COINTEGRATION OF FINANCIAL MARKETS: A REVIEW

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Abstract

This paper's goal is to provide a systematic review of the literature on financial market co-integration. The current research is based on a review of empirical, conceptual, and literature-based studies primarily focused on financial market co-integration and causality, and it was conducted using the Scopus database, which gathers reputable publications for the years 2000–2021. This paper explains the origins and history of the concept of co-integration and its application in finance, as well as how it may be used to better understand investor attitudes toward portfolio diversification and investment decisions.

Keywords: Co-integration, Causality, Market Interdependence, Financial Markets.

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1. Introduction

Cointegration is most typically connected with economic theories that assume a relationship of equilibrium between time series variables in economics. Because the economic forces that act in reaction to deviations from equilibrium might take a long time to restore equilibrium, the equilibrium relationship predicted by these economic theories is known as a long run equilibrium relationship. As a result, cointegration is calculated using monthly, quarterly, or annual frequency timeseries data. Cointegration can be defined as a high or low frequency relationship. Arbitrage arguments are used to justify greater frequency cointegration. This means that the prices of the same assets on multiple marketplaces are cointegrated. Many scholars have looked into the cointegration of financial markets in various contexts. This paper's major goals are to conduct an exhaustive assessment of the literature, pinpoint any gaps, and provide potential future topics for study.

Objectives Of The Study

1) To identify the publication trend of research in financial market cointegration.
2) To review the existing literature on financial market co-integration and
3) To identify the gap in the existing literature and suggest future directions of the study.

Literature Review

Researchers are interested in studying the cointegration of financial markets in the early stages of 1990's. The discussions were in different contexts including contagion effects in stock markets, transmission of shocks, driving forces behind correlations between financial markets, interdependence of financial markets in different countries etc.

Nobel Laureates Robert Engel and Clive Granger initially proposed the concept of cointegration in 1987. The investigations of Engle and Granger (1987) propelled the modelling of vector autoregressions with unit roots into the center of attention in macro econometrics, according to (Hervás & Millares, 2004). In addition, they created a collection of tools for analyzing macroeconomic and financial time series. Furthermore, they produced extensions in the areas of panel data cointegration, seasonal cointegration, and models for explosive roots to make the theory more easily applied.

Granger (1981) proposed co-integration, which is now utilized to build estimation processes, tests, and empirical examples. Based on Granger (1983), the paper develops a representation theorem for co-integrated systems that connects the moving average, autoregressive, and error correction representations (Engle & Granger, 2015, 107-135). (Hubrich et al., 2001, 247-318) compared the assumptions of several test processes in a review. They established a relationship between the test's local power and the generality of the assumptions used to determine its validity. Based on their findings, the researchers concluded that lag augmentation tests, canonical correlation tests, Stock & Watson tests, and Bierens tests all perform badly even in idle settings. As a result, their usage in applied work is not suggested. In general, likelihood approaches outperform other methods, however they have flaws in particular cases.

2. Methodology

To find relevant studies on financial market co-integration, the researchers conducted a comprehensive literature search in the Scopus database by using the keywords "market co-integration", "market integration", "market co-movements", "market inter-linkages", "market interdependence", and "market long-term interactions". Using Scopus journal articles presume that the journals chosen are the most referenced and read in finance research and that they play a significant role in the field. From 1999 to 2022, the search yielded 69 studies. The authors limited the search by applying subject areas such as "Economics, Econometrics, and Finance" and "Business, Management, and Accounting." Again, the authors selected articles and review papers published in scientific journals in English language only. The filtering finally produced a total of 50 documents for the research on financial markets co-integration.

