Transmission Of Interest Rates Volatility: A Case Study Of Upper, Middle And Lower Income Groups Countries

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Abstract

With the development of liberalization of capital movements, an increasing attention has been given to international transmission of volatility to different market returns. This article empirically tests the effects of the volatility in the time value of the US t bills and RBI t bills on the developed, developing, and underdeveloped market. By using daily values of twelve equity markets and the interest rates on the 10 years treasury bills from 2000 to 2010, the Gaussian and Student's-t GARCH models are tested to display the international Transmission effects of the US and Indian interest rates on the world equity markets. The empirical findings vary between the sub-economy groups. The equity markets in the upper, middle, and lower income group do not have strong interest rate effects. The markets are affected by the volatility in the US and RBI interest rates at low levels. On the other hand, impacts of the volatility in the US interest rates on the domestic money markets –i.e. bond spreads- in the emerging economies are stronger with negative direction.

I Introduction

The liberalization and following reform measures have drawn the attention of foreign investors most important to a rise in portfolio investment in the developing markets like Indian capital market. Over the recent years, India has emerged as a major recipient of portfolio investment among the emerging market economies**.** Recent McKinsey Global Institute (MGI) research highlights the unrelenting growth and deepening of global capital markets as investors pour more money into equities, debt securities, bank deposits, and other assets around the world the soaring growth of financial markets in emerging economies and the growing ties between financial markets in developed and developing countries the shift of financial weight in Asia from Japan toward China and other fast-growing emerging markets the growing financial clout of the eurozone countries and the significance of the euro the burgeoning role of oil-rich Middle Eastern countries as suppliers of capital to the world, along with the rise of new financial hubs in the Middle East to complement the rapidly growing hubs in London and Asia.
While these trends expose a shift in financial power from the United States toward other parts of the world, the absolute size and depth of the US market will give it a leading role on the international financial stage for years to come. The going up level of foreign investment is making the world more financially inter-dependent than it was even a few years ago**.**

Additionally, the source and route of cross-border investment flows are shifting. In 1999, the United States was the central hub of the global financial system. By 2006, it remained the largest single foreign investor and a major hub in global capital markets—but the euro-zone countries together had as many financial links with other parts of the world, including budding markets. The United Kingdom too has become a more

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significant global financial hub, and Middle Eastern countries are now major investors in global financial markets, thanks to the one-off generated by rising oil prices. In 2006, for the first time since the 1970s, the oil-exporting countries joined those of East Asia as the world's largest net suppliers of capital.

As the international equity markets have veteran their most volatile growth over the past decade, budding equity markets have experienced an even more rapid growth, taking on an ever larger share of this global explosion. The Indian financial system has undergone structural transformation over the past decade. The financial sector has acquired strength, efficiency, and stability by the combined effect of competition, regulatory measures, and policy environment.

Volatility in the Treasury bill markets is influenced by a number of factors foremost among which is interest rates in determining the level of long–term volatility in the stock market. Interest rates are themselves influenced by volatility, since the fluctuations caused by ongoing and long-term volatility strongly influence the decisions of central banks. The aim of the paper is to present empirical results from different types of economies in the world on the subject under investigation. In this research, the normal and Student's-t distribution GARCH (1;1) models are chosen to test the volatility transmission. The paper continues with a literature review on the interest rates effects on the stock markets. The emphasis is given on the global interest rates effects in domestic equity indexes. In the third part, the data and methodology used in the research are introduced. The results of ADF and P-P tests with descriptive statistics are presented. The GARCH model as a test method in the stock return volatility is discussed in detail. The empirical results of the research are categorized into types of the economies. The findings of the research is discussed in terms of both theoretical and portfolio management perspectives. The concluding remarks include some methodological and empirical suggestions for the future research on the global interest rate risk in return volatility of the stock markets.

A. Transmission of Volatility

The diffusion of international investments and capital movements across borders has marked the evolution of financial markets and has changed the profile of correlations among assets denominated in different currencies which are exchanged in geographically separated markets. Single market volatility reacts to innovations in other markets as a result of financial integration. Mechanisms of transmission of shocks across variables in an econometric model have received a great deal of attention in the literature. Single market volatility reacts to innovations in other markets as a result of financial integration. Mechanisms of transmission of shocks across variables in an econometric model have received a great deal of attention in the literature.

