The Month-of-the-year Effect: Evidence from GARCH models in Fifty Five Stock Markets

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Abstract
This paper studies the month of the year effect, where January effect presents positive and the highest returns of the other months of the year. In order to investigate the specific calendar effect in global level, fifty five stock market indices from fifty one countries are examined. Symmetric GARCH models are applied and based on asymmetries tests asymmetric GARCH models are estimated. The main findings of this study is that a December effect is found on twenty stock markets, with higher returns on the specific month, while February effect is presented in nine stock markets, followed by January and April effects in seven and six stock markets respectively. These patterns provide positive and highest returns on the mentioned months, while a pattern where a specific month gives a persistence signal of negative returns couldn't be found.

Keywords: seasonality, stock returns, calendar effects, month of the year effect, asymmetric GARCH models, asymmetry tests, January effect

1. Introduction

January and the month of the year effect has been examined and investigated in various studies. Choudhry (2001) used monthly data for Index of Industrial shares in UK , Index of common stocks in Germany, Index of all industrial and public utilities and railroad common stocks to test the month-of-the year effect. Choudhry (2001) employed a MA(1)-GARCH-(1,1)-GJR model , including a moving average MA term to capture the effect of non-synchronous trading and found significant positive returns in January for UK and on January, April and August for USA, significant negative returns in March and July for UK, while significant positive returns in February, August, September and December and significant negative returns in June and October were found for Germany. Arsad and Coutts (1997) found that January displays significant positive returns after the introduction of capital gains tax in 1965, while Aggarwal and Rivoli (1989) have found that January effects exists.

Furthermore, other studies report positive and higher returns in both January and February (Mills *et al.*, 2000; and Marquering, *et al.*, 2006).

On the contrary other studies report different results. Szakmary and Kiefer (2004) found that the turn of the year effect in small capitalization stocks as the S&P 400 Midcap and Russell 2000 indices, is eliminated by market participants. Generally January effect doesn't exist, but increased returns for small-cap stock indices on the last trading day of December are reported. Floros (2008) rejected January effect for three stock indices examined in Athens stock exchange market and higher returns over other months rather January are reported, but the estimated coefficients are statistically insignificant, except significant negative returns in June for all indices. Tonchev and Kim (2004) find that January effect exists only in the Czech Republic. Some evidence there is for the January effect for Slovenia and the half-month effect for the Czech Republic. Also they found a weak evidence for monthly seasonality in variance in all three countries. Giovanis (2009) examined fifty five stock markets and the January effect is rejected, as it is presented only in seven stock markets, while the most frequent significant higher monthly returns are reported in December of twelve stock markets. Since 1990 new approaches have been introduced in finance, which is the artificial intelligence, as neural networks and fuzzy logic. These approaches have been applied with success in finance, but they haven't been applied for the data mining of the calendar effects. Giovanis (2008) examined the month of the year effect in Athens stock exchange market and found higher returns in December.

The purpose of this paper is to investigate and test the January or the month of the year effect in a global level, without to be restricted in regional or national level, in order to examine if actually January presents the highest returns than the other months of the year, as also to recognize other monthly patterns which can be used for the

optimum asset allocation with result the maximization of profits. Because each stock market behaves differently and presents different monthly patterns, the trading strategy should be formed in this way where the buy and sell signals and actions will be varied in each stock index.

2. Methodology

2.1 The Regression Model

The stock returns are defined by the following relation

$$R_t = \log(P_t - P_{t-1}) \tag{1}$$

Variable P_t denotes the closed stock prices, while P_{t-1} expresses the closed stock prices with one lag. For the examination of the month-of-the year effect the following regression is estimated:

$$R_t = \sum_{i-1}^{12} \beta_i D_{it} + \varepsilon_t \tag{2}$$

,where R_t is defined as in the relation (1), D_{it} represents the twelve dummy variables for twelve months, where D_{1t} takes value *1* if returns belong in days of January and *0* otherwise, continuing at the last dummy variable D_{12t}, which takes value *1* if stock returns belong in days of December and *0* otherwise and ε_t is the disturbance term. The ordinary least squares method has been applied in all estimations, but the results are not reported, as in all cases heteroskedasticity, ARCH effects and autocorrelation were present. So for this reason is claimed that OLS estimations reports are not necessary, as the results are not reliable.

2.2 GARCH Methodology

In order to estimate regression (2) GARCH models are applied. The first is the simple symmetric GARCH (1,1) model which was proposed by Bollerslev (1986) and is defined as

$$\varepsilon_t \sim (0, \sigma_t^2) \tag{3}$$

, where ε_t is the disturbance term of mean equation (2) and

$$\sigma_t^2 = \omega + a_0 u_{t\text{-}1_t}^2 + a_1 \sigma_{t\text{-}1}^2 \tag{4}$$

The standard GARCH model is symmetric in its response to past innovations. Since good news and bad news may have different effects on the volatility two alternative GARCH models are considered in an attempt to capture the asymmetric nature of volatility responses. Since the symmetric GARCH model is unable to account for the leverage effects observed in stock returns, asymmetric GARCH models were proposed that enable conditional variance to respond asymmetrically to rises and falls in innovations

The other two GARCH models which are considered are the asymmetric EGARCH and GJR models. EGARCH (1,1) model was proposed by Nelson (1991) and has the following form:

$$\varepsilon_t \sim (0, \sigma_t^2) \tag{5}$$

$$\log(\sigma_t^2) = \omega + \log a_0(\sigma_{t-1}^2) + a_1 \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma \left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] \tag{6}$$

, where ε_t is defined as in relation (3). We except for the asymmetries allowed finding a negative value for coefficient γ if the relationship between volatility and returns is negative. More specifically it is expected $\gamma < 0$, “good news” generate less volatility

than “bad news”, where γ reflects the leverage effect. The second asymmetric GARCH model we estimate is GJR-GARCH (1,1), which was proposed by Glosten *et al.* (1993)

$$\sigma_t^2 = \omega + a_0 u_{t-1}^2 + a_1 \sigma_{t-1}^2 + \gamma u_{t-1}^2 I_{t-1} \quad (7)$$

I_{t-1} is a dummy variable, where $I_{t-1} = 1$ *if* $u^2_{t-1} < 0$ and $I_{t-1} = 0$ otherwise. Also for a leverage effect is expected that $\gamma > 0$, so that the “bad news” have larger impacts, and is required that $\alpha_1 + \gamma \geq 0$ and $\alpha_1 \geq 0$ for non-negativity condition. It should be mentioned that the normal distribution, which was used by Engle (1982) is not followed, but in order the model to fully capture the excess kurtosis more fat tailed distributions that were proposed in the literature are used. Generally GARCH estimation behavior manifests itself as excessive kurtosis in residuals of the model. This property is known as fat tail or heavy-tailed distribution and means that extreme values have higher probabilities to occur. Since *student- t* (Bollerslev, 1987) and the GED distribution (Nelson, 1991) have heavier tails than normal distribution, there is a better ability of generating large values (outliers) and therefore might be a better representative of conditional variance in the data. The *t* distribution was chosen, as the estimated results between *t* and GED distributions are almost the same.

It should be mentioned that we don’t present the results of both asymmetric GARCH models in all stock markets, but each time we present only that we have chosen as the optimum. This choice is done based on *Akaike* and *Schwartz* information criteria, the *Log-Likelihood* statistic, as also based on which model is able to eliminate ARCH effects and autocorrelation.

2.3 Asymmetric tests

Because the symmetric GARCH model is unable to capture for leverage effects, as it was mentioned previously we investigate if there are asymmetries in volatility of the calendar effects we examine. Here the methodology of the asymmetry tests proposed by Engle and NG (1993) is presented. We define S^{-}_{t-1} as a dummy indicator taking value one if $u_{t-1}<0$ and zero otherwise. So the first test is the sign test and is defined by equation:

$$\hat{u}_t^2 = d_0 + d_1 S^{-}_{t-1} + e_t \tag{8}$$

,where e_t is an iid error term. If positive and negative shocks impact differently the upon the conditional variance then d_1 should be statistically significant. The second test is the negative sign bias and is defined as:

$$\hat{u}_t^2 = d_0 + d_1 S^{-}_{t-1} u_{t-1} + e_t \tag{9}$$

, where d_1 should be also statistically significant. Then $S^{+}_{t-1} = 1 - S^{-}_{t-1}$ is defined, so that S^{+}_{t-1} picks out the observations with positive innovations and the positive sign bias test can be defined as:

$$\hat{u}_t^2 = d_0 + d_1 S^{+}_{t-1} u_{t-1} + e_t \tag{10}$$

Engle and NG (1993) proposed a joint test for size and sign bias based on the following regression

$$\hat{u}_t^2 = d_0 + d_1 S^{-}_{t-1} + d_2 S^{-}_{t-1} u_{t-1} + d_3 S^{+}_{t-1} u_{t-1} + e_t \tag{11}$$

, where significance of d_1 indicates the presence of sign bias, while on the other hand the significance d_2 or d_3 would suggest the presence of sign bias, where both the sign and the magnitude of the shock are important. The joint test is calculating by NR^2,

where N is the sample size, and asymptotically follows chi-square distribution with *3* degrees of freedom under the null hypothesis of no asymmetric effects. The null hypothesis is H_0: $d_1 = d_2 = d_3 = 0$.

3. Data

The analysis is conducted in terms of daily returns More specifically in table1 we present the countries, the indices symbols and the sources-websites where we found the data. The final period is 31 December 2008 for all series except from the starting period, where is shown in table 1.

(Table 1)

4. Empirical results

In table 2 the asymmetry tests of GARCH (1,1) model are reported. We observe that the null hypothesis of the joint test (11) is rejected in all stock markets, except from stock markets in Luxemburg and Turkey. For this reason GARCH(1,1) is applied for these two stock markets. In table 3 the symmetric and asymmetric GARCH estimations of equation (2) are reported, where we note which asymmetric GARCH model is obtained in each stock market we examine. Table 4 reports the diagnostic tests of GARCH regressions.

