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Applying asymmetric GARCH models on developed capital markets :An empirical case study on French stock exchange

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Abstract

The transmitting impact of international financial markets on emerging and other developed financial markets are in very broad manner today. The financial market pattern represents risks and opportunity returns worldwide. The significant characteristics can be categorized individually while computing return statistics including leverage effects and impact of news on financial market in present global transmitting pattern. This study has focused widely on financial market behavior of developed financial market and leverage effect in series returns. In addition the computations of impact of news on French financial market of CAC40 index. This study aims to compute leverage effect and impact of news on financial market of CAC40 stock exchange considering data from Jan 2000 to last day transaction of July 2014. The results are indicators of presence of leverage effect in financial series returns and computation of impact of news on financial market, ie French stock market of CAC40 index. We employed asymmetric GARCH models to compute the results considering Exponential GARCH a (EGARCH and GJR GARCH models. The econometrical computations are in manner to furnish diluted results in according manner to broadcast leverage effect and scale magnitude of news impact in respect to emerging market moments, particularly post financial crisis era.

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***Index Terms*—asymmetric effect, GARCH modeling, financial series, stock returns, news impact**

Introduction

The financial market opportunities are open and presented in enlarged scale all over the world. The degree of returns can never be exempted from degree of risks in any particular financial markets. The investor's perspective is changed towards investment in financial market after global financial crisis. Global financial crisis has slowed down the returns from financial markets all over the world and no financial market exempted from it. Emerging countries having advantages of higher degree of returns against comparative degree of risks from the time market of concerned period. The global crisis has represented the filtered financial investment process without bar of emerging or developed market. The advancements in econometrics and statistical measurements of past records has delivered systematic framing idea about concerned financial market movements. Leverage effect and impact of news on financial market are among the filtered analytical backgrounds of any financial market. We have priorized CAC 40 index of French stock market as the area of study.

EGARCH or Exponential GARCH (Nelson 1991) has highly used econometric tool to estimate leverage effect in financial time series and one of the asymmetric GARCH model. GARCH model originally introduced by Engle 1982 and again by Bollerslev, T., (1986) particularly framed to estimate financial market volatility (conditional variances). EGARCH model is extended logathematic version which allows financial time series for model the leverage effect. The concerned study also meant to compute the impact of good news of bad news on financial market of CAC40 in the scale degree of magnitudes. For such purpose we implement GJR GARCH model which introduced by Glosten, Jagannathan and Renkle (1993), this is secondary asymmetric model to compute leverage effect and also impact of news on financial market of CAC40. GJR-GARCH model indicates results in scale of magnitude.

The CAC 40 index is France's benchmark stock market index which reflects the performance of the 40 largest equities listed on that market considering free-float market capitalisation and liquidity. We obtained data from yahoo finance from first day transaction of Jan 2000 to last day transaction of July 2014 consisting 3728 daily closing observations. We process this study according to this manner; first we compute logs for entire financial time series data and consider first log difference to stationary the series returns. The third step is to compute ADF test statistics and basis statistics from series returns which also visible in graphical presentation in respected figures. And entire modeling process and final results are discussed in empirical analysis.

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Econometric Methods

We work with large financial series consisting 3728 daily observations from first transaction of Jan, 2000 to last day transaction of July2014. The object of this paper is to check leverage effects and effect of news on financial series of CAC40 index, and we employ EGARCH or Exponential GARCH model (Nelson 1991) and GJR-GARCH model (Glosten, Jagannathan and Renkle, 1993). Before we start to working with model, we followed ADF, Augmented Dickey Fuller test (ADF) test statistics, which provides stationary of data and proves no unit root problems in financial series of CAC40 index. The data has significantly found stationary at 10%, 5% and at level of 1% (see table1). Following is detailed execution of asymmetric GARCH modeling. We failed to process with first log difference of data, hence we computed first difference of first log difference of series returns of CAC40 while computing asymmetric modeling.

EGARCH model :

EGARCH or Exponential GARCH Nelson (1991) model assures confidence for positivity of conditional variance. It covers the asymmetric impact. The specimen of EGARCH model can be explored as;

$$\text{Log } h_t = \omega + \beta_1 \log h_{t-1} + \alpha_1[\theta V_{t-1} + \gamma\{|V_{t-1}| - E|V_{t-1}|\}]$$

This model takes a long form and adds an additional term for leverage effect which we call as asymmetric effect. This model guarantees positive variance because of h_t= exp (R.H.S.) > 0 always and θV_{t-1} covers asymmetric effect. Nevertheless this model is also limited to tell about effects of good news and bad news.

