Quantifying the Influence of Macro-Financial Variables on Cryptocurrency Adoption: A Multidimensional Index Approach

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Abstrato

Esta dissertação investiga a dinâmica da adoção de criptomoedas por meio da criação do Índice de Adoção de Criptomoedas (CAI), uma medida composta que busca refletir de forma mais completa a participação no ecossistema cripto. Diferente do uso tradicional do preço como proxy de adoção, o CAI combina indicadores de sentimento, atividade de mercado e métricas on-chain, oferecendo uma perspectiva mais holística.

A análise empírica examina a sensibilidade do CAI a variáveis macrofinanceiras, como S&P 500, Nasdaq e oferta monetária M2. Utilizando regressões múltiplas, testes de causalidade de Granger e modelos VAR com funções de resposta ao impulso, o estudo avalia o grau de conexão entre a adoção cripto e os ciclos financeiros tradicionais. Os resultados mostram que o CAI, apesar de capturar tendências únicas do setor, ainda é influenciado pelo sentimento de risco convencional — com o S&P 500 sendo o principal preditor. O índice Nasdaq tem influência estatística, mas menos dinâmica, enquanto a oferta M2 não apresenta relação causal de curto prazo.

Além disso, foi conduzido um estudo de eventos para avaliar o impacto da aprovação dos ETFs de Bitcoin e da reeleição de Donald Trump. Os ETFs tiveram efeitos limitados, enquanto o segundo evento gerou respostas mais marcantes na adoção.

Em síntese, apesar de seu caráter disruptivo, o mercado cripto permanece sensível às condições macroeconômicas, sugerindo que sua maturidade e autonomia ainda estão em desenvolvimento. Essas conclusões são relevantes para investidores, acadêmicos e reguladores.

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Title : Quantificando a Influência de Variáveis Macrofinanceiras na Adoção de Criptomoedas: Uma Abordagem com Índice Multidimensional

Palavras-chave: Adoção de Criptomoedas, Índice de Adoção Cripto (CAI), Indicadores Macrofinanceiros, Finanças Descentralizadas (DeFi), Análise de Sentimento, Estudo de Evento

Abstract

This thesis examines cryptocurrency adoption through the development and analysis of the Crypto Adoption Index (CAI), a composite indicator designed to provide a more comprehensive view of digital asset engagement. Unlike traditional approaches that use price as a proxy for adoption, the CAI combines sentiment indicators, market activity, and on-chain usage metrics to capture the multifaceted nature of participation in the crypto space.

The empirical analysis investigates the CAI's responsiveness to macro-financial variables such as the S&P 500, Nasdaq Composite, and M2 money supply. Using multiple regression, Granger causality tests, and vector autoregression with impulse response functions, the study assesses how closely crypto adoption is tied to traditional financial conditions. Results show that the CAI reflects unique internal trends but remains influenced by broader market sentiment, with the S&P 500 being the most significant predictor. Nasdaq showed limited dynamic influence, while M2 had no short-term causal impact.

The thesis also conducts a market-adjusted event study to evaluate the effects of two key events: the approval of Bitcoin spot ETFs and the re-election of Donald Trump. While the ETF approval had minor or delayed effects, the Trump event triggered more pronounced shifts in adoption.

Overall, the findings suggest that despite its technological evolution, the crypto market is still intertwined with conventional financial systems. This has important implications for stakeholders assessing the maturity, resilience, and external dependencies of digital asset adoption.

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Keywords: Cryptocurrency Adoption, Crypto Adoption Index (CAI), Macro-Financial Indicators, Decentralized Finance (DeFi), Sentiment Analysis, Event Study

Table of Contents

Introduction *5*

Theoretical Framework and Literature Review *6*

Data *6*

Rationale for Variable Selection **9**

Sentiment Indicators 9

Composite Price Metric 10

On-Chain Metrics 11

Empirical Analysis *16*

1. Regression Analysis: Measuring the Impact of Financial Market Drivers on CAI **18**

2. Granger Causality Analysis **20**

3. Impulse Response Analysis **23**

4. Event Study **27**

I. Bitcoin ETF Approval (January 10, 2024) 30

II. Trump Election (November 5, 2024) 31

Conclusion *32*

Thesis Limitations **33**

DeFAI's Potential Impact on Future Adoption Trends **34**

Suggestions for Future Research and Final Reflections **35**

Introduction

In the past decade, cryptocurrencies have evolved from niche digital assets into an increasingly influential component of the global financial system. Once dismissed as speculative instruments, they have shown significant resilience and development. This evolution has attracted both institutional and retail investors. In 2024, global crypto ownership increased by over 30%, surpasing 560 million users worldwide. This growth highlights not only the expanding reach of the sector but also the speed with which digital assets are integrating into mainstream finance.

Several factors have led to this growth. The U.S. spot Bitcoin exchange-traded funds (ETFs) approval was an important growth of the regulation process, facilitating institutional investors in their access to the crypto markets via standardized and regulated vehicles. These ETFs achieved inflows and trading volumes quite rapidly. Those were succeeded by policy signals, like Donald Trump's post-election plan for a U.S. strategic reserve of digital assets. Presented as a vehicle for conserving national competitiveness, this step added weight to the role of the new class of cryptocurrencies for macroeconomic policy. At the same time, the European Union implemented the Markets in Crypto-Assets (MiCA) framework, a set of common rules for digital finance in the EU. This mechanism facilitates cross-border adoption and investor protection by providing regulatory certainty.

Despite these advancement, the cryptocurrency market continues to exhibit high volatility and structural fragmentation. Much of the trading activity remains speculative, and a significant portion of tokens still lack clear valuation models. These conditions make it difficult to distinguish between temporary market enthusiasm and genuine adoption. This uncertainty leads to a broader question that guides this study, that is to what extent is cryptocurrency adoption and interest shaped by traditional macro-financial variables such as equity market performance and monetary conditions.

In traditional financial analysis, price is often used as a sufficient proxy for value. The price of an asset, such as a stock, index or commodities, is information rich. It is assumed to reflect all relevant fragments of information including investors' expectations, liquidity constraints and perceived risk. However,Bitcoin's extreme volatility and sensitivity to speculative flows make

it poorly suited for long-term adoption measurements of price. In this regard, the price index falls within an information unit that can capture short-term enthusiasms but not deeper trend characteristics such as user engagement with its applications or integration into technology infrastructure projects.

To address these limitations, this thesis introduces the Crypto Adoption Index (CAI), a composite indicator designed to capture adoption dynamics in a more comprehensive manner. The CAI incorporates not only price-based data but also sentiment and on-chain measures. Its aim is not to replace Bitcoin as a market indicator but to complement it by providing a broader perspective on adoption patterns. By aggregating metrics such as active addresses, transaction counts, volumes on the main trading exchanges and beyond, the CAI serves as a more robust tool for monitoring the evolution of the crypto ecosystem.

The CAI is constructed through a weighted combination of normalized indicators choosen for their theoretical relevance. The empirical analysis then explores the relationship between the CAI and traditional financial variables, including the S&P 500, the Nasdaq Composite, and the M2 money supply. Additionally, event studies are used to evaluate the CAI's response to major political and regulatory events, such as the approval of ETFs and the outcome of U.S. elections. These methodologies aim to separate structural adoption trends from short-term speculative reactions, offering aclearer view of the drivers behind crypto adoption.

As a further point, by placing the CAI within a macro-financial framework, this study connects digital asset trends with broader economic conditions. In doing so, it provides both a conceptual and empirical foundation for more rigorous academic inquiry and more informed decision-making in the domain of cryptocurrency adoption.

