

# Measuring Efficiency of South American Foreign Exchange Derivatives Market in Minimizing Currency Risk: A Lesson for Bangladesh

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**Abstract:** *This paper attempts to reveal whether the foreign exchange (FX) derivatives market effectively and efficiently reduces the volatility to foreign exchange rate fluctuations. Cross-country evidence suggests that development of the FX derivatives market does not boost up spot exchange rate volatility and reduces aggregate exposure to currency risk. Intraday evidence for Chile shows that activity in the forward market has not been associated with higher volatility in the exchange rate following the adoption of a floating exchange rate regime. We also find no evidence that net positions of large participants in the FX derivatives market help to predict the exchange rate. These findings support the view that development of the FX derivatives market is valuable to reduce aggregate currency risk. Although in Bangladesh, the use of currency derivatives to hedge foreign exchange risk is not popular among the existing firms engaged in foreign exchange transactions, there are a few firms such as ACI and General Motors with extensive foreign exchange-rate exposure and economies of scale in hedging activities, which are more likely to use currency derivatives. This is because, given the potential shifts in the supply of or demand for currency, firms and individuals who have assets denominated in foreign currencies can be affected favorably or unfavorably. These firms may want to alter their currency exposure in order to grab benefit or hedge risk from the expected movements of exchange rates. This study provides a detailed analysis along with a background on currency derivatives which are commonly used by some of large firms existing in Bangladesh in order to capitalize on or hedge against expected exchange rate exposures measured by these firms. In this paper, we have also divulged an analytical framework for measuring exchange rate exposures accelerating the use of currency derivatives in foreign exchange market of Bangladesh.*

**Keywords:** *Volatility, FX Derivatives, NER, Openness, PPP, BIS, GDP, Exposures, Hedging, Speculation.*

## 1. Introduction:

A Foreign exchange derivatives market may not be effective in diminishing an economy's aggregate vulnerability to exchange rate fluctuations. FX derivatives reduce the cost of adjustment of foreign exchange positions for participants in the market who

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want to hedge their initial positions, as well as for those who want to increase their exposure to foreign exchange risk. They can also help amplify the stabilizing (or destabilizing) effects of agents' decisions on the foreign exchange rate. In the aggregate, the net effects of FX derivatives could well be to increase the volatility of the exchange rate or the overall exposure of the agents of the economy to fluctuations in the exchange rate. The end result could be more, rather than less, overall vulnerability to foreign currency risk.

In addition, even if a FX derivatives market may contribute to reduce currency risk, the efficiency with which it operates may be unsatisfactory. Two aspects of particular concern are market transparency and competition. No participant should systematically have superior information about exchange rate movements that would enable them to take more profitable positions when they foresee a convenient movement in the foreign currency, or have sufficient market power that their actions generate significant changes in the exchange rate. In short, there should be no asymmetric information among traders that may be price relevant.

The issue whether FX derivatives are effective and efficient in reducing currency risk is particularly relevant in the case of emerging market economies. Potential problems in FX derivatives markets are likely to be accentuated in these economies, given their relatively thinner, less liquid, and less developed financial markets. Consequently, agents in these countries are debating the merits of foreign exchange derivatives as a mechanism for reducing currency risk, in particular in light of concerns stemming from the fairly recent adoption of floating exchange rate regimes.

This paper provides empirical evidence of whether foreign exchange derivatives markets effectively and efficiently reduce currency risk, with use of experience in the Chilean economy. Among emerging market economies, Chile offers a particularly interesting case. The country adopted a floating exchange rate in September 1999, after a decade of enforcing an exchange rate band whose width and level were often revised. The new floating exchange rate regime is widely perceived as successful. In addition, while its foreign exchange derivatives market has grown into a reasonably active market given the size of the economy, the degree of market development is still far from the level in advanced economies, and the market's usefulness as a mechanism for reducing agents' currency risk has often been called into question. Finally, we were able to access a unique daily and intraday database on the purchases and sales of most market participants.

## **2. Literature Review**

Empirical evidence on whether and how the FX derivatives market reduces vulnerability to foreign exchange rate fluctuations is scant. While a few studies address the effects of

derivatives on the volatility of other financial prices, we are not aware of previous attempts to empirically assess the effects of foreign exchange derivatives on foreign exchange rate volatility, for either advanced or emerging market economies. **Allayannis and Ofek (2001)** and **Cowan, Hansen, and Herrera (2004)**, among others, suggest that foreign exchange derivatives indeed tend to reduce currency exposure, but these valuable studies are conducted only at the firm level. Works such as **Wei and Kim (1997)** and **Klitgaard and Weir (2004)** take on the issue of whether traders in foreign exchange derivatives markets possess price-relevant asymmetric information, based on weekly data for U.S. markets using; no studies to date use daily or intraday data or extend the analysis to emerging market economies.

**Cornell (1981)**, by associating volatility with uncertainty, argues that volatility may lead to an increase in both hedging and speculative trading in derivatives contracts. **Stein (1987)** develops a model in which prices are determined by the interaction between hedgers and informed speculators. In this model; (1) The derivatives market improves risk sharing and therefore reduces price volatility, and (2) If the speculators observe a noisy but informative signal, the hedgers react to the noise in the speculative trades, producing an increase in volatility. In contrast, **Danthine (1978)** argues that futures markets improve market depth and reduce volatility because the cost of informed traders of responding to mispricing is reduced. Models developed by **Kyle (1985)**, **Ross (1989)** and **Froot and Perold (1991)**, among many others, associate the volatility of the asset to the rate of information flow. Their models imply that the volatility of the asset price will increase as the rate of information flow increases. Thus, if forward operations increase the flow of information, the volatility of the spot price must change accordingly.

In recent years there have been a number of empirical studies of the effects of index futures on the volatility of the underlying index. Some of them strongly support the view that index futures do not increase the long-run volatility of the spot price (Yu, 2001). They also conclude that stock market volatility is not related to either the existence of, or the level of activity in the futures market. Although other studies reach the exact opposite conclusion claiming that futures increase the volatility of the spot price (see **Borsen, 1991, among others**).

### 3. Objective of the Study

The major objective of this study is to analyze whether the use of currency derivatives is effective in reducing currency risk of foreign exchange market for a specific country or for a group of countries. The other specific objective of this study is to discuss how a typical firm in Bangladesh can measure the expected exposures in foreign exchange transactions.

