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RETURNS ON INVESTMENTS AND VOLATILITY RATE IN THE NIGERIAN BANKING INDUSTRY

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ABSTRACT

Most investment decisions focus on a forecast of future events that is either explicit or implicit. Generally asset pricing models postulate a positive relationship between a stock portfolio's expected returns and risk, which is often modelled by the variance of the asset price. The essence of this paper is to use GARCH in mean and EGARCH to examine the relationship between mean returns on the Nigeria commercial banks portfolio investments and its conditional variance or standard deviation. After estimating a variety of models from Central Bank of Nigeria Statistical Bulletin 2010 data, we found out that using the GARCH in mean a positive and significant relationship exist between commercial bank portfolio return and volatility, while the EGARCH model gives a negative relationship. We suggest that market operators should try as much as possible to prevent avoidable bad news.

Keywords: Commercial banks, EGARCH, GARCH-M, Investment, Returns, Volatility

INTRODUCTION

No one invests for fun; every rational investor invests so as to make gain from such an act. However, the investment climate is characterised with a number of risk limiting investment. Good investment decision requires a forecast of future events that is either explicit or implicit. Since no one has a perfect picture of the future outcome, as most of the important facts are uncertain, it is important to reduce the degree of risk and uncertainty associated with such an investment to the barest minimum before commitment of fund is made. Mainstream theory of finance and investment teaches that the higher the expected return on an investment the higher the levels of risk or volatility associate with such an investment. But not all higher risk connote higher return, this makes intelligent investors to hold portfolio in a manner that will promote higher returns avoiding higher risk as much as possible. The risk or volatility component of an investment is measured by the standard deviation and variance of the return of such investment over a period of time. A number of literature relates returns on an assets to the level of its standard deviation and/or its variance (see Sharpe (1964), Black. and Scholes (1974), R. (1984). Myung and Jeffrey (2008), French *et al.* (1987) Campbell and Hentschel (1993) Sentana (1995), Baillie and Degennaro (1990), Nelson (1991), Glosten *et al.* (1993), Rabemananjara and zakoian (1993), Campbell and Hentschel (1993)) and Lundblad (2007). Though, these and other authors adopt the use of return variance to measure risk- volatility, there is no clear consensus view as to what method to use in determining the relationship between volatility and investment decisions. Also the sample sizes used in analysing this relationship play crucial roles in determining the nature of results as it was observed by most of the researchers that small sample always give a negative relationship (see Lundblad (2007)). However, we have been able to demonstrate that using GARCH in mean, a small sample size will still give a positive and significant relationship between volatility and return in investment decisions. The essence of this paper is to examine whether or not volatility affects returns on investment decisions in the Nigerian banking industry. We humbly submit that we are the first to use GARCH in mean and EGARCH to examine volatility-return on investment relationship in the Nigeria banking industry.

This paper is organised as follows: Section 2 provides the literature review; section 3 provides the methodology used; section 4 presents the empirical results, while section 5 provides conclusion and recommendations.

LITERATURE REVIEW

Vast literature exist on the casual relationship between volatility and return on financial assets in the developed economies, for instance Dixit (1995), observed that most business manager are likely to be neutral towards decision on risk and since investment decisions are rarely repeated, it is advisable for business decisions to be made solely on the basis of expected return. He explained that expected return is calculated by weighting each of the profit levels by its associated probability. For this paper, we examined works relating to the use of GARCH models in measuring the relationship between returns and volatility on the one hand, and the literatures relating to commercial banks investment and volatility on the other hand, as hardly could one find existing literature using GARCH models to directly assess the relationship between banks returns and volatility.

Garch Models

Developed by Engle (1983) ARCH model was meant to be a model that could assess the validity of a conjecture of Friedman (1977) that the unpredictability of inflation was a primary cause of business cycles. The tenet of his hypothesis was that the level of inflation was not a problem; it was the uncertainty about future costs and prices that would prevent entrepreneurs from investing and lead to a recession. Today, it has become a household model in measuring volatility and its effects on a number of economic variables.

