

Article

Global Financial Market Integration: A Literature Survey

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Abstract: This article undertakes a literature review on the topic of market integration, covering over 380 articles from the 1980s to 2024. The review consists of a qualitative analysis for context and a quantitative analysis for content, identifying key research streams and proposing directions for future research. I have identified six research groups: (1) market segmentation, (2) portfolio diversification, (3) market integration evidence from developed and emerging markets, (4) spillovers and linkages, (5) economic market integration, and (6) financial market integration and volatility. The literature focuses on market integration; it aims to answer the following questions: (1) What is the scope of market integration research? (2) What are the direct influences of market integration looking at top journals and authors and characteristics of most studied and cited topics? (3) What are the past and recent topics studied within the area of market integration? (4) What are the potential future research questions to explore in market integration? The topic of market integration has been controversial in many studies, as seen in policy decision-making, investments, and other related areas; this literature will provide great benefit for such an audience.

Keywords: global market integration; a survey of literature; stock market integration; financial market integration; portfolio diversification; cointegration; time-varying correlations; time varying correlations

1. Introduction

The scope of market integration has been part of the economic growth in many countries, allowing for innovation and providing investors and policymakers the confidence to invest and implement new strategies/policies. It is known that well-integrated markets have a better advantage at attracting global markets to invest (see, for example, [Bekaert and Harvey 1995, 2003](#); [Bekaert et al. 2007](#); [Albuquerque et al. 2005](#); [Yaprak and Karademir 2010](#)). In general, market integration in different economies plays a vital role in the development and globalisation of the economy, the liberalisation process, international trade, and the diversification of markets. This review will aim to address these factors under three types of integration: equity markets, economic markets, and financial markets. As world economies become increasingly integrated, equity markets focus on the changes across developed and emerging markets (see, for example, [Huth 1994](#); [Kearney and Lucey 2004](#); [Berben and Jansen 2005](#); [Kenourgios and Samitas 2011](#); [Majdoub et al. 2016](#); [Mishra et al. 2023](#)). Over the years, the world economy has been significantly liberalised, enhancing the flow of goods and financial services (see, for example, [Rahman et al. 2023](#)). Economic integration has developed labour, trade, and growth in the economy (see, for example, [Song et al. 2021](#); [Demirci and Kirdar 2023](#); [Andersson Joona and Gupta 2023](#); [Kanas and Kosyakova 2023](#)). From a financial standpoint, markets that benefit from portfolio diversification have a lower risk of investing (see, for example, [Levy and Sarnat 1970](#); [French and Poterba 1991](#); [Bekaert and Urias 1996](#); [Gupta and Donleavy 2009](#); [Rahim and Masih 2016](#); [Bekaert and Mehl 2017](#); [Patel 2019](#); [Zaimovic et al. 2021](#); [Patel et al. 2023](#)). As countries globalise, there is an increase in global power and regulatory quality and legal measures factors arise. Countries that exhibit higher levels of integration have more global power than less integrated economies.



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The focus on market integration stems from early work in the 1970s when researchers focused on the integration of capital markets across different countries and the benefits associated with investors (see, for example, [Lele 1967](#); [Subrahmanyam 1975](#); [Hughes et al. 1975](#)). Other researchers have examined international diversification using a frontier analysis approach across developing countries, research which, given the lower levels of integration with other emerging markets, shows evidence that there are benefits (see, for example, [Berger et al. 2011](#); [Zaremba et al. 2019](#)). Other works in the related studies in finance examine time varying correlations, such as the seminal work of [Bekaert and Harvey \(1995\)](#). Other techniques and models used to estimate the time varying correlations include a moving window of time ([Bekaert et al. 2009](#)) and the most prominent model, which used the ADCC GARCH¹ the model proposed by [Cappiello et al. \(2006\)](#). Other researchers in related fields have looked at market integration using a time varying approach (see, for example, [Andrew and Bekaert 1999](#); [Boldanov et al. 2016](#); [Jones and Olson 2013](#); [Heaney and Srianthakumar 2012](#); [Selvanathan et al. 2022](#); [Bekaert et al. 2023](#); [Jiang et al. 2023](#)) between developed and emerging markets. In contrast, some researchers have used cointegration techniques for estimation (see, for example, [Perman 1991](#); [Kremers et al. 1992](#); [Gianfreda et al. 2023](#); [Rajput and Bhalla 2023](#)); cointegration stems from the first work by [Granger \(1981\)](#) and involves testing long-run relationships of markets and the Johansen test first introduced estimating the vector autoregressive models ([Johansen 1991](#)). The integration of economies is crucial for the development of the world economy; factors that are influenced by the world economy including, trade, innovation, growth, and world power (see, for example, [Ma 2022](#); [Bastos et al. 2023](#)). Concurrently, equity market integration was developed over time in the era of globalisation, deregulation, and lower trade barriers. After the increasing growth of the economy, it also brought financial stability and promoted regulated policymaking (see, for example, [Saâdaoui and Ghadhab 2020](#); [Mishra and Mishra 2022](#); [Robiyanto et al. 2023](#)). During times of crises, there is evidence of setbacks in economic growth, especially during the Asian financial crisis in 1997, the 2008 global financial crisis, and more recently, COVID-19 and the Russia-Ukraine war in 2022, contributing to changes in stock markets.

In previous years, there has been a significant amount of research study in the area of market integration from a global lens, focusing on different areas; few studies comprehensively assess market integration globally (see, for example, [Bekaert et al. 2007](#); [Pukthuanthong and Roll 2009](#); [Hau 2011](#); [Lewis 2011](#); [Boamah 2017](#); [Zaremba et al. 2019](#); [Hung 2021](#); [Ghosh et al. 2023](#); [Mattison et al. 2023](#)). In contrast, the present study focuses on a literature survey. Therefore, following the work and models of seminal researchers, including [Bekaert and Harvey \(1995\)](#), [Bracker et al. \(1999\)](#), and [Johnson and Soenen \(2002\)](#). The survey contributes by conducting a more extensive review of market integration literature to answer several questions aimed at this goal: (1) What is the scope of market integration research? (2) What are the direct influences of market integration looking at top journals and authors and characteristics of most studied and cited topics? (3) What are the past and recent topics studied within the area of market integration? (4) What are the potential future research questions to explore in market integration?

I conducted a survey of literature review of market integration from a global perspective between the 1980s and 2024. The review consists of a qualitative analysis of context and a quantitative analysis of content ([Carriero et al. 2007](#)). Literature review surveys are a common survey type across many fields of studies, providing a reliable summary of sources. For instance, [Akbari and Ng \(2020\)](#) examine the literature in international markets by applying a literature survey technique entailing a citation technique and providing a theoretical framework to identify the relationships among citations, authors, different countries, and themes. Concurrently, [Sharma and Seth \(2012\)](#) conducted a similar review of market integration in 2012. I aim to build on the knowledge from such authors and provide the most recent work conducted in global market integration.

From this survey, I have identified six research groups: (1) Market Segmentation, (2) Portfolio Diversification (3) Market integration evidence from developed and emerging

markets (4) Spillovers and linkages, (5) Economic market integration, and (6) Financial Market Integration and Volatility, as well as providing new future research directions. Global market integration has been influenced by many countries and continues to develop in many parts of the world, and policymakers and researchers will benefit greatly from the review I have produced.

The rest of the paper is organised as follows. Section 2 surveys the historical context. Section 3 summarises the theoretical literature in the area of market integration and its impact on globalisation. Section 4 surveys the empirical works on market integration. Section 5 offers a conclusion and avenues for future research.