In this era of globalization and mounting integration among global financial markets, inter linkages and spillovers have been a major focus of financial debate in the last few decades. Early works in this field came up with strong evidence of inter linkage between the stock markets around the globe, a result of global economic integration.

The rationale of the study is to find out the impact of volatility in interest rate of us T-bills and RBI T-bills on stock returns of developed, under-developed, and developing nations. The reason for doing this study was to investigate the predictive power of interest rate on the stock returns. There are very few studies done on this subject especially in on the international level by using stock indices of all the nations. The results of this study provide valuable information for both financial decision makers and domestic and global fund investors who are more interested in investing in growing emerging stock market. This study contributed a lot to the literature as it examine the impact of interest rates on stock returns of developed, under-developed and developing nations. In the study, the world's equity market is divided into three main segments: developed, developing, and under-developed market. Four major representative indices of each segment are taken to find the exact effect of volatility transmission.

B. Literature Review on Impact of interest rates volatility on stock returns of developed nations

The below given section gives a brief idea about the existing research work done in the area of volatility transmission among different nations. For example the study Agmon (1972), Hillard (1979); Ripley (1973) did study on the developed countries during the 60s. Glezakos, Merika and Kaligosfiris (2007) found strong influence of the US financial market, DAX and FTSE on the other markets of the sample.

Mukherjee and Leblang 2007 found that the relationship between government partisanship, interest rates and the mean and volatility of stock prices in the United States and United Kingdom. Ibrahim and Sulaiman (2001) study results indicated that there is no long-run relationship between the stock market index and any of the exchange rates

C. Literature Review on Impact of interest rates on stock returns of developing nations

Several studies recently focused on the role of exchange rate fluctuations in the capital market around the Asian financial crisis. Sharma and Kennedy (1977) find strong link between Indian, US and UK markets in term of interest rates. Rao and Naik (1990) conducts a Cross-Spectral analysis and finds a weak relationship of Indian market with international markets which they attribute to the controlled Indian Economy regime throughout the 70s with liberalization measures initiated only in the late 80s.

However, in recent years there has not been much investigation into this aspect, except one by Wong, Agarwal and Du (2005); specifically it also tries to identify the interest rates volatility transmission channels for Indian stock market in recent years. Raju and Ghosh (2004) in their study amongst emerging markets except India and China, all other countries exhibited low returns (sometimes negative returns with high volatility).

Arshanapalli and Doukas (1993); Cheung and Ng (1992) confirmed the dominant role of US in the global financial scenario. Lee and Kim (1994); Jeon and Von-Furstenberg (1990) cited evidence for a significant increase in the movement of the stock

price indices after the crash. Frankel and Roubini (2003) find out the empirical results that the IFC Global index of equities declines by 17 points and Emerging Markets Bond Index (EMBI) decreases 34 % if the real G-7 interest rate increases 1 point. Dailami, Masson, and Padou (2005) also display that a 200 bps increase in US short-term interest rates decreases emerging market spreads ranging from 6 bps to 65 bps, depending on debt/GDP ratios of examined countries.

Abdalla et al. (1997) have done a study on the interaction between exchange rates and stock prices with reference to India, Korea, Pakistan and the Philippines by applying bivariate vector autoregressive models on monthly observations of stock price index and the real effective exchange rate over 1985:1 to 1994:7. The study found the unidirectional causality from exchange rate to stock prices in all the countries except the Philippines.

D. Literature of Impact of interest rates on stock market returns of under developed nations

Yau and Nieh (2006) investigated the interrelationship between new Taiwan dollar/Japanese yen exchange rate and stock prices of Taiwan and Japan for the period of January 1991 to July 2005 and find that there was no long-term linkage between the exchange rate and stock prices of Taiwan and Japan, but the linkage existed only for short durations.

Wu (2001) used the monthly distributed-lag model to examine the impact of macroeconomic variables on the Straits CTimes Industrial Index (STII) by categorizing the macroeconomic indicators into three groups: money supply, interest rates, and the government fiscal stance. Choi, Elyasiani and Kopecky (1992), Fama (1991), Evans (1998), Unal and Kane (1987), Ehrhardt (1991), Titman and Warga (1989), Ramsey and Lampart (1998), Elyasiani and Mansur (1998), Faff and Howard (1999), Staikouras (1998) found out the empirical fact that the interest rates with other macroeconomic variables such as GDP growth rate, exchange rates, inflation and trade balance are effective on the stock returns.

