ANALYZING THE IMPACT OF MACROECONOMIC VARIABLES ON STOCK MARKET: A JAPANESE PERSPECTIVE

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Abstract

Stock markets are important indicators of any economy. The soundness of any economy is reflected by growth and development of its capital markets in general and stock markets in particular. Japanese stock exchange being the world's second largest stock exchange has grown by leaps and bounds after 2nd world war. Japanese stock exchange is an important stock exchange of the world. This paper investigates the impact of some macroeconomic variables like consumer price index, foreign stock market index & yen/USD exchange rate on stock market efficiency of japan for the period April 2007 to March 2013. The study relies on ADF test, correlation analysis and descriptive statistics to validate and interpret the results thereof. The study has found there is strong positive correlation between selected macroeconomic variables and stock market efficiency. The authorities are expected to pursue economic growth, fiscal discipline and a relatively low interest rate to expected inflation rate.

Key Words: Stock Market index, Exchange rate, CPI, Foreign stock market, ADF test, Correlation Analysis, Descriptive Statistics.

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INTRODUCTION

Japan is world's second largest economy. It has phenomenal track record in terms of growth and development. It has grown by leaps and bounds. The Tokyo stock exchange is one of the biggest trading places in the world and a symbol of innovation and technological progress. With trading being completely computerized already in 1999, it has almost 2500 companies registered most of which are combined into renowned NIKKEI-225. Tokyo stock exchange was first in the world to achieve a completely automatic trading procedure. Tokyo stock exchange is major stock exchange of Asia-Pacific region influencing most of its neighboring stock markets. The NIKKEI average hit its highest point on December 29, 1989 reaching 38957.44 and then closing at a slightly lower 39915.56.Now the critical question is whether the decades old development or recent degradation are in any way influenced by domestic and international macroeconomic fundamentals. Mukherjee and Naka(1995) stated that Tokyo stock exchange is positively associated with Industrial production, Money supply, YEN/USD exchange rate. Yen and chi(2009) stated that stock returns and inflation in japan do not show a long term relation or negative co-movement in the short run. There are several other studies regarding interaction of share market returns and macroeconomic variables and all studies provide different conclusion related to their test and methodology.

LITERATURE REVIEW

In the past decades, many industry researchers, financial analysts and practitioners have attempted to predict the relationship between stock markets movement and macroeconomic variables. They have conducted empirical studies to examine the effect of stock price on macroeconomic variables or vice-versa or relationship between the two and the results of all those studies have provided different conclusions according to the combination of variables, methodologies and tests used. Here some previous research works/papers and their empirical conclusions that are related to analysis are discussed:

1. **Mahmood and Dinniah (2009**) show that the stock market index, the exchange rate, inflation rate and the industrial production in japan are co-integrated in the long run but doesn't have a co-integration relationship in the short run.
2. **Yen and Chi (2009)** report that the real stock returns and inflation in japan donot show a long term relationship or negative co-movement in the short run.

3. **Mukherjee and Naka (1995)** reveal that Tokyo stock exchange (TSE INDEX) is positively associated with Industrial production, the Money supply, YEN/USD exchange rate, call money rate and is negatively affected by CPI and long term Government bond yield.
4. **Hamao (1998)** reveals that the Japanese stock market index is significantly affected by a change in the expected inflation rate and an unexpected change in risk premium and the slope of term structure is weakly affected by industrial production and terms of trade and is not affected by an unanticipated change in the oil price.
5. **Fama** (1981, 1982) and many other research studies like Fama and Schwert(1977), Gallagher and Taylor(2002), Geske and Roll(1983) empirically found that the stock returns are negatively affected by both expected and unexpected inflation.
6. **Stone and Ziemba (1993)** studied the stock and land prices in japan. The summary of their analysis says that the stock prices and land prices are highly correlated. Stock prices are more volatile than land prices. Stock returns lead land returns.
7. **Kwan and Shin (1999)** applied Engle-Granger co-integration and Granger Causality tests from the VECM and found that the Korean stock market was co-integrated with a set of macroeconomic variables.
8. **Ma and Kao (1990)** examined stock price reactions to exchange rate changes. A case of six developed countries like UK, Canada, France, Italy, West Germany and Japan was studied and it was found that there are two possible impacts of changes in a country's current value on stock price movements. Firstly, the financial effects of exchange rate changes on transaction exposure. Secondly, the economic effect from exchange rate changes suggests that, for an export dominant country, the currency appreciation reduces competitiveness of export markets and has negative effect on domestic stock market. On the other hand, the currency appreciation will lower import costs and generate a positive impact on the stock market.
9. **Choi and Prasad (1995)** estimated a model of firm valuation to examine the exchange risk sensitivity of firm value. The study reveals that approximately 60% of the firms with significant exposure benefitted and 40% lost, with a depreciation of dollar. It is also found that the exchange rate factor is less important in explaining the industry portfolio.