2. Historical Context

The emergence of stock markets can be traced back to the early 16th century when different East Indian companies issued stocks to finance their operations in India's international markets. Earlier joint stock companies were generally high-risk voyages that created these limited liability companies with investors' money for the voyage. These companies will dissolve after the voyage, and a new company will be created for the next expedition. Issuance of stocks for these voyages provided much-needed resources for the risky business of building ships, undertaking voyages, and importing goods from Eastern markets. After that period, stock markets became increasingly integrated post-liberalisation (see, for example, [Hunter 2006](#); [Hoang and Mateus 2023](#)). Trading in stocks was completed entirely through brokers until the formation of the first stock exchange in London in 1773, and subsequently the New York Stock Exchange was formed in 1792 ([Neal and Davis 2005](#); [Buchinsky and Polak 1993](#)). This was the golden era of free trade and instructional investment of market integration, where stocks from companies that existed around the world and conducted business anywhere in the world could be traded in either of the two stock exchanges.

2.1. Market Segmentation

The segmentation of markets was first introduced by [Wendell \(1956\)](#), explaining that market segmentation provides a precise adjustment of product and marketing efforts to consumers. It also separates other markets from other distinct markets globally ([Kara and Kaynak 1997](#)). Other researchers extend this knowledge by looking at the types of markets; for example, [Bekaert et al. \(2011\)](#) examine equity market segmentation by using cross-country variation of developing and emerging markets, and [Carriero et al. \(2007\)](#) discuss the importance of financial market developments and financial liberalisation policies to be beneficial for the integration of emerging markets. [Bau and Matray \(2023\)](#) examine the fact that foreign capital liberalisation reduces capital misallocation; however, it can increase aggregate productivity, as is evident in India. Throughout the development of markets, it has opened avenues for investors to grow internationally and benefit from the diversified assets. This will contribute to the overall economy (see, for example, [Srivastava et al. 2015](#)).

2.2. Portfolio Diversification

Stocks in different markets are differently affected as they reflect on the country's circumstances, creating a diversified portfolio for investors who want to invest in any of the countries ([Dutta et al. 2023](#); [Guo et al. 2023](#)). Researchers extend the knowledge of portfolio diversification and highlight the impact it has on different markets. For example, [Gupta and Guidi \(2012\)](#) look into the benefits of diversifying of portfolios through investing in international markets, in which domestic markets may not have been profitable in their study of time varying co-movements among Indian Asian developed stock markets. [Patra and Panda \(2021\)](#) examine the interdependence between emerging markets such as BRICS and other major global markets and commodities that provide investors with opportunities for portfolio diversification. The emergence of market integration has integrated markets globally. As a result, segmented markets were left to local environment integration levels

([Carrieri et al. 2007](#)). The stock market correlation levels indicate a correlation score of 0, which indicates markets are segmented, and a score of 1 indicates markets are integrated.

2.3. Market Integration Evidence from Developed and Emerging Economies

Market integration has spread across many economies, allowing for growth and increased opportunities. Studies have looked into the influence of market integration on developed and emerging countries in greater detail (see, for example, [Mishra et al. 2023](#); Working paper [Gómez et al. 2023](#); [Wang et al. 2023](#)). Another example is [Boamah \(2017\)](#), who looks at emerging stock markets (ESM) and contributes to the structural shifts in both emerging and world market integration of ESMs. Emerging market assets in global portfolios are deemed beneficial for the overall growth of the economy and for the diversification of markets ([Boamah 2017](#); [Li et al. 2003](#); [Hollstein 2022](#)). [Click and Plummer \(2005\)](#) explore five stock markets in the ASEAN that help to coordinate existing and emerging markets. Another study by [Brunner et al.](#) looks into developed and emerging markets measuring stock price indexes using the Capital Asset Pricing Model (CAPM) to determine the cost of capital and to see to what extent markets are integrated. However, major turning points in the economy and world market integration challenged markets, creating shocks in the economy. For example, [Elfakhani et al. \(2008\)](#) look into the financial crisis that rapidly spread from Thailand to other Asian countries during the period of the Asian financial crisis in 1997. The disasters, including the recession between 1991 and 2001 in the Japanese markets and the financial crisis in the emerging markets in mid-1997, indicated difficulties for institutions investing globally. Another study by [Qian et al. \(2023b\)](#) examines the dependence of the Chinese markets across international markets. Results showcase that from 2002 to 2018, the dependence was negative due to the differences in interest rates at the time. Market Integration continues to bring new ideas and evidence that help to contribute to emerging stocks; for example, ([Lukanima et al. 2024](#)) look into the impact of MILA (Mercados Integrados Latinoamericanos) on the integration of stock markets. Period between pre-GFC (2004) and COVID-19 (2023). The global emerging markets have increased their investment opportunities for which historical equity market data were not informative of future asset returns. [Bekaert and Harvey \(1997\)](#) state the returns in emerging capital markets vary from returns in developed economies. This is important to understand before making any investment decisions.

From the early historical years of market segmentation, the world has progressed, and markets have become more integrated over time, opening the economy to opportunities for growth, trade, and other political gains. This has consequently provided many benefits globally for investors seeking to increase their portfolio diversification. From the exchange of stocks to trade and now to an ever-globalised world. Market integration has contributed to the rise of the economies in both developed and emerging markets. Moving forward, this literature will contribute to the development of economies, providing benefits to markets and assisting them with gaining new opportunities to grow and move towards global investments and trade and building on knowledge about the future and the innovation that drives it.

3. Theoretical Background

The degree to which domestic stock markets are integrated into global markets has a direct impact on several issues mentioned by the international financial market theory. These issues include the cost of capital, portfolio diversification, and other criteria for capital budgeting decisions have different outcomes under domestic and international pricing (see, for example, [Stehle 1977](#); [Durnev et al. 2004](#); [Kim et al. 2005](#); [Singh et al. 2022](#); [Chen et al. 2023](#)). [Aroui and Foulquier \(2012\)](#) examine the evolution of market integration, which is affected by institutional and behavioural factors. Firstly, financial market integration is a result of economic, institutional, and political reforms. For the integration of economics to work, it depends on the ability of global investors to find opportunities to increase their portfolio diversification and access to domestic securities. Other factors

include an increase in the exposition of domestic assets to global factors, which further improves the global stock market integration (see, for example, [Qiu et al. 2022](#); [Boamah 2022](#); [Nazlioglu et al. 2022](#); [Yousaf et al. 2022](#)). Secondly, behavioural factors, including risk aversion and information perception, may affect the desire to invest internationally (see, for example, [Saivasan and Lokhande 2022](#); [Ahmed et al. 2022](#); [Almansour et al. 2023](#)). Market integration can be theoretically seen as a market that seeks to improve its international outlook, increase investment opportunities, and allow investors to invest in many of the foreign stock markets.

Another theory outlook on market integration would include the use of CAPM, introduced by [Sharpe \(1964\)](#) and [Lintner \(1965\)](#), for application to estimate the cost of capital for firms and portfolio management. [Fama and French \(2004\)](#) examine the CAPM as a powerful and intuitively pleasing prediction about how to measure risk and the relation between expected return and risk. The CAPM has developed over time, adapting to new risk factors such as liquidity. For countries to move from segmented markets to integrated markets, a theoretical model was established by the seminal work of [Bekaert and Harvey \(1995\)](#). They propose an empirical model of time varying market integration that allows for the importance of global and domestic information on stock returns to change over time (see, for example, [De Jong and De Roon 2005](#)). Recent literature ([Lago-Balsalobre et al. 2023](#)) looks into the cross-sectional implications of dynamic asset pricing accounting for volatility and ambiguity. This combines the international markets through the empirical model and the domestic markets through the CAPM model.

