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Economic Growth and Exchange Rate Volatility in Case of Pakistan

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Abstract

This study was designed to investigate the relationship of economic growth and exchange rate volatility in Pakistan. The empirical relationship between exchange rate volatility and economic growth have been found while employing Error Correction techniques along with Auto Regressive Distributed Lag Model (ARDL) 1982 -1 to 2007 – IV. Notwithstanding, co-integration relationship between growth, exchange rate volatility, reserve money and manufacturing are detected in the long run except exports and imports. Conclusion suggests that domestic economic performance is very sensitive to the exchange rate volatility in the long-run period.

Key words: Exchange rate volatility, economic growth, co-integration

Introduction

The main objective of this research is to present a rationalized concept of the theory and composition of exchange rate that are compulsory to solve the important economic problems facing the economy in the country, like volatile exchange rate, unbalanced financial circumstances and frustration of government to have control over domestic money market. “Exchange rate” shows that how much unit of one nation’s currency can be purchased with one unit of domestic currency. More precisely, exchange rate is a conversion factor that determines rate of change of currencies. While exchange rates volatility shows that exchange rate is settled on demand and supply of one nation’s currency, it may turn out fastest moving price of currency and bring all the foreign capital in the economy.

Exchange rate volatility can influence the decisions of policy makers and affect the volume of exports and imports. It can also affect the allocation of manufacturing of goods, reserve money, exports, imports and balance of payments. Exchange rate volatility provides chances to domestic investors to invest in foreign currency to obtain higher profits and thus domestic currency undervalue and foreign currency gain values. Moreover, this volatility of exchange rate directly influences the prices of exports, imports, reserve money, manufacturing productions and their growth rates. Traders and investors always support the system where the discrepancy of the difference between actual and expected value of exchange rate is minimized but some traders and investors like volatile exchange rate, which can maximize their earnings. Sengupta and Sfeir (1995) state that there are two reasons of what exchange rate volatility has achieved a particular result in the international trade. One is that the impact of exchange rate volatility raises level of exports, improves balance of payments and provides a large incentive to domestic economy’s growth. Secondly, the investors increase global varieties in the asset market.

An assumption is made-up in mind that exchange rate volatility and selected macroeconomic variables play a pivotal role in the domestic and foreign economy. Therefore, it is considered an appropriate time for such an analysis for the economy of Pakistan. Nevertheless, theory recommends that exchange rate volatility; exports, imports, manufacturing products and reserve money in the presence of open economies have deep relationship with each other.

The foremost purpose of the present study is to see whether exchange rate volatility affects imports and exports, manufacturing products, and reserve money or not and if so, then in what direction? Exchange rate appreciation will affect exports, reserve money and manufacturing products positively and imports negatively, conversely, depreciation of exchange rate will affect exports, reserve and manufacturing productions negatively and imports positively. Here we will see the short-run and long run relationship between volatility of the exchange rate and selected macroeconomic variables. Theoretically, if depreciation of Pakistani currency exists (Pak Rupees/US$ increase in value), then this will raise competitiveness of the domestic goods and hence encourage exports. By the same way, appreciation of the Pak Rupees is expected to reduce imports and to improve trade balance.

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In view of the fact that the adoption of volatile exchange rates in the developing countries in 1973, the question arises whether exchange rate volatility has some effect on exports, imports, manufacturing products and reserves or not. The answer to this question may be framed in the review of literature. Therefore, various studies have estimated the relationship between exports, imports and exchange rate volatility. Akhtar and Hilton (1984), Kenen and Rodrik (1986), Rogoff (1998), Persson and Svensson (1989), have created adverse influence of exchange rate uncertainty on imports and exports. Rogoff (1998) stated that exchange rate flexibility generates significant problems for both exporters and importers. Arize (1998) also proposed that negative significant relationship between exchange rate instability and imports and exports exists in the long run and short run. De Grauwe (1988) suggested that if the fabrication of model is accurate, then relationship between exchange rate volatility and trade should be positive. Qayyum and Kemal (2006) found that there is strong relationship between the volatility of foreign market and the volatility of returns in stock market. Khan and Sajid (2005) investigated both the long and the short run relationship between real money balances, real income, inflation rate, foreign interest rate and real effective exchange rate with reference to Pakistan over the period of 1982:Q2 to 2002:Q4. They use ARDL and estimated results indicate that in the long-run real income, inflation rate, foreign interest rate and real effective exchange rate have a significant impact on real money balances in Pakistan.

