Exchange rate Volatility and Interest rate Risk: In the case of Pakistan.

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Abstract:

The study examines the volatility of exchange rate effects on interest rates and inflation. For this purpose the study monthly data over the period January 1990 to December 2010 is considered. To explore the volatility of exchange rate study used the ARCH (Auto Regressive Conditional Heterosidasticity) and GARCH (Generalized Auto regressive conditional Heterosidasticity). The result shows that positive association between exchange rate risk and interest rate in the form risk premia in the interest rate. The result of the study fulfills the interest parity condition and purchasing power parity.

Keyword: Exchange rate volatility, ARCH and GARCH

JEL Classification: F31

1. Introduction:

After the collapse of the Bratton Wood system in 1970, most of the developing and developed countries have followed the managed floating exchange rate system. After 1980s the pace of globalization and international financial integration increases rapidly, so the behavior of exchange rate becomes very important to understand monetary and financial aggregate. The purpose behind this study is to explore the effects of exchange rate and its risk of interest rates, The exchange rate volatility positively influences to risk on foreign asset returns. Hence higher volatility in the exchange rate is compensated with higher risk premium in the form of higher domestic interest rate. This indicates a positive association between exchange rate volatility and interest rate volatility.

As these financial position of an economy is mostly determined by the efficiency of capital markets. The volatility in the exchange rate is harmful and susceptible to the capital market. Bentia and Lauterbach (2004) argued that exchange rate volatility has real economic costs in the form of price instability and economic instability. Exchange rate volatility is of greater inference for the financial system of a country especially for the stock market (Chen et al. 2004). However, economic literature reveals disagreement among economists on the Impact of exchange rate volatility on stock market volatility. (Carruth et al 2000; Kanas 2000 and Serven, 2003).

The remaining part of the study constrict as follows. Section 2 and 3 highlighted the review literature and econometric methodology respectively. Section 4, provides findings. The study concludes with section 5 which draws the main conclusion.

2. Review of Literature:

Omerbegivic (2005) examines the equilibrium of exchange rate in different criteria. Their study also examines the effects of exchange rate volatility on goods market and labor market equilibrium. The study concluded that proper understanding of exchange rate is very essential for policy maker to design appropriate exchange rate policy in achieving the long run equilibrium of the balance of payment.

Grossman and Levinsohn (1989) tried to design the method which captures the volatility of stock market return to variation in import competition. The study also explores the foreign exchange rate impact on stock return of firms in six United States import substitution industries. Grossman and Levinsohn find insignificant relationship among the exchange rate volatility and firm stock market returns.

Arize, Osang and Slottie (2000) tried to explore the empirical relationship between real exchange rate volatility on the export flows of underdeveloped countries over the period 1973 to 1996. The result of the study highlighted that real effective exchange rate volatility significantly impact the export demand in both short run as well as long run.

Baum, Caglayan and Ozkan (2004) tried to explore the empirical relationship between real effective exchange rate volatility and trade flows. The study used cross sectional data in 13 developing countries from the period of 1980-1998. The study concluded that effects of exchange rate on trade flows is non linear.. The trade flows also depend on the volatility of macroeconomic variables of importing countries.

Dornbusch (1976), explained the short run and long run relationship among prices, wages and exchange rate.They found prices and wages are rigid so investors are willing to level the expected return among countries.

Frankel (1979) organized a model of exchange rate, which is known as ‘real interest rate differential model’ that explains the role of inflationary expectations of the FPM and the sticky prices of the Dornbusch’s model of exchange rate determination.

Branson, (1976) found that in Portfolio balance model, risk factors, current account, fiscal policy, managerial intervention with the international exchange market are the key factors of exchange rates.

Furman (1998) examined that exchange rate is affected by interest rate through two channels, first, the risk of default and another one is the risk premium. The interest parity theory explained no role for both these channels, the interest rate represents the promised return on domestic

assets, i.e., actual interest receipts are equal to promised interest receipts. But in a post crisis situation, the high interest rate policy may decrease the probability of repayment which resulted in an increment of a risk premium on domestic assets.Because of its adverse effect on domestic economic activity, it reduces the profitability of domestic firms and increase borrowing costs. Therefore an increase in interest rate may lead to exchange rate depreciation. This could be stronger when the financial position of firms and banks are fragile.

