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BITCOIN, HEDGE OR RISK? AN INVESTIGATION THROUGH HISTORY, BLOCKCHAIN AND EXCHANGES ANALYSIS

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ABSTRACT

Bitcoin is among the least regulated assets in the world, attracting all kinds of comments regarding its possible illicit uses. Thus, this research aims to bring greater clarity to the Bitcoin market by determining the magnitude of the market size for each activity within this blockchain. A historical approach to the cryptocurrency will be conducted, followed by exploratory analyses of the Bitcoin blockchain and Bitcoin exchanges. Finally, a time series method will be employed to classify bitcoin as a hedge or risk asset.

Keywords: Bitcoin, Blockchain, Time Series, Hedge, Risk.

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SUMÁRIO

1 INTRODUCTION

Since its creation in 2008, bitcoin has become an asset that piques the interest of various segments of society. For investors, it represents an opportunity to profit from this revolutionary asset. For criminals, a hard-to-trace currency. For enthusiasts, the uncensorable currency.

Bitcoin has been the subject of debate regarding its utility since its inception. There have been discussions about whether it serves as a medium of exchange or a store of value, and to this day, there is no consensus.

Currently, bitcoin has a market value of $591,813,062,612[4], which is relatively small compared to its main competitor in the store of value category, gold, with a market capitalization of approximately $12,720,000,000 [9], more than 20 times larger, allowing for significant appreciation of bitcoin.

Another reason to believe that bitcoin is relevant to the investment debate arises from the request to the SEC[1] for the creation of spot ETFs [2] for bitcoin by the world's largest asset manager, BlackRock, which generates speculation about the potential massive influx of institutional capital into the cryptocurrency with the potential for significant price multiplication. [3]

Thus, this monograph aims to analyze the bitcoin market composition and shed light on its coin concentration, as well as to understand if it can become a medium of exchange or a store of value, or if it is destined to remain a speculative asset.

Time series method will be used to classify bitcoin as a hedge against inflation (and mean of exchange) or a risk asset, taking account its nature. Classifying bitcoin is useful for hedge funds to know better the qualities and features of bitcoin market, and then take better decisions in that regard.

The methodology employed consisted of 3 steps: The first step involved a contextualization of the bitcoin history and how it works. Second, was conducted an exploratory analysis of the Bitcoin blockchain, with data processing and visualization using the Python programming language. The last part, we present a VAR model to show that the bitcoin is a risk asset and not a hedge one.

[1] Securities and Exchange Commission
[2] Exchange-Traded Funds
[3] ETFs spots differ from futures ETFs and bitcoin shorts ETFs because only the spots trade the actual asset, not just a representation of its price

2 BACKGROUND REVIEW AND RELATED WORK

The paper [7] discusses functional methods for classifying Bitcoin wallets, categorizing them into five groups: Darknet Marketplace, Exchanges, Gambling, Pools, and Services/others. The classification is obtained by projecting credits and debits over time on a functional basis, and these characteristics are then used as functional features. However, the article does not utilize all the relevant information for wallet classification, such as transaction fees in Bitcoin, defined by users when conducting an on-chain transaction.[1]

The book [16] serves as the primary guide to operating the Bitcoin blockchain. Although published in 2019, it contains some outdated information about the blockchain's operation, such as the no longer used ECDSA (Elliptic Curve Digital Signature Algorithm), replaced in the Taproot upgrade in November 2021 by the Schnorr signature.

Due to the constant evolution of Bitcoin, its history of creation and updates will be addressed, focusing on Bitcoin Improvement Proposals (BIPs). BIPs are updates requiring miner consensus for approval, and the most relevant discussions about the cryptocurrency's future will be explored.

To provide context for the discussion of Bitcoin's use, the history of the community, as discussed in [8] and [1], will be examined. These sources delve into the 2016 battle over the cryptocurrency's future, with one side arguing for its primary function as a means of payment and the other advocating for it to be a store of value. This debate resulted in a hard fork that created Bitcoin Cash as an alternative to Bitcoin, with a focus on transfers.

While models like Stock-to-Flow have been widely employed to forecast Bitcoin's price, it's important to acknowledge that such analyses often oversimplify the cryptocurrency's value proposition. They primarily rely on scarcity as a driving factor, disregarding other essential features such as security, scalability, and usability.

[1] A transaction that is authenticated and stored in the Bitcoin blockchain, opposite of off-chain transactions.

3 BITCOIN HISTORY

The evolution of the concept of money has been a dynamic journey throughout human history, transitioning from primitive forms like shells to the utilization of precious metals such as copper, silver, and gold. In the contemporary landscape, the emergence of virtual assets has taken center stage, with bitcoin standing out as the largest player in terms of market capitalization [4].

In the ongoing discourse surrounding the nature of bitcoin, there is a prevailing skepticism regarding its classification as money. Despite this skepticism, the growing adoption of bitcoin and the inclination of holders to maintain their positions over time suggest a potential evolution into a digital equivalent of gold, serving as a reliable store of value.

Several factors cast doubt on bitcoin's prospects as a currency. It lacks key attributes traditionally associated with money, such as being a medium of exchange, a measure of value, and a secure store of value. The considerable annualized volatility of bitcoin, averaging at 86%, hampers its ability to function as a stable measure of value for goods and services. Additionally, its relatively short existence since 2009 raises concerns about its security as a store of value.

Assuming bitcoin persists without encountering major issues, the anticipated increase in the number of bitcoin holders may contribute to its role as a digital counterpart to gold. This envisioned scenario sees Bitcoin not as a currency but as an asset for storing value, akin to the traditional role of gold, albeit without considering the various industrial applications of gold.

The concept of bitcoin as a modern digital counterpart to gold is rooted in several factors. Firstly, like gold, bitcoin is finite in supply, capped at 21 million coins. This scarcity fosters a perception of value and encourages individuals to hold bitcoin as a long-term store of wealth. Secondly, the decentralized nature of bitcoin and the inherent security measures in its blockchain technology enhance its appeal as a resilient and secure digital asset.

Relating this discussion to whether bitcoin is a risk or a hedge asset, the narrative leans towards bitcoin being positioned as a hedge asset, particularly as a store of value akin to gold. The observed trend of long-term holding and the perceived scarcity of bitcoin align with the characteristics traditionally associated with hedge assets, which are sought for wealth preservation and resilience in times of economic uncertainty. However, the debate

on Bitcoin's nature and its role in investment portfolios remains unclear having a high correlation with S&P, 0.795 in 2020 to 2023.

Table 1 was constructed to help better understand the cronological life of bitcoin.

