

The Bull or Bear Characterization of Bitcoin Market Conditions

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ABSTRACT - The Bitcoin exchange market is basically hosted on the blockchain and every good market as we know involves transactions. The Bitcoin exchange market is an internet based market which is done via the blockchain. These transactions could either be categorized as been bullish or bearish bearing in mind that the blockchain doesn't deal with intermediaries as seen in the supply chain. The bear and bull market conditions have attracted a lot of attention as economic phenomena, thus characterizing the bitcoin markets as bullish or otherwise bearish goes a long way in describing the behaviour of the market. However, this paper will use the regime switching method to identify the turning points of the Bitcoin market conditions, predict the bull and bear Bitcoin market conditions and also emphasize the properties of the bear and bull market conditions that would aid investors in making the right investment decisions.

Keywords: Bear, Bull, Market conditions, Bitcoin, Regime switching, Blockchain, Supply chain

1. Introduction

Characterization of the bitcoin market conditions is a trendy issue that calls for serious attention. Telling whether a market is a bear or bull has attracted a lot of attention as economic phenomena thus, the market faces the most thrilling and important question, the questions that face market participants in our world today is on how to identify when a market is actually a bear market or a bull market and also to tell when it switches from a bear regime to a bull regime vice versa. Most market participants and researchers find it important since each of the market phases are characterized by asymmetric volatilities. Ordinarily, the bitcoin market trend is known to exhibit switches amongst states which are majorly characterized by two states; an upward or rising state and a downward or decreasing state. The bull market as given by [1] are known to be associated with rising share prices that are persistent but in our case, we are looking at the bitcoin market trend as regards the prices. In general, there is a belief that is accepted by policy makers, investors and of course academicians that the stock market exhibits low frequency

trends [2] although the low frequency are characterized by both positive and negative values which on one hand can be referred to as bull and bear markets respectively [2]. On a lighter mood, it can be of interest for one to know that there also exist turning points which could go either ways, that is, from an upward (bull) to a downward (bear) or the other way around but the issue lies on how one can identify and distinguish whether the fluctuations are actually a short term thing or the beginning of fluctuations in the long term. Although, a couple of methods have been used to identify whether the market is actually bull (upward) or bear (downward), in 1971, Bry & Boschman developed a method that could capture and identify peaks and troughs in a macroeconomic data. The Bry and Boschman method was a directional method in the sense that it looks at the stock price index and tells whether it is an upward movement or a downward movement [3], [4]. The second method is that developed by Hamilton in 1989 which is referred to as the Markov Switching model (MSM). In the MSM, the probabilities determines the change so that a change in the market states is as a result from the change in the probabilities which are modelled by parameters.

The third method used the Duration-Dependent Markov Switching Autoregressive Heteroskedasticity model and it was developed by [5] and they explored it on the New York Stock Exchange and on the American Exchange. The remainder of this paper is organised as follows; section 2 discusses literatures surrounding the study, section 3 explains the model, section 4 explains the findings, section 5 discusses the results and proffers possible recommendation, section 6 concludes.

2. Literature Review

A group of researchers tested stylized facts of bitcoin limit order books, their data were derived from different cryptocurrency exchange markets (i.e. bitfinex, bitstamp and coinbase) but focus was on BTC/USD market because