Sulaiman and Lal (2010) examined the Euro-Dollar exchange rate impact on macroeconomic variables (real output, general price level, money supply and Pak-US exchange rate of Pakistan and found insignificant relationship among them due to heavy reliance on US dollar in term of trade they applied VAR based tools Impulse response and variance decomposition.

Gould (2000) explained the interest rate and exchange rate relationship with the channel of interest rate, risk premium, and default probabilities in some three growing economies Indonesia, South Korea, Malaysia, the Philippines, Thailand, and Mexico. Results showed exchange rates in these countries were influenced by credit spreads and stock prices rather than interest rates.

Pattanaik (2001) examined the interest rate and exchange in Indian economy he used monthly data for his research and their result showed that standard deviation shock to the call rate leads to rupee appreciation in the short run. His result also explained that in response to one standard deviation shock the exchange rate appreciates by about 8 paisas in the short run, but subsequently the exchange rate depreciates more than offsetting the initial impact of the hike in interest rates.

3. Econometric Methodology:

In this part of the study we introduced the set of equations which are used to analysis the association between exchange rate risk and interest rate. Three types of equations are specified here.

1. The exchange rate
2. The conditional volatility of exchange rate
3. The interest rate.

Following Akcay, Alper and Karasulu (1997) the exchange rate equation is modelled as follows

$$ER_t = \beta_0 + \beta_1 \sum_{i=1} ER_{t-i} + \varepsilon_t \text{ ----------(1)}$$

ER_t represents the domestic currency value of the foreign currency, while βo is an intercept term (i=1,2,…,n) are the slope coefficients of the log value of the exchange rate, While ε_t is a white noise error term (conditional mean is zero with constant variance)

$$\varepsilon / \Omega_{t-1} \approx (h,0) \text{ ----------(2)}$$

Where **Ω** represents the information set that includes all information available at time t-1 (lag time) regarding economic activities. Therefore the expected value of the exchange rate is

$$E(ER/\Omega_{t-1}) = \beta_0 + \beta_1 \sum_{i=1} ER_{t-i} + \varepsilon_t \text{ ----------(3)}$$

It is worth mentioning that his time varying (Variance) which measures the risk of exchange rate. Engle (1982) established the methodology of ARCH (Autoregressive Conditional Heteroscedastic) model to determine the time varying risk or time varying conditional variance. This equation can be written as follows.

$$h_t = \alpha_0 + \sum_{j=1}^{q} \alpha_{t-j} \varepsilon^2 \text{ ----------(4)}$$

Above equation no. 4 denoted the ARCH (q) process. Bollersev (1996) extends the ARCH(q) process by introducing lagged values of time varying (Variance) to the right hand side of equation 4, now equation 4 is written as follows.

$$h_t = \alpha_0 + \sum_{j=1}^{q} \alpha_{1j} \varepsilon_{t-j}^2 + \sum_{j=}^{q} \alpha_{2j} h_{t-1} \text{ ----------(5)}$$

The above equation is known as GARCH (p,q) process. The GARCH specification requires that the sum of all coefficient is less than one to satisfy the stationary condition. Recently, GARCH model is extensively used in stock prices and exchange rate volatility.

The interest parity condition defines as return of domestic and foreign currency is equal. The interest parity condition is also helpful to explain the association between exchange rate and interest rate. Under the perfect mobility of capital, interest rate differences must be balanced by the estimated exchange rate volatility. The foreign interest rate exceeds the domestic interest rate only if the local currency is expected to be appreciated. It is also known as uncovered interest parity. (Romar, 1996, Page no. 210). The Pakistan interest rate is more volatile as compare to foreign interest rate, so we don't take consider into account is volatility equation. The interest rate equation can be written by as follows.

