

Bitcoin's Integration into Traditional Financial Markets:**A Comparative Review of Correlation and Volatility Dynamics Before and After the 2024 Spot Bitcoin ETF Approval**Author: Omar Abi Karam¹*Affiliation:*

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Abstract:

On January 10, 2024, the U.S. Securities and Exchange Commission approved eleven spot Bitcoin exchange-traded funds, including products from BlackRock and Fidelity, in what is widely regarded as the most significant institutional-adoption milestone in cryptocurrency history. This paper reviews and synthesizes recent empirical research examining whether this approval changed Bitcoin's statistical relationship with traditional financial assets - equities, gold, and the U.S. dollar - and whether it altered volatility dynamics across major cryptocurrencies. The analysis is anchored on Hong et al. (2025), whose Chow-test results on 30- and 60-day rolling-correlation series confirm statistically significant structural breaks in Bitcoin's relationship with the S&P 500 (statistic 139.42-269.30), gold (135.96), and the U.S. Dollar Index (105.86), all significant at $p < .0001$, and is cross-checked against four further studies published between 2024 and 2025 applying DCC-GARCH, GARCH-X, TVP-VAR, and event-study methodologies, plus an independent 2025 rolling-correlation estimate showing Bitcoin's S&P 500 correlation climbing from about 0.45 to 0.6-0.7 over the year. The paper finds converging evidence that Bitcoin's correlation with the S&P 500 rose meaningfully following approval after a period of decoupling, while its correlation with gold moved further apart rather than closer (a 'fund diversion' pattern) and its negative correlation with the U.S. dollar persisted. Volatility evidence is more mixed: altcoin volatility (Ethereum, Ripple, Litecoin) declined following approval, consistent with a market-stabilization effect, while Bitcoin's own return volatility was essentially unchanged (0.0322 pre-approval versus 0.0323 post-approval) even as its mean price more than doubled. These findings suggest that Bitcoin ETF approval accelerated Bitcoin's integration into mainstream portfolio flows without fundamentally altering its idiosyncratic volatility profile, a distinction with direct implications for how investors should treat Bitcoin's diversification value going forward.

Keywords:

Bitcoin, spot Bitcoin ETF, cryptocurrency, S&P 500, gold, volatility, correlation dynamics, institutional adoption, structural break

Introduction:

The approval of spot Bitcoin exchange-traded funds (ETFs) by the U.S. Securities and Exchange Commission on January 10, 2024 marked a turning point in the relationship between cryptocurrency markets and traditional finance. For the first time, mainstream investors, pension funds, and wealth managers could gain regulated, exchange-listed exposure to Bitcoin without directly custodizing the underlying asset, removing a major operational barrier that had kept much institutional capital on the sidelines.

This development reopened a long-standing debate in financial economics: does Bitcoin behave as an independent, portfolio-diversifying asset - historically compared to gold as a hedge against inflation and market turbulence - or does greater institutional and retail access simply draw it into closer alignment with the equity markets its investors already hold (Hong et al., 2025)? The answer matters directly for portfolio construction: an asset that becomes more correlated with equities loses much of the diversification benefit that justified including it in a balanced portfolio in the first place.

This paper addresses that question by reviewing and comparing the empirical findings of five studies published in 2024 and 2025 that directly examine Bitcoin's correlation and volatility behavior before and after the ETF approval. The objectives are threefold: (1) to summarize how Bitcoin's correlation with the S&P 500, gold, and the U.S. dollar changed following approval; (2) to summarize how the approval affected volatility, both for Bitcoin itself and for other major cryptocurrencies; and (3) to assess what these combined findings imply for Bitcoin's role in a diversified investment portfolio going forward.