it is the leading cryptocurrency market. The currency pairs were connected directly to the exchange's application programming interface (API). The limit order data collected involved the depth at all price steps. The data collected according to them ranges from 2nd December, 2017 to 12th October, 2018. They concluded that there are deviations that abound in the trade size and limit order prices. They were different from the commonly observed patterns and also the limit order books were relatively shallow and liquidity costs were high when it was compared to other established markets [6]. There are also studies that were on bitcoin volatility and prediction, studies such as [7]–[9]. [7] Investigated the trend prediction classification for high frequency bitcoin time series with deep learning. They provided a trend prediction framework which was named random sampling method (RSM), the framework according to them is based on deep learning (DL). The performance of their approach were compared to 2 classical baseline methods with respect to prediction of unstable bitcoin prices in the okcoin market. According to [7], their result show that the baseline approaches were biased easily by class imbalance but their model exceeds the odds with 3 outcomes. In other words, predicting the market is just possible to some degree. Their result also shows that the profit rates of the RSM outperformed the profit rates of the long short term memory (LSTM). [10] Investigated the connectedness within the crypto markets across the bitcoin index and asset classes that are widely traded such as traditional stock markets, currencies, gold and Brent (commodities). He employed a spill over index approach with a spectral representation of decomposed variance of Networks. His results show that there are no significant spill over effects between other financial markets and the crypto markets, thus, cryptocurrencies are independent financial instruments that are real and pose no danger to financial system stability. As regards connectedness according to [10], he reported that there exist a nature time frequency dynamics, the nascent market ascending to them is highly dominated by short frequency of 2-4 days which proves that the nascent market is highly speculative in nature. The GARCH-MIDAS model was employed by [8] in extracting the long and short term volatility components of cryptocurrencies. They discovered that the S&P 500 realized volatility posed a negative effect on bitcoin volatility and that the S&P 500 volatility risk premium also significantly showed a positive effect on the long term bitcoin. Thus, according to them, their overall findings show that bitcoin volatility is closely linked to global economic activity and their findings can be used to improve forecast of long term bitcoin volatility. [11] analyzed the statistical properties of the largest cryptocurrencies, of which bitcoin and Litecoin were ranked the most prominent. Their findings prove that the generalized hyperbolic distribution fits best for the bitcoin and Litecoin while for other non prominent cryptocurrencies which were regarded as smaller cryptocurrencies exhibited normal inverse gaussian distribution, generalized 't' distribution and Laplace distribution fits good and not best. [12] Didn't concern

themselves on volatility nature of the bitcoin but rather looked at the blockchain technology and infrastructure. The Yet Another Bitcoin wallet (YAB) according to them is a hybrid application that communicates with the blockchain to store, send, receive bitcoins but it is majorly used on financial issues and on cryptocurrencies. [12] Applied this hybrid application on non-financial related issues and on non cryptocurrencies. They introduced the decentralized platform Ethereum which allows one create a smart contract. They concluded that although further studies as regards applying the blockchain technology and infrastructure to non financial related issues should be encouraged. Another group of researchers studied the volatility spillover and return between the largest cryptocurrency and 4 asset classes (i.e. equities, stocks, commodities and bonds) with respect to bear and bull market conditions. They employed the VAR GARCH in mean model covering data from July 19, 2010 to October 31, 2017. They found strong significant evidence that bitcoin returns are quite closely related to other assets particularly commodities. Thus, according to them, the bitcoin market is not completely isolated and also that the bitcoin receives greater volatility than it transmits in the first place [13].

2.1. Blockchain and Supply Chain

It is of utmost importance to note that blockchain and supply chain work hand in hand. The blockchain can be seen as a trending technology that validates, records and finally distribute transactions in an encrypted but decentralized pattern. Here, the patterns can be referred to as ledgers. The blockchain came into limelight in the year 2008 and the invention was to give aid and credence to the bitcoin cryptocurrency. It is also interesting to note that every dealings or better still say transactions are recorded on the block and since the ledgers are not put in a central location, it is quite difficult for hackers to penetrate. Thus, the blockchain is invariably a system that keeps track and records of the movement and changes of transactions. It is the buzzword of the 21st century and since records of the transactions are kept from start (beginning) to finish (end). One could see that it works hand in hand with the supply chain. The supply chain is thus essential and important to businesses and businesses on the other hand involves chains of transactions. Transactions are likened to block chain, though the mechanism of the block chain are displayed over the internet. Currently, many businesses are executed over the internet and that gives credence to block chain as the game changer. Several researchers have supported the onus as regards blockchain and supply chains, authors like [14]–[20]. Contrary to the extant literature on blockchain and supply chain, a particular researcher differed in his submission by only looking at the supply chain management in the oil sector activities [21].

