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# An Empirical Study on the Impact of Macro-Economic Variables on Asian Stock Markets Returns

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## Abstract

The stock exchange is one of the most powerful sectors, which contribute significantly to the economy's wealth. It plays a crucial role in economic growth and economic development, to which industry, trade and trade as a whole would be benefiting. Therefore, a significant number of research projects have been devoted not surprisingly to understanding the nature of stock market movements and their general performance. A number of studies have shown that macroeconomic variables have a significant impact on stock market performance, while other studies have at best found an inconclusive relationship. It is also worth noting that most of these studies were conducted on developed markets and rarely touched on the combination of emerging and developed markets. Hence this study aims at understanding the impact of selected macroeconomic variables such as Export growth, Import growth, Trade balance, Inflation rate, Broad money growth and exchange rate on the stock market chosen Indices of five Asian countries such as India, Japan, China, Hong Kong and Singapore. The Augmented Dickey-Fuller test (ADF), Granger causality test, Johansen cointegration test the short-run and long-run cointegration between the variables. Variance decomposition analysis is also used to determine how much of the variability in stock returns is lagged by its own variance. The study's findings reveal a substantial long-run cointegration among the macroeconomic variables and stock indices in the case of Japan, China, Hong Kong, and Singapore. All the macroeconomic variables are integrated into I (1) except for the trade balance in the case of Japan, which is integrated into I (2).

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## 1. Introduction

In developed capital markets like the United States, Japan, Australia, Canada, and Europe, the relationship between macroeconomic variables and stock market returns has been extensively studied and reported. Macroeconomic factors influence the stock market's success. When valuing stocks, investors take into account macroeconomic variables. Interest rates, exchange rates, inflation, and GDP are significant macroeconomic variables influencing stock market efficiency. Various studies were carried out to establish the relationship between macroeconomic variables and stock prices in the past. Notable among them is one by Chen, Roll and Ross (1986) on the US stock market, which set the tone for a series of recent studies within the Arbitrage Pricing Theory (APT) framework. According to Fama (1981), macroeconomic variables such as the industrial production index positively relate to stock market performance. When the industrial production index increases, the stock returns also increase. Germany's industrial production and interest rate positively correlate with other European stock market returns, such as the United Kingdom, France and Italy (Cheung and Ng 1998; Nasseh and Strauss 2000; Mukherjee and Naka 1995; McMillan 2001; Chaudhuri and Smiles 2004). Previous notable research papers have concentrated only on the influence of the macroeconomic variables in developed markets. Hence to fill in the research gap, a rare combination of the developed market such as Japan and emerging economies such as India, China, Hong Kong and Singapore are taken for research. This empirical research helps the reader understand whether the movement of stock prices of India, Japan, China, Hong Kong and Singapore is subject to some macroeconomic variables change. Investors will find this study as a helpful tool for them to identify some basic economic variables that they should focus on while investing in the stock market and will have the advantage to make their own suitable investment decisions. In this study, 6 macroeconomic variables such as the Export growth, import growth, Trade balance, Inflation rate, Broad money growth and exchange rate are taken and their impact on the indices of BSESensex (INDIA), Nikkei225 (Japan), SSEcomposite (CHINA), Hang Seng index (Hong Kong) and Straits times index (Singapore) is analysed in the short run and the long run using various tools such as Augmented dickey fuller test (ADF), Granger causality test, Johansen cointegration test.

## 2. Review of Literature

In their time-series study, Asai and Shiba (1995) employed a vector auto-regressions (VAR) model to determine a relationship between Japan's stock market and macroeconomic variables. The study utilised a multivariate specification using the inflation rate, interest rate, industrial production index and stock market development proxy. The study's result indicates a relationship between the stock market and the macroeconomic variables.

Asteriou and Price (2000) employed a vector autoregressions (VAR) model in their time-series study to determine the existence of a relationship between financial development and economic growth in the UK. They also utilised real GDP per capita as a measure of growth. They found evidence that supported a relationship between financial development and economic growth, with the direction being from financial development to economic growth. The result indicates that, contrary to what happens in the Japanese economy, financial development drives economic growth in the UK.