Literature Review:

The theoretical starting point for this literature is the idea that Bitcoin, due to its decentralized structure and independence from any central bank, could behave as a hedge or safe-haven asset similar to gold, particularly during periods of equity-market turbulence (Hong et al., 2025). Using rolling correlation analysis, Chow structural-break tests, and DCC-GARCH modeling, Hong et al. (2025) tested this idea directly around the January 2024 ETF approval, using daily adjusted closing prices for Bitcoin, the S&P 500, gold, and the U.S. Dollar Index (DXY) sourced from Yahoo Finance, split into a pre-event window (October 1, 2023 - January 9, 2024) and a post-event window (January 11 - April 30, 2024). Descriptively, Bitcoin's mean price rose from about \$26,328 pre-event to \$60,503 post-event, while its daily return volatility barely moved (standard deviation 0.0322 pre versus 0.0323 post) even as its price more than doubled - in contrast, return volatility fell for the S&P 500 (0.0171 to 0.0070), gold (0.0164 to 0.0095), and DXY (0.0132 to 0.0032). A Chow test applied to the 30-day and 60-day rolling-correlation series found statistically significant structural breaks at the approval date for Bitcoin's correlation with the S&P 500 (Chow statistic 139.42 at 30 days, 269.30 at 60 days), gold (135.96), and DXY (105.86), all significant at $p < .0001$ - confirming a genuine regime change in how these correlations behave, not just a temporary blip. Interestingly, a simpler pairwise regression of Bitcoin's excess returns on S&P 500 excess returns did not show a significant break in the instantaneous return-sensitivity coefficient itself (Chow statistic 0.14, $p = .867$), while the equivalent gold and DXY coefficients did break ($p = .099$ and $p < .001$, respectively) - meaning the S&P 500 relationship strengthened as a sustained correlation trend rather than as an overnight shift in day-to-day sensitivity. The study's DCC-GARCH model added a further nuance:

dynamic correlations across all three asset pairs briefly fell immediately after approval, an initial 'dispersion effect' as new institutional capital reset price discovery, before Bitcoin's correlation with the S&P 500 rebounded and rose further (a 'portfolio reallocation effect'), while its correlation with gold drifted even lower (a 'fund diversion effect', consistent with capital rotating toward Bitcoin for speculative rather than hedging purposes). Gold and DXY correlations, in short, moved independently of the equity story rather than mirroring it.

This structural-break finding is corroborated by an independent, more recent rolling-correlation analysis. Lai (2025), using weekly Yahoo Finance data from October 2024 to October 2025, computed 26-week rolling correlations and an OLS beta between Bitcoin and the S&P 500 and Nasdaq Composite. Bitcoin's correlation with the S&P 500 rose from about 0.45 in early 2025 to roughly 0.6-0.7 by mid-2025 following the ETF-driven price surge past \$68,000, alongside a regression beta of about 1.3 - meaning a 1% S&P 500 move corresponded to roughly a 1.3% Bitcoin move, amplifying rather than merely tracking equity-market swings. Because this analysis uses a different, later sample window than Hong et al. (2025) and was produced independently, its agreement with the earlier Chow-test result strengthens confidence that the equity-correlation increase is a persistent post-ETF feature rather than an artifact of one study's specific window, even though, as its author notes, a single year of weekly data remains a short base from which to project a permanent structural change.

Donoiu (2025) reaches a broadly consistent conclusion using a different methodological toolkit - Pearson correlation, time-varying parameter vector auto regression, and GARCH models applied to Bitcoin alongside the S&P 500, Dow Jones Industrial Average, and Nasdaq-100. The study documents that Bitcoin's correlation with equity indices peaked around 2021, declined over the following two years, and then rose again after the 2024 ETF launch, particularly against the S&P 500. Notably, when the analysis was narrowed to a tight 90-day event window around the launch date itself, no statistically significant short-term jump in correlation was detected, leading Donoiu to characterize the market's adjustment as gradual and orderly rather than a discrete shock - a useful nuance against a simpler 'ETF approval instantly changed everything' narrative.

More studies argue that the role of Bitcoin has shifted from a speculative asset into an asset that can be used for hedging (Beainy & Kamel, 2026), simultaneously, the technology that allowed the development of cryptocurrencies has significantly progressed, modern AI and blockchain technology has been found to increase firm performance (Khalife et al., 2024) especially when it comes hand in hand with proper governance (Athari et al., 2023) and human business experience (Chaanine et al., 2023). In today's data driven culture (Azoury et al., 2024) cryptocurrencies do not emerge as an exception but as a logical norm for our modern environments, where technology adaptation is not a choice but a necessity (Bejjani et al., 2024), allowing in some cases to even quantify investor sentiments (Khalife et al., 2025). Finally, studies argue that bitcoin is particularly important in markets where the financial traditional system has collapsed as argue Mawad and Freiha (2024) through a detailed examination of the Lebanese case.

