

Volatility and Dynamic Correlation of Global Stock Markets: Evidence from Switzerland, Japan, Turkey, and Indonesia (2020–2025)

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Abstract. This study examines the volatility and dynamic correlations of stock market indices in Switzerland, Japan, Turkey, and Indonesia during the period 2020–2025, which was characterized by heightened global uncertainty. This period was characterized by heightened uncertainty due to the COVID-19 pandemic, monetary policy tightening, and geopolitical tensions that affected global financial market stability. The study utilizes secondary data consisting of daily closing prices of the Swiss Market Index (SMI), Nikkei 225, BIST 100, and the Indonesia Composite Index (IHSG), which were transformed into logarithmic returns. After synchronizing trading dates, the final dataset comprised 1,310 observations for each index. The analysis was conducted using Python and employed descriptive statistics, unit root tests, ARCH-LM tests, GARCH models, and DCC-GARCH models. The results indicate that all stock markets exhibit volatility clustering and persistent volatility, with the BIST 100 showing the highest volatility and the Nikkei 225 exhibiting the lowest volatility persistence and faster adjustment to market shocks. Furthermore, the DCC-GARCH model reveals time-varying correlations with high persistence, indicating that changes in inter-market relationships remain influential over time. These findings suggest that international stock markets are interconnected and that dynamic correlations tend to strengthen and remain influential during periods of heightened uncertainty, potentially reducing the benefits of international diversification.

Keywords: volatility; dynamic correlation; GARCH; DCC-GARCH; global stock markets; financial crisis

1 Introduction

Over recent years, the global financial system has become increasingly interconnected through the expansion of cross-border capital flows, technological innovation, and the digitalization of financial markets. These developments have accelerated information transmission and strengthened linkages among international financial markets, making

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economic shocks more rapidly transmitted across countries (International Monetary Fund, 2023; World Bank, 2022). Within this interconnected environment, stock markets play an important role in reflecting economic conditions, investor expectations, and financial stability. Stock markets function not only as mechanisms for capital allocation but also as indicators of macroeconomic conditions and future growth prospects (Bodie et al., 2021; Drake et al., 2022). Consequently, stock market performance is increasingly influenced not only by domestic economic fundamentals but also by developments in the global financial environment.

The period of 2020–2025 was characterized by heightened global uncertainty. The COVID-19 pandemic disrupted economic activity worldwide and was subsequently followed by inflationary pressures, monetary policy tightening by major central banks, and geopolitical tensions such as the Russia–Ukraine conflict. These developments significantly increased market volatility and heightened concerns regarding systemic financial risk (Bank for International Settlements, 2024; International Monetary Fund, 2025). The substantial increase in the Volatility Index (VIX) during the pandemic further reflected elevated investor uncertainty and risk perception (Cboe Global Indices, 2026 ; Hu et al., 2023). During periods of uncertainty, stock markets often experience substantial changes in volatility and cross-market relationships. Volatility reflects the degree of market fluctuation and serves as an important indicator of financial risk, while dynamic correlation captures how relationships among markets evolve over time. Understanding these two aspects is essential for portfolio diversification, risk management, and investment decision-making.

Recent empirical studies have documented significant changes in stock market behavior during crisis periods. Ampountolas (2023) found that the COVID-19 pandemic intensified volatility and dynamic correlations across financial assets, indicating stronger shock transmission under conditions of uncertainty. Similarly, Bouri et al. (2022) reported that financial market connectedness became stronger under changing investor sentiment and risk perceptions, highlighting the increasing interconnectedness of global financial markets. Furthermore, Sahabuddin et al. (2023), Sun et al. (2023), and Wu et al. (2024) showed that stock market correlations vary over time and tend to increase during periods of economic stress. In addition, Balcı Yıldız (2024) and Gençyürek (2024) found that crisis episodes amplify volatility spillovers across markets, suggesting that financial shocks can be transmitted more rapidly between countries. Collectively, these findings indicate that volatility and dynamic correlations become more pronounced during periods of heightened uncertainty.

