European Journal of Business and Management
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol.6, No.2, 2014
www.iiste.org

Effect of FINSSP ON Stock Price Volatility In Ghana; Firm Level Analysis

ERNEST CHRISTIAN WINFUL, PETER ARHENFUL & DAVID SARPONG (JNR)
Accountancy Department, Accra Polytechnic, Accra, Ghana.
ephlameswinful@yahoo.com

ABSTRACT
This study investigates the effect of trading volume on the conditional volatility persistence of 13 individual stocks listed on the GSE using Lamoureux and Lastrapes (1990) model. All the stocks show a high degree of volatility persistence. FINSSP succeeded in making volatility of various stocks on GSE decay faster. It also turn out that FINSSP is significant in increasing the leverage effect of stocks on GSE. It was observed that volume traded has significant effect on conditional variance that volume traded may be a good proxy for stock-level analysis, but not for market-level analysis. The effect of expected trading volume on conditional variance in most stocks turnout to be stronger than unexpected trading volume.
Keywords: GSE, Expected and Unexpected Trading Volume, Volatility, FINSSP and GARCH.

1. INTRODUCTION

There is also a large literature on financial sector liberalization and stock market volatility. However, none of such studies has appeared in the literature focusing on stock market volatility and financial section liberalization (FINSSP). Aggarwal et al. (1999), found dominance of local events in causing large shifts in volatility. It is argued that capital market liberalization significantly reduce volatility in emerging markets. It is important to understand the effects of a changing trading system on stock price discovery as they may show local policy makers how to design better systems in the future. As Pagano and Roell (1993) point out, trading systems differ in the speed of dissemination of order flow information.

Much has been written about the disappointing experiences of many less developed countries that implemented aggressive financial liberalization programmes in the mid to late 1970s and early 1980s. These contradicted the predictions of economists McKinnon and Shaw (Urrutia, 1988), argued that financial liberalization in the less developed countries would induce a virtuous cycle of increased savings, investment and growth (McKinnon, 1973; 1991; Shaw, 1973). In the area of the capital market little is known about the effect of financial liberalization programmes on stock market volatility. Hammoudeh and Li (2008) finding volatility is in sharp contrast to the study of Aggarwal et al. (1999), which found dominance of local events in causing large shifts in volatility. It for this reason that we want to determine the Effect of FINSSP on Stock Price Volatility in Ghana. The inadequate literature on the effect of financial liberalization programmes on stock market volatility has motivated us to investigate the case of GSE. Another motivation is the fact that most papers on stock volatility have been analyzed on the market level and very little is known on firm level analysis. The change in trading procedures in GSE as a result of the inception of FINSSP offers an opportunity to examine how the evolution of a trading system affects the informational content of trading activity and its relationship with conditional volatility of closing stock price. The hypotheses for this paper is to test whether financial liberalization has no impact on closing stock price volatility. The motivation to study GSE is supported by the work of Bekaert and Harvey (2002) that emerging markets have different institutional, legal and regulatory environments as compared to developed markets.

The remainder of the paper is organized as follows. The next section lists theoretical and empirical findings in the literature. The third section introduces the methodology. The four section contains the empirical results.

2. LITERATURE

The study by Cont (2001), Guillaume et al., (1997) and Pagan (1986) of statistical properties of financial time series has revealed a wealth of interesting stylized facts which seem to be common to a wide variety of markets, instruments and periods. According to Lobato and Velasco (2000) stylize facts are Excess volatility, Heavy tails**,** absence of autocorrelations in returns, Volatility clustering and Volume/volatility correlation. Proposed origin of volatility clustering are Heterogeneous arrival rates of information (Guillaume et al. (1997)); Behavioral switching (Kirman (1993)) and the role of investor inertia (Liu (2000), Bayraktar et al. (2003)).

The finance literature on stock market volatility has shown that the time series of market returns is not drawn from a single probability distribution but rather from a mixture of conditional distributions with varying degrees of efficiency in generating the expected returns. The autoregressive mixing variable is considered to be the rate at which information arrives at the market, and explains the presence of GARCH effects in daily stock price movements. Assuming trading volume as a proxy for this mixing variable, several studies have provided empirical evidence on this positive linkage. Tauchen and Pitts (1983) suggest that, in liquid or mature markets, where the number of traders is large, the relationship between trading volume and volatility of price change should be positive. Andersen (1996), Gallo and Pacini (2000), Kim and Kon (1994), Lamoureux and Lastrapes (1990), Omran and McKenzie (2000) and Zarraga (2003) provide support for this notion in developed stock markets. With respect to less developed markets, Pyun et al. (2000) provide supporting evidence from the Korean stock market, Bohl and Henke (2003) from the Polish stock market, while Lucey (2005) finds mixed evidence for the Mixture of Distributions Hypothesis (MDH) in the Irish stock market.

There are explanations other than MDH for the positive relationship between volume and conditional volatility. In the work of Jennings et al. (1981) they argued in favor of asymmetric dissemination of information. That is informed traders take positions and adjust their portfolios accordingly, resulting in a series of sequential equilibria before a final equilibrium is attained. They stated that this sequential dissemination of information from trader to trader is correlated with the number of transactions. Trading volume rises as the rate of arrival of information to the market increases.

Brailsford (1996) stated that including total trading volume in the conditional volatility model reduces the GARCH effect notably; indicating that total trading volume is a suitable proxy for information flow. Tauchen and Pitts (1983) described the possibility of a negative relationship between volume and volatility of stock returns. Pyun et al. (2000) and Bohl and Henke (2003) discovered that there is a significant positive relationship between surprise trading volume and conditional volatility. They included surprise trading volume in their model which gave rise to a moderate decline in volatility persistence. Martin and Rey (2005) analyze the impact of stock market liberalization on capital flows, asset prices and investment. They concluded that when there is transaction costs in international assets, stock market liberalization can lead to two possible outcomes for an emerging market economy. Under normal circumstances, liberalization performs the positive role of generating capital inflows, expanding diversification opportunities and lowering the cost of capital. The other outcome is that it can leads to low investment and low growth.

Phylaktis et al. (1996) examine the relationship between total trading volume and conditional volatility. They divide the sample period into two sub-periods with respect to size of the market to examine and compare the relationship between total trading volume and conditional volatility. The outcome is that total trading volume is a good proxy for information flow. It was also discovered that the GARCH effect decline after total trading volume is included in the model. Comparing the results for the two periods, it was established that, as the size of the market increases, the information content of trading volume also increases.

Sharma et al. (1996) also confirms that inclusion of volume in the conditional volatility model gives rise to a notable reduction but not to a complete disappearance of the GARCH effects in the case of NYSE. Their results are weaker than those of Lamoureux and Lastrapes (1990). Sharma et al. (1996) attribute this to volume being a poor proxy for the news arrival that contributes conditional heteroskedasticity to market-wide returns. Their argument is based on the difference between an individual stock and a market portfolio regarding the extent to which systematic and firm-specific factors affect their volume and return volatility. Both factors affect both volume and return volatility for individual stocks. While both factors affect market volume, only systematic factors affect market index volatility.

Pyun et al. (2000) provide firm-level evidence using 15 individual stocks listed in the Korean Stock Market from 1990 to 1994. Their paper analyzes the relationship between volatility spillover and information flow for firms with different sizes. The authors report that total trading volume reduces the GARCH effect and volatility spillover occurs only from large to small firms, not vice versa.

Employing the same method and sample period as Lamoureux and Lastrapes (1990), Omran and McKenzie (2000) tests show that their GARCH model cannot fully capture the volatility persistence in their data even though their results were consistent with them. Miyakoshi (2002) investigates the effects of total trading volume on conditional volatility persistence for both individual stocks and the market index of the Tokyo Stock Exchange. The results show that trading volume reduces the GARCH effect, both for individual stocks and the market index. The results are consistent with the view that total trading volume is a good proxy for information flow. Bohl and Henke (2003) observe a decline in conditional volatility persistence after including total trading volume in the model. They argue that their results are consistent with the previous studies done in developed stock markets. Wang et al. (2005) examine the relationship between total trading volume and volatility and concluded that trading volume can be a proxy for information flow for individual stocks, but not for the market indices. The reason for this is asynchronous information arrivals for each firm listed in the index.

Wagner and Marsh (2005) and Arago and Nieto (2005) use unexpected trading volume (surprise volume) as a proxy for information flow and examine its relationship with conditional volatility for developed stock markets. They discovered a significant positive relationship between surprise trading volume and conditional volatility, and that including surprise trading volume in the model gives rise to a moderate decrease in volatility persistence. They also detect that there is an asymmetric relationship between surprise volume and conditional volatility, meaning that compared to negative surprise volume positive surprise volume has a significantly greater effect on conditional volatility.

Arago and Nieto (2005) also using unexpected trading volume as a proxy for the information flow results conflict with Wagner and Marsh's. The inclusion of neither total volume nor its predictable and unpredictable components leads to a substantial reduction in volatility persistence. Indication regarding the adequacy of trading volume as a proxy for information arrival as reported by studies that performed a stock-level analysis and firm level analysis are the same (either a considerable or complete reduction in GARCH effects). Mattes (2012) studied volatility dynamics in five African stock markets. It is found that African volatility is persistence and volatility linkages exist between the five markets and the overseas markets.

3. METHODOLOGY

Following Glosten et al. (1993) and Zakoian (1994), we use an asymmetric GARCH method known as Threshold GARCH (TGARCH) to model stock return volatility. The model captures asymmetric characteristics such as the leverage effect, in which negative shocks have a greater impact on conditional volatility than positive shocks of the same magnitude. The TGARCH specification also captures volatility clustering, i.e. when large (small) price changes tend to follow large (small) price changes. Further, the TGARCH model allows accounting for leptokurtosis and skewness, both of which indicate departure from normality of the data, and both of which are regarded as well known characteristics of daily stock returns and in our case the closing stock price.

The data set for 13 stocks listed on the market was gathered GSE. The variables in the data set are GSE closing stock price and daily trading volumes for the period from 3rd January 2000 to 31st August 2009. The daily market returns, Rt, are calculated as the logarithmic first differences of the daily closing stock price.

Below is the Threshold GARCH (1, 1); Model 1

$$R_t = \alpha + \partial R_{t-1} + \varepsilon_t$$

$$\sigma_t^2 = \gamma + \omega\varepsilon_{t-1}^2 + \eta\varepsilon_{t-1}^2 d_{t-1} + \psi\sigma_{t-1}^2 \qquad 1$$

Where R_t is the realized return of stock expressed as a random walk process with an error term of mean zero and conditional variance σ_t^2. The conditional variance σ_t^2 is specified as a function of the mean volatility γ, ε_{t-1}^2, which is the lag of the squared residual from the mean equation (the ARCH term) and which provides news about volatility clustering. σ_{t-1}^2, which is last period's forecast variance (the GARCH term) and finally, the term for capturing the asymmetry, $\varepsilon_t^2 d_{t-1}$. The parameter $d_t = 1$ if $\varepsilon_t < 0$, and zero (0) otherwise, so that good news ($\varepsilon_t < 0$) are allowed to have different impacts on the conditional variance; good news has an impact of ω, while bad news has an impact of $\omega + \eta$. Accordingly, if $\eta > 0$, a leverage effect exists: bad news has a greater impact than good news. Owing to the well-known non-normality of the disturbance term (ε_t), the distribution is better approximated by the General Error Density (GED) distribution.

