VOLUME 7 NU.

JOURNAL OF BUSINESS AND ECONOMIC ISSUES

ISSN 0974-9144

..ollege

EDITORIAL BOARD

All communications should be addressed to :
Chief Editor
Journal of Business and Economic Issues
Barrackpore Rastraguru Surendranath College
85, Middle Road & 6, Riverside Road, Barrackpore
North 24 Parganas, Kolkata-700 120, West Bengal, India
Tel: (033) 2592-0603, 2545-1402, Telefax : (033) 2594-5270
E-mail: brsnc_commercejournal@rediffmail.com

Subscription Rate :

	India	Abroad
1-Year	Rs. 200	$8
3-Year	Rs. 550	$ 22
5-Year	Rs. 900	$ 36

ADVISORY BOARD

Journal of Business And Economic Issues

Contents

Volume 7 **Number 1** **2017**

Journal of
Business And Economic Issues
Vol. 7 No. 1

Exchange Rate Return Co-movements and Volatility Spillover : The Case of Emerging Market Economies

Suman Das*

Abstract

The paper examines the return co-movements and volatility spillover among four major foreign exchange markets and four emerging markets. In particular the return co-movement and the volatility spillover between the foreign exchange markets of India, China, Brazil and South Africa and several other currencies namely the Euro, Japanese Yen, Australian Dollar and Swiss Franc for the period 1995-2015 is the main objective of the study. Based on daily data, the paper estimates a flexible MGARCH-Dynamic Conditional Correlation model and VAR-based spillover index. The econometric estimation suggests the presence of significant return co-movement and volatility spillover between the foreign exchange markets with emerging markets as the net receiver of volatility and developed markets as the net transmitter of volatility.

JEL Classification : *C32, C58, E44, F31, F41, G15*

Key Words : *Exchange Rate, Volatility, MGARCH-DCC Model, Return Co-movement, VAR based Spillover Index.*

1. Introduction

The appearance that immediately importunes in the mind with the word 'volatile' is that of unstable stock market, balance of payments crisis of the late 1990s or the unpredictable capital flows in the emerging market economies. But over the last decade the perception of volatility had widened and began to develop itself into an independent field of inquiry in the foreign exchange market as well. Conceptually volatility can be decomposed into a predictable component and an unpredictable component. In common dialect, it is a arduous task to make a distinction among volatility, uncertainty, risk, variability, fluctuation or oscillation but according to

* [1] *Ph.D Scholar, Department of Economics, Jadavpur University, Kolkata, IndiaTel: 09836583154. Email: sumandas.eco@gmail.com*

Knight's (1921) volatility is allied to risk in that it provides a measure of the possible variation or movement in a particular economic variable or some function of that variable over some historical period. Mainly there are two key essence of volatility namely variability and uncertainty - variability in an economic variable may be anticipated while the residual which captures pure risk or uncertainty is unanticipated and constitutes a 'shock'. The size and persistence of such shocks can pose a major challenge to the economic management as it can evolve into extreme volatility or a crisis. In addition volatility in exchange rate can be explained in the presence of three possible factors - volatility in market fundamentals, changes in expectations due to new information and speculative "bandwagons" (Engel and Hakkio 1993). Volatility in market fundamentals such as the money supply, income and interest rates affects volatility in exchange rate as exchange rate is a function of these fundamentals. Changes in expectations about future market fundamentals or economic policies also affect exchange rate volatility as new information induces the market participants to alter their forecasts of future economic conditions and policies thereby leading to exchange rate volatility. Finally volatility in exchange rate can be caused by speculative bandwagons or speculative exchange rate movement unrelated to current or expected market fundamentals.

In particular exchange rate is defined as the relative price of currencies between two or more countries, its behavior impacts the competitiveness of exports, international investment portfolios, international reserves and currency value of debt payments and more precisely impacts the overall stability of the economy. So any misalignment in the exchange rate thus requires intervention in the exchange market through appropriate exchange rate policy along with monetary and fiscal policies to ensure stability and growth in the economy. Nonetheless as the emerging markets progressed towards floating exchange regime and got more associated with the world financial market, the chances of volatility in exchange rate had increased manifold and managing such periods of volatility has emerged as a great challenge in view of the impossible trinity of independent monetary policy, open capital account and exchange rate management for nearly a decade. Therefore on this backdrop it calls for understanding the nature of volatility and anticipate and manage its consequences should be of considerable interest to policymakers as empirical investigation had increasingly shown that weak policies and institutions in developing countries magnifies the negative impact of volatility and can lead to permanent setback relative to richer countries.

This study investigates the exchange rate return co-movement and volatility spillover between four emerging foreign exchange markets of India, China, Brazil and South Africa and several other currencies namely the Euro, Japanese Yen, Australian Dollar and Swiss Franc. The notion of correlation reveals the nature of interdependencies among assets whereas the knowledge of spillover helps in understanding the proliferation of shocks from one market to another. Even though a variety of techniques could be applied to assess the return co-movement and volatility spillover but the most plausible among them is the Dynamic Conditional Correlation model and Vector Autoregression framework.

The structure of the paper is as follows: Section 2 provides with a review of the existing literature on the subject and section 3 delineates the econometric methodology and the data used in the study. Section 4 presents the empirical results. Section 5 concludes with summary of major findings and policy implications.

2. Review of Literature

A large number of literatures have primarily focused on the stock market volatility spillover with little emphasis on the foreign exchange markets. However, in the past decade there came the necessity to examine the return co-movement and volatility in foreign exchange market as it became more integrated with the world market. There is substantial literature on developed economies concerning the occurrence of volatility in exchange rates and its spillover effects to other foreign exchange markets with the papers emphasizing on the causes and methods of testifying volatility in exchange rate by employing GARCH family models. However, there is a dearth of literature in the context of co-movement and spillover in case of emerging economies as majority of the papers have largely concentrated on the role of intervention policy of the central bank in controlling volatility. A brief review of the existing papers is presented below.

While there are many approaches to measure volatility but the most common among them is the generalized autoregressive conditional heteroskedasticity model. The basic GARCH family models are frequently applied and quoted to describe the volatility in financial markets such as stock exchanges and foreign exchange markets. GARCH estimates of volatility are calculated using a time series of past exchange rate changes. Mundaca (1991) showed that GARCH models perform better than the ARCH model (Johnston and Scott 2000, Chong et al. 2002, Mckenzie & Mitchell

2002) whereas Sandoval (2006) captured the important characteristics of daily exchange rate by applying ARMA, GARCH, EGARCH and GJR-GARCH models (Kocenda and Valachy 2006). Giannellis and Papadopoulos (2011) use monetary, real and financial variables to assess the relevant importance of each of the variables to exchange rate volatility even as Erdemlioglu, Laurent and Neely (2012) modelled the volatility in exchange rate by incorporating intraday periodicity, autocorrelation and discontinuities in prices. Djeutem and Kasa (2013) shows that revision of robust forecasts are more volatile than revisions of non-robust forecasts in the context of the monetary model of exchange rates. In another paper, Stancik (2007) states that more openness leads to lower volatility, effect of news varies across countries and only key changes in exchange rate regimes have significant effect on exchange rate volatility while Annachhatre (2013) argues that exchange rate volatility is caused due to deviation from fundamentals, excessive speculative activities, macro-economic shocks or other global and domestic news. On the other hand Alam and Rahaman (2012) explored that both AR and ARMA models best suits the in-sample data and GARCH and TARCH model suits the out-of-sample data. Similarly Kamal, Haq, Ghani & Khan (2012) also exhibited that EGARCH model best explains the volatile behavior of the daily exchange rate (Narayan et al. 2009). These deliberations indicate that the variance of daily exchange rate changes is forecastable using GARCH models.

Regarding volatility spillover, studies that examined exchange rate volatility transmission were initiated by Engle et al. (1990) where the authors found supporting evidence for two hypotheses namely the 'heat waves' and the 'meteor shower'. Heat waves refer to exchange rate volatility in one particular market having only country specific effect while the meteor shower refer to volatility being transmitted to other countries.[1] Ross (1989) note that volatility is an important source of information in the financial markets and the first channel of volatility spillover is news which affects a set of financial variables simultaneously (Bollerslev et al. 1992) whilst the second channel operates through the information spillover caused by the cross market hedging (Ederington & Lee 1993). Moreover the contagion hypothesis notes that agents who observe a price decline in one market becomes more risk averse and reduces their position in the other markets thereby creating an apparent spillover effect (Ebrahim 2000). Anderson et al. (1999) reported a normality-inducing volatility transmission,

[1] *Accordingly, enquiry in this field were carried out by Bollerslev (1990), Speight and McMillan (2001), Melvin and Melvin (2003), Black and McMillan (2004) and Calvet et al. (2006). The main feature of these studies is the application of GARCH family models to assess volatility dependencies across currencies.*

high contemporaneous correlation across volatilities, high correlation between correlation and volatility, pronounced and highly persistent temporal variation in both volatilities and correlation and clear evidence of long memory dynamics in both volatilities and correlation. Inagaki (2007) uses residual cross-correlation function to investigate the volatility spillover from the euro to the pound. Antonakakis (2012), in a DCC and VAR framework, suggested that euro is the net transmitter of volatility while pound is the net receiver of volatility. Moreover the cross-market volatility spillovers are bidirectional and the highest spillovers occur between European markets (Chowdhury and Sarno 2004). Perez-Rodriguez (2006) employs the DCC model to find evidence of significant volatility spillovers between the euro, yen and the pound and that correlations are high between the euro and the pound. Under a similar approach Kitamura (2010) finds significant volatility spillovers between the euro, pound and the franc and that the pound and franc are highly integrated to the euro market. Nikkinen et al. (2006), in a VAR framework, found that correlation is highest between Euro and Franc. Likewise Diebold and Yilmaz (2009), in a VAR framework, found remarkable facts of contradictory performance in the dynamics of return spillovers and volatility spillovers in the context of nineteen global equity markets.[2] Kearney and Patton (2000) pointed out both direct and indirect volatility transmission within the EMS and the results further hold up the conjecture that markets are more likely to transmit volatility in active phases rather than in calm ones (Ghose and Kroner 1996, Andersen and Bollerslev 1998). The study by Sahoo (2012) marked the volatility transmission from Brazilian real, the Russian ruble, the South Korean won, the Singapore dollar, the Japanese yen, the Swiss franc, the British pound sterling and the euro to the exchange rate of the Indian rupee and Hong (2001) proved the existence of granger causality between two weekly nominal US Dollar exchange rates with respect to Deutsche Mark and Japanese For instance, Ghosh (2012) displayed that volatility has actually spilled over from stock market, government securities market, forward market, derivative market and international crude prices to the Indian foreign exchange market. In addition the stock market volatility emerged as the most important factor influencing volatility spillover in the foreign exchange market (Mishra et al. 2007). Mukherjee (2011) had theorized that return volatility of the Indian equity market exhibits a sudden sharp increase and the conditional correlation of the equity return with all other markets has increased over

[2] *See also Diebold and Yilmaz (2012)*

time much as Lee (2010) who suggested the presence of both regional spillover and the transmission of shocks from external stock and foreign exchange markets. Yet Saha and Chakrabarti (2011) displayed volatility spillover with no asymmetric impact between stock to exchange rate market and vice versa. Cappiello et al. (2006) demonstrated that equity returns show strong evidence of asymmetries in conditional volatility. Behera (2011) signifies that Non-Deliverable-Forward market (NDF) shocks and volatilities influence the onshore markets. Horng and Chen (2010) unfolded that exchange rate volatility negatively affects Thailand's stock market and Japanese stock return volatility affects the variation risks in the Thailand's stock market. Song (2009), using MGARCH models, witnessed significant volatility spillover between Shanghai and Shenzhen stock markets. To finish with Fang et al. (2006) suggest that within the domestic cross markets, the volatility transmission is unidirectional from the stock market to the bond market. But in case of international cross-market analysis, there is a strong evidence of volatility spillover among the international stock markets than between international stock and bond markets.

A wide range of unending literature is furnished above which gives an idea about the occurrence of volatility in the foreign exchange markets. Nevertheless the preceding section also provides a view of the co-movement and volatility spillover among different currencies and the process of modelling that spillover and analyzing the consequences. Consequently the next section will present a detailed econometric analysis of the return co-movement and volatility spillover and interpret the results.

3. The Data and Methodology

3.1. The Data

The study focuses on the period 1995-2015 using daily exchange rate of Euro, Japanese Yen, Australian Dollar, Swiss Franc, Indian Rupee, Chinese Yuan, South African Rand and Brazilian Real respectively. These series were extracted from Federal Reserve Bank database. The rationale behind choosing Euro, Japanese Yen, Australian Dollar and Swiss Franc is that according to the Bank for International Settlements (BIS) (2013), these currencies are rated as the most traded currency among others. The BIS's Triennial Central Bank Survey on the turnover of these currencies in 2013 are $ 1,785,720 million, $ 1,231,249 million, $ 4,61,689 million and $ 2,75,472 million of all transactions including the spot transactions, outright forwards, foreign exchange swaps, currency swaps and foreign exchange options. It

is also worth mentioning here that according to the European Central Bank, the conversion of European Currency Unit (ECU) to Euro on 1st January, 1999 was at 1:1 basis.

Before proceeding with the estimation, the variables were tested for non-stationary behaviour. The stationarity test based on Augmented Dickey-Fuller (Table 1) rejects the null hypothesis of unit roots in exchange rate at the first difference. Further a detailed view of the descriptive statistics and the time path of the variables (Figure 1) will help in signifying that most of them show abnormal movement during the period of analysis. The return of each foreign exchange is calculated by taking the first logarithmic differences in exchange rate denoted as:

$$\Delta \ln S_t = \ln S_t - \ln S_{t-1}$$

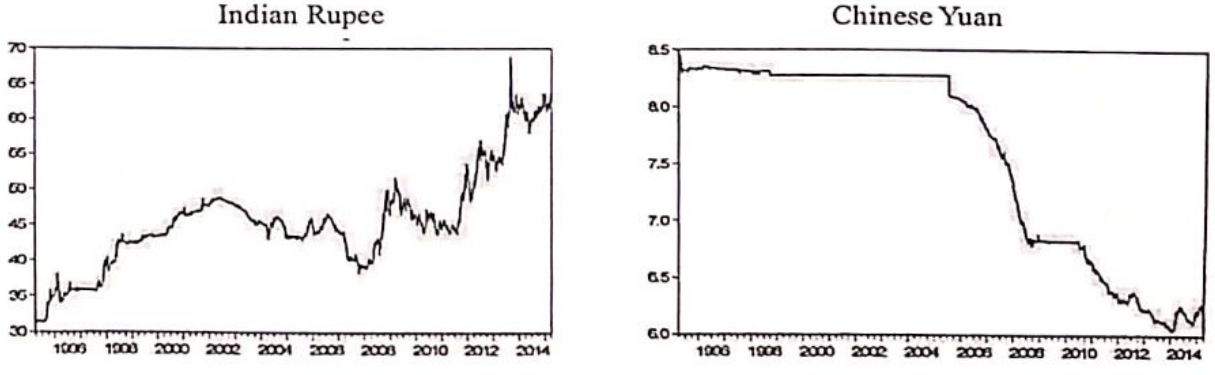
A close view at the return series (Figure 2) of the variables reveals the presence of volatility clustering and ARCH effect which is supportive of modelling the volatility in exchange rate in a GARCH framework.

Table 1: Unit Root Test

Exchange Rates	ADF at Level	ADF at 1st difference
Indian Rupee	-1.638818	-29.80382*
Chinese Yuan	-1.402004	-28.61324*
Brazilian Real	-1.332779	-68.86502*
South African Rand	-1.819792	-71.37670*
Euro	-1.641437	-70.17663*
Japanese Yen	-2.250685	-70.65205*
Australian Dollar	-1.854496	-72.25537*
Swiss Franc	-2.800984	-70.70936*

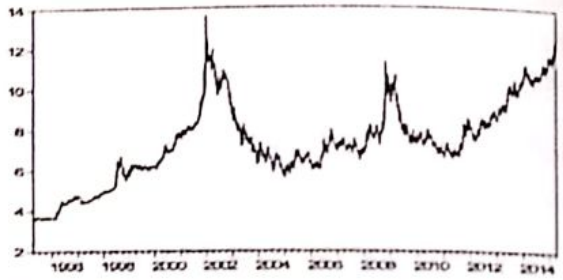
* *denotes significance at 1% level*

Figure 1: Time Path of the Variables
Emerging Market Economics



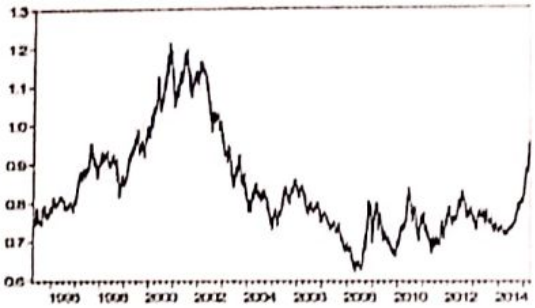
Brazilian Real

South African Rand



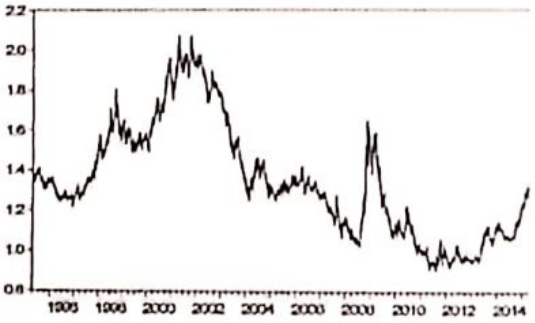
Developed Economies

Euro



Japanese Yen

Australian Dollar



Swiss Franc

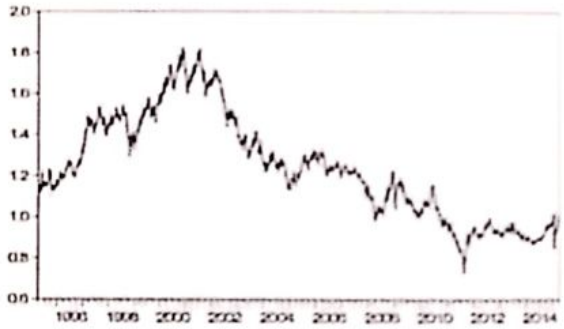
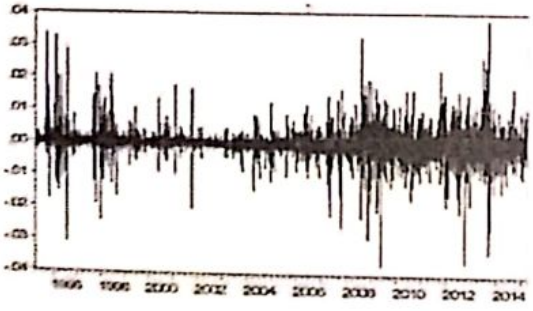


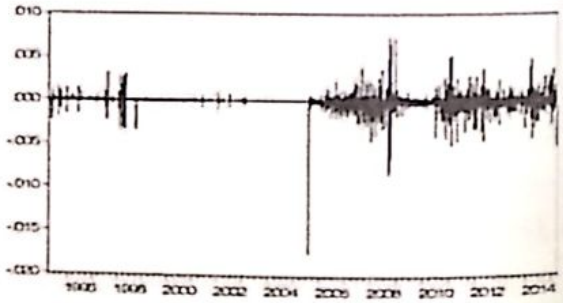
Figure 2: Return Series

Emerging Market Economies

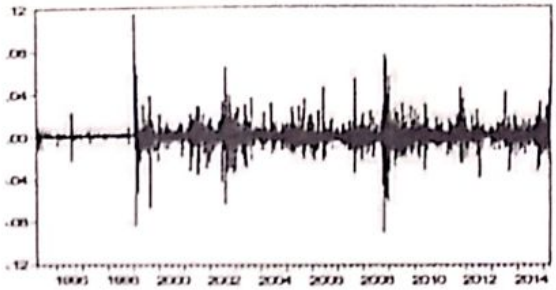
Indian Rupee



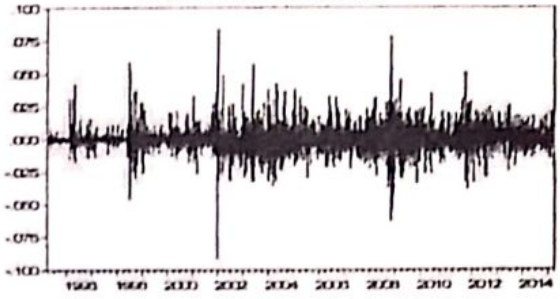
Chinese Yuan



Brazilian Real

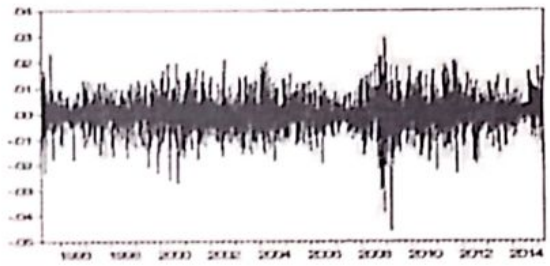


South African Rand

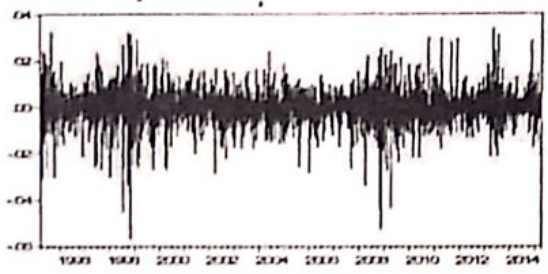


Developed Economies

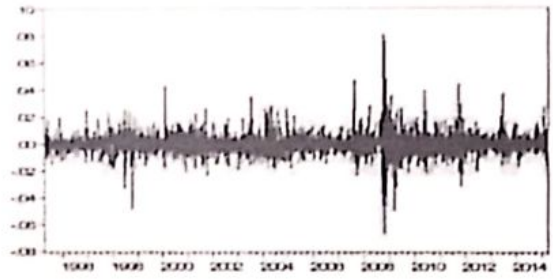
Euro



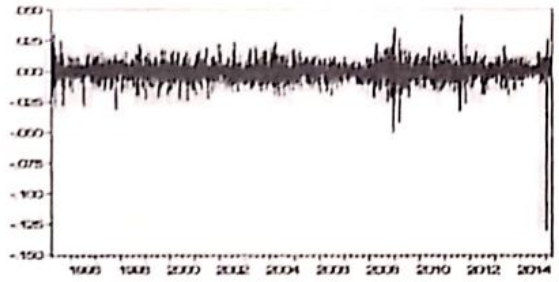
Japanese Yen



Australian Dollar



Swiss Franc



3.2 The Methodology:

Time-varying volatility models have been popular since the early 1990s in empirical research in finance. The analysis of volatility in financial market has been widely studied in ARCH-GARCH framework pioneered by Engle (1982) and further developed by Bollerslev (1986), Nelson (1991) and others. To investigate the return co-movement among the foreign exchange markets, MGARCH-DCC model was put in place as this method explicitly takes into account the time-varying nature and interrelations among the markets. The Dynamic Conditional Correlation (DCC) model was proposed by Engle (2002)[3] as an attempt to establish that correlations, both conditional and unconditional, among the markets are not constant rather time-

