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# Evaluation of the Integration of Pakistan Stock Market with Selected Asian Stock Market

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**Abstract**

This study investigated the cointegration of the PSX-Asian stock market. The study hypotheses were tested using the closing monthly data of the returns of selected stock market spanning from January 2001 to December 2020. This data was collected from reputable sources such as Yahoo Finance, Business Recorders, and the World Bank. This study examines nine Asian stock markets, selected based on data availability, using the MSCI (Morgan Stanley Capital International) index as a benchmark. The research employed time-series diagnostics. The Pakistan Stock Exchange (PSX) demonstrates heightened volatility and yields relatively superior returns in comparison to other Asian markets. The PSX demonstrates a restricted correlation with the majority of Asian stock markets. The results of the ADF (augmented Dickey-Fuller) and PP (Phillip Peron tests) suggest that the data exhibits stationarity following a first-order differencing. The analysis of cointegration reveals the presence of three distinct patterns of cointegration among variables or series related to the Asian stock market. The subsequent utilization of the Granger causality test aimed to investigate the temporal link between the stock market return series. A lead-lag relationship can be observed between the PSX and specific markets. The research employs a vector error correction model to quantify the rate at which shocks are adjusted. The results indicate that PSX demonstrates a rapid adaptability to various stock markets in Asia. The research employs an impulse response analysis to visually evaluate the rate of adjustment.

**Keywords:** Pakistan Stock Exchange (PSX); Asian Stock Market; liberalization; Market Integration; PSX-100

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## 1. Introduction

The KSE (Karachi Stock Exchange) was established in 1947, afterwards LSE (Lahore Stock Exchange) started operations in 1974 and the ISE (Islamabad Stock Exchange) in 1997 (Khan & Khan, 2016). Karim et al. (2020) reported that in 2007, the 85% of the overall turnover was due to KSE, while the Lahore Stock Exchange (LSE) accounted for 14% and the Islamabad Stock Exchange (ISE) accounted for 1%. According to Awan et al. (2020), the conclusion of the year 2007 witnessed a total of 671 firms listed on the KSE, with a listed capital amounting to $12 billion. Furthermore, the market capitalization of these listed firms was recorded at $70.18 billion. The KSE-100 index is widely recognized as a prominent benchmark that monitors market prices of the top 100 companies with regards to market capitalization (Iqbal, 2008). As discussed by Kiran, Khan, and Shah (2020), the consolidation of the KSE, LSE, and ISE resulted in the establishment of the PSX (Pakistan Stock Exchange). The stock exchange's success is regarded as an indicator of a nation's economic expansion (Awan et al., 2020). The PSX-100 index is currently used to measure the performance of the PSX. It showed a growth rate of 4656% from 1991 to June 2017 (Zaheer & Kiran, 2020). However, there have been periods of both bullish and bearish trends in the index, influenced by factors such as US aid, economic restrictions, major economic indicators, and global financial crises (Akhtar & Khan, 2016; Shah & Husain, 2012; Khan et al., 2017). The PSX's performance can be influenced by many market anomalies, such as liquidity, size, Islamic calendar, and momentum anomalies (Sadaqat & Butt, 2017; Syed & Khan, 2017; Shah & Shah, 2018). The PSX is also influenced by factors such as governance systems and other important factors (Ullah and Kamal, 2017; Ullah et al., 2017).

### 1.1 The Course of Market Liberalization

Henry (2000) posits that the liberalization of financial markets is expected to lead to reduction in the cost of capital in the cost of capital inside the country undergoing liberalization.. This is attributed to the facilitation of risk-sharing between domestic and international investors. This would make investment ventures more feasible and promote economic growth (Henry, 2000). In the early 1990s, Pakistan opened up its capital market to foreign investors, deregulating and privatizing its economy (Uppal, 1998). However, after liberalization, Pakistan experienced a deterioration in real GDP growth and real investment growth (Bekaert & Harvey, 2003). Pakistan also saw an increase in volatility after liberalization, unlike other emerging markets (Bekaert & Harvey, 1997). This suggests that the impacts of liberalization on the economy and market of Pakistan may not have been good (Kim & Singal, 2000). Other factors such as political uncertainty, currency devaluations, and sanctions may have also influenced the effects of liberalization (Kim & Singal, 2000).

### 1.2 The integration of domestic markets with global markets

The integration of financial markets has been the subject of extensive research in the scientific literature for the past twenty years (Bekaert & Harvey, 2002). The correlation coefficient between Pakistan's stock market and the US market was found to be -0.01 between February 1993 and January 1996 (Smith & Walter, 1998). Pakistan's stock market has shown a weak correlation with developed markets (Harvey, 1995). Korajczyk (1996) found that pricing mistakes in Pakistan were comparatively smaller, but larger in the post-liberalization phase.

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According to the study conducted by Naz et al. (2012), it was observed that the fluctuations in Pakistan's stock market were correlated with the movements in established markets. However, the researchers did not find any evidence of a causal relationship between these fluctuations and the overall impact on Pakistan. According to the findings of Darrat and Zhong (2002), it appears that the stock market in Pakistan exhibits a significant influence from the United States economy. Lamba (2003) concluded that the Pakistan market is largely segregated from the established markets of South Asia. Overall, it appears that Pakistan is still not strongly integrated with advanced markets (Bekaert & Harvey, 2002).

