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An Analysis of Seasonal Tokens

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Abstract

Bitcoin's money supply algorithm was programmed so that the number of new bitcoins generated decreases geometrically, with a 50% reduction approximately every four years. Because Bitcoin's money supply algorithm is static and long-term deflationary, BTC is volatile and Bitcoin failed as a payment system. However, because it is long-term deflationary, BTC is arguably a good, albeit volatile, long-term store of value, and can act as an effective, but unregulated, diversifier within a portfolio. Thus far, contrary to expectations vis-à-vis market efficiency, after each Bitcoin halving event the price of BTC has tended to increase for about a year, before decreasing. This observation motivated the creation of Seasonal Tokens. The four tokens—Spring, Summer, Autumn and Winter—each in turn have their money supply halved every three years, with one token halving every nine months. Thus far, again in apparent contradiction to the efficient-market hypothesis, the relative price of a token has started to increase three weeks before its halving, and continued to increase linearly for another four months.

Keywords: *Seasonal tokens, Cryptocurrency, Bitcoin, Halving*

1. Introduction

Bitcoin's money supply algorithm was programmed so that the number of new bitcoins generated decreases geometrically, with a 50% reduction every 210,000 blocks, approximately every four years, reaching zero around the year 2140. Because Bitcoin's money supply algorithm is static and long-term deflationary, BTC is volatile. Because BTC is volatile and long-term deflationary, Bitcoin failed as a payment system. However, because it is long-term deflationary, BTC is arguably a good, albeit volatile, long-term store of value, and can act as an effective—but unregulated—diversifier within a portfolio. Thus far, contrary to expectations vis-à-vis market efficiency, after each Bitcoin halving event the price of BTC has tended to increase for about a year, before decreasing. This observation motivated the creation of Seasonal Tokens (seasonaltokens, 2021).[1] The tokens were launched in September 2021, and were designed from the outset to be an investment. There are four tokens—Spring, Summer, Autumn and Winter—that, each in turn, have their money supply halved at regular intervals. In practice, thus far and at odds with the efficient-market hypothesis, the relative price of a token starts to increase three weeks before its halving, and continues to increase linearly for another four months.

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[1] https://seasonaltokens.org

The following sections consider the theory of value and price, Bitcoin halvings, and an analysis of Seasonal Tokens.

2. Theory of Value and Price

The *intrinsic value* of something is an objective estimate of what it 'should' be worth (for example the value of a security according to discounted cash flow analysis), as opposed to its current market price. The *cost-of-production theory of value*, due to Adam Smith, is the theory that the value of a good is determined by the sum of the cost of the resources that went into producing it. It works best as a normative theory, rather than a positive theory: it is often not an accurate description of reality. Among modern mainstream economists it is considered to be superseded by the marginal utility approach.

Whereas in a market, the equilibrium *price* of a good is reached when the quantity demanded (at that price) equals the quantity supplied (at that price), where supply is a non-decreasing function of price and demand is a non-increasing function of price. A good's *price elasticity of supply* is a measure of how sensitive the quantity supplied is to its price. Whilst a good's *price elasticity of demand* is a measure of how sensitive the quantity demanded is to its price.

A market is said to be *efficient* with respect to an information set if the price 'fully reflects' that information set (Fama, 1970), i.e., if the price would be unaffected by revealing the information set to all market participants (Malkiel, 1992). If the information set includes only the history of prices, the concept is known as *weak-form efficiency*. If a market is weak-form efficient, the discounted price of the asset follows a martingale under a risk-neutral measure and it will not be possible to make abnormal returns using price history alone. The efficient-market hypothesis (EMH) asserts that financial markets are efficient. Note that it is not necessary for all market participants to be rational for markets to be efficient.

Market value and market price are equal only under conditions of market efficiency, equilibrium and rational expectations.

Due to changes in the climate, the supply and / or demand of some commodities is *seasonal*. If the commodities are durable and there is no cost of storage, traders would buy when the price was low, and sell when the price was high, thus eroding any seasonality in the price. The market would be efficient, and, from the above, approximate a martingale. However, if the commodities are perishable and / or there is a cost of storage, buying low and selling high may not make economic sense, so the seasonality in the price would persist.

