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Dynamic Volatility Spillovers between Spot and Futures Markets during Market Crises: A Systematic Literature Review Using the TCCM Framework

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ABSTRACT- This article presents a structured literature review of dynamic volatility spillovers between spot and futures markets during financial crises, applying the TCCM (Theory, Context, Characteristics, Methodology) framework. Drawing from influential and Scopus-indexed studies, it offers a consolidated understanding of volatility dynamics, key transmission mechanisms, and methodological advancements. The study also identifies evolving trends, critical research gaps, and future research directions relevant to academics and financial practitioners.

KEYWORDS- Dynamic Volatility, Spillovers, Spot and Futures Markets, Financial Crises, TCCM Framework

I. INTRODUCTION

Financial markets are dynamic by nature, and one key characteristic that reflects the extent of change in asset prices over time is volatility. Because of its implications for risk management, pricing efficiency, and market stability, the relationships between the spot and futures markets has attracted enormous academic and practical attention among the many market mechanisms[7][10]. Asset pricing, risk management, and market efficiency are all impacted by the very apparent volatility spillovers between the spot and futures markets during market crises. Understanding these dynamics is essential for sound investing strategies and financial stability. One important phenomena that illustrates how uncertainty in one market or asset spills over into another is the transmission of volatility, especially during financial crises. Volatility spillover is a phenomena that is particularly pertinent in light of growing global market integration.

There is compelling evidence that the spot and futures markets experience bidirectional volatility spillovers. This implies that one market's volatility may have an impact on another and vice versa. For example, the spillover effects were most noticeable during the global financial crisis of 2008–2009 and the Eurozone debt crisis, demonstrating the high degree of interconnection across various sectors [1][9] [17][25]

According to theoretical foundations like the Information Arrival Hypothesis and the Efficient Market Hypothesis (EMH), futures markets frequently act as leading indicators of price movements in the underlying spot markets because of their greater liquidity and cheaper transaction costs [11][22]. These markets influence spot market volatility, particularly in times of economic uncertainty, because they respond quickly to fresh information.

For example, because of heightened speculative activity and changes in investor attitude, futures markets frequently led volatility transmission during the 2008 Global Financial Crisis and the COVID-19 pandemic .These occurrences have changed the structural interconnectedness between markets in addition to increasing volatility.

Furthermore, volatility patterns are significantly shaped by investment behavior. According to behavioral finance, investor sentiment can increase market reactions, decrease arbitrage opportunities, and add noise to price discovery mechanisms when there is a heightened uncertainty [4] .Asymmetric spillover, in which the impact of negative shocks is greater than that of positive ones, are caused by these structural and psychological elements.

Researchers have used advanced econometric models like the Dynamic Conditional Correlation (DCC-GARCH), Time-Varying Parameter VAR (TVP-VAR), and Wavelet Coherence approaches to correctly represent the changing character of these interdependencies [10][21]. Better risk assessment and hedging techniques are made possible by these models, which make it easier to comprehend volatility across time, frequency, and regimes.

This study fills this gap by reviewing and analyzing the literature on volatility spillovers across spot and futures markets using the Theory–Context–Characteristics–Methodology (TCCM) paradigm [1] [9] [18] [20]. It offers a thorough grasp of the area and lays out directions for future research by fusing theoretical underpinnings with bibliometric evidence.

II. THEORETICAL BACK GROUND

A. Bidirectional Spillovers:

There is strong evidence of bidirectional volatility spillovers between spot and futures markets. This means that volatility in one market can influence the other and vice

versa. For instance, during the 2008-09 global financial crisis and the Eurozone debt crisis, the spillover effects were particularly pronounced, indicating a high level of interconnectedness between these markets [1] [9][17].

B. Market-Specific Dynamics:

The nature and intensity of these spillovers can vary significantly across different markets and crises. For example, in the UK and US markets, spot volatilities were net receivers of shocks from futures trading volumes and open interest during the global financial crisis, while in the US, futures markets were net transmitters 1. Similarly, in the Chinese markets, futures markets had a stronger influence on spot markets during the 2015 market crash [18].