2.2 Bull and Bear Characterization

The bull and bear terms are basically used to describe the market conditions, one needs to know the rudiments of the market, the directions the market will take matters a lot since whatever direction(s) it takes, tells more on one's portfolio, so the cutting edge issue is what does the term bear signify in the market, what does the bull market signify, how does it affects us or better still the investor or players. The term bear and bull markets were first and majorly used in the stock markets, see ([3]; [2]; [8]; [1]) but it is now been applied in the bitcoin market. In the investing world, appreciating and depreciating are two strong terms that are as important and strong as the bear and bull market condition. So, what is a bear market?, as the name implies and as the animal it signifies and represents, a bear is an animal known for swiping its paws downwards. A bear swipes its paws downwards which represents the falling or dropping nature of the market. The bear market is characterized by falling prices or dropping prices, thus, there is a decline. The bear market is typically shrouded in pessimism or shrouded in distrust. In the bear market, investors are of the opinion that the dropping or falling prices will continue in the long run. In the bear market, the economy is majorly characterized by a slowdown. The bull's market is a complete opposite of the bear's market, the bull's market is characterized by a sustained rise, a sustained increase, an expected rise in price thus, and one can say that there is a sustained increase in the market share price unlike what is attainable in the bear's market. Investors in the bull market believe that the uptrend will continue even in the long run. The bull animal is known for thrusting its horn in the air, always in an uprising condition, a typical opposite of the bear animal. It is of utmost importance that the market is also determined by investors' attitudes, thus, the way an investor feels also matters in determining the market trend. Thus in a nutshell, the bear's swipe down and the bull thrusts its horns are two great actions that are metamorphosed into the movement of the market. Thus with an uptrend, we say bull market and with a down trend, we refer to a bear market. Thus the characteristics of a bull market or bear market are highlighted below but not totally exhaustive:

- The supply for bitcoins and the demand for bitcoins; investors would be willing to buy bitcoins in a bull market since the demand for bitcoins are strong unlike in the bear market where the demand for bitcoins are weak. In the bull market, supply for bitcoins are weak, thus, investors would be happier to buy bitcoins although very few are willing to sell. This situation will skyrocket the prices of bitcoin and competition becomes the order of the day since the available equity will be competed for by investors. In the bear market, the issue becomes who will buy as more are hoping to sell.
- The attitude and behaviour of the Investor; in the bull market, investors are willing to engage and

participate because there is a high believe that they will make profit. This is because the attitude or behaviour of the investor affects the performance of the bitcoin exchange market (vice versa). There exists a mutual dependence between the investors' behaviour and the performance of the bitcoin exchange market. Thus, their relationship is such that one cannot operate without the existence of the other. Whereas in the bear market, investors aren't ready to invest rather they hoard their bitcoins till they see positive signal and thus, the performance of the bitcoin exchange market would be on the decline

- Weak and strong economy; a weak economy is associated with a bear market while a strong economy is associated with the bull market. No maximum profit is made in the bear market while the reverse is the case in the bull market. In the bull market, investors are willing to buy more and more bitcoins which in turn strengthens the bitcoin economy.

3. Methodology

The regime switching model also known as the Markov switching model is proposed. The Markov switching model was pioneered and applied majorly in the macroeconomics area by Hamilton in 1989. Many researchers have used Markov switching in different areas and in different capacities, see ([22]; [23]; and [24]) and so on.

The daily bitcoin exchange rate data from Quandl Bistamp database ranging from 15/04/2014 to 5/03/2019 would be used.

Thus let $y = \{y_1, y_2, \dots, y_T\}$ be a time series observation and let y also be a daily bitcoin exchange prices. Suppose also that y_t can be from 2 states S_t , where S_t can assume 0 and 1, that is, $S_t = \{0, 1\}$.