In model 2 we include in the mean equation a dummy variable to control for FINSSP. Model 1 is developed into model 3 by extend the TGARCH specification to investigate the volume-volatility relationship as suggested by Lamoureux and Lastrapes (1990). Under MDH, the variance of daily price increments is heteroskedastic and positively related to the rate of daily information arrival. Accordingly, the unexpected price change in a day, ε_t, will be the sum of a number of intra-day price changes. GARCH effects may be explained as a manifestation of time dependence in the rate of evolution of intra-day price changes driven by new information arrival. Following earlier studies, we use daily trading volume as a proxy for the unobservable new information arrival.

Assuming that the daily number of information arrivals is serially correlated, equation (1) can be modified as follows:

Model 3

$$R_t = \alpha + \partial R_{t-1} + \varepsilon_t$$

$$\sigma_t^2 = \gamma + \omega\varepsilon_{t-1}^2 + \eta\varepsilon_{t-1}^2 d_{t-1} + \zeta_0 v_{t-1} \qquad 3$$

where v_{t-1} is the detrended trading volume. We use lagged volume for representing contemporaneous volume to avoid the problem of simultaneity since lagged values of endogenous variables are classified as predetermined (Harvey, 1989). As in the case of equation (1), equation (3) is also estimated under the GED distribution assumption.

We hypothesize that the more efficient the trading system, the higher will be the informational content of trading volume, reflecting a higher level of transparency of transactions.

Model 4 is a modification of model 2 to control for the effect of FINSSP in the mean equation. Model 5, we examine whether surprises in trading activity convey more information and thus have a larger effect on return volatility than expected activity. As mentioned earlier, trading volume, being serially correlated, is highly predictable. Accordingly, we apply ARMA(p,q) processes to partition activity into expected and unexpected components as follows:

$$EV_t = \sum_{i=1}^{p} \beta_i V_{t-1} + \sum_{j=1}^{p} \delta_j \varepsilon_{t-j} + Dum_t + \varepsilon_t \qquad 4$$

And $$UV_t = V_t - EV_t \qquad 5$$

where V_t is the observed volume at time t; EV_t is the expected volume at time t; UV_t is the unexpected volume at time t, and "Dum" is a dummy variable that controls for the day of the week. As in Arago and Nieto (2005), for the first forecast, we use data for total daily volume corresponding to the first six months. From then on, the ARMA models are estimated using a moving window which drops the first day of the series and introduces the following day. Consequently, the ARMA model always uses information from the immediately preceding six months. For each stock, we have a series of daily volume, expected volume and unexpected volume. In order to examine the impact of unexpected volume of information, we investigate an expanded version of model 3 which gives us model 5. The expanded version of model 4 gives us model 6 to bring to light the effect of FINSSP on the individual stocks on the market.

Model 5

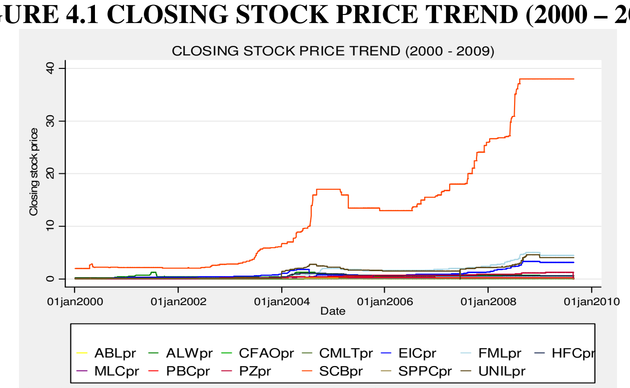
$$R_t = a + \partial R_{t-1} + \varepsilon_t$$
$$\sigma_t^2 = \gamma + \omega \varepsilon_{t-1}^2 + \eta \varepsilon_{t-1}^2 d_{t-1} + \psi \sigma_{t-1}^2 + \zeta_1 EV_{t-1} + \zeta_2 UV_{t-1} \qquad 6$$

where EV_{t-1} and UV_{t-1} represent the expected and unexpected components of volume at t-1, respectively. We use lagged variables as proxies for contemporaneous volume to avoid the problem of simultaneity and we estimate all the models under the GED distribution assumption.

4 DISCRIPTIVE STATISTICS

To assess the distributional properties of the daily closing stock price and volume, various descriptive statistics are reported in the "sample statistics" sections in Table 4.1 below. We have thirteen (13) stocks covering the period under study giving us total observation of between 1836 – 1858. The daily closing stock prices are calculated as the logarithmic first difference of the closing stock price for each of the 13 stocks used in our sample. To capture the effect of FINSSP, the sample was divided into period before the FINSSP that is from 2000 to end of 2003 and the period 2004 to August 2009. The Before FINSSP 2004 (B2004) gave us a total of between 588 to 610 observations. For the period After FINSSP 2004 (A2004) we had 1248 observations.

FIGURE 4.1 CLOSING STOCK PRICE TREND (2000 – 2009)



SOURCE: DRAWN WITH DATA FROM GSE USING STATA

For the entire period the stock with maximum change in mean closing stock price is SCB (15.37) and the minimum is CFAO (0.026). The standard deviation also ranges between 12.12 (SCB stock) to low of 0.016 (CFAO). In other words the stock with highest volatility on the market for the period under study is SCB stocks and lowest is CFAO stocks. The range of skewness and kurtosis are given as in table 4.1. The mean Total Trading Volume ranges between 2.22 high (stock of ALW) to 0.235 low (stock of CML). In the case of the Unexpected Trading Volume it ranges between a high of 0.002 (FML) to a low of -0.005 (PBC). The variability of the unexpected trading volume also ranges between 1.75 (ALW) to a low of 0.724 (CML).

Skewness and kurtosis are terms that describe the shape and symmetry of a distribution of scores. Skewness refers to whether the distribution is symmetrical with respect to its dispersion from the mean. For a normal distribution the skewness is zero (0) and for excess kurtosis it is three (0). If on one side of the mean has extreme scores but the other does not, the distribution is said to be skewed. If the dispersion of scores on either side of the mean is roughly symmetrical the distribution is said to be not skewed. Kurtosis on the other hand refers to the weight of the tails of a distribution. Distributions where a large proportion of the scores are towards the extremes are said to be platykurtic. If on the other hand, the scores are bunched up near the mean, the distribution is said to be leptokurtic that is, excess kurtosis is positive. A normally distributed of scores is said to be mesokurtic that is excess kurtosis is positive.
The skewness of the entire period closing stock price also ranges from a high of 1.693 (stock of SPP) to a low of -0.451 (stock of MLC). Six out of the thirteen stocks are negatively skewness. Kurtosis of closing stocks price on the other hand ranges between 4.618 (stock of SPP) to a minimum of 1.23 (stocks of CFAO). Appendix A1 shows Shapiro – Wilk W test for normal data and it points out that all the variables are not mesokurtic. This means that the variables are not normally distributed. The large values of V are the indication nonnormality.

The descriptive statistic for closing stock price, total trading volume, expected trading volume and unexpected trading volume for the period B2004 are presented in appendix A2 and that of A2004 presented in appendix A3. Appendix A2 shows that the mean of daily closing stock prices ranges from between 2.763 (SCB) to 0.006 (CFAO). For A2004 it ranges between 21.534 (SCB) to 0.03556 (CFAO). For the two subsamples the maximum mean daily closing stock prices increased by 679% and the minimum also increased by 508%. The maximum mean of total stocks traded dropped by 32%. The variability of unexpected trading volume for the two subsamples changed by -3%.

5. RESULTS

To determine whether the series for the various stocks are a good candidate for ARCH modeling, we fit a constant-only model by OLS and test ARCH effects by using Engle's Lagrange-multiplier Test. Because the p-value for the stocks presented in table 4.2 below are all zeros to four decimal places we strongly reject the null hypothesis that there are no ARCH (1) effect which implies we have to model conditional variance in our model. The first-order generalized ARCH model (GARCH, Bollersklev 1986) is the most commonly used specification for the conditional variance in empirical work and is typically written GARCH(1; 1). We can estimate a GARCH(1; 1) process for all the stocks to determine the volatility of each stock.

