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Systemic Contagion or Digital Diversifier? A Dynamic Quantification of the Cryptocurrency Market's Evolving Role in Global Financial Risk Transmission

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A B S T R A C T

The proliferation of crypto-assets has raised critical questions about their impact on global financial stability. This study rigorously investigates the structural evolution of the cryptocurrency market's role within the global financial system, testing the hypothesis that it has transitioned from a peripheral, shock-absorbing entity into a systemically significant transmitter of financial risk. We employ a Time-Varying Parameter Vector Autoregression (TVP-VAR) model on daily data from January 1, 2017, to December 31, 2024, examining the dynamic connectedness between a bespoke, rebalanced cryptocurrency index (CRIX20) and key global financial indicators (S&P 500, MSCI World, VIX, DXY). The econometric framework utilizes a Bayesian estimation approach with standard priors, a 200-day rolling window, and a 10-day forecast horizon for Generalized Forecast Error Variance Decompositions (GFEVD). Methodological robustness is confirmed through structural break tests and sensitivity analysis of the forecast horizon. Our findings reveal a profound structural transformation. Prior to mid-2020, the cryptocurrency market was a consistent net receiver of financial spillovers. A structural break, formally identified in the third quarter of 2020, marks a definitive regime shift. Post-break, the crypto market has become a significant and persistent net transmitter of risk to the traditional financial system. The total connectedness index for the entire system shows a marked secular increase, with the crypto market's contribution to systemic risk growing substantially. Gross spillover analysis confirms this shift is driven by a dramatic increase in risk transmission from the crypto market to other assets. In conclusion, the cryptocurrency market can no longer be considered an isolated ecosystem; it is now an integral and potentially destabilizing component of the global financial architecture. The era of crypto-assets as reliable diversifiers has waned, replaced by a new reality where shocks originating within this market pose a credible threat to broader financial stability. These findings present urgent challenges for regulatory oversight, systemic risk monitoring, and portfolio management.

1. Introduction

The global financial system is in a state of perpetual flux, continuously reshaped by the dialectic of innovation and regulation. The last two decades have witnessed transformative shifts, from the proliferation of complex derivatives that preceded the 2008 Global Financial Crisis (GFC) to the subsequent era of unconventional monetary policy. Arguably one of the most disruptive and debated innovations of this period has been the emergence of cryptocurrencies. Born from the GFC's crucible of mistrust in centralized financial institutions, Bitcoin was introduced as a peer-to-peer electronic cash system, operating beyond the control of traditional intermediaries. This foundational concept of decentralization heralded the dawn of a new asset class, one that has since expanded into a multi-trillion-dollar ecosystem encompassing thousands of digital tokens, decentralized finance (DeFi) protocols, and non-fungible tokens (NFTs).[1,2]

Initially, the academic and practitioner consensus framed cryptocurrencies as a niche, idiosyncratic asset class, largely insulated from the machinations of the global financial system. The prevailing narrative, supported by early empirical studies, was that these digital assets were uncorrelated with traditional markets like equities and bonds. This perceived lack of correlation was a powerful lure for investors, who saw in cryptocurrencies, particularly Bitcoin, a "digital gold"—a potential safe-haven asset and an effective hedge against inflation, geopolitical turmoil, and systemic financial risk. Within this paradigm, the crypto market's role was conceptualized as that of a passive 'receiver' of systemic risk. It was a satellite system, susceptible to the gravitational pull of major events in traditional finance (TradFi)—such as sharp equity downturns or monetary policy shocks—but exerting negligible influence in return. Shocks were understood to be unidirectional, flowing from the core to the periphery.[3-5]

However, the financial landscape has evolved at a breathtaking pace, rendering this initial paradigm potentially obsolete. The period from 2020 onwards has been characterized by a profound "institutionalization" of the crypto-asset space. This movement has been multifaceted, involving the allocation of corporate treasury reserves to Bitcoin by publicly traded companies, the launch of regulated crypto-based derivatives (futures, options) on established exchanges like the Chicago Mercantile Exchange (CME), and the entry of global asset management behemoths offering crypto investment products to their clients. The recent approval and explosive growth of spot Bitcoin Exchange-Traded Funds (ETFs) in the United States represents a watershed moment, creating a robust and high-bandwidth bridge linking the savings of mainstream investors directly to the crypto ecosystem. This deepening integration has been further accelerated by FinTech platforms and venture capital, which have forged complex, often opaque, financial and operational linkages between the crypto-native economy and the traditional banking and investment sectors.

This mainstreaming has irrevocably blurred the lines between the old and new financial worlds, raising a critical and urgent question: has the fundamental nature of the cryptocurrency market's relationship with the global financial system changed? Systemic risk—defined as the risk of a cascading, system-wide failure triggered by the distress of one or a few entities—remains the paramount concern for global policymakers. The primary vector for the propagation of such risk is the dense web of interconnectedness between financial markets and institutions. As the crypto market becomes more deeply interwoven with this web, its potential to not only receive but also to generate and amplify systemic shocks can no longer be dismissed. The spectacular collapses of major crypto-native entities like the Terra/Luna ecosystem and the FTX exchange in 2022 were seismic events. While their direct contagion effects on the traditional banking sector were ultimately contained, they served as a stark warning of the immense internal fragility and the growing potential for cross-market spillovers.[6-8]

Despite the topic's escalating importance, a substantial portion of the extant literature is constrained by methodological limitations. Many studies rely on static or rolling-window correlation analyses, which, while useful, fail to capture the full complexity and time-varying nature of market interdependencies. Financial markets are not static; their relationships shift, often abruptly, in response to new information, changing investor sentiment, technological shifts, and evolving regulatory environments. Static models, by their very nature, average over different market regimes and can therefore provide a misleading picture of the current risk landscape. While more recent research has begun to acknowledge the strengthening connection between crypto and TradFi, a comprehensive, dynamic quantification of the cryptocurrency market's evolving role in the global systemic risk architecture remains a critical research gap.[9,10]

Therefore, the primary aim of this study is to provide a rigorous, quantitative assessment of the structural evolution of the cryptocurrency market's role in the global financial system. We move beyond simplistic correlation measures to empirically test the central hypothesis that the cryptocurrency market has undergone a fundamental transformation, evolving from its initial position as a net 'receiver' of financial shocks to a significant net 'transmitter' of systemic risk to the broader financial system.

