

Sources of Return and Volatility Spillover for Pakistan: An Analysis of Exogenous Factors by using EGARCH Model

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Abstract. The purpose of this research is to determine the behavior and magnitude of return movements and volatility movements of KSE-100 index (Pakistan) with respective global index FPI (Foreign portfolio Investment), FDI (Foreign direct Investment). The ultimate goal is to find out the diversification opportunity of FPI for international investors during the Global financial crisis as well as to understand the behavior of investors during crisis. We found that FPI and FDI strong predictors of KSE-100 index. The results demonstrated that the negative behavior of return movements of KSE-100 with global index during crisis period provides an opportunity for international investors diversification.

Keywords: FDI, FPI, Return and volatility spillover, Global financial meltdown, Pakistan

1. Introduction

The possible return and volatility movement explanation has been a topic of prime importance for the practitioners and academicians. Asset pricing, return volatility spillover models covering the financial integration & correlation between stock markets and behavioral & psychological explanations of investor's decision making are the key facets of current research prospective. A large number of articles have been written to explain the return patterns of stock markets. But still the abnormal movements of stock markets during the world crises are not answered properly by standard finance. The world have witnessed the series of financial crises of 1990s including, the Mexican collapse of peso in 1994, the Asian crisis of 1997, the Russian debacle of Ruble in 1998, the Brazilian devaluation of Real in 1999, and crash in USA stock markets caused by subprime mortgages of 2008 entailed in the "financial meltdown" in the USA, the EU and other advanced economies. Even the developing economies were also hit by the global meltdown. These crises made foreign investors fled from the emerging stock exchanges in fear of a global recession. The S&P Emerging market indices, demonstrating overall performance of the markets, fell by around 50% in 2008. The fall was especially sharp in emerging countries like Pakistan as economic survey of Pakistan (2009) have mentioned, and it forced authorities to shut down markets temporarily to halt further losses.

Previous literature discussed possible sources of this global return and volatility comovements. Theoretically, there are three sources of financial integrations as discussed by Masson (1998). First is "monsoonal effects" that will tend to take place when concerned countries have similar economic systems or situated in the same region facing common regional stocks. The second type of financial market integration takes place from "spillover effects", which may be due to bilateral trade activities or financial dependence on one another. The third transmission source is "contagion effect". It is contagion effect if crisis in one country triggers a crisis in another country/market for reasons which are not explained by macroeconomic variables. For instance, in the time of recessions, sometime the poor understanding of the investor about the information asymmetry leads him to pull out his investments from other countries to avoid a potential loss

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which is against the rational decision making. From above discussion we can say the spillover effect & contagion effect may have explanatory power to describe the volatility of local market. The purpose of this article is to evaluate the period of global financial Meltdown crisis and its impact on the Pakistani stock markets by focusing on the exogenous sources; Global regional indices, FDI and FPI changes before and after the crisis period.

2. Literature review

There are several studies of different countries using different models to capture this return and volatility spillover and movements relationship.

Eun and Shim (1989) analyzed daily returns in nine countries, Hong Kong, France, Japan Switzerland, Canada, Australia, USA, Germany and UK capital markets. This study reported a significant correlation between USA equity market and other stock markets. Syriopoulos (2007) also investigated the effect of the EMU on the long-run relationships of four emerging countries Poland, Hungary, Czech Republic, Slovakia and the developed equity markets of US & Germany by using co-integration methodology. He found that Central European stock markets had a tendency to show stronger linkages with Germany the counterpart, and the US market showed a world leading significant role for cross boarder linkages. No dramatic changes were found in the stock market dynamics in post-EMU period.

Moreover, all these studies only are gagging the presences of spillover effects but sources of spillover are continuously neglected. The stream of study regarding the global meltdown is also very limited. Aktan et al, (2009) investigated the impact of global melt down on the emerging countries Brazil, Russia, India, China, and Argentina. They employed the vector auto regression (VAR) techniques to model the interdependencies and Granger causality test to find evidence of a short-run relationship between these markets. They found that the US market had a significant effect on all emerging countries in the same trading day. The most integrated markets to the emerging countries are Russia and Brazil; the least integrated ones are China and Argentina.