Black (1976), Christie (1982), Nelson (1991), Poon and Taylor (1992), using GARCH-M and E-GARCH models have observed that the asymmetric models are better-off symmetric models as stock market volatility tends to rise in response to any decrease in stock returns (bad news) and fall in response to an increase in stock returns (good news). They found out that announcement effect have a significant leverage effect on the returns of CRSP value weighted stock market index, the stock returns in UK, Canada, France, Japan and Italy.

Baillie and Degennaro (1990) in a study 'Stock Returns and Volatility' examined the econometric evidence for the relationship between stock returns and stock returns volatility using GARCH in mean model. Their models show very little evidence for statistically significant relationship between a stock portfolio's return and its volatility. Their results suggest traditional two-parameter models relating portfolio means to variances, which are inappropriate and indicates the need for research into other measures of risk. They submit that investors consider some other risk measure to be more important than the variance of portfolio returns (see also Tim Bollerslev (2011)). In another development, Athanasios *et al.* (2006) examined the relationship between stock price returns and volatility for industrialised countries of Australia, Canada, France, Japan, the US, the UK, Germany and Italy using two models: GARCH-M and E-GARCH and found out that the GARCH –M model has modelling limitations and gives inconclusive results in comparison with the E-GARCH model, which provides a more accurate result in respect to the relationship between stock price return and volatility. They examined the impact of both symmetric and asymmetric (bad and good news) from stock price on the conditional volatility on the expected returns of these countries. They found out that the two models show a weak relationship between stock price returns and volatility for the specific stock market of these industrialized countries (see also De Santis and A. (2009), Akpan. *et al.* (2012), Akpan (2012) and Chowdhury *et al.* (2006). However, Theodossiou and Lee (1995) examined the relationship between volatility and expected returns across international stocks markets using alternative version of GARCH-M, and observed that there is symmetric effect on capital market return across international boarder (see also Berndt and Hausman (1974), Bollerslev (1987), French *et al.* (1987), Baillie and Bollerslev (2000) and Engle *et al.* (1987). Scholes and Williams (1977) in a paper titled 'Estimating Betas from Nonsynchronous Data' noted that the effect of nonsynchronous data, among other things can be used to evaluate the level of volatility of data on returns.

Tobias and Joshua (2008) using a cross-sectional pricing of volatility risk to decompose equity market volatility into short run and long run components found out that prices of risk are negative and significant for both volatility components. This implies that investors pay for insurance against increases in volatility even if those increases have little persistence. Their findings suggest that short run components reveal the market skewness risk or degree of the tightness of financial constraints, while the long run component is a function of business cycle.

Raggi and Bordignon (2012) in a paper titled 'Long memory and nonlinearity in realized volatility: A Markov Switching Approach' proposed a methodology to analyse the sequential parameter learning problem for stochastic volatility model with jumps and predictable conditional mean. They focus on estimating the time invariant parameters and nonobservable dynamics and found out that simulated and real data is presented to assess the performance of the algorithm. They proposed a Monte Carlo Algorithm for sequential parameter learning for a stochastic volatility model with leverage, non constant conditional means and jumps. Their work was an improvement on earlier authors kernel Smoothing approximation algorithm in which a Monte Carlo Methods MCMC step is incorporated in order to reduce sampling impoverishment problems.

In another development, Muhammad Imtiaz Subhani *et al.* (2012) examined the volatility in stock returns of various stock exchange in relation to interest rates and exchange rates over a range of eight (8) countries for assorted periods using GARCH (1,1) so as to investigate the possible eventualities of volatilities of stock markets. They observed that for Pakistan, India, Hong Kong, Japan, United State, United Kingdom, Spain and Germany various results emerges, though GARCH (1,1) yielded significant results indicating an existence of volatility of stock markets for the period under study (i.e 1990-2011). Moreover, there findings suggests that volatility in the current period is influenced by volatility in the previous lags. Their findings are useful in educating investors on the trends associated with stock market trends in relating to returns and volatility as affected by interest rates and / or exchange rate.