3. Bitcoin

The goal of Bitcoin's pseudonymous creator, Satoshi Nakamoto, was to enable trusted electronic transfer of value between peers without recourse to a trusted third party by building a practical decentralized electronic payment system (Nakamoto, 2008). This involved solving the double-spending problem and dealing with Sybil attacks. As a Sybil control mechanism Satoshi employed a *proof-of-work* protocol. In order to validate transactions a Bitcoin 'miner' must gather together recent transactions into a 'block' and calculate a partial hash inversion, which takes significant CPU power, to prove that work was done. The first miner to successfully calculate the partial hash inversion is rewarded with, in addition to transaction fees, a block reward: newly created bitcoins.[2] The Bitcoin protocol thus introduces money into the economy via this mechanism for *money creation*. It also solves the problem of *seigniorage*, when there is a difference between the value of money and the cost of producing and distributing it. With a digital currency, seigniorage is inevitable as there is no significant cost to creating new money, so someone has to profit. However, for a new currency to be generally accepted within a community the issuance of currency should be deemed to be 'fair'. Especially as when money is created, it depletes the market value and purchasing power of the existing currency. As Bitcoin mining is open to anyone, and miners invest time and money in mining and those who are rewarded for solving a block are decided at random using a transparent algorithm, such a protocol is deemed to be fair. The Bitcoin protocol combines a Sybil control mechanism (proof of work), a consensus protocol (select the chain with the greatest amount of proof of work), a money creation / issuance algorithm that simultaneously solves the problem of seigniorage and incentivises the security of the currency (miners are rewarded with newly created bitcoins), an incentive to buy the currency (deflation) and a mechanism to deal with Moore's Law (mining difficulty is automatically adjusted).

[2] Note that the block rewards do not affect waiting times or transaction fees (Easley *et al.*, 2019), and are not a tax on Bitcoin holders (Schilling and Uhlig, 2019).

The total amount of monetary assets available in an economy at a specific time is known as the *money supply*. The path of monetary supply of new bitcoins is programmed into Bitcoin's source code. Bitcoin implements a controlled finite money supply. The Bitcoin protocol was designed such that the number of new bitcoins generated is set to decrease geometrically, with a 50% reduction approximately every four years. The number of bitcoins in existence, the monetary base, will never exceed 20,999,999.9769. In the early stages the monetary base was expanding much more rapidly than the number of users, but the long-term trend is towards both variables reaching zero growth, so the growth of money supply per capita tends towards zero. This creates anticipated short-term inflation but long-term deflation. So Bitcoin is ultimately deflationary.

Bitcoin failed as a payment system because of its static and deflationary money supply algorithm (most macroeconomists now favor a low but still positive rate of inflation (Hummel, 2007). However, Bitcoin's monetary policy, in terms of its inflation rate, was optimal in terms of maximising market capitalisation (Pagnotta and Buraschi, 2018). Because it is long-term deflationary, it turned out to be an effective—but unregulated—diversifier within a portfolio (Almeida and Gonçalves, 2023).

Investments may be conceptualized as consisting of neither, one or both of two factors: growth and income. The *growth* aspect is the difference between the price at which an investment is sold, and the price at which it was purchased. Over the long term, we expect stock and property prices to increase, as the economy grows. This is not the case for, say, bonds, gold or GBP/USD, which have no long-term trend. The *income* aspect involves an endogenous periodic positive return. For example, a bond pays interest, shareholders receive dividends and landlords receive rent. Whilst gold or GBP/USD do not generate income. Cryptocurrencies are unique in the sense that they are subject to growth without income. Cryptocurrencies, therefore, should be treated as a new asset class. Note that the lack of income makes Bitcoin a *zero-sum game*. In terms of realised profit and loss, investors, in aggregate, lose money to miners and exchanges. However, because Bitcoin has a long-term expectation of increasing value, early adopters can expect to profit, although volatility is inevitable (there is always a trade-off between (low) risk and (high) return).

Authors have variously argued that the intrinsic value of Bitcoin is zero (Cheah and Fry, 2015), the cost of production (Hayes, 2015; 2017), depends on the value consumers put on the services of a decentralized financial network (censorship resistance and trustlessness) (Pagnotta and Buraschi, 2018) or depends upon self-fulfilling beliefs (Garratt and Wallace, 2018). Bitcoin has become increasingly efficient over time (Martín *et al.*, 2021), and follows a martingale (Schilling and Uhlig, 2019). Bitcoin's money supply algorithm is static, but the demand can fluctuate significantly. This creates an unstable economy, and volatility. As discussed, Bitcoin's money supply algorithm is programmed so that it is long-term deflationary. Deflation motivates hoarding, and subsequent cashing in, both of which can involve positive feedback and nonlinear effects. Again, this creates volatility. Bitcoin's price is unstable (Iwamura *et al.*, 2019). According to Pagnotta and Buraschi (2018), even the equilibrium price (without speculators) is nonlinear, and exogenous shocks to fundamentals can initiate price–hashrate spirals. Because there is no central bank to manage the stability of the price, and arguably no intrinsic value, there are few constraints on the instability of the price of Bitcoin. Ultimately, investor sentiment drives the Bitcoin price.