The coefficients of GARCH equations are statically significant in the most cases. Furthermore, the coefficient γ denoting the leverage effect is statistically significant and presents the expected and correct sign in all cases, except from the stock markets in Estonia, Latvia, Sri Lanka and Yugoslavia, where the coefficient γ has the correct

sign, but is insignificant, as well as in the case of Jordan, where the coefficient γ presents the wrong sign as also is insignificant too.

From the overall results we observe that January effect is presented only in seven stock markets, which are in Malaysia, Pakistan, Peru, Singapore, Thailand and Dow Jones and Nasdaq-100 in USA. O the contrary we find a December effect, where the highest significant returns are reported in December, where the specific effects are presented in twenty stock markets. These are in Austria, Belgium, Brazil, Canada, Denmark, Estonia, Germany, India, Indonesia, Ireland, Luxemburg, Mexico, Netherlands, New Zealand, Philippine , Switzerland, Turkey, UK indices FTSE-100 and FTSE-250 and finally in Yugoslavia, where in Canada and New Zealand the highest returns are presented also in February and September respectively. Furthermore, a February effect is stronger than January, as it is presented in ten stock markets, Chile, Egypt, Finland, Hong Kong, Italy, Portugal, Russia, Spain, and Sweden including the stock market examined in Canada, as it was mentioned previously.

April effect is followed in Australia, China, Greece, Israel, Kuwait and S&P 500 index in USA, while October presents the highest significant returns in the stock markets examined in Argentina, Croatia, and Norway. Some other weaker monthly anomalies are March, September and November effects presented in Japan, and France for March**,** Lithuania and Sri Lanka for September and South Korea and NY Composite for November. Finally, May exhibits higher significant returns in the stock market of Jordan, July in Latvia, June in Taiwan and August in Zambia.

On the contrary there aren't persistent anomalies and negative returns categorized in groups. For example it was expected that September might present negative returns in stock markets, but this is not happened as it is present only in China, while in the

most cases returns in September are insignificant, while in few stock markets present positive significant returns, but not the lowest among the other months of the year.

(Tables 2-4)

5. Conclusions

The purpose of this paper was to examine the month of the year and the January effect. Because the most studies are restricted and repeated in major stock markets in the world, as Dow Jones Industrial and S&P 500 in USA and FTSE-100 in UK among others, we tried to examine representative stock markets around the world and the analysis was not restricted in national and regional level or major stock markets, but was extended in global level. Generally, the results are mixed, but we conclude that January effects doesn't exist in global level and it is a very week calendar effect, as it is presented only in seven stock markets, while December presents higher returns in twelve stock markets. Furthermore, this study shows that the market efficiency hypothesis, always based on the month of the year effects, is violated, as in each stock market separately monthly patterns, with purpose the exploitation of profits, are formulated.

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Table 1 Stock Market Indices and estimating periods

Countries	Period	Countries	Period
Argentina (MERVAL INDEX)[1]	9 October 1996	Indonesia (JKSE Composite Index)[1]	2 July 1997
Australia (All ordinaries Index)[2]	9 January 2001	Ireland (GENERAL INDEX) www.ise.ie	4 January 1983
Austria (ATX INDEX)[1]	12 November 1992	Israel (TA-100 INDEX)[1]	2 July 1997
Belgium (BFX INDEX)[1]	14 February 2005	Italy (MIBTEL INDEX)[1]	4 January 2000
Brazil (IBOVESPA INDEX)[1]	28 April 1993	Japan(Nikkei 225)[1]	5 January 1984
Canada (S&P/TSX Composite index)[1]	4 January 2000	Jordan (Weighted General Index) www.ase.com.jo	4 January 1992
Chile (IPSA INDEX)[2]	23 September 2003	Kuwait (All Share Index)[2]	19 June 2001
China (Shanghai composite Index)[2]	4 July 1997	Latvia (OMX Riga) www.baltic.omxnordicexchange.com	4 January 2000
Croatia (CROBEX INDEX) www.zse.hr	3 January 1997	Lithuania (OMX Vilnius) www.baltic.omxnordicexchange.com	4 January 2000
Denmark (KFX INDEX)[2]	6 January 2000	Luxemburg (LuxX INDEX) www.bourse.lu	10 May 1988
Egypt (CCSI INDEX)[1]	3 July 1997	Malaysia (KLSE INDEX)[1]	6 December 1993
Estonia (OMX Tallinn)[6]	3 January 2000	Mexico (IPC INDEX)[1]	11 November 1991
Finland (Helsinki General Index)[2]	4 July 1997	Netherlands (AEX INDEX)[1]	13 October 1990
France (CAC 40 INDEX)[1]	2 March 1990	New Zealand (New Zealand Stock Exchange 50 Index)[2]	5 May 2004
Germany (DAX INDEX)[1]	27 November 1990	Norway (OSEAX INDEX)[1]	8 February 2001
Greece (GENERAL INDEX) www.enet.gr	5 Januaary 1998	Pakistan (Karachi 100 Index)[2]	8 July 1997
Hong Kong (HANG SENG INDEX)[1]	2 January 1987	Peru (Lima General Index)[2]	4 May 1998
India (BSE SENSEX)[1]	2 January 1997	Philippine (PSE Composite Index)[2]	7 July 1997
Portugal (PSI GERAL INDEX) www.euronext.com	14 February 2005	Turkey (ISTANBUL NAT-100)[2]	4 July 1997
Russia Federation (RTSI INDEX) www.rts.ru,	4 September 1995	UK (FTSE-100)[2]	3 April 1984
Singapore (STI INDEX)1	7 July 1997	UK (FTSE-250)[2]	6 January 2000
South Korea (KOSPI Composite Index)1	2 July 1997	USA (Dow Jones composite)[1]	24 December 1980
Spain (IBEX 35)2	9 January 2002	USA (Nasdaq 100)[1]	8 February 1971
Sri Lanka (CSE All share Index)[2]	4 July 1997	USA (NY composite)[1]	3 January 1966
Sweden (SAX ALL SHARE INDEX)2	9 January 2001	USA (S&P 500)[1]	4 January 1950
Swiss (SSMI INDEX)[1]	12 November 1990	Yugoslavia (BELEX 15) www.belex.co.yu	5 October 2005
Taiwan (TSEC weighted index)[1]	3 July 1997	Zambia (LASI INDEX) www.luse.co.zm	2 January 2002
Thailand (SET INDEX)[2]	3 July 1997		