Therefore the regime switching equation or stochastic markov-switching equation is given as:

$$y_t = \beta_1(1 - S_t) + \beta_2 S_t + [\theta_1(1 - S_t) + \theta_2 S_t] \varepsilon_t \quad (1)$$

Where ε_t is the stochastic error term and also $\varepsilon_t \sim N(0,1)$, thus, which implies that in state 1, the above equation (1) becomes:

$$Y_{t/s} = \beta_1 + \theta_1 \varepsilon_t \quad (2)$$

And the corresponding probability transition matrices (TPM) are given as:

$$P = \begin{bmatrix} P_{11} & 1 - P_{22} \\ 1 - P_{11} & P_{22} \end{bmatrix} \quad (3)$$

From the TPM (3), one can see basically the transition that exists from one state to the other.

Note that, there exist also 6 distinct parameters that further describes Y and these parameters are:

$$\pi = (\beta_1, \beta_2, \theta_1, \theta_2, P_{11}, P_{22})$$

The above parameters will be achieved by applying the maximum likelihood estimation method.

The steps for dating the turning points are itemized as follows:

1. Use the Markov-switching pattern to identify the switching states of the market condition
2. Breaks which marks the turning points are identified if and only if the current state is intercepted by another state and consecutively remains in the new state for a minimum number of $2n+1$ steps such that $2n + 1 \leq v_t$ for all $n = 1$. Thus v_t implies the number of steps which can assume values to infinity. For maximum number of $2n+1$ steps, $n = 2, 3, \dots, \infty$.
3. Any established break refers to a known turning point.
4. For all $n = 0$ such that $2n + 1$ implies no known break and thus should be ignored, the previous state thus supersedes such case.

4. Analysis and Interpretation of Results

Table 1 THE SWITCHING STATES, TRANSITION PROBABILITIES AND POOLED FREQUENCY

SWITCHING STATES	FREQUENCY (2014-2019)	TRANSITION PROBABILITY	TRANSITION PROBABILITY VALUES
HH	592	P11	0.576436
LH	435	P21	0.423564
HL	433	P12	0.589116
LL	302	P22	0.410884

From the table above, one can see the switches of states as regards levels of high and low. Thus from a high to high state which actually depicts the Bull market condition and from a low state to a high state which also depicts the Bull market condition. Thus the probability value from a bull market to another bull market is 0.576436 approximately 0.58 and that is 58%. From the bear market to the bull market, the probability value is 0.423564 approximately 0.42 which is 42%. Thus, one can see that the switches from bear to bull is actually low to compare to the switches from bull to bull. It spends longer time in the bull's market than in the bear. From a bull to a bear, we also have approximately 0.58 which is 59% and from a bear to a bear, that is 41%, it simply means that the market stays less in the bear form than in the bulls form and if it were to switch from the bull's form the percentages are higher (59%) than when it is actually switching from the bear to the bull (LH) (42%).

TURNING POINT DATES	STATE OF THE MARKET CONDITION	DURATION (DAYS)	TURNING POINT DATES	STATE OF THE MARKET CONDITION	DURATION (DAYS)
15/04/14 to 19/4/14	BULL	5	25/8/15 to 17/9/15	BULL	24
20/4/14 to 27/4/14	BEAR	8	18/9/15 to 8/10/15	BEAR	21
28/4/14 to 8/6/14	BULL	42	9/10/15 to 18/12/15	BULL	70
9/6/14 to 12/6/14	BEAR	4	19/12/15 to 22/12/15	BEAR	4
13/6/14 to 2/7/14	BULL	20	23/12/15 to 20/1/16	BULL	30
3/7/14 to 7/7/14	BEAR	5	21/1/16 to 9/2/16	BEAR	20
8/7/14 to 25/8/14	BULL	46	10/2/16 to 10/3/16	BULL	30
26/8/14 to 8/9/14	BEAR	14	11/3/16 to 13/3/16	BEAR	3
10/9/14 to 15/9/14	BULL	6	14/3/16 to 15/5/16	BULL	63
16/9/14 to 5/10/14	BEAR	19	16/5/16 to 22/5/16	BEAR	7
6/10/14 to 16/11/14	BULL	41	23/5/16 to 28/5/16	BULL	6
17/11/14 to 4/12/14	BEAR	17	29/5/16 to 31/5/16	BEAR	3
5/12/14 to 7/12/14	BULL	3	1/6/16 to 19/6/16	BULL	19
8/12/14 to 17/1/15	BEAR	37	20/6/16 to 22/6/16	BEAR	3
18/1/15 to 11/3/15	BULL	53	23/6/16 to 19/7/16	BULL	27
12/3/15 to 18/3/15	BEAR	7	20/7/16 to 22/7/16	BEAR	3
19/3/15 to 7/4/15	BULL	20	23/7/16 to 29/7/16	BULL	7
8/4/15 to 6/5/15	BEAR	29	30/7/16 to 2/8/16	BEAR	4
7/5/15 to 15/5/15	BULL	9	3/8/16 to 7/8/16	BULL	5