E. Other Empirical Evidences

Apart from this theoretical investigation, there is a well-documented but puzzling empirical relation between stock prices and exchange rates. Most of the empirical literature has examined dynamic interaction between stock prices and exchange rates in the context of developed countries rather than developing countries. The review of literature in this line brings out that the results of these studies are, however, mixed and inconclusive. Studies like Smith (1992) Solnik (1987), Aggarwala (1981), Franck and Young (1972), Granger, CWJ. et al. (2000), Abdalla et al. (1997) have found a significant positive relationship between stock prices and exchange rates while others such as Soenen and Hennigar (1998), Ajayi, A and Mogoue (1996), Ma and Kao (1990) have reported a significant relationship between the two variables. On the other hand, some studies such as Bartov and Bodnar (1994), Franck and Young (1972) found very weak or no relationship between stock prices and exchange rates. On the issue of

causation, most of the studies found mixed results. Representative examples are Morley (2000), Oskooe, BM and Sohrabian (1992), Ibrahim (2000), Kanas, A (2000) etc.

To examine the impact of exchange rate changes on stock markets, Franck and Young (1972) investigated the relationship between stock prices and exchange rates and found no relationship between these two financial variables. Solnik (1987) found a negative relationship between real domestic stock returns and real exchange rate movements. Taylor, MP et al. (1988) the study concluded that there has been no significant increase in the correlation of stock market returns as a result of the abolition of exchange control. Cointegration test confirmed that the UK and foreign (non-US) stock market indices were cointegrated in post 1979 period but not before that.

Ma and Kao (1990) countries found that domestic currency appreciation negatively affected the domestic stock price movements for an export dominant economy and positively affected an import dominant economy. Oskooe, BM, et al. (1992) found that there is a bi-directional causality between stock prices and the effective exchange rate of dollar at least in the short-run. The cointegration analysis reveals that there is no long-run relationship between the two variables. Jorion (1998) attempted to analyze and compare the empirical distribution of returns in the stock market and in the foreign exchange market found that exchange rates displayed significant variations, which were much more than in that of stock market.

Ong, LL and Izan HY (1999) found that US share price returns fully reflect information conveyed by movements in both Japanese yen and the French franc after four weeks. Nissim and penman (1988) has stated that changes in interest rates are positively related to subsequent earnings, but the change in earnings is typically not large enough to cover the change in the required return.

From the above literature, it can be seen that researches are available in the area of exchange rate volatility and its impact on stock returns but few researches are available in The area of interest rates volatility and its impact on stock returns. This lacuna of research prompted the present study. The present study is carried out to fulfill the

Objective of studying the transmission of volatility in the interest rates (treasury bills) to the index returns in the selected developed developing and under developed nations.

II Research Methodology

For the study a sample of 4 developed countries, 4 developing countries and 4 under developed countries indices were chosen. Individual stock exchange of each nation during the study period acted as a sample element. Non probability judgmental sample technique was used in our study. Secondary source was used to collect the data i.e. official website of bank of Japan, Reserve bank of India, official website of Federal Reserve's for collecting U.S. Treasury bill rates, official website of Bloomberg, utv to find out the representatives of world stock exchanges. Apart from this we also used other official and reliable sites for collecting the data of different stock exchanges.

After collecting the stock index data for all the nations under study, the first thing for proceeding for volatility calculation was checking of normality and stationarity of data. Then normality of the data was checked with the help of jarque bera test. Stationarity was checked by ADF and PP test. Further GARCH model (1,1) was used to study the effects of the US T Bills rates and RBI interest rates of Treasury bills on stock market volatility in 12 equity markets indices under study. Volatility calculation was done using the following formulation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

where α_0 is the mean, ε_{t-1}^2 is the ARCH term and σ_{t-1}^2 is the GARCH term.

$$y_t = x_t' r + \varepsilon_t \qquad (1)\text{.....} \text{ Mean equation}$$

$$\sigma_t^2 = \varpi + \alpha \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2 \qquad (2)\text{.....} \text{ The conditioal variance}$$

III Result & Discussion

The two-variate GARCH-in-mean model is estimated for 12 countries. They are the following: Argentina, Malaysia, Mexico, America, Sri Lanka, Indonesia, India, China, Hong Kong, Australia, and London, Japan. For each country, the variables collected include 90-day US Treasury Bill rates, 90-day RBI Treasury Bill and return of various major stock indices of different countries. The financial time series are chosen from different emerging markets and advanced markets.