This study focuses on four countries representing different market characteristics. Switzerland is frequently associated with safe-haven characteristics due to its stable financial system and the role of the Swiss franc in global financial markets (Feder-Sempach et al., 2024; Tronzano, 2023). Japan represents a major developed market, whereas Turkey and Indonesia represent emerging markets that generally exhibit higher sensitivity to external shocks and market fluctuations International Monetary Fund (2025). These differences provide an opportunity to examine how stock markets with distinct characteristics respond to common global disturbances.

Despite the growing literature on stock market volatility and dynamic correlation, several research gaps remain. Previous studies have primarily focused on specific market settings. For example, Sun et al. (2023) examined dynamic correlations among major global economies, while Wu et al. (2024) investigated the relationship between the Chinese and U.S. stock markets. Sahabuddin et al. (2023) focused on volatility spillovers between Islamic and conventional stock markets, whereas Gençyürek (2024) analyzed volatility interactions between the Turkish and Russian stock markets. In addition, Ampountolas (2023) examined volatility spillovers between cryptocurrencies and stock markets during the COVID-19

pandemic. Although these studies provide important insights, they generally focus on bilateral market relationships, specific market segments, or cross-asset interactions.

As a result, limited evidence is available regarding how stock markets with safe-haven-oriented, developed, and emerging market characteristics differ in terms of volatility behavior and dynamic correlations during recent global crises. This gap is particularly relevant because these markets possess different levels of maturity, risk exposure, and responses to external shocks. Therefore, a comparative analysis employing GARCH and DCC-GARCH models is needed to provide a broader understanding of volatility dynamics and time-varying correlations across heterogeneous stock markets under conditions of heightened uncertainty.

This study contributes to the literature in several ways. First, it simultaneously examines Switzerland, Japan, Turkey, and Indonesia, representing safe-haven-oriented, developed, and emerging market characteristics. Second, it investigates stock market volatility and dynamic correlations across heterogeneous markets using the GARCH and DCC-GARCH approaches, allowing a direct comparison between markets with different structural characteristics. Third, the analysis covers the period 2020–2025, encompassing major global events such as the COVID-19 pandemic, monetary policy tightening, inflationary pressures, and geopolitical tensions. Therefore, this study provides a more comprehensive understanding of stock market volatility and dynamic correlations under conditions of heightened global uncertainty.

Accordingly, this study aims to analyze the volatility and dynamic correlation of stock market indices in Switzerland, Japan, Turkey, and Indonesia during the period 2020–2025 using the GARCH and DCC-GARCH approaches. The findings are expected to contribute to the literature on international stock market behavior and provide insights for investors and policymakers in managing financial risks under conditions of heightened uncertainty.

1.1 Literature Review

Financial market integration refers to the increasing interconnectedness among financial markets through capital flows and information transmission. Higher levels of integration may strengthen co-movements and correlations among stock markets, particularly during periods of economic uncertainty (Bouri et al., 2022).

1.1.1 Stock Market Volatility

Volatility refers to the degree of fluctuation in stock prices or returns over time and is widely used as an indicator of financial risk and market uncertainty. Higher volatility reflects greater variability in asset returns and increased uncertainty regarding future market conditions (Bodie et al., 2021; Drake et al., 2022). In financial markets, volatility commonly exhibits clustering behavior, where periods of high volatility tend to be followed by high volatility, while periods of low volatility are followed by relatively stable conditions.

To capture this characteristic, the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model developed by Bollerslev (1986) allows current volatility to depend on both past shocks and past volatility. Consequently, GARCH has become one of the most widely used approaches for modeling financial market volatility Brooks (2019).

Recent studies highlight the importance of volatility analysis during periods of uncertainty. Ampountolas (2023) found that the COVID-19 pandemic intensified volatility across financial assets, while Balcı Yıldız (2024) and Gençyürek (2024) reported stronger volatility spillovers and persistent volatility dynamics during crisis periods. These findings indicate that stock market volatility tends to increase significantly under conditions of heightened economic uncertainty.

1.1.2 *Dynamic Correlation*

Dynamic correlation refers to the relationship between financial markets that changes over time in response to evolving economic conditions, investor sentiment, and market shocks. Unlike traditional correlation measures that assume constant relationships, dynamic correlation recognizes that market linkages may strengthen or weaken across different periods.

