

Several yellow Bitcoin icons of varying sizes are scattered around the title. One large icon is on the top left, another on the top right, and a medium one on the bottom right. There are also smaller icons in the top center and middle left.

What factors drive the return of cryptocurrency?

Team Beatcoin

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Agenda

Introduction

Research Question
Hypothesis
Necessary Data

Part 2

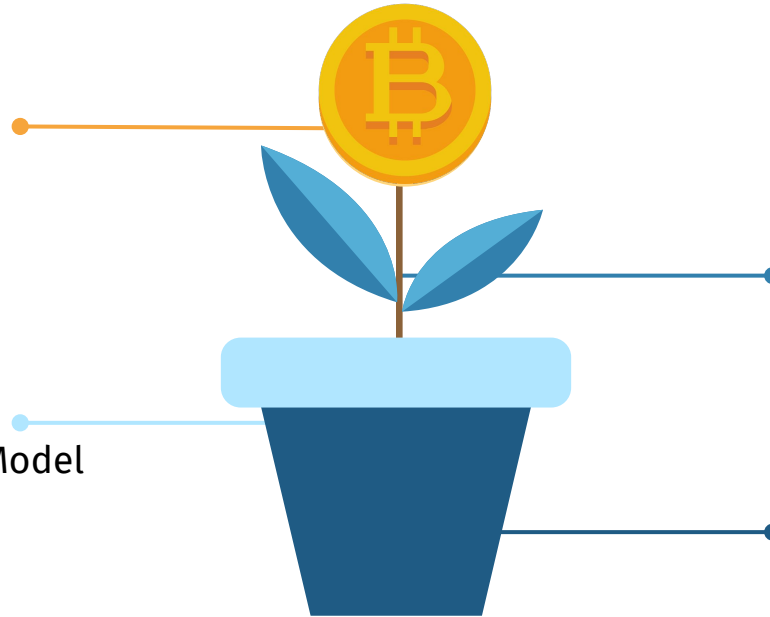
Cryptos &
Simplified Three-Factor-Model

Part 1

Cryptos &
Stock Market

Part 3

Cryptos &
Public Events/ News



A network diagram with blue nodes and lines is in the top-left corner. Two gold Bitcoin coins are positioned below it.

Introduction




Research Question



❑ Bigger Picture

❑ What factors drive the returns of cryptocurrency?

❑ Specific Research Questions

- ❑ If the stock market drives the return of cryptocurrency?
 - ❑ If the simplified three-factor-model explains the returns of cryptocurrency?
 - ❑ If the public news/events drive the return of cryptocurrency?
- 

Hypothesis

- ★ The returns of cryptocurrency has little relationship with the traditional stock market.
 - The R^2 of the market model of cryptocurrencies returns would be poor.
- ★ The simplified three-factor-model can explain the price change of cryptocurrency to some extent.
 - The R^2 of the simplified three-factor-model would be better.
- ★ The price of cryptocurrency is mainly driven by investors' expectations, which are highly influenced by the public news and events.
 - The combination of simplified three-factor-model and public news will explain the crypto returns best.

What data do we download?

Sample period
03/01/2019 - 04/30/2021



01

**Price, Trading Volume, and return info of
Top 10 Market Cap. Cryptocurrencies**

Cryptos: BTC, ETH, ETH2, BNB, XRP,
USDT, ADA, DOGE, DOT, LTC

02

Index info of market

Stock market index: S&P500, Dow Jones
Crypto market index: CCI30 - The crypto
currencies index*

03

Risk Free Rate

1-month U.S. Treasury bills rate



Cryptos & Stock Market



Approach

- ❑ Part 1 Approach
 - ❑ Download return information of SP500 & DJ30 on Yahoo Finance and the price information of top 10 market cap cryptocurrencies on Coinbase
 - ❑ Merge these two datasets
 - ❑ Split the dataset in training and testing by 75% : 25% ratio
 - ❑ Run the regression analysis and visualizations to explore the relationship between stock returns and return of each top 10 cryptocurrency