The equity indexes are categorized into three groups:
a. Upper Middle Income Economies - Argentina, Malaysia, Mexico, America
b. Lower Middle Income Economies - Sri Lanka, Indonesia, India, China
c. High Income Economies - Hong Kong, Australia, London, Japan.

The market indices selected for each country are as follows: All Ordinaries (Australia), Shanghai Composite (China), Hang Seng (Hong Kong), BSE 30 (India), Jakarta Composite (Indonesia), KLSE Composite (Malaysia), Nikkei 225 (Japan), Mreval Aires (Argentina), IPC (Mexico), S&PTSX Composite index (America), All Composite Index (Sri Lanka), KlSE (Malaysia). The data frequency is daily, ensuring a sufficiently high number of observations. The sample period varies depending upon data availability. For all the 12 countries, it goes from 01.04.2000 to 31.03.2010.

The daily values of the interest rates on the 10 years US Treasury Bills, 10 years RBI Treasury Bills and 12 equity indexes from 01.04.2000 to 31.03.2010 are used for the empirical tests. The logarithmic values of the first difference (return) are calculated.

A. Descriptive Statistics and Normality Check

The descriptive statistics and Jarque-Bera test results of all financial time series (log-returns) are presented in the Table 1.

Normality Of Errors (Tests Jarque-Bera)

The Jarque–Bera test is a goodness-of-fit measure of departure from normality, based on the sample kurtosis and skewness. The Jarque-Bera test statistics point out the finding that the time series satisfy the normality distribution assumption. On the basis of results of Skewness, Kurtosis and Jarque-Bera test statistics, we can either accept or reject the null and alternative hypothesis.

The below given table shows that the data of all the indices return is not normally distributed. The Negative skewness implies that the distribution has a long left tail. The kurtosis of the normal distribution is 3. If the kurtosis exceeds 3, the distribution is peaked (leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (platykurtic) relative to the normal (Peters, 2001) The Value of Jarque Bera test is at 0% level of probability; a small probability value leads to the rejection of the null hypothesis of a normal distribution Therefore we reject the null hypothesis of normality. Hence reject the **Ho** and conclude that the residues are not normally distributed.

Table 1. Descriptive Statistics and Jarque-Bera Test Results

Variable	Max.	Min.	Standard Dev.	Skewness	Kurtosis	Jarque-Bera
Upper Middle Income Economies						
Argentina	0.486848	-1	0.145184	-2.41784	22.50245	2018.648
Malaysia	0.135454	-1	0.10406	-7.37806	71.32628	24431.49
Mexico	0.165604	-1	0.111766	-6.18006	56.16986	14899.03
America	0.112092	-1	0.102975	-7.64509	74.01185	26382.36
Lower Middle Income Economies						
Sri Lanka	0.252602	-1	0.121055	-4.73998	42.00218	8055.107
Indonesia	0.201305	-1	0.119675	-5.14586	43.50168	8731.529
India	0.282551	-1	0.121739	-4.73766	40.18611	7362.941
China	0.274464	-1	0.12617	-4.19507	34.27182	5241.604
High Income Economies						
Hong Kong	0.170737	-1	0.112825	-5.81021	51.99069	12675.61
Australia	0.168502	-1	0.11171	-6.17425	55.40035	14491.41
London	0.086541	-1	0.100755	-8.05264	79.63173	30659.01
Japan	0.128499	-1	0.108438	-6.4278	59.06548	16543.02

B. ADF & PP Test

The unit root for serial correlation and stationary tests are performed with Augmented Dickey-Fuller (ADF) and Phillips and Perron (P-P) unit root tests. For ADF test, Schwarz Information Criterion, for P-P test Newey-West Bandwidth is preferred.

ADF Test - This test is to see if an econometric model estimated has a unit root or not, i.e. if I is zero order (0) or is of order 1 I (1). It has three processes generate data model with no deterministic component, model with intercept and with intercept and trend model presents the enlarged part.

$$\Delta\mu_t = \alpha_0 + \alpha_1 t + \lambda\mu_{t-1} + \Sigma\beta_i\Delta\mu_{t-i} + \nu_t$$

PP Test - It is a generalization of the proceedings of the DF, but unlike this, allows for autocorrelation and heteroskedasticity in the error term, which consists of three data generating processes: model without deterministic component, model and model intercept and trend, however it is not the augmented, so this test is a nonparametric solution, i.e not follow any known distribution.

$$\Delta Y_t = \Delta\beta + pY_{t-1} + \Delta_t$$

The hypothesis is prepared to check out whether the dependent variable (returns of stock indices) is stationary or not and whether it has any unit root or not.

