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Discovering The Relation Between Stock Prices and Exchange Rates

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Abstract

This paper tries to examine the relation between the USD/INR exchange rate and NSE Nifty50 in India. Further this paper attempts to draw possible theoretical explanations explaining the relation between the two. It is a well known fact that the dollar price or money exchange rate has a great influence on NSE, therefore; this research identifies the level of influence of exchange rate on Nifty50. For establishing the relationship, Regression Analysis has been implemented using excel. The results suggest that the Exchange Rate significantly affects the performance of Nifty50.

Introduction

Although several theoretical and empirical studies have devoted considerable work to find the relationship between financial market development and exchange rates, much disagreement and debate remain on the issue of whether exchange rate volatility affects financial market development. Furthermore, the empirical results obtained are sensitive to the estimation techniques used, the sample of countries used, and the measures of financial depth considered.

As businesses are increasingly interconnected globally, foreign exchange rate movements have been perceived as one of the most important sources of uncertainty to firms' cash flows and profitability. Financial theory predicts that changes in foreign exchange rates affect the value of firms and the dependence structure between stock market and foreign exchange market also assists MNCs, private equity firms, international portfolio managers and policy makers in international investment decision making.

This paper mainly consists of five sections. We start with a rationale for the chosen topic followed by a review of related literature in order to set up an idea about the topic. That is followed by the empirical study and its analysis after which comes the suggestions and the research gap that is identified after analysing the related literature and the empirical results and finally the paper concludes with a short discussion on the possible theory behind the findings.

Rationale

Stock markets and foreign exchange markets are two major sources for investment and to maximize returns on investment. For every country, it is crucial to choose and implement appropriate financial market and exchange rate policies as the dependence structure between stock market and foreign exchange market assists MNCs, private equity firms, international portfolio managers, banks and even individuals in international investment decision making. Moreover, authorities can use the stock prices as a policy tool to attract the foreign portfolio investment by taking stabilising measures for the stock

market.

Therefore, if a relationship does exist between the stock market and exchange rates, the investors could even use information obtained from stock market to predict the behavior of exchange rate or vice-versa. Also, even individuals hold domestic and foreign assets, including currencies, in their portfolio and therefore exchange rates play the role of balancing the demand for and supply of assets. Thus, these reasons give us all the more reason to explore the relation between the stock prices and exchange rates and draw possible explanations for the same.

Objective

Exchange rate uncertainty is considered to be one of the many factors that affect financial market performance and the effect of exchange rate risk on individual countries' macroeconomic variables can follow an ambiguous pattern. Thus, the main purpose of this study is to draw out a relation between the exchange rates and the stock market prices to form possible theoretical explanations explaining the relation between the two variables, if any and to try and verify and justify those explanations via empirical analysis using a suitable methodology.

Review of Literature

Existing literatures help provide a good foundation and knowledge on any topic. They also help us identify inconstancies and gaps in research or open questions left from other research. *Farooq, M. T., & Keung, W. W. (2004)* explore the linkage and directionality between stock prices and exchange rates in the emerging Pakistan stock market using statistical analysis of developing economies, particularly the Karachi Stock Exchange (KSE). Unexpected oscillation in Stock and Forex markets is a phenomenon more common in emerging economies and their relationship has yet to be investigated. In support of this aim, Granger non-causality test is performed in exchange for interesting evidence – this study successfully establishes a unidirectional causality flow from general stock prices to exchange rate, at least in the short term. In the author's analysis, an interesting observation can be made that the exchange rate Granger cause services sector, which suggests that, currency fluctuations effect services index. Hence exchange rate movements can also affect the prices of services sector. Similar results were found in another study conducted by *Mustafa, K. & Nishat, M. (2008)* where the relationship between stock prices and exchange rate in Pakistan has been examined. For the purpose of this study, the author used monthly data from July 1981 to June 2004. The study utilizes the cointegration and error-correction model and Granger trivariate causality techniques to test the causal relationship between exchange rate and stock prices, the results for which suggest unidirectional causal relationship between stock prices and exchange rate and the empirical results indicate that the stock price has negative significant short run causal effect on exchange rate in Pakistan. Moreover, the author also tries to find is there exists a relationship between stock prices and gold and finds none which suggests that Gold is treated as precautionary purpose in Pakistan, whereas equities are used for speculative purpose. The author further suggests that the monetary policy could be used more effectively to check the movement in stock prices in Pakistan by finding that money supply and interest rate also affect the stock prices.

