Portfolio strategy effects on leveraged safe havens and cryptocurrencies

Abstract: This study investigates the dynamic interplay between risky, safe, momentum and profit-seeking portfolio strategies using indices and combinations of long and short positions on leveraged ETFs based on precious metals and cryptocurrencies. Using daily data, covering the period from 10 June 2024 to 9 February 2026, the Quantile-VAR framework is utilized to assess the dynamic averaged connectedness and the network connectedness. Our findings reveal that risky and profit-seeking portfolio strategies drive systemic risk in bull markets while safer and momentum strategies stabilize the system. Gold-based ETFs absorb systemic instability while Bitcoin-based ETFs have a dual role, and silver-based and Ether-based ETFs are settlers of systemic connectedness, partly crowding out gold's and Bitcoin's influence in leveraged markets. This indicates the need for more anchors in the modern sophisticated financial landscape, providing insights and rules-of-thumb for policymakers and investors.

Keywords: Leveraged ETFs, Portfolio strategy, Gold, Silver, Cryptocurrencies, Systemic connectedness

JEL Classification: G11, G12, G15, E52, E58

1. Introduction

The recent sequence of crises has led to the emergence of heated debate about the potential for a transition to a more sophisticated financial outlook. The elevated interest in modern investments stems from investors' efforts to find an antidote to the continuously decreasing real value of national currencies, which has increased interest in the bull market phenomena for safe haven assets. Constructing portfolios by using sophisticated investment tools that can multiply profits (or losses) via leverage constitutes one of the main practices adopted by investors for achieving better risk-adjusted performance, trying to mitigate the adverse effects of inflationary pressures (Hackethal et al., 2022; Huang et al., 2025; Platanakis and Uqruhart, 2019).

Based on these contemplations, this study employs four alternative portfolio strategies (high risk, low risk, momentum and profit-seeking) and four different combinations of positioning (long-long, short-short, long-short, short-long) on leveraged ETFs based on precious metals and major cryptocurrencies. Their dynamic relationship is placed under scrutiny in different market conditions. Our investigation seeks to cast light on whether safe haven or risky characteristics in spot markets also exist in leveraged derivatives markets. Moreover, we reveal how the type of portfolio strategy considered affects the safe haven and risky character of investments, providing insights into optimal portfolio construction, investor behaviour and offer new perspectives for success in investing in modern financial system.

The theory underlying this investigation is based on the connection between investment strategy and investor sentiment, expressed by investing in safe or risky assets, revealing over-pessimism or over-optimism in investors' behaviour. We use portfolio theory combined with behavioral finance as the basis for our investigation, through the lens of pursuing outperformance of the market, also motivated by the rapid devaluation of conventional assets. In other words, the 'animal spirits' triggered by the consistent turmoil in financial markets and inflationary phenomena create extraordinary financial conditions and a significant gap in both portfolio management and behavioral finance. The present study tries to fill this gap in relevant literature, investigating how modern financial instruments such as ETFs and dynamic investment strategies Combined with leveraged positions can be used to generate excess returns in investors' portfolios. We make an effort to assess which of the portfolio strategy indices is more influential on specific scenarios of long and short positioning on safe havens and risky assets. This provides a roadmap for better decision-making and offers a useful tool on how to strategically exploit mixed positioning and the leveraging opportunities for enhancing performance. This research builds on previous research on optimal portfolio construction (Elton et al., 1976; Buraschi et al., 2010; Fang and Post, 2022; Burkhardt and Ulrych, 2023; Fassas and Papadamou, 2025), modern financial assets (Dwyer, 2015; Khomyn et al., 2024; Marta and Riva, 2025) and leveraged positions as profit-making instruments (DeVault et al., 2021; Gilstrap et al., 2024).

Daily data are employed covering the lifespan of leveraged ETFs (June 10, 2024 up to the present) and two specifications of the advanced Quantile-VAR methodology, estimations reveal the dynamic relationship between an array of investment strategies and leveraged investments, focusing on precious metals and cryptocurrencies. Estimations at the 5th, 50th and 95th quantiles inform how the sophisticated financial tools based on these different money types shape investors' activity in conditions of over-pessimism (low market performance), normal markets (modest market performance) or over-optimism (high market performance).

Based on the aforementioned considerations, this study tests the following five hypotheses:

H1: Specific portfolio strategies are more influential on systemic fragility in leveraged ETFs markets

H2: Investors' over-optimism is favorable for high-risk and profit-seeking portfolio strategies

H3: Different combinations of long/short positions in leveraged ETFs affect the influence of different portfolio strategies

H4: Gold-based ETFs display safe haven properties

H5: ETFs based on leading assets are partly crowded-out by ETFs based on sub-leading peers

Our econometric findings reveal that during bull markets, portfolio strategies that are profit-seeking and risky contribute to systemic risk, whereas safer and momentum strategies help stabilize the system. Gold-based ETFs mitigate systemic instability, while Bitcoin-based ETFs serve a dual function both as stabilizers and destabilizers/ Silver-based and Ether-based ETFs act as mediators of systemic interconnections, partially diminishing the impacts of gold and Bitcoin in leveraged markets, pointing to the necessity of additional anchors in the contemporary, complex financial environment,

The remainder of this paper is structured as follows. Section 2 offers an overview of the main literature about portfolio strategies, leveraged investments and money forms. Section 3 outlines the data utilized and Section 4 presents the methodological framework employed. Section 5 illustrates and analyzes the econometric results, and interprets the economic implications. Finally, Section 6 concludes and suggests avenues for further research.

2. Literature review

Previous literature has investigated portfolio strategies and sophisticated investments and their role in investor decision-making. This constitutes the first stream of academic literature related with our study. In general, active management is considered to bring higher performance to investor portfolios (Avramov and Wermers, 2006; Berk and Green, 2004; Jagannathan et al., 2010) and characteristics-based portfolios that minimize risk lead to better out-of- sample performance (Joenväärä et al., 2021). Moreover, hedge funds with lower *R*-squareds with respect to systematic factors have higher Sharpe ratios, higher information ratios, and higher alphas and enjoy higher manipulation-proof performance (Titman and Tiu, 2011). Dierkes et al (2010) argue that the attractiveness of investment strategies depends on the time horizon of investments while Forner et al. (2018) support that the negative connection between leverage and future abnormal returns is seen exclusively in loser stocks. This comes into contrast with the positive relationship between past returns and future abnormal returns that occurs only in non-low leverage stocks.

Focusing on ETFs, Clifford et al. (2014) argue that the development of ETFs markets has been mostly based on the naïve extrapolation bias on the part of investors while Davydov and Peltomäki (2023) argue that more attentive investors gain more from using investment leverage. Moreover, Charupat and Miu (2014) reveal that explicit costs like the expense ratios and other factors such as financing costs can be substantially influential on the performance of leveraged ETFs, most strikingly for those with high leverage ratios

Furthermore, there is a vast literature about precious metals and how they interact with the real economy and financial markets. This is the second strand of academic research related with this study. It is shown that gold can hedge against all types of inflation (headline, expected and core CPI), especially in the US (Bampinas and Panagiotidis, 2015). Furthermore, it is argued that gold and oil are useful absorbers of systemic risk in conditions of elevated uncertainty (Li et al., 2025a). Precious metals are tightly connected with financial market conditions as gold, silver as well as the US dollar exhibit safe haven properties and are closely linked in times of financial stress (Cevik and Gillman, 2022). In addition to gold's status as the best shield against risk, silver and copper also efficiently hedge spillovers and mitigate risk in investor portfolios (Chattapadhyay et al., 2025). The hedging and safe haven abilities of precious metals vary as they are strong during the Global Financial Crisis but these metals become risky during the pandemic, indicating loss of protection potential (Cheema et al., 2022). Other assets exist that threaten the hedging leadership of precious metals, according to Enilov and Mishra (2023) that supports cryptocurrencies (altcoins) better protecting from risk during the pandemic and the Russia-Ukraine conflict.

The third stream of academic investigation connected with our research is the relationship of national currencies with alternative investments. The performance of the majority of national currencies (US dollar, Euro, Japanese yen, inter alia) follows opposite direction from gold performance (Pukthuanthong and Roll, 2011). Moreover, a group of major national currencies is considered to be more susceptible to systemic risk, the Japanese yen being the lower-quality currency (Bhatia and Tuteja, 2024). Regarding the interplay between national currencies and the real economy, the real exchange rate depreciation leads to higher economic growth but linkages of global production could dampen this positive effect (Chen et al., 2025b). The exchange rate regime is crucial for recovery from crises, especially for emerging and developing countries which are more vulnerable to external shocks than advanced economies (Nguyen and Nguyen, 2024). National currencies suffer competition from alternative money forms like the Central Bank Digital Currencies (CBDC) and this is more obvious in the case of emerging markets (Chen and Siklos, 2023). Exchange rates are also affected by economic and market sentiment, as revealed by the appreciation of the US dollar caused due to positive tweets about the macroeconomy and trade (Filippou et al, 2025). Similarly, news serves as important predictors of national currency performance and this phenomenon strengthens with higher risk levels (Jia et al., 2024),

The fourth strand of related academic work focuses on cryptocurrencies and their interplay with the macro-financial landscape. Bitcoin is considered to be money accepted by a limited portion of economic agents (Hazlet and Luther, 2020) and its inclusion in economic systems along with fiat money could decrease welfare, more emphatically in conditions of high inflation (Kang and Lee, 2020). On the other hand, safer forms of digital currencies like CBDCs could help mitigate systemic risk, implying that this money form could be smoothly accepted internationally (Rizwan et al., 2025). Cryptocurrencies are significantly connected with the monetary environment. Contractionary monetary policy by the Fed had a positive effect on Bitcoin's performance that has switched into negative since the onset of the pandemic (Karau, 2023) while negative shadow policy rates strengthen the relationship between monetary policy and cryptocurrency performance, which gradually fades away (Elsayed and Sousa, 2024). Other fundamental factors of cryptocurrency performance are the cryptocurrency market, size and momentum (Liu et al., 2022) while the bubble character of Bitcoin is defined by the non-stable marginal cost of mining the target supply of bitcoins (Podhorsky, 2024). By examining cryptocurrencies vis-à-vis alternative investments, they are considered to be significantly more volatile than gold and national currencies (Dwyer, 2015) and substantially vulnerable to market sentiment even though panic in their markets does not spread systemically (Li et al., 2025b). Giving emphasis on their roles as diversifiers, hedges or safe havens, they are positively connected with global equity markets, highlighting their diversification abilities and their potential to improve risk-adjusted performance in portfolios (Marti and Reimat, 2025) and become safe havens during crises (Liu et al., 2024), with their safe haven and speculative character varying in different stages of their development (Chen et al., 2025a).

The existing academic work explores the diversifying and protection capacities of precious metals, national currencies and cryptocurrencies in different economic conditions. Nevertheless, to the best of our knowledge, no study up to the present has investigated how the leveraged ETFs of these alternative investments, respond to different portfolio strategies in different market conditions. Moreover, the innovation of this paper also lies in the varying focus of each of the portfolio strategy indices, reflecting risky, low risk, momentum and profit-focused investment strategy behaviour. Our examination could prove beneficial for investors, enabling them to better allocate funds and take advantage of the opportunities for profitability that leveraged investment vehicles offer in the current sophisticated financial markets.

3. Data and Methodology

This paper investigates the dynamic interplay and the complex causal relationship between an array of portfolio investment volatilities and long/short positions combinations in precious metal- and cryptocurrency based ETFs. The dataset spans from 10 June 2024 to 9 February 2026, utilizing daily closing prices. The portfolio strategy uncertainties employed are: the Nasdaq Factor Laggard US Low Volatility Index, the Nasdaq Factor Family US Low Volatility Index, the Nasdaq-100 Dorsey Wright Momentum Index and the Nasdaq Victory US Multi-

Factor Minimum Volatility Index[1] that represent high volatility-, low volatility-, momentum- and high performance- focused strategies, respectively. The selection of these strategies permits us to look into how different investment motives and behaviour can inform the decision making of risk taking investors focusing on leveraged derivatives. This is the reason why both long and short positions on leveraged exchange-traded mutual funds are used. These represent different investor stance on ETFs enabling multiplicative impacts of both safe havens and risky tools. ETFs based on precious metals (safe havens) are: the ProShares Ultra Gold ETF and the ProShares Ultra Silver ETF while the respective ETFs with short positions are the ProShares UltraShort Gold ETF and the ProShares UltraShort Silver ETF. As concerns the cryptocurrency-based ETFs (risky assets), the ProShares Ultra Bitcoin ETF and ProShares Ultra Ether ETF and their short counterparts, the ProShares UltraShort Bitcoin ETF and ProShares UltraShort Ether ETF are adopted. Studying the connectedness between investor strategies and leveraged positions allows us to provide insights into the driving forces of modern investing in the sophisticated financial landscape. Data about the portfolio strategy uncertainties are downloaded from the FRED database while leveraged ETFs are categorized in the VettaFi website and downloaded from the Datastream on the LSEG Workspace. All variables are expressed in daily frequencies and transformed into logarithmic differences for the purposes of estimations.