- **Null Hypothesis, Ho:** The dependent variable (returns of stock indices) is not stationary and it has a unit root.
- **Alternative Hypothesis, Ha:** The dependent variable (returns of stock indices) is stationary and it has no unit root.

The results presented in the Table 2 show that there do not exit any unit root problem and the series are stationary.

Table 2. The ADF and P-P Tests Results

Variable	ADF Test	ADF Test Results	P-P Test	P-P Test results
Upper Middle Income Economies				
Argentina	-7.29585	Null hypothesis is rejected	-7.39067	Null hypothesis is rejected
Malaysia	-4.9251	Null hypothesis is rejected	-4.95958	Null hypothesis is rejected
Mexico	-6.25221	Null hypothesis is rejected	-6.51376	Null hypothesis is rejected
America	-4.38922	Null hypothesis is rejected	-4.20016	Null hypothesis is rejected
Lower Middle Income Economies				
Sri Lanka	-5.86456	Null hypothesis is rejected	-5.82267	Null hypothesis is rejected
Indonesia	-6.02892	Null hypothesis is rejected	-6.08088	Null hypothesis is rejected
India	-6.71669	Null hypothesis is rejected	-7.02704	Null hypothesis is rejected
China	-6.78686	Null hypothesis is rejected	-7.97175	Null hypothesis is rejected
High Income Economies				
Hong Kong	-5.30732	Null hypothesis is rejected	-5.26092	Null hypothesis is rejected
Australia	-5.57008	Null hypothesis is rejected	-6.31537	Null hypothesis is rejected
London	-5.53448	Null hypothesis is rejected	-5.46926	Null hypothesis is rejected
Japan	-6.47386	Null hypothesis is rejected	-6.52668	Null hypothesis is rejected

Notice here that the statistic value is greater than the critical values of 1.96 so that we do reject the null at conventional test sizes.

C. GARCH Estimation For Checking Causality In Variance

The model is a **Generalized Autoregressive Conditional Heteroskedasticity** (**GARCH**, Bollerslev(1986)) model. Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent or exogenous variables. In developing an ARCH model, you will have to provide two distinct specifications—one for the conditional mean and one for the conditional variance.

The GARCH(1, 1) Model specification (1), (2) in which the mean equation given in (1) is written as a function of exogenous variables with an error term. Since is the one-period ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation specified in (2) is a function of three terms:

* A constant term
* News about volatility from the previous period, measured as the lag of the squared residual from the mean equation: (the ARCH term).
* Last period's forecast variance: (the GARCH term).

The GARCH(1,1) model is given by

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

where α_0 is the mean, ε_{t-1}^2 is the ARCH term and σ_{t-1}^2 is the GARCH term.

$$y_t = x_t' r + \varepsilon_t \qquad \text{(1)..... Mean equation}$$

$$\sigma_t^2 = \varpi + \alpha \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2 \qquad \text{(2)..... The conditioal variance}$$

The GARCH(1,1) variance specification is analogous to the sample variance, but that it down-weights more distant lagged squared errors.

* The error in the squared returns is given by substituting for the variances in the variance equation and rearranging terms we can write our model in terms of the errors.

The financial markets are sensitive to the time dependent information flows. For that reason, financial data should be parameterized with Autoregressive Conditional Heteroskedastic (ARCH) models. ARCH process models a time- varying conditional variance as a linear function of past squared residuals and of its past values. ARCH test says that the prediction error variance is not constant, but it varies from one period to another, i.e. if there is any kind of autocorrelation in the variance of prediction errors. The above model is tested by GARCH with Gaussian distribution and GARCH with Student's-t-distribution for each stock market by using E-views5. The test results of the interest rates effect show deviation between upper middle, lower middle and high income economies. Therefore, the empirical findings are discussed in three different categories as specified in the data part.