### 1.3 PSX in an International Perspective

In their seminal work, Demirguc-Kunt and Levine (1996) undertook a comparative analysis of various stock exchanges, culminating in the creation of an index aimed at quantifying their level of development. Based on their research findings, Malaysia, Singapore, and Hong Kong were classified as economies with a high level of development. Conversely, Pakistan, Turkey, Argentina, and Greece were categorized as economies within the development markets. Additionally, Zimbabwe, Colombia, Nigeria, and Venezuela were identified as economies that are considered underdeveloped. Reputable sources, such as the World Development Indicators, World Stock Market Factbook and World Bank (2004–2007), provided the data for these categories (Harvey, 1995).

## 2. Literature Review

Co-integration is a statistical tool that is utilized to analyze the degree of integration or co-movement between separate stock markets. The concept was initially introduced by Kasa in 1992 and has since been employed to examine the impacts of novel announcements within stock markets. The 2007 economic crisis precipitated a notable decline in various prominent stock exchanges. However, scholars have identified a phenomenon known as cointegration between the US market and Asian markets during this period. The researchers reached the conclusion that the propagation of crises in Asian markets can be attributed to the presence of significant co-movement. According to Bhunia's (2012) study, it was discovered that the Indian stock markets exhibit cointegration with South Asian markets, thereby presenting investors with prospects to enhance their investment portfolios through diversification in both the short and long term. Singh and Singh (2011) conducted a study to investigate the degree of co-movement observed between developed and developing economies. Their findings revealed a significant correlation between the markets of India and China, as well as those of developed economies. In a study conducted by Kim (2010), the author investigated the cointegration dynamics between East Asian markets and the US market through the application of wavelet analysis and impulse response tests. The researchers discovered that there exists a causal relationship between the United States market and certain East Asian markets, although the extent of this causality varies across different time zones. In a study conducted by Chow (2017), an investigation was carried out to analyze the cointegration among East Asian countries with both the US market and each other. The study utilized weekly data spanning from 1980 to 2011. No co-movement in stock returns was observed between the two blocks, and there was no significant association found between the US and Japanese markets.

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The study conducted by Blackburn and Chidambaran (2015) examined the correlation between emerging and developed economies by analyzing weekly data spanning from 1980 to 2010. It was discovered that during the intermediate period spanning from 1995 to 2000, there was an observed increase in the level of co-movement among the countries within the group. Co-integration was also observed in the stock prices of both small and large economies, indicating that country and industry factors have limited or negligible impact on stock price fluctuations.

In their study, Hussain et al. (2013) investigated the relationship between the Pakistan Stock Exchange (PSX) and emerging markets such as the United States, India, China, Germany, and the United Kingdom. The researchers discovered a strong correlation between PSX and the US market, while no significant correlation was observed between PSX and the UK and US markets. The study conducted by Subhani et al. (2011) investigated the presence of cointegration among various Asian stock markets. The researchers discovered evidence of cointegration among certain economies, but did not find any indication of cointegration between the PSX and the selected stock markets.

Hussain and Saeed (2017) discovered a weak correlation between the PSX and developed markets as well as emerging Asian markets, indicating that foreign investors can profit from utilizing the platform for investment. According to the findings of Chang et al. (2019), it was determined that Pakistani investors have the potential to take advantage of the advantages associated with portfolio investment. In a study conducted by Maher, Asif, and Batool (2017), it was determined that the Pakistan Stock Exchange (PSX) exhibits cointegration with specific Asian markets.

The study conducted by Ahmed et al. (2021) employed a cointegration research methodology to investigate the correlation between Asian stock markets. The findings of the study revealed significant interdependencies between the stock markets of China, Hong Kong, India, and Sri Lanka. Additionally, a significant correlation was observed between the PSX and the various stock markets under consideration, indicating that the potential advantages of diversification may be limited over an extended period of time.

## 3. Research Methodology

To study the co-integration between Pakistan Stock Exchange and Asian Countries,09 counties were purposively selected from Morgan and Stanley Capital International (MSCI). That includes China, India, Indonesia, Korea, Malaysia, Philippines, Taiwan and Thailand. Monthly data of selected Stock Exchanges were collected from 2001 to 2020 from MSCI. The collected data underwent analysis using various statistical techniques, including the Unit Root test, the Johnsen and Juselius (1990) co-integration Test, the Granger Causality Test, the Vector Error Correction Model (VECM), and Impulse Response analysis.

## 4. Result And Discussion

Based on the data available to the scholars and keeping in view the study constructs the results were calculated through descriptive and inferential statistics.