Theoretical Framework and Literature Review

The contribution to the current literature is worthy of note. While prior studies have explored adoption using user surveys, transaction data, or price movements, few have attempted to synthesize these into a single, composite index that captures market dynamics, public sentiment, and technological engagement. Rabhi and Soujaa (2024) approached adoption by

using Bitcoin client downloads as a proxy. While useful for capturing early-stage userr engagement, this method does not reflect sustained usage or infrastructure development. Nakagawa and Sakemoto (2022) employed dynamic factor models to identify macroeconomic influences on cryptocurrency returns, but their focus remained on asset price behavior rather than adoption itself. Similarly, the World Bank's use of macro-financial indicators offers valuable insights into global financial trends but remains centered on price-based variables, lacking direct measures of user participation or technological integration.

More recent studies have shifted attention toward cross-border flows and regulatory dimensions. Cerutti et al. (2024) and Graf von Luckner et al. (2023) analyzed international crypto movements using transaction-level data, providing important perspectives on capital mobility and policy implications. Their focus lies more in the financial and regulatory use of crypto than in measuring adoption. The IMF working paper *On Cross-Border Crypto Flows* (2024) adds to this discussion by comparing methodologies for tracking usage across countries. Yet, none of these works proposes a unified index that captures both behavioral engagement and market development.

At the industry level, the Chainalysis (2024) Global Crypto Adoption Index measures adoption using adjusted transaction volumes across countries. The report emphasizes that adoption is not limited to developed economies but is often more pronounced in regions experiencing inflation, capital controls, or restricted access to traditional banking systems. Examples include Sub-Saharan Africa and Eastern Europe. These findings illustrate the role of crypto as a financial alternative in unstable environments. However, the Chainalysis approach remains largely descriptive and transaction-focused, without integrating sentiment or structural indicators. This supports the need for a more comprehensive analytical tool such as the CAI.

Academic literature has also explored adoption as a technological and behavioral process. Gans (2019) conceptualizes crypto adoption as a form of technological diffusion, where network effects and early adopters shape the path toward long-term sustainability. The adoption model proposed in the *European Journal of Operational Research* distinguishes between innovator-driven and imitator-driven behavior, emphasizing a gradual shift from speculative experimentation to informed, utility-based engagement. These studies support the idea of adoption as a dynamic phenomenon and provide a theoretical foundation for including both speculative and structural dimensions within the CAI.

Cognitive and behavioral perspectives have further enriched the understanding of adoption. A 2024 article in *Humanities and Social Sciences Communications* highlights the importance of trust, perceived safety, and institutional credibility, even in decentralized environments. Despite the promise of decentralization, users still rely on platforms, exchanges, and custodians. These findings justify the inclusion of sentiment and behavioral metrics in the CAI, reinforcing the view that adoption is shaped as much by user perception as by technical infrastructure.

From a methodological standpoint, studies employing Hierarchical Decision Models (HDM) show that users evaluate cryptocurrencies based on multiple factors, including interface design, regulatory oversight, and community reputation. This contrasts with findings in quantitative finance, which often emphasize financial returns as the primary motivation. Survey-based research confirms that investors are also influenced by values such as transparency, ideological alignment, and brand integrity. These perspectives highlight the need for an index that captures the multifaceted nature of adoption beyond simple market performance.

Industry outlooks offer further context. Reports such as the *21Shares Crypto Market Outlook 2025* and the *Sygnum Future Finance Report 2024* highlight ongoing trends in institutional participation, the tokenization of real-world assets, and the growing maturity of decentralized finance infrastructure. These developments mark a transition from speculative experimentation to more integrated financial applications. They also suggest that as crypto becomes embedded in traditional finance, measuring adoption requires frameworks that account for both immediate activity and long-term engagement.

This transition reinforces the relevance of the CAI, which is designed to capture both behavioral and structural aspects of adoption. By incorporating market sentiment, on-chain metrics, and financial signals, the CAI provides a more comprehensive and forward-looking measure of cryptocurrency adoption. It fills a critical gap in the literature by offering a unified and empirically testable index that reflects the evolving nature of the crypto ecosystem within the broader financial landscape.

Data

Adoption in this space spans a wide range of behaviors, from individual participation in on-chain transactions to the integration of blockchain infrastructure by financial institutions. It also reflects broader shifts in technological acceptance, regulatory engagement, and global market access. Capturing these dynamics demands a framework that can account for not just usage, but also interest, engagement, and systemic relevance across different layers of the crypto landscape.

For this reason, this study introduces the Crypto Adoption Index (CAI), acomposite indicator designed to reflect the broader evolution of the crypto ecosystem. The CAI incorporates sentiment data, financial market performance, and on-chain metrics to construct a more robust and representative measure of market-wide adoption. Data was collected from several providers to ensure accuracy, granularity, and credibility. On-chain indicators were retrieved from Artemis, a blockchain analytics platform that provides detailed transaction-level data across major blockchain networks. Price data was sourced from CoinMarketCap, a widely used aggregator offering reliable historical and real-time cryptocurrency pricing information. Sentiment and search metrics were collected from Alternative.me and Google Trends, respectively. The former offers the Fear & Greed Index, a sentiment indicator constructed from volatility, trading volume, social media sentiment, and survey responses. The latter provides an aggregated search index to track the frequiency of searches related to cryptocurrencies, thereby capturing retail attention and information demand. These sources collectively support the multidimensional structure of the CAI.

Rationale for Variable Selection

The variables selected for inclusion in the CAI reflect a deliberate effort to balance market sentiment, financial market performance, and fundamental blockchain activity.

Sentiment Indicators (14%)

1. **Fear & Greed Index (7%)**

   This indicator, developed by Alternative.me, aggregates multiple factors such as market volatility, momentum, volume, and social sentiment into a scale from 0 (extreme fear)

to 100 (extreme greed). In crypto markets, where fundamentals are less established and narratives can move markets, investor psychology often drives trading behavior. Including this metric helps capture short-term psychological shifts that may precede or reinforce adoption cycles.

2. **Google Search Index (7%)**
   Google Trends data was used to track public interest in cryptocurrency related terms. This variable functions as a proxy for retail awareness and attention. Historically, surges in search volume have correlated with bull market inflows and increased onboarding. As such, this indicator helps measure retail curiosity and the potential for near-term growth in adoption.

These sentiment indicators allow the CAI to incorporate behavioral drivers of participation that are not directly observable through price or usage alone.

Composite Price Metric (26%)

To avoid multicolinearity and over-representation of market pricing signals, the CAI includes a **composite price metric** calculated as the average of three equally weighted components. Aggregating them prevents overfitting and balances exposure across the maturity spectrum of digital assets.

3. **Bitcoin Price (8.6%)**
   Bitcoin was included as the foundational benchmark of the crypto market. It is the most liquid, widely held, and recognized cryptocurrency globally. Its price movement reflects broad market sentiment and functions as a proxy for systemic interest in digital assets. Including Bitcoin ensures that the CAI remains anchored to the historical and psychological center of the industry.

4. **Normalized Ethereum Price (8.6%)**
   Ethereum was selected for its major role in supporting decentralized applications (dApps) and smart contracts[1]. Unlike Bitcoin, Ethereum facilitates programmable

[1] **Smart contracts** are self-executing programs stored on a blockchain that automatically enforce agreements between parties when predefined conditions are met. When combined, they form the functional backbone of decentralized applications (dApps).

finance and supports ecosystem-wide innovation. Its inclusion allows the CAI to reflect adoption related to infrastructure and utility, not just speculative store-of-value behavior.

5. **Normalized Total3 Market Cap (8.6%)**
   Total3 refers to the aggregate market capitalization of all cryptocurrencies excluding Bitcoin and Ethereum. It reflects investor interest in altcoins and newer projects that represent the innovative frontier of the ecosystem. Including this variable ensures that the CAI captures diversification and signals adoption beyond the two dominant networks.

On-Chain Metrics (60%)

These metrics are the core of the CAI and were assigned the largest weight. They reflect actual usage and engagement within blockchain networks, as opposed to speculative or psychological indicators. The selected metrics provide insight into financial infrastructure usage, user behavior, and real-world integration.