C. Impact of Major Economic Events:

Major economic events such as the global financial crisis and the Eurozone debt crisis tend to exacerbate volatility spillovers. These crises increase the overall volatility and return spillover effects, making the markets more interconnected and volatile [17] [25][21]

D. Hedging Opportunities:

During periods of market downturns, futures markets often provide stronger hedging opportunities. This is because the volatility spillover from futures to spot markets tends to be higher during downtrends, offering better risk management options for investors [9]

E. Dynamic Interdependence:

The interdependence between spot and futures markets is dynamic and can change over time. For instance, during the COVID-19 crisis, there was increased symmetry in own-market volatility and a quicker recovery to pre-crisis levels compared to the 2008-09 crisis 2. Additionally, the influence of futures markets on spot markets can grow over time, as observed in the Chinese markets .[5].

F. Investor Sentiment:

High investor sentiment can reduce the correlation between spot and futures markets, leading to less impactful volatility shocks. This suggests that during periods of high sentiment, noise trading increases, and arbitrage activity decreases, affecting the spillover dynamics [2]

III. METHODOLOGY

This study uses a two-pronged methodological approach that combines bibliometric analysis with Systematic Literature Review (SLR). We used the Scopus database to conduct a systematic search in order to gather the variety of academic works on volatility spillovers between spot and futures markets. Keyword combinations including **“volatility" OR "price fluctuation" OR "market variability" OR "risk") AND ("spillover" OR "transmission" OR "contagion" OR "influence") AND ("spot market" OR "cash market" OR "immediate market") AND ("futures market" OR "derivative market" OR "forward market") AND ("market crisis" OR "financial crisis" OR "economic downturn" OR "market shock").** This initial query returned **276 articles**, which were refined to **240 articles** by applying Scopus filters. The eligibility criteria encompassed empirical studies employing volatility modelling, articles examining relationships between spot and futures prices, and studies using high-frequency or daily financial data. Excluded studies lacked methodological clarity or were not written in English and published studies subject area limited to economics and business studies. The dataset was exported in CSV format, including citation data, abstracts, keywords, funding information, and bibliographic metadata.

To highlight gaps and future directions, the **TCCM framework** is applied (Knight et al., 2004; [20].This framework categorizes the literature into four dimensions: **T**heory, **C**ontext, **C**haracteristics, and **M**ethodology, and has been widely used across domains including finance and international business.

IV. RESULTS & DISCUSSION

A. Evolution Of The Research

The evolution of research on dynamic volatility spillovers between spot and futures markets reveals a clear upward trajectory in scholarly interest, particularly in response to major financial and economic disruptions. From 1996 to 2010, the number of publications remained minimal, with only sporadic contributions—typically one article per year—indicating limited academic focus during that period. However, beginning in 2011, the volume of research began to show a gradual increase, reflecting a growing awareness of inter-market volatility interactions. A notable surge occurred after 2019, with significant peaks in 2021 (26 articles), 2023 (31 articles), and a remarkable high in 2024 (37 articles), driven largely by the increased financial uncertainty and complexity brought about by events such as the COVID-19 pandemic and its aftermath. This trend suggests that economic crises serve as catalysts for volatility-related studies. The steady rise in publications also underscores a shift toward more sophisticated econometric modeling, greater availability of high-frequency data, and increasing relevance of cross-market linkages in a globalized trading environment. As of 2025, with six publications already identified, the trend indicates sustained academics Figure 1.