Another study conducted in Pakistan, by *Sohail, N., & Hussain, Z. (2009)* tries to understand long-run and short-run relationships between Lahore Stock Exchange and macroeconomic variables in Pakistan and for the purpose of which, the authors use the monthly data from December 2002 to June 2008. The movements in the stock prices are an important indicator of the economy. The research revealed that

there is a negative correlation between consumer price index and the stock returns, but a positive correlation can be seen be notices between the macroeconomic factors of industrial production index, money supply andmost noticeably the real effective exchange rate which had a significant positive effect on thestock returns in the long-run.

In an attempt to examine if and what dynamic linkages exist exists between the exchange rate, stock prices and interest rate in Pakistan, *Khalid, A. M., & Rajaguru, G. (2006)* collected data from October 1999 to September 2006 for the three variables to conducts the study. The author used high frequency daily data for the three and proceeded to use three different empirical testing procedures to determine if the three markets are interlinked. Although the co-integration tests failed to find a long-run relationship among the three markets, the Granger causality tests, however, found empirical evidence suggesting a causal relation from the currency market, i.e., the exchange rate, to the stock market and from the stock market to the money market, i.e., the interest rate, thus suggesting a link amongst the three markets. However, the reverse relationship does not exist but the reasons for that have not been provided.

Hajilee, M., & Nasser, O. M. A. (2014) investigate the effect of exchange rate uncertainty on stock market development as one of the most important indicators of financial market development. To do this, the authors developed long- and short-run models (a bounds testing approach to cointegration) for twelve emerging economies over the period 1980-2010. Through the study, it was found that exchange rate volatility has a significant effect on stock market development in both the short run and long run in a majority of countries. Despite many similarities among emerging economies, the results obtained in this study suggest that the effect of exchange rate volatility on stock market development works differently for each country via their specific structures and characteristics. In another study, the authors expand their area of research and try to determine the short-run and long-run effects of exchange rate volatility on financial depth in 26 selected countries, which they have classified under developed, developing, and emerging economies over the period 1980-2011. They did this to factor in and confirm with the fact that financial depth increases the power of the financial system of a country and the results were in line with this showing that for 16 countries out of 26, financial depth responds significantly to exchange rate volatility in both short-run and long-run. Moreover, using the bounds testing approach, it can be seen that exchange rate volatility has a significant impact on financial deepening in 20 out of 26 countries in the shortrun.

Quite contrary to the above findings, *Muhammad, N., & Rasheed, A. (2002)* in their research examined the long-run and short-run associations between stock prices and exchange rates for 4 South Asian countries for the period January 1994 to December 2000 by employing error correction modelling approach, monthly data and applied cointegration and standard Granger causality tests and found that there exist no long-run and short-run associations between exchange rates and stock prices for Pakistan and India, while, for Bangladesh and Sri Lanka, only a bi-directional long-run causality was found with no evidence of any short-run association. The results thus suggest that in South Asian countries, the stock prices and exchange rates are unrelated (at least in the short run), therefore, investors cannot use information obtained from one market to predict the behaviour of the other market. But as if to debate with these findings, *Kamal, J. B., & Haque, A. E. (2016)*, in their study analyze the dependence pattern between stock market and foreign exchange market for the period of July 2009 to July 2013, of three South Asian countries using five copula functions, the results of which reveal that the two markets are directly proportional for the most part. Correlation, Kendall's tau and Spearman's rho reveal linear dependence. At thesame time, Copulas reveals upper tail dependence between all pairs. The results from

copula models indicate existence of asymmetric dependence, implying dependence increases in bull market situation which means that the stock market booms when the local currency appreciates.

Kabir, S. H., Bashar, O. K., & Masih, A. M. M. (2014) dived into research upon the case of Malaysia for the time period 1990-2010. In their analysis they considered quarterly time series data and ran cointegration and other tests to showcase that the Malaysian financial market showed high and strong degree of positive correlation not only with exchange rates. Moreover, the study also found that the stock prices were cointegrated with foreign stock prices and indices like the S&P 500 index. However, they stress upon the presence of a stronger relationship between the stock prices and the exchange rate, it also being the leading variable. To support their point further, they used impulse response functions to indicate the presence of a high negative impact of the Asian Financial Crisis on the Malaysian stock prices. The markets of Malaysia were studied in greater detail in a study by *Ibrahim, M. H. (2000).* He analyzed the interaction and looked for the presence of a possible relationship between the exchange rates and stock prices using both bivariate and multivariate models, giving a more elaborate result. The article included three measures of exchange rates—real effective, nominal and RM/US$— to account for deviations and to get unbiased results. The tests found that, considering the bivariate model, there existed no long run relationship between the two variables. But multivariate cointegration was found when accounting for M2 money supply and reserves. The paper pointed towards the need of a concerted stance on monetary and reserve policies for the financial markets stability.