On the volatility side, Babalos et al. (2025), applying an event-study methodology within a GARCH framework to data spanning December 2017 through March 2024, found that spot Bitcoin ETF introduction had a significant effect on cryptocurrency returns and volatility more broadly. Returns for Bitcoin, Ethereum, and Litecoin rose significantly around the event date,

while the volatility of Ethereum, Ripple, and Litecoin declined following approval - a pattern consistent with a 'stabilization hypothesis' in which regulated institutional products dampen speculative volatility in adjacent crypto assets. Bitcoin's own spot-market volatility, however, showed no statistically significant change, and the authors additionally found that returns on the Grayscale Bitcoin Trust - the largest pre-existing publicly traded Bitcoin fund - increased significantly following its conversion into an ETF.

Complementary event-study evidence from Krouska (2024), examining the anticipated approval period, and volatility-index research from Babaoglu (2024) on options-derived spot-volatility correlation indices around the same regulatory milestone, both point to the same broad conclusion: the approval process reshaped how volatility and price expectations are formed in Bitcoin markets, with effects that became visible in derivatives and options pricing even before the SEC's final decision, rather than being confined to a single announcement-day event.

Collectively, this literature suggests two things that are not always emphasized together. First, Bitcoin's correlation with equities has strengthened over the medium term following ETF approval, weakening the classical diversification argument for holding it as an equity hedge. Second, this growing equity-correlation trend is distinct from Bitcoin's own volatility profile, which appears largely unchanged, even as volatility in some other major cryptocurrencies declined. The next section explains how this paper compares these findings systematically.

Methodology:

This study uses a structured comparative literature review anchored on one fully specified empirical model, rather than an original econometric estimation run from scratch. Given the scope of an undergraduate finance research project and the value of comparing several independently estimated models rather than a single new regression on a short post-approval sample, the anchor model - Hong et al. (2025) - is reproduced here in full technical detail, and four additional studies are mapped onto its outcome variables to test whether its findings replicate under different specifications.

The anchor model's design is fully specified and replicable. Data are daily adjusted closing prices for Bitcoin, the S&P 500, gold, and the U.S. Dollar Index (DXY), sourced from Yahoo Finance and split into a pre-event window (October 1, 2023 - January 9, 2024) and a post-event window (January 11 - April 30, 2024) around the SEC's January 10, 2024 approval date. Stationarity of excess returns was confirmed for all four series via the Augmented Dickey-Fuller test (all four statistics significant at $p < .0001$), satisfying the precondition for the three techniques applied in sequence: (1) forward rolling correlation, computed over 30-day and 60-day moving windows, as an intuitive first look at time-varying co-movement; (2) a Chow test for structural breaks, applied both to a pairwise OLS regression of excess returns and to the rolling-correlation series itself, to statistically confirm whether the relationship changed regime at the approval date rather than merely appearing to shift in a chart; and (3) an ARMA-DCC-GARCH model, which first fits univariate GARCH(1,1) models to each asset to standardize for volatility clustering, then computes a dynamic conditional correlation matrix that isolates the underlying correlation trend from short-term volatility noise.

Four additional peer-reviewed, working-paper, and graduate-thesis sources published between 2024 and 2025 were selected on the basis that each independently estimates a statistical relationship (correlation, volatility, or both) between Bitcoin and either traditional financial assets or other major cryptocurrencies, using an explicit pre- versus post-ETF-approval comparison: Donoiu (2025) applies Pearson correlation, TVP-VAR, and GARCH to a different asset set (S&P 500, Dow Jones, Nasdaq-100); Babalos, Bouri, and Gupta (2025) apply an event-study/GARCH-X design to Bitcoin, Ethereum, Ripple, and Litecoin; Krouska (2024) and Babaoglu (2024) examine derivatives and options-implied measures around the same event. A fifth, independent source (Lai, 2025) provides a later, out-of-sample rolling-correlation and OLS-beta check using weekly data through October 2025. Mapping five independently specified models onto the same event and the same core question - did Bitcoin's relationship with traditional assets structurally change - lets this paper assess replication rather than rely on any single model's specification choices.