[3] *See also Bauwens et al. (2006).*

varying. The model works in two steps. In the first step, the individual conditional variances are specified as univariate GARCH processes and in the second step the correlation among the series is presented. The model has a computational advantage over other MGARCH models in that the number of parameters to be estimated in the process is independent of the number of series to be correlated. As a result, very large correlation matrices can be estimated. Nonetheless it is an investigation against the too restrictive assumption of constant correlation of Constant Conditional Correlation (CCC) Model. The DCC model is represented as

$y_t = \mu_t(\theta) + \epsilon_t$, where $\epsilon_t|\Omega_{t-1} \sim N(0, H_t)$ ..... (1)

$\epsilon_t = H_t^{1/2} u_t$, where $u_t \sim N(0, I)$

$H_t = D_t R_t D_t$ ..... (2)

where $y_t = (y_{1t} \dots \dots y_{nt})'$ is a n 1 vector of exchange rate return, $\mu_t(\theta) = (\mu_{1t}, \dots \dots, \mu_{nt})'$ is the conditional n 1 mean vector of y_t, H_t, is the conditional covariance matrix, $D_t = diag(h_{1it}^{1/2} \dots \dots h_{nnt}^{1/2})$ is a diagonal matrix of square root conditional variances, where can be defined as any univariate GARCH type models and R_t is the $t * (n(n-1)/2)$ matrix containing the time varying conditional correlations defined as

$R_t = diag\,(q_{11,t}^{-1/2} \dots q_{nn,t}^{-1/2}) Q_t diag(q_{11,t}^{-1/2} \dots q_{nn,t}^{-1/2})$ or $\rho_{ij,t} = \rho_{ji,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}\, q_{jj,t}}}$ ....(3)

where $Q_t = (q_{ij,t})$ is a n n symmetric positive definite matrix given by

$Q_t = (1 - \alpha - \beta)\overline{Q} + \alpha u_{t-1} u_{t-1}' + \beta Q_{t-1}$ ....(4)

where $u_t = (u_{1t}, u_{2t}, \dots . u_{nt})'$ is the $n * 1$ is the vector of standardized residuals, $\overline{Q}$ is the n n unconditional variance of u_t and α and β non-negative scalar parameters satisfying $\alpha + \beta > 1$.

All the flexible versions of the MGARCH models are estimated under a multivariate Student t distribution as the normality assumption is rejected in most empirical applications dealing with daily exchange rate data[4]. This view is also endorsed by Bollerslev (1986), Heish (1989) and Baillie and Bollerslev (1989) who find evidence that GARCH (1,1) model with Students t distribution, rather than normal distribution, is the most appropriate for analyzing exchange rate data.

[4] *Harvey et al. (1992) and Fiorentini et al. (2003).*

In order to study the volatility spillover among the foreign exchange market returns, the generalised vector autoregression structure (Koop et al. 1996 and Pesaran and Shin 1998) was used as this method produces variance decomposition which is invariant to the ordering of the variables. The generalised VAR approach allows correlated shocks and accounts for them accurately using the historically observed distribution of the errors. Since the shocks to each variable are not orthogonalised, the sum of the contributions to the variance of the forecast error is not necessarily one.

Consider a p-order N-variable VAR:

$x_t = \sum_{i=1}^{p} \varphi_i x_{t-1} + \epsilon_t,$, where $x_t = (x_{it}, \ldots\ldots, x_{nt})$ is a vector of endogenous variables, $\epsilon_t \sim (0, \Sigma)$ is a vector of independently and identically distributed disturbances. The moving average representation is $x_t = \sum_{i=0}^{\infty} A_i \epsilon_{t-1}.$, where NxN coefficient matrices A_i obey the recursion $A_i = \varphi_1 A_{i-1} + \varphi_2 A_{i-2} + \ldots. + \varphi_p A_{i-p},$, with A_0 being an NxN identity matrix and with $A_i = 0$ for $i < 0$.

Denoting the KPPS H-step ahead forecast error variance decomposition as

$$\theta_{ij}^{g}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} (e_i' A_h \Sigma e_j)^2}{\sum_{h=0}^{H-1} (e_i' A_h \Sigma A_h' e_i)} \qquad \ldots.(5)$$

where Σ is the variance matrix for the error vector ε, σ_{jj} is the standard deviation of the error term for the *jth* equation and e_i is the selection vector with one as the *ith* element and zeros otherwise. As was mentioned above, the sum of the each row of the variance decomposition matrix is not equal to one, so each variable of the matrix is normalized by row sum, so that resultant row sum of the variables is equal to one. This is as follows

$$\tilde{\theta}_{ij}^{g}(H) = \frac{\theta_{ij}^{g}(H)}{\sum_{j=1}^{N} \theta_{ij}^{g}(H)} \qquad \ldots.(6)$$

with $\sum_{j=1}^{N} \tilde{\theta}_{ij}^{g}(H) = 1$ and $\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^{g}(H) = N$ by construction.

Using these results, the total volatility spillover index is constructed as

$$S^{g}(H) = \frac{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^{g}(H)}{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^{g}(H)} * 100 = \frac{\sum_{i,j=1}^{N} \tilde{\theta}_{ij}^{g}(H)}{N} * 100 \qquad \ldots.(7)$$

This index measures the contribution of spillovers of volatility shocks across five markets to the total forecast error variance. Additionally, the directional spillovers received by market *i* from all other markets *j* are defined as

$$S_{i<}^{g}(H) = \frac{\sum_{j=1}^{N} \overline{\theta}_{ij}^{g}(H)}{\sum_{i,j=1}^{N} \overline{\theta}_{ij}^{g}(H)} * 100 = \frac{\sum_{j=1}^{N} \overline{\theta}_{ij}^{g}(H)}{N} * 100 \quad \ldots.(8)$$

Equally the directional spillovers transmitted by market i to all other markets j are defined as

$$S_{i>}^{g}(H) = \frac{\sum_{j=1}^{N} \overline{\theta}_{ji}^{g}(H)}{\sum_{i,j=1}^{N} \overline{\theta}_{ji}^{g}(H)} * 100 = \frac{\sum_{j=1}^{N} \overline{\theta}_{ji}^{g}(H)}{N} * 100 \quad \ldots.(9)$$

and finally the net volatility spillover from market to all other markets is defined as

$$S_{i}^{g}(H) = S_{i>}^{g}(H) - S_{i<}^{g}(H) \quad \ldots.(10)$$

3. Empirical Results

4.1 Descriptive Statistics

Table 2 reports the descriptive statistics of Indian Rupee, Chinese Yuan, Brazilian Real, South African Rand, Euro, Japanese Yen, Australian Dollar and Swiss Franc for the period 1995-2015.

Table 2: Descriptive Statistics

	Indian Rupee	Chinese Yuan	Brazilian Real	South African Rand	Euro	Japanese Yen	Australian Dollar	Swiss Franc
Mean	0.000132	-5.91E-05	0.000247	0.000234	3.90E-05	5.35E-05	-2.99E-05	-7.03E-06
Median	-3.60E-05	-7.61E-06	0.000158	0.000119	8.44E-05	0.000152	0.000137	-0.000180
Std. Dev.	0.004318	0.000730	0.009550	0.009724	0.005906	0.006791	0.006869	0.007635
Skewness	0.100569	-3.074689	0.488242	0.329507	-0.170353	-0.472464	-1.417929	0.702707
Kurtosis	14.64613	84.09503	20.12225	9.982374	5.423840	8.047721	30.25439	15.09329
Jarque Bera (Prob.)	29486.23 (0.000)*	1437490 (0.000)*.	63923.16 (0.000)*	10690.16 (0.000)*	1302.062 (0.000)*	5731.596 (0.000)*	163183.3 (0.000)*	32213.79 (0.000)*
Q(30)	80.245 (0.000)*	186.81 (0.000)*	99.482 (0.000)*	49.680 (0.013)**	19.305 (0.933)	46.693 (0.027)**	59.626 (0.001)*	30.799 (0.425)
$Q^2(30)$	1583.8 (0.000)*	138.80 (0.000)*	5416.9 (0.000)*	3111.9 (0.000)*	1415.0 (0.000)*	1042.1 (0.000)*	5311.5 (0.000)*	140.81 (0.000)*
Obs.	5216	5216	5216	5216	5216	5216	5216	5216

*Notes: *, ** indicates significance at 1% and 5% level. P-values are in the parentheses.*
Q(1) and $Q^2(1)$ is the Ljung-Box statistic for serial correlation in return series and squared series respectively

From the table, it is evident that the standard deviation values show that the returns of the foreign exchange markets are positive and highest for South Africa followed by Brazil, India and China. This result signifies that variation in South African Rand is more as compared to others emerging economies. The kurtosis coefficients points to the leptokurtic nature of the foreign exchange markets and the Jarque-Bera statistics indicate the presence non-normal distribution since all the coefficients are significant

at one percent level thus rejecting the null hypothesis of normally distributed returns. Accordingly the table also reports the Ljung-Box Q and the Q^2 statistics for all the return series and the squared return series. The Q statistic results points to the fact that only Euro and Swiss Franc can be characterized as random walk processes. Alternatively the Q^2 statistic is significant for each return series indicating the presence of higher order serial correlation and non-linearity among the variables. These findings also strengthen the fact that exchange rate volatility can be modelled in a GARCH framework.

Furthermore the returns series of all the currencies exhibit non-randomness and volatility clustering which means that large movements are characterized by large changes and vice-versa. This conclusion also finds evidence from the literature that exchange rate volatility can be modelled in a GARCH process.

4.2 Return Co-movement

In this section we look into the return co-movement of the emerging foreign exchange markets with world's four most traded currencies by applying Dynamic Conditional Correlation model. But before continuing with the estimation, the correlation among the variables is presented in table 3.

Table 3: Cross Correlation

	Euro	Japanese Yen	Australian Dollar	Swiss Franc
Indian Rupee	0.187661 (0.000)*	0.003984 (0.7736)	0.265589 (0.000)*	0.114220 (0.000)*
Chinese Yuan	0.067685 (0.000)*	0.006305 (0.6489)	0.089584 (0.000)*	0.042771 (0.0020)*
Brazilian Real	0.200760 (0.000)*	-0.016091 (0.2453)	0.365206 (0.000)*	0.086949 (0.000)*
South African Rand	0.387282 (0.000)*	0.007100 (0.6082)	0.507310 (0.000)*	0.262830 (0.000)*

*Note: * indicates significance at 1% level. P-values are in the parentheses*

These correlation coefficients determine the degree to which two variable's movements are associated. The table discloses that Indian Rupee, Chinese Yuan and South African Rand are positively correlated with Euro, Japanese Yen, Australian Dollar and Swiss Franc. On the other hand the Brazilian Real is also positively correlated with Euro, Australian Dollar and Swiss Franc but negatively correlated with Japanese Yen. It is important to note here that almost all the emerging markets have the highest significant positive correlation with Australian Dollar, Euro and

Swiss Franc and nearly insignificant correlation with Japanese Yen. The positive correlation symbolizes that an appreciation of one currency leads to an appreciation of other and vice-versa and the negative correlation exhibits that an appreciation of one currency leads to depreciation of other and vice-versa.

We shall now focus on simple MGARCH-DCC(1,1) model for illustrating the return co-movement in the foreign exchange market. Four DCC model was estimated separately to understand the co-movements between the emerging markets with the developed foreign exchange markets. For instance, DCC model was conducted for Indian Rupee, Chinese Yuan, Brazilian Real and South African with the developed country's currency independently.

Table 4: DCC Estimate

Parameters	India Rupee	China Yuan	Brazilian Real	South African Rand
α	0.022359*	0.022047*	0.024284*	0.024712*
β	0.974251*	0.974935*	0.973667*	0.973085*
$\alpha + \beta$	0.997694	0.997782	0.997951	0.997797
Stability Condition $\alpha + \beta < 1$	Met	Met	Met	Met

*denotes significance at 1% level

Table 4 depicts the estimates of DCC parameters α and β to be statistically significant indicating that the second moments of exchange rate returns are time varying. Moreover the summation of the parameters are less than one in all the cases which signifies that the DCC model is very well specified as the stability condition is met.

Henceforth the univariate GARCH estimate of emerging market economies and the developed economies are presented in table 5 and table 6 respectively. The estimated outcomes through some light on how the nature and behaviour of the emerging foreign exchange markets vary from their developed counterparts.

Table 5: Univariate GARCH Estimate and Diagnostic Test: Emerging Market Economies

Countries	ARCH (γ)	GARCH (δ)	$\sum(\gamma + \delta)$	Status of the series	ARCH-LM test
Indian Rupee	0.254492*	0.808864*	1.063357	Explosive	0.003253 (0.8143)
Chinese Yuan	0.491677*	0.738855*	1.179532	Explosive	-0.000198 (0.9886)
Brazilian Real	0.164723*	0.898247*	1.063397	Explosive	-0.000356 (0.9795)
South African Rand	0.164427*	0.899714*	1.014141	Explosive	0.037116 (0.0073)*

Note: * denotes significance at 1% level

Table 6: Univariate GARCH Estimate and Diagnostic Test: Developed Economies

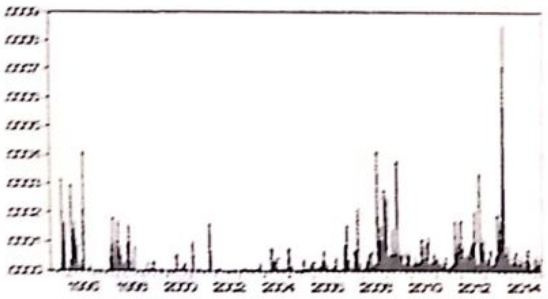
Countries	ARCH (γ)	GARCH (δ)	$\sum(\gamma + \delta)$	Status of the series	ARCH-LM test
Euro	0.031710*	0.967370*	0.99908	Persist for long time	-0.030892 (0.8582)**
Japanese Yen	0.037300*	0.954671*	0.991971	Persist for long time	0.024152 (0.8811)
Australian Dollar	0.041354*	0.953000*	0.995053	Persist for long time	-0.002195 (0.8741)
Swiss Franc	0.029669*	0.964356*	0.994225	Persist for long time	0.004962 (0.7202)

*Note: * and ** denotes significance at 1% level and 5% level*

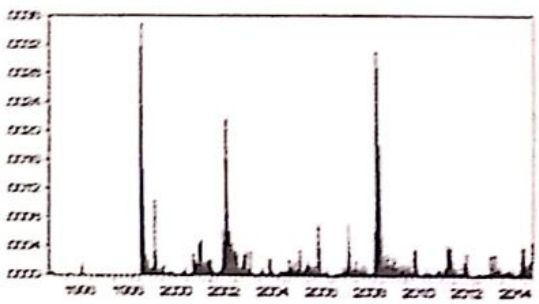
In the case of emerging market economies, the summation of ARCH and GARCH coefficients are all greater than one which relates that the return series of the emerging foreign exchange markets are explosive thus pointing to the tendency to move away from the mean value (Kuruvila et al. 2012, Sekhar 2003) whereas the summation of ARCH and GARCH coefficients of the developed economies (Table 6) are less than one which means the volatility of the return series of the developed economies have a leaning to persist for a long time. Furthermore the conditional variances graphs (Figure 3) of the respective markets also strengthen the above argument. Nevertheless the ARCH-LM test confirms that no further ARCH effect exists in the returns series except in South African Rand and Euro.

Figure 3: Conditional variance
Emerging Market Economies

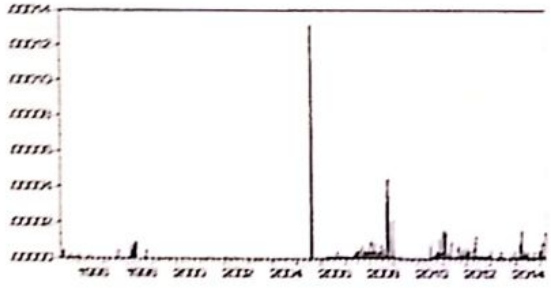
India



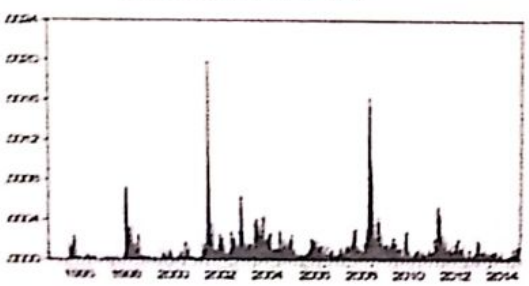
Brazilian Real



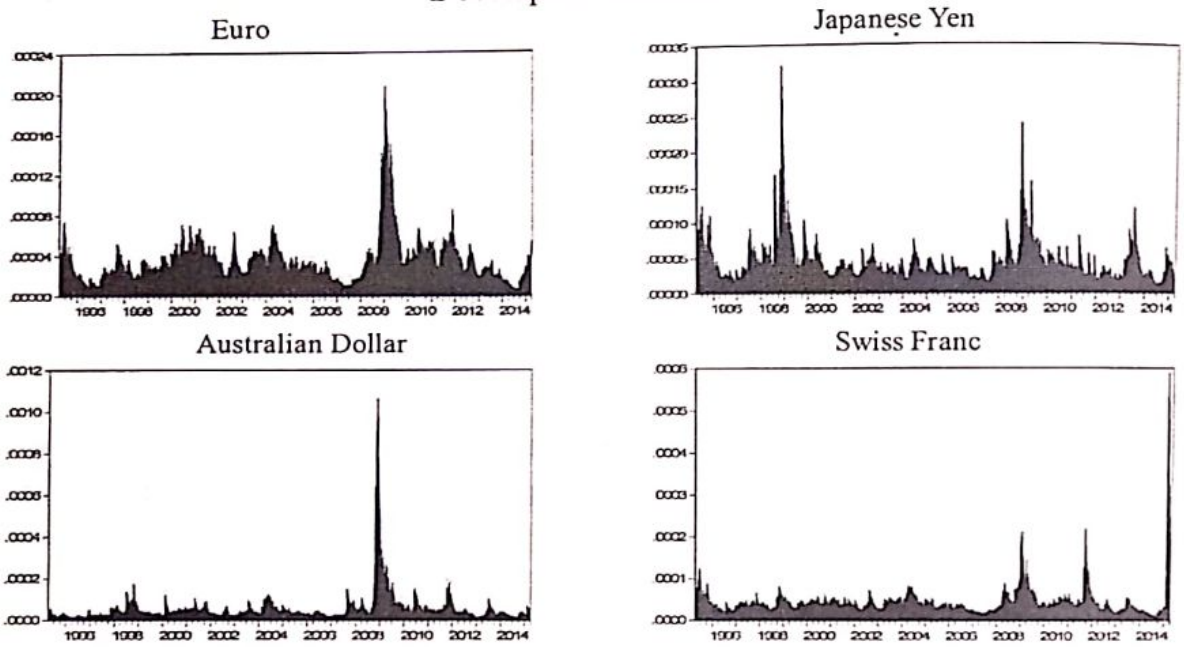
Chinese Yuan



South African Rand



Developed Economies

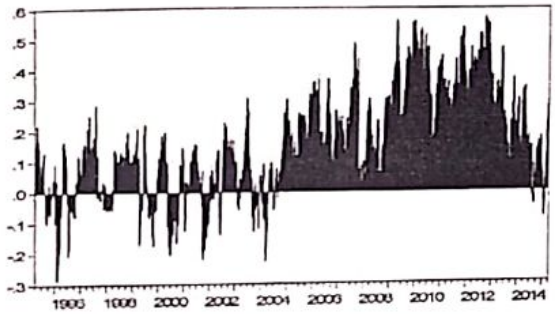


Besides the conditional correlation graphs (Figure 4) report evidence of significant dynamic conditional correlation among the emerging markets and developed markets. It is indicative that there is high positive correlation between Indian Rupee, Brazilian Real and South African Rand with Australian Dollar, Euro and Swiss Franc, but the degree of correlation, though positive, is small in case of Chinese Yuan. Conversely the correlation with Japanese Yen does not turn out any alluring conclusion. It is notable from the graphs that the correlation is relatively positive with the magnitude increasing particularly after the period 2004 to the end. It is also interesting to mark that the conditional variance curves reflect similar pattern during the same period. This increase in conditional variances and correlations are probably connected with extreme episodes of disorder or crises such as the Asian crisis of 1997-98, the Brazilian crisis of 1999, the recession in US and EU in early 2000s, the terror attack of 2001, the dollar crisis in 2005, the capital outflow from emerging markets following the signal from FED to increase the Fed Funds rate in 2006, the global financial crisis starting in 2007 and finally occurring in 2008 or the Eurozone debt crisis in 2011. The correlation figures further signifies that Indian Rupee, Chinese Yuan, Brazilian Real and South African Rand have a considerable co-movement with Euro, Australian Dollar and Swiss Franc. On the contrary it can as well be argued that the implied volatility of Euro, Australian Dollar and Swiss Franc significantly affects the volatility expectations of Rupee, Yuan, Real and Rand.

