweets vs Nasdaq Data

Date	Text	Closing_Price	Percent_Change_Prev_Day	Percent_Change_Prev_Week	Percent_Change_Following_Day	Percent_Change_Following_Week	Fave_to_Retweet_Ratio
2020/05/17	Take the red pill 💊	null	null	null	null	null	5.12
2018/08/07	Am considering ta...	75.91	10.9886	27.7239	2.4317	11.6237	5.67
2020/04/29	FREE AMERICA NOW	160.1	4.0813	7.2552	2.3273	-2.3622	5.67
2018/04/01	Tesla Goes Bankru...	null	null	null	null	null	6.85
2019/08/16	Nuke Mars!	43.99	1.9941	-5.775	-3.1327	2.6644	8.06
2020/05/01	Tesla stock price...	140.26	-10.3034	-4.2057	-8.5368	-15.4124	8.83
2018/08/28	@yoda @RMac18 @Ti...	62.37	-2.3209	2.0818	2.1965	15.5903	9.54
2019/04/15	I was always craz...	53.28	-0.4931	-0.5228	-2.6203	7.0388	17.03

*Tweets associated with null values for stock prices were tweeted on weekends, and thus there was no stock activity correlating to the day the tweet was made
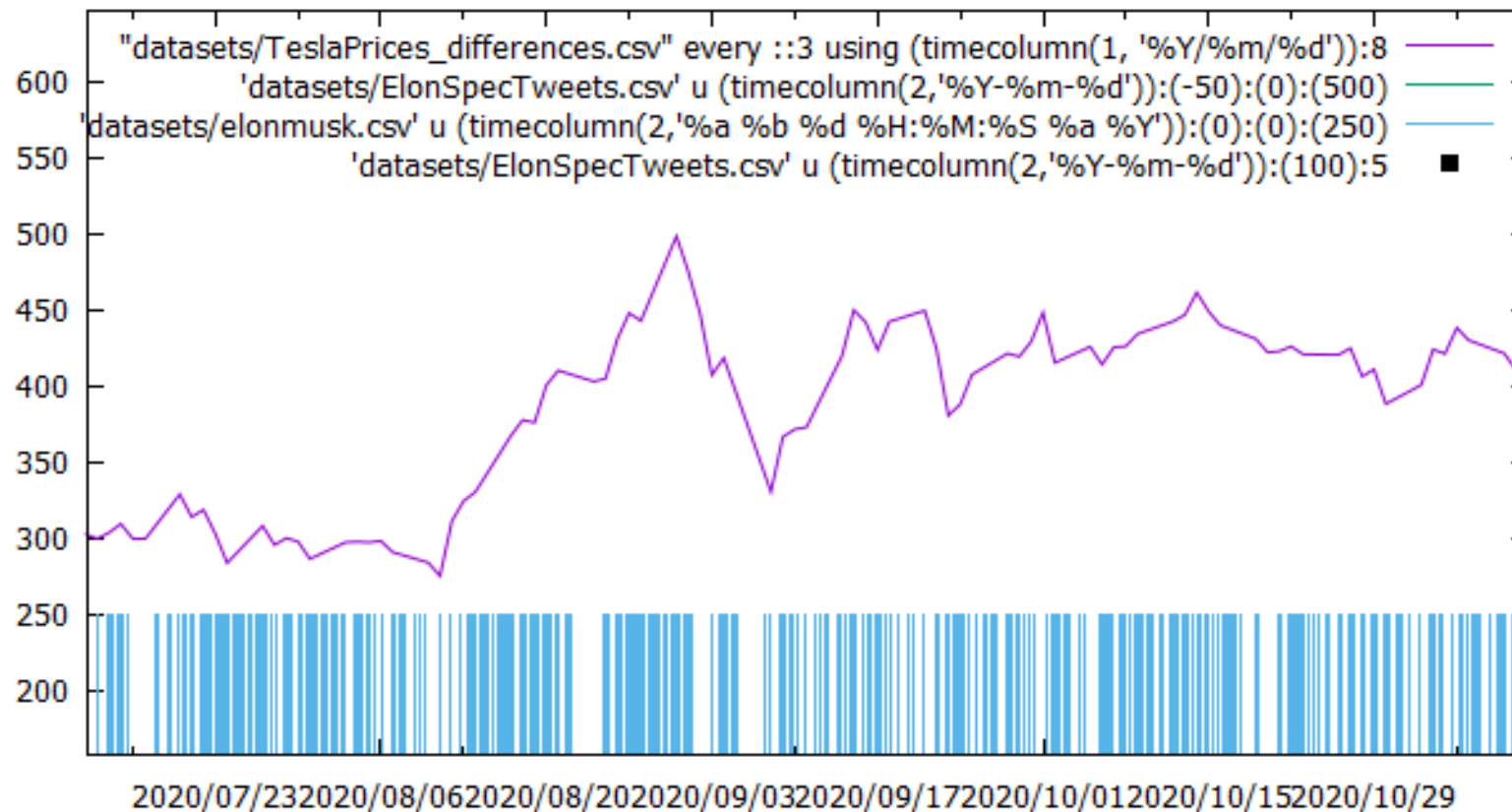
Elon Musk Tweets vs Nasdaq Data

