CSCI E-118 Introduction to Blockchain and Bitcoin

Final Project Demonstration

James Burns

Not Based on Thin Air: Where Do Cryptocurrency Prices Come From?

Analysis

Using 3 sets of fundamental valuation techniques, BTC prices have been explored. This analysis concludes that the current price of BTC is overvalued. This work is primarily based on Bhambhwani et al. (2019)[1] and Ark Invest "On-Chain Data" series[2]. Graphical evidence is used to demonstrate ACP & ANET comparisons for BTC & ETH. The code used to evaluate can be used for other cryptocurrencies, simply plug in the new data. Finally, a technical time-series prediction is shown, using the Facebook Prophet forecast.[3]

Aggregate Computing Power, Aggregate Network Factor (ACP, ANET)

ACP is the computing power of the network, measured by hash rate. ANET is the network factor, measured by active addresses. These two factors are arguably the most fundamental to a currency. The ACP represents network security, confidence in continued network support, and the investment of hardware into the network's success. ANET represents actual users trading with the tokens.

My project extends the work of Bhambhwani et al. by graphically representing the ACP and ANET factors alongside price, in a normalized graph. In this graphical evidence, BTC price is greater than both underlying metrics- this indicates that the asset is overvalued. The adjusted R-squared value is .906 for these two factors, meaning that they have strong correlation. Both underlying factors are significant predictors.

The Facebook Prophet time series predictor is bullish on BTC, predicting a moderate price increase in the next 180 days.

[1] https://wpcarey.asu.edu/sites/default/files/george_korniotis_seminar_paper_november_8_2019.pdf
[2] ARK Invest Yassine Elmandjra, David Puell https://ark-invest.com/articles/analyst-research/on-chain-data-bitcoin/
[3] Facebook Prophet https://facebook.github.io/prophet/docs/quick_start.html#python-api