$$R_t = \gamma_0 + \gamma_1 E(ER_t) + \eta \text{----------(6)}$$

Where R is the nominal interest rate on local currency assets, η is a white noise error term which mean is zero and variance is constant. The estimated value of the expected exchange rate coefficient is one , we allow the effects of the exchange rate risk of interest rate, which is measured with GARCH conditional variance equations.

$$R_t = \gamma_0 + \gamma_1 E(ER_t) + \gamma_2 h_t + \eta \text{----------(7)}$$

Inflation risk is another determinant of the interest rate. According to economic theory ambiguous relation between interest rate and inflation risk. Chan (1994) and Evans (1998) argued more risky assets provided more risk premia to investor as compared to less risky assets. Therefore, there should be a positive association between interest rate and inflation risk. On the other hand, finding of Cukierman and Wachtel (1997) find that government agencies create surprise inflation and reduce the nominal interest rate, so there is negative association found between inflation risk and interest rate. In this study, we introduce inflation risk in the interest rate equation. Now equation of interest rate is written as follows.

$$R_t = \gamma_0 + \gamma_1 E(ER_t) + \gamma_2 h_t + \gamma_3 \pi_t + \eta_t \text{ ----------(8)}$$

In this study, it is presumed that there is a one way casualty between exchange rate risk and inflation risk to the interest rate. Most of the study pointed out that interest also affects the exchange rate risk and inflation risk. In this study we measure the both risks (inflation risk and exchange rate risk) with the help of ARCH and GARCH process. The exchange rate risk and inflation risk are the deterministic function of the squared lagged residual. Here the risk is exogenous at given time. Therefore, no simultaneity biased problem in the estimation of above ARCH and GARCH equations.

4. Empirical Result:

This section of the study presents an estimate of the exchange rate, exchange rate risk and interest rate equation by employing the monthly data form January 1990 to December 2010. 2011. The exchange rate proxy is a log of Pak Rupee to US dollar rate, interest rate is the weighted average of the Treasury auction interest rate of 3 months, and the inflation is the log of the consumer price index. All data are taken from IFS (International Financial Statistics) for IMF (International Monetary Funds)

Table no. 1

Estimated equation of 6, 7 and 8.
$R_t = 6.3245+0.1658E(ER_t)+\eta$ t= (12.586) (4.568)
$R_t =4.523+0.14568E(ER_t)+0.2145h_t+\eta$ t =(5.3654) (2.1456) (6.694)
$R_t = 2.5698+0.12365E(ER_t)+0.1398h_t+0.1156\pi+\eta$ t =(4.2654) (2.1459) (4.2145) (6.2146)

The numbers under the estimated coefficients are the t-ratios.

ER_t, is the exchange rate, h_t, is the conditional variance of the exchange rate, π, is the conditional variance of the inflation, R_t, is the interest rate, η is the white noise error term

Table no.1 describes estimated interest rate equations 6, 7 and 8 respectively. The expected exchange rate is calculated by including two lags values of spot exchange rate. Two lags is included by using Akika Information Cretaria (AIC). Exchange rate risk and inflation risk should be measured with the help of GARCH process.

After measuring expected exchange rate, inflation risk and exchange rate risk,next we have measured the equation number 6, 7 and 8. The estimated result shows that the expected exchange rate is insignificant and positive. As expected exchange rate is depreciated interest rate increases. On the other hand, when we include exchange rate risk as an additional variable of exchange rate risk, it is statistically significant. The result suggests that exchange rate risk depreciation leads to higher interest rate in the form of risk premia.

The result is also parallel to the uncovered interest parity conditions but the coefficient is less than one and statistically significant. Berument and Malatyali (2001) found that inflation risk also increases interest rate. So this study modelled the inflation risk and exchange risk in the GARCH (1,1) process. Inflation risk is positive and significant which shows that as expected inflation risk increase interest rate also increases.

5. Conclusion

The purpose behind this study is to explore the effects of exchange rate volatility with the interest rate risk, monthly data January 1990 to December 2010 is used. The null hypothesis that there is a one to one relationship between the expected depreciation and interest rates. The result is robust after considering the inflation risk.

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