1.Source www.yahoofinance.com, 2. Source www.econstats.com

Table 2. Asymmetric tests for the month-of-the-year effect

Countries	Sign Bias	Negative Size Bias	Positive Size Bias	Joint test F-statistic	**Countries**	Sign Bias	Negative Size Bias	Positive Size Bias	Joint test F-statistic	**Countries**	Sign Bias	Negative Size Bias	Positive Size Bias	Joint test F-statistic
ARGENTINA	7.60e-05 (0.1225)	-0.00885 (0.000)	0.00348 (0.0224)	12.167 (0.000)	IRELAND	-1.69e-05 (0.9048)	-0.0059 (0.000)	-0.003 (0.0009)	22.399 (0.000)	SINGAPORE	8.23e-07 (0.9777)	-0.00401 (0.0024)	0.0053 (0.0001)	7.896 (0.000)
AUSTRALIA	4.80e-05 (0.0737)	-0.0175 (0.000)	-0.00192 (0.2872)	22.545 (0.000)	ISRAEL	3.19e-05 (0.1279)	-0.00698 (0.000)	-0.00270 (0.0076)	18.659 (0.000)	SOUTH KOREA	7.56e-05 (0.0548)	-0.00374 (0.0047)	0.00091 (0.4812)	4.076 (0.0067)
AUSTRIA	4.02e-05 (0.0007)	-0.00462 (0.000)	-0.0029 (0.000)	20.557 (0.000)	ITALY	3.73e-05 (0.0060)	-0.00317 (0.0002)	-0.00369 (0.0131)	13.752 (0.000)	SPAIN	4.78e-05 (0.0024)	-0.00383 (0.000)	-0.00289 (0.0006)	14.616 (0.0000)
BELGIUM	2.85e-05 (0.3246)	-0.00516 (0.0024)	-0.00461 (0.0140)	5.627 (0.0008)	JAPAN	2.77e-05 (0.0580)	-0.00324 (0.000)	-0.00442 (0.000)	19.422 (0.000)	SRI LANKA	1.91e-05 (0.4876)	-0.00531 (0.0006)	0.00257 (0.1371)	4.809 (0.0024)
BRAZIL	-6.51e-05 (0.3591)	-0.0114 (0.000)	-0.0085 (0.000)	18.726 (0.000)	JORDAN	-1.81e-05 (0.0178)	-0.00464 (0.000)	-0.00018 (0.7334)	21.625 (0.000)	SWEDEN	3.19e-05 (0.0848)	-0.00291 (0.0023)	-0.00374 (0.0001)	9.046 (0.000)
CANADA	3.32e-05 (0.0236)	-0.00273 (0.0038)	-0.00198 (0.0448)	5.708 (0.0007)	KUWAIT	2.45e-05 (0.0234)	-0.0108 (0.000)	0.00012 (0.8738)	66.566 (0.000)	SWITZERLAND	2.40e-05 (0.0157)	-0.00479 (0.000)	-0.00185 (0.0022)	25.502 (0.000)
CHILE	2.07e-05 (0.0974)	-0.00663 (0.000)	-0.00332 (0.0008)	23.080 (0.000)	LATVIA	2.42e-05 (0.5921)	-0.0197 (0.000)	0.00686 (0.0014)	35.090 (0.000)	TAIWAN	1.81e-05 (0.3937)	-0.00448 (0.000)	-0.00083 (0.3579)	8.532 (0.000)
CHINA	2.97e-05 (0.2520)	-0.00505 (0.0001)	-0.00232 (0.0312)	6.717 (0.0002)	LITHUANIA	1.69e-05 (0.1898)	-0.00499 (0.000)	0.00033 (0.7284)	9.086 (0.000)	THAILAND	-0.00011 (0.0164)	-0.00103 (0.4977)	0.0111 (0.000)	18.765 (0.000)
CROATIA	-1.64e-05 (0.7478)	0.00265 (0.1889)	-0.0171 (0.0157)	19.460 (0.000)	LUXEMBURG	0.00015 (0.3053)	-0.00714 (0.000)	-0.00248 (0.0131)	1.747 (0.1550)	TURKEY	-1.47e-05 (0.8572)	-0.00208 (0.3094)	-3.30e-05 (0.9873)	0.3563 (0.7846)
DENMARK	3.75e-05 (0.0009)	-0.00126 (0.0715)	-0.00174 (0.0202)	7.042 (0.0001)	MALAYSIA	-1.8e-05 (0.7263)	0.0218 (0.000)	0.0102 (0.000)	33.061 (0.000)	UK-FTSE 100	2.08e-05 (0.0180)	-0.00475 (0.000)	-0.00347 (0.000)	35.628 (0.000)
EGYPT	1.70e-05 (0.2942)	-0.00793 (0.000)	-0.00277 (0.0154)	20.584 (0.000)	MEXICO	9.05e-06 (0.6789)	-0.0067 (0.000)	-0.0025 (0.0075)	18.823 (0.000)	UK-FTSE 250	3.87e-05 (0.0006)	-0.00324 (0.0001)	-0.00242 (0.0032)	12.395 (0.000)
ESTONIA	1.00e-05 (0.4411)	-0.0056 (0.000)	0.00155 (0.1474)	11.224 (0.000)	NETHERLANDS	3.87e-05 (0.0116)	-0.0039 (0.000)	-0.0033 (0.000)	16.089 (0.000)	US DOW JONES COMPOSITE	2.43e-05 (0.1231)	-0.00825 (0.000)	-0.0003 (0.7843)	17.730 (0.000)
FINLAND	8.89e-05 (0.0672)	-0.0061 (0.0003)	-0.00392 (0.0156)	7.697 (0.000)	NEW ZEALAND	1.19e-05 (0.0295)	-0.00129 (0.0232)	0.00038 (0.5178)	3.474 (0.0156)	US NASDAQ 100	4.66e-05 (0.000)	-0.0056 (0.000)	-0.0055 (0.000)	64.245 (0.000)
FRANCE	1.68e-05 (0.1650)	-0.00249 (0.0001)	-0.00139 (0.0273)	7.925 (0.000)	NORWAY	6.37e-05 (0.0009)	-0.00833 (0.000)	-0.00519 (0.000)	35.364 (0.000)	US NEW YORK COMPOSITE	1.23e-05 (0.1643)	-0.00498 (0.000)	-0.00264 (0.0001)	22.489 (0.000)
GERMANY	3.70e-05 (0.0071)	-0.00415 (0.000)	-0.00248 (0.0004)	18.621 (0.000)	PAKISTAN	0.000118 (0.000)	-0.00627 (0.000)	-0.00224 (0.0419)	19.396 (0.000)	US – S&P 500	1.63e-05 (0.0414)	-0.00677 (0.000)	-0.00151 (0.0110)	39.958 (0.000)
GREECE	-0.0001 (0.2167)	-0.0106 (0.0002)	-0.0548 (0.000)	110.122 (0.000)	PERU	2.04e-05 (0.2704)	-0.0101 (0.000)	-0.00293 (0.0043)	34.555 (0.000)	YUGOSLAVIA	-1.98e-05 (0.7487)	-0.00995 (0.0005)	0.0146 (0.000)	11.314 (0.000)
HONG KONG	0.000105 (0.1318)	-0.0390 (0.000)	-0.0075 (0.0064)	58.649 (0.000)	PHILLIPINE	1.56e-06 (0.9579)	-0.00387 (0.0035)	0.00529 (0.0001)	7.657 (0.000)	ZAMBIA	-0.00021 (0.000)	0.00544 (0.000)	-0.0103 (0.000)	34.558 (0.000)
INDIA	7.52e-05 (0.0017)	-0.00795 (0.000)	-0.00393 (0.0001)	28.850 (0.000)	PORTUGAL	3.19e-05 (0.0922)	-0.00465 (0.000)	-0.00608 (0.2413)	10.430 (0.000)					
INDONESIA	7.38e-05 (0.1347)	-0.0085 (0.000)	0.00368 (0.0157)	11.497 (0.000)	RUSSIA	0.000171 (0.0285)	-0.0187 (0.0015)	0.00226 (0.000)	29.452 (0.000)					

P-values in parentheses

Table 3. GARCH estimations of equation (2)