Elon's Tweets overlayed on Tesla's Stock

Elon Musk Tweets vs Nasdaq Data

Elon's Tweets overlayed on Tesla's Stock

Elon Musk Tweet Analysis

❖ It can be seen that during periods of high tweet activity, Tesla's stock generally rose dramatically. From the period of July to August 2020, Tesla's stock nearly doubled, this coincided with a majority of tweet activity from Elon himself. However, it is possible that this correlation does not extend beyond our limited dataset. It would be interesting to examine this with a larger set of tweets going back further in time.

❖ Tesla stock also has a tendency for its price to drop dramatically following special tweets we highlighted from before our data set. This is probably because Elon Musk has a tendency to tweet regarding more controversial topics and shows less regard for maintaining a strictly professional online persona than CEOs like Jeff Bezos or Tim Cook.
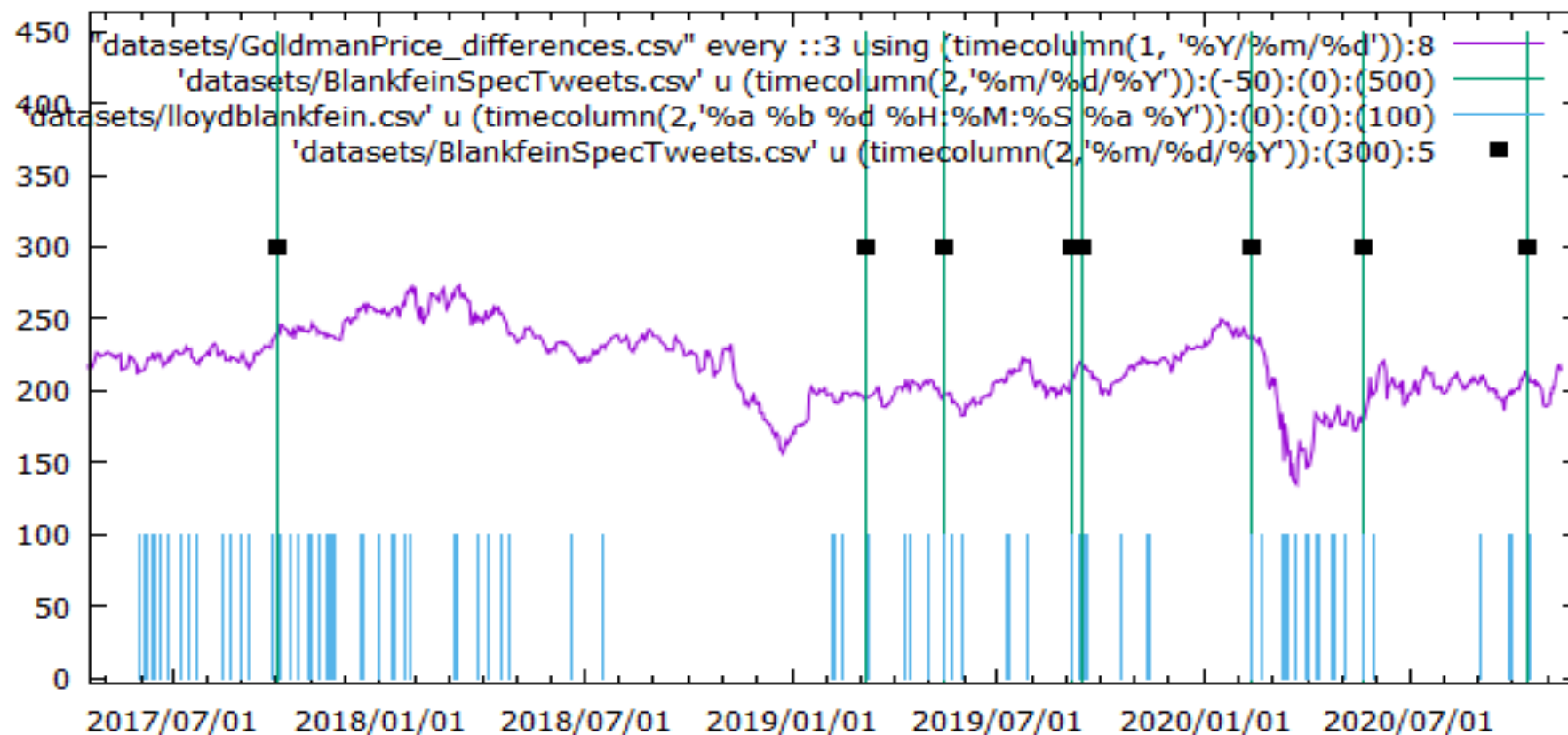
Lloyd Blankfein Tweets vs Nasdaq Data