Table 4.1 DESCRIPTIVE STATISTICS

stocks	Variable	N	Mean	sd	Skewness	kurtosis	Max	Min
abl	ΔCS	1858	0.0979	0.0391	-0.4421	1.6521	0.1480	0.0320
	TV	1840	0.6856	1.4529	1.7883	4.4464	4.6347	0.0000
	EV	1836	0.6852	0.8332	1.2151	3.8921	3.9098	0.0000
	UEV	1836	0.0005	1.1840	1.0070	4.4654	3.7078	-3.2535
alw	ΔCS	1858	0.6114	0.2132	0.7248	4.0027	1.2500	0.2400
	TV	1840	2.2221	2.3834	0.2953	1.2668	5.7071	0.0000
	EV	1836	2.2244	1.6140	-0.0203	1.7422	5.4299	0.0000
	UEV	1836	-0.0032	1.7552	0.0170	2.7470	4.5078	-4.2594
cfao	ΔCS	1858	0.0258	0.0160	-0.3283	1.2292	0.0500	0.0038
	TV	1840	1.0141	1.8356	1.4017	3.1559	5.2523	0.0000
	EV	1836	1.0080	1.1017	1.2380	4.2541	5.1088	0.0000
	UEV	1836	0.0003	1.4747	0.7875	3.7131	4.2018	-4.0060
cml	ΔCS	1858	0.1190	0.0587	-0.3735	1.2446	0.1800	0.0400
	TV	1840	0.2354	0.8483	3.5695	14.2788	4.1431	0.0000
	EV	1836	0.2348	0.4403	2.1203	7.6264	2.6789	0.0000
	UEV	1836	-0.0007	0.7273	2.1416	10.6846	3.3145	-2.2815
eic	ΔCS	1858	1.1280	0.9527	1.2697	3.3033	3.3000	0.1900
	TV	1840	1.7380	2.1274	0.5711	1.5152	5.2470	0.0000
	EV	1836	1.7408	1.2922	0.3227	2.1052	4.9600	0.0000
	UEV	1836	-0.0007	1.7022	0.2902	2.5667	4.1806	-4.0227
fml	ΔCS	1858	1.6893	1.5102	0.7867	2.6082	5.0000	0.0000
	TV	1840	1.7923	2.0313	0.4161	1.3725	5.0499	0.0000
	EV	1836	1.7909	1.1289	0.2576	2.3524	4.7327	0.0000
	UEV	1836	0.0022	1.7005	0.2467	2.2768	4.0399	-3.8677
hfc	ΔCS	1858	0.4774	0.2733	-0.1111	2.1633	1.0100	0.0000
	TV	1840	1.2098	1.9816	1.1484	2.4884	5.3471	0.0000
	EV	1836	1.2092	1.3193	0.9250	2.7803	5.1355	0.0000
	UEV	1836	-0.0050	1.4921	0.5376	3.7492	4.2102	-4.1658
mlc	ΔCS	1858	0.1635	0.1037	-0.4507	1.6094	0.3100	0.0100
	TV	1840	0.7256	1.5439	1.7911	4.4284	4.8442	0.0000
	EV	1836	0.7253	0.9075	1.3309	4.3792	4.3711	0.0000
	UEV	1836	-0.0012	1.2524	0.9780	4.4720	3.8754	-3.5284
pbc	ΔCS	1858	0.2024	0.1125	-0.3506	1.6746	0.3900	0.0000
	TV	1840	0.6764	1.5404	1.9638	5.0694	5.0239	0.0000
	EV	1836	0.6729	1.1138	1.9443	6.1483	4.8344	0.0000
	UEV	1836	-0.0050	1.0659	1.2004	6.8932	4.0138	-3.8523
pz	ΔCS	1858	0.5547	0.3615	0.1492	1.9189	1.2000	0.0000
	TV	1840	0.5505	1.2710	2.0251	5.3565	4.2341	0.0000
	EV	1836	0.5517	0.6340	1.1658	4.2075	3.3720	0.0000
	UEV	1836	0.0000	1.0963	1.2898	4.6789	3.3873	-2.5281
scb	ΔCS	1858	15.3712	12.1210	0.6662	2.3069	38.0000	0.0000
	TV	1840	1.3388	1.8096	0.7509	1.7558	4.6347	0.0000
	EV	1836	1.3374	0.9620	0.4549	2.5803	4.2559	0.0000
	UEV	1836	-0.0006	1.5414	0.3889	2.3957	3.6921	-3.6039
spp	ΔCS	1858	0.0436	0.0231	1.6930	4.6176	0.1000	0.0200
	TV	1840	0.3210	1.0000	2.9234	9.8511	4.1589	0.0000
	EV	1836	0.3217	0.5314	1.9480	7.2355	3.5385	0.0000
	UEV	1836	0.0000	0.8461	1.7443	7.8475	3.3145	-2.7483
unil	ΔCS	1858	1.6224	1.2940	0.6329	2.6486	4.6000	0.0000
	TV	1840	1.8733	2.0485	0.3555	1.3502	5.1059	0.0000
	EV	1836	1.8735	1.1861	0.0375	2.1059	4.7812	0.0000
	UEV	1836	-0.0027	1.6842	0.0897	2.2922	4.0244	-3.7743

Table 4.2 LM test for autoregressive conditional heteroskedasticity (ARCH)

STOCK	Abl	Alw	Cfao	Cmlt	Eic	fml	Hfc	Mlc	Pbc	Pz	Scb	Sppc	Unil
chi2	796.997	793.779	796.018	796.568	798.194	797.56	798.34	797.74	687.28	797.43	797.173	797.342	795.23

The results for the benchmark model (model 1) are presented in table 6.3 below. They show that volatility persistence, as measured by the sum of all the ARCH and GARCH coefficients ranges between a low of 0.103

(scb) to a high of 0.9867 (fml). That gives an average volatility of 0.545. Four stocks (eic, fml, hfc and pbc) have volatility persistence more than 0.5. The stocks with low volatility persistence are five stocks (alw, cfao, mlc, scb and sppc) with the rest of the stock not significant. In other words we have more stock having their volatility decaying faster as their value is less than 0.5. If the volatility persistence is less than one allows for the existence of a stationary situation. On the other hand if it is greater or equal to one, corresponds to the case of an integrated process. A value more than one or equal to one implies that the response function of volatility is explosive and a value less than unity implies that the response to volatility shocks declines over time**.** The GARCH coefficient which measures the extent to which volatility shock today feeds through into next period volatility, seven stocks were significant. The statistical significant GARCH coefficients range between a high of 0.986 (fml) to a low of 0.209 (sppc). ARCH(1) and GARCH(1) coefficients are significant collectively for nine (9) of thirteen (13) stocks at 1% significantly with only one being significant at 10%. Volatility persistence is very high in five (5) stocks (abl, cmlt, eic, fml and pz) that are greater than one which implies nonstationarity in the variance of these stocks. Even though the volatility persistence for abl is not one, it is approximately one.
Specifying threshold ARCH terms and adding TARCH is another way to make the standard ARCH and GARCH models respond asymmetrically to positive and negative innovations. Specifying tarch(1) with arch(1) and GARCH(1) corresponds to one form of the GJR model (Glosten Jagannathan and Runkle, 1993). There is this assertion that firms on the stock market respond differently to unanticipated increases in stock prices than it does to unanticipated decreases. To test that our data support this supposition we specified an ARCH model that allows an asymmetric effect of “news” (innovations or unanticipated changes). In model 1, three of the stocks (fml, mlc and pbc) sampled have statistical significant TARCH effect. Of the three fml had negative asymmetric effect. The mean volatility is statistically significant in six (6) stocks and of the six stocks two were negatively correlated with conditional variance.
Table 4.3 point out that the shape of all the 13 stocks are all less than 2 indicating that the distribution of the errors have tails that are fatter than they would be if the errors were normally distributed. By implication the distribution is leptokurtotic, meaning the extreme closing stock prices are more frequent than would be expected if the closing stock prices were normally distributed.

Model 2 take into consideration the impact of FINSSP on volatility of firms listed on Ghana Stock Exchange. Volatility of firms listed on the market did not change much with the introduction of a dummy variable for FINSSP. The GARCH coefficient which measures the extent to which volatility shock today feeds through into next period volatility, eight stocks were significant. The GARCH coefficient range between a low of 0.00 (abl) to high of 0.993 (unil). The volatility persistence is all below one with exception of one stock (unil). The range is between a low of 0.0004 (alw) to high of 1.18 (unil) giving us an average of volatility persistence of 0.5902. The volatility persistence as measured by the sum of all GARCH coefficients, is higher than 0.5 for six (6). This finding implies not only high volatility persistence but also nonstationarity in the variance of the closing stock prices for unil. In other words autocorrelation decays faster in two of the eight significant stocks. Put differently if the value is equal or greater than one response function of volatility is explosive and a value less than unity implies that the response to volatility shocks declines over time.

The effect of FINSSP is statistical significant in seven (7) stocks (abl, alw, cfao, fml, mlc, pz and scb). The impact was negative for fml and pz even though the sign is not as expected. The leverage effect is negative and statistically significant in three stocks (abl, cfao and fml) after the introduction of FINSSP which means that bad news generates less volatility than good news. This result is consistent with Guner et al (2008), Wagner et al. (2005) and Arago and Nieto (2005). There are not much significant changes in the distribution of the errors of the various stocks after the year 2004.
Table 4.4 below shows that, the lags of closing stock prices for all the thirteen stocks are statistically significant in explaining the conditional volatility of the stocks on GSE market. ARCH effects for the 13 stocks were all statistically insignificant at all the conversational significant levels whiles eight of the stocks (ablp, alw, cfao, eic, hfc, mlc, pbc and unil) were statistically significant in relation to the GARCH effect. But the p-value for ARCH (1) and GARCH (1) coefficients are statistically significant collectively for eight (8) of thirteen (13) stocks at 1% significant level. The number of statistically significant p-values of joint test of significance for ARCH (1) and GARCH (1) did not change much in relation to model one. The difference is that some stocks that turnout significant in model one some turnout to be statistically insignificant and the vice versa. These stocks alw, cfao, eic and hfc were statistical significant in both situations.
Controlling for FINSSP in model 2 the lowest volatility persistence is 0.0004 (abl) and the highest is 1.18 (unil) an average of 0.5902. The number of stocks with volatility persistence greater than 0.5 are six (6) stocks. As the volatility persistence increased in some stocks it deceased in some stocks as well when we control for FINSSP.

The leverage effect did not change much after the introduction of FINSSP. In other words the negative leverage effect in model one did not change. All other stocks were not statistically significant. The negative leverage effect indicate that the stocks responds with much more volatility to unexpected drops in closing stock price (bad news) than it does to increases in closing stock price (good news). Table 4.4 also point out that the shape of all the 13 stocks are all less than 2 indicating that the distribution of the errors have tails that are fatter than they would be if the errors were normally distributed.

Table 4.3 RESULTS OF ESTIMATING GARCH(p, q) - THRESHOLD ARCH MODEL 1

Firm				ARMA				ARCH		TARCH	GARCH				G/ARCH
		Lcspr	Cons	ar(L1)	ar(L2)	ma (L1)	ma (L7)	(L1)	(L2)	(L1)	(L1)	(L2)	cons	shape	P-VAL
Abl	Coef.	1.0007	-0.0001					0.0003		-0.2184	0.9554		0.0000	1.8148	0.5893
	Std.Err.	0.0017	0.0002					0.0016		0.3513	0.9845		0.0000	0.0206	
Alw	Coef.	0.9951	0.0037	-1.5920		1.6308	0.0121	0.0060		0.0530	0.2660		0.0000	1.4272	0.0000
	Std.Err.	0.0013	0.0008	0.7341		0.7006	0.0115	0.0240		0.0294	0.0170		0.0000	0.0230	
Cfao	Coef.	0.9970	0.0001	-1.1780		1.3505	0.0162	0.0010		0.0025	0.4500		0.0000	1.4971	0.0000
	Std.Err.	0.0013	0.0001	0.4393		0.4074	0.0052	0.0008		0.0021	0.0300		0.0000	0.0284	
Cmlt	Coef.	1.0007	-0.0001		3.04	0.5804	-0.0599	0.8788		4.3052	0.1480		0.0000	1.4054	0.9345
	Std.Err.	0.0138	0.0029		47.96	3.7904	0.4964	3.0870		257.90	3.6880		0.0000	0.1156	
Eic	Coef.	1.0022	-0.0005	0.1126		-0.1148	0.0720	0.0050		-0.0130	0.9760		0.0002	1.9406	0.0000
	Std.Err.	0.0195	0.0384	10.0400		9.8110	0.8267	4.0940		4.1027	0.2360		0.0000	0.1819	
Fml	Coef.	0.9921	0.0703	-0.3910		-0.4248	0.8631	0.0004		-0.0060	0.9863		0.0040	1.2374	0.0000
	Std.Err.	0.0031	0.0085	0.0426		0.0103	0.0016	0.0010		0.0009	0.0740		0.0006	0.0269	
Hfc	Coef.	0.9913	0.0048	-0.0940		0.1065	0.0167	0.0020		-0.0020	0.8890		0.0005	1.3777	0.0000
	Std.Err.	0.0312	0.0186	22.6330		22.6180	0.7773	0.5480		0.5992	0.0210		0.0003	0.6039	
Mlc	Coef.	0.9997	0.0001				0.9331	0.0880		0.0400	0.0970		0.0000	0.7819	0.0237
	Std.Err.	0.0001	0.0000				0.1135	0.0820		0.0055	0.0850		0.0000	0.0129	
Pbc	Coef.	1.0738	-0.0198	-0.3900		0.0593	-0.1632	0.0007		0.3446	0.6230		0.0001	1.2829	0.0000
	Std.Err.	0.0120	0.0032	0.4283		0.2720	0.0218	0.0010		0.0865	0.0680		0.0000	0.0405	
Pz	Coef.	0.9984	0.0036	-1.1170		0.5858	-0.1811	0.8840		1.9672	0.0080		0.0009	1.3485	0.9800
	Std.Err.	0.0093	0.0080	0.4795		0.5471	0.2326	9.3900		9.4018	0.2830		0.0003	0.0479	
Scb	Coef.	1.0083	-0.0927	-0.0460		-0.1670	0.1054		0.0600	0.1719		0.0430	0.1780	1.2000	0.0000
	Std.Err.	0.0020	0.0398	0.6895		0.6172	0.0488		0.0831	0.3092		0.0830	0.0270	0.0277	
Sppc	Coef.	1.0002	-0.0001	0.5690		-0.6902	0.0072	0.0080		-0.0040	0.2090		0.0000	1.5861	0.0000
	Std.Err.	0.0017	0.0004	0.5604		0.5499	0.0235	0.0030		0.0027	0.0460		0.0000	0.0906	
Unil	Coef.	1.0292	0.0097	-0.1100		0.0625	-0.0480	0.4280		0.3362	0.2050		0.0180	1.2828	0.7538
	Std.Err.	0.0152	0.0396	1.4864		1.4006	0.1196	1.4620		1.9319	0.3630		0.0170	0.6769	

