Int. Journal of Economics and Management **4(2):** 373 – 390 (2010) ISSN 1823 - 836X

Export Demand within SAARC Members: DOES Exchange Rate Volatility MATTER?

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ABSTRACT

This paper examines the impact of currency volatility on the export demand within the SAARC region, covering Bangladesh, India, Pakistan and Sri Lanka. We model the conditional exchange rate volatility using a multivariate asymmetric CCC-GARCH model and applied the bound testing approach on the standard trade model framework. Our result shows that there exists evidence of significance long-run steady state equilibrium where foreign income, real exchange rate and exchange rate volatility does affects export decisions of producers in the region of SAARC. Real exchange rate volatility was found to have a significant and negative impact on the export demand of most of the SAARC countries. This implies that higher exchange rate fluctuation does not encourage intra-regional trade within SAARC region.

Keywords: SAARC, Exports Demand, Bound Test, Exchange Rate Volatility, CCC-GARCH.

INTRODUCTION

The South Asian Association for Regional Cooperation (SAARC) comprises of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The latest new member is Afghanistan, recently joined in 2007. The SAARC was established in December 1985 as a platform to promote regional economic integration in South Asia. The institutionalization of SAARC Preferential Trade Arrangement (SAPTA) in 1997 marked a significant milestone to promote and sustain mutual trade and economic cooperation among the members of SAARC, and leading towards the regional vision of forming a free trade area, customs union, common market and subsequently a monetary and economic union, as envisaged by international

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economic theory. Indeed, during the 10th SAARC Summit in Colombo July 1998, the member states agreed to set up a Committee of Experts (COE) to draft the treaty for a free trade area and in 6 January 2004, the Agreement on South Asian Free Trade Area (SAFTA) was signed during the 12th SAARC Summit in Islamabad.

The SAARC members basically aims to strengthen their economic competitiveness through the establishment of SAPTA and SAFTA, which allow them to enjoy significant cut in tariff, reductions in production cost, and more product specialization in their production networks. Subsequently, the region can expect greater demand expansion which will leads to substantial trade creation between the member states, as well as with the rest of the world. Before the cooperation effort of SAARC, South Asian countries have import-substitution and tight exchange controls policies, which restricted their economy development relative to other regions in the world. With the SAPTA and SAFTA agreements, however, these countries have open up their market to their counterparts and expose themselves to greater external shocks not only from their counterparts, but also from the rest of the world due to higher trade creation both intra- and inter-regionally.

According to the *de jure* classification by International Monetary Fund (IMF), as reported in Table 1, we can see that the South Asian countries basically have different mix of exchange rate regime and monetary policy framework. Based on 2008 classification, we can see that majority of the SAARC members, comprising Bangladesh, Sri Lanka, Nepal, Bhutan and Maldives, are following other conventional fixed peg while Afghanistan, India and Pakistan adopted a managed floating system. The SAARC members also have different style of monetary policy framework; a member either adopts a monetary aggregate targeting, single exchange rate anchoring or other monetary programs that have no explicitly stated nominal anchor, but rather monitor various indicators in conducting monetary policy (footnote 1 in IMF, 2008). As reported in Table 1, compared with the 2003 IMF classification, only Afghanistan, Sri Lanka and Pakistan have gone through some changes in the structure of currency regimes over the last decade. The heterogeneous in currency regime among SAARC members implies they have different degree of vulnerabilities and flexibility to adjust external shocks.[1]

Given the different exchange rate regimes adopted, we can expect varying degrees of exchange rate risk exposure in the trade sector across the SAARC members. In terms of magnitude, countries that follow flexible regime (independently float, managed float) like Afghanistan, India, Sri Lanka, Pakistan are expect to have high currency risk exposure as compared to those with fixed regime like Bangladesh, Nepal, Bhutan, and Maldives. However, in terms of direction, although existing trade theories suggest that currency uncertainty is the main source

[1] SAARC members adopted auction based market microstructure which tends to have higher transaction costs and bid-ask spreads as compared to dealer based system. Only India, Pakistan, Bangladesh and Sri Lanka have a flexible format of two-sided multiple price auctions (Dutch auctions) in the form of electronic brokerage system provided by international vendor Reuters (IMF, 2003).

of risk in international trade, in practice however, there is no consensus on the net impact of exchange rate volatility on trade flows. This is because it is difficult to gauge the net impact of exchange rate risk in the presence of hedging instruments and the conflicting position of exporters and importers in the hedging process. The assumption that exporters and importers are risk aversion is also questionable as it needs to depend on the outcome of income effect and substitution effect (De Grauwe, 1988).