Thus far, there have been three *Bitcoin halvings*. The block reward halved on November 28, 2012 from 50 to 25 bitcoins, on July 9, 2016 from 25 to 12.5 bitcoins, and on May 11, 2020 from 12.5 to 6.25 bitcoins. Within each era, nominal supply growth decreases slightly, since the total supply increases but the reward stays constant. The reduction in the rate of supply on the halving date is not hugely significant in the short-term, but over a year or so makes a significant difference to the rate of supply. The nominal supply of bitcoins is perfectly exogenous and predictable, and essentially invariant to anything except time. The halvings are deterministic, so do not come as a surprise to the market, so should be priced in. Although some market participants could have short time horizons. Adam Hayes built a cost-of-production model for Bitcoin (Hayes, 2015; 2017) and argued that the cost-of-production price may represent a theoretical value around which the market price tends to gravitate. Empirical data from June 2013 to April 2018 showed that the model worked well in practice (although naturally it does not forecast bubbles) (Hayes, 2019). The model implies that when the Bitcoin block reward halves, the cost of production will immediately increase, and the price of Bitcoin should follow (Fantazzini and Kolodin, 2020). Pagnotta and Buraschi (2018) argued that the cost of mining a Bitcoin is a constant proportion of the price. Theoretical models developed by Pagnotta and Buraschi (2018); Pagnotta (2022) determined that the reward halving could lead to a price increase or decrease, depending on other variables. Whereas Marthinsen and Gordon (2022) argued that the cost of mining a Bitcoin has virtually no impact on its price (changes in Bitcoin's mining cost follow, and therefore cannot cause, changes in Bitcoin's

price). In practice, after each Bitcoin halving event the price has tended to increase for about a year (see Meynkhard (2019) and Figure 1). The rate of supply suddenly decreases, and the rate of demand suddenly decreases too, then the demand gradually increases. There was media coverage in advance of halving events, so informed investors would have been aware. Market participants were likely hesitant before the first halving, in case there were any unanticipated issues. Then once the date passed without any issues, investors were relieved so happy to buy, creating a bull market. Then a bull market following each halving date became a self-fulfilling prophecy. If market participants believe that the price will go up, they will buy, which in turn causes the price to go up. Even if the market price followed a random walk in the past, because market participants are human, and subject to behavioural biases and identify patterns and cycles, even in random data (e.g., the constellations in the sky), a subsequent self-fulfilling prophecy is still possible. Alternatively, in the future, in anticipation of the price rise, buyers could increasingly try to buy before other buyers, leading to an increasingly early price rise and ultimately the erosion of the predictable pattern. This would be consistent with the efficient-market hypothesis.

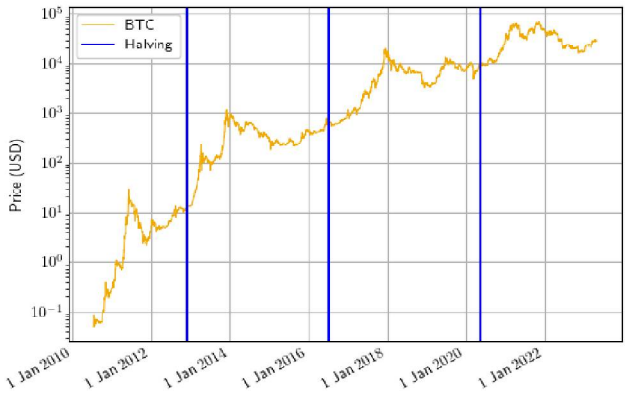

Figure 1: Price of BTC

4. Seasonal Tokens

Seasonal Tokens are ERC-20 tokens issued on the Ethereum blockchain. They are mined using proof-of-work, like Bitcoin. There was no premining (the founders were not rewarded). The initial reward amounts, produced every 10 minutes, on average, were 168 Spring, 140 Summer, 120 Autumn and 105 Winter tokens. Five minutes of mining Spring, six minutes of mining Summer, seven minutes of mining Autumn and eight minutes of mining Winter all produced the same number of tokens. So the amount of time needed to produce the four different tokens by mining had the ratio 5:6:7:8. For each token, the rewards are halved every three years. Once every nine months, the rate of production of one of the four tokens is halved. Thus far, there have been two halvings. On June 6, 2022 there was a Spring halving. The ratio of the times needed to mine the tokens changed to 10:6:7:8. On March 6, 2023 there was a Summer halving. The ratio of the times needed to mine the tokens changed to 10:12:7:8. When the size of the reward drops below the minimum representable quantity, no more tokens will be mined, which will happen in approximately 200 years. Each token will have a total supply of approximately 33,112,800 tokens. Traders can provide liquidity via Uniswap (a decentralized cryptocurrency exchange). Four months after a halving, the payout for liquidity provision for the token almost doubles.