Table 4.4 RESULTS OF ESTIMATING GARCH(p, q) - THRESHOLD ARCH MODEL 2(FINSS)

Firm		VARIABLES		ARMA			ARCH	TARCH	GARCH		Shape	G/ARCH
		Lcsp	Dumfinss	ar(L1)	ma (L1)	ma (L7)	(L1)	(L1)	(L1)	Const		P-VALUE
Abl	Coef.	0.9971	0.0008				0.0004	-0.1467	0.0000		1.5607	0.0000
	Std.Err.	0.0003	0.0001				0.0002	0.0572	0.0000		0.01714	
Alw	Coef.	0.9806	0.0123	1.2530	-1.0863	0.1449	0.0020	0.0001	0.4140		1.4283	0.0000
	Std.Err.	0.0035	0.0023	0.0663	0.0764	0.0148	0.0060	0.0061	0.0440		0.0298	
Cfao	Coef.	0.9970	0.0001	-1.4083	1.5619	0.0108	0.0022	-0.0038	0.5260	2.76E-09	1.4042	0.0000
	Std.Err.	0.0010	0.0000	0.4151	0.4048	0.0053	0.0012	0.0015	0.0244	2.25E-10	0.0266	
Cmlt	Coef.	0.9984	0.0003	0.7900	0.4264	0.4487	0.5680	1.2153	0.0330		1.3332	0.9912
	Std.Err.	0.0088	0.0015	2.4209	2.9837	1.5272	49.0700	48.4620	0.2450		0.02625	
Eic	Coef.	1.0055	-0.0073	0.0157	-0.0103	0.0625	0.0020	-0.0280	0.9780		1.8656	0.0000
	Std.Err.	0.0198	0.0391	7.4368	7.2963	0.8537	3.5080	3.5195	0.1610		0.1896	
Fml	Coef.	1.0253	-0.0273	-0.0190	-0.0200	0.0588	0.0000	-0.0005	0.0740		1.9641	0.9946
	Std.Err.	0.0054	0.0114	0.4050	0.2567	0.0089	0.0002	0.0001	4.4160		0.0471	
Hfc	Coef.	0.9891	0.0065	-0.3190	0.3664	0.0132	0.0020	-0.0009	0.7580		1.319	0.0000
	Std.Err.	0.0409	0.0241	18.9330	19.1265	0.6059	1.4710	0.8433	0.0440		0.4333	
Mlc	Coef.	0.9933	0.0013			0.9982	0.3640	0.2507	0.5980		1.4104	0.0000
	Std.Err.	0.0004	0.0001			0.0084	0.8330	0.8338	0.0880		0.017	
Pbc	Coef.	1.2338	-0.0573	0.9128	-0.3846	0.0422	0.0010	0.3392	0.6550		1.3973	0.0044
	Std.Err.	0.1898	0.0457	0.2661	0.5515	0.0450	0.0050	0.2052	0.2360		0.0456	
Pz	Coef.	1.0177	-0.0074	-0.1620	0.8449	-0.3464	0.0140	1.5363	0.0170		0.6019	0.5443
	Std.Err.	0.0019	0.0014	0.0532	0.0327	0.0140	0.0260	1.5823	0.0180		0.0204	
Scb	Coef.	1.0010	0.3635	0.2801	-0.1541	0.0053	0.9960	1.4976	0.0030		1.1765	0.8647
	Std.Err.	0.0031	0.1493	0.8557	0.8778	0.1034	0.3010	4.2558	0.0260		0.095	
Sppc	Coef.	1.0048	-0.0003	1.9885	-1.7843	0.0016	0.9770	-2.1390	0.5630		1.7128	0.5464
	Std.Err.	0.0206	0.0011	1.7808	2.0093	0.0257	0.2350	28.3720	0.5980		0.0407	
Unil	Coef.	1.0372	0.0171	-0.1080	0.0755	0.0207	0.1900	-0.1280	0.9930		1.902	0.0000
	Std.Err.	0.0117	0.0247	2.8588	2.8391	0.0942	0.3350	0.3896	0.0020		0.4713	

Volatility And Trading Volume

Table 4.5 reports the estimation results of the model 3, where total trading volume is used as a proxy for information flow. They show that total trading volume has a statistically significant effect on conditional volatility of nine (9) stocks (abl, cfao, eic, fml, hfc, pbc, pz, sppc and unil). Of the nine stocks four of them have negative effect on conditional volatility of the stocks' closing stock price.

The GARCH coefficient which measures the extent to which volatility shock today feeds through into next period volatility, five stocks were significant. The range of the volatility coefficient ranges between a low of 0.0001 (abl) to high of 0.976 (mlc). Volatility persistence is also statistical significant in nine stocks. The strength of the volatility persistence ranges between a low of 0.0001 (abl) to high of 1.303 (mlc) an average of 0.6516. Here only one (1) stock has volatility persistence greater than one an indication of nonstationarity in the

variance of closing stock price. The GARCH coefficients are statistically significant in nine (9) out of the thirteen (13) stocks. Table 4.5 shows a reduction in the number of stocks with nonstationarity in the variance of closing stock price of the stocks from two to one. Seven of the thirteen stocks were significant to TARCH effect and of the seven stocks (cfao, eic, mlc, pz scb sppc and unil) three (3) stocks (cfao, eic and sppc) had negative effect on volatility of the closing stock price of those stocks.
The shape of five stocks were greater than two (2) indicating that the distribution of their errors do not have tails that are fatter than they would be if the errors were normally distributed. In others words five stocks have the distribution of their errors normally distributed as portrayed in table 4.5 below.

Table 4.5 RESULTS OF ESTIMATING GARCH(p, q) - THRESHOLD ARCH MODEL 3

Firm		VARIABLES		ARMA				HET		ARCH		TARCH	GARCH		shape	G/ARCH
		Lcsp	Cons	ar(L1)	ar(L2)	ma (L1)	ma (L7)	Tva	_cons	(L1)	(L2)	(L1)	(L1)	(L2)		P-VALUE
Abl	Coef.	0.9978	0.0003				0.8581	1.5252	-21.9477	0.0000		-0.0001	0.0000	0.0001	1.9182	0.0000
	Std.Err.	0.0001	0.0000				0.0077	0.0330	0.1148	0.0000		0.0003	0.0003	0.0000	0.0201	
Alw	Coef.	1.0529	0.0496		0.9664	0.9567	-0.0654	0.0342	-6.3319	0.4692		-4.5332	0.1338		2.0648	0.9497
	Std.Err.	0.3826	0.2575		0.4012	0.4086	0.3565	0.0530	0.2177	1.6422		18.9398	0.9087		1.7423	
Cfao	Coef.	1.0024	-0.0001	-3.4405		3.4967	0.0233	-0.1996	-22.439	0.0000		-0.0001	-0.0430		1.9728	0.0000
	Std.Err.	0.0001	0.0000	0.0335		0.0325	0.0003	0.0013	0.0090	0.0000		0.0000	0.0006		0.0033	
Cmlt	Coef.	1.0000	0.0000		0.1987	0.7010	0.6064	-13.253	-18.7041	0.9860		-1.6008	0.0002		1.5300	0.7171
	Std.Err.	0.0018	0.0003		54.5196	16.9713	8.1331	14.0890	0.0920	535.503		1523.528	0.0003		0.0188	
Eic	Coef.	1.0018	-0.0010	0.0249		0.0829	0.0412	0.0012	-11.3213	0.0637		-0.0632	0.0272		1.9393	0.0000
	Std.Err.	0.0001	0.0003	0.0785		0.0804	0.0053	0.0002	0.0258	0.0069		0.0069	0.0151		0.0055	
Fml	Coef.	0.9991	0.0056	0.1099		-0.0854	-0.0392	0.0733	-8.8482	0.0000		0.0001	0.0186		2.0112	0.6410
	Std.Err.	0.0005	0.0018	0.1142		0.0738	0.0015	0.0026	0.0031	0.0000		0.0004	0.0213		0.0076	
Hfc	Coef.	1.0000	0.0000	-2.7989		2.8085	0.0026	0.3409	-17.1769	0.0000		0.0000	0.1335		1.9193	0.0000
	Std.Err.	0.0010	0.0006	1.3962		1.3870	0.0023	0.0043	0.0611	0.0006		0.0006	0.0180		0.0194	
Mlc	Coef.		0.1591					0.0000	-4.4316	0.3268		0.7157	0.9760		1.9731	0.0000
	Std.Err.		0.0016					0.0008	0.0028	0.1776		0.1651	0.0024		0.9617	
Pbc	Coef.	0.9911	0.0019	0.0513		-0.0530	-0.0163	-1.0255	-11.5968	0.0000		-0.0004	0.0010		2.0998	0.9066
	Std.Err.	0.0317	0.0065	7.2907		3.7637	0.0093	0.0769	0.0320	0.0026		0.0399	0.0026		0.0090	
Pz	Coef.	1.0003	0.0000	0.2038		-0.1609	0.0465	-0.6529	-9.3055	0.8446		0.8386	0.0230		1.9366	0.0095
	Std.Err.	0.0055	0.0047	7.2888		7.2599	0.0895	0.0541	0.0649	0.3135		0.3175	0.0126		0.0199	
Scb	Coef.	0.9992	-0.7617	1.8630		-2.6489	0.1113	-0.1481	-2.0009		0.0330	0.3082		0.0299	2.0163	0.0002
	Std.Err.	0.0012	0.0527	0.1413		0.0747	0.0070	0.1470	0.4290		0.0127	0.0183		0.0186	0.0987	
Sppc	Coef.	1.0006	0.0001	-4.6993		4.6987	0.0002	0.2576	-15.9610		0.0011	-0.0011		0.0011	1.9280	0.0040
	Std.Err.	0.0004	0.0001	33.0906		33.0948	0.0050	0.0054	0.1181		0.0006	0.0002		0.0011	0.0438	
Unil	Coef.	0.9963	0.0238	-0.8479			0.3394	-0.5067	-8.5988	0.0002		0.0002		0.0822	2.0445	0.0000
	Std.Err.	0.0001	0.0002	0.0028			0.0011	0.0027	0.0020	0.0000		0.0000		0.0021	0.0009	