Figure 1: Bitcoin Price and Active Accounts, January 2016 – April 2021

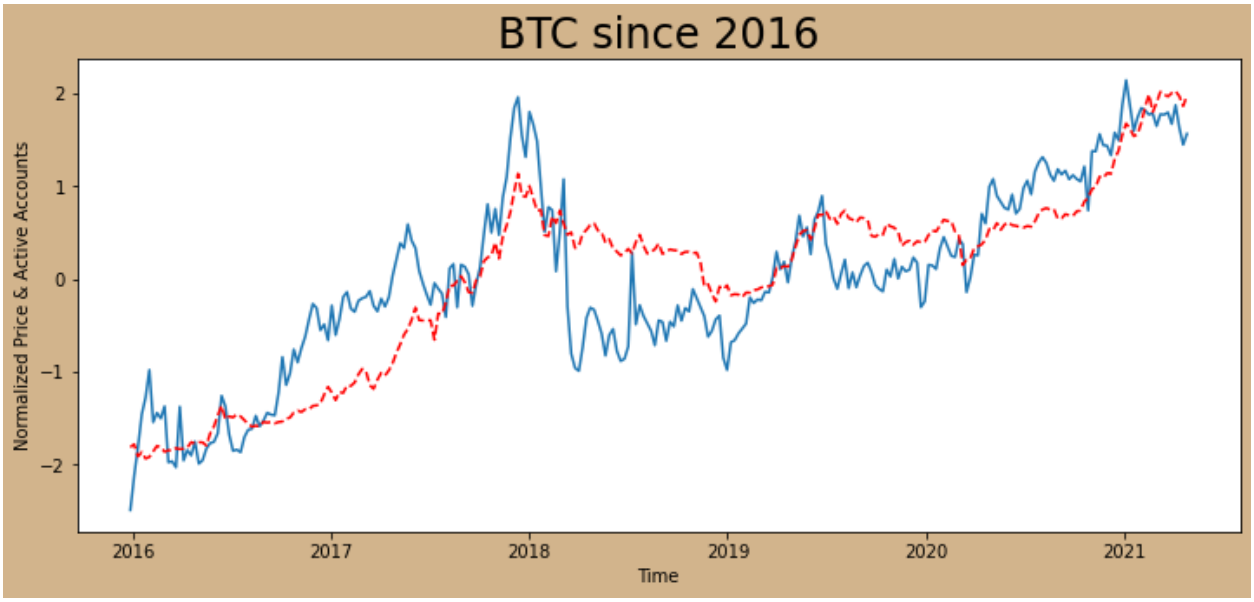


Figure 2: Bitcoin Price and Hash Rate, January 2016 – April 2021

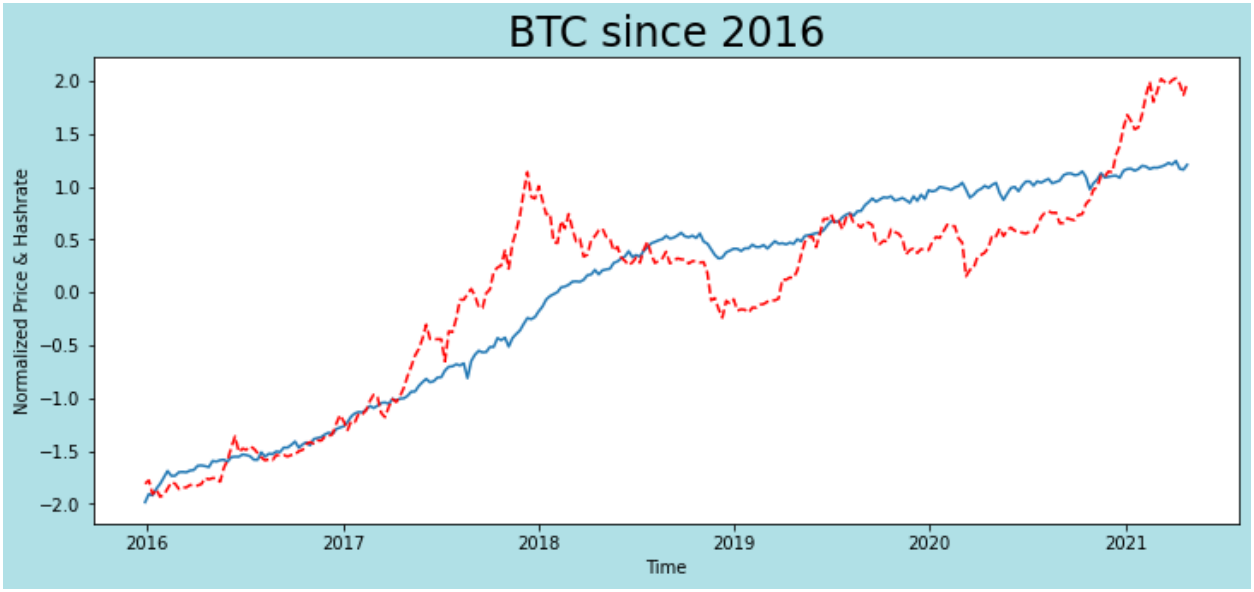


Figure 3: Ordinary Least Squares Regression, ‘h’ is Hash Rate, ‘a’ is Active Accounts