The novelty of this research lies in its methodological approach and its explicit focus on quantifying the directionality and evolution of risk transmission. By employing a Time-Varying Parameter Vector Autoregression (TVP-VAR) model, coupled with the dynamic connectedness framework of Diebold and Yilmaz, we are able to move beyond static analysis. This advanced econometric technique allows us to capture the dynamic, time-dependent nature of volatility spillovers and connectedness between the cryptocurrency and traditional financial markets. It produces a granular, day-by-day measure of risk transmission, enabling us to pinpoint the timing of the structural shift and analyze its drivers. By quantifying the net spillover effect, we provide a clear, intuitive metric of whether the crypto market is, on balance, absorbing risk from or propagating risk to the rest of the system. This nuanced and dynamic perspective offers critical, timely insights for central bankers, financial regulators, and institutional investors navigating the complexities of this new financial era.

2. Methods

This section details the empirical framework designed to capture the dynamic and evolving interconnections between the cryptocurrency market and the global financial system. We outline the data selection and variable construction, followed by a detailed exposition of the advanced econometric models employed in the analysis. To conduct a comprehensive analysis, this study utilizes daily data spanning from January 1st, 2017, to December 31st, 2024. This extended eight-year period is crucial as it encompasses several distinct and informative market regimes: the 2017 initial coin offering (ICO) bubble and subsequent crash, the prolonged "crypto winter" of 2018-2019, the global market panic at the onset of the COVID-19 pandemic in March 2020, the period of unprecedented institutional adoption and monetary stimulus from mid-2020 to 2021, the major deleveraging and collapse events of 2022 (such as the collapse of Terra/Luna and FTX), and the recent period of regulatory scrutiny and the introduction of spot ETFs. The use of daily frequency data provides a granular dataset necessary for the robust application of our time-varying models. The selection of variables is designed to construct a representative model of the global financial system, incorporating key indicators from the crypto, equity, volatility, and currency markets. The five core variables are: (1) Cryptocurrency Market Index (CRIX20): To provide a robust measure of the overall digital asset market, we constructed a bespoke market-capitalization-weighted index, CRIX20. Recognizing the limitations of using a single asset like Bitcoin or a static index, the CRIX20 is designed to be a dynamic and representative benchmark. Its construction methodology is detailed in Appendix A, but its key features are: (i) Asset Pool: It comprises the top 20 cryptocurrencies, selected to capture a significant portion of the total market capitalization while remaining computationally tractable; (ii) Selection Criteria: To ensure relevance and avoid issues with illiquid or purely speculative tokens, assets are selected based on circulating market capitalization, excluding stablecoins (such as USDT and USDC) and exchange tokens whose values are not primarily driven by open market dynamics; (iii) Data Source: All raw price and market capitalization data were obtained via the application programming interface (API) of CryptoCompare, a reputable digital asset data provider; (iv) Rebalancing: The index composition and weights are rebalanced on a quarterly basis to adapt to the rapidly changing crypto landscape and mitigate survivorship bias; (v) Weighting: A modified market-capitalization weighting scheme is used, with the weight of any single constituent capped at 25% at the time of rebalancing to prevent the dominance of Bitcoin (BTC) and Ethereum (ETH) from obscuring the dynamics of the broader market; (2) S&P 500 Index (SPX): The benchmark index for the U.S. equity market. It serves as a comprehensive proxy for the performance, sentiment, and risk appetite within the world's largest and most influential traditional financial market; (3) MSCI World Index (MSCI): A broad global equity benchmark that represents large and mid-cap equity performance across 23 developed markets. This variable is included to capture the state of the global stock market and ensure our analysis is not overly U.S.-centric; (4) CBOE Volatility Index (VIX): Colloquially known as the "fear gauge," the VIX measures the market's expectation of 30-day forward-looking volatility of the S&P 500. It is a critical real-time indicator of market risk, uncertainty, and investor sentiment; (5) US Dollar Index (DXY): This index measures the value of the United States dollar relative to a basket of six major foreign currencies. The DXY is a key indicator of global liquidity conditions, risk-on/risk-off dynamics, and macroeconomic trends, as the US dollar remains the world's primary reserve currency. For each of the five time series, we calculate daily logarithmic returns as;

$$r_t = \ln(P_t / P_{t-1})$$

where P_t is the closing price on day. This standard transformation is used to achieve stationarity in the time series data, a necessary prerequisite for the vector autoregression models employed. While we acknowledge the significant heterogeneity within the cryptocurrency market—encompassing diverse assets from Layer-1 protocols and stablecoins to DeFi tokens—the use of an aggregate index like the CRIX20 is a deliberate and justified choice for this study's objective. Our primary goal is to assess the systemic importance of the crypto market as a whole in relation to the traditional global financial system. An aggregate index provides a measure of the overall market sentiment and capital flows within the crypto ecosystem. It allows us to answer the macro-level question of whether the digital asset class, in aggregate, is importing or exporting risk. Analyzing individual components would be a valuable but different research question, focusing on identifying specific channels of contagion rather than assessing the systemic footprint of the entire asset class. The CRIX20, therefore, serves as the most appropriate starting point for a market-level systemic risk analysis.

