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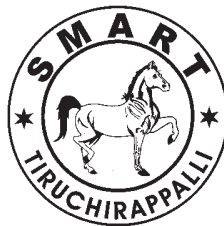
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RELATIONSHIP BETWEEN STOCK PRICES AND EXCHANGE RATES

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Abstract

*Since liberalisation, the Indian Industry has been exposed to a variety of global challenges. Specifically, export oriented/import dependent companies have been influenced by changes in exchange rates in the floating exchange rates regime. The present study is primarily focused on capturing such forex exposure on equity returns of companies with global transactions. Considering a sample of 62 companies, the present study has tried to find the possible existence of **forex beta** in addition to market beta, explored by the traditional CAPM. The results are mixed. Although the market has not shown any clear premium for compensating the exchange rate exposure, the coefficient is found positive and linear in a two factor CAPM context*

I. Introduction

The Indian stock market, though one of the oldest in Asia,(in operation since 1875) remained largely outside the global integration process until the late 1980s. In line with the global trends of reforms, the Indian stock market has witnessed a series of changes since the economy opted for liberalization presumably due to pressure from IMF on account of external payment crisis. Prior to nineties, the Indian financial system was full of inhibiting rigidities and was under severe administrative controls. Administered interest rate structure, thin foreign exchange market, fixed exchange rate mechanism, under-developed secondary markets for equities as well as for government securities, inadequate depth of money and capital markets, inadequate institutional arrangements/framework are the dominant characteristics, resulting in substantial segmentation of financial markets .

Major developments that have taken place during the reform process and which might facilitate the integration of financial markets are:

i. Dismantling of various price and non-price controls in financial markets; relaxation of foreign investment restrictions primarily through deregulation;

ii. Permission to Indian corporate for issuance of American Depository Receipts (ADRs) or Global Depository Receipts (GDRs) which in turn facilitate the trade of securities on NYSE, NASDAQ, etc.;

iii. Allowing the exchange rates to be determined by market forces (through, at times, the intervention of Reserve Bank of India) and gradual move towards full convertibility on Indian Rupee which enabled the international investors to invest substantial amounts (about US $15bn) in Indian capital market;

iv. The two-way fungibility of ADRs/GDRs allowed by RBI has further strengthened the linkages between the stock and foreign exchange markets.

The relationship between a country's stock market and its foreign exchange market has been a subject of theoretical and empirical investigation in international finance for over two decades. The traditional CAPM tells us that exchange rate risk being firm-specific and non-systematic and should be diversifiable and hence would not be considered by markets.

However, international CAPM says that the expected excess returns on risky asset is a linear function of not only their beta, but also the exchange rate factor. The extension of traditional CAPM to a multi-country context under the assumption of integrated capital market must account for exchange rate risk and its co-variance with world market portfolio. Two outstanding issues in extending the pure domestic Capital Asset Pricing Model (CAPM) to the International context are: (a) Whether the global capital markets are integrated or segmented (b) the impact of exchange rate on asset pricing. The Asian currency crisis of 1997-98 had revealed a dynamic link between stock price and exchange rates. During the crisis, the currencies which emerging markets have depreciated, resulted in greater outflow of funds from portfolio investment and led to the dramatic fall in stock prices.

If stock prices and exchange rates are related and the causation runs from exchange rates to stock prices, then crises in stock markets can be prevented by controlling the exchange rates. Moreover, developing countries can exploit such a link to attract/stimulate foreign portfolio investment into their 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 to each other, then investors can use this information to predict the behavior of one market using the information on other market.

Most of the empirical literature on stock price exchange rate relationship has focused on examining this relationship for the developed countries with very little attention to the developing countries. The results of these studies are, moreover, inconclusive. Some studies have found a significant positive relationship between stocks prices and exchange rates (Smith (1992),

Solnik (1987) and Aggarwal (1981) while others have reported a significant negative relationship between the two (e.g., Soenen and Hennigar (1998)). On the other hand, there are some studies that have found very weak or no association between stock prices and exchange rates (Franck and Young (1972), Eli Bartov and Gordon M.Bodnor (1994)).