Table 1 – Bitcoin Major Events

Date	Event
2008-10-31	Publication of Bitcoin whitepaper by Satoshi Nakamoto.[14]
2009-01-03	Genesis block mined, marking the start of the Bitcoin blockchain.[3]
2010-05-22	First documented real-world transaction: 10,000 BTC for pizza.[12]
2010-07-18	Mt. Gox, one of the first Bitcoin exchanges, is founded. [11]
2010-11-06	Bitcoin's market capitalization surpasses 1 million USD.
2011-04-11	Bitcoin achieves parity with the US dollar
2011-06-19	Mt. Gox experiences a major security breach
2013-02-28	Bitcoin's market capitalization exceeds 1 billion USD
2013-10-02	The FBI shuts down the Silk Road, a prominent darknet marketplace
2013-11-29	China issues a ban on financial institutions handling Bitcoin transactions
2013-12-04	Bitcoin price reaches 1,000 USD for the first time
2014-02-28	Mt. Gox, once the largest Bitcoin exchange, files for bankruptcy
2016-07-09	Debate over Bitcoin's block size limit intensifies
2016-07-26	Bitfinex, a major cryptocurrency exchange, experiences a significant hack
2017-03-03	The SEC rejects the Winklevoss twins' Bitcoin ETF proposal
2017-08-01	Bitcoin Cash is created through a contentious hard fork
2017-09-04	China bans cryptocurrency exchanges and initial coin offerings (ICOs)
2017-12-17	Bitcoin price surpasses 20,000 USD for the first time
2018-02-05	Bitcoin price experiences a sharp drop below 7,000 USD
2020-12-16	Bitcoin reaches a new all-time high, surpassing its 2017 record
2021-02-08	Tesla announces a 1.5 billion investment in Bitcoin
2021-09-07	El Salvador becomes the first country to adopt Bitcoin as legal tender
2022-12-05	Crash of Terra-LUNA, one of the biggest stable coins
2022-09-28	Collapse of FTX, one of the major crypto exchanges

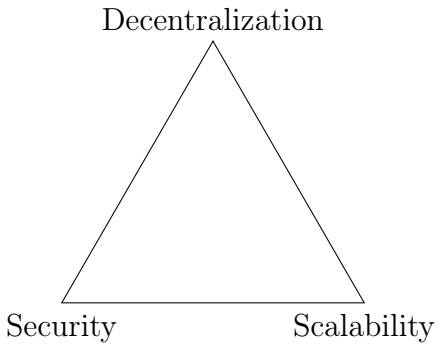

Figure 1 – The Blockchain Trilemma

3.0.1 Bitcoin Trilemma

All cryptocurrencies face a trilemma among decentralization, security, and scalability, represented in Figure 1. bitcoin focuses on security and decentralization, processing only about 6 to 10 transactions per second, which is extremely slow for something that aspires to handle transactions globally.

That is why some technologies have been created to increase the scalability of the Bitcoin network without compromising security and decentralization. However, even the most promising one, the Lightning Network, requires users to enter a private server, thereby sacrificing some security to gain scalability.

In this context, decentralization means the number of people with direct decision-making power to control the blockchain. One might argue that anyone can "vote" on any blockchain simply by buying or selling it with price, but this does not allow for direct decision-making in the direction of the project.

Security entails the impossibility of counterfeiting the cryptocurrency, double-spending, undoing a transaction, constant code review for security breaches, and addressing other problems that could cast doubt on the solidity of the transaction in the minds of the receiver or sender.

Scalability, the third facet of the trilemma, addresses the ability of a cryptocurrency network to handle an increasing number of users and transactions efficiently. As the user base and transaction volume grow, scalability becomes crucial to processing transactions in a timely manner.

3.1 THE HOWEY TEST AND CRYPTOCURRENCY REGULATION

The classification of cryptocurrencies has been a central issue in the realm of regulation. The United States Securities and Exchange Commission (SEC) has played a pivotal

role in this regard.

The Howey test is a framework for determining whether a given financial instrument qualifies as a security. According to [18], this test consists of four criteria:

1. Investment of money.
2. Intent to gain a profit.
3. Participation in a common enterprise.
4. Profits derived from the efforts of others.

Bitcoin's classification as a commodity has been reinforced by former SEC Chairmen Jay Clayton and the present Gary Gensler. This classification stems from the fact that Bitcoin does not meet these criteria, as described in [13], [10], and [6].

Unlike traditional Initial Coin Offerings (ICOs), bitcoin had no initial investment phase. Furthermore, bitcoin allows individuals to securely store it on their personal computers, differentiating it from typical securities.

Despite this clarity, the broader definition of security, commodity, and utility tokens remains a gray area in cryptocurrency regulation. While bitcoin's status has been established, future interpretations of the Howey test may yield different outcomes under new leadership. Hence, the need for more precise regulatory definitions persist

4 DATA

4.1 BLOCKCHAIN

The data used were accessed through the Remote Procedure Call (RPC)[1] feature of the Bitcoin Core software, which could be easily accessed through the Python programming language.

4.2 CCXT API

The price data was acquired through the CCXT API[2], covering the period from 2013-03-15 to 2023-07-31, excluding data related to the Mt. Gox exchange.

For the construction of the bitcoin price in this article, all the free close price series of the pair BTC/USD was collected from the CCXT API, excluding those with historical data less than 365 days. The tags in the Figure 2 represent the first date the CCXT API has access to the data and do not necessarily represent the foundation of the exchange or the first time bitcoin was negotiated. This is mainly because cryptoassets transact more with other cryptoassets, such as stablecoins of the dollar, than with the fiat dollar itself, due to faster and native integration associated with lower transaction fees.

The price we are going to use is the average price for the 15 exchanges previously shown, with a weighted price at time t:

$$\overline{P_t} = \frac{\sum_{i=1}^{n} P_{i,t} \times V_{i,t}}{\sum_{i=1}^{n} V_{i,t}}, \tag{1}$$

where, i is the exchange index, $P_{i,t}$ is the close price of the exchange i on the date t and $V_{i,t}$ is the volume of transactions of BTC/USD in the exchange i on the date t.

4.3 MT. GOX

The largest bitcoin exchange in the initial years of bitcoin (2010-2014) was Mt. Gox, responsible for about 70% of all bitcoin transactions. In February 2014, it filed for bankruptcy after losing 850,000 BTC of customer and its own funds, worth about $500 million at the time of filing.

[1] Remote Procedure Call
[2] https://github.com/ccxt/ccxt accessed October 13, 2023

The Mt. Gox price data was obtained through leaked transaction records, covering the period from 2011-04-01 to 2013-11-30. This data was derived by dividing the total BTC quantities purchased by their respective USD price equivalents. Transactions conducted without incurring either USD or BTC fees were omitted from the price calculation due to concerns about data integrity.

The data price was constructed as a weighted average price at time t, as shown below

$$\overline{P_t} = \frac{\sum_{i=1}^{n} Money_{i,t} \dfrac{Money_{i,t}}{Bitcoins_{i,t}}}{\sum_{i=1}^{n} Money_{i,t}}, \tag{2}$$

where $Money_{i,t}$ is the total amount of USD paid in exchange for an amount of Bitcoins in transaction i on day t, $Bitcoins_{i,t}$ is the total amount of Bitcoins exchanged for an amount of USD in transaction i on day t, i is the index of a transaction and starts from 1 on day t.

It is worth noting that while some exchanges initially traded BTC/USDT before BTC/USD, this price reconstruction exclusively relies on BTC/USD values. This choice is made because the USDT stablecoin experienced occasional deviations in its parity, at times trading at approximately $0.92 USD. These deviations could potentially lead to misleading conclusions regarding the price of Bitcoin in U.S. dollars.