#### **4. Methodology of the Study**

The study has been divided into three parts where first part deals with the methods used by Bangladeshi firms engaged in Hedging to measure the exposures to exchange rate fluctuation, second part deals with the relationship between the Foreign exchange derivatives market and the volatility of spot exchange rate and the second part deals with measuring efficiency of using foreign exchange derivatives instruments to minimize currency risk causing exchange rate exposure in global financial market.

##### ***4.1 Research Type***

This is a descriptive research which is relevant to an inquisitive study as it requires some analysis on the foreign exchange operations conducted by the local companies existing in Bangladesh such as ACI or General Motors. It also includes the detailed analysis of methods used by ACI Ltd., a local company based on Bangladesh, to measure its foreign exchange exposures related the operations in foreign exchange market of Bangladesh. In final part, this paper reveals the process of using currency derivatives to hedge against the foreign exchange risk measured by ACI Corporation in terms of its net cash inflows denominated in different currencies.

##### ***4.2 Types of Data***

Preparing this study requires the use of only secondary data related to firm's value, correlations among the exchange rates and the assistance from various books and articles etc as shown below:

Annual Reports of ACI (Advanced Chemical Industries Ltd.) from 2005 to 2010.

WEB sites of ACI Ltd.

Annually published materials related to currency hedging throughout the global foreign exchange market.

Corporate publications such as **BEAMS** - a quarterly newsletter that communicate stories about the various activities of the diverse business and functions to promote awareness among the ACI family members.

**Another Corporate Publication such as Synergy** – that aims towards enriching several types of practical knowledge to enhance employee motivation and work culture in ACI Corporation.

WEB site of Bangladesh Bank.

### ***4.3 Data Analysis Tools***

The following mathematical models are used to analyze the exchange rate exposures associated with the local companies such as ACI Ltd or General Motors Ltd etc engaged in currency hedging through using several currency derivative contracts as revealed below:

Application of Portfolio Standard Deviation Model for calculating the exchange rate exposures associated with net inflows denominated with four different currencies for ACI Corporation.

Multiple Regression Models using OLS Estimators have been also used to depict the relationship between volatility and activities in foreign exchange market.

## **5. Measuring Exposures to Exchange Rate Movements**

The value of a firm's future contractual transactions in foreign currencies is affected by exchange rate movements. The sensitivity of the firm's contractual transactions in foreign currencies to exchange rate movements is referred to as transaction exposure. Transaction exposure can have a substantial impact on a firm's value. It is not unusual for a currency to change by as much as 10 percent in a given year. If an exporter denominates its exports in a foreign currency, a 10 percent decline in that currency will reduce the dollar value of its receivables by 10 percent. This effect could possibly eliminate any profits from exporting. To assess transaction exposure, a renowned firm named ACI based on Bangladesh, follows a specific methods consisting of following estimations:

- (1) ACI estimates of its net cash flows in each currency; and
- (2) the potential impact of the currency exposure.

ACI Corporation, a Bangladeshi firm expects to receive substantial payments denominated in four different types of currencies as shown below along with other information:

**Table 5.1: Substantial inflows and outflows denominated in four different currencies for ACI**

Types of Currencies	Inflow of currencies	Outflow of currencies	Std. Deviation	Expected Exchange rate	value of net Inflow
British Pound	£17,000,000	£ 11,000,000	0.05	BDT 1.50	-----
Canadian BDT	C\$ 12,000,000	C\$ 5,000,000	0.09	BDT 0.80	-----
Japanese Yen	¥ 20,000,000	¥ 12,000,000	0.07	BDT 0.15	-----
Euro	€ 90,000,000	€ 25,000,000	0.08	BDT 0.25	-----

*Source:* Annual reports of ACI

The calculated correlation between British Pound and Canadian Dollar is 0.69, the correlation between British Pound and Japanese Yen is 0.95, the correlation between British Pound and Euro is 0.56, the correlation between Canadian Dollar and Japanese Yen is 0.26. All other correlations are 0.

On the basis of above information, if we want to assess transaction exposure, we need to calculate the net cash flows along with their corresponding weights of each currency as shown below:

**Table 5.2: Value of net inflow denominated in domestic currency (BDT) & their corresponding weights for ACI Corporation in Bangladesh**

Types of Currencies (1)	Inflow of currencies (2)	Outflow of currencies (3)	Net inflow (4) = (2)-(3)	Expected Exchange rate (5)	value of net Inflow (6) = (4)*(5)	Weights (7) = 6/ total
British Pound	£17,000,000	£ 11,000,000	£ 6,000,000	BDT1.50	BDT 9,000,000	0.281
Canadian BDT	C\$ 12,000,000	C\$ 5,000,000	C\$ 7,000,000	BDT0.80	BDT 5,600,000	0.175
Japanese Yen	¥ 20,000,000	¥ 12,000,000	¥ 8,000,000	BDT0.15	BDT 1,200,000	0.037
Euro	€ 90,000,000	€ 25,000,000	€ 65,000,000	BDT0.25	BDT 16,250,000	0.507
<b>Total</b>					<b>BDT 32,054,000</b>	<b>1.000</b>

*Source:* Analysis report of Treasury department in ACI

Secondly, we have to assess the potential impact of the currency exposure by arranging the correlation table on the basis of above information regarding correlation between the currencies as depicted below:

**Table 5.3: Correlation Table**

	<b>British Pound</b>	<b>Canadian \$</b>	<b>Japanese Yen</b>	<b>Euro</b>
<b>British Pound</b>	<b>1</b>	<b>0.69</b>	<b>0.95</b>	<b>0.56</b>
<b>Canadian \$</b>	<b>0.69</b>	<b>1</b>	<b>0.26</b>	<b>0</b>
<b>Japanese Yen</b>	<b>0.95</b>	<b>0.26</b>	<b>1</b>	<b>0</b>
<b>Euro</b>	<b>0.56</b>	<b>0</b>	<b>0</b>	<b>1</b>

*Source:* Analysis report of Treasury department in ACI

The dollar net cash flows of ACI are generated from a portfolio of currencies. The exposure of the portfolio of currencies can be measured by the standard deviation of the portfolio, which indicates how the portfolio's value may deviate from what is expected. After that the risk (as measured by the standard deviation of monthly percentage changes) of a two-currency portfolio ( $\sigma_p$ ) can be estimated as follows:

$$\sigma = \sqrt{(W_x\sigma_x)^2 + (W_y\sigma_y)^2 + 2W_xW_y\sigma_x\sigma_y\text{CORR}_{xy}}$$

Here,

$W_x$  = proportion of total portfolio value that is in currency X

$W_y$  = proportion of total portfolio value that is in currency Y

$\sigma_x$  = standard deviation of monthly percentage changes in currency X

$\sigma_y$  = standard deviation of monthly percentage changes in currency Y

$\text{CORR}_{xy}$  = correlation coefficient of monthly percentage changes between currencies