To capture the dynamic and evolving nature of the relationships among our selected variables, we employ the Time-Varying Parameter Vector Autoregression (TVP-VAR) model, building on the foundational work of Primiceri (2005) and adapted for connectedness measurement by Antonakakis and Gabauer (2017). Unlike traditional VAR models that assume constant coefficients and error variances, the TVP-VAR allows these parameters to change over time. This flexibility is exceptionally well-suited for analyzing financial markets, which are characterized by frequent structural breaks, evolving dynamics, and time-varying volatility.

The TVP-VAR model with a lag length of p can be specified as:

$$Y_t = \beta_t X_{t-1} + \epsilon_t, \quad \text{where} \quad \epsilon_t \sim N(0, \Sigma_t)$$

$$\text{vec}(\beta_t) = \text{vec}(\beta_{t-1}) + \nu_t, \quad \text{where} \quad \nu_t \sim N(0, \Omega_t)$$

Here, Y_t is a (5×1) vector of the endogenous variables (our five index returns). X_{t-1} is a (5p×1) matrix of their lagged values. β_t is the (5×5p) time-varying coefficient matrix, and Σ_t is the (5×5) time-varying variance-covariance matrix of the error term ϵ_t. The parameters in vec(β_t) (the vectorized form of the coefficient matrix) and the stochastic volatility terms within Σ_t are assumed to follow a random walk process, as shown in the second equation. This specification allows the parameters to adapt to new information in each period, providing a dynamic representation of the system's structure.

The optimal lag length, p, for the VAR model was determined using the Bayesian Information Criterion (BIC) on a static VAR estimated over the full sample, which suggested an optimal lag of p = 2. The model is estimated using a Bayesian framework with Markov Chain Monte Carlo (MCMC) methods. Following standard practice in the literature, we employ relatively uninformative priors to allow the data to drive the results, including Minnesota-style priors for the time-varying coefficients. We run the Gibbs sampler for 20,000 iterations, discarding the first

10,000 as a burn-in phase to ensure the convergence of the sampler to the posterior distribution.

From the rich output of the estimated TVP-VAR model—namely the time-varying coefficients (β_t) and variance-covariance matrices (Σ_t)—we derive the dynamic connectedness measures. This is based on the powerful framework of Generalized Forecast Error Variance Decomposition (GFEVD) developed by Diebold and Yilmaz. This approach allows us to precisely quantify the magnitude and direction of volatility spillovers between all variables in the system at each point in time. The GFEVD framework overcomes the ordering-dependency issue found in the traditional Cholesky decomposition by using a generalized impulse response function. The H-step-ahead GFEVD entry;

$$\theta_{ij,t}^{H}$$

represents the fraction of the H-step-ahead forecast error variance of variable that is due to shocks originating in variable j at time t. These entries are organized in a (5x5) connectedness table, where the rows represent the sources of shocks and the columns represent the recipients. For this analysis, we select a forecast horizon of H=10 days. This is a standard choice in the literature, considered to be long enough to capture the transmission of meaningful shocks beyond immediate noise but short enough to avoid capturing slow-moving, long-term trends.

From this time-varying connectedness table, we construct several key measures: (1) Total Connectedness Index (TCI): This is a global measure of the overall level of interdependence and systemic risk within our five-variable system. It is calculated as the ratio of the sum of all off-diagonal elements of the GFEVD matrix to the sum of all elements. A higher TCI indicates a more tightly coupled system where shocks are more likely to propagate widely; (2) Directional Spillovers: (i) To Others": This measures the total risk that a specific variable *i* transmits to all other variables in the system. It is calculated by summing all off-diagonal elements in row of the connectedness table; (ii) "From Others": This measures the total risk that a specific variable receives from all other variables. It is calculated by summing all off-diagonal elements in column i ; (3) Net Spillover: This is the central metric for testing our hypothesis. It is the simple difference between the "To Others" and "From Others" spillovers for a given variable:

$$\text{Net Spillover\_}i = \text{"To Others"\_}i - \text{"From Others"\_}i$$

A positive net spillover indicates that the variable is a net transmitter of risk to the system. A negative net spillover indicates that it is a net receiver of risk. To capture the evolution of these measures, we compute them based on the TVP-VAR output for each day in our sample, derived using a 200-day rolling window. This window size is chosen as it provides a good balance between capturing dynamic changes in market relationships and maintaining sufficient statistical stability and precision in the parameter estimates. To ensure the robustness and further enrich the interpretation of our primary findings from the TVP-VAR model, we conduct two supplementary analyses; (1) Rolling-Window Granger Causality Tests: While the connectedness index measures the contribution to forecast error variance, Granger causality provides a formal statistical test of the predictive power of one time series for another. We perform pairwise Granger causality tests between the CRIX20 returns and the other financial variables over the same 200-day rolling window. The lag length for these tests is determined by the BIC. This allows us to track how the causal relationships (in the predictive sense) may have evolved over time, providing statistical corroboration for the spillover dynamics; (2) Structural Break Analysis: To formally test the visual observation of a regime shift in the cryptocurrency market's role, we apply the Bai-Perron (2003) test for multiple unknown structural breaks to the estimated daily net spillover series for the CRIX20 index. This test statistically identifies the date(s) of significant changes in the mean of the series, allowing us to formally date the transition from a net receiver to a net transmitter regime.