Table 4.6 RESULTS OF ESTIMATING GARCH(p, q) - THRESHOLD ARCH MODEL 4

Firm		VARIABLES						HET		ARCH		TARCH	GARCH	shape	G/ARCH
		Lcsp	dumfinss	ar(L1)	ar(L2)	ma (L1)	ma (L7)	Tva	cons	(L1)	(L2)	(L1)	(L1)		P-VALUE
Abl	Coef.	1.000	0.000					0.187	-24.081	0.000		0.000	0.000	1.526	0.000
	Std.Err.	0.000	0.000					0.032	0.166	0.000		0.000	0.000	0.012	
Alw	Coef.	1.010	-0.001	1.016		0.606	0.165	0.113	-15.766	0.016		0.006	0.012	1.933	0.000
	Std.Err.	0.000	0.000	0.002		0.002	0.000	0.001	0.013	0.000		0.000	0.004	0.002	
Cfao	Coef.	0.543	0.017		0.442	-0.366	0.259	-0.205	-23.744	4.022		3.972	0.054	1.294	0.954
	Std.Err.	0.549	0.020		0.456	0.495	0.212	0.230	0.394	7.769		6.769	1.046	1.762	
Cmlt	Coef.	1.000	0.000		-0.062	0.299	-0.270	-11.327	-25.144	0.009		0.050	0.000	0.712	0.949
	Std.Err.	0.000	0.000		1.337	0.558	0.176	11.064	0.282	0.062		4.323	0.000	0.015	
Eic	Coef.	0.995	-0.004	0.983		-1.061	0.227	0.056	-11.640	-0.015		0.016	1.669	2.456	0.000
	Std.Err.	0.001	0.004	0.057		0.041	0.011	0.040	0.326	0.009		0.009	0.018	0.020	
Fml	Coef.	1.000	0.005	0.158		-0.110	-0.047	0.078	-8.876	0.000		0.002	0.027	2.011	0.144
	Std.Err.	0.000	0.002	0.084		0.056	0.002	0.002	0.023	0.000		0.015	0.018	0.010	
Hfc	Coef.	1.001	-0.001	-2.634		2.616	-0.001	0.345	-17.044	0.000		0.000	0.004	1.989	0.990
	Std.Err.	0.000	0.000	0.240		0.243	0.008	0.002	0.011	0.000		0.001	0.035	0.008	
Mlc	Coef.		0.207					0.353	-9.895	0.642		0.777	0.016	2.026	0.003
	Std.Err.		0.001					0.080	0.305	1.694		1.696	0.005	0.148	
Pbc	Coef.	1.014	0.003	-0.066		-0.066	0.608	3.675	-11.413	0.000		0.000	0.202	1.954	0.000
	Std.Err.	0.006	0.002	0.014		0.008	0.001	0.057	0.027	0.000		0.000	0.002	0.009	
Pz	Coef.	0.996	0.006	2.358		-2.285	0.003	-0.611	-9.356	-0.534		0.528	0.027	1.913	0.000
	Std.Err.	0.003	0.002	0.651		0.671	0.019	0.032	0.040	0.171		0.171	0.005	0.011	
Scb	Coef.	0.997	0.077	1.187		-0.951	0.073	-0.051	-2.948		-0.052	0.035	0.048	1.975	0.000
	Std.Err.	0.003	0.061	0.235		0.254	0.020	0.002	0.005		0.003	0.001	0.003	0.000	
Sppc	Coef.	1.001	0.000	-0.896		0.867	0.006	-0.017	-16.442		0.001	0.000	0.011	1.613	0.085
	Std.Err.	0.001	0.000	0.549		0.571	0.011	0.006	0.083		0.007	0.004	0.008	0.027	
Unil	Coef.	1.004	-0.008	-0.622			0.146	-0.507	-5.639	0.024		0.025	0.075	1.910	0.000
	Std.Err.	0.001	0.002	0.024			0.033	0.017	0.069	0.033		0.033	0.001	0.012	

Model 4 examines the impact of FINSSP on closing stock price volatility by including a Dummy variable for FINSSP in the mean equation. The impact of FINSSP is statistically significant for seven stocks. Of the seven stocks three stocks (alw, hfc and unil) were negative to FINSSP. Control for FINSSP in model 4 total trading volume of ten of the thirteen stocks turnout to be statistically significant. The coefficients of four (4) of the ten (10) stocks were negative as shown in table 4.6 above. These signs were not as expected. The introduction of FINSSP improved the results slightly in relations to model 3. Conditional volatility of closing stock price is statistically significant in eight stocks. The volatility in the stocks ranges from a low of 0.000 to high of 0.879 (eic) for stocks that have statistically significant GARCH effect. In case of volatility persistence it ranges from a low 0.00005 (abl) to high of 0.8637 (eic) an average of 0.4319 for model 4 whiles that of model 3 ranges between 0.0001 (abl) to 1.303 (mlc).

Comparatively the volatility persistence average for model 4 is 0.281 and that of model 3 is 0.287 for all the statistically significant stocks. It is also interesting to note that there is not much difference in the presence of volatility persistence for the two models but volatility persistence could be said to be high for model 4 than model 3 had it not being the high and nonstationarity volatility persistence in mlc stock for mdoel 3.

In the case of leverage effect on condition variance of closing stock prices, four stocks (abl, alw, pz and scb) turnout to be significant. The leverage effect is positive in all the four stocks. In regard to the leverage effect, the results from model four (4) shows reduction in the leverage effect as compared to leverage effect in model three (3). The shape for three stocks are greater than two which implies their distributions are not leptokurtotic.

Overall, the results in tables 4.3 and 4.5 show that the inclusion of total trading volume helps in explaining conditional volatility persistence. The results from model one gave us five stocks with less than 50% volatility persistence whiles model 3 gives us eight stocks with less than 50% volatility persistence. The implication here is that with the introduction of total volume traded, volatility persistence reduced for more stocks. These findings are consistent with those in Sharma et al. (1996) and thus gives support to their argument that volume may be a good proxy for stock –level analysis, but not for market-level analysis. Comparing mode two and four where dummy variable is introduced to measure the effect of FINSSP on volatility persistence the results was that volatility persistence was reduced under model four. The results from model two shows that four stocks have low volatility persistence of less than 0.5 whiles in the case model four, nine out of the thirteen stocks under review had volatility persistence less than 0.5. In the case of leverage effect, there is an increase in the effect from two stocks in model two to four stocks in model four. For the results from models one and three the leverage effect increased from three stocks to seven stocks.

Table 4.7 RESULTS OF ESTIMATING GARCH(p, q) - THRESHOLD ARCH MODEL 5

Firm		VARIABLES		ARMA				HET				ARCH		TARCH	GARCH		shape	G/ARCH
		Lcsp	Const	ar(L1)	ar(L2)	ma (L1)	ma (L7)	EV	UNV	DUM	CONST	(L1)	(L2)	(L1)	(L1)	(L2)		P-VALUE
Abl	Coef.	0.996	-0.001					4.866	-0.218	9.886	-22.929		0.017	0.070	0.000		2.484	0.0000
	Std.Err.	0.000	0.000					0.010	0.005	0.030	0.004		0.001	0.001	0.000		0.005	
Alw	Coef.	0.991	0.006		-0.024	0.438	0.151	0.300	1.781		-15.710	0.376		-0.359	0.071		1.145	0.0000
	Std.Err.	0.001	0.001		0.079	0.056	0.012	0.095	0.070		0.325	0.114		0.114	0.008		0.054	
Cfao	Coef.	0.999	0.000	0.236		-0.234	0.020	-0.231	-0.096		-22.406	0.000		0.000		0.001	1.991	0.0000
	Std.Err.	0.000	0.000	0.402		0.403	0.001	0.015	0.001		0.039	0.000		0.000		0.000	0.001	
Cmlt	Coef.	0.999	0.000	0.549		-0.283	0.048	0.935	-0.018	0.011	-17.130		0.044	-0.067	0.000		2.000	0.9719
	Std.Err.	0.582	0.087	1022.840		1481.950	138.374	0.287	0.122	0.083	0.644		0.209	19.590	0.223		0.322	
Eic	Coef.	0.995	0.027	1.008		-1.279	0.070	-0.154	0.131	1.715	-11.244	0.077		-0.077	0.070		2.010	0.0000
	Std.Err.	0.000	0.000	0.018		0.014	0.001	0.005	0.005	0.008	0.017	0.001		0.001	0.013		0.007	
Fml	Coef.	1.013	-0.004	0.055		-0.034	-0.262	0.289	0.069	0.567	-8.386	0.000		0.000	0.075		2.026	0.0044
	Std.Err.	0.000	0.001	0.046		0.023	0.004	0.006	0.004	0.028	0.008	0.000		0.000	0.023		0.018	
Hfc	Coef.	0.998	0.001		-0.041		-0.002	1.034	0.578	2.783	-19.169		0.002	0.002		0.323	0.616	0.0104
	Std.Err.	0.000	0.000		0.023		0.002	0.282	0.215	0.366	1.502		0.069	0.008		0.110	0.035	
Mlc	Coef.		0.210					0.141	-0.019	-2.056	-5.736		0.013	0.999	1.164		1.620	0.0000
	Std.Err.		0.002					0.005	0.002	0.014	0.006		0.016	0.028	0.032		0.030	
Pbc	Coef.	0.993	0.002					0.826	-0.159	-0.049	-13.651	0.000		0.000	0.005		1.999	0.0000
	Std.Err.	0.000	0.000					0.050	0.046	0.037	0.039	0.000		0.000	0.000		0.001	
Pz	Coef.	0.990	0.008	-0.625		0.607	-0.031	-0.912	-0.629	-1.309	-8.340	0.554		-0.521	0.015		1.778	0.4360
	Std.Err.	0.002	0.001	1.950		1.926	0.020	0.142	0.062	0.066	0.099	0.897		0.896	0.014		0.022	
Scb	Coef.	1.004	0.067	0.388		0.197	0.240	-0.749	0.203	-0.607	-4.209		0.002	0.573	0.000		0.731	0.0001
	Std.Err.	0.001	0.016	0.094		0.034	0.016	0.023	0.017	0.105	0.075		0.000	0.452	0.000		0.017	
Sppc	Coef.	1.002	0.000	0.518		-0.562	-0.041	0.769	0.176	-8.682	-11.424		0.006	0.002		0.049	1.027	0.0000
	Std.Err.	0.000	0.000	0.107		0.098	0.004	0.529	0.314	1.324	0.316		0.026	0.004		0.026	0.022	
Unil	Coef.	1.002	-0.006	-0.254		0.196	0.080	-0.757	0.487	-0.776	-7.840	0.000		0.000	0.027		1.970	0.0000
	Std.Err.	0.000	0.001	0.090		0.090	0.007	0.003	0.008	0.057	0.038	0.000		0.000	0.009		0.017	

For model 5, conditional volatility equation includes both expected and unexpected trading volumes. It came out that ARCH effect is significant in explaining conditional variance in six of the stock whiles GARCH effect is significant for only nine stocks. ARCH and GARCH coefficients are significant collectively for eleven stocks. In situations where the ARCH effect is significant in explaining conditional variance the coefficient of the ARCH turns to be greater than the GARCH coefficient as shown in table 4.7 above. The extent to which shock today feeds through into next period volatility is statistically significant in eleven stocks. Of the eleven stocks only one stock (mlc) have an explosive volatility and the rest it decays slowly. Volatility persistence ranges from a low value of 0.0006 (cfao) to high of 1.1766 (mlc) giving us an average of 0.589. Of those stocks that have their volatility shock decline over time none was above 50% and that implies volatility shocks decays very fast in most stocks. The TARCH effect which make the ARCH and GARCH models to respond asymmetrically to positive and negative innovations is significant in eight stocks and the coefficients ranges from a low value of 0.00015 (fml) to high of 0.998 (mlc). Of the eight stocks four stocks have negative TARCH effect.