X and Y

The equation shows that ACI's exposure to multiple currencies is influenced by the variability of each currency and the correlation of movements between the currencies. The volatility of a currency portfolio is positively related to a currency's volatility and positively related to the correlation between currencies. Each component in the equation

that affects a currency portfolio's risk can be measured by using a series of monthly percentage changes in each currency. So the estimation of risk (as measured by the standard deviation of monthly percentage changes) of a four currency portfolio ( $\sigma_p$ ) can be estimated as follows:

$$\begin{aligned}\sigma_p^2 = & (.05 \times 0.281)^2 + (0.09 \times 0.175)^2 + (0.07 \times 0.037)^2 + (0.08 \times 0.507)^2 \\ & + 2 \times 0.69 \times 0.05 \times 0.09 \times 0.281 \times 0.175 \\ & + 2 \times 0.95 \times 0.05 \times 0.07 \times 0.281 \times 0.037 \\ & + 2 \times 0.56 \times 0.05 \times 0.08 \times 0.281 \times 0.507 \\ & + 2 \times 0.26 \times 0.09 \times 0.07 \times 0.175 \times 0.037 \\ & + 2 \times 0.0 \times 0.09 \times 0.08 \times 0.175 \times 0.507 \\ & + 2 \times 0.0 \times 0.07 \times 0.08 \times 0.037 \times 0.507\end{aligned}$$

So,  $\sigma_p = 0.0538$  or 5.38% (approximately)

It means that the exposure of ACI Incorporation of Bangladesh for deriving substantial payments denominated in four different types of currencies is estimated about 5.038%. More precisely, a corporation is exposed to risk estimated as 5.038% on the portfolio consisting of four different types of currencies.

## **6. Relationship between the FX Derivatives Market and the Volatility of the Spot Exchange Rate**

### **6.1 Nexus Between Volatility and Activity in the Derivatives Market**

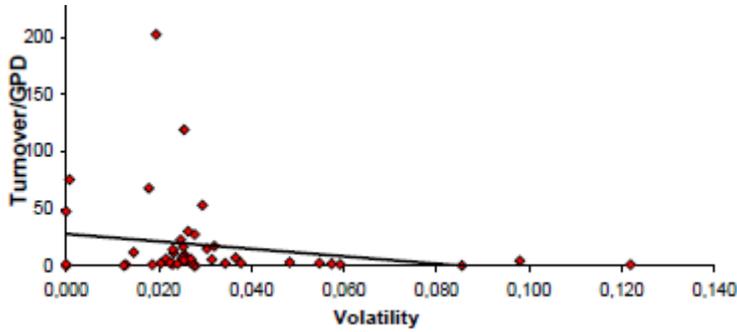
Earlier Models predict different relations between price and volume that depend on the rate of information flow to the market, how the information is disseminated, the extent to which market prices convey information and the size of the market. Price variability affects the volume of trade in forwards. The time to delivery of a forward or futures contract affects the volume of trading, and through this effect, possibly also the variability of price. The price-volume relation can also indicate the importance of private versus public information in determining investors' demands.

We make a simple cross-country association between volatility and development of the derivatives market based on data from the BIS (2012) (Figure 1). Although the number of observations is not enough to set a convincing stylized fact, there seems to be a negative association between exchange rate volatility and derivatives. We also split the sample between advanced and emerging economies, and the negative association subsists,

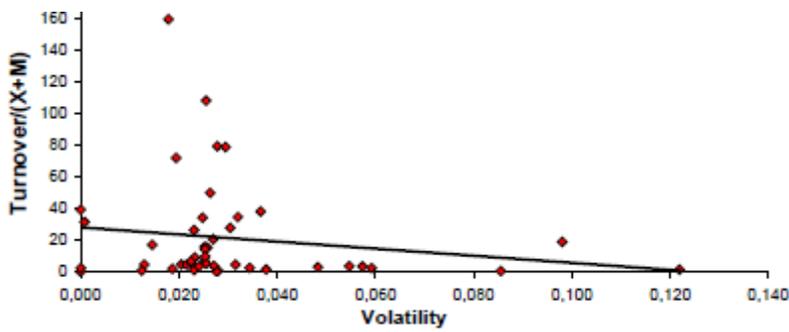
although it weakens for the former group because of the inclusion of United Kingdom. In the next subsection we further explore this finding.