Tanij Dutt and Mark (2013) in a paper titled Stock Return Volatility, Operating Performance and Stock Returns: International Evidence on Drivers of the low Volatility Anomaly examined the links between stock returns and observed that in line with the existing studies, low volatility stocks earns higher returns than high volatility stocks in both emerging and developed markets outside the North America. Their findings also suggests that low volatility stocks have higher operating returns and this might account for the fact that low volatility attracts higher stock returns. The centre piece of their work lies in the significant of controlling for stock return volatility when analysing operating performance and stock performance.

In another development, Dimitrios and Theodore (2011) examined the relationship between expected stock returns and volatility in the twelve EMU countries as well as five major EMU international markets between 1992 and 2007 using GARCH in mean models observed that a weak relationship exist between expected returns and volatility for most of the markets. Their findings further identified existence of a significant but negative relationship in almost all the markets when a flexible semi-parametric tools is used for the conditional variance. Moreover, an investigation was carried out on the asymmetric reaction of volatility to positive and negative shocks in a stock returns, the result indicates a negative asymmetric in all markets.

Commercial Banks Return-Volatility Relationship

Robert and Karin (1999), used data from 472 commercial banks from 1988 to 1995 to examine the product mix and earnings volatility of commercial banks in the US and found out that unlike the conventional wisdom in the banking industry where earnings from fee-based products are more stable than loan-based earnings, and where fee-based activities reduce bank risk *via* diversification a test of the conventional wisdom shows a new 'degree of total leverage' framework which conceptually links a bank's earnings volatility to fluctuations in its revenues, to the weaken of its expenses, and to its product mix. They observed various mixes of financial services produced and marketed jointly within commercial banks, this makes their evidence to reflect the impact of production synergies (economies of scope) and marketing synergies (cross-selling) not captured in previous studies. They modify standard degree of leverage estimation methods to conform to the characteristics of commercial banks. Their results contradicts mainstream believes in that, it was observed that as the average bank tilts its product mix toward fee-based activities and away from traditional lending activities, bank's revenue volatility; its degree of total leverage, and the level of its earnings all increases. The results of their findings have implications for bank regulators, who must set capital requirements at levels that balance the volatility of bank earnings against the probability of bank insolvency. It also suggest another explanation for the shift toward fee-intensive product mixes: a belief by bank managers that increased earnings volatility will enhance shareholder value (or at least will increase the value of the managers' call options on their banks' stock).

In another development, Kevin (2006), examined the impact of increased non-interest income on equity market measures of return and risk of U.S. bank holding companies from 1997 to 2004 using portfolio analytical tools which offers a transparent and informative means for examining the relative risks and returns of heterogeneous bank activities and find out that non-interest activities are relatively risky, but yielded similar average returns to shareholders under the year reviewed. Despite controlling for bank size and equity ratios, which help control for management skills, internal diversification, leverage, and scale, and for a subset of relatively large banks that one might expect to be best able to successfully operate in many product markets, the situation still holds. The implication is that the pervasive shift toward non-interest income has not improved the risk/return outcomes of U.S. banks in recent years.

Stiroh (2005) explored the link between the growing reliance on non-interest income and the volatility of bank revenue and profits in the US. He observed that the results from both aggregate and bank data provide little evidence that shift offers large diversification benefits in the form of more stable profits or revenue. His findings show that at the aggregate level, noninterest income is much more volatile than more traditional net interest income. Although net operating revenue has in fact become less volatile in the 1990s as non-interest income grew in importance, this can be directly traced to the declining volatility of net interest income that more than offset the increased contribution from the growing share of the relatively volatile noninterest income. He explained that trading income, in particular, shows enormous volatility. Moreover, net interest income and noninterest income growth rates have become more highly correlated in the 1990s.