Park and Ratti (2000) also examined the dynamic interdependencies for inflation, real economic activity, monetary policy and stock returns by adopting the VAR model using monthly U.S. data from 1955 to 1998 and concluded that shocks due to the monetary contraction raise statistically significant changes in expected real stock returns and inflation and that these movements are not found in opposite directions.

Herriott and Durham (2001) undertook a fascinating empirical investigation of the connection

between financial development and economic growth in Switzerland, using quarterly time-series data from 1990 to 1999. He used a vector auto-regressive (VAR) estimation framework to specify the model. Herriott and Durham (2001) also used the variable real GDP as a proxy for economic growth and three measures of stock market development (market capitalisation, stock market volume divided by market value and stock market volume divided by GDP) and one measure of the banking sector development (M1). Beltratti and Morana (2006) investigated the relationship between the stock market volatility and macroeconomic variables using S&P500 data from 1970 to 2001. Macroeconomic fundamentals were money supply, interest rate, inflation and industrial production. Hondroyiannis, Lolos and Papapetrou (2004) employed a vector auto-regressions (VAR) model in their time-series study to investigate Greece's financial development/economic growth relationship and found the existence of a relationship. Their study utilised monthly time-series data from 1986 to 1999. Their results indicate a two-way causal relationship between the financial development proxies and growth in the long run. It, however, shows that the effect from the stock market measure was smaller than the effect from the bank measure on economic growth. In another study, Chaudhuri and Smiles (2004) investigated the empirical relationship between real aggregate economic activity and real Australian market stock prices, applying Johansen's multivariate cointegration methodology. They confirmed that real stock return in Australia was correlated to short-term departures from the long-run relationship and varied in real macroeconomic activity.

Thangavelu and Jiunn (2004) obtain contrasting results after employing a vector auto-regressions (VAR) model to examine Australia's relationship between financial development and economic growth.

Similar results were obtained by Van Nieuwerburgh, Buelens and Cuyvers (2006) after an extensive empirical investigation of the long-term relationship between stock market development and economic growth in Belgium using annual time-series data for 1830 to 2000.

Gan et al. (2006) examined the relationships between the New Zealand Stockmarket Index and seven macroeconomic indicators such as CPI, real GDP figures, and domestic retail oil price (ROIL), employing Cointegration from January 1990 to January 2003 tests and Granger-causality test. The analysis showed a long-run relationship between the macroeconomic variables tested and New Zealand's stock market index

Yang and Yi (2008), using annual Korean data from 1971 to 2002, examined the financial development/economic growth relationship in the Korean economy. The study's findings provide evidence that financial development causes economic growth, and that is, there is a one-directional relationship between the stock market and economic growth, running from the stock market to grow.

Chang (2009) employed the GJR-GARCH model and analysed macroeconomic variables' effect on stock return movements in the U.S stock market using monthly data from January 1965 to July 2007. His macroeconomic variables were interest rate, dividend yield, and default premium.

Antonios (2010) also obtained similar results applying the Johansen cointegration and Granger causality tests within the Vector Error Correction Model (VECM), which examined Germany's relationship between stock market development and economic growth. His analysis covered 1965 to 2007 using the stock market overall price index, gross domestic product (GDP) and bank lending rate.

Sariannidis et al. (2010) investigate the impact of several macroeconomic variables on the Dow Jones Wilshire 5000 indexes and Dow Jones Sustainability, using a GARCH model and monthly data from January 2000 to January 2008. The results revealed that changes in returns of crude oil prices inversely affect the U.S. stock market, divergent to the changes in returns to the 10-year bond

price that affect it positively.