**Whole Sample**

2012

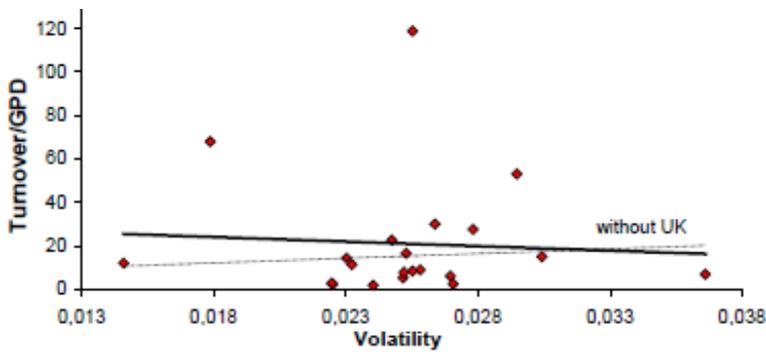


2012

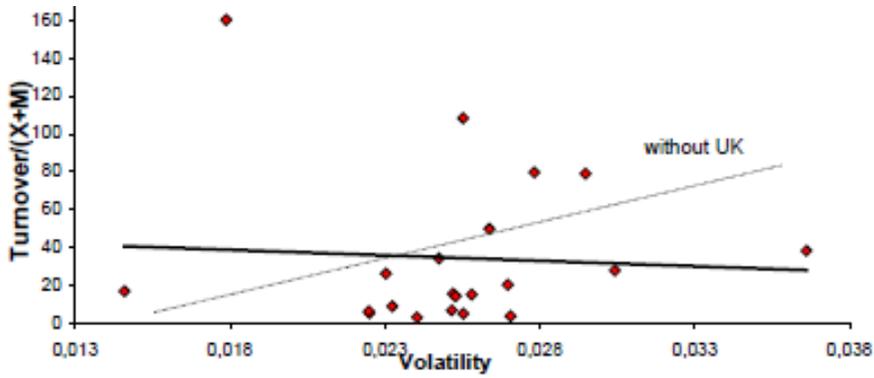


**Advanced Economy**

2012

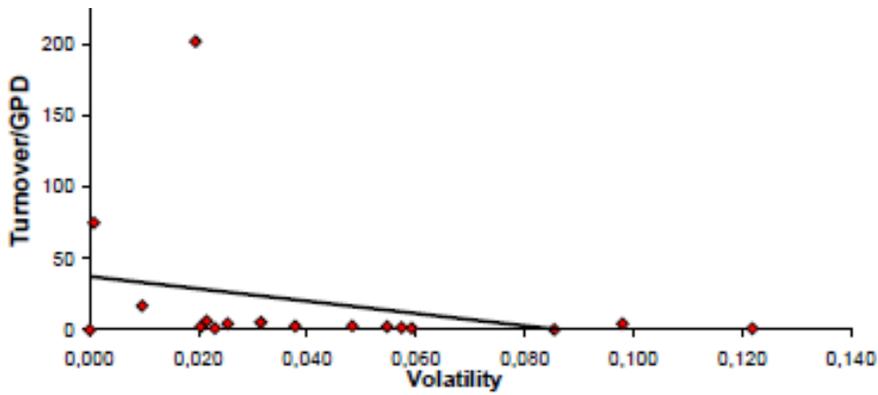


2012

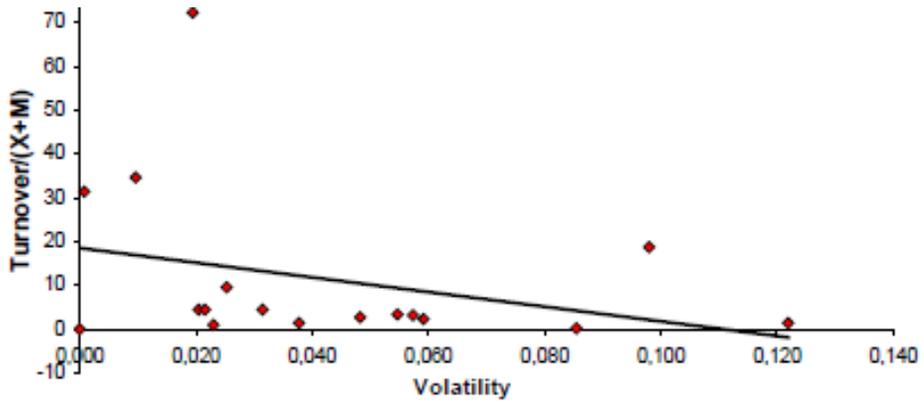


Emerging Economies

2012



2012



**Note:**

Volatility constructed as the standard deviation of the change in the monthly (log) exchange rate for the period 2004 - 2009. Turnover corresponds to subscriptions of forwards, fx swaps, options and futures.

**Source:** Authors' calculations based on data from BIS (2012) and IMF *International Financial Statistics*.

**6.2 Volatility and Derivatives: A Cross-Country Approach**

We explore the following empirical specification for exchange rate volatility across countries:

$$\text{Vol}_i = \beta_0 + \beta_1 \text{Openness}_i + \beta_2 \text{Fin.Develop}_i + \beta_3 \text{Size}_i + \beta_4 \text{GDPpc}_i + \beta_5 \text{Derivatives}_i + \mu_i$$

Where  $\text{Vol}_i$  is the level of nominal exchange rate volatility constructed using monthly data over 2004.1 to 2009.4, drawn for the IMF *International Financial Statistics*. *Openness* is the ratio of the sum of exports and imports over GDP. The benefit of a floating nominal exchange rate is inversely related to the level of trade with the rest of the world. *Size* is the log of the average real GDP adjusted by PPP of years 2009 to 2012 obtained from the World Bank *Development Indicators*. This variable is intended to proxy for microeconomics benefits of exchange rate stability: smaller countries should be more reluctant to tolerate fluctuations in the nominal exchange rate. *Financial development* is measured as the ratio of private lending to GDP 2009. More financially sophisticated countries should also be able to tolerate a higher level of exchange rate volatility. Although the sign may also be negative if domestic financial development helps to stabilize the exchange rate. Finally, *Derivatives Usage* corresponds to currency derivatives reported at the BIS (2012) over current GDP.

We include *GDP per capita* (in PPP units), following Devereux and Lane (2002), as an extra control variable. This is intended as a general check for potential omitted variable bias, and the expected sign is negative: richer countries may have more stable exchange rates.

In the following table, we present a cross-country estimation. For the full sample of countries, columns (1)-(2), standard variables work reasonably well. Only *openness* does not have the expected sign, although the parameters are not significant either. The simple pair wise correlation between openness and volatility is -0.07, which may indicate that a time series analysis may yield the expected negative sign.

For the full sample and also for non-OECD countries, *Financial development* enters with a significantly negative coefficient. This suggests that domestic financial development helps to stabilize the exchange rate movements, for instance by facilitating intertemporal smoothing by households and firms or adding liquidity to financial markets (Devereux and Lane, 2002). Finally, *Derivatives Usage* is consistently negative but not significant for all cross section estimates.

The OLS results may not be fully reliable if some of the regressors are endogenously determined by the exchange rate volatility. We consider three variables to be potentially affected by this problem: *Openness*, *Financial Development* and *Derivative Usage*. There are two reasons to believe that exploring a IV estimation procedure may not be appealing: (1) find good instruments will not be an easy job, in particular, for *derivatives usage*; (2) evidence with respect to bilateral exchange rate volatility presented by Devereux and Lane (2002) suggest that the IV procedure may not change substantially the results.

While tentative in that they do not account for endogeneity of the right-hand side variables, the results suggest that the exchange rate volatility may be better explained by adding to standard variables, other financial determinants. After controlling for macro determinants, it seems that a more developed derivatives market does not increase the exchange rate volatility. Finally, further extensions incorporating other financial linkages across countries, in particular currency-hedging variables, may be promising to better assess the robustness of our findings.

