Cross-Market Linkages: Analyzing NIFTY50's Relationship with Major Asian Indices

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Abstract

The international financial markets are increasingly interconnected, and each stock index affects others based on economic linkages, sentiment, and capital flows. The current study explores the spillover relationship between NIFTY50 and six major global stock indices: KOSPI (South Korea), HK50 (Hong Kong), FTSE (United Kingdom), NIKKEI225 (Japan), SSEC (China), and TSEC50 (Taiwan). These relationships are important for investors, policymakers, and financial economists to understand market integration and risk diversification approaches.

Through statistical methods, the study establishes the significance of these relations with hypothesis testing and variance inflation factor (VIF) test. Findings yield KOSPI, HK50, FTSE, NIKKEI225, and TSEC50 to have a significant relationship with NIFTY50 but not SSEC index. That indicates that Shanghai Composite Index does not rely on the Indian stock market, and that could be due to structural differences, regulatory barriers, or other economic fundamentals of the two economies.

Furthermore, the multicollinearity test also reveals that most of the indices possess a variance inflation factor of below the cut-off value of 10 except for TSEC50, whose VIF is nearly 18, demonstrating too much correlation with NIFTY50. Strong multicollinearity demonstrates that TSEC50 can be prone to distorting regression estimates and model specification must be undertaken carefully in order to make correct inferences.

These findings add to overall stock market integration literature through their provision of precise evidence on the spillover effect between NIFTY50 and a few foreign indices. The findings have implications for diversification of portfolios as investors would consider correlations between these indices when making investment decisions. These findings can also be employed by policymakers in order to observe how developments across the world impact the stability of domestic finance.

Keywords- Stock Market Integration, NIFTY50, Global Indices, Financial Interdependence, Multicollinearity, Hypothesis Testing, Market Linkages, Risk Diversification, International Finance

1.Introduction

World financial markets are extremely integrated with each other, and stock indices are interdependent with others through economic conditions, investor mood, and capital flows. Highly integrated equity markets have immense implications for policy-makers, investors, and financial analysts in attempting to quantify risk exposure and diversification benefit. To that degree, India's NIFTY50's dependence on large international stock indices is high in quantifying the extent to which movements in the global market impact the Indian stock market.

This study analysis examines correlations of NIFTY50 with six of the globe's biggest stock markets: HK50 (Hong Kong), FTSE (United Kingdom), KOSPI (South Korea), NIKKEI225 (Japan), SSEC (China), and TSEC50 (Taiwan). Since global indexes will trend together because of macroeconomic considerations such as interest rates, inflation, and trade policies, directions and magnitudes of such correlations vary from market to market. These connections lead investors to make portfolio decisions more effective and allow policymakers to craft financial stability instruments.

By statistical tests like hypothesis testing and variance inflation factor (VIF) testing, this study determines if NIFTY50 is highly correlated with these foreign indices or not. From initial data, it is observed that all the indices are highly correlated with NIFTY50 except SSEC (Shanghai Composite Index). Likewise, TSEC50 is also highly multicollinear, i.e., highly correlated and can have a strong impact on forecasting models.

Through the study of these interactions, this research contributes to the general literature on stock market integration and establishes how Indian markets are influenced by global financial forces. The results can be utilized by policy planners and investors in decision-making, and the policymakers can make economic planning based on them.

2.Literature Review

The increasing interconnectedness of financial markets has been a major area of research in financial economics. The integration of stock markets across regions has significant implications for risk diversification, capital allocation, and financial stability. Several studies have explored the nature and extent of stock market interdependence, examining return and volatility spillovers, economic integration, and the role of external shocks. This section reviews existing literature on stock market integration, cross-market linkages, and volatility spillovers, focusing on global and Asian markets while identifying research gaps that this study aims to address.

The integration of global stock markets has been widely studied, with early research by **Bekaert and Harvey (1995)** indicating that financial liberalization enhances market interdependence. As capital markets become more open, the movement of funds between markets increases, leading to stronger co-movements. **Kim, Moshirian, and Wu (2005)** further emphasize that deregulation, technological advancements, and increased foreign institutional investment have intensified these linkages, making national stock markets more sensitive to global shocks. **Caporale et al. (2009)** confirm that market correlations strengthen during financial crises, reducing the effectiveness of risk diversification. These studies collectively highlight that global stock market integration is driven by both economic fundamentals and investor sentiment.

The integration of financial markets is not uniform across regions, and the degree of linkage varies based on economic structure, regulatory environment, and geopolitical factors. **Gupta and Guidi (2012)** examine the co-movements between Indian and developed Asian stock markets, showing that while integration has increased over time, Indian markets still maintain some level of independence. This suggests that global influences impact different markets in varying magnitudes, depending on factors such as economic policy, trade relationships, and financial openness.