## 3. Research Methodology

The study covers 10 years from Jan 2008 to Dec2017. Monthly closing prices of the select indices of India, Japan, China, Hong Kong and Singapore are taken for research. The selected indices are BSE Sensex, Nikkei225, SSE Composite, HangSeng and Straits times index. The data collected is secondary data. Month wise Closing share prices from January 2008 to December 2017are collected for the study. Monthy data about the select macroeconomic variables such as Export Growth, Import growth, Trade balance, Inflation, Broad money growth, and Exchange rate were collected from the World Bank and ADB database. The share prices were collected from yahoo finance. co and money control.com. Apart from this, various journals, magazines, and articles have been referred to as relevant information. The closing prices are then converted into long-returns; the macroeconomic variables are then tested for stationarity using the Augmented Dickey-Fuller test (ADF), Granger causality test, Johansen cointegration test the short-run and long-run cointegration between the variables. To illustrate the implication of relationships among macroeconomic variables and stock indices.

### 3.1. Objectives of the study

1. To analyse the impact of the selected macroeconomic variables on the selected Asian Stock market returns.
2. To analyse the short-run and long-run -equilibrium relationship of the macroeconomic variables on Asian stock market returns.
3. To analyse the responsiveness of the selected macroeconomic variables on stock returns.

### 3.2. Hypothesis tested

1. $H_0$ –Macroeconomic variables do not Granger cause Asian Stock returns
2. $H_0$-There is no long-run relationship among the macroeconomic variables and Asian Stock returns

## 4. Analysis and Interpretation

To conduct a time-series analysis, it is essential to determine the stationary of the data series because if a linear combination of the variables is stationary and integrated of the same order, it indicates that a long-term relationship can exist between the variables of a data series. With this expectation, unit root tests are conducted for the data series of this study. The above summarises the Augmented Dickey-Fuller Test results for all the selected macroeconomic variables. The results of the ADF test indicates that the Null hypothesis of non-stationarity for the data series of India cannot be rejected at any significance level under the ADF test. In the case of the first difference of these variables, the null hypothesis of non-stationarity is rejected by the ADF test at a 1% significance level for all the variables. This implies that the variable has two unit-roots, and hence to integrate order 1, they are differenced a second time. Hence are integrated at I(1).

In the case of Japan, the null hypothesis of non-stationarity cannot be rejected at any significance level under the ADF test in the case of all macro-economic growth except export and import growth

at their levels. In the case of the first difference of these variables, the null hypothesis of non-stationarity is rejected by the ADF test at a 1% significance level for all the variables except Trade balance which has attained stationarity after differencing the variable for the second time.

**Table 1:** Test for Unit Root among the selected macro economic variables

| **India** | **Constant** | | **Constant and trend** | |
|---|---|---|---|---|
| | Level | Diff1 | Level | Diff1 |
| Exporgrowth | -2.303 | -14.88 | -2.146 | -14.883 |
| Importgrowth | -3.251 | -12.45 | -3.181 | -12.435 |
| Tradebalance | -4.958 | -11.266 | -4.949 | -11.22 |
| Inflationrate | -2.024 | -8.296 | -3.874 | -8.27 |
| Broadmoneygrowth | -2.026 | -14.09 | -5.16 | -14.109 |
| Exchangerate | -1.549 | -8.164 | -2.219 | -8.195 |
| Japan | **Constant** | | **Constant and trend** | |
| | Level | Diff1 | Level | Diff1 |
| Exporgrowth | -4.207 | -4.64 | -4.158 | -4.664 |
| Importgrowth | -4.107 | -4.693 | -3.983 | -3.627 |
| Tradebalance | -1.232 | -2.422 | -7.802 | -1.201 |
| Inflationrate | -2.161 | -7.991 | -2.38 | -7.98 |
| Broadmoneygrowth | -3.081 | -6.119 | -3.942 | -6.216 |
| Exchangerate | -1.213 | -7.856 | -2.24 | -7.926 |
| China | **Constant** | | **Constant and trend** | |
| | Level | Diff1 | Level | Diff1 |
| Exporgrowth | -2.72 | -19.239 | -2.774 | -10.678 |
| Importgrowth | -2.766 | -15.995 | -2.776 | -15.942 |
| Tradebalance | -5.113 | -10.963 | -6.395 | -10.915 |
| Inflationrate | -2.098 | -11.044 | -2.601 | -11.181 |
| Broadmoneygrowth | -0.971 | -10.293 | -2.208 | -10.297 |
| Exchangerate | -2.075 | -6.572 | -1.615 | -6.774 |
| Hongkong | **Constant** | | **Constant and trend** | |
| | Level | Diff1 | Level | Diff1 |
| Exporgrowth | -9.161 | -10.948 | -9.142 | -10.904 |
| Importgrowth | -2.781 | -11.158 | -3.1 | -11.1 |
| Tradebalance | -2.513 | -9.7 | -2.435 | -7.573 |
| Inflationrate | -3.175 | -12.098 | -3.091 | -12.089 |
| Broadmoneygrowth | -3.368 | -11.22 | -3.454 | -11.174 |
| Exchangerate | -2.728 | -8.965 | -1.918 | -9.06 |
| Singapore | **Constant** | | **Constant and trend** | |
| | Level | Diff1 | Level | Diff1 |
| Exporgrowth | -2.293 | -14.98 | -2.179 | -14.962 |
| Importgrowth | -3.851 | -4.838 | -3.803 | -4.878 |
| Tradebalance | -3.75 | -8.829 | -4.881 | -8.806 |
| Inflationrate | -1.396 | -4.524 | -1.95 | -4.432 |
| Broadmoneygrowth | -1.98 | -10.273 | -2.512 | -5.704 |
| Exchangerate | -1.919 | -7.237 | -1.874 | -7.215 |