At the bank level, non-interest income growth also shows an increased correlation with net interest income over the last decade. Service charges and fees in particular are highly correlated with net interest income, while trading and fiduciary income is less so. He found negative association between non-interest income shares and profits per unit of risk for bank risk and return. He identified trading activities as the biggest drag on profit per unit of risk and suggests that continued expansion may ultimately lower risk-adjusted returns, while fiduciary income is associated with higher profit per risk and more stable net income growth. His results questioned the belief that non-interest income will stabilize revenue and profitability and thereby reduce risk.

In a related development, Kevin and Adrienne (2006) examined the impact of diversification on risk-return on the US commercial banks to know whether the observed shift toward activities that generate fees, trading revenue, and other non-interest income has improved the performance of US Financial Holding Companies (FHCs) from 1997 to 2002, and observed that diversification benefits exist between FHCs, but these gains are offset by the increased exposure to non-interest activities, which are much more volatile but not necessarily more profitable than interest-generating activities. Within FHCs, however, marginal increases in revenue diversification are not associated with better performance, while marginal increases in non-interest income are still associated with lower risk-adjusted profits. Their findings revealed that diversification gains are more than offset by the costs of increased exposure to volatile activities which represents the dark side of the search for diversification benefits and has implications for supervisors, managers, investors, and borrowers. Kevin (2006) in a study, 'New Evidence on the Determinant of Bank Risk' observed that two main items: the balance sheet items such as commercial and industrial loans and consumer lending; and income statement items such as other non-interest income drive the cross-sectional differences in Bank Holding Company risk. It was stressed that newly mandated regulatory data on the components of other non-interest income show that investment banking, servicing, securitization income, gains from loan sales, gains other asset sales, and other non-interest income are particularly volatile activities. This suggests that the value of increased transparency as a means to improve market discipline and reduce the difficulty associated with complex financial institutions. Finally, in the years after 2000, the focus of risk has shifted off the balance sheet and onto the income statement as investors identify the new risks associated with evolving and expanding bank activities.

In another development, Dan (2010) in a paper titled 'Collateral Shortages, Asset Price and Investment Volatility with Heterogeneous Beliefs' developed a dynamic general equilibrium model to examine the effects of belief heterogeneity on the survival of agents and on asset price and investment volatility under different financial markets structures. He observed that, when financial markets are endogenously incomplete, agents with incorrect beliefs survive in the long run. The survival of these agents leads to higher asset price and investment volatility. This is in contrasts with the frictionless complete markets case, in which agents holding incorrect beliefs are eventually driven out and as a result, asset prices and investment exhibit lower volatility. His findings show the existence of stationary Markov equilibrium in the framework with Wealth Distribution and Asset Price Volatility over Time. The centre piece of his work deals with introduction of a dynamic general equilibrium model with aggregate shocks potentially incomplete markets and heterogeneous agents to investigate the role of financial markets. He observed that besides being risk averse, agents differ in their beliefs about the future aggregate states of the economy. This, he explained induces them to take large bets under frictionless complete financial markets, which enable agents to leverage their future wealth. He further explained that under incomplete markets generated by collateral constraints, agents with heterogeneous (potentially incorrect) beliefs survive in the long run and their speculative activities drive up asset price volatility and real investment volatility. He added that collateral constraints are always binding even if the supply of collateralizable assets endogenously responds to their price. He used this framework to study the effects of different types of regulations and the distribution of endowments on leverage, asset price volatility and investment.

It is also important to note that Robert and Karin (1999), established a number of empirical links between bank non-interest income, business strategies, market conditions, technological change, and financial performance between 1989 and 2001 so as to determine the nature of return- volatility level in the US financial market and observed that well-managed banks expand more slowly into non-interest activities, and that marginal increases in non-interest income are associated with poorer risk-return tradeoffs on average. They suggested that non-interest income is coexisting with, rather than replacing, interest income from the intermediation activities that remain banks' core financial services function.

