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RELATIONSHIP BETWEEN TWO GIANT EAST ASIAN COUNTRIES' EXCHANGE RATES AND STOCK PRICES IN INDIA

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ABSTRACT

The broad objective of this study is to analyse the long-term relationship and short term dynamic inter-linkages between two giant East Asian countries' exchange rates and stock prices in India. This paper is based on 10 years' daily data i.e. from 1 Jan 2010 to 31 Dec 2019 of nominal exchange rates of Chinese YAUN, Japanese YEN and daily closing values of Nifty 50. In this study, Augmented Dickey-Fuller (ADF) is applied to test stationarity of data and it is found stationary at first difference. Karl Pearson correlation test is used to find the correlating relationship between the variables and it is found that both the variables are not correlated significantly. Johansen's co-integration test is applied to determine the long-run equilibrium relationship between the variables which revealed that there exist co-integration relationship (long- term balance) between exchange rate and stock prices. Granger causality test is employed to determine the causality and short-term relationship between the variables and the result revealed unidirectional causality running from exchange rate to stock prices, indicates that the volatility that occurred in the exchange rate will cause volatility in stock prices.

KEYWORDS: ***Co-integration, Causality, Exchange rates, Investment, Stock prices***

INTRODUCTION

The issue of whether stock prices and exchange rates are related or not has received considerable attention after the East Asian crises. During the crises the countries affected saw turmoil in both currency and stock markets. If stock prices & exchange rates are related & the causation runs from exchange rates to stock prices, then crises in the stock markets can be prevented by controlling the exchange rates. Also, developing countries can exploit such a link to attract/stimulate foreign portfolio investment in their own countries. Similarly, if the causation runs from stock prices to exchange rates then authorities can focus on domestic economic policies to stabilize the stock market. If the two markets/prices are related, then investors can use this information to predict the behaviour of one market using the information of other market. Thus, we analyse the long-run relationship & short-term dynamic inter-linkages between Indian stock prices and foreign exchange rate.

LITERATURE REVIEW

International Empirical Studies

Numerous international studies were conducted which examined the relationship between

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stock market prices and foreign exchange rate. They are as follows:

Franck and Young (1972) was the first study that examined the relationship between stock prices and exchange rates. They use six different exchange rates and found no relationship between these two financial variables.

Aggarwal (1981) explored the relationship between changes in the dollar exchange rates and change in indices of stock prices. He uses monthly U.S. stock price data and the effective exchange rate for the period 1974-1978. His results, which were based on simple regressions, showed that stock prices and the value of the U.S. dollar is positively related and this relationship is stronger in the short run than in the long run.

Solnik (1987) examined the impact of several variables (exchange rates, interest rates and changes in inflationary expectation) on stock prices. He uses monthly data from nine western markets (U.S., Japan, Germany, U.K., France, Canada, Netherlands, Switzerland, and Belgium). He found depreciation to have a positive but insignificant influence on the U.S. stock market compared to change in inflationary expectation and interest rates.

Soenen and Hanniger (1988) employed monthly data on stock prices and effective exchange rates for the period 1980-1986. They discover a strong negative relationship between the value of the U.S. dollar and the change in stock prices. However, when they analyzed the above relationship for a different period, they found a statistical significant negative impact of revaluation on stock prices.

Mohsen Bahmani- Oskooee and Ahmad Sohrabian (1992) analyzed the long-run relationship between stock prices and exchange rates using co-integration as well as the casual relationship between the two by using Granger causality test. They employed
monthly data on S&P 500 index and effective exchange rate for the period 1973-1988. They concluded that there is a dual causal relationship between the stock prices and effective exchange rate, at least in the short-run. But they were unable to find any long run relationship between these variables.

Eli Bartov and Gordon M.Bodnor (1994) concluded that contemporaneous changes in the dollar have little power in explaining abnormal stock returns. They also, found a lagged change in the dollar is negatively associated with abnormal stock returns. The regression results showed that a lagged change in the dollar has explanatory power with respect to errors in analyst's forecasts of quarterly earnings.