The effect of total trading volume of shares on conditional variance is divided into expected and unexpected trading volume in model 5. Expected trading volume and unexpected trading volume are statistical significant to conditional variance in all the 13 stocks with the exception of sppc and cml. For stock sppc both the expected and unexpected were all not significant to conditional variance of closing stock price. Correlation between expected trading volume and conditional variance is negative for five stocks. Also correlation between unexpected trading volume and conditional variance is negative for five stocks. It is only two stocks (cfao and pz) that have both expected and unexpected trading volume coefficients to be negative.

As expected, there is a leverage effect in nine stocks out of the thirteen stocks. This result is consistent with Wagner et al. (2005) and Arago and Nieto (2005) where they concluded that leverage effect is present in some stock market indices in their data sets. The difference from our findings and that of Wagner et al. and Arago et al. is that our work looks at stock level analysis. Surprisingly, negative leverage effect is observed in the stocks of mlc, pz, scb, sppc and unil. This means that bad news generate less volatility than good news. There is no leverage effect in two stocks (pbc and cmlt). It is interesting to note also that two stocks (alw and cfao) have all their innovations over period under study recording positive values, hence no leverage coefficient for these stocks.

Controlling for the effect of FINSSP in model 5 gives us model 6. The result of models 6 is as displayed in table 4.8 below. Expected trading volume is statistically significant in all of the stocks with four stocks (cfao, pz, scb and unil) having indirect correlation with conditional volatility. The expected trading coefficients for the 13 stocks range between a low of 0.0241 (alw) to a high of 2.1(pz) in absolute terms. In the case of the unexpected trading volume eight stocks are statistically significant while four stocks (cmlt, mlc, pbc and unil) are statistically insignificant.

It is interesting to note that both expected and unexpected trading volume is not significant for two stocks (alw and cmlt). In all situations where expected trading volume and unexpected trading volume is statistically significant, the coefficient of expected trading volume is greater than the unexpected trading volume in all stocks with the exception of two stocks (alw and eic). Leverage effect is statistically significant in twelve (12) stocks out of which five stocks have negative leverage effect. That is bad news generate less volatility than good news. The coefficient of the leverage effect ranges from a low of (-0.002) unil to high of -7.04 (alw).

ARCH effect is statistically significant in explaining conditional volatility in six stocks while the GARCH effect explains seven stocks as displayed in table 4.8 above. In most cases the effect of GARCH turns to be stronger than ARCH. Joint test of significance of ARCH and GARCH coefficients were statistically significant in explaining conditional volatility in eleven stocks as shown in table 4.8 above. Shocks today feeds through the next period volatility for nine (9) stocks. Volatility persistence which measure the rate at which the effect of volatility dies over time, is statistically significant in nine stocks. The strength of volatility persistence in the stocks ranges between a low of 0.0002 (hfc) to high of 0.989 (mlc) giving us an average of 0.495. Volatility shock dies very fast in almost all the stocks that significant with the exception of stock mlc which volatility shock decay very slowly. The TARCH effect which make the ARCH and GARCH models to respond asymmetrically to positive and negative innovations is significant in six stocks and the coefficients ranges from a low value of 0.0001 (unil) to high of 0.743 (abl). Of the six stocks three stocks have negative TARCH effect.

In order to check the robustness of our findings, a series of diagnostic tests are also carried out. The results are presented in table 4.9 below. For the six models, the null hypothesis of no autocorrelation is tested by Ljung-box tests on the level and squared residual series with 5 lags (Q(5) and $Q^2(5)$, respectively). The results show that the null hypothesis of autocorrelation on the level and squared residuals cannot be rejected generally at ten (10) percent significant level for all the models.

Table 4.8 RESULTS OF ESTIMATING GARCH(p, q) - THRESHOLD ARCH MODEL 6

Firm		VARIABLES		ARMA				HET				ARCH		TARCH	GARCH		shape	G/ARCH
		lcsp	Dumfinss	ar(L1)	ar(L2)	ma (L1)	ma (L7)	EV	UNV	DUM	CONST	(L1)	(L2)	(L1)	(L1)	(L2)		P-VALUE
Abl	Coef.		0.1201					1.3939	-0.1899	1.7064	-11.5459		0.2077	0.7427		0.0091	4.3668	0.0000
	Std. Err.		0.0008					0.1069	0.0600	0.2317	0.2393		0.0231	0.0399		0.0024	0.2476	
Alw	Coef.	0.9995	0.0003	-1.8001		1.8062	0.0003	0.0241	0.0690	-7.0395	-10.1000	0.0005		-0.0002	0.0006		1.8015	0.0001
	Std. Err.	0.0004	0.0003	0.7993		0.7930	0.0011	0.0064	0.0144	0.1020	0.0097	0.0013		0.0013	0.0001		0.0292	
Cfao	Coef.	0.9982	0.0001			0.1360	0.0769	-1.3202	-0.0873	0.1489	-21.1540	0.0122		-0.0122	0.0151		2.0148	0.0000
	Std. Err.	0.0001	0.0000			0.0017	0.0004	0.0015	0.0004	0.0141	0.0015	0.0010		0.0010	0.0007		0.0004	
Cmlt	Coef.	0.9995	0.0001		1.4495		-0.6430	0.9300	-0.0067	0.3140	-20.9335	0.7939		-3.7996	0.0100		0.9431	0.7745
	Std. Err.	0.0005	0.0001		0.2976		0.2270	0.3531	0.2004	0.2499	0.1576	1.7991		6.0321	0.0141		0.0315	
Eic	Coef.	1.0087	-0.0129	1.0624		-1.1956	0.1073	0.1383	0.3309	-3.0675	-11.6727	0.0612		-0.0594	0.2254		2.1234	0.0000
	Std. Err.	0.0001	0.0001	0.0096		0.0081	0.0010	0.0003	0.0011	0.0755	0.0005	0.0007		0.0007	0.0028		0.0026	
Fml	Coef.	0.9977	0.0091	0.0661		-0.0520	-0.0096	0.0559	0.0549	-1.3399	-7.7698		0.0015	-0.0015	0.0161		1.9850	0.9538
	Std. Err.	0.0013	0.0037	1.7526		1.7520	0.0033	0.0072	0.0048	0.1637	0.0523		0.0087	0.0085	0.0597		0.0241	
Hfc	Coef.	1.0007	-0.0005					0.6179	-0.0299	2.3719	-21.6685	0.0001		-0.0001	0.0001		1.9558	0.0000
	Std. Err.	0.0000	0.0000					0.0000	0.0000	0.0001	0.0000	0.0001		0.0001	0.0000		0.0000	
Mlc	Coef.		0.2363					0.2449	-0.0173	2.3528	-6.7420	0.1522		0.5190	0.8373		3.7005	0.0000
	Std. Err.		0.0014					0.0352	0.0106	0.3918	0.0596	0.1000		0.0822	0.0513		0.4593	
Pbc	Coef.	0.9855	0.0032					0.3002	-0.0879	-0.0498	-13.8473	0.0000		0.0000	0.0000		2.0000	1.0000
	Std. Err.	0.0002	0.0001					0.1416	0.1143	0.0013	0.1183	0.0000		0.0001	0.0007		0.0008	
Pz	Coef.	0.9966	0.0034	-0.1414		0.2046	0.0022	-2.1012	-0.3283	-1.5550	-8.0086	0.0525		0.0606	0.0114		1.6765	0.2310
	Std. Err.	0.0017	0.0013	3.1638		3.1665	0.1525	0.0703	0.0525	0.0302	0.0093	0.0396		0.0426	0.0279		0.0200	
Scb	Coef.	1.0002	0.0803	0.4051		0.4609	0.3692	-0.4232	0.1198	2.0602	-2.5580		0.0000	0.0023		0.0012	1.9968	0.0000
	Std. Err.	0.0070	0.1583	0.1935		0.0963	0.0319	0.0296	0.0130	0.0582	0.0586		0.0130	0.1189		0.0131	0.0464	
Sppc	Coef.	1.0007	0.0000	-1.7689		1.7661	-0.0014	0.8280	0.1071	1.1005	-15.8828		0.0058	-0.0012		0.0007	1.9843	0.0006
	Std. Err.	0.0003	0.0003	12.7792		12.8163	0.0095	0.1226	0.0059	0.2600	0.1328		0.0015	0.0005		0.0077	0.0198	
Unil	Coef.	0.9944	0.0107	-1.3733		1.3554	-0.0076	-0.3254	-0.0021	0.2603	-8.9858	0.0000		0.0001	0.2652		1.8020	0.0000
	Std. Err.	0.0003	0.0008	0.0651		0.0660	0.0011	0.0042	0.0098	0.0558	0.0105	0.0000		0.0000	0.0043		0.0031	

Table 4.9 DIAGNOSTIC TEST FOR WHITE NOISE FOR THE MODELS (LJUNG-BOX TEST)