Countries	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	β_{11}	β_{12}	ω	α_0	γ	α_1
ARGENTINA GJR-GARCH	0.00161	0.00197	-0.00034	0.00058	0.00063	-0.00043	0.00051	-0.00098	0.00174	0.00206	0.00131	0.00189	1.50e-05	0.0588	0.1151	0.8531
	(0.00098)	(0.00098)	(0.00095)	(0.00098)	(0.00110)	(0.00097)	(0.00101)	(0.00097)	(0.00093)	(0.00090)	(0.00096)	(0.00109)	(2.99e-06)	(0.0154)	(0.0232)	(0.0170)
	[1.640]	[2.003]**	[-0.360]	[0.588]	[0.578]	[-0.445]	[0.504]	[-1.007]	[1.885]***	[2.284]**	[1.361]	[1.730]***	[5.033]*	[3.825]*	[4.974]*	[50.259]*
AUSTRALIA EGARCH	0.00068	0.00040	0.00060	0.00113	0.00025	-3.46e-05	0.00081	0.00063	0.00035	0.00105	1.26e-06	0.00097	-0.4608	0.1645	-0.0585	0.9656
	(0.00028)	(0.00030)	(0.00029)	(0.00031)	(0.00030)	(0.00030)	(0.00028)	(0.00030)	(0.00029)	(0.00030)	(0.00033)	(0.00033)	(0.0558)	(0.0148)	(0.0083)	(0.0051)
	[2.355]**	[1.299]	[2.010]**	[3.640]*	[0.821]	[-0.112]	[2.822]*	[2.127]**	[1.234]	[3.492]*	[0.003]	[2.895]*	[-8.251]*	[11.112]*	[-7.020]*	[187.25]*
AUSTRIA GJR-GARCH	0.00134	0.00156	-0.00016	0.00120	0.00082	0.00020	0.00017	0.00016	-0.00069	0.00093	0.00084	0.00175	4.20e-06	0.0489	0.0822	0.8710
	(0.00047)	(0.00047)	(0.00049)	(0.00048)	(0.00047)	(0.00049)	(0.00045)	(0.00051)	(0.00048)	(0.00052)	(0.00049)	(0.00050)	(7.72e-07)	(0.0139)	(0.0171)	(0.0146)
	[2.877]*	[3.329]*	[-0.330]	[2.504]**	[1.744]***	[0.412]	[0.382]	[0.319]	[-1.421]	[1.790]***	[1.705]***	[3.520]*	[5.447]*	[3.519]*	[4.817]*	[59.492]*
BELGIUM EGARCH	0.00129	0.00124	-0.00078	0.00023	-0.00032	-0.00066	0.00056	-0.00046	0.00092	0.00013	-0.00023	0.00165	-0.2113	0.0457	-0.1639	0.9815
	(0.00060)	(0.00062)	(0.00056)	(0.00059)	(0.00065)	(0.00071)	(0.00064)	(0.00063)	(0.00061)	(0.00061)	(0.00060)	(0.00057)	(0.0468)	(0.0262)	(0.0202)	(0.0044)
	[2.138]**	[2.164]**	[1.387]	[0.388]	[-0.499]	[-0.928]	[0.874]	[-0.734]	[1.520]	[0.212]	[0.380]	[2.894]*	[-4.514]*	[1.714]***	[-8.051]*	[221.33]*
BRAZIL GJR-GARCH	0.00201	0.00153	0.00064	0.00161	0.00233	0.00090	0.00061	0.00081	0.00132	0.00129	0.00274	0.00327	9.79e-06	0.0689	0.0761	0.8789
	(0.00103)	(0.00119)	(0.00106)	(0.00106)	(0.00096)	(0.00102)	(0.00095)	(0.00099)	(0.00104)	(0.00098)	(0.00112)	(0.00104)	(2.19e-06)	(0.0113)	(0.0139)	(0.0126)
	[1.945]***	[1.279]	[0.601]	[1.521]	[2.427]**	[0.886]	[0.641]	[0.818]	[1.265]	[1.318]	[2.443]**	[3.138]*	[4.465]*	[6.105]*	[5.471]*	[69.990]*
CANADA EGARCH	0.00057	0.00115	8.56e-05	0.00022	0.00107	-7.74e-05	0.00070	0.00038	0.00034	0.00063	0.00040	0.00115	-0.2081	0.1010	-0.0761	0.9862
	(0.00047)	(0.00053)	(0.00053)	(0.00060)	(0.00056)	(0.00053)	(0.00054)	(0.00053)	(0.00049)	(0.00056)	(0.00060)	(0.00051)	(0.0377)	(0.0180)	(0.0134)	(0.0035)
	[1.215]	[2.165]**	[0.160]	[0.369]	[1.930]***	[-0.145]	[1.313]	[0.720]	[0.694]	[1.119]	[0.674]	[2.247]**	[-5.513]*	[5.606]*	[-5.674]*	[279.91]*
CHILE EGARCH	0.00085	0.00216	2.04e-05	0.00043	0.00065	0.00135	0.00049	0.00094	0.00076	0.00136	0.00021	0.00094	-0.8265	0.2819	-0.1055	0.9369
	(0.00078)	(0.00067)	(0.00077)	(0.00074)	(0.00073)	(0.00076)	(0.00070)	(0.00060)	(0.00083)	(0.00068)	(0.00078)	(0.00085)	(0.1373)	(0.0457)	(0.0224)	(0.0130)
	[1.091]	[3.219]*	[0.026]	[0.577]	[0.885]	[1.765]***	[0.703]	[1.559]	[0.920]	[2.006]**	[0.276]	[1.109]	[-6.016]*	[6.169]*	[-4.704]*	[71.575]*
CHINA EGARCH	0.00137	-7.20e-05	0.00073	0.00185	0.00111	-0.00071	-0.00020	0.00012	-0.00132	-0.00087	0.00060	-8.21e-05	-0.3979	0.2261	-0.0615	0.9726
	(0.00082)	(0.00107)	(0.00070)	(0.00072)	(0.00089)	(0.00078)	(0.00073)	(0.00066)	(0.00068)	(0.00083)	(0.00071)	(0.00066)	(0.0684)	(0.0260)	(0.0140)	(0.0069)
	[1.675]***	[-0.067]	[1.042]	[2.550]**	[1.245]	[-0.917]	[-0.282]	[0.193]	[-1.95]**	[-1.048]	[0.842]	[-0.122]	[-5.811]*	[8.669]*	[-4.379]*	[140.38]*
CROATIA EGARCH	0.00087	-0.00039	0.00114	0.00246	-0.00045	4.25e-05	0.00092	0.00066	0.00138	0.00280	0.00131	0.00037	-0.3889	0.2427	-0.0338	0.9738
	(0.00065)	(0.00081)	(0.00066)	(0.00046)	(0.00072)	(0.00090)	(0.00063)	(0.00074)	(0.00051)	(0.00046)	(0.00091)	(0.00058)	(0.0254)	(0.0107)	(0.0061)	(0.0026)
	[1.348]	[-0.484]	[1.711]***	[5.289]*	[-0.621]	[0.046]	[1.455]	[0.893]	[2.731]*	[6.015]*	[1.438]	[0.643]	[-15.273]*	[22.514]*	[-5.461]*	[369.21]*
DENMARK GJR-GARCH	0.00063	0.00040	-0.00007	0.00056	0.00077	0.00052	0.00099	0.00048	0.00033	0.00069	0.00056	0.00130	2.53e-06	0.0557	0.0718	0.8873
	(0.00049)	(0.00048)	(0.00049)	(0.00058)	(0.00054)	(0.00048)	(0.00044)	(0.00048)	(0.00049)	(0.00048)	(0.00051)	(0.00050)	(5.39e-07)	(0.0122)	(0.0163)	(0.0121)
	[1.300]	[0.841]	[-0.135]	[0.959]	[1.426]	[1.084]	[2.238]**	[1.012]	[0.677]	[1.449]	[1.092]	[2.608]*	[4.702]*	[4.575]*	[4.406]*	[73.117]*
EGYPT EGARCH	0.00092	0.00151	0.00047	-2.55e-05	-0.00126	0.00025	2.88e-05	-0.00037	8.00e-05	0.00067	0.00014	0.00022	-0.4576	0.3179	-0.0246	0.9756
	(0.00030)	(0.00027)	(0.00059)	(0.00040)	(0.00028)	(0.00051)	(0.00058)	(0.00033)	(0.00039)	(0.00038)	(0.00042)	(0.00046)	(0.0300)	(0.0145)	(0.0075)	(0.0026)
	[3.081]*	[5.521]*	[0.796]	[-0.063]	[-4.495]*	[0.499]	[0.049]	[-1.117]	[0.203]	[1.760]***	[0.336]	[0.486]	[-15.221]*	[21.926]*	[-3.268]*	[363.03]*
ESTONIA EGARCH	0.00090	0.00121	0.00136	0.00017	-0.00017	-3.67e-05	0.00016	0.00132	0.00110	0.00034	0.00110	0.00149	-0.5005	0.3201	-0.0061	0.9697
	(0.00053)	(0.00064)	(0.00054)	(0.00051)	(0.00043)	(0.00041)	(0.00039)	(0.00043)	(0.00045)	(0.00055)	(0.00065)	(0.00056)	(0.0960)	(0.0411)	(0.0182)	(0.0089)
	[1.691]***	[1.883]***	[2.503]*	[0.340]	[-0.392]	[-0.088]	[0.424]	[3.062]*	[2.410]**	[0.616]	[1.697]***	[2.644]*	[-5.210]*	[7.785]*	[-0.335]	[108.90]*
FINLAND EGARCH	0.00050	0.00226	0.00111	0.00072	0.00040	0.00091	0.00067	-0.00046	0.00138	0.00262	0.00146	-0.00035	-0.1678	0.1454	-0.0382	0.9929
	(0.00085)	(0.00081)	(0.00073)	(0.00088)	(0.00097)	(0.00085)	(0.00075)	(0.00086)	(0.00080)	(0.00088)	(0.00090)	(0.00108)	(0.0256)	(0.0175)	(0.0107)	(0.0023)
	[0.586]	[2.764]*	[1.518]	[0.814]	[0.411]	[1.073]	[0.896]	[-0.531]	[1.721]***	[2.992]*	[1.616]	[-0.331]	[-6.534]*	[8.275]*	[-3.577]*	[419.45]*
FRANCE EGARCH	0.00046	0.00074	0.00085	0.00041	-0.00015	-0.00053	0.00018	7.62e-05	-0.00043	0.00036	0.00033	0.00075	-0.2287	0.1157	-0.0812	0.9845
	(0.00046)	(0.00048)	(0.00046)	(0.00050)	(0.00050)	(0.00048)	(0.00047)	(0.00048)	(0.00041)	(0.00046)	(0.00049)	(0.00051)	(0.0291)	(0.0123)	(0.0079)	(0.0028)
	[1.005]	[1.540]	[1.853]***	[0.822]	[-0.301]	[-1.122]	[0.387]	[0.157]	[-0.844]	[0.784]	[0.688]	[1.460]	[-7.856]*	[9.376]*	[-10.26]*	[350.76]*

*denotes significance in 0.01 level , **denotes significance in 0.05 level *** denotes significance in 0.10 level - standard errors in parentheses, z-statistics in brackets

Table 3. (cont.) GARCH estimations of equation (2)

