



Bitcoin Cycles: The Macroeconomic Factor Model

Executive Summary

- **The short-term macroeconomic cycle offers the best explanation for Bitcoin boom and bust cycles.** Two factors are considered: the availability of capital seeking risk, and the purchasing power of that capital.
- **Of the two factors, interest rates provide an early signal by as much as 18 months.** Lower interest rates simultaneously increase the amount of capital for investment into Bitcoin, while increasing the present value of existing Bitcoin vis-à-vis its adoption curve.
- **The U.S. dollar can serve as a concurrent indicator for Bitcoin cycle price tops.** The dollar-Bitcoin relationship mimics the currency use aspect of Bitcoin. A high demand for dollars necessarily means low demand for other currencies, including Bitcoin.
- **Given that credit cycles repeat, and Bitcoin's short-term supply is fixed, a future boom is nearly certain.** Further, the magnitude of that boom is likely driven by several factors, and it is not a foregone conclusion that each cycle must peak lower than the previous.

Background

Bitcoin's price history has exhibited cycles of boom and bust since 2010. Explanations have included "halvings", fraudulent manipulation, speculative mania (aka "FOMO"), and macroeconomic factors.

Flaws in Halving Theory

Bitcoin halvings are events that occur approximately every four years, or after every 210,000 blocks are mined on the Bitcoin blockchain. During a halving, the reward that miners receive for validating and adding new transactions to the blockchain is cut in half. By reducing the number of new Bitcoins created through mining, halvings effectively slow down the rate at which new Bitcoins enter circulation. If demand is

constant or increasing, this reduction in supply growth may manifest in price increases.

However, if the market already anticipates the halving and prices it in well in advance, the event should not lead to a significant price increase. Where such increases have occurred, the price impacts attributed to Bitcoin halvings have not been consistent or predictable around the actual halving dates. A quantitative study by Strix Leviathan researchers "found no evidence that cryptocurrencies experiencing a halving event 'outperform the broader market in the months leading up to, and following, a reduction in miner rewards.'" [Micky, 2019]. In fact, such halving explanations fail will all other cryptocurrencies except Bitcoin, despite different halving schedules and reward payouts.