Cryptos & Stock Market - Training Results (S&P500)

y = return of crypto

	BTC	ETH	BNB	XRP	USDT
Intercept	0.002103 (0.002021)	0.002885 (0.002429)	0.002870 (0.002424)	-0.000165 (0.002124)	-0.000088 (0.000292)
sp500_rtn	0.372766*** (0.114615)	0.483076*** (0.137761)	0.505668*** (0.137476)	0.399522*** (0.120492)	-0.069261*** (0.016573)
R-squared	0.025953	0.030043	0.032956	0.026947	0.042140
R-squared Adj.	0.023499	0.027599	0.030520	0.024496	0.039728
No. observations	399	399	399	399	399

	DOGE	ADA	BCH	LTC	LINK
Intercept	0.002236 (0.002523)	0.003643 (0.002816)	0.002351 (0.002931)	0.001514 (0.002510)	0.010716*** (0.003776)
sp500_rtn	0.282754** (0.143085)	0.597429*** (0.159693)	0.446966*** (0.166247)	0.484784*** (0.142345)	0.505650** (0.214165)
R-squared	0.009741	0.034054	0.017882	0.028387	0.013847
R-squared Adj.	0.007246	0.031621	0.015408	0.025939	0.011363
No. observations	399	399	399	399	399

Standard errors in parentheses.

* p<.1, ** p<.05, ***p<.01

- ❑ Number of Observations: 399
- ❑ Most coefficients are positive, except USDT
- ❑ Low adjusted R² value
- ❑ Highest Adj. R² value: 0.039 (USDT)
- ❑ Lowest Adj. R² value: 0.007 (DOGE)

Cryptos & Stock Market - Training Results (Dow Jones 30)

y = return of crypto

	BTC	ETH	BNB	XRP	USDT
Intercept	0.002198 (0.002016)	0.003007 (0.002421)	0.003004 (0.002419)	-0.000063 (0.002119)	-0.000108 (0.000293)
DJ30_rtn	0.379055*** (0.107710)	0.495555*** (0.129374)	0.499475*** (0.129260)	0.405828*** (0.113228)	-0.061319*** (0.015649)
R-squared	0.030252	0.035640	0.036247	0.031344	0.037235
R-squared Adj.	0.027810	0.033211	0.033820	0.028904	0.034810
No. observations	399	399	399	399	399

	DOGE	ADA	BCH	LTC	LINK
Intercept	0.002310 (0.002520)	0.003795 (0.002806)	0.002463 (0.002925)	0.001636 (0.002501)	0.010829*** (0.003764)
DJ30_rtn	0.282266** (0.134681)	0.609422*** (0.149946)	0.461636*** (0.156289)	0.500045*** (0.133675)	0.564360*** (0.201136)
R-squared	0.010943	0.039946	0.021504	0.034047	0.019445
R-squared Adj.	0.008452	0.037528	0.019039	0.031614	0.016975
No. observations	399	399	399	399	399

Standard errors in parentheses.

* p<.1, ** p<.05, ***p<.01

- ❑ Number of Observations: 399
- ❑ Most coefficients are positive, except USDT
- ❑ Low adjusted R² value
- ❑ Highest Adj. R2 value: 0.037(ADA)
- ❑ Lowest Adj. R2 value: 0.008 (DOGE)