Figures 1a, 1b and 1c depict the time series of the NASDAQ-based investment strategies, long position-based leveraged ETFs and short-position-based leveraged ETFs. All the strategy uncertainties present a sudden fall in the spring of 2025 but rebound and follow upward direction thereafter. As concerns long position-based leveraged ETFs, they are consistently increasing in the case of precious metals but have numerous fluctuations in the case of cryptocurrencies. On the contrary, short position-based leveraged ETFs are consistently decreasing, the case of Ether being the most volatile.

[1] The Nasdaq Factor Laggard US Low Volatility Index (NASDAQNQFFLUSLV) represents a portfolio of securities exhibiting high volatility characteristics. The Index selects 50 securities from the Nasdaq US 500 Large Cap Index based on factors derived from realized volatility. The Nasdaq Factor Family US Low Volatility Index (NASDAQNQFFUSLV) stands for a portfolio of securities exhibiting low volatility characteristics. The Index selects 50 securities from the Nasdaq US 500 Large Cap Index based on factors derived from realized volatility. The Nasdaq-100 Dorsey Wright Momentum Index (NASDAQNDXDWA) tracks the performance of the 21 securities from the Nasdaq-100 Index with highest momentum. Each security must meet certain momentum requirements, and the securities selected for the index are equally weighted at each Reconstitution. The Nasdaq Victory US Multi-Factor Minimum Volatility Index (NASDAQNQVMVUS) seeks to deliver superior risk-adjusted returns by constructing rules-based equity portfolios which minimize expected volatility while outperforming over a market cycle.

Figure 1a. NASDAQ-based investment strategy uncertainties

Figure 1b. Market values of long-position based ETFs on precious metals and cryptocurrencies

Figure 1c. Market values of short-position based ETFs on precious metals and cryptocurrencies

The descriptive statistics indicate that the Laggard index has the highest mean daily return over the whole period (8.6%) and the highest volatility, with daily standard deviation over the whole period equal to 3.846, among the portfolio strategy indices. Regarding the long-based leveraged ETFs, the gold and silver ones present substantial positive performance while the Bitcoin and Ether ETFs have significantly negative performance. In the case of the short-based leveraged ETFs, it is only the Ether ETF with substantial positive performance (0.159) and by far the most volatile and the remaining ones have considerable losses. These statistics show that leveraging on precious metals proves to be considerably lucrative due to the strong demand for these safe havens and the multiplicative effects allowed by leveraged ETFs. This is in contrast with the poor performance of cryptocurrencies, especially in long positions, which brings large losses through leverage. Investing in short positions of strongly poor performing assets like Ether can prove to be rewarding for investors. All the variables considered are asymmetric and leptokurtic. Non-normality in return distributions is also revealed by the Jarque-Bera test. No unit root problem exists in any of the series as indicated by the ERS test.

1. Q-VAR framework

The dynamic interplay is revealed by utilizing the advanced Quantile Vector Autoregression framework (QVAR) of Antonakakis et al. (2021) and Cunado et al. (2023), also employed by Das et al. (2025), Kyriazis and Corbet (2024) and Long and Li (2023). The QVAR model of order p at a specific quantile $\tau \in (0,1)$, takes the following form:

$$y_t = \mu(\tau) + \sum_{j=1}^{p} \Phi_j(\tau) y_{t-j} + u_t(\tau) \tag{1}$$

where:

y_t constitutes a vector of endogenous variables with $k \times 1$ dimensions,

$\mu(\tau)$ is a vector of intercept terms with $k \times 1$ dimensions at quantile τ,

$\Phi_j(\tau)$ are matrices of quantile-based autoregressive coefficients for lag j, with dimensions $k \times k$

$u_t(\tau)$ is a $k \times 1$ vector error terms for specific quantiles τ

In conditions of stationarity, the QVAR(p) scheme can be represented by its moving average (MA) form as:

$$y_t = \mu(\tau) + \sum_{h=0}^{\infty} A_h(\tau) u_{t-h}(\tau). \tag{2}$$

the initial matrix being:

$$A_0 = \mathrm{I}_k \tag{3}$$

and the subsequent matrices:

$$A_h = \sum_{i=1}^{\min(h,p)} \Phi_i A_{h-i}, \text{ for } h = 1, 2, \ldots, H-1 \tag{4}$$

These $A_h(\tau)$ reflect the quantile-specific dynamic systemic responses to innovations at horizon h. They are important for producing Quantile Impulse Response Functions (QIRFs) and assessing the dynamic relationship at quantiles.

4.1 QVAR Estimation

Minimization of the quantile-based loss function, known as check function, results into estimation of each equation of the Quantile-VAR framework, penalizing the residuals depending on their positioning in relation to the conditional quantile.
Conducting estimations at various quantiles of the return distribution is an advantage for the Q-VAR framework when compared with the conventional OLS framework. This happens because quantile estimations allow tracing distributional non-normalities, tail dependencies and different effects across various parts of the distribution. These estimating capacities are suitable for investigating financial phenomena, including non-linearities, volatility clustering and extreme phenomena, offering a comparative advantage vis-à-vis conventional mean-based methods.

Focusing on specific quantiles, including the lower and upper tails of distributions, is useful for clarifying the differences between the effects of extreme market events and normal markets. They further allow discriminating between lower-tail and upper-tail dynamics, providing insights on the different effects of bear and bull markets, which stand for over-pessimism and over-optimism, respectively.

Assessing the quantile based Generalized Forecast Error Variance Decompositions (GFEVDs), which reveals the extent to which shocks to one variable shape the forecast error variance of another variable at a given quantile, is achieved by the Q-VAR framework. As such, the size and direction of directional spillovers across the variables is captured, indicating how innovations have varying effects at different quantiles of the return distribution, especially lower and upper ones, offering a better analysis of tail-risk behavior.

4.2 Generalized Forecast Error Variance Decomposition (GFEVD)

The Generalized Forecast Error Variance Decomposition (GFEVD) framework was originally introduced by Koop, Pesaran, and Potter (1996) and further developed by Pesaran and Shin (1998). Orthogonalization of shocks is not required with this framework, neither is the order of variables important. The GFEVD in the Q-VAR model makes feasible to focus interest on quantile-based metrics. In this perspective, the GFEVD at a given quantile level τ and forecast horizon H, displays the portion of the forecast error variance in variable i which can be attributed to innovations in variable j:

$$\theta_{i,j}^{H}(\tau)=\frac{\sigma_j(\tau)\sum_{h}^{H-1}\left(e_i^T A_h(\tau)\Sigma(\tau)e_j\right)^2}{\sum_{h}^{H-1}\left(e_i^T A_h(\tau)\Sigma(\tau)A_h(\tau)^T e_j\right)^2} \tag{5}$$

where:

$A_h(\tau)$ stands for the quantile-specific moving average coefficient matrices at horizon h,
$\Sigma(\tau)$ represents the variance-covariance matrix of the QVAR error terms at quantile τ,
$\sigma_j(\tau)$ denotes the standard deviation of the error term for variable j, which equals the square root of the j-th diagonal element of $\Sigma(\tau)$,
e_i and e_j are selection vectors with unity in the i-th or j-th position and zeros in the remaining positions,
T is the symbol for the transpose operator.

This decomposition makes feasible to assess the directional effects of innovations in one variable on another variable, conditional on a specific quantile that stands for normal or extreme market conditions. Furthermore, based on this decomposition, estimations about systemic risk and the network of directional interactions across groups of variables can take place, focusing also on tail characteristics.

4.3 Connectedness Measures Based on Normalized GFEVD

Based on the normalized GFEVD, dynamic spillovers between a variable and a group of variables are traced and quantified in the system:

The spillover effects originated from a specific variable i on a group of variables are represented by the Joint directional connectedness TO others:

$$C_{i\to\bullet}^{H}\left(\tau\right)=\sum_{j=1,i\neq j}^{k}\tilde{\theta}_{j,i}^{H}\left(\tau\right) \tag{7}$$

While the reverse causal impacts are given by the Joint directional connectedness FROM others:

$$C_{\bullet\to i}^{H}\left(\tau\right)=\sum_{j=1,i\neq j}^{k}\tilde{\theta}_{i,h}^{H}\left(\tau\right) \tag{8}$$

This permits the calculation of the Net joint directional connectedness that reveals whether variable *i* is a net source or receiver of spillovers:

$$C_{i}^{H,\mathrm{NET}}\left(\tau\right)=C_{i\to\bullet}^{H}\left(\tau\right)-C_{\bullet\to i}^{H}\left(\tau\right) \tag{9}$$

Moreover, the overall systemic connectedness and fragility to shocks is provided by the Total Connectedness Index (TCI):

$$TCI^{H}\left(\tau\right)=\frac{1}{k}\sum_{i=1}^{k}C_{\bullet\to i}^{H}\left(\tau\right)=\frac{1}{k}\sum_{i=1}^{k}\sum_{j=1,i\neq j}^{k}\tilde{\theta}_{i,j}^{H}\left(\tau\right) \tag{10}$$

The TCI measure, along the lines of Chatziantoniou et al. (2021), ranges from zero to unity, representing the overall market connectedness and the level of systemic fragility. Higher values of TCI reflect higher probability of domino effects due to larger spillovers across the network of variables.

Estimating the dynamic relationships by the Quantile-VAR model specifications allows bringing to the surface asymmetric transmission and irregular behavior in tails across financial markets and the financial environment. This is especially fruitful when studying extreme economic events that spur irrationality in investors' behavior, providing advantageous assessment of the dynamic structure of interdependencies in the system. This framework avoids mean-based estimations which are insensitive to non-linearities and distribution parts. This is the reason why this methodology adds value to crisis examination that focuses on extreme sentiment and elevated systemic risk.

4. Econometric outcomes

Econometric estimations are conducted using a 30-day rolling window and a 10-day forecast horizon and bring to the surface a number of interesting findings. Four different groups of variables are examined, accounting for different scenarios. The first case (basic scenario) consists of long positions in both precious metal- and cryptocurrency-based leveraged ETFs. The second scenario considers short positions in both these asset categories. The third scenario is about long positions in precious metal-based and short positions in cryptocurrency-based ETFs. Finally, the fourth scenario focuses on short positions on precious metal-based and long positions on cryptocurrency-ETFs. Moreover, each of the four NASDAQ portfolio strategy indices adopted is examined vis-à-vis each of these four scenarios. Estimations are conducted at the lower (5th), the middle (50th) and the upper (95th) quantiles of the return distributions, standing for bear, normal and bull conditions in the leveraged ETFs markets. Empirical results are produced by the use of i) the averaged dynamic connectedness and ii) the network dynamic connectedness specifications of the Quantile-VAR framework.

4.1.Averaged dynamic connectedness

Tables 2, 3, 4 and 5 present the dynamic interactions between the Laggard, Family, Dorsey-Wright and Victory NASDAQ portfolio indices, respectively, and each of the four scenarios at the lower quantile, representing bear markets. The Laggard index is the strongest source of effects versus all the four scenarios (long-long, short-short, long-short, short-long) and the Dorsey-Wright index follows, being influential only on the second, third and fourth scenarios. The Family and Victory indices are modestly strong sources of spillovers, revealing a weaker effect than the Laggard and Victory portfolio strategy indices in pessimistic market conditions. Notably, the second (short-short) scenario always presents the largest level of systemic connectedness, providing evidence for higher systemic fragility when short positions are taken in leveraged ETFs. Across all the scenarios, the TCI index takes values ranging from 80 to 87, reflecting very high systemic risk in market downturns.

<please Insert Tables 2, 3, 4 and 5 about here>

Moreover, Tables 6, 7, 8 and 9 display the dynamic connectedness between each portfolio strategy index and each of the four scenarios at the middle quantile, standing for normal market conditions. Laggard remains the strongest net source of spillover effects with regard to all scenarios, with gold-based ETFs serving as net absorbers of spillovers, stabilizing the system. Results about Dorsey-Wright largely resemble the Laggard case, also revealing a consistently important systemic role while gold- and Bitcoin-based ETFs stabilize the system, indicating similarities in the behavior of safe haven- and risky-based ETFs in normal conditions. Moreover, the Family and the Victory indices function for mitigating systemic instability in the ETFs markets in all scenarios, revealing similar roles. In all cases at the middle quantile, the TCI takes values close to 60, demonstrating significantly weaker systemic fragility than in bear market conditions.

<please Insert Tables 6, 7, 8 and 9 about here>

The respective results at the upper quantile are given in Tables 10, 11, 12 and 13. The Laggard portfolio strategy becomes a strong settler of systemic cohesion in the second (short-short) scenario and the third (long-short) scenario. The Family and the Victory indices are weak stabilizers in the basic (long-long) scenario and become weakly influential on the fourth (short-long) scenario. The Dorsey-Wright index is almost neutral in all scenarios in bull market conditions. Interestingly, no matter which portfolio strategy index is considered, the basic (long-long) scenario reveals that precious metal-based ETFs are the systemic leaders and cryptocurrency-based ETFs are the stabilizers, supporting that leveraged positions enable the emergence of profitable assets as systemic settlers, even if these ETFs are based on safe havens. On the other hand, the poor performance of cryptocurrencies, which deteriorates in their leveraged version, suggests that investors exit cryptocurrency-based investments, strengthening the resilience of the financial system. It is also worth mentioning that gold-based ETFs function for mitigating spillovers when the Victory portfolio strategy is considered, indicating their safe haven character when investors are motivated to seek high return performance. This verifies that precious metals contribute to the stability of the system when high returns are the main target.