10. **Chamberlin *etal (1997)*** examined the foreign exposure of a sample of United States and Japanese Banking firms. The analysis reveals that stock returns of approximately 1/3 of thirty large U.S bank holding companies appear to be sensitive to exchange rate changes, whereas few Japanese bank return appear to be sensitive to exchange rate changes.

OBJECTIVES OF THE STUDY

1. To investigate the impact of Consumer Price index (CPI) on Japanese Stock Market Index.

2. To investigate the impact of Foreign Stock Market index (S&P 500) on Japanese Stock Market Index.

3. To investigate the impact of YEN/USD exchange rate on Japanese Stock Market Index.

HYPOTHESIS

H0: There is significant relationship between selected macroeconomic variables and Japanese Stock Market Index.

H1: There is no significant relationship between selected macroeconomic variables and Japanese Stock Market Index.

RESEARCH METHODOLOGY

The study has heavily relied on academic journals, books and research papers for obtaining the relevant data. For the purpose of analyzing the relationship between selected macroecoeconomic variables and Japanese stock market index, the monthly stock prices of Tokyo Stock Exchange for the period April 2007 to March 2013 are taken into account. The data has been obtained from the official website of Tokyo Stock Exchange. For the purpose of study, three macroeconomic variables like Consumer Price Index, YEN/USD exchange rate and Foreign Stock Market Index (represented by S&P 500) are taken into consideration. The following methods are used to test the relationship between selected Macroeconomic variables and Japanese Stock Market Index. The computations in the present study are aided by Eviews 6.0:

- The ADF test is used to find the stationarity of data.

- The Correlation analysis is used to analyze the relationship between the selected macroeconomic variables and Stock market index.
- The Descriptive Statistics technique is used to check the data for normality.

ANALYSIS AND DISCUSSION

Table 1:Results of ADF Test

VARIABLE	Level		
	ADF t-statistic	Critical Value @ 5%	Probability
TOKYO STOCK INDEX	-2.428740	-2.902953	0.1376
DOLLAR	-2.063931	-2.902953	0.2597
CPI	-1.634870	-2.903566	0.4596
S&p500	-1.106910	-2.902953	0.7089

d Dickey Fuller Test

One of the common methods to find whether a time series is stationary or not is the unit root test. There are numerous unit root tests. One of the most popular among them is the Augmented Dickey-Fuller (ADF) test. Augmented Dickey -Fuller (ADF) is an extension of Dickey -Fuller test. Following equation of ADF test checks the stationarity of time series data:

$$\Delta Y_t = \alpha + \beta T + \rho Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + e_t$$

where Y_t is the variable in period t, T denotes a time trend, Δ is the difference operator, e_t is an error term disturbance with mean zero and variance σ^2, and k represents the number of lags of the differences in the ADF equation. The ADF is restricted by its number of lags. It decreases the

power of the test to reject the null of a unit root, because the increased number of lags necessitates the estimation of additional parameters and a loss of degree of freedom. The test for a unit root is conducted on the coefficient of y_{t-1} in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that y contains a unit root is rejected. Rejection of the null hypothesis denotes stationarity in the series.

The ADF tests are presented in Table 1.The ADF test done on time series data of Tokyo stock exchange reveals that the t-statistic is less negative compared to test critical value at 5% (-2.902953). Also the probability of accepting the null hypotheses (H0 data is non-stationary) is greater than 5% (13.76%), therefore in both the cases, it is concluded that the stock exchange is non-stationary.

The results of ADF test for S&P 500 is also presented in table 1. Here again the ADF t-statistic is less negative compared to critical value at 5% with the probability of accepting null hypotheses (H0) being greater than 0.05. It is therefore concluded that S&P 500 time series data is non-stationary.

The ADF test for YEN/USD exchange rate is presented in table 1. Here also null hypotheses stands accepted as probability is greater than 0.05.