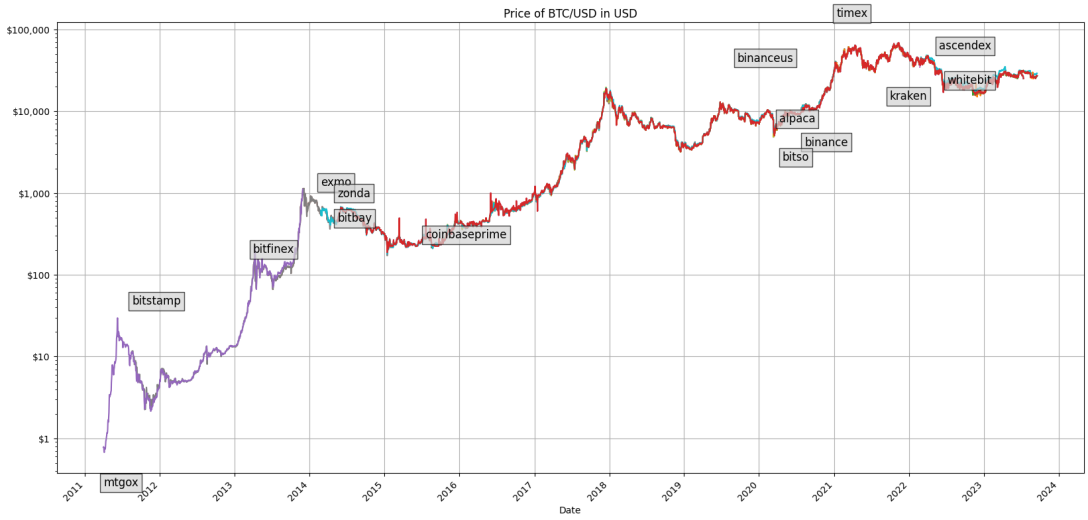

Figure 2 – Bitcoin price aggregated exchanges

5 BLOCKCHAIN ANALISYS

The bitcoin blockchain is a set of interconnected blocks containing transaction history. In its early stages, each block had a capacity of only 1 MB of information because the goal was to create a small program containing the blockchain accessible to a large number of people.

Later, the block size became an issue during the "war of blocks" where one group advocated for a larger block of 8 MB to enable the blockchain to store more data and subsequently decrease the cost of each transaction. This led to a hard fork, resulting in the creation of bitcoin Cash.

To address the struggle of handling the increasing demand for transactions, bitcoin approved BIP 141, endorsing the Segregated Witness (SegWit) soft fork. This involved extending the block to store an additional 3 MB of information, as depicted in Figure 3.

It is crucial for the software to be retrocompatible, and an increase of 4 MB in the block size would require a hard fork. This would force everyone to update their nodes or risk being excluded from the network, which is not seen as a good practice in the community.

The more information there is in one transaction, the more expensive it will be, as there is limited space in each block. Each block is designed to be mined in approximately

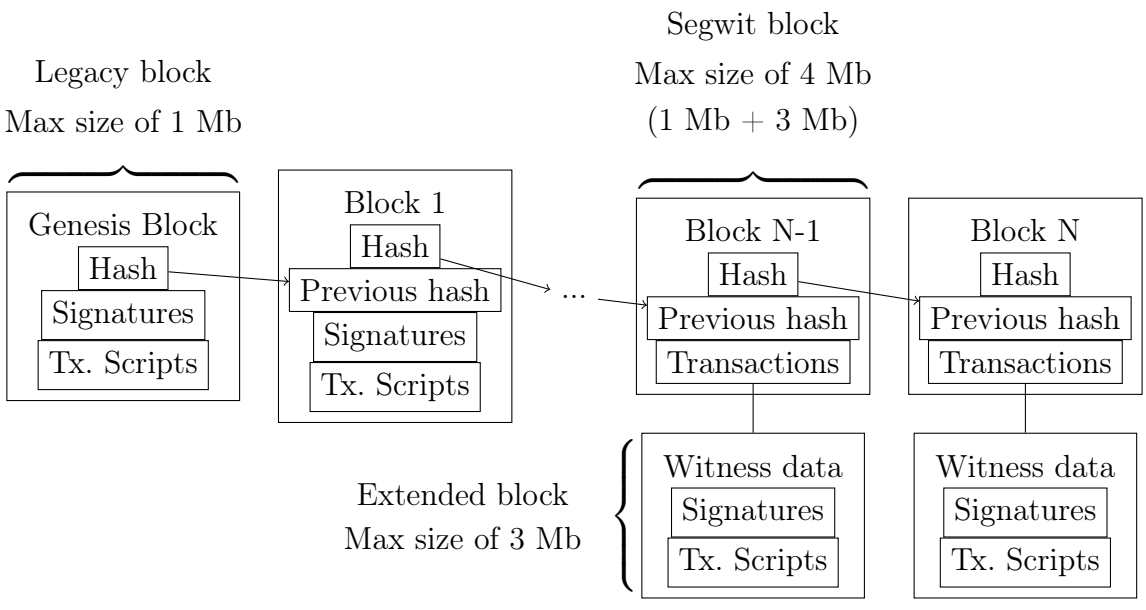

Figure 3 – Bitcoin blockchain diagram

10 minutes.

However, as a compensation, the blockchain is relatively lightweight. The total size of the bitcoin Core software, including the blockchain data, is approximately 635 GB, which is relatively low considering that the intended financial system can be stored and run on an average computer.

5.1 BLOCK DATA

Table 2 displays the name of the features, description and measure unit we get from the RPC of the bitcoin core.

5.1.0.1 Fees

The fee per transaction does not mean much by itself since the miner is going to look at the ratio satoshis/virtual byte as the miner can to fill at most 4,000,000 Weights Units.

Moreover, the fee/rate does not mean too much by itself as well since when someone does a transaction they look to the fee price in dollars. We can notice a high correlation between the number of transactions and the bitcoin's price Figure 2. This is not surprising since when the price goes up, more people are going to buy bitcoin increasing the number of transactions. Since the amount of transactions in a block is limited (4M weight units) it is reasonable that some of them will increase their fees for their transactions to be incorporated in a block faster.

As the segwit transactions increased the average fee decreased due the discount of the segwit transactions, and after 2018 most of the transactions are segwit ones, and almost 95% in 2023.

5.1.0.2 Inputs/Outputs

The relation of outputs/inputs is on average 1.94 and the ratio is greater than 1 82.03% of the time. This relation is expected with the UTXO [1] model of the bitcoin blockchain.

To make one transaction in this UTXO model, one needs to reference at least one UTXO, and this will produce on average, as said on the first paragraph ≈ 2 outputs, one usually being to transfer the ownership of the bitcoin to the other person and the other is usually the change that comes back to some of the sender's public addresses.

[1] Unspent Transaction Output, or the bitcoin that can be spent.