Cryptos & Stock Market - Testing Results

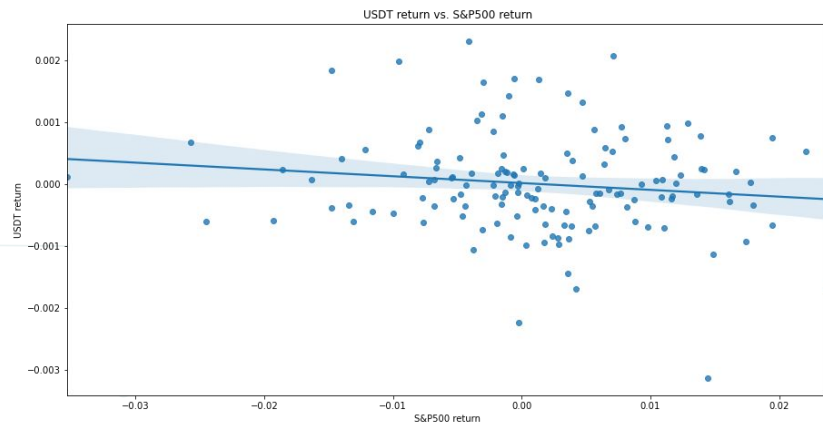
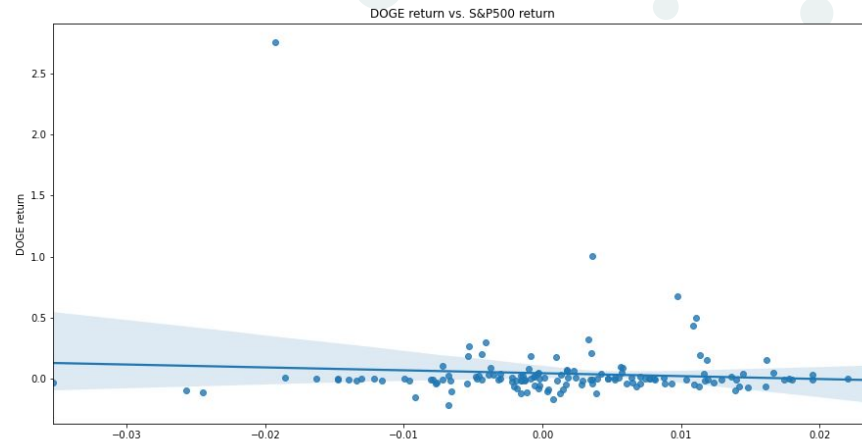
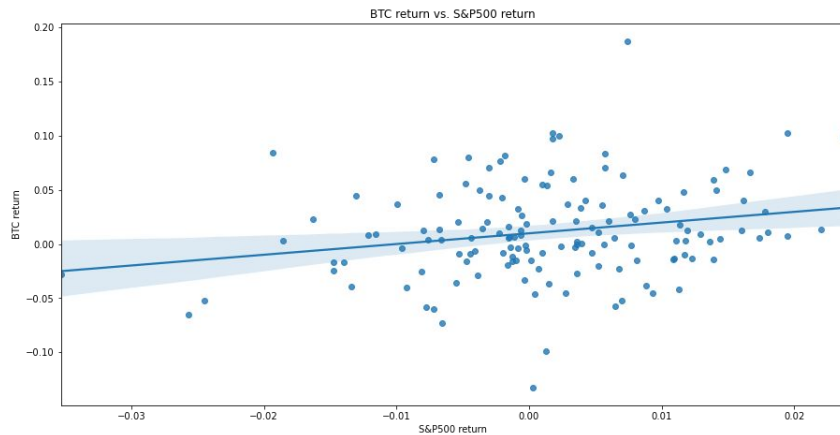
SP500	BTC	ETH	BNB	XRP	USDT	DOGE	ADA	BCH	LTC	LINK
R^2	-0.003	0.006	-0.02	-0.004	-0.536	-0.022	-0.003	0.023	0.011	0.017

- ❑ There are 6 negative R^2 values, and it means that these 6 models fit our data badly
- ❑ The highest R^2 value is 0.023 (BCH), which is still a really low R^2 value

Dow Jones	BTC	ETH	BNB	XRP	USDT	DOGE	ADA	BCH	LTC	LINK
R^2	-0.011	-0.002	-0.030	-0.005	-0.425	-0.023	-0.009	0.013	0.004	0.015

- ❑ There are 7 negative R^2 values, it means that these 7 models fit our data badly
- ❑ The highest R^2 value is 0.015 (LINK), which is also a really low R^2 value

Visualizations of Cryptos & Stock Market



- ❑ Most returns of cryptos have non-significant positive relationship with stock return
- ❑ Only one(USDT) has non-significant negative relationship with stock return
- ❑ Therefore, they **don't exhibit significant relationship**

Hypothesis

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 - The R^2 of the simplified three-factor-model would be better.
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 - The combination of simplified three-factor-model and public news will explain the crypto returns best.