The standard definition of exchange rate exposure is a measure of the correlation between real asset values and real exchange rates. Exchange rate fluctuations can have a substantial impact on the profitability of domestic industries. Price changes caused by movements in the exchange rate may (a) change the terms of competition with foreign firms for domestic exporters and import competitors; (b) alter input prices for industries that use internationally priced inputs or firms that import for resale; (c) Change the value of assets denominated in foreign currencies. Exchange rate movements affect different industries differently because of these diverse sets of influences.

Indian companies are now allowed to tap foreign equity by using GDRs and ADRs. Apart from that, exchange rate regime was liberalized with almost complete current account convertibility since 1994. In this context this paper explores whether share prices in India are likely to get influenced by changes in foreign exchange rates.

2. Literature Review

Several studies have been conducted to examine the effect of changes in exchange rate on the stock prices. Aggarwal (1981) was the first to conduct a study to examine the relationship between stock prices and the floating values of dollars. He found that the value of the US dollar and US stock prices were positively correlated for the period of 1974-1978. Jorion (1990) has explored the sensitivity of a firm's

value to exchange rate exposure of US multinationals. This study observes such relationship as positive and it is largely related to the degree of foreign operations. The study has used the rates of foreign sales to total sales as a proxy for foreign involvement.

Apte (1997) has examined the exchange rate exposure of stock prices by considering monthly share prices of 143 firms from CMIE corporate database during 1990 to 1997. Considering trade weighted indices of NEER and REER, the study estimated the exchange beta and regressed it with firm- specific characteristics like exports ratio and imports ratio. The results obtained from REER and NEER indicate that 32 firms out of 143 samples are having significant exchange rate exposure out of which eight are negative and rest report a positive exposure. Thus, it reveals that exchange rate risk is behaving as a systematic risk over and above market risk in case of many Indian companies.

Apte (2001) further investigated the relationship between the volatility of the stock market and that of the nominal exchange rate in India using daily closing stock market indices of BSE-30 and NSE-50 and daily closing USD/INR exchange rates using EGARCH specification proposed by Nelson (1991). The study addressed the question whether the innovations in stock returns have any impact on the volatility in foreign exchange markets and vice versa. The results reveal that the hypothesis of returns innovations in one market support not only the conditional variance in the same market but also in the other market.

Yamini and Kawadia (2002) have examined the relationship between sectoral indices and exchange rates by considering sectoral indices like BSE-IT, BSE-CG, BSE-FMCG, BSE-CD and BSE-HC. Their results show that the impact of SENSEX on exchange rate is positive and significant on various indices, viz BSE-CG, BSE-CP and BSE-CP and BSE HC. FMCG and IT sectors do not seem to have any significant exchange exposure.

Nath and Samanta (2003) have tested whether returns in stock market are interrelated with returns in capital market considering a period from March 1993 to December 2002, using daily NSE-50 index price and daily INR/USD value. The Granger - causality tests conducted to find the relationship between exchange rate and stock prices with a lag of 5-days suggest that these two markets did not have any causal relationship. If one goes into specific years to see whether the liberalizations in both the markets have brought them together or not, then even no significant causal relationship is observable between exchange rates and stock prices except for the years 1993,2001 and 2002, during which period unidirectional causal influence from stock index returns to returns in forex market is detected (with corresponding F statistics significant at 5 percent level of significance). Very mild causal influence in reverse direction is also found in some years (1997, 2002).

Nath and Samanta (2003) in another paper examined the extent of integration between foreign exchange and stock markets in India during the liberalization era. Considering NIFTY index and exchange rate of Indian Rupee to Dollar for a period of 10 financial years from April 1993 to March 2003, the study tried to employ two methodologies, Granger's causality in Vector Auto Regression(VAR) context and the Geweke's Feed Back measures. The results show contemporaneous relationship between returns in two markets as very strong (statistically significant at 1 percent level) during four financial years, 1998-99, 1999-00, 2001-02 and 2002-03 and in other years, this relationship as statistically insignificant. The

hypothesis of no causal influence of exchange rates and stock prices could be accepted in three years, viz., 1994-95 (10 percent level), 1995-96 (1 percent level) and 1998-99 (10 percent level). The causal impact in reverse direction is found to be significant in the years 1994-95 (1 percent level), 1996-97 (5 percent level) and 2001-02 (1 percent level) and 2002-03 (10 percent level). Thus, the tests reveal the sign of mild-to-strong causal relationship (either contemporaneously or lagged) between returns in foreign exchange and capital markets during some years. However, the Geweke's feedback measures detect strong causal relationship in each financial year.