Table 1 Currency regimes for the SAARC members

Country [currency]	Currency Regime in IMF (2003) [monetary policy framework]	Currency Regime in IMF (2008) [monetary policy framework]
Afghanistan [The Afghani]	Independently Floating [other]	Managed floating [monetary targeting]
India [Indian rupee]	Managed floating [other]	Managed floating [other]
Bangladesh [Taka]	Other conventional fixed peg [exchange rate anchor against a single currency]	Other conventional fixed peg [exchange rate anchor against US$]
Sri Lanka [Sri Lankan rupee]	Managed floating [monetary targeting]	Other conventional fixed peg [exchange rate anchor against US$]
Nepal [Nepalese rupee]	Other conventional fixed peg [exchange rate anchor against a single currency]	Other conventional fixed peg [exchange rate anchor against a single currency]
Pakistan [Pakistani rupee]	Managed floating [IMF-supported or other monetary program]	Managed floating [other]
Bhutan [Ngultrum]	Other conventional fixed peg [exchange rate anchor against a single currency]	Other conventional fixed peg [exchange rate anchor against a single currency]
Maldives [Rufiyaa]	Other conventional fixed peg [exchange rate anchor against a single currency]	Other conventional fixed peg [exchange rate anchor against US$]

Source: Extracted from (i) International Monetary Fund (2003) Exchange Arrangements and Foreign Exchange Markets: Developments and Issues, IMF: Washington D.C. (ii) IMF (2008): *De Facto Classification of Exchange Rate Regimes and Monetary Policy Frameworks* [Updated 30th April 2008] Available at: http://imf.org/external/np/mfd/er/2008/eng/0408.htm [Accessed 8th October 2009]

The argument on the sign of exchange rate volatility is also reflected in empirical literature. With aggregate trade data, empirical studies suggest insignificant or weak impact of exchange rate volatility on trade flows (see for example Makin 1976; Kenen, 1979; Bailey *et al*., 1986; Koray and Lastraper, 1989 and Bini-Smaghi, 1991). However, if bilateral trade data were used, exchange rate volatility become statistically significant but no consensus can be reach on its sign. On US market,

most studies manage to find negative impact of exchange rate volatility on bilateral trade with developed countries (see for example Hooper and Kohlhagen, 1978; Cushman, 1983, 1988; Kroner and Lastrapes, 1993 and Caporale and Doroodian, 1994), but MacKenzie and Brooks (1997) report a positive effect, and Aristotelous (2001) and Klaassen (2004) find no significant impact. Daly (1998) reports a positive effect from bilateral trade of Japan with others. For emerging market most evidence support a negative impact of exchange rate volatility on bilateral trade data, see for example: Hassan and Tufte (1998) for Bangladesh; Rahmatsyah *et al*. (2002) for Thailand and Siregar and Rajan (2004) for Indonesia.

Obviously, there is less attention given to South Asian countries in this specific area of research. Empirical works on the impact of exchange rate volatility on trade offers no insight for the SAARC region. This paper contributes to the literature in two ways. First, we extend the investigation on the impact of exchange rates volatility on trade to SAARC countries. This is a region that received less attention in empirical literature but in terms of population, SAARC sphere of influence is the largest of any regional trading bloc as the bloc involved almost 1.5 billion people of its member states.[2] The second contribution lies in our empirical analysis employing the bounds testing approach developed recently by Pesaran, *et al*. (2001) on monthly bilateral trade flows of four of the major SAARC countries covering a long sample period of 1980-2010. Also, an asymmetric volatility model is employed to generate the exchange rate volatility. This is quite a new attempt in this line of research. Given that exchange rate risk is not symmetry for most of the emerging markets, the asymmetrical volatility model is able to accommodate the good and bad exchange rate shocks to the trade sectors of the South Asian region.[3]

The rest of this paper is organized as follows. Section 2 outlines the trade model that we adopted for our investigation, our empirical model specification, and all the data employed. Section 4 presents the results and discussion on the findings. Concluding comments are in the final section of the paper.

METHODOLOGY

The Trade Model

Theoretically there are two main determinants of exports demand function (Dornbusch, 1988, and Hooper and Marquez, 1993). The first is foreign income variable, which represents the economic activity and the purchasing power of the

[2] Currently there is a few countries showing interest in joining SAARCH. Among others, the People's Republic of China has gained strong support from SAARC members. With the fast rising of India and China economies in the world arena, the prospect of SAARC is expected to grow significant in the near future.

[3] For evidences of asymmetric in exchange rate volatility in emerging countries, see Tse and Tsui (1997), Mckenzie and Mitchell (2002) and Baharumshah and Hooy (2007).

trading partner. One would expect that increases in real GDP of trading partners lead to a greater volume of exports to those partners. This effect is well-known as income effect. The second is the relative price or the term of trade variable. If a country's real exchange rate appreciates (depreciates), this will cause the domestic goods to become less (more) competitive than foreign goods, therefore exports will fall (increase) and imports will rise (fall). This effect is so-called the relative price effect or the real exchange rate effect. As noted, exchange rate volatility is a crucial factor in affecting export flows, so this new determinant needs to be explicitly taken into account in estimating the export demand function (defined as the volatility effect).

For our empirical test, the following export demand function which incorporate all these three factors are adopted:

$$\ln \mathrm{EXP}_t = \alpha + \beta_1 \ln WY_t + \beta_2 \ln RER_t + \beta_2 \ln VOL_t + e_t \tag{1}$$

where *EXP* is real export, *WY* is foreign income of a trading partner country, *RER* is the real exchange rate, *VOL* is the nominal exchange rate volatility.

In order to examine the export demand function among countries in SAARC, we employ the bounds testing approach developed by Pesaran, *et al*. (2001). One of the advantages of this technique is it has better small-sample properties than cointegration techniques developed by Engle and Granger (1987) and Johansen and Juselius (1990). In addition, Pesaran, *et al*. (2001) demonstrate that, within autoregressive distributed lag (ARDL) model, the ordinary least squares (OLS) estimators of the short-run estimates are consistent while the ARDL based estimators of the long run coefficients are super-consistent in the small sample size.