**Cryptos
&**

Simplified Three-Factor-Model



Original Three-Factor-Model

- ❑ Original Fama-French 3 factors model
 - ❑ Market risk factors
 - ❑ Size risk factor
 - ❑ Value risk factors
- ❑ Original 3 factors model for cryptocurrency
 - ❑
$$r_{it} = \alpha + \beta_i (r_{mt} - r_{ft}) + \beta_{SMB} * SMB_t + \beta_{LMH} * LMH_t + \epsilon_{it}$$
 - ❑ **Market risk factor**
 - ❑ $r_{mt} - r_{ft}$ -- market risk premium
 - ❑ **Size risk factor (SMB_t)**
 - ❑ daily average return of small cryptocurrency – daily average return of big cryptocurrency
 - ❑ **Value risk factors (LMH_t)**
 - ❑ daily average return of low cryptocurrency – daily average return of high cryptocurrency

Simplified Three-Factor-Model

❑
$$r_{it} = \alpha + \beta_i (r_{mt} - r_{ft}) + \beta_{SMB} * SMB_t + \beta_{LMH} * LMH_t + \varepsilon_{it}$$

❑ r_{it} : the return of cryptocurrency

❑ β : factor's coefficient

❑ **Market risk factor** -- $r_{mt} - r_{ft}$: market risk premium

❑ Crypto Market Index Return - Risk-Free Rate

❑ **Size risk factor (SMB_t)** -- daily trading volume of each crypto

❑ representing investors' expectations and their trading actions in some extent


❑ **Value risk factors (LMH_t)** -- return of low return over high return

❑ The difference between lowest return and highest return among the 10 Cryptocurrencies

Approach & Rationale



❏ **Part 2 Approach**

- ❏ Download daily adjusted close price and volume information of each Top 10 Cryptocurrency & risk free rate
 - ❏ Merges these datasets
 - ❏ Split the dataset in training and testing by 75%:25% ratio
 - ❏ Run the regression analysis to explore the correlation between simplified three-factor-model and returns of each Top 10 cryptocurrency
- 

Cryptos & Simplified Three-Factor-Model Training Results

y = return of crypto					
	BTC	ETH	BNB	XRP	USDT
Intercept	0.003458 (0.003382)	0.005335 (0.004155)	0.036983*** (0.010757)	0.004468 (0.005807)	-0.001423** (0.000564)
mkt_premi	0.393533*** (0.043801)	0.501961*** (0.051683)	0.426201*** (0.051819)	0.365891*** (0.046369)	-0.045865*** (0.006597)
lmh	-0.033688 (0.026932)	-0.038121 (0.032107)	0.014712 (0.033136)	-0.043983 (0.029352)	-0.010817*** (0.004058)
BTC	-0.000562 (0.003685)				
ETH		0.000304 (0.004328)			
BNB			0.090797*** (0.030552)		
XRP				0.011555 (0.011291)	
USDT					0.000367 (0.000680)
R-squared	0.179706	0.202571	0.173533	0.153614	0.127095
R-squared Adj.	0.173396	0.196437	0.167176	0.147103	0.120381
No. observations	394	394	394	394	394

Standard errors in parentheses.
* p<.1, ** p<.05, ***p<.01

y = return of crypto					
	DOGE	ADA	BCH	LTC	LINK
Intercept	0.115516*** (0.019824)	0.009144 (0.016534)	-0.002778 (0.004447)	0.002381 (0.004394)	-0.018986*** (0.007209)
mkt_premi	0.280015*** (0.051748)	0.474342*** (0.062349)	0.591985*** (0.061014)	0.482093*** (0.053080)	0.407971*** (0.079247)
lmh	-0.158907*** (0.032258)	-0.063747 (0.039640)	-0.131852*** (0.037960)	-0.071832** (0.034017)	-0.403503*** (0.049493)
DOGE	0.642887*** (0.098328)				
ADA		0.014030 (0.037958)			
BCH			0.000325 (0.003027)		
LTC				0.005891 (0.004852)	
LINK					0.013270 (0.036808)
R-squared	0.250537	0.141536	0.217868	0.192617	0.198744
R-squared Adj.	0.244771	0.134932	0.211851	0.186406	0.192580
No. observations	394	394	394	394	394