To estimate time-varying correlations, Engle (2002) introduced the Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity (DCC-GARCH) model. This approach extends the multivariate GARCH framework by allowing conditional correlations to evolve over time while accounting for volatility dynamics (Brooks, 2019). As a result, DCC-GARCH has become a widely applied method for analyzing interdependence among financial markets.

Empirical evidence suggests that stock market correlations are not constant and tend to increase during periods of financial stress. Sahabuddin et al. (2023) found that conventional and Islamic stock markets exhibit time-varying correlations that intensify during crises. Similarly, Sun et al. (2023) reported significant dynamic correlations among major global stock markets, while World Bank (2022) documented increased market interconnectedness during the COVID-19 pandemic. These findings suggest that the benefits of international diversification may decline when correlations rise during periods of uncertainty.

1.1.3 *Safe Haven and Market Characteristics*

Financial markets differ in terms of market maturity, liquidity, institutional quality, and sensitivity to external shocks. These differences influence market behavior, volatility patterns, and responses to global economic disturbances.

The concept of a safe haven refers to an asset that retains or increases its value during periods of market stress and exhibits low or negative correlation with risky assets (Cheema et al., 2022). Although stock market indices are generally not classified as safe-haven assets, Switzerland is frequently associated with safe-haven characteristics due to its stable financial system and the international role of the Swiss franc during periods of financial uncertainty (Feder-Sempach et al., 2024; Tronzano, 2023). Therefore, the Swiss Market Index (SMI) represents a stock market operating within a country commonly perceived as having safe-haven characteristics.

Japan represents a major developed market characterized by high liquidity and strong institutional frameworks, whereas Turkey and Indonesia represent emerging markets that generally exhibit higher volatility and greater sensitivity to global financial conditions. Empirical evidence suggests that emerging markets are more responsive to changes in capital flows, monetary policy, and investor sentiment than developed markets (Bank for International Settlements, 2024; International Monetary Fund, 2025). Consequently, these different market characteristics may lead to varying volatility patterns and dynamic correlations during periods of global uncertainty.

2 **Method**

2.1 **Research Design**

This study employs a quantitative research design with a descriptive-comparative approach to analyze the volatility and dynamic correlation of international stock markets. The quantitative approach enables the examination of financial market behavior using numerical

data and statistical techniques, thereby facilitating objective measurement and analysis (Creswell & Creswell, 2023).

Furthermore, this study adopts a financial time-series econometric framework because stock market data exhibit dynamic characteristics that evolve over time. Time-series analysis is particularly suitable for modeling volatility persistence, volatility clustering, and time-varying relationships among financial markets (Brooks, 2019). To achieve the research objectives, volatility is estimated using the GARCH(1,1) model, while dynamic correlations among stock markets are analyzed using the DCC-GARCH model.

2.2 Data and Sample

This study utilizes secondary data in the form of daily closing prices of four stock market indices, namely the Swiss Market Index (SMI), Nikkei 225, BIST 100, and the Indonesia Composite Index (IHSG). The data cover the period from January 2020 to December 2025 and were obtained from Investing.com, which provides historical market data for international financial indices.

The selected indices represent different market characteristics, including Switzerland as a market associated with safe-haven characteristics, Japan as a developed market, and Turkey and Indonesia as emerging markets. Daily closing prices were chosen because higher-frequency data provide a larger number of observations and are more appropriate for estimating volatility persistence and time-varying correlations in financial markets (Brooks, 2019; Hyndman & Athanasopoulos, 2021).

To ensure comparability across markets, the trading dates of all indices were aligned. Observations corresponding to non-overlapping trading days due to differences in national holidays and market schedules were excluded. After the synchronization process, the final dataset consisted of 1,310 observations for each index.

2.3 Data Collection

The data were processed using the Python programming language. Several libraries were utilized in the analysis, including Pandas for data management, NumPy for numerical computation, Statsmodels for statistical testing, and ARCH for volatility estimation. Python has become a widely used platform for financial econometric analysis due to its flexibility, computational efficiency, and reproducibility (Perktold et al., 2024).