We re-formulate Equation (4) to derive the following Unrestricted Error Correction Model (UECM):

$$\begin{aligned}\Delta \ln EXP_t = {} & \beta_0 + \beta_1 \ln EXP_{t-1} + \beta_2 \ln WY_{t-1} + \beta_3 + \ln RER_{t-i} + \\ & \beta_4 \ln VOL_{t-1} + \sum_{i=1}^{p} \beta_5 \ln \Delta EXP_{t-i} + \sum_{i=0}^{p} \beta_6 \ln \Delta WY_{t-i} + \\ & \sum_{i=0}^{p} \beta_7 \ln \Delta RER_{t-i} + \sum_{i=0}^{p} \beta_8 \ln \Delta VOL_{t-i} + u_t\end{aligned} \tag{2}$$

where u_t is the white noise error term; Δ is the first difference operator; and p is lag structure, which is determined by Akaike's information criterion.

There are two steps in examining the long run relationship between exports and its explanatory variables. First, we estimate Equation (4) by ordinary least square (OLS) technique. Second, we examine the long run relationship by imposing the restriction that all estimated coefficients of lagged one level variables equal to zero. That is, the null hypothesis is $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$. In order to test the null

hypothesis, following Pesaran, *et al.* (2001), we apply either standard Wald test or *F*-statistic, which has a non-standard distribution that depends on few factors such as sample size, the inclusion of intercept and trend variable in the estimation, and number of regressors. If the *F*-statistic obtained from the restriction is less than lower bound critical value, we do not reject the null hypothesis of no long run relationship. In contrast, if the computed *F*-statistic is greater than upper bound critical value, then we reject the null hypothesis and conclude that there appears steady state long run equilibrium between the variables under study. However, if the *F*-statistic falls within lower and upper bound critical values, then the results are inconclusive and the stationarity properties of the series must be examined and investigated.

Exchange Rate Volatility Measure

There are two popular approaches to measure exchange rate volatility. The first approach is to use historical standard deviation of the time series of exchange rates while the second is to employ volatility model to generate conditional volatility series. In empirical literature concerning currency volatility on trade flows, both of these approached are widely employed. In the first approach, the common method is to use the standard deviation of the growth rate of the exchange rate with a moving average transformation (IMF, 1984; Kenen and Rodrik, 1986; Cushman, 1988; Lastrapes and Koray, 1990; Klein, 1990; Chowdhury, 1993; Daly, 1998; Wei, 1998; Aristotelous, 2001). Other variation include the squared residual from ARIMA process by Asseery and Peel (1991), the difference between forward and current spot rates by Hooper and Kohlhagen (1978) and the Gini mean difference coefficient by Rana (1981). For the conditional volatility approach, the predominant method is to employ the autoregressive conditional heteroscedastic (ARCH) or Generalized-ARCH (GARCH) processes (Kroner and Lastrapes, 1993; Caporale and Doroodian, 1994; Mckenzie and Brooks, 1997; Mckenzie, 1998; Chou, 2000).

The existing currency-trade literature used univariate conditional volatility model. This specification does not address plausible volatility spillover effect of currency volatilities, which is by now, a quite well accepted currency behavior in empirical research. In view of this research gap, therefore, this study adopted a multivariate conditional volatility model to generate the conditional volatility of the SAARC currencies in examining the effect of currency volatility on their trade flow. The multivariate conditional model basically is a system of equations that is able to simultaneously accommodate the volatility spillover effect between currencies in the SAARC region. It thus provides a more efficient measure on the conditional currency volatilities.

Among the few multivariate GARCH models available, we decided to employ the Conditional Constant Correlation (CCC) model of Bollerslev (1990). This is the improved version of CCC model of Bollerslev *et al*. (1988). It has added restriction

to reduce the number of parameters in the system of conditional variance equations and thus is more popular than the VECH model of Bollerslev *et al*. (1988) which requires a large number of parameter estimation. Another variant - the BEKK model of Baba *et al*. (1990) and Engle and Kroner (1995) has problem as the statistical significance of its parameters is unclear due to the combinations of different parameters serving as new coefficients for a particular regressor (Baur, 2003).

The conditional mean of our exchange rate model is specified as followings:

$$EX_t = D + G\,(EX_{t-1}) + \Xi_t \tag{3}$$

where EX_t is the vector of export series for the four SAARC countries, D and G represent the intercept and the autoregressive slope coefficients. The system of errors Ξ_t is assumed to follow a multivariate GARCH specification:

$$\Xi_t \,\big|\, \Omega_{t-1} \sim \left(0, H_t\right)$$

where H_t is the conditional variance-covariance matrix in multivariate GARCH specification.

We incorporate an asymmetric terms to the variance-covariance matrix to capture the asymmetric responses of the conditional variances and covariances to good and bad news. There are evidences that emerging countries exhibit asymmetric behavior in exchange rate volatility, see for example Tse and Tsui (1997), Mckenzie and Mitchell (2002) and Baharumshah and Hooy (2007). The asymmetric terms capture the adverse shocks (bad news) of exchange rate volatility which is assumed to be more severely than favorable shocks (good news). A conceivable reason for the asymmetric exchange rate behavior can be explained by the risk-premium effect, due to agent's risk aversion during a market downturn.