Countries	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	β_{11}	β_{12}	ω	α_0	γ	α_1
GERMANY EGARCH	0.00052 (0.00045) [1.147]	0.00117 (0.00047) [2.452]**	-0.00021 (0.00051) [-0.415]	0.00039 (0.00051) [0.762]	0.00065 (0.00047) [1.378]	-0.00012 (0.00047) [-0.254]	0.00096 (0.00046) [2.104]**	0.00024 (0.00051) [0.481]	-0.00042 (0.00047) [-0.890]	0.00072 (0.00049) [1.452]	0.00079 (0.00049) [1.608]	0.00160 (0.00052) [3.031]*	-0.2260 (0.0284) [-7.942]*	0.1366 (0.0138) [9.891]*	-0.0699 (0.0084) [-8.313]*	0.9866 (0.0026) [378.18]*
GREECE GJR-GARCH	0.00122 (0.00073) [1.665]***	-0.00036 (0.00077) [-0.461]	-0.00078 (0.00091) [-0.854]	0.00178 (0.00090) [1.989]**	0.00036 (0.00078) [0.460]	-0.00182 (0.00076) [-2.375]**	0.00101 (0.00076) [1.336]	0.00039 (0.00077) [0.508]	0.00007 (0.00081) [0.088]	0.00082 (0.00082) [0.990]	0.00118 (0.00076) [1.551]	0.00099 (0.00082) [1.205]	7.16e-06 (1.49e-06) [4.792]*	0.0940 (0.0165) [5.682]*	0.1014 (0.0231) [4.389]*	0.8364 (0.0156) [53.709]*
HONG KONG EGARCH	0.00112 (0.00049) [2.271]**	0.00156 (0.00055) [2.820]*	-0.00054 (0.00051) [-1.055]	0.00070 (0.00050) [1.269]	0.00109 (0.00050) [2.197]*	0.00027 (0.00050) [0.545]	0.00117 (0.00046) [2.539]**	7.30e-05 (0.00047) [0.155]	0.00049 (0.00050) [0.983]	0.00115 (0.00051) [2.229]**	0.00095 (0.00050) [1.894]***	0.00100 (0.00053) [1.864]***	-0.2951 (0.0324) [-9.094]*	0.1613 (0.0138) [11.610]*	-0.0584 (0.0083) [-7.045]*	0.9796 (0.0031) [308.02]*
INDIA GJR-GARCH	-0.00019 (0.00079) [-0.239]	0.00148 (0.00079) [1.857]***	-0.00067 (0.00091) [-0.736]	-0.00021 (0.00094) [-0.223]	0.00134 (0.00092) [1.456]	0.00095 (0.00087) [1.094]	0.00110 (0.00079) [1.397]	0.00093 (0.00078) [1.201]	0.00153 (0.00080) [1.929]***	-0.00003 (0.00079) [-0.038]	0.00232 (0.00085) [2.723]*	0.00260 (0.00081) [3.203]*	1.19e-05 (2.15e-06) [5.547]*	0.0536 (0.0184) [2.922]*	0.1731 (0.0280) [6.192]*	0.8167 (0.0195) [41.956]*
INDONESIA GJR-GARCH	0.00143 (0.00083) [1.715]***	-0.00019 (0.00085) [-0.217]	0.00066 (0.00082) [0.810]	0.00163 (0.00087) [1.876]***	0.00225 (0.00089) [2.541]**	0.00073 (0.00082) [0.883]	0.00064 (0.00072) [0.880]	-0.00158 (0.00084) [-1.86]***	0.00100 (0.00091) [1.097]	0.00022 (0.00086) [0.252]	0.00179 (0.00081) [2.222]**	0.00246 (0.00086) [2.846]*	1.92e-05 (3.41e-06) [5.640]*	0.0945 (0.0205) [4.607]*	0.1635 (0.0351) [4.661]*	0.7718 (0.0246) [31.359]*
IRELAND EGARCH	2.67e-05 (0.00021) [0.128]	1.42e-05 (0.00023) [0.059]	-2.85e-07 (0.00025) [-0.011]	1.82e-05 (0.00025) [0.071]	9.88e-07 (0.00026) [0.003]	1.06e-05 (0.00026) [-0.004]	0.00032 (0.00022) [1.420]	-5.36e-07 (0.00025) [-0.002]	-1.51e-05 (0.00025) [-0.059]	1.78e-05 (0.00025) [0.071]	1.01e-05 (0.00026) [0.037]	0.00057 (0.00024) [2.397]**	-0.0605 (0.0079) [-7.652]*	0.1332 (0.0234) [5.678]*	-0.0843 (0.0156) [-5.396]*	0.9978 (0.0094) [1061.1]*
ISRAEL EGARCH	-0.00073 (0.00086) [-0.846]	0.00062 (0.00081) [0.765]	0.00105 (0.00080) [1.316]	0.00204 (0.00094) [2.159]**	0.00126 (0.00088) [1.428]	-0.00068 (0.00086) [-0.799]	-7.29e-05 (0.00074) [-0.097]	-0.00097 (0.00077) [-1.248]	-0.00016 (0.00078) [-0.208]	0.00201 (0.00085) [2.365]**	0.00187 (0.00089) [2.103]**	0.00185 (0.00079) [2.331]**	-0.8120 (0.1504) [-5.398]*	0.1909 (0.0287) [6.634]*	-0.1133 (0.0188) [-6.014]*	0.9222 (0.0164) [56.052]*
ITALY EGARCH	0.00086 (0.00039) [2.155]**	0.00121 (0.00051) [2.369]**	0.00017 (0.00056) [0.312]	0.00052 (0.00054) [0.973]	-0.00029 (0.00057) [-0.514]	-0.00056 (0.00053) [-1.052]	-0.00033 (0.00053) [-0.620]	-4.50e-05 (0.00049) [-0.092]	0.00036 (0.00055) [0.819]	0.00052 (0.00051) [1.028]	0.00064 (0.00046) [1.397]	0.00059 (0.00045) [1.291]	-0.1991 (0.0290) [-6.848]*	0.0846 (0.0169) [4.985]*	-0.1124 (0.0103) [-10.90]*	0.9861 (0.0025) [395.62]*
JAPAN EGARCH	0.00030 (0.00035) [0.844]	0.00081 (0.00039) [2.060]**	0.00165 (0.00035) [4.695]*	0.00050 (0.00044) [1.124]	5.46e-05 (0.00044) [0.123]	9.32e-07 (0.00039) [0.002]	-0.000101 (0.00039) [-0.255]	2.23e-05 (0.00040) [0.055]	4.49e-05 (0.00037) [0.119]	3.68e-06 (0.00039) [0.009]	0.00045 (0.00040) [1.114]	0.00079 (0.00041) [1.936]***	-0.3215 (0.0298) [-10.76]*	0.1681 (0.0133) [12.554]*	-0.0918 (0.0085) [-10.772]*	0.9784 (0.0028) [344.85]*
JORDAN EGARCH	0.00026 (0.00031) [0.841]	0.00015 (0.00031) [0.495]	-0.00074 (0.00027) [-2.681]*	-0.00031 (0.00033) [-0.949]	0.00057 (0.00033) [1.710]	-0.00018 (0.00031) [-0.581]	-0.00075 (0.00033) [-2.248]**	-1.86e-05 (0.00028) [-0.065]	0.00027 (0.00029) [0.944]	-0.00013 (0.00030) [-0.428]	0.00011 (0.00030) [0.372]	0.00012 (0.00029) [0.415]	-0.9031 (0.088) [-10.26]*	0.4637 (0.0299) [15.478]*	0.0128 (0.0151) [0.852]	0.9412 (0.0080) [117.10]*
KUWAIT EGARCH	0.00092 (0.00042) [2.208**]	0.00073 (0.00045) [1.638]	0.00180 (0.00051) [3.515]*	0.00208 (0.00056) [3.672]*	0.00090 (0.00057) [1.563]	0.00071 (0.00048) [1.481]	0.00082 (0.00052) [1.569]	0.00078 (0.00049) [1.590]	0.00067 (0.00044) [1.505]	0.00104 (0.00046) [2.254]**	0.00098 (0.00050) [1.959]**	0.00117 (0.00043) [2.742]*	-1.0117 (0.1430) [-7.072]*	0.3711 (0.0397) [9.327]*	-0.1072 (0.0213) [-5.032]*	0.9246 (0.0136) [67.797]*
LATVIA EGARCH	0.00070 (0.00048) [1.456]	-0.00031 (0.00053) [-0.578]	0.00084 (0.00055) [1.548]	0.00098 (0.00050) [1.933]***	-0.00077 (0.00052) [-1.473]	0.00054 (0.00046) [1.179]	0.00114 (0.00055) [2.086]**	0.00064 (0.00059) [1.092]	0.00078 (0.00055) [1.434]	3.37e-05 (0.00054) [0.062]	0.00070 (0.00059) [1.194]	0.00101 (0.00050) [2.009]**	-1.0211 (0.1337) [-7.635]*	0.4843 (0.0485) [9.979]*	-0.0324 (0.0255) [-1.271]	0.9209 (0.0134) [68.376]*
LITHUANIA GJR-GARCH	0.00097 (0.00048) [2.019]**	0.00087 (0.00056) [1.544]	0.00161 (0.00050) [3.223]*	0.00002 (0.00053) [0.037]	-0.00046 (0.00052) [-0.894]	-0.00027 (0.00052) [-0.524]	0.00015 (0.00050) [0.300]	0.00094 (0.00049) [1.923]***	0.00174 (0.00054) [3.242]*	0.00053 (0.00052) [1.020]	0.00136 (0.00055) [2.479]**	0.00094 (0.00053) [1.785]***	1.56e-05 (2.83e-06) [5.513]*	0.2184 (0.0460) [4.748]*	0.1643 (0.0633) [2.595]*	0.5666 (0.0512) [11.072]*
LUXEMBURG GARCH	-0.00124 (0.00045) [-2.744]*	-0.00086 (0.00068) [-1.258]	-0.00023 (0.00061) [-0.379]	0.0003 (0.00055) [0547]	9.20e-05 (0.00055) [0.167]	0.00017 (0.00057) [0.309]	-0.0005 (0.00039) [-1.281]	-7.54e-05 (0.00075) [-0.001]	6.98e-05 (0.00047) [0.148]	-2.83e-05 (0.00044) [-0.063]	0.00283 (0.000108) [26.256]*	0.00305 (0.00043) [7.117]*	4.92e-08 (7.42e-09) [6.634]*	0.1620 (0.0007) [23.186]*		0.8771 (0.0035) [244.61]*

*denotes significance in 0.01 level , **denotes significance in 0.05 level *** denotes significance in 0.10 level - standard errors in parentheses, z-statistics in brackets

Table 3. (cont.) GARCH estimations of equation (2)