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### 4.1 Descriptive Statistics

**Table 4.1 PSX and Asian Markets' Descriptive Statistics**

| | Pakistan | India | Korea | Philippines | Indonesia | Malaysia | Thailand | Taiwan | China |
|---|---|---|---|---|---|---|---|---|---|
| *M* | 9.390 | 3.280 | 3.780 | 3.420 | 3.230 | 3.580 | 4.140 | 2.690 | 3.280 |
| *Mdn* | 9.400 | 3.270 | 3.960 | 3.440 | 3.340 | 3.480 | 4.170 | 2.460 | 3.230 |
| *Max* | 10.740 | 3.510 | 4.350 | 3.760 | 3.520 | 4.160 | 4.610 | 4.060 | 4.070 |
| *Min* | 7.030 | 3.010 | 2.390 | 3.050 | 2.080 | 2.780 | 3.050 | 1.550 | 2.600 |
| *SD* | 0.690 | 0.110 | 0.450 | 0.190 | 0.260 | 0.360 | 0.290 | 0.600 | 0.410 |
| *Skewness* | -0.630 | -0.020 | -1.120 | -0.160 | -1.940 | 0.010 | -1.380 | 0.520 | 0.150 |
| *Kurtosis* | 2.620 | 2.110 | 3.200 | 1.690 | 7.000 | 1.930 | 5.800 | 2.170 | 1.750 |
| *Jarque-Bera* | 16.570 | 7.480 | 49.020 | 17.320 | 29.780 | 10.820 | 18.600 | 16.900 | 15.650 |
| *P* | 0.052 | 0.020 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.020 | 0.000 |
| *Sum* | 2151.600 | 751.580 | 865.800 | 784.700 | 740.020 | 821.280 | 949.300 | 616.050 | 751.460 |
| *Sum SD* | 223.480 | 3.240 | 46.250 | 8.580 | 15.920 | 30.110 | 19.470 | 84.610 | 39.630 |
| Observations | 229.000 | 229.000 | 229.000 | 229.000 | 229.000 | 229.000 | 229.000 | 229.000 | 229.000 |

The descriptive statistics outcomes for the Asian stock markets are presented in Table 4.1 above. The analysis was conducted on a sample of eight Asian stock markets over a 20-year period spanning from January 2001 to December 2020. The aforementioned descriptive statistics indicate that the mean return of the PSX is 9.40, with a standard deviation of 0.69, representing the current level of risk. The data indicates that, in comparison to other Asian nations, there is a notable increase in returns at a specified level of risk. The mean returns for Thailand, Korea, and Malaysia are 4.14, 3.78, and3.58, respectively, with standard deviation of 0.36, 0.45, and0.29. The stock market of Indonesia has the lowest level of favorable return in comparison to other stock markets in Asian countries, with a recorded value of 3.23. This is accompanied with a corresponding risk level, as indicated by a standard deviation of 0.26. Comparing the PSX market to other Asian markets, descriptive statistics show that it exhibits a slightly greater level of risk. However, it also presents an opportunity for investors to potentially achieve substantial returns. Conversely, the Indonesian stock market exhibits comparatively lower risk levels and offers investors a relatively diminished level of return.

### 4.2 Analysis of Correlation

**Table 4.2 The correlation between the Pakistan Stock Exchange (PSX) and Asian stock markets.**

| | Pakistan | China | India | Indonesia | Korea | Malaysia | Philippines | Thailand |
|---|---|---|---|---|---|---|---|---|
| Pakistan | 1.00 | | | | | | | |
| China | -0.460 | 1.00 | | | | | | |
| India | 0.590 | -0.720 | 1.00 | | | | | |
| Indonesia | 0.810 | -0.460 | 0.510 | 1.00 | | | | |
| Korea | 0.870 | -0.390 | 0.530 | 0.860 | 1.00 | | | |
| Malaysia | 0.470 | -0.500 | 0.600 | 0.680 | 0.720 | 1.00 | | |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Philippines | 0.750 | -0.690 | 0.650 | 0.690 | 0.720 | 0.520 | 1.00 | |
| Thailand | 0.390 | -0.030 | 0.310 | 0.620 | 0.600 | 0.580 | 0.320 | 1.00 |

The findings of the correlation analysis between PSX returns and Asian stock market returns are presented in Table 4.2. The correlation matrix above reveals a weak correlation between PSX and the stock returns of certain Asian countries. According to the provided table, it can be observed that the correlation coefficient of PSX exhibits the highest value with Korea, specifically 0.87, followed by Indonesia with a correlation coefficient of 0.81. Conversely, the lowest correlation coefficient of PSX is observed with Thailand, amounting to 0.39. Multiple research studies have consistently demonstrated that the examination of the correlation matrix is a methodologically limited approach for assessing the relationship between distinct variables. The study utilized the co-integration approach to examine and quantify the level of co-movement between different stock markets, with the aim of enhancing the analysis.