In previous literature mayakoshi (2003) discussed the importance of exogenous variables as antecedents of stock market volatility but he has selected only regional and global stock volatility regarding this context. Some other studies have discussed the relationship between macro economic variables like FDI and FPI with stock returns like Maseti et al (2011). They found a positive relationship between FDI & FPI with stock market returns. But no research has been conducted taking them as predictor of local market return volatility during crises.

As our research focus is Pakistan, one of the developing countries of the world, is playing a vital role in the global concerns. It is actively participating in economic blocks to share markets and investment opportunities with rest of the world. Pakistan is member of OECD, ASEAN, ECO, SAARC and other economic blocks. Pakistan has witnessed High growth rate of 5.4% between 2001 and 2007(i.e see Final reports of economic survey of Pakistan 2001-09). These all above stated factors have made Pakistan an attractive investment and diversification opportunity for international portfolio managers.

3. Methodology

3.1. Data

Monthly closing prices of Pakistan (KSE-100) and respective Global index (Standard & Poor's "All Countries Global Index") have been used. Return "RE_(j,t)" for all time series is calculated by using following formula:

$$RE_{(j,t)} = \ln(P_t / P_{t-1})$$

(j,t) in sub script means a return series from all variables. The data ranged from January 2005 to June 2010.

3.2. Multivariate EGARCH model

An extension of GARCH model is derived by Nelson (1991) named Exponential GARCH. This frame work employed two equations, mean and volatility equations. To estimate the mean return spillover effect following relationship will be used.

$$RE_{(loc,t)} = \beta_{(loc,0)} + \beta_{(loc,1)}RE_{(loc,t-1)} + \beta_{(loc,2)}RE_{(glo,t-1)} + \beta_{(loc,3)}RE_{(fpi,t-1)} + \beta_{(loc,4)}RE_{(fdi,t-3)} + \beta_{(loc,5)}Dum_{(GFM,t)} + \varepsilon_{(loc,t)} \quad (1)$$

Where,

$$(\varepsilon_{(loc,t)} | \varepsilon_t) \sim N(0, \sigma^2) \quad (2)$$

Here all relevant information known at time "t" is denoted by " ε_t ", and σ^2 is the variance.

The variance equation is given below:

$$\ln(\sigma^2_{(loc,t)}) = \alpha_{(loc,0)} + \alpha_{(loc,1)} \frac{\varepsilon_{(loc,t-1)}}{\sigma_{(loc,t-1)}} + \alpha_{(loc,2)} \frac{\varepsilon_{(glo,t-1)}}{\sigma_{(glo,t-1)}} + \alpha_{(loc,3)} \frac{\varepsilon_{(fdi,t-3)}}{\sigma_{(fdi,t-3)}} + \alpha_{(loc,4)} \frac{\varepsilon_{(fpi,t-1)}}{\sigma_{(fpi,t-1)}} + \gamma_{loc} \ln(\sigma^2_{(loc,t-1)}) + \delta_{loc} \left| \frac{\varepsilon_{(loc,t-1)}}{\sigma_{(loc,t-1)}} \right|$$

If the sample size is T then the log likelihood function to be maximized with respect to the parameter is:

$$L(\varphi) = -\frac{1}{2} T \ln(2\pi) - \frac{1}{2} \sum_{t=1}^T \ln |\sigma^2| - \frac{1}{2} \sum_{t=1}^T \varepsilon_{(t)}' (\sigma^2)^{-1} \varepsilon_t \quad (7)$$