Standard errors in parentheses.
* p<.1, ** p<.05, ***p<.01

Cryptos & Simplified Three-Factor-Model Testing Results

Three-Factor-Model	BTC	ETH	BNB	XRP	USDT	DOGE	ADA	BCH	LTC	LINK
R^2	0.401	0.417	-2.54	0.098	-10.196	-23.215	0.109	0.106	0.207	-3.17

- ❑ There are 6 positive R^2 values
 - ❑ The highest positive R^2 value is 0.417(ETH)
- ❑ There are 4 negative R^2 values
 - ❑ The lowest negative R^2 value is -23.215(DOGE)
 - ❑ Why -23.215?!

Dogecoin the latest crypto asset to explode

Dogecoin started as an online joke, but has exploded to be worth more than \$65 billion US this week.



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**Cryptos
&**

Public Event/ News



Approach

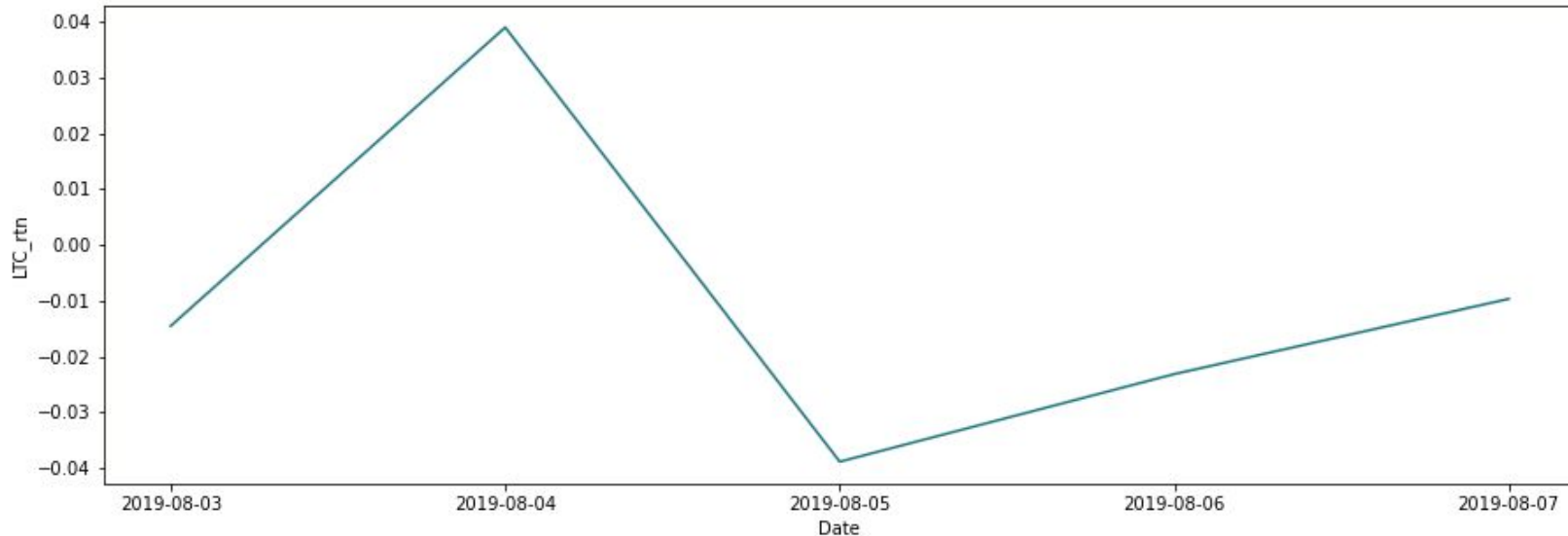


- Select several important public events that might relate to daily price and daily return changes of cryptocurrencies (2019-03-13 to 2021-04-30)