Countries	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	β_{11}	β_{12}	ω	α_0	γ	α_1
MALAYSIA EGARCH	0.00098	0.00038	-0.00055	0.00050	-0.00050	9.36e-06	0.00027	-0.00015	-0.00020	0.00024	0.00027	0.00091	-0.3382	0.2373	-0.0580	0.9821
	(0.00045)	(0.00054)	(0.00042)	(0.00045)	(0.00047)	(0.00045)	(0.00044)	(0.00039)	(0.00039)	(0.00036)	(0.00040)	(0.00046)	(0.0374)	(0.0202)	(0.0105)	(0.0033)
	[2.172]**	[0.702]	[-1.313]	[1.124]	[-1.077]	[0.020]	[0.615]	[-0.395]	[-0.505]	[0.699]	[0.674]	[1.965]**	[-9.027]*	[11.743]*	[-5.509]*	[296.99]*
MEXICO EGARCH	0.00141	0.00085	0.00125	0.00011	0.00043	3.45e-05	0.00042	0.00016	0.00073	0.00138	0.00172	0.00201	-0.4344	0.1921	-0.1041	0.9663
	(0.00058)	(0.00061)	(0.00065)	(0.00062)	(0.00062)	(0.00062)	(0.00054)	(0.00061)	(0.00062)	(0.00062)	(0.00065)	(0.00060)	(0.0483)	(0.0180)	(0.0102)	(0.0049)
	[2.409]**	[1.373]	[1.907]***	[0.181]	[0.700]	[0.055]	[0.783]	[0.262]	[1.174]	[2.209]**	[2.658]	[3.329]*	[-8.978]*	[10.667]*	[-10.191]*	[194.62]*
NETHERLANDS GJR-GARCH	0.00034	0.00090	0.00024	0.00062	0.00002	0.00045	0.00097	0.00032	-0.00016	0.00031	0.00069	0.00128	1.55e-06	0.0243	0.1084	0.9095
	(0.00043)	(0.00047)	(0.00046)	(0.00051)	(0.00048)	(0.00048)	(0.00046)	(0.00048)	(0.00048)	(0.00045)	(0.00049)	(0.00046)	(2.82e-07)	(0.0098)	(0.0134)	(0.0083)
	[0.777]	[1.939]***	[0.525]	[1.210]	[0.044]	[0.944]	[2.142]**	[0.655]	[-0.343]	[0.699]	[1.421]	[2.785]*	[5.477]*	[2.477]**	[8.116]*	[109.07]*
NEW ZEALAND EGARCH	-0.0002	0.0007	0.0010	0.0007	0.0000	0.0002	0.0005	-0.0010	0.0011	-0.0001	0.0005	0.0011	-0.2321	0.0694	-0.0669	0.9824
	(0.0006)	(0.0005)	(0.0006)	(0.0008)	(0.0004)	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0005)	(0.0006)	(0.0700)	(0.0244)	(0.0152)	(0.0062)
	[-0.282]	[1.254]	[1.558]	[0.856]	[-0.058]	[0.437]	[0.770]	[-1.94]***	[1.959]***	[-0.088]	[1.006]	[1.820]***	[-3.313]*	[2.839]*	[-4.415]*	[158.16]*
NORWAY GJR-GARCH	0.00081	0.00114	0.00047	0.00161	0.00165	0.00095	0.00011	-0.00005	0.00012	0.00197	0.00106	0.00121	1.31e-05	0.0188	0.2099	0.7819
	(0.00081)	(0.00083)	(0.00077)	(0.00075)	(0.00082)	(0.00084)	(0.00077)	(0.00080)	(0.00088)	(0.00084)	(0.00086)	(0.00086)	(2.45e-06)	(0.0215)	(0.0359)	(0.0294)
	[1.004]	[1.370]	[0.605]	[2.154]**	[2.011]**	[1.133]	[0.148]	[-0.059]	[0.135]	[2.347]**	[1.228]	[1.405]	[5.361]*	[0.878]	[5.852]*	[26.617]*
PAKISTAN GJR-GARCH	0.00342	0.00180	0.00107	0.00226	-0.00032	0.00175	0.00044	0.00076	0.00107	0.00308	0.00108	0.00308	1.24e-05	0.1801	0.0860	0.7526
	(0.00081)	(0.00082)	(0.00088)	(0.00072)	(0.00087)	(0.00098)	(0.00070)	(0.00074)	(0.00075)	(0.00070)	(0.00088)	(0.00078)	(2.40e-06)	(0.0323)	(0.0388)	(0.0250)
	[4.230]*	[2.190]**	[1.217]	[3.124]*	[-0.364]	[1.788]***	[0.638]	[1.031]	[1.417]	[4.381]*	[1.230]	[3.940]*	[5.157]*	[5.584]*	[2.215]**	[30.118]
PERU GJR-GARCH	0.00246	0.00111	0.00079	-0.00018	0.00051	-0.00075	0.00029	0.00061	0.00193	0.00081	0.00103	0.00063	8.13e-06	0.2203	0.0631	0.7096
	(0.00064)	(0.00060)	(0.00053)	(0.00068)	(0.00058)	(0.00059)	(0.00053)	(0.00058)	(0.00060)	(0.00058)	(0.00056)	(0.00063)	(1.43e-06)	(0.0331)	(0.0375)	(0.0266)
	[3.860]*	[1.847]***	[1.497]	[-0.258]	[0.882]	[-1.264]	[0.544]	[1.045]	[3.223]*	[1.399]	[1.846]***	[0.997]	[5.691]*	[6.665]*	[1.682]***	[26.652]*
PHILLIPINE GJR-GARCH	0.00160	-0.00053	-0.00035	0.00017	-0.00047	-0.00029	-0.00106	-0.00139	0.00057	-0.00082	-0.00059	0.00178	1.36e-05	0.1197	0.0760	0.7893
	(0.00081)	(0.00086)	(0.00079)	(0.00077)	(0.00078)	(0.00082)	(0.00074)	(0.00080)	(0.00077)	(0.00078)	(0.00080)	(0.00080)	(2.73e-06)	(0.0221)	(0.0280)	(0.0244)
	[1.986]**	[-0.612]	[-0.438]	[0.221]	[-0.600]	[-0.352]	[-1.436]	[-1.72]***	[0.746]	[-1.054]	[-0.732]	[2.231]**	[4.993]*	[5.413]*	[2.712]*	[32.300]*
PORTUGAL GJR-GARCH	0.00103	0.00197	0.00036	0.00081	0.00130	-0.00015	0.00039	0.00098	0.00097	0.00006	0.00072	0.00160	1.83e-06	0.0066	0.2763	0.8330
	(0.00052)	(0.00058)	(0.00060)	(0.00046)	(0.00046)	(0.00069)	(0.00055)	(0.00049)	(0.00058)	(0.00052)	(0.00053)	(0.00050)	(5.00e-07)	(0.0185)	(0.0581)	(0.0255)
	[1.977]**	[3.389]*	[0.596]	[1.761]***	[2.802]*	[-0.211]	[0.711]	[1.995]**	[1.676]***	[0.106]	[1.364]	[3.226]*	[3.669]*	[0.357]	[4.751]*	[32.634]*
RUSSIA GJR-GARCH	0.00111	0.00334	0.00040	0.00175	0.00155	0.00209	0.00088	0.00290	0.00002	0.00245	0.00158	0.00191	2.07e-05	0.1757	0.0384	0.7892
	(0.00096)	(0.00122)	(0.00124)	(0.00106)	(0.00134)	(0.00122)	(0.00119)	(0.00126)	(0.00117)	(0.00107)	(0.00117)	(0.00098)	(1.95e-06)	(0.0150)	(0.0161)	(0.0103)
	[1.158]	[2.746]*	[0.319]	[1.647]***	[1.159]	[1.710]***	[0.736]	[2.300]**	[0.017]	[2.290]**	[1.354]	[1.940]***	[10.607]*	[11.688]*	[2.382]**	[76.414]*
SINGAPORE GJR-GARCH	0.00189	-0.00068	-0.00029	-0.00021	-0.00022	-0.00059	-0.00095	-0.00142	0.00046	-0.00063	-0.00084	0.00187	1.34e-05	0.1213	0.0731	0.7900
	(0.00078)	(0.00084)	(0.00078)	(0.00076)	(0.00078)	(0.00083)	(0.00073)	(0.00081)	(0.00076)	(0.00079)	(0.00079)	(0.00080)	(2.76e-06)	(0.0222)	(0.0280)	(0.0243)
	[2.427]**	[-0.813]	[-0.372]	[-0.277]	[-0.284]	[-0.708]	[-1.308]	[-1.75]***	[0.607]	[-0.802]	[-1.060]	[2.349]**	[5.001]*	[5.451]*	[2.613]*	[32.551]*
SOUTH KOREA GJR-GARCH	0.00020	0.00143	-0.00020	0.00165	0.00164	0.00019	0.00111	0.00044	0.00040	0.00037	0.00274	0.00062	2.27e-06	0.0400	0.0606	0.9256
	(0.00093)	(0.00100)	(0.00099)	(0.00090)	(0.00098)	(0.00094)	(0.00090)	(0.00089)	(0.00090)	(0.00108)	(0.00102)	(0.00101)	(7.40e-07)	(0.0109)	(0.0139)	(0.0095)
	[0.214]	[1.434]	[-0.198]	[1.838]***	[1.677]***	[0.198]	[1.232]	[0.501]	[0.440]	[0.341]	[2.681]*	[0.613]	[3.067]*	[3.669]*	[4.348]*	[97.619]*
SPAIN EGARCH	0.00051	0.00169	-0.00030	0.00083	0.00045	0.00016	-0.00014	-0.00054	0.00127	0.00088	0.00118	0.00135	-0.2737	0.1694	-0.0757	0.9842
	(0.00052)	(0.00051)	(0.00061)	(0.00060)	(0.00056)	(0.00055)	(0.00054)	(0.000570	(0.00048)	(0.00055)	(0.00053)	(0.00058)	(0.0392)	(0.0178)	(0.0101)	(0.0036)
	[0.975]	[3.303]*	[-0.487]	[1.371]	[0.801]	[0.293]	[-0.254]	[-0.947]	[2.673]*	[1.604]	[2.226]**	[2.350]**	[-6.989]*	[9.518]*	[-7.477]*	[271.77]*
SRI LANKA EGARCH	-0.00002	0.00125	-0.00041	0.00061	0.00036	-0.00023	0.00052	-0.00082	0.00143	-0.00011	0.00054	0.00060	-1.6124	0.5905	-0.0358	0.8729
	(0.00051)	(0.00049)	(0.00042)	(0.00052)	(0.00048)	(0.00048)	(0.00043)	(0.00046)	(0.00044)	(0.00047)	(0.00053)	(0.00051)	(0.1751)	(0.0435)	(0.0238)	(0.0173)
	[-0.038]	[2.575]*	[-0.961]	[1.171]	[0.751]	[-0.487]	[1.203]	[-1.80]***	[3.292]*	[-0.240]	[1.022]	[1.190]	[-9.210]*	[13.566]*	[-1.501]	[50.323]*

*denotes significance in 0.01 level , **denotes significance in 0.05 level *** denotes significance in 0.10 level - standard errors in parentheses, z-statistics in brackets

Table 3. (cont.) GARCH estimations of equation (2)