<please Insert Tables 10, 11, 12 and 13 about here>

In general, when focusing at the upper quantile, silver is a more consistent net source of causality and settler of systemic risk than gold while Ether is a more consistent stabilizer of the system than Bitcoin. This reveals that the second largest-cap assets in their category play a more active role than their largest-cap peers, displaying a transition toward a financial system where the closest substitutes of the leasing assets can become the protagonists and partly crowd-out the established leaders. Gold preserves its role as a settler of systemic connectedness only in the basic scenario while Bitcoin is a systemic driver only in the fourth (short-long) scenario. Therefore, mixed long/short strategies mutate the role of leading assets and make the portfolio strategy indices the main factors that determine the performance and systemic resilience. This is confirmed by the lower quantile case where the majority of portfolio strategy indices, especially the most aggressive ones like Laggard and Victory and Dorsey-Wright) are the indisputable systemic settlers, gold being a consistent hedge and Bitcoin having a mixed role.

4.2. Network connectedness

For bear market conditions, estimations by the network connectedness approach at the lower (5^{th}) quantile are presented in Figures 2a, 2b, 2c and 2d, representing the Laggard, Family, Dorsey-Wright and Victory cases, correspondingly. In Figure 2a, Laggard is the only driver of systemic connectedness in the basic scenario, with all the ETFs acting as stabilizers. The same holds in the second (short-short) scenario, revealing that the Laggard portfolio strategy index determines systemic fragility in this case. Moreover, the Laggard index keeps the role of the leading force in the remaining scenarios, with short positions in Bitcoin and silver also serving as destabilizers. In Figure 2b, the Family portfolio strategy index is also a consistent net source of spillovers as the Laggard. Short positions in silver-, Bitcoin- and Ether-based ETFs gain higher systemic importance in the presence of the Family index. In Figure 2c, the Dorsey-Wright index is ineffective in the basic scenario but is the indisputable leading force in the remaining scenarios, leaving no space for leveraged ETFs to significantly affect the systemic cohesion. In Figure 2d, the Victory index consistently generates systemic risk in all scenarios while gold-based ETFs, either in long or short positions, are the main stabilizing force, enhancing the resilience of the financial system. This reveals that in pessimistic market conditions, when portfolio strategies seeking for the highest performance are employed, safe havens are the best means to ensure stability.

<please Insert Figure 2 about here>

When it comes to the middle quantile, which stands for normal conditions in the leveraged ETFs markets, systemic connectedness is significantly weaker. The Laggard and the Dorsey-Wright portfolio strategy indices preserve their leading roles in the financial system, with gold- and Bitcoin-based ETFs serving as stabilizers. On the other hand, the low volatility index (Family) and the performance-focused index (Victory) both serve as stabilizers in the system. Precious metal- and Ether-based ETFs are the main destabilizers in the case of the Family index while cryptocurrency- and silver- based ETFs are the principal stabilizers in the case of the Victory index.

<please Insert Figure 3 about here>

Network connectedness at the upper quantile, standing for bull market conditions, is displayed in Figure 4. The Victory index is the main consistent net source of systemic instability with the Dorsey-Wright following with weaker net effects and the Laggard and the Family indices presenting mixed results. Long positions in precious metal-based ETFs obviously lead systemic risk in the basic scenario, irrespectively of the portfolio strategy index considered, displaying the importance of the high demand for safe havens that makes them strong performers in bull markets. Gold-based ETFs are consistent stabilizers in the remaining cases. Notably, silver-based ETFs constitute consistent stabilizing forces in the third (long-short) scenario, indicating that when the good performance of gold-linked assets makes investors willing to hold them, the systemic role of silver-based assets strengthens. This reinforces silver's prominence in the financial system, partly crowding out gold's influence. Moreover, in the fourth (short-long) scenario, where investors are more willing to invest in cryptocurrency-based ETFs, Bitcoin emerges as the consistent driving force in financial markets, with Ether consistently mitigating the destabilizing effects of Bitcoin on systemic cohesion.

Overall, our findings indicate that the risky and profit-focused portfolio strategy indices like the Laggard and the Victory are the major determinants on the system of precious metal-based and cryptocurrency-based leveraged ETFs. This reveals that the motivation for outperforming the market drives systemic risk in complex and risky investment strategies. On the other hand, less risky portfolio strategy indices like the Family index mainly serve for stabilizing the system of leveraged investments. Gold-based ETFs prove to be the most consistent stabilizers in the form of both long and short positions. Silver-based ETFs are major drivers of systemic causality, mainly in the basic (long-long) scenario, indicating that silver's systemic role has strengthened, partly crowding-out gold's influence. This resembles the role of Ether-based ETFs, which also drive systemic risk, partly mitigating the influence of Bitcoin-based ETFs, which function as stabilizers in numerous cases, revealing their dual role. The emergence of silver and Ether as major determinants in leveraged financial markets indicates their increasing influence in the transition toward more sophisticated financial markets. This is more obvious in bull market conditions. Interestingly, gold preserves its safe haven character even in leveraged markets, while Bitcoin comes into contrast with the speculative character it shows in spot markets. The rising influence of silver- and Ether-based assets confirms the tendency for crowding out market leaders, such as gold and Bitcoin, which is also obvious in spot markets, providing insights into the evolving nature of traditional and modern forms of money and investments. The pivotal function of gold in reducing systemic risk in sophisticated leveraged markets, beyond just spot markets, and the conversion of Bitcoin into a stability factor for leveraged ETFs markets indicate that the transition to a modern financial landscape requires more safety anchors than presently envisioned.

The risky (Laggard) portfolio strategy having the largest effect in bear markets and the Laggard and Victory indices displaying the largest effects in bull markets provides evidence that investor appetite and the willingness to achieve abnormal returns are the main settlers of interconnectedness and systemic cohesion in the markets of leveraged ETFs. Moreover, while the basic (long-long) scenario is the benchmark for the analysis of the connection between portfolio strategy indices and scenarios of leveraged ETFs combinations, the second (short-short) scenario increases systemic risk and enhances the risk-averse (Family) and the momentum (Dorsey-Wright) portfolio strategy indices' roles on systemic connectedness. Leveraged investments switch roles depending on the portfolio strategy index considered, reflecting the primary role of investor behavior on how useful leveraged ETFs can be as financial tools.

5. Conclusions

This study examines the dynamic relationship between risky (Laggard), low-risk (Family), momentum (Dorsey-Wright) and profit-focused (Victory) portfolio strategy indices and combinations of long and short positions on precious metal-based and cryptocurrency-based leveraged ETFs. The period examined spans from 10 June

2024 to 9 February 2026, covering the lifespan of these modern leveraged ETFs. The advanced Quantile-VAR framework is employed for assessing the averaged dynamic connectedness and the network connectedness in alternative scenarios (long-long, short-short, long-short and short-long). This investigation is conducted at the lower, middle and upper quantiles of the return distribution in an attempt to capture the dynamics in bear, normal and bull market conditions in the leveraged ETFs markets.

The reported econometric results reveal that the Laggard and the Victory indices, representing high risk and profit-seeking portfolio strategies, respectively, determine systemic risk in the groups of precious metal-based and cryptocurrency-based leveraged ETFs. By contrast, the Family index, standing for safer strategies, absorbs spillovers and enhances systemic resilience in the leveraged ETFs markets. Both long and short positions in gold-based ETFs ensure stability while silver-based ETFs are strong sources of spillovers mainly in the basic (long-long) scenario. This resembles the destabilizing role of Ether-based and the dual but mostly mitigating role of Bitcoin-based ETFs, which is more prominent in bull markets and gives credence to the crowding-out phenomena of leading assets by sub-leaders, also evident in spot markets. The central role of gold for mitigating systemic risk also in sophisticated leveraged markets, apart from spot markets, and the transformation of Bitcoin into a determinant of stability in the leveraged ETFs markets support that the transition to the most modern financial landscape needs more safety anchors than is currently available. This abides by the transformation of previously safe havens assets (silver) into risk drivers that gain prominence in markets. Notably, investors holding short positions in all ETFs makes less risky portfolio strategies (Family and Dorsey-Wright) being more influential in markets.

The implications from this study provide a roadmap for better decision making by policymakers and investors by shedding light on the determinants of sophisticated markets that permit leveraging on asset performance. Insights into the motivation, optimal strategies and the viability of leveraged investments offer a better understanding of the driving forces of financial development and fill an important research gap. This study has limitations due to the lack of available data for previous crises and for other types of major investments that shape the financial system. Avenues for future research could include the examination of more complex sentiment measures being incorporated into portfolio strategy indices vis-à-vis more strongly leveraged assets, allowing for insights into how changes in sentiment impacts portfolios combined with portfolio management techniques, motivated by the opportunity for stronger leveraging.

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Figure 2a. Laggard uncertainty effects at the 5th quantile

