DANA 4810
TEAM PROJECT

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Abstract

Bitcoin's breakthrough on the mainstream radar suggest that cryptocurrencies will gain adoption and real use in today's industry. This report is a historical price-data analysis of Bictoin. In the present project we propose to explore three aspects of the Bitcoin market. First, the long-term price prediction can be made using non-linear relationships with the stock-to-flow variable. Secondly, features like price velocity, acceleration and Pi-cycle crossing are indicators of high price appreciation periods prior to market corrections or market crashes but they are not indicators of the market price. Lastly, we explore the correlation of Bitcoin with other markets such as Ehtereum, Gold, and most importantly the S&P500.

1 Objectives

Predict bitcoin value from its intrinsic characteristic such as SF, PI cycle etc. and extrinsic macro market situation such as S&P500 index, index and the value of gold etc., as well as the second largest cryptocurrency: Ethereum.

Prediction of when a major market correction is likely to occur.

2 Introduction

2.1 Bitcoin Stock-to-Flow and Blockchain

Since the early days of humanity the concept of exchange of goods between people has certainly driven the development of more organized and healthy societies. From the early days of bartering to the modern days of online banking the most fundamental cornerstone is the narrative of agreeing that the base mean of exchange is something of value for everybody. This has been the situation in the past, for example Aztecs and Mayans used to barter using cacao seeds, Egyptians used gold and now we use fiat currencies [9]. Ever since the modern world economy was developed we came up with the implementation of institutions that act as regulators and coordinate with banks to provide services to people [7]. Removing the dependency on external organizations is the problem that Bitcoin was trying to solve.

The fundamental question is: Can we, as a world wide population, interact economically with each other without the need of middlemen or third parties? The major challenges to this are two folded [8]. 1) A platform on which a record-keeping book of financial balances of all users is needed. 2) The protocol which underlies the functionality of the system should be trusted and incorruptible. We discuss both issues briefly below.

The emergence of the internet provided better record-keeping platforms than paper. As opposed to traditional databases like SQL, like banks use, Bitcoin was built on blockchain. One of its main characteristics is that it allows complete transparency of its information because all activity occurring in the blockchain is recorded and is accessible to anyone. Furthermore, there is no central authority in ownership of Bitcoin's blockchain therefore it is immutable. This means that all past and future data is stored as long as the blockchain is active and can not be changed. This satisfies the first point.

Before mentioning the second solution we should have a brief understanding that a blockchain is nothing more than a protocol that runs on different computers anywhere in the world and have different users that do not need to know or agree with each other to be part of the network. This is called a decentralized system without one central authority in control, but all users have the control. Another major feature of the blockchain is that the rules for verification before the infor-

mation is approved and appended to the chain has to be verified by all computers running the network.

2.2 Bitcoin as a Scarce Asset

The main characteristics that are needed for an asset to be considered hard money are: 1) Scarce, 2) Fungible and 3) Divisible [10]. The first requirement refers to a limited supply. This can translate in if the asset is hard to produce or obtain by industrial means. As is the case with scarce precious metals or diamonds, due to their scarcity their value is preserved if not turned more valuable over time. Bitcoin has the novelty of being the scarcest asset in human history because its supply is hard coded and fixed. With respect to the second point, for an asset to be fungible it has to verify that there is more of it to be tradeable. Basically it can be verified that the value of one Bitcoin in particular is exactly the same as the value as another Bitcoin. Lastly, cryptocurrencies are extremly divisible, since they are digital decimal numbers. As an example of this, Bitcoin's smallest unit is called a Satoshi and it is equivalent to 1×10^{-8}BTC.

Among all of the characteristics of the first ever cryptocurrency, the one that started gaining a lot of attention is its scarcity. Throughout history humans always had the motivation of investing more technological and industrial effort in finding more of a scarce asset. Such is the case of the huge industrial market behind the extraction of diamonds or gold. As a consequence the supply of this elements is not zero. In contrast, Bitcoin is the very first real scarce asset, because its fixed supply is coded in an immutable way and set to a maximum supply of 21 million coins. It can be said that Bitcoin is the first engineered money, designed to have all the characteristics of hard money.

Latter in this manuscript, in Section 3.2 we will see more of the effects of Bitcoin's scarcity on its historical price and potentially long term price.

2.3 Halving Cycles

Halving is referring to the mechanism that the subsidy (Block reward) of mining a new block of bitcoin and transacting it into blockchain is reduced by half for every 210,00 blocks of bitcoin mined. This "halving" mechanism was pre-programmed into the Bitcoin protocol. This event occurs approximately once every 4 year based

on the estimation that for about 10 minutes, miners add a new block of transactions to the bitcoin blockchain.