**4.3 Analysis of Unit Roots by using ADF and test of Phillips-Perron**

| **Stock Index** | **ADF** | **PP** | **Stock Index** | **ADF** | **PP** |
|---|---|---|---|---|---|
| **Panel-A Log levels** | | | **Panel-B 1st Difference** | | |
| Pakistan | -1.680 | -1.700 | | -14.680 | -14.690 |
| China | -1.790 | -1.770 | | -15.210 | -15.240 |
| India | -1.820 | -1.830 | | -15.490 | -15.720 |
| Indonesia | -2.400 | -2.480 | | -17.130 | -17.050 |
| Korea | -1.900 | -2.580 | | -14.460 | -14.510 |
| Philippines | -0.780 | -0.830 | | -15.140 | -15.150 |
| Malaysia | -1.540 | -1.700 | | -14.320 | -14.520 |
| Taiwan | -0.390 | -0.340 | | -14.760 | -14.880 |
| Thailand | -1.750 | -2.100 | | -12.460 | -12.430 |

**Test Critical Values:** 1% level -3.46; 5% level -2.87, 10% level -2.57

The outcomes of the ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) unit root tests are shown in Table 4.3. The stated table above comprised two separate panels, labeled as A and B. The ADF and PP tests are utilized to calculate the logarithmic values of all variables in Panel-A. Panel A provides evidence that each variable or index displays a unit root when both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used simultaneously. The data shown in Panel A demonstrates that all variables or series has values that are lower than the crucial threshold of -2.87. Moreover, the variables in question exhibit a P value that is determined to be less than 0.05, a threshold commonly accepted as statistically significant at a confidence level of 5%. This result is drawn based on the utilization of both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Therefore, this study aims to examine the stationarity of all variables by analyzing their initial differences. Panel-B presents the variables in the table in their first difference. The outcomes of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests reveal that all variables surpass the crucial value (-2.87) at a significance level of 5%. Table 1, Panel B, presents the variables in their first difference, indicating that stationarity has been established for all variables by the use of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests.

In Panel A, it is noticed that all variables demonstrate non-stationarity when examined at the logarithmic level. However, when analyzing the first difference, the variables in Panel B

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exhibit stationarity at the 95% confidence interval. Therefore, it can be inferred that all indices are suitable for doing cointegration analysis.

**4.4 Co-integration Approach of Johansen-Juselius**

The table presented above illustrates that each variable in the series exhibits stationarity when subjected to first-order differencing, indicating integration at the first order. The acquired results also facilitate the examination of the Johansen-Juselius (JJ) multivariate and bivariate co-integration, commonly referred to as the J.J technique. In order to attain the given objective, the following table presents the outcomes derived from the J.J co-integration study..

**Table 4.4 Analysis of Multivariate Cointegration Using Max-Eigen Values and Trace Statistics**

| **Hypothesis Values** | **Trace P.V** Statistics | **Critical Values** at 0.05 | **P Values** at 0.05 | **Max-Eigen** | **Critical** at 0.05 | at 0.05 |
|---|---|---|---|---|---|---|
| None * 0.010 | 261.150 | 208.430 | 0.000 | 63.480 | 59.240 | |
| At most 1 * 0.010 | 197.670 | 169.590 | 0.000 | 57.620 | 53.180 | |
| At most 2 * 0.020 | 140.040 | 134.670 | 0.000 | 40.540 | 47.070 | |
| At most 3 0.260 | 99.500 | 103.840 | 0.090 | 33.510 | 40.950 | |
| At most 4 0.580 | 65.980 | 76.970 | 0.250 | 23.140 | 34.800 | |
| At most 5 0.760 | 42.850 | 54.070 | 0.330 | 15.750 | 28.580 | |
| At most 6 0.340 | 27.080 | 35.190 | 0.280 | 15.400 | 22.290 | |
| At most 7 0.620 | 11.680 | 20.260 | 0.470 | 07.370 | 15.890 | |
| At most 8 0.360 | 4.300 | 9.160 | 0.360 | 04.300 | 09.160 | |

At the 0.05 level, the Max-Eigen value test reveals three co-integrating equations.
At the 0.05 level, a trace test reveals three co-integrating equations.

The list provided above presents the outcomes obtained from the co-integration analysis carried out on the PSX and many Asian Stock Exchanges. The above table shows three co-integrating equations between the series. Thus, the study's variables or series show three common patterns. The above results align with both panels, multivariate trace statistics co-integration and maximum Eigen value test. At the 5% critical value, trace statistics show three

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co-integrating patterns in the variables. The Max-eigenvalue test shows three patterns at 0.05. Finally, the result shows subject market co-integration. Without co-integration, there is no need for a lead-lag relationship. Three co-integration patterns are found in the above results, allowing for lead-lag relationships and more. The study tests Granger causality for lead-lag relationships.

### 4.5 Test for Granger Causality

There are observable trends in the series, as seen by the data table presented. Hence, the present investigation applies the Granger causality test and utilizes the return series as the principal methodology for this analytical strategy. When the P-value is greater than 0.05, it suggests that there is no statistically significant lead-lag relationship present within the series or variables. When the P-value is found to be statistically significant, often shown by a value less than 0.05, it suggests the presence of a lead-lag relationship between the variables. The idea of Granger causality posits that the attainment of statistical significance by a series or variable indicates the presence of a unidirectional relationship.