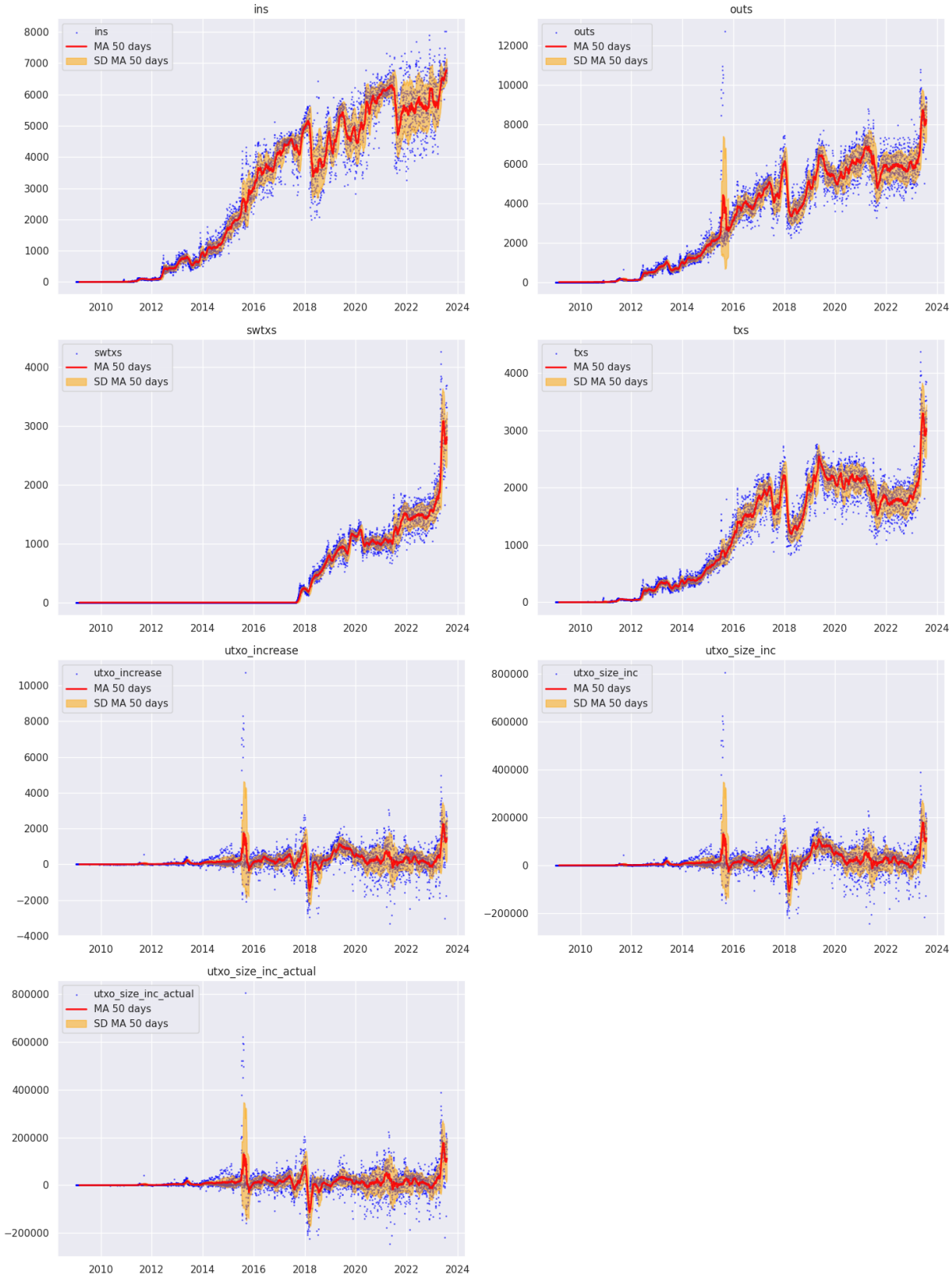

Figure 4 – bitcoin blockchain - Daily block average

One good example of the UTXO model is to think each UTXO as a dollar bill. Imagine each UTXO can assume the values of 100, 50, 20 and so on. The analogy is if someone wants to transfer $120.50 dollars but only have two notes (2 UTXOs), one of 100

and another of 50, then he has to spend all is notes (2 inputs) and this transactions will result in two outputs, the reciever with $120.50 and a change back to the sender of $29.50. This relationship have no limitations of how many inputs or outputs on transaction can has.

And there are reasons to multiples outputs as explained in [5] and [2]:

Feature	Description	Unit
avgfee	Average fee in the block	satoshis
avgfeerate	Average feerate (in satoshis per virtual byte)	satoshis/vbyte
avgtxsize	Average transaction size	bytes
blockhash	"hex" (string) The block hash (to check for potential reorgs)	-
feerate_percentiles	(json array) Feerates at the 10th, 25th, 50th, 75th, and 90th percentile weight unit (in satoshis per virtual byte); The 10th percentile feerate; The 25th percentile feerate; The 50th percentile feerate; The 75th percentile feerate; The 90th percentile feerate	satoshis/vbyte
height	The height of the block	-
ins	The number of inputs (excluding coinbase)	-
maxfee	Maximum fee in the block	satoshis
maxfeerate	Maximum feerate (in satoshis per virtual byte)	satoshis/vbyte
maxtxsize	Maximum transaction size	bytes
medianfee	Truncated median fee in the block	satoshis
mediantime	The block median time past	-
mediantxsize	Truncated median transaction size	bytes
minfee	Minimum fee in the block	satoshis
minfeerate	Minimum feerate (in satoshis per virtual byte)	satoshis/vbyte
mintxsize	Minimum transaction size	bytes
outs	The number of outputs	-
subsidy	The block subsidy	satoshis
swtotal_size	Total size of all segwit transactions	bytes
swtotal_weight	Total weight of all segwit transactions	weight units
swtxs	The number of segwit transactions	-
time	The block time	-
total_out	Total amount in all outputs (excluding coinbase and thus reward [i.e., subsidy + totalfee])	satoshis
total_size	Total size of all non-coinbase transactions	bytes
total_weight	Total weight of all non-coinbase transactions	weight units
totalfee	The fee total	satoshis
txs	The number of transactions (including coinbase)	-
utxo_increase	The increase/decrease in the number of unspent outputs	-
utxo_size_inc	The increase/decrease in size for the utxo index (not discounting op_return and similar)	-

Table 2 – bitcoin Block Information Features and Descriptions [15]

6 VAR MODEL

6.1 CHOICE OF VARIABLES

We proposed 8 variables to explain the bitcoin price, 5 of which are macroeconomic variables to represent the business cycle, the bitcoin price, one bitcoin proxy of volume of transactions in the blockchain (total_out_btc_usd),the volume of bitcoin transactions of the 15 greatest exchanges (exchanges_volume).The data spans from January 1, 2020, to July 15, 2023, as shown in Figure 5.

2 year interest rate. To capture the interest rate influence in the bitcoin market was used the Market Yield on U.S. Treasury Securities at 2-Year Constant Maturity (DGS2), Quoted on an Investment Basis ;

Yield curve slope. 10-Year Treasury Constant Maturity Minus 3-Month Treasury Constant Maturity (T10Y3M) time series was used as a indicator of crisis since its negative values is commonly associated with economic recessions.

Expected inflation. 10-Year Breakeven Inflation Rate (T10YIE) time series represents the expectation of the inflation for the next 10 years and is another factor that is known for having a negative relation with risk assets.

Dolar index. Nominal Broad U.S. Dollar Index (DTWEXBGS) represents the strength of the dollar in relation with a basket of fiduciary currencies and is greater when the dollar is appreciated relative to them.

S&P 500. S&P 500 (SP500) represents the risk market that is being more correlated with the bitcoin market.

Bitcoin price. The Bitcoin price series was created following the methodology described in section 4.