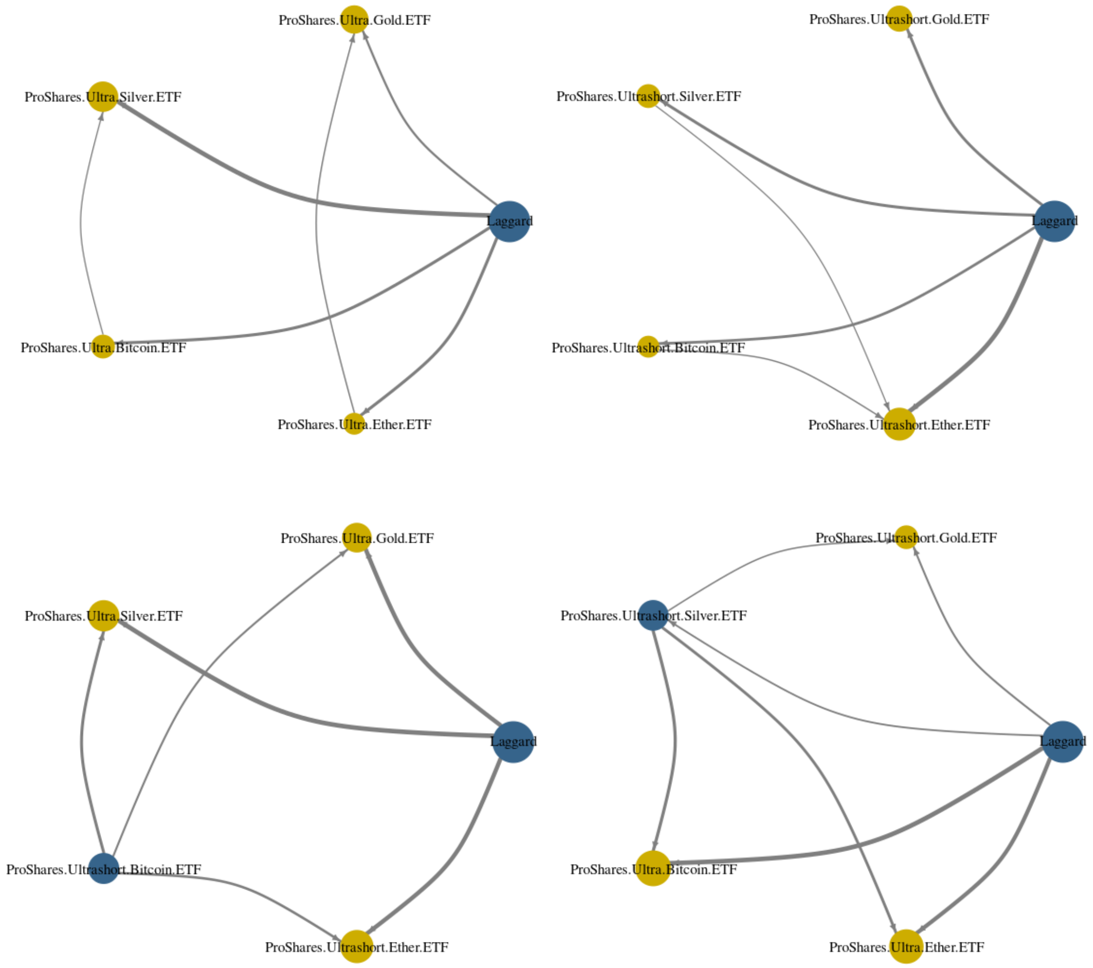


Figure 2b. Family uncertainty effects at the 5th quantile

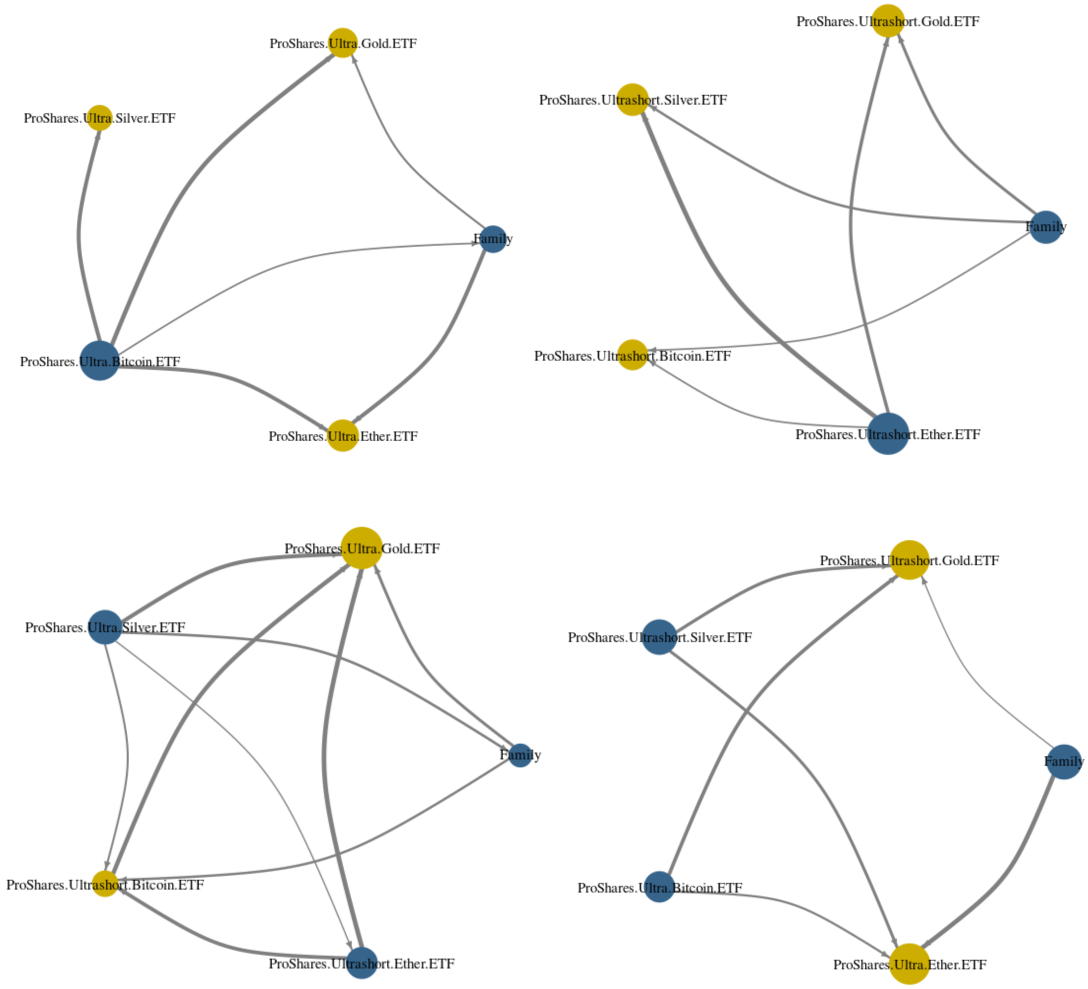


Figure 2c. Dorsey-Wright uncertainty effects at the 5th quantile

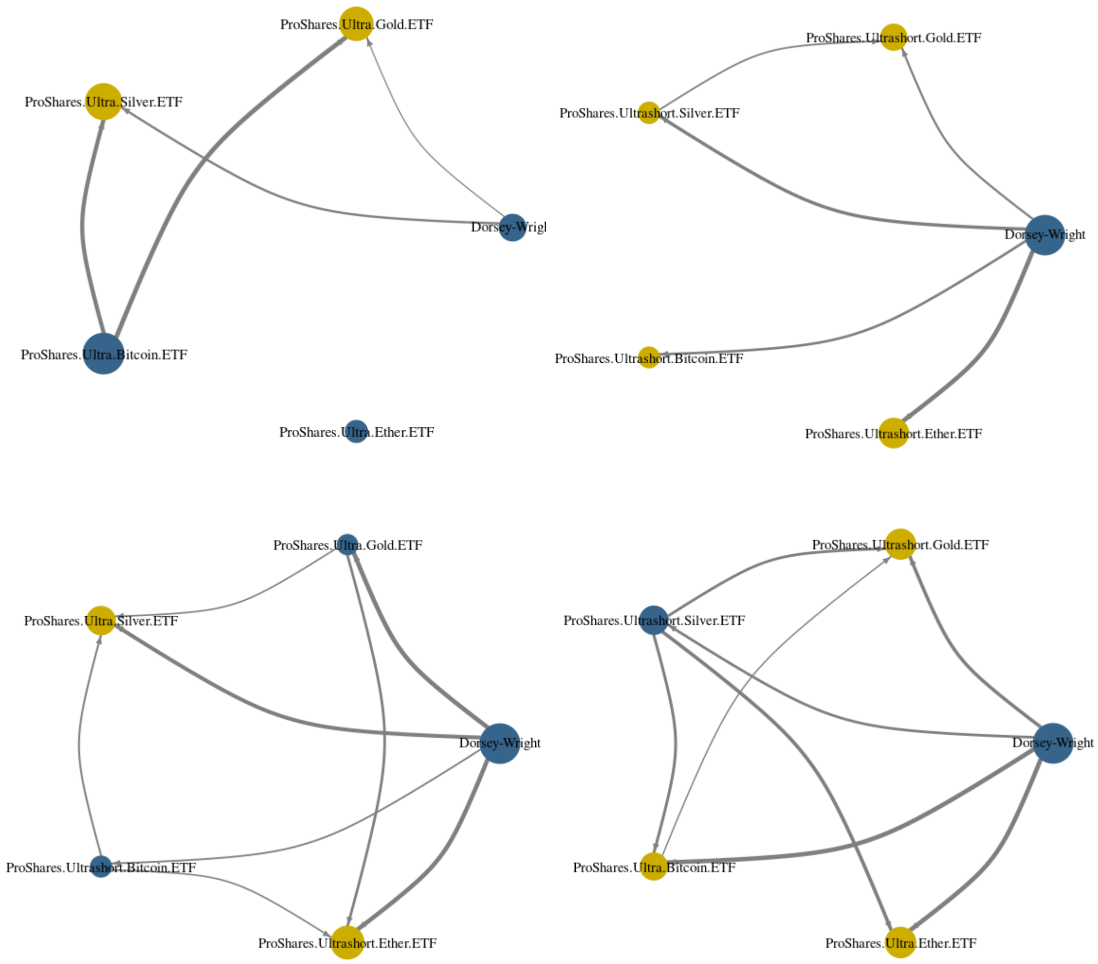


Figure 2d. Victory uncertainty effects at the 5th quantile

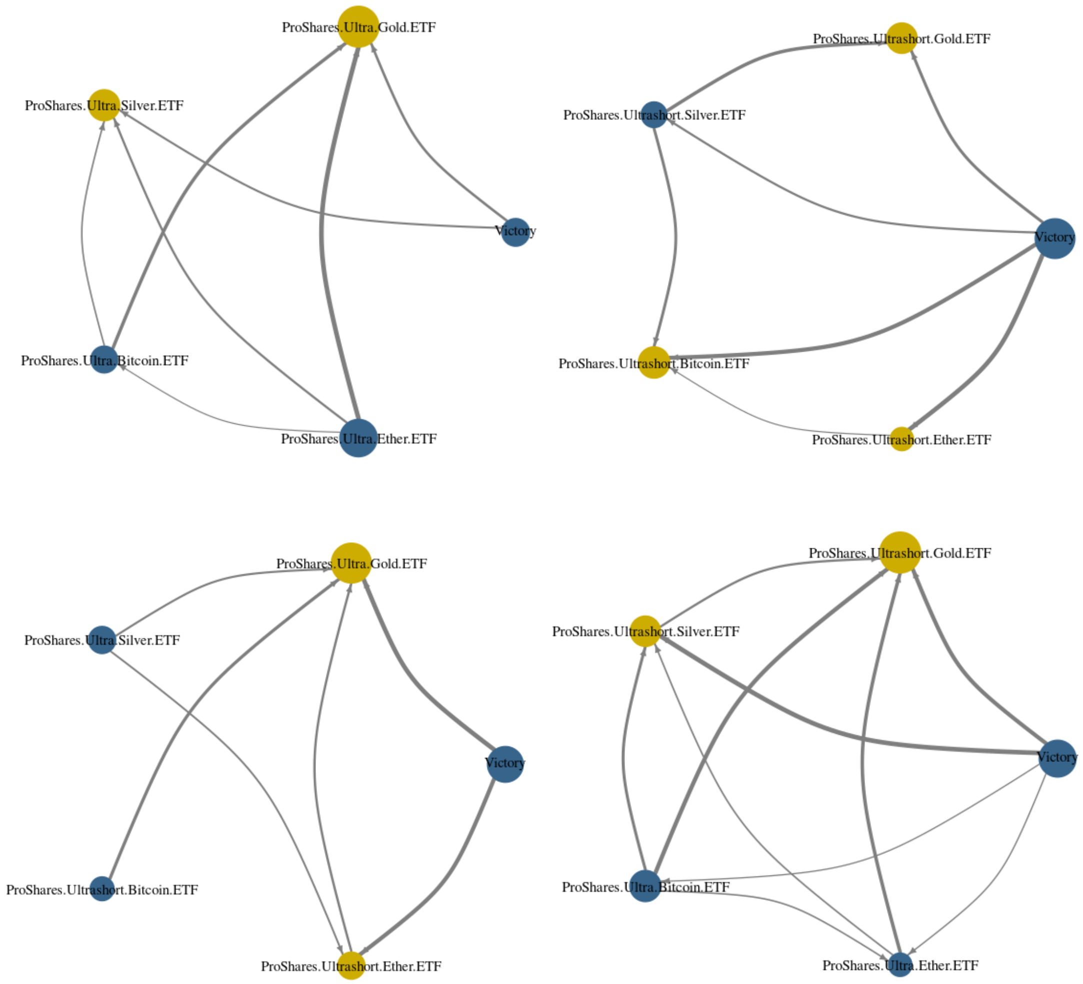


Figure 3a. Laggard uncertainty effects at the 50th quantile

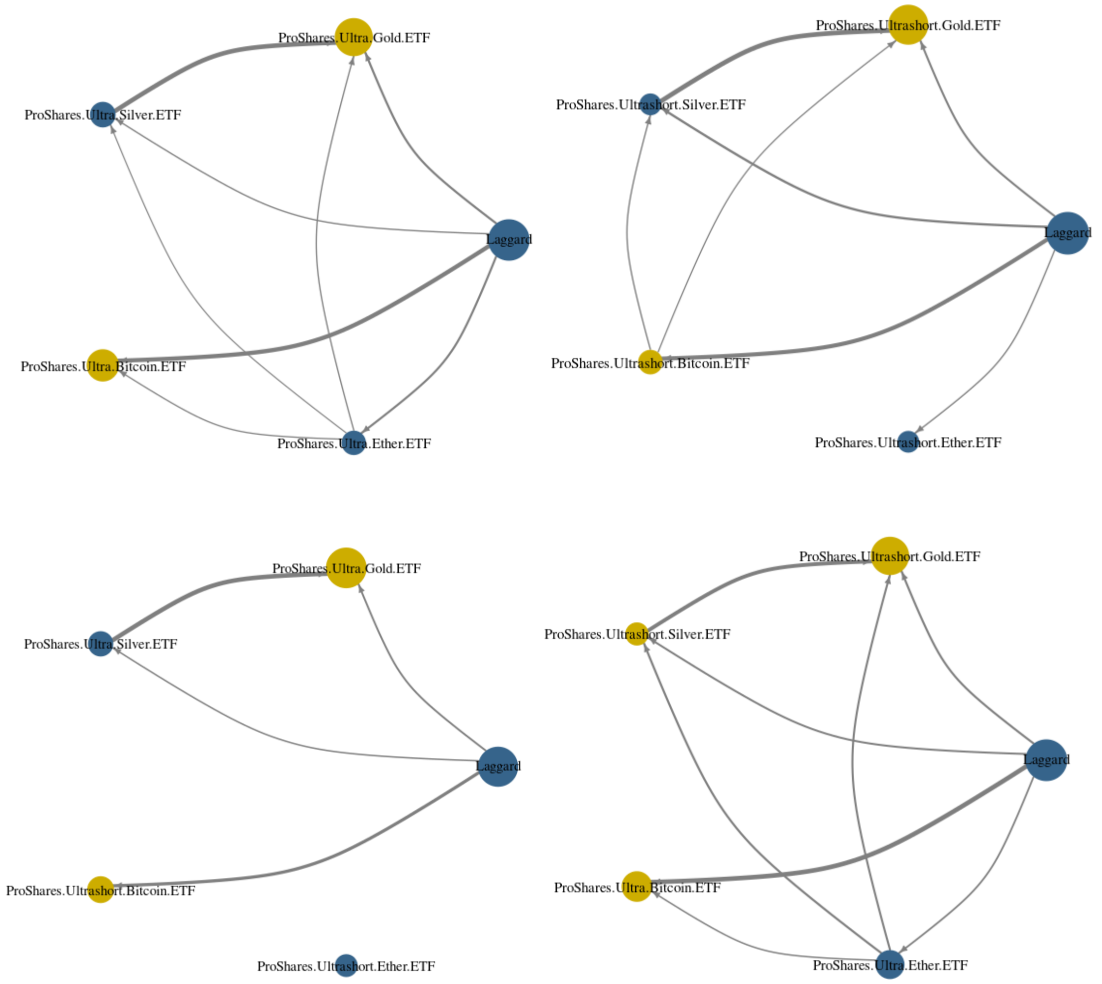


Figure 3b. Family uncertainty effects at the 50th quantile

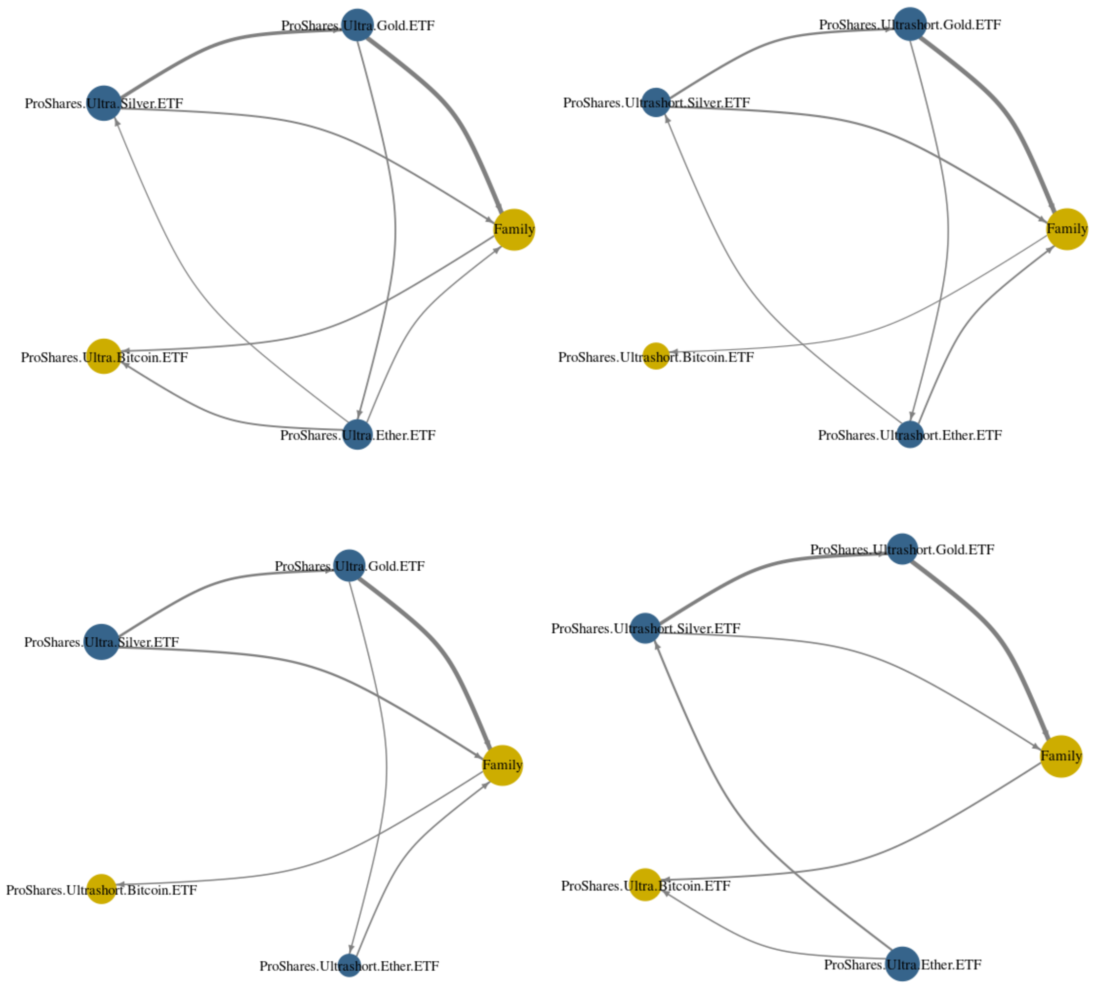


Figure 3c. Dorsey-Wright uncertainty effects at the 50th quantile

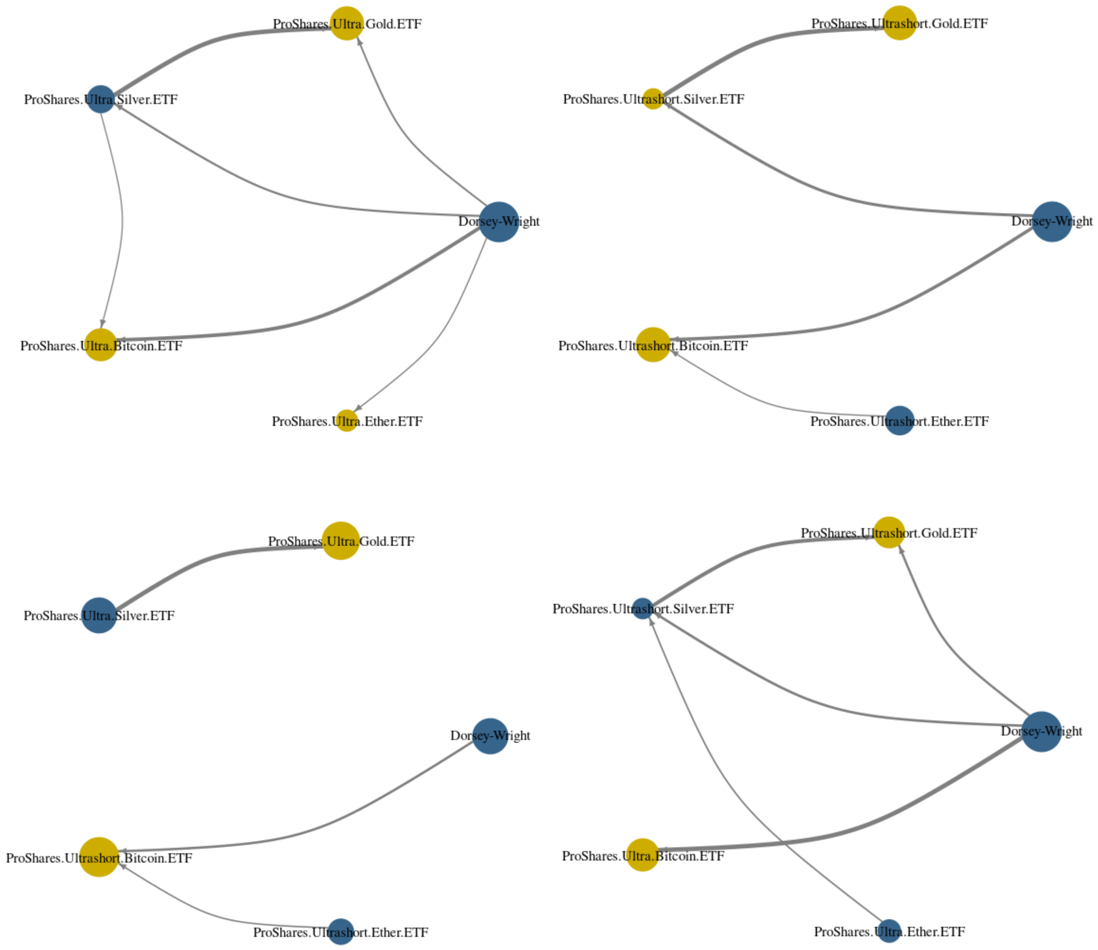


Figure 3d. Victory uncertainty effects at the 50th quantile

Figure 4a. Laggard uncertainty effects at the 95th quantile

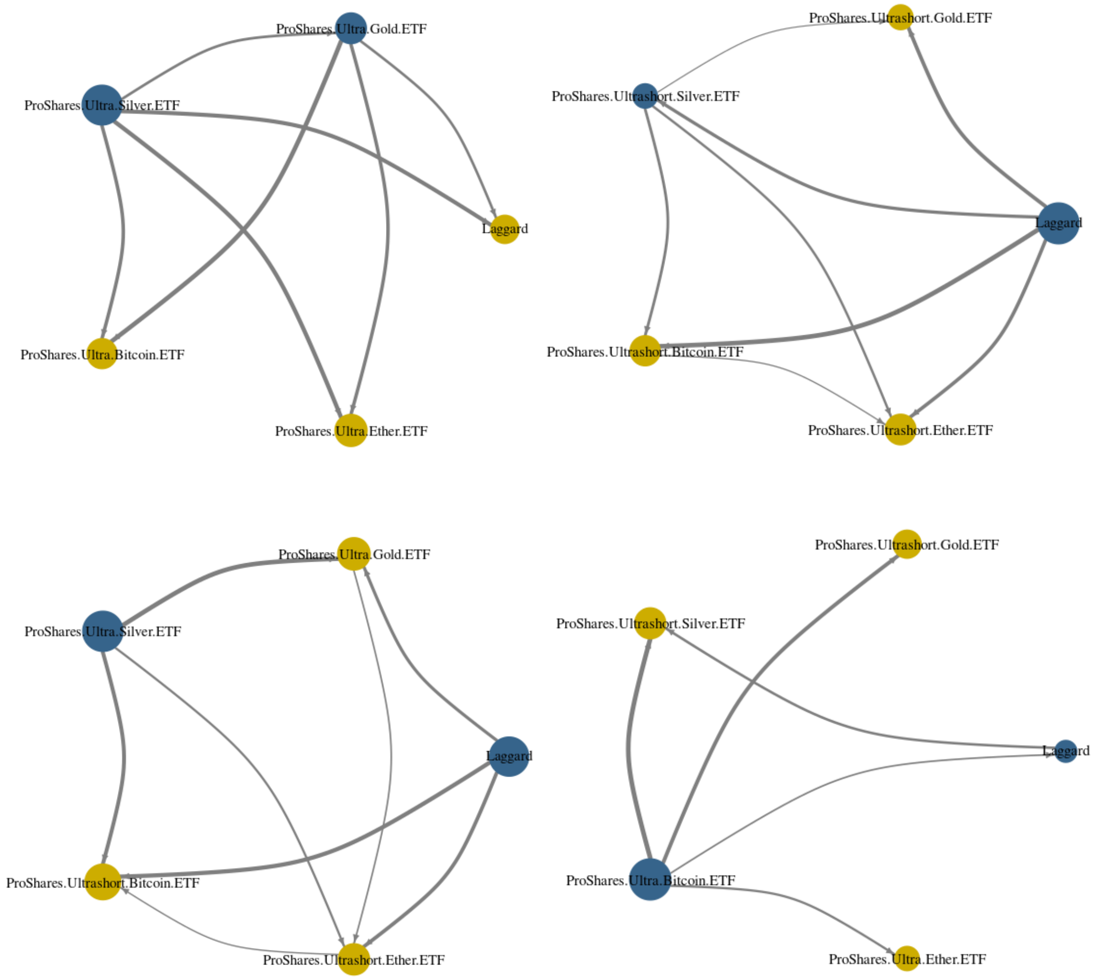


Figure 4b. Family uncertainty effects at the 95th quantile

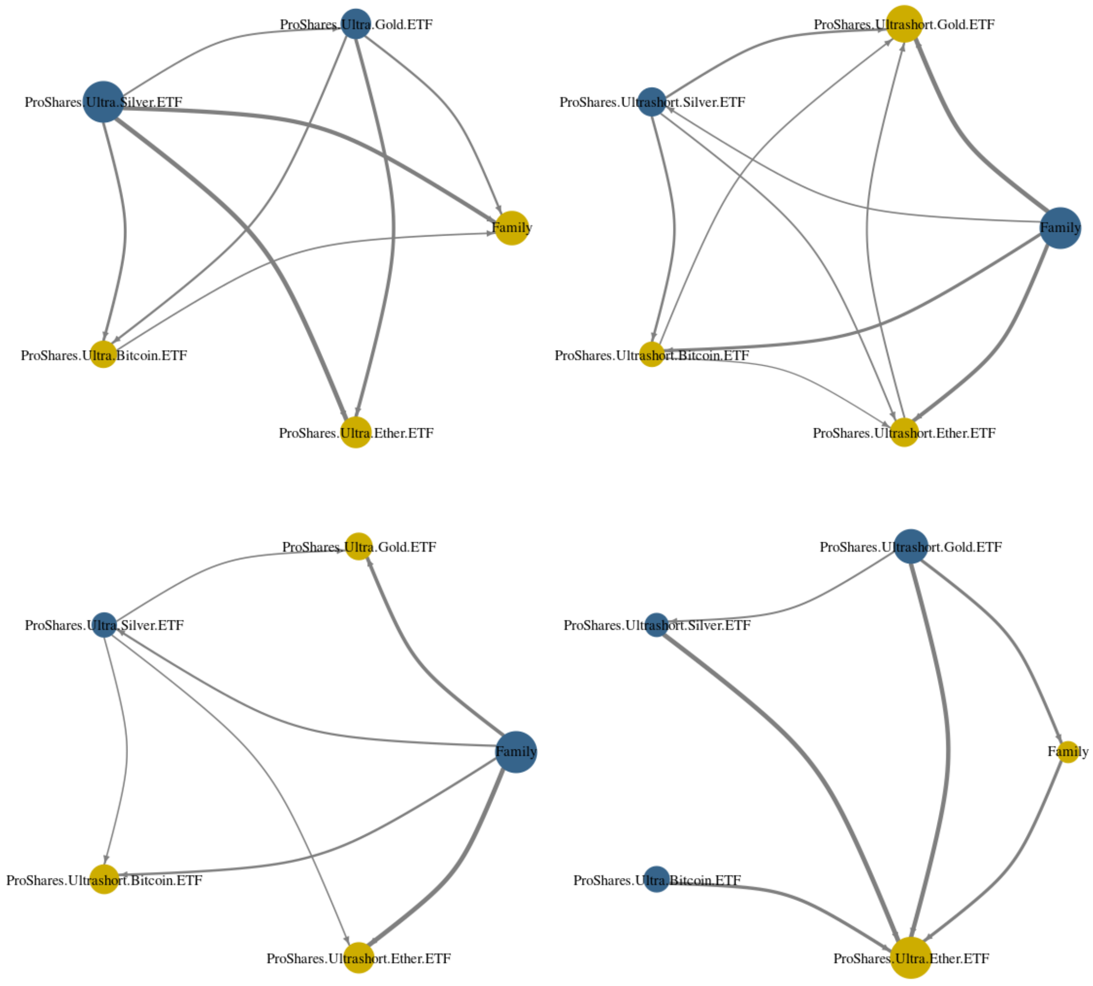
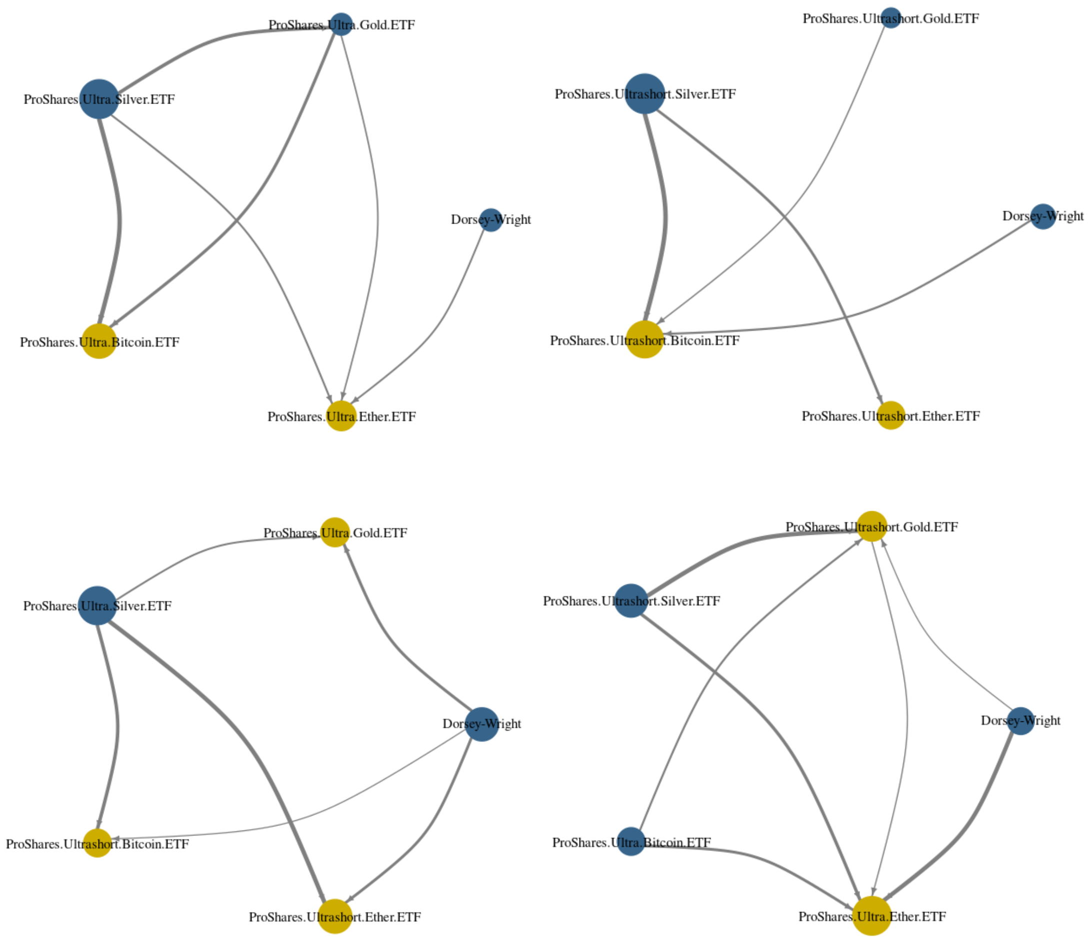
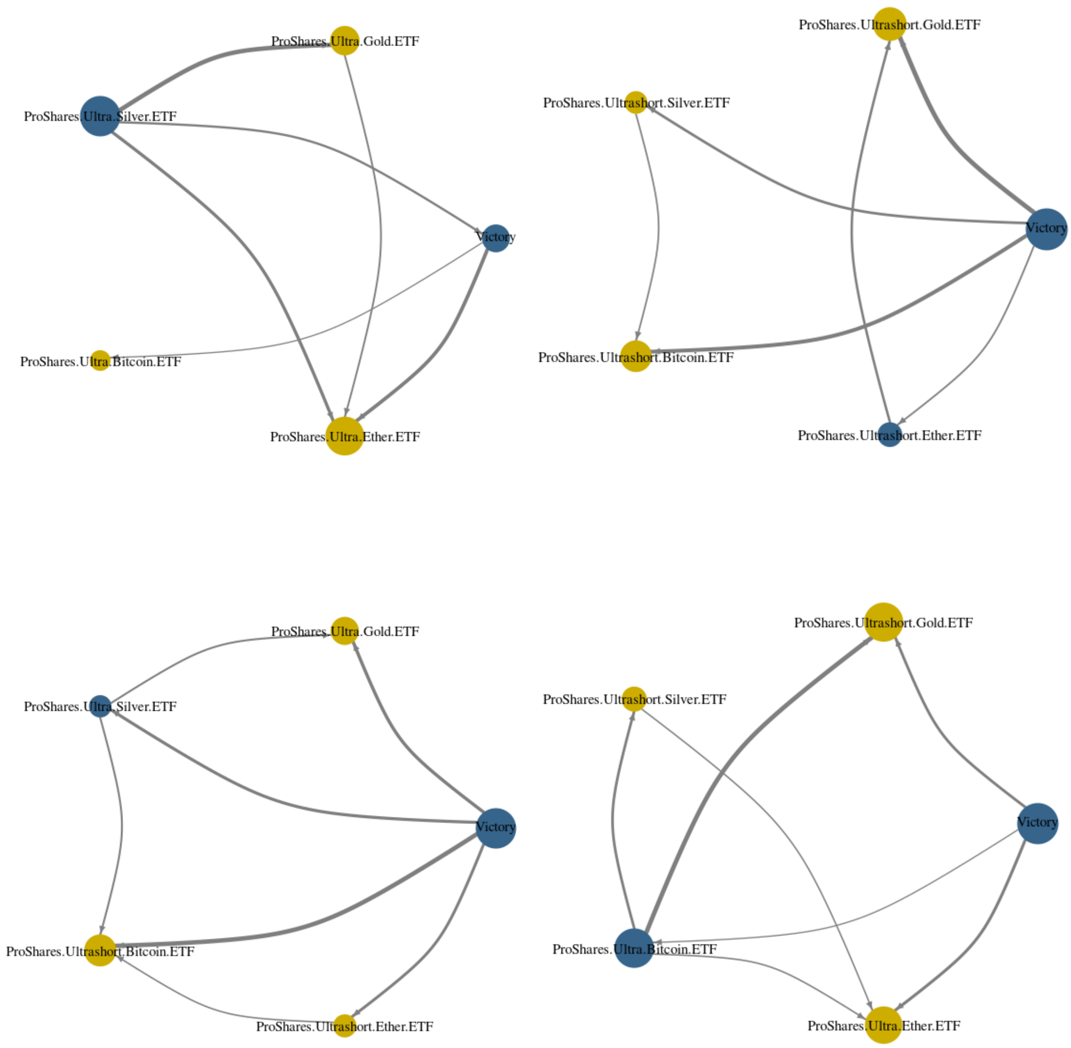


Figure 4c. Dorsey-Wright uncertainty effects at the 95th quantile



igure 4d. Victory uncertainty effects at the 95th quantile



	Mean	Variance	Skewness	Ex.Kurtosis	JB	ERS	Q(10)	Q2(10)
Market uncertainties								
Laggard	0.086	3.846	0.305**	10.075***	1774.5***	-9.269***	11.609**	47.408***
Family	0.034	0.576	-0.667***	9.859***	1723.8***	-7.160***	9.534*	62.368***
Dorsey-Wright	0.045	3.179	-0.099	7.824***	1067***	-8.487***	6.993	44.153***
Victory	0.064	0.608	-0.014	17.219***	5154***	-6.424***	14.268***	92.069***
Leveraged ETFs based on long positions								
ProSharesUltraGold	0.315	7.577	-1.701***	14.146***	3686.5***	-10.338***	7.541	37.234***