**Table 4.5 Granger Causality Tests in Pairs**

| $H_0$: | F-Statistics | Probability. |
|---|---|---|
| RCH → RPAK | 0.26493 | 0.7676 |
| RPAK → RCH | 1.14704 | 0.3193 |
| RIN → RPAK | 0.15292 | 0.8582 |
| RPAK → RIN | 0.80371 | 0.4491 |
| RINDO → RPAK | 0.08265 | 0.9208 |
| RPAK → RINDO | 1.16216 | 0.3148 |
| RKO → RPAK | 7.07092 | 0.0012 |
| RPAK → RKO | 1.28197 | 0.2794 |
| RMA → RPAK | 10.3070 | .05073 |
| RPAK → RMA | 1.94864 | 0.1448 |
| RPHI → RPAK | 0.11575 | 0.8908 |
| RPAK → RPHI | 1.10615 | 0.3327 |
| RTAW → RPAK | 2.37757 | 0.0952 |
| RPAK → RTAW | 1.28751 | 0.2781 |
| RTHI → RPAK | 8.08668 | 0.0003 |
| RPAK → RTHI | 1.78045 | 0.1711 |
| RIN → RCH | 0.13931 | 0.8701 |
| RCH → RIN | 0.17333 | 0.8411 |
| RINDO → RCH | 0.09723 | 0.9073 |
| RCH → RINDO | 0.13374 | 0.8748 |
| RKO → RCH | 4.58991 | 0.0112 |
| RCH → RKO | 0.00351 | 0.9964 |
| RMA → RCH | 9.01168 | 0.0001 |
| RCH → RMA | 0.15851 | 0.8534 |
| RPHI → RCH | 0.16441 | 0.8484 |
| RCH → RPHI | 0.23127 | 0.7936 |

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| | | |
|---|---|---|
| RTAW → RCH | 1.78981 | 0.1693 |
| RCH → RTAW | 0.05743 | 0.9441 |
| RTHI → RCH | 6.21341 | 0.0023 |
| RCH → RTHI | 0.21008 | 0.8106 |
| RINDO → RIN | 0.04262 | 0.9582 |
| RIN → RINDO | 0.35977 | 0.6981 |
| RKO → RIN | 5.51937 | 0.0045 |
| RIN → RKO | 0.32528 | 0.7226 |
| RMA → RIN | 8.07217 | 0.0003 |
| RIN → RMA | 0.41488 | 0.6608 |
| RPHI → RIN | 0.05583 | 0.9458 |
| RIN → RPHI | 0.20135 | 0.8177 |
| RTAW → RIN | 2.18263 | 0.1153 |
| RIN → RTAW | 0.24237 | 0.7851 |
| RTHI → RIN | 7.58936 | 0.0006 |
| RIN → RTHI | 0.20040 | 0.8184 |
| RKO → RINDO | 6.04467 | 0.0027 |
| RINDO → RKO | 0.04804 | 0.9532 |
| RMA → RINDO | 8.44675 | 0.0003 |
| RINDO → RMA | 0.16205 | 0.8504 |
| RPHI → RINDO | 0.33682 | 0.7143 |
| RINDO → RPHI | 0.08064 | 0.9224 |
| RTAW → RINDO | 1.28484 | 0.2788 |
| RINDO → RTAW | 0.49258 | 0.6116 |
| RTHI → RINDO | 4.68915 | 0.0102 |
| RINDO → RTHI | 0.15851 | 0.8534 |
| RMA → RKO | 2.89092 | 0.0577 |
| RKO → RMA | 1.04274 | 0.3543 |
| RPHI → RKO | 0.19073 | 0.8264 |
| RKO → RPHI | 5.37062 | 0.0052 |
| RTAW → RKO | 0.07262 | 0.9301 |
| RKO → RTAW | 3.46288 | 0.0331 |
| RTHI → RKO | 3.19962 | 0.0426 |
| RKO → RTHI | 4.65125 | 0.0104 |
| RPHI → RMA | 0.11843 | 0.8883 |
| RMA → RPHI | 8.71512 | 0.0002 |
| RTAW → RMA | 0.48278 | 0.6176 |
| RMA → RTAW | 4.66658 | 0.0102 |
| RTHI → RMA | 1.89517 | 0.1526 |
| RMA → RTHI | 6.72108 | 0.0014 |
| RTAW → RPHI | 2.47158 | 0.0867 |
| RPHI → RTAW | 0.19942 | 0.8192 |
| RTHI → RPHI | 6.96372 | 0.0011 |
| RPHI → RTHI | 0.33603 | 0.7151 |

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| | | |
|---|---|---|
| RTHI → RTAW | 3.78993 | 0.0242 |
| RTAW → RTHI | 2.81281 | 0.0621 |

*("→" implies Fail to Granger-cause)*

Table 4.5 presents the results of the pair-wise Granger causality tests. A thorough collection of claims that are categorized as null hypotheses is included in the table above. If the P-value associated with a specific statement or series is determined to be significant ($P < 0.05$), the null hypothesis will be rejected and the alternative hypotheses will be considered as valid. A P-value less than the predetermined cutoff of 0.05 serves as proof that the results from the Korea Stock Exchange and Pakistan Stock Exchange are statistically significant. The resulting P-value suggests statistical significance, therefore supporting the acceptance of the null hypothesis, which proposes the lack of a causal association between the returns of the Korea Stock Exchange and the Pakistan Stock Exchange. As a result, the null hypothesis of the study will be rejected, but the alternative hypothesis will be upheld. The alternative hypothesis proposes a probable correlation between the lag in the Korean stock exchange and the earnings of the PSX.