These outcome variables are compiled in Table 1, contrasting the pre-approval pattern reported in each study with the corresponding post-approval finding, using the anchor model's exact statistics where available and the other four studies' reported findings elsewhere. Because each source uses a different sample window, asset universe, and econometric specification, Table 1 should be read as a synthesis of largely convergent, independently produced results rather than a single pooled estimate - a distinction addressed further in Section 5.

Results:

Table 1 summarizes the pre- and post-ETF-approval findings reported across the five studies reviewed.

Relationship / Variable	Pre-ETF pattern (through Jan 2024)	Post-ETF finding (2024-2025)
Bitcoin mean price / return volatility	Mean \$26,328; return std. dev. 0.0322 (Oct 2023-Jan 2024)	Mean \$60,503; return std. dev. 0.0323 - price more than doubled while volatility barely moved (Hong et al., 2025)
Bitcoin - S&P 500 correlation	Peaked ~2021, then declined; volatile and idiosyncratic through Jan 2024 (Donoiu, 2025)	Chow test on rolling correlation: statistic 139.42 (30-day), 269.30 (60-day), both $p < .0001$ - a statistically confirmed structural break, later corroborated by an independent 2025 estimate of correlation rising ~0.45 to ~0.6-

		0.7 with beta ~ 1.3 (Hong et al., 2025; Lai, 2025)
Bitcoin - Gold correlation	Historically low and variable, underpinning the 'digital gold' hedge narrative	Structural break confirmed (Chow statistic 135.96, $p < .0001$) but in the direction of DCC correlation drifting lower, not higher - a 'fund diversion' away from gold, not toward it (Hong et al., 2025)
Bitcoin - US Dollar Index (DXY) correlation	Generally negative, consistent with Bitcoin's framing as a dollar alternative	Remained consistently negative; DXY beta break confirmed (Chow statistic 105.86, $p < .0001$) but correlation direction unchanged (Hong et al., 2025)
Instantaneous return-sensitivity (pairwise OLS beta)	N/A	No significant break in the BTC/S&P 500 return-sensitivity coefficient itself (Chow statistic 0.14, $p = .867$) - the shift shows up in the sustained correlation trend, not an overnight beta jump (Hong et al., 2025)
Short-term (90-day window) correlation shift	N/A	No statistically significant short-term jump detected around the launch date itself - an orderly adjustment, not a shock (Donoiu, 2025)
Volatility of Ethereum, Ripple, Litecoin	Elevated and closely tracking Bitcoin's own volatility cycles	Declined following SEC approval, consistent with a volatility-stabilization spillover from Bitcoin ETFs (Babalos et al., 2025)
Grayscale Bitcoin Trust (GBTC) returns	Traded at a persistent discount to net asset value under the closed-end fund structure	Returns increased significantly following conversion and approval (Babalos et al., 2025)

Table 1. *Comparative summary of Bitcoin correlation and volatility findings before and after the January 2024 spot ETF approval.*

Three findings stand out, and unlike a purely qualitative synthesis, each is now backed by a specific test statistic rather than a directional adjective. First, on the correlation dimension, the Chow test provides formal statistical confirmation, not just visual suggestion, that Bitcoin's relationship with the S&P 500 underwent a genuine structural break at the January 2024 approval date (statistic 139.42 at the 30-day window, 269.30 at 60 days, both $p < .0001$), and this break is corroborated by an entirely independent, later dataset showing correlation climbing from about 0.45 to 0.6-0.7 through 2025 (Lai, 2025). Revealingly, the break shows up in the sustained rolling-correlation trend rather than in the instantaneous return-sensitivity coefficient (pairwise OLS Chow statistic 0.14, $p = .867$) - Bitcoin did not suddenly start reacting to daily S&P 500 moves overnight; it gradually began moving with the market over the following weeks and months, which is why Donoiu's (2025) narrow 90-day window found no jump while the medium-term trend clearly shows one.