Understanding how returns and volatility spill over across stock markets is crucial for assessing financial contagion and market integration. **Eun and Shim (1989)** conducted one of the earliest studies on international stock market linkages, showing that the US stock market exerts a strong influence on global markets, particularly Asian and European indices. Their findings highlight that movements in one market can rapidly transmit to others, impacting investment strategies and risk management decisions.

More recent studies have explored volatility spillovers using advanced econometric models. **Diebold and Yilmaz (2012)** developed a spillover index that quantifies the transmission of volatility across markets. Their findings suggest that during periods of economic uncertainty, volatility spillovers intensify, making global markets more synchronized. **Cheung and Ng (1996)** used cointegration analysis to study long-term relationships among international stock indices, concluding that financial markets exhibit strong interdependencies, particularly within the same geographical region.

Asian financial markets, in particular, have been the subject of many spillover studies. **Yilmaz (2010)** examined return and volatility spillovers among East Asian equity markets, finding that regional markets influence each other more strongly than external markets. Similarly, **Pati and Rajib (2011)** analyzed the relationship between stock and foreign exchange markets in India, demonstrating that financial shocks often propagate across asset classes, further increasing market vulnerability. These studies indicate that understanding return and volatility spillovers is essential for investors and policymakers to manage financial risks effectively.

While financial linkages are primarily driven by market dynamics, economic and political factors also play a critical role in shaping stock market relationships. **Forbes and Rigobon (2002)** differentiate between financial contagion and interdependence, arguing that markets tend to exhibit higher correlations during crises due to increased volatility rather than genuine integration. Their study suggests that distinguishing between temporary market reactions and structural linkages is essential for understanding financial stability.

Baur and Schulze (2009) investigated the influence of economic policies on stock market co-movements, finding that monetary policies, fiscal policies, and trade agreements significantly impact market correlations. Similarly, **Baruník and Křehlík (2018)** explored frequency-dependent spillovers, revealing that short-term and long-term market interactions differ, with short-term shocks often being more pronounced in highly integrated markets. These findings highlight that financial linkages are not static but evolve based on macroeconomic conditions and policy decisions.

In the context of Asian markets, **Wang and Moore (2009)** studied sudden changes in volatility in Central European stock markets and their transmission to other financial markets. Their findings suggest that financial shocks in one region can have spillover effects across geographically distant markets, emphasizing the importance of monitoring global economic conditions. This has significant implications for investors in emerging markets like India, where external economic shocks can influence domestic stock market behavior.

Emerging markets have become increasingly important in the global financial system, prompting researchers to examine their interactions with developed markets. **Johansen (1991)** introduced cointegration techniques to study long-run equilibrium relationships among financial time series, providing a framework for analyzing market integration. His methodology has been widely applied to assess emerging market linkages with global indices.

Al Nasser and Hajilee (2016) examined the integration of emerging stock markets with global markets, concluding that while financial globalization has increased connectivity, emerging markets still exhibit distinct characteristics. Their study found that factors such as market size, liquidity, and regulatory environment influence the degree of integration. Similarly, **Studenmund (2016)** highlighted that econometric models need to account for structural breaks and regime changes when analyzing financial time series, as market relationships are not always stable over time.

Asian financial markets, particularly India, have unique characteristics that differentiate them from developed markets. **Pati and Rajib (2011)** found that volatility spillovers between stock and forex markets in India exhibit asymmetrical behavior, meaning that negative shocks tend to have a greater impact than positive ones. This aligns with findings by **Gupta and Guidi (2012)**, who reported that Indian stock market

movements are increasingly influenced by regional markets like Japan and South Korea but still retain some independence from China.

Research Gaps

The existing literature highlights the strong interdependence between global stock markets, particularly in times of economic crises. However, gaps remain in understanding the specific relationships between NIFTY50 and select global indices, particularly regarding volatility spillovers and multicollinearity effects. This study aims to contribute to the literature by providing empirical insights into these relationships using statistical methodologies.

3. Research Methodology

3.1. Research Design

This study adopts a quantitative research approach to investigate the relationship between the NIFTY50 index and major Asian stock indices, including Nikkei 225, Shanghai Composite Index, Hang Seng, FTSE Straits Times Index (STI), TSEC, and KOSPI. The research follows a deductive approach, where statistical techniques are used to test predefined hypotheses regarding cross-market linkages.

3.2. Data Collection

The study is based on secondary data sourced from YFinance available financial databases, stock exchange reports, and other authentic sources. The dataset consists of monthly closing prices of the selected stock indices, spanning from January 2010 onwards.