3.1. Cointegration

Markets are co-integrated if they have a long-run relationship in equilibrium. However, they can deviate in the interim. There are two types of tests used for long-run relationships, including the [Engle and Granger \(1987\)](#) test and the [Johansen \(1991\)](#) test. Engle and Granger look at the cointegration and error correction estimations using a multivariate approach to estimating cointegration. [Granger \(1981, 1983\)](#) was the first author to develop the concept of cointegration, later including [Granger and Weiss \(1983\)](#), then after [Engle and Granger \(1987\)](#) emerged. Engle and Granger use a multivariate time series for paired series, aiming to maintain proximity with each other given the external forces influencing the movement of the series. These forces include household income and expenditures and commodity prices in different markets. The equilibrium relationships are also influenced by the external forces which keep the equilibrium stationary. In any case of movement in the trend, the economy will direct equilibrium back to its normal position.

3.1.1. Spillovers and Linkages

Market integration can have many impacts and advances, such as wavelet analysis (frequency system), multivariate modelling, and spillover analysis ([Diebold and Yilmaz 2011](#)). [Qian et al. \(2023a\)](#) look into the spillovers between China and major international stock markets, and the results showcase that R-vine copula is the optimal model to look into the high-dimensional dependence structure of the markets after China joined the WTO, which suggests positive dependences. Another study by [Ahmad et al. \(2018\)](#) examines the financial connectedness through returns and volatility spillovers between the BRICS, the US, the European Union, and Japan. Results show that there is a weak transmission between China and India; however, there is a stronger transmission between the US and China. Indicating a strong linkage between the two economies, and BRICS would have to look somewhere else for better risk management strategies. Market integration is commonly referred to when providing linkages in conditional means and variances of stock market returns in different collection periods (see, for example, [Wheatley 1988](#); [Ammer and Mei 1996](#)). Most integrated markets have strong market integration; however, that is not the case for all markets. Not all markets have a strong market linkage; [Morelli \(2010\)](#) examines the integration between capital markets using a covariance portfolio for 15 sampled European countries. The study uses a cross-sectional approach for each country to test for integration

across the markets. Results showcase the commonality between different factors. For some countries, the price of risk is the same, implying that their capital markets are related; however, for the 15 countries, that is not the case. Based on the empirical work of the study after testing a European multifactor asset pricing model, the outcome does not support the null hypothesis, as there is no evidence for full market integration between the countries. This may affect international investment due to the lack of integration in certain European countries. Other studies also show similar results, including [Duan et al.'s \(2023\)](#) study, which looks at the relationship between China and global oil markets from the standpoint of return and volatility spillovers through quantile-based framework. Results show return and volatility spillovers have a positive increase in the Chinese oil market. This may also impact international investments and lower prospects for trade. Another study that provides links with Chinese markets is [Zeng and Ahmed's \(2023\)](#), the first study on the dynamic linkage between Bitcoin and major East Asian stocks. This study extends further by providing diversification benefits.

3.1.2. Economic Market Integration

Global markets provide better opportunities for diversifying investments; however, to benefit, we must understand the trends in integration between those markets. [Pukthuanthong and Roll \(2009\)](#) study global market integration as an alternative measure and its application. The study uses daily stock market index returns between 1973 and 2006, 34 years, and to take care of any a-synchronicity made by the time difference, the years will be from 1974 to 2006. A total of 81 countries are using the daily stock returns coming from global factors. Most countries show high levels of integration in comparison to other local markets, for example, Bangladesh, Pakistan, and Sri Lanka. Other studies have also looked at the increased popularity of international stock market integration. [Dickinson \(2000\)](#) examines the stock market integration and macroeconomic fundamentals using an empirical analysis between 1980 and 1995. The study considers the US and the European stock markets, testing for an increase in international market integration from the result of the correlations of the markets as a result of the globalisation of the financial market. The study identifies the macroeconomic variables as industrial production, the real interest rate, and the discount rate. Studies suggest that these three cases will result in a negative effect on the real interest rate of the stock market. The study uses the Johansen test for cointegration, and there is evidence that the European markets are closer to real integration. More recent literature, such as a study by [Foglie and Panetta \(2020\)](#), looks into Islamic stock markets vs. conventional, and given the different Islamic finance principles, ethical and sustainable investments prove to be more reliable for investors. Results showcase that there is no significant difference between the conventional and Islamic markets. Global markets do provide better investment options; however, investors must be aware of any changes and differences in markets that may affect their investment decision-making.

3.1.3. Empirical Modelling for Cointegration

For a two-variable system, a typical error correction model would relate to a change in one variable to past equilibrium errors, as well as for two variable changes. For a multivariate system, Engle and Granger use B to represent the Backshift operator as the general error correction.

Vector timeseries x_t has an error correction representation if it can be expressed as:

$$A(B)(1 - B)x_t = -yz_{t-1} + u_t \quad (1)$$

where u_t is a stationary multivariate disturbance, with $A(0) = 1$, $A(1)$ has all elements finite, $z_t = a'x_t$, and $y \neq 0$.

In this representation, the change in price from the previous period acts as an explanatory variable. However, by rearranging terms, any set of lags of the z can be written in this form; this allows any type of gradual adjustment towards a new equilibrium.

The second type of cointegration is the [Johansen \(1991\)](#) test. Johansen looks at estimating cointegration using Gaussian vector autoregressive (VAR) models, which are used to describe the variation of data and used to formulae economic-related questions as hypotheses using the VAR model technique. Johansen illustrates these techniques using two countries, Denmark and Finland, providing an underlying probability theory for assessing the properties of estimators and statistical tests.

The I(1) time series X_{t-i} and X_{t-k} are said to be cointegrated if a linear relationship exists of the form as in Equation (1), where X_t is I(0).

$$X_t = \delta + \Gamma_1 X_{t-1} + \Gamma_2 X_{t-2} + \dots + \Gamma_k X_{t-k} + \Pi X_t + \varepsilon \tag{2}$$

The VAR can be re-written as follows

$$\Delta X_t = \delta + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-k} + \varepsilon_t \tag{3}$$

where,

$$\Pi = \sum_{i=1}^{k-1} (r - 1) \tag{4}$$

Such that X_t is that non-stationary I(0) times-series vector for the proxies of GDP of the five-member countries, t is a linear trend. $I = 1, 2, \dots, k$, are the autoregressive approximations of moving average. Δ is the operator for the first difference, i.e., $\Delta X_t = X_{t-i} - X_{t-k}$. δ is a constant term, Γ represents coefficients, ε represents an uncorrelated random error term and Π is the matrix for the long-run impact matrices (see, example [Yussuf 2022](#)).

3.2. Time Varying Correlations

Initially, correlations were assumed to be constant, and researchers and practitioners estimated a single estimate of the coefficient for the period, and it was implicit in this that this relationship stayed constant over time. Following that, researchers realised that the relationships among economic variables change over time (see, for example, [Bekaert and Harvey 1995](#); [Zulkarnain and Nawi 2023](#); [Sadiq et al. 2023](#)). To incorporate these changes, researchers began using a moving window of time to estimate correlations (see, for example, [Jeon and McCurdy 2017](#)). However, this method also suffers from a weakness in that the observations within the window of time are assumed to be equally important, and observations outside of the window are ignored. Both of these assumptions are incorrect. This led to researchers using a GARCH type model where the errors from a past fit of the model are used to adjust for the future, thus developing a time series of correlations that incorporates all the variations in the relationship over time.