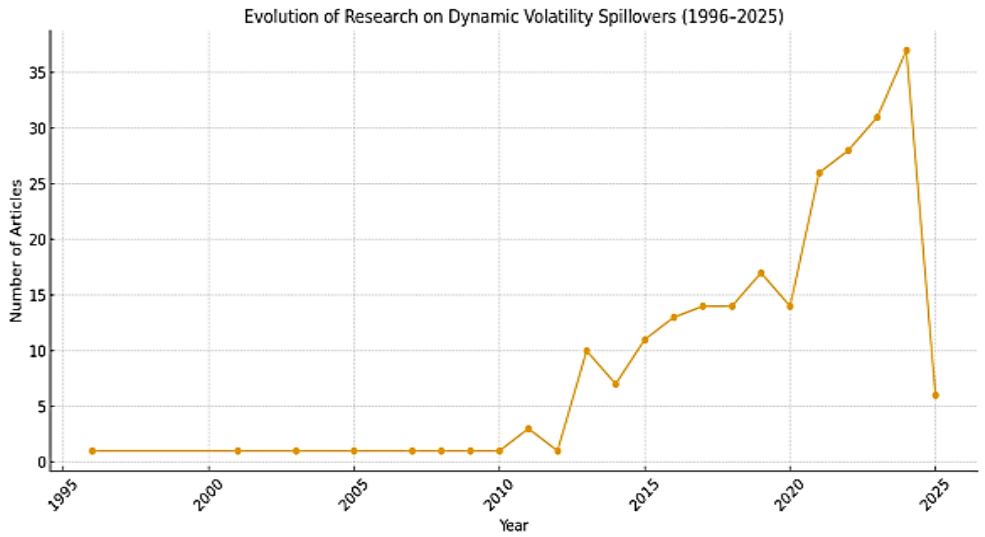

Figure 1: Evolution of Research on Dynamic Spillover

B. TCCM Framework

Here, we use the TCCM framework (Theory–Context–Characteristics–Methodology) to review the literature on dynamic volatility spillovers between spot and futures markets in a systematic manner. This methodical approach enables a thorough synthesis of previous research, providing insights into theoretical underpinnings, contextual settings, empirical features, and methodological trends. By arranging the literature in this way, we identify important knowledge gaps and suggest directions for future research. The following sections are organized as follows: (1) theory development; (2) contextual relevance; (3) important characteristics and findings; and (4) methodological developments.

- **Theory**
  - **Efficient Market Hypothesis (EMH)** and **Price Discovery Theory** propose that prices in efficient markets instantly reflect new information, with futures markets often leading spot markets in assimilating such information due to higher liquidity and trading volume [11] [22][15].
  - **Risk Transmission Theory** explains how financial shocks and uncertainty spread across markets, especially during crises. Volatility co-movements intensify due to systemic risk exposure and interdependence[7]; [12][10].
  - **Behavioral Finance Theory** highlights the impact of investor sentiment, herding, and noise trading on volatility. These factors often lead to asymmetric spillovers during high-stress periods [4][6] [2][5]
  - **Information Asymmetry Theory** suggests that informed traders in futures markets exploit superior access to information, causing spillovers that affect the price formation in spot markets [19].
- **Context**

Understanding the context in which volatility spillovers are studied is essential for interpreting results and identifying generalizability. The literature reveals three main dimensions of contextual exploration:

  - **Temporal Context** Volatility spillovers have been extensively examined across various financial crises, including the **2008–09 Global Financial Crisis**, **Eurozone Debt Crisis**, **2015 Chinese market crash**, and the **COVID-19 pandemic**. These periods are marked by increased uncertainty, leading to elevated cross-market interdependence [5][17] [16].Recent work also captures post-pandemic volatility adjustments [2][21].
  - **Geographical Context** Most research has focused on major financial markets in the **US, UK, China, and India**, offering robust empirical data. However, there is limited coverage of **emerging markets** and **Islamic financial systems**, which exhibit distinct institutional features and risk behaviors [9] [3]. Few studies have considered African or Southeast Asian contexts, signaling a cleargap.
  - **Market Context** The literature spans various asset classes including **equities**[14], **commodities** [21][17],and **currency futures** [13].Recent studies also examine **green and ESG-linked assets** as sources or buffers of volatility spillovers during crises [5] and some highlight **sector-specific interlinkages** within national markets [24].
- **Characteristics**