Date	Text	Closing_Price	Percent_Change_Prev_Day	Percent_Change_Prev_Week	Percent_Change_Following_Day	Percent_Change_Following_Week	Fave_to_Retweet_Ratio
2017/10/03	Still thinking ab...	241.62	0.4031	4.5838	0.5422	0.7532	1.88
2020/02/12	If Dems go on to ...	238.65	0.9262	-0.1506	0.1257	5.9124	4.61
2020/05/22	Hospitals are not...	179.93	-0.0944	4.7322	-8.9646	-17.0288	5.1
2020/05/15	An earlier Harvar...	171.87	-1.4789	-2.8544	-5.8242	-21.9875	5.24
2020/09/16	The socialism deb...	200.68	1.3535	-4.8639	2.9151	2.8553	5.3
2019/09/05	Thank you UK for ...	207.05	2.6372	3.7065	-0.0773	-4.9119	6.03
2019/03/08	"The House not fo...	195.24	1.2813	-1.4437	-0.3739	-3.0117	6.12
2020/10/14	Stimulus bill: De...	211.23	0.1992	4.6729	1.2451	2.9305	6.25

Lloyd Blankfein Tweets vs Nasdaq Data

Blankfein's Tweets overlayed on GoldmanSachs' Stock
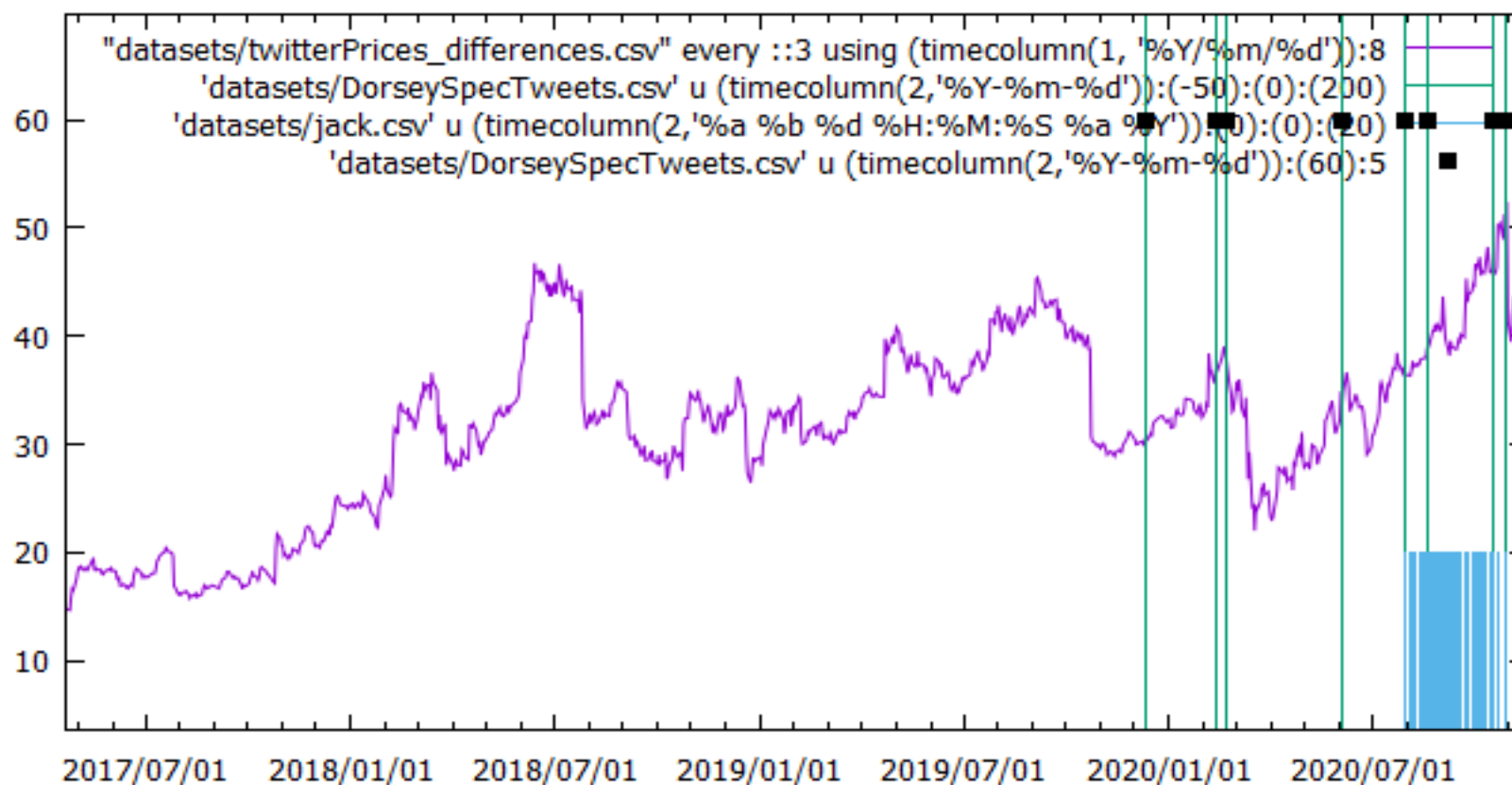
Lloyd Blankfein Tweet Analysis

❖ We see that Blankfein tweets comparatively less than the other CEOs in our analysis, though he does have a habit of tweeting about contentious political topics there doesn't appear to be much fluctuation in the stock price based on tweet subject with the exception of 2 Covid-19 related tweets, these we think may be outliers due to the generally heightened societal stigma surrounding the topic