17/5/15 to 10/6/15	BEAR	24	8/8/16 to 17/8/16	BEAR	10
11/6/15 to 12/7/15	BULL	32	18/8/16 to 14/9/16	BULL	28
13/7/15 to 1/8/15	BEAR	20	15/9/16 to 17/9/16	BEAR	3
2/8/15 to 14/8/15	BULL	13	18/9/16 to 8/12/16	BULL	80
15/8/15 to 24/8/15	BEAR	10	9/12/16 to 16/12/16	BEAR	8

21/2/18 to 1/3/18	BEAR	9	8/12/18 to 23/12/18	BULL	16
2/3/18 to 5/3/18	BULL	4	24/12/18 to 8/2/19	BEAR	47
6/3/18 to 17/3/18	BEAR	12	9/2/19 to 13/2/19	BULL	5
18/3/18 to 23/3/18	BULL	6	14/2/19 to 5/3/19	BEAR	20
24/3/18 to 31/3/18	BEAR	7			
1/4/18 to 4/5/18	BULL	34			

TURNING POINT DATE	STATE OF THE MARKET CONDITION	DURATION (DAYS)	TURNING POINT DATE	STATE OF THE MARKET CONDITION	DURATION (DAYS)
17/12/16 to 15/3/17	BULL	89	5/5/18 to 11/5/18	BEAR	7
16/3/17 to 30/3/17	BEAR	14	12/5/18 to 20/5/18	BULL	9
31/3/17 to 24/5/17	BULL	55	21/5/18 to 31/5/18	BEAR	11
25/5/17 to 1/6/17	BEAR	8	1/6/18 to 6/6/18	BULL	6
2/6/17 to 11/6/17	BULL	10	7/6/18 to 22/6/18	BEAR	15
12/6/17 to 14/6/17	BEAR	3	23/6/18 to 5/8/18	BULL	44
15/6/17 to 22/6/17	BULL	8	6/8/18 to 8/8/18	BEAR	3
23/6/17 to 15/7/17	BEAR	23	9/8/18 to 6/9/18	BULL	27
16/7/17 to 9/11/17	BULL	116	7/9/18 to 11/9/18	BEAR	5
10/11/17 to 13/11/17	BEAR	4	12/9/18 to 22/9/18	BULL	11
14/11/17 to 19/12/17	BULL	36	23/9/18 to 6/10/18	BEAR	14
20/11/17 to 31/12/17	BEAR	12	7/10/18 to 7/11/18	BULL	31
1/1/18 to 7/1/18	BULL	7	8/11/18 to 27/11/18	BEAR	20
8/1/18 to 14/2/18	BEAR	38	28/11/18 to 2/12/18	BULL	5
15/2/18 to 20/2/18	BULL	6	3/12/18 to 7/12/18	BEAR	5