Seshaiah, Ganesh and Vuyyuri (2003) examined the effect of exchange rates and inflation on stock returns. The entire period of study from 1980-81 to 1999-2000 has been subdivided into two parts, before and after 1991 to find the effect of liberalizations. Using annual changes in BSE Index, Gold and Silver Returns and inflation rates, the study conducted stepwise linear regression equation. It is found that stock returns and exchange rates during pre-liberalization era have no significant relationship. However, during the post-liberalization period, the degree of dependence of stock returns on exchange rate movements is found significant at 5 percent level. This may be due to huge inflow of foreign portfolio investment into Indian capital markets after liberalizations. This means that exchange rate movements and stock returns volatility are closely related to exchange flows affecting stock returns.

Yamini Karmarkar and Kawadia(2002) have explored the interrelationship between capital market, forex market and bullion market in India. Considering the indices of BSE-Sensex, BSE National and Nifty as the representatives of capital market, the Rupee Dollar exchange rate as indicator of movements in forex market, the study has estimated the response functions. It is observed that there is price integration between stock prices, bullion prices and exchange rates. The growth of stock prices was much more than the growth in bullion prices and exchange rates during the period under study. All these markets are found more stable in the era of economic reforms.

3. Methodology

Exchange rate exposure, defined as the effect of exchange rate changes on the values of a firm, does not employ any causal relationship between exchange rate fluctuations and changes in firm values. Both stock prices and firm values are assumed to be endogenously determined. This means that stock prices and exchange rates depend on the nature of the shocks affecting the economy (Jorion 1990). But for the purpose of the analysis, as in earlier studies, it is assumed that the exchange rates are exogenous to the value of the firm.

The exchange rate exposure of sample is measured using a two-factor model of stock returns as dependent on the market returns and exchange rate changes

$$R_{it} = \alpha + \beta_{im} R_{mt} + \beta_{ie} E_t u_{it} \qquad (1)$$

Where R_{it} is the returns on the stock of firm 'i' during period 't', R_{mt} is the market returns and E_t is the exchange rate factor. β_{im} and β_{ie} denote the sensitivities of the stock returns to the market and exchange rate factors respectively. In order to overcome the problem of correlation between market returns and exchange rates, the latter is orthogonalised by running an auxiliary regression of changes in exchange rates on market index returns and using the residuals in place of E_t (Results of auxiliary regression is given in Table3)

4. Data Sources

The study has used 225 weekly stock prices pertaining to BSE 100 companies and

Rupee value against four major currencies, viz., Dollar, Euro, Pound and Yen. The main source of data is the CMIE corporate data base which provides data on individual stocks as well as Index Value. It also contained summaries of Income Statement and Balance Sheet from which data on Export, Imports, Exports to sales ratio and the ratio of value of imported raw materials were obtained. However, data on exchange rates are collected from website of RBI.

Sixty two companies were selected out of BSE 100 companies. In order to get included into sample, a company should fulfil anyone of the following conditions, viz., a. Imports should exceed 20 per cent of total raw material; b. Exports to sales ratio to exceed 20 percent of total sales; c. Size of total imports exceeding 100 crores; d. Annual size of export sales exceeding 100 crores.

5. Results and Discussions

Exchange rate fluctuations are likely to influence the bottom lines of the companies whose operations involve either exports or imports. In addition, the exchange rate fluctuations or its stability is likely to influence the capital flows in the form of portfolio investment by Foreign Institutional Investors(FIIs). While the latter phenomenon is of short term nature, the influence on firm level performance and its consequence on stock market prices is likely to have a long term implications in an economy.

The estimated results for each company based on a time series of 225 weeks have been analysed separately for 'market beta' and 'exchange beta'. The tables have been prepared taking distribution of beta across companies. The results of two factor model against four currencies indicates that explanation (R^2 value) put forth by two risk variables on stock returns found ranging from 0.02 to as much as 0.35 indicating that Indian stock market's response to two systematic variables is to the extent of 15 to 20 percent, on an average. The company wise market 'beta' found more or less the same for all the sets of results and thus giving stability to the estimated coefficients. This is due to the fact that running of auxiliary regression has delimited the market index and exchange rates not to inter-relate and result in a multicollinearity problem.