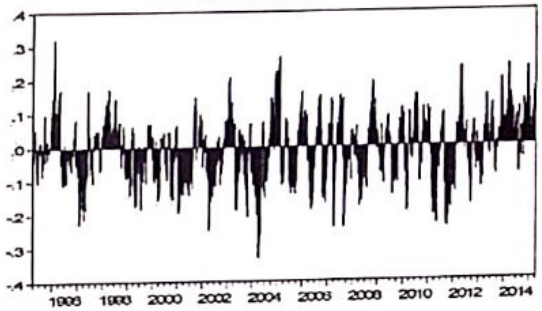
Figure 4: Correlation

Indian rupee

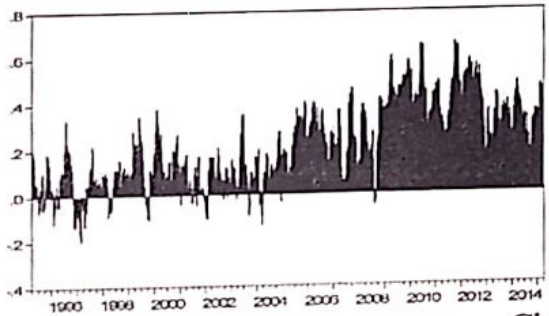
INR/Euro



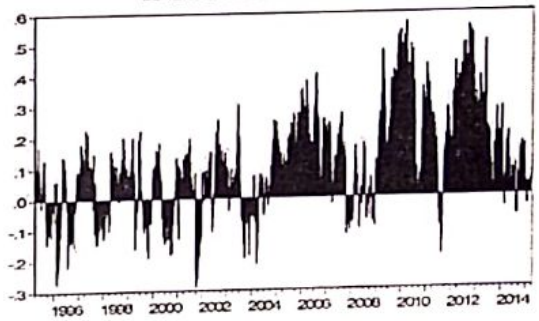
INR/Yen



INR/Australian Dollar

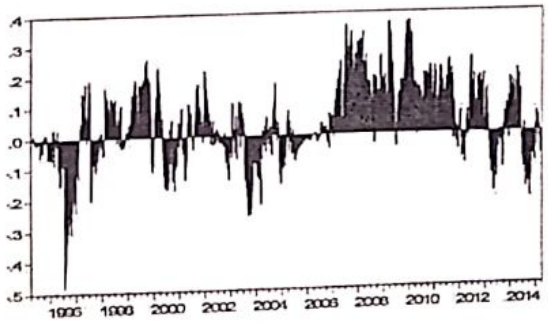


INR/Swiss Franc

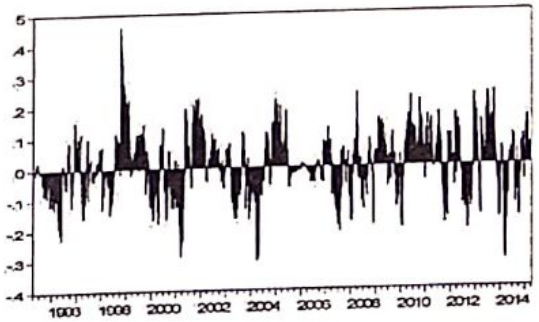


Chinese Yuan

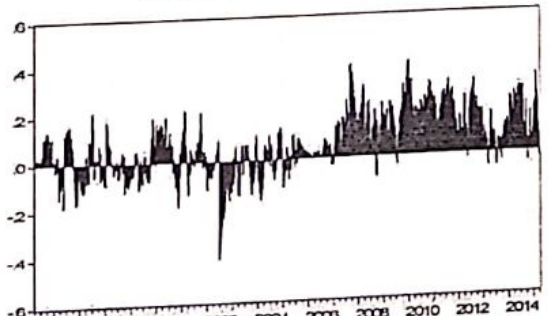
Chinese Yuan/Euro



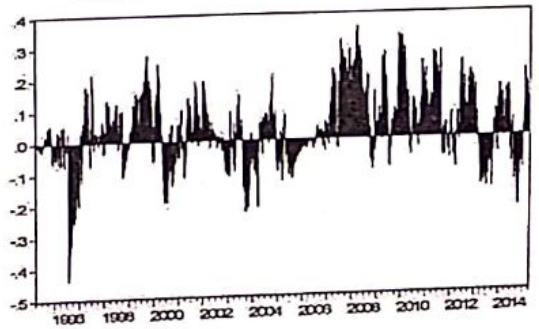
Chinese Yuan/Yen



Chinese Yuan/Australian Dollar

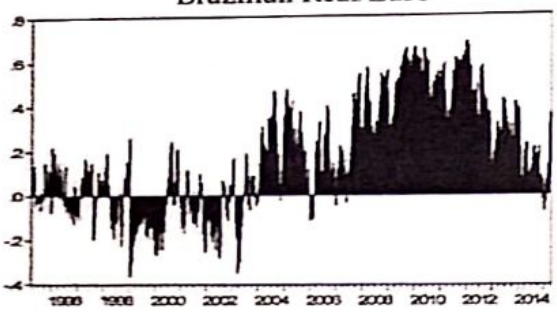


Chinese Yuan/ Swiss Franc

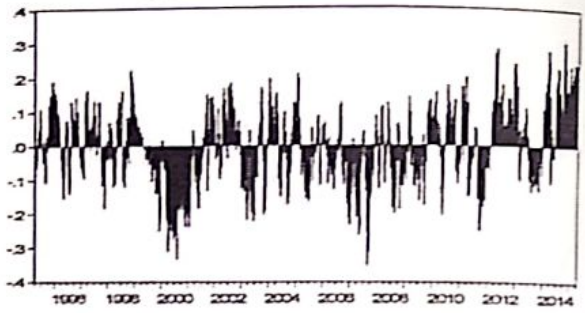


Brazilian Real

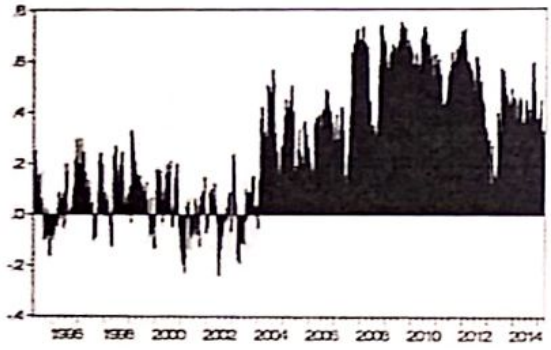
Brazilian Real/Euro



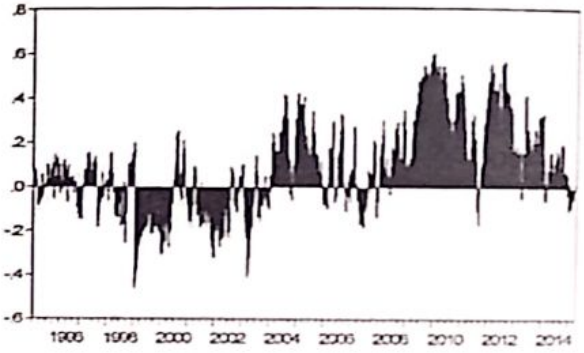
Brazilian Real/Yen



Brazilian Real/ Australian Dollar

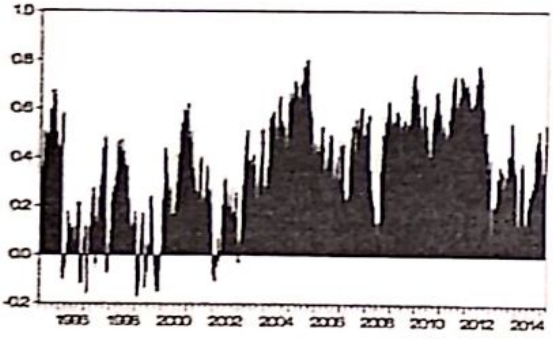


Brazilian Real/ Swiss Franc

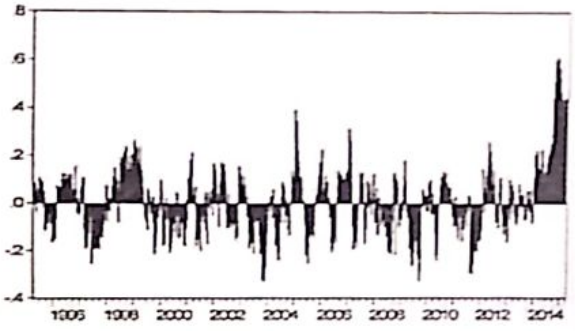


South African Rand

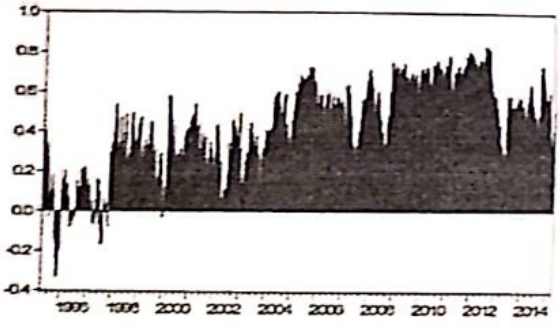
South African Rand/Euro



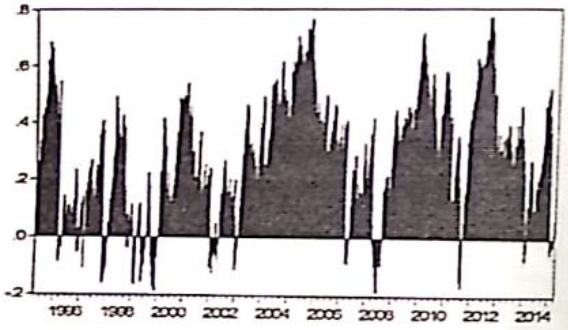
South African Rand/Yen



South African Rand/ Australian Dollar



South African Rand/Swiss Franc



4.2 Volatility Spillover

In this section, the estimate of the volatility spillover based on generalised vector autoregression process is presented. Specifically the variance decomposition technique is used to measure the volatility spillover between the foreign exchange markets. The results of the degree and direction of volatility spillovers within and across the four emerging market economies are shown in table 7, table 8, table 9 and table 10 successively.

Before citing the results, it is essential to explain the rows and columns of the spillover table. The $ijth$ entry is the estimated contribution to the forecast error variance of market i coming from innovations to market j. The diagonal elements measure the own-market volatility spillover and the off-diagonal elements measure the cross-market volatility spillover. Therefore the off-diagonal column sum (Contributions to others) and row sum (Contribution from others) are the 'to' and 'from' volatility spillovers in each market and the difference between 'from and to' gives the net volatility spillover from market to market . The total volatility spillover index appears in the lower right corner of the table shows the grand off-diagonal column sum (row sum) relative to the grand column sum including diagonals (row sum including diagonals) expressed in percentage.

Table 7: Indian Rupee

	From					
To	Indian Rupee	Euro	Japanese Yen	Australian Dollar	Swiss Franc	Contribution From Others
Indian Rupee	88.849	3.347	0.003	6.484	1.317	11.151
Euro	1.836	51.811	0.001	12.630	33.722	48.189
Japanese Yen	0.005	0.002	99.833	0.148	0.012	0.167
Australian Dollar	5.119	16.985	0.051	69.568	8.277	30.432
Swiss Franc	0.739	36.477	0.012	6.686	56.086	43.914
Contribution to Others	7.700	56.812	0.066	25.948	43.327	133.854
Contribution including own	96.549	108.622	99.899	95.516	99.413	
Net Spillover	-3.451	8.623	-0.101	-4.484	-0.587	Spillover Index 26.771%

Notes: Values reported are the variance decomposition based on 10-step ahead forecasts. The VAR lag length of order 1 was selected by the Hannan-Quinn Criterion.

Table 8: Chinese Yuan

	From					
	Chinese Yuan	Euro	Japanese Yen	Australian Dollar	Swiss Franc	Contribution From Others
To						
Chinese Yuan	96.049	1.785	0.009	1.323	0.833	3.951
Euro	0.227	52.667	0.001	12.826	34.279	47.333
Japanese Yen	0.003	0.002	99.832	0.152	0.011	0.168
Australian Dollar	0.571	17.785	0.056	72.917	8.672	27.083
Swiss Franc	0.120	36.705	0.012	6.726	56.437	43.563
Contribution to Others	0.920	56.277	0.078	21.027	43.796	122.098
Contribution including own	96.970	108.944	99.909	93.944	100.233	
Net Spillover	-3.031	8.944	-0.09	-6.056	0.233	Spillover Index 24.420%

Notes: Values reported are the variance decomposition based on 10-step ahead forecasts. The VAR lag length of order 1 was selected by the Hannan-Quinn Criterion.

Table 9: Brazilian Real

	From					
	Brazilian Real	Euro	Japanese Yen	Australian Dollar	Swiss Franc	Contribution From Others
To						
Brazilian Real	84.535	3.453	0.042	11.288	0.682	15.465
Euro	2.083	51.674	0.001	12.590	33.652	48.326
Japanese Yen	0.025	0.002	99.810	0.151	0.011	0.190
Australian Dollar	8.941	16.295	0.051	66.778	7.935	33.222
Swiss Franc	0.413	36.613	0.012	6.699	56.263	43.737
Contribution to Others	11.463	56.363	0.105	30.728	42.280	140.939
Contribution including own	95.998	108.037	99.915	97.506	98.543	
Net Spillover	-4.002	8.037	-0.085	-2.494	-1.457	Spillover Index 28.188%

Notes: Values reported are the variance decomposition based on 10-step ahead forecasts. The VAR lag length of order 1 was selected by the Hannan-Quinn Criterion.

	From					
	South African Rand	Euro	Japanese Yen	Australian Dollar	Swiss Franc	Contribution From Others
To						
South African Rand	67.614	10.220	0.025	17.419	4.722	32.386
Euro	7.367	48.882	0.001	11.937	31.813	51.118
Japanese Yen	0.012	0.002	99.824	0.151	0.011	0.176
Australian Dollar	15.904	15.072	0.047	61.623	7.355	38.377
Swiss Franc	3.786	35.347	0.011	6.500	54.355	45.645
Contribution to Others	27.069	60.642	0.084	36.007	43.900	167.702
Contribution including own	94.683	109.524	99.908	97.630	98.255	
Net Spillover	-5.317	9.524	-0.092	-2.37	-1.745	Spillover Index 33.540%

Notes: Values reported are the variance decomposition based on 10-step ahead forecasts. The VAR lag length of order 1 was selected by the Hannan-Quinn Criterion.

A number of interesting results appear in the tables. In all the cases, the own market volatility spillover is highest with the diagonal elements having higher values as compared to off-diagonal elements. In case of Indian Rupee, Brazilian Real and South African Rand, the highest spillover is from Australian Dollar followed by Euro, Swiss Franc and Japanese Yen whereas in case of Chinese Yuan, the highest spillover is from Euro followed by Australian Dollar, Swiss Franc and Japanese Yen. So it can be inferred that Australian Dollar is the dominant currency in volatility transmission to the Indian, Brazilian and South African markets and Euro is the dominant currency in volatility transmission to Chinese markets. It is also observed from the table that all the emerging markets pass on maximum volatility to Australian Dollar succeeded by Euro, Swiss Franc and Japanese Yen. The estimates of the table above further strengthen the discussion.

According to the 'contribution to others' row and 'contribution from others' column, the emerging markets show similar picture. All the emerging foreign exchange markets contribute less and absorb more volatility from the developed markets. The ensuing figures of 'contribution to others' row for Indian Rupee, Chinese Yuan, Brazilian Real and South African Rand are 7.700, 0.920, 11.463 and 27.069 and 'contribution from others' are 11.151, 3.951, 15.465 and 32.386. These statistics disclose that the emerging markets are net receiver of volatility while the developed markets are net transmitter of volatility.

Furthermore it is also revealed from the corresponding table that the spillover index is highest for South African Rand followed by Brazilian Real, Indian Rupee and Chinese Yuan. This result corroborate the finding that variance of South African Rand is higher. In fact, the examination of the full table at a glance and explicitly at the 'contribution to others' row and 'contribution from others' column reflects that the gross directional volatility spillover 'to others' and 'from others' is highest for Euro and lowest for Japanese Yen. Moreover the net volatility spillover row emulate that Euro is the dominant currency in transmission of volatility to other markets.

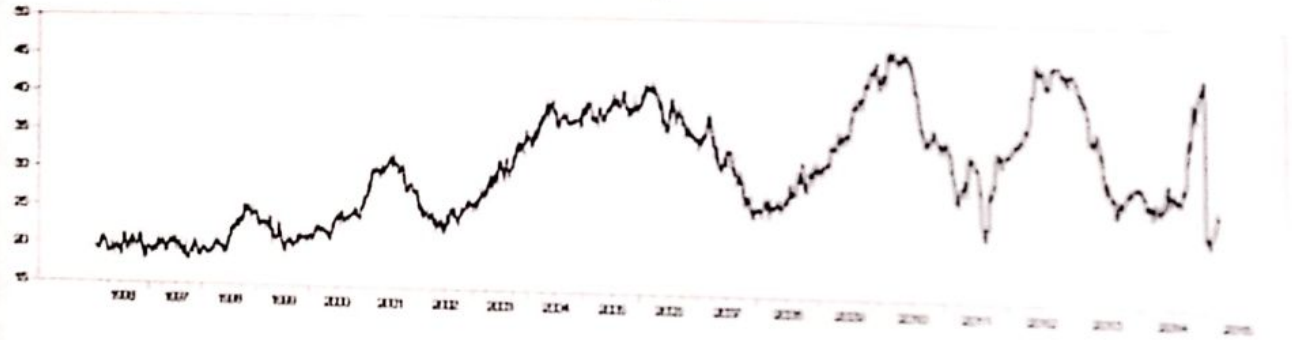
Although the spillover tables provide a summary of the average behaviour of the foreign exchange markets but it is likely to miss the impact of several crises or economic events that might have cropped up during the period of analysis. To deal with this issue, the volatility spillover is evaluated using 200-day rolling sample to suggest the enormity and character of the spillovers through the corresponding time

series of the spillover indices.

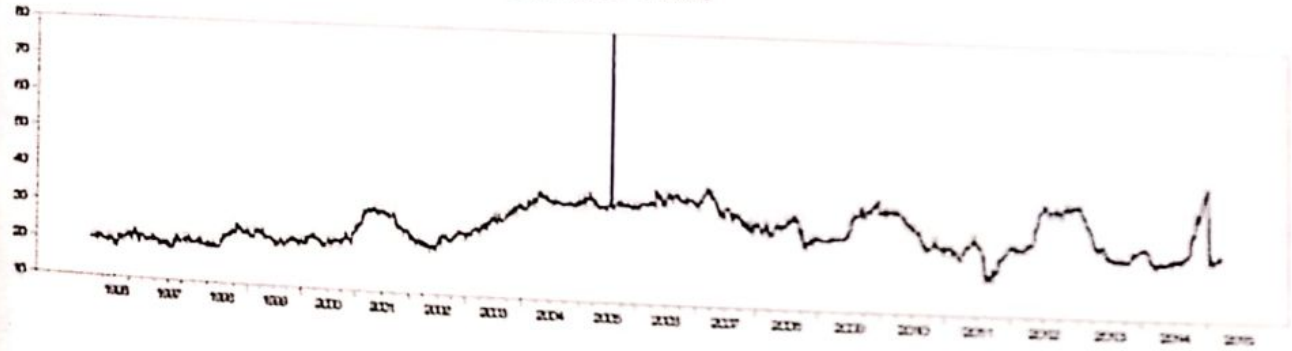
Figure 5 depicts the total volatility spillover plots for the four emerging foreign exchange markets. This spillover graphs is a reaction to the economic events such as debt crisis, stock market crash, currency crisis etc. The figures show a gentle upward trend at the beginning but reached a peak during 2005, 2009, 2012 and 2014. This can be on account of the dollar crisis in 2005, the global financial crisis in 2008 and the Eurozone debt crisis in 2011. Even if the volatility spillover index is crucial, still it fails to produce a design regarding the directional spillover.