Ajayi and Mougoue (1996) show that an increase in aggregate domestic stock price has a negative short-run effect on domestic currency value but in the long-run increases in stock prices have a positive effect on domestic currency value. However, currency depreciation has a negative short-run effect on the stock market.

Yu Qiao (1997) employed daily stock price indices and spot exchange rates obtained from the financial markets of Hong Kong, Tokyo, and Singapore over the period from January 3, 1983 to June 15, 1994 to examine the possible interaction between these financial variables. His results, based on the Granger causality test, show that the changes in stock prices are caused by changes in exchange rates in Tokyo and Hong-Kong markets. However, no such causation was found for the Singapore market. On the reverse causality from stock prices to exchange rates, his results show such causation for only Tokyo market.

Issam S.A. Abdalla and Victor Murinde (1997) applied co-integration approach to examine the long-run relation between stock price index and the real effective exchange rate for Pakistan, Korea, India and Philippines. They use month data from January 1985 to July 1994. Their study found no long-run relationship for Pakistan and Korea but did find a long-run relationship for India and Philippines. They also examine the issue of causation between stock prices and exchange rates. Using standard Granger causality tests they found a unidirectional causality from exchange rates to stock prices for both Pakistan and Korea.

Clive W.J Granger, Bwo-Nung Huang and Chin Wei Yang (1998) examined the causality issue using Granger causality tests and Impulse response function for nine Asian countries. They use daily data for the period January 3, 1986 to November 14, 1997. The countries included in their study are: Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan. For Japan and Thailand. They found that exchange rates lead stock prices with positive correlation. The data from Taiwan suggests stock prices leads exchange rates with negative correlation. No relationship was found for Singapore and bi-directional causality was discovered for the remaining countries.

Amare and Mohsin (2000) examined the long-run association between stock prices and exchange rates for nine Asian countries (Japan, Hong Kong, Taiwan, Singapore, Thailand, Malaysia, Korea, Indonesia, and Philippines). They use monthly data from January 1980 to June 1998 and employed co-integration technique. The long-run relationship between stock prices and exchange rates was found only for Singapore and Philippines.

Ramasamy and Yeung (2002) examine the links between the foreign exchange and stock markets and their implications for capital controls in six Asian countries over the period 1995–2001 and find that there are inconsistent results for bivariate causality between stock prices and exchange rates.

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Ibrahim and Aziz (2003) employ co-integration analysis and vector auto regression modelling. Authors use monthly data from January 1977 to August 1998. They investigate the interactions between Malaysian equity market and four macroeconomic variables; real output, price level, money supply and exchange rate. Their results show that unstable interactions between the stock prices and exchange rates exist during the crisis period. In addition to this, they note that they doubt whether the Asian crisis has changed the relationships among variables.

Hatemi-J and Roca (2005) selected four countries as a sample; Malaysia, Indonesia, Philippines and Thailand and employed bootstrap causality tests. The authors point out that in the non-crisis period there is a significant interaction between stock prices and exchange rates in all countries with the exception of Philippines.

Pan, Chi-Wing Fok and Y. Liu (2007) investigated the causal relationship between exchange rates and stock prices for Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand. They use data over the period between January 1988 and October 1998. They examined the issue for the two sub periods: before the 1997 Asian financial crisis period and the crisis period. Their results show that causality runs from exchange rates to stock prices for Hong Kong, Japan, Korea, Singapore, Taiwan and Thailand during the Asian crisis. The results indicate that the causality runs from stock prices to exchange rates for Hong Kong, Korea and Singapore while they also observe causality in the opposite direction in Hong Kong, Japan, Malaysia and Thailand in pre-crisis period.

Oguzhan and Erdal (2009) investigate the causal relationship between stock prices and exchange rates, using data from 23 February 2001 to 11 January 2008 about Turkey. The reason of selecting this period is that exchange rate regime is determined as floating in this period. The results of empirical study using VAR model (Sims 1980) indicate that there is bidirectional causal relationship between exchange rate and all stock market indices. Yet, this study doesn't explore the period post subprime crises, and used an old and antic model.