Researchers that used the GARCH type models introduced many other different models that were also used to estimate time varying relationships. The GARCH type model uses conditional variance to estimate time varying relationships. These models include the DCC, TGARCH, ADCC, and GJR. The DCC model has an advantage in the number of parameters to be established in the correlation process is independent of the number of series to be correlated (see, for example, [Gupta and Donleavy 2009](#); [Engle et al. 2019](#); [Ampountolas 2023](#)). Another technique is the T GARCH model (threshold GARCH), which looks at the negative and positive returns on conditional volatility dynamics (see, for example, [Ausloos et al. 2020](#); [Chávez et al. 2022](#)). The T GARCH is more suitable for a regime switch or a significant shift in the relationships between the two variables. The ADCC model measures the time varying conditional correlations used by [Cappiello et al. \(2006\)](#). It allows the reader to perceive active investor behaviour concerning the dynamic/significant changes in innovation ([Rajwani and Kumar 2016](#)). The GIR model is similar to the ADCC model. It uses distribution to estimate the relationship (see, for example, [Monfared and Enke 2014](#); [Shehadeh and Zheng 2023](#)). These types of models allow us to understand the many types of models used to estimate time varying correlations.

However, the most commonly referred to model is the Asymmetric Dynamic Conditional Correlation (ADCC) GARCH model used by [Cappiello et al. \(2006\)](#). The ADCC

model has been extensively used in the estimation of time varying correlations (for example, see [Abakah et al. 2023](#)).

Stock market integration has been one of the leading topics in finance and economics ([Chen et al. 2014](#)). Stock market integration is influenced by globalisation, providing opportunities to diversify investment in different economies (see, for example, [Moshirian 2003](#); [Kakran et al. 2023](#); [Khan 2023](#)). Theoretically, the survey will incorporate segmented domestic markets and integrated global markets.

Empirical Modelling for Time Varying Correlations

Using [Cappiello et al. \(2006\)](#) Asymmetric Dynamic Conditional Correlation (ADCC) GARCH model for the construction of time varying correlations for segmented and integrated markets. Below is a particular way used to describe [Cappiello et al. \(2006\)](#) ADCC-GARCH approach. First, I discuss the DCC-GARCH framework.

Let r_t be a $n \times 1$ vector of asset returns and assume they are conditionally normal with mean 0 and conditional covariance matrix H_t . That is,

$$r_t | I_{t-1} \sim \text{Normal}(0, H_t)$$

This matrix H_t can be decomposed as follows:

$$H_t = D_t R_t D_t$$

where $D_t = \text{diag} \left(h_{1,t}^{\frac{1}{2}}, \dots, h_{n,t}^{\frac{1}{2}} \right)$ is a $n \times n$ diagonal matrix of time varying standard deviations from univariate GARCH model with $h_{i,t}^{\frac{1}{2}}$ is on the i th diagonal and $R_t = \text{diag} \left(q_{1,t}^{-\frac{1}{2}}, \dots, q_{n,t}^{-\frac{1}{2}} \right)$ is the time varying correlation matrix.

The Dynamic Conditional Correlation (DCC) model follows a two-stage estimation of the conditional covariance matrix H_t .

Stage 1:

Use one univariate volatility models, such as GARCH ([Wang and Wu 2012](#)) or EGARCH ([Nelson 1991](#); [Lu et al. 2023](#)), to fit for r_t and obtain an estimate of $h_{i,t}$.

Stage 2:

Asset return r_t is transformed by their estimated standard deviations resulting from Stage 1 and used to estimate the parameters of the conditional correlations.

For example, consider a case where the asset returns r_t follows the AR (1) process, which can be written as:

$$r_t = \mu + ar_{t-1} + e_t \quad e_t | I_{t-1} \sim \text{Normal}(0, H_t) \tag{5}$$

and the time varying variance $h_{i,t}$ follows as GARCH (1, 1) model,

$$h_{i,t} = w_i + \alpha_i e_{i,t-1}^2 + \beta_i h_{i,t-1} \quad \alpha_i + \beta_i < 1 \tag{6}$$

When Model (1) is estimated under (2), the standardised residuals ε_{it} can be calculated as

$$\varepsilon_{it} = e_{it} / \sqrt{(h_{it})} \text{ or } \varepsilon_t = D_t^{-1} e_t$$

Obviously, $E(\varepsilon_t \varepsilon_t') = D_t^{-1} E(e_t e_t') D_t^{-1} = D_t^{-1} H_t D_t^{-1} = R_t$.

Following [Engle \(2002\)](#), we can write the resulting correlation matrix in the standard DCC model as

$$Q_t = S(1 - \alpha - \beta) + \alpha(\varepsilon_{t-1} + \varepsilon_{t-1}') + \beta Q_{t-1} \tag{7}$$

where Q_t is a symmetric positive definite matrix and S is the unconditional correlation matrix of the standardised residuals ε_t .

As this model does not allow for asymmetries and asset-specific news impact, the modified model that [Cappiello et al. \(2006\)](#) used for incorporating the asymmetrical effect and the asset-specific news impact can be written as:

$$h_{i,t} = w_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i h_{i,t-1} + d_i \varepsilon_{i,t-1}^2 I(\varepsilon_{i,t-1}) \tag{8}$$

The indicator function $I(\varepsilon_{i,t-1})$ is equal to 1 if $\varepsilon_{i,t-1} < 0$ and 0 otherwise. For this specification, a positive value for d means that negative residuals tend to increase the variance more than positive ones. The leverage effect, also known as the asymmetric effect, aims to depict a common trait found in financial assets, wherein an unexpected decrease in asset prices typically increases volatility to a greater extent than an unexpected rise in asset price of equivalent magnitude (see for example, [Phylaktis and Ravazzolo 2002](#); [Raza et al. 2023](#)). This can be understood as indicating that volatility tends to rise to a greater extent in response to negative news compared to positive news. For the ADCC model, the dynamics of Q are given by:

$$Q_t = \left(\bar{Q} - A' \bar{Q} A - B' \bar{Q} B - G' \bar{N} G \right) + A' \varepsilon_{t-1} \varepsilon'_{t-1} A + B' Q_{t-1} B + G' n_{t-1} n'_{t-1} G \tag{9}$$

Equation (5) above estimates the correlations for the dependent variable. The matrices A, B and G are diagonal parameter matrices. The indicator function $n_t = I(\varepsilon_{i,t-1})$ is equal to 1 if $\varepsilon_{i,t-1} < 0$ and 0 otherwise and $N = E[n_t n'_t]$. For Q and N , expectations are infeasible and are replaced with sample analogues, $T^{-1} \sum_{t=1}^T \varepsilon_t \varepsilon'_t$ and $T^{-1} \sum_{t=1}^T n_t n'_t$, respectively. In this context, [Cappiello et al. \(2006\)](#) only look for the asymmetrical effects and not the asset-specific news impacts.

4. Empirical Work

This section presents empirical work performed in the area of market integration. Empirical works in this area can be naturally divided into two sections; first, [Section 4.1](#) discusses work in the area of cointegration analysis, and second, [Section 4.2](#) discusses empirical work in the area of time varying correlations. The survey presents an empirical model and evidence of stock market integration. The survey also looks at other contributing factors, such as the changes in the stock market, foreign direct investment (FDI), and long-term cointegration of economic GDP and trade.