6. **Aggregated Active Addresses (8%)**
   This variable aggregates the number of unique blockchain addresses[2] active over a given period across multiple networks. It acts as a proxy for user participation, capturing how many individuals are sending, receiving, or interacting with crypto assets. It reflects organic growth and helps distinguish structural adoption from temporary spikes in price-driven interest. High levels of address activity usually correspond with increased wallet creation, greater transaction volumes, and deeper user engagement.

7. **Solana Transaction Fees (8%)**
   Solana fees represent the cumulative value of transaction costs paid on the Solana blockchain. Solana is one of the most used and efficient blockchains in the crypto space.

[2] **Blockchain addresses** are unique alphanumeric identifiers used to send and receive digital assets on a blockchain. Similar to a bank account number, they represent ownership and activity on the network, though they do not reveal the user's real-world identity.

It was chosen due to its high performance, low fees, and growing user base, particularly in NFT[3] marketplaces and consumer-grade applications. Unlike Ethereum, Solana's speed and cost-efficiency attract different user segments. Including this variable allows the CAI to account for usage on non-Ethereum layer-1s, making the index more representative of cross-chain adoption.

8. **Tokenized Real World Assets (RWAs) (8%)**

   This metric tracks the total value of real-world assets (e.g., treasuries, real estate, commodities) tokenized and issued on blockchain networks. It captures institutional experimentation and the blending of traditional finance with digital infrastructure. RWAs are a key indicator of long term integration, and their inclusion reflects the transition of crypto from a speculative market to one with practical financial applications.

9. **Stablecoin Transaction Volume (10%)**

   Stablecoins are cryptocurrencies designed to maintain a fixed value, usually pegged to the U.S. dollar. Unlike volatile assets like Bitcoin, they provide price stability, making them ideal for everyday transactions and financial operations. Popular examples include USDT and USDC, which are widely used across major blockchains for payments, lending, and trading. By tracking stablecoin transaction volume, the CAI captures the extent to which crypto is used for real-world financial activity, serving as a strong indicator of utility-based adoption.

10. **DeFi Total Value Locked (TVL) (10%)**

    TVL refers to the total amount of funds locked in decentralized finance protocols. It indicates the size and credibility of the DeFi[4] ecosystem, reflecting trust in smart

[3] **NFTs (Non-Fungible Tokens)** are unique digital assets stored on a blockchain that represent ownership of a specific item, such as art, collectibles, or in-game assets.

[4] **DeFi (Decentralized Finance)** refers to blockchain-based financial services that operate without traditional intermediaries. It includes activities such as lending, borrowing, trading, and asset management through smart contracts and decentralized applications.

contract platforms. Growth in TVL corresponds with increased user confidence and institutional engagement in on-chain financial services.

11. **DEXs Volume (10%)**

    This metric captures the total trading volume on decentralized exchanges (DEXs)[5]. They offer non-custodial alternatives to centralized platforms and are a core component of the DeFi stack. DEX volume measures adoption of decentralized trading infrastructure and helps assess market depth and capital allocation in crypto-native environments.

12. **Perpetual Futures Volume (8%)**

    Perpetual futures are derivative contracts that allow users to speculate or hedge on the price of cryptocurrencies with leverage, without an expiration date. Their high-risk, high-reward nature makes them a popular tool for short-term speculation. In decentralized finance, they also reflect the growing availability of advanced financial instruments outside traditional exchanges. Including this metric in the CAI captures not only the increasing sophistication of user behavior but also the intensity of speculative activity that continues to shape crypto market dynamics.

To enable aggregation, all data series were normalized on a [0, 1] scale using min-max normalization, thereby perserving the shape of the original distributions while enabling comparability across different units and magnitudes:

$$X_{\text{norm}} = \frac{X_t - X_{\min}}{X_{\max} - X_{\min}}$$

Unlike rolling window or z-score transformations, min-max normalization maintains the full amplitude of observed market behavior. This choice was made to retain the extreme variations and rapid shifts that characterize crypto markets, which are often informative rather than statistical noise.

[5] **DEXs (Decentralized Exchanges)** are blockchain-based platforms that allow users to trade cryptocurrencies directly with one another, without intermediaries. Functionally, they resemble a brokerage account, but operate through smart contracts instead of a centralized service provider.

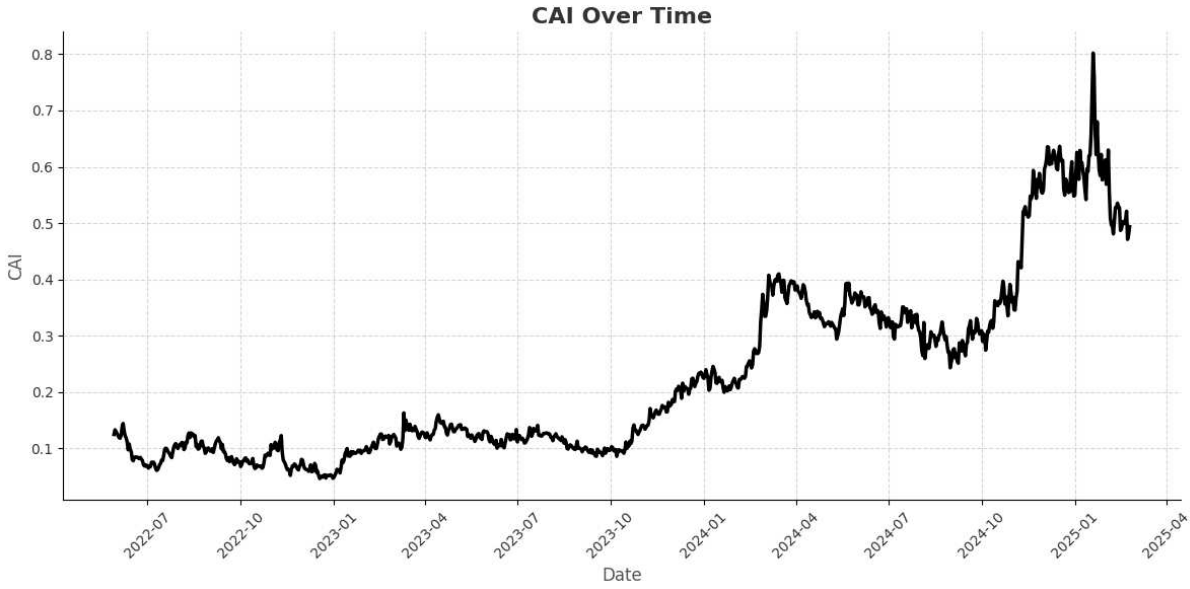
The CAI was computed as a weighted average of the normalized variables, reflecting the relative importance of each component in measuring genuine adoption.

$$CAI_t = \sum_{i=1}^{n} w_i X_{\text{norm},i,t}$$

Category	Metric	Weight	Rationale
Sentiment Metrics (14%)	Normalized Fear & Greed Index	7%	Captures market sentiment and psychological factors
	Normalized Search Index	7%	Gauges mainstream interest and potential retail adoption
Composite Price Metric (26%)	Normalized BTC Price	8.6%	Serves as a barometer for the entire crypto market
	Normalized ETH Price	8.6%	Base layer for most layer-2 cross-chain applications
	Normalized Total 3	8.6%	Assesses diversification and altcoin market performance
On-Chain Metrics (60%)	Aggregated Active Adressess	8%	Indicates user growth and network activity
	Solana Fees	7%	Measures economic activity on a leading non-Ethereum blockchain, increased for emphasis.
	RWA Tokenized Assets	7%	Reflects institutional adoption and tokenization of traditional assets, increased for emphasis.
	Stablecoin Transaction Volume	10%	Captures liquidity and usability for payments and trading.
	Normalized DeFi TVL	10%	Gauges adoption of decentralized finance protocols.
	Normalized DEX Volumes	10%	Reflects activity in decentralized exchanges, a core component of DeFi.
	Normalized Perps Volume	8%	Captures adoption of perpetual futures markets within the crypto space
TOTAL		100%	

CAI variables, corresponding weights & Rationale

The behavior of the CAI components offers support for the index's multidimensional structure. The tendency of price-related indicators to move in alignment reinforces their interpretation as a coherent dimension of market sentiment. At the same time, transaction-level and usage-based metrics exhibit more varied patterns, indicating that they capture additional aspects of adoption not fully reflected in price movements. By combining these perspectives, the CAI aims to provide a more balanced view of cryptocurrency adoption that considers both short-term market dynamics and the gradual development of infrastructure and real world application.