3.3. Variables Selection

- Dependent Variable: NIFTY50 (National Stock Exchange, India)

  Independent Variables:
- Nikkei 225 (Tokyo Stock Exchange, Japan)
- Shanghai Composite Index (China)
- Hang Seng Index (Hong Kong Stock Exchange)
- FTSE Straits Times Index (STI) (Singapore Stock Exchange)
- TSEC (Taiwan Stock Exchange)
- KOSPI (Korea Composite Stock Price Index, South Korea)

3.4. Hypothesis Development

To examine the linkages, the study formulates the following hypotheses:

- ***Null Hypothesis (H_0):*** There is no significant relationship between NIFTY50 and the selected Asian stock indices.
- ***Alternative Hypothesis (H_1)*:** There is a significant relationship between NIFTY50 and at least one of the selected Asian stock indices.

A p-value threshold of 0.05 is used to determine statistical significance.

3.5. Statistical Tests and Analytical Techniques

3.5.1 Correlation Analysis

A Pearson correlation test is conducted to measure the strength and direction of the relationships between NIFTY50 and the independent indices. The correlation coefficients help identify whether the indices move together and provide preliminary indications of multicollinearity.

3.5.2 Multicollinearity Test - Variance Inflation Factor (VIF)

To detect multicollinearity, a Variance Inflation Factor (VIF) test is performed.

- If VIF > 10, multicollinearity is considered severe, meaning that the variable is highly correlated with other independent variables.
- If VIF < 10, multicollinearity is not a concern, and the variable can be retained in the model.

3.5.3 Multicollinearity Treatment

If multicollinearity is detected, it is addressed using one of the following methods:

1. Removing the Highly Correlated Variable: The variable with the highest VIF is eliminated to reduce redundancy.
2. Combining Variables: Similar indices are grouped into composite indices.

3.6. Regression Analysis

A multiple linear regression model is used to assess how the independent indices impact NIFTY50. The regression equation is structured as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon$$

where:

- Y = NIFTY50 (dependent variable)
- $X_1, X_2, \ldots, X_n$ = Independent indices (Nikkei 225, Shanghai Composite, Hang Seng, STI, TSEC, KOSPI)
- $\beta_1, \beta_2, \ldots, \beta_n$ = Coefficients measuring the impact of independent indices
- α = Intercept
- ε = Error term

3.7. Statistical Software Used

The entire analysis, including correlation tests, VIF calculations, multicollinearity treatment, and regression modelling, is conducted using EViews, a widely used econometrics tool for financial research.

3.8. Interpretation

- A significant p-value (≤ 0.05) indicates a meaningful relationship between NIFTY50 and the respective index.
- A VIF value > 10 suggests strong multicollinearity, warranting corrective measures.
- Post-multicollinearity adjustments, the final regression model presents an unbiased and more reliable relationship between NIFTY50 and the major Asian indices.

3.9. Limitations of the Study

- The study is based solely on historical price movements and does not incorporate macroeconomic factors like GDP, inflation, or interest rates.
- The assumption of a linear relationship may not fully capture complex, non-linear dependencies.
- External factors such as global crises, policy changes, or market anomalies are not explicitly modelled.

This methodology systematically examines the cross-market linkages between NIFTY50 and major Asian indices using correlation, VIF, and regression analysis. The findings provide insights into market interdependencies and guide investors and policymakers in understanding regional stock market dynamics.

4. Interpretation of the Study

This study explores the cross-market linkages between NIFTY50 and major Asian stock indices—Nikkei 225, Shanghai Composite Index, Hang Seng, FTSE Straits Times Index (STI), TSEC, and KOSPI—using correlation, regression, and multicollinearity tests. The key interpretations from the analysis are as follows:

4.1. Correlation Analysis Findings

The **Pearson correlation coefficients** reveal the degree of association between NIFTY50 and the selected Asian indices. The findings suggest:

- **KOSPI, Nikkei 225, Hang Seng, FTSE STI, and TSEC exhibit a strong positive correlation** with NIFTY50, implying that movements in these indices are closely aligned with the Indian stock market.
- **Shanghai Composite Index (SSEC) shows weak or no significant correlation** with NIFTY50, indicating that the Chinese market operates relatively independently from India's stock movements.
- Strong correlations among some independent variables suggest potential multicollinearity issues.

4.2. Multicollinearity Test (VIF) Interpretation

The **Variance Inflation Factor (VIF) test** was conducted to detect multicollinearity among independent variables. The results indicate:

- **Most indices have VIF values below 10**, meaning they do not exhibit severe multicollinearity.
- **TSEC shows a VIF above 10**, suggesting a high degree of correlation with other independent variables, which could distort regression results.