DATA AND METHODOLOGY

Data

The data used in the study consisted of time series of commercial banks' investment profile of all the Nigerian commercial banks sourced from the 2010 Central Bank of Nigeria Statistical Bulletin. The data spanned from 1992 to 2009

The GARCH in mean specification is as specified as follows:

$$r_t = \mu + \lambda h_t + \epsilon_t, \quad \epsilon_t \sim N(0, h_t) \qquad \text{(equ. 1)}$$

where r_t is the return on investment, u is the risk free return, h_t is the conditional variance and λ is the coefficient that represent the risk-return trade-off.

The EGARCH or the Exponential GARCH model developed by Nelson (1991) provides a good ground to capture the missing link or inability of GARCH in mean Athanasios *et al.* (2006) to provide an even function of the past disturbances, u_{t-1}, $u_{t-2}....u_{t-n}$. For this work, we used estimates of the followings augmented version of the E-GARCH model

$$R_t = \beta R_{t-1} + \gamma h^2_t + u_t \qquad \text{(equ. 2)}$$

Where R_t is the logarithm investment return at time t

h^2_t is the conditional heteroskedastic term at time t

u_t is the error term

$h^2_t = V(u_t/\Omega_{t-1}) = E(u^2_t/\Omega_{t-1})$. However, it is important to note that for h^2_t, Nelson (1991) used an exponential form which is written as:

$$\text{Log } h^2_t = \alpha_0 + {}^q\textstyle\sum_t = {}_1\alpha_l(u_{t-l}/h_{t-l}) + {}^q\sum_l = {}_1\alpha_l(|u_{t-l}/h_{t-l}|-\mu) + {}^q\sum_l = {}_1\varphi_l \log h^2_{t-l} \qquad \text{(equ 3)}$$

where $\mu = E(|u_t/h_t|)$

As noted by Athanasios *et al.* (2006), the value of μ depends on the density function assumed for the standard disturbances, ε_{tt} = ut/ht, under this condition $\mu = (2/\prod)^{1/2}$,

if $\varepsilon_{tt} \approx N(0,1)$.

Also, it should be noted that for unconditional variance to exist, $1\text{-p}\sum_{l=1}\varphi t\ \varepsilon_{tt}^{\ t} = 0$ (equ. 4)

The implication is that the root of our equation will fall outside the unit cycle. Furthermore, Athanasios k. Et al [21] explained that if ${}^p\sum_l = 1\ \varphi t\ \varepsilon_{tt}^{\ t} < 1$, then the log of unconditional variance will be given by: log (h2t) = $\alpha_0(1\text{-p}\sum_{l=1}\varphi t\ \varepsilon_{tt}^{\ t}\ t)^{-1}$. This makes it clear that the E-GARCH model will always yield a positive conditional variance.

EMPIRICAL RESULTS

Table 3 below (see appendix) presents the result of our analysis on GARCH in mean model using Eviews 7, from the table one can deduce that all the variables except Subsidiary shows a positive relationship when the Treasury bill is the dependent variable. The implication is that, there is evidence that volatility affects returns. The mean equation at 0.001952 shows that the average returns is about 1.95%. However, a mixed result is obtained from the volatility coefficients as the ARCH effects shows a negative effect of -0.150910 while the GARCH effect is at 0.584258. Their sum is between zero (0) and one (1) i.e. 0.433348, as required by theory (see (William *et al.*, 2008),Walter (2010)). Furthermore, taking a look at the table, one could see from our GARCH in mean result that the GARCH- M term 115.0193 is significantly different from zero (0), this shows that there is evidence that volatility affects returns as there is an established linkages between the conditional variance and the conditional mean. In other words, as volatility increases, the returns correspondingly increase by a factor of 115.0193. Our result support Theodossiou and Lee (1995) findings. This result also supports the usual view in financial market that high risk connotes higher returns. It should be noted that when bad news hits financial markets, assets prices tends to enter a turbulent phase and volatility increases, but with positive news, volatility tends to be small and market enters a period of tranquillity.