3. Result And Discussion

a. Publication Trend of Research in Financial Markets Co-integration

The publication trend of research on financial markets co-integration is presented in Figure 1. where the total number of articles published is mapped against their respective year of publication from 1999 to 2022. It shows that, despite the fact that research on financial markets co-integration is not a new field, the productivity per year is significantly lower. There are a total of 69 publications on this topic, most of which were published after 2006. The graph also points out that the growth in the publication trend in recent years is remarkable compared to 1999. The most unusual stock market crisis in March 2020, which occurred when investors realized the gravity of the Covid-19 pandemic and its impact on global economy, also contributed to the recent rise in studies.

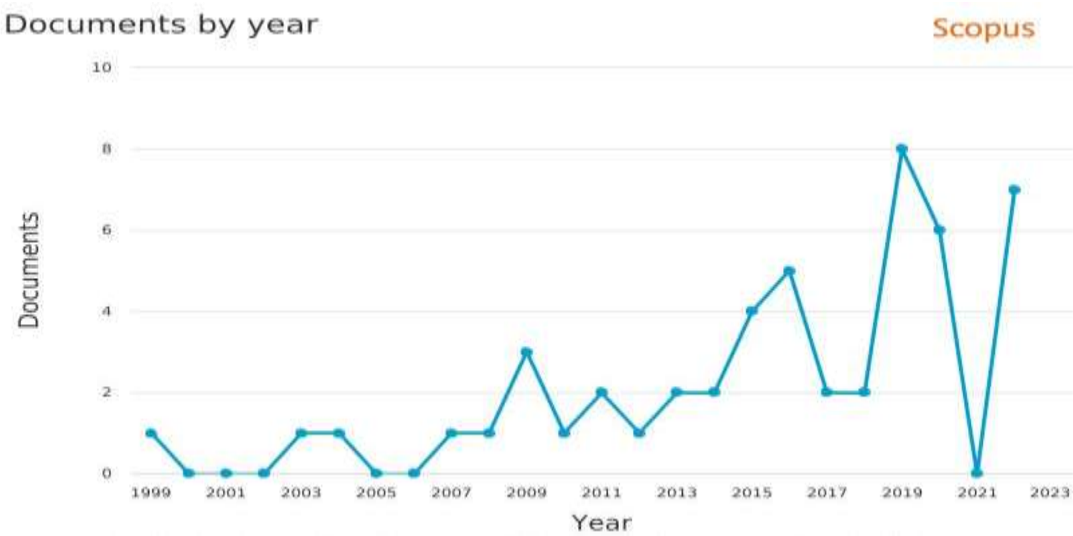

Figure 1: Publication trend of research in financial markets co-integration

b. Description of Research in Financial Markets Co-integration.

Table 1 describes the research in financial markets co-integration chronologically. Based on the 50 documents on financial markets co-integration, the researchers discovered that, over the last 22 years, studies on financial market co-integration have primarily focused on stock market shock transmissions, driving forces behind stock market linkages, long-run co-movements, impact of wars on stock markets, interdependencies between markets, role of trade connections on market interdependence, impact of globalization, impact of financial liberalization, and chances for financial market co-integration. According to the current literature, research have primarily focused on stock markets in industrialised countries such as the United States, the United Kingdom, Germany, Australia, France, Italy, Spain, Chile, and Japan. Developing countries such as Brazil, Mexico, Mauritius, China, India, and Pakistan are also the subjects of several of the research. European financial markets are another area found to be widely studied. There are a few studies that compare the integration of stock markets or financial markets in developed, developing, and emerging countries around the world.

Financial crises and credit crunches that occurred during specific years, as well as their impact on stock markets, are another key subject of inquiry for the researchers. In this way, the influence of the Covid 19 recession on financial market links, particularly stock market linkages between trading partners, could be investigated. Future research should focus on the long-term equilibrium link between different trade blocs. Another issue that has to be examined is the prospects for international diversification by finding market cointegration and developing strategies to hedge investment risk. According to the findings, there are extremely few studies on investor financial decision-making and investor psychology, such as behavioral biases. Interdependencies between stock markets and other local financial markets such as bond, commodity, money, and foreign currency markets are also underrepresented in the studies.