4.1. Empirical Evidence: Cointegration

[Engle and Granger \(1987\)](#) introduced the theory and knowledge behind understanding cointegration by looking at univariate, multivariate, and bivariate testing. They formalised the cointegrating vector approach, which created the concept that two or more non-stationary times series data are integrated, which does not allow them to separate away from equilibrium in the long term. Time series is used when introducing the economic variables between pairs, in which some forces bring those pairs together. In theory, these forces may be external, for example, interest rate and household expenditure. Under this branch of knowledge, other studies have also looked into the area of cointegration, including [Stock \(1987\)](#), [Phillips and Ouliaris \(1988\)](#), [Phillips and Hansen \(1990\)](#), [Johansen \(1991\)](#), and [Johansen and Juselius \(1990\)](#).

The changes in economic variables are likely to influence the returns of the stock market. Such economic variables include GDP per capita. These changes in returns may be different in different economies depending on how relative global power affects the empirical behaviour of the markets. [Kwon and Shin \(1999\)](#) examine whether current economic activities can explain stock market returns in Korea based on stock prices within the macroeconomic fluctuations. This study uses the cointegration test and the Granger causality test ([Granger 1988](#)). Findings indicate that when using the cointegration method, there are direct long-run and equilibrium relations with the economic variables. Some

variables include money supply and exchange rates. Changes in macroeconomic variables can result in cointegration within the economic variables and activities.

There are other models used to account for long-run relationships between variables. Ghosh (2010) examines the cointegration and Granger causality between carbon emissions and economic growth, specifically in India, using the Johansen and Juselius (1990) maximum likelihood procedure in a multivariate framework by incorporating energy supply, investment, and employment. The study establishes a long-run equilibrium between those variables. The study finds a long-term non-causality between those variables and shifts focus to more renewable energy for the economy. Kugler and Lenz's (1993) study looks into the exchange rates and domestic and foreign price levels, using Johansen's (1988) and Johansen and Juselius (1990) multivariate cointegration methodology to test for long-run validity of purchasing power parity (PPP) on exchange rates domestic and foreign levels. Findings showcase that the PPP for testing long-run property for exchange rates is a good measure for the majority of currencies.

Norrbin (1996) looks at bivariate cointegration in European Monetary system exchange rates using two different cointegration tests. The first cointegration method uses the maximum likelihood procedure by Johansen (1988). In addition, an alternative cointegration procedure using Park's (1992) canonical cointegration regressions (CCR). Results of the paper showcase that the European Monetary System (EMS) has lower levels of stochastic integration when using the Johansen test, in comparison to the deterministic cointegration used from the CCR test. Brunetti and Gilbert (2000) use bivariate Fractional integration type GARCH (FIGARCH) and fractional cointegration using two methodologies, including the New York Mercantile Exchange (NYMEX) and International Petroleum Exchange (IPE) crude oil markets. Results of the study show the movement in NYMEX and IPE is both highly correlated and fractionally cointegrated with NYMEX as the dominating market. Risso et al. (2013) examine the long-run equilibrium between GDP per capita and income inequality. Results indicate there is a relationship between GDP and income inequality using Granger causality in cointegrated bivariate systems.

The previous literature has looked at using the Vector Autoregressive Model (VAR) within a cointegration analysis. Di Sanzo et al. (2017) examine the relationship between tax structure and economic growth by relying on linear and non-linear panel cointegrated VAR models using the 20 OECD countries from 1970 to 2012. Results have two outcomes: first, taxes are least impactful or harmful towards economic growth due to the increase in revenues from taxes leading to an increase in GDP growth, and second, a negative sign on taxes becomes strongly significant when they reach the 30% threshold. Bende-Nabende et al. (2003) examine whether FDI has a direct impact on the long-run effects on output selection of East Asian countries or an indirect impact due to spillover effects. The Johansen cointegration methodology and the VAR model were used to determine the long-run impacts of FDI on these countries. The observations showcased that the direct long-run impacts of FDI output were positive, and the indirect long-run effects findings were different across countries.

4.2. Empirical Evidence: Time Varying Correlation

Stock market volatility is commonly discussed as a measure of how much the stock market's overall fluctuates up or down. High volatility levels indicate high risk. The volatility of the stock markets provides useful information measuring risk. There are many models used to measure volatility within a market, including ARCH, which was proposed by Engle (1982), and the generalised ARCH proposed by Bollerslev (1986) and Taylor (2008). After the introduction of ARCH and GARCH models, many researchers have proposed extensions and alternatives to these models, such as GARCH-M, IGARCH, and EGARCH (Nelson 1991), including threshold GARCH (Glosten et al. 1993), Asymmetric GARCH model AGARCH (Engle 1990), and Fractionally Integrated FIGARCH (Baillie et al. 1996). Lim and Sek (2013) conducted a comparative analysis forecasting the risk and performance of the asymmetric and symmetric GARCH-type models for stock market

volatility in Malaysia. These models included GARCH, TGARCH, and EGARCH models. The results of the study showcase GARCH/TGARCH to be the best estimator for the data chosen.

Hwang (2012) examined the stock market linkages within the Asia Pacific region and between Asian markets and the US markets dataset from 2000 to 2010, using the DCC GARCH model. Results of the study showcase there is a high correlation between markets during the 2008 financial crisis. The TGARCH model is deemed to be the better-fit model, as there is strong evidence of asymmetry between some Asian markets. With extensions of other models, researchers have also proposed the SARCH model that accounts for both conditional heteroskedasticity and spatial autocorrelation. Simlai (2014) studied housing price volatility within a spatial econometrics context using Boston housing price data for analyses. The SARCH model aims to capture the conditional spatial variability of Boston housing prices, and this analysis is independent of traditional housing characteristics. Filis et al. (2011) examine the time varying correlation between stock market prices and oil prices for oil-importing and oil-exporting countries. The study uses a DCC-GARCH-GJR approach based on data from six countries between 1987 and 2009. The GJR model by Glosten et al. (1993) is used to estimate the conditional covariance of the study. Results of the study showcase that time varying correlations of oil and stock prices do not differ for oil-importing and oil-exporting economies.

Financial Market Integration and Volatility

Researchers have used the moving window of time for measuring correlations over a specific period. Junior and Franca (2012) examine the financial markets in times of crisis within the years 1986 (Black Monday), 1998 (Russian crisis), 2001 (Burst of the dot-com bubble) and 2008 (Subprime mortgage crisis), marking the largest downfalls in the financial markets. Using the correlation matrices of the log-returns of a diversity of market indices during times of crisis showed markets move similarly during times of high volatility (see, for example, Junior and Franca 2012). More recently, at the event of COVID-19, researchers, for example, Mishra and Mishra (2022), examined the effects of equity market performance and integration on COVID-19 from the BRICS markets. Results showcase there were weaknesses in the BRICS economy; factors affecting it include the changed interest and inflation rates in the long run and trade performance in the short run. Another study by Memon and Yao (2021) extends the impact of COVID-19 on the dynamic Topology and network flows of world stock markets using local stock data. After COVID-19, the world economy began to return to normal; however, in 2022, the war between Russia and Ukraine also caused major disruptions in politics and economics. Ahmed et al. (2022) examine the effect of the Russia and Ukraine crisis on the European stock markets. Results indicate the European stock markets responded negatively to the crisis, given the increased political and economic instability, geographical proximity, and any sanctions imposed on Russia. Morales et al. (2012) explore the Hurst exponent over a weighted moving window of time to evaluate the level of stability/instability of financial firms over 13 years (1996–2009). Abid et al. (2014) examine regional financial integration and its determinants in the South Asian region. The study uses a conditional version of the international capital asset pricing model (ICAPM) and accounts for any deviations, including the purchasing power parity (PPP). The empirical analysis is conducted based on a nonlinear approach, which relies on the multivariate of GDC-GARCH. The study looks into market risk premium as the total risk of the economy used within financial integration (see, for example, Phylaktis and Ravazzolo 2002; Arouri 2006; Guesmi 2012).