**Table 6.1 Volatility Regressions (OLS Estimations)**

Dependent variable: STDEV [d(log (NER <sub>t</sub> ))]				
	Full Sample		Non-OECD countries	
	(1)	(2)	(3)	(4)
Openness	0.003 (0.004)	0.007 (0.004)	0.003 (0.005)	0.009 (0.007)
Financial Development	-0.011 (0.003)	-0.007 (0.003)	-0.010 (0.003)	-0.009 (0.004)
Size	0.003 (0.001)	0.004 (0.001)	0.004 (0.001)	0.005 (0.001)
GDP per Capita		-0.004 (0.002)		-0.005 (0.003)
Derivatives Usage	-0.001 (0.001)	-0.0007 (0.001)	-0.001 (0.001)	-0.001 (0.001)
R <sup>2</sup>	0.11	0.13	0.10	0.13
Number of Observations	124	124	102	102

Notes: a. White Heteroskedasticity-Consistent Standard Errors & Covariance. Standard

Errors in parenthesis. \*\*\*, \*\*, \* denote 1%, 5% and 10% levels of significance respectively

### 6.3 Volatility and Derivatives: Daily Approaches for Chile

Empirical research thus far has not produced any conclusive evidence as to the general impact of futures trading on the spot market volatility. Therefore, it is of particular interest to examine the case of the FX markets. In the case of these markets, the references are nonexistent, so we follow approaches regularly applied in the analysis of stock markets.

At First, we estimate a **EGARCH (1,1)-M** augmented by activity measures following closely **Bessembinder and Seguin (1992)**. We use as activity measures: *turnover*, which corresponds to the volume of purchase and sales in all FX derivatives and; notional *outstanding* amounts, which correspond to the notional values of all deals concluded and not yet settled at a given date. We calculate volatility based on a real exchange rate obtained by deflating the nominal one by daily inflation. The sample period covers from January 1st 2002 to June 30th 2011. We report the results in Table No. 03 (Referred to Appendix section: specification (A)).

It is important to mention that the daily and intraday approaches are the most commonly used since; in general, it is more difficult to find reasonable explanations that justify a weekly or monthly association between volatility and activity. Although there is agreement that uncovering the relationship between these two markets may depend upon the time frame used for analysis.

Referred to Table 01 (Appendix Section)

#### **Volatility –Activity Relationship**

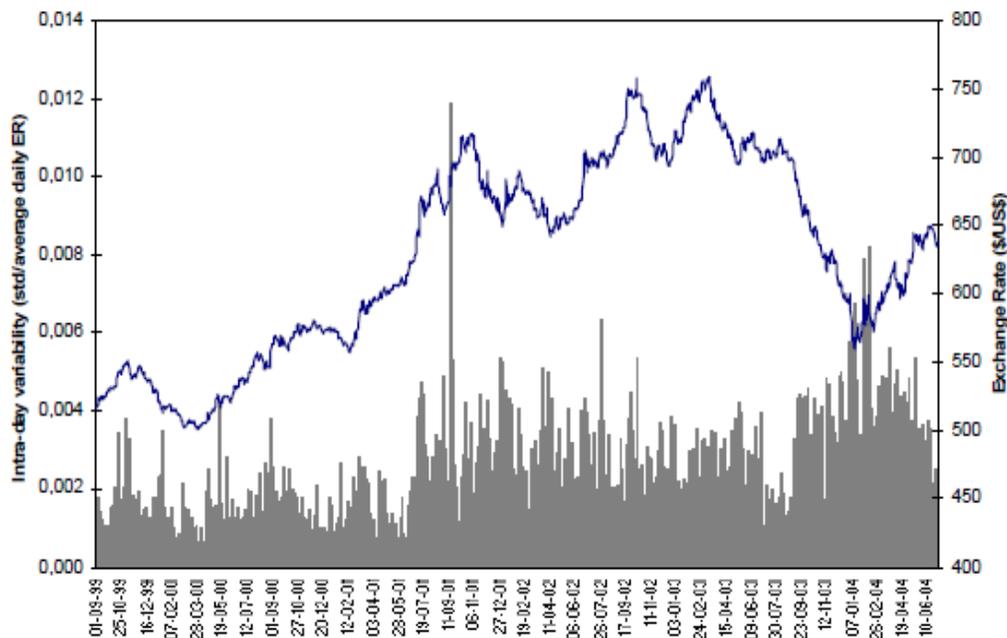
For the full sample period –columns (1) to (6) in Table 01, we do not observe a significant link between activity and volatility for the forward and spot market variables tested. For the period after the exchange rate band (columns labeled (1) to (6), we observe the same pattern with all coefficients negative and non-significant. To further test the reliability of the results, we perform an instrumental variable estimation. To do so, we employ the conditional volatility obtained from a GARCH model. The results are in table 02.

Referred to Table No. 02 (Appendix Section)

### Volatility –Activity Relationship

Under this approach we observe a weak “negative” link between volatility and activity in the derivatives market for the crawling band period (columns (1) and (2)). Similarly, we observe a positive link between activity in the spot FX market and volatility. Even though, there is no link during the free floating period for any of the variables tested.

Our last exercise works with a measure of volatility based on *intraday* prices and we focus our attention to the free floating period. The Following **Figure** presents the level of the nominal exchange rate and a measure of intraday variability constructed with all interbank transactions excluding derivatives contracts expiring within a given day. Our proxy of variability is the intraday standard deviation over the daily weighted average nominal exchange rate. From a simple graphical perspective, it seems that nominal exchange rate volatility has increased after the elimination of the crawling band.



**Figure 6.1:** Intraday Volatility

We first present the Pearson correlation coefficients between our intraday volatility measure and the contemporaneous and lagged temporary component of outstanding positions held by each participant. We extract temporary components by the standard HP filter (**table 3.2**).

**Table 6.2: Cross-correlation coefficients: volatility measure vs. temporary component of outstanding position series.**

<i>Outstanding</i>	<i>Correlation</i>	<i>Causality</i>	<i>Outstanding</i>	<i>Correlation</i>	<i>Causality</i>
<i>Banks with foreign clients</i>			<i>Banks with the financial non banking sector</i>		
Temporary <sub>t</sub>	0.000	no	Temporary <sub>t</sub>	-0.004	no
Temporary <sub>t-1</sub>	0.052	no	Temporary <sub>t-1</sub>	-0.004	no
<i>Non banking domestic agents with foreign clients</i>			<i>Banks with the non-financial sector</i>		
Temporary <sub>t</sub>	-0.049	no	Temporary <sub>t</sub>	0.097	no
Temporary <sub>t-1</sub>	-0.129	no	Temporary <sub>t-1</sub>	0.016	no
<i>Banks with pension funds</i>			<i>Banks with the rest of domestic agents</i>		
Temporary <sub>t</sub>	0.160	yes	Temporary <sub>t</sub>	0.096	no
Temporary <sub>t-1</sub>	0.211	yes	Temporary <sub>t-1</sub>	0.068	no

**Notes:**

- Series filtered by the Hodrick-Prescott filter setting  $\lambda=(2502)\times 100$ .
- Granger causality test for 36 lags and 5 percent probability. Volatility never caused temporary outstanding series.