Second, Bitcoin's relationship with gold and the U.S. dollar did structurally break too (Chow statistics 135.96 and 105.86 respectively, both $p < .0001$) - but not in the direction the 'digital gold' narrative would predict. The DCC-GARCH results show Bitcoin's dynamic correlation with gold trending further downward after approval, which Hong et al. (2025) interpret as a 'fund diversion effect': capital that might once have flowed to gold as a hedge is instead flowing to Bitcoin, but for speculative reasons rather than because Bitcoin has started behaving like gold. Its negative correlation with the dollar persisted, largely unchanged in direction even as its statistical relationship shifted.

Third, the volatility evidence draws a sharper distinction between Bitcoin and other major cryptocurrencies than the correlation evidence does. Bitcoin's own return volatility was essentially flat (0.0322 pre-approval versus 0.0323 post-approval) even as its mean price more than doubled - a genuinely striking descriptive fact, since a price that large rarely moves with unchanged volatility. Ethereum, Ripple, and Litecoin volatility, by contrast, declined following approval, consistent with a stabilization spillover from regulated Bitcoin investment products (Babalos et al., 2025). Combined with the significant increase in Grayscale Bitcoin Trust returns, the picture is one of capital reallocating around Bitcoin - into it from gold, into adjacent altcoins more calmly - without Bitcoin itself becoming a calmer asset.

Discussion and Conclusion:

This review set out to determine whether the January 2024 approval of spot Bitcoin ETFs changed Bitcoin's relationship with traditional financial markets, and the Chow-test evidence answers that question with more than directional confidence: a statistically significant structural break did occur in Bitcoin's correlation with the S&P 500, gold, and the U.S. Dollar Index alike, confirmed at $p < .0001$ across every rolling-correlation series tested and independently

corroborated by a separate 2025 dataset. What differs by asset is the direction and character of that break. Against the S&P 500, Bitcoin gradually built a stronger, sustained co-movement - undermining the simple case for Bitcoin as an equity-market hedge - while its relationship with gold moved further apart (a fund-diversion effect, not fund convergence), and its negative dollar correlation persisted. At the same time, Bitcoin's own return volatility barely moved despite its price more than doubling, even as volatility fell in other major cryptocurrencies such as Ethereum, Ripple, and Litecoin.

For portfolio management, the practical implication is specific rather than general: investors who added Bitcoin to a portfolio for equity diversification should reassess that assumption given a statistically confirmed, not merely apparent, rise in equity correlation; investors interested in Bitcoin as a dollar-alternative store of value find more support in the persistence of its negative dollar correlation; and investors expecting Bitcoin to behave like gold should note that the ETF approval pushed the two further apart, not closer together. More broadly, the findings are consistent with a maturing asset class increasingly shaped by the same institutional flows, macro liquidity conditions, and investor sentiment that drive equity markets, rather than one that trades purely on idiosyncratic crypto-specific news.

This study still has real limitations, though they are narrower than a purely qualitative synthesis would carry. The anchor model (Hong et al., 2025) is reproduced in full technical detail, but its own post-event window is short (through April 2024), and while the independent 2025 correlation estimate from Lai (2025) corroborates the direction of the finding over a longer, later horizon, neither paper covers more than about two years of post-approval data - too little to be fully confident these relationships represent a permanent regime rather than one still-settling market phase. The four supporting studies also use different asset universes and specifications than the anchor model, so Table 1 synthesizes convergent findings rather than pooling them into a single re-estimated statistic. Future research, following the direction proposed by Babaoglu (2024) and Krouska (2024), could extend the anchor model's Chow-test and DCC-GARCH framework using options-implied volatility measures and a longer post-approval sample as more data become available, and as sustainability is gaining importance (Kaspard et al., 2025 ; Kaspard et al., 2026), future research regarding the impact of cryptocurrencies and their mining on the environment is recommended.

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