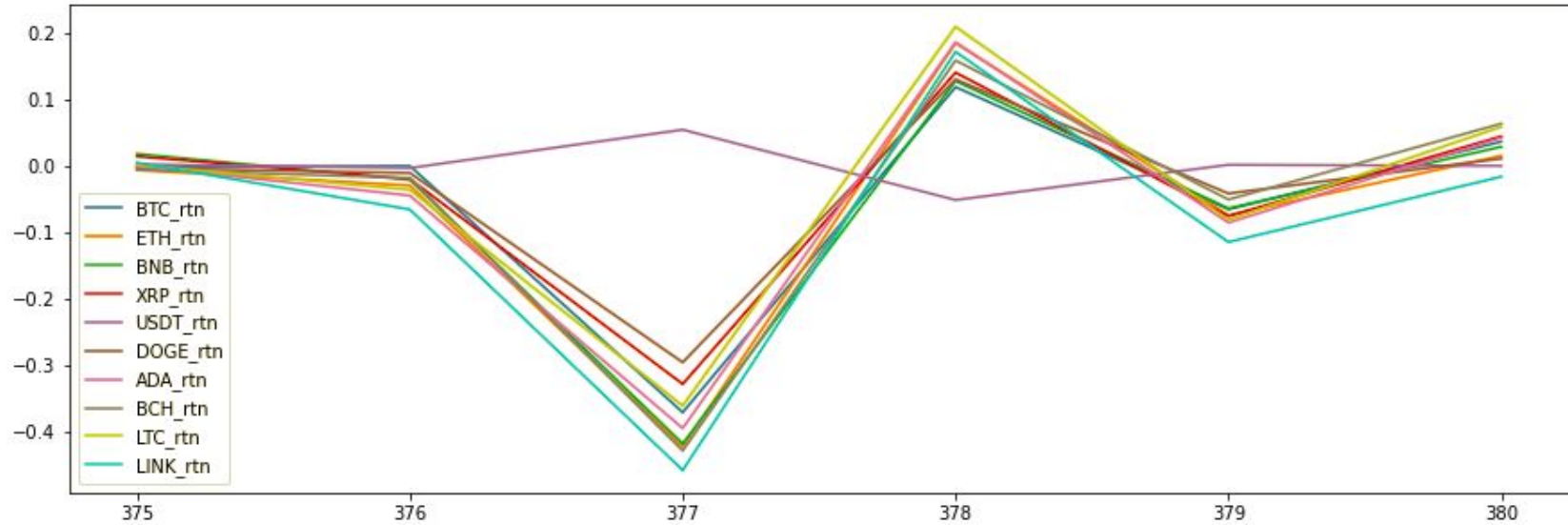
Cryptos & Public Events/ News

- Event 1:
 - Date: 2019-08-05
 - Event: The Litecoin halving took place on August 5 2019, when the mining reward reduced from 25 Litecoins per block to 12.5 Litecoins per block.