Empirical research on volatility spillovers incorporates a diverse set of variables to capture market behavior and interdependence. The most commonly used variables include:

  - **Volatility Indices & Return Series**: These are the primary metrics for analyzing spillover intensity and direction. They reflect the magnitude and timing of market reactions to shocks [1][25] [8].
  - **Trading Volume & Open Interest**: Frequently used in futures market studies, these variables serve as proxies for information flow and liquidity. Higher trading volume often amplifies spillover transmission [21][17].
  - **Crisis Dummies & Event Indicators**: Researchers use these to isolate the effect of major

events such as the Global Financial Crisis, Eurozone Debt Crisis, and COVID-19 pandemic [5][2]. They help identify structural breaks and shifts in volatility regimes.

- **Investor Sentiment and Market Uncertainty Proxies**: Variables like the VIX, Google Trends, or news-based indices are increasingly employed to explain behavioral aspects of volatility spillovers [4][24].
- **Asset-Specific Controls**: Some studies integrate ESG ratings, geopolitical risk indices, or sector classifications to control for market-specific shocks [5].These variables are essential for developing robust models that can capture both temporal dynamics and asymmetric market responses under varying conditions.

- **Methodology**

A variety of advanced econometric models have been employed in the literature to capture the complex and dynamic nature of volatility spillovers between spot and futures markets:

- **Diebold and Yilmaz Spillover Index**: Widely used to measure directional and total spillovers across markets using forecast error variance decomposition [5][7].
- **DCC-GARCH and DECO-GARCH Models**: These models estimate time-varying correlations, allowing researchers to detect shifts in market comovement under different conditions [21][18][2].**TVP-VAR (Time-Varying Parameter Vector Autoregression)**: Useful for modeling evolving relationships between markets over time, especially during major crises [14][9].
- **Wavelet Coherence**: Captures both time and frequency domain interdependence, revealing short-term vs long-term spillover patterns [13][24].
- **Copula Models and Quantile Regression**: Increasingly used to account for non-linear dependence and tail-risk interactions, especially in turbulent markets [23].

V. CONCLUSION

This systematic literature review analyzed the evolving research on dynamic volatility spillovers between spot and futures markets, especially during periods of financial crises. By applying the TCCM framework, the study synthesized key theoretical foundations, contextual developments, empirical characteristics, and methodological approaches across the existing body of work.

Theoretically, the review confirms the relevance of the Efficient Market Hypothesis, Risk Transmission Theory, Behavioral Finance Theory, and Price Discovery frameworks in explaining volatility interactions. Contextually, studies have largely concentrated on advanced economies and well-known crises such as the 2008 Global Financial Crisis and COVID-19 pandemic, with limited attention to emerging and Islamic financial markets. The characteristics of the reviewed studies highlight the diverse use of variables such as return series, volatility indices, trading volume, and event dummies, while the methodological landscape reveals a transition toward advanced econometric tools like DCC-GARCH, TVP-VAR, and wavelet coherence.

Despite the growing volume of literature, significant gaps remain. There is a need for greater exploration of underrepresented regions, cross-asset volatility behavior under structural breaks, and the role of behavioral biases in spillover dynamics. Additionally, the integration of high-frequency and alternative data sources (e.g., sentiment indices, ESG metrics) can enhance understanding of asymmetric and nonlinear spillovers.

Future research should aim to bridge these gaps by adopting multi-market, multi-period comparative studies, especially in emerging and sector-specific contexts. Expanding the theoretical lens to include sustainability risks, macroeconomic uncertainty, and digital asset volatility may also enrich the field. Overall, this review not only consolidates existing knowledge but also charts a clear path for future inquiry into volatility transmission mechanisms in modern financial systems.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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