In equation form, the individual elements of H_t for the augmented multivariate CCC model are given by:

$$h_{i,t} = c_i + a_1 e^2_{i,t-1} + b_i h_{i,t-1} + s_i \eta^2_{i,t-1} \tag{5}$$

$$h_{ij,t} = h_{ji,t} = \rho_{ij,t} \sqrt{h_{i,t} h_{j,t}}; \qquad i \neq j \tag{6}$$

where i,j = Bangladesh, India, Pakistan, Sri Lanka; h_i is the variance and h_{ij} is the covariance ($i \neq j$) element in H_t ; e_i is the error term, ρ_{ij} is the conditional correlation ($i \neq j$). The asymmetric term is represented by $\eta_{i,t-1} = e_{i,\,t-1} \mathrm{I}_{t-1}$ and $\mathrm{I}_{t-1} = 1$ if $e_{i,\,t-1} < 0$ and $\mathrm{I}_{t-1} = 0$ otherwise. The log-likelihood function for the conditional densities of the errors process in the multivariate model takes the following form:

$$L(\theta) = -\frac{n}{2}\ln(2\pi) - \frac{1}{2}\ln\left|H_T\right| - \frac{1}{2}\Xi' H_T^{-1}\Xi_t$$

where θ denote the vector of all the parameters.

Data

The empirical analyses are applied to a sample of monthly series spanning from January 1980 to January 2010. Data on bilateral exports are extracted from the IMF Direction of Trade Statistics, while industrial production, exchange rates are downloaded from DataStream. Only four members of the SAARC are covered, i.e. Bangladesh, India, Pakistan and Sri Lanka. The other four, i.e. Afghanistan, Bhutan, Maldives and Nepal are excluded due to the lack of data on their industrial production series.

RESULTS AND DISCUSSIONS

Preliminary Analysis on SAARC Trade Flows

Before we proceed to the econometric modeling perhaps a look at summary of descriptive statistics of the dataset would provides us an insight on the behavior of trade (export) flows of the SAARC countries. From Table 2, it is seen that the bilateral trade (export) flows within SAARC are quite small in size for the period early 1980- early 2010. However, India is the largest SAARC country which has received a large portion of exports from Pakistan while Sri Lanka enjoyed the highest export flows from Bangladesh. The bilateral flows between the rests of the SAARC members are relatively small. Looking at the fluctuation of bilateral flows between SAARC countries, the standard deviation is relatively high in these countries, except the bilateral flows from India to the rest of SAARC countries. This is evident by the large range between maximum and minimum values.

Results for Intra-Trade of SAARC

The results of the UECM estimation adopted under bounds testing procedure for the intra-trade relationship between these SAARC countries are reported in Table 3. There is strong evidence in favour of cointegration among exports, foreign income (income of trade partner), real exchange rate and exchange rate volatility in all the four SAARC countries. The calculated *F*-statistic of all export demand equations is statistically significant at 5 per cent level. Hence, the null hypothesis of no cointegration relationship is rejected. This implies that there is a long-run equilibrium relationship among real exports, foreign income, and exchange rate volatility for bilateral trade in all the SAARC countries under study.

Table 2 Summary Statistics for Export Demand within SAARC Members (in million USD)

Bangladesh export to	**Bangladesh**	**India** (1980M7-2010M1)	**Pakistan** (1980M7-2010M1)	**Sri Lanka** (1980M7-2010M1)
Mean	-	0.360	-0.104	1.361
Standard deviation		36.057	24.210	63.516
Minimum		-162.634	-94.545	-226.245
Maximum		123.841	86.892	274.663
India export to	**Bangladesh** (1980M1-2010M1)	**India**	**Pakistan** (1980M1-2010M1)	**Sri Lanka** (1980M1-2010M1)
Mean	0.338	-	0.377	0.431
Standard deviation	8.706		37.774	13.457
Minimum	-42.542		-223.769	-79.225
Maximum	34.294		166.194	85.804
Pakistan export to	**Bangladesh** (1980M2-2010M1)	**India** (1980M2-2010M1)	**Pakistan**	**Sri Lanka** (1980M2-2010M1)
Mean	-0.100	1.060	-	0.111
Standard deviation	28.088	37.261		28.370
Minimum	-120.926	-296.047		-173.640
Maximum	113.566	187.559		146.019
Sri Lanka export to	**Bangladesh** (1980M1-2010M1)	**India** (1980M1-2010M1)	**Pakistan** (1980M1-2010M1)	**Sri Lanka**
Mean	-0.076	0.089	-0.045	-
Standard deviation	35.797	26.238	14.343	
Minimum	-284.386	-96.848	-54.369	
Maximum	261.066	106.358	43.418	