From table 3.2, we see that temporary changes in activity associated to the unexpected component of the series have a feeble positive relationship with the intraday volatility of the nominal exchange rate. In fact, the trading volumes of the financial non-banking sector and non-banking domestic agents with foreign clients are negatively related to volatility. We also perform a bivariate auto regression to test for granger-causality between volatility and temporary activity in the derivatives market (**Lee and Rui, 2002**). Granger causality tests indicate that series do not cause volatility with the exception of temporary activity of pension funds.

Finally, among the many alternatives, we chose to evaluate the contemporaneous relationship between trading volumes and volatility estimating the following two simultaneous equation models:

One model is

$$\text{Vol}_t = \alpha_0 + \alpha_1 \text{Temporary}_t + \alpha_2 \text{Vol}_{t-1} + \varepsilon_t$$

And another model is:

$$\text{Temporary}^i_t = \beta_0 + \beta_1 \text{Vol}_t + \beta_2 \text{Temporary}^i_{t-1} + \zeta_t$$

where *Temporary* corresponds to the temporary component of outstanding position of participant, and *Vol* corresponds to the intraday variability measure presented in Figure 4.

To avoid problems of simultaneous bias we estimate the system (1) and (2) using the Generalized Method of Moments (GMM) and a 3 SLS procedure. Results are in table 06. Remarkably, none of the outstanding position series has a significant link with the intraday volatility measure during the free floating period.

**Table 6.3: Contemporaneous relationship between volume and volatility**

Estimation Method	GMM		3SLS	
	$\alpha_1$	$\beta_1$	$\alpha_1$	$\beta_1$
<u>Temporary component of Outstanding</u>				
<i>Banks with foreign clients</i>	$-2.3 \times 10^{-7}$ ( $2.2 \times 10^{-7}$ )	3813.4 (3879.9)	$-2.2 \times 10^{-7}$ ( $2.5 \times 10^{-7}$ )	2958.5 (3800.9)
<i>Non banking domestic agents with foreign clients</i>	$-9.8 \times 10^{-8}$ ( $1.2 \times 10^{-7}$ )	-3225.1 (7942.9)	$-9.5 \times 10^{-8}$ ( $1.3 \times 10^{-7}$ )	-2490.7 (7774.9)
<i>Banks with pension funds</i>	$2.5 \times 10^{-7}$ ( $2.5 \times 10^{-7}$ )	510.79 (2683.66)	$2.8 \times 10^{-7}$ ( $1.9 \times 10^{-7}$ )	404.84 (2266.73)
<i>Banks with the financial non banking sector</i>	$3.5 \times 10^{-9}$ ( $6.9 \times 10^{-8}$ )	-2788.7 (9557.4)	$1.6 \times 10^{-9}$ ( $7.0 \times 10^{-8}$ )	-6510.2 (9137.9)
<i>Banks with the non-financial sector</i>	$1.4 \times 10^{-8}$ ( $1.4 \times 10^{-7}$ )	5951.9 (3901.8)	$2.3 \times 10^{-8}$ ( $1.3 \times 10^{-7}$ )	5349.3 (4160.1)
<i>Banks with the rest of domestic agents</i>	$3.5 \times 10^{-8}$ ( $7.4 \times 10^{-8}$ )	7822.9 (10164.0)	$3.7 \times 10^{-8}$ ( $6.7 \times 10^{-8}$ )	7822.9 (10164.0)

**Notes:**

- Daily observations since September 1999 to June 2004. White Heteroskedasticity-Consistent Standard Errors & Covariance. Instruments are lags of endogenous variables. Standard errors in parenthesis. \*\*\*, \*\*, \* denote 1%, 5% and 10% levels of significance.

The previous results suggest that the link between nominal exchange rate volatility and activity in the derivatives market has been quite weak or non-existent during the free floating period.

#### **6.4 Does the FX Derivatives Market Reduce Exposure to FX Fluctuations?**

The notional value of the net outstanding FX forward positions indicates that, in recent years, Chilean residents have been in a net short position with respect to non-residents. This reflects the fact that the hedging by foreign investors of their direct and portfolio investments in the local market, and by resident firms of their external liabilities, has more than surpassed the hedging positions taken by domestic agents (pension funds, mutual funds and the non-financial sector) that invest abroad. Perhaps most important, the net short position also has been quite small as a percentage of the GDP (-1% in 2009 and -2% during 2010). Thus, it seems unlikely that the Chilean FX derivatives market is currently modifying substantially the overall gap between assets and liabilities denominated in foreign currency.

As Chile's FX derivatives market is less developed than those of advanced economies, it is interesting to explore whether economies with more developed FX derivatives markets present more or less aggregate exposure to currency risk.

A measure of aggregate currency mismatches that has often been used is net foreign debt (see Caballero et al., 2004 and Goldstein and Turner, 2004). This is shown in **table 6.4** for a group of selected economies. This measure does not incorporate the net outstanding position in the FX derivatives market because of the lack of reliable data at a cross-country basis. Also, foreign debt does not completely summarize currency mismatch since it ignores the currency composition of debt, the value of other assets and liabilities and the response of income to exchange rate fluctuations. Nonetheless, it is interesting that there is a tenuous but positive association between net external debt and derivatives usage with a pair wise correlation of 0.17 for the sample of countries. This is confirmed in the figure next to **table 6.4**.

**Table 6.4: Net foreign debt and derivatives usage for selected economies in 2011**

Country	Net foreign debt/GDP	Net foreign debt (X+M)	Derivatives '11/GDP
Australia	49%	147%	27
Argentina	35%	106%	.003
Austria	35%	50%	5
Brazil	44%	183%	4
Canada	41%	60%	12
Chile	29%	54%	2
Colombia	29%	95%	0.2
Czech Republic	-2%	-2%	5
Finland	22%	37%	2
France	3%	6%	8
Germany	12%	21%	9
Greece	60%	195%	6
Hungary	35%	32%	1
India	16%	71%	1
Indonesia	69%	125%	1
Israel	23%	41%	1
Italy	36%	86%	3
Mexico	19%	37%	2
Netherlands	30%	32%	16
New Zealand	66%	135%	15
Peru	44%	166%	0.1
Philippines	55	61	2
Poland	27	51%	5
Portugal	49	89	2
Russia	-11	-22	0.1
Spain	32%	72%	2
Thailand	29%	30%	3
Turkey	62%	129%	1