The Durbin-Watson stat (1.377402) lies between 0.820 and 1.872; this suggests that there is inconclusive evidence regarding the presence or absence of positive first order serial correlation (see Gujarati. and Porter. (2009) Walter (2010) and William *et al.* (2008)). It should be noted that measures such as R^2 may not be meaningful, if there are no repressor in the mean equation, for example, the R^2 is negative in all the models used. A meaningful value of R^2 will be shown when diagnostics test is performed on the variables used (see Table 5).

The EGARCH results also shows a mixed result in the Nigeria context as it could be deduced from Table 4 that the coefficient of the EGARCH terms (-518) is negative which shows that negative shocks have a larger effects on volatility than positive shocks such that as volatility increase by one (1), it is accompanied by a fall in return by 518 percent, an indication that the market is highly volatile and sensitive to announcement effects, this result contradict Athanasios *et al.* (2006) view of the supremacy of EGARCH model over GARCH in mean models. Also, it can be deduced from the table that the mean return on investment (C) is 0.002%. However, the coefficient of the asymmetric term is negative at -0.22 percent, while that of the GARCH effect is positive at 0.98, a sum of these two coefficients: 0.75459 is both positive and lies between zero (0) and one (1). The implication is that the shock on the conditional variance will be highly persistence. This is also in line with the theory. A large sum of these coefficients connotes that large positive or a large negative return will lead future forecast of the variance to be high for a protracted period. The Durbin-Watson stat (1.230350) for the EGARCH also lies between 0.820 and 1.872, which also suggest that there is inconclusive evidence regarding the presence or absence of positive first order serial correlation (see Gujarati. and Porter. (2009)).

In Table 5, we present the result of diagnostic test, from the table it could be deduced that both the F-version and LM-statistics are very significant, suggesting the presence of ARCH in the risk-return relationship (see also (Koenker and Machado, 1999; Guide, 2009). It could be seen from the table that the lower portion of the outlook shows the goodness of fit measure (pseudo R-squared) to be about 0.914 meaning that the analysis is about 91.4% explained by the explanatory variables and the adjusted R is about 0.7156. Though these two results (GARCH-M) and EGARCH shows different results, one interesting thing about the two results is that it is established from the duo that volatility affects returns, and that negative shocks have a larger effects on volatility than positive shocks.

CONCLUSION

This paper examined returns on investments and volatility rate in the Nigerian banking industry for a period of eighteen years covering 1992 to 2009 using GARCH in mean and EGARCH models and found out that volatility do affects return on investments made by the banks. We identified the effects of announcement or news (good or bad) on relationship between risk and returns as both have a contributory effect on the volatility - return relation on investments decision made by these banks. We therefore suggest that policy makers and regulators should put in place measures that will encourage free flow of relevant but good information and avoiding unnecessary bad information from entering the market. Also bank investment should be tailored towards less volatile investment so as to reduce the level of volatility witnessed in the market. We recommend the use of other econometric tools to analyse the nature of risk – return relationship in the market.

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APPENDIX:

Table-1. Actual Investment In Millions By The Nigerian Commercial Banks 1992-2009