A preliminary analysis of the CAI presents a visible upward trend for the period observed, meaning that cryptocurrency acceptance have been increasing in a steady manner. At the beginning of 2025, although the index continues to rise gradually it is increasingly characterized by its mild upswings, which occur when the market is hot. From this chapter we see that in the first part of the sample, the CAI stays fairly low, probably due to the impact of the 2021 bear market and the drop that came after.

During this stage, both investor involvement and on-chain activity seemed to be muted. As time goes on, this pattern changes and the index starst rising more regularly than before, indicating fresh vitality across a range of crypto world. The evolution of the CAI over time shows that not only has adoption recovered strength, but it is now far more structurally diverse.

Empirical Analysis

Building the Crypto Adoption Index (CAI) was the starting point for a broader investigation into how cryptocurrency adoption unfolds. The main objective was not just to measure adoption more comprehensively, but also to examine whether this adoption represents independent growth within the crypto ecosystem or remains closely tied to movements in traditional financial markets.
This section explores how the CAI relates to key macro-financial variables. The aim is to understand whether crypto adoption is driven by internal developments or shaped by broader financial trends. Studying this relationship helps clarify if the adoption of digital assets depends on equity markets, liquidity cycles, or remains structurally independent. It also contributes to assessing how closely crypto is integrated with the wider financial system.

The variables considered in this analysis are the S&P 500 index, the Nasdaq Composite index, and the M2 money supply. These variables were selected based on their specific relevance in capturing different dimensions of the macro financial environment. The S&P 500 index, often viewed as the benchmark for global equity markets, reflects broader investor sentiment and economic outlook. It serves as a proxy for general market direction and is widely followed by institutional investors across geographies. Including it in the analysis allows for an assessment of whether crypto adoption, as captured by the CAI, aligns with global risk-on or risk-off cycles.

The Nasdaq Composite index was choosen due to the frequent characterization of Bitcoin and the broader crypto market as technology driven assets. Much like high growth tech stocks, cryptocurrencies are often treated as speculative instruments with significant innovation potential, which positions them closer to the tech sector. Bitcoin alone does have the necessary characeristics to be considered also a currency and/or a commodity, due to the mining process needed to mint it. If CAI responds more strongly to movements in the Nasdaq than in the broader S&P 500, this could suggest that adoption dynamics are influenced by narratives similar to those driving the performance of technology stocks.

The inclusion of M2 money supply serves a different analytical purpose. It is meant to capture the liquidity backdrop of the economy. A rising M2 reflects the expansion of money in circulation, which in turn can ease financial conditions and support higher risk investments. By including M2 in the analysis, the aim is to test whether increases in crypto adoption are merely a function of a more liquid environment or whether the adoption trend persists independently of central bank driven monetary expansion.

To assess this relationship, three approaches are used. First, a *multi-variable regression* is run with the CAI as the dependent variable. The independent variables, S&P 500, Nasdaq, and M2, are normalized so that their influence can be directly compared. This allows the estimation of how changes in these macro variables correspond to changes in the CAI, while accounting for their simultaneous effects.

In a second step, *Granger causality tests* are conducted. These are used to examine whether past values of the macroeconomic indicators help anticipate movements in the CAI. If such relationships are found, it would indicate that financial market variables not only move with CAI but may actually play a predictive role. In contrast, the absence of such patterns would suggest that adoption follows a different rhythm, less dependent on conventional market trends.

To complement this, a vector autoregression (VAR) model is estimated. From this model, *impulse response functions* are derived to trace how the CAI responds in the days following a sudden change in one of the explanatory variables. This helps to understand whether shocks in traditional financial markets lead to immediate or delayed reactions in the crypto space, and how persistent such responses might be.

The dataset used for this part of the analysis spans from June 2022 to March 2025. Price data for the S&P 500 and Nasdaq were sourced from Refinitv Eikon, while M2 figures were obtained from the Federal Reserve Economic Data (FRED). Since M2 is published monthly, its values were interpolated to match the daily frequency of the other variables. All series were normalized to make the regression coefficients more interpretable.

This analysis aims to offer a clearer understanding of whether crypto adoption, as captured by the CAI, is being shaped by structural developments within the crypto ecosystem or by broader financial conditions. A strong relationship with traditional variables would suggest that the two

markets remain closely linked, while weaker or no connections could point to a more independent trajectory for digital asset adoption.

1. Regression Analysis: Measuring the Impact of Financial Market Drivers on CAI

1.1 Hypotheses and Motivation

To quantify the extent to which macro financial conditions shape cryptocurrency adoption, a multiple linear regression was performed using the Crypto Adoption Index (CAI) as the dependent variable. The independent variables consisted of the normalized S&P 500 index, Nasdaq Composite index, and M2 money supply. The equation estimated was:

$$CAI_t = \alpha + \beta_1 \cdot \text{S\&P500}_t + \beta_2 \cdot \text{M2}_t + \beta_3 \cdot \text{Nasdaq}_t + \epsilon_t$$

For each independent variable, the hypotheses tested were:

- **H_0**: The coefficient of the variable is equal to zero (no effect on CAI)
- **H_1**: The coefficient of the variable is not equal to zero (significant effect on CAI)

The regression results are presented below:

Regression Statistics	
Multiple R	0.926966424
R Square	0.859266751
Adjusted R Square	0.858843705
Standard Error	0.05814713
Observations	1002

	Coefficients	*P-value*
Intercept	-0.015859329	3.81326E-05
Nasdaq_norm	0.057702703	0.000891014
M2_supply norm	0.033694655	0.000407997
S&P_500 norm	0.445126936	1.2478E-229

Regression statistics

To assess whether the inclusion of sentiment indicators in the CAI introduces mechanical correlation with broader equity indices, separate regressions were performed using the

sentiment varibles as a predictor of both S&P 500 and Nasdaq returns. While both models yielded statistically significant results, the explanatory power was extremely limited, with R-squared values remaining low and the coefficients economically negligible, at approximately 0.07 percent. These findings suggest that the observed statistical relationship is likely spurious. The sentiment metrics are specific to cryptocurrency markets and were not designed to reflect general equity market sentiment. The lack of substantial predictive power in these regressions supports its validity as a domain-specific input, rather than a source of endogenous correlation within the CAI's relationship to traditional financial indices.

To ensure the validity of the regression estimates, a series of robustness checks were conducted. The model was estimated using Ordinary Least Squares (OLS), and potential heteroskedasticity was assessed through the Breusch–Pagan test. While the test indicated the presence of mild heteroskedasticity ($p < 0.001$), the use of White's heteroskedasticity-consistent standard errors helped to adjust the inference accordingly, ensuring that standard errors and test statistics remained reliable.

In addition, multicollinearity was evaluated using Variance Inflation Factors (VIF). All VIF values remained comfortably below the threshold of 5, suggesting that the explanatory variables do not exibhit problematic levels of collinearity. These diagnostic checks confirm the robustness of the model and support the validity of the conclusions drawn from the regression analysis.

1.2 Statistical Analysis and Results

The estimated model demonstrates explanatory power, with an R-squared of 0.859. This indicates that the three independent variables jointly account for approximately 86% of the variance in CAI values.

- The **S&P 500** coefficient was estimated at **0.4452**. This result is highly statistically significant and suggests that a one-unit increase in the normalized S&P 500 is associated with a 0.4452-unit increase in the normalized CAI, holding other variables constant.
- The **Nasdaq Composite** coefficient was **0.0574**, also statistically significant at the 1% level. While the effect is positive, its magnitude indicates a comparatively smaller role for tech-sector dynamics in driving adoption.