H0: The interest rates effect show no deviation between upper middle, lower middle and high income economies
Ha: The interest rates effect show deviation between upper middle, lower middle and high income economies

Table 3 given below displays the test results with (Gaussian) normal GARCH model for the US T-bills interest rate effects on the return volatility of upper middle, lower middle and high income economies. Test results show that the time value of US dollar has statistically significant negative impact on the return volatility of stock markets but its effect is relatively at low level. All equity indexes have similar empirical results both in terms of levels coefficients, R square values, and direction. America, Japan and London are an exception in those general results because the US interest rates do have statistically significant effects on it. a strong effect on US interest rates has been diluted, perhaps reflecting the effect of massive purchases of US securities by foreign central banks

Table3: showing Test Results of GARCH with Gaussian Distribution for Returns of Stock Indices

ECONOMIES	Coeff. (US T-Bill)	z-Statistics	RESID(-1)^2	GARCH(-1)	R2	Results
UPPER MIDDLE INCOME ECONOMIES						
Argentina	-0.0101	-0.0089	0.0341	0.40859	-0.0055	H0 is accepted
America	-0.0086	3.92933	2.31504	0.51938	-0.0252	H0 is not accepted
Malaysia	-0.0062	-0.1415	-0.7305	0.55903	-0.000038	H0 is accepted
Mexico	-0.0034	0.51244	-0.6324	0.05711	-0.0003	H0 is accepted
LOWER MIDDLE INCOME ECONOMIES						
Indonesia	-0.0064	-0.1934	-0.2579	0.53003	-0.0122	H0 is accepted
India	-0.0066	-0.1837	-0.2879	0.57147	-0.0076	H0 is accepted
China	-0.0044	2.1189	-0.2518	0.1409	-0.0342	H0 is accepted
Sri Lanka	-0.0022	0.68136	-0.2111	-0.0206	-0.0004	H0 is accepted
HIGH INCOME ECONOMIES						
Japan	-0.0039	-1.4713	1.52635	0.34255	-0.0005	H0 is not accepted
Hongkong	-0.0054	-0.7965	-0.5058	0.54349	-0.0013	H0 is accepted
London	-0.0017	-0.7388	4.12277	0.1514	-0.0044	H0 is not accepted
Australia	-0.0031	0.5935	3.85737	0.0165	-0.000006	H0 is accepted

Table 4 given below displays the test results with (Gaussian) normal GARCH model for the RBI T-bills interest rate effects on the return volatility of upper middle, lower middle and high income economies. All equity indexes have similar empirical results both in terms of levels coefficients, R square values, and direction.

Table 4 showing Test Results of GARCH with Gaussian Distribution for Returns of Stock Indices

ECONOMIES	COEFF. OF RBI-TBILL	Z-Statistics	RESID(-1)^2	GARCH(-1)	R2	Results
UPPER MIDDLE INCOME ECONOMIES						
Argentina	-0.0115	1.5997	0.7688	0.37231	-0.0028	H0 is not accepted
America	-0.009	1.45925	3.15071	0.33269	-0.0123	H0 is not accepted
Malaysia	-0.0044	-0.1961	-0.3136	0.5722	-0.0011	H0 is accepted
Mexico	-0.0031	0.65795	-0.6743	0.1592	-0.000085	H0 is accepted
LOWER MIDDLE INCOME ECONOMIES						
Indonesia	-0.0058	0.87059	1.59018	0.15842	-0.0005	H0 is not accepted
India	-0.0029	0.1889	-0.2293	0.43812	-0.0003	H0 is accepted
China	-0.0041	-0.4044	-0.3159	0.55005	-0.0035	H0 is accepted
Sri Lanka	-0.002	0.38585	-0.1964	-0.6371	-0.0034	H0 is accepted
HIGH INCOME ECONOMIES						
Japan	-0.00445	-1.4705	1.57394	0.29132	-0.0006	H0 is not accepted
Hongkong	-0.00204	-0.8572	-0.4471	0.50139	-0.0052	H0 is accepted
Australia	-0.00371	0.46186	3.15103	-0.0098	-0.000005	H0 is not accepted
London	-0.002736	-0.2736	3.676325	0.220790	-0.005658	H0 is not accepted

Hypothesis tests the sensitivity of returns of selected stock indices to interest rates. By the results of the table some null hypothesis are accepted. It means that the independent variable (interest rates) does not have any effect on dependent variable (returns of selected stock indices).