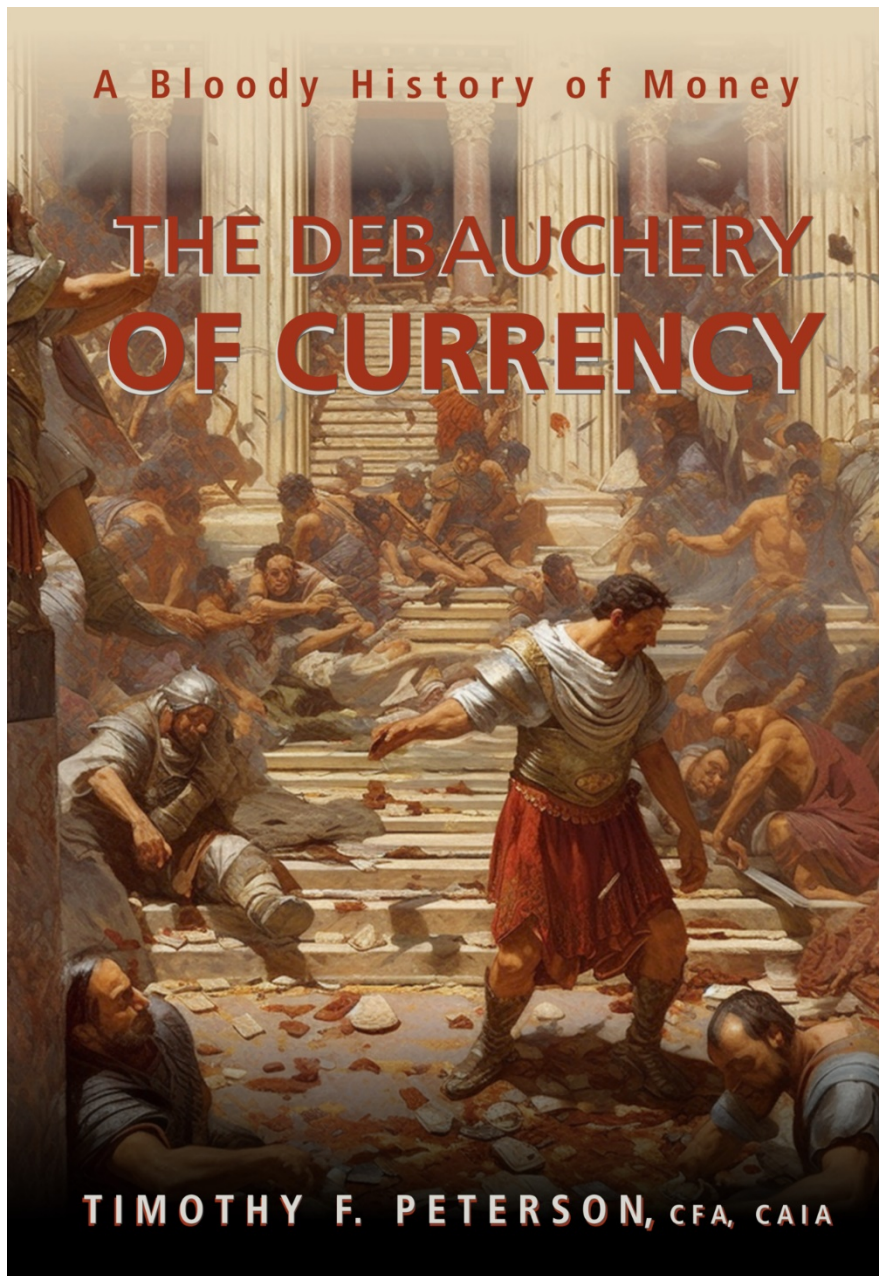
Fraudulent Manipulation

Peterson [2021] found forensic evidence of price manipulation in several periods, primarily during cycle peaks. That research concluded "with near 100% confidence that bitcoin's price has been fraudulently manipulated at some point in its lifespan since 2010," with specific instances identified in 2013, 2017, and 2019.

Speculative Mania

Speculative mania may have been present in Bitcoin during these cycles. However, quantifying a psychological phenomenon is difficult. Speculative mania often involves emotional and psychological factors that are difficult to quantify objectively. It's challenging to measure the extent to which market participants are driven by hype, fear of missing out (FOMO), or irrational exuberance. The underlying "mania" may in fact be driven by a combination of social factors, including media coverage, social media trends, celebrity endorsements, and market sentiment. These factors are difficult to quantify and may not have consistent patterns.

Additionally, the underlying causes may be grounded in genuine economics. Because such factors may be



A TEXTBOOK LIKE NO OTHER

"The Debauchery of Currency: A Bloody History of Money" is an unconventional textbook that takes you on a shocking journey through the tumultuous history of money. This captivating book uncovers the consequences of poor monetary economics and explains the fundamental concepts of money itself. It sheds light on the nature and value of money, explaining why gold and bitcoin serve as protection against the ravaging effects of currency debasement.

In this book, you will learn how inflation and debt have destroyed societies through war and bloodshed. It explains the web of trust, scarcity, and societal consensus underlying the worth of money. From ancient civilizations to modern economies, "The Debauchery of Currency" provides insight into the causes of the violent cycles of wealth creation and destruction.

With meticulously crafted content, this book offers valuable insights into how the turbulent past of money led to Bitcoin being called "digital gold." It examines how Bitcoin aligns with the principles of good money established throughout history. This fresh perspective on the evolving finance landscape helps you understand why Bitcoin resonates as a groundbreaking form of currency.

"The Debauchery of Currency" is not just informative—it is a thought-provoking journey that brings history to life. Through engaging examples and a comprehensive glossary, it serves as an invaluable resource for both seasoned investors and beginners. This concise guide breaks down complex concepts into easily digestible chapters, ensuring accessibility and engagement for all readers.



unobservable or not well understood, “bubbles” is commonly attributed, often erroneously, to the cause.