- The **M2 money supply** coefficient was **0.0339**, positive and significant at conventional levels. This result supports the idea that liquidity conditions are associated with fluctuations in crypto adoption, though with lower intensity than equity market effects.

1.3 Interpretation and Contribution

These findings indicate that cryptocurrency adoption, as measured by the CAI, remains significantly influenced by macro-financial conditions. The S&P 500 emerges as the most influential variable, highlighting the central role of broad equity market performance in shaping crypto adoption patterns. Although the CAI is often perceived as tracking an independent or counter cyclical asset class, the analysis suggests that it's still highly responsive to traditional risk sentiment.

The positive relationship with Nasdaq returns underscores the relevance of the technology sector, although with a more moderate effect size. The association between M2 and CAI implies that monetary conditions and liquidity availability also matter, although less so than equity dynamics.

Taken together, the results provide strong empirical evidence that crypto adoption remains embedded in conventional financial cycles. The digital asset market may exibhit unique features, but its short-term adoption trajectory continues to reflect broader macroeconomic signals.

2. Granger Causality Analysis

To complement the previous regression results, this section examines the directional predictability of macro-financial variables on the CAI. The objective is to assess whether past values of the S&P 500, Nasdaq Composite, and M2 money supply improve forecasts of CAI returns. This helps determine whether the previously observed associations reflect genuine lead-lag relationships rather than contemporaneous correlations .

The analysis applies Granger causality tests using daily return data. This approach evaluates whether each variable provides information that helps predict future CAI returns, conditional

on the CAI's own lagged values. Identifying such effects contributes to the thesis by clarifying the temporal structure of crypto market linkages.

2.1 Hypotheses and Motivation

For each independent variable, the hypotheses tested were:

- **H_0:** The lagged values of the variable do not help predict CAI returns (no Granger causality).
- **H_1:** The lagged values of the variable help predict CAI returns (Granger causality is present).

These hypothesis were tested to determine whether traditional market indicators contain information that improves forecasts of crypto adoption dynamics, beyond the autoregressive structure of CAI itself. Granger causality, as employed here, does not imply structural causality. Rather, it evaluates whether past values of one variable help predict another, controlling for the target variable's own history.

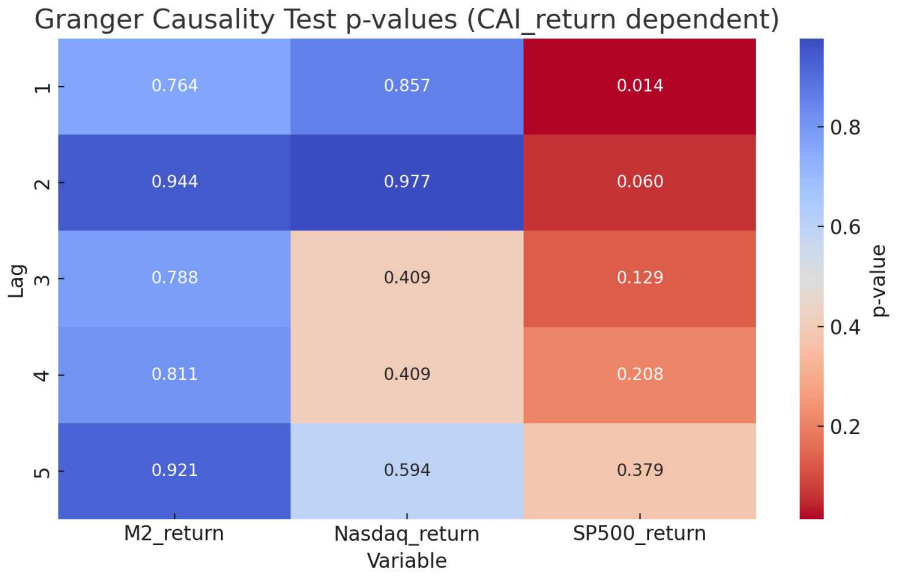
2.2 Statistical Analysis

Daily log returns were computed for CAI, the S&P 500, M2 supply, and the Nasdaq index. Prior to estimation, the Augmented Dickey-Fuller (ADF) test was applied to confirm stationarity. All series were found to be stationary at the 5% level, allowing valid use of the Granger framework without differencing.

The Granger causality tests were performed for lags 1 to 5, in line with standard practice for daily financial data to capture short-term predictive relationships. Each model regressed CAI return on its own lags and the lags of one explanatory variable. The joint significance of the additional lagged terms was tested using an F-statistic.

Predictor	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
S&P 500 return	**0.0137**	0.0605	0.1289	0.2111	0.3795
M2 return	0.7636	0.9444	0.7882	0.8116	0.9209
Nasdaq return	0.8551	0.9755	0.4067	0.4055	0.5938

Granger Causality Test results



The results indicate that S&P 500 returns Granger-cause CAI returns at lag 1 ($p = 0.0137$), providing evidence of short-term predictive power from equity market sentiment to crypto adoption dynamics. This finding is consistent with the hypothesis that CAI is influenced by broader market behavior and investor risk appetite.

In contrast, M2 supply and Nasdaq returns do not Granger-cause CAI returns at any of the tested lags. Their p-values remain well above conventional significance levels, which suggets the absence of a lead-lag relationship between these variables and CAI in the short run.

2.3 Interpretation and Contribution

These results contribute to the thesis by identifying the S&P 500 as the only macro-financial variable among those tested that offers short-term predictive value for CAI. This supports the view that crypto markets are still closely aligned with general financial sentiment and risk conditions. The absence of Granger causality from M2 or Nasdaq indicates that liquidity dynamics and tech-sector speculation do not appear to drive short-term crypto adoption patterns at the daily frequency.

It is emphasized that Granger causality captures predictive precedence rather than structural causation. However, it does not quantify the magnitude or persistence of these effects over time. To address this, the analysis proceeds with Vector Autoregression (VAR) and Impulse Response Functions (IRFs), which allow for a dynamic assessment of how macro financial shocks influence CAI within a multivariate framework.

3. Impulse Response Analysis

This section investigates the dynamic effects of macro financial shocks on the Crypto Adoption Index (CAI) by estimating IRFs derived from the VAR model. While Granger causality established lead-lag relationships, IRFs provide a time-dependent profile of CAI's response to one-time shocks, offering insight into their direction, timing, and persistence.

3.1 Hypotheses and Rationale

The IRF analysis builds directly on the Granger causality results. After identifying that the S&P 500 exhibits predictive power over CAI returns, and that M2 and Nasdaq do not, this section evaluates whether those relationships manifest in dynamic adjustments over time.

The shocks analyzed include:

I. A shock in S&P 500 returns (proxy for broad market sentiment),
II. A shock in M2 growth (proxy for systemic liquidity),
III. A shock in Nasdaq returns (proxy for risk-on tech sector momentum)

3.2 Statistical Analysis

The general VAR(p) model with k variables is defined as :

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \epsilon_t$$

Where:

• Y_t is a k *x* 1 vector of endogenous variables (*CAI return, S&P 500 return, M2 return),*

• A_i are k *x* k coefficient matrices,

• ε_t is a vector of white noise error terms.

IRFs were computed over a 10-day horizon, with 95% asymptotic confidence intervals applied. All responses are interpreted as the percentage change in CAI returns resulting from a one-standard-deviation shock in the corresponding variable.