As the results show that the time value of interest rates and exchange rates has statistically insignificant but negative impact on the selected stock indices of different countries and its effect is relatively at low level. All stock indexes have similar empirical results both in terms of levels of coefficients, R square values and direction. Argentina, America, Japan, Indonesia, Australia and London are an exception in those general results because the RBI t-bills interest rates do have statistically significant effects on it. Spiegel (2006) opines that although QEP led to fall in long term interest rates, change in expectation of market participants along with increased risk tolerance, the magnitude of impact of QEP was uncertain and that QEP had delayed the long overdue structural reform in the Japanese economy. QE in the UK also led to improved liquidity in the government securities market.

All the selected stock indices of different countries are under a low negative impact of the changes in the interest rates (US & RBI Treasury Bills). The percentages of significance are not so high and there is no volatility effect of interest rates on the returns of selected stock indices of different countries. The results have distinctive empirical results. The financial markets in lower middle income economies are under positive impact of the changes in the US Treasury Bills. The reason for this distinctive difference might be the effects of the US monetary policies on the Asian currency/USD parity.

IV Suggestions for Future Research

The empirical findings of the research have important results. Volatility in the time value of the US bills and RBI bills have international transmission effects on the world equity markets. However, the level of illustrative power of the US interest rates varies on the types of equity markets. For example the stock markets in the Asian and the US stock markets (domestic markets) are strongly affected by the volatility in the US interest rates. The empirical findings for the stock markets in the Asian Zone might be explained by the fact that the US interest rates also affect the Asian currency/USD parity. The emerging stock markets and non-US financial markets are affected by the US interest rates at statistically significant but low levels. The direction of the effect is positive. In those economies, the stock markets are affected by the changes in the US interest rates but they might behave in accordance with other factors such as domestic interest rates or foreign exchange rates. The same is the case with RBI treasury bills rate but in this case the economies which are comparatively stronger than Indian economy have significantly lesser transmission effect. The future research might focus on the other international factors such as the parity, business cycles, and excess liquidity, affecting the equity markets. The US interest rates might have stronger effects on the money markets rather than the stock markets in emerging markets. The future research might examine the issue by using monetary variables. Even more stock indices can be included in order to cover a larger area. Time period of the study can be increased upto 20 to 25 years to know a generalized result.

Conclusion

This study examines the transmission of volatility in interest rates on stock markets of twelve countries and also looks about the effect of interest rate on returns of stock markets. In this study, we have studied the effect of interest rates on the returns of stock market with the help of GARCH (1, 1) model. We have also tested for the presence of causality-in-mean and volatility spillovers. The extensive coverage of representative indices of high, middle and lower income economies, and the careful (simultaneous) modeling of risk sensitivity and causality-in-variance effects differentiate the present study from earlier ones, normally focusing on a single country. For applying this some assumptions are taken into consideration like normality check and stationery check. The whole data was found to be not normally distributed (by Jarque-Bera test) and the time series proven as stationery. For stationery check Augmented Dickey-Fuller (ADF) and Phillips and Perron (P-P) unit root tests were used and the result shows that the dependent variable series at 5% is stationary and therefore has no unit root.

While computing the transmission volatility in interest rates on returns of different economies we found that 2 countries from upper middle income segment (Argentina, America) has found volatility impact, 1 country from lower middle income segment(Indonesia) and 3 from high income segment(Japan, Australia and London) has shown significant impact of volatility in their returns. But the study shows no impact of transmission of volatility in interest rates risk on returns of stocks indices. In overall, the theoretical argument of negative relationship between stock price and prevailing interest rate is not rejected.

GARCH was used to check causality-in-variance running from the interest rate volatility to the stock market index volatility of the selected indices for the study. Tests of no causality in mean effect is used to check out whether there is any impact of independent variable (US T-Bills and RBI T-Bills) on dependent variable (returns of stock indices) The results have similar empirical results. All the selected stock indices of Asian countries are under a low negative impact of the changes in the interest rates (US and RBI Treasury Bills). The percentages of significance are not so high and there is no volatility effect of interest rates on the returns of selected stock indices of the world. The results of our study are in line with (DORON NISSIM, STEPHEN H. PENMAN) (2003).

There could be many reasons for this like stock and bond interest rates, consumer and business spending, inflation, terrorism and recessions. All these reasons are macroeconomic factors. Hence, the overall effect of changes in interest rates on equity value is negative, consistent with the negative correlation between changes in interest rates and stock returns.

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