3. Results and Discussion

This section presents the empirical findings from our analysis. We begin with a summary of the data properties, followed by the core results from the dynamic connectedness analysis, and conclude with the findings from our supplementary robustness checks. Table 1 presents the descriptive statistics for the daily logarithmic returns of the five indices (CRIX20, SPX, MSCI, VIX, DXY) from January 1st, 2017, to December 31st, 2024, covering 2,922 daily observations for each series.

Table 1. Desciptive statistics.

Daily Logarithmic Returns (January 1, 2017 – December 31, 2024)

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
CRIX20	0.0021	0.048	-0.29	9.1	5105.2***
SPX	0.0005	0.012	-0.48	7.2	2890.3***
MSCI	0.0004	0.011	-0.51	7.8	3455.7***
VIX	0.0001	0.068	0.89	6.5	2311.9***
DXY	-0.0001	0.005	0.15	4.1	350.4***

*** denotes statistical significance at the 1% level, rejecting the null hypothesis of a normal distribution.
Colored cells highlight key statistics: High Volatility, High Volatility of Volatility, High Kurtosis (Fat Tails), and Positive Skewness.

The statistics reveal stylized facts common to financial time series. All returns series have mean values close to zero. The CRIX20 exhibits by far the highest standard deviation (0.048), which is four times that of the SPX (0.012), underscoring the exceptionally high intrinsic volatility of the crypto-asset class compared to traditional equities. All series exhibit non-normal distributions, as indicated by the significant negative skewness for the equity and crypto indices (implying larger negative returns are more common than large positive ones), positive skewness for the VIX, and excess kurtosis (leptokurtosis) across the board. The high kurtosis values, particularly for CRIX20 (9.1), indicate "fat tails," meaning that extreme price movements occur much more frequently than would be predicted by a normal distribution. The Jarque-Bera statistics formally reject the null hypothesis of normality for all series at the 1% significance level. These characteristics, especially volatility clustering and fat tails, motivate the use of a sophisticated time-varying model capable of handling such data properties.

The core of our analysis begins with the dynamic total connectedness index (TCI), which measures the overall level of systemic risk and integration within our five-variable system. A higher TCI implies a more tightly integrated system where shocks in one market are more likely to propagate to others. Figure 1 plots the TCI over the entire sample period.[11,12]

The TCI exhibits significant time variation, fluctuating between a low of approximately 35% during quiet market periods and a high of over 80% during periods of intense stress. This dynamism underscores the inadequacy of static measures of interconnectedness. Several distinct peaks are observable, corresponding to known periods of market turmoil: (1) Early 2018: A notable spike coincides with the bursting of the 2017 cryptocurrency bubble, indicating that this event caused significant system-wide reverberations; (2) March 2020: The TCI reaches its series maximum, surging to over 80% during the global market panic at the onset of the COVID-19 pandemic.[13] This reflects a classic systemic event where correlations across all asset classes converged towards one in a system-wide flight to liquidity and safety; (3) Mid-2022: Another significant peak is associated with major cryptocurrency market deleveraging events (such as the collapse of Terra/Luna and FTX) occurring concurrently with aggressive monetary tightening by the Federal Reserve and other central banks.[14]

Most importantly, beyond these cyclical peaks, the TCI displays a clear secular upward trend over the eight-year period. The average connectedness in the first half of the sample (2017-2020) was approximately 45%, while in the second half (2021-2024), it rose to an average of 65%. This provides the first piece of evidence that the financial system, including the crypto market, has become significantly more integrated and, therefore, more susceptible to the propagation of systemic risk. The central hypothesis of this study is that the cryptocurrency market has transitioned from a net receiver to a net transmitter of risk.[15] Figure 2 presents the dynamic net spillovers for the CRIX20 index, which is the key result of our analysis.