Firm		MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5		MODEL 6	
		Q	Q^2	Q	Q^2	Q2	Q^2	Q	Q^2	Q	Q^2	Q	Q^2
abl	statistic	0.00	0.01	0.10	0.01	32.12	27.07	734.95	570.73	0.05	0.02	1941.69	2035.21
	p-value	1.000	1.000	1.000	1.000	0.103	0.132	0.215	0.996	1.000	1.000	0.143	0.683
alw	statistic	0.25	0.02	1.17	0.15	92.33	91.28	241.24	177.03	25.16	2.91	22.43	35.44
	p-value	0.999	1.000	0.948	1.000	0.421	0.814	0.128	0.719	0.116	0.714	0.133	0.958
cfao	statistic	16.55	0.64	12.98	0.39	1.31	0.01	157.73	14.21	0.08	0.19	14.37	0.28
	p-value	0.205	0.986	0.124	0.996	0.934	1.000	0.182	0.988	1.000	1.000	0.278	1.000
cmlt	statistic	0.08	0.00	0.71	0.12	0.17	0.210	0.1	0.1	0.01	0.00	0.01	0.01
	p-value	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
eic	statistic	0.34	0.02	2.07	0.02	6.83	0.18	156.75	189.15	159.96	4.86	209.08	174.74
	p-value	0.997	1.000	0.840	1.000	0.234	0.999	0.201	0.933	0.120	0.434	1.000	1.000
fml	statistic	102.16	12.36	105.22	197.45	192.32	198.38	203.05	197.93	158.04	198.53	188.12	198.52
	p-value	0.951	1.000	0.351	1.000	0.255	0.994	0.309	1.000	0.890	1.000	0.966	1.000
hfc	statistic	1.78	0.02	2.25	0.01	1.39	0.01	25.53	2.14	1.69	0.02	24.82	2.21
	p-value	0.879	1.000	0.813	1.000	0.926	1.000	0.313	0.939	0.891	1.000	0.116	0.999
mlc	statistic	0.001	0.001	0.03	0.00	1960.88	2161.95	5199.87	5127.74	1960.88	2072.65	5344.52	4735.75
	p-value	1.000	1.000	1.000	1.000	0.891	1.000	0.885	1.000	0.763	1.000	0.199	1.000
pbc	statistic	2.80	2.84	49.68	25.14	19.25	5.19	206.26	57.38	19.51	5.21	18.96	5.15
	p-value	0.730	0.925	0.321	0.997	0.099	0.394	0.884	1.000	0.102	0.391	0.190	0.953
Pz	statistic	0.04	0.00	1.32	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.11	0.877
	p-value	1.000	1.000	0.933	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Scb	statistic	0.08	0.00	0.00	0.00	52.50	0.52	0.111	0.00	0.00	0.00	0.04	0.00
	p-value	1.000	1.000	1.000	1.000	0.311	0.991	1.000	1.000	1.000	1.000	1.000	1.000
sppc	statistic	1.13	0.01	10.81	1.12	0.03	0.02	5.50	1.15	0.14	0.02	6.43	1.18
	p-value	0.952	1.000	0.155	0.952	1.000	1.000	0.939	1.000	1.000	1.000	0.893	1.000
Unil	statistic	53.13	2.82	68.88	2.10	207.18	201.46	188.09	176.91	6.89	5.58	4.54	3.46
	p-value	0.177	0.728	0.291	0.835	0.334	0.867	0.327	0.902	0.229	0.349	0.972	0.991

6. CONCLUSION

All the stocks in sample show a high degree of volatility persistence. The introduction of FINSSP reduced the number of stocks with volatility persistence from nine stocks to eight stocks. But on the average the rate of decay reduce from 0.6849 to an average of 0.761. In other words the rate at which volatility dies over time decreased with the introduction of FINSSP. This is supported by the average of the lowest and highest volatility persistence. It increased from an average of 0.545 to 0.5902. In the case of model 3 and 4 average of the lowest and highest volatility persistence reduced, implying that FINSSP increases the rate at which shocks in stocks decay. The situation is not different for model 5 and 6.

When trading volume is included in the conditional variance equation, as a proxy for information inflow, an increase in the rate of decay of shock is observed in the volatility persistence as average of all the statistically significant stocks reduced from 0.6849 to 0.2873. This implies the rate of decay has increased with the introduction of volume traded in conditional variance equation. When we consider the impact of FINSSP the extent to which a shock dies over time reduced slightly in value from 0.2873 to 0.3716. As the rate of decay is still less than 50% we will still stay that volatility persistence decay at faster rate. The implication here is that FINSSP has positive impact on volatility of individual stocks since the average volatility of all this significant stocks is less than 0.5. It is also observed that volume traded has significant effect on conditional variance. This

finding is consistent with the argument in Sharma et al. (1990) that volume traded may be a good proxy for stock-level analysis, but not for market-level analysis.
The use of expected and unexpected trading volume instead of total trading volume in conditional variance equation gives some support to the argument that unexpected traded volume acts as a proxy for new information arrival. Both expected and unexpected trading volumes have statistically significant effect in explaining conditional volatility of stocks on Ghana Stock Exchange. The effect of expected trading volume on conditional variance in most stocks turnout to be stronger than unexpected trading volume. With the introduction of trading volume into the variance equation the average volatility persistence of the stocks reduced from 0.6849 to 0.2873. In other words shock decay faster. When we included both expected and unexpected trading volume in the variance equation, shock on stocks turn to decay faster from volatility persistence average of all statistically significant stocks of 0.2873 to 0.2072 and when the effect of FINSSP is controlled in the mean equation it further increases the rate of decay of current shock. By this FINSSP succeeded in making volatility of various stocks on GSE decay faster.
Nine stocks in model 5 have statistically significant leverage effect and of the nine stocks five of that have negative leverage effect. In the case of model 6 only one stock turn out to be insignificant to leverage effect and of the 12 statistically significant stocks, five stocks registered negative leverage effect which means that with these stocks bad news generate less volatility than good news. It also turn out that FINSSP is significant in increasing the leverage effect of stocks on Ghana Stock Exchange. The distribution of most stocks closing stock price were leptokurtosis that is they exhibit fat tails and excess peakedness at the mean.

APPENDICES

APPENDIX A1

STOCKS	VARIABLE	OBS	W	V	Z	PROB>Z
Abl	ΔCS	1858	0.899	112.32	11.98	0.000
	TV	1840	0.947	58.479	10.32	0.000
	EV	1836	0.959	45.414	9.676	0.000
	UEV	1836	0.919	88.643	11.37	0.000
Alw	ΔCS	1858	0.934	73.429	10.9	0.000
	TV	1840	0.893	118.14	12.1	0.000
	EV	1836	0.967	36.321	9.109	0.000
	UEV	1836	0.99	11.398	6.171	0.000
Cfao	ΔCS	1858	0.774	251.04	14.02	0.000
	TV	1840	0.924	83.19	11.21	0.000
	EV	1836	0.943	62.824	10.5	0.000
	UEV	1836	0.932	74.128	10.92	0.000
Cml	ΔCS	1858	0.833	185.32	13.25	0.000
	TV	1840	0.903	106.82	11.85	0.000
	EV	1836	0.922	85.545	11.28	0.000
	UEV	1836	0.818	199.72	13.43	0.000
Eic	ΔCS	1858	0.807	214.14	13.61	0.000
	TV	1840	0.911	97.54	11.62	0.000
	EV	1836	0.982	20.165	7.617	0.000
	UEV	1836	0.982	19.49	7.531	0.000
Fml	ΔCS	1858	0.876	137.69	12.49	0.000
	TV	1840	0.912	96.258	11.58	0.000
	EV	1836	0.99	11.153	6.115	0.000
	UEV	1836	0.979	22.956	7.946	0.000

APPENDIX A1 CONTINUATION

Stocks	Variable	Obs	W	V	z	Prob>z
Hfc	ΔCS	1858	0.889	123.53	12.22	0.000
	TV	1840	0.926	80.842	11.14	0.000
	EV	1836	0.955	49.747	9.907	0.000
	UEV	1836	0.954	50.522	9.946	0.000
Mlc	ΔCS	1858	0.884	129.06	12.33	0.000
	TV	1840	0.934	72.344	10.86	0.000
	EV	1836	0.95	55.117	10.17	0.000
	UEV	1836	0.918	90.461	11.42	0.000
Pbc	ΔCS	1858	0.894	117.54	12.09	0.000
	TV	1840	0.934	72.75	10.87	0.000
	EV	1836	0.885	126.45	12.27	0.000
	UEV	1836	0.877	135.15	12.44	0.000
Pz	ΔCS	1858	0.943	63.412	10.53	0.000
	TV	1840	0.938	67.68	10.69	0.000
	EV	1836	0.963	40.341	9.376	0.000
	UEV	1836	0.88	132.16	12.39	0.000
Scb	ΔCS	1858	0.888	123.84	12.23	0.000
	TV	1840	0.931	76.242	10.99	0.000
	EV	1836	0.986	15.08	6.88	0.000
	UEV	1836	0.969	34.132	8.952	0.000
Spp	ΔCS	1858	0.768	257.23	14.08	0.000
	TV	1840	0.938	67.739	10.69	0.000
	EV	1836	0.937	68.786	10.73	0.000
	UEV	1836	0.855	159.45	12.86	0.000
Unil	ΔCS	1858	0.953	51.989	10.02	0.000
	TV	1840	0.913	95.6	11.56	0.000
	EV	1836	0.987	14.219	6.731	0.000
	UEV	1836	0.987	13.967	6.686	0.000

APPENDIX A2 DESCRIPTIVE STATISTIC BEFORE 2004 FINSSP

stocks	Variable Name	N	Mean	Sd	skewness	kurtosis	max	min
Abl	ΔCS	610	0.047	0.011	0.144	1.604	0.063	0.032
	TV	592	1.065	1.706	1.123	2.471	4.635	0
	EV	588	1.069	0.809	0.303	2.155	3.169	0
	UEV	588	-0.001	1.504	0.686	2.682	3.643	-2.893
Alw	ΔCS	610	0.423	0.171	2.727	12.445	1.21	0.24
	TV	592	3.202	2.194	-0.458	1.565	5.707	0
	EV	588	3.21	1.164	-0.556	2.93	5.43	0
	UEV	588	-0.004	1.866	-0.203	2.227	4.508	-4.259
Cfao	ΔCS	610	0.006	0.001	-0.576	2.195	0.008	0.004
	TV	592	0.869	1.732	1.66	3.974	5.247	0
	EV	588	0.853	0.838	0.809	2.818	3.476	0
	UEV	588	-0.004	1.505	0.977	3.629	4.198	-3.084
Cml	ΔCS	610	0.044	0.005	0.612	1.83	0.06	0.04
	TV	592	0.355	1.016	2.737	8.945	4.143	0
	EV	588	0.354	0.506	1.567	5.415	2.618	0
	UEV	588	-0.002	0.876	1.723	7.251	3.315	-2.267
Eic	ΔCS	610	0.373	0.166	1.057	3.672	0.99	0.19
	TV	592	0.815	1.659	1.719	4.26	5.242	0
	EV	588	0.817	0.794	0.899	3.363	3.591	0
	UEV	588	-0.002	1.462	1.108	3.862	4.168	-2.89
Fml	ΔCS	610	0.15	0.077	1.42	4.111	0.38	0.08
	TV	592	1.695	2.013	0.494	1.432	5.043	0
	EV	588	1.688	1.029	0.291	2.505	4.645	0
	UEV	588	0.009	1.755	0.297	2.176	3.948	-3.696