❖ However, there were periods of significant sell off when Blankfein did not tweet at all. This could indicate that the financial world follows social media and news especially closely, and that no news is seen as bad news.
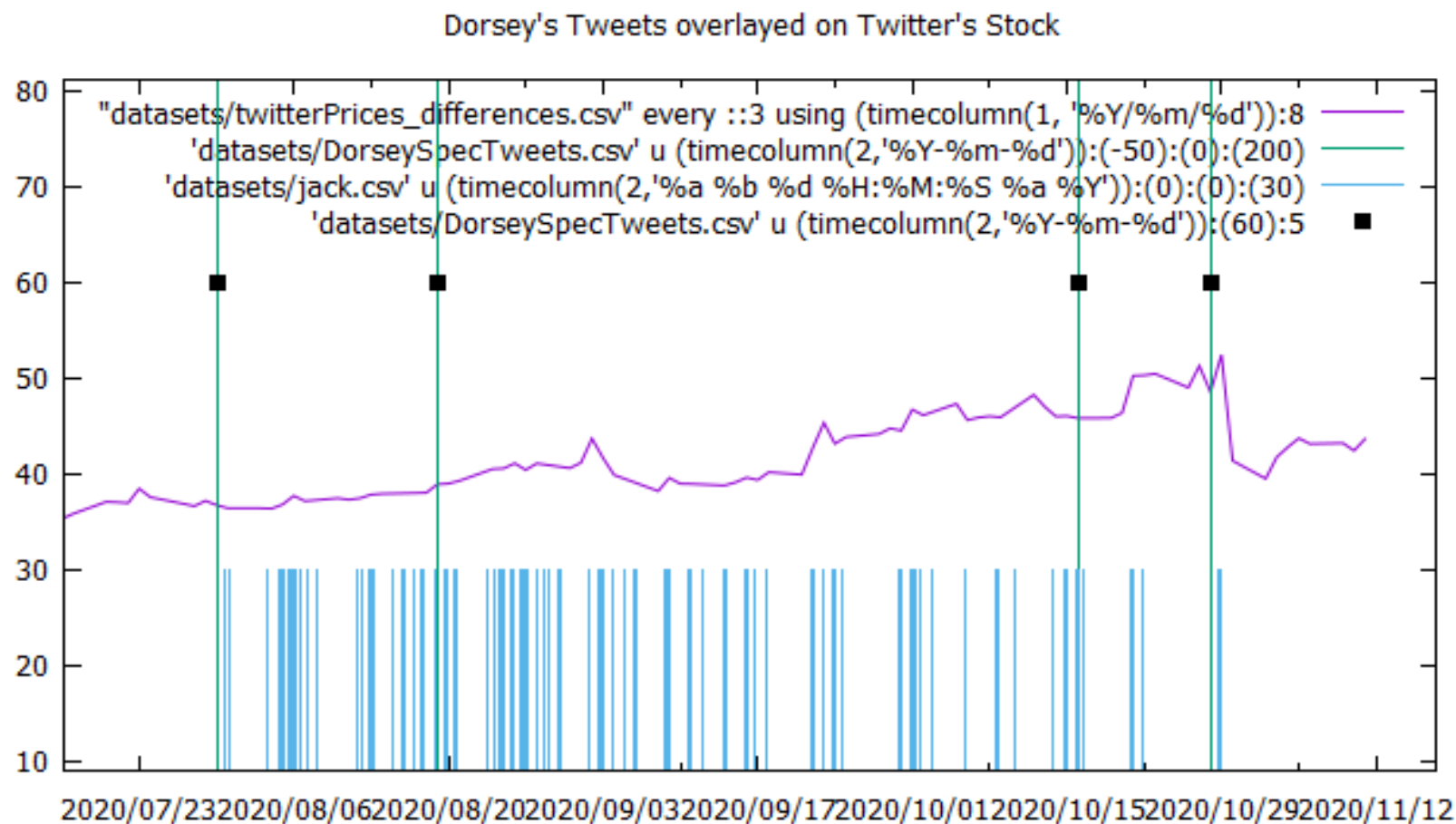
Jack Dorsey Tweets vs Nasdaq Data

Date	Text	Closing_Price	Percent_Change_Prev_Day	Percent_Change_Prev_Week	Percent_Change_Following_Day	Percent_Change_Following_Week	Fave_to_Retweet_Ratio
2020/10/16	Straight blocking...	45.81	-0.4779	-0.1308	-0.0218	-11.9188	3.3
2019/12/11	Finally, new tech...	30.55	2.3794	0.4274	0.8183	-5.1718	5.38
2020/08/19	Our new transpare...	38.89	2.3152	3.8729	-0.18	-5.6056	5.43
2020/06/03	The principles:\n...	34.88	8.1215	6.9283	3.3257	4.2431	6.76
2020/10/28	Requiring 1) mode...	48.53	-5.3443	5.9144	-8.0363	11.1477	7.19
2020/02/12	Really sad Andrew...	36.79	3.1978	11.2489	-1.0057	2.4463	7.81
2020/07/30	The power of the ...	36.72	-1.1841	-0.7836	0.8715	-1.9608	8.05
2020/02/21	I've discovered t...	38.31	-1.895	7.4614	6.3169	8.8228	13.3

Jack Dorsey Tweets vs Nasdaq Data

Dorsey's Tweets overlayed on Twitter's Stock

Jack Dorsey Tweets vs Nasdaq Data

Dorsey's Tweets overlayed on Twitter's Stock

Jack Dorsey Tweet Analysis

❖ The majority of Jack Dorsey's tweets are related to Twitter policy and technical topics relating to the company with a comparatively small segment of them discussing political issues unrelated to Twitter.