GJR-GARCH model :

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Glosten, Jagannathan and Renkle (1993) have developed GJR-GARCH model which estimates effects of good news and bad news from CAC40 financial markets. This model also covers asymmetric or leverage effect confidently. GJR-GARCH can be explored like;

$$h_t = \omega + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1} + \theta I_{t-1} u_{t-1}^2$$

Model explanations:

Here $I_{t-1} = 1$ if $u_{t-1} < 0$ and $I_{t-1} = 0$ or otherwise and if $\theta > 0$, we say that there is a leverage effect. This model also represents effect of good news or bad news on volatility. If ($u_{t-1} > 0$), that has an effect of $\alpha_1 u_{t-1}^2$ on the variance and represents effect of good news on volatility, while bad news effects ($u_{t-1} < 0$) has an effect of $(\alpha_1+\theta) u_{t-1}^2$ on the variance. We deal with large series of data, first day transaction of January, 2000 to last day transaction of July, 2014 which covers daily closing indices of CAC40 French stock market.

Empirical Analysis

The basic statistics process resulted in table1 and suggests the degree of risk; skewness and kurtosis for CAC40 index (see table1). The basic statistics indicates the statistics value of first log difference of CAC40 series returns :

Table – 1 Descriptive statistics using the observations (3728) Jan, 2000 to July 2014

Variance	**Greece-CAC40**
Mean	-8.90480e-005
Median	0.000252903
Min	0.0947154
Max	0.105946

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Std.Dev	0.0151361
Skewness	0.0229804
Kurtosis	4.80596
ADF-TEST	0.118586
10%, 5%, 1%	Significant

Source: Author's computation using stock index – CAC40

We can observe that mean returns represents negative valuations and there is positive skewness with high degree of kurtosis. The return difference from Min to Max is quite more than double in total return valuations i.e 0.0947154 to 0.105946. Standard deviations (Std) represents degree of risks involves in CAC40 0.0151361. The actual series return graph is indicated in Fig1 and stationary processed (logethematic first difference in indicated in Fig2). Series return graph indicates actual series returns from Jan 2000 to July 2014 from CAC40 index.

Furthermore we can ADF test statistics in table1. ADF, Augmented Dickey Fuller test (ADF) test statistics provides stationary of data and proves no unit root problems in financial series of CAC40 market and that allows ARCH effect to proceed. Test statistics results mentioned in table1 and found significant at degree of 10%, 5% and at level of 1%. That allows CAC40 financial series returns to proceed for modeling estimation and compute statistical degree for Exponential GARCH and GJR GARCH.

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Fig1. CAC40 CAC40 index financial time series from Jan 2000 to July 2014 (original data series)

Source: Author's computation using daily closing prices of CAC40 index

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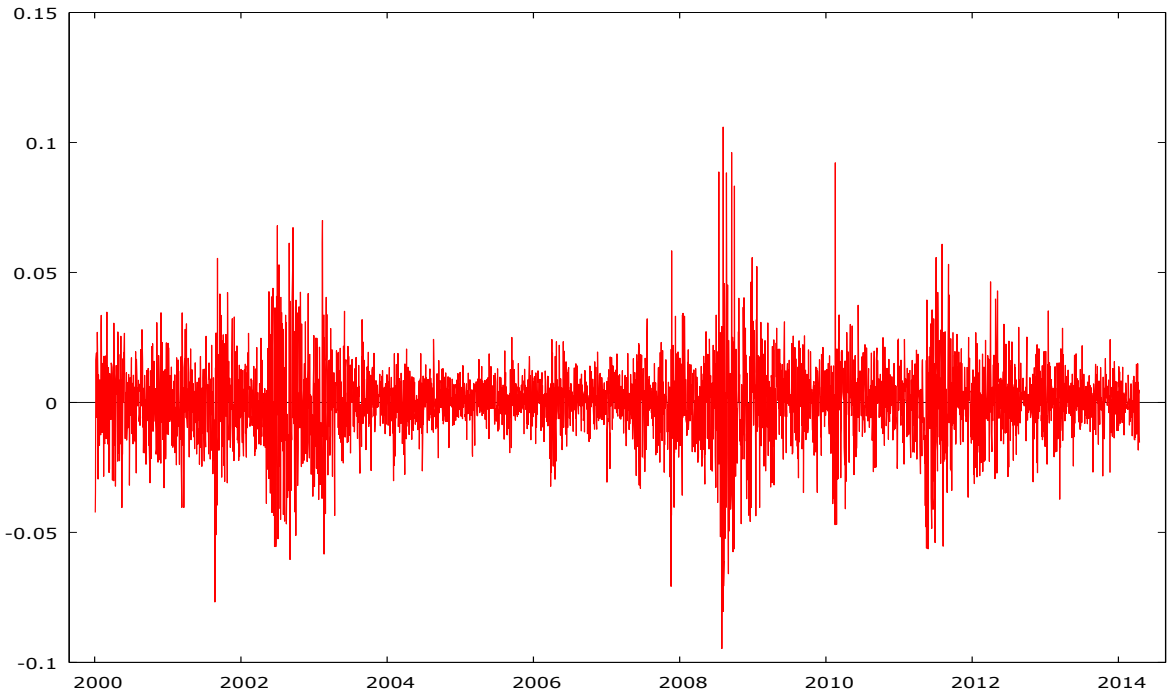
Fig2. CAC40 index financial time series log-difference from Jan 2000 to July 2014 (stationary series)