Table 3 Cointegration analysis for export demand within SAARC members

Export	Computed F-statistic
Bangladesh to India (1980M7 – 2010M1: observations: 355)	22.182***
Bangladesh to Pakistan (1980M7 – 2010M1: observations: 355)	45.488***
Bangladesh to Sri Lanka (1980M7 – 2010M1: observations: 355)	67.381***
India to Bangladesh (1980M2 – 2010M1: observations: 360)	24.107***
India to Pakistan (1980M2 – 2010M1: observations: 360)	34.529***
India to Sri Lanka (1980M2 – 2010M1: observations: 360)	25.750***
Pakistan to Bangladesh (1980M2 – 2010M1: observations: 360)	9.328***
Pakistan to India (1980M2 – 2010M1: observations: 360)	66.358***
Pakistan to Sri Lanka (1980M2 – 2010M1: observations: 360)	6.493***
Sri Lanka to Bangladesh (1980M1 – 2010M1: observations: 361)	6.623***
Sri Lanka to India (1980M1 – 2010M1: observations: 361)	22.171***
Sri Lanka to Pakistan (1980M1 – 2010M1: observations: 361)	5.764***

Notes: The lower bound critical values are 2.45 (10%), 2.86 (5%) and 3.74 (1%) while the upper bound critical values are 3.52 (10%), 4.01 (5%) and 4.06 (1%), respectively. Critical values are obtained from Pesaran, *et al*. (2001), Table CI(iii) Case III: Unrestricted intercept and no trend, p. 300.
*, ** and *** indicate significance at 10%, 5% and 1% level, respectively.

The estimated coefficients for export demand function are shown in Table 4. The models fulfill the conditions of no serial correlation, homoscedasticity, normality of residuals and no specification errors. The adjusted R-squares are ranging from 0.7134 to 0.8077, which indicate the goodness of fit of the models is fairly good. The results indicate that foreign income (WY) of the trading partner is the main determinant in encouraging bilateral trade from India, Pakistan and Sri Lanka to Bangladesh and the sign is positive, which consistent with the theory in all regressions. In contrast, real exchange rate variable (home currency against US dollar) is negative and statistically significant at 10% significance level or better in the bilateral trade between Bangladesh and its three trading partners (India, Pakistan and Sri Lanka). The negative sign of the variable suggests that the bilateral trade between Bangladesh with her neighboring countries is very

Table 4 Estimated long-run coefficients of export demand within SAARC members

Export	Variables					Goodness of Fit & Diagnostic Checking
	LEXPO	LWY	LER	LVOL	C	
Bangladesh to India	1.00	0.267** (1.950)	-0.257* (-1.645)	-0.829* (-1.723)	-5.231 (-1.509)	$\overline{R}^2$ = 0.7215; AR{1} = 0.1647 [0.6851]; ARCH{1} = 0.1369 [0.5569]; RESET{1}= 1.4466 [0.2301]
Bangladesh to Pakistan	1.00	0.095** (2.155)	-0.094* (-1.863)	0.169 (0.986)	-2.395** (-2.001)	$\overline{R}^2$ = 0.7680; AR{1} = 0.0228 [0.8800]; ARCH{1} = 2.0713 [0.1511]; RESET{1}= 0.0392 [0.8431]
Bangladesh to Sri Lanka	1.00	1.074* (1.680)	-1.395* (-1.884)	-8.781*** (3.437)	3.096 (0.8427)	$\overline{R}^2$ = 0.7244; AR{1} = 0.0225 [0. 8807]; ARCH{1} = 0.1862 [0.8302]; RESET{2}= 1.935 [0.1651]
India to Bangladesh	1.00	0.055* (1.748)	-0.059* (-1.645)	0.541** (2.496)	-4.808*** (-2.685)	$\overline{R}^2$ = 0.7134; AR{3} = 0.5531 [0.6464]; ARCH{1} = 1.6284 [0.1523]; RESET{1}= 1.9963 [0.1378]
India to Pakistan	1.00	0.091* (1.950)	-0.098* (-1.824)	0.569* (1.661)	-6.174** (-2.192)	$\overline{R}^2$ = 0.8077; AR{2} = 1.5477 [0.2148]; ARCH{1} = 1.7146 [0.1914]; RESET{1}= [0.]
India to Sri Lanka	1.00	0.099* (1.694)	-0.132* (-1.917)	1.634*** (2.665)	-11.554*** (-2.679)	$\overline{R}^2$ = 0.8009; AR{2} = 0.2611 [0.7704]; ARCH{2} = 1.2216 [0.2372]; RESET{8}= 1.6156 [0.1218]

Table 4 (*Cont'd*)

Pakistan to Bangladesh	1.00	0.061** (2.114)	-0.041* (-1.678)	0.093 (0.563)	-2.792** (-2.127)	$\overline{R}^2$ = 0.7431; AR{2} = 0.1554 [0.8561]; ARCH{1} = 0.8274 [0.5496]; RESET{10}= 1.5239 [0.1311]
Pakistan to India	1.00	0.448* (1.866)	-0.356* (-1.755)	0.402 (0.324)	-18.424* (-1.731)	$\overline{R}^2$ = 0.7323; AR{2} = 1.4445 [0.2377]; ARCH{1} = 1.9858 [0.1599]; RESET{1}= 0.6638 [0.4159]
Pakistan to Sri Lanka	1.00	0.169*** (3.003)	0.139*** (2.891)	-0.504* (-1.955)	8.022*** (3.172)	$\overline{R}^2$ = 0.7323; AR{2} = 1.4445 [0.2377]; ARCH{1} = 1.9858 [0.1599]; RESET{1}= 0.6638 [0.4159]
Sri Lanka to Bangladesh	1.00	0.204** (2.351)	0.112** (2.394)	0.001 (1.373)	7.432** (2.233)	$\overline{R}^2$ = 0.8069; AR{2} = 0.7025 [0.4965]; ARCH{1} = 2.4265 [0.1204]; RESET{1}= 0.4664 [0.7060]
Sri Lanka to India	1.00	0.414** (2.141)	0.219** (2.156)	0.001 (1.095)	15.323* (1.944)	$\overline{R}^2$ = 0.7739; AR{2} = 0.8772 [0.4171]; ARCH{1} = 0.5830 [0.6266]; RESET{1}= 0.0681 [0.7943]
Sri Lanka to Pakistan	1.00	0.081* (1.779)	0.049** (1.976)	0.001 (-0.265)	2.717 (1.561)	$\overline{R}^2$ = 0.7805; AR{2} 0.0341= [0.9664]; ARCH{1} = 0.1378 [0.7106]; RESET{1}= 1.8584 [0.1740]