The first block of Bitcoin blockchain was mined on 3 January 2009 and the initial subsidy was set at 50 BTC in order to incentivize participation in mining. The first halving took place on 28 November 2012 when block 210,000 was mined and the subsidy was cut in half to 25 BTC. Thus far, three halvings have already taken place and the most recent Bitcoin halving happened on 11 May 2020, when block 630,000 was mined. The current Block reward is cut to 6.25 BTC. The next halving is expected to be around 2024 and the Block reward will drop to 3.125 BTC.

There is an upper limit of 21 million of Bitcoin set in the Bitcoin protocol. The maximum number of Bitcoin to be circulated in the market will only be 21 million at the end. By that time, the block reward will drop to almost zero BTC. It is believed that the price of Bitcoin can be kept stable and deflationary by reducing the new block supply through the design of halving.

3 Methods

3.1 Datasets

For the purposes of this project we have queried five datasets. the first dataset is for the Bicoin price in USD. The second dataset was obtained by querying number of blocks produced directly from the Bitcoin blockchain [1], to obtain information about its stock and supply. The third dataset corresponds to the S&P 500 stock market, obtained from [6]. The fourth dataset corresponds to the second largest cryptocurrency: Ethereum, and was obtained through "Crypto-data download" [3] and finally the last dataset corresponds to Gold.

For our first dataset only (Bitcoin price). There were multiple data sources visited. We have combined two datasets. The most complete dataset up to minute data is provided by the crytocurrency exchange Bitstamp [2], and the API-extracted file can be found in kaggle [5]. However this dataset lacks the first months of 2021, which can not be ignored due to significant price action. Therefore, we complement the data with Yahoo!-finance dataset [4]. Ultimately with the sets combined we were able to have historical data from January 2012 to February 2021.

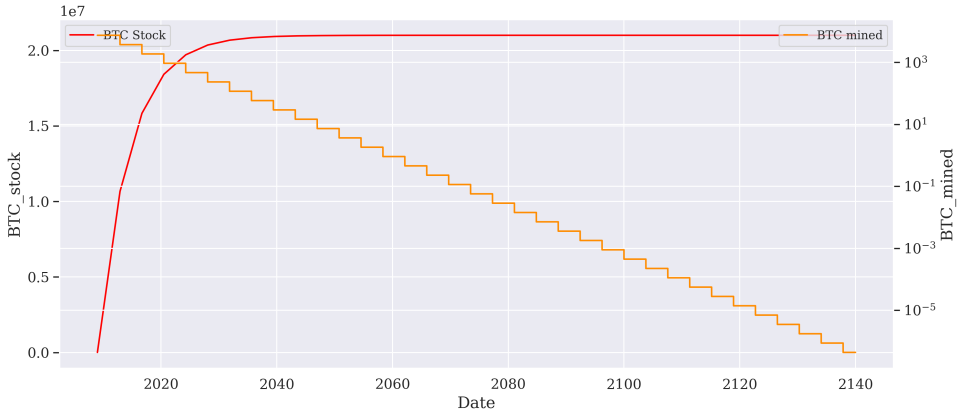

Figure 1: Nature of the scarcity of Bitcoin. In red we can see the Bitcoin daily stock in circulation. The Bitcoin daily supply is shown in orange, we can see the stairs-like character due to halvings.

3.2 Scarcity and Stock-to-Flow

Genesis block produced in "2009-3-1" and thereafter there is a halving event every four years where the amount of Bitcoins being mined is cut by one half its previous cycle. Bitcoin maximum supply is 21 million and there is no chance in extracting more. The last Bitcoin will be mined in "2140".

3.3 π-cycle Crossing

We compute the π-cycle based on a long and short moving averages (MAs). The condition for the choice of the daily range for the MAs a one combination which ratio approximates to π, this is

$$\frac{\mathrm{MA}^{*}_{\mathrm{long}}}{\mathrm{MA}_{\mathrm{short}}} = \frac{\mathrm{MA}^{*}(x, \tau = 350)}{\mathrm{MA}(x, \tau = 111)} \approx \pi$$

$$\mathrm{MA}(x, \tau) = (\mathrm{MA}_1(x_1, \tau),\ \mathrm{MA}_2(x_2, \tau),\ \ldots,\ \mathrm{MA}_n(x_n, \tau))$$

where MA is the simple moving average function for the price x and price lag τ. The MA at the i-th time point is computed as

Table 1: Stock-to-Flow fitted to the Bitcoin price..

$$\mathrm{MA}_i(x,\tau) = \frac{1}{\tau}\sum_{k=-\tau}^{i} x_i$$

From Fig. 2, we can see the robust reliability of the π-cycle indicator for signaling market corrections. Every time the short MA (red line) crosses the long MA (green line) from below to over it, a price drop was about to be triggered. Moreover, whenever the distance between the two MAs gets short and positively steep over time, the price went into parabolic moves. At the latest price from the data (February 2021) the π-cycle is close to suffer a crossing, which based on price history this could translate into a severe correction.