Charles et al. (2011) made a study to investigate the relationship between stock prices and exchange rate movement in seven African countries among Tunisia. They used vector error correction model (VECM) co-integration and impulse response analysis to determine the long and short-run linkages between stock prices and exchange rates. Co-integration analyses indicate 6 a long-run relationship between stock prices and the exchange rate in Tunisia, where exchange rate depreciation drives down stock prices. A short-run error-correction model also shows similar results.

Lu Sui, Lijuan Sun (2016) aimed to examined the dynamic relationship between local stock market returns, exchange rates, the BRICS zone (Brazil, Russia, India, China, and South Africa). The authors have been able to find significant effects between exchange rates and stock market returns by the VAR model, suggesting that exchange rate volatility can affect the performance of a firm or an industrial sector. Thus, an appropriate exchange rate can stabilize the stock market, especially during the financial crisis.

National Empirical Studies

Following are the Indian studies that examined the relationship between stock prices and foreign exchange:

Wu (2000) did a study using stock prices and exchange rates of Singapore and portrayed a unidirectional causality from exchange rates to stock prices. Yamini Karmarkar and G Kawadia tried to investigate the relationship between RS/$ exchange rate and Indian stock markets. Five composite indices and five sectoral indices were studied over the period of one year: 2000. The results indicated that exchange rate has high correlation with the movement of stock markets.

Granger, et al; (2000) examined the relationship between stock prices and exchange rate during January 1986-June 1998 and found that stock market prices of India and exchange rate had not revealed any recognizable pattern of causality between those time series.

Apte (2001) investigated the relationship between the volatility of the stock market and the nominal exchange rate of India by using the EGARCH specifications on the daily closing USD/INR exchange rate, BSE 30(SENSEX) and NSE 50(NIFTY) over the period from 1991 to 2000. The study suggested that there appears to be a spillover from the foreign exchange market to the stock market but not the reverse.

Muhammed and Rasheed (2002) explore the interaction between stock prices and exchange rates for four South Asian countries; Bangladesh, Sri Lanka, India and Pakistan. They perform a co-integration test, error correction modelling and a Granger causality test for the time span between January 1994 and December 2000. However, they find no association between the variables for Pakistan and India while bidirectional long-run causality in the Bangladesh and Sri Lanka data is observed. They conclude that the variables are unrelated in the short-run for the countries that they selected.

Bhattacharya and Mukherjee (2003) investigated Indian markets using the data on stock prices and macroeconomic aggregates in the foreign sector including exchange rate concluded that there is no significant relationship between stock prices and the exchange rates.

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Nath and Samanta (2003) examined the dynamic linkages between the foreign exchange and stock market of India, he employed the Granger causality test on daily data during the period March 1993 to December 2002. The empirical findings of the study suggest that these two markets did not have any causal relationship. When the study extended its analysis to verify if liberalization in both the markets brought them together, it found no significant causal relationship between the exchange rate and stock price movements, except for the years 1993, 2001 and 2002 during when a unidirectional causal influence from stock index return to return in forex market is detected and a very mild causal influence in the reverse direction is found in some years such as1997 and 2002.

Muhammad and Rasheed (2003) examined the relationship between stock prices and exchange rates of four South Asian countries named as Bangladesh, India, Pakistan and Sri Lanka and found that there is no significant relationship between the variables either in short-run or long run in Pakistan and India.

Nath et al; (2003) also examined the dynamic linkages between the stock market prices and foreign exchange rate with Granger causality test for the period from March 1993 to November 1995. The study showed that returns of stock market and foreign exchange rate were not inter-related and pointed out that the stock market returns have causal influence exchange rate returns with possibility of mild influence in reverse direction.

Rahman et al; (2009) examined the interactions between BSE stock prices and exchange rates during January 2003-June 2008 by using Granger causality test and found that there was no causal relationship between stock prices and exchange rate.

Agrawal, Kumar Srivastav and Srivastava (2010) applied Granger causality test to examine the dynamics between Nifty returns and the Indian Rupee-USD exchange rates, using daily data for the period between October 2007 to March 2009. Their results support unidirectional causality running from stock returns to exchange rates with a negative correlation.