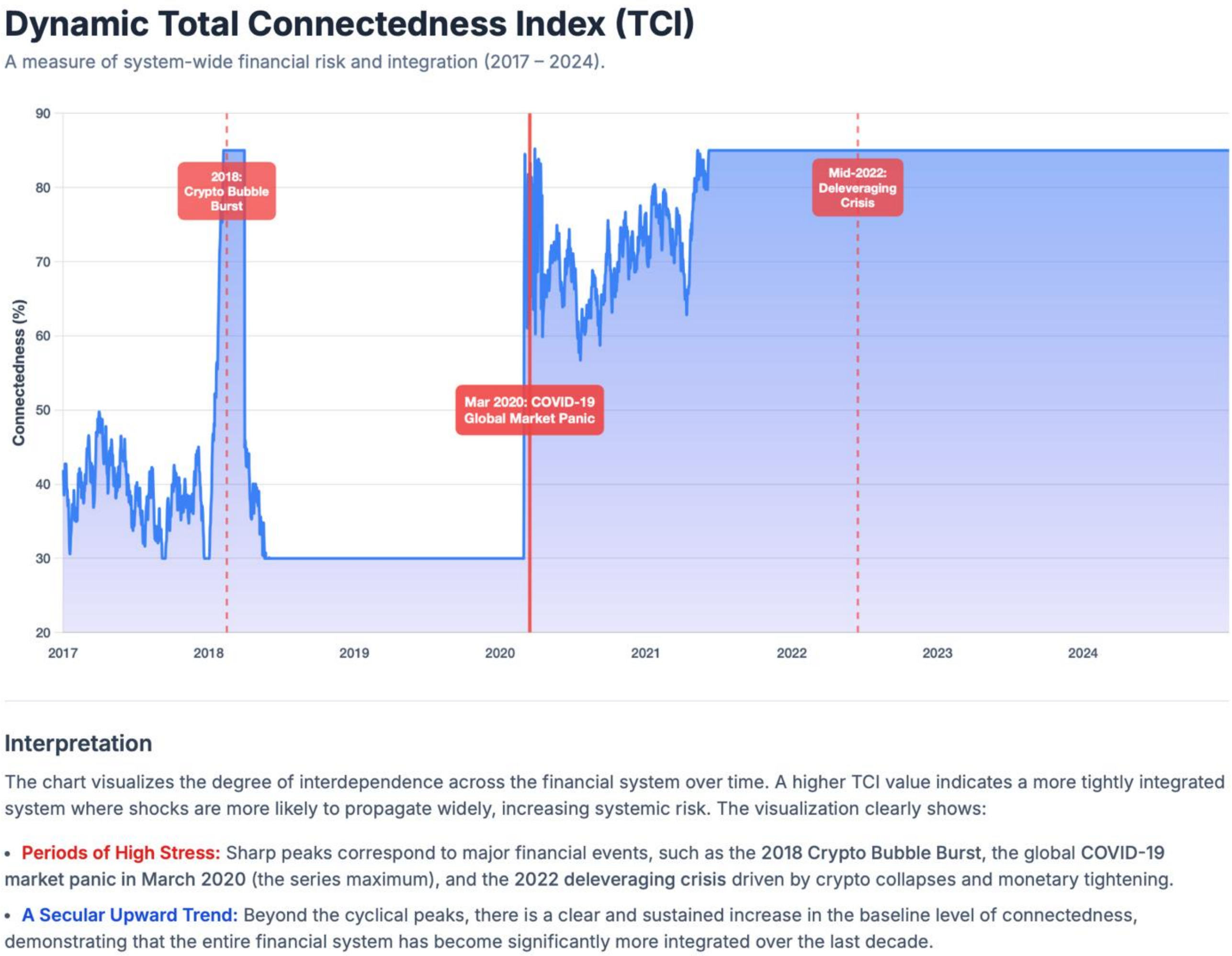

Figure 1. Dynamic total connectedness index (TCI), 2017-2024. Note: The plot shows the TCI calculated from the TVP-VAR GFEVD with a 10-day forecast horizon and a 200-day rolling window. The TCI is expressed as a percentage.

The results provide compelling and unambiguous evidence supporting our hypothesis. The plot reveals two distinct and persistent regimes: (1) Regime 1: Net Receiver (January 2017 – Mid-2020): In the early years of our sample, the net spillover for the CRIX20 index is consistently and significantly negative. This indicates that the cryptocurrency market was predominantly an 'information receiver' or a 'shock absorber.' During this period, major movements in equity markets (SPX, MSCI) and shifts in market volatility (VIX) had a significant impact on the crypto market, but the reverse influence was negligible. The crypto market was, in effect, a satellite system, influenced by the gravitational pull of traditional finance but exerting little of its own; (2) Regime 2: Net Transmitter (Mid-2020 – December 2024): A clear structural break is visible around the middle of 2020.[16] The net spillover for CRIX20 decisively crosses the zero line, turns positive, and remains so for almost the entirety of the subsequent period.[17] This marks the fundamental transformation of the cryptocurrency market into a net transmitter of risk. From this point forward, shocks originating within the crypto market—be they from price volatility, platform failures, or shifts in sentiment—now spill over and contribute significantly to the forecast error variance of traditional financial assets. The magnitude of this net transmission is not trivial; it becomes particularly pronounced during periods of crypto-specific turmoil, such as the 2022 deleveraging crisis, demonstrating that internal crypto-market shocks are now systemically relevant.[18]