Khair-uz-Zaman (2005) stated that the problems faced by Iranian exporters have had a statistically significance and positive impact on the Pakistan exports of carpets of supply function. Ortega and Giovanni (2005) suggested empirically the impact of trade cost on real exchange rate volatility.

Glauco and Abott (2004) investigated that exchange rate uncertainty has a significant influence on UK exports to EU countries. Supaat et al. (2003) found a little evidence of a relationship between exchange rate volatility and variables. Notwithstanding, the results of the analysis provide some support to the argument that volatility in the foreign exchange market may not be transferred to other parts of the economy.

Yelten (2003) suggested in his paper that due to depreciation of the Japanese Yen and Jerman Mark, currencies have routinely depreciated against U.S dollar. Sjaastad and Manzur (2003) say that empirical results strongly support the hypothesis. The facts from three small countries indicate that during the period from the 1970s to 1990s, capital flow was large for Argentina, substantial for Australia but negligible for Canada due to variation in real exchange rate. Doganlar (2002) analyzed empirically the impact of exchange rate instability on the exports of five Asian countries including Pakistan, Turkey, S. Korea, Malaysia and Indonesia. The results indicate that there a long run relationship exists between real exports, foreign activity, relative prices and exchange rate volatility. Zhang (2000) says that inflation occurs in the end due to devaluation of the currency. Esquivel et al. (2002) described exchange rate volatility has certainly played a role in reducing exports in developing countries. Virgil (2001) investigated that the long run relationship between Turkey's real exports and its exchange rate instability is negative but statistically significant for Germany, France and the United states. Smith (1999) stated that the analysis shows that an increase in exchange rate volatility is set out along with a decline in international correlations between bound and stock market. Abeysinghe and Yeok (1998) suggested that exchange rate deprecation stimulates exports and restrain imports, while exchange rate appreciation would be reduced exports and encourage imports. Aizenman (1992) and Goldberg (1993) find that increase in exchange rate volatility is associated with reductions in the level of investment.

Materials and Methods

The data for the variables such as exchange rate volatility, exports, imports, growth, manufacturing products, reserve money (RM), and consumer price index (CPI) are collected from the International Finance Statistics (IFS) which are published and organized by International Monetary Fund (IMF) and various issues of Economic Survey of Pakistan. The impact of exchange rate volatility on economic growth in Pakistan is covering the period of 1982 - I to 2007 - IV. An econometric analysis based on Auto Regressive Distributed Lag approach is used to analyze the trends and patterns of exchange rate volatility and its impact on variables in Pakistan. Adhoc estimation method is used to estimate distribution of lags. Dependant and explanatory variables except exchange rate volatility are deflated by the consumer price index (CPI). All involved series are transformed into log form. Log form use to reduce the problem of heteroskedasticity (Gujarati, 2003). Economic growth will be taken as dependent variable and real exports (X), imports (M), exchange rate volatility, manufacturing products (MP) and reserves money (RM) are taken as explanatory variables. The approach of (Pesaran and Shin 1995 and Pesaran *et al.* 2001) has been used in this study to test the existence of short and long run relationships between exchange rate and explanatory variables.

This test has several advantages; one of the most important advantages is that the existence of long run relationship is computed without any knowledge of the order of the series. Either, it consists of I (0) or I (1) for the possibility of co-integration. Moreover, this technique is suitable for small or large number of observations (Nagayasu, 1998). The second quality of this test is that it is not necessary whether the explanatory variables are exogenous or not. The short and long run relationship between variables can be found by using OLS to ARDL, with in a suitable lag length.