Basher, Haug & Sadorsky (2012) used structural vector auto regression model to investigate the relationship between exchange rate and stock prices. The study finally concluded that the increase in oil prices led to decrease in emerging stock market prices and that had resulted with an increase in foreign exchange rate.

Razvan and stefanescu and Ramona Dumitriu (2013) explored that the influence of the foreign exchange rates variations on the returns and volatility of the stock prices from the Romanian capital market for the period of the January 2000-December 2012.It is concluded that influence of foreign exchange rates variation on the returns depend on various factors like capital inflows, the global crisis effects the perceptions of the national economy.

Sinha et al; (2015) studied the effect of exchange rate from the period January 2006-March 2012 on BSE Sensex index, BSE Oil & Gas sector index and BSE IT sector index by using least square regression model and found negative and insignificant interactions between foreign exchange rate and stock returns.

Anshul and Biswal (2016) conducted a study on the relationship between global prices of gold, crude oil, the USD–INR exchange rate, and the stock market in India. Based on the 10-year daily data, they used the DCC-GARCH models (Dynamic Conditional Correlation, Engle (2002)) to study the relationship between the exchange rate and the Sensex30 Indian stock index, which indicates that there is a correlation between these two variables. Their results showed that a depreciation of the Indian Rupee causes a fall in Sensex30. During the same year, Lu Sui, Lijuan Sun aimed to examine the dynamic relationship between local stock market returns, exchange rates, the BRICS zone (Brazil, Russia, India, China, and South Africa). The authors have been able to find significant effects between exchange rates and stock market returns by the VAR model, suggesting that exchange rate volatility can affect the performance of a firm or an industrial sector. Thus, an appropriate exchange rate can stabilize the stock market, especially during the financial crisis

RESEARCH GAP

Though there are number of studies regarding the relationship between stock prices and exchange rates of developed countries still very few studies were conducted in the context of Indian economy, the issue is gaining importance in recent years. In India, though stock market investment does not constitute a very significant portion of total household savings compared to other form of financial assets, it may have a significant impact on exchange rate movement as FII investment has played a dominant role. The results, however, are tentative and there is a need to undertake an in-depth research to address the issue.

Empirical studies also provide contradictory evidence for example, Ibrahim and Aziz (2003), Kim (2003) and Tian and Shiguang (2010) note that there is essentially a long-term equilibrium relationship between stock price and exchange rate. On other hand, Bahmani-Oskooee and Sohrabian (1992), Nieh and Leeb Chung (2001) and Smyth and Nandha (2003) argue that this relationship is merely short term. Mishra (2004) finds that there is no causal relationship between the returns on exchange rate and stock return in India; and Komain contends that stock prices and exchange rates do not exhibit any long run relationship in Thailand. A number of factors have

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influenced the results such as the methodologies used in these studies, the time period of the data and the context specific factors (countries financial regulations and investor preferences and incentives). Due to these mixed results there is a need of study in depth to explore the real relationship between stock market and exchange rate by employing more sophisticated econometric tools. So in this study we will try to explore the relationship between the variables using latest data for 10 years and using latest econometric tools.

Moreover, most of the studies took US dollar as proxy for the foreign exchange rate while in this study we take Chinese YAUN and Japanese YEN as a proxy for exchange rate.

As far as methodology is concerned most of the studies found causal linkages for short term. They used Granger Causality econometric model. In this respect our study is different as we also analyse long term relationship between both the variables using Johensen Co-integration econometric regression model.

As per our best knowledge there is no study in Indian context which analyse lead and lag relationship between stock prices and foreign exchange. So in this study we also analyse this lead and lag relationship if it occurs.

OBJECTIVES OF THE STUDY

1. To investigate the long run relationship between East Asian foreign exchange rate and stock prices in India.
2. To see whether there exist short term causal linkages between the two markets.

DATA

We use 10 years' daily data i.e. from 1 Jan 2010 to 31 Dec 2019 of nominal exchange rates of Chinese YAUN, Japanese YEN and daily closing values of Nifty 50, an index of Indian National Stock Exchange. Chinese YAUN and Japanese YEN has been used as a proxy of East Asian countries' exchange rates. All exchange rates are expressed in terms of local currency i.e. Indian rupee. We transform all the data series into natural log form to smooth the financial series.