4. Results

Table 1: Summary statistics for KSE-100 returns with FDI, FPI and global index

	KSE-100	FDI	GLOBAL	FPI
Mean	0.005619	0.002911	-7E-05	-0.09123
Std. Dev.	0.198573	0.115985	0.056348	0.653828
Skewness	-1.51399	-0.11805	-1.34393	-6.38966
Kurtosis	11.30409	2.528111	6.39219	48.85463
Jarque-Bera Probability	211.5931 0	0.754055 0.685897	50.73126 0	6136.971 0
Observations	65	65	65	65

The summary statistics of KSE-100 returns with FDI, FPI and global index show that the descriptive statistics for all the time series. The FDI, FPI and global index volatility is ranging from 19.8% (KSE-100) to 65.38% (FPI). FDI has 11.5% volatility and global index has shown. In general the distributional properties of the return series appear to be non-normal.

5. EGARCH Analysis

The results in Table 2 demonstrates a strong price spillover comovements from the global to KSE-100 index, even rather than their own past values, as indicated by the $\beta_{(loc,1)}$ and $\beta_{(loc,2)}$ coefficients. The returns dependence of KSE is negative for own lagged returns. These coefficients are also statistically significant. As indicated by the $\beta_{(loc,3)}$ and $\beta_{(loc,4)}$, the KSE has shown strong return dependence on FPI and FDI. But price spillover is more dependent on FDI as compare to FPI. And FDI is more statistically significant. In the literature, FDI has been used with 3 to 6 lags in the models and some studies used this range to find out the appropriate lag with more statistically significance. We implied the same procedure and find 3 month lag as the most significant. $\beta_{(loc,5)}$ has captured the effect of global financial meltdown on Pakistan. The negative value of the parameter has shown that Pakistan has inverse relationship with changes caused by global financial meltdown. i.e. GFM caused 0.522% change in the index in the peak of crisis.

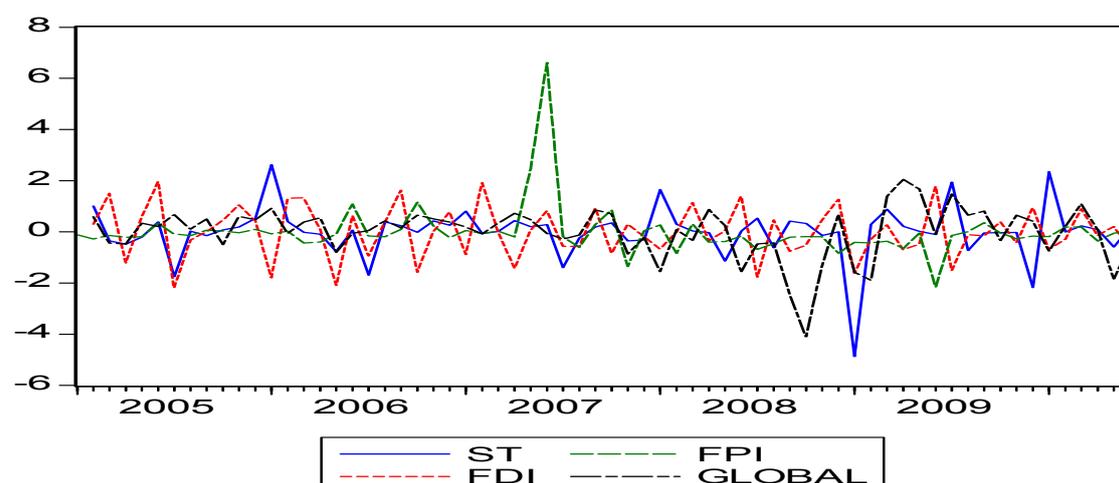
Table 2: Parameter estimates for KSE-100 (Pakistan), FDI, FPI, GFM (Global financial meltdown) and global index.