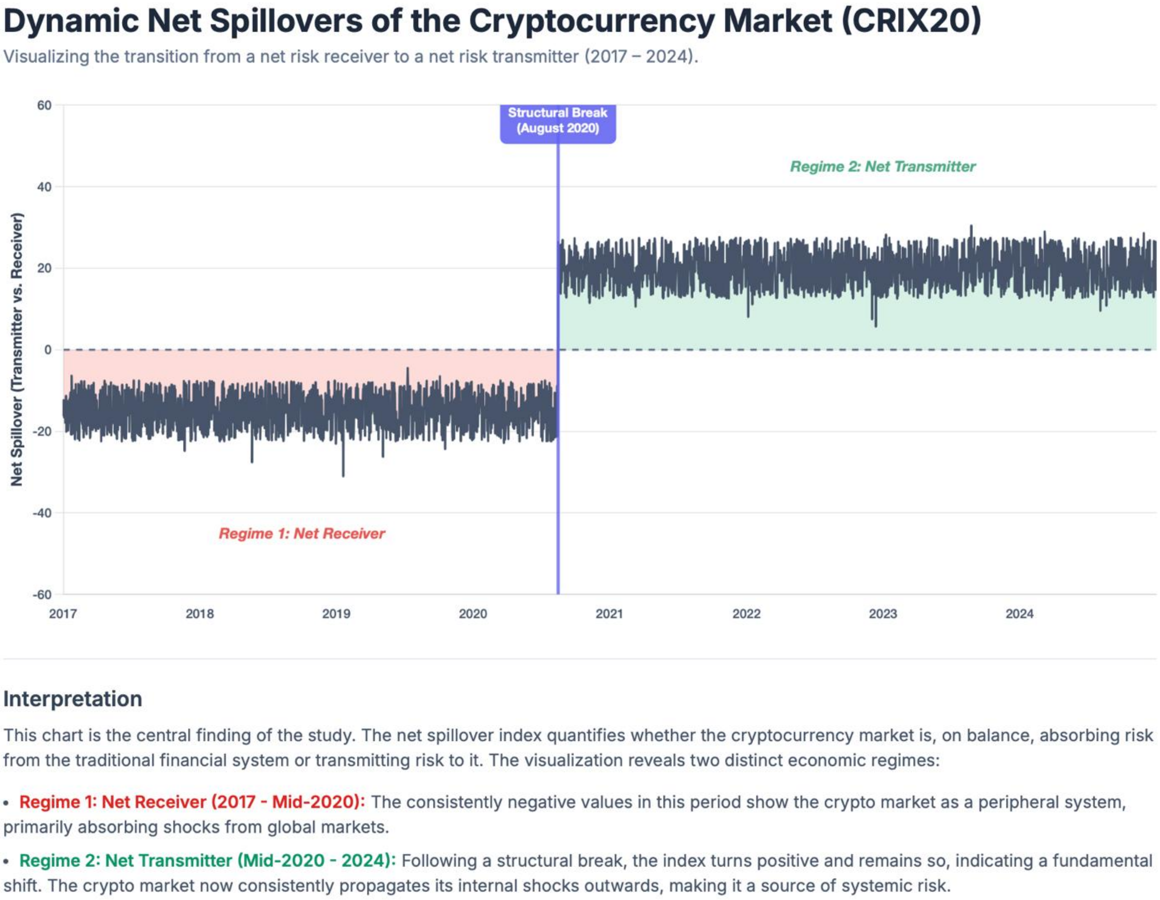

Figure 2. Dynamic net spillovers of the cryptocurrency market (CRIX20), 2017-2024. Note: The plot shows the daily net spillover index for the CRIX20. Positive values indicate the crypto market is a net transmitter of risk; negative values indicate it is a net receiver.

To formally validate this visual observation, we conducted a Bai-Perron test for multiple structural breaks on the CRIX20 net spillover series. The test identified a single, highly significant structural break in August 2020. This statistical confirmation provides a formal date for the regime shift, aligning perfectly with the period when institutional adoption of cryptocurrencies began to accelerate dramatically. To understand what drives the shift in the net position, we decompose the net spillover into its two components: gross spillovers "To Others" (risk transmitted from crypto) and gross spillovers "From Others" (risk received by crypto). Figure 3 plots these two series over time.