Countries	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	β_{11}	β_{12}	ω	α_0	γ	α_1
SWEDEN GJR-GARCH	0.00047 (0.00063) [0.754]	0.00152 (0.00064) [2.390]**	0.00004 (0.00080) [0.054]	0.00017 (0.00067) [0.246]	-0.00028 (0.00069) [-0.405]	-0.00077 (0.00082) [-0.948]	0.00042 (0.00069) [0.604]	-0.00040 (0.00067) [-0.603]	0.00114 (0.00066) [1.722]***	0.00003 (0.00070) [0.041]	0.00061 (0.00079) [0.767]	0.00030 (0.00080) [0.375]	1.71e-06 (2.89e-07) [5.913]*	-0.0163 (0.0082) [-1.993]**	0.1265 (0.0121) [10.484]*	0.9402 (0.0075) [124.87]*
SWITZERLAND EGARCH	0.00036 (0.00041) [0.889]	0.00108 (0.00040) [2.689]*	0.00033 (0.00044) [0.755]	0.00023 (0.00044) [0.536]	0.00084 (0.00042) [1.994]**	-0.00004 (0.00039) [-0.106]	0.00078 (0.00039) [2.026]**	0.00013 (0.00041) [0.324]	0.00030 (0.00041) [0.724]	0.00070 (0.00045) [1.544]	0.00069 (0.00043) [1.608]	0.00142 (0.00041) [3.443]*	-0.3229 (0.0414) [-7.805]*	0.1516 (0.0162) [9.334]*	-0.0868 (0.0094) [-9.222]*	0.9781 (0.0037) [261.73]*
TAIWAN EGARCH	0.00104 (0.00080) [1.307]	0.00136 (0.00091) [1.496]	-0.00015 (0.00081) [-0.186]	-0.00009 (0.00079) [-0.108]	-0.00019 (0.00078) [-0.238]	0.00149 (0.00074) [2.009]**	0.00006 (0.00072) [0.080]	-0.00043 (0.00080) [-0.542]	-0.00118 (0.00080) [-1.477]	0.00006 (0.00078) [0.082]	0.00110 (0.00080) [1.382]	0.00112 (0.00081) [1.389]	-0.2839 (0.0451) [-6.297]*	0.1443 (0.0189) [7.652]*	-0.0753 (0.0112) [-6.743]*	0.9796 (0.0045) [216.25]*
THAILAND GJR-GARCH	0.00265 (0.00129) [2.058]**	-0.00151 (0.00137) [-1.097]	-0.00276 (0.00137) [-2.019]**	0.00004 (0.00135) [0.027]	0.00055 (0.00146) [0.377]	0.00129 (0.00142) [0.912]	-0.00340 (0.00143) [-2.372]**	-0.00092 (0.00132) [-0.696]	-0.00156 (0.00130) [-1.202]	0.00079 (0.00136) [0.577]	0.00065 (0.00129) [0.506]	0.00131 (0.00146) [0.896]	1.53e-05 (4.48e-06) [3.426]*	0.0882 (0.0200) [4.420]*	0.0744 (0.0304) [2.445]**	0.8381 (0.0270) [31.087]*
TURKEY GARCH	0.0074 (0.00147) [0.545]	0.00112 (0.00148) [0.757]	-0.00148 (0.00141) [-1.047]	0.00282 (0.00168) [1.680]***	-0.00128 (0.00151) [-0.845]	-0.00028 (0.00147) [-0.195]	0.0024 (0.0013) [1.851]***	-1.13e-05 (0.0015) [-0.007]	0.00342 (0.0011) [3.116]*	0.00351 (0.00105) [3.323]*	0.00058 (0.00148) [0.395]	0.003 (0.00176) [1.698]***	8.65e-06 (1.90e-06) [4.540]*	0.1029 (0.0083) [12.305]*		0.8920 (0.0076) [116.93]*
UK-FTSE 100 GJR-GARCH	0.00054 (0.00033) [1.670]***	0.00047 (0.00036) [1.319]	0.00023 (0.00034) [0.675]	0.00047 (0.00038) [1.225]	0.00016 (0.00036) [0.456]	-0.00008 (0.00034) [-0.249]	0.00042 (0.00035) [1.208]	0.00068 (0.00037) [1.843]***	-0.00009 (0.00035) [-0.263]	0.00050 (0.00036) [1.390]	0.00035 (0.00037) [0.950]	0.00101 (0.00038) [2.637]*	1.62e-06 (2.64e-07) [6.120]*	0.0341 (0.0078) [4.347]*	0.0786 (0.0104) [7.560]*	0.9087 (0.0078) [116.82]*
UK-FTSE 250 EGARCH	0.00027 (0.00037) [0.734]	0.00075 (0.00047) [1.589]	0.00025 (0.00052) [0.471]	0.00036 (0.00050) [0.717]	0.00088 (0.00048) [1.822]***	0.00026 (0.00052) [0.497]	0.00009 (0.00047) [0.180]	0.00123 (0.00051) [2.435]*	0.00007 (0.00046) [0.146]	0.00067 (0.00058) [1.160]	0.00073 (0.00054) [1.353]	0.00126 (0.00055) [2.281]*	-0.3986 (0.0595) [-6.700]*	0.2017 (0.0247) [8.178]*	-0.0863 (0.0134) [-6.451]*	0.9749 (0.0054) [181.42]*
US DOW JONES COMPOSITE EGARCH	0.00085 0.00028 (3.002)*	0.00056 (0.00031) [1.794]***	0.00031 (0.00029) [1.052]	0.00060 (0.00032) [1.893]***	0.00042 (0.00030) [1.388]	-0.00007 (0.00030) [-0.247]	0.00055 (0.00030) [1.833]***	0.00015 (0.00030) [0.509]	-0.00036 (0.00031) [-1.167]	0.00083 (0.00030) [2.801]*	0.00073 (0.00032) [2.251]**	0.00049 (0.00030) [1.631]	-0.2232 (0.0278) [-8.018]*	0.1007 (0.0102) [9.861]*	-0.0579 (0.0068) [-8.493]*	0.9846 (0.0026) [384.87]*
US NASDAQ 100 EGARCH	0.00148 (0.00026) [5.726]*	0.00080 (0.00027) [2.935]*	0.00087 (0.00024) [3.568]*	0.00117 (0.00023) [5.023]*	0.00081 (0.00024) [3.333]*	0.00062 (0.00024) [2.616]*	0.00056 (0.00023) [2.469]**	0.00072 (0.00024) [3.052]*	0.00030 (0.00024) [1.263]	0.00046 (0.00025) [1.849]***	0.00125 (0.00028) [4.508]*	0.00104 (0.00026) [3.983]*	-0.2231 (0.0181) [-12.298]*	0.1721 (0.0101) [16.994]*	-0.0425 (0.0051) [-8.289]*	0.9905 (0.0015) [645.22]*
US NEW YORK COMPOSITE EGARCH	0.00062 (0.00020) [3.106]*	0.00028 (0.00022) [1.292]	0.00045 (0.00021) [2.132]**	0.00062 (0.00022) [2.816]*	0.00026 (0.00022) [1.199]	-0.00004 (0.00022) [-0.173]	0.00027 (0.00022) [1.221]	0.00022 (0.00021) [1.035]	0.00021 (0.00021) [0.997]	0.00025 (0.00021) [1.195]	0.00076 (0.00024) [3.209]*	0.00060 (0.00022) [2.706]*	-0.2259 (0.0199) [-11.338]*	0.1144 (0.0083) [13.760]*	-0.0653 (0.0050) [-12.971]*	0.9857 (0.0018) [562.61]*
US – S&P 500 EGARCH	0.00061 (0.00017) [3.508]*	-0.00003 (0.00018) [-0.162]	0.00041 (0.00017) [2.503]**	0.00075 (0.00017) [4.404]*	0.00037 (0.00017) [2.175]**	0.00007 (0.00018) [0.390]	0.00056 (0.00018) [3.092]*	0.00014 (0.00018) [0.783]	0.00034 (0.00017) [2.018]**	0.00041 (0.00017) [2.347]**	0.00072 (0.00019) [3.695]*	0.00053 (0.00018) [2.946]*	-0.2107 (0.0158) [-13.305]*	0.1235 (0.0072) [17.166]*	-0.0663 (0.0044) [-15.086]*	0.9881 (0.0014) [721.77]*
YUGOSLAVIA GJR-GARCH	0.00142 (0.00121) [1.169]	0.00126 (0.00115) [1.098]	0.00104 (0.00115) [0.910]	-0.00080 (0.00133) [-0.600]	-0.00168 (0.00123) [-1.375]	-0.00230 (0.00106) [-2.165]**	0.00172 (0.00116) [1.485]	-0.00068 (0.00095) [-0.711]	-0.00106 (0.00122) [-0.868]	-0.00004 (0.00084) [-0.048]	0.00066 (0.00102) [0.643]	0.00196 (0.00097) [2.022]**	1.54e-05 (4.39e-06) [3.498]*	0.4828 (0.1048) [4.608]*	0.0433 (0.1182) [0.366]	0.5110 (0.0582) [8.775]*
ZAMBIA EGARCH	0.00278 (0.00034) [8.284]*	0.00375 (0.00042) [8.910]*	0.00053 (0.00072) [0.728]	0.00109 (0.00027) [4.020]*	0.00164 (0.00033) [4.973]*	0.00145 (0.00050) [2.907]*	-0.00039 (0.00052) [-0.752]	0.00388 (0.00039) [9.914]*	0.00008 (0.00107) [0.077]	-0.00108 (0.00049) [-2.200]**	0.00096 (0.00056) [1.703]***	0.00001 (0.00063) [0.009]	-0.9933 (0.0805) [-12.334]*	0.2945 (0.0179) [16.420]*	-0.0818 (0.0150) [-5.454]*	0.9075 (0.0084) [107.67]*

*denotes significance in 0.01 level , **denotes significance in 0.05 level *** denotes significance in 0.10 level - standard errors in parentheses, z-statistics in brackets