The results of ADF test for CPI is presented in table 1. Here also the ADF t-statistic is less negative compared to critical value at 5%. Also probability is 0.45whihich is higher than 0.05. Therefore the data is non-stationary.

Correlation Analysis

Correlation is generally used to determine the strength of relationship among any two variables. The test is relevant here as the current study aims to analyze the correlation (strength of correlation of relationship between Tokyo Stock Exchange and three macroeconomic variables like CPI, S&P 500 index, YEN/USD Exchange rate). The value of correlation coefficients ranges from -1 to +1. The value of +1 reflects perfect positive correlation. Similarly value of -1 and 0 reflect perfect negative correlation respectively. The study has employed Karl Pearson's

correlation method to analyze the variables and interpret the results thereof which have been presented in table 2.

Table 2:Results of Correlation Analysis

		CPI	TSE Index	YEN/USD Exchange rate	S&P 500
CPI	Pearson Correlation	1	.369**	.667**	-.158
	Sig. (2-tailed)		.001	.000	.185
	N	72	72	72	72
TSE Index	Pearson Correlation	.369**	1	.855**	.601**
	Sig. (2-tailed)	.001		.000	.000
	N	72	72	72	72
YEN/USD Exchange rate	Pearson Correlation	.667**	.855**	1	.203
	Sig. (2-tailed)	.000	.000		.088
	N	72	72	72	72
S&P 500	Pearson Correlation	-.158	.601**	.203	1
	Sig. (2-tailed)	.185	.000	.088	
	N	72	72	72	72

**. Correlation is significant at the 0.01 level (2-tailed).

The results of correlation analysis clearly reveal that there is positive correlation if not perfect between selected macroeconomic variables and Japanese Stock Market Index. The Karl Pearson's correlation coefficient of two variables (TSE data & CPI is 0.36, while the coefficient between TSE time series data & YEN/USD exchange rate is 0.855. Also the correlation between TSE time series data & S&P 500 stands at 0.601. this clearly reveal that the TSE is highly affected by YEN/USD Exchange rate compared to other macroeconomic taken for study.

Descriptive Statistics

Table 3:- Results of Descriptive Statistics

The results of Descriptive Statistics are presented in Table 3.As clear from the table, the Skewness and Kurtosis coefficient for TSE Index are 1.274927 and 3.556740, which clearly means that the given distribution is positively skewed and slightly leptokurtic. Also, the

Descriptive Statistics	TSE Index	YEN/USD	CPI	S&P 500
Mean	10929.29	92.6785	100.4514	1243.471
Median	9894.470	90.25500	100.2500	1290.725
Kurtosis	3.556740	2.413703	3.630515	2.590312
Skewness	1.274927	13.06772	1.052593	-0.609417
Jarque-Bera Statistic	20.43514	4.960208	14.48731	4.960208
Probability (Jarque-Bera Statistic)	0.000037	0.0083735	0.000715	0.0083735

probability for the Jarque Bera Statistic is only 0.000037 which is less than 0.05 (level of significance) so it can be concluded that the data is not normal and hence not random. Also an analysis of this test clearly reveals that while the YEN/Dollar Exchange rate is highly positively skewed, CPI is slightly positively skewed and S&P 500 is marginally negatively skewed. The coefficient of Kurtosis for the three economic variables i.e. YEN/USD Exchange rate, CPI and S&P 500 is 2.413703, 3.630515 and 2.590312 respectively. This in other words means that while the CPI is slightly leptokurtic while the other two are platykurtic. All in all, it is concluded that none of the variables taken for the study follows the characteristics of a normal distribution.

Conclusion

The present study is an attempt to analyze the impact of three macroeconomic variables like CPI, YEN/USD Exchange Rate & S&P 500 Index on the Japanese Stock Market Index. The authors have relied on number of parametric and non-parametric tests like ADF test, Correlation Analysis & Descriptive Statistics. The tests clearly reveal that Tokyo Stock Exchange is highly influenced by selected macroeconomic variables. Out of the selected macroeconomic variables, it is YEN/USD Exchange rate that influences Tokyo Stock Exchange the most, followed by S&P 500 & CPI. ADF test clearly reveal that most the variables move in random manner and

therefore seldom can be controlled which in other words means that variability to TSE Index is caused by the macroeconomic variables which are themselves random. The study has opened gates to new areas of research which can aim to find the impact of other macroeconomic variables like WPI, Gold price, Crude oil, etc. on Stock Exchanges of Japan

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