The copula model is used by many researchers to represent a multivariate uniform distribution that helps examine the dependence between arrangements of variables. Hafner and Manner (2012) examine the dynamic stochastic copula models following an autoregressive approach. The model discusses the estimation, inferences, and applications. This model includes the Gaussian copula with a stochastic correlation process and can be viewed as a generalisation of the multivariate stochastic volatility models. The study involves a two-

step estimation process. First, the parameters of the marginal distribution are estimated; second, it involves the copula method. [Abraj et al. \(2022\)](#) introduce a new mixture of copula methods for spatially correlated multiple variables. The model used was performed using the cross-validation of actual versus the predicted values at sampled locations. The study uses a multivariate spatial dependence to predict a univariate dependence whilst also including the non-linear Gaussian approach and mixed copula methods, which were compared with the existing univariate pairs of copula. Results showcase that the proposed spatial mixture copula model outperforms the existing methods used in the study, including root mean square and mean absolute percentage error.

Table 1 provides the literature published in the area of cointegration and time varying correlations since the seminal work of [Bekaert and Harvey \(1995\)](#). Showcasing data from 2002 to 2023 of most cited articles, including authors and providing further details about the objective and method/techniques used to carry out the intended research.

Table 1. Most referenced articles using keywords: Time varying correlations and cointegration.

(1)	(2) Date + Author (s)	(3) Article Title	(4) Objective of Study	(5) Method/Technique	(6) No. of Times Cited
1.	(Ng 2002)	Stock market linkages in South-East Asia (Scopus)	To examine the linkage between the South-East Asian stock markets in the 1990s.	Time varying correlations	58
2.	(Lafuente and Novales 2003)	Optimal hedging under departures from the cost-of-carry valuation: Evidence from the Spanish stock index futures market (Web of Science)	To provide an analytical discussion of the optimal hedge ratio through discrepancies between future market price and theoretical valuation.	Time varying correlations GARCH models	32
3.	(Hui and Fong 2015)	Price cointegration between sovereign CDS and currency option markets in the financial crises of 2007–2013	To look at the interconnectivity between the anticipated sovereign credit risks of developed economies (US, Japan, Switzerland and the eurozone) and the market expectations of their exchange rates.	Cointegration Engle Granger approach	14
4.	(Herwartz and Neumann 2005)	Bootstrap inference in systems of single equation error correction models	Analyse OLS-based tests of long-run relationships, weak exogeneity and short-run dynamics in conditional error correction models.	Panel cointegration analysis	10
5.	(Lien and Yang 2006)	Spot-futures spread, time varying correlation, and hedging with currency futures (Web of Science)	Investigate the effects of the spot-future spread on the return and risk structure in currency markets.	Dynamic conditional correlation (DCC) GARCH framework	38
6.	(Giovannini et al. 2006)	Conditional correlations in the returns on oil companies stock prices and their determinants (Scopus)	To investigate the stock prices returns and their financial risk factors for several integrated oil companies.	DCC GARCH framework Constant Conditional Correlation (CCC) multivariate GARCH model	10
7.	(Phengpis and Swanson 2006)	Portfolio diversification effects of trading blocs: The case of NAFTA (Scopus)	Investigates the evolving nature of North American Free Trade Agreement (NAFTA) stock market interdependences and their relationship with diversification gains from US investors.	Cointegration test	6
8.	(Ku et al. 2007)	On the application of the dynamic conditional correlation model in estimating optimal time varying hedge ratios (Web of Science)	Apply the DCC model with error correction terms in order to investigate the optimal hedge ratios of British and Japanese currency futures markets.	GARCH type models Ordinary least squares (OLS) Error correction model (ECM)	149
9.	(Floros 2007)	Causality and price transmission between fish prices: New evidence from Greece and UK (Web of Science)	Examines the evidence of causality and price transmission between fish prices of main species landed into Greece and the UK.	Bivariate cointegration model (BGARCH)	5
10.	(Ku 2008)	Student-t distribution based VAR-MGARCH: an application of the DCC model on international portfolio risk management (Web of Science)	Comparison on the hedging efficiency of hypothetical portfolio consisting of stock and currency future positions.	MGARCH model Student t-distribution	18

Table 1. *Cont.*

(1)	(2) Date + Author (s)	(3) Article Title	(4) Objective of Study	(5) Method/Technique	(6) No. of Times Cited
11.	(Olusi and Abdul-Majid 2008)	Diversification prospects in Middle East and North Africa (MENA) equity markets: A synthesis and an update (Scopus)	Investigates the extent to which Eurozone and Middle East and North Arica (MENA) equity markets are integrated.	Time varying conditional correlations	14
12.	(Johansson 2008)	Interdependencies among Asian bond markets (Scopus)	Analyses the relationships among four (China, Republic of Korea, Malaysia, and Thailand) Asian bond markets.	Cointegration test DCC model Multivariate GARCH	24
13.	(Evans and McMillan 2009)	Financial co-movement and correlation: Evidence from 33 international stock market indices (Scopus)	Analyses the financial market co-movements across 33 daily international stock market indices.	Cointegration Multivariate GARCH frameworks	21
14.	(Harrison and Moore 2009)	Spillover effects from London and Frankfurt to central and Eastern European stock markets (Scopus)	Investigates co-movement in stock markets between emerging economies of Central and Eastern Europe and developed markets of Western Europe.	Multivariate GARCH frameworks	27
15.	(Liow 2010)	International direct real estate market linkages: Evidence from time varying correlation and cointegration tests (Scopus)	Examines the linkage between direct real estate markets in the US, the UK, Australia, Hong Kong, and Singapore over period 1988–2008.	DCC model	8
16.	(Bohl et al. 2011)	Price discovery and investor structure in stock index futures (Web of Science)	The study relates time varying spot-futures linkages studied within a VECM-DCC-GARCH framework to changes in the investor structure of future market over time.	VECM-DCC-GARCH framework	76
17.	(Chang et al. 2011)	Crude oil hedging strategies using dynamic multivariate GARCH (Web of Science)	Examines the performance of several multivariate volatility models (CCC, VARMA_GARCH, DCC, BEKK) for crude oil spot and futures returns of international crude oil markets.	CCC, VARMA_GARCH, DCC, BEKK	188
18.	(Kenourgios and Samitas 2011)	Equity market integration in emerging Balkan markets (Scopus)	Examines the long-run relationships among five Balkan emerging stock markets (Turkey, Romina, Bulgaria, Croatia, Serbia), the US and three developed European markets (UK, Germany, Greece) during 2000–2009.	Asymmetric Generalised Dynamic Conditional Correlation (AG-DCC) multivariate GARCH model	89
19.	(Chevallier 2011)	Anticipating correlations between EUAs and CERs: A dynamic conditional correlation GARCH model (Scopus)	Modelling the inter-relationships between European Union Allowances (EUA) and Certified Emissions Reductions (CER).	Multivariate GARCH frameworks DCC MGARCH	15
20.	(Gupta and Guidi 2012)	Cointegration relationship and time varying co-movements among Indian and Asian developed stock markets (Web of Science/Scopus)	Explore the links between Indian stock market sand three developed Asian markets (Hong Kong, Japan and Singapore) using cointegration methodologies to explore interdependence.	Cointegration Time varying correlations	79/98