Prior to model estimation, daily closing prices were transformed into logarithmic returns to stabilize variance and facilitate comparability across markets (Brooks, 2019). The return series were subsequently analyzed using descriptive statistics to examine their distributional characteristics. Stationarity was then assessed using the Augmented Dickey-Fuller (ADF) test, followed by the ARCH-LM test to determine the presence of conditional heteroskedasticity. The results of these preliminary tests were used to justify the application of the GARCH and DCC-GARCH models in the subsequent analysis.

2.4 Data Analysis

The empirical analysis is conducted through several sequential stages to ensure the robustness of the results.

First, stock prices are transformed into logarithmic returns to achieve stationarity and comparability across markets. Logarithmic returns are widely used in financial time-series analysis because they possess time-additive properties and facilitate comparisons across assets (Brooks, 2019; Hyndman & Athanasopoulos, 2021):

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

Where r_t denotes the return at time t , P_t , is the closing price at time t , and P_{t-1} is the closing price at time $t - 1$. Logarithmic returns are preferred due to their time-additive properties and ability to stabilize variance.

Second, descriptive statistics are employed to summarize the distributional characteristics of the return series.

Third, unit root tests are conducted to examine the stationarity of the data, while ARCH effect testing is performed to identify conditional heteroskedasticity and volatility clustering in the return series (Engle, 1982; Gujarati, 2023).

To estimate volatility dynamics, the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is applied. The standard GARCH(1,1) specification is expressed as follows Bollerslev (1986):

$$r_t = \mu + \varepsilon_t, \varepsilon_t \sim N(0, h_t) \quad (2)$$

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \quad (3)$$

Where h_t represents conditional variance, ω is a constant, and α and β capture the ARCH and GARCH effects, respectively.

Furthermore, to analyze *time-varying* correlations across markets, the Dynamic Conditional Correlation (DCC-GARCH) model proposed by Engle (2002) is employed. The model is specified as follows:

$$H_t = D_t R_t D_t h_t \quad (4)$$

$$Q_t = (1 - \alpha - b) \bar{Q} + \alpha (\varepsilon_{t-1} \varepsilon_{t-1}^T) + b Q_{t-1} \quad (5)$$

$$R_t = (diag(Q_t))^{-\frac{1}{2}} Q_t (diag(Q_t))^{-\frac{1}{2}} \quad (6)$$

Where H_t denotes the conditional covariance matrix, D_t is a diagonal matrix of conditional standard deviations, and R_t represents the time-varying correlation matrix. The parameters a and b capture the dynamics of correlation and must satisfy $\alpha + b < 1$.

This methodological framework enables a comprehensive analysis of both individual market volatility and dynamic interdependence across international stock markets, particularly during periods of financial turbulence.

3 Results and Discussion

3.1 Results

3.1.1 Descriptive Statistics

The descriptive statistics of daily stock returns for the SMI, Nikkei 225, BIST 100, and IHSG indices during 2020–2025 are presented in Table 1.

Table 1. Descriptive Statistics Results

Index	Mean	Maximum	Minimum	Standar Deviasi
SMI	0.0002	0.0678	-0.1247	0.0110
Nikkei 225	0.0006	0.0974	-0.1354	0.0147
BIST 100	0.0018	0.0948	-0.1031	0.0192
IHSG	0.0002	0.0970	-0.0823	0.0111

The results show that the BIST 100 recorded the highest average daily return (0.0018), followed by Nikkei 225 (0.0006), IHSG (0.0002), and SMI (0.0002). In terms of volatility,

the BIST 100 exhibited the highest standard deviation (0.0192), indicating greater return fluctuations and risk compared to the other indices. Conversely, the SMI showed the lowest standard deviation (0.0110), suggesting relatively more stable return movements during the observation period. These findings provide preliminary evidence that emerging markets, particularly Turkey, experienced larger return fluctuations than developed markets during the period of global uncertainty.

3.1.2 Stationary Test

To ensure the validity of the time-series analysis, the stationarity of the return series was examined using the Augmented Dickey-Fuller (ADF) test. Stationary data are required to avoid spurious regression results and ensure reliable estimation results in time-series models (Gujarati, 2023). The results of the ADF test are presented in Table 2.