Notes: t-statistics are shown in parentheses. $\overline{R}^2$ is adjusted coefficient of determination. AR{2) is 2nd order LM test of residual serial correlation. ARCH{1) is 1st order LM test of autoregressive conditional heteroscedasticity. RESET is Ramsey's RESET mis-specification test. NORM is a test for residual normality. The asterisks *, ** and *** indicate the rejection of null hypothesis at 10, 5 and 1 per cent level of significance, respectively. C = Intercept.

competitive, that is, a depreciation of Bangladesh's currency reduces the trade volume with her neighboring countries. Looking at the exchange rate volatility, it is found that the variable is negative and statistically significant for the bilateral trade between Bangladesh and India, and Bangladesh and Sri Lanka. Although the sign is positive between Bangladesh and Pakistan, it is not statistically significant. This indicates that a rise in exchange rate volatility in the SAARCH countries has negative implications on their export flows, which is consistent with previous studies (Hassan and Tufte, 1998; Rahmatsyah *et al*., 2002; and Siregar and Rajan, 2004).

With regard to the export demand function of India, we find that foreign income is a crucial factor in influencing bilateral trade with its trading partners. This suggests that the higher the income level of its trading partners will lead to higher purchasing power of the country and then encourage more exports from India. Similar to the results reported for Bangladesh, the exchange rate is negative and statistically significant, which suggests that exchange rate devaluation may not appropriate to be used to promote bilateral trade between the intra-trade between SAARC countries. It is worth noting that sign of the exchange rate volatility is positive and statistically significant for the export flows from India to Bangladesh, Pakistan and Sri Lanka. This result is very different as compared to the Bangladesh's trade flows with its trading partners. This reveals that the risks associated with exchange rate variability discourage economic agents from trading across borders. Exchange rate volatility increases cost on risk-averse investors and, therefore, respond by favoring to trade at the margin. As a consequence, the volume of exports from India to these three countries reduces. Our findings support the notion that a raise in exchange rate risk leads to a reduction in the level of bilateral trade, which is consistent with Clark (1973), Baron (1976), Hooper and Kohlhagen (1978), Broll (1994), and Wolf (1995).

Next, we proceed to investigate the Pakistan's bilateral export flows to Bangladesh, India and Sri Lanka. The estimated coefficients for the income variable are significant at 10 percent level or better with theoretically consistent signs. In contrast, real exchange rate variables have negative effect on the Pakistan's exports and mostly significant at 10 percent significance level. Results for the volatility measure indicate that exchange rate volatility has a negative impact on the bilateral export flows from Pakistan to Sri Lanka while its impact on the export flows to Bangladesh and India is positive, but it is not statistically significant.

In the case of Sri Lanka and its trading partners, the foreign income variable for the bilateral export flows is positive and significant. This implies that, consistent with other countries' export flows, its market size or economic growth is likely to be conducive to increase the export volume from Sri Lanka. It is surprisingly shown that the estimated coefficient of real exchange rate is positive and statistically significant, which indicates that the devaluation strategy is effective to promote higher export volume in its bilateral trade with Bangladesh, India and Pakistan. Different from the other countries' export flows, there is no evidence that uncertainty

of exchange rates is likely to generate higher (or lower) export flows from Sri Lanka to Bangladesh, India and Pakistan.

It is noteworthy that three main findings of bilateral trade between these SAARC countries can be summarised as follows. Firstly, the income level of their trading partners is one of the significant determinants in promoting the bilateral intra-trade among these countries. The positive and significant effect of foreign income on the export flows of these countries suggesting that intra-trade between these SAARC countries is highly dependent on the purchasing power of the countries. Obviously, income effect can be viewed as the dominant factor in encouraging bilateral trade between the countries. Secondly, looking at the role of exchange rate in affecting the bilateral trade between SAARC, it is revealed that the devaluation strategy is not effective in most of the South Asian countries, except Sri Lanka, as indicated by the negative sign. Hence, this may suggest that depreciation of their currency (Bangladesh, India and Pakistan) leads to a contractionary effect from their exports.