Figure 5: Total Volatility Spillover, 200-day Rolling Windows

Indian Rupee

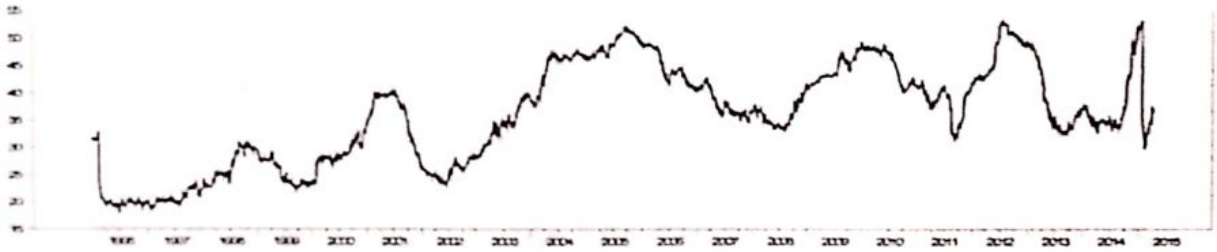


Chinese Yuan



Brazilian Real

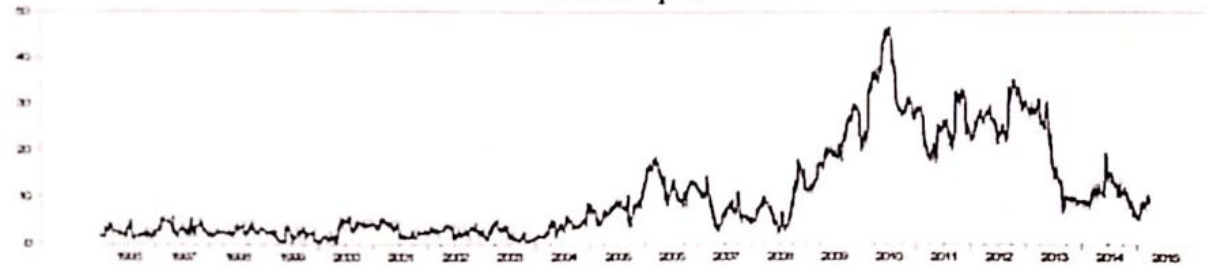
South African Rand



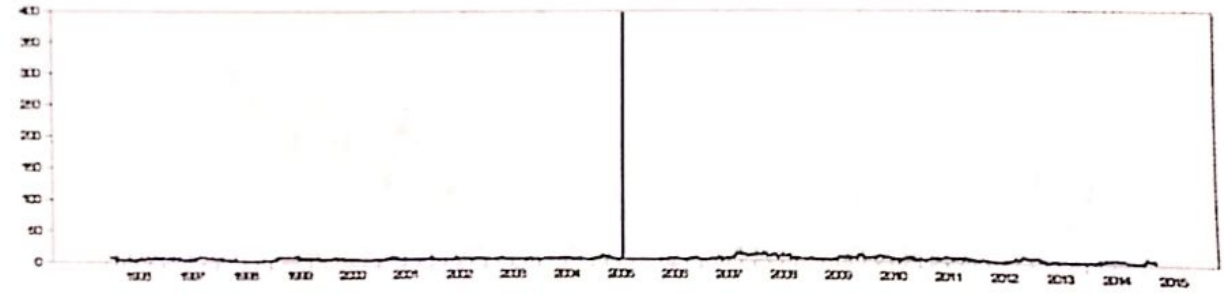
The directional spillover plots were obtained by estimating the aforesaid row and column using 200-day rolling sample. Figure 6 and figure 7 present the directional volatility spillover 'from others' and 'to others' for the four emerging foreign exchange markets. According to the figure, the directional spillovers 'from and to' is more definite and strong for South African Rand with Brazilian Real, Indian Rupee and Chinese Yuan securing the second, third and fourth position. The directional spillover varies significantly overtime and is responsive to the economic events. Finally, figure 8 displays the net volatility spillover of the four emerging foreign exchange markets which is obtained by estimating equation (10) using 200-day rolling sample. This figure also suggests that among the emerging markets, South African Rand is highest receiver of volatility followed by Brazilian Real, Indian Rupee and Chinese Yuan. This finding is also evident from the volatility spillover tables discussed earlier.

Figure 6: From Four Emerging Markets, 200-day Rolling Windows

Indian Rupee



Chinese Yuan



Brazilian Rand

South African Rand

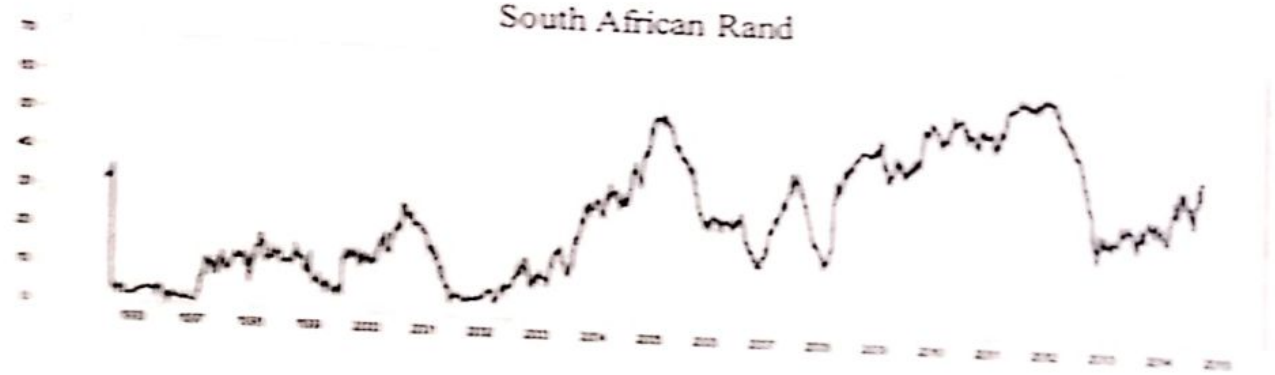
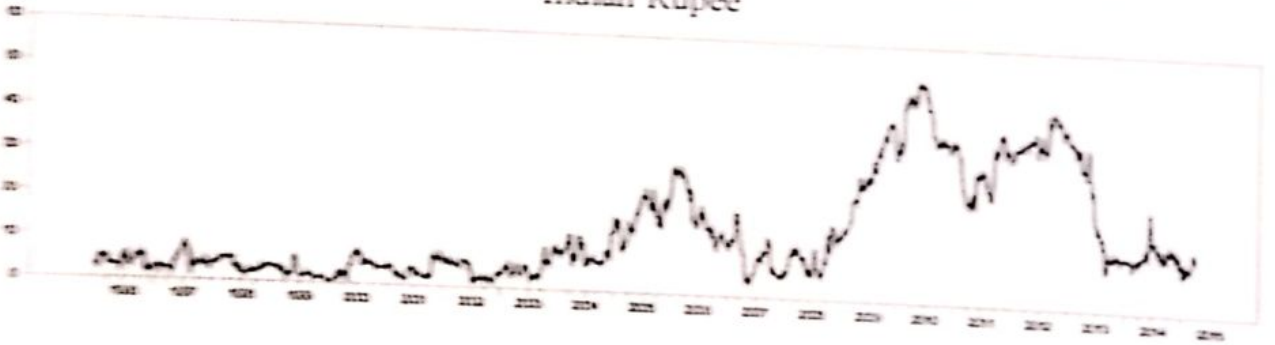
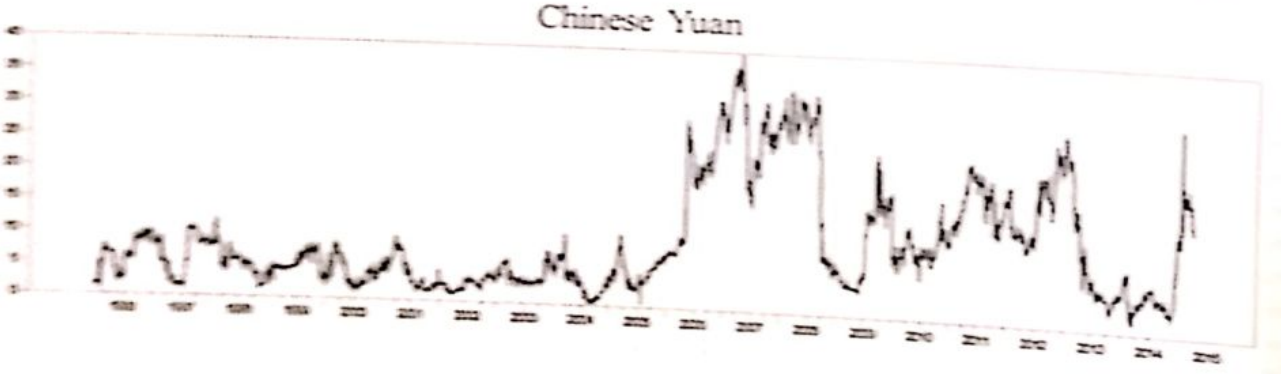


Figure 7: To Four Emerging Markets. 200-day Rolling Windows

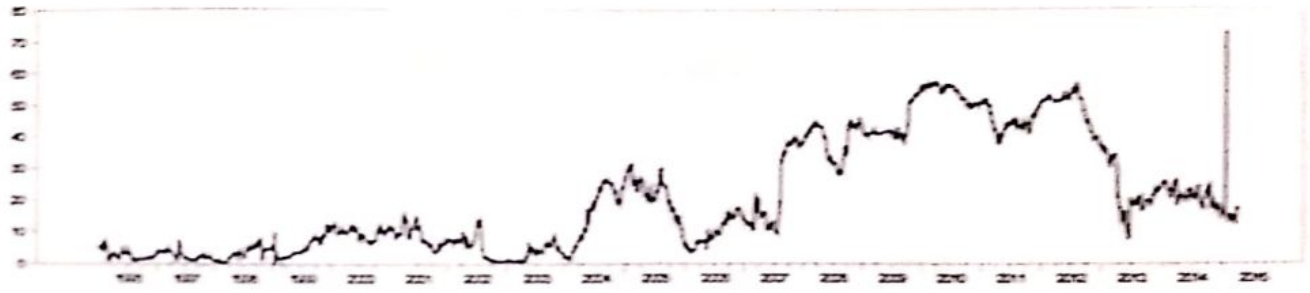
Indian Rupee



Chinese Yuan



Brazilian Real



South African Rand

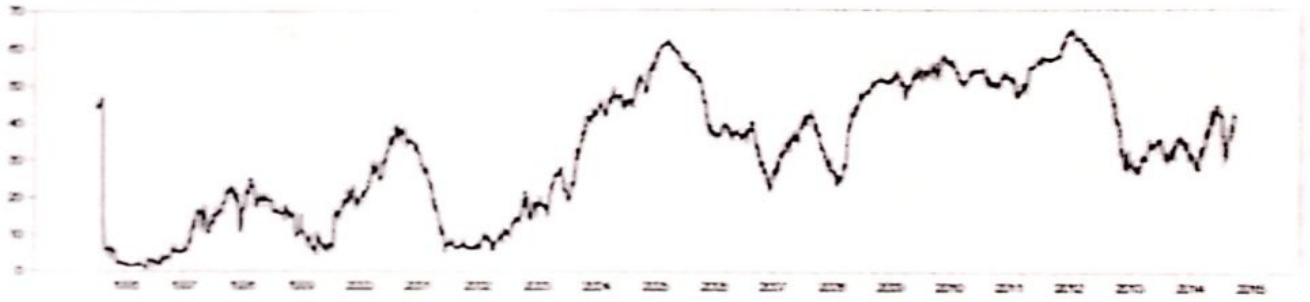
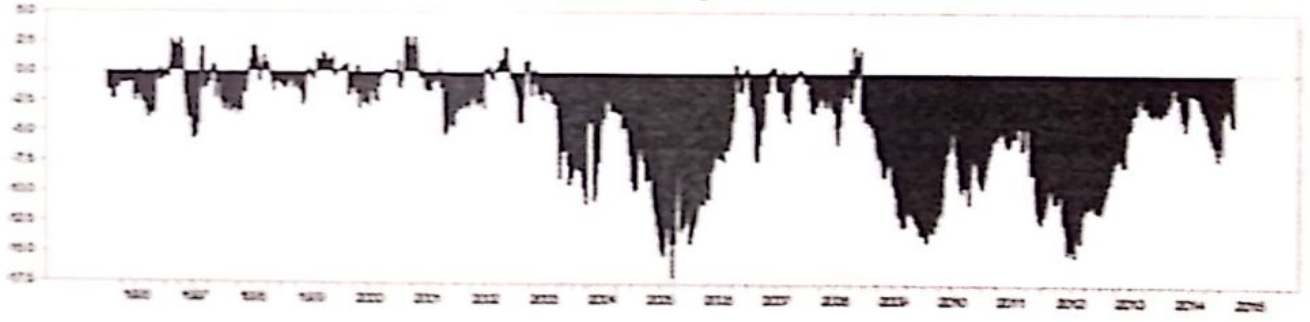
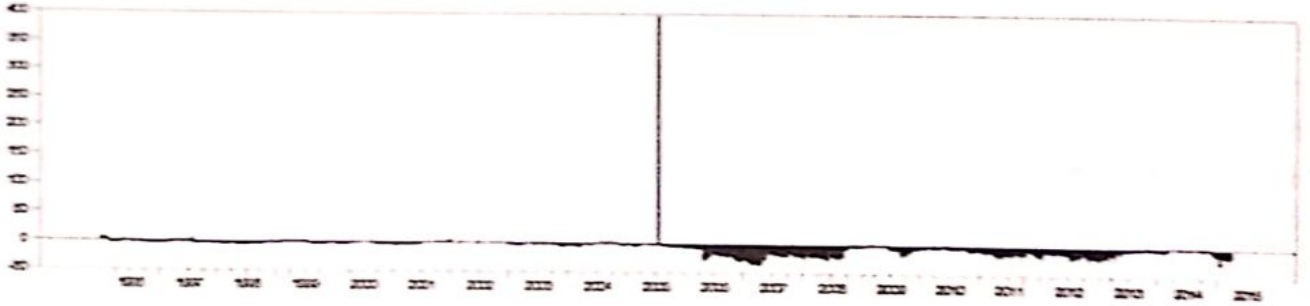


Figure 8: Net Volatility Spillover, 200-day Rolling Windows

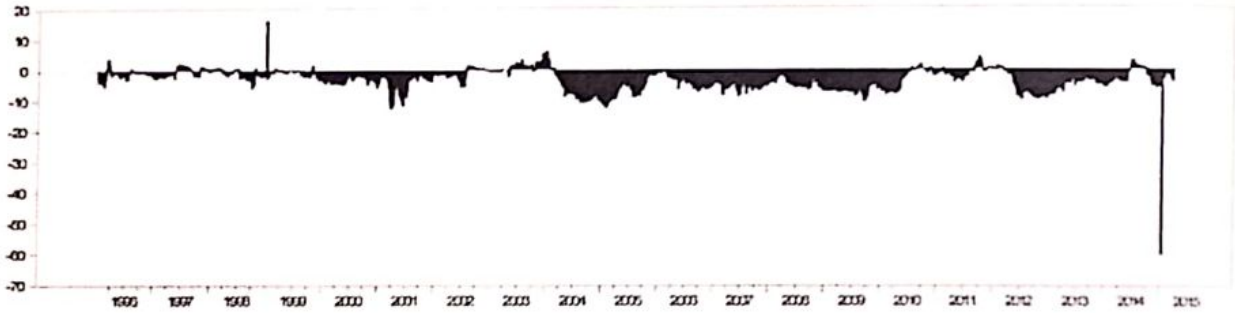
Indian Rupee



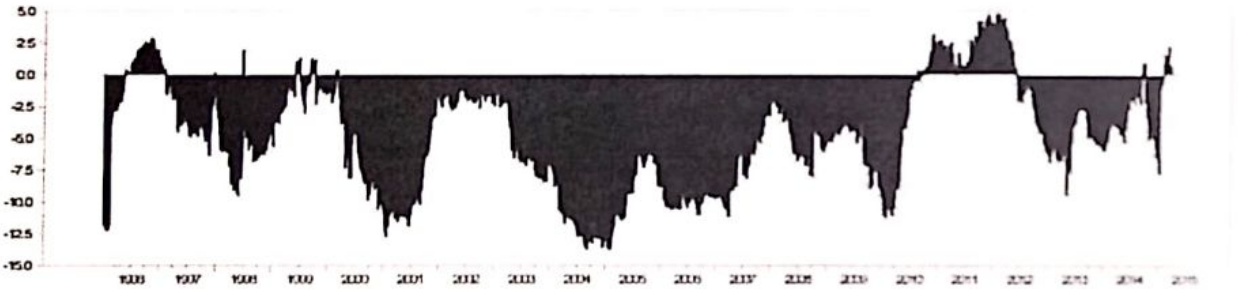
Chinese Yuan



Brazilian Real



South African Rand



3. Conclusion and Policy Implication

This paper has investigated the return co-movement and volatility spillover among the emerging market economies and the developed economies. To recapitulate, exchange rate is one of the critical variables that occupy a central position in policy proposals and whose stability is considered as one of the most important parameters in achieving high economic growth. Ever since the exchange rate became market determined, the pattern of volatility has undergone a distinct change and the possibility of such volatility transmission had multiplied. The period from 2000 onwards witnessed sustained volatility in the exchange rate of developing economies. This necessitated a detailed econometric analysis of the return co-movement and volatility spillover.

The econometric analysis had set out in identifying that most of the emerging foreign exchange markets are explosive compared to the developed economies. It is also inferred from the analysis that Indian Rupee, Chinese Yuan, Brazilian Real and South African Rand are more influenced by Euro, Australian Dollar and Swiss Franc. Apart from this it is also revealed from the study that emerging foreign exchange markets are net receiver of volatility and developed markets are net transmitter of volatility. The investigation further propounds that South African rand is the highest receiver

of volatility among other emerging markets. This proposition is further supported by the statistics in the spillover index and the graphs of the 200-day rolling sample. Nonetheless, dynamic correlations and volatility spillovers show large variability and are positively associated with extreme economic episodes, such as during the global recession.

Finally these results paved the path for the central banks of the emerging market economies to concentrate more on proper policy formulations to restore peace and tranquility in the foreign exchange markets as investors decide on portfolio diversification and risk management on the basis of the prevailing conditions in the foreign exchange markets.

References

Alam, Md. Z. and Md. A. Rahman (2012), 'Modelling Volatility of the BDT/USD Exchange Rate with GARCH Model', *International Journal of Economics and Finance*, 4 (11).

Anderson, T. G. et al. (1999), 'The Distribution Exchange Rate Volatility', *NBER Working Paper No. 6961*, Cambridge.

Anderson, T. and T. Bollerslev (1998), 'Answering the Skeptics: Yes, Standard Volatility Models Do Provide Accurate Forecasts', *International Economic Review*, 39 885-905.

Annachhatre, M. (2013), 'Exchange Rate Volatility and Risk Management - Indian Scenario', *Proceedings of Economics, Politics, and Civil Society*, 1-21.

Antonakakis, N. (2012), 'Exchange Return Co-movements and Volatility Spillovers before and after the Introduction of Euro', *Journal of International Financial Markets, Institutions & Money*, 22 1091-1109.

Baillie, R. T. and T. Bollerslev, 'The Message in Daily Exchange Rates: A Conditional Variance Tale', *Journal of Business and Statistics*, 7 297-305.

Bank for International Settlements (2013), 'Triennial Central Bank Survey: Global foreign Exchange Market Turnover in 2013', *Monetary and Economic Department.*

Bauwens, L., S. Laurent and J. V. K. Rombouts (2006), 'Multivariate GARCH Models: A Survey', *Journal of Applied Econometrics*, 21 79-109.

Behera, H. K. (2011), 'Onshore and Offshore Market for Indian Rupee: Recent Evidence on Volatility and Shock Spillover', *Macroeconomics and Finance in Emerging Market Economies*, 4(1) 43-55.

Black, A. J. and D.G. McMillan (2004), 'Long Run Trends and Volatility Spillovers in Daily Exchange Rates', *Applied Financial Economics*, 14 (12) 895-907.

Bollerslev, T. (1986), 'Generalized Autoregressive Conditional Heteroscedasticity', *Journal of Econometrics*, 31 309-328.

Bollerslev, T. (1990), 'Modelling the Coherence in Short-run Nominal Exchange Rates: A Multivariate Generalized ARCH Approach', *Review of Economics and Statistics*, 70 498-505.

Bollerslev, T., R. Y. Chou and K. F. Kroner (1992), 'ARCH Modelling in Finance: a Review of the Theory and Empirical Evidence', *Journal of Econometrics*, 52 5-59.

Calvet et al. (2006), 'Volatility Comovement: A Multifrequency Approach', *Journal of Econometrics*, 131 179-215.

Cappiello, L. et al. (2006), 'Asymmetric Dynamics in the Correlations of Global Equity and Bond Returns', *Journal of Financial Econometrics*, 4 (4) 537-572.

Chong et al. (2002), 'Modelling the Volatility of Currency Exchange Rate Using GARCH Model', *Journal of Social Science and Humanities*, 10 (2) 85-95.

Chowdhury, I. and L. Sarno (2004), 'Time-Varying Volatility in the Foreign Exchange Market: New Evidence on its Persistence and on Currency Spillovers', *Journal of Business Finance and Accounting*, 31 (5-6) 759-793.

Diebold, F.X. and K. Yilmaz (2009), 'Measuring Financial Asset Return and Volatility Spillovers, with Application to Global Equity Markets', *Economic Journal*, 119 (534) 158-171.

Diebold, F.X. and K. Yilmaz (2012), 'Better to Give Than to Receive: Predictive Directional Measurement of Volatility Spillovers', *International Journal of Forecasting*, 28 (1) 57-66.

Djeutem, E. and K. Kasa (2013), 'Robustness and Exchange Rate Volatility', *Journal of International Economics*, 91 27-39.

Ebrahim, S. K. (2000), 'Volatility Transmission Between Foreign Exchange and Money Markets', *Working Paper 2000-16*, Bank of Canada.

Ederington, L. H. and Lee J. H. (1993), 'How Markets Process Information: News Releases and Volatility', *The Journal of Finance*, 48 (4) 1161-1191.