Table 2. ADF Unit Root Test Results

Index	ADF Statistic	p-value	Critical Value 1%	Critical Value 5%	Critical Value 10%	Conclusion
SMI	-37.0374	0.0000	-3.4353	-2.8640	-2.5680	Stationary
Nikkei 225	-26.3840	0.0000	-3.4353	-2.8640	-2.5680	Stationary
BIST 100	-16.4979	2.1620	-3.4353	-2.8640	-2.5680	Stationary
IHSG	-8.6484	5.1951	-3.4354	-2.8640	-2.5680	Stationary

The results presented in Table 2 indicate that all return series are stationary. The ADF statistics for the SMI, Nikkei 225, BIST 100, and IHSG are lower than the corresponding critical values at the 1%, 5%, and 10% significance levels. In addition, all p-values are below 0.05. Therefore, the null hypothesis of a unit root is rejected, confirming that the return series do not contain unit roots and are suitable for further volatility modeling using the GARCH and DCC-GARCH approaches.

3.1.3 ARCH-LM Test

Before estimating the GARCH model, the ARCH-LM test was conducted to examine the presence of conditional heteroskedasticity in the return series. The presence of significant ARCH effects indicates volatility clustering and justifies the application of GARCH-based models (Engle, 1982). The results of the ARCH-LM test are presented in Table 3.

Table 3. ARCH-LM Test Results

Index	LM Statistic	p-value	Interpretation
SMI	92.2314	1.9314E-15	ARCH Effect Present
Nikkei 225	191.6631	8.8111E-36	ARCH Effect Present
BIST 100	110.9057	3.5034E-25	ARCH Effect Present
IHSG	222.2067	3.6890E-50	ARCH Effect Present

Table 3 presents the results of the ARCH-LM test. All stock market indices exhibit highly significant ARCH effects, as indicated by p-values below 0.05. Therefore, the null hypothesis of no ARCH effect is rejected for all return series. These findings confirm the presence of conditional heteroskedasticity and volatility clustering, suggesting that periods of high volatility tend to be followed by periods of high volatility, while periods of low volatility tend to be followed by periods of low volatility. Consequently, the GARCH model is appropriate for estimating volatility dynamics in the SMI, Nikkei 225, BIST 100, and IHSG indices.

3.1.4 GARCH-Based Volatility Estimation

The volatility dynamics of each stock market index were estimated using the GARCH(1,1) model. The estimated parameters are presented in Table 4.

Table 4. GARCH (1,1) Estimation Results

Index	ω (Constant)	α (ARCH)	β (GARCH)	$\alpha + \beta$
SMI (Switzerland)	1.2145	0.1000	0.8000	0.9000
Nikkei 225 (Japan)	5.9342	0.1412	0.5604	0.7016
BIST 100 (Turkey)	3.6630	0.1004	0.7996	0.9000
IHSG (Indonesia)	1.2389	0.2000	0.7000	0.9000

The GARCH(1,1) estimation results presented in Table 4 indicate persistent volatility across all stock markets. Persistence is measured by the sum of the ARCH (α) and GARCH (β) coefficients. The SMI, BIST 100, and IHSG exhibit persistence values of approximately 0.9000, suggesting that volatility shocks dissipate gradually and continue to influence future market conditions. Since all persistence values are below one, the variance processes remain stationary and mean-reverting.

In contrast, the Nikkei 225 records a lower persistence value (0.7016), indicating that shocks are absorbed more rapidly than in the other markets. The ARCH coefficients further reveal differences in market responsiveness to new information. The IHSG exhibits the highest ARCH coefficient ($\alpha = 0.2000$), indicating greater sensitivity to recent shocks, whereas the SMI and BIST 100 display relatively higher GARCH coefficients ($\beta \approx 0.8000$), suggesting a stronger influence of past volatility on current market conditions.

Overall, the findings indicate that volatility persistence is evident across both developed and emerging markets during the period of global uncertainty. However, volatility magnitude and persistence are not necessarily identical. For example, the BIST 100 exhibits the highest fluctuations, whereas the SMI displays lower volatility despite having a similar degree of persistence.