Lee, Y., & Han, K. (2012) studied the impact of foreign stock investments on the host country's financial market and exchange rate, showcasing that they respond in the same way to a change in the investment conditions. Their study considered the data from East Asia for the time period 2007-09, factoring in the period of the global financial crisis, to check for the presence of deviations in results. Not surprisingly, they found that the negative impact that foreign stock investments had during the crisis were heightened and more accentuated than time periods with regular market conditions. They suggest that these investments are potentially destabilizing for the concerned financial markets and exchange rate conditions, more so in times of crisis. The Korean markets were found to be specifically more volatile among the countries in question. The financial crisis period was read into further in the paper by *Jeon, B. N., Zhu, L., & Zheng, D. (2017),* who included the Asian financial crisis of 1997-98 in their research. They used stock data in the firm level and trade-weighted exchange rate as the variable for six emerging economies and examined the exposure of the exchange rates in these economies. They found that exchange rate fluctuations affect individual stock prices at the firm level considerably for each of the six countries. However, they peculiarly found that the two financial crises did not impact the firms the same way. Smaller economies, still emerging, so more significant exchange rate exposures in the Asian financial crisis, while larger economies followed suit in the global crisis later.

The effect of exchange rate fluctuations on the stock market around the Asian financial crisis was further studied by *Mun, K. C. (2008).* The author tried to find how and to what extent exchange rate fluctuations contribute to the international stock market volatility and US local market correlations around the Asian financial crisis using variance decomposition of forecast errors. The results from this model reveal that the exchange rate fluctuation contributes significantly to a higher local equity market volatility and the contribution becomes larger in times of high market volatility, which is consistent with the findings of the above authors. Thus, a positive correlation is drawn between the US market returns and local currency values.

Jeon, B. N., Zhu, L., & Zheng, D. (2017) in another paper examine the effect of changes in the foreign

exchange rate on firms' stock returns in global markets. The author uses daily firm-level data from January 2000 to December 2011 for 14 international markets.The results reveal that changes in the trade-weighted multilateral exchange rate systematically impact individual firms' stock returns for all seven emerging markets and some advanced economies. The study also shows that the stocks in export-oriented economies benefit quite a lot from local currency depreciation. Moreover, in emerging markets, larger firms are affected by exchange rate movements, whereas in advanced markets, smaller firms with limited access to hedging are affected by exchange rate movements to a larger extent.

Dar, A. B., Bhanja, N., & Tiwari, A. K. (2014) in their article analyse whether stock and foreign exchange markets are related to each other uasing the methodology of wavelets. For the purpose of this study, the authors take monthly data from April 1993 to March 2012 for the share prices and the exchange rates. Other than the wavelet cross-correlation and overall cohesion, the Granger causality test is also used to bring out results. The wavelet correlation analysis shows that the relationship between stock return and exchange rate is positive at all the time scales. It is also noteworthy that while most of the earlier studies in India deny a relation between the two markets, the results in this study reveal that the two markets are related. Moreover, it is found that the Indian data are in agreement with the new portfolio approach at some lower scales and with the traditional approach at other lower time scales. Further, it is found that both traditional as well as new portfolio approach hold simultaneously at higher scales.

Azman-Saini, W., Habibullah, M., & Azali, M. (2003) conducted a study to empirically determine the causal relation between the exchange rate and stock price using Thai data. Daily data set for exchange rate and stock price from January 1990 to December 2001 was utilized for the purpose of this study. Using both bivariate and multivariate models, the study reveals a one-way causality running from exchange rates to stock prices in Thailand. An interesting thing to note is that the author brings out a psychological factor that has not been included in any of the models to explain the possibility behind the findings of the analysis. It is that the recent behaviour in Thai financial market may be accurately explained by the psychological factor called as the herding behaviour, also known as the contagion effect which can be interpreted in the following way, as the Thai Baht depreciates, fear among the people rises as they think that the currency might depreciate even further, so people are encouraged to liquidate their shares holding, which ultimately results in the fall ofthe stock prices.