Proxy of bitcoin blockchain transactions volume. This series was created by the average of daily outputs (of transactions in the Bitcoin blockchain) values + subsidy mined by the miners + fee payed to the miners, in dollar values. This is a proxy for the volume of transactions in the bitcoin blockchain which is not perfect since the vast majority of transactions has at least two outputs, the real value and the exchange (as explained in section 5), and it is almost impossible to classify which is which. The series was divided by the total market cap of bitcoin to normalize the data.

Exchanges bitcoin volume. The series of daily volume of transactions of bitcoin in exchanges was created to capture the financialization of bitcoin. The series was made by the sum of daily volume of BTC/USD, BTC/USDT, BTC/USDC, BTC/DAI, BTC/TUSD, BTC/BUSD, BTC/USDD, BTC/USDP, BTC/GUSD, BTC/USTC, of 15 exchanges with average daily volume greater than U$4,000.00 (BigOne, Binance, BinanceUSDM, Bitfinex, Bitrue, Bitstamp, CoinbasePrime, CurrencyCom, DigiFinex, Huobi, KuCoin, LBank, OKX, Tokocrypto, Whitebit), with the final series being weighted by the individual volume, expressed in the formula:

$$V_t = \sum_{p}^{P} \sum_{i}^{I} V_{ipt}, \tag{3}$$

where V_{ipt} is the volume of transactions of the pair p in the exchange i in the day t. The series was divided by the total market cap of bitcoin to normalize the data.

To run a VAR on the data, we begin by verifying the stationarity of the time series through the Augmented Dickey-Fuller (ADF) test. Time series with a p-value greater than 0.05 are classified as non-stationary, and we proceed to compute the differences between consecutive observations, a process known as differencing. The **diff** label is then appended at the end of the time series for identification.

6.2 FINANCIALIZATION OF BITCOIN

One question that arises when studying the Bitcoin price is whether the market is primarily influenced by the fundamentals of the technology or by speculative activities. A crucial aspect of speculation is often measured by metrics, with the open-interest share of Bitcoin derivatives being the ideal choice and shown in [17]. However, due to insufficient data from the ccxt API, we opted for the second-best proxy for Bitcoin speculation: the transaction volume of BTC with USD and nine other stable coins based on the dollar.

Using the volume of transactions on exchanges as a speculation metric has its challenges, as not everyone engages in speculation. Today, the most straightforward method to acquire Bitcoin is through an exchange (off-chain transaction), followed by a transfer to a self-hosted Bitcoin wallet (on-chain transaction), measured by the volume of Bitcoin blockchain transactions.