It was certainly the case that Bitcoin’s price was manipulated by trading bots on the Mt. Gox exchange in 2013; the operator of the exchange admitted it in court in Japan. And it is certainly true that perfectly inelastic supply (meaning supply does not adjust to price or demand) can cause dramatic price swings. But there are few instances beyond Bitcoin where short-term supply is truly inelastic. Hence most economists have no experience assessing the price behavior of such goods.

Macroeconomic Factors

The remainder of this note will focus on the macroeconomic factors that affect Bitcoin’s price cycles. There has been little research on this topic to date.

Methodology

Data was sourced from coinmetrics.io (Bitcoin price) and the Federal Reserve Economic Database (interest rates and dollar index values). Monthly data is used commencing July 2010 through September 2023.

Adoption Curve Value and Cycles

The baseline metric is deviation from adoption curve value. Bitcoin’s adoption curve has been modeled using techniques in prior research cited in the References section. The dataset is Cane Island’s proprietary adoption curve value.

When price is plotted relative to this trendline (P to ACE), the cycles are revealed. These are calculated as lognormal percentages.

$$PACE = \ln(\text{Price}/ACE)$$

High Yield Index

A High Yield Total Return Index is calculated using daily interest rate data from the FRED *ICE BofA US High Yield Index Effective Yield* (BAMLH0A0HYM2EY). The trendline and its deviation (*PHY*) are calculated identical to *PACE* above.

Dollar Index

A High Yield Total Return Index is calculated using daily interest rate data from the FRED *Nominal Broad U.S. Dollar Index* (DTWEXBGS). The trendline and its deviation (*PUSD*) are calculated identical to *PACE* above.

Two-Factor Regression

A simple constrained (intercept = 0) two-factor regression is performed such that

$$PACE = \beta_1 \times PHY + \beta_2 \times PUSD + \varepsilon$$

The interim results are then scaled to fit a nonlinear relationship associated with the price behavior of a supply-constrained asset.

Model and Discussion

The model components represent two primary macroeconomic conditions. The high yield rate proxies the availability of capital. Low interest rates allow for easier borrowing and easy money creation. The Dollar Index proxies the purchasing power of that capital. These two factors tend to move opposite to each other: when money is relatively easy to obtain its value is worth relatively less, and vice-versa.

High Yield Rates

Interest rates are influenced by macroeconomic factors such as central bank policies, inflation expectations, and economic growth. These factors can affect investor sentiment and risk appetite, which in turn influence the demand for and pricing of various assets, including Bitcoin.

There is an inverse relationship between interest rates and asset prices. Higher-risk assets, such as equities and junk bonds, are associated with greater uncertainty and volatility. All assets are interest rate-sensitive to some degree. Interest rates play a fundamental role in determining the present value of a future amount. Investors generally require a higher rate of return (discount rate) to compensate for the

additional risk they take on when investing in these assets. This is known as the risk premium.

Bitcoin’s price is influenced by changes in interest rates, both directly and indirectly. Indirectly, when interest rates rise, traditional fixed-income investments like bonds may become more attractive to investors. (This can be seen as competing with the demand for Bitcoin. In fact, the demand for Bitcoin doesn’t decline. The adoption rate simply slows down).

Directly, Bitcoin’s future network value is discounted using a higher rate, resulting in a lower present value. Bitcoin’s future value is a function of the S-curve associated with the diffusion of innovations, Metcalfe’s law, and transaction volume. The price of Bitcoin should reflect that future value, discounted using an appropriate rate or risk premium.

High yield investments, often referred to as "junk bonds" or "high-yield bonds," typically offer higher interest rates or yields to compensate investors for the higher level of risk associated with these assets. Bitcoin also carries a relatively high level of risk. Comparing Bitcoin to high yield bonds can highlight the risk-return tradeoff investors face when choosing among assets along the risk spectrum. Among traditional investments, the high yield bond is perhaps the most sensitive to investor risk tolerances.

However, because even high yield bonds provide interest payments whereas Bitcoin does not, the interest sensitivities can be mismatched. To offset this, the index we created assumes a 10-year bullet bond with no interest coupon. This better simulates a risk-sensitive, long-term asset with no cash flows, comparable to Bitcoin.