Finally, for intra-trade of these SAARC countries with their trading partners, export flows are negatively significant stimulated by exchange rate volatility. The contrasting impact of exchange rate volatility can be attributed to difficulty in hedging exchange rate volatility in these countries. In other words, currency risk is difficult to be covered within the SAARC region due to less-developed domestic financial sector development in these countries. Financial sectors are crucial in giving hedging protection against the exchange rate risk but the hedging facilities of these SAARC countries, however, are not capable to provide sufficient protection against the exchange rate risk for their bilateral trade. Besides, given the different exchange rate regimes implemented by these SAARC countries, it is not surprised that the effect of exchange rate volatility on bilateral trade is different in these countries as India, Sri Lanka and Pakistan adopted flexible exchange rate regime (such as independently float or managed float) while Bangladesh adopted fixed exchange rate regime.

CONCLUSIONS

The present paper aimed to examine the effect of exchange rate volatility on the bilateral trade between four members of South Asian Association for Regional Cooperation (SAARC), i.e. Bangladesh, India, Pakistan and Sri Lanka. Using bounds testing approach, there are few findings that can be drawn from the results.

First, we find strong evidence of a significant long run relationship between export flow and the selected explanatory variables (foreign income, real exchange rate and exchange rate volatility) in the export demand functions. The long-run estimates for most bilateral trade in South Asian countries show that foreign income, real exchange rate and real exchange rate volatility play a pivotal role in affecting export decisions by producers in the region of SAARC.

Second, foreign income is significant and positive related to real exports. Our finding is consistent with other studies such as Arize *et al*. (2000). Third, real exchange rate variable is negative and significant in most cases, which implies that the depreciation of exchange rate is not an effective strategy in stimulating the growth of export volume in some countries, especially Bangladesh, India and Pakistan. These findings, however, need further examination on the Marshall-Lerner condition in these South Asian economies and this is beyond the scope of the present study.

Finally, exchange rate volatility does play a crucial role in explaining the pattern of exports in Bangladesh, India, Pakistan and Sri Lanka. The results indicate that the impact of exchange rate volatility on exports is negative and significant, which suggest that higher exchange rate fluctuation tends to reduce bilateral trade with their SAARC counterparts. Hence, it is important to take into account the fluctuation of exchange rate in designing and implementing their trade policies.

REFERENCES

Aristotelous, K. (2001) Exchange-Rate Volatility, Exchange-Rate Regime, and Trade Volume: Evidence from the UK-US Export Function (1889-1999), *Economic Letters*, **72**, 87-94.

Arize, A.C., Osang, T. and Stottje, D.J. (2000) Exchange-rate Volatility and Foreign Trade: Evidence from Thirteen LDC's, *Journal of Business & Economic Statistics*, **18**, 10-17.

Asseery, A. and Peel, D.A. (1991) The Effects of Exchange Rate Volatility on Exports – Some New Estimates, *Economics Letters*, **37**, 173-177.

Baba, Y., Engle, R.F., Kraft, D.F. and Kroner, K.F. (1990) *Multivariate Simultaneous Generalized ARCH*. Department of Economics Mimeo, University of California, San Diego.

Baharumshah, A.Z. and Hooy, C.W. (2007) The exchange rate volatility and Asian financial crisis: Evidence from South Korea and ASEAN-5, *Review of Pacific Basin Financial Markets and Policies*, **10(2)**, 237-268.

Bailey, M.I., Tavlas, G.S. and Ulan, M. (1986) Exchange Rate Variability and Trade Performance: Evidence for the Big Seven Industrial Countries, *Weltwirtschaftliches Archiv*, **122**, 466-477.

Baron, D.P. (1976) Fluctuating Exchange Rates and the Pricing of Exports, *Economic Inquiry*, **14**, 425-438.

Baur, D. (2003) Testing for Contagion – Mean and Volatility Contagion, *Journal of Multinational Financial Management*, **13**, 405-422.

Bini-Smaghi, L. (1991) Exchange Rate Variability and Trade: Why is it so Difficult to Find any Relationship? *Applied Economics*, **23**, 927-936.

Bollerslev, T., Engle, R.F. and Wooldridge, J.M. (1988) A Capital Asset Pricing Model with Time-Varying Covariances, *Journal of Political Economy*, **96**, 116-131.

Bollerslev, T. (1990) Modeling the Coherence in the Short-Term Nominal Exchange Rates: A Multivariate Generalized ARCH Model, *Journal of Political Economy*, **96**, 116-131.

Broll, U. (1994) Foreign Production and Forward Markets, *Australian Economic Papers*, **33**, 1-6.

Caporale, T. and Doroodian, K. (1994) Exchange Rate Variability and the Flow of International Trade, *Economics Letters*, **46**, 49-54.

Chou, W. (2000) Exchange Rate Variability and China's Exports, *Journal of Comparative Economics*, **28**, 61-79.

Chowdhury, A.R. (1993) Does Exchange Rate Volatility Depress Trade Flows? Evidence from Error-Correction Models, *The Review of Economics and Statistics*, **75**, 700-706.

Clark, P.B. (1973) Uncertainty, Exchange Risk, and the Level of International Trade, *Western Economic Journal*, **11**, 302-313.

Cushman, D.O. (1983) The Effects of Real Exchange Rate Risk on International Trade, *Journal of International Economics*, **15**, 45-63.

Cushman, D.O. (1988) US Bilateral Trade Flows and Exchange Risk During the Floating Period, *Journal of International Economics*, **24**, 317-330.