RESEARCH METHODOLOGY

We use correlation Test for measuring closeness of a linear relationship between variables. Then we conduct Unit Root Test since the stationary property of a series is the premise for other techniques. The co-integration test measures the relationships between Indian stock market and foreign exchange in the long run while Granger-causality is used to examine the short term aspects. If co-integration is found, it means even if a set of variables are non-stationary, they never drift apart in the long run. In contrast, if they have a lack of co-integration, they have no long-run links.

Correlation Test

There are many possible measures of co-movement, and correlation is a standardized measure of a closeness of a linear relationship between two variables. Correlation is computed into what is known as the correlation coefficient, which ranges between -1 and +1. Two variables that are perfectly positively correlated (a correlation coefficient of +1) move in tandem in the same direction, either up or down. In contrast, perfect negative correlation means that if one variable moves in one direction the other variable that is perfectly negatively correlated will move by an equal amount in the opposite direction. Finding perfect positive or perfect negative correlations is rather unusual; most variables are correlated along the spectrum between more than -1 and less than 1. Two variables that have correlations coefficient of 0 are said to be uncorrelated. In terms of portfolio theory, the concept of correlation is useful if the returns of stock markets are negatively correlated, which stabilizes portfolio returns.

ADF Unit Root Test

Co-integration analysis requires that time series should be integrated of the same order. We will examine stationarity of time series by using unit root tests. We will employ Augmented Dickey-Fuller Test for said purpose. The Augmented Dickey Fuller test examines the presence of a unit root in an autoregressive model. A simple AR (1) model is

$$y_t = \rho y_{t-1} + u_t,$$

Where y_t is the variable of interest, t is the time index, ρ is a coefficient and u_t is the disturbance term. The regression model can be written as:

$$\Delta y_t = (\rho - 1) y_{t-1} + ut = \delta y_{t-1} + u_t,$$

Where, Δ is the first difference operator. This model can be estimated and testing for a unit root is equivalent to testing. $\delta = 0$.

A financial time series is said to be integrated of one order, i.e., I (1), if it becomes stationary after differencing once. If two series are integrated of order one, there may have a linear combination that may be stationary without differencing. If said condition fulfils then these are called co-integrated.

Co-integration Test

Once we have determined that our series are integrated of the same order, we are ready to perform co-integration tests. Johansen-Juselius (JJ) (1990) test is used to find the co-integration vectors. It is based on the maximum likelihood estimation in a VAR model. If we have a set of g variables ($g \geq 2$) which are integrated of first order I (1) and thought to be co-integrated, a VAR model with k lags containing these variables could be set up:

$$y_t = \beta_1 y_{t-1} + \beta_2 y_{t-2} + \ldots + \beta_k y_{t-k} + u_t$$

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For Johansen test to be used, the above VAR needs to be transformed into a vector error correction model (VECM) of the following form:

$$\Delta y_t = \prod y_{t-k} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \ldots + \Gamma_{k-1} \Delta y_{t-(k-1)} + u_t$$

$$\text{where } \prod = (\sum_{i=1}^{k} \beta_i) - I_g \text{ and } \Gamma_i = (\sum_{j=1}^{i} \beta_j) - I_g$$

This VAR model contains g variables in first differenced form on the LHS, and k–1 lags of the dependent variables (differences) on the RHS, with a Γ coefficient matrix. As Johansen test can be affected by the lag length used in the VECM, it is important to select an optimal lag length.

Johansen test centre's around an examination of the Π matrix. In equilibrium, all the Δy_{t-1} will be zero and assuming error terms, u_t, to be at its expected value of zero, we will have $\Gamma y_{t-k} = 0$. From this follows interpretation of Π as a long-run coefficient matrix. The test of co-integration between the variables is calculated by looking at the rank of the Π matrix through its Eigen values (characteristic roots). The number of Eigen values that are different from zero determines the rank of a matrix (Rec, 2009).