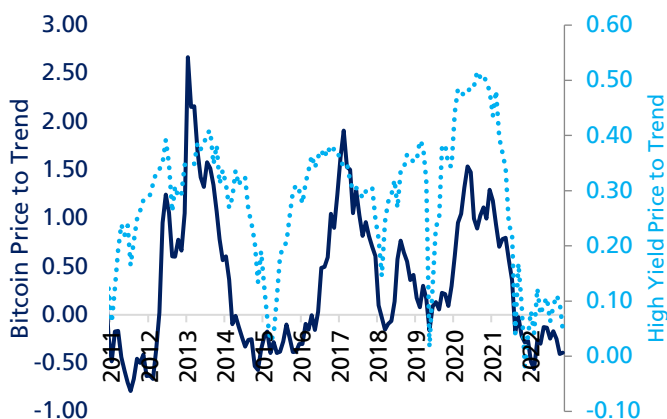
US Dollar Index

The U.S. Dollar Index, known as DXY, is a widely recognized measure of the U.S. dollar's value against a basket of major world currencies. It provides insights into the dollar's relative strength or weakness in international currency markets. The index is primarily composed of six major currencies: the Euro (EUR), Japanese Yen (JPY), British Pound (GBP), Canadian Dollar (CAD), Swedish Krona (SEK), and Swiss Franc (CHF). These currencies represent the United States' major trading partners, and their weightings in the index reflect the significance of their economic relationships.

The use of the Dollar Index is relevant because a large portion of Bitcoin trading is conducted in U.S. dollars [deBest, 2023]. Without adjusting for purchasing power parity, the U.S. has the most crypto owners at roughly 13% of the population (or 46 million), as of 2022. Many 2021 surveys suggest at least 16% of Americans traded crypto. The U.S. was the only industrialized country in the top 10 of Chainalysis' 2022 Global Crypto Adoption Index.

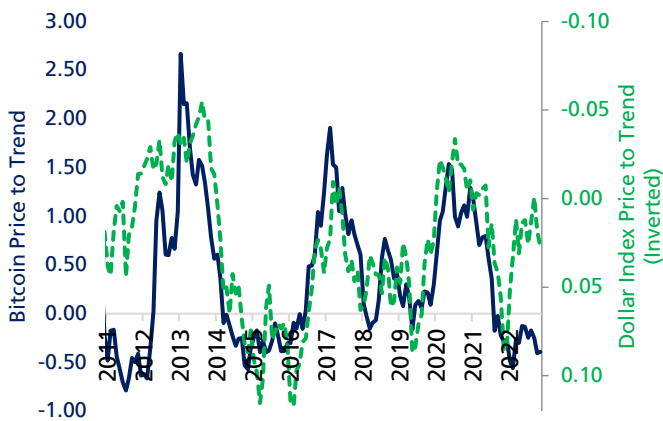
Bitcoin has been used as a currency of crisis in various political and economic contexts due to its unique properties and capabilities. In this regard, it competes with gold and dollars. Bitcoin adoption tends to be higher in countries that experience crisis conditions or perceived political uncertainty. Examples include high inflationary environments in Venezuela, Turkey, Argentina; banking restrictions in Iran, Cyprus, and Nigeria; political change such as the UK (Brexit), and El Salvador; and financial repression through zero-interest rate policies (Japan).

FIGURE 1
Bitcoin and High Yield Price to Trend



Bitcoin also serves as a fast conduit for global money transfers, as was the case with the invasion of Ukraine.

FIGURE 1
Bitcoin and Dollar Index Price to Trend



There is some assertion that Bitcoin is used to circumvent conventional dollar networks, economic sanctions, or law enforcement. However, on-chain metrics as well as several studies find such activity is negligible when compared to both the dollar and Bitcoin’s overall transaction volume.

The US Dollar and High Yield Relationship

One of the primary drivers of the relationship between the U.S. Dollar Index and a High Yield Index is the difference in interest rates between the U.S. and other countries. Higher interest rates in the U.S. relative to other nations make U.S. assets more attractive to investors seeking yield. When U.S. interest rates rise (or are higher compared to other countries), it attracts foreign capital seeking higher returns. Investors may move their funds into U.S. assets, including U.S. Treasuries and High Yield bonds, to take advantage of the yield differentials.