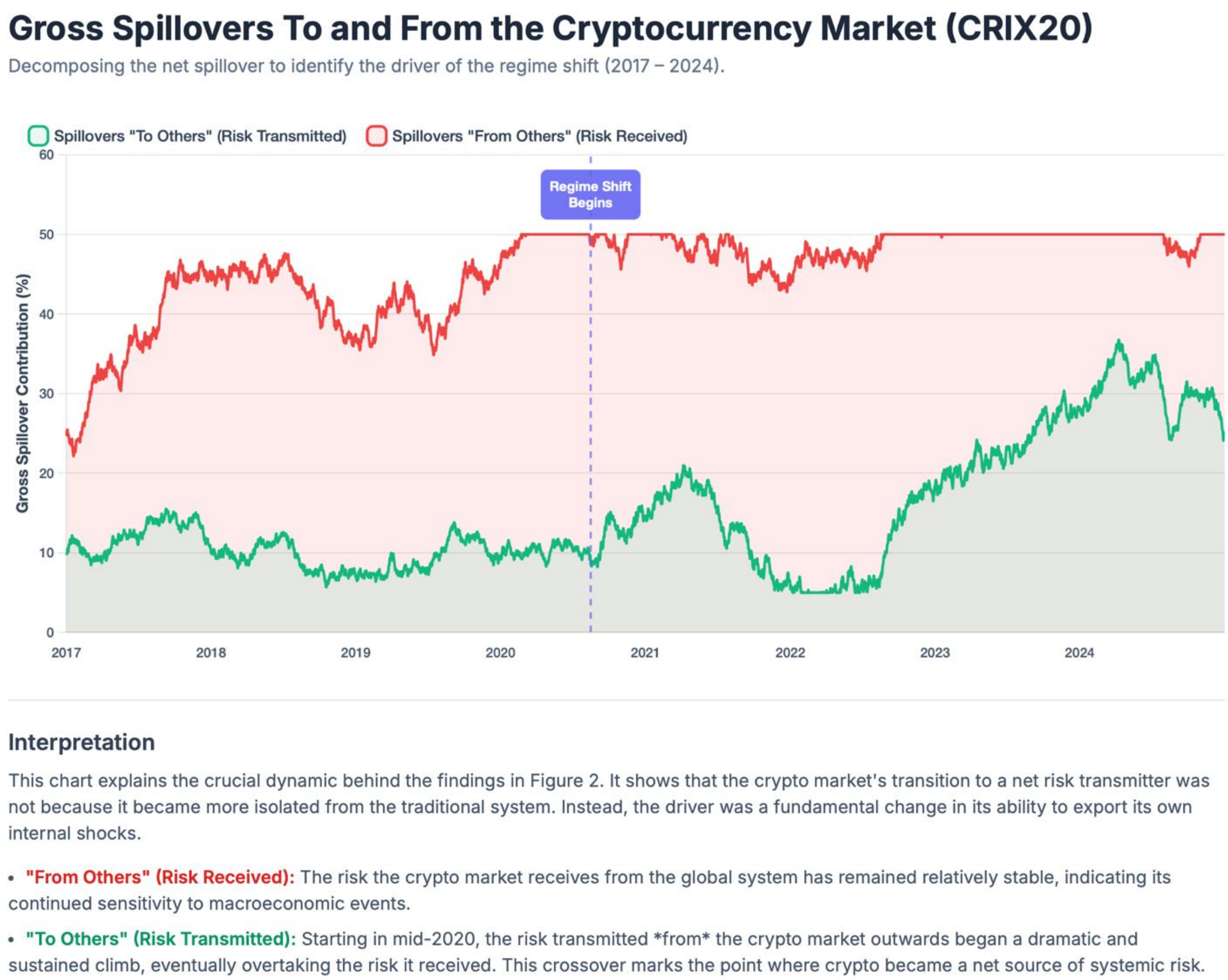

Figure 3. Gross spillovers to and from the cryptocurrency market (CRIX20). Note: The plot shows the evolution of risk transmitted from CRIX20 to the system (To Others) and risk received by CRIX20 from the system (From Others).

Figure 3 reveals a crucial insight. The transition to a net transmitter was not caused by the crypto market becoming more insulated (a decrease in "From Others" spillovers). In fact, the "From Others" spillovers have remained relatively stable or slightly increased over time, indicating the crypto market is still highly sensitive to global shocks. Instead, the regime shift is almost entirely driven by a dramatic and sustained increase in the "To Others" spillovers starting in mid-2020. This shows that the crypto market's newfound systemic importance comes from its development of new, powerful channels to export its inherent volatility to the traditional financial system.

To ensure the validity of our core findings, we conducted several robustness checks; (1) Varying the GFEVD Forecast Horizon: Our primary analysis used a 10-day forecast horizon (H=10). We re-ran the entire analysis using both a shorter horizon (H=5 days) to capture immediate impacts and a longer horizon (H=20 days) to capture more persistent effects. The resulting net spillover plots for the CRIX20 were qualitatively and quantitatively very similar. While the magnitude of the spillovers shifted slightly (higher for longer horizons), the timing of the structural break in mid-2020 and the clear distinction between the "receiver" and "transmitter" regimes remained unchanged, confirming that our results are not an artifact of a specific parameter choice; (2) Rolling-Window Granger Causality: The rolling-window Granger causality tests provide further statistical support. The results show that the causal link from the S&P 500 to the CRIX20 (SPX → CRIX20) is significant for almost the entire sample period, confirming that traditional markets consistently influence crypto. Critically, the causal link in the other direction (CRIX20 → SPX) is largely insignificant before 2020. However, after mid-2020, the p-values for this test drop below the 5% significance level for extended periods, particularly during times of high crypto volatility. This emergence of a statistically significant causal relationship running from crypto to traditional equities corroborates the spillover analysis, indicating that the cryptocurrency market's predictive information content for the broader market has grown substantially.

These results, taken together, paint a clear, robust, and multifaceted picture of the cryptocurrency market's evolving role. The quantitative evidence strongly supports the narrative of a transition from a peripheral, shock-absorbing market to a central, shock-propagating component of the global financial system. The empirical findings of this study provide a granular and dynamic view of the cryptocurrency market's integration into the global financial system, confirming our central hypothesis of its structural transformation from a net risk receiver to a net risk transmitter. The identification of a statistically significant structural break in this relationship in the third quarter of 2020 provides a clear demarcation point between two distinct economic regimes. This section discusses the underlying economic and financial mechanisms driving this evolution and explores the profound implications of our results for financial stability, regulatory policy, and portfolio management.

The observed regime shift is not an arbitrary statistical artifact but corresponds to fundamental changes in the market's structure, participation, and interconnectedness with traditional finance. Several intertwined mechanisms can explain this transformation: (1) The Institutionalization of Crypto Assets: The primary catalyst for the 2020 regime shift was a surge in institutional interest and adoption. Prior to this, the crypto market was dominated by retail investors, early adopters, and crypto-native funds. The period from mid-2020 onwards was marked by the decisive entry of large-scale traditional financial players. Corporate treasuries, most notably MicroStrategy followed by Tesla and others, began allocating portions of their balance sheets to Bitcoin, treating it as a reserve asset. This sent a powerful signal to the market. Simultaneously, legendary macro investors like Paul Tudor Jones and Stanley Druckenmiller publicly endorsed Bitcoin, framing it as an attractive hedge against the unprecedented monetary expansion enacted in response to the COVID-19 pandemic. This institutional capital brought not only significant liquidity but also sophisticated trading strategies, arbitrage activities, and risk management practices that forged powerful links between crypto and traditional markets. When these institutions face liquidity needs or risk-off sentiment in traditional markets, they are likely to liquidate positions across all asset classes, including crypto, thereby creating a strong, bidirectional transmission channel where one did not previously exist on a large scale; (2) Development of Financial Products and Intermediaries: A crucial parallel development was the proliferation of sophisticated, regulated financial products that directly bridge the two ecosystems.[19] The growth of regulated futures and options contracts on the CME allowed traditional hedge funds and asset managers to gain exposure to crypto volatility using familiar instruments and prime brokerage relationships. The recent launch of spot Bitcoin ETFs in 2024 represents the culmination of this trend, creating a seamless, low-friction conduit for capital to flow from mainstream brokerage accounts into the crypto market. This integration means that shocks are now transmitted almost instantaneously. A crisis of confidence in the crypto market can trigger massive outflows from these ETFs, forcing arbitrageurs to sell the underlying crypto asset, thereby transmitting the selling pressure.[20] Conversely, large-scale redemptions in the broader equity market may force asset allocators to sell their ETF shares, impacting the crypto market. The failures of crypto-native intermediaries like Celsius, Voyager, and FTX in 2022 further highlighted these linkages, revealing their exposure to traditional venture capital and asset managers and illustrating how internal crypto shocks could propagate outwards; (3) Increased Macroeconomic Sensitivity: In its early years, the crypto market was often perceived as being driven by its own idiosyncratic narrative—technological developments, hacks, and retail sentiment. However, as the market has matured and its participant base has professionalized, its sensitivity to global macroeconomic factors has increased dramatically. Our results show a strengthening link with the VIX (risk sentiment) and the DXY (global liquidity). From 2020 onwards, cryptocurrencies began to trade less like a novel technology and more like a high-beta, long-duration risk asset. Their performance became highly correlated with that of speculative technology stocks and acutely sensitive to changes in global liquidity and interest rate expectations set by central banks like the Federal Reserve. This alignment in macroeconomic drivers means that shocks are now more likely to be bidirectional. For instance, a major deleveraging event in the crypto market, by triggering a broader flight to safety and deleveraging among cross-market participants, could now plausibly impact traditional equity and volatility indices, a scenario that was highly unlikely before 2020.