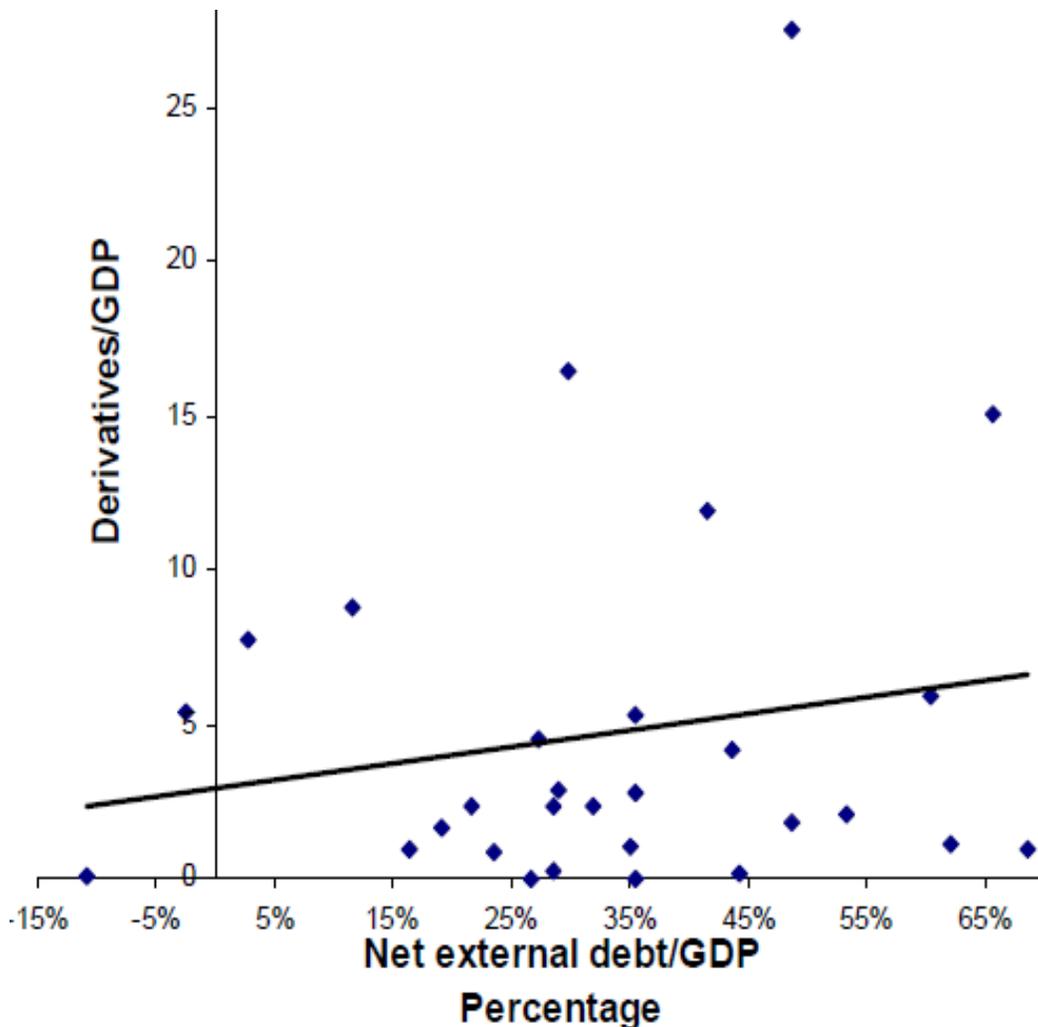
**Notes:**

a. Net external debt = [Debt Securities (liabilities)+other investment (liabilities)]-[debt securities (assets) + other investment (assets)].

b. For Brazil and Perú, derivatives were obtained directly from the corresponding central banks.

**Source:** Author’s calculations based on data from the Balance of Payments Statistics Yearbook 2012, BIS (2011) and IMF International Financial Statistics.

**Figure 6.2:**



One interpretation of this result is that economies with a more developed derivatives market also have more room to borrow in foreign currency. Implicitly, behind this assessment is the assumption that a more developed derivatives market brings together a larger net bought position. Unfortunately, however, this says nothing about the association between the depth of the FX derivatives market and net foreign exchange exposures.

In the absence of direct data to measure aggregate currency mismatches across countries, we examine the association between a complementary measure of currency exposure derived from a regression analysis and the turnover in the currency derivatives market.

$$R_{i,t} = a_0 + a_1MR_t + a_2\Delta NER_t + e_t.$$

Where  $R_i$  represents the monthly return of sector  $i$ ,  $MR$  represents the monthly return of the market, and  $\Delta NER$  the monthly change in the log of the nominal exchange rate with respect to the dollar.

Under this measure of exchange rate exposure, a sector/firm exhibits exchange rate exposure if its share value is influenced by changes in currency values after controlling for the market return. We used the Morgan Stanley Capital Indices available at Bloomberg at monthly frequency from January 2002 to June 2011. The stock market return and nominal exchange rates were also obtained from Bloomberg. We consider eight sectors: Consumer discretionary, consumer staples, financials, health care, industrial, material, telecommunications and utilities.

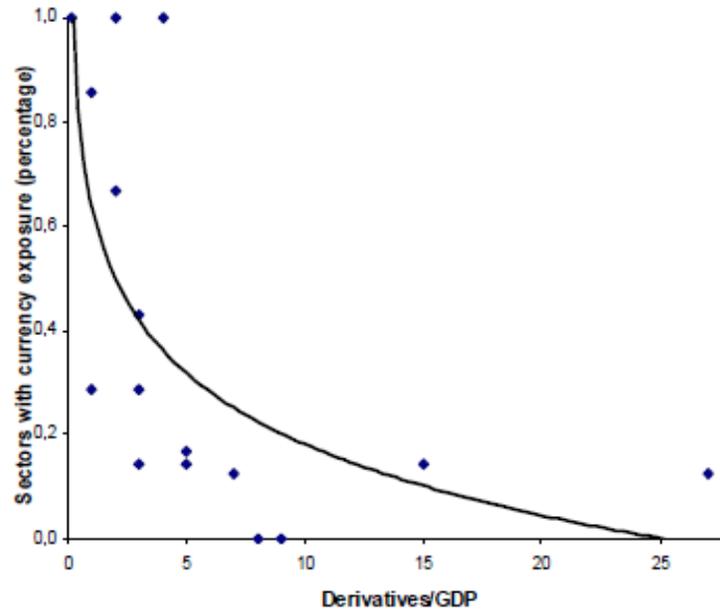
**Table 6.5: Exposure by regression analysis for selected countries**

Country	Exposure from a panel OLS	Number of sectors with exposure	<i>Derivatives/GDP</i> <i>2011</i>
Australia	non significant	1 out of 8	27
Brazil	0.6%	7 out of 7	4
Chile	1.08%	8 out of 8	2
Czech Republic	0.25%	1 out of 6	5
France	non significant	0 out of 8	8
Germany	non significant	0 out of 8	9
Hungary	-0.35%	2 out of 7	1
Indonesia	0.07%	6 out of 7	1
Italy	non significant	1 out of 7	3
Japan	non significant	1 out of 8	7
Malaysia	-0.28%	3 out of 7	3
Mexico	-0.22%	4 out of 6	2
New Zealand	non significant	1 out of 7	15
Poland	0.22%	1 out of 7	5
Russia	2.11%	5 out of 5	1
Thailand	-0.37%	2 out of 7	3

**Notes:**

a. Estimation based on end-of-month changes in MSCI, nominal exchange rate and stock market returns. Period covers January 2002 to June 2012 (114 observations).

b. Derivatives obtained from the BIS (2012).