The results indicate that market beta is statistically significant across the board in all the equations. For better understanding, the calculated market betas across the sample of 62 companies are tabulated against different ranges. Theoretically, these betas represent the responsiveness of individual scrip to the market index. Empirical results show that the size of the beta largely revolve around a range of 0.20 to 0.50 only. Seven companies out of 62 sample units possesses beta higher than 0.50. The prime reason for low beta values in case of majority of sample units is due to peculiar condition prevailing in the market during the period of study. Further, the weekly changes in stock prices generally report low beta value compared to monthly or quarterly changes.During April 1999 to March 2003, the market is very volatile for different external shocks like September 11 incidence, Gulf War II, and internal factors like Ketan Parak scam, introduction of derivatives and prolonged bearishness in bourse.

Out of the few sample units who have reported a beta larger than one include Iflex Solutions with beta of 1.08 and Wipro Limited with a beta of 1.12. A beta of more than one for both the software companies indicate the tech stock boom during the period of study. On similar lines, Satyam Computers (beta = 0.70), Polaris Software Ltd (0.87), Infosys technology (beta=0.59) and Digital Global Soft (beta=0.63) report good value of beta and thus follows the bandwagon. The technology boom may be one

of the reasons for many old economy stocks to report a beta ranging between 0.30 to 0.40 during the study period. For example, Century Textiles report a beta of 0.45, Mahindra & Mahindra 0.45, ABB 0.32, and Bharat Forge 0.40, Grasim industries 0.31, SAIL 0.54 and so on.

Distribution of exchange rate exposures of select sample units for four currencies have been tabulated and presented in Table-2. The exposure co-efficient is called as 'Exchange Beta' in the present study. A negative sign of the coefficient for the exchange beta indicates that any depreciation in the value of the currencies is likely to bring added advantage to the market value of the stocks.

It is very surprising that most of the (41) sample units report a negative beta against US Dollar. The same beta is more or less equally distributed against all other ranges in case of Pound Sterling and found concentrating the initial ranges of 0 to 0.30 roughly in about 42 companies in case of Euro and in the range of 0.20 to 0.40 in case of Japanese Yen. The results are more or less same even when one considers the logarithmic values.

If one goes by company wise results, only six out of 62 companies exhibit significance, that too at 10 per cent or 20 per cent levels. The story is more or less same across different currencies. However, if one considers the logarithmic results of exchange beta, it works out to be very significant in case of Dr. Reddy's Lab (1.99), Glaxco Smith (2.40), Hero Honda, Nestle, Workhard followed by Zee telefilms, Hai man and MRF.

Thus, the existence of exchange beta at least notionally obsorbable when one considers the logarithmic result. The logarithmic regression co-efficient naturally works out to the elasticity of exposure co-efficient.

In the second case, CAPM logic has been estimated to examine the impact of "Exchange Beta" in a given risk-returns framework. The CAPM, time honored and much celebrated asset pricing frame-work, provides a logic that equity returns entirely depend upon the systematic risk which is alone to be compensated if the security markets are efficient. Although the firm specific exposure due to fluctuations in exchange rates are expected to be wiped out, if one constructs efficient portfolio, the exchange beta is becoming an important additional factor in CAPM frame work.

The present study has estimated a two-factor CAPM using the following model

$$\overline{R}_i = \lambda o + \lambda_1 \, \beta_m + \lambda_2 \, \beta_e + \mu \text{ (ii)}$$

Where $\overline{R}_i$ refers to the average returns, β_m market beta and β_e is exchange beta. The results have been presented in Table-4. The cross sectional CAPM results for each currency indicate that the two factor CAPM has slightly higher explanatory power when compared to single factor CAPM. Further, the market beta is found positive although the exchange 'beta' showed mixed results. While the co-efficient is negative on US dollar regression, the same is positive in other currencies. However, the insignificance of the coefficient of 'exchange beta' does not lend any clear support for any further argument for possible inclusion of it in asset pricing models in Indian context. Almost similar trend is observable when the data is reworked with logarithmic values.