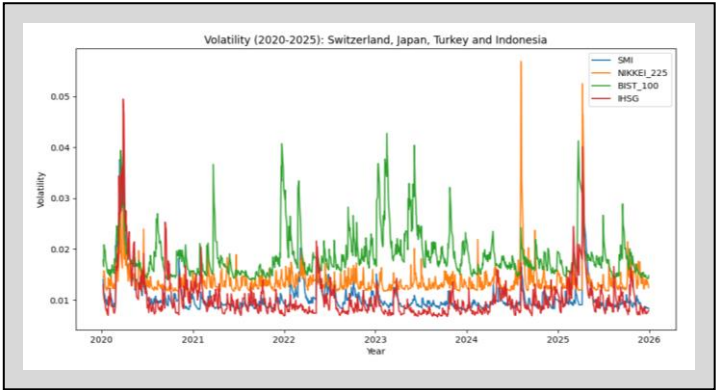


Fig 1. Conditional Volatility of SMI, Nikkei 225, BIST 100, and IHSG (2020–2025)

Fig 1 presents the conditional volatility of the four stock market indices during 2020–2025. Volatility increased sharply during the early phase of the COVID-19 pandemic, reflecting heightened uncertainty in global financial markets. Although volatility gradually declined after the pandemic shock, several spikes remained visible throughout the observation period.

Among the four indices, the BIST 100 exhibits the highest volatility levels, indicating greater market fluctuations and risk. The Nikkei 225 also experienced several notable volatility spikes, particularly during 2024–2025. In contrast, the SMI displays relatively

lower and more stable volatility patterns, while the IHSG exhibits moderate volatility with occasional increases during periods of global uncertainty.

Overall, the results indicate that stock market volatility is time-varying and tends to intensify during periods of economic and financial stress, supporting the presence of volatility clustering identified by the GARCH model.

3.1.5 Dynamic Correlation DCC-GARCH Estimation

To examine the time-varying correlations among the stock markets, the DCC-GARCH model proposed by Engle (2002) was estimated. The estimated DCC parameters are presented in Table 5.

Table 5. DCC-GARCH Estimation Results

Parameter	Value	Interpretation
α (DCC)	0.0066	Low sensitivity of correlations to new shocks
β (DCC)	0.9070	High persistence of dynamic correlations
$\alpha + \beta$	0.9136	Persistent and stable correlation dynamics ($a+b < 1$)

The estimated DCC parameters satisfy the stability condition ($a + b < 1$), indicating that the model is well specified. The parameter a is estimated at 0.0066, while the parameter b is 0.9070, resulting in a persistence value of 0.9136.

The relatively low value of parameter a suggests that dynamic correlations respond moderately to new shocks and information. In contrast, the high value of parameter b indicates that past correlations play an important role in determining current correlations. The persistence value of 0.9136 implies that dynamic correlations are highly persistent and adjust gradually over time.

These findings indicate that changes in market co-movements are not purely temporary but tend to remain influential for a relatively long period following major economic and financial events. Therefore, the relationships among stock markets exhibit both time-varying behavior and substantial persistence throughout the observation period.

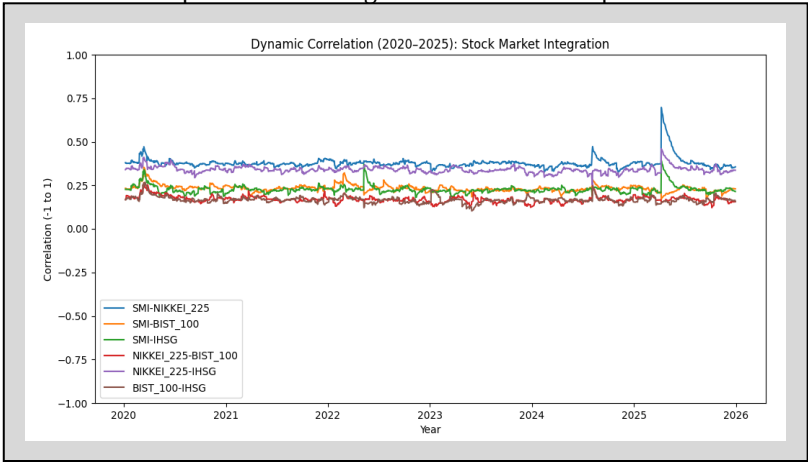


Fig 2. Dynamic Correlations among Stock Market Pairs (2020–2025)