Shock Variable	Max Effect	Day of Max Effect	Effect Sign
S&P 500 return	0.00422	1	Positive
M2 return	0.00189	4	Positive
Nasdaq return	–0.00293	3	Negative

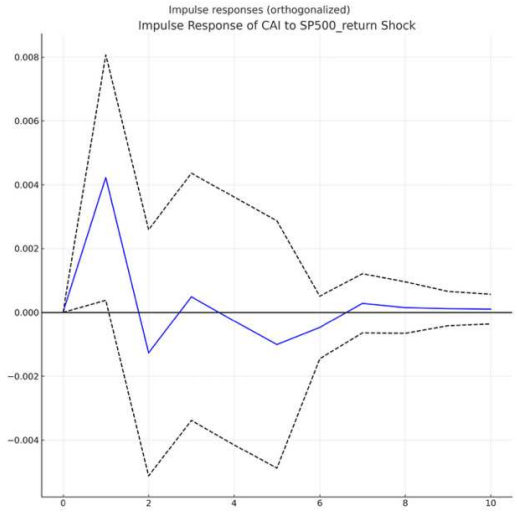
IRF Summary Statistics

The table confirms that the CAI responded most strongly and immediately to equity market shocks. In contrast, responses to liquidity and tech-sector shocks were smaller in magnitude and delayed in timing.

3.3 Interpretation and Contribution

I. S&P 500

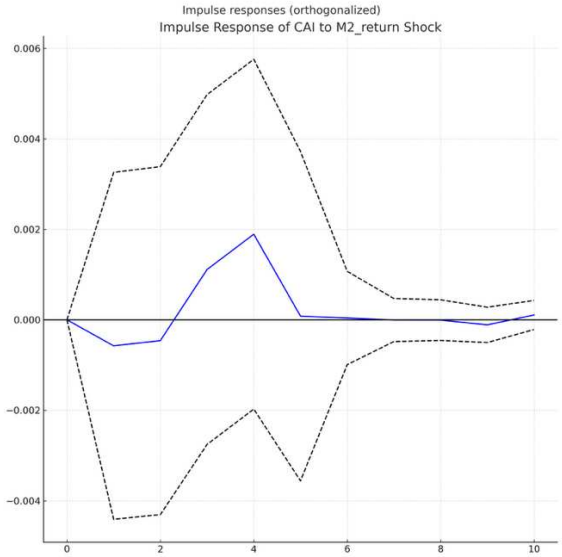
The response is immediate, peaking on Day 1 with a value of approximately **0.42%**. This indicates that a one-standard-deviation positive movement in the S&P 500 leads to a statistically significant and short-lived increase in CAI returns. The effect dissipates within five days.



This behavior supports the hypothesis that general equity market sentiment plays a key role in shaping short-term crypto adoption trends. The timing and direction of the response align with expectations from the Granger causality results. The effect is also economically meaningful, highlighting that crypto markets still reflect broader risk sentiment despite their narrative of independence.

II. M2

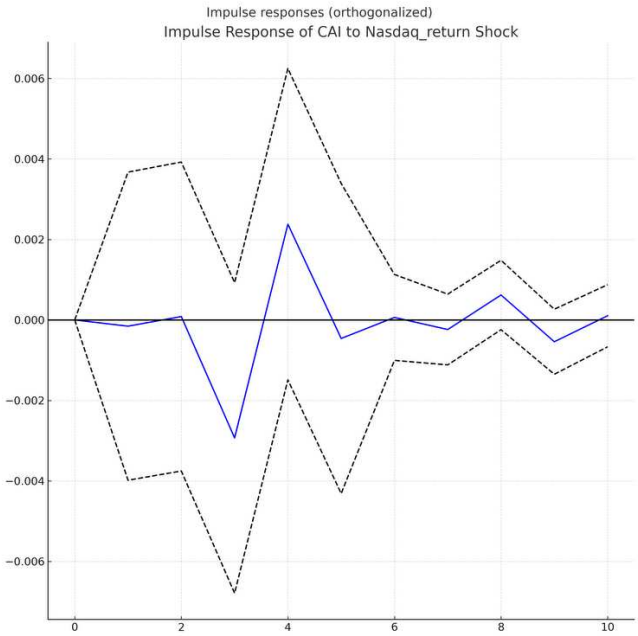
The effect is delayed, peaking on Day 4 at a magnitude of **0.19%**. However, the response remains within the confidence bands throughout the horizon, indicating no statistical significance.



These results suggest that monetary aggregates do not have a measurable short-term impact on CAI. Liquidity conditions may affect long-term asset allocation but do not appear to influence high-frequency crypto adoption dynamics.

III. NASDAQ

The effect reaches its maximum on Day 3 with a value of **–0.29%** . The response is weak, negative, and statistically insignificant.



This result aligns with the absence of Granger causality from Nasdaq returns to CAI. It indicates that sector-specific equity trends do not contribute meaningfully to short-term crypto adoption behavior.

The use of impulse response functions within a vector autoregression framework proved to be a valuable tool for tracing the temporal evolution of CAI behavior following exogenous shocks. This dynamic perspective is particularly relevant in the context of crypto adoption, where reactions to macro-financial signals unfold both over time and instantaneously. By modeling these lagged effects, the analysis enabled to have clearer view of the structural dependencies between the digital asset ecosystem and the broader financial environment.

4. Event Study

To complete the investigation into the central research question, this section turns to the analysis of specific market events. The aim is to assess to what extent crypto adoption, as captured by the Crypto Adoption Index (CAI), is shaped by traditional financial variables and external shocks.
This will deepen the understanding of whether crypto markets internalize and respond to changes in regulatory and political expectations in a manner consistent with traditional financial assets.

4.1 Hypotheses and Rationale

Event studies are particularly effective in detecting short-term adjustments in market behavior following the release of anticipated information. This methodology is designed to determine whether a specific event produces statistically significant deviations from a baseline pattern, after accounting for general market dynamics.

To extract the component of CAI variation that is specifically linked to the event under consideration, the analysis uses a market-adjusted model. This approach filter out the influence of broader equity market movements, as represented by the S&P 500 index, allowing the estimation of abnormal changes in the CAI that are not explained by prevailing market sentiment. Such an adjustment is critical in this context given the previously documented correlation between the CAI and traditional financial indices.

Two events were selected for analysis due to their significant relevance for the cryptocurrency market:

1. **Approval of US-listed Bitcoin Spot ETFs on January 10, 2024.** This moment is widely seen as a turning point in the institutionalization of digital assets. The decision by U.S. regulators allowed traditional financial institutions to offer regulated access to Bitcoin. This reduced the barriers for large investors and increased the credibility of Bitcoin as a financial asset. According to the *21Shares Market Outlook 2025*, the launch of spot ETFs led to more than 100,000 BTC being allocated to these vehicles. This demonstrated a shift

away from speculative retail trading toward more structured, long-term investment strategies. The approval also reinforced the view that cryptocurrencies could be treated as a macro-asset, comparable to gold or other strategic holdings.

2. **US Presidential Election on November 5, 2024.** Donald Trump's re-election introduced new expectations about the direction of crypto regulation. Shortly after the election, the administration announced plans to create a national reserve of digital assets. The policy was viewed as an endorsement of crypto at the highest level of government. The initiative was detailed in *Sygnum's 2024 report* on the potential creation of a U.S. Bitcoin reserve. The report argued that this move marked a shift in how digital assets are seen in terms of national strategy. It also raised the likelihood of more accommodative regulation and infrastructure investment.

4.2 Statistical Analysis

The event study is structured as follows:

Estimation Window: A period of 60 trading days prior to the event, ranging from day -90 to day -31, is used to estimate the normal relationship between CAI and the S&P 500 index. This window is intended to capture the typical behavior of the CAI in the absence of extraordinary news.

Event Window: The impact of the event is examined over a 31-day period, from day -15 to day +15 relative to the event date. This timeframe was specifically chosen to account for both anticipatory market behavior and post-event reactions.

A linear regression is estimated using returns during the estimation window according to the following market model:

$$r_{\mathrm{CAI},t} = \alpha + \beta \cdot r_{\mathrm{S\&P500},t} + \epsilon_t$$

Where:

• $r_{CAI,t}$ is the return of the Crypto Adoption Index on day *t*,

• $r_{S\&P500,t}$ is the return of the S&P 500 on the same day,

• α and β are estimated regression coefficients.