ProSharesUltraSilver	0.297	44.431	-6.643***	86.435***	133193***	-6.215***	10.07*	7.721
ProSharesUltraBitcoin	-0.256	41.806	-0.512***	3.155***	191.625***	-3.841***	8.151	8.966
ProSharesUltraEther	-0.597	91.905	-0.694***	3.248***	217.374***	-3.863***	6.448	2.644
Leveraged ETFs based on short positions								
ProSharesUltraShortGold	-0.381	7.068	0.699***	6.972***	880.693***	-10.005***	6.950	98.868***
ProSharesUltraShortSilver	-0.701	29.177	1.201***	11.462***	2388.73***	-4.811***	4.286	119.825***
ProSharesUltraShortBitcoin	-0.251	40.293	-0.414***	2.433***	115.043***	-3.668***	8.936	18.324***
ProSharesUltraShortEther	0.159	227.668	9.587***	153.137***	414841***	-5.636***	4.833	0.024

Notes: The sample period spans from June 10, 2024 to February 9, 2026. * , ** , and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The SK statistic is the third standardized moment and quantifies the skewness of the empirical distribution. The KU statistic, which represents the fourth standardized moment, is expressed as excess kurtosis—calculated by subtracting the theoretical kurtosis value of 3 (under normality) from the sample kurtosis. The BJ statistic is associated with the Jarque–Bera test, which assesses the null hypothesis of normality in the data by examining its skewness and excess kurtosis. Under the normality null hypothesis, the BJ test statistic is chi-squared distributed with 2 degrees of freedom. and is found by the following equation: BJ = (OBS / 6) (SK2 + KU2 /4). Q(10%), Q(50%), and Q(90%), represent the 10th percentile, median, and 90th percentile of the empirical distribution, respectively.