More research is also needed on stock market stability and instability following an exogenous shock, and event studies such as the impact of the major global economic crisis '2020 stock market crash', and the effect of 2020 Russia-Suadi Arabia Oil Price War on stock markets, the peaks and troughs in international financial markets as a result of the Brexit Withdrawal Agreement, and the shift in contagion following 2021 Global Energy Crisis are all factors to be considered for future research. Another topic that has to be investigated is the interconnections between stock markets and bitcoin markets, as well as the relationship between stock market dependency and portfolio diversification utilizing crypto currencies. The cointegration studies also can be conducted using different approaches and technologies, such as the Dynamic Network Interaction (DIN) methodology (Lukmanto & Widiputra, 2009), Kernel Adaptive Filtering (Garcia-Vega et al., 2020). There is also a possibility for researchers to identify thematic clusters, intellectual linkages, and knowledge development in the research on financial markets co-integration through a bibliometric analysis.

Table 1: Chronological Study of Financial Markets Co-integration

Sl No.	Authors &Year	Contributions
1	(Soydemir, 2000, 149-176)	The underlying economic fundamentals are the basic reasons for stock market transmissions.
2	(Pretorius, 2002, 84-105)	Identified driving mechanisms behind the developing stock market linkages
3	(Pascaul, 2003, 197-203)	By investigating long-term stock market correlations in the United Kingdom, France, and Germany, an alternative technique for measuring growing co-integration, namely "speed of adjustment co-efficients," was presented.
4	(Chong et al., 2003, 51-76)	Australian stock exchange was Granger caused only by the US market, for the years 1991 to 2001
5	(Paleari et al., 2005, 25-38)	The Iraq War had an impact on the stock market indices of five of the world's most well-capitalized countries: the United States, the United Kingdom, France, Germany, and Italy.
6	(Rezayat & Yavas, 2006, 440-458)	International market correlations change following an exogeneous shock yields conflicting results in the market dependence among the equity markets of US, UK, France, Germany and Japan.
7	(Liu et al., 2006, 1-15)	Differences in trade connections between nations might explain differences in stock market interdependencies in the case of US-Canada trade ties.
8	(Rivas et al., 2008, 33-68)	Mexico and Brazil trade more internationally with Spain and Germany, making them more vulnerable to external shocks.
9	(Awokuse et al., 2009, 549-559)	In the 1990s, financial liberalisation measures resulted in a large expansion in market linkages, which were subsequently reduced by the 1997 Asian financial crisis. According to the data, Japan and the United States have the most effect on emerging markets, but Singapore and Thailand's influence has grown.
1	(Ramlall, 2009, 30-44)	The SEMDEX (Mauritius Stock Exchange) has been exposed to the whims of international stock markets. The SEMDEX has become more susceptible to happenings in overseas stocks as a result of the US crisis. Even for a developing country like Mauritius, the US Credit Crunch has harmed foreign portfolio diversification.
1	(Lukmanto & Widiputra, 2009)	Used Dynamic Interaction Network (DIN) methodology to show critical and complex dynamic stock market relationships and suggest that it may also be used to anticipate the movement of stock market indices with a high degree of precision.
1	(Manner & Candelon, 2010, 364-384)	To solve the skewness in contagion test, a sequential algorithm is proposed. The research indicates that the dependent parameters have undergone a strong 'J-shape' evolution.
1	(Popa et al., 2010, 391-396)	Developed a model to capture the financial crisis and since evidence for the high volatility- high reliance effect is shown.
1	(Mandaci & Torun, 2010, 16-32)	looked at the long-term relationship between emerging market stock prices in Europe, the Middle East, and Africa and the US stock market