(Source: Researcher's estimate using E views 10)

In the case of China, the null hypothesis of non-stationarity cannot be rejected at any significance level under the ADF test in the case of all macro-economic variables except Trade balance at their levels. In the case of the first difference of these variables, the null hypothesis of non-stationarity is rejected by the ADF test at a 1% significance level for all the variables which has attained stationarity after first differencing. Hence are integrated at I(1).In the case of Hong Kong, the null hypothesis of non-stationarity cannot be rejected at any significance level under the ADF test in the case of all macro-economic variables except Export Growth at their levels. In the case of

the first difference of these variables, the null hypothesis of non-stationarity is rejected by the ADF test at a 1% significance level for all the variables that have attained stationarity after first differencing. Hence are integrated at I(1).In Singapore, the null hypothesis of non-stationarity cannot be rejected at any significance level under the ADF test in the case of all macro-economic variables except import growth at their levels. In the case of the first difference of these variables, the null hypothesis of non-stationarity is rejected by the ADF test at a 1% significance level for all the variables which has attained stationarity after first differencing. Hence are integrated at I (1).

### 4.1. Granger causality test

The results of the pairwise granger causality between the stock returns and the macroeconomic variables for India, Japan, China, Hong Kong and Singapore are given in Appendix1. The results of the Granger causality test with the F-statistic values and its associated probability values are given. The results of the Granger test were tested at a lag length of 2 .based on the results of the test, the relationship is directional in the case of Export growth and Import growth and unidirectional in the case of trade balance and exchange rate in the case of India.

The relationship is unidirectional in the case of Export growth, Import growth, Trade balance, broad money growth and exchange rate. In the case of Japan, unidirectional in case of, Import growth, Inflation rate and no causal relationship with other variables for China, unidirectional in case of Broad Money growth and Exchange rate and no causal relationship with other variables in case of Hong Kong and the case of Singapore all the macroeconomic variables does not Granger Cause STI returns and vice –versa.

### 4.2. Johansen cointegration test

To investigate the presence of a long-run equilibrium relationship between the stock price index and the macroeconomic variables, the Johansen cointegration test is used in this study. This method applies the maximum likelihood technique to a VAR model to determine the presence of co-integrating vectors in a non-stationary time series through two likelihood ratio tests of trace test and maximum eigenvalue test. After ensuring that all the series are I(1), the integration test is used to find any cointegration relationship between stock prices and the select macroeconomic variables. The results of the Johansen cointegration test shows one cointegration relationship is found in India, whereas Japan and China have four cointegration relationships. Three co-integrating relationships are found in the case of Hong Kong and Singapore. Hence, there is a significant long-run correlation between stock prices and macroeconomic variables in Japan, China, Hong Kong and Singapore, but significant relation exists in India.