Edison, H. (1993), 'The Effectiveness of Central Bank Intervention: A Survey of the Post-1992 Literature', *Special Papers in International Economics No. 18*, Princeton University.

Engle, R. F. (1982), 'Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation', *Econometrica*, 50 987-1007.

Engle, R.F. et al. (1990), 'Meteor Showers or Heat Waves? Heteroskedastic Intra-Daily Volatility in the Foreign Exchange Market', *Econometrica*, 58 (3) 525-542.

Engel, C. and C. S. Hakkio (1993), 'Exchange Rate Regimes and Volatility', *Economic Review, Third Quarter*, 43-58, Federal Reserve Bank of Kansas City.

Engle, R. (2002), 'Dynamic Conditional Correlation: A Simple Class of Multivariate Generalised Autoregressive Conditional Heteroskedasticity Models', *Journal of Business and Statistics*, 20 (3) 339-350.

Erdemlioglu D., S. Laurent and C. J. Neely (2012), 'Econometric Modelling of Exchange Rate Volatility and Jumps', *Working Paper 2012-008A*, Federal Bank of St. Louis.

Fang et al. (2006), 'Volatility Transmissions between Stock and Bond Markets: Evidence from Japan and the US', *International Journal of Information Technology*, 12 (6).

Fiorentini, G., G. Sentana and G. Calzolari (2003), 'Maximum Likelihood Estimation and Inference in Multivariate Conditionally Heteroskedastic Dynamic Regression Models with Student *t* Innovations', *Journal of Business and Economic Statistics*, 21 532-546.

Ghose, D. and K. Kroner (1996), 'Components of Volatility in Foreign Exchange Markets: An Empirical Analysis of High Frequency Data?', *Mimeo Department of Economics*, University of Arizona.

Ghosh, S. (2012), 'Volatility Spillover in the Foreign Exchange Market: The Indian Experience', *Working Paper No. 460*, Advanced Studies in International Economic Policy Research, Kiel Institute for the World Economy, Germany.

Giannellis, N. and A. P. Papadopoulos (2011), 'What Causes Exchange Rate Volatility? Evidence from Selected EMU Members and Candidates for EMU Membership Countries', *Journal of International Money and Finance*, 30 39-61.

Harvey, A., E. Ruiz and N. Shephard (1992), 'Unobservable Component Time Series Models with Arch Disturbances', *Journal of Econometrics*, 52 129-158.

Hong, Y. (2001), 'A Test of Volatility Spillover with Application to Exchange Rates', *Journal of Econometrics*, 103 (1-2) 183-224.

Horng W. and C. Chen, 'DCC and Analysis of the Exchange Rate and the Stock Market Returns Volatility: An Evidence Study of Thailand Country', *Chia Nan University of Pharmacy and Science, Tainan, China*, Available at doi:10.4236/ib.2010.23027 Published Online September 2010 (http://www.SciRP.org/journal/ib).

Hsieh, D. A. (1989), 'Modelling Heteroscedasticity in Daily Foreign-Exchange Rates', *Journal of Business and Economic Statistics*, 7/3 307-317.

Inagaki, K. (2007), 'Testing for Volatility Spillover between the British Pound and the Euro', *Research in International Business and Finance*, 21 161-174.

Johnston, K. and E. Scott (2000), 'GARCH Models and the Stochastic Process Underlying Exchange Rate Price Changes', *Journal of Financial and Strategic Decisions* 13 (2).

Kamal, Y. et al. (2011), 'Modelling the Exchange Rate Volatility using Generalized Autoregressive Conditionally Heteroscedastic (GARCH) Type Models: Evidence from Pakistan', *African Journal of Business Management*, 6 (8) 2830-2838.

Kearney, C. and A. J. Patton (2000), 'Multivariate GARCH Modelling of Exchange Rate Volatility Transmission in the European Monetary System', *The Financial Review*, 35 (1) 29-48.

Kitamura, Y. (2010), 'Testing for Intraday Interdependence and Volatility Spillover among the Euro, the Pound and the Swiss Franc Markets', *Research in International Business and Finance*, 24 (2) 158-171.

Knight, F. (1921), "Risk, Uncertainty and Profit", *Boston: Houghton Mifflin.*

Kocenda, E. and J. Valachy (2006), 'Exchange Rate Volatility and Regimes Change: A Visegrad Comparison', *Journal of Comparative Economics*, 34 727-753.

Koop, G. et al. (1996), 'Impulse Response Analysis in Non-linear Multivariate Models', *Journal of Econometrics*, 74 119-147.

Kuruvila, A. et al. (2012), 'Assessing the Implications of International Price Volatility and Transmission on Indian Agricultural Prices in the Context of Trade Liberalization', *Sanei Working Paper Series 12-01*, South Asian Network of Economic Research Institute, Bangladesh.

Lee, J. (2010), 'Currency Risk and Volatility Spillover in Emerging Foreign Exchange Markets', *International Research Journal of Finance and Economics*, 42.

Mckenzie M. and H. Mitchell (2002), 'Generalized Asymmetric Power ARCH Modeling of Exchange Rate Volatility', *Applied Financial Economics*, 12 (3) 555-564.

McMillan, D.G. and A. E. Speight (2010), 'Return and Volatility Spillovers in Three Euro Exchange Rate', *Journal of Economics and Business*, 62 (2) 79–93.

Mishraa, A. K., N. Swain and D. K. Malhotra (2007), 'Volatility Spillover between Stock and Foreign Exchange Markets: Indian Evidence', *International Journal of Business*, 12 343-359.

Melvin, M. and B. P. Melvin (2003), 'The Global Transmission of Volatility in the Foreign Exchange Market', *The Review of Economics and Statistics*, 85 (3) 670-679.

Mukherjee, P. (2011), 'An Exploration on Volatility across India and some Developed and Emerging Equity Markets', *Asia-Pacific Development Journal*, 18 (2).

Mundaca, B.G. (1991), 'The Volatility of the Norwegian Currency Basket', *Scandinavian Journal of Economics*, 93 (1) 53-73.

Narayan et al. (2009), 'Modelling Fiji–US Exchange Rate Volatility', *Applied Economics Letters*, 16 831-834.

Nelson, D. B. (1991), 'Conditional Heteroskedasticity in Asset Returns: A New Approach', Econometrica, 59 349-370.

Nikkinen, J., P. Sahlstrom and S. Vahamaa (2006), 'Implied Volatility Linkages among Major European Currencies', *Journal of International Financial Markets, Institutions and Money*, 16 (2) 87-103.

Perez-Rodrìguez, J. (2006), 'The Euro and other Major Currencies Floating against the U.S. Dollar', *Atlantic Economic Journal*, 34 (4) 367-384.

Pesaran, M. H. and Y. Shinn (1998), 'Generalised Impulse Response Analysis in Linear Multivariate Models', *Economic Letters*, 58 17-29.

Ross, S. A. (1989), 'Information and Volatility: The No-Arbitrage Martingale Approach to Timing and Resolution Irrelevance, *Journal of Finance*, 44 1-17.

Sandoval, J. (2006), 'Do Asymmetric GARCH Models Fit Better Exchange Rate Volatilities on Emerging Markets?', *Colombia, Odeon Magazine-Cen. Econ. Operat.*, 1 (3) 99-117.

Sahoo, S. (2012), 'Volatility Transmission in the Exchange Rate of the Indian Rupee', *RBI Working Paper (DEPR) 08/2012.*

Saha, S. and G. Chakrabarti (2011), 'Financial Crisis and Financial Market Volatility Spill-Over', *International Journal of Applied Economics and Finance*, 5 (3) 185-199.

Sekhar, C. S. C. (2003), 'Volatility Of Agricultural Prices- An Analysis of Major International And Domestic Markets', *ICRIER Working Paper No. 103*, Indian Council For Research On International Economic Relations, New Delhi, India.

Stancik, J. (2007), 'Determinants of Exchange-Rate Volatility: The Case of the New EU Members', *Czech Journal of Economics and Finance*, 57 9-10.

Song, X. (2009), 'Multivariate GARCH Models for the Greater China Stock Markets', *Singapore Management University*, Singapore.

Journal of
Business And Economic Issues
Vol. 7 No. 1

Operationalization and Evaluation of Community Participation within Primary Healthcare System in West Bengal

Shatarupa Dey Neogi*, Dr. Subhra Chattopadhyay & Dr. Debaprasad Sarkar*****

Abstract

Community participation has gained ground since the Declaration of "Health for All" during Alma Ata Conference in 1978 worldwide. Community participation is promoted by Primary Healthcare System in India through decentralization of power from Primary healthcare system to community in need of the services. This paper reviews the status of community participation in primary healthcare system drawing examples and case studies from West Bengal. Deprivation index is calculated using ten parameters of community participation to understand the spatial differentiation in operationalization of community participation within the preview of Primary healthcare system. Inequality analysis has done following Wagstaff (2003) to understand community participation's share in overall inequality of primary healthcare in West Bengal. Results show that community participation has higher deprivation value in northern part of West Bengal than in southern part. Darjeeling and Uttar Dinajpur are most deprived districts in community participation while Hooghly has lowest value of deprivation. The most pathetic performance is by Panchayet Raj Institution and Rogi Kalyan Samiti among all components of community participation in primary healthcare system. Community participation shares 21.92% of the inequality which is also the highest among all other domains of primary healthcare system. Thus, we are far behind the goal of National Health Mission in achieving "Health for All". This paper concludes that the evaluation of community participation in healthcare reflects that it is still an untouched niche till today where, knowledge sharing, representation and decision-making, three major components of community participation is severely deficient in West Bengal.

JEL Classification : *I15, I18, P36, R12*

Key Words : Primary Health Care, Community Participation, Deprivation, Spatial differences.

* *Assistant Professor, Dept of Geography, Sarojini Naidu College for Women, 9831344818, shatarupa.neogi@gmail.com. Corresponding Author.*
** *Associate Professor, Dept of Geography, Lady Brabourne College.*
*** *Assistant professor, Dept of Economics, Barrackpore Rastraguru Surendranath College.*

Acknowledgement: The paper is a part of the ongoing ICSSR sponsored Major Research Program "Measurement and Evaluation of Primary Healthcare Facility System in West Bengal". The author is grateful to the ICSSR project advisory committee for the financial support. The stated facts and opinion and conclusion reached are entirely the responsibility of the author.

1. Introduction

The process of identification of health needs and its possible solution by the community is defined as community participation in health. Community participation as a measure of participatory planning and development strategy has been envisaged in "Health For All" as proposed by Alma Ata of World Health Organization in 1978. Medical services in prior decades were unable to rectify health inequalities (WHO Technical Report 1991).The principles of community participation focusses on community based programmes that allows community to define, implement, monitor and evaluate their self-defined health needs (Susan B. Rifkin 2003). Community Participation initiates is gaining a full-fledged responsibility in collaboration with health institutions and finally ends in active participation. The African Medical Research Foundation (AMREF), Asian Community Health Action Network (ACHAN), United Nations Children's Fund (UNICEF), and Australian National Rural Health Alliance opines that improvement of health of people can be accomplished by shifting the decision making capacity from the 'Government' to 'Governed'. While rural areas have common health properties yet rural inequalities vary considerably (Kulig J. Williams 2012) Inclusion of community capacity in health planning is integral part as it seeks to develop locally responsive health services (Kilpatrick S 2009). It also taps the huge experiential knowledge of rural people to maximize the benefits of preventive, curative, promotive and rehabilitative healthcare services. The community based management practices performed by the community are important determinants of quality at the primary healthcare level [5] yet community participation in health faces analytical complexities, definitional disputes, operational challenges and inherent measurement challenges[5,6].Poverty, prejudice, despair, local power structure, legal restrictions, past experiences of commoners discourage community from active participation [7]. Another problem is the reluctance by policy makers to measure community participation since they are more concerned with health schemes and project they introduce and control. In India since the Bhore Committee in 1946 many committees has subsequently emerged but it took twenty five long years after Alma Ata in identifying the role of communities in healthcare planning in Indian healthcare system. In West Bengal the rural communities are still perceived as distanced and disempowered from healthcare facilities. In 2005 National Rural Health Mission harnessed the community involvement, as is evident from its goals and approaches; one of the major goals of this flagship programme is promotion

of increased community participation by primary healthcare system through capacity building of the community and human resource management. Although literature suggests that participation of communities in management practices of primary healthcare system is a crucial determinant of quality of primary healthcare (Timothy P et.al 2013) yet evidences on role of Primary healthcare system in promoting the community participation is meager, case-study based and sketchy. In this backdrop, this paper attempts to throw light on two specific objectives: 1) to highlight the geographical inequity in community participation in Primary healthcare at District level in West Bengal, 2) to identify inter domain disparity in Primary healthcare system with special emphasis on community participation in West Bengal.

Materials

Data:

Data is gleaned from Facility Assessment Report of Health Information Management System (HMIS), Ministry of Health and Family Welfare, Government of West Bengal in 2013-2014. Detailed information is taken on the existing services and the provisions of community participation provided across all PHCs in 341 blocks of West Bengal. The analysis and measurement comprises ten indicators that are essential inputs on involvement of beneficiaries for the functioning of PHCs as per the principles of community empowerment.(Table 1)

Table 1: Indicators Selected for Community Participation in Primary Healthcare System

1.	Citizen's charter
2.	Constitution of Rogi Kalyan Samiti (RKS)
3.	Internal Monitoring by RKS
4.	External Monitoring by Panchayet Raj Institutions
5.	Participation of PRIs and RKS in Standard Operating Procedures nd
6.	Suggestion Box
7.	Monitoring of ASHA
8.	Facilities under Janani Surakhya Yojana
9.	Monitoring of Village Health Sanitation Committee
10.	Preparation of Village Health Plan

Methodology

Methods:

We have constructed a Deprivation Index of relative structural quality of community participation in health care based on the composite measure comprising of ten (Table 1) structural aspects of community participation within PHCs. The Deprivation Index of community participation at PHCs varies spatially within the blocks as well as districts of West Bengal. The Deprivation Index of community participation domain of primary healthcare system indicates its spatial variation across districts of West Bengal taking PHCs and sub-centers as unit. The aim of this part of the analysis is to specify the extent to which the PHCs and sub-centers are capable to promote participation up to the desirable standards spatially. (Table 1).

Deprivation Index:

$$I_{ij} = \frac{(Max_i - X_{ij})}{(Max_i - Min_i)} \ldots\ldots\ldots\ldots 1$$

Where I_{ij} indicates deprivation index of the i^{th} variable at j^{th} unit of study. Max_i and Min_i denotes maximum and minimum values of the i^{th} variable in the series respectively. X_{ij} denotes original value of the i^{th} variable at j^{th} unit of study. The value ranges from 0(absence of deprivation) to 1(Highest deprived).

Average Deprivation Index (A.D.I)

$$A.D.I(I_j) = \sum_{i=1}^{n} I_{ji}/n \text{——————————} 2$$

Ij denotes the Index of Deprivation of jth unit of study

[The basis of selection of each indicator are i) the 10 indicators make use of almost all available data in the report, restricting bias of selection of some indicators and leaving others. ii) All the indicators are according to Indian Public Health Standards and are meant to be available in PHCs and iii) all the six domains are mentioned in Alma Ata Declaration of 1978. Footnote 1]

Inequality Analysis:

Addressing and understanding the need of community participation in primary healthcare and the geographical variation in capacity building provision of PHCs will be halfhearted. It is imperative to understand the extent of inequality that exists among the six domains (availability of services, clinical staff in position; laboratory services; physical infrastructure; essential equipment & drugs, community participation of primary healthcare facilities across all spatial regions districts). It would be more insightful if the analysis focuses on finding the one spatial region laggard behind compare to other region. It is also urgent to pointing out the laggard

domain for the vertical progression of equitable primary healthcare. For this, Inequality in Overall Deprivation (modified Gini, Wagstaff et.al 2003) is used to identify whether inequality in six domains exists across the spatial region. The value of Inequality in Overall Deprivation ranges from -1 to +1.In case of absence of inequality the value of overall deprivation is 0.A negative value of Inequality in Overall Deprivation (modified Gini1997,Wagstaff et.al 2003) means inequality is higher among poor(Wagstaff et.al 2000). The Modified Overall Gini (M.O.G) can be written as

$$M.O.G = \left(\frac{2}{n\mu}\right)\sum h_i r_i - 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 1$$

Here, h_i is the health service variable, μ is the mean, n is number of observation and r_i= i/N, which is the fractional rank of achievement scores of items at Block level of West Bengal.

The Modified Overall Gini (M.O.G) can be presented as weighted average of the Sectoral Gini (Clarke .P et al 2002) of the five domain(s) of health service on which it is based.

$$M.O.G = \sum W_s G_s \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 3$$

$$W_s = \mu_s^h/\mu^h \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 3a$$

Here μ_h is composed of six individual domain of health service delivery together. Let $G_s$be the sectoral Gini for each service domain and μ^h_s is mean of item score. Ws is the share the item represents of the total primary health service qualities by PHCs.

Analysis and Results:

The results of Deprivation Index reveals that knowledge sharing through Citizen's Charter which is considered as the passive participation is relatively better in Primary Healthcentres in West Bengal although intra-district variation does persist (Map 1).It is as low as 0 i.e absence of deprivation for Hooghly and as high as 1 i.e most deprived for Darjeeling. Dakshin Dinajpur (0.965), Cooch Bihar (0.939) and Maldah (0.813) also show significantly higher value of deprivation. The geographical location of all four laggard District in displaying Citizen's Charter are in northern part of the State. Rogi Kalyan Samiti constituted by a local body of elected community members that are responsible for major health decisions and disbursement of untied funds also show a dismal picture with huge regional variation. Hooghly has lowest deprivation Index (0) while Uttar Dinajpur has highest deprivation as far as

constitution of Rogi Kalyan Samiti in PHCs is concerned. Darjeeling (0.77), and West Medinipur (0.77) are other States with high deprivation value (Map 2).

[Table: 2 and Map: 1&2 Here]

The Rogi Kalyan Samites has the responsibility of external monitoring of role of Primary Health Centres in identifying village health needs. Uttar Dinajpur has highest deprivation in external monitoring by RKS. Next highest deprivation is of Darjeeling (0.61) (Map 3).The values show that its deprivation is relatively lesser than other indicators. However the scenario is contrasting in case of Internal monitoring of the functions of Primary Healthcare Centres in West Bengal. Most of the Districts show higher deprivation value with Uttar Dinajpur having highest deprivation value followed by Darjeeling (0.88) (Map 4). Participation of Panchayet Raj Institutions and Rogi Kalyan Samiti in Standard Operating Procedures (Map 5) shows Uttar Dinajpur is again most lacked behind district in this parameter while Birbhum shows no sign of deprivation which means participation of PRIs and RKS in Standard Operating System is fully functional. Availability of suggestion box /complaint box reveals the urge on part of Primary Healthcare system to pay heed to the needs and grievances of the patients and modify the functions accordingly however the scenario of this parameter is worst among all other parameters. Maldah has highest deprivation value of 1, followed by Murshidabud (0.91), Uttar Dinajpur (0.90), Birbhum (0.83), and Purulia (0.82) (Map 6).The higher values of deprivation in most districts suggest the gloomy picture of this parameter in West Bengal. Janani Surakhya Yojana has been considered as a parameter of community participation because the intensity and availability of JSY in Primary Healthcare centres is directly related to community involvement like Accredited Social Health Activist who are responsible to promote institutional deliveries of pregnant women and in turn receive monetary incentive which is a financial empowerment for ASHA community. Darjeeling shows highest value of deprivation in case of availability of JSY, Howrah also shows a higher value of (0.8), rest of the districts show lower deprivation value (Map 7). The role of Primary Health Centres in monitoring the roles of ASHA is poorest in Maldah, Uttar Dinajpur (0.92), Howrah (0.78), and Darjeeling (0.78) (Map 8). The provision of monitoring the functions of PHCs by Village Health and Sanitation Committee also reveals a depressing scenario with highest deprivation in West Medinipur, followed by Howrah (0.93), Burdwan (0.83) (Map 9). The deprivation value for most of the districts in this parameter is higher which indicates the meagre monitoring provision

of VHSC on the functionability of PHCs. The last parameter of our study is preparation of Village Health Plan in PHCs in West Bengal. The most deprived District in this parameter is Howrah followed by West Medinipur (0.96) (Map 10). The deprivation value of preparation of Village Health Plan for almost all the district is higher relative to the deprivation value of other parameters.

[Map: 3, Map: 4, Map: 5, Map: 6, Map: 7, Map: 8, Map: 9, Map: 10, Here]

The provision of community participation shows wide variation for each indicator spatially, it's imperative to prepare a summary index considering all ten selected indicators to get an overall picture of communities extent of participation in healthcare activities. It provides a composite picture of the performance of Primary Healthcare System in promoting community participation in healthcare across districts. The Average deprivation Index (Table 2, Map 11) shows the unweighted average of all the indicators. The mean score is 0.52 in West Bengal suggesting that there is plenty of room for improvement. There is expected variation across districts with Uttar Dinajpur (0.81) showing lowest performance in community participation and Hooghly (0.18) showing highest performance in community participation at primary healthcare level. The gap between the low and high districts is largest with respect to participation of Panchayet Raj Institutions and Rogi Kalyan Samiti in Standard Operating Procedures (0.99) (Fig 1).