A relatively older study by *Zhu, Z. (1998)* investigates the relationship between stock prices and the real exchange rate in a structural model with an application to the case of France by examining data from the period of 1979 to 1996. By incorporating stock prices in a conventional model, the author was more precisely able to reveal the interactions of stock prices and the real exchange rate. The results from the study show that stock prices and the real exchange rate are cointegrated with each other as well as with other macroeconomic variables. Incorporating stock prices in a model allows us to better understand the interactions among the variables, especially the responses between stock prices and the real exchange rate. Furthermore, the study reveals some interesting dynamics. We do not observe the straight forward negative relationship, instead, the exchange rate responds negatively and then positively.

Bahar, D., Molina, C., & Santos, M. A. (2018) in a study attempt to analyse the impact of Venezuelan currency devaluations on multinational stock prices. For the purpose of the study, the author collected data for 110 MNCs with subsidiaries in Venezuela, from April 2009 to February 2015. The analysis reports that as a response to currency devaluations, there are negative returns to the stock prices of MNCs, thus establishing a positive relationship between the stock prices and the exchange rates. The

analysis also shows negative cumulativeabnormal returns (CARS) to five exchange rate devaluations in Venezuela and the effect of each devaluation on the stock prices shows results that are consistent, although the results are at odds with the predictions of the efficient market hypothesis stating that predictable devaluations should not affect the stock prices of large multinational companies on the day ofthe event, and even less so when they happen in small countries. Similar results can be foundin a study conducted by *Kelilume, I. (2016),* who investigated the effects of exchange rate volatility on firm performance in Nigeria, by examining data over the period of 2004-2013 for the 20 most active companies listed on the Nigerian Stock Exchange. The study developed three dynamic panel models that account for heterogeneity among the companies. In the study, the volatility variable for the exchange rate is obtained by taking the square of the mean adjusted relative change in the official exchange rate. The result of the three estimates revealed that exchange rate volatility has significant negative impacts on the rate of return on assets, asset tum ratio and the portfolio activity & resilience, therefore establishing that significant negative impact of exchange rate volatility on firm performance exists in Nigeria between 2004 and 2013. Overall, the study suggests that the higher the exchange ratevolatility in an economy the less efficient will firms operating in the economy and by implication the lower will be firms' operating performance.

Moore, T. (2007) in his research aims to analyse the effect of the euro on the stock markets of Hungary, Poland and the UK, along with the co-movement of stock prices againstthat of Germany using the daily stock market and exchange rate data starting from January 1999 to January 2005. The author conducts Engle-Granger test which shows a cointegration relationship between the relative stock prices and exchange rates. The overall estimated coefficients hold true both in the long and short run. Moreover, it can observed that the Hungarian stock market outperforms the German stock market when the currency appreciates, whereas the Polish stock market outperforms when the currency depreciates which shows that appreciation of exchange rates may be an appropriate policy for Hungary, versus that of depreciation for Poland in order to stimulate equity finance for the corporate sector. The finding of a cointegration relationship between the domestic stock prices relative to German stock prices and exchange rates suggests that entry to the EMU may, ceteris paribus, lead to stabilise the stock markets for Hungary, Poland and UK.

Hypothesis

H0: Stock performance is not dependent on foreign exchange rate.

H1: Stock performance has significant dependence on foreign exchange rate.

Methodology and Data

For the purpose of the study two variables have been taken i.e., Nifty 50 and Foreign (USD/INR) exchange rate. Out of these, Nifty has been taken as the Dependent Variable (y) and foreign exchange rate as the Independent Variable (x). For evaluating the degree of dependency of Nifty on Exchange Rate, Excel was used to run linear regression. The representative variables used for the study are weekly values from the period of January 2010to December 2019.

Regression model was used to derive the relationship and formula to compute the relationship is given below.