Table 2. Averaged dynamic connectedness between Laggard uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 5th quantile

	Laggard	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Laggard	20.70	19.86	19.91	19.53	20.00	79.30
PSU_Gold	21.98	15.18	23.44	19.27	20.13	84.82
PSU_Silver	24.30	23.00	13.96	19.75	18.97	86.02
PSU_Bitcoin	22.47	18.74	18.54	15.91	24.35	84.09
PSU_Ether	22.94	18.75	18.38	23.85	16.06	83.92
TO	93.69	80.35	80.27	82.40	83.45	
NET	12.39	-4.47	-5.76	-1.69	-0.48	TCI=83.63

	Laggard	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Laggard	22.41	19.91	19.52	20.15	18.01	77.59
PSUS_Gold	23.75	11.89	22.34	22.19	19.83	88.11
PSUS_Silver	23.48	22.03	11.75	22.64	20.09	88.25
PSUS_Bitcoin	23.82	21.41	22.31	11.10	21.35	88.90
PSUS_Ether	24.16	20.38	21.72	23.24	10.51	89.49
TO	95.21	83.74	85.88	86.22	79.28	
NET	17.62	-4.38	-2.36	-0.68	-10.20	TCI=86.47

	Laggard	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Laggard	19.00	20.42	20.99	21.65	17.94	81.00
PSU_Gold	25.12	12.07	23.27	21.26	18.28	87.93
PSU_Silver	26.05	22.93	11.57	21.42	18.03	88.43
PSUS_Bitcoin	22.60	19.05	18.16	17.04	23.14	82.96
1SUS_Ether	22.64	19.23	18.52	25.92	13.69	86.31
TO	96.40	81.64	80.94	90.25	77.40	
NET	15.40	-6.30	-7.48	7.29	-8.91	TCI=85.33

	Laggard	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Laggard	19.12	20.81	20.76	19.27	20.03	80.88
PSUS_Gold	23.27	17.17	24.45	17.64	17.47	82.83
PSUS_Silver	22.97	22.59	21.26	16.49	16.69	78.74
PSU_Bitcoin	25.07	18.72	20.45	12.34	23.43	87.66
PSU_Ether	25.16	18.89	20.25	23.26	12.43	87.57
TO	96.47	81.01	85.91	76.67	77.62	
NET	15.59	-1.82	7.17	-11.00	-9.95	TCI= 83.53