**Figure 6.3**

**Source:** Authors' calculations based on Morgan Stanley Capital Indices available at Bloomberg.

As can be seen in Table 6.5, the results suggest that countries with the lowest ratios of derivatives usage are also the ones with more currency exposure. This is confirmed either when we consider the panel estimates or the number of sector with significant exposure.

In Brief, the evidence examined in this section suggests that, while countries with a more develop derivatives market may increase its share of net foreign currency debt; they present lower degrees of exposure to fluctuations in the foreign exchange rate.

## 7. Findings

Followings are the generalized statements after analyzing the above scenario in order to render a conclusive output for this study:

- a) After analyzing the foreign exchange exposures of ACI Incorporation of Bangladesh, We have found that the cross-sectional variation in exchange risk sensitivity of individual firms is related to firm-specific operational variables.

- b) We find that at the country level like Bangladesh, the extent of exposure is robust, although which firms such as ACI or General Motors engaged in currency hedging are affected by movements in the exchange rate and the direction of exposure depends on the specific exchange rate and varies over time.
- c) Our estimations revealed a transparent relationship between the scope of the foreign operations of a firm such as ACI corporation—measured by foreign sales, assets, and operating profits—and its exchange risk sensitivity.
- d) In addition, it's also derived from the above analysis that the use of currency derivative to hedge currency risk is not so popular among the firms (except ACI & General Motors) existing in Bangladesh due to its complexity related to the expectation of future exchange rates between Bangladesh and other foreign countries.
- e) Future studies that include additional operational and managerial information collected from survey data should provide further insights into the complex relationship between exchange rate fluctuations and firm value.
- f) In case of effectiveness, our cross-country evidence suggests that development of the FX derivatives market helps a country to decrease its degrees of exposure to fluctuations in the foreign exchange rate, and that it does not increase the volatility of its foreign exchange rate.
- g) Due to the recent catastrophic fall of capital market, rapidly declining FDI and scarcity of investment opportunities in an equity centric economy, investors of Bangladesh is crying out for an innovative and versatile financial product such as derivative securities for hedging and market expansion. In my paper, I have provided clear examples of how derivative securities can strengthen foreign exchange market or currency market of Chili, both in terms of risk mitigation and creating alterative investment vehicles as well as reduce burden on our major import and export sectors. Furthermore, we have also looked into the prerequisite of setting up a derivative markets in Bangladesh and provided a clear roadmap. In view of recent turmoil in the equity markets, we need to be circumspect and foresighted in our approach; a standardized exchange traded derivative market with phase-by-phase introduction of product has been recommended.

## 8. Concluding Remarks

To further explore the issue of volatility, we used a unique database containing detailed statistics of foreign exchange market operations of private agents in Chile, and tested a pool of models to evaluate whether derivatives exacerbated the volatility of exchange rate after the implementation of the free float. Consistently, we were not able to find a significant relationship between activity and volatility. This paper constitutes a novel attempt to explore empirically the overall effects of the FX derivatives market on aggregate currency risk. This issue merits further research, given the increased adoption of floating exchange rate regimes by many developing and emerging market economies, together with general concerns about the risks associated with derivatives, currency mismatches, and exchange rate volatility. Empirical evidence based on panel and time series models for both advanced and emerging market economies would prove insightful, although in principle such studies are limited by the availability of data. As a corollary, the evidence in this paper supports the view that development of the FX derivatives market is valuable to reduce aggregate currency risk.

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**Appendix:****Table 01 Volatility-Activity Relationship: Specification (A)****Volatility –Activity Relationship: Specification (A)**

EGARCH-M augmented by activity measures

Period	Full						Crawling Band						Free Floating					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Coeff. Estimate for Activity																		
Turnover Derivatives	0.067 (0.050)		0.039 (0.059)	0.082 (0.050)		0.057 (0.059)	0.161** (0.073)		0.142 (0.109)	0.111 (0.091)		0.105 (0.125)	-0.045 (0.059)		-0.044 (0.069)	0.021 (0.073)		0.022 (0.072)
Open Interest		0.280 (0.230)	0.241 (0.275)		0.291 (0.235)	0.249 (0.277)		0.331 (0.327)	0.178 (0.466)		0.164 (0.286)	0.081 (0.412)		-0.076 (0.167)	-0.007 (0.195)		0.016 (0.195)	-0.007 (0.190)
Turnover Spot				-0.035 (0.112)	-0.017 (0.100)	0.045 (0.101)				0.216 (0.174)	0.251** (0.127)	0.205 (0.156)				-0.129 (0.108)	-0.117 (0.098)	-0.129 (0.108)
# Obs.	2366	2366	2366	2366	2366	2366	1164	1164	1164	1164	1164	1164	1201	1201	1201	1201	1201	1201

**Table 02 Volatility-Activity Relationship : Specification (B)****Volatility –Activity Relationship: Specification (B)**

$$Activity_t = \alpha + \beta Activity_{t-1} + \gamma Volatility_t + \delta Trend + e_t$$

Period	Full			Crawling Band			Free Floating		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Coeff. Estimate for Volatility									
Turnover Derivatives	-1428*** (427)			-695.6 (670.2)			-27.1 (484.6)		
Open Interest		-31.0*** (11.49)			-50.1*** (18.8)			-22.9 (15.9)	
Turnover Spot			632.7*** (243.3)			964.4*** (283.9)			472.4 (311.3)
# Obs.	2366	2366	2366	1164	1164	1164	1201	1201	1201
Adj. R <sup>2</sup>	0.70	0.99	0.59	0.65	0.99	0.29	0.28	0.99	0.44