3.4 Analysis with other markets

To further analyze whether the Bitcoin price is correlated with other markets we include in this section the study of S&P500. The argument behind why these markets in particular can be correlated is because when there is a big retail investment pressure it typically is translated into the S&P500 stock index. Since, the Bitcoin Market Cap has overcome the 1 trillion USD, now it is gaining a lot of retail hands as well. Therefore we can expect a proportional trading pressure in Bitcoin correlated with S&P500.

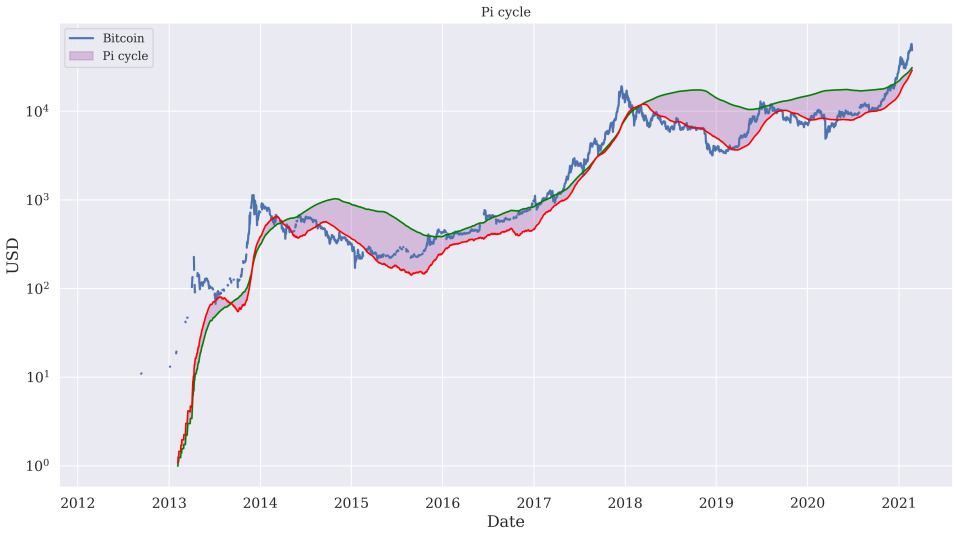

Figure 2: Pi-cycle overlayed on the bitcoin price. Long MA is shown in green whereas the short MA is in red. We can observe that crossings indicate up to three days in advance a major market pullback.

4 Timeline

The timeline for the project is shown below

Feb 26 - Mar 01	**Mar 01 - Mar 08**
>Construct the dataset >Read about bitcoin >Construct indicators from data	>Source the data >Data exploration Get Monica's approval
Mar 08 - Mar 15	**Mar 15 - Mar 22**
>Write the report >Build price models	>Prepare the presentation > Discuss further perspectives on the topic

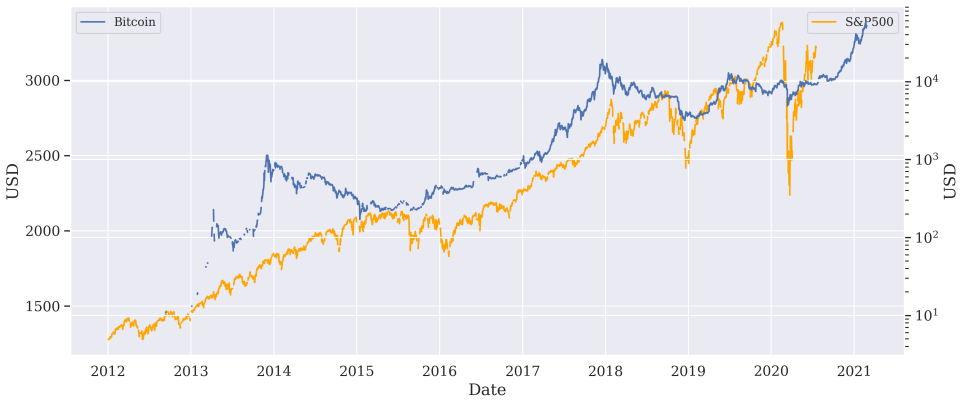

Figure 3: Comparison of the Bitcoin price with S&P500 stock in USD, we can visually see that major market corrections coincide for both assets.

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