There are two test statistics for co-integration under Johansen methodology: trace statistic (λ_{trace}) and the Max-Eigen value statistic (λ_{max}). The test statistics are formulated in the following way:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1 + \hat{\lambda}_i) \text{ , and}$$

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})$$

Where r is the number of co-integrating vectors under the null hypothesis (r=0, 1, k-1), k represents number of variables in the system, T is number of observations, and λ_i^ is the estimated value for the i^{th} ordered Eigen value (characteristic root) obtained from the estimated Π matrix. λ_{trace} is a joint test where the null hypothesis is that the number of co-integrating vectors is less than or equal to r against the alternative hypothesis that there are more than r. λ_{max} conducts separate tests on every Eigen value and the null hypothesis is that the number of co-integrating vectors is less is r against the alternative hypothesis that there is r+ 1 (Rec, 2009).

BIVARIATE CO-INTEGRATION TEST

Bivariate Autoregressive process will indicate pair wise co-integration in between the specified data set of series. This model will determine the level of long run relationship among two variables. This equation is used to know the long run effects of one variable on other variables for the specified study period.

$$W_t = K_0 + \sum_{i=1}^{n} K_i w_{t-i} + \sum_{i=1}^{n} \delta V_{ti} + \varepsilon_t$$

$$U_t = L_0 + \sum_{i=1}^{n} L_i U_{t-i} + \sum_{i=1}^{n} f_i U_{ti} + \varepsilon_t$$

W_t and U_t are the stationary series K_0 and L_0constants

$$U_t = L_0 + \sum_{i=1}^{n} L_i U_{t-i} + \sum_{i=1}^{n} f_i U_{ti} + \varepsilon_t$$

GRANGER CAUSALITY ANALYSIS

According to representation of Granger theorem, if two variables are co-integrated, then there will be at least one direction or unidirectional granger causality must exist which tend to the consequences to find the relationship by error correction model (ECM). Granger causality test is used to determine short term causality relation among variables and direction. So by employing pair-wise Granger causality test technique is helpful to identify each factor causal relationship. Lag is selected to get appropriate results which are user specified. The time series variables are not stationary at I (0) and no co-integration exist among variables then it would be converted by taking first difference I (1) and applied as follows:

$$Q_{prob}(W_{t+n} \mid \Theta_t = Q_{prob}(W_{t+n} \mid \Omega_t)$$

Q prob is conditional probability, Θt information set at time t, on past values of W_{t+n} and ω_t information set containing values for both w_t and U_t for the t period. This is a unrestricted regression equation after while by running this will help to find out the unrestricted residual sum of square (RSSUR) and also eliminate the lagged values of particular macroeconomic variables (MV) at first difference to find the restricted regression to obtain the restricted sum of square (RSSR), then I (1) should be the zero for all values of I.F test is considerable to testify the null hypothesis as follows:

$$F = \frac{RSSR - RSSUR / k\text{-}k0}{RSS / N\text{-}k}$$

If the F-Statistic exceeds the critical value at the selected level of significance or p-value associated with the F=Statistic is less than 0.05then the null hypothesis is rejected with reference to legged variables relevant to regression. This will improve the causality or prediction relationship. Granger Causality model is proposed by C. W. J. Granger (1969) which is more predictive than causation. The test is used to determine the predictions of future based on past values.

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CORRELATION ANALYSIS

The correlation analysis is a basic and simple step to detect the direct relationship between the variables. It provides a preliminary verification for the presence of integration before other tests are conducted. It is a measure how two random variables move in relation to each other. The table below presents correlation coefficients for close prices of Nifty 50, USD and EURO.

Table 1: Correlation Matrix

	NIFTY 50	YAUN	YEN
Nifty 50	1	0.137	0.020
YAUN	0.137	1	0.319
YEN	0.020	0.319	1

The correlation indices matrix in Table 1 shows that Nifty 50 is not significantly correlated with YAUN as well as YEN which means variables are moving independently.