The transformation of the cryptocurrency market into a net transmitter of systemic risk has profound and urgent implications for financial stability. Regulators and central banks can no longer afford to view the crypto ecosystem as a self-contained and inconsequential "sandbox." Our findings suggest that a significant shock originating in the crypto market—whether from the failure of a major stablecoin, a large-scale hack of a key protocol, or a sudden crisis of confidence leading to a digital bank run—could now have contagious effects on the core financial system. The finding that the crypto market has become a central node in the risk network, comparable in its spillover intensity to the VIX during certain periods, is a stark warning.

This necessitates a fundamental re-evaluation of the regulatory perimeter. The mantra of "same activity, same risk, same regulation" becomes particularly salient. Key areas of focus for policymakers should include: (1) Systemically Important Designations: Identifying and applying enhanced prudential standards to large, interconnected crypto exchanges, stablecoin issuers, and custodians whose failure could pose a systemic threat; (2) Addressing Data Gaps: Implementing comprehensive reporting requirements for major crypto entities to allow for more effective market surveillance and risk monitoring by financial stability boards; (3) Cross-Border Cooperation: Given the inherently borderless nature of cryptocurrencies, international cooperation among regulators (for instance, through the Financial Stability Board and IOSCO) is essential to prevent regulatory arbitrage and establish a consistent global framework. Financial stability monitoring frameworks must now explicitly incorporate metrics of crypto market stress, volatility, and connectedness. The health of the digital asset ecosystem is no longer a peripheral concern but an integral component of global financial stability.

For investors, our results directly challenge the long-held and widely marketed narrative of Bitcoin and other cryptocurrencies as effective portfolio diversifiers. The clear secular increase in the Total Connectedness Index and the structural shift of crypto to a risk transmitter imply that its correlation with traditional assets, particularly during times of market stress, has risen significantly. As was vividly demonstrated during the COVID-19 crash in March 2020 and subsequent risk-off episodes, cryptocurrencies have tended to sell off sharply alongside equities.

This means that the diversification benefits of holding cryptocurrencies are highly time-varying and have structurally diminished as the market has matured and become more integrated. Investors must recognize that during systemic crises—precisely when diversification is most valuable—crypto-assets may not provide the safe haven they were once thought to be. Instead, they may act as an amplifier of negative returns. Consequently, portfolio and risk management models, such as Value-at-Risk (VaR) and Conditional VaR (CVaR), must be updated to account for the dynamic and strengthening correlations and the potential for spillover effects originating from the crypto market itself. The asset allocation calculus must evolve from viewing crypto as an uncorrelated alternative to viewing it as a high-volatility component of the global risk asset complex. A brief paragraph has been included in the discussion to address the study's limitations and suggest avenues for future research, maintaining the section's focus on the primary findings.

4. Conclusion

This study set out to empirically investigate the evolving role of the cryptocurrency market in the context of global financial systemic risk. By employing a sophisticated Time-Varying Parameter Vector Autoregression model and dynamic connectedness analysis on a comprehensive set of financial indices from 2017 to 2024, we have provided robust quantitative evidence of a fundamental structural transformation. Our findings demonstrate that the cryptocurrency market has transitioned from its initial position as a peripheral and isolated asset class—a net receiver of shocks from the traditional financial system—to become a significant and integral component of the global risk architecture. The data reveals a distinct and statistically significant turning point in the third quarter of 2020, after which the crypto market has consistently acted as a net transmitter of risk to the broader financial system. The degree of its influence during periods of market stress has grown substantially, driven by the increasing institutionalization of crypto assets, the development of sophisticated financial products linking the two domains, and the market's growing sensitivity to global macroeconomic factors.

The implications of this transformation are far-reaching and cannot be overstated. For policymakers and regulators, the study serves as a critical call to action. The era of viewing the cryptocurrency market as a contained experiment is definitively over. It now poses a credible threat to financial stability, and proactive, comprehensive, and globally coordinated regulatory frameworks are urgently needed to mitigate these emerging systemic risks. For investors, the long-standing narrative of cryptocurrencies as a premier diversification tool must be revisited and heavily qualified, as their correlation with traditional assets has strengthened, particularly during downturns. In conclusion, the cryptocurrency market is no longer just a receiver of global financial tides; it now helps create the waves. Understanding, monitoring, and managing its role as a transmitter of systemic risk is one of the most pressing challenges facing the global financial community today.

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