Table 3. Averaged dynamic connectedness between Family uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 5th quantile

	Family	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Family	21.92	18.94	18.73	21.52	18.89	78.08
PSU_Gold	20.33	15.03	24.65	21.92	18.07	84.97
PSU_Silver	19.15	24.79	16.66	21.72	17.68	83.34
PSU_Bitcoin	20.39	18.97	19.10	16.82	24.72	83.18
PSU_Ether	21.55	17.78	18.27	27.30	15.10	84.90
TO	81.42	80.48	80.75	92.46	79.36	
NET	3.34	-4.49	-2.60	9.28	-5.53	TCI=82.89

	Family	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Family	21.63	19.83	19.38	19.04	20.12	78.37
PSUS_Gold	21.03	15.20	22.78	20.63	20.36	84.80
PSUS_Silver	20.40	22.69	16.42	19.45	21.05	83.58
PSUS_Bitcoin	19.71	20.80	19.91	15.42	24.16	84.58
PSUS_Ether	19.67	19.00	19.16	23.48	18.69	81.31
TO	80.81	82.31	81.23	82.60	85.68	
NET	2.44	-2.49	-2.35	-1.98	4.37	TCI=82.53

	Family	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Family	20.16	19.77	21.98	18.67	19.42	79.84
PSU_Gold	20.87	12.56	25.56	20.38	20.63	87.44
PSU_Silver	20.99	24.05	15.10	19.80	20.05	84.90
PSUS_Bitcoin	19.59	18.76	20.54	16.61	24.50	83.39
PSUS_Ether	19.06	18.88	20.56	23.11	18.39	81.61
TO	80.51	81.46	88.64	81.96	84.61	
NET	0.67	-5.98	3.74	-1.43	3.00	TCI=83.44

	Family	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Family	19.34	19.74	20.94	20.92	19.06	80.66
PSUS_Gold	20.59	15.99	24.90	19.96	18.55	84.01
PSUS_Silver	20.81	22.72	19.65	19.82	17.00	80.35
PSU_Bitcoin	21.54	17.52	19.94	15.45	25.55	84.55
PSU_Ether	22.10	18.27	19.03	27.03	13.57	86.43
TO	85.04	78.24	84.82	87.73	80.17	
NET	4.38	-5.77	4.47	3.18	-6.27	TCI=83.20

Table 4. Averaged dynamic connectedness between Dorsey-Wright uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 5th quantile

	Dorsey-Wright	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Dorsey-Wright	19.06	19.51	20.09	21.26	20.08	80.94
PSU_Gold	20.22	15.23	23.51	21.60	19.44	84.77
PSU_Silver	21.45	23.72	14.48	21.43	18.93	85.52
PSU_Bitcoin	20.87	18.90	18.99	16.54	24.69	83.46
PSU_Ether	20.26	18.92	18.46	24.97	17.40	82..60
TO	82.80	81.05	81.04	89.25	83.15	
NET	1.87	-3.72	-4.48	5.79	0.54	TCI=83.46

	Dorsey-Wright	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Dorsey-Wright	20.25	20.80	20.09	20.28	18.58	79.75
PSUS_Gold	22.69	11.93	23.67	21.52	20.20	88.07
PSUS_Silver	22.99	22.16	12.32	22.14	20.39	87.88
PSUS_Bitcoin	22.52	20.78	21.96	11.83	23.11	88.37
PSUS_Ether	22.47	20.65	20.98	23.73	12.16	87.84
TO	90.67	84.39	86.70	87.67	82.28	
NET	10.93	-3.68	-0.99	-0.70	-5.55	TCI=86.34

	Dorsey-Wright	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Dorsey-Wright	18.998	20.78	20.73	20.93	18.58	81.02
PSU_Gold	23.51	14.32	23.33	20.05	18.78	85.68
PSU_Silver	23.10	24.30	13.85	20.39	18.36	86.15
PSUS_Bitcoin	22.02	20.48	19.22	14.81	23.48	85.19
PSUS_Ether	21.25	20.40	18.96	24.44	14.95	85.05
TO	89.89	85.96	82.24	85.82	79.19	
NET	8.87	0.28	-3.91	0.62	-5.86	TCI=84.62

	Dorsey-Wright	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Dorsey-Wright	19.67	20.14	21.05	20.11	19.02	80.33
PSUS_Gold	23.05	14.95	23.97	19.56	18.48	85.05
PSUS_Silver	23.34	21.64	19.80	18.38	16.84	80.20
PSU_Bitcoin	23.90	18.37	20.83	13.31	23.59	86.69
PSU_Ether	22.83	18.25	19.88	23.85	15.19	84.81
TO	93.12	78.40	85.73	81.89	77.93	
NET	12.79	-6.65	5.53	-4.79	-6.88	TCI=83.41

Table 5. Averaged dynamic connectedness between Victory uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 5th quantile

	Victory	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Victory	17.69	18.97	20.02	20.77	22.55	82.31
PSU_Gold	21.16	12.86	24.09	20.71	21.18	87.14
PSU_Silver	21.77	23.95	13.09	20.40	20.79	86.91
PSU_Bitcoin	21.02	17.79	19.06	16.49	25.65	83.51
PSU_Ether	21.74	17.21	16.88	24.65	17.51	62.49
TO	85.69	77.92	82.05	86.52	90.17	
NET	3.38	-9.21	-4.86	3.01	7.68	TCI=84.47

	Victory	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Victory	23.06	19.66	19.72	18.90	18.86	78.34
PSUS_Gold	20.82	16.09	23.37	20.20	19.52	83.91
PSUS_Silver	20.57	22.03	15.98	20.81	20.61	84.02
PSUS_Bitcoin	20.51	20.15	21.93	13.57	23.85	86.43
PSUS_Ether	20.42	19.17	20.64	23.40	16.37	83.63
TO	82.31	81.01	85.65	83.30	82.64	
NET	5.38	-2.90	1.63	-3.13	-0.99	TCI=82.98

	Victory	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Victory	19.30	19.46	22.67	20.71	17.86	80.70
PSU_Gold	22.15	12.86	24.94	20.50	19.54	87.14
PSU_Silver	22.69	23.70	14.04	20.28	19.28	85.96
PSUS_Bitcoin	21.29	18.60	20.63	15.31	24.17	84.69
PSUS_Ether	20.31	18.14	20.39	24.69	16.47	83.53
TO	86.45	79.89	88.63	86.20	80.86	
NET	5.74	-7.25	2.67	1.50	-2.67	TCI=84.41

	Victory	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Victory	18.26	18.28	18.23	22.51	22.72	81.74
PSUS_Gold	20.88	15.53	23.65	20.26	19.68	84.47
PSUS_Silver	21.21	22.17	17.91	20.12	18.59	82.09
PSU_Bitcoin	23.33	17.53	18.23	15.04	25.86	84.96
PSU_Ether	23.60	17.43	17.54	26.86	14.56	85.44
TO	89.03	75.41	77.65	89.75	86.86	
NET	7.29	-9.06	-4.44	4.79	1.42	TCI=83.74

Table 6. Averaged dynamic connectedness between Laggard uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 50th quantile

	Laggard	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Laggard	48.34	9.24	11.45	13.68	17.29	51.66
PSU_Gold	10.79	38.58	34.70	7.60	8.33	61.42
PSU_Silver	12.41	31.45	37.13	9.69	9.33	62.87
PSU_Bitcoin	16.72	7.43	9.78	31.34	34.73	68.66
PSU_Ether	18.80	7.39	8.51	33.83	31.47	68.53
TO	58.73	55.51	64.44	64.79	69.67	
NET	7.07	-5.90	1.57	-3.87	1.14	TCI=62.63

	Laggard	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Laggard	49.19	9.41	11.00	14.58	15.83	50.81
PSUS_Gold	10.57	39.51	33.66	8.29	7.97	60.49
PSUS_Silver	12.35	30.97	37.53	10.67	8.48	62.47
PSUS_Bitcoin	16.95	7.57	9.88	31.88	33.73	68.12
PSUS_Ether	16.61	7.60	7.97	33.81	34.01	65.99
TO	56.48	55.54	62.51	67.35	66.01	
NET	5.67	-4.95	0.03	-0.77	0.02	TCI=61.58

	Laggard	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Laggard	48.76	9.34	11.49	14.58	15.83	51.24
PSU_Gold	10.65	38.54	34.98	7.97	7.86	51.46
PSU_Silver	12.54	31.82	36.68	10.31	8.45	63.12
PSUS_Bitcoin	16.84	7.47	9.95	32.12	33.61	67.88
PSUS_Ether	16.47	7.42	7.94	33.35	34.83	65.17
TO	56.50	56.05	64.36	66.21	65.75	
NET	5.26	-5.41	1.24	-1.67	0.58	TCI=61.77

	Laggard	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Laggard	49.07	9.30	10.64	13.52	17.48	50.93
PSUS_Gold	10.62	39.35	33.24	7.92	8.86	60.65
PSUS_Silver	11.86	30.84	38.00	9.84	9.46	62.00
PSU_Bitcoin	16.40	7.50	9.41	31.54	35.15	68.46
PSU_Ether	18.58	7.58	8.11	34.22	31.51	68.49
TO	57.45	55.23	61.40	65.50	70.94	
NET	6.52	-5.42	-0.60	-2.95	2.45	TCI=62.10

Table 7. Averaged dynamic connectedness between Family uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 50th quantile

	Family	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Family	57.44	10.74	9.42	10.68	11.72	42.56
PSU_Gold	7.73	39.25	37.07	7.79	8.17	60.75
PSU_Silver	8.18	34.75	36.94	10.13	10.01	63.06
PSU_Bitcoin	11.80	8.21	10.16	31.34	38.50	68.66
PSU_Ether	10.79	9.30	9.21	37.28	33.43	66.57
TO	38.50	63.00	65.85	65.87	68.39	
NET	-4.06	2.24	2.79	-2.79	1.82	TCI=60.32

	Family	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Family	58.16	10.58	9.29	10.80	11.16	41.84
PSUS_Gold	7.42	40.02	36.29	7.90	8.38	59.98
PSUS_Silver	7.84	34.63	37.39	10.44	9.70	62.61
PSUS_Bitcoin	11.61	8.36	10.20	33.75	36.06	66.25
PSUS_Ether	9.94	9.42	8.78	35.71	36.15	63.85
TO	36.80	62.99	64.56	64.85	65.32	
NET	-5.03	3001	1.95	-1.40	1.47	TCI=58.91

	Family	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Family	58.01	10.62	9.63	10.66	11.07	41.99
PSU_Gold	7.32	39.18	37.55	.76	8.19	60.82
PSU_Silver	7.94	35.69	37.04	10.13	9.19	62.96
PSUS_Bitcoin	11.76	8.20	10.55	33.27	36.23	66.73
PSUS_Ether	9.87	9.21	9.11	35.84	35.97	64.03
TO	36.89	63.72	66.85	64.39	64.67	
NET	-5.10	2.90	3.89	-2.33	0.64	TCI=59.30

	Family	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Family	57.86	10.67	9.05	10.81	11.61	42.14
PSUS_Gold	7.96	39.78	36.08	7.87	8.31	60.22
PSUS_Silver	8.10	33.99	37.55	10.33	10.03	62.45
PSU_Bitcoin	11.86	8.09	9.94	31.73	38.37	68.27
PSU_Ether	10.95	8.99	8.81	37.50	33.75	66.25
TO	38.87	61.73	63.88	66.51	68.33	
NET	-3.26	1.52	1.43	-1.76	2.08	TCI=59.87

Table 8. Averaged dynamic connectedness between Dorsey-Wright uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 50th quantile

	Dorsey-Wright	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Dorsey-Wright	53.13	8.11	10.74	12.50	15.53	46.87
PSU_Gold	9.26	39.58	35.67	7.78	7.71	60.42
PSU_Silver	12.13	32.73	37.24	9.27	8.63	62.76
PSU_Bitcoin	14.87	7.69	10.04	31.47	35.92	68.53
PSU_Ether	16.37	8.00	8.44	35.41	31.77	68.23
TO	52.63	56.53	64.91	64.95	67.79	
NET	5.75	-3.89	2.14	-3.57	-0.44	TCI=61.36

	Dorsey-Wright	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Dorsey-Wright	51.87	8.64	10.61	13.32	15.56	48.13
PSUS_Gold	8.89	41.21	33.90	8.02	7.97	58.79
PSUS_Silver	11.86	31.98	37.91	9.99	8.26	62.09
PSUS_Bitcoin	14.73	8.13	9.68	31.95	35.50	68.05
PSUS_Ether	15.10	8.32	7.82	34.94	33.81	66.19
TO	50.60	57.07	62.02	66.28	67.29	
NET	2.47	-1.72	-0.07	-1.77	1.10	TCI=60.65