$y = mx + c$

Where,

y= return on Niftyc= intercept. m=slope of forex.x= forex

Empirical Results

Model Summary

Table No. 1

Model	Multiple R	R Square	Adjusted R Square
Linear Regression	0.83072364	0.690101766	0.689505808

ANOVA

Table No. 2

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1763978392	1763978392	1157.970195	0.00
Residual	520	792135037.25	1523336.61		
Total	521	2556113429			

Statistical Analysis

Table No. 3

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-4921.64237	376.737663	-13.06384483	0.00
X Variable 1	211.181046	6.205921046	34.02896113	0.00

Interpretation of Results

1. From Table No.1, we can see that the correlation coefficient (Multiple R) has a valueof 0.83 which is pretty close to +1, so this indicates a strong correlation between the exchange rate and the stock market performance. Also, we get a R Square value of 0.69, which means that the regression indicates that 69% of the variation in the stockmarket can be explained by the changes in exchange rate and 31% of the variation is caused by factors other than forex.
2. From Table No.3, it can be seen that the significance value is 0.00 at 99% level confidence. Therefore, as p <<< 0.05, the null hypothesis is rejected, and the regression analysis can be applied.
3. Table No.2 gives us the Significance F which has a value of 0.00, which means that there is zero probability that all the coefficients in our regression output are actually zero or we can also say that there is zero probability that the null hypothesis can't berejected.

Testing of Hypothesis

For Exchange Rate, significance value is 0.00 which is less than the 0.05 level of significance which means the hypothesis (H0) is rejected i.e. Stock performance is not dependent on foreign exchange rate and the alternate hypothesis (H1) is accepted, .i.e. performance has significant dependence on foreign exchange rate.

Suggestions (for further research)

1. Since the exchange rate is complex variable that depends on a number of macroeconomic variables, we can also consider the influence of interest rate, IIP, money supply, central government policies etc. on exchange rate.
2. Since the exchange rate is very active variables, the data can be taken on daily instead of weekly basis.
3. We can also directly link the inflow or outflow of FII and DII on the stock exchange value and consequently to exchange rate.
4. We can also analyze the effect of major foreign stock exchange performances i.e., Dow Jones industrial average etc. on Indian stock exchange

Research Gap

Existing literature offered theoretical as well as empirical links between stock prices and exchange rates via various models but results could be very country specific depending on each country's particular characteristics. It can also be seen that most research had taken either monthly or quarterly data, so the significance of our results is improved as we have applied weekly data, because the use of more frequent observations can better capture the dynamics of stock and currency market interrelationships.

Also, although all the papers show using historical data and use statistical tools the relation between the exchange rate and stock market, they don't talk about what might be the factors causing these relations, other the research on Thailand *(Azman-Saini, W., Habibullah,M., & Azali, M.)* that gave a psychological reasoning for its findings. Another possible extension could be to employ the firm level data for the countries and examining the above relationship for those firms that are engaged in international trade (e.g., multinational firms) and for those firms that are not directly affected by exchange rates. These gaps can be interesting avenues for future research.

Conclusion

The major conclusion which can be drawn from the existing literature is that changes in exchange rates affect the competitiveness of multinational firms and consequently their earnings and stock prices. Thus, when exchange rate shocks are imminent or the foreign exchange environment changes, investors and market participants can alter or rebalance theirportfolios with stocks of dissimilar firms by looking at the response of the firms to volatile changes exchange rate.

There is no significant theoretical consensus on the relationship between stock prices and exchange rates either. Empirically, there are quite a number of studies that attempt to determine the impact of stock prices on exchange rate changes and vice-versa. The findings however, are not uniform across the various studies. Some studies documented positive effects of exchange rate changes on the stock market, while others found negative effects. Yetother studies concluded that the exchange rate changes have no significant impact on the stock market. However, the following theoretical explanation can be provided after going through the various and diverse works of literature.

In case of an increase in domestic stock prices, individuals would demand more domestic assets and to do this, local investors would sell foreign assets as they appear less attractive than domestic assets now, which would lead to an appreciation of the local currency. Another explanation for the same negative relationship can be an increase in foreign demand for domestic assets due to stock price increase. This would also cause a domestic currency appreciation. In contrast, a positive relationship between stock

prices andexchange rates with causation running from exchange rates to stock prices can be explained as follows: a domestic currency depreciation would make local firms more competitive, which would lead to an increase in their exports and would therefore raise their stock prices.

And as per our empirical results, it is safe to say that there is a positive relation between exchange rates and stock prices with Nifty 50 having a significant dependance on the exchange rate. These results also give credibility to the above theoretical explanations and the results are also in line with the historical data found in some of the existing literature.

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