OLS Regression Results

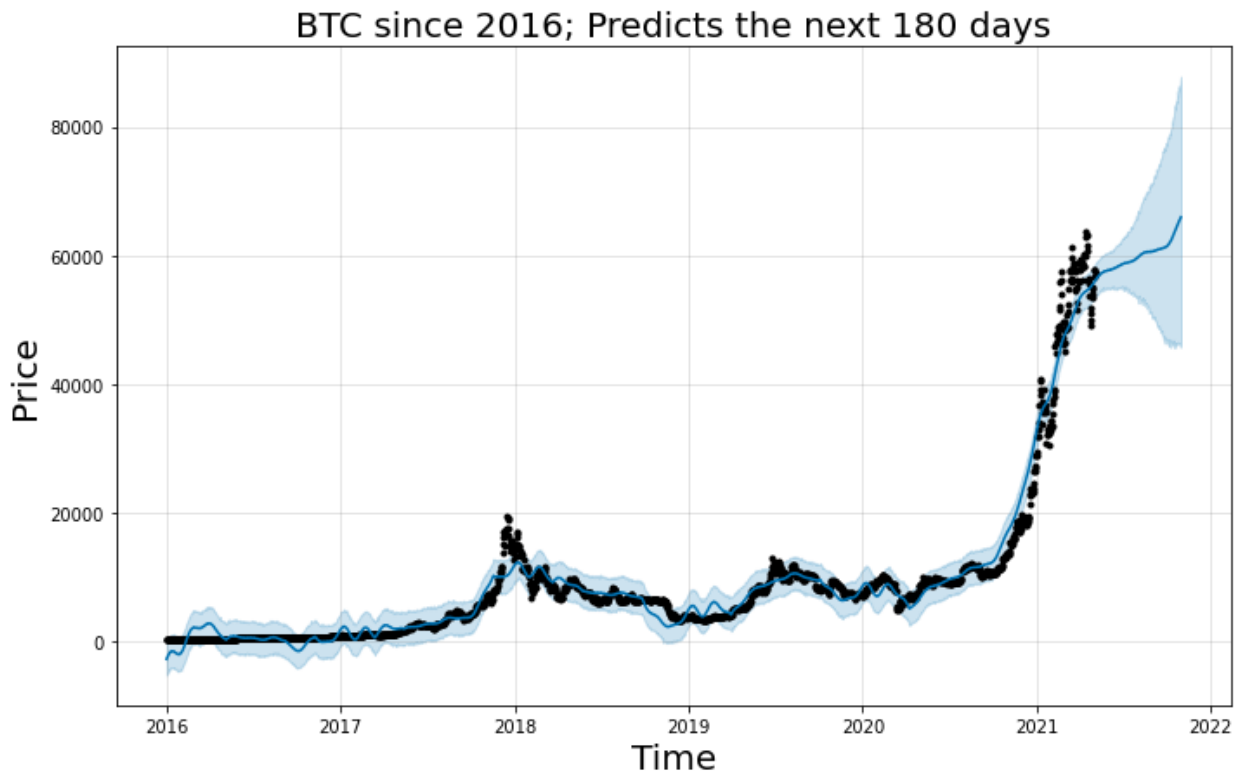
Dep. Variable:	p	R-squared:	0.907
Model:	OLS	Adj. R-squared:	0.906
Method:	Least Squares	F-statistic:	1339.
Date:	Mon, 03 May 2021	Prob (F-statistic):	8.59e-143
Time:	19:01:44	Log-Likelihood:	-64.708
No. Observations:	279	AIC:	135.4
Df Residuals:	276	BIC:	146.3
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	4.354e-16	0.018	2.37e-14	1.000	-0.036	0.036
h	0.6196	0.026	23.640	0.000	0.568	0.671
a	0.4057	0.026	15.476	0.000	0.354	0.457

Omnibus:	21.454	Durbin-Watson:	0.145
Prob(Omnibus):	0.000	Jarque-Bera (JB):	11.762
Skew:	0.334	Prob(JB):	0.00279
Kurtosis:	2.248	Cond. No.	2.44

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

Figure 4: Facebook Prophet Time Series Price Prediction, 180 days



Conclusion

Unlike the stock market, Bitcoin's unique market characteristics allow for surprisingly insightful analysis. The Bhambhwani method shows that when cryptocurrency prices exceed the two fundamental factors, the prices eventually fall. The correlations between price and these factors reach up to .9 for Bitcoin from January 2016 to April 2021. People choose market prices, and the purity of the coin- as opposed to companies with real world assets and liabilities- creates an environment where fundamentals analysis is different. Maybe Bitcoin behaves in a more predictable way than we give it credit for. After all, we are the ones who made it, and move it.

Cryptocurrency prices aren't based on thin air, they're based on our behavior.

Appendix: Common Cryptocurrency Fundamentals Analysis Metrics

Using 3 sets of fundamental valuation techniques, BTC prices have been explored. This analysis concludes that the current price of BTC is overvalued. This work is primarily based on Bhambhwani et al. (2019)[4] and Ark Invest "On-Chain Data" series[5]. There are many metrics that seek to evaluate investor sentiment, market conditions, etc. These three were chosen because they claim to show fundamental valuations. The first is the most complex, while the last is the simplest.

Valuation Metrics Used:

Market-Value-to-Realized-Value Ratio (MVRV)[6]

Mining Profitability Fundamentals (Puell Multiple)[7]

Network Valuation to Transaction Value, with smoothing volatile transactions (NVTS)[8]

Valuation Metrics Analysis

Market-Value-to-Realized-Value Ratio (MVRV)

This indicator seems to be the most concise single value for evaluating BTC fundamentals. This ratio compares the theoretical market value (market cap) to the realized value - what the tokens traded for last. An MVRV of 3.7 suggests overbought, while a ratio below 1 suggests oversold.[9] On April 15th , 2021 the BTC was $63,290 and the MVRV was 3.38; a fairly high value. In one week, BTC fell almost 10k, to a new price on April 21st of $53,740 and 2.92 MVRV.[10] Metric is bearish toward current market.