❖ There appears to be a clear trend of stock volatility when Dorsey is tweeting actively and flat stability when he is less active. This would make sense as he often tweets information that would be important to shareholders but we are limited by the number of tweets we could acquire from the API
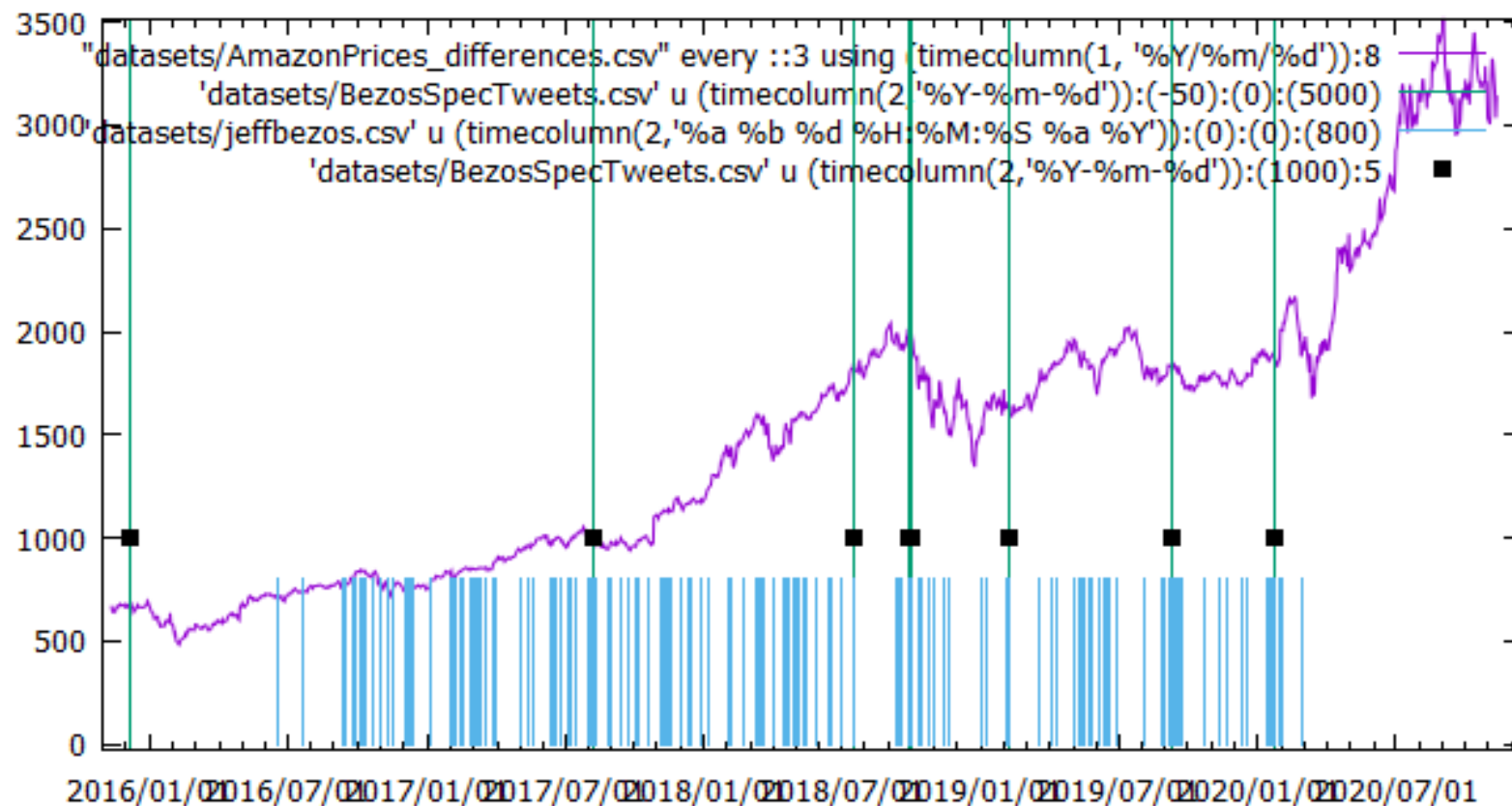
Jeff Bezos Tweets vs Nasdaq Data