		to see if these markets offer US investors chances for foreign diversification.
1	(Samarakoon, 2011, 724-742)	Emerging markets have significant bidirectional, but asymmetric, interaction and contagion. With the exception of Latin America, there is no cross-border contagion from the United States to emerging markets.
1	(Lucey & Muckley, 2011, 215-224)	European stock markets have superior long-term diversity than Asian stock markets.
1	(Dajcman et al., 2012, 22-32)	International investors' financial decisions are heavily influenced by co-movements between developed and emerging European stock markets.
1	(Liu, 2013, 226-238)	The EMU had a positive impact on stock market integration, but its impact decreased after 2002.
1	(Asgharian & Nossman, 2013, 343-363)	Economic integration is mostly responsible for the fluctuation in stock market interdependence over time, according to examinations into the consequences of U.S. and regional stock exchanges on local stock exchanges in the Pacific Basin and China.
2	(Subha & Nambi, 2013, 97-101)	The Granger causality test is used to see if the popular Indian stock index BSE SENSEX and the main American stock indices have a cause-and-effect relationship (NASDAQ and NYSE).
2	(He et al., 2014, 434-444)	China's stock market has been more reliant on the world market than the US, leading to overreaction and economic overheating.
2	(Kumar & Srividya, 2014)	For India and China, researchers looked at stock market interconnections / co-integration, causality, and innovation accounting. The BSE Sensex and Shanghai Composite Index's 10-year closing logarithmic returns were used from 2005 to 2014.
2	(Joseph et al., 2014, 1-11)	Portfolio investment networks in cross-border stock and long-term debt instruments, as well as the global financial crisis of 2008, are studied from 2002 to 2012. Two financial crisis early-warning indicators have been identified. The proliferation of over-the-counter-traded financial derivatives is described by the edge density of the debt securities network.
2	(Shen et al., 2015, 193-199)	This research looks into the impact of the European financial crisis on the Chinese stock market. After adjusting macro fundamental factors and global shocks, the impact on investor psychology is minimal. A mechanism is included in the model for systematic tracking of time-varying correlation coefficients.
2	(He et al., 2015, 125-129)	China's reforms after joining the World Trade Organization (WTO) have greatly increased financial market interdependence
2	(Paramati et al., 2015, 5303-5319)	The quantity and character of Australia's stock market reliance on its trading partners were investigated. Markets having a higher (lower) trade intensity with Australia will be more (less) interconnected. The bulk of Australia's primary commercial partners are highly linked with the country.

2	(Mohanasundaram & Karthikeyan, 2015, 475-485)	JALSH, NIFTY, and NASDAQ have a correlation, but no long-term relationship.
2	(Dghais & Ismail, 2015, 364-369)	The US stock market index and regional stock indices are linked by applying discrete wavelet filtering.
2	(Vardar et al., 2015)	International investors face increased diversification risks due to increased stock market interdependence following crises.
3	(Paramati et al., 2016, 4210-4226)	Australia and Asia's stock markets are vulnerable to contagion due to their increasing economic integration.
3	(Agrawal, 2017, 277-299)	The concept of stock market integration is founded on the idea that markets can bring economies together. Depending on the situation, economic integration has its own set of benefits and drawbacks. The study investigates whether global market integration patterns have shifted as a result of the financial crisis of 2007-2008.
3	(Panda & Nanda, 2017)	In comparison to the United Kingdom, Denmark, Finland, Germany, Portugal, Spain, Sweden, Switzerland, Greece, Ireland, Luxembourg, and Norway, Austria, Belgium, the Netherlands, and France are less actively interconnected. The long run equilibrium relationship between the return distributions of the stock markets in the region is significant.
3	(Rijanto, 2017, 393-407)	ASEAN-5 stock exchanges and the rest of the world's stock exchanges have shifted due to the financial crisis, making integration difficult.
3	(Paramati et al., 2018, 141-145)	The stock market reliance was exacerbated by the Global Financial Crisis. Australia and China's stock markets have converged over time as a result of their bilateral trading links..
3	(Aggarwal Raja, A & Raja, 2019, 59-74)	Cointegration analysis reveals the co-movement of four stock market indices in a long-term equilibrium relationship. Between the four markets under consideration, there is just one long-run cointegrating link.
3	(Panda & Nanda, 2019, 314-335)	Israel, South Africa, and Jordan have the region's most interconnected stock markets in Africa's and the Middle East's stock markets.
3	(Joyo & Lefen, 2019, 303)	Interdependence of stock markets is heavily influenced by international trade. The study's findings revealed that Pakistan's stock markets were tightly linked during the 2008 financial crisis.
3	(Garcia-Vega et al., 2020)	Different data sources continuously generate stock returns, which are influenced by a variety of factors such as financial policies and national economic growth.
3	(Jhunjhunwala & Suresh, 2020)	The developing negative connection between the stock and commodity markets demonstrates gold's role as a safe haven asset. Investors can gain from metals such as zinc, nickel, and lead since they provide significant diversification. In contrast to developed countries, there is no indication of financialization of commodity markets in India.
4	(Bhandari & Kamaiah, 2020, 62-71)	Examined global equities markets from the standpoint of a diverse set of investors. It employs