From the table above, one can see that the bitcoin market condition is majorly characterized as been bullish than bearish, thus, it is characterized by increased rising prices. From 16/7/2017 to 9/11/2017, it was recorded that the bitcoin market entered the bull state and its duration which happens to be the highest had 116 days followed by 89 days, that is, from 17/12/2016 to 15/3/2017 then from 18/9/2016 to 8/12/2016; 80 days. These days were basically the tail end of 2017 and beginnings of 2018. One can deduce that the market is heavily affected and determined by seasons, that is the Yuletide and New year festivities respectively. On 24/12/2018, the bitcoin exchange market recorded the highest number of days (47) for the bear market condition. There were days when the market condition actually remained same such that 14/2/19 to 5/3/19; 8/11/18 to 27/11/18; 21/1/16 to 9/2/16; 13/7/15 to 1/8/15 were all bearish and all had 20 days duration. Although, there were cases of such in the bullish market condition, cases such as 10/2/16 to 10/3/16 (30 days) and 23/12/15 to 20/1/16 (30 days) are amongst those days that are with same duration. Thus in a nutshell, the bitcoin exchange market is characterised more as been bullish than bearish.

Table 3A NUMBER OF THE TURNING POINTS AND THE EPISODES YEARLY

Year	Episodes	Turning Points	Year	Episodes	Turning Points
2014			2017		
Bull	163	7	Bull	232	6
Bear	104	7	Bear	64	6
2015			2018		
Bull	251	8	Bull	199	12
Bear	115	7	Bear	193	13
2016			2019		
Bull	354	10	Bull	5	1
Bear	64	10	Bear	20	1

Table 3B POOLED NUMBER OF TURNING POINTS AND EPISODES FROM 2014 TO 2019

STATE MARKET CONDITION	Episodes	Turning Points
Bear	44	560
Bull	44	1204

The above table 3B depicts that from 2014 to early 2019, there had been at least 560 episodes of 44 turning points for the bear market conditions and 1204 episodes of 44 turning points for the bull market conditions. Table 3B still depicts that the market condition is favourably characterized as been bullish rather than bearish.

Table 3A further explained via the years how the pooled values were achieved. In the year 2019, it could be seen that her turning points were only once (1) but that was as a result of availability of the table as at the time the research was done. The years with the highest episodes and turning points were years 2016 (for episodes of 354 for Bull) 2018 (for episodes of 193) and finally year 2018 (for turning points of 12 and 13 respectively for Bull and Bear). Thus, it simply implies that the market quickly returns to the bear form faster than to the bull except in the year 2015, when it was discovered that the market condition was in the bull form than in the bearish. There were also cases when both the market conditions maintained constant turning points meaning that the turning points were same (see years 2014, 2016, 2017 and 2019 respectively). Although there were more of constant turning points but there were serious disparities in their episodes. Finally, we can see that the least episodes were from the Bull (5) in 2019.

5. Conclusion and Recommendation

From the on-going analysis and interpretations on the Bitcoin exchange market, it could be seen that the transactions carried out in the market are done via the blockchain. These transactions could either be categorized as been bullish or bearish bearing in mind that the blockchain doesn't deal with intermediaries as seen in the supply chain. Thus with the application of the regime switching, this research paper endorses that the daily Bitcoin exchange data ranging from 2014 to 2019 are majorly categorized into two (2) states which are characterized by the bull and bear market conditions respectively. The states are categorized as been bull if it's a High to a High switching states and a low to a high switching states; then a bear, if it was from a high to a low and a low to a low switching states. This study also discovered the turning points and turning points dates of the market conditions, the duration, the episodes, the frequencies, the transition probabilities. From the study, it was discovered that the pooled episodes from 2014 to 2019 were more for the bull market conditions than for the bear market conditions with 1204 episodes for Bull, 560 for Bear with a constant turning points of 44. It was also discovered that the yearly episodes favour the bull more than the bear with a value of 354 although in the year 2018, with turning points of 13, it was discovered that the bear switches more. As regards duration, it was seen that from 16/7/2017 to 9/11/2017, the market conditions were bullish and not bearish with a duration value of 116 days which happens to be the highest in the series. The estimated values in this paper is viably important for investors and

investment practices. This paper can be stretched to include stability test, convergence of the market conditions as regards the two states and considerations on doing the same analysis done on the Bitstamp Bitcoin market on the different bitcoin markets.

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