Figure 2 shows the historical price charts for Seasonal Tokens and Ether (Ethereum's native cryptocurrency). The relative price of a token starts to increase three weeks before the halving, and continues to increase linearly for another four months (Figure 3). Whilst the relative prices of the other three tokens decrease one by one in turn. At a Spring halving, traders sell Summer, Autumn and then Winter tokens in exchange for Spring tokens. Traders do this gradually over time, so that the market does not move against them. Four months after the

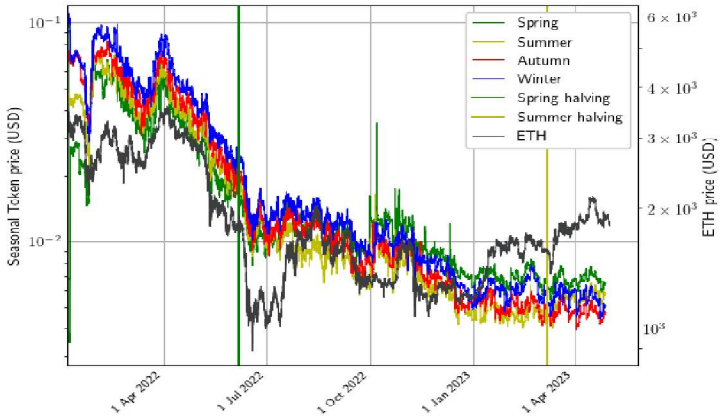

Figure 2: The Prices of Seasonal Tokens, Plus Ether

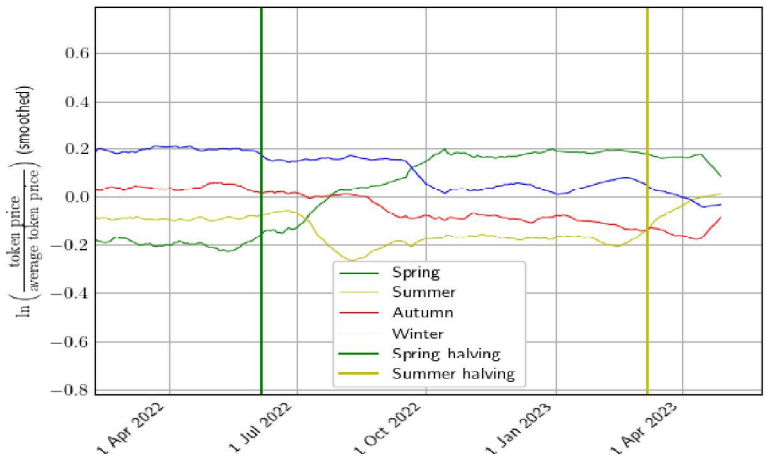

Figure 3: Smoothed Relative Prices of Seasonal Tokens

Spring halving, the payout for liquidity provision for Spring almost doubles, and the market equilibrium across the four tokens is restored.

5. Conclusion

Bitcoin's money supply algorithm was programmed so that the number of new bitcoins generated decreases geometrically, with a 50% reduction approximately every four years. However, because it is long-term deflationary, BTC is arguably a good, albeit volatile, long-term store of value, and can act as an effective—but unregulated—diversifier within a portfolio. Thus far, contrary to expectations vis-à-vis market efficiency, after each Bitcoin halving event the price of BTC has tended to increase for about a year, before decreasing. This observation motivated the creation of Seasonal Tokens. The four tokens each have their money supply halved, in turn, every three years. Once every nine months, the rate of production of one of the four tokens is halved. In

practice, thus far, the relative price of a token starts to increase three weeks before the halving, and continues to increase linearly for another four months. Whilst the relative prices of the other three tokens decrease one by one in turn. This pattern appears to contradict the efficient-market hypothesis.

Conflict of Interest

The author is independent and owns no cryptocurrency, but was paid by the creator of Seasonal Tokens.

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