The findings indicate a unidirectional relationship between the Korean stock exchange and PSX return. A P-value below the threshold of 0.05 signifies the rejection of the null hypothesis and the acceptance of the alternative hypothesis. This suggests that the Korean stock exchange takes the lead, while the PSX follows suit. This implies that the initial set of results will serve as the leading factor, while the subsequent variables will exhibit a corresponding pattern.

The preceding findings demonstrate the financial gains observed in the Thailand stock exchange and PSX. The analysis of statistics reveals that the observed P-value for the association between the Taiwan stock exchange and PSK returns is deemed to be statistically significant. The null hypothesis is deemed invalid, while the alternative hypothesis is deemed valid, suggesting that the Thai stock exchange takes precedence over the PSX. This implies that the initial series of results will precede, while the subsequent variables will subsequently ensue.

Similar results were observed for the Taiwan Stock Exchange and the PSX. The statistical significance of the relationship between the Taiwan stock exchange and PSK return is determined to be 10% at a critical level. The numerical magnitude of P0.10 is lesser than that of 0.10. The null hypothesis has been refuted, resulting in the acceptance of the alternative hypothesis, which suggests that the returns of the Taiwan Stock Exchange precede those of the PSX. This suggests that the initial set of results will serve as the primary determinant, while the subsequent variables will demonstrate a corresponding trend.

Additional findings indicate that the P-values associated with the returns of China, Malaysia, and Korea Thailand to the stock exchange are0.002, 0.0002, and0.01, correspondingly. The analysis reveals that there is no correlation between the Chili stock exchange and the stock exchanges of Korea, Malaysia, and Thailand. The aforementioned study hypotheses are

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anticipated to be refuted, while the alternative hypothesis, which suggests a positive relationship between the stock exchanges of Korea, Malaysia, and Thailand and the Chili stock exchange, is expected to be supported. The stock exchanges of Korea, Malaysia, Thailand, and the Chili stock exchange are expected to exhibit the earliest signs of recovery.

According to other findings, the P-values for the returns of Korea, Malaysia, and Thailand to the Indian stock exchange are, respectively, 0.024, 0.004, and 0.0006. The data indicates that the reintegration of Korea, Malaysia, and Thailand into the global economy does not have a causal relationship with India's reintegration. The aforementioned study hypotheses are expected to be rejected, while the alternate hypothesis, which posits that the stock exchanges of Korea, Malaysia, and Thailand exhibit a significant impact on the returns of the India stock exchange, is anticipated to be accepted. The return of the Indian stock exchange will be led by Korea, Malaysia, and Thailand.

The remaining findings indicate that the P-values associated with the returns of Korea, Malaysia, and Thailand to the Indonesian stock exchange are 0.0028, 0.0003, and 0.01, respectively. The data indicates that the Indonesian stock exchange does not exhibit a positive correlation with the stock exchanges of Korea, Malaysia, and Thailand. The aforementioned study hypotheses will be deemed invalid, while the alternate hypothesis, which posits that the stock exchanges of Korea, Malaysia, and Thailand exhibit a positive relationship with the Indonesian stock exchange, will be supported. The Indonesian stock exchange's return is expected to be led by Korea, Malaysia, and Thailand.

With comparable P-values of 0.04 and 0.01, respectively, the bidirectional character of the returns from the Thailand stock exchange and the Korea stock exchange was observed.