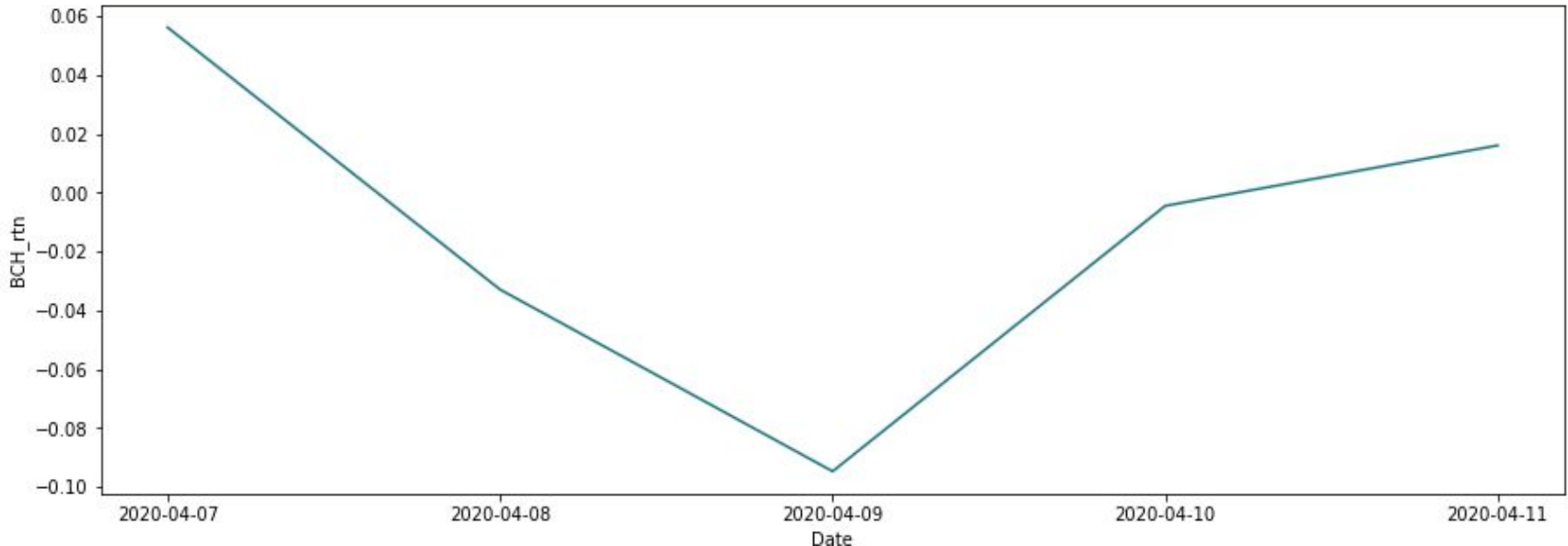
Cryptos & Public Events/ News

- Event 2:
 - Date: 2020-03-12
 - Event: CoronaVirus Outbreak and many countries announced travel Ban
 - Crypto Market broke



Cryptos & Public Events/ News

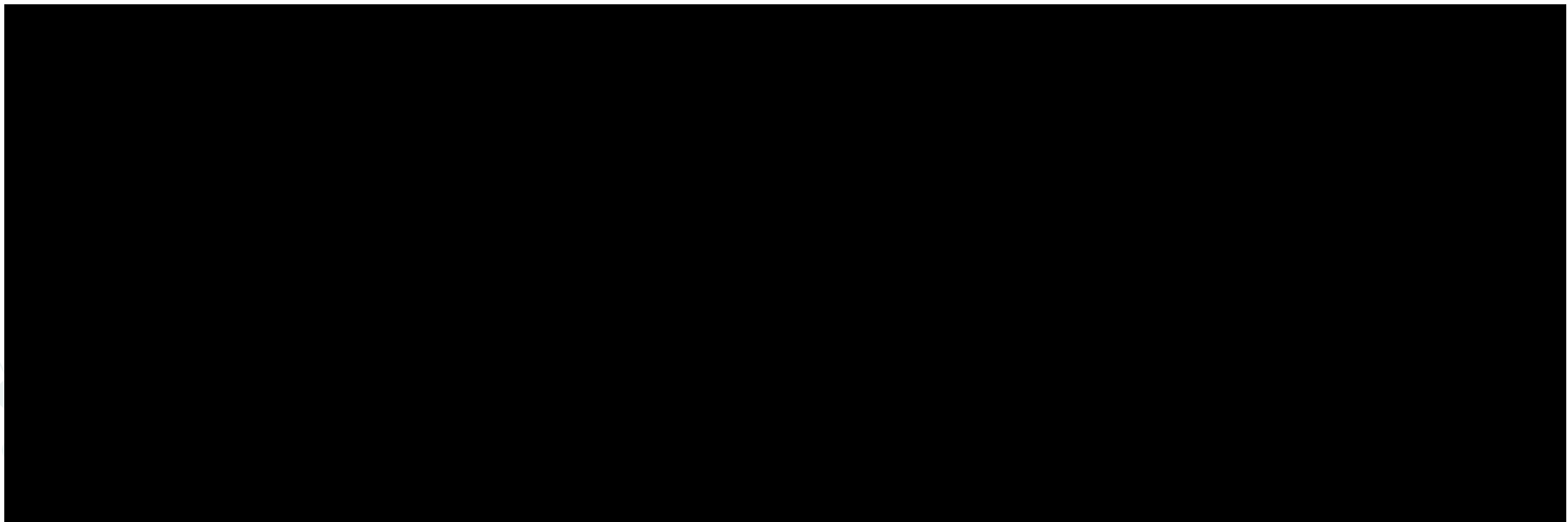
- Event 3:
 - Date: 2020-04-08
 - Event: The Bitcoin halving took place on April 8, when the mining reward reduced from 12.5 bitcoins per block to 6.25 bitcoins per block.