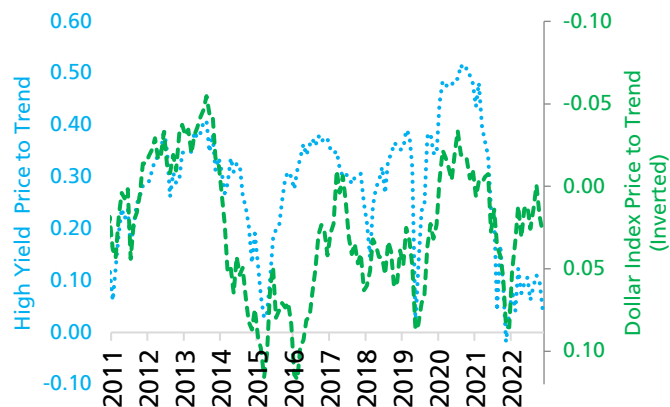
The increased demand for U.S. assets leads to an appreciation of the U.S. dollar as foreign investors need to exchange their currencies for dollars to invest in U.S. assets.

Further, when investors are in a "risk-on" mode, they are more willing to invest in higher-yielding and riskier

assets, such as high yield bonds. In such periods, demand for high yield bonds increases, and their prices rise, leading to lower yields (bond prices and yields move inversely). This reflects a positive sentiment in financial markets. Conversely, during "risk-off" periods, investors seek safety and liquidity, often favoring the U.S. dollar and U.S. Treasuries. This increased demand for the dollar can lead to a stronger U.S. Dollar Index. Hence there is an inverse relationship between the High Yield Index and the U.S. Dollar Index.

Similarly, there is positive expected relationship between Bitcoin and High Yield, and an inverse relationship between Bitcoin and the U.S. dollar. The latter should be self-evident, since Bitcoin priced in dollars (BTC/USD) is a tautological inverse relationship. In that regard, Bitcoin has demonstrated varying degrees of inverse correlation with the USD and other major fiat currencies.

FIGURE 3
High Yield and Dollar Index Price to Trend



Model Results

Certain elements of the model are proprietary to Cane Island Alternative Advisor, LLC. Consequently, we will not show all regression output statistics here. The coefficients are trivial, since the magnitude of the changes in High Yield and USD are different (High Yield is greater, so it has a smaller coefficient.)

What was most impressive were the robustness statistics, given by the high *t*-statistic and small *p*-

value. This statistics show that the relationship between the factor(s) and Bitcoin's price movements are not random.

	<i>t Stat</i>	<i>P-value</i>
PYH	12.45	0.00
PUSD	(6.75)	0.00

Visually, the model results and Bitcoin price show striking, repeating 3–5-year cycles that coincide nearly perfectly. This cycle, known as the business cycle or credit cycle, manifests in the availability of credit and the impact of changes in interest rates and lending standards on economic activity. For more on these cycles, please watch “How the Economic Machine Works” by Ray Dalio.

Discussion

Asset classes exist on a spectrum of risk. To explain this risk and how investors perceive Bitcoin, we will use Maslow's Hierarchy as a guide.

Maslow's Hierarchy of Needs is a psychological concept that organizes human needs into five levels. At the base are physiological needs, such as food and shelter, followed by safety needs, including personal and financial security. The next level encompasses social needs, involving relationships and a sense of belonging, while esteem needs encompass self-confidence and recognition. The top of the pyramid represents endeavors associated with personal growth. This hierarchy suggests that individuals must first satisfy lower-level needs before moving on to higher-level ones, and it has been influential in understanding human motivation and well-being across various fields.

Investors first seek to satisfy these need through the safest investments (such as cash), and then as their financial well-being is secured, they can move up the risk ladder to bonds, stocks, and alternative investments. It is typically the case that volatile investments are perceived as the riskiest. Likewise, investors will perceive investments as riskier if the

nature of those investments is not well understood. (This is why some investors prefer real estate to stock investing, though real estate is less liquid.) Bitcoin, being highly volatile and not well understood, sits at the top of this hierarchy. In that position, it is often described as “purely speculative” though that perception is likely unfounded.