This model was then used to calculate *abnormal returns (AR)* during a [-15, +15] trading day event window. Abnormal returns were defined as the difference between observed CAI returns and those predicted by the model for each day in the window:

$$AR_t = r_t^{\text{CAI}} - (\alpha + \beta \cdot r_t^{\text{S\&P500}})$$

Summing these daily ARs over the event window yields the *cumulative abnormal return (CAR),* which quantifies the net abnormal impact of the event on the CAI index.

$$CAR_{[-15,+15]} = \sum_{t=-15}^{+15} AR_t$$

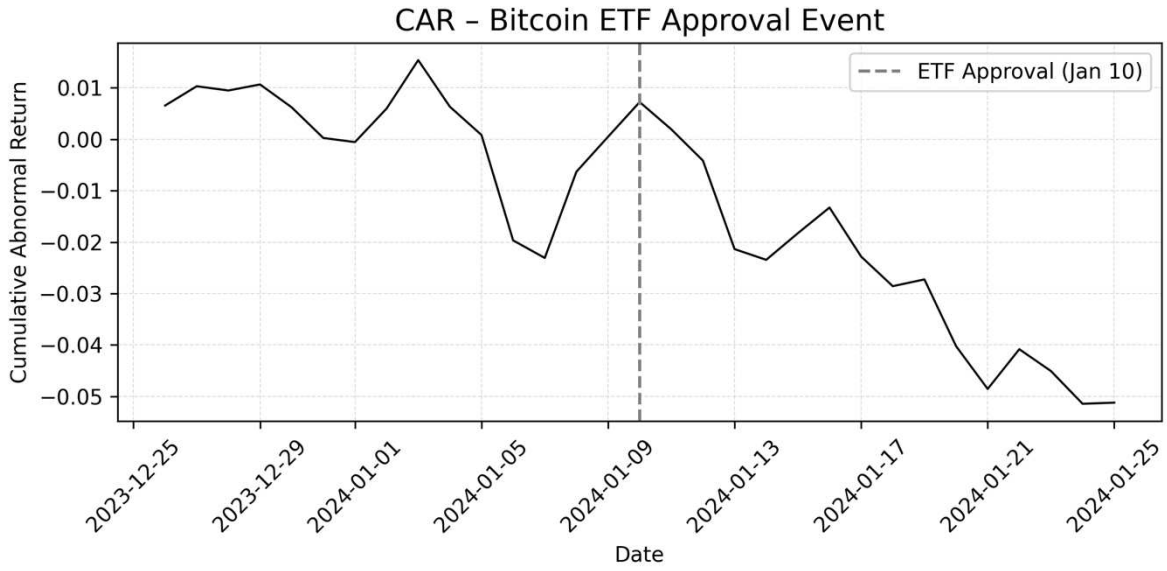
The findings are the following:

Metric	Bitcoin ETF (Jan 10, 2024)	Trump Election (Nov 5, 2024)
Total CAR at +15 Days	-5.12%	+16.87%
Max Abnormal Return (AR)	1.68%	3.70%
Min Abnormal Return (AR)	-2.05%	-2.59%
Avg AR pre-event	-0.1% per day	+0.28% per day
Avg AR post-event	-0.39% per day	+0.82% per day

Event Study Results

4.3 Interpretation and Contribution

I. Bitcoin ETF Approval (January 10, 2024)



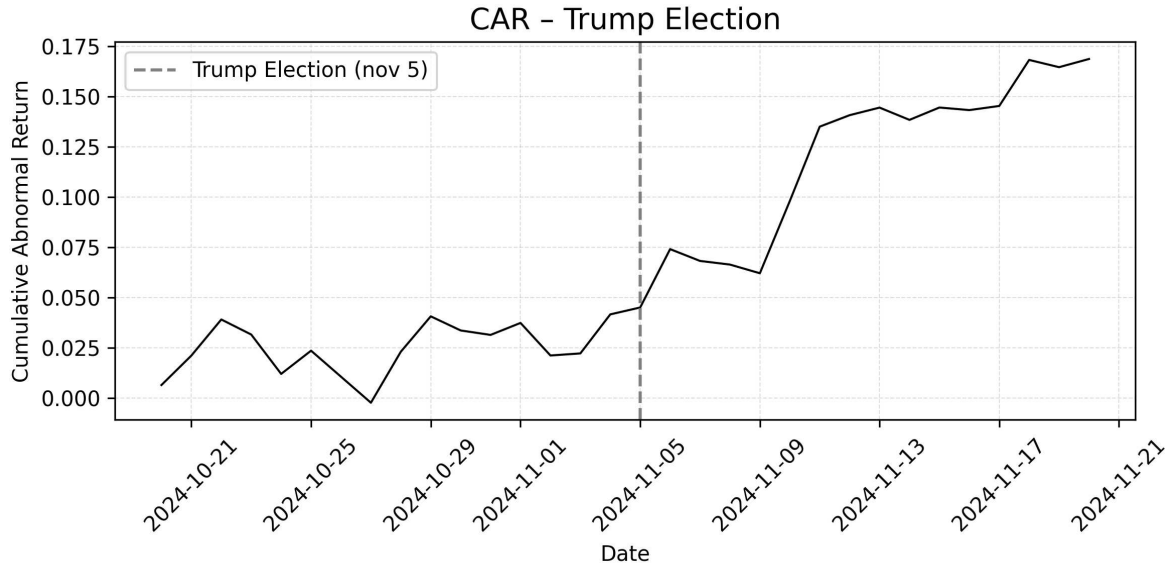
Market participants and commentators anticipated the Bitcoin ETF as a turning point for institutional adoption, given that it introduced a regulated financial instrument offering direct exposure to Bitcoin. From this perspective, the event had the potential to influence investor sentiment and, by extension, crypto adoption dynamics.

However, the results of the event study suggest that the response of the Crypto Adoption Index (CAI) was not consistent with this narrative. The cummulative abnormal return (CAR) over the [–15, +15] day window following the ETF approval was negative, reaching **–5.12%** . This indicates that the CAI underperformed its expected value, conditional on movements in the S&P 500 index.

The average abnormal return prior to the event was slightly negative (–0.1%), and this trend continued and intensified in the days following the approval. Post-event, the CAI exhibited an average abnormal return of –0.39% per day, reflecting a steady downward deviation from market-adjusted expectations . Although some daily fluctuations were observed (with a maximum abnormal return of +1.68% and a minimum of –2.05%), these did not accumulate into a sustained positive trajectory.

Overall, the CAI's reaction appears to reflect a short lived optimism followed by market fatigue or disappointment. One plausible explanation is that expectations surrounding the ETF approval had already been priced in before the official announcement. In this case, the observed underperformance would be consistent with a "buy the rumor, sell the news" pattern, where market participants reduced their exposure once the anticipated event materialized. The lack of a sustained positive response suggests that the approval, while symbolically important, may not have triggered an immediate expansion in crypto adoption as measured by the CAI.

II. Trump Election (November 5, 2024)



The results of the event study confirm a substantial and sustained positive response from the Crypto Adoption Index (CAI). Over the full event window ([–15, +15] days), the cumulative abnormal return (CAR) reached **+16.87%.** This indicates that, after controlling for movements in the S&P 500 index, the CAI significantly outperformed expectations during this period.

The CAI began to react positively even before the event, with an average abnormal return of +0.28% per day in the pre-event period. This upward trend intensified following the election outcome. In the post-event period, the average abnormal return increased to +0.82% per day, suggesting strong and persistent momentum. The maximum abnormal return observed during the event window was +3.70%, while the minimum remained moderate at –2.59%.

These results point to a clear shift in adoption sentiment surrounding the Trump victory. Unlike the ETF approval, which failed to generate lasting effects, the political implications of the election appear to have produced a meaningful and prolonged impact on the CAI. This could be attributed to expectations of a more favorable regulatory environment, as well as to broader market optimism regarding innovation and financial liberalization under the new administration.