Table 1. *Cont.*

(1)	(2) Date + Author (s)	(3) Article Title	(4) Objective of Study	(5) Method/Technique	(6) No. of Times Cited
21.	(Dajcman et al. 2012)	Comovement Dynamics between Central and Eastern European and Developed European Stock Markets during European Integration and Amid Financial Crises-A Wavelet Analysis (Web of Science)	Looking at stock market co-movements between develop (Austria, France, Germany and the UK) and developing (three Central and Eastern European markets of Slovenia, the Czech Republic and Hungary) stock markets.	Granger causality tests Cointegration analysis GARCH modelling	24
22.	(Kenourgios and Padhi 2012)	Emerging markets and financial crises: Regional, global or isolated shocks? (Scopus)	Investigates Financial contagion of three emerging markets crises of the late 1990s, crisis of 2007, emerging economies, USA and 2 global indices.	ADCC GARCH model	104
23.	(Ndako 2013)	Dynamics of Stock Prices and Exchange Rates Relationship: Evidence From Five Sub-Saharan African Financial Markets (Scopus)	Examine the dynamic relationship between stock prices and exchange rates for five Sub-Saharan African financial markets (Ghana, Kenya, Mauritius, Nigeria, and South Africa).	DCC GARCH model	11
24.	(Caporale et al. 2014)	On the linkages between stock prices and exchange rates: Evidence from the banking crisis of 2007–2010 (Scopus)	Examine the nature of the linkages between stock market prices and exchange rates in six advanced economies (The US, the UK, Canada, Japan, the euro area and Switzerland).	Cointegration	102
25.	(Chang and Lee 2015)	Do oil spot and futures prices move together? (Web of Science)	Investigate the time varying correlations and the casual relationship between crude oil spot and futures prices using a newly developed approach.	Wavelet coherence analysis	57
26.	(Chen and Shen 2015)	Revisiting the Feldstein–Horioka puzzle with regime switching: New evidence from European countries (Web of Science)	Test for the presence of the Feldstein–Horioka puzzle in nine European countries	Markov switching model	23
27.	(Hui and Fong 2015)	Price cointegration between sovereign CDS and currency option markets in the financial crises of 2007–2013 (Web of Science)	Looking at the interconnectivity between the anticipated sovereign credit risks of these economies (the US, Japan, Switzerland, and the Eurozone) and the market expectations of their exchange rates.	Cointegration Credit default swaps	15
28.	(Cevik and Charap 2015)	The behavior of conventional and Islamic bank deposit returns in Malaysia and Turkey (Scopus)	Examining the empirical behaviour of conventional bank deposit rates and the rate of return on retail Islamic profit and loss sharing investment accounts in Malaysia and Turkey.	Time varying volatility	20
29.	(Perez-Rodríguez et al. 2015)	Testing dependence between GDP and tourism’s growth rates (Scopus)	To link the economic behaviour and statistical properties of GDP and tourism receipts growth rates through modelling the dependence.	Copula-based GARCH approach	64
30.	(Sehgal et al. 2015)	An investigation of price discovery and volatility spillovers in India’s foreign exchange market (Scopus)	To examine the price discovery and volatilities believers in sport and future prices of four currencies in between future prices of both stock exchanges namely multi commodity Stock Exchange and national Stock Exchange in India.	GARCH-BEKK model	41

Table 1. *Cont.*

(1)	(2) Date + Author (s)	(3) Article Title	(4) Objective of Study	(5) Method/Technique	(6) No. of Times Cited
31.	(Bein and Mehmet 2016)	On the linkage between the international crude oil price and stock markets: evidence from the Nordic and other European oil importing and oil exporting countries. (Web of Science)	Investigate the interrelationship between the stock market and the crude oil price for the Nordic countries [Denmark Finland Iceland Norway and Sweden] and two other European countries for high imports (Germany) and high exports (Russia).	Markov switching model	8
32.	(Ding et al. 2016)	The impact of coal price fluctuations on China’s economic output (Web of Science/Scopus)	Analyse the influence of coal price fluctuations on the volume and structure of Chinese economic output.	GARCH type models	6
33.	(Yarovaya and Lau 2016)	Stock market comovements around the Global Financial Crisis: Evidence from the UK, BRICS and MIST markets (Web of Science/Scopus)	Analyse stock market co-movements around recent crises and explore the traditional portfolio diversification benefits available for UK investors.	Cointegration analysis with brakes	48
34.	(Paramati et al. 2016)	Trade and investment linkages and stock market long run relationship (Web of Science/Scopus)	Examine whether the intensity of trade and investment linkages among the countries matter for their stock market long run relationship.	Granger non causality test Multivariate cointegration test	5
35.	(Majdoub et al. 2016)	Market integration between conventional and Islamic stock prices (Web of Science/Scopus)	Assess the market integration between conventional and Islamic stock prices for the long and short run perspectives for France Indonesia the UK and the US.	Cointegration Time varying correlation Portfolio diversification	40/51
36.	(Gómez-Puig and Sosvilla-Rivero 2016)	Causes and hazards of the euro area sovereign debt crisis: Pure and fundamentals-based contagion (Web of Science)	Assess the transmission of the European sovereign debt crisis.	Dynamic Granger causality approach to detect episodes of contagion	32
37.	(Kim et al. 2016)	Returns, correlations, and volatilities in equity markets: Evidence from six OECD countries during the US financial crisis (Web of Science)	Investigate the dynamic interactions between stock market access returns, time burying correlations and volatilities in six OECD countries and the United States during the US financial crisis.	Granger causality tests multivariate EGARCH estimation	12
38.	(Abdullah et al. 2016)	Diversification in crude oil and other commodities: A comparative analysis (Scopus)	Empirically test the time varying and scale dependent volatilities of and correlation stop the sample commodities.	Multivariate GARCH model	5
39.	(Ftiti et al. 2016)	Relationship between crude oil prices and economic growth in selected OPEC countries (Scopus)	examine the degree of interdependence between oil prices and economic activity growth for four major countries (United Arab Emirates, Kuwait, Saudi Arabia, and Venezuela).	Time varying dynamic correlation	56
40.	(Rad et al. 2016)	The profitability of pairs trading strategies: distance, cointegration and copula methods (Scopus)	Performing a robust a study of the performance of three different pairs trading strategies; the distance, cointegration and copula methods.	Cointegration Copula method	74