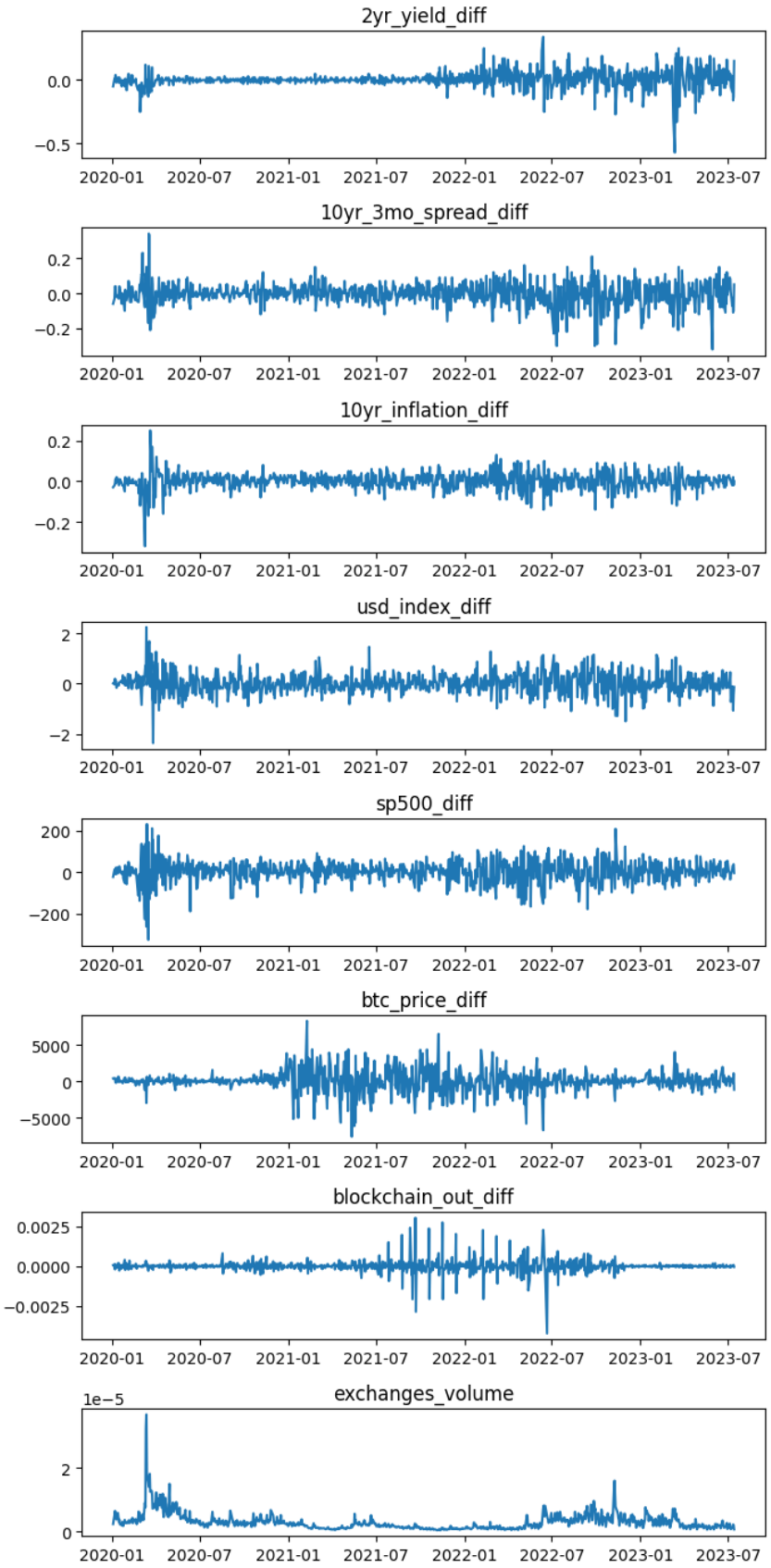

Figure 5 – Variables for VAR, 2020 to 2023

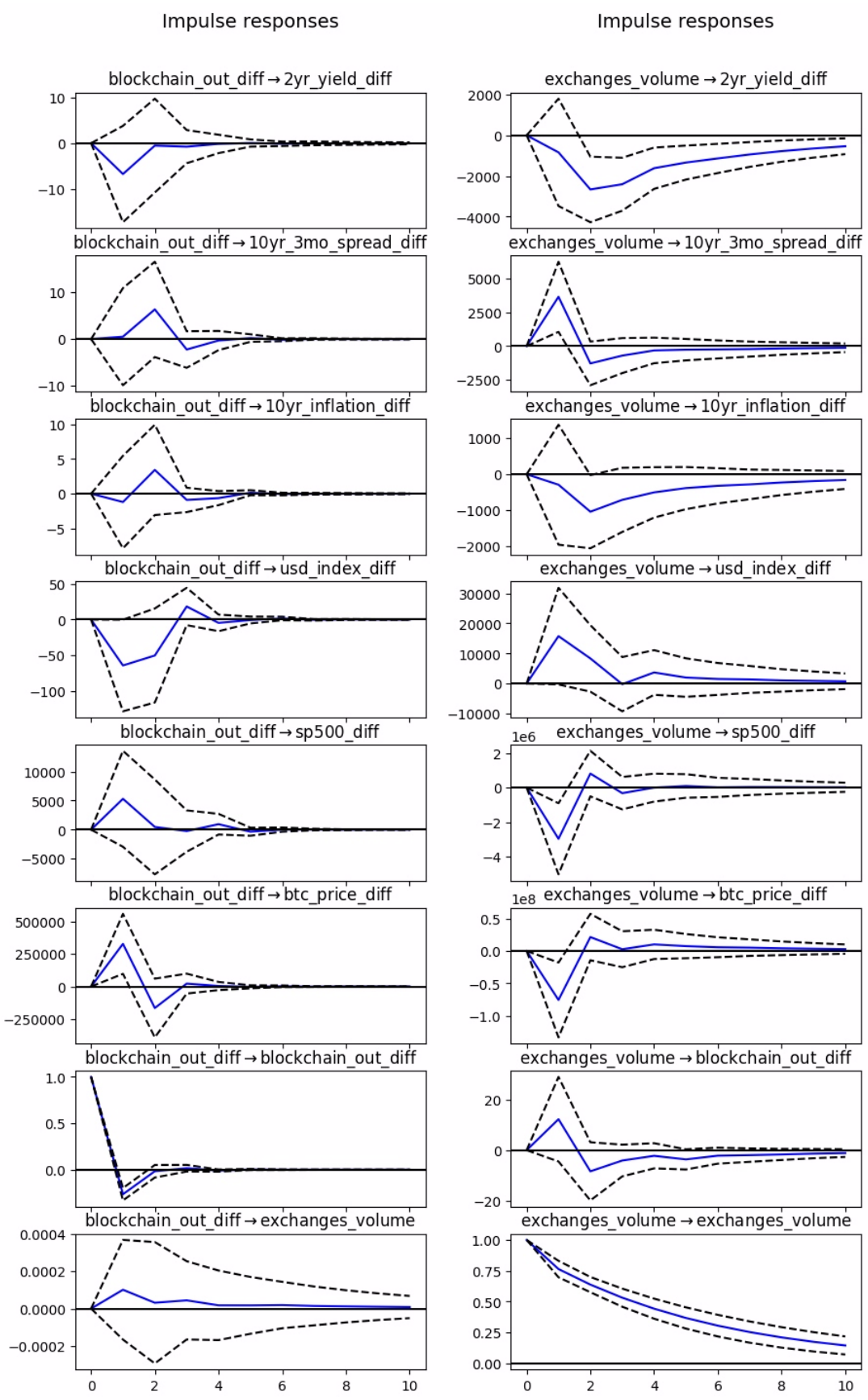

Figure 6 – Impulse response for VAR, 2020 to 2023

7 RESULTS

The Granger causality test was conducted, revealing a significant p-value for lag values of 2 (p=0.0957) and 3 (p=0.0384) concerning exchange volumes explaining blockchain volume. This indicates that the volume of Bitcoin transactions on exchanges impacts the volume of transactions on the Bitcoin blockchain.This finding suggests that the financialization by exchanges may be steering the Bitcoin ecosystem, rather than the other way around, wich is a indicative of a risk asset not of a hedge one.

Bitcoin is often compared to traditional hedge assets like gold due to shared characteristics such as limited supply and decentralization. Both are seen as potential stores of value and hedges against inflation. However, it's crucial to recognize key differences that categorize Bitcoin as a risk asset.

Similarities include limited supply (21 million coins for Bitcoin), decentralization, and the perception of being a hedge against inflation. Gold is known for stability, while Bitcoin has gained attention for its extreme price volatility.

The primary differences and risks associated with Bitcoin include its significant price fluctuations, speculative nature, and the relative immaturity of the cryptocurrency market compared to the well-established gold market. Bitcoin's value is influenced by factors like market sentiment, regulatory developments, and technological changes, making it prone to rapid and unpredictable movements.

Unlike gold, which has a long history as a store of value, Bitcoin is a relatively new asset with evolving regulatory landscapes. Its acceptance and value can be affected by changes in regulations or government attitudes.

In summary, while Bitcoin shares certain characteristics with traditional hedge assets, its volatility, speculative tendencies, and regulatory uncertainties position it more as a risk asset. Investors considering Bitcoin should be aware of these dynamics and carefully assess the potential risks and rewards associated with this emerging digital asset.