Mining Profitability Fundamentals (Puell Multiple)

A second metric created by Puell, this one examines the fundamentals of mining profitability. To calculate, divide the daily value of mining revenue by the 1 year moving average of mining revenue.[11] The Puell Multiple for April 2021 has ranged between 2-3. In July 2019, the most recent time range with similar numbers, the price of BTC fell moderately in the following months. Metric is bearish toward current market.

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[4] Ibid.

[5] ARK Invest Yassine Elmandjra, David Puell https://ark-invest.com/articles/analyst-research/on-chain-data-bitcoin/

[6] Created by Murad Mahmudov and David Puell https://academy.glassnode.com/market/mvrv/mvrv-ratio

[7] Coined by David Puell https://academy.glassnode.com/indicators/coin-issuance/puell-multiple

[8] Created by Willy Woo, Dmitry Kalichki https://woobull.com/nvt-signal-a-new-trading-indicator-to-pick-tops-and-bottoms/

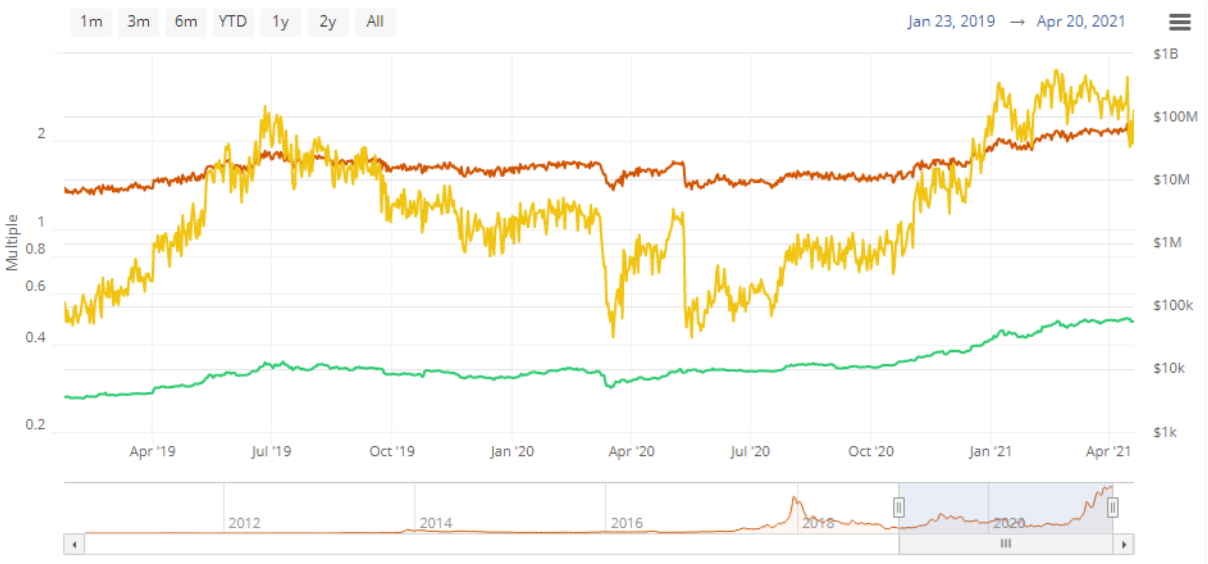
[9] https://medium.com/@kenoshaking/bitcoin-market-value-to-realized-value-mvrv-ratio-3ebc914dbaee

[10] https://charts.woobull.com/bitcoin-mvrv-ratio/

[11] https://medium.com/unconfiscatable/the-puell-multiple-bed755cfe358

Figure: Puell Multiple Historical Chart[12]

Green is log BTC Price, Red is miner revenue, Orange is Puell Multiple



Network Valuation to Transaction Value Signal, with smoothing volatile transactions (NVTS)

Originally the NVT ratio, created by Willy Woo, was meant to approximate a 'PE' ratio for cryptocurrency. To get the NVT, simply divide the network value (market cap) by the daily transaction value- both in USD. Woo claims that a value above 150 signals overbought, and any value below 45 signals oversold. The ratio has mostly been in the 90's during April 2021.[13] Recently, this ratio correctly indicated a BTC correction in January. This metric also indicated good low entry points for BTC in 2020. Metric is neutral toward current market.

[12] Graph courtesy of https://bitcoinvisuals.com/misc-puell-multiple

[13] Willy Woo http://charts.woobull.com/bitcoin-nvt-signal/