Estimated Mean equation parameters			
Pakistan			
		Coefficient	t-stat
Constant	$\beta_{(loc, 0)}$	0.034199	5.461196
Pakistan(-1)	$\beta_{(loc, 1)}$	-0.045793	-3.98297
Global(-1)	$\beta_{(loc, 2)}$	0.067594	1.698347
FPI(-1)	$\beta_{(loc, 3)}$	0.008505	0.170761
FDI(-3)	$\beta_{(loc, 4)}$	0.09271	5.910926
GFM	$\beta_{(loc, 5)}$	-0.005224	-0.37041
Estimated Volatility equation parameters			
Constant	$\alpha_{(loc,0)}$	-2.284144	-4.81975
Pakistan(-1)	$\alpha_{(loc,1)}$	-0.412121	-1.53535
Global(-1)	$\alpha_{(loc,2)}$	-0.165629	-0.04813
FDI(-3)	$\alpha_{(loc,3)}$	0.124716	0.059485
FPI(-1)	$\alpha_{(loc,4)}$	0.333334	0.167607
lagged var	γ_{loc}	-2.031752	-8.00647
Leverage	δ_{loc}	0.137504	1.022047

For KSE-100 index, parameters $\alpha_{(loc,1)}$, captures the affect of the index own conditional innovations on the volatility for the KSE-100. The parameter $\alpha_{(loc,1)}$ is highly statistically significant for Pakistan (KSE) which shows that the volatility in Pakistan, depends highly on its respective lagged innovations. Pakistan indicates a negative dependency of volatility on lagged innovations. The value of γ_{loc} , parameter measure the propensity for the volatility of shocks to continue in a market. Using the HL parameter, the volatility propensity can be measured in certain time period cycle.

$$\text{It is given by } HL = \frac{\text{LN}(0.5)}{\text{LN}(\gamma_{loc})} .$$

The parameter of HL illustrates that pakistan takes approximately 0.95 months to make a volatility shock half of its original size. Parameters $\alpha_{(loc,2)}$, $\alpha_{(loc,3)}$ and $\alpha_{(loc,4)}$ capture the impact of innovations on each other for the KSE-100 index, the global market index, FPI and FDI. Based on the results demonstrated in Table 3, Pakistan stock market conditional volatility is determined by previous innovations in the global but there is negative relationship. There is also a positive volatility spillover from FDI to Pakistan stock market but the dependence of Pakistan stock market volatility is more on FPI as compare to FDI. As discussed by Bhar and Nikolova (2009) that almost 50% of the global index is contributed by the USA stock indices and USA investors have equity investments in Pakistan. Consequently the change of volatility in global index also affects the volatility of Pakistan negatively in the crisis due to diversification strategies of the international investors.



The graph is clearly expressing the movements of returns and the explanation provided the econometric analysis. The negative behavior of KSE-100 with global index is clear in the graph and the large unexplained movements of FPI are prominent in the movement of the return series.

6. Conclusions and Discussion

The purpose of this research is to determine the behavior and magnitude of return and volatility movements of KSE-100 index (Pakistan) with respective global index FPI, FDI as exogenous sources of return and volatility. The ultimate goal of the research is to find out the diversification opportunity of FPI for international investors during the Global financial crisis as well as to understand the behavior of investors during crisis. The negative behavior of return movements of KSE-100 with global index during crisis period provides an opportunity for international investors to be benefited by this diversification and to hedge against adverse movement in their local stocks. The parameters of FDI and FPI also strongly demonstrate huge amount of inflows during the 2005 and 2010. This phenomenon concludes that FPI and FDI can explain the return and volatility depends of KSE-100 index on global index during crisis as it is discussed in the results section. The volatility dependence of KSE-100 index on own lagged and global innovations may be due to behavior of the investors those include the sign of large stock markets into their mental accounting to evaluate and rearrange their portfolios. This notion was discussed by Olson (1998). He concluded that the contagion effects can be explained by the behavior of the investors. And the return and volatility movement and correlations are formed due to investor's perceptions instead of macro economic variable and bilateral trade. Our results also support this notion as the volatility transmission is not fully explained by the predictors. However, if we consider the behavior of KSE-100, it has demonstrated positive dependence on the FDI and FPI consequently we can say that FDI and FPI are proved to be exogenous factors for return and volatility movements of Pakistan stock market.

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