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APPENDIX A –

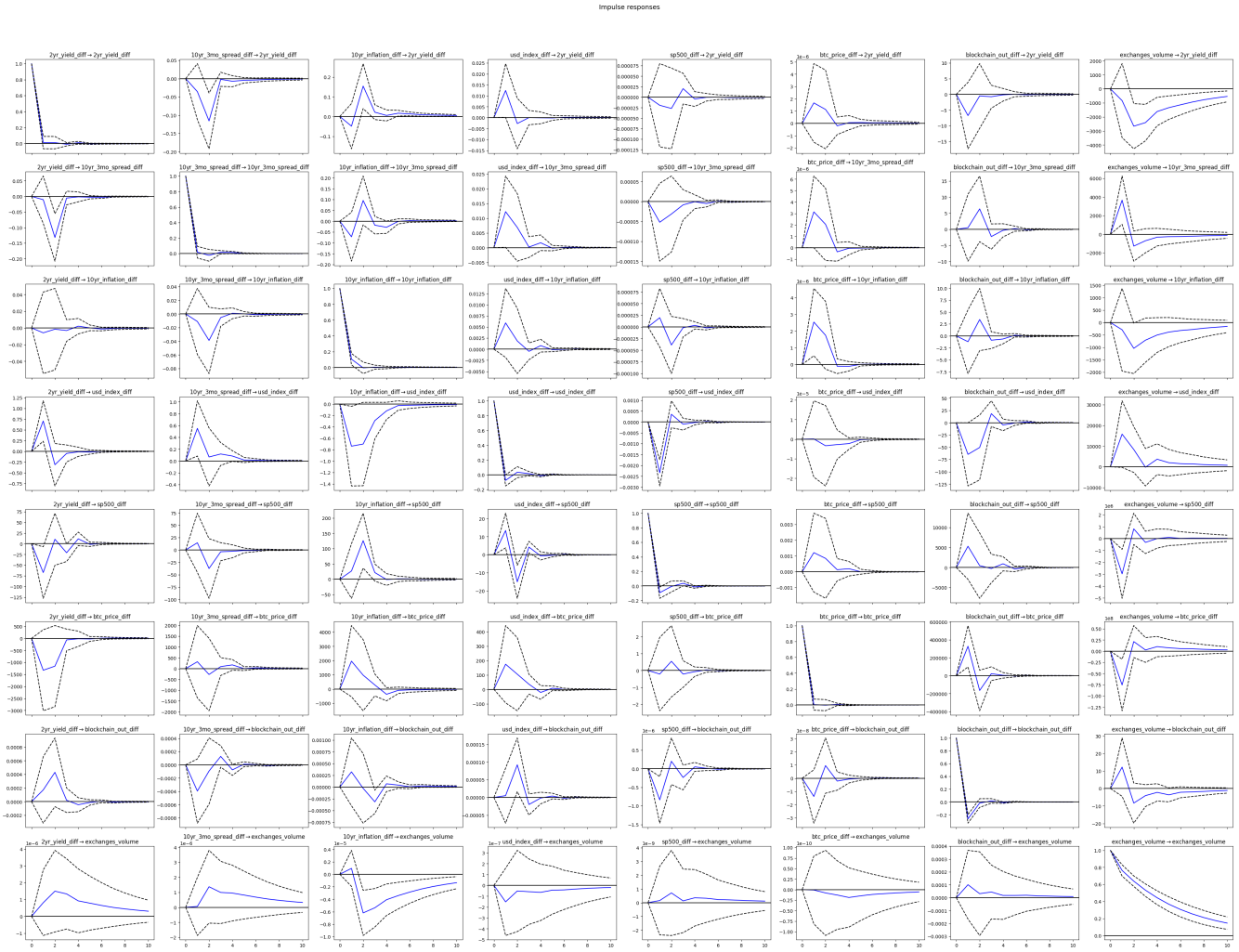

Figure 7 – Full Impulse response for VAR, 2020 to 2023

Table 3 – Summary of Regression Results

Model	VAR
Method	OLS
Date	Fri, 08, Dec, 2023
Time	17:47:56

No. of Equations	8.00000
BIC	-38.8621
Nobs	875.000
HQIC	-39.3203
Log likelihood	7530.26
FPE	6.31165×10^{-18}
AIC	-39.6042
Det(Omega_mle)	5.41113×10^{-18}

Table 4 – Results for equation 2yr_yield_diff

	Coefficient	Std. Error	t-stat	Prob
const	0.011699	0.003456	3.385	0.001
L1.2yr_yield_diff	0.012203	0.039384	0.310	0.757
L1.10yr_3mo_spread_diff	-0.035658	0.039097	-0.912	0.362
L1.10yr_inflation_diff	-0.048900	0.058361	-0.838	0.402
L1.usd_index_diff	0.012401	0.006269	1.978	0.048
L1.sp500_diff	-0.000019	0.000051	-0.381	0.703
L1.btc_price_diff	0.000002	0.000002	1.018	0.309
L1.blockchain_out_diff	-6.757277	5.384584	-1.255	0.210
L1.exchanges_volume	-837.648794	1346.319972	-0.622	0.534
L2.2yr_yield_diff	0.004558	0.039298	0.116	0.908
L2.10yr_3mo_spread_diff	-0.124953	0.039065	-3.199	0.001
L2.10yr_inflation_diff	0.166173	0.058233	2.854	0.004
L2.usd_index_diff	-0.001322	0.005874	-0.225	0.822
L2.sp500_diff	-0.000005	0.000052	-0.104	0.917
L2.btc_price_diff	0.000001	0.000002	0.776	0.438
L2.blockchain_out_diff	-1.826933	5.387903	-0.339	0.735
L2.exchanges_volume	-1940.349622	1353.736565	-1.433	0.152

Table 5 – Results for equation 10yr_3mo_spread_diff

	Coefficient	Std. Error	t-stat	Prob
const	0.000115	0.003400	0.034	0.973
L1.2yr_yield_diff	-0.010551	0.038744	-0.272	0.785
L1.10yr_3mo_spread_diff	0.016541	0.038462	0.430	0.667
L1.10yr_inflation_diff	-0.071940	0.057412	-1.253	0.210
L1.usd_index_diff	0.012206	0.006167	1.979	0.048
L1.sp500_diff	-0.000052	0.000050	-1.041	0.298
L1.btc_price_diff	0.000003	0.000002	1.953	0.051
L1.blockchain_out_diff	0.515867	5.297096	0.097	0.922
L1.exchanges_volume	3655.044355	1324.445235	2.760	0.006
L2.2yr_yield_diff	-0.143045	0.038659	-3.700	0.000
L2.10yr_3mo_spread_diff	-0.031455	0.038430	-0.819	0.413
L2.10yr_inflation_diff	0.104288	0.057287	1.820	0.069
L2.usd_index_diff	0.008850	0.005779	1.531	0.126
L2.sp500_diff	-0.000005	0.000051	-0.096	0.924
L2.btc_price_diff	0.000002	0.000002	1.402	0.161
L2.blockchain_out_diff	5.979906	5.300361	1.128	0.259
L2.exchanges_volume	-4278.582088	1331.741325	-3.213	0.001

Table 6 – Results for equation 10yr_inflation_diff

	Coefficient	Std. Error	t-stat	Prob
const	0.002994	0.002186	1.370	0.171
L1.2yr_yield_diff	-0.005893	0.024907	-0.237	0.813
L1.10yr_3mo_spread_diff	-0.011031	0.024726	-0.446	0.656
L1.10yr_inflation_diff	0.104256	0.036909	2.825	0.005
L1.usd_index_diff	0.005917	0.003965	1.492	0.136
L1.sp500_diff	0.000020	0.000032	0.617	0.537
L1.btc_price_diff	0.000003	0.000001	2.464	0.014
L1.blockchain_out_diff	-1.207205	3.405377	-0.354	0.723
L1.exchanges_volume	-291.293650	851.454168	-0.342	0.732
L2.2yr_yield_diff	0.000007	0.024853	0.000	1.000
L2.10yr_3mo_spread_diff	-0.042464	0.024706	-1.719	0.086
L2.10yr_inflation_diff	-0.018016	0.036829	-0.489	0.625
L2.usd_index_diff	0.001147	0.003715	0.309	0.757
L2.sp500_diff	-0.000026	0.000033	-0.803	0.422
L2.btc_price_diff	0.000001	0.000001	1.433	0.152
L2.blockchain_out_diff	2.674899	3.407476	0.785	0.432
L2.exchanges_volume	-582.244985	856.144650	-0.680	0.496

Table 7 – Results for equation usd_index_diff

	Coefficient	Std. Error	t-stat	Prob
const	-0.009194	0.021089	-0.436	0.663
L1.2yr_yield_diff	0.708152	0.240313	2.947	0.003
L1.10yr_3mo_spread_diff	0.550509	0.238563	2.308	0.021
L1.10yr_inflation_diff	-0.737365	0.356107	-2.071	0.038
L1.usd_index_diff	-0.075651	0.038252	-1.978	0.048
L1.sp500_diff	-0.002338	0.000309	-7.563	0.000
L1.btc_price_diff	0.000000	0.000010	0.012	0.990
L1.blockchain_out_diff	-64.553175	32.855871	-1.965	0.049
L1.exchanges_volume	15787.221111	8215.029199	1.922	0.055
L2.2yr_yield_diff	-0.422642	0.239790	-1.763	0.078
L2.10yr_3mo_spread_diff	0.124120	0.238366	0.521	0.603
L2.10yr_inflation_diff	-0.536764	0.355330	-1.511	0.131
L2.usd_index_diff	0.052478	0.035843	1.464	0.143
L2.sp500_diff	-0.000037	0.000316	-0.119	0.906
L2.btc_price_diff	-0.000002	0.000010	-0.242	0.809
L2.blockchain_out_diff	-58.084968	32.876123	-1.767	0.077
L2.exchanges_volume	-10284.695249	8260.284066	-1.245	0.213