Source: Author's computation using daily closing prices of CAC40 index

We can notice the highest level of CAC40 index in between year 2000 to 2001and continuous lower-side moments till 2003. This time duration also includes smaller degree of upper shocks between 2001 to 2003. The interesting part is the later moments after 2003, where we can notice the CAC40 stock moments has moved towards upper-side in similar pattern followed for lower-side from 2001 to 2003 and continued the pattern over year 20071. Global financial crisis impact is clearly visible in original series returns (see Fig1) and abnormal shocks upper-side and lower-side during these periods (see fig2).

The model estimation for EGARCH and GJR-GARCH is presented hereunder. The equation follows formula execution mentioned in methodology.

We have followed - EGARCH model examines the leverage effect in French stock exchange CAC 40 index considering data series from Jan 2000 to Jan 2014.

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$$\text{Log } h_t = \omega + \beta_1 \log h_{t-1} + \alpha_1[\theta V_{t-1} + \gamma\{|V_{t-1}| - E|V_{t-1}|\}]$$

And the model execution for EGARCH is as followes;

$$\text{Log } h_t = 0.500128\ (\omega) + 0.968067\ \beta_1)\log h_{t-1} + 0.309295\ (\alpha_1)\ [\theta V_{t-1} + 0.139240 \quad \{|V_{t-1}| - E|V_{t-1}|\}]$$

*Note: EGARCH (Nelson, 1991) computation of data CAC40 index based on first difference of first logethematic log difference of series returns using time series from Jan 2000 to July 2014.

The above EGARCH executed model suggests that gamma value is non zero and indicates presence of leverage effect in volatility of CAC40 financial market. Exponential GARCH model fitted perfectly on first difference of first difference of logathematic series return data. We need to employ GJR GARCH model to finding out impact of news on CAC40 financial markets.

We have executed following formulations :

$$h_t = \omega + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1} + \theta I_{t-1} u_{t-1}^2$$

The above GJR-GARCH model introduced by Glosten, Jagannathan and Renkle (1993) amd that estimates effects of good news and bad news from CAC40 financial markets. This model also covers asymmetric or leverage effect confidently. Following are formularizing executions of CAC40 financial series returns.

$$h_t=0.0000094(\omega) + 0.167992(\alpha_{1)}u_{t-1}^2 + 0.811719(\beta_1)\ h_{t-1} + 0.304411(\theta)I_{t-1}\ u_{t-1}^2$$

The above formulations suggest; the presence of leverage effect in CAC40 financial series and effect of good news magnitude and bad news magnitude. GJR GARCH outcome suggests that CAC40 financial market has good news impact of 0.167992 magnitude on financial market while impact of bad news is 0.472403 magnitude. The scaled difference reaches to 3 time more powerful magnitude impact on financial market of CAC40 when market starts to move lower-side by one or another bad news. And and or we can say that market moves 75% negatively

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when there is bad news in market and pushes 25% market upper-side when there is good news in French stock exchange of CAC40 index.

Conclusions

The Exponential GARCH (EGARCH) model fitted well considering first difference of (FLD) of series returns CAC40. There is evidence of leverage effects in financial market and long kurtosis (abnormal level) reaches to 5 (4.80) suggests higher the degree for 2.80 (more than normal level of 3. GJR GARCH model has successfully computed the impact of news on French stock exchange considering the financial time series of CAC 40 index. The good news impacts at a scale of 0.167992 magnitude while bad news effects comparatively 3 times more powerful scale impact with 0.472403 magnitude on financial market of CAC40. Investors takes note that degree of risks in CAC40 suggests average risk level and French stock exchange of CAC40 is capable to generate good returns at long time investment. The present financial market moment patterns for both emerging and developed stock markets creates great return opportunity throughout the world financial market.

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