

Impact of U.S. President Trump Tweets on Financial Markets in 2019 and the prediction of the percentage change in Gold price using NLP and Machine Learning

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OBJECTIVE OF OUR STUDY



1. To study relationship between various Financial Asset classes

2. To study quantitative relationship among Financial Market and between different sentiment label (Positive, Negative and Neutral) of President Trump Tweet

3. To study the significance of different categories of Sentiment Variable on four financial markets - Equity Market, Commodity Market, Bond Market and Currency Markets

4. To estimate the range of volatility of different financial asset classes with Positive, Negative and Neutral Tweet sentiment in short-term

5. To do comparative study of President Trump tweets on the financial market prices in Hourly Basis, 2-Hourly basis or 4-Hourly basis

6. To create a Model for Predicting the price of COMEX Gold in short term using Machine Learning

7. To understand whether President Trump Tweet is noise or important determinant for Gold price movement

- **President Trump Tweet has NULL effect on the prediction of COMEX Gold price, so we can say that it is just a NOISE and other determinants should be taken into account for forecasting.**
- **Negative Tweet could be used for Tactical trading as its effect is instantaneous..**



INTRODUCTION

Using Social Media as Alternative Data

President Trump Twitter presence and its Impact on Financial Markets

Examples of Alternative Data Sources



Satellite Data - These are companies that utilize image data from orbiting satellites to do things like measure the number of cars in Walmart parking lots or farm health based on the color of crops.



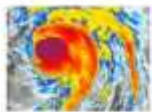
Alternative Credit - Companies developing new credit models that utilize sources of alternative data (like mobile usage).



Web/App/Social Media Data - These are companies which mine social media or use data firehoses from the web/mobile to understand what's happening in the world or how people are interacting with their devices.



Credit Card Transactions - These are companies that use anonymous aggregate transaction data to understand trends in consumer purchasing habits.



Weather Data - These are companies which are developing weather models and utilizing more sensors to get better localized data or improve weather forecasting.



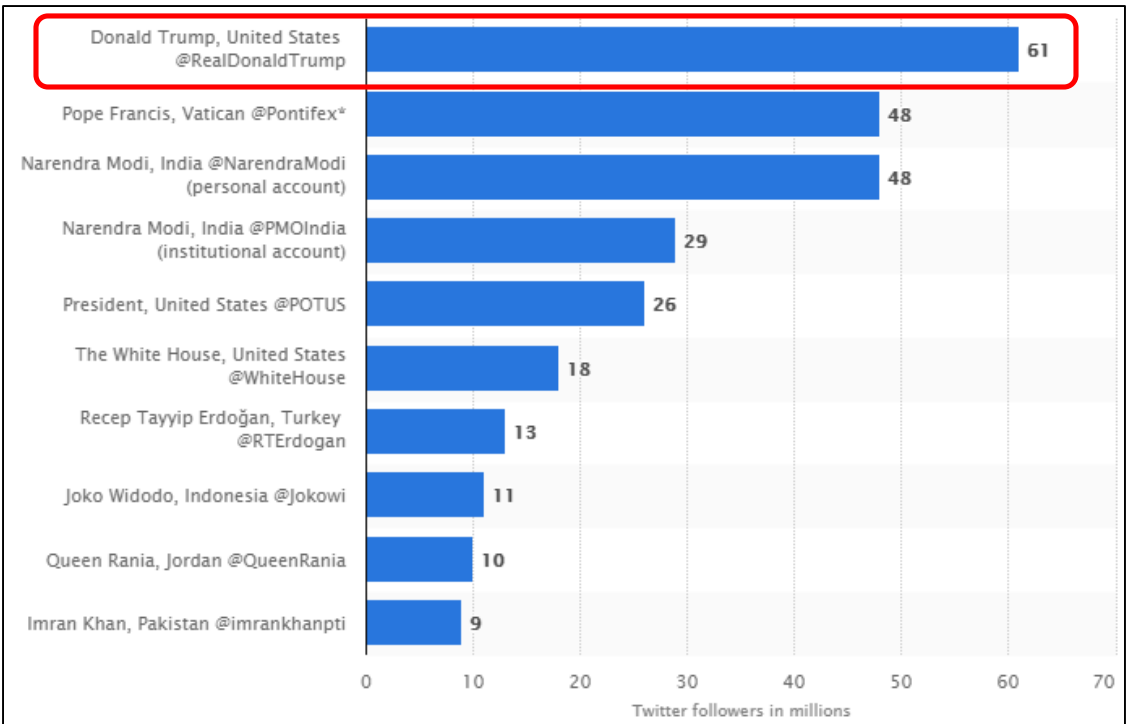
Alternative Data Monetizers/Aggregators - These are companies who pay for access to individual data streams which become more valuable in a bundle, and then sell those packages to investors.



Location/Foot Traffic Data - Companies that use different means to understand where consumers are going by measuring foot traffic via check-ins, video analysis, etc.



Local Prices - These companies can see what's happening to prices and inflation by aggregating data from ground-level sources.



PROBLEM STATEMENT

?

No such study found which observes the Impact of Twitter on Financial markets Volatility on very short-term i.e. Hourly Time Frame

?

No researcher has studied the impact of Tweets on all four Financial markets together - on the Equity Market, Foreign exchange markets, Commodity Market and Bond Market

?

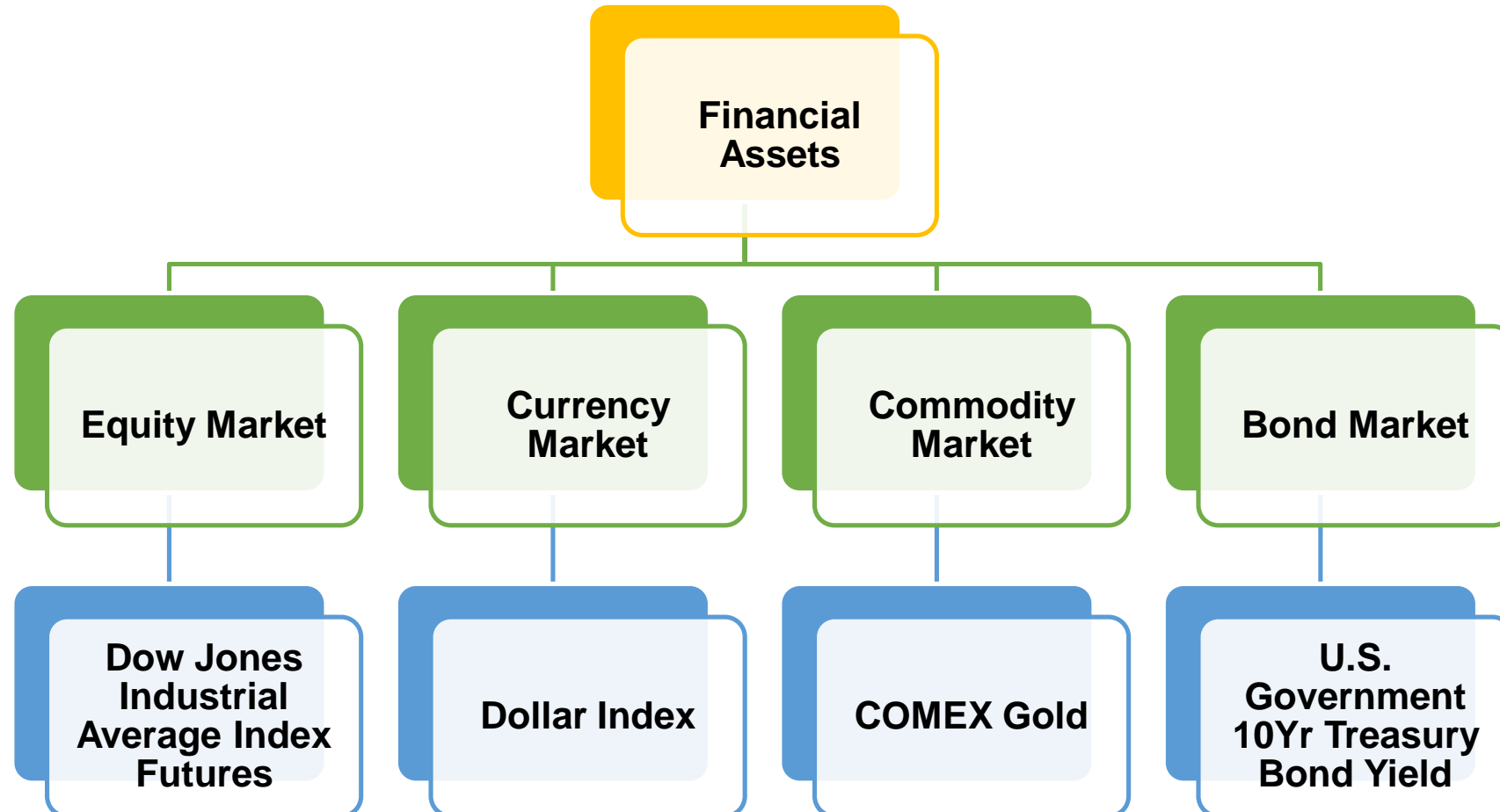
None of the previous work predicted COMEX Gold prices using President Trump Twitter Sentiment and other Financial Assets as predictor variables

?