Table 8 – Results for equation sp500_diff

	Coefficient	Std. Error	t-stat	Prob
const	2.955117	2.698961	1.095	0.274
L1.2yr_yield_diff	-67.315118	30.754444	-2.189	0.029
L1.10yr_3mo_spread_diff	14.447955	30.530442	0.473	0.636
L1.10yr_inflation_diff	26.714347	45.573375	0.586	0.558
L1.usd_index_diff	13.375565	4.895367	2.732	0.006
L1.sp500_diff	-0.092134	0.039556	-2.329	0.020
L1.btc_price_diff	0.001213	0.001273	0.953	0.341
L1.blockchain_out_diff	5302.470825	4204.784035	1.261	0.207
L1.exchanges_volume	-2966799.146530	1051331.853297	-2.822	0.005
L2.2yr_yield_diff	-0.993153	30.687463	-0.032	0.974
L2.10yr_3mo_spread_diff	-44.018348	30.505247	-1.443	0.149
L2.10yr_inflation_diff	132.043165	45.474004	2.904	0.004
L2.usd_index_diff	-12.911447	4.587073	-2.815	0.005
L2.sp500_diff	0.020211	0.040489	0.499	0.618
L2.btc_price_diff	0.001024	0.001275	0.803	0.422
L2.blockchain_out_diff	2697.372949	4207.375833	0.641	0.521
L2.exchanges_volume	2521937.182891	1057123.419170	2.386	0.017

Table 9 – Results for equation btc_price_diff

	Coefficient	Std. Error	t-stat	Prob
const	47.304466	75.478356	0.627	0.531
L1.2yr_yield_diff	-1327.289489	860.069909	-1.543	0.123
L1.10yr_3mo_spread_diff	317.095846	853.805551	0.371	0.710
L1.10yr_inflation_diff	1956.811607	1274.491863	1.535	0.125
L1.usd_index_diff	174.408056	136.902417	1.274	0.203
L1.sp500_diff	-0.212159	1.106198	-0.192	0.848
L1.btc_price_diff	0.003698	0.035605	0.104	0.917
L1.blockchain_out_diff	328386.844035	117589.778250	2.793	0.005
L1.exchanges_volume	-75478711.388816	29401243.553071	-2.567	0.010
L2.2yr_yield_diff	-1254.669254	858.196751	-1.462	0.144
L2.10yr_3mo_spread_diff	-263.766899	853.100948	-0.309	0.757
L2.10yr_inflation_diff	820.390652	1271.712889	0.645	0.519
L2.usd_index_diff	108.344381	128.280766	0.845	0.398
L2.sp500_diff	1.170257	1.132304	1.034	0.301
L2.btc_price_diff	-0.001757	0.035669	-0.049	0.961
L2.blockchain_out_diff	-66170.266060	117662.259725	-0.562	0.574
L2.exchanges_volume	70273437.600675	29563208.814817	2.377	0.017

Table 10 – Results for equation blockchain_out_diff

	Coefficient	Std. Error	t-stat	Prob
const	0.000010	0.000022	0.481	0.631
L1.2yr_yield_diff	0.000171	0.000248	0.690	0.490
L1.10yr_3mo_spread_diff	-0.000395	0.000247	-1.600	0.110
L1.10yr_inflation_diff	0.000322	0.000368	0.875	0.382
L1.usd_index_diff	0.000005	0.000040	0.129	0.898
L1.sp500_diff	-0.000001	0.000000	-2.617	0.009
L1.btc_price_diff	-0.000000	0.000000	-1.342	0.180
L1.blockchain_out_diff	-0.264379	0.033971	-7.783	0.000
L1.exchanges_volume	12.187618	8.493752	1.435	0.151
L2.2yr_yield_diff	0.000383	0.000248	1.543	0.123
L2.10yr_3mo_spread_diff	-0.000169	0.000246	-0.684	0.494
L2.10yr_inflation_diff	0.000044	0.000367	0.121	0.904
L2.usd_index_diff	0.000110	0.000037	2.972	0.003
L2.sp500_diff	-0.000000	0.000000	-0.343	0.732
L2.btc_price_diff	0.000000	0.000000	0.690	0.490
L2.blockchain_out_diff	-0.076920	0.033992	-2.263	0.024
L2.exchanges_volume	-16.341515	8.540542	-1.913	0.056

Table 11 – Results for equation exchanges_volume

	Coefficient	Std. Error	t-stat	Prob
const	0.000001	0.000000	6.305	0.000
L1.2yr_yield_diff	0.000001	0.000001	0.814	0.416
L1.10yr_3mo_spread_diff	0.000000	0.000001	0.057	0.954
L1.10yr_inflation_diff	0.000001	0.000001	0.643	0.520
L1.usd_index_diff	-0.000000	0.000000	-0.962	0.336
L1.sp500_diff	0.000000	0.000000	0.120	0.904
L1.btc_price_diff	-0.000000	0.000000	-0.024	0.981
L1.blockchain_out_diff	0.000101	0.000136	0.742	0.458
L1.exchanges_volume	0.764090	0.033976	22.489	0.000
L2.2yr_yield_diff	0.000001	0.000001	0.981	0.327
L2.10yr_3mo_spread_diff	0.000001	0.000001	1.507	0.132
L2.10yr_inflation_diff	-0.000007	0.000001	-4.844	0.000
L2.usd_index_diff	0.000000	0.000000	0.230	0.818
L2.sp500_diff	0.000000	0.000000	0.255	0.799
L2.btc_price_diff	-0.000000	0.000000	-0.240	0.810
L2.blockchain_out_diff	-0.000023	0.000136	-0.167	0.867
L2.exchanges_volume	0.056670	0.034163	1.659	0.097

Table 12 – Correlation Matrix of Residuals

	2yr_yield	*10yr_3mo_spread*	*10yr_inflation*	*usd_index*	*sp500*	*btc_price*	*blockchain_out*	*exchanges_volume*
2yr_yield	1.0000	0.4603	0.2038	0.1918	0.0093	-0.0640	0.0119	0.0350
10yr_3mo_spread	0.4603	1.0000	0.2429	0.0388	0.0609	0.0153	-0.0089	-0.0383
10yr_inflation	0.2038	0.2429	1.0000	-0.1324	0.2949	0.0638	-0.0310	-0.1062
usd_index	0.1918	0.0388	-0.1324	1.0000	-0.4095	-0.1643	0.0621	0.0896
sp500	0.0093	0.0609	0.2949	-0.4095	1.0000	0.2813	-0.0831	-0.1098
btc_price	-0.0640	0.0153	0.0638	-0.1643	0.2813	1.0000	-0.0883	-0.0427
blockchain_out	0.0119	-0.0089	-0.0310	0.0621	-0.0831	-0.0883	1.0000	0.0370
exchanges_volume	0.0350	-0.0383	-0.1062	0.0896	-0.1098	-0.0427	0.0370	1.0000