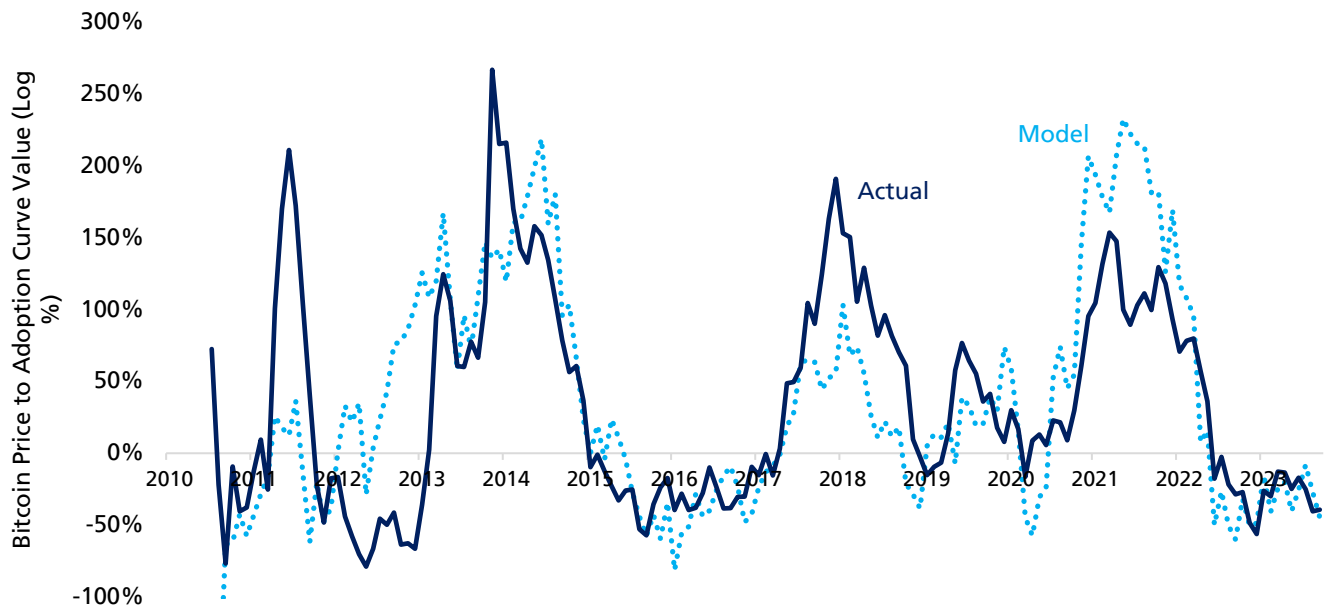
In Figure 1 we notice that the High Yield Index leads Bitcoin going up, and lags Bitcoin going down. This exemplifies Bitcoin's position at the top of the risk ladder. As newly created dollars seek investment, Bitcoin would lag even risky assets such as equity and high yield bonds. When the appetite for traditional investments is satiated, excess dollars flow into Bitcoin.

It is at this point Bitcoin's fixed supply comes into play. Inelastic supply means that the quantity available for sale does not change in response to changes in price. Elastic demand means that consumers are highly responsive to changes in price. When the price of the good changes, the quantity demanded changes significantly. The increased demand quickly outpaces the supply, leading to a shortage of Bitcoin. Consumers, flush with available money, are eager to buy more Bitcoin, but the supply constraints prevent the market from immediately meeting this demand. As a result of the shortage, prices start to rise as consumers are willing to pay more to secure the limited supply. Sellers may capitalize on this situation by further increasing prices. The result is a feedback loop of spiraling upward prices.

When the credit cycle peaks and investors grow bearish, the situation reverses. However, investors will unwind their riskiest positions first, making Bitcoin last to go up and first to go down in a full credit cycle. Bitcoin's price plummets just as quickly as the demand curve shifts left. Price settles back to its long-term adoption value (perhaps overshooting below that level temporarily).