Years	Ordinary Shares	Preference Share	Debenture	Subsidiary	Other Investments	Total
1992	455.3	22.3	330.2	172.8	249.9	1230.5
1993	139.9	17.5	570.2	25.8	902.6	1656
1994	426.6	154.1	269.8	83.9	608.9	1543.3
1995	28.9	595.9	354.1	202.3	973.7	2154.9
1996	416.9	144.7	239.7	426.2	1280	2507.5
1997	472.2	84.2	922.4	446.1	1534.4	3459.3
1998	1001.2	57.5	866.8	1697.8	575.2	4198.5
1999	777.2	1964.2	118.1	1426.6	961.3	5247.4
2000	2676.9	0.3	1131.2	1591.2	2549.1	7948.7
2001	6486.7	62.8	1501.7	2213.4	5655.3	15919.9
2002	10871.6	40.2	5807.9	3794.9	14860.4	35375
2003	24576.5	470.4	15111	8757	14013.7	62928.6
2004	31970.1	2333.5	13168.616972.5	95784	15721.7	145809.3
2005	31786.5	10899.7	16972.5	13598.6	15124.8	88382.1
2006	75814	0	2728.3	18954	44081.2	141577.5
2007	177352.8	0	631.8	38859	75454.7	292298.3
2008	358539	5776000	2136.1	93433.6	89370.8	6319480
2009	611965.1		27587.8	155970.9	94808.8	890332.6
Total	1335757	5792847	77279.6	437438.1	378726.5	8022049
Mean	140606	643649.7	8586.622	46046.12	39865.95	844426.2

Source: Central Bank of Nigeria Statistical Bulletin 2010

Table-2. Actual Returns and Averages of Nigerian Commercial Banks Investments

Years	**Treasury Bill**	**Preference Share**	**Debenture**	**Subsidiary**	**Other Investments**	**Ordinary Share**	**Total**
1992	0	0.003	0.0002	0.0004	0.0003	0.0005	0.0044
1993	0.0024	3.9371	0.1208	2.6705	0.0763	0.4925	7.2996
1994	0.0024	0.5846	0.334	1.0739	0.1418	0.2112	2.3479
1995	0.0042	0.1235	0.2079	0.3638	0.0756	2.5467	3.3217
1996	0.0027	0.868	0.524	0.2945	0.0981	0.3013	2.0866
1997	0.0029	1.3088	0.1195	0.247	0.0718	0.2333	1.9833
1998	0.008	6.5287	0.4331	0.2211	0.6526	0.375	8.2185
1999	0.0027	0.02539	4.2235	0.3496	0.5189	0.6418	5.9904
2000	0.0025	2260.7	0.5995	0.4262	0.2661	0.2534	2262.2
2001	0.0026	8.2787	0.3462	0.2349	0.0919	0.0801	9.0344
2001	0.0006	6.99	0.0484	0.074	0.0189	0.0258	7.1577
2003	0.0002	1.4996	0.04668	0.08056	0.05034	0.0287	1.70608
2004	0.0033	0.3265	0.05785	0.07953	0.0485	0.02383	0.53951
2005	0.0052	0.2438	0.1566	0.1954	0.1757	0.08361	0.86031
2006	0.0058	0	1.396	0.2009	0.0864	0.0524	1.7415
2007	0.003	0	1.6586	0.0486	0.0601	0.0256	1.7959
2008	0.0039	0	7.2375	0.0212	0.0222	0.0055	7.2903
2009	-0.0003	-0.0003	-0.0069	-0.0023	-0.002	-0.0003	-0.01183
X2	7.5537	5110945.3	76.0767	9.072	0.8684	0.00022	5119722
Total	5.38094	2291.65	17.50283	6.57979	2.45354	0.2586	2323.825
x	0.2989	127.3139	0.972379	0.365516	0.1363	0.0144	129.1014
x^2/n	1.6086	291,758.87	17.0194	2.4048	0.3344	0.00037	300009.1
d^2	5.94526	4770560.5	59.2387	6.6639	0.52513	0.0014	4770633
$d^2/n-1$	0.349721	280621.21	3.4846	0.392	0.0309	0.00008	280625.5

Source: Author's computation from Table 1

Table-3. Presentation of Garch in Mean Result

Dependent Variable: TREASURY_BILL
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 10/12/12 Time: 14:25
Sample: 1 18
Included observations: 18
Convergence achieved after 71 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(6) + C(7)*RESID(-1)^2 + C(8)*GARCH(-1)

Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
GARCH	115.0193	1081.005	0.106400	0.9153
C	0.001952	0.003586	0.544387	0.5862

DEBENTURE	0.000140	0.000651	0.215308	0.8295
ORDINARY_SHARE	0.000454	0.002514	0.180494	0.8568
SUBSIDARY	2.67E-05	0.005191	0.005149	0.9959
	Variance Equation			
C	1.82E-06	3.53E-06	0.516289	0.6057
RESID(-1)^2	-0.150910	0.141573	-1.065954	0.2864
GARCH(-1)	0.584258	1.043120	0.560107	0.5754
R-squared	0.069018	Mean dependent var		0.002894
Adjusted R-squared	-0.217438	S.D. dependent var		0.002095
S.E. of regression	0.002312	Akaike info criterion		-9.068635
Sum squared resid	6.95E-05	Schwarz criterion		-8.672914
Log likelihood	89.61771	Hannan-Quinn criter.		-9.014070
Durbin-Watson stat	1.377402			

Source: Authors computation using Eview 7.

Table-4. Presentation of Egarch Result

Dependent Variable: TREASURY_BILL
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 10/14/12 Time: 13:39
Sample: 1 18
Included observations: 18
Convergence achieved after 87 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(6) + C(7)*RESID(-1)^2 + C(8)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	-518.0997	229.1806	-2.260661	0.0238
C	0.002273	0.000420	5.408067	0.0000
DEBENTURE	0.000169	0.000185	0.914301	0.3606
ORDINARY_SHARE	0.000949	0.004087	0.232158	0.8164
OTHER_INVESTMENTS	0.009766	0.005174	1.887605	0.0591
	Variance Equation			
C	6.83E-07	8.63E-07	0.792186	0.4283
RESID(-1)^2	-0.219729	0.160382	-1.370038	0.1707
GARCH(-1)	0.974319	0.288445	3.377832	0.0007
R-squared	0.296775	Mean dependent var		0.002894
Adjusted R-squared	0.080398	S.D. dependent var		0.002095
S.E. of regression	0.002009	Akaike info criterion		-9.276283
Sum squared resid	5.25E-05	Schwarz criterion		-8.880562
Log likelihood	91.48654	Hannan-Quinn criter.		-9.221718
Durbin-Watson stat	1.8923			

Source: Authors computation using Eview 7.

Table-5. Diagnostic Test of the Models

Heteroskedasticity Test: ARCH

F-statistic	4.595107	Prob. F(7,3)	0.0000
Obs*R-squared	10.06159	Prob. Chi-Square(7)	0.0000

Test Equation:
Dependent Variable: WGT_RESID^2
Method: Least Squares
Date: 02/22/13 Time: 14:55
Sample (adjusted): 1999 2009
Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.878296	0.912699	0.962306	0.0009
WGT_RESID^2(-1)	-0.187570	0.229742	-0.816434	0.0001
WGT_RESID^2(-2)	-0.150510	0.229893	-0.654695	0.0000
WGT_RESID^2(-3)	0.018014	0.229557	0.078471	0.0000
WGT_RESID^2(-4)	-0.098923	0.253358	-0.390448	0.0003
WGT_RESID^2(-5)	-0.025665	0.263553	-0.097380	0.0003
WGT_RESID^2(-6)	-0.005362	0.243461	-0.022026	0.0000
WGT_RESID^2(-7)	0.972506	0.263276	3.693860	0.0000

R-squared	0.914690	Mean dependent var	0.16946
Adjusted R-squared	0.715632	S.D. dependent var	0.87666
S.E. of regression	0.580010	Akaike info criterion	1.903721
Sum squared resid	1.009236	Schwarz criterion	2.193099
Log likelihood	-2.470465	Hannan-Quinn criter.	1.721308
F-statistic	4.595107	Durbin-Watson stat	1.9854
Prob(F-statistic)	0.0000		

Source: Authors computation using Eveiw 7