The table2 indicates the rejection of the null hypothesis of no co-integrating vector, at most one co-integrating vector in the case of India and most four co-integrating vectors in the case of Japan and China and three co-integrating vectors in the case of Hong Kong and Singapore at 5% significance level under the Trace test. The cointegration relationship is also justified with the Max Eigen Test values.

Variance Decomposition is another way to analyse VAR model results. It distinguishes the part of the information that one variable contributes to others. The whole error term consists of the

shocking part of the information that affected the variable's own lags, and the information came from other variables' exogenous shocks. Therefore, variance decomposition is used to identify the proportion of other variables. The forecast error variance decomposition measures the percentage of the variance of an endogenous variable that can be attributed to a shock in itself or to another endogenous variable.

**Table2**. Showing results of Johansen Cointegration Test for Asian Stock Marker returns and select macroeconomic variables

| Country | | Trace test | 0.05Critical value | Max- Eigen Statistic | 0.05Critical value |
|---|---|---|---|---|---|
| India Sensex | r=0 | 143.5 | 125.61 | 49.43 | 46.23 |
| | r≤1 | 94.07 | 95.75 | 32.33 | 40.077 |
| | r≤2 | 61.74 | 69.81 | 23.67 | 33.87 |
| | r≤3 | 38.06 | 47.85 | 18.83 | 27.58 |
| | r≤4 | 19.23 | 29.79 | 12.97 | 21.13 |
| | r≤5 | 6.25 | 15.49 | 5.495 | 14.26 |
| | r≤6 | 0.76 | 3.84 | 0.76 | 3.84 |
| Japan Nikkei 225 | r=0 | 189.58 | 125.61 | 65.84 | 46.231 |
| | r≤1 | 123.74 | 95.75 | 46.72 | 40.077 |
| | r≤2 | 77.02 | 69.81 | 24.36 | 33.87 |
| | r≤3 | 52.65 | 47.85 | 23.58 | 27.58 |
| | r≤4 | 29.06 | 29.79 | 16.69 | 21.13 |
| | r≤5 | 12.36 | 15.49 | 9.41 | 14.26 |
| | r≤6 | 2.92 | 3.84 | 2.95 | 3.841 |
| China SSE Composite | r=0 | 193.58 | 125.61 | 63.43 | 46.23 |
| | r≤1 | 130.14 | 95.75 | 44.87 | 40.07 |
| | r≤2 | 85.27 | 69.81 | 37.36 | 33.87 |
| | r≤3 | 47.9 | 47.85 | 24.52 | 27.58 |
| | r≤4 | 23.38 | 29.78 | 17.21 | 21.13 |
| | r≤5 | 6.16 | 15.49 | 5.68 | 14.26 |
| | r≤6 | 0.48 | 3.84 | 0.48 | 3.84 |
| Hongkong Hang Seng | r=0 | 176.87 | 125.61 | 55.04 | 46.23 |
| | r≤1 | 121.82 | 95.75 | 48.84 | 40.07 |
| | r≤2 | 72.98 | 69.81 | 30.05 | 33.87 |
| | r≤3 | 42.92 | 47.85 | 27.65 | 25.58 |
| | r≤4 | 15.27 | 29.79 | 11.77 | 21.13 |
| | r≤5 | 3.49 | 15.49 | 2.87 | 14.26 |
| | r≤6 | 0.62 | 3.84 | 0.62 | 3.84 |
| Singapore STI | r=0 | 153.16 | 125.61 | 45.79 | 46.23 |
| | r≤1 | 107.37 | 95.75 | 33.7 | 40.07 |
| | r≤2 | 73.66 | 69.81 | 27.29 | 33.87 |
| | r≤3 | 46.37 | 47.85 | 25.98 | 27.58 |
| | r≤4 | 20.39 | 29.79 | 14.53 | 21.13 |
| | r≤5 | 5.85 | 15.49 | 3.26 | 14.26 |
| | r≤6 | 2.59 | 3.84 | 2.59 | 3.84 |