A rule of this model can be expressed as;

$$W_t = \mu + \sum_{t=1}^{P} \beta W_{t-1} + \varepsilon_t, \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where W_t is the vector of both X_t and Y_t where, Y_t dependent variable is defined as economy growth and X_t shows a set of explanatory variables, t is the time or trend variable, β_t is a matrix of VAR parameter for lag i.

We constructed a vector error correction model as follow:

$$\Delta W_t = U + \alpha_t \lambda W_{t-1} + \sum_{i=1}^{P-1} \gamma \Delta y_{t-1} + \sum_{i=0}^{P-1} \gamma \Delta X_{t-1} + \varepsilon_t, \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where Δ is first difference operator, t is the time trend and X is a vector of explanatory variables namely; exports (X), imports (M), exchange rate volatility, manufacturing products (MP), reserve money (RM). Variables, can be conducting by examining the joint hypothesis as follows;

The VECM procedures are the most important to find long run relationship between dependent variable X_t and set of independent variables. More precisely, following the assumption of Pesaran et al (2001), the above modal can be written as:

$$\Delta GDP_t = \beta_0 + GDP_{t-1} + \beta_1 ER_{t-1} + \beta_2 X_{t-1} + \beta_3 M_{t-1} + \beta_4 MP_{t-1} + \beta_5 RM_{t-1} + \sum_{i=1}^{P} \beta_6 \Delta ER_{t-1} + \sum_{i=0}^{q}$$

$$\beta_7 \Delta X_{t-1} + \sum_{i=0}^{r} \beta_8 \Delta M_{t-1} + \sum_{i=0}^{s} \beta_9 \Delta MP_{t-1} + \sum_{i=0}^{v} \beta_{10} \Delta RM_{t-1} + \mu_t, \text{---------} (3)$$

Where Δ the first difference operator, μ_t is a white-noise disturbance term.

Estimation of short Run Dynamics

Adhoc estimation method is used to estimate distribution of lags. In this case explanatory variable X_t is assumed to be non-stochastic, X_{t-1}, X_{t-2} and so on, are non-stochastic too. Therefore, in this principal, the ordinary least squares (OLS) can be used in ALTQ and Tinbergen approach Gujarati (2003). They suggest estimation distributed lag model, one may proceed sequentially; that is first regress Y_t on X_t, then regress Y_t on X_t, X_{t-1} and X_{t-2} and so on. This sequential procedure stops when the regression coefficient of lag variables start becoming statistically insignificant or the coefficient of at least one of the variables changes sign from positive to negative.

Data analysis

Dependant and explanatory variables except exchange rate volatility are deflated by the consumer price index (CPI), subsequently this deflation provide appropriate data for analysis. Here we want to find the long- run relationship between economy growth, exchange rate(ER), imports (M), exports (X), manufacturing products (MP) and reserve money (RM) by using appropriate techniques such as error correction modeling and co-integration analysis. Before applying co-integration technique, we first check the degree of integration of each variable of series in the model. The order of integration can be detected by using unit root. If it is found that all the series of variables are based on non-stationary at I (0) and are stationary at I (1). Nevertheless, both tests

give the same result after first differencing of series, that is all the series are stationary at I(1). So it is clear that Jhonsen co-integration technique cannot be used to detect the relationship between the variables at I (0) and I (1) level. The choice of lag length is based on the lower values of Akaike and Schwarz statistics. The lowest value of Akaike and Schwarz shows the goodness of the model.

Results and Discussion

The Augmented Dicky-Fuller (ADF) and Philips Perron (PP) unit test are used to find the order of integration of macroeconomic variables. The results obtained are reported in table 1.

The null hypothesis is that the series is non-stationary or contains a unit root. The rejection region of a null hypothesis for both ADF and PP is based on the Mackinnon critical Values.