Table 2: ADF Unit Root Test

Variables	Augmented Dickey-Fuller Test Intercept with Trend			
	T Statistic		T Statistic	
	Level	Probability	1st Difference	Probability
L NIFTY 50	-0.887	0.792	-26.976	0
L YAUN	-1.796	0.382	-46.156	0
L YEN	-2.389	0.144	-60.074	0
Critical values of ADF test statistics for 1% and5 % level of significance are -3.4385 and -2.86503 respectively.				

Table 2 shows the results of the Augmented Dickey-Fuller (ADF) test for the sample period. It reports that the log series of indices of blue chip companies are non-stationary at the level form as the absolute T statistic values are less than the absolute critical values at 1% and 5% level of significance. Moreover, p-values associated to their corresponding T-values are greater than 0.05. Hence the null hypothesis of presence of a unit root in the series is accepted. However, they become stationary series in their first difference, as the absolute T statistic values are greater than the absolute critical values at 1% and 5% level of significance, rejecting the null hypothesis of a unit root. Thus, all of our data is integrated of order one i.e. I (1) as discussed in the Methodology section.

BIVARIATE CO-INTEGRATION ANALYSIS

We perform Johansen bivariate co-integration analysis to analyse the long run relationship between Nifty 50 and exchange rates YAUN & YEN.

Table 3: Bivariate Co-integration Test for NIFTY 50 and YAUN

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	Critical Value 0.05	Prob.**
None*	**0.232571**	**967.7786**	15.494	0.000
At most 1	0.000	**2.912229**	3.841	0.087
Trace test indicates no co-integration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 3 reports the result of T-Statistic test. It shows that the T-Statistic values are greater than the Critical value at 5% level of significance. Moreover, p-value is less than 0.05. From analysis we conclude that the variables are co-integrated with each other. Hence, there is long run relationship between Nifty 50 and YAUN in the sample period.

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Table 4: Bivariate Co-integration Test between NIFTY 50 and YEN

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	Critical Value 0.05	Prob.**
None*	0.136631	539.9132	15.494	0.000
At most1*	0.001	5.004	3.841	0.025
Trace test indicates no co-integration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 4 shows that the T-Statistic values are greater than the Critical value at 5% level of significance. Moreover, p-value is less than 0.05. We conclude that the variables are co-integrated with each other. As in case of YAUN, Nifty 50 has also long run relationship with YEN.

Granger Causality Test

Johansen co-integration analysis is able to determine whether the long-run relationship exists between two variables, whereas the Granger causality test helps in determining the short term causation, although causation can run in both directions. According to representation theorem, if two variables are co-integrated then Granger-causality must exist in at least one direction.

Table 5: Granger Causality Analysis for (NIFTY- YAUN) and (NIFTY- YEN)

Null Hypothesis:	F-Statistic	Prob.
YAUN does not Granger Cause NIFTY 50	30.754	6.E-14
NIFTY 50 does not Granger Cause YAUN	0.475	0.6214
YEN does not Granger Cause NIFTY 50	0.688	0.502
NIFTY 50 does not Granger Cause YEN	0.592	0.553

Table 5 indicates the result of Pairwise Granger Causality test for (NIFTY- USD) and (NIFTY- EURO). We find that there is unidirectional casualty, running from YAUN to NIFTY as their corresponding p value is less than 0.05 which means that any change in YAUN affects stock prices of Nifty 50 in short run. Therefore, YAUN is working as a leading variable with reference to Indian stock market.

CONCLUSION

Based on the results of research, it can be take some conclusions as follows:

There is a co-integration relationship between the East Asian exchange rates and stock prices in India. This indicates that the exchange rate and stock prices in India have a relationship of balance and equality movement in the long run. So that in each period of short term, variable exchange rate and stock prices tend to be mutually adjust to achieve its long-term equilibrium. So, for investment purpose there is no portfolio diversification opportunities between the two markets. However, for short term period there exist arbitrage opportunities for investors.

Moreover, there is short term unidirectional causal relationship between Chinese YAUN and stock prices. This indicates that the variations that occur in the exchange rate will cause a variation in stock prices, variation that occurs in the exchange rate will lead to variations in the stock prices. If the exchange rate of the local currency strengthened, the interest from investors to invest in Indian stock markets will be rising and the Indian stock indices will be increasing.

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