File Edit Format View Help

Date	Text	Closing_Price	Percent_Change_Prev_Day	Percent_Change_Prev_Week	Percent_Change_Following_Day	Percent_Change_Following_Week	Fave_to_Retweet_Ratio
2015/12/07	Finally trashed b...	669.83	-0.4178	-0.8159	-1.1197	-0.8868	1.27
2019/02/07	I've written a po...	1614.37	-1.5784	1.2855	1.6198	-0.8183	3.54
2018/10/02	Thank you @SenSan...	1971.31	-1.6489	2.9399	0.941	12.7808	5.57
2018/09/27	Big win for @Blue...	2012.98	1.9308	3.7057	0.4958	7.3801	5.78
2020/01/22	#Jamal https:\/\/...	1887.46	-0.24	0.2283	0.1526	-6.4245	5.88
2019/09/09	We're sending two...	1831.35	-0.1178	3.8033	0.5897	0.7585	7.77
2018/07/19	Appreciate the su...	1812.97	-1.6251	4.0102	-0.0403	1.8616	8.57
2017/08/09	Couldn't happen t...	982.01	-0.791	-0.5841	2.555	2.3971	9.53

Jeff Bezos Tweets vs Nasdaq Data

Bezos' Tweets overlayed on Amazon's Stock
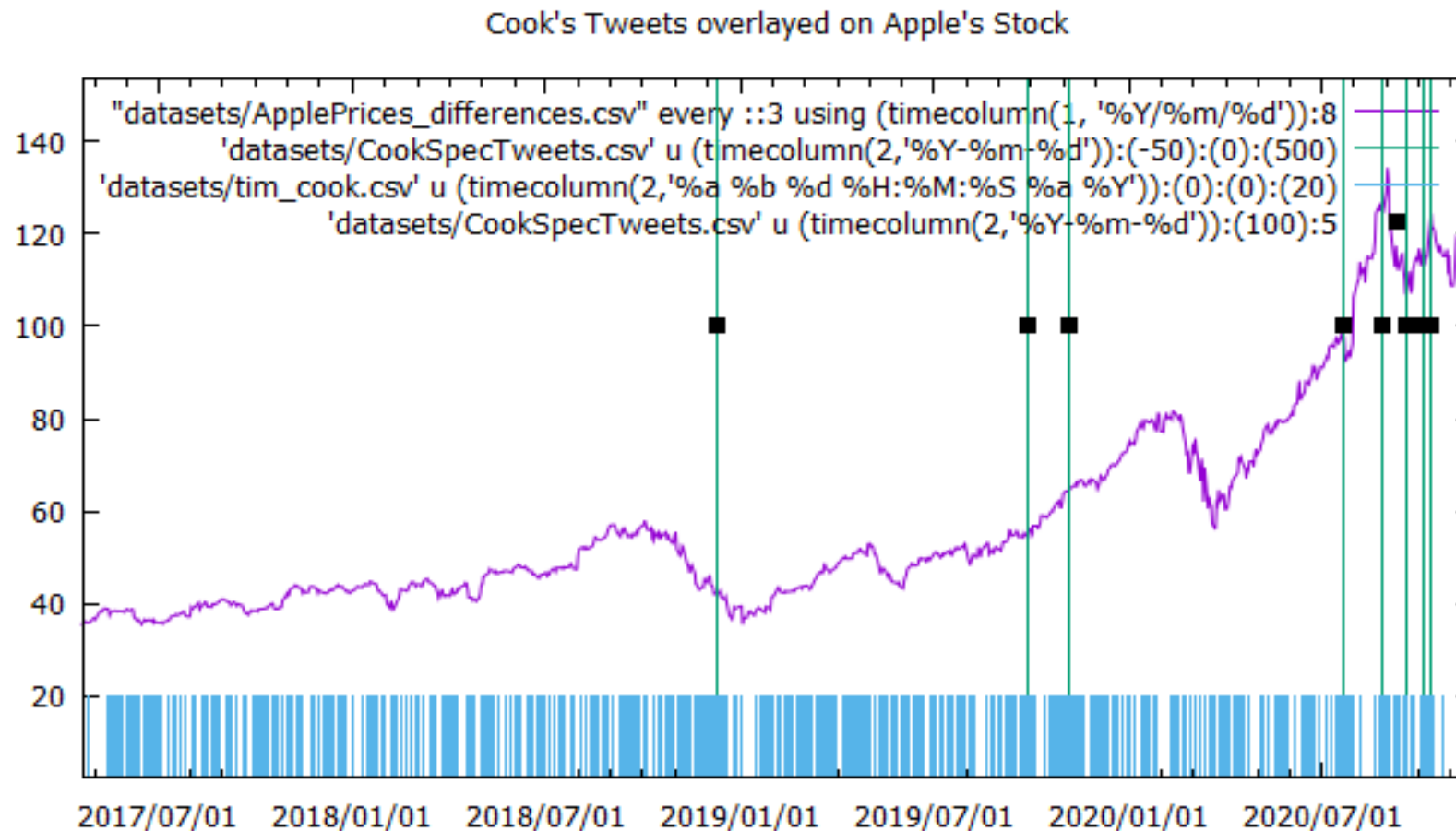
Jeff Bezos Tweet Analysis