	Dorsey-Wright	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Dorsey-Wright	51.49	8.56	11.46	13.46	15.04	48.51
PSU_Gold	8.68	40.22	35.44	7.73	7.93	59.78
PSU_Silver	12.06	32.78	37.18	9.80	8.19	62.82
PSUS_Bitcoin	14.92	7.84	9.99	32.26	34.99	57.74
PSUS_Ether	14.99	8.16	8.06	34.10	34.69	65.31
TO	50.66	57.33	64.95	65.08	66.15	
NET	2.15	-2.45	2.12	-2.66	0.83	TCI=60.83

	Dorsey-Wright	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Dorsey-Wright	53.41	8.29	10.20	12.38	15.72	46.59
PSUS_Gold	9.45	40.74	33.98	7.79	8.03	59.26
PSUS_Silver	11.47	32.07	38.16	9.38	8.92	61.84
PSU_Bitcoin	14.66	7.92	9.76	31.47	36.20	68.53
PSU_Ether	16.21	8.09	8.11	35.73	31.87	58.13
TO	51.79	56.36	62.04	65.28	68.87	
NET	5.20	-2.89	0.20	-3.25	0.74	TCI=60.87

Table 9. Averaged dynamic connectedness between Victory uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 50th quantile

	Victory	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Victory	53.61	9.22	9.95	13.05	14.17	46.39
PSU_Gold	9.60	38.08	36.05	8.17	8.11	61.92
PSU_Silver	8.74	34.60	37.13	10.15	9.37	62.87
PSU_Bitcoin	10.69	7.79	10.09	33.17	38.26	66.83
PSU_Ether	12.95	7.63	8.47	37.67	33.26	66.72
TO	41.98	59.24	64.56	69.04	69.91	
NET	-4.41	-2.68	1.69	2.20	3.19	TCI=60.95

	Victory	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Victory	54.91	9.50	9.56	13.44	12.60	45.09
PSUS_Gold	9.01	39.32	35.09	8.47	8.11	60.68
PSUS_Silver	8.91	34.65	37.08	10.60	8.76	62.92
PSUS_Bitcoin	11.54	8.09	10.24	34.24	35.89	65.76
PSUS_Ether	12.18	8.03	7.59	36.18	36.02	63.98
TO	41.65	60.27	62.48	68.69	65.36	
NET	-3.45	-0.42	-0.44	2.93	1.38	TCI=59.69

	Victory	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Victory	54.51	9.11	9.98	13.49	12.91	45.49
PSU_Gold	9.13	38.31	36.50	8.16	77.90	61.69
PSU_Silver	9.10	35.79	36.44	9.99	8.67	63.56
PSUS_Bitcoin	11.64	8.04	10.14	34.71	35.46	65.29
PSUS_Ether	12.24	7.96	7.87	35.65	36.28	63.72
TO	42.11	60.91	64.50	67.29	64.94	
NET	-3.38	-0.78	0.95	2.00	1.22	TCI=59.95

	Victory	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Victory	53.64	9.30	9.70	13.04	14.32	46.36
PSUS_Gold	9.63	38.69	34.56	8.21	8.91	61.31
PSUS_Silver	8.44	33.72	37.91	10.22	9.71	62.09
PSU_Bitcoin	10.76	7.87	9.92	33.02	38.44	66.98
PSU_Ether	12.86	7.75	8.16	37.92	33.30	66.70
TO	41.70	58.64	62.33	69.38	71.38	
NET	-4.56	-2.66	0.24	2.40	4.68	TCI=60.69

Table 10. Averaged dynamic connectedness between Laggard uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 95th quantile

	Laggard	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Laggard	18.49	20.33	20.37	19.93	20.87	81.51
PSU_Gold	18.73	22.18	24.23	17.48	17.38	77.82
PSU_Silver	17.93	22.60	22.37	18.91	18.19	77.63
PSU_Bitcoin	19.93	20.23	21.04	15.91	22.90	84.09
PSU_Ether	21.20	19.47	20.77	23.28	15.29	84.71
TO	77.79	82.63	86.41	79.60	79.33	
NET	-3.72	4.81	8.78	-4.49	-5.38	TCI=81.15

	Laggard	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Laggard	29.80	19.08	18.19	16.25	16.68	70.20
PSUS_Gold	21.80	13.57	25.72	19.71	19.20	86.43
PSUS_Silver	20.57	24.88	15.65	19.84	19.07	84.35
PSUS_Bitcoin	19.62	20.52	21.85	12.53	25.48	87.47
PSUS_Ether	19.28	19.46	20.84	26.41	14.01	85.99
TO	81.26	83.94	86.60	82.21	80.43	
NET	11.06	-2.49	2.25	-5.26	-5.56	TCI=82.89

	Laggard	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Laggard	22.78	20.20	22.21	17.42	17.40	77.22
PSU_Gold	21.70	16.71	25.01	18.88	18.70	84.29
PSU_Silver	21.98	22.84	19.27	17.78	18.14	80.73
PSUS_Bitcoin	19.42	18.51	19.62	13.86	28.59	86.14
PSUS_Ether	19.16	19.47	19.21	27.94	14.21	85.79
TO	82.27	81.01	86.05	82.02	82.82	
NET	5.05	-3.27	5.32	-4.12	-2.96	TCI=82.83

	Laggard	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Laggard	17.86	18.71	17.24	23.05	23.14	82.14
PSUS_Gold	18.58	16.09	26.60	20.26	18.47	83.91
PSUS_Silver	18.54	26.13	17.90	19.63	17.80	82.10
PSU_Bitcoin	22.20	18.31	17.28	17.22	24.99	82.78
PSU_Ether	23.28	18.40	17.77	26.15	14.40	85.60
TO	82.60	81.55	78.88	89.09	84.40	
NET	0.45	-2.35	-3.22	6.32	-1.20	TCI=83.30

Table 11. Averaged dynamic connectedness between Family uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 95th quantile

	Family	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Family	23.11	18.47	19.61	19.53	19.28	76.89
PSU_Gold	17.42	20.38	26.38	18.57	17.25	79.62
PSU_Silver	17.67	25.53	18.93	19.23	18.65	81.07
PSU_Bitcoin	18.77	19.61	20.48	14.89	26.26	85.11
PSU_Ether	19.06	18.83	20.76	25.92	15.43	84.57
TO	72.92	82.43	87.23	83.25	81.44	
NET	-3.97	2.81	6.16	-1.87	-3.13	TCI=81.45

	Family	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Family	25.60	18.26	19.51	18.56	18.07	74.40
PSUS_Gold	21.50	15.09	25.32	19.28	18.82	84.91
PSUS_Silver	20.66	23.59	17.82	19.35	18.57	82.18
PSUS_Bitcoin	20.81	18.13	21.14	14.02	25.90	85.98
PSUS_Ether	20.83	17.51	19.84	26.83	14.98	85.02
TO	83.79	77.49	85.81	84.02	81.37	
NET	9.40	-7.42	3.63	-1.95	-3.65	TCI=82.50

	Family	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Family	24.08	19.41	19.32	18.89	18.30	75.92
PSU_Gold	22.13	15.67	26.26	17.86	18.08	84.33
PSU_Silver	20.96	25.04	20.96	16.89	16.17	79.04
PSUS_Bitcoin	20.73	17.99	18.02	14.95	26.30	85.05
PSUS_Ether	21.77	18.94	17.32	27.45	14.51	85.49
TO	85.59	81.38	80.91	81.09	80.86	
NET	9.68	-2.95	1.87	-3.96	-4.63	TCI=81.97

	Family	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Family	19.71	19.36	18.96	21.58	20.39	80.29
PSUS_Gold	18.58	17.52	26.333	19.61	17.95	82.48
PSUS_Silver	19.01	26.82	18.62	18.50	17.05	81.38
PSU_Bitcoin	21.39	19.78	18.41	14.63	25.79	85.37
PSU_Ether	21.18	19.04	18.20	26.63	14.94	85.06
TO	80.16	84.99	81.91	86.33	81.19	
NET	-0.13	2.51	0.53	0.96	-3.67	TCI=82.92

Table 12. Averaged dynamic connectedness between Dorsey-Wright uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 95th quantile

	Dorsey-Wright	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Dorsey-Wright	21.69	18.71	18.86	19.75	20.98	78.31
PSU_Gold	18.52	21.49	24.57	17.47	17.96	78.51
PSU_Silver	18.48	22.44	22.14	18.42	18.53	77.86
PSU_Bitcoin	20.24	19.34	21.10	14.71	24.61	85.29
PSU_Ether	22.06	18.89	19.67	24.82	14.56	85.44
TO	79.29	79.38	84.21	80.45	82.08	
NET	0.99	0.86	6.35	-4.85	-3.36	TCI=81.06

	Dorsey-Wright	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Dorsey-Wright	29.39	19.00	18.82	15.01	16.79	70.61
PSUS_Gold	19.07	14.93	26.90	19.40	19.70	85.07
PSUS_Silver	18.48	26.39	15.83	19.93	19.37	84.17
PSUS_Bitcoin	17.13	20.12	22.31	14.15	26.29	85.85
PSUS_Ether	17.10	19.52	20.78	26.48	16.01	83.99
TO	71.78	85.14	88.81	81.82	82.15	
NET	1.17	0.06	4.64	-4.03	-1.84	TCI=81.94

	Dorsey-Wright	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Dorsey-Wright	23.51	19.63	21.29	18.30	17.26	76.49
PSU_Gold	21.23	15.18	14.95	19.64	19.00	84.82
PSU_Silver	21.39	23.96	20.05	17.56	17.04	79.95
PSUS_Bitcoin	18.93	19.10	19.44	14.08	28.46	85.92
PSUS_Ether	18.78	19.50	19.39	28.05	14.28	85.72
TO	80.33	82.19	85.07	83.56	81.76	
NET	3.84	-2.63	5.12	-2.36	-3.97	TCI=82.58

	Dorsey-Wright	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Dorsey-Wright	18.32	18.38	19.12	22.76	21.42	81.68
PSUS_Gold	18.97	17.23	27.82	18.52	177.46	82.77
PSUS_Silver	18.70	25.55	19.97	18.71	17.06	80.03
PSU_Bitcoin	22.76	17.48	18.57	15.89	25.30	84.11
PSU_Ether	23.61	18.11	18.72	26.76	12.80	87.20
TO	84.04	79.53	84.23	86.75	81.23	
NET	2.37	-3.24	4.20	2.64	-5.97	TCI=83.16

Table 13. Averaged dynamic connectedness between Victory uncertainty and i) long positions on leveraged precious metals and major cryptocurrencies, ii) short positions on leveraged precious metals and major cryptocurrencies, iii) long positions on leveraged precious metals and short positions on major cryptocurrencies, and iv) short positions on leveraged precious metals and long positions on major cryptocurrencies, at the 95th quantile

	Victory	PSU_Gold	PSU_Silver	PSU_Bitcoin	PSU_Ether	FROM
Victory	21.71	18.00	20.06	20.33	19.90	78.29
PSU_Gold	18.58	20.82	24.81	18.81	17.0	79.18
PSU_Silver	18.83	22.41	20.66	20.13	17.97	79.34
PSU_Bitcoin	21.00	18.41	20.15	15.43	25.01	84.57
PSU_Ether	21.86	17.97	19.69	25.29	15.19	84.81
TO	80.27	76.78	84.72	84.55	79.87	
NET	1.98	-2.40	5.38	-0.02	-4.94	TCI=81.24

	Victory	PSUS_Gold	PSUS_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Victory	28.05	18.28	18.54	16.64	18.50	71.95
PSUS_Gold	22.85	13.09	24.69	19.01	20.36	86.91
PSUS_Silver	21.15	24.03	14.83	19.79	20.19	85.17
PSUS_Bitcoin	20.51	19.04	21.40	12.30	26.75	87.70
PSUS_Ether	20.22	17.92	19.70	25.88	16.29	83.71
TO	84.74	79.26	84.32	81.32	85.79	
NET	12.79	-7.65	-0.84	-6.38	2.08	TCI=83.09

	Victory	PSU_Gold	PSU_Silver	PSUS_Bitcoin	PSUS_Ether	FROM
Victory	25.63	18.72	20.36	16.93	18.36	74.37
PSU_Gold	21.19	16.80	24.97	17.98	19.05	83.20
PSU_Silver	22.68	23.52	18.43	17.60	17.75	81.57
PSUS_Bitcoin	20.26	18.03	19.06	14.21	28.45	85.79
PSUS_Ether	20.54	18.99	18.13	27.33	15.03	84.97
TO	84.68	79.26	82.50	79.84	83.63	
NET	10.31	-3.94	0.93	-5.95	-1.35	TCI=81.98

	Victory	PSUS_Gold	PSUS_Silver	PSU_Bitcoin	PSU_Ether	FROM
Victory	19.52	18.34	18.95	22.10	21.09	80.48
PSUS_Gold	20.26	16.12	25.15	20.46	18.01	83.88
PSUS_Silver	19.72	24.68	19.04	19.33	17.22	80.96
PSU_Bitcoin	22.98	17.32	17.48	16.22	26.00	83.78
PSU_Ether	23.16	18.46	18.23	27.04	13.11	86.89
TO	86.13	78.80	79.81	88.94	82.31	
NET	5.64	-5.07	-1.15	5.16	-4.59	TCI=83.20