Table 4. Diagnostic tests of GARCH estimations

Countries	R^2adj.	**AIC**	**SBC**	**LL**	**LBQ^2(12)**	**ARCH-LM (5)**	**Countries**	R^2adj.	**AIC**	**SBC**	**LL**	**LBQ^2(12)**	**ARCH-LM (5)**
ARGENTINA GJR-GARCH	0.0001905	-5.160	-5.125	7664.433	14.161 {0.291}	1.102 {0.3562}	INDIA GJR-GARCH	0.001094	-5.593	-5.557	7808.594	9.204 {0.685}	0.332 {0.8935}
AUSTRALIA EGARCH	-0.000303	-6.890	-6.871	21081.61	6.9416 {0.861}	1.389 {0.2246}	INDONESIA GJR-GARCH	0.005046	-5.555	-5.518	7608.255	5.217 {0.950}	0.418 {0.8365}
AUSTRIA GJR-GARCH	0.004281	-6.418	-6.391	12622.61	9.651 {0.646}	0.780 {0.5634}	IRELAND EGARCH	-0.000083	-6.721	-6.703	22001.48	1047.8 {0.000}	107.472 {0.000}
BELGIUM EGARCH	-0.004098	-6.602	-6.515	3117.079	17.508 {0.131}	1.459 {0.2007}	ISRAEL EGARCH	0.005664	-5.796	-5.754	6770.230	13.675 {0.316}	1.833 {0.1029}
BRAZIL GJR-GARCH	0.000555	-4.878	-4.850	9327.323	15.103 {0.236}	1.355 {0.2380}	ITALY EGARCH	0.000296	-6.491	-6.448	7326.350	10.437 {0.578}	0.694 {0.6278}
CANADA EGARCH	-0.000579	-6.542	-6.498	7252.581	13.640 {0.324}	0.423 {0.8324}	JAPAN EGARCH	-0.000533	-6.066	-6.047	18485.11	5.360 {0.945}	0.927 {0.4616}
CHILE EGARCH	0.001048	-6.672	-6.599	4007.030	13.369 {0.343}	0.939 {0.4544}	JORDAN EGARCH	-0.002495	-6.943	-6.917	14262.29	6.581 {0.884}	0.839 {0.5215}
CHINA EGARCH	-0.000383	-5.723	-5.685	7539.898	8.779 {0.722}	0.197 {0.9635}	KUWAIT EGARCH	0.000475	-6.912	-6.862	6552.565	7.943 {0.790}	0.369 {0.8698}
CROATIA EGARCH	0.001665	-5.856	-5.821	8569.988	1.315 {1.000}	0.125 {0.9867}	LATVIA EGARCH	0.002417	-6.401	-6.357	7163.862	3.220 {0.994}	0.294 {0.9160}
DENMARK GJR-GARCH	-0.000127	-6.403	-6.375	12256.91	11.445 {0.490}	1.071 {0.3741}	LITHUANIA GJR-GARCH	-0.000020	-6.783	-6.738	7444.488	1.282 {1.000}	0.202 {0.9614}
EGYPT EGARCH	0.002470	-6.884	-6.840	7596.527	9.468 {0.663}	1.102 {0.3569}	LUXEMBURG GARCH	-0.001806	-5.306	-5.279	11316.96	1.3854 {1.000}	0.072 {0.9963}
ESTONIA EGARCH	0.003567	-6.850	-6.796	5912.008	5.187 {0.951}	0.155 {0.9784}	MALAYSIA EGARCH	0.001960	-6.316	-6.287	11570.24	8.552 {0.741}	1.209 {0.3020}
FINLAND EGARCH	0.000329	-5.317	-5.280	7084.155	4.905 {0.961}	0.648 {0.6630}	MEXICO EGARCH	0.001734	-5.686	-5.661	12007.48	21.384 {0.045}	3.064 {0.0091}
FRANCE EGARCH	0.002269	-6.059	-6.035	14229.10	8.778 {0.722}	1.304 {0.2589}	NETHERLANDS GJR-GARCH	0.001468	-6.280	-6.253	12775.54	11.034 {0.526}	1.335 {0.2458}
GERMANY EGARCH	0.002016	-6.085	-6.060	13717.76	1.209 {1.000}	0.099 {0.9922}	NEW ZEALAND EGARCH	0.002838	-7.313	-7.231	3706.905	16.020 {0.190}	0.397 {0.8505}
GREECE GJR-GARCH	0.002824	-5.653	-5.616	7575.885	24.876 {0.015}	3.231 {0.0065}	NORWAY GJR-GARCH	0.002330	-6.081	-6.032	5870.386	9..838 {0.630}	0.163 {0.9759}
HONG KONG EGARCH	0.000714	-5.806	-5.786	15669.69	252.26 {0.000}	54.707 {0.000}	PAKISTAN GJR-GARCH	0.001115	-5.676	-5.637	7265.310	7.209 {0.843}	0.400 {0.8491}

p-values in {}. AIC and SBC refer to Akaike and Schwarz information criteria, LL is the Log Likelihood, LBQ^2 is the Ljung-Box test on squared standardized residuals

Table 4. (cont.) Diagnostic tests of GARCH estimations

Countries	R^2adj.	**AIC**	**SBC**	**LL**	**LBQ^2(12)**	**ARCH-LM(5)**	**Countries**	R^2adj.	**AIC**	**SBC**	**LL**	**LBQ^2(12)**	**ARCH-LM(5)**
PERU GJR-GARCH	-0.000233	-6.367	-6.327	7836.431	12.074 {0.440}	1.095 {0.3605}	THAILAND GJR-GARCH	0.005109	-5.205	-5.148	4207.102	12.454 {0.410}	0.628 {0.6781}
PHILLIPINE GJR-GARCH	0.004395	-5.790	-5.752	7703.279	21.180 {0.048}	3.459 {0.0040}	TURKEY GARCH	0.005586	-4.574	-4.541	6081.203	14.358 {0.278}	0.900 {0.4794}
PORTUGAL GJR-GARCH	-0.005169	-7.192	-7.104	3386.642	11.639 {0.475}	1.036 {0.3945}	UK-FTSE 100 GJR-GARCH	0.001180	-6.583	-6.564	20389.16	25.488 {0.013}	3.255 {0.0061}
RUSSIA GJR-GARCH	-0.000042	-4.753	-4.723	7783.382	9.485 {0.661}	0.352 {0.8808}	UK-FTSE 250 EGARCH	0.002036	-6.793	-6.749	7523.809	8.577 {0.740}	0.448 {0.8149}
SINGAPORE GJR-GARCH	0.005666	-5.798	-5.760	7714.159	21.479 {0.044}	3.555 {0.0033}	US DOW JONES COMPOSITE EGARCH	0.001140	-6.683	-6.666	23424.66	12.386 {0.415}	1.395 {0.2224}
SOUTH KOREA GJR-GARCH	-0.000650	-5.198	-5.161	7203.808	5.258 {0.949}	0.386 {0.8584}	US NASDAQ 100 EGARCH	-0.000599	-6.634	-6.622	31522.97	71.570 {0.000}	12.500 {0.000}
SPAIN EGARCH	0.000909	-6.110	-6.079	10239.49	14.533 {0.268}	2.301 {0.0424}	US NEW YORK COMPOSITE EGARCH	0.000625	-6.883	-6.872	37052.48	16.776 {0.158}	2.369 {0.0217}
SRI LANKA EGARCH	0.002140	-6.644	-6.604	8295.616	21.645 {0.042}	1.685 {0.1346}	US – S&P 500 EGARCH	0.000722	-6.936	-6.927	51267.24	26.926 {0.008}	4.551 {0.0004}
SWEDEN GJR-GARCH	-0.002850	-6.061	-6.016	6095.232	8.439 {0.750}	0.612 {0.6902}	YUGOSLAVIA GJR-GARCH	0.005578	-6.173	-6.069	2341.67	8.176 {0.771}	1.247 {0.2852}
SWITZERLAND EGARCH	0.000447	-6.456	-6.432	14537.16	1.142 {1.000}	0.043 {0.9989}	ZAMBIA EGARCH	-0.003332	-6.229	-6.174	4902.757	12.983 {0.370}	0.270 {0.9293}
TAIWAN EGARCH	0.002320	-5.618	-5.581	7775.845	19.689 {0.073}	2.973 {0.0111}							

p-values in {}. AIC and SBC refer to Akaike and Schwarz information criteria, LL is the Log Likelihood, LBQ^2 is the Ljung-Box test on squared standardized residuals

Appendix

Programming routines for asymmetry tests in EVIEWS software

1. Sign Test

```
smpl @all
eq1.arch(1,1) returns jan feb mar apr may jun jul aug sep oct nov dec
eq1.makeresids resid01
GENR S_0 = 0
SMPL @all IF resid01 < 0
GENR S_0 = 1
smpl @all
eq1.ls resid01^2 c  S_0
show eq1
```

2. Negative Bias Test

```
smpl @all
eq1.arch(1,1) returns jan feb mar apr may jun jul aug sep oct nov dec
eq1.makeresids resid01
GENR S_0 = 0
SMPL @all IF resid01 < 0
GENR S_0 = 1
SMPL @all
eq1.ls resid01^2 c  S_0
GENR N_0 = S_0*resid01(-1)
eq1.ls resid01^2 c  N_0
show eq1
```

3. Positive Bias Test

```
smpl @all
eq1.arch(1,1)returns jan feb mar apr may jun jul aug sep oct nov dec
eq1.makeresids resid01
GENR S_0 = 0
SMPL @all IF resid01 < 0
GENR S_0 = 1
GENR N_0 = S_0*resid01(-1)
GENR P_01=1-S_0
 GENR P_0=P_01*resid01(-1)
smpl @all
eq1.ls resid01^2 c   P_0
show eq1
```

4. Joint Test

```
smpl @all
eq1.arch(1,1) returns jan feb mar apr may jun jul aug sep oct nov dec eq1.makeresids
resid01
GENR S_0 = 0
SMPL @all IF resid01 < 0
GENR S_0 = 1
SMPL @all
eq1.ls resid01^2 c  S_0
GENR N_0 = S_0*resid01(-1)
GENR P_01=1-S_0
 GENR P_0=P_01*resid01(-1)
smpl @all
eq1.ls resid01^2 c  S_0 N_0 P_0
eq1.wald c(2)=0, c(3)=0, c(4)=0
```