6. Conclusion

The objective of this paper is to examine whether there exists any relationship between stock returns and fluctuations in the exchange rates among firms who are exposed to international operations, Viz, exports and imports. In most of the companies, Exchange Beta

is not found significant implying that there is no significant exchange rate exposure. When the results are re-worked in logarithmic form, it is observed that a handful of companies show significant exchange rate exposure. Literature suggests that if firm undertakes sufficient hedging policies to minimize the effect of exchange rate risk, a weak relationship is bound to exist between foreign exchange exposure and firm value (Collier,Davis,Coats and Longden 1990) However in the era of floating exchange rate regime and the integration of Indian stock market with the rest of the world, an investor is compelled to consider an additional risk factor viz. foreign exchange risk apart from market risk in his investment decisions.

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Table I
DISTRIBUTION OF MARKET BETA

Range	USD		GBP		EURO		YEN	
	Abo	Log	Abo	Log	Abo	Log	Abo	Log
Below. 10	2	5	2	5	2	5	2	5
0.10 - .20	10	5	10	5	10	5	10	5
0.20 - .30	21	20	21	20	21	20	21	20
0.30 - .40	16	15	16	15	16	15	16	15
0.40 - .50	4	5	4	5	4	5	4	5
0.50 - .60	2	4	2	4	2	4	2	4
0.60 - .70	3	3	3	3	3	3	3	3
0.70 & Above	4	5	4	5	4	5	4	5

Table II
DISTRIBUTION OF EXCHANGE BETA

Range	USD		GBP		EURO		YEN	
	Abo	Log	Abo	Log	Abo	Log	Abo	Log
Below-0.5	27	37	. 3	6	0	1	0	4
-0.5 to -0.4	2	1	5	2	0	0	0	4
-0.4 to -0.3	4	2	1	2	0	0	0	4
-0.3 to -0.2	2	3	3	3	1	2	0	4
-0.2 to -0.1	3	2	9	4	2	2	0	8
-0.1 to 0	3	0	7	6	12	5	0	9
0 to.10	4	2	6	4	10	3	0	5
.10 to .20	1	1	8	10	21	7	8	7
.20 to .30	1	3	3	6	11	8	35	6
.30 to .40	0	1	8	2	4	9	16	4
.40 to .50	1	0	4	6	0	13	2	0
.50& above	15	10	5	11	1	21	1	6

Table III
COEFFICIENTS FOR REGRESSION OF EXCHANGE AS DEPENDENT ON STOCK MARKET INDEX (AXILLARY REGRESSION)

Model	λ	B_m	R^2
$\widehat{R}_s = f(R_m)$	0.00053 (3.20)	- 0.0059 (2.21)	0.0219
$\widehat{R}_f = f(R_m)$	0.00032 (0.44)	0.0032 (0.27)	0.0034
$\widehat{R}_E = f(R_m)$	0.00018 (0.18)	0.0075 (0.48)	0.0010
$\widehat{R}_Y = f(R_m)$	0.00032 (0.32)	-0.0146 (0.92)	0.0039
In $\widehat{R}_\$ = f(R_m)$	0.00052 (3.13)	-0.0061 (2.17)	0.0211
In $\widehat{R}_x = f(R_m)$	0.00027 (0.38)	0.0036 (0.29)	0.0004
In $\widehat{R}_E = f(R_m)$	0.00009 (0.10)	0.0069 (0.42)	0.0008
In $\widehat{R}_Y = f(R_m)$	0.00019 (0.19)	-0.011 (0.68)	0.0021

Table IV
TWO FACTOR CAPM RESULTS

Particulars	N	λo		λt		$\lambda 2$		R^2	
		Abo	Log	Abo	,Log	Abc	Log	Abo	Log
Pooled	60	0.0003 (0.33)	0.0003 (0.39)	0.0085 (3.70)	-0.0057' (3.18)			0.18	0.14
USD	59	0.0003 (0.33)	0.0003 (0.26)	0.0082 (3.57)	0.0057 (3.13)	0.0001- (0.30)	-8.48E- (0.48)	0.18	0.14
GBP	59	0.0003 (0.38)	0.0003 (0.42)	0.0084 (3.68)	0.0057 (3.10)	0.0004 (0.29)	-0.0002 (0.21)	0.18	0.14
EURO	59	0.0007 (0.77)	0.0003- (0.25)	0.0082 (3.68)	0.0060 (3.29)	*0.0042* (1.35)	0.0016 (1.13)	0.21	0.16
YEN	59	0.0002- (0.29)	0.0003 (0.27)	0.0082 (3.55)	0.0060 (3.25)	0.0007 (0.36)	-0.0010 (0.7)	0.18	0.15