Table 1. *Cont.*

(1)	(2) Date + Author (s)	(3) Article Title	(4) Objective of Study	(5) Method/Technique	(6) No. of Times Cited
41.	(Singh and Singh 2017)	How linkages fuel dependent economic policy initiatives: Empirical evidence from US and Indian financial stress indices (Scopus)	Attempt to quantify and capture long run short run as well as time varying linkages among the two financial stress. indices (Kansas City financial stress index and Indian financial stress index.	Bivariant Johansen cointegration model Vector error correction model Toda-Yamamoto’s Granger causality test	1
42.	(Gatfaoui 2017)	Equity market information and credit risk signaling: A quantile cointegrating regression approach (Scopus)	Investigate linkages between credit and equity markets considering daily aggregate US credit default swaps spreads as well as the chosen equity market.	Cointegration	6
43.	(Jebabli and Roubaud 2018)	Time varying efficiency in food and energy markets: Evidence and implications (Web of Science)	Investigate the weak efficiency of the food and energy markets.	Threshold vector error correction model	7
44.	(Singh and Singh 2018)	Co-movement among US, Frontier and BRIC Equity Markets after the Financial Crisis (Web of Science/Scopus)	Attempts to capture static long term as well as short term time varying car movements among the US, frontier, and Brazil, Russia, India, and China (BRIC).	Johansen cointegration and VAR: ADCC-MVGARCH	6/6
45.	(Prakumpai and Sethapramote 2018)	Stock Market Integration in the ASEAN-5 (Web of Science)	Investigate the degree of stock market integration in the ASEAN region both internally and externally in relation.	Global market: internally and externally Engle and Granger cointegration	2
46.	(Ji et al. 2018)	Risk spillover between energy and agricultural commodity markets: A dependence-switching CoVaR-copula model (Web of Science)	Characterise the conditional dependence between energy and agricultural commodities.	Use CoVar and delta CoVaR to study risk spillover	187
47.	(Panda et al. 2019)	An empirical analysis of stock market interdependence and volatility spillover in the stock markets of Africa and Middle East region (Web of Science)	Examine the short term and long term and interdependence among the stock markets of Africa and Middle East region	Granger causality test	7
48.	(Joseph et al. 2020)	Volatility and asymmetric dependence in Central and East European stock markets (Web of Science)	Look at the effects of contagion a Randall global financial crisis in the eurozone crisis. Using German and UK return.	Bivariate vector error correction model estimated in GARCH	6
49.	(Haddad et al. 2020)	Common shocks, common transmission mechanisms and time varying connectedness among Dow Jones Islamic stock market indices and global risk factors (Web of Science)	Investigate the role of common shocks in explaining the business cycle fluctuations of the Islamic stock markets.	Dow Jones Islamic stock market (DIM)	19
50.	(Boubaker et al. 2021)	Interdependence between exchange rates: Evidence from multivariate analysis since the financial crisis to the COVID-19 crisis (Web of Science/Scopus)	Examine the relationship in dynamic dependence structure between the Australian dollar, Euro, and the British pound American dollar.	GARCH type model	1/6

Table 1. *Cont.*

(1)	(2) Date + Author (s)	(3) Article Title	(4) Objective of Study	(5) Method/Technique	(6) No. of Times Cited
51.	(Pajor and Wróblewska 2022)	Forecasting performance of Bayesian VEC-MSF models for financial data in the presence of long-run relationships (Web of Science/Scopus)	Comparing the forecasting performance of two relatively new types of vector error correction.	Cointegration tests	1
52.	(Wang and You 2023)	New insights into the role of global factors in BRICS stock markets: A quantile cointegration approach (Web of Science/Scopus)	Offer insights into the short and long run linkages between global factors and BRICS stock markets.	Quantile autoregressive distributed lags (QARDL)	1

Note: Summary of literature survey using Scopus and Web of science—Key words, Abstract, and Article title. Limitations: Keywords. Exclusion: subject area, language, document type. Citation Date (Oldest to Newest).

Since liberalisation has an important bearing on the integration of the economies, this survey provides a summary of the stock markets that form the G20 group of economies. Table 2 provides a summary for each G20 market, reporting the year of the first stock market liberalisation observation with data taken from Akbari and Ng (2020)², and countries that are not covered are used from the OCED database. The table marks developed markets with DEV and emerging markets with EMG and shows a two-digit and three-digit country code. The table also reports the ratio of total market capitalisation for each country to that of the world from Akbari and Ng (2020) in percentages (market share %) for December 2015³. The GDP percentage for the OECD countries' as provided in the Table 2, is for the year 2022⁴.

Table 2. Summary of liberalisation data for G20 markets.

Stock Market					
(1) Country	(2) Symbol	(3) DEV/EMG	(4) Liberalisation Date	(5) Market Share %	(6) GDP %
1. Argentina	AR	EMG	1989	0.12	53.8
2. Australia	AU	DEV	Pre-1985	1.98	N/A
3. Brazil	BR	EMG	1988	0.85	N/A
4. Canada	CN	DEV	Pre-1985	2.72	101.47
5. China	CH	EMG	1991	1.36	N/A
6. France	FR	DEV	Pre-1985	3.81	117.16
7. Germany	BD	DEV	Pre-1985	4.69	N/A
8. India	IN	EMG	1986	2.54	N/A
9. Indonesia	ID	EMG	1989	0.56	N/A
10. Italy	IT	DEV	Pre-1985	1.17	148.43
11. Japan	JP	DEV	Pre-1985	8.77	254.62
12. Republic of Korea	ROK	EMG	1987	1.75	57.55
13. Mexico	MX	EMG	1989	0.66	N/A
14. Russia	RU	EMG	1989	N/A	N/A
15. Saudi Arabia	SA	EMG	1989	N/A	N/A
16. South Africa	ZA	EMG	1989	0.80	N/A
17. Turkey	TR	EMG	1989	0.31	N/A
18. The United Kingdom	UK	DEV	Pre-1985	6.52	102.90
19. The United States	US	DEV	Pre-1985	43.84	119.70

Note: Liberalisation data file for G20 markets and global stock market capitalisation current data. Liberalisation date and market share for individual countries for 2015, as given in Akbari and Ng (2020), showcasing the global markets and percentage of GDP taken from the OECD, shows the individual growth in a market over the economic growth as of 2022. N/A refers to unavailability of data either from market share % or GDP %.

5. Discussion and Avenues for Future Research

The development of market integration within developing and emerging markets concerning international trade, investments, and portfolio diversification can be explored. For example, would investing in emerging economies first allow us to gain a better understanding of the market and how to handle things if we undergo a crisis situation? What are the impacts of investing in smaller economies than developed economies? Further, research suggests that frontier markets are less developed. This motivates further study to identify investment and trade opportunities in markets that are less developed.

Future research questions include: 1. Would market segmentation be considered a viable option for lower-level investments? 2. What is the relationship between having a diversified portfolio and risking the investment? 3. How often are financial regulations regulated in research? 4. Why do not all markets have a strong spillover integration?

5. When assessing market integration, local markets are not looked at; is there a common factor that could help us to better understand the in-depth? 6. Is there a better alternative to dealing with crises in a quantified manner?

This paper is the first in the literature to use both qualitative and quantitative analyses in global market integration. I used over 380 articles, providing a comprehensive collection of relevant literature within the area of market integration. I have used Scopus and Web of Science as my database for Table 1, which provides a comprehensive approach to the articles listed.

I contributed by identifying important aspects of global market integration literature, including many top journals, authors, the objective of each study, methods, and techniques, and looking at works by seminal authors, including (Bekaert and Harvey 1995). I have identified six research groups: (1) market Segmentation, (2) portfolio diversification (3) market integration evidence from developed and emerging markets (4) spillovers and linkages, (5) economic market integration, and (6) financial market integration and volatility.

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Conflicts of Interest: The author declares no conflict of interest.

Notes

- ¹ Asymmetric dynamic conditional correlations generalized autoregressive conditional heteroscedasticity.
- ² Countries used from Akbari and Ng include Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, South Africa, Turkey, the UK and the US.
- ³ The table idea was used from Akbari and Ng (2020).
- ⁴ The GDP percentage data is from the OECD database: https://stats.oecd.org/Index.aspx?DataSetCode=FIN_IND_FBS (accessed on 10 Septmeber 2023).

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