Cryptos & Public Events/ News



- Event 4:
 - Time period: 2021-02-01 to 2021-04-30
 - Elon Musk has been continuously mentioned Doge Coin.



Cryptos & Public Events/ News

- Dates that Elon Musk mentioned about Doge on Twitter

1. 2021-02-04
2. 2021-02-06
3. 2021-02-08
4. 2021-02-10
5. 2021-02-15
6. 2021-02-22
7. 2021-02-24
8. 2021-03-02
9. 2021-03-06
10. 2021-03-14
11. 2021-04-15

'DOGE_change > 0.2 &
DOGE_rtn_change > 0.2'

Date	
702	2021-02-04
705	2021-02-07
772	2021-04-14
773	2021-04-15
776	2021-04-18

Conclusion

- Social events do affect the price and return of cryptocurrency since the Internet is one of the most popular information source for cryptocurrency.
- The influence on the daily price and return caused by single or one-time events is less than we expected.
- Continuous and Powerful social events (Elon Musk's tweets) could increase the volatility of daily price and daily return significantly.

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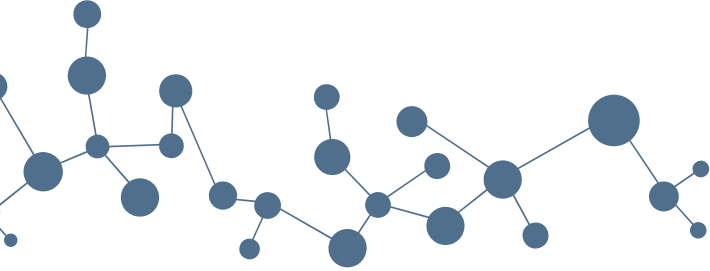


Conclusion



Limitations

- ❑ 2020 is not a normal year for stock market
- ❑ Select TOP 10 cryptocurrencies based on the Market Cap -- they are changing consistently
- ❑ Split the training and testing dataset based on date
 - ❑ Part 2
 - ❑ Training: 2019-03-01 to 2020-09-25
 - ❑ Testing: 2020-09-26 to 2021-04-30
 - ❑ DOGE has totally different features during testing period



Conclusions

- ❑ The return of cryptocurrency has non-significant relationship with the stock market (SP500 & DJ30).
- ❑ The simplified three-factor-model could explain the return of some TOP 10 cryptocurrencies.
 - ❑ Relationship between the return of each TOP 10 cryptocurrency and the simplified three-factor-model varies independently.
- ❑ The return of cryptocurrency would be impacted by the public events and news.

References

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- ❑ investopedia.com/terms/f/famaandfrenchthreefactormodel.asp
- ❑ <https://www.atlantis-press.com/article/125941209.pdf>



Thank You!

Any Questions?