		cutting-edge time-frequency wavelet techniques, with a particular focus on the Indian stock market.
4	(Aslam et al., 2021, 5)	Volatility spillovers from German and Dutch markets are highest during times of crisis.
4	(Herbst et al., 2021)	Crude oil returns and volatility cause US-GCC correlation to weaken, but robustness checks support findings.
4	(Song et al., 2021, 366-377)	Economic integration in the region has a major favourable impact on regional stock market co-movements. And the global financial crisis had a favourable impact on Asian stock market interconnectedness.
4	(Duarte & da Silva, 2022, 163-189)	The U.S. dollar is still the main foreign exchange anchor, while the euro is out-of-phase, the British pound has separated, the Brazilian real leads the Chinese yuan, and exchange rates increased during the global financial crisis.
4	(Mensi et al., 2022)	Significant time-scale correlations between traditional and Islamic stock markets, with fundamental contagion over the long term and short-term pure contagion both being evident.
4	(Maiti et al., 2022)	BRICS countries have a distinct contagion effect, favoring short-term investments over longer-term investments.
4	(Urom et al., 2022)	The Discrete Wavelet Technique and Time-Varying Parameter VAR show a stronger relationship between economic activity and financial and commodity markets.
4	(Batondo & Uwilingiye, 2022)	Short-term investors from the BRICS nations have significant investment opportunities in the Chinese market.
4	(Kakinuma, 2022, 693-711)	Empirical evidence suggests that equities in Southeast Asia are more dependent during the COVID-19 pandemic, but bitcoin offers no protection.
5	(Othman et al., 2022, 745-761)	Investors should take short-term co-movement into account when creating portfolios.

4. Conclusion

Market co-integration is a popular topic among finance scholars. Granger (1981) developed the notion of co-integration, which has since been applied to the development of estimate techniques, tests, and empirical examples. Researchers have mostly concentrated on determining the interdependence of various markets around the world, as well as the fundamental mechanisms that drive stock market transmissions (Soydemir, 2000, 149-176). Different models and instruments for measuring long-run co-movements between financial markets have also been developed by researchers (Pascaul, 2003, 197-203). The studies were also concentrated on the impact of financial crisis occurred in different time periods on contagion effects of stock markets.

According to the results of the content analysis of the literature, it was possible to clarify co-integration concepts, their various concepts, applications in measuring co-movements, and also to present some research propositions for the advancement of knowledge in the field of financial market research. Based on changing market trends in developing and emerging economies, it is plausible to conclude that stock market co-integration will become a rising subject of research and will be visible across different countries' financial markets. This research is highly useful for academics, research scholars and policy makers in the field of finance to identify the major contributions of existing literature in this field and also to develop new strategies for gaining more investment returns through international linkages and diversifications.

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