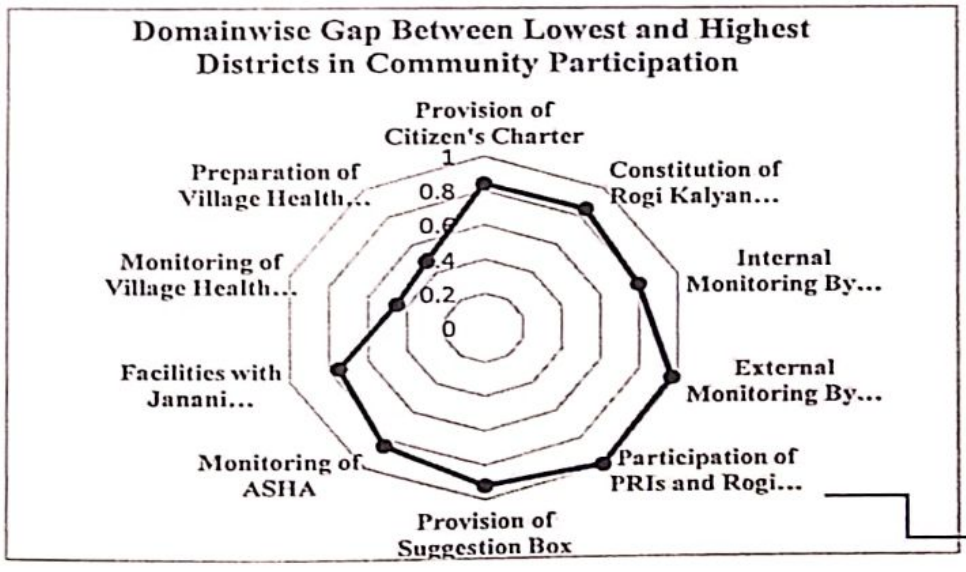


Figure-1

[Map: 11 Here]

The evaluation report (Table 3) has highlighted immense shortage of Medical officers and specialist doctors at the PHC level. Although quarters are available at the sub centres but the auxiliary nurse midwives (ANMs) are reluctant in residing there. This has resulted in low proportion of Subcentres with twenty four hour services and villagers are to depend on district hospitals or private practitioners. Although much is expected from RKS, but the performance is not at per. In most districts of West Bengal the RKS is seen as an alternative funding agency and not as a body of community leaders for regulating the work of health centres. The untied funds of RKS are not utilized in its entirety nor are utilization certificates submitted regularly. Accourding to NRHM ASHAs will act as 'an interface between the community and the public health system' 'In WEST Bengal the evaluation report suggest that a good percentage of ASHAs are lacking in training. Most of the ASHAs have drug kits that are not restocked. Many ASHA's don't escort mothers at night (https// www.wbhealth.gov.in).

Inter Domain Disparity in Healthcare Facility:

Disparity in primary healthcare is both spatial and structural. After finding the spatial disparities among districts, it is important to examine the domain specific structural inequality analysis to show the extent of performance in each domain keeping in mind the fact that the absolute difference of structure is realized on the basis of the region specific need.

Higher the value of M.O.G implies PHCs are more catastrophic in nature in terms of service provided for a specific domain. In our analysis the Modified Overall Gini (equation 1) ranges from 0.60 for community participation to 0.27 for manpower. The contribution of each domain ($W_s G_s$) in overall inequality is the weighted average of domain specific O.M.G (Clarke .P et al 2002), where weights are nothing but the share of domain specific deprivation value divided by total deprivation value ($W_s = \mu_s^h / \mu^h$). The higher the value of contribution implies that this specific healthcare facility domain is performing badly compared to other domain and vice-versa. It is evident that not all domains contribute equally. Among PHCs in West Bengal community participation contribute highest to the overall inequality (21.9%). Laboratory contributes (20.3%) second, Service (15%) third and manpower and

physical infrastructure each contribute (13%). The intuition behind the percentage contribution is that if there is no inequality in community participation the overall inequality will reduce by 21%. From the analysis it is thus unambiguously evident that community participation needs great attention from the reallocation or redistribution point of view to reduce inequality in primary healthcare facilities in PHCs level (Table 3).

Thus, the present section of the analysis deals with the theme that how domains of primary healthcare facilities are contributing within the overall inequality. The identification of comparatively weak domains is thus the first and foremost task and thus the Overall Structural Deprivation are measured to understand health-service related inequality by using Overall Modified Gini (O.M.G) (Clarke .P et al 2002).

The overall inequality (O.M.G) containing all (six healthcare services) considering all of 341 blocks in West Bengal is high (0.47) (Table 5) while the overall inequality is (0.18) (Table 4) considering five domains excluding community participation. Thus community participation increases overall inequality of primary healthcare system by 0.29%. The present analysis is extent to the inequality analysis of primary health facilities provided by the PHCs, with respect to each domain. The disaggregated picture for domain specific inequality gives the interesting result.

The Modified Gini (O.M.G) of primary healthcare facilities, by domain, is illustrated in the following table (4,5). The positive value of modified Gini implies facility density for any specific domain is less than the requirement of density of PHCs and it is aggravating with more and more number of densities of PHCs.

Table: 4 Domain specific Contribution in Overall Inequality in Primary Healthcare Facilities

Domain	O.M.G	ws	Sectoral Contribution	% Contribution
Services	0.47	0.17	0.08	20.34
Manpower	0.27	0.24	0.06	17.20
Lab	0.41	0.24	0.10	25.92
Infrastructure	0.34	0.20	0.06	17.46
Equipment	0.57	0.13	0.07	19.06
Overall	0.18		0.39	100

Source: Computed by the authors

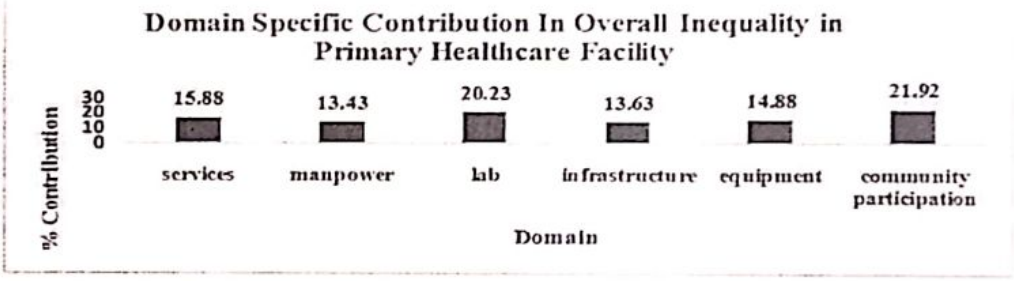
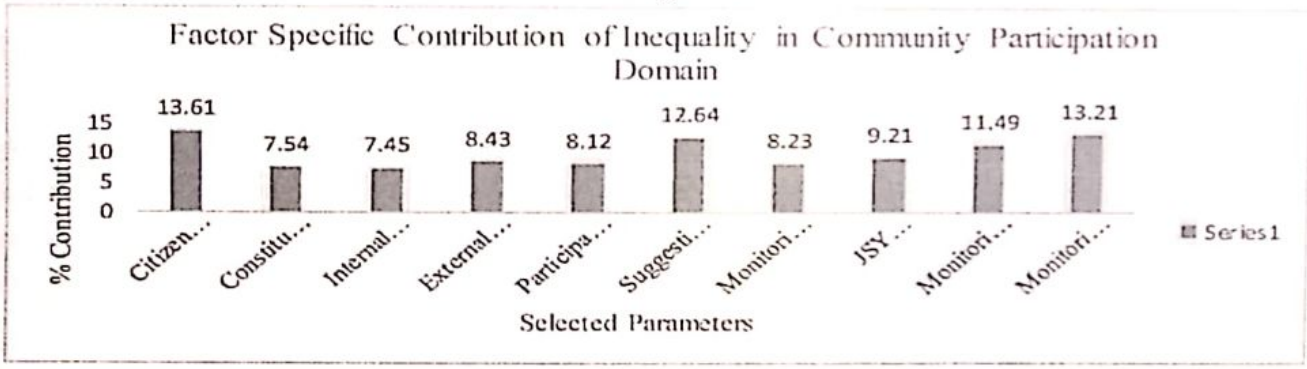


Table: 5 Domain Specific Contribution in Overall Inequality in Primary Healthcare Facilities Including Community Participation

Domain	O.M.G	ws	Sectoral Contribution	% Contribution
Services	0.47	0.86	0.40	15.88
Manpower	0.27	1.25	0.34	13.43
Lab	0.41	1.25	0.52	20.23
Infrastructure	0.34	1.02	0.35	13.63
Equipment	0.57	0.66	0.38	14.88
Community Participation	0.60	0.92	0.56	21.92
Overall	0.47		2.57	100

Source: Computed by the authors

Figure 3



Once we know that the domain Community participation is contributing highest inequality within the primary healthcare system we now further decompose this domain to observe which selected factors are responsible for the highest share of inequality that surge 21.92% of the inequality share in Community Participation. Within the Community Participation Domain ten factors were identified and analyzed based on NRHM guidelines. The Modified Overall Gini is as high as (0.66) for Citizen's Charter and as low as 0.38 for Facilities provided under Janani Surkhya Facilities. Thus it is evident that factors like Citizen's Charter, External Monitoring by Panchayati Raj Institutions(PRI's) and Participation of Rogi Kalyan Samitis and PRI's are deteriorating in nature as far as Participation of communities is concerned.

The factors that share highest inequality within the domain of Community participation are PHC's Display of Citizen's Charter (13.61%), PHC's Role in Monitoring Village Health Plan (13.21%) and PHC's role in Monitoring Village Health and Sanitation Committee (11.49%).

Table: 5 Factor Specific Contribution of Inequality in Within Community Participation Domain

Parameters	O.M.G	ws	Sectoral Contribution	% Contribution
Citizen Charter	0.66	1.04	0.69	13.61
Constitution of RKS	0.47	0.80	0.38	7.54
Inter Monitoring by RKS	0.44	0.86	0.38	7.45
External Monitoring by PRI's	0.64	0.67	0.43	8.43
Participation of RKS,PRI's in SOS	0.64	0.64	0.41	8.12
Suggestion box	0.59	1.08	0.64	12.64
Monitoring of ASHA	0.49	0.84	0.42	8.23
JSY Facilities	0.38	1.21	0.47	9.21
Monitoring of VHSC	0.42	1.36	0.58	11.49
Preparation of VHP	0.46	1.45	0.67	13.21
Overall	0.22		5.11	100

It is evident from the study that greater inputs of equipment's, services and other medical facilities in PHC's are not the sole determining factors of better outputs of health. It reassures the development discourse of PHC's that health improved not merely by the provision of medical services but on the socio-economic conditions and involvement of beneficiaries in decisions about healthcare. Despite the observance of signatories of Alma Ata the laggard condition of PHC's in promoting, monitoring, facilitating and encouraging community participation in West Bengal is evident from its highest inequality share in overall inequality in primary healthcare. Although management practices by local bodies and community leaders like Rogi Kalyan Samiti, Panchayet Raj Institutions are crucial in maintaining the quality of primary health care yet PHCs role remains blurred in display of citizen's charter, monitoring the functioning of Village Health Sanitation Committee, preparation of Village Health Plan, receiving suggestion from community through suggestion box etc. All these factors provide platform for mutual participation by medical personnel of Primary healthcare services and community leaders however its accomplishment rate is meager.

Conclusion

Although the National Rural Health Mission is a flagship programme that centrally monitors the activities of primary healthcare system including its inputs and outputs, yet the spatial disparity still exists in each domain and particularly community involvement in health care decisions. Different districts with its myriad population

characteristics, geographical location and involvement of community in healthcare decisions have put forth a challenge towards the Mission to achieve 'Health for All'. The formal health system has achieved good community participation in some districts and vice-versa. This wide range of community participation has led to 0.52 mean score of average deprivation index. The active involvement of Panchayet Raj Institution and Rogi Kalyan Samiti needs to be geared up. They should be recognized as an integral part of healthcare system and as a formal body of the community itself.

Establishment of Rogi Kalyan Samiti, inclusion of Panchayet Raj Institution is expected to improve the service quality of Primary Healthcare System and become more accountable to the people in need of the services. However the progress is meager in reality. Although most of the Sub Centres, Rural Hospitals have registered RKS, PHCs are less covered. Although NRHM has made provision for regular meetings of PHCs and Sub Centre personnel with members of RKS but reports suggest meetings are not held at regular intervals, RKS have little say in the internal and external monitoring of PHCs. RKS are seen as alternative funding agencies and does not contribute in community empowerment. Display boards stating decision of meetings are not in place. Most of the community members are unaware of the Rogi Kalyan Samiti or their constitution. There is no proper system of grievance redressal or suggestion box. Although two Saturdays in a month are fixed for meeting of health staffs, women representatives of villages, socially backward classes with the leaders of Panchayet but these meetings are irregular with high absenteeism of members.

The poor performance of community participation in various districts has consequently resulted in community involvement and participation being the most vulnerable and lacked behind domain. Domain specific Overall Modified Gini shows an inequality share of 21.9% , which is highest share of inequality among all the domains of Primary Healthcare Centres. This highest share of inequality depicts that the sense of communism, responsibility and connectedness of community is slipping silently. People lack sense of participation and empowerment in primary healthcare system. They lack motivation and additionally, skill to promote and demand their community based health needs from the healthcare system.

The comparison of overall inequality containing five domains and overall inequality containing six domains (including community participation) leads to an increase of the value by 0.29 %. This implies that the community participation and involvement in healthcare decision should be the major focus of National Health Mission in coming years. Since community participation does not follow any framework hence

participation needs to be region-specific. It should not follow the "one size fits all" framework.

It is evident from the results of component specific contribution of inequality that knowledge sharing through citizen's charter, monitoring by community representatives like Panchayet Raj Institution and decision making of the health needs of a community in the form of Village health plan are in most deplorable situation. Thus, knowledge sharing, representation and decision three major components of community participation is severely deficient in West Bengal. Inter- sect oral convergence scheme of Panchayet Raj Institution, Village Health and Sanitation Committee has never really converged with Primary Healthcare System.

Thus to reduce at least 21% of inequality in West Bengal's Primary Healthcare System, the providers must make healthcare community controlled and community specific. The needs of healthcare in Char of Murshidabud cannot be at per with the colliery area of Bankura. Nor can the health needs of agricultural community be befitting with health needs of fishing community. Thus before implementation of health measures regular field visit, and continuous follow up of community members is the first and foremost need of community participation of primary healthcare system.

Reference:

1. Ashtekar.S (2008): "The National rural Health mission: A Stocktaking", Economic and Political weekly, XLIII (37):23-26.
2. Balarajan,Y,S. Selvaraj and S V Subramanian(2011): "Health Care and Equity in India", Lancet, 377(9764):505-15
3. Bajpai, N, J D Sachs and R H Dholakia (2009): 'Improving Access, Service Delivery and Efficiency of Public Health System in Rural India: Mid-term Evaluation of National Rural Health Mission", Working Paper No37.
4. Bhattacharya P.K, "Do West Bengal and Other Provinces in India Need Reforming for a poor-friendly, safe, quality and effective healthcare system instead of a Health industry, public-private partnership, or health tourism for the Rich and middle Class society of The State or Country?"Annals of Tropical Medicine and Public Health, 6:(269-73)
5. Clarke P, Smith L, JekinsonC(2002): "Comparing health inequalities among men aged 18-65 years in Australia and England using the SF-36," Austr New Zealand Journal Public health,26(136-143).
6. Gangolli.L, Duggal.R, Shukla.A(2005): Review of Healthcare in India, CEHAT.

7. Gerdtham U-G, Johannesson M(2001): "Income –Related Inequality in Life Years and Quality-Adjusted Life Years", Journal Health Economics, 19:1007-1026

8. Husain.Z (2011): "Health of the National Rural health Mission", *Economic and Political Weekly*, XLVI (4): 53-60

9. Kilpatrick S: Multilevel Rural Community Engagement in Health, Australian Journal of Rural Health,17(1)(2009):39-45.

10. Kulig J. Williams, 'A Health in Rural Canada', Vancouver,UBC Press.2012

11. Nayar. K.R (2004): "Rural Health: Absence of Mission or Vision"? Economic and Political Weekly :(4872-4874).

12. Patil.A.V, Somasundaram and R C Gopal(2002): "Current Health Scenario in Rural India", *Australian Journal of Rural Health*,10(2):129-35

13. Park.K (2009),'Preventive and Social Medicine', 12th edition, BanarasidasBhanotPublishers,India :29-30

14. Planning Commission of India (2011): High Level Expert Group Report on Universal Health Coverage for India, Government of India, New Delhi.

15. Reddy, K S, V Patel, P Jha, V K Paul, A K Kumar, L Dandona and H Lancet India Group (2011): "Towards Achievement of Universal Healthcare in India by 2020: A Call to Action", Lancet, 377(9767):760-68.

16. Sinha.A (2009): "In Defence of National Rural Health Mission", Economic and Political Weekly, XLIV (14): 72-76

17. Susan B. Rifkin, (2003) :'A Framework for Linking Community Empowerment and Health Equity: It is a Matter of Choice', Journal of Health, Population and Nutrition,21, no-3:168-80.

18. Timothy P, Jackson, Acharya A, Mills A (2013): "An Assessment of the Quality of Primary Healthcare in India", Economic and Political Weekly, 13(9):53-58.

19. Van Doorslaer E, Wagstaff A, Bleichrodt H: (1997) "Income related inequality in health some international Comparisons", Journal of Health Economics, 16:93-112.

20. Wagstaff. A (2000): "Socio-economic Inequalities in Child Mortality: Developing Countries", Bulletin of the World Health Organisation 2000, (78): 19-29.

21. Wagstaff. A, van Doorslaer. E: "Overall versus Socio-economic Health Inequality: A Measurement Framework and Two Empirical Illustrations. Health Economic Lett 2003.

22. WHO Technical Report, 'Community Involvement in Health Development: Challenging Health Services,' Series No 809(Geneva: WHO 1991)

23. http://www.wbhealth.gov.in/annual_report/2010-11.pdf

24. http://www.wbhealth.gov.in/health sector/strategy.pdf

25. http://www.wbhealth.gov.in/health sector/strategy2004-13.pdf

Appendix:

Table 2: Average Deprivation Index

Districts	citizen's chart	constitution c	internal monit	external monitori	participation c	suggestion/grie	monitorin	facilities under Jsy	monitorin	preparatic	Avg D.I
Bankura	0.601357549	0.255613951	0.334602284	0.161331236	0.171716004	0.705367538	0.360809	0.59461404	0.749936	0.788572	0.472392
Burdwan	0.475024343	0.579775993	0.480414747	0.418252401	0.169394435	0.345860857	0.484953	0.770594654	0.832983	0.849111	0.540636
Birbhum	0.309209952	0.47176961	0.28984586	0.320122319	0	0.837472538	0.317594	0.460992908	0.731776	0.799298	0.453808
Dakshin Dinajpur	0.965400844	0.549450549	0.307219662	0.074679113	0.305851064	0.570944906	0.487101	0.691489362	0.719842	0.799298	0.547128
Darjeeling	1	0.774725275	0.879765396	0.605282699	0.382978723	0.821896248	1	0.784977434	0.751303	0.799298	0.780023
Howrah	0.333233212	0.579996275	0.631726939	0.506575955	0.347683015	0.61211794	0.824156	0.787354249	0.931008	1	0.655385
Hooghly	0	0	0	0.039957879	0.027439024	0	0.162839	0.528455285	0.534142	0.528533	0.182137
Jalpaiguri	0.164157229	0.31231926	0.443123939	0.632868636	0.456047032	0.303615687	0.463581	0.718551698	0.756271	0.799298	0.504983
Coochbihar	0.939153208	0.23872679	0.524392182	0.320122319	0.454787234	0.083580094	0.594969	0	0.55277	0.620655	0.432916
East Medinipur	0.390924289	0.149906697	0.20502565	0.031703397	0.291298675	0.629279256	0.381705	0.565368661	0.75902	0.827225	0.423146
West Medinipur	0.421699819	0.774725275	0.635615537	0.506834472	0.531724924	0.720798707	0.447201	0.654761905	1	0.957888	0.665125
Murshidabud	0.634452394	0.412326804	0.46603887	0.235604485	0.272317299	0.907001485	0.535675	0.83307637	0.780029	0.724216	0.580074
Nadia	0.511931053	0.15641805	0.320619669	0.307902381	0.220518334	0.523958272	0.403905	0.461747397	0.690388	0.767804	0.436519
North 24 Parganas	0.453067186	0.410819949	0.469514357	0.307378153	0.276186579	0.231195397	0.388272	0.651936716	0.746463	0.81353	0.474836
Purulia	0.630481013	0.152967033	0.418064516	0.507444574	0.577340426	0.818282548	0	0.259574468	0	0	0.336415
South 24 Parganas	0.491222245	0.209691947	0.20397371	0	0.007455528	0.085827165	0.33692	0.565050576	0.731189	0.787165	0.341849
Uttar Dinajpur	0.584810127	1	1	1	1	0.902200677	0.487101	0.92001576	0.681389	0.758181	0.83337
Maldah	0.813164557	0.446467818	0.41158657	0.265844307	0.482142857	1	0.18386	1	0.759394	0.841588	0.620405