Daly, K. (1998) Does Exchange Rate Volatility Impede the Volume of Japan's Bilateral Trade? *Japan and the World Economy*, **10**, 333-348.

De Grauwe, P. (1988) Exchange Rate Variability and the Slowdown in Growth of International Trade, IMF Staff Papers, No.35, 63-84.

Dornbusch, R. (1988) *Exchange Rates and Inflation*. Cambridge: MIT Press.

Engle, R.F. and Granger, C.W.J. (1987) Cointegration and Error-Correction: Representation, Estimation, and Testing, *Econometrica*, **55**, 251-276.

Engle, R.F. and Kroner, K.F. (1995) Multivariate Simultaneous GARCH, *Econometric Theory*, **11**, 122-150.

Hassan, M.K. and Tufte, D.R. (1998) Exchange Rate Volatility and Aggregate Export Growth in Bangladesh, *Applied Economics*, **30**, 189-201.

Hooper, P. and Kohlhagen, S.W. (1978) The Effect of Exchange rate Uncertainty on the Prices and Volume of International Trade, *Journal of International Economics*, **8**, 483-511.

Hooper, P. and Marquez, J. (1993) Exchange Rates, Prices, and External Adjustment in the United States and Japan, International Finance Discussion Paper, No.456, Board of Governors of the Federal Reserve System.

International Monetary Fund. (1984) Exchange Rate Volatility and World Trade. Occasional Paper, No.28.

International Monetary Fund. (2003) *Exchange Arrangements and Foreign Exchange Markets*. IMF: Washington D.C.

International Monetary Fund (2008) De facto classification of exchange rate Regimes and monetary policy frameworks. Available at http://imf.org/external/np/mfd/er/2008/eng/0408.htm. (accessed October 8, 2009)

Johansen, S. and Juselius, K. (1990) Maximum Likelihood Estimation and Inference on Cointegration - with Applications to the Demand for Money, *Oxford Bulletin of Economics and Statistics*, **52**, 169-210.

Kenen, P. and Rodrik, D. (1986) Measuring and Analyzing the Effects of Short-Term Volatility in Real Exchange Rates, *The Review of Economics and Statistics*, **68**, 311-315.

Kenen, P.B. (1979) *Exchange Rate Variability: Measurement and Implications*. Mimeo, Princeton University: New Jersey.

Klaassen. (2004) Why is it so Difficult to Find an Effect of Exchange Rate Risk on Trade? *Journal of International Money and Finance*, **23**, 817-839

Klein, M. (1990) Sectoral Effects of Exchange Rate Volatility on United States Exports, *Journal of International Money and Finance*, **9**, 299-308.

Koray, F. and Lastrapes, W.D. (1989) Real Exchange Rate Volatility and U.S. Bilateral Trade: A VAR Approach, *Review of Economics and Statistics*, **71**, 708-712.

Kroner, K.F. and Lastrapes, W.D. (1993) The Impact of Exchange Rate Volatility on International Trade: Reduced Form Estimates Using the GARCH-in-Mean Model, *Journal of International Money and Finance*, **12**, 298-318.

Lastrapes, W.D. and Koray, F. (1990) Real Exchange Rate Volatility and US Multilateral Trade Flows, *The Journal of Macroeconomics*, **12**, 341-362.

Makin, J.H. (1976) Eurocurrencies and the Evolution of the International Monetary System. In *Eurocurrencies and the International Monetary System* (Ed.) C.H. Stem, J.H. Makin, and D.E. Logue, American Enterprise Institute, Washington, D.C., pp.17-51.

Mckenzie, M. and Mitchell, H. (2002) Generalized Asymmetric Power ARCH Modelling of Exchange Rate Volatility, *Applied Financial Economics,* **12**, 555-564.

McKenzie, M.D and Brooks, R. (1997) The Impact of Exchange Rate Volatility on German-U.S. Trade Flows, *Journal of International Financial Markets, Institutions, and Money*, **7**, 73-88.

McKenzie, M.D. (1998) The Impact of Exchange Rate Volatility on Australian Trade Flows, *Journal of International Financial Markets, Institutions and Money*, **8**, 21-38.

Pesaran, M.H., Shin, Y. and Smith, R. (2001) Bounds Testing Approaches to the Analysis of Level Relationships, *Journal of Applied Econometrics,* **16**, 289-326.

Rahmatsyah, T., Rajaguru, G. and Siregar, R. (2002) Exchange Rate Volatility, Trade and 'Fixing for Life' in Thailand, *Japan and the World Economy*, **14**, 445-470.

Rana, P. (1981) *ASEAN Exchange Rates: Policies and Trade Effects*. Institute of South Asian Studies: Singapore.

Siregar, R. and Rajan, R.S. (2004) Impact of Exchange Rate Volatility on Indonesia's Trade Performance in the 1990s, *Journal of the Japanese and International Economies*, **18**, 218-240.

Tse, Y.K. and Tsui, A.K.C. (1997) Conditional Volatility in Foreign Exchange Rates: Evidence from Malaysian Ringgit and Singapore Dollar, *Pacific-Basin Finance Journal,* **5**, 345-356.

Wei, S.J. (1998) Currency Hedging and Goods Trade, NBER Working Paper, No.256.

Wolf, A. (1995) Import and Hedging Uncertainty in International Trade, *Journal of Futures Markets*, **15**, 101-110.