Fig 2 illustrates the dynamic correlations among the six stock market pairs during 2020–2025. The results show that correlations vary over time, confirming the presence of time-varying relationships among international stock markets.

Among the observed pairs, the SMI–Nikkei 225 and Nikkei 225–IHSG exhibit relatively higher correlation levels compared to the other market pairs. In contrast, the Nikkei 225–BIST 100 and BIST 100–IHSG pairs generally display lower correlation values throughout the observation period.

Several noticeable increases in correlation are observed during periods of heightened global uncertainty, particularly around the COVID-19 pandemic and subsequent economic disturbances. These increases indicate stronger market co-movements during crisis periods. However, the correlations do not remain constant and gradually return to their normal levels after major shocks subside.

Overall, the results suggest that international stock markets are interconnected, but the degree of correlation differs across market pairs and evolves over time. The relatively high DCC persistence further indicates that changes in market relationships tend to remain influential beyond the immediate impact of external shocks.

3.2 Discussion

The results provide evidence that volatility and correlation dynamics are influenced by both market characteristics and global economic conditions. The GARCH estimates confirm the presence of persistent volatility across all stock markets, indicating that the effects of shocks tend to remain influential over time. Among the examined markets, the BIST 100 exhibits the highest volatility level, whereas the SMI demonstrates relatively lower volatility. Nevertheless, the SMI, BIST 100, and IHSG display similarly high persistence levels, suggesting that volatility persistence is influenced not only by market classification but also by broader economic and financial conditions.

The DCC-GARCH results reveal that correlations among stock markets are time-varying and tend to strengthen during periods of heightened global uncertainty, particularly during the COVID-19 pandemic and subsequent economic disturbances. These findings indicate stronger market co-movements during crisis periods, reflecting the increasing interconnectedness of international financial markets. Furthermore, the estimated DCC persistence value of 0.9136 suggests that changes in market relationships are highly persistent and adjust gradually over time. Therefore, the effects of major economic and financial shocks on market correlations remain influential beyond their immediate impact.

These findings imply that the benefits of international portfolio diversification may decline during periods of global uncertainty as correlations across markets increase. Although Switzerland exhibits relatively lower volatility compared to the other markets, no market is completely insulated from external shocks. Overall, the results highlight the importance of considering both volatility persistence and dynamic correlations when assessing international financial risk and developing portfolio diversification strategies.

4 Conclusion

This study examines volatility and dynamic correlations across four global stock markets using the GARCH and DCC-GARCH models over the period 2020–2025. The findings indicate that all markets exhibit persistent volatility, with the SMI, BIST 100, and IHSG showing persistence values of approximately 0.90, while the Nikkei 225 demonstrates lower persistence and a faster adjustment to market shocks. In terms of volatility magnitude, the BIST 100 exhibits the highest fluctuations among the examined markets.

Dynamic correlation analysis shows that inter-market relationships vary over time and tend to strengthen during periods of global uncertainty. The estimated DCC persistence value ($a + b = 0.9136$) indicates that dynamic correlations are highly persistent and adjust gradually following major economic and financial shocks. This finding suggests that changes in market

co-movements remain influential over time and contribute to the interconnectedness of international stock markets.

In conclusion, the study highlights that global stock markets are interconnected, particularly during periods of heightened uncertainty. Both volatility persistence and dynamic correlations play important roles in understanding international financial risk and portfolio diversification. Therefore, investors and policymakers should consider not only the magnitude of market fluctuations but also the evolving relationships among international stock markets when making investment and risk management decisions. Future research may expand the sample coverage, include additional financial markets, and examine the role of macroeconomic and geopolitical factors in shaping volatility and market interconnectedness.

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