Fig 1

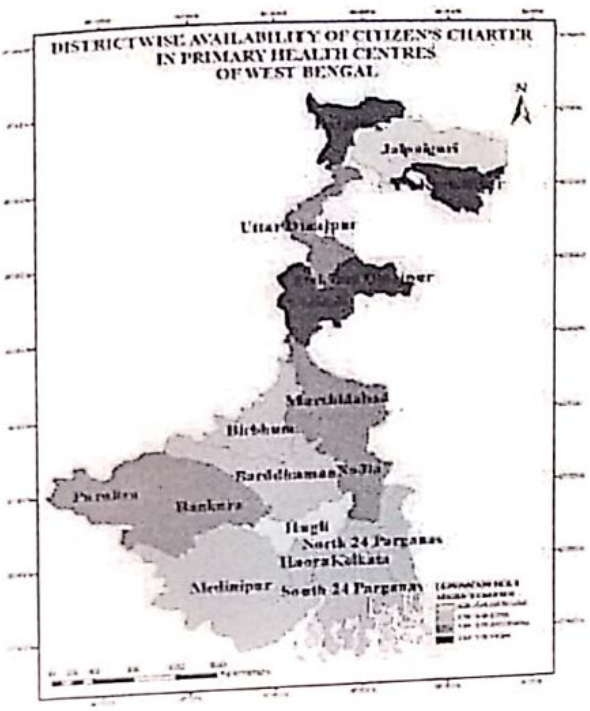


Fig 2

Fig 3

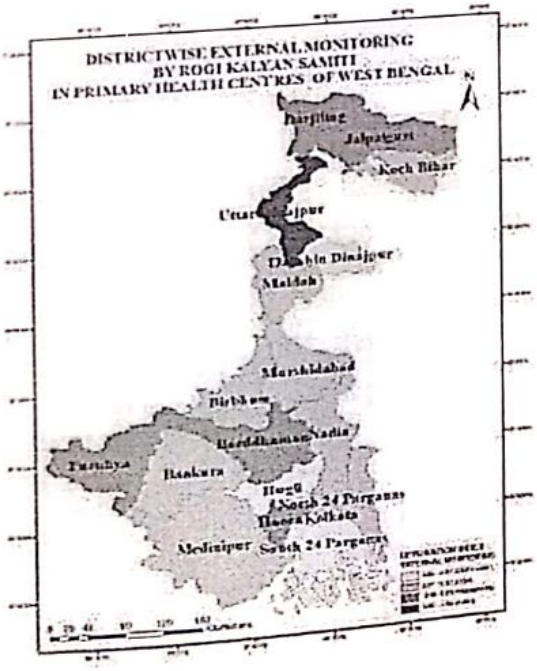


Fig 4

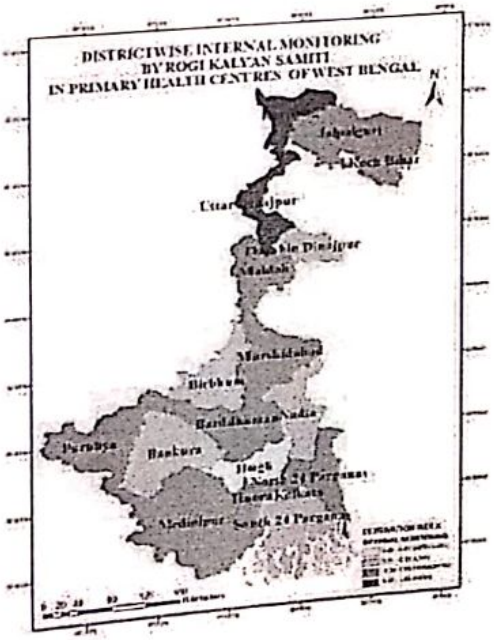
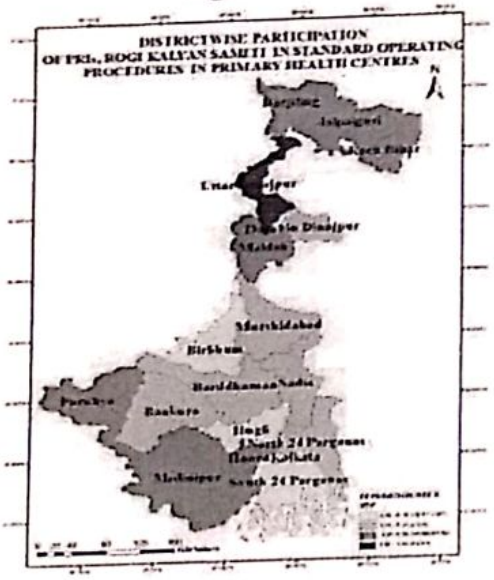


Fig5



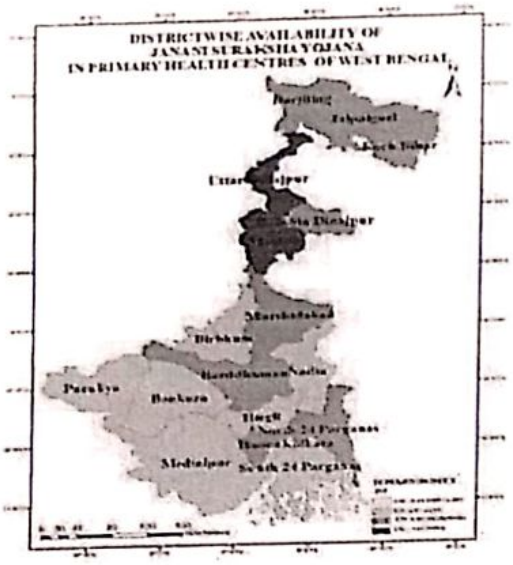


Fig 7

Fig 6

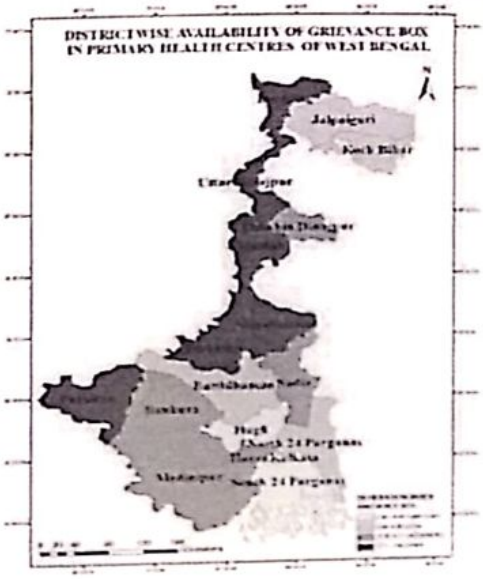


Fig 8

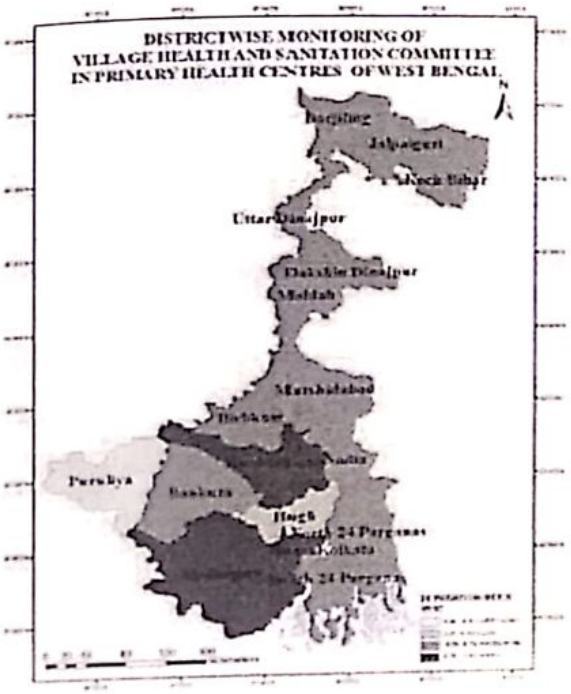


Fig 9

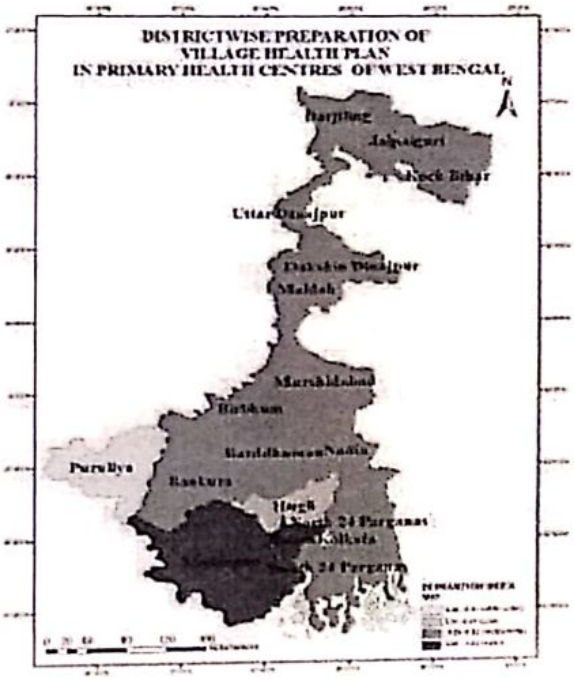


Fig 10

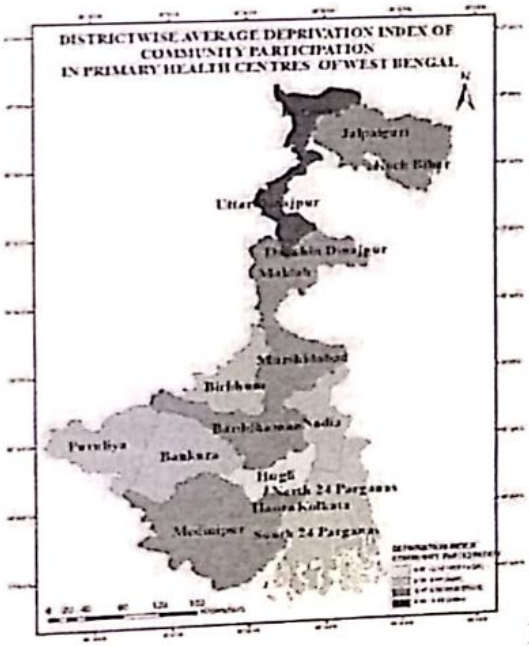


Fig 11

Table 3: Some Case Studies in Support of the Explanation.

Districts	Human Resource	Functioning of RKS	Role of ASHAs	JSY	Opinion of Community
Purulia	49 MOs out of 221 sanctioned post and 89 Specialist out of 147 are vacant	RKS meet Quarterly. In 2009 out of Rs 1, 06, 36,665 only Rs 25, 86,898 was spent. Utilization certificate for untied fund was irregular.	For 2945 villages, 662 ASHAs were selected. Role of ASHA in escorting mothers for institutional delivery was not satisfactory.	It was observed that JSY fund was not provided in proper time. Out of allotted funds of Rs 94901461 only Rs 25557218 was spent.	Antenatal and post natal checkups, counseling of mothers need to gear up for increasing quality services. Mothers, AWW, ASHA and Villagers were not aware about ARI, ORT, HIV, STD Diseases
Darjeeling	76 MOs out of 159 sanctioned post and 43 specialist out of 127 are vacant	RKS has spent Rs 3, 05,173 out of Rs 47, 40,367 Utilization certificate was regularly submitted.	In 708 villages 804 posts of ASHA was sanctioned of which 354 were in position. Involvement of ASHA in escorting mothers was absent	Out of allotted funds of Rs 79 15,219 funds 18556483 was utilized.	Health workers don't stay at sub centers and was not available as and when needed. There was no visit of Medical officers to villages during last 6 months
Murshidabad	The district is facing great difficulty due to large number of vacancy in medical and paramedical staffs 360 posts of MO out of 458 and 56 specialist out of 108 were lying vacant	RKS has spent Rs4162518 out of Rs 1, 49, 46,422 in 2009-10. Utilization certificate and statement of expenditure was submitted regularly.	In view of total 2210 villages, the target of 4360 ASHAs, 3246 ASHAs were in position. Only 1883 ASHA have been provided 5th module training.	Under JSY scheme 397, 08,500 out of 4, 16, 88,355 was utilized. Back log cases due to in sufficient fund allotment persisted. ANM reported that they have not received JSY fund since August 2010.	Involvement of ASHA particularly escorting mothers for institutional delivery was almost nil.

Journal of
Business And Economic Issues
Vol. 7 No. 1

A Study of the Impact of Cluster on the Change in Real Income of the Members of Self-help Groups

Dhrubajyoti Chattopadhyay* and Dr Kiranjit Sett**

Abstract

A poor individual has insignificant collateral, meager amount of savings or no savings, limited skills for manual works, few contacts, less ability to market products, less information and less bargaining power. If individuals who are poor form a group for mutual benefits, on the basis of trust and co-operation among the members, the group becomes an institution that helps the survival of the poor by increasing their bargaining power, contacts, information, avenues to market their products and services. Under the SGSY, individuals are organized as self-help groups in the rural areas. Again, a self help group (hereinafter referred as SHG) has limited resources and it faces many challenges with respect to procurement of raw materials, marketing of output, getting its members trained, building infrastructure, procuring technology and maintaining quality of its products or services. A cluster of SHGs can have sufficient resources and can overcome the limitations faced by an SHG provided there is synergy among the member SHGs. A cluster of SHGs can have greater bargaining power and can force the government to develop infrastructure facilities.

The objective of this paper is to make a comparative analysis of the change in real income of the members of SHGs which have formed clusters vis-à-vis the change in real income of the members of SHGs which have not formed clusters. It also has the objective of identifying the variation in the impact of the variables which affect the change in real income of the members of clustered as well as non-clustered SHGs. On the basis of the data on 1248 members of 192 SHGs operating in the districts of North 24 Parganas and Hooghly of West Bengal, it has been found that change in real income is more in case of the members of non-clustered SHGs than the members of clustered SHGs.

JEL Classification: *H55, O12, P46, R53*

Keywords: *Self help groups, change in real income, cluster*

**Nahata J. N.M. S. Mahavidyalaya & **West Bengal State University*

Introduction

A poor individual has insignificant collateral, meager amount of savings or no savings, limited skills for manual works, few contacts, less ability to market products, less information and less bargaining power. Asymmetry of information and transaction cost create hurdle for banks to lend money and provide other financial services to the poor (Dasgupta, 2001; Basu and Srivastava, 2005; Basu, 2005).

If those poor persons form a group for mutual benefits and develop trust and co-operation among themselves, the group becomes an institution that increases their bargaining power, information and avenues to market their products and services (Galab and Rao, 2003; Dasgupta and Rao, 2003; Satish, 2005; Mitra and Gupta, 2009). Transaction cost falls if the group is allowed to get access to the financial institution (Vatta, 2003). The peer pressure acts as a substitute for collateral if the members of the group are made responsible for repayment of loan (Bhatia, 2007). The other members of the group collect information about the credit worthiness of the member who applies for loan and share the information with the lending institution (Vatta, 2003). As a result, asymmetry of information between borrower and lender gets reduced. Moreover, the members of the group may get access to the fund borrowed by the group from the financial institutions.

Despite the above advantages, an SHG does not have resources which are sufficient to enable it to bring its scale of operation to such a level where it can bargain for getting discount for bulk procurement of raw materials and procure technology, market the output of its members, get its members trained, develop infrastructure and maintain quality of its product or service. There are also severe limits on choices relating to activities which the members of an SHG may select. A cluster of SHGs may have sufficient resources which help its member groups to overcome the limitations faced by the individual groups (Dasgupta and Rao, 2003) provided there is synergy among the member SHGs. Moreover, the cluster may have more information and greater bargaining power. It may exert greater pressure on the government for the development of infrastructure and help in improving the use of the available infrastructure by sharing information about such facilities among its members. Cluster provides backward and forward linkages to the member groups effectively (SGSY Guideline, Government of India). The cluster approach is advantageous both from implementation and marketing point of view, by virtue of economies of scale (Panth, 2001).

Thus, the members of clustered SHGs are likely to earn more than the members of non-clustered SHGs. Identifying the difference in the impact of various variables

affecting the change in real income of the members of SHGs is also likely to help those who make policies. The objective of this paper is to make a comparative analysis of the change in real income of the members of SHGs which have formed clusters vis-à-vis the change in real income of the members of SHGs which have not formed clusters. It also has the objective of identifying the difference in the impact of the variables which affect the change in real income of the members of clustered as well as non-clustered SHGs.

Methodology

This study is based on the data collected from April 2014 to March 2016 through a survey of 1248 members of 192 SHGs formed under SGSY. The selected SHGs have been operating in the districts of North 24 Parganas and Hooghly. Multiple regression technique has been used for the analysis of the collected data.

The Model

The change in real income of a member of an SHG is likely to be caused by a number of variables. Hence, the following model is used for the purpose of analyzing the data:

$$Y_i = a + \Sigma b_j X_{ij} + u_i \quad \ldots\ldots\ldots\ldots (1)$$

Where, $i = 1,2,3,\ldots\ldots\ldots,1248$; **and** $j = 1,2,3,\ldots,18$.

Change in real income (Y_i) has been considered as dependent variable and educational attainment (X_1), age (X_2), religion (X_3), caste (X_4), health (X_5), family size (X_6), nature of employment (X_7), continuity in employment (against New Employment) (X_8), participation in MGNREGA (X_9), motivation (X_{10}), parent's educational attainment (X_{11}), nature of employment of the parent (X_{12}), training (X_{13}), loan (X_{14}), perceived potential demand (X_{15}), age of the group (X_{16}), district (X_{17}) and cluster (X_{18}) have been considered as explanatory variables. In case of a respondent who belongs to a group which is linked with a cluster, the variable cluster (X_{18}) is given 1, otherwise it is given 0. u_i is the random error term. Now, let us see the impact of cluster on the change in real income of the poor who have been organized as SHGs under SGSY.

Findings

It is observed (Table-1) that the mean and standard deviation and coefficient of variation of change in real income of the members of non-clustered SHGs are more than the members of clustered SHGs. This implies that although the mean change in real income of the members of non-clustered SHGs is more but the variability in

such change in real income is also more for that group compared to that of the members of clustered groups. Thus, on the basis of descriptive statistics no conclusion on the relative performance of the members of clustered and non-clustered SHGs can be drawn.

Table-1: Descriptive Statistics on Change in Real Income of the Respondents

	Clustered SHGs	Non-clustered SHGs	Total
Mean	323.06	332.36	326.15
Standard Deviation	221.52	245.22	229.60
Coefficient of Variation	68.57%	73.78%	70.40%
Observations	834	414	1248

The multiple regression analysis has been carried out using data on 1248 respondents and the results have been reported in Table – 2.

Table – 2 : Results of Regression involving 1248 observations (First Regression)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	157.66 *	41.19	3.82	0.000
Educational Attainment (X_1)	(-) 4.63 *	1.75	(-) 2.63	0.009
Age (X_2)	(-) 0.64	0.65	(-) 0.97	0.331
Religion (X_3)	41.61 **	16.25	2.56	0.011
Caste (X_4)	26.52 **	12.51	2.12	0.034
Health (X_5)	46.26 *	12.69	3.64	0.000
Family Size (X_6)	2.22	3.81	0.58	0.559
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Nature of Employment (X_7)	80.97 *	11.49	7.04	0.000
Continuity of Employment (X_8)	(-) 172.85 *	11.16	(-) 15.47	0.000
Participation in MGNREGA (X_9)	32.40 **	13.25	2.44	0.015
Motivation (X_{10})	40.07 *	10.67	3.75	0.000
Parents' Educational attainment (X_{11})	4.65 *	1.67	2.77	0.006
Nature of Parent's Employment (X_{12})	9.42	13.02	0.72	0.469
Training (X_{13})	30.03 **	11.88	2.52	0.012
Loan (X_{14})	9.29 **	3.69	2.51	0.012
Perceived Potential Demand (X_{15})	144.03 *	12.03	11.96	0.000
Age of the Group (X_{16})	4.49 **	1.788	2.51	0.012
District (X_{17})	30.08 **	13.40	2.24	0.025
Cluster (X_{18})	(-) 52.06 *	12.75	(-) 4.08	0.000

R-squared	0.382			
Adjusted R-squared	0.373			
F-statistic	42.19 *			0.00

Dependent Variable: Change in real income (Y), Observations: 1248

*Significant at 1% level of significance

** Significant at 5% level of significance

R-squared has been found quite low i.e. 0.382 (Table –2). Adjusted R- squared has been found 0.373 (Table –2). F-statistic has been found to be 42.19 which has been found to be significant at 1% level of significance (Table –2). The model has explained a small part of the variance of the dependent variable. The heteroscedasticity in the residuals has been checked with Breusch-Pagan-Godfrey test. The results have been reported in Table – 3.

Table - 3: Results of Breusch - Pagan - Godfrey test

H_0 : Constant Variance
Chi^2 (1) = 28.84*
Prob > Chi^2 = 0.00

The computed Chi^2 has been found to be 28.84 which has been found to be significant at 1% level of significance (Table - 3). The result has indicated the presence of heteroskedasticity. Then, 1248 respondents have been plotted on the X – axis and the residuals have been plotted on the Y – axis (Figure – 1). The residuals for 59 respondents have been found to have fallen far from zero (Figure - 1). The normality test of the residuals has been conducted with the Jarque-Bera (JB) test. The JB Statistic has been found to be 175.04 which has been found to be statistically significant at 1% level of significance (Figure - 2). It has the implication that the residuals have not been normally distributed.