**4.6 Model for VECM (Vector Error Correction)**

**Table 4.6 Estimates of VECM**

| Error Correction: | D-(RPAK) | D-(RCH) | D-(RIN) | D-(RINDO) | D-(RKO) | D-(RMA) | D-(RTAW) |
|---|---|---|---|---|---|---|---|
| CointEq1 | -0.421 | -0.157 | -0.279 | -0.142 | -0.250 | -0.118 | -0.266 |
| | (0.717) | (0.235) | (0.227) | (0.225) | (0.257) | (0.202) | (0.269) |
| | [-0.587] | [-0.669] | [-1.229] | [-0.633] | [-0.972] | [-0.586] | [-0.986] |
| D-(RPAK) | -0.736 | -0.324 | -0.279 | -0.185 | -0.256 | -0.164 | -0.191 |
| | (0.576) | (0.188) | (0.182) | (0.181) | (0.206) | (0.162) | (0.216) |
| | [-1.270] | [-1.722] | [-1.527] | [-1.023] | [-1.243] | [-1.015] | [-0.882] |
| D-(RCH) | -0.108 | -0.615 | 0.090 | 0.048 | 0.030 | 0.005 | 0.060 |
| | (0.514) | (0.168) | (0.163) | (0.161) | (0.184) | (0.144) | (0.193) |
| | [-0.211] | [-3.664] | [0.552] | [0.301] | [0.162] | [0.035] | [0.310] |
| D-(RIN) | -2.070 | 0.151 | -0.512 | -0.142 | -0.214 | -0.246 | 0.112 |
| | (1.864) | (0.610) | (0.591) | (0.584) | (0.668) | (0.524) | (0.700) |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | [-1.110] | [0.248] | [-0.869] | [-0.243] | [-0.325] | [-0.468] | [0.160] |
| D-(RINDO) | -0.405 | -0.129 | 0.059 | -0.859 | -0.095 | 0.041 | -0.157 |
| | (1.021) | (0.334) | (0.323) | (0.320) | (0.366) | (0.287) | (0.383) |
| | [-0.397] | [-0.385] | [0.184] | [-2.685] | [-0.261] | [0.143] | [-0.411] |
| D-(RKO) | -0.866 | 0.044 | -0.103 | -0.193 | -0.959 | -0.172 | -0.194 |
| | (0.783) | (0.256) | (0.248) | (0.245) | (0.280) | (0.220) | (0.294) |
| | [-1.106] | [0.172] | [-0.415] | [-0.787] | [-3.422] | [-0.782] | [-0.661] |
| D-(RMA) | -0.814 | -0.375 | -0.398 | -0.407 | -0.325 | -0.974 | -0.558 |
| | (0.928) | (0.303) | (0.294) | (0.291) | (0.332) | (0.261) | (0.348) |
| | [-0.877] | [-1.236] | [-1.353] | [-1.399] | [-0.974] | [-3.733] | [-1.601] |
| D-(RTAW) | -0.039 | -0.053 | 0.014 | 0.084 | 0.119 | 0.052 | -0.464 |
| | (0.586) | (0.192) | (0.186) | (0.184) | (0.210) | (0.165) | (0.220) |
| | [-0.068] | [-0.275] | [0.075] | [0.458] | [0.567] | [0.313] | [-2.111] |
| C | -0.047 | -0.014 | -0.015 | -0.015 | -0.016 | -0.014 | -0.017 |
| | (0.048) | (0.016) | (0.015) | (0.015) | (0.017) | (0.014) | (0.018) |
| | [-0.966] | [-0.859] | [-0.950] | [-0.984] | [-0.934] | [-1.024] | [-0.939] |

The results of the VECM are shown in the table. The table above presents the PSX normalized cointegrating vector error correction. According to the information presented in the table, it is imperative that the value of D (PSX) be negative. The error correction model presented above indicates that the CointEq1 and D (PSX) variables have respective values of -0.4211 and are statistically significant at a 5% level of significance. This demonstrates the rapidity of the adjustment process within a brief timeframe. The statement suggests that the Pakistan Stock Exchange exhibits short-term responsiveness to other lesser-explored markets, leading to deviations from equilibrium. The presence of a negative value signifies a 42.11% adjustment towards disequilibrium that has occurred over a certain time frame. The presence of negative and statistically significant relationships enables diverse investors to mitigate risk through investments in the integration of Asian markets.

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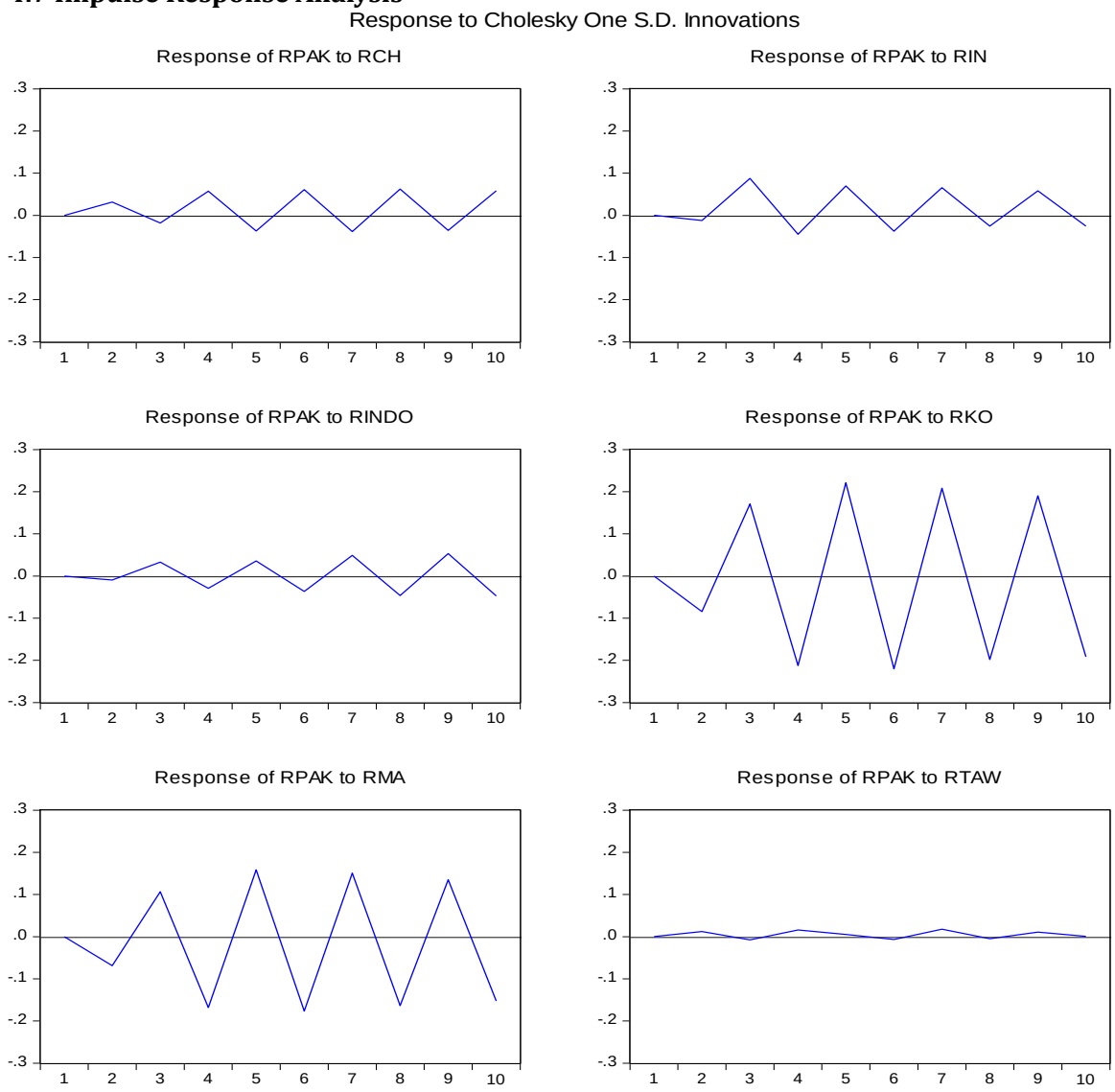
## 4.7 Impulse Response Analysis