It is found that all the series except imports (M) and reserve money (RM) are non-stationary in the test of Augmented Dicky- fuller (ADF). Similarly in the test of Philips-Perron (PP), growth, imports (M), reserve money (RM) and exports (X) are stationary at level while exchange rate (ER) and manufacturing products (MP) are non-stationary at level. All series are stationary at first difference in the test of ADF and PP; by the reason of mixed results here, Johnson technique cannot be used to determine the co-integration between dependant and explanatory variables. Consequently, Autoregressive Distributed Lag (ARDL) technique is used to find the long-run relationship.

Table 1. Results of the unit root tests

Variable	ADF		PP	
	Level	1st diff	Level	diff
ER_t	-0.079	-9.36^{*}	-0.13	-9.39^{*}
M_t	-2.75^{**}	-	-3.75^{*}	-
X_t	- 0.601	-13.29^{*}	- 2.11	-15.21^{*}
MP_t	-1.27	-10.78^{*}	-0.04	-14.22^{*}
RM_t	-3.70^{*}	-	5.53^{*}	-
GR	-3.65	-	-4.56	-

ER = Exchange Rate, M = Imports, X = Exports, MP = Manufacturing Products, RM = Reserve Money

Critical value; -3, -2.60, -1.95 at 1%, 5% and 10% respectively

Author's calculations using E-views Soft ware package (3.1).

We use Pesaran et al (2003) co-integration approach on equation 3 to see the impact of exchange rate volatility over the period of 1982 - I to 2007 - IV on explanatory variables. We have estimated equation 3 by using two, four and six lags on each first differenced variable and calculated F-tests. Nevertheless, when two lags are imposed, we find strong evidence for co integration, because of the lower value of Akaike and Schwarz statistics and our calculated F-statistics is 12.79, which is greater than critical value of upper bound value. The result suggests that long-run relationship exists between growth, exchange rate, imports, reserve money and manufacturing products and there is no long run relationship between exports and exchange rate volatility, this is so because volume of exports of Pakistan is stumpy. The co-integration disappears out, when we estimate equation 3 at four and six lags. Thus, results of the equation of 4 using ARDL approach are given in Table 2.

Table 2. Estimating Model for Exchange rate in equation 3

$$\Delta GDP_t = \beta_0 + GDP_{t-1} + \beta_1 ER_{t-1} + \beta_2 X_{t-1} + \beta_3 M_{t-1} + \beta_4 MP_{t-1} + \beta_5 RM_{t-1} + \sum_{i=1}^{P} \beta_7 \Delta ER_{t-1} + \sum_{i=0}^{q}$$

$$\beta_8 \Delta X_{t-1} + \sum_{i=0}^{r} \beta_9 \Delta M_{t-1} + \sum_{i=0}^{s} \beta_{10} \Delta MP_{t-1} + \sum_{i=0}^{v} \beta_{11} \Delta RM_{t-1} + \mu_t, \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Variable	Co-efficient Value	t-value
GDP	1.00	
M_{t-1}	-4.97	-4.92
RM_{t-1}	-3.58	-0.67
MP_{t-1}	-0.001	-1.74

X_{t-1}	0.486	0.498
	M Regression	
ΔX_{t-1}	-0.493	-4.24
ΔMP_{t-1}	316.75	6.16
ΔMP_{t-2}	146.3	2.44
	MP Regression	
ΔMP_{t-1}	-0.127	-2.21
ΔMP_{t-2}	-0.79	-11.90
	RM Regression	
$\Delta X_{t(-1)}$	-1.97	-3.26
ΔRM_{t-2}	-0.305	-2.365
	X Regression	
$\Delta X_{t(-1)}$	-0.78	-6.95
$\Delta X_{t(-2)}$	- 0.331	-2.65
ΔMP_{t-1}	2.45.44	4.95
ΔRM_{t-2}	0.049	2.089

Diagnostic Checking

$R^2 = 0.724$ Adjusted $R^2 = 0.716$

The results of error correction model are reported in Table 2. In M regression, only X at lag 1 and MP at lags 1 and 2 are statistically significant. Similarly, in MP regression, MP at lag 1 and lag 2 are statistically significant, while in RM regression X at lag 1 and RM at lag 2 are statistically significant. Nevertheless, in X regression, X at lag 1 and 2 and MP at lag 1 and RM at lag 2 are significant.