When we modified the initial model to account for elastic demand and inelastic supply, we were shocked at how well the fit appeared. This modification,

FIGURE 4
Bitcoin Macroeconomic Factor Model



perhaps not coincidentally, is a quadratic equation consistent with Metcalfe's Law.

This model does an exceptional job of identifying the timing of Bitcoin cycles. Within that context, a discussion of 2013 is necessary and incredibly important.

2013 Double Bubble

One of the most notable events in Bitcoin's price behavior in 2013 was the "April 2013 Bubble." During this period, Bitcoin's price saw an explosive increase, surging from around \$100 to over \$250 in just a few days. However, this rapid rise was followed by a significant crash, and Bitcoin's price fell back to around \$50. Despite the crash, Bitcoin's price gradually recovered over the course of the year. By November, it had surpassed its previous all-time high, reaching over \$1,000 per Bitcoin. These two peaks are evident in Bitcoin's price chart.

These two peaks are attributed to two automated trading bots named "Markus" and "Willy." These bots appeared to be executing large buy orders for

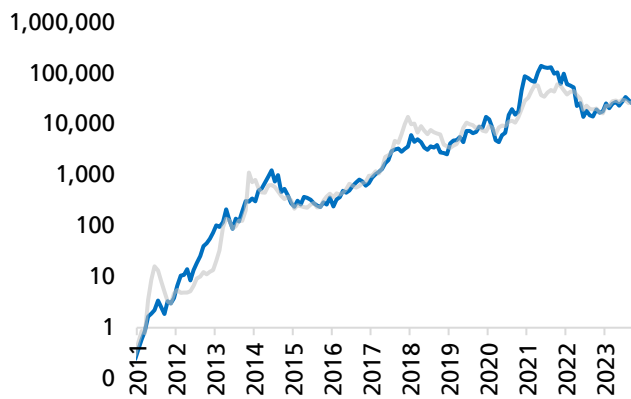
Bitcoin at seemingly arbitrary prices, often with no regard for market conditions.

The purpose of these bots was to artificially inflate the price of Bitcoin on the Mt. Gox exchange. They would create a perception of high demand by executing large buy orders, which, in turn, led to increased trading activity and inflated prices.

We know, factually, that this price manipulation took place based on the exchange operator's own admission as well as forensic research by Selkis [2014], Gandal [2017], Peterson [2021], and others.

However, we were amazed to see these same two peaks occur at nearly the same time in 2013 as a result of credit and dollar cycles. This leads to the revelation that Bitcoin's price behavior is far more complex than previously thought. While manipulation may have attracted capital, the impact on price may not have materialized without a sea of risk capital available to be plowed into what was at that time an obscure fintech experiment.

FIGURE 5
Value of One Bitcoin Based on the Model



It could be that manipulative events occur continuously but are relatively ineffective. In other words, it is most likely the case that macroeconomic factors—and not halvings or manipulation—are the single greatest explanation of Bitcoin’s price cycles.

Caveats and Limitations

This model is less reliable at identifying the magnitude of the peaks. There are numerous explanations for this:

1. The model assumes the demand curve (the convexity) is constant; this is almost certainly not the case. Demand curves flatten when there are more substitutes (which in the case of Bitcoin might be any number of “competitors”). They also flatten as the market becomes saturated (or consumer preferences are satiated). This would result in lower peaks over time, something apparent in the actual price record.
2. The model omits certain variables. There are probably other macroeconomic factors which influence these prices, such as discretionary income levels. We did not attempt to identify every variable or capture the effects of all of them, just two of the primary ones.
3. Changes in base currency (e.g. non-dollar demand) and the effects associated with purchasing power parity are not considered.

4. The shape of the yield curve and variations in credit spreads are not considered.
5. No microeconomic factors are considered, such as changes in short-term adoption rates, transaction volume, trading margin from exchanges, etc.

The price record, specifically the relationship between Bitcoin price and interest rate levels, occurs during a secular bear market. Rate increases are short-lived and rate declines represent a resumption of normality rather than corrective action against a faltering economy. In a secular bear market, falling rates may be primarily a tool to abate serious economic harm. In such cases, capital may not flow into risk assets like Bitcoin, even though rates are falling.