APPENDIX A2 DESCRIPTIVE STATISTIC BEFORE 2004 FINSSP

stocks	**Variable Name**	**N**	**Mean**	**Sd**	**skewness**	**kurtosis**	**max**	**min**
Hfc	ΔCS	610	0.128	0.069	2.137	6.174	0.38	0.08
	TV	592	1.478	2.09	0.843	1.891	5.342	0
	EV	588	1.466	1.317	0.712	2.607	5.135	0
	UEV	588	-0.003	1.633	0.449	3.064	4.21	-4.042
Mlc	ΔCS	610	0.024	0.018	1.357	3.941	0.07	0.01
	TV	592	0.939	1.697	1.392	3.136	4.787	0
	EV	588	0.938	0.853	0.542	2.329	3.494	0
	UEV	588	-0.002	1.482	0.8	3.138	3.81	-2.918
Pbc	ΔCS	610	0.054	0.022	2.693	9.036	0.13	0.04
	TV	592	0.911	1.728	1.489	3.391	5.017	0
	EV	588	0.894	1.261	1.615	4.645	4.821	0
	UEV	588	-0.008	1.176	1.1	5.921	3.992	-3.852
Pz	ΔCS	610	0.13	0.069	0.438	1.77	0.27	0.04
	TV	592	0.58	1.287	1.913	4.917	4.234	0

	EV	588	0.584	0.684	1.12	3.79	3.372	0
	UEV	588	0	1.089	1.075	4.374	3.387	-2.528
Scb	ΔCS	610	2.763	1.212	1.876	5.095	6.1	1.91
	TV	592	1.633	1.886	0.427	1.375	4.635	0
	EV	588	1.63	0.936	0.281	2.461	4.223	0
	UEV	588	-0.001	1.643	0.22	2.068	3.692	-3.604
Spp	ΔCS	610	0.033	0.008	-0.554	1.839	0.04	0.02
	TV	592	0.532	1.24	2.016	5.271	4.159	0
	EV	588	0.535	0.637	1.241	4.221	2.937	0
	UEV	588	0	1.06	1.228	4.602	3.315	-2.249
Unil	ΔCS	610	0.181	0.004	7.714	88.081	0.23	0.18
	TV	592	2.589	2.002	-0.275	1.381	5.106	0
	EV	588	2.586	0.952	-0.177	2.573	4.693	0
	UEV	588	-0.001	1.754	-0.236	2.001	3.573	-3.774

APPENDIX A3 DESCRIPTIVE STATISTIC AFTER 2004 FINSSP

Stocks	Variable Name	**N**	**mean**	**Sd**	**skewness**	**kurtosis**	**max**	**min**
Abl	ΔCS	1248	0.123	0.019	-1.355	6.586	0.148	0.055
	TV	1248	0.506	1.278	2.271	6.45	4.635	0
	EV	1248	0.504	0.781	1.915	6.614	3.91	0
	UEV	1248	0.001	0.999	1.37	6.492	3.708	-3.254
Alw	ΔCS	1248	0.703	0.167	1.45	5.955	1.25	0.35
	TV	1248	1.757	2.329	0.689	1.619	5.697	0
	EV	1248	1.76	1.588	0.391	1.876	5.37	0
	UEV	1248	-0.003	1.701	0.154	3.065	4.461	-4.207
Cfao	ΔCS	1248	0.036	0.01	-1.915	5.4	0.05	0.008
	TV	1248	1.083	1.88	1.294	2.856	5.252	0
	EV	1248	1.081	1.199	1.189	3.873	5.109	0
	UEV	1248	0.002	1.461	0.69	3.755	4.202	-4.006
Cml	ΔCS	1248	0.156	0.032	-1.987	5.325	0.18	0.06
	TV	1248	0.178	0.75	4.209	19.29	4.094	0
	EV	1248	0.178	0.394	2.514	9.61	2.679	0
	UEV	1248	0	0.646	2.481	13.754	3.161	-2.282
Eic	ΔCS	1248	1.497	0.96	0.905	2.227	3.3	0.36
	TV	1248	2.176	2.185	0.194	1.235	5.247	0
	EV	1248	2.176	1.252	-0.063	2.164	4.96	0
	UEV	1248	0	1.805	0.081	2.208	4.181	-4.023
Fml	ΔCS	1248	2.442	1.291	0.763	2.332	5	0
	TV	1248	1.838	2.039	0.38	1.349	5.05	0
	EV	1248	1.839	1.17	0.219	2.263	4.733	0
	UEV	1248	-0.001	1.675	0.219	2.326	4.04	-3.868

APPENDIX A3 CONTINUATION

Stocks	Variable Name	N	mean	Sd	skewness	kurtosis	max	min
Hfc	ΔCS	1248	0.648	0.141	1.571	5.032	1.01	0
	TV	1248	1.083	1.916	1.317	2.9	5.347	0
	EV	1248	1.088	1.303	1.057	2.973	4.973	0
	UEV	1248	-0.006	1.421	0.594	4.188	4.198	-4.166
Mlc	ΔCS	1248	0.231	0.042	-0.59	6.185	0.31	0.07
	TV	1248	0.625	1.456	2.032	5.365	4.844	0
	EV	1248	0.625	0.915	1.741	5.763	4.371	0
	UEV	1248	-0.001	1.129	1.115	5.59	3.875	-3.528
Pbc	ΔCS	1248	0.275	0.051	-0.074	4.681	0.39	0
	TV	1248	0.565	1.43	2.266	6.381	5.024	0
	EV	1248	0.569	1.022	2.117	7.086	4.834	0
	UEV	1248	-0.003	1.01	1.26	7.459	4.014	-3.394
Pz	ΔCS	1248	0.762	0.247	0.269	2.561	1.2	0
	TV	1248	0.536	1.263	2.081	5.583	4.234	0
	EV	1248	0.536	0.609	1.171	4.39	3.246	0
	UEV	1248	0	1.1	1.388	4.816	3.387	-2.383
Scb	ΔCS	1248	21.534	10.114	0.625	1.956	38	0
	TV	1248	1.199	1.756	0.924	2.051	4.635	0
	EV	1248	1.199	0.944	0.577	2.762	4.256	0
	UEV	1248	0	1.492	0.493	2.588	3.692	-3.36
Spp	ΔCS	1248	0.049	0.026	1.234	2.911	0.1	0.02
	TV	1248	0.221	0.845	3.708	15.169	4.143	0
	EV	1248	0.221	0.439	2.497	11.111	3.539	0
	UEV	1248	2.327	0.99	1.119	2.829	4.6	0
Unil	ΔCS	1248	1.534	1.982	0.685	1.69	5.1	0
	TV	1248	0	0.724	2.281	11.583	3.315	-2.75
	EV	1248	1.538	1.136	0.286	2.16	4.781	0
	UEV	1248	-0.004	1.651	0.273	2.456	4.024	-3.73

APPENDIX 4

Variable Name	**Label**
Closing Stock (Change)	ΔCS
Total Volume	TV
Expected Volume	EV
Unexpected Volume	UEV

REFERENCES

- Aggarwal, R., Inclan, C., and Leal, R., (1999), “Volatility in Emerging Stock Markets”. Journal of Financial and Quantitative Analysis, Vol. 34, No. 1, pp. 33- 55.
- Andersen, T.G. (1996), “Return volatility and trading volume: an information flow interpretation of stochastic volatility”, Journal of Finance, Vol. 51, pp. 169-204.
- Arago, V., and Nieto, L., (2005), Heteroskedasticity in returns of the Main World Stock Exchange Indices, Internal Financial Markets Institutions and Money, No., pp 271 – 284.

- Bekaert, G., C.B. Erb, C. R. Harvey, and T.E. Viskanta, (1998), "Distributional characteristics of emerging market returns and asset allocation". Journal of Portfolio Management, Winter, pp 102-116.
- Bekaert, G., Harvey, C., and C. Lundblad, (2006), Growth volatility and financial liberalization, Journal of International Money and Finance 25, 370-403.
- Bekaert, Geert and Campbell, R. Harvey (1995), "Emerging Equity Market Volatility". National Bureau of Economic Research, Working Paper 5307, pp 1- 77.
- Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, (2005), "Does Financial Liberalization Spur Growth?" Journal of Financial Economics, July, 7(1): 3-55.
- Bohl, M. T., and Henke, H., (2003), Trading Volume and Stock Market Volatility: The Polish Case, International Review of Financial Analysis, No., 12, pp., 513 – 525.
- Frimpong, M. J. and Fosu, E. Oteng-Abayie, (2006), "Modelling and Forecasting Volatility of Returns on Ghana Stock Exchange Using GARCH Models", American Journal of Applied Sciences, 3 (10), Science Publications, pp 2042-2048.
- Gallo, G. and Pacini, B. (2000), "The effects of trading activity on market volatility", European Journal of Finance, Vol. 6, pp. 163-75.
- Hammoudeh, S. M and Li, Hi, (2008), "Sudden Changes in Volatility in Emerging Markets: The Case of Gulf Arab Stock Markets". International Review of Financial Analysis, 17, pp. 47- 63.
- Harvey, A.C. (1989), Forecasting, Structural Time Series Models and the Kalman Filter, Cambridge University Press, Cambridge.
- Kim, D. and Kon, S. (1994), "Alternative models for the conditional heteroskedasticity of stock returns", Journal of Business, Vol. 67, pp. 563-88.
- Kirman, A. (1993), Ants, rationality, and recruitment, Quarterly Journal of Economics, 108, pp. 137–156.
- Lamoureux C.G. and Lastrapes, W.D. (1990), Heteroskedasticity in Stock Return Data: Volume versus GARCH Effects, Journal of Finance, No. 45, pp. 221-229.
- Liu, M., (2003), Modeling long memory in stock market volatility, Journal Econometrics, 99, pp. 139–171.
- Lucey, B.M. (2005), "Does volume provide information? Evidence from the Irish stock market", Applied Financial Economics Letters, Vol. 1 No. 2, pp. 105-9.
- McKinnon, R.I. (1973), Money and Capital in Economic Development, Washington, DC: Brookings Institution.
- Miyakoshi, T., (2002), ARCH versus Information-Based Variances: Evidence from the Tokyo Stock Market, Japan and World Economy, No.14, pp. 215 – 231.
- Omran, M. F., and Mckenzie, E., (2000), Heteroscedasticity in Stock Returns Data Revisited: Volume versus GARCH Effects, Applied Financial Economics, No. 10, pp. 553 – 560.
- Pagano, M. and Roell, R. (1993), "Auction and dealership markets. What is the difference?", European Economic Review, Vol. 36, pp. 613-23.
- Tauchen, G. and Pitts, M. (1983), "The price variability-volume relationship on speculative markets", Econometrica, Vol. 51, pp. 485-505.
- Wagner, N. and Marsh, T. A., (2005), Surprise Volume and Heteroskedasticity in Equity Market Returns, Quantitative Finance, No.5, pp. 153 – 168.
- Wang, P. and Liu, A., (2005), Stock Return Volatility and Trading Volume: Evidence from the Chinese Stock Market, Journal of Chinese Economic and Business Studies, No.3, pp. 485 – 505.