Figure - 1: Plot of Residuals of the First Regression

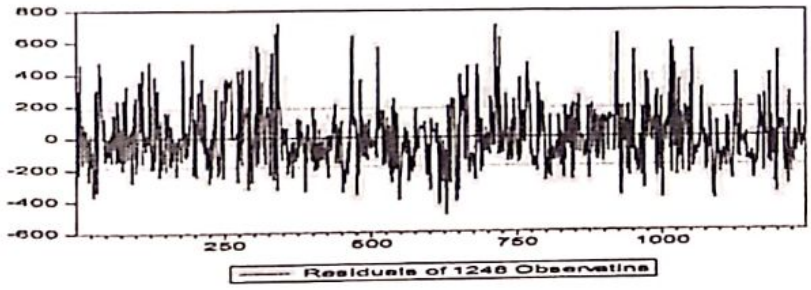
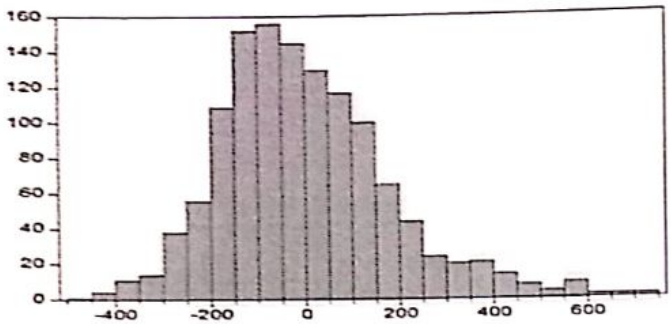


Figure - 2: Normality Test of the Residuals of the First Regression



The 7th (D_1), 39th (D_2), 41th (D_3), 42th (D_4), 112th (D_5), 123th (D_6), 180th (D_7), 181th (D_8), 182th (D_9), 196th (D_10), 253th (D_11), 254th (D_12), 256th (D_13), 257th (D_14), 258th (D_15), 259th (D_16), 260th (D_17), 261th (D_18), 262th (D_19), 274th (D_20), 281th (D_21), 294th (D_22), 306th (D_23), 310th (D_24), 330th (D_25), 331th (D_26), 332th (D_27), 338th (D_28), 342th (D_29), 343th (D_30), 467th (D_31), 468th (D_32), 469th (D_33), 513th (D_34), 653th (D_35), 666th (D_36), 681th (D_37), 682th (D_38), 683th (D_39), 684th (D_40), 714th (D_41), 717th (D_42), 721th (D_43), 768th (D_44), 769th (D_45), 921th (D_46), 923th (D_47), 924th (D_48), 952th (D_49), 973th (D_50), 1016th (D_51), 1019th (D_52), 1020th (D_53),), 1023th (D_54), 1030th (D_55), 1052th (D_56), 1053th (D_57), 1129th (D_58) and 1200th (D_59) respondents have been considered as outliers and so dummy variables for those respondents have been introduced. The multiple regression analysis has been carried out again by applying white's heteroskedasticity-consistent method and the results have been reported in Table – 4.

Table-4: Results of Regression involving 1248 observations (Second Regression)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	168.26 *	34.39	4.89	0.000
Educational Attainment (X_1)	**(-) 5.03 ***	1.59	(-) 3.15	0.002
Age (X_2)	(-) 0.54	0.57	(-) 0.94	0.348
Religion (X_3)	**47.65 ***	14.26	3.34	0.001
Caste (X_4)	**22.79 ****	11.01	2.06	0.039
Health (X_5)	**19.98 *****	11.30	1.76	0.077
Family Size (X_6)	0.85	2.97	0.28	0.773
Nature of Employment (X_7)	**77.96 ***	10.47	7.44	0.000
Continuity of Employment (X_8)	**(-) 174.75 ***	9.95	(-) 17.55	0.000

Participation in MGNREGA (X_9)	40.27 *	10.95	3.67	0.000
Motivation (X_{10})	29.28 *	9.47	3.09	0.002
Parents' Educational attainment (X_{11})	4.33 *	1.54	2.81	0.005
Nature of Parent's Employment (X_{12})	(-) 5.50	11.80	(-) 0.47	0.641
Training (X_{13})	29.88 *	10.37	2.88	0.004
Loan (X_{14})	9.76 *	3.15	3.09	0.002
Perceived Potential Demand (X_{15})	134.01 *	10.32	12.98	0.000
Age of the Group (X_{16})	1.98	1.73	1.14	0.252
District (X_{17})	42.41 *	12.15	3.48	0.001
Cluster (X_{18})	(-) 42.58 *	10.84	(-) 3.92	0.000
R-squared	0.601			
Adjusted R-squared	0.575			
F-statistic	22.87 *			0.000

Dependent Variable: Change in real income (Y), Observations: 1248

*Significant at 1% level of significance,

**Significant at 5% level of significance,

***Significant at 10% level of significance

Figure - 5.3: Plot of Residuals of the Second Regression

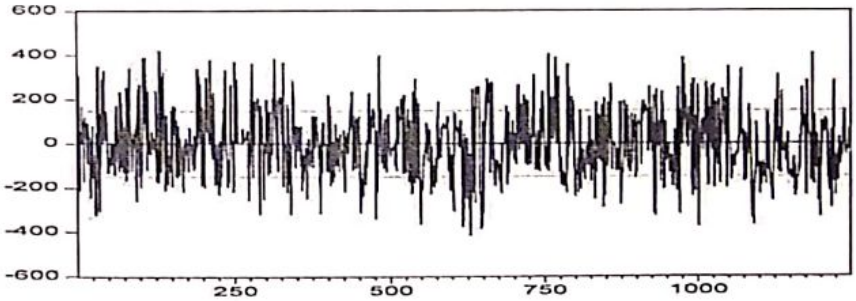
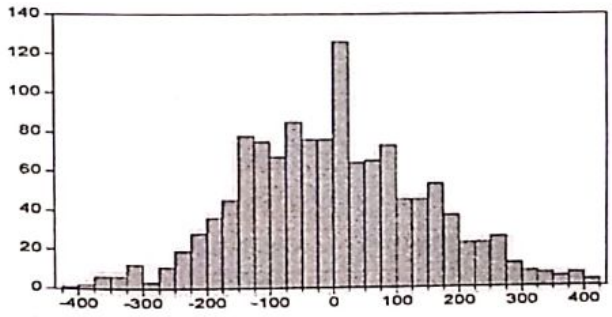


Figure - 5.4: Normality Test of the Residuals of the Second Regression



Series: Residuals
Sample 1 1248
Observations 1248

Mean	-2.08e-13
Median	-0.740970
Maximum	420.8768
Minimum	-413.7605
Std. Dev.	145.0559
Skewness	0.182603
Kurtosis	2.922993
Jarque-Bera	7.243912
Probability	0.026730

R-squared has been found to be 0.601. It means that about 60% of variance in Y has been explained by the explanatory variables. Adjusted R- squared has been found to be 0.575. F-statistic has been found to be 22.87 which has been found to be statistically significant at 1% level of significance. These statistics have the implication that the chosen model has satisfied the goodness of fit criterion. The JB Statistic has been found to be 7.24 with p – value of 0.026 indicating that the JB Statistic is statistically significant at 5% level of significance. It has the implication that the residuals have not been normally distributed at 5% level of significance (Figure – 5.4). The second regression has been found to be an improvement on the first regression.

Moreover, the regression coefficients of identified 59 outliers have been found to be positive and statistically significant at 1% level of significance that has not been reported in Table-4. The mean change in monthly real income of 59 outliers has been found to be significantly more than the intercept.

The objective of the study is to examine the effect of cluster on change in real income. So, our interest lies in examining the regression coefficient of cluster. The regression coefficient of cluster has been found to be negative and statistically significant at 1% level of significance. It implies that the average change in real income of the members of clustered SHGs is lower than that of the members of non-clustered SHGs.

Let us now see the effects of the selected variables on change in real income of the members of clustered as well as non-clustered groups. Multiple regressions for the clustered as well as non-clustered groups have been run separately and the results have been reported in Table - 5.

Table - 5: Results of Regression for Clustered and Non-clustered SHGs

Variable	Members of Clustered groups (Observations : 834)			Members of Non-Clustered groups (Observations: 414)		
	Coefficient	Std. Error	t – statistic (p-value)	Coefficient	Std. Error	t – statistic (p-value)
Intercept	130.52*	38.06	3.43 (0.001)	121.17	77.18	1.57 (0.117)
Educational Attainment (X_1)	(-) 0.86	1.91	(-) 0.45 (0.652)	(-) 11.00*	2.76	(-) 3.98 (0.0)
Age (X_2)	(-) 0.72	0.67	(-) 1.08 (0.279)	0.51	1.15	0.45 (0.656)
Religion (X_3)	23.00	17.66	1.30 (0.193)	93.95*	30.82	3.05 (0.003)
Caste (X_4)	19.68	13.37	1.47 (0.141)	32.82	22.16	1.48 (0.139)
Health (X_5)	19.95	14.23	1.40 (0.161)	7.33	21.17	0.35 (0.730)

Family Size (X_6)	4.18	3.66	1.14 (0.253)	(-) 5.98	5.54	(-) 1.08 (0.282)
Nature of Employment (X_7)	**62.16***	**13.20**	**4.71 (0.0)**	**114.46***	**20.66**	**5.54 (0.0)**
Continuity of Employment (X_8)	**(-) 188.95***	**11.58**	**(-) 16.32 (0.0)**	**(-) 148.89***	**20.59**	**(-) 7.23 (0.0)**
Participation in MGNREGA (X_9)	**52.66***	**14.62**	**3.60 (0.0)**	25.47	18.38	1.39 (0.167)
Motivation (X_{10})	17.39	11.41	1.52 (0.128)	**43.16****	**18.73**	**2.30 (0.022)**

Variable	**Members of Clustered groups (Observations : 834)**			**Members of Non-Clustered groups (Observations: 414)**		
	Coefficient	**Std. Error**	**t – statistic (p-value)**	**Coefficient**	**Std. Error**	**t – statistic (p-value)**
Parents' Educational attainment (X_{11})	**4.78****	**1.87**	**2.56 (0.011)**	3.44	2.90	1.18 (0.237)
Nature of Parent's Employment (X_{12})	(-) 5.82	13.31	(-) 0.44 (0.662)	(-) 7.46	27.06	(-) 0.28 (0.783)
Training (X_{13})	17.63	13.07	1.35 (0.178)	**36.64*****	**20.70**	**1.77 (0.078)**
Loan (X_{14})	6.64	4.25	1.56 (0.178)	**14.64****	**5.83**	**2.51 (0.013)**
Perceived Potential Demand (X_{15})	**144.96***	**12.88**	**11.25 (0.0)**	**119.32***	**18.40**	**6.48 (0.0)**
Age of the Group (X_{16})	**3.78*****	**2.26**	**1.67 (0.095)**	(-) 0.32	3.13	(-) 0.10 (0.919)
District (X_{17})	**38.81****	**15.44**	**2.51 (0.012)**	**53.48****	**24.26**	**2.20 (0.028)**
R-squared	0.603			R-squared	0.637	
Adjusted R-squared	0.577			Adjusted R-squared	0.596	
F-statistic	22.84*			F-statistic	15.89*	
Prob (F-statistic)	**0.00**			Prob (F-statistic)	**0.00**	

Dependent Variable: Change in real income (Y)

*Significant at 1% level of significance

**Significant at 5% level of significance

***Significant at 10% level of significance

The following have been observed from the results of regression (Table - 5):

1. R-squared for the clustered groups has been found to be 0.603. Adjusted R-squared has been found to be 0.577. F-statistic has been found to be 22.84 which has been found to be statistically significant at 1% level of significance. R-squared for the non - clustered groups has been found to be 0.637. Adjusted R-squared has been found to be 0.596. F-statistic has been

found to be 15.89 which has been found to be statistically significant at 1% level of significance. These statistics have the implication that the chosen models for clustered as well as non-clustered groups have satisfied the goodness of fit criterion.

2. Three explanatory variables viz., Participation in MGNREGA, Parent's Educational Attainment (above Class VIII) and Age of the Group have positive and statistically significant impact on change in real income of the members of clustered SHGs whereas these variables have no statistically significant impact for the non -clustered SHGs.

3. Four explanatory variables viz., Religion (Hindu), Motivation (for getting Financial Assistance), Training and Loan have positive and statistically significant impact on change in real income of the members of non - clustered SHGs whereas these variables have no statistically significant impact for the clustered SHGs.

   Educational Attainment (upto Class VIII) has negative and statistically significant impact on change in real income of the members of non - clustered SHGs whereas this variable has no statistically significant impact for the clustered SHGs.

4. Three explanatory variables viz., Nature of Employment (Non-Farm Employment), Perceived Potential Demand and District have positive and statistically significant impact on change in real income of the members of the clustered as well as the non -clustered SHGs.

   Continuity in Employment (against New Employment) has negative and statistically significant impact on change in real income of the members of the clustered as well as the non -clustered SHGs.

In order to test the significance of the difference in the regression coefficients of Nature of Employment (Non-Farm Employment), Continuity in Employment (against New Employment), Perceived Potential Demand and District for the clustered and non-clustered SHGs, a multiple regression with additional dummy variables (denoted by DD_i) has been run and the results have been reported in Table – 6.

Table-4: Results of Regression involving 1248 observations (Second Regression)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	143.67*	33.80	4.25	0.000
Educational Attainment (X_1)	(-) 4.79 *	1.59	(-) 3.01	0.003
Age (X_2)	(-) 0.50	0.58	(-) 0.86	0.388
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Religion (X_3)	43.50*	14.55	2.99	0.003
Caste (X_4)	23.83**	10.91	2.19	0.029
Health (X_5)	20.09***	11.44	1.76	0.080
Family Size (X_6)	0.51	3.00	0.17	0.866
Nature of Employment (X_7)	126.04*	19.00	6.63	0.000
X_{19} ($X_{19} = X_7 \times DD_1$, $DD_1 = 1$ for members of clustered SHGs and 0 otherwise)	**(-) 68.77***	**22.11**	**(-) 3.11**	**0.002**
Continuity of Employment (X_8)	(-) 142.83*	15.51	(-) 9.21	0.000
X_{20} ($X_{20} = X_8 \times DD_2$, $DD_2 = 1$ for members of clustered SHGs and 0 otherwise)	**(-) 45.45***	**16.81**	**(-) 2.70**	**0.007**
Participation in MGNREGA (X_9)	39.23*	10.91	3.60	0.000
Motivation (X_{10})	27.73*	9.50	2.92	0.004
Parents' Educational attainment (X_{11})	4.31*	1.56	2.76	0.006
Nature of Parent's Employment (X_{12})	(-) 7.57	11.78	(-) 0.64	0.521
Training (X_{13})	31.93*	10.65	3.00	0.003
Loan (X_{14})	9.52*	3.15	3.03	0.003
Perceived Potential Demand (X_{15})	122.45*	16.31	7.51	0.000
X_{21} ($X_{21} = X_{15} \times DD_3$, $DD_3 = 1$ for members of clustered SHGs and 0 otherwise)	14.30	18.29	0.78	0.434
Age of the Group (X_{16})	1.81	1.76	1.03	0.303
District (X_{17})	26.67	18.13	1.47	0.142
X_{22} ($X_{22} = X_{17} \times DD_4$, $DD_4 = 1$ for members of clustered SHGs and 0 otherwise)	12.74	18.71	0.68	0.496
R-squared	**0.605**			
Adjusted R-squared	**0.578**			
F-statistic	**22.31***			**0.000**

Dependent Variable: Change in real income (Y), Observations: 1248, *Significant at 1 % level of significance, **Significant at 5 % level of significance, ***Significant at 10% level of significance

From the regression (Table - 6), the following observations have been noted:

1. In case of Nature of Employment (Non-Farm Employment), the difference in the regression coefficient (represented by the regression coefficient of X_{19}) has been found to be negative and statistically significant at 1% level of significance. It has the implication that for clustered SHGs, the impact of Nature of Employment (Non-Farm Employment) has been found to be statistically significantly lower than that for non - clustered SHGs.

2. In case of Continuity in Employment (against New Employment), the difference in the regression coefficient (represented by the regression coefficient of X_{20}) has been found to be negative and statistically significant at 1% level of significance. It has the implication that for clustered SHGs, the impact of Continuity in Employment (against New Employment) has been found to be statistically significantly lower than that for non - clustered SHGs.

3. In case of Perceived Potential Demand and District, the differences in the regression coefficients (represented by the regression coefficient of X_{21} and X_{22}) have been found to be not statistically significant.

Conclusion

This paper has examined the impact of cluster on the change in real income of the members of SHGs formed under SGSY. On the basis of the data on 1248 members of 192 SHGs operating in the districts of North 24 Parganas and Hooghly, it has been found that the change in real income is more in case of the members of SHGs operating separately (Non-Cluster) than the members of SHGs which have formed cluster.

The further analysis of the impact of cluster has been done. It has been observed that Participation in MGNREGA, Parent's Educational Attainment (above Class VIII) and Age of the Group have positive and statistically significant impact on change in real income of the members of clustered SHGs whereas these variables have no statistically significant impact for the members of non - clustered SHGs. On the other hand, Religion (Hindu), Motivation (for getting Financial Assistance), Training and Loan have positive and statistically significant impact on change in real income of the members of non - clustered SHGs whereas these variables have no statistically significant impact for the members of clustered SHGs. Educational Attainment (upto Class VIII) has negative and statistically significant impact on change in real income of the members of non - clustered SHGs whereas this variable has no statistically significant impact for the members of clustered SHGs. Nature of Employment (Non-

farm Employment), Perceived Potential Demand and District have positive and statistically significant impact on change in real income of the members of the clustered as well as the non - clustered SHGs, while Continuity in Employment (against New Employment) has negative and statistically significant impact on change in real income of the members of the clustered as well as the non - clustered SHGs.

In case of Nature of Employment (Non-Farm Employment) and Continuity in Employment (against New Employment), the difference in the regression coefficients have been found to be negative and statistically significant. It has the implication that for clustered SHGs, the impact of Nature of Employment (Non-Farm Employment) and Continuity in Employment (against New Employment) have been found to be statistically significantly lower than that for non - clustered SHGs. In case of Perceived Potential Demand and District, the differences in regression coefficients have been found to be not statistically significant.

References

Basu, P. and Srivastava, P. (2005), Scaling-up Microfinance for India's rural poor, Policy Research Working Paper 3646, World Bank

Basu, P. (2005), A Financial System for India's Poor, Economic and Political Weekly, Vol. 40, No. 37

Bhatia, N. (2007), Revisiting bank-linked Self Help Groups (SHGs) – A Study of Rajasthan State, Reserve Bank of Occasional Papers, Vol. 28, No. 2

Dasgupta, R. (2001), An Informal Journey through Self Help Groups, Indian Journal of Agricultural Economics, Vol. 56, No. 3

Dasgupta, R. and Dinker, R. K. (2003), Microfinance in India: Issues, Challenges and Policy Options, Economic and Political Weekly, Vol. 44, No. 43

Galab, S. and Rao, C. N. (2003), Women's Self-Help Groups, Poverty Alleviation and Empowerment, Economic and Political Weekly, Vol. 38, No. 12/13

Government of India; Swarnjayanti Gram Swarozgar Yojana Guidelines (http://rural.nic.in/sgsy/htm)

Mitra, S. and Gupta, G. (2009), The Logic of Community Participation : Experimental Evidence from West Bengal, Economic and Political Weekly, Vol. 44, No. 20

Panth, S. A. (2001), Swarozgar Yojana : Old wine, New cocktail, Economic and Political Weekly, Vol. 36, No. 36

Satish, P. (2005), Mainstreaming of Indian Microfinance, Economic and Political Weekly, Vol. 40, No. 17

Vatta, K. (2003), Microfinance and Poverty Alleviation, Economic and Political Weekly, Vol. 38, No. 5

Guidelines for Authors

)ur peer-reviewed journal seeks articles of interest on contemporary issues pertaining to the eld of Accounting, Finance, Business Laws, Management, Economics and allied areas.

All manuscripts should be formatted in 12-point font on A4 size paper and should be double-spaced. Margins should be at least one inch from all sides.

The cover page should contain the title of the manuscript, author(s)' names, titles and affiliations, e-mail addresses, telephone numbers and any acknowledgements. The author(s)' names or any other identification designations should not appear in the body of the text so that the referee will not know the identity of the author.

The subject matter should commence from the second page with the manuscript's title and an abstract of not more than 200 words. The abstract must be followed by at least three keywords.

The manuscripts should start with an introduction and end with a conclusion summarizing the findings.

Headings should be from left margin in 12 point, bold, upper. Sub-headings should be from left margin in 10 point, bold, upper-lowers.

Statistical tables, charts and diagrams should be clearly titled and serially numbered. The source, however necessary, should be clearly stated.

In the text, links are cited using an author-year format as follows: author's last name and year, without comma, in parentheses. For example: one author, (Easton 2003); two authors, (Grec... and Watts 1996); three or more authors, (Chen et al. 1986); more than one work cited, (Fama 1981; Geske and Roll 1983; Kaul 1987); with two works by the same author(s), (Nelson 2003,2005).

The article should provide complete references with the necessary information. Footnotes, if any, should be consecutively numbered and placed at the end of the article:

References: Samples:

Books : Mueller, G. G, Gernon, H. M., and Meek, G. K. (1996). *Accounting:An International Perspective*. 4th ed. New York: McGraw-Hill, 35-42.

Journal: Sharpe,W.F.(1994). The Sharpe Ratio. *Journal of Portfolio Management*, 21,49-59.

The manuscript should be original unpublished work, neither submitted nor accepted for publication anywhere else. The authors are fully responsible for the views expressed and the accuracy of the data used in the manuscripts.

Manuscript should accompany an electronic form and sent to:

Chief Editor
Journal of Business and Economic Issues
Barrackpore Rastraguru Surendranath College,
85, Middle Road & 6, Riverside Road,
Barrackpore, North 24 Parganas, Kolkata-700 120
Tel: (033)2592-0603,2545-1402 Telefax: (033) 2594-5270
E-mail: brsnc_commercejournal@rediffmail.com, jbeijournal@gmail.com • www.brsnc.org

Publishing Office :
Barrackpore Rastraguru Surendra College
85, Middle Road and 6, Riverside Road.
Barrackpore, North 24-Parganas, Kolkata 700 120
West Bengal, India
E-mail : jbeijournal@gmail.com • www.brsnc.org