Conclusions

The model provides some insightful revelations.

1. *It could be pure coincidence that loose monetary policy cycles have coincided with Bitcoin halving dates.* This seems to be the case, meaning the timing of halving booms are not reliable in the future. That said, the 3–5-year business cycle is a recurring feature of the U.S. economy and is not likely to go away.
2. *Consequently, future booms – caused by monetary policy - are likely to overlap halving events, perpetuating the “myth.”* Halvings and their immediate effects occur over weeks and days (probably not months) whereas monetary policy takes anywhere from 7 to 16 months to be felt in an economy.
3. *The timing of Bitcoin booms is better explained by macro factors than halving factors.* Perhaps the most useful outcome of this research is a reliable macro timing model for Bitcoin investors. Credit markets move first, providing a signal for the commencement of a new boom. The dollar confirms that signal and also provides insight regarding the timing of market tops.
4. *The magnitude of Bitcoin booms is better explained by macro factors than halving factors.* There is no arguing that, all other things equal, a

slowing growth rate in supply affects price. That story affects the behavior of many Bitcoin retail investors. For an inelastic (vertical) supply curve, and all other things equal, an X% change in supply will reduce the price by Y%, subject to the slope of the demand curve. In the base case, an increase in supply -X% will nearly be offset by a change in price $Y = -X\%$. When Bitcoin halvings occur, supply is still increased, not reduced. This puts downward pressure on price. But if demand is constant, and the supply increases are themselves progressively smaller, then that downward pressure on price is mitigated over time.

Demand in the real world is not constant, and investors—however misinformed—probably buy Bitcoin close to halving periods, negating the -X% effect of increased supply, and creating a self-fulfilling prophecy of halving-inspired upward price spirals. Historically, this has happened at times when money was exceptionally cheap and the dollar exceptionally weak.

Macroeconomic conditions are not a backdrop upon which investment trends unfold. Macroeconomic factors are *the driving force* behind financial activity, and that includes Bitcoin adoption and price behavior.

Changes in the production rate of Bitcoin, market manipulation, government regulation, and production costs are all important influences in the formation of Bitcoin price in the long and short term.

However, this research concludes that the availability of risk capital, and the purchasing power of the dollar are perhaps more important than all these other considerations combined, at least when explaining the 4-year cycle associated with Bitcoin's price behavior. The long-term cycle plays out as follows:

- As the number of available for sale Bitcoin increases over time, and as the rate of production of new Bitcoin declines over time, *the impact of changes in demand on price grows stronger.*

- When coupled with freely available risk capital, *demand for Bitcoin increases dramatically.*
- Network effects manifest as *exponential increases in price* in a relatively short period of time.
- Finally, the fixed short-term supply serves as rocket fuel for Bitcoin's price. Large amounts of capital attempt to acquire an extremely limited available and inelastic supply, and *price moves toward vertical* consistent with the supply curve.
- When risk-seeking investors are satisfied and macro traders unwind positions, Bitcoin's *price quickly reverts* back to its long-term, adoption curve value.

This cycle is almost certain to repeat. One need only look for relaxing credit conditions. Any number of ancillary trigger conditions, including a scheduled halving, would cause another near-vertical price launch. It is not a foregone conclusion that the next cycle peak will be lower than the last, despite the law of diminishing marginal returns; rather, cycle peaks may be driven purely by the availability of capital and the strength of the dollar.



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The hypothetical back-tested performance data is derived from actual cryptoasset price data obtained by coinmetrics.io. The data series begins with data on July 18, 2010.

Hypothetical strategies are rebalanced according to the strategy design on the first of each month. The data shown is hypothetical and is provided to illustrate historical risk and return performance had these portfolios been in existence over the relevant time period shown. CIAA does not offer or manage cryptoasset portfolios.

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Hypothetical back-tested performance also differs from actual performance because it is achieved through the retroactive application of model index portfolios designed with the benefit of hindsight. As a result, the portfolios described may be changed from time to time and the effect on hypothetical performance results could be either favorable or unfavorable.

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