(Source: Researcher's estimate using E views 10

In the short run, the shock to BSE returns can contribute 88.46% on its own, and the shock, in the long run, has decreased by 5%, and the shock of other macroeconomic variables causes only minimal fluctuation in BSE returns. In the case of Japan in the short run, the shock to Nikkei 225 returns can contribute 95.21% on its own, and the shock, in the long run, has decreased by 4%. The shock of other macroeconomic variables causes only minimal fluctuation in Nikkei 225 returns. In the case of China, in the short run, the shock to SSE Composite returns can contribute 90.27% on its own, and the shock, in the long run, has decreased by 15%, and the shock of other macroeconomic variables causes only minimal fluctuation in SSE Composite returns. In the case of Hong Kong, in the short run, the shock Hang Seng returns can contribute 4.31% on its own, and the shock, in the long run, has decreased by 7%, and the shock of other macroeconomic variables causes only minimal fluctuation in Hang Seng returns. In the case of Singapore, in the short run, the shock to STI returns can contribute 94.75% on its own, and the shock, in the long run, has decreased by 2%, and the shock of other macroeconomic variables causes only minimal fluctuation in STI returns.

## 5. Conclusion

The present study examined short and long term relationships among the selected macroeconomic variables, such as Export Growth, Import growth, Trade balance, Inflation, Broad money growth and exchange rate about the Asian stock market returns of India, Japan, China, Hong Kong and Singapore. Through the statistics of the trace and the maximum eigenvalue, the tests revealed the existence of at least one cointegration vector. Cointegration relationship is found in India, whereas Japan and China have four cointegration relationships. Three co-integrating relationships are found in the case of Hong Kong and Singapore. Hence, there is a significant long-run correlation between stock prices and macroeconomic variables in Japan, China, Hong Kong and Singapore, but significant relation exists in India. The Granger causality test was applied to observe any causal connection and causation movement between selected macroeconomic indicators and Asian stock market indices. The relationship is directional in the case of Export growth and Import growth and unidirectional in the case of trade balance and exchange rate in the case of India.

The relationship is unidirectional in the case of Export growth, Import growth, Trade balance, broad money growth and exchange rate. In the case of Japan, unidirectional in case of, Import growth, Inflation rate and no causal relationship with other variables for China, unidirectional in case of Broad Money growth and Exchange rate and no causal relationship with other variables in case of Hong Kong and the case of Singapore all the macroeconomic variables does not Granger Cause STI returns and vice –versa. This paper is limited to only certain selected macroeconomic variables; future researchers should include more economic variables such as gold price, oil price, GDP etc., to provide more insights into the research. Further, more robust and consistent estimates of the effects of macroeconomic variables on stock market returns could be attained by employing the vector error correction and cointegration analysis. The methodology provides both the short-run and long-run estimates of the effects of macroeconomic variables on stock market returns. This provides another avenue for future research in the domain of the Asian market.

The results of the variance decomposition analysis explain that the changes in returns of the selected indices such as BSE Sensex, Nikkei225, SSE Composite, Hang Seng and STI are influenced by their own shock, and the shock of the selected macroeconomic variables cause only minimal fluctuations in the returns, and similarly the impulse or the shock to the macro variables and in turn caused by its own fluctuations both in the short run and in the long run. Hence the results clearly explain that the fluctuation in the Asian stock returns is influenced by themselves and hence are not dependent on the changes in the macroeconomic variables and vice versa. But the markets can be vulnerable to external shocks, which can seriously complicate the macroeconomic

policy management, hindering their growth in the long run. Hence, policymakers can identify where these economies can further diversify economically to cope with the vulnerability of external shocks. Policymakers need to accelerate efforts to make the international financial system more stable and crisis resilient. Much has been achieved in this respect since the worldwide monetary crisis, but as important deficiencies in regulatory and supervisory frameworks continue, the international financial system remains susceptible to booming and busting cycles, which can entail important economic and social expenses in the brief term.

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