It is important to say that the cryptocurrency industry played a significant role in supporting Trump's campaign. According to a report by *Fortune*, crypto firms contributed over $18 million to Trump's inauguration, with Ripple's $4.9 million donation being the second-largest overall . This substantial financial backing from the crypto sector underscores the industry's vested interest in shaping a regulatory environment conducive to digital assets.

The findings support the idea that political signals can exert a measurable influence on crypto adoption behavior. The magnitude and persistence of the post-event CAR suggest that the market did not simply adjust to the election outcome but rather incorporated it as a forward-looking catalyst for the crypto ecosystem.

Conclusion

This thesis set out to explore how cryptocurrency adoption evolves by developing a more nuanced way to measure it. The result was the Crypto Adoption Index (CAI), a composite indicator that brings together various dimensions of crypto activity, from user engagement and on-chain behavior to market sentiment and financial indicators. Rather than relying on price alone or focusing solely on Bitcoin, the CAI offers a broader view that reflects both how widely crypto is used and how deeply it is integrated into emerging financial structures.

Empirical evidence from a range of methodologies demonstrates that although structurally CAI does not have any netting from asset prices, its dynamics are strongly influenced by macro-financial variables.

Event study analysis introduced another level of understanding where crypto specific news, such as the authorization of Bitcoin spot ETFs, did have a limited or short-lived impact on CAI movements. More sweeping political and economic changes (eg, the re-election of Donald Trump) were related to longer-lived obscure shifts in CAI. But on a market model adjusted for general market movements based on the SP500 much of it can be attributed to traditional financial trends than unique crypto-sentiment.

Thesis Limitations

While the construction of the Crypto Adoption Index (CAI) and the associated empirical analysis provide new insights into adoption dynamics, several limitations must be considered.

First, although the CAI incorporates a wide range of sentiment, market, and on-chain indicators, it does not capture every aspect of adoption. Important elements such as institutional custody solutions, developer activity, and the commercial use of cryptocurrencies in daily transactions were excluded due to data unavailability or scope constraints. These factors may play a significant role in shaping adoption patterns but are more difficult to quantify reliably.

Second, the CAI, although in a limited way, includes price-based and trading-related variables. Although informative, these are inherently influenced by speculative behavior. This introduces a level of procyclicality into the index, where increases in adoption may, at times, reflect market enthusiasm more than structural growth. This make it more complex in the distinction between genuine adoption and short-term investor sentiment.

Third, the empirical analysis focuses primarily on short and medium-term dynamics. The use of daily data and event windows of limited duration is appropriate for capturing immediate responses but may not fully reflect long-term trends or gradual changes in the adoption landscape.

Fourth, the set of macro-financial indicators used in the analysis, specifically the S&P 500, Nasdaq Composite, and M2 money supply, provides only a partial view of the external environment. Other influential variables such as regulatory developments, technological

innovations, and demographic shifts were not included and may offer further explanatory power in future research.

Finally, the time period analyzed, from mid-2022 to early 2025, corresponds to a specific macroeconomic and regulatory climate. This includes monetary tightening, geopolitical uncertainty, and evolving institutional attitudes toward digital assets. As a result, the findings may not be fully generalizable to different market conditions or future phases of the crypto industry.

DeFAI's Potential Impact on Future Adoption Trends

The results of this study emphasize the importance of traditional financial markets and regulatory developments on cryptocurrency penetration. But as the crypto landscape evolves, that may be changing. The impact of technology innovation is anticipated to be more and more influential in future adoption trends. One trend that might really impact the way these trends play out is the increasing user friendliness of DeFi, in large part due to Decentralized Finance Artificial Intelligence, or DeFAI.

DeFAI is short for envisioning a better decentralized finance ecosystem through the implementation of artificial intelligence. Presently, most of the DeFi protocols are not easy to be accessed if the user is not tech savvy. These obstacles are compound wallet management systems, transaction fees and contact with smart contract. DeFi has the potential to significantly increase access to financial services, but these barriers have prevented widespread usage.

Adoption of the DeFAI could solve these problems. AI has the potential for automation, user interfaces and even personal financial advice. For instance, AI-powered tools can provide users recommendations on yield farming[6] and liquidity provisioning strategies adjusted for market parameters, personal risk tolerance, and historic performance.

[6] **Yield farming** is the DeFi equivalent of earning interest by depositing money in a bank, but typically involves higher risk and returns through lending or providing liquidity

Facilitating ease of use via DeFAI could potentially drive DeFi adoption further. In the descriptive summary, on-chain based metrics, in particular stable coin volumes and decentralized exchange activities, are responsible for a considerable share of the CAI. More involved use of DeFi through simpler and more accessible exchange interfaces would probably move these metrics upward and imply more genuine network use. This in turn would show a greater overall inclusivity trend. A more regular and smooth user experience might also draw in those that were intimidated by the complexities of DeFi, both as individuals and institutions.

Such a transition would take away from the current dependence of the stock market indicator on conventional financial markets. In the regression and causality tests it was observed that S&P 500 has short-term predictability of CAI behavior. If DeFAI can help innovation and penetration, the expansion of the cryptocurrency space could be internal rather than macro-financial driven.

The degree of this transformation is, however, contingent on how well DeFAI systems can deal with these fundamental issues. These involve ranging from challenges of scalability, cyber-security and changing regulatory needs. If these barriers are tackled, DeFAI could change the dynamics of cryptocurrency adoption and help build a more robust and self-sufficient digital financial ecosystem.

Suggestions for Future Research and Final Reflections

This thesis offers a deeper understanding of cryptocurrency adoption by introducing and analyzing the Crypto Adoption Index (CAI). Still, there's room to take this work further and adapt it to the constantly changing landscape of the crypto world.

One way forward could be to let the index evolve over time. Right now, the CAI uses fixed weights to combine different variables, but the crypto ecosystem doesn't stay still. Some areas grow in importance while others fade. Decentralized infrastructure, tokenized real-world assets, and AI-based protocolls are all examples of sectors that have gained momentum in recent years. If the index could adjust its focus based on how the market shifts, it would give a more accurate picture of what adoption truly looks like in different moments. This could be done through models that learn from new data or through regular reassessment of what matters most in the space.

It would also be meaningful to look at how adoption changes from country to country. Each region brings its own mix of rules, financial systems, and cultural openness to innovation. For example, people in countries facing inflation or limited acces to banks might turn to crypto out of necessity, while in others it might be more of a speculative trend or a form of tech enthusiasm. Including local variables would help compare how adoption behaves in different settings, and could guide both companies and regulators in their decisions.

The way the CAI currently tracks sentiment could also be made richer. Today, it uses structured tools like the Fear & Greed Index or search trends, which are helpful but still limited. There's potential to dig deeper into what people are really thinking and feeling by analyzing social media conversations, headlines, or forum posts using natural language processing tools. Even simple user behaviors like reading articles, interacting with crypto wallets, or joining online discussions could offer signals that reflect interest and confidence more accurately than basic indicators alone.

The section of this thesis that looked at specific events, such as the ETF approval or Trump's re-election, helped to show how external news can shape adoption. But these are just two examples. The crypto space responds to a wide range of signals, from changes in tax laws, to security breaches, to major technological updates like Ethereum upgrades or the rise of new platforms. Looking at how different types of events move the adoption needle would give a clearer sense of which developments truly matter and which are just noise.

Another idea worth exploring is how adoption holds up over longer periods. A short-term spike in usage might be exciting, but it doesn't always last. Understanding what makes adoption stick, especially through bear markets or regulatory pressure, would be key to measuring real progress. The CAI could be used in the future not just to track trends, but to identify deeper patterns of engagement that show when crypto is moving from hype to habit.

These paths suggest that while the CAI in its current form is already a useful lens, its greatest strength might be in how it can grow. Crypto adoption isn't a fixed destination but more so something that changes with time, technology, and human behavior. Continuing to improve the way we measure it can help everyone, from developers to policymakers, make better decisions in a space that's still defining itself.

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