4.3. Regression Analysis Interpretation

The **multiple linear regression model** examines how the selected indices impact NIFTY50. The findings include:

- **KOSPI, Nikkei 225, Hang Seng, and FTSE STI significantly influence NIFTY50**, with positive coefficients, suggesting that an increase in these indices generally corresponds to an increase in NIFTY50.

- **Shanghai Composite Index (SSEC) remains statistically insignificant**, reinforcing the correlation analysis finding that China's stock market movements do not strongly impact NIFTY50.
- **The overall model fit (R^2) is high**, indicating that the independent variables explain a significant portion of NIFTY50's movements.
- **P-values for significant indices are < 0.05**, confirming their relationship with NIFTY50 is statistically meaningful.

4.4. Key Implications

1. **Investment Strategy:** Indian stock market movements are closely linked with KOSPI, Nikkei 225, Hang Seng, and FTSE STI, suggesting that investors should monitor these markets when making investment decisions in NIFTY50.
2. **Risk Management:** Diversification strategies should account for the high interdependence among these indices, as a downturn in one market could impact NIFTY50.
3. **Policy Considerations:** Regulators and policymakers can use these insights to anticipate external shocks affecting the Indian market and implement strategies to mitigate risks.
4. **Shanghai Composite (SSEC) Independence:** The lack of correlation with NIFTY50 suggests that China's market is less integrated with India's, possibly due to economic, regulatory, and structural differences.

4.5. Study Limitations

- The study focuses solely on price movements and does not incorporate macroeconomic indicators like interest rates, GDP, or trade volumes.
- The assumption of linearity may overlook potential non-linear relationships between indices.
- Market anomalies or external shocks (e.g., financial crises, geopolitical events) are not explicitly modelled.

5. Summary of Findings

5.1. Correlation Analysis

- Strong positive correlation exists between NIFTY50 and KOSPI, Nikkei 225, Hang Seng, FTSE STI, and TSEC.
- Weak or no correlation between NIFTY50 and the Shanghai Composite Index (SSEC), indicating market independence.

5.2. Multicollinearity Test (VIF Analysis)

- TSEC exhibited high multicollinearity (VIF > 10), making it unsuitable for regression analysis.
- After removing TSEC, the multicollinearity issue was resolved, ensuring a stable model.

5.3. Regression Analysis

- KOSPI, Nikkei 225, Hang Seng, and FTSE STI significantly impact NIFTY50 (p-values < 0.05).
- Shanghai Composite Index (SSEC) is not statistically significant, confirming its weak relationship with NIFTY50.
- The model achieved a high R^2 value, indicating strong explanatory power.

5.4. Key Implications

- Market Interdependence: NIFTY50 is highly influenced by regional stock markets except SSEC.
- Investment Strategy: Investors should monitor KOSPI, Nikkei 225, Hang Seng, and FTSE STI for NIFTY50 movements.
- Risk Management: Diversification is necessary due to high interlinkages among Asian markets.
- Policy Considerations: Regulators must track external market influences on NIFTY50.

Significant relationships exist between NIFTY50 and major Asian indices (except SSEC), demonstrating strong cross-market linkages.

6. Conclusion

This research analyses cross-market relationships between NIFTY50 and major stock indices of Asian economies—Nikkei 225, Shanghai Composite Index, Hang Seng, FTSE Straits Times Index (STI), TSEC, and KOSPI—through statistical analysis like correlation analysis, variance inflation factor (VIF), and multiple regression analysis. The results indicate high interdependencies between some Asian markets except for the Shanghai Composite Index (SSEC), which is not or has very little correlation with NIFTY50. This means that while most Asian indices influence the Indian stock market, the Chinese market is relatively independent.

The correlation and regression tests reveal that Nikkei 225, KOSPI, Hang Seng, and FTSE STI significantly influence NIFTY50, additional proof of regional market integration. However, the multicollinearity issue, especially with TSEC, was noted as a potential concern, which was avoided by excluding it from the regression model. Exclusion acted to stabilize and make the model more stable by avoiding estimated relations to be distorted due to overlapping predictors.

The findings of the study have significant implications for investors, policymakers, and financial analysts. Investors can utilize these findings to formulate well-informed trading strategies with the understanding that NIFTY50 is affected by Asian markets. Policymakers also need to track these interdependencies in order to be able to forecast external shocks affecting India's stock market. Even though the study adequately captures important market relationships, it is possible in future studies that macroeconomic factors and non-linear modelling methods could capture more intricacies of deeper market relationships. On balance, the current study has found evidence of cross-market integration of the Asian financial market.

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