- ❖ Jeff Bezos generally tends to be less controversial, appearing to always adopt a professional tone, and rarely comments on personal matters or current social trends. As such, we think of Bezos as more of a stable control variable.

- ❖ A future point to explore involves how the likability of the company itself relates to the stock price, since Amazon is consistently rated as one of the top customer-centric company in the US. Only Apple has this close of a customer satisfaction ratio, other than Amazon.

Tim Cook Tweets vs Nasdaq Data

Date	Text	Closing_Price	Percent_Change_Prev_Day	Percent_Change_Prev_Week	Percent_Change_Following_Day	Percent_Change_Following_Week	Fave_to_Retweet_Ratio
2018/12/10	"All human beings...	42.4	0.6588	-6.2673	0.5719	5.1356	4.77
2020/09/19	Ruth Bader Ginsbu...	null	null	null	null	null	6.17
2020/10/05	"A great soul nev...	116.5	3.0791	7.6511	2.867	-4.0258	6.31
2020/07/21	By 2030, Apple's ...	97.0	-1.3802	1.1259	-0.2809	0.8351	6.35
2019/11/06	At Apple, privacy...	64.31	0.0428	3.2885	-0.8513	-3.3121	6.89
2020/08/28	On this day in 19...	124.81	-0.162	7.8647	-3.3912	5.9992	8.72
2019/09/29	To everyone at Ap...	null	null	null	null	null	10.57
2020/10/12	The fires across ...	124.4	6.3521	6.516	2.6527	6.0531	11.76

*Tweets associated with null values for stock prices were tweeted on weekends, and thus there was no stock activity correlating to the day the tweet was made

Tim Cook Tweets vs Nasdaq Data

Cook's Tweets overlayed on Apple's Stock

Tim Cook Tweet Analysis

❖ Tim Cook has a similar professional persona to Jeff Bezos, but tweets much more frequently. Cook also has a tendency to be much more outspoken on progressive topics, such as those that relate to environmentalism and social justice.

❖ The high volume of Cook's tweets supports the hypothesis that we had with Bezos, that overall positive tweet popularity and the ratio of favorites to retweets contributes to a "high likability" which positively affects stock price.

Website and GUI

❖ Used Spark streaming to create a web interface that updates the stock prices of the 5 companies once per day one hour after market close.

❖ Displays the prices of these stocks in a nice graph view using a npm package. The graph view is flexible and resizes with the size of the browser window.

❖ Users can choose to manually display the tweets for each company, and the site provides a user-friendly GUI for navigating between each of the company pages.

Sources

- https://old.nasdaq.com/symbol/tsla/historical

- https://old.nasdaq.com/symbol/aapl/historical

- https://old.nasdaq.com/symbol/amzn/historical

- https://old.nasdaq.com/symbol/twtr/historical

- https://old.nasdaq.com/symbol/gs/historical

- https://marketdata.websol.barchart.com

- https://api.twitter.com/1.1/statuses/user_timeline.json

- https://twitter.com

Questions?