Short Run Error Correction Model

In M regression exports negatively at lag 1 and manufacturing product (MP) are positively at lag 1 and lag 2 are related with exchange rate volatility. This shows that 1% increase in exports will appreciate economic growth by 4.9%. Similarly, in MP regression MP at lag 1 and lag 2 are statistically significant and are negatively connected with economic growth with estimated elastic ties of 0.12 and 0.79 respectively. The results show that 1% decrease in MP will raise economic growth 1.2% and 7.9%. Nevertheless, in RM regression X and RM at lag 1 and lag 2 are negatively associated significantly with growth and in RM regression X at lag 1 and 2 positively, while MP at lag 1 and RM at lag 2 are negatively related with economic growth significantly and have elasticties -0.78, -0.33, 2.45 and 0.049 respectively. This shows that 1% decrease in imports and reserve money will raise economic growth by 2% and 6% respectively. The appreciation of flexible exchange rate has positive impact on exports and negative impact on imports in the short run. Therefore, appreciation of exchange rate has negative impact on reserve assets. This shows that 1% decrease in reserve money will increase by 2.7% economic growth. The result shows that changes in imports, manufacturing production, reserve money and exports have significant impact in the short run at different lags.

The Estimated Equation for Long-Run Relationship

$$GDP_t = -54.67 - 0.021RM - 0.19ER + 31.93MP + 0.104M \text{ - } 0.14\,X$$

(-2.19) (-2.90) (2.71) (1.27) (1.19)

Long run equation indicates that reserve money (RM) is negatively correlated to economic growth with estimated elasticity of 0.021. This shows that 1% decrease in reserve money will raise economic

growth by 0.2%. Results indicate that MP and M is positively linked to GDP with value of slope 31.93 and 0.10, but the value of M is insignificant. X is negatively related to economic growth with a value of slope coefficient of 0.14. The appreciation of imports indicates contradiction result with theoretical model but this value is insignificant. The findings of this study shows negative relationship between these two variables, which define that the depreciation of exchange rate will slow down economic growth. The relationship between manufacturing product (MP) and economic growth is positive. This shows that an increase of 1% in MP will result in about 32% increase in economic growth. Nevertheless, the findings of this research coincide with the conclusion of Yeyati and Sturzenegger (2002), Mustafa and Nishat (2006) and Doganlar (2002). Kemal (2006) also concluded that exchange rate instability affects exports positively and imports negatively which shows that volatility of exchange rate improves trade balance.

Conclusions

This paper examined the impact of exchange rate volatility on macroeconomic variables in Pakistan using quarterly data from 1982 -1 to 2007-IV. The findings of this study show positive relationship between these two variables, which contradict with the theoretical model but these values are insignificant. The manufacturing product (MP) and economic growth show positive relationship. This shows that 1% rise in MP will increase economic growth by 32%.

Reserve money has negative impact on economic growth: An increase in domestic reserve money may reduce the international of reserve and decrease economic growth. Results shows that over the sample period of study a 1% increase in imports will bring about a 0.2 % decrease in economic growth. Moreover, manufacturing sector and economic growth have positive relationship with each other. The overall conclusion of this research is that exchange rate volatility, reserve money, exports have long-run positive relationship with economic growth, but the statistical value of exports, and imports are insignificant. Notwithstanding, in the short run, exports, imports, manufacturing production, exchange rate volatility, economic growth and reserve money in various regressions have positive or negative relationship to economic growth at lags 1 and 2 correspondingly. The explanatory variables are insignificant except imports in the short-run. From this conclusion, we can find that domestic economic performance is very sensitive to the change in exchange rate volatility in the long-run period. Therefore, a stable period exchange rate policy may bring good economic performance.

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