The impulse response functions relating to PSX and Asian stock returns are shown in the graph above. The resulting graphs show how standard deviation shocks affect the PSX's returns. The aforementioned graphs also indicate that the Asian market is poised to undergo short-term fluctuations, and provide insights into the frequency of the PSX's corresponding reactions.

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## 5. Conclusion And Recommendations

Based on the descriptive statistics of nine Asian markets spanning from 2001 to 2020, encompassing a total of 229 observations, it has been determined that the PSX exhibits an average return of 9.40 with a corresponding risk level of 0.69. In comparison to other Asian markets, it exhibits a relatively high return on investment in relation to the associated level of risk. The mean returns for Malaysia, Korea, and Thailand are3.58, 3.78, and4.14. The corresponding standard deviations for these countries are 0.29, 0.45, and 0.36. Indonesia exhibits the most modest stock market return in the Asian region, with a value of 3.23, accompanied by 0.26 standard deviation (source). The analysis of descriptive statistics indicates that the PSX market exhibits the highest level of risk among Asian markets, while also offering favorable returns to investors. However, the Indonesian stock market is safer and yields less. The findings are consistent with Bhunia and Das (2012), Khan (2018), Bibi (2021), Hussain (2020), Tauseef and Dupuy (2022), and Gulzar (2019) studies. The aforementioned studies have additionally indicated that the PSX exhibits a higher level of risk and provides greater returns to investors. Furthermore, it has been observed that Asian markets tend to display higher volatility and offer substantial returns. Moreover, the PSX has been identified as the most volatile among developing stock markets. According to the research conducted by Tauseef and Dupuy (2022), it was observed that non-financial firms listed on the PSX exhibit a greater propensity to assume risk, resulting in higher profitability.

The stationarity of the data was assessed through the application of the Augmented Dickey Fuller (ADF) and Phillip Peron (PP) tests. The preceding chapter demonstrated that the ADF and PP tests indicate the stationarity of the data at the first difference, with a confidence level of 95% and a significance level of 0.05. Cointegration is an effective tool for analyzing co-movement among stock returns in Asian markets, as all variables are stationary at the first difference.

The study found that there is co-integration between the Pakistan Stock Exchange (PSX) and other Asian stock markets (Bhunia and Das, 2012; Khan et al., 2018; Bibi et al., 2021; Hussain et al., 2020). The findings suggest the presence of three co-integrating patterns among the variables, as evidenced by the results of both the multivariate trace statistics co-integration test and the multivariate maximum Eigen value test. This observation implies the existence of shared patterns among the variables that have been chosen. The Granger causality test is then applied to explore lead-lag relationships.

The study also examined PSX and Asian market stock return adjustment speed using the vector error correction model (VECM). The coefficient for CointEq1 and D (PSX) exhibits a negative value of -0.4211, which is found to be statistically significant. This suggests that PSX demonstrates a rapid adjustment to other Asian markets. In the short term, the Pakistan Stock Exchange is expected to respond to fluctuations in Asian markets. The presence of a negative value signifies a disequilibrium adjustment of 42.11% over a certain period. The presence of negative and statistically significant relationships facilitates risk reduction for various investors through their investments in the integration of Asian markets. The findings of this study provide further support for the assertions made by Joyo and Lefen (2019) regarding the rapid adaptability of PSX to its trading counterparts. The findings are consistent with the findings of Wahid and Mumtaz (2018). According to the study conducted by Shah et al. (2012), it was observed that PSX demonstrates a rapid adaptability to G-8 economies. According to

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the study conducted by Aamir and Shah (2018), it was observed that the Pakistan Stock Exchange (PSX) exhibits cointegration with emerging markets and demonstrates a high level of adaptability. Hussain and Saeed (2017) reported similar findings. Khan et al. (2018) and Noor et al. (2019) reported congruent findings.

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