It is not known whether President Trump Tweets are important determinant for predicting Gold prices or not?

DATA COLLECTION

- Financial Data Collection



DATA COLLECTION



- Financial Data Collection

Date	COMEX Gold	% Change	Date	Dollar Ind	% Change	Date	10 Yr Bond	% Change	Date	Dow Futur	% Change
2019-18-01 22:00	1282.5	0.05%	2019-17-04 22:00	96.989	-0.03%	2019-10-04 20:00	2.4738	0.15%	2019-23-09 20:00	26927	0.18%
2019-18-01 21:00	1281.9	-0.03%	2019-17-04 21:00	97.016	0.04%	2019-10-04 19:00	2.4702	-1.22%	2019-23-09 19:00	26878	0.24%
2019-18-01 20:00	1282.3	0.02%	2019-17-04 20:00	96.979	-0.01%	2019-10-04 02:00	2.5006	-0.07%	2019-23-09 18:00	26814	-0.15%
2019-18-01 19:00	1282	-0.74%	2019-17-04 19:00	96.992	-0.07%	2019-10-04 01:00	2.5024	0.00%	2019-23-09 17:00	26853	-0.11%
2019-18-01 02:00	1291.6	0.03%	2019-17-04 02:00	97.059	-0.02%	2019-10-04 00:00	2.5024	0.28%	2019-23-09 16:00	26883	0.03%
2019-18-01 01:00	1291.2	-0.08%	2019-17-04 01:00	97.081	0.03%	2019-09-04 23:00	2.4953	-0.07%	2019-23-09 15:00	26874	0.10%
2019-18-01 00:00	1292.2	-0.02%	2019-17-04 00:00	97.052	0.00%	2019-09-04 22:00	2.4971	0.07%	2019-23-09 14:00	26847	-0.03%
2019-17-01 23:00	1292.4	0.10%	2019-16-04 23:00	97.054	0.01%	2019-09-04 21:00	2.4953	0.07%	2019-23-09 13:00	26856	-0.39%
2019-17-01 22:00	1291.1	-0.01%	2019-16-04 22:00	97.044	0.00%	2019-09-04 20:00	2.4935	-0.07%	2019-23-09 12:00	26960	-0.13%
2019-17-01 21:00	1291.2	0.07%	2019-16-04 21:00	97.042	0.02%	2019-09-04 19:00	2.4953	-1.07%	2019-23-09 11:00	26995	0.02%
2019-17-01 20:00	1290.3	-0.02%	2019-16-04 20:00	97.026	0.07%	2019-09-04 02:00	2.5222	0.14%	2019-23-09 10:00	26990	0.01%
2019-17-01 19:00	1290.5	-0.22%	2019-16-04 19:00	96.957	0.02%	2019-09-04 01:00	2.5186	0.00%	2019-23-09 09:00	26986	-0.02%
2019-17-01 02:00	1293.3	0.03%	2019-16-04 02:00	96.936	0.00%	2019-09-04 00:00	2.5186	0.14%	2019-23-09 08:00	26991	-0.03%
2019-17-01 01:00	1292.9	0.05%	2019-16-04 01:00	96.939	-0.01%	2019-08-04 23:00	2.515	0.00%	2019-23-09 07:00	26999	-0.10%
2019-17-01 00:00	1292.3	-0.11%	2019-16-04 00:00	96.946	0.00%	2019-08-04 22:00	2.515	0.00%	2019-23-09 06:00	27027	0.04%
2019-16-01 23:00	1293.7	-0.08%	2019-15-04 23:00	96.942	0.01%	2019-08-04 21:00	2.515	0.22%	2019-23-09 05:00	27016	0.02%

DATA COLLECTION



- **Tweet Collection**

- **Population** – 7080 Tweets fetched from **@realDonaldTrump** through Twitter API
- **Sample** - 500 Tweets using **Keywords** – [*"economy", "bond price", "DOW", "S&P", "dollar", "growth", "GDP", "employment", "trade", "job", "tariff", "currency", "America", "bond yields", "unemployment", "war", "commodity", "FED"*]

source	text	created_at
Twitter for iPhone	Amazon Calls 'Profiles in Corruption' the 'Most Anticipated' Nonfiction Book https://t.co/sOQcs3OHS4 via @Bre	01-16-2020 15:59:19
Twitter for iPhone	This is a total disgrace, but just another reason that I'm going to win Michigan again! https://t.co/XrqveOvYcG	01-16-2020 15:49:37
Twitter for iPhone	Looking at this strongly! https://t.co/Giw8UknN3m	01-16-2020 15:23:26
Twitter for iPhone	The farmers are really happy with the new China Trade Deal and the soon to be signed deal with Mexico and Ca	01-16-2020 15:14:29
Twitter for iPhone	"There is no crime here. I just think this whole thing should be rejected out of hand. I wouldn't waste a minute	01-16-2020 15:04:51
Twitter for iPhone	Cryin' Chuck Schumer is saying privately that the new China Trade Deal is unbelievable, which it is, but publicl	01-16-2020 13:59:15
Twitter for iPhone	One of the greatest trade deals ever made! Also good for China and our long term relationship. 250 Billion Doll	01-16-2020 13:41:21
Twitter for iPhone	https://t.co/RcUcLBI9tT https://t.co/1OIXKTv0hp	01-16-2020 00:51:39
Twitter for iPhone	Here we go again, another Con Job by the Do Nothing Democrats. All of this work was supposed to be done by	01-15-2020 15:33:21
Twitter for iPhone	I agree with him on this, 100%. But why would anyone vote Democrat? We are setting all time records with the	01-15-2020 06:13:50
Twitter for iPhone	Now up to 187 Federal Judges, and two great new Supreme Court Justices. We are in major record territory. Ho	01-15-2020 05:45:31
Twitter for iPhone	Steyer is running low on cash. Nobody knows him. Made his money on coal. So funny! https://t.co/vS48ta5IFr	01-15-2020 04:46:25
Twitter for iPhone	Prime Minister of the United Kingdom, @BorisJohnson, stated, "We should replace the Iran deal with the Trum	01-15-2020 04:32:01
Twitter for iPhone	Former National Security Adviser for President Obama said "President Trump was absolutely correct" in taking	01-15-2020 03:18:03
Twitter for iPhone	Republicans are fighting for citizens from every background, & from every race, religion, color & cree	01-15-2020 02:53:55
Twitter for iPhone	Democrats are now the party of high taxes, high crime, open borders, late-term abortion, socialism, and blatan	01-15-2020 02:49:47
Twitter for iPhone	GOD BLESS THE U.S.A.! https://t.co/xi2yTS5fy1	01-15-2020 02:43:27
Twitter for iPhone	Thank you Milwaukee, Wisconsin! #KAG2020 #MAGA https://t.co/Oj2pOxsYIA	01-15-2020 02:36:27
Twitter for iPhone	Cryin' Chuck Schumer just said, "The American people want a fair trial in the Senate." True, but why didn't Nen	01-14-2020 23:45:49

SENTIMENT ANALYSIS

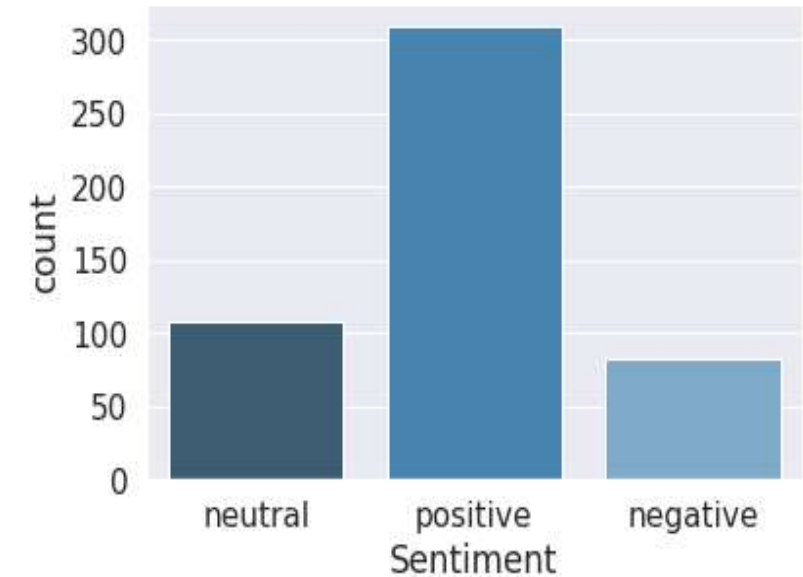


- Lexicon based Sentiment Analysis Method – Loughran McDonald financial sentiment dictionary - NLTK package

Sample Tweet Sentiment Analysis

Clean_Tweets	created_at	Sentiment
rt the last time the unemployment rate was this low we were about to land for t	2019-04-05 17:00:12	neutral
rt with president trump leading us america is a better and safer place	2019-04-05 13:54:28	positive
i am continuing to monitor the censorship of american citizens on social media p	2019-03-05 22:55:02	neutral
we discussed trade venezuela ukraine north korea nuclear arms control and ever	2019-03-05 17:06:31	neutral
we can all agree that america is now we are the envy of the world and the best is	2019-03-05 16:22:14	positive
the u s created jobs in april unemployment fell to lowest level since	2019-03-05 15:18:50	neutral
jobs jobs jobs jobs surge in april unemployment rate falls to the lowest since	2019-03-05 13:35:49	neutral
rt president is fixing american trade to bring our steel and manufacturing jobs ba	2019-03-05 12:12:25	neutral
rt trump job approval jumps to seven points higher than obama	2019-10-04 02:00:46	neutral
make america great again	2019-09-04 20:43:35	positive
rt our economy is on fire jobs are up unemployment is at record lows and wages	2019-09-04 04:51:09	negative
the lowest average jobs number for any president since economy doing great if t	2019-06-04 13:24:51	positive
rt americans will write our own economic destiny never believe the pessimists p	2019-05-04 23:05:14	positive
the press is doing everything within their power to fight the magnificence of the	2019-05-04 17:41:29	positive
america created jobs in march beating expectations for	2019-05-04 16:58:29	neutral
despite the unnecessary and destructive actions taken by the fed the economy is	2019-04-04 12:01:15	neutral
the crazed and incompetent mayor of san juan have done such a poor job of bring	2019-02-04 03:38:29	negative
democrats should stop fighting sen david perdue s disaster relief bill they are blc	2019-01-04 16:47:16	neutral
there s not one shred of evidence that president trump has done anything wrong	2019-10-03 23:42:31	negative

Sample Tweet Classification



SENTIMENT ANALYSIS

Positive Word cloud



Negative Word Cloud



***Most frequently occurring bigrams connected by same color and font size*

DATA MAPPING



- Three Different datasets were created: **Hourly % Change, 2-Hourly % Change and 4-Hourly % Change**, by mapping Date and Time of tweets to Date and Time of Financial Data using **pandas** and **numpy** library in python

Hourly Mapped Data

Time	Tweet	Hr +1	Sentiment	Gold	Dollar	Dow	Bond
01-15-2019 13:04:16	RT @charliekirk11: GREAT AGAIN:Prior to 2018, unemployment has only b	14	neutral	0.14	0.19	0.06	-0.73
01-18-2019 01:18:07	RT @realDonaldTrump: For decades, politicians promised to secure the b	2	neutral	0.03	-0.03	0.14	-0.13
01-18-2019 15:59:35	MAKE AMERICA GREAT AGAIN!	16	positive	-0.74	0.08	0.58	0.77
01-18-2019 16:00:07	AMERICA FIRST!	17	positive	-0.74	0.08	0.58	0.77
01-19-2019 12:51:30	The Economy is one of the best in our history, with unemployment at a 50	13	negative	-0.1	0.05	-0.66	-0.06
01-20-2019 12:40:04	Always heard that as President, its all about the economy! Well, we have	13	positive	-0.1	0.05	-0.66	-0.06
01-21-2019 15:22:36	Last year was the best year for American Manufacturing job growth since	16	positive	-0.1	0.05	-0.66	-0.06
01-21-2019 21:57:59	China posts slowest economic numbers since 1990 due to U.S. trade tensi	22	positive	-0.01	0	-0.66	0
01-21-2019 23:45:02	Democrats are kidding themselves (they dont really believe it!) if they sa	24	negative	0.16	-0.01	-0.66	0
01-24-2019 11:56:31	The economy is doing great. More people working in U.S.A. today than at	12	positive	-0.1	0.08	-0.09	-1.18
01-30-2019 04:00:56	Our economy, right now, is the Gold Standard throughout the World. @In	5	neutral	-0.04	0.15	-0.17	0.52
01-30-2019 21:54:12	Dow just broke 25,000. Tremendous news!	22	positive	0.01	0.01	0.14	0.2
01-31-2019 12:41:56	Chinas top trade negotiators are in the U.S. meeting with our representat	13	positive	0.41	-0.12	0.11	-1.26
03-18-2019 11:45:19are all coming back to the U.S. So is everyone else. We now have the b	12	positive	0.18	-0.03	-0.09	0.35
03-18-2019 16:00:58	GDP growth during the four quarters of 2018 was the fastest since 2005. T	17	neutral	0.18	-0.03	-0.07	0.35
03-19-2019 13:31:02	You cant dispel this mood of positive energy. @Varneyco The Economy is	14	positive	0.37	-0.11	0.2	0.62
03-19-2019 21:28:55	Amazingly, CNN just released a poll at 71%, saying that the economy is in	22	positive	-0.05	-0.01	-0.26	-0.07
03-22-2019 02:39:49	RT @GOPChairwoman: You can't deny our economy is roaring: *fastest GD	3	negative	0.29	0.39	0.04	-3.51
03-22-2019 10:52:12	3.1 GDP FOR THE YEAR, BEST NUMBER IN 14 YEARS!	11	positive	0.29	0.39	-0.1	-3.51

OBJECTIVE OF THE STUDY

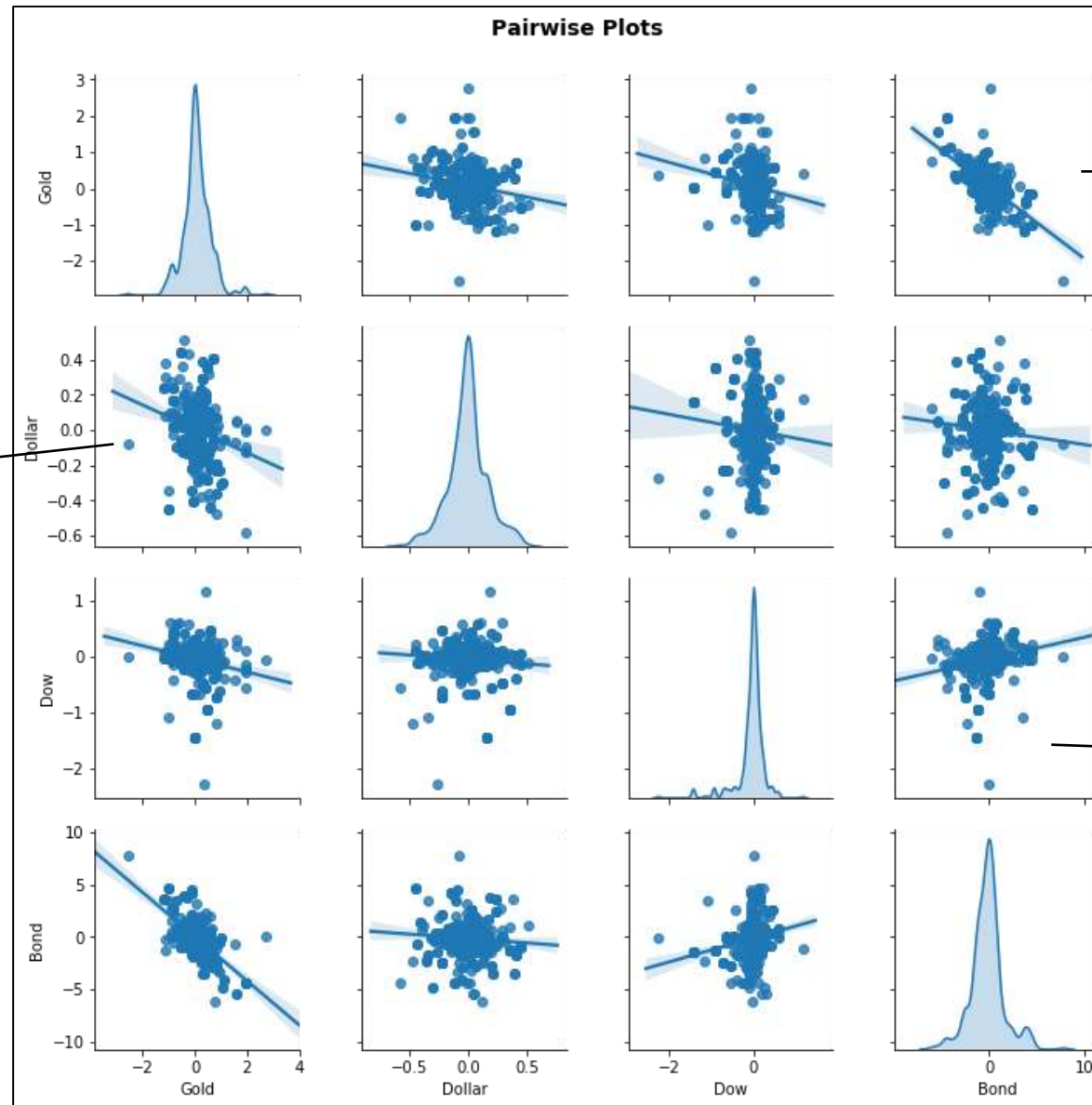


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OBJ -1: TO STUDY RELATIONSHIP BETWEEN VARIOUS FINANCIAL ASSET CLASSES

**NEGATIVE LINEAR
RELATIONSHIP**



**NEGATIVE LINEAR
RELATIONSHIP**

**POSITIVE LINEAR
RELATIONSHIP**

OBJ -1: TO STUDY RELATIONSHIP BETWEEN VARIOUS FINANCIAL ASSET CLASSES



Findings:

- COMEX Gold has negative relationship with U.S. Govt. 10Yr Treasury Bond Yield, DOW Future and Dollar Index
- U.S. Govt. 10Yr Treasury Bond Yield, DOW Future and Dollar Index have positive relationship with each other.
- Main highlight was that COMEX Gold has highly negative linear relation with U.S. Govt. 10Yr Treasury Bond Yield as it can be inferred from negative Regression Slope line.

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OBJ -2: TO STUDY QUANTITATIVE RELATIONSHIP AMONG FINANCIAL MARKET AND BETWEEN DIFFERENT SENTIMENT LABEL (POSITIVE, NEGATIVE, NEUTRAL) OF PRESIDENT TRUMP TWEET



Hourly %Change in price Correlation Heat Map



4-Hourly %Change in price Correlation Heat Map



OBJ -2: TO STUDY QUANTITATIVE RELATIONSHIP AMONG FINANCIAL MARKET AND BETWEEN DIFFERENT SENTIMENT LABEL (POSITIVE, NEGATIVE, NEUTRAL) OF PRESIDENT TRUMP TWEET



Findings:

- COMEX Gold is negatively correlated with the Positive sentiment and other financial asset classes are positively correlated with positive sentiment.
- With negative sentiment, Gold is positively correlated and other financial asset classes are negatively correlated.
- It was also observed that Gold is highly negatively correlated with U.S. Govt. 10Yr Treasury Bond Yields having Correlation Coefficient of **-0.65** on Hourly basis and **-0.66** on 4-Hourly Basis.

OBJECTIVE OF THE STUDY



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OBJ -3: TO STUDY THE SIGNIFICANCE OF DIFFERENT CATEGORIES OF SENTIMENT VARIABLE ON FOUR FINANCIAL MARKETS - EQUITY MARKET, COMMODITY MARKET, BOND MARKET AND CURRENCY MARKETS



Hypothesis Testing

Hypothesis -1

- **Null Hypothesis (H_0 1):** There is same impact of different categories of Sentiment Variable on COMEX Gold prices on Hourly, 2-Hourly and 4-Hourly basis.
- **Alternate Hypothesis (H_a 1):** There is different impact of different categories of Sentiment Variable on COMEX Gold prices on Hourly, 2-Hourly and 4-Hourly basis.

Similarly, Hypothesis -2 for U.S. Govt. 10Yr Treasury Bond Yield, Hypothesis-3 for DOW Future and Hypothesis -4 for Dollar Index

```
import statsmodels.api as sm
from statsmodels.formula.api import ols
mod = ols('Gold~ positive+negative+neutral',
          data=df_new).fit()
model= sm.stats.anova_lm(mod, typ=2)
print(model)
##similarly we did for all financial asset classes
```

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Results of ANOVA on Hourly %Change in Financial Asset Classes

<i>COMEX Gold</i>					<i>U.S. Govt. 10Yr Treasury Bond Yield</i>				
	sum_sq	df	F	PR(>F)		sum_sq	df	F	PR(>F)
positive	0.1689	1.0000	0.6264	0.4290	positive	0.6856	1.0000	0.2408	0.6239
negative	1.0996	1.0000	4.0776	0.0440	negative	18.5864	1.0000	6.5275	0.0109
neutral	0.0483	1.0000	0.1791	0.6724	neutral	4.9577	1.0000	1.7411	0.1876
Residual	134.0270	497.0000	nan	nan	Residual	1,415.1494	497.0000	nan	nan

<i>DOW Futures</i>					<i>Dollar Index</i>				
	sum_sq	df	F	PR(>F)		sum_sq	df	F	PR(>F)
positive	0.0359	1.0000	0.3637	0.5467	positive	0.0070	1.0000	0.2480	0.6187
negative	0.1069	1.0000	1.0834	0.2984	negative	0.0012	1.0000	0.0441	0.8338
neutral	0.0028	1.0000	0.8392	0.3601	neutral	0.0017	1.0000	0.0617	0.8039
Residual	49.0227	497.0000	nan	nan	Residual	13.9441	497.0000	nan	nan

Results of ANOVA on 4-Hourly %Change in Financial Asset Classes

<i>COMEX Gold</i>					<i>U.S. Govt. 10Yr Treasury Bond Yield</i>				
	sum_sq	df	F	PR(>F)		sum_sq	df	F	PR(>F)
positive	0.1455	1.0000	0.5295	0.4672	positive	1.5385	1.0000	0.5845	0.4449
negative	0.9673	1.0000	3.5198	0.0612	negative	14.3792	1.0000	5.4627	0.0198
neutral	0.0044	1.0000	0.0161	0.8991	neutral	3.0577	1.0000	1.1616	0.2817
Residual	136.5891	497.0000	nan	nan	Residual	1,308.2330	497.0000	nan	nan

<i>DOW Futures</i>					<i>Dollar Index</i>				
	sum_sq	df	F	PR(>F)		sum_sq	df	F	PR(>F)
positive	0.0094	1.0000	0.0978	0.7547	positive	0.0295	1.0000	0.8846	0.3474
negative	0.0423	1.0000	0.4392	0.5078	negative	0.0026	1.0000	0.0772	0.7813
neutral	0.0356	1.0000	0.3699	0.5433	neutral	0.0143	1.0000	0.4275	0.5135
Residual	47.8626	497.0000	nan	nan	Residual	16.5793	497.0000	nan	nan

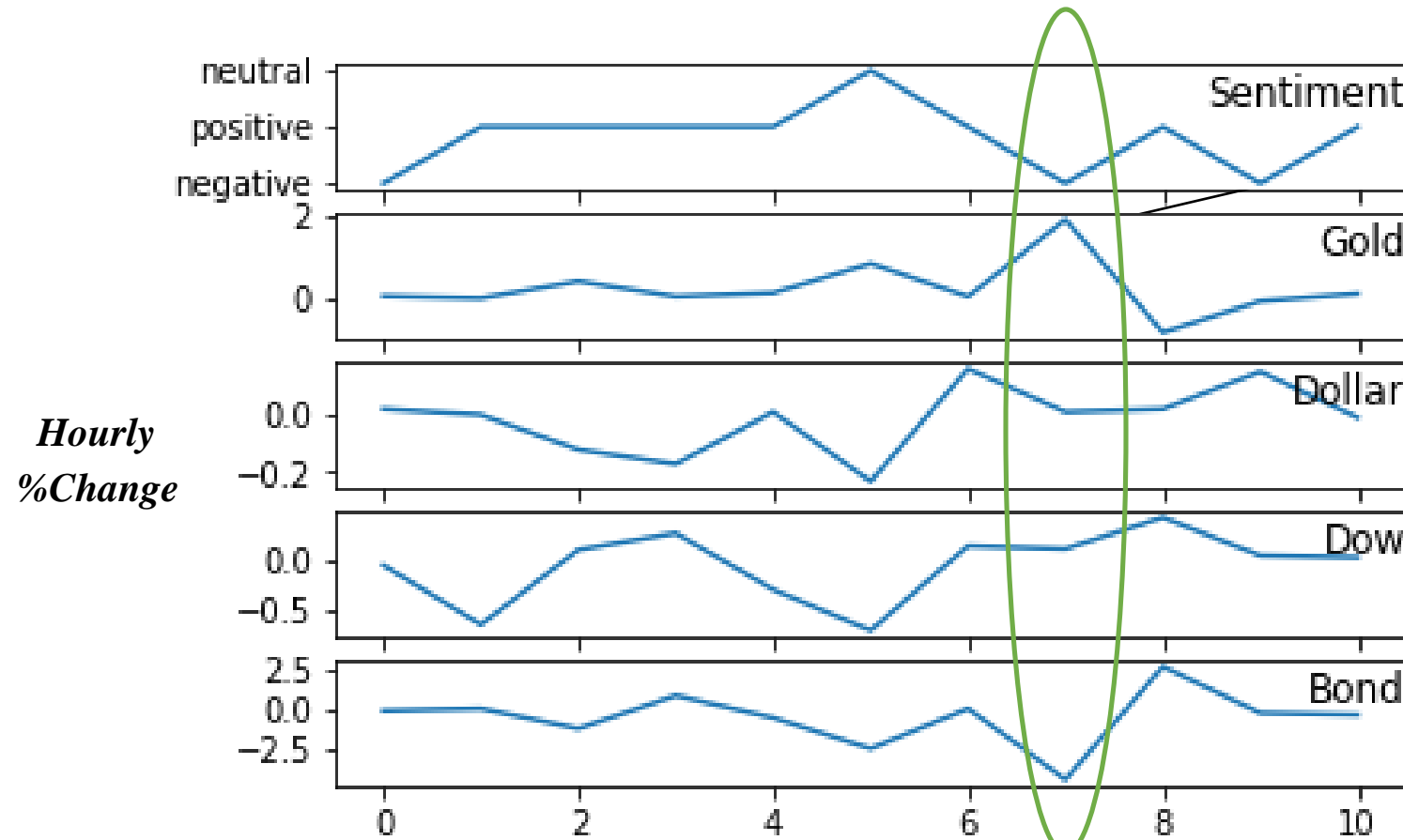
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Findings:

- In Hourly ANNOVA Analysis, COMEX Gold price and U.S. Govt. 10Yr Treasury Bond Yield are significantly impacted by Negative Tweets ($p < 0.05$), so we reject our Null Hypothesis H_01 and H_02 .
- In 2-Hourly ANNOVA Analysis, same trend was observed as of Hourly Analysis.
- In 4-Hourly ANNOVA Analysis, only U.S. Govt. 10Yr Treasury Bond Yield is significantly impacted by Negative Tweets in short-term, where ($p < 0.05$), therefore we reject the Null Hypothesis H_02

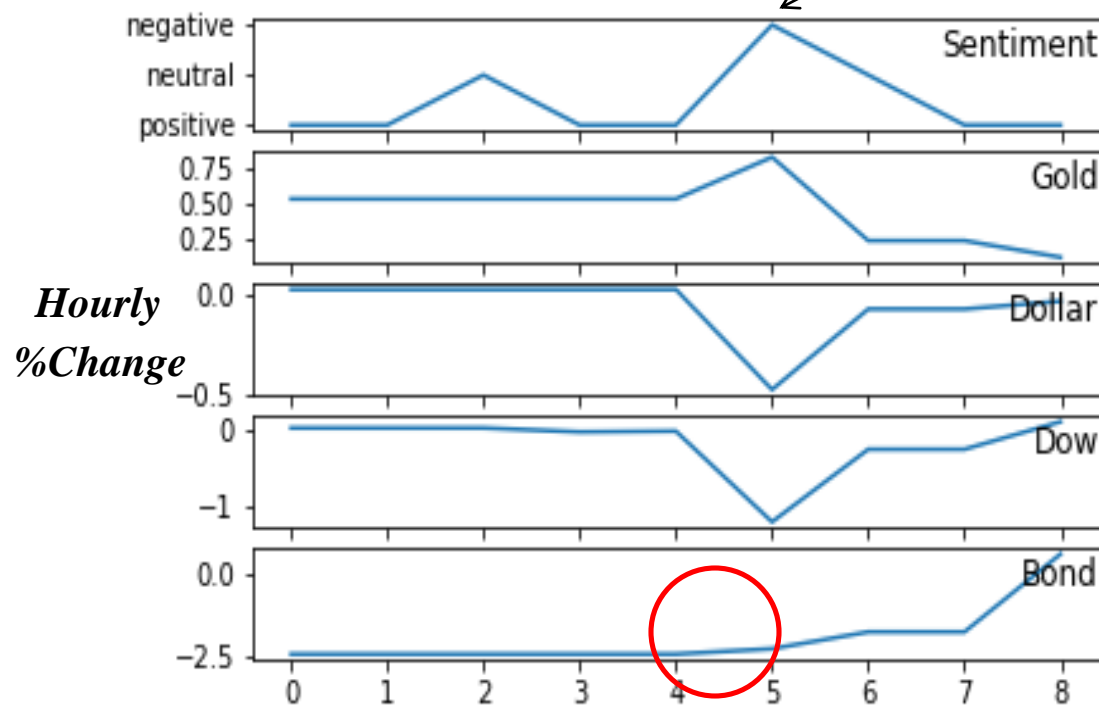
CASE 1: TWEETS WITH “CHINA” AND “TRADE” KEYWORDS



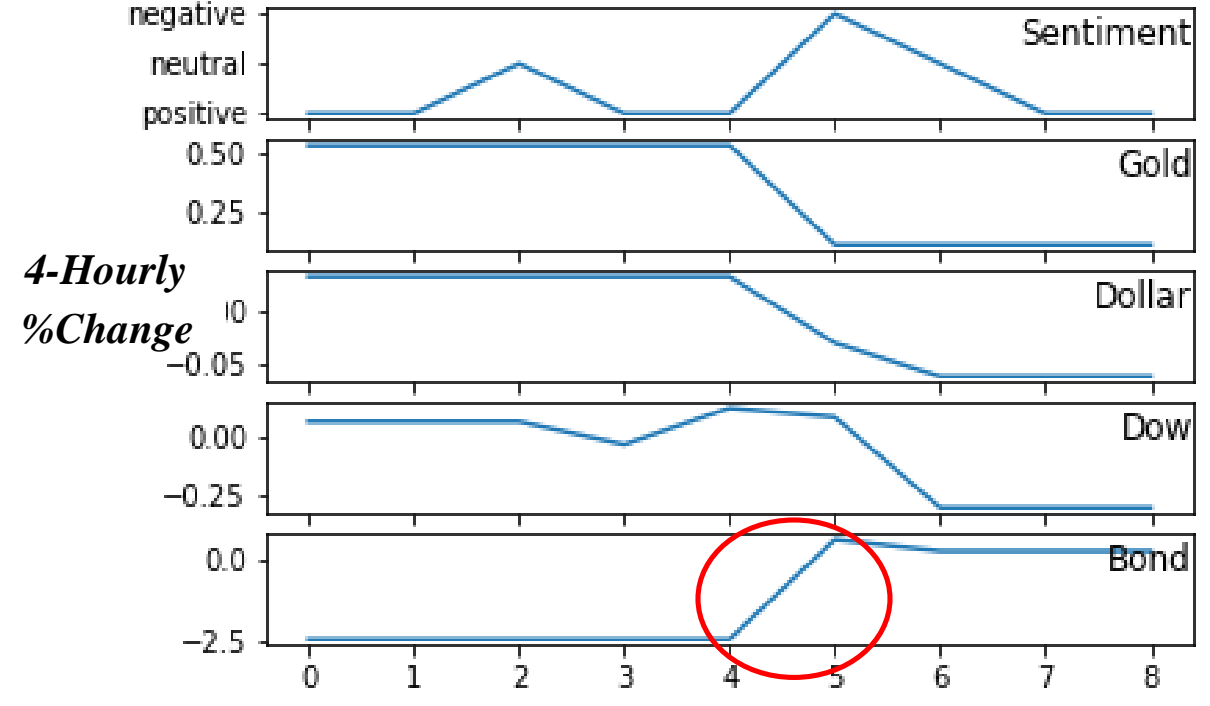
China is intent on continuing to receive the hundreds of Billions of Dollars they have been taking from the U.S. with unfair trade practices and currency manipulation. So one-sided, it should have been stopped many years ago!!

CASE 2: DAY WITH MAXIMUM TWEETS

The Dow is down 573 points perhaps on the news that Representative Seth Moulton, whoever that may be, has dropped out of the 2020 Presidential Race



Day with max tweets, 28th Aug



Day with max tweets, 28th Aug

OBJECTIVE OF THE STUDY

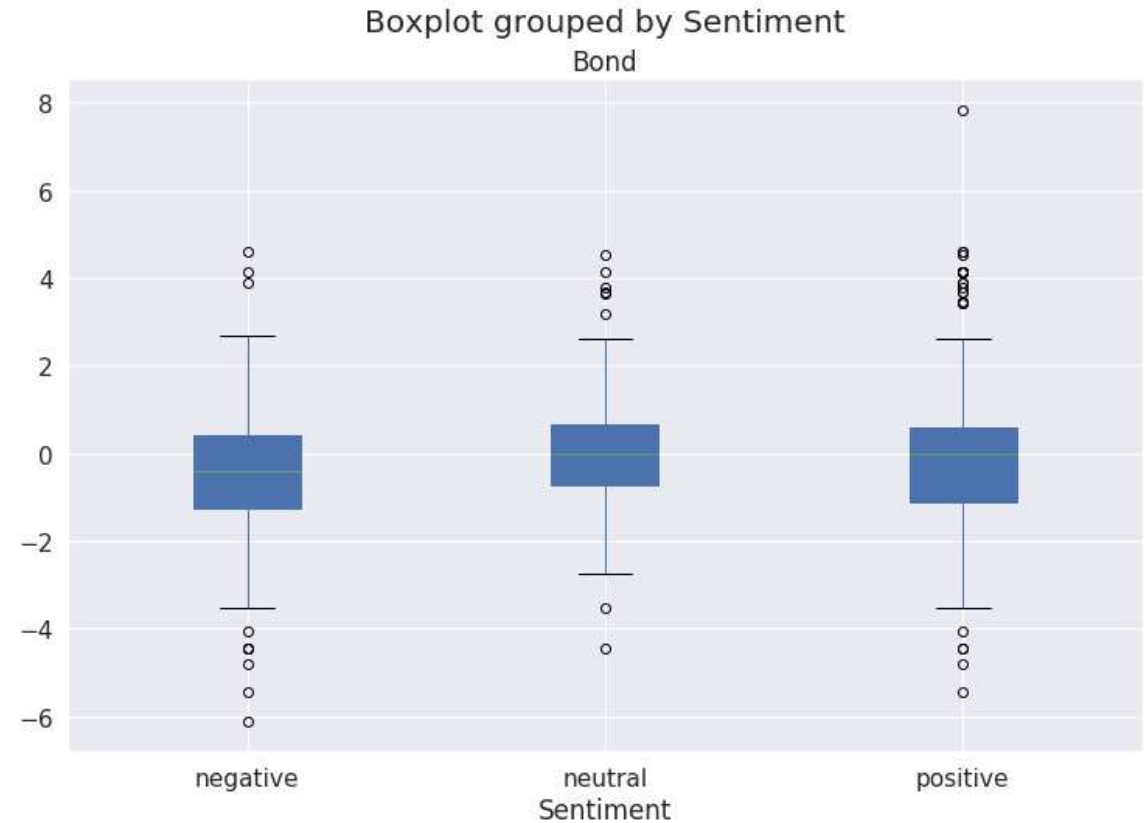
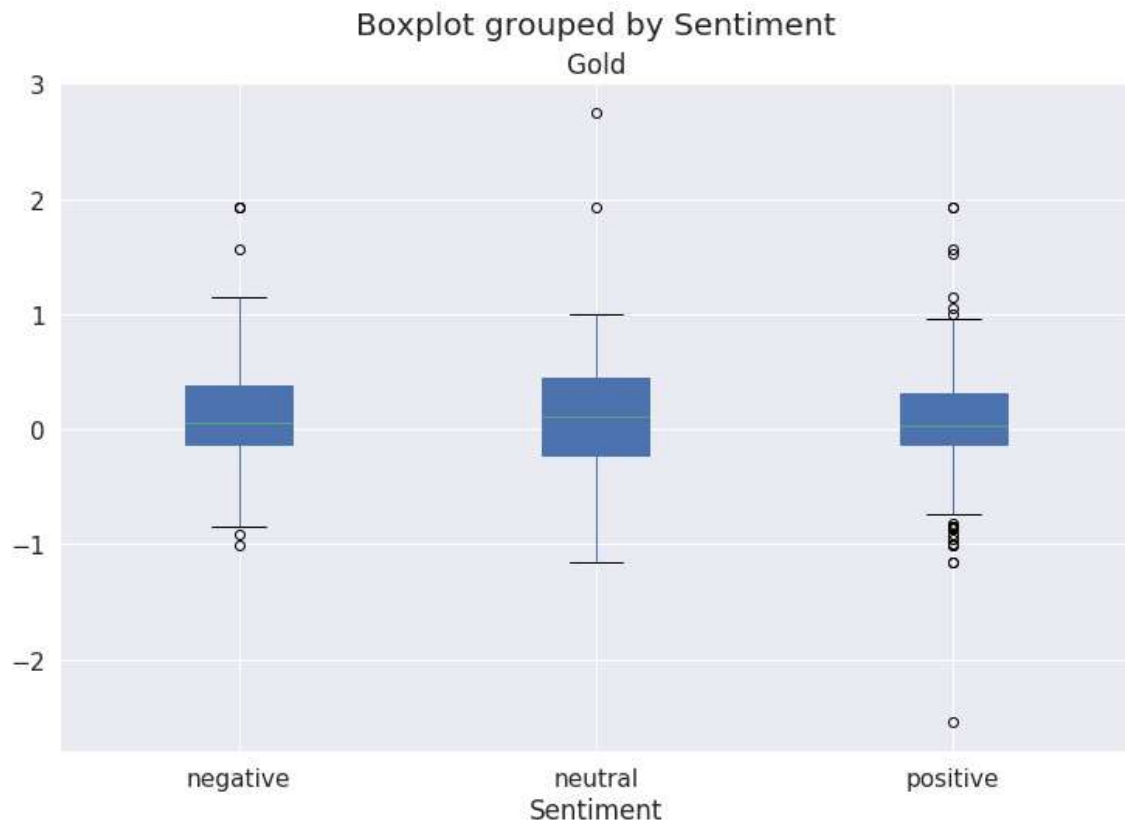


1. To study relationship between various Financial Asset classes
2. To study quantitative relationship among Financial Market and between different sentiment label (Positive, Negative and Neutral) of President Trump Tweet
3. To study the significance of different categories of Sentiment Variable on four financial markets - Equity Market, Commodity Market, Bond Market and Currency Markets
- 4. To estimate the range of volatility of different financial asset classes with Positive, Negative and Neutral Tweet sentiment in short-term.**
5. To do comparative study of President Trump tweets on the financial market prices in Hourly Basis, 2-Hourly basis or 4-Hourly basis
6. To create a Model for Predicting the price of COMEX Gold using Machine Learning in short-term.
7. To understand whether President Trump Tweet is noise or important determinant for Gold price movement

OBJ -4: TO ESTIMATE THE RANGE OF VOLATILITY OF DIFFERENT FINANCIAL ASSET CLASSES WITH POSITIVE, NEGATIVE AND NEUTRAL TWEET SENTIMENT IN SHORT-TERM



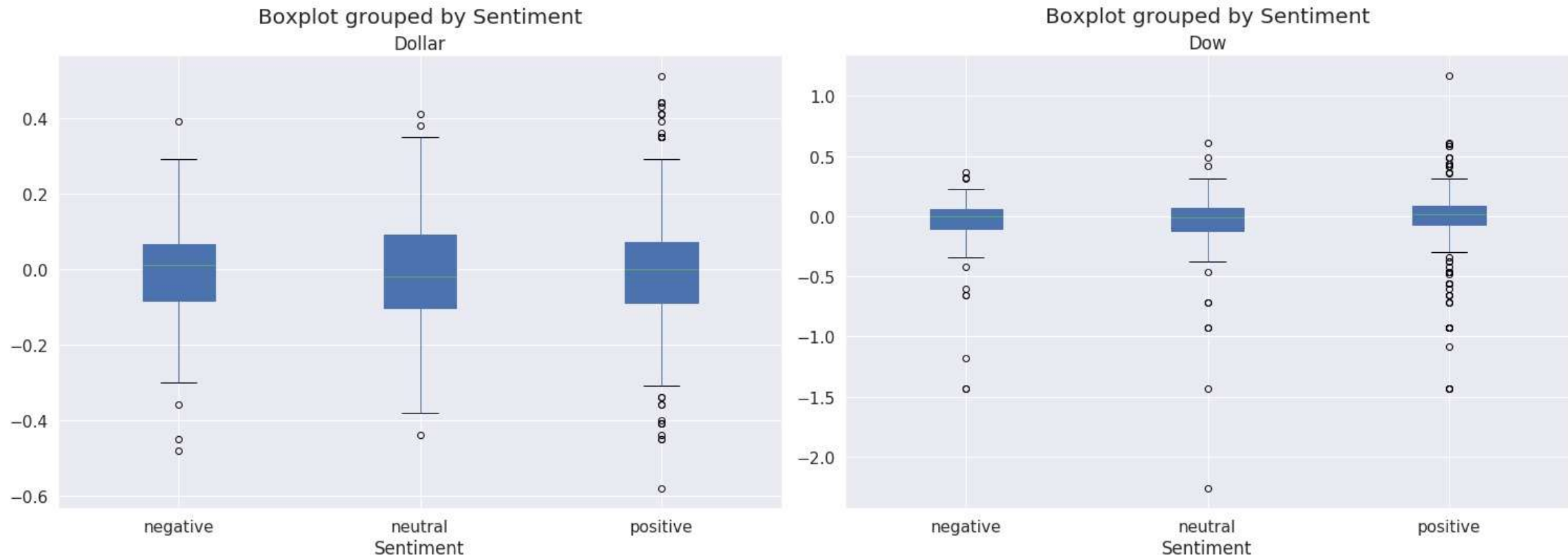
Categorical distribution plots – Box plot – COMEX Gold and U.S. 10Yr Bond Yield



OBJ -4: TO ESTIMATE THE RANGE OF VOLATILITY OF DIFFERENT FINANCIAL ASSET CLASSES WITH POSITIVE, NEGATIVE AND NEUTRAL TWEET SENTIMENT IN SHORT-TERM



Categorical distribution plots – Box plot – Dollar Index and DOW Future



OBJ -4: TO ESTIMATE THE RANGE OF VOLATILITY OF DIFFERENT FINANCIAL ASSET CLASSES WITH POSITIVE, NEGATIVE AND NEUTRAL TWEET SENTIMENT IN SHORT-TERM



Findings:

- In COMEX Gold, 25percentile to 75percentile of %change lies between -0.2% to 0.4%, while the range maximum and minimum values are -0.8% to 1.2% on hourly basis.
- If we consider it in price terms, average COMEX Gold price was around \$1400/oz in 2019, so with negative sentiment tweet, COMEX Gold moved in the range of -\$12.2 to \$16.8 on hourly basis during 2019. While median is 0.1% for negative tweets, which means Gold moves average \$1.4 with the release of Negative tweet
- U.S. Treasury 10Yr Bond yield has highest volatility. 25percentile to 75percentile of %change of negative tweet lies between -1.2% to 0.5%, while the range maximum and minimum values are -3.8% to 2.5% on hourly basis.

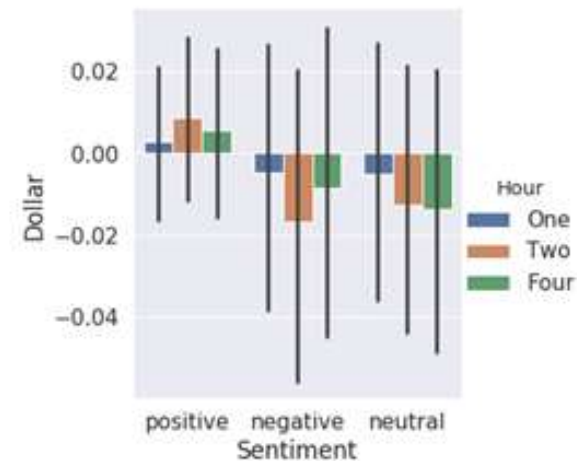
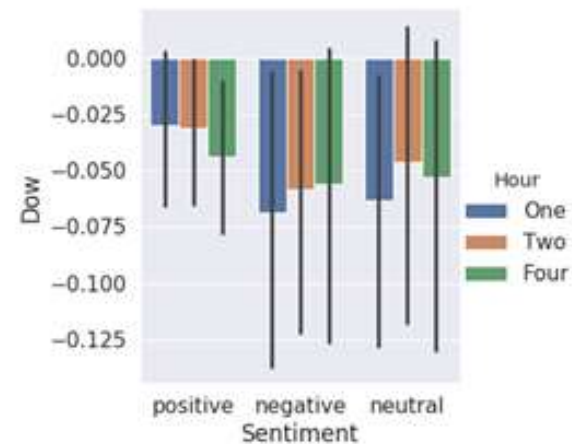
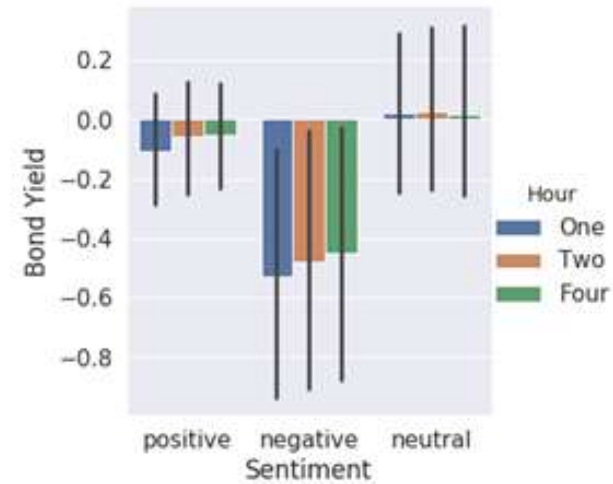
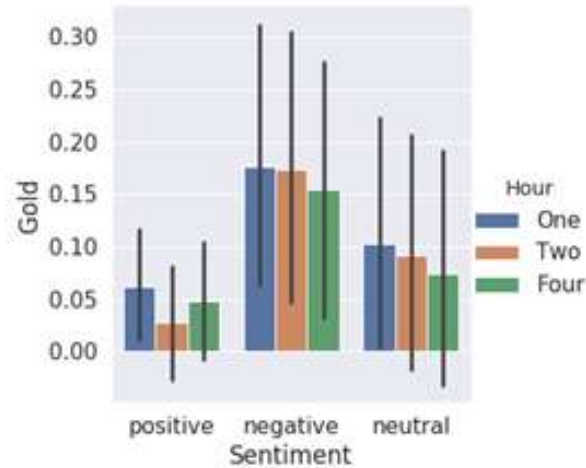
OBJECTIVE OF THE STUDY



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6. To create a Model for Predicting the price of COMEX Gold using Machine Learning in short-term.
7. To understand whether President Trump Tweet is noise or important determinant for Gold price movement

OBJ -5: TO DO COMPARATIVE STUDY OF PRESIDENT TRUMP TWEETS ON THE FINANCIAL MARKET PRICES IN HOURLY BASIS, 2-HOURLY BASIS OR 4-HOURLY BASIS

Categorical Estimate plots – Bar plot



OBJ -5: TO ESTIMATE THE RANGE OF VOLATILITY OF DIFFERENT FINANCIAL ASSET CLASSES WITH POSITIVE, NEGATIVE AND NEUTRAL TWEET SENTIMENT IN SHORT-TERM



Findings:

- Negative Sentiment Tweets has more impact on COMEX Gold prices and U.S. 10Yr Bond Yield on all time-frames
- All the Financial Assets are impacted by the negative tweet on very short-term i.e Hourly basis and the same trend persists on 2-Hourly and 4-Hourly basis. So it can be inferred that President Trump Negative Tweets discount the news in knee-jerk reaction.
- Highest Volatility is seen in U.S. Govt. 10Yr Treasury Bond Yield with the release of Negative Tweet with range of 0 to -0.9%. Second highest volatility is seen in COMEX Gold with range of 0 to 0.3%. DOW Futures and Dollar Index least impacted by the Trump Tweets in short-term.

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OBJ -6: TO CREATE A MODEL FOR PREDICTING THE PRICE OF COMEX GOLD IN SHORT-TERM USING MACHINE LEARNING



Multiple Linear Regression Model

- Dependent Variables => US 10 Yr Bond Yield, Dollar Index, Dow Futures, Negative Tweets
- Independent Variable => COMEX Gold

Regression Results on Hourly % Change

OLS Regression Results						
Dep. Variable:	Gold	R-squared (uncentered):	0.538			
Model:	OLS	Adj. R-squared (uncentered):	0.534			
Method:	Least Squares	F-statistic:	115.4			
Date:	Sat, 01 Feb 2020	Prob (F-statistic):	3.68e-65			
Time:	11:56:58	Log-Likelihood:	-156.37			
No. Observations:	400	AIC:	320.7			
Df Residuals:	396	BIC:	336.7			
Df Model:	4					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Dollar	-0.8536	0.106	-8.029	0.000	-1.063	-0.645
Bond Yield	-0.2081	0.011	-19.010	0.000	-0.230	-0.187
Dow	-0.1117	0.057	-1.975	0.049	-0.223	-0.000
negative	0.0592	0.045	1.313	0.190	-0.029	0.148
Omnibus:	5.044	Durbin-Watson:	2.098			
Prob(Omnibus):	0.080	Jarque-Bera (JB):	6.379			
Skew:	0.083	Prob(JB):	0.0412			
Kurtosis:	3.596	Cond. No.	10.1			

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Regression Results on 4-Hourly % Change

OLS Regression Results						
Dep. Variable:	Gold	R-squared (uncentered):	0.554			
Model:	OLS	Adj. R-squared (uncentered):	0.550			
Method:	Least Squares	F-statistic:	123.0			
Date:	Sat, 01 Feb 2020	Prob (F-statistic):	4.07e-68			
Time:	12:04:38	Log-Likelihood:	-147.48			
No. Observations:	400	AIC:	303.0			
Df Residuals:	396	BIC:	318.9			
Df Model:	4					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Dollar	-0.8939	0.098	-9.155	0.000	-1.086	-0.702
Bond	-0.1997	0.011	-18.017	0.000	-0.222	-0.178
Dow	-0.2027	0.057	-3.528	0.000	-0.316	-0.090
negative	0.0374	0.044	0.852	0.394	-0.049	0.124
Omnibus:	4.732	Durbin-Watson:	2.169			
Prob(Omnibus):	0.094	Jarque-Bera (JB):	5.710			
Skew:	-0.097	Prob(JB):	0.0576			
Kurtosis:	3.552	Cond. No.	9.21			

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

OBJ -6: TO CREATE A MODEL FOR PREDICTING THE PRICE OF COMEX GOLD IN SHORT-TERM USING MACHINE LEARNING



Findings:

- Co-efficient of Regression for Dollar Index is “-0.85” which signifies for every one unit of change in % Change in COMEX Gold price, the change in the Dollar Index is about - 0.85%.
- R-Squared is 0.554, which signifies 55% of the response variable (%Change in COMEX Gold) variation is explained by the model.
- Calculated Accuracy for 4-Hourly Model is about 0.4964, which signifies that this model predicted test data with 50% Accuracy and hence could predict COMEX Gold price on short-term time frame of 4-Hours by 50% Accuracy.

Actual vs Predicted Bar Graph



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OBJ -7: TO UNDERSTAND WHETHER PRESIDENT TRUMP TWEET IS NOISE OR IMPORTANT DETERMINANT FOR GOLD PRICE MOVEMENT



Significance of each Predictor Variable in the Model

Vars	Hourly		4- Hourly	
	R-Sq	R-Sq (adj)	R-Sq	R-Sq (adj)
Bond Yield	0.458	0.456	0.451	0.45
Bond Yield + Dollar	0.531	0.529	0.539	0.537
Bond Yield + Dollar+Dow	0.536	0.533	0.553	0.550
Bond Yield + Dollar+Dow+Negative Tweets	0.538	0.534	0.554	0.550

Findings:

- R-squared with Bond alone is 0.45 so Bond is a good predictor of Gold price.
- On **Hourly model** adding Negative Tweets, R-sq(adj) increases by a very small amount i.e. 0.001 and adding Dow variable also R-sq(adj) increases by a small amount i.e. **they have little significance on prediction of %change in Gold price on hourly basis**.
- On **4-Hourly model** adding Negative Tweets, R-sq(adjusted) **remains same i.e. 0.55** that means this predictor (Negative Tweets) **has null effect on the model** and can be considered as **noise variable**. The same result was inferred in Objective 5. “Comparative Study of Different Timeframes” that **negative tweet has instantaneous effect and later the effect is nullified**.

CONCLUSION



- Out of three Sentiment Labels, only President Trump **Negative Tweet has maximum impact** on the Financial Asset Classes in short-term
- Highest Impact is on Bond Yield and COMEX Gold on Hourly Basis and only on Bond Yield on 4-Hourly Basis
- The **impact is very instantaneous** and same trend persists for next few hours.
- Since Accuracy of our Regression Model (with predictor variables – Bond Yield, DOW Futures, Dollar Index, Negative tweet) is 50%, **it can be concluded that there are many other determinants that should be taken into account** (for eg. Consuming Nations Demand, US Economic Data, etc) for predicting Gold prices.
- Since $R^2(\text{adj})$ is same for Model with Tweet and without Tweet in 4-Hourly Model, it can be concluded that **Tweet Variable has NULL effect on the Prediction of COMEX Gold**
- President Trump Tweet is **NOISE** and not important determinant for predicting Gold